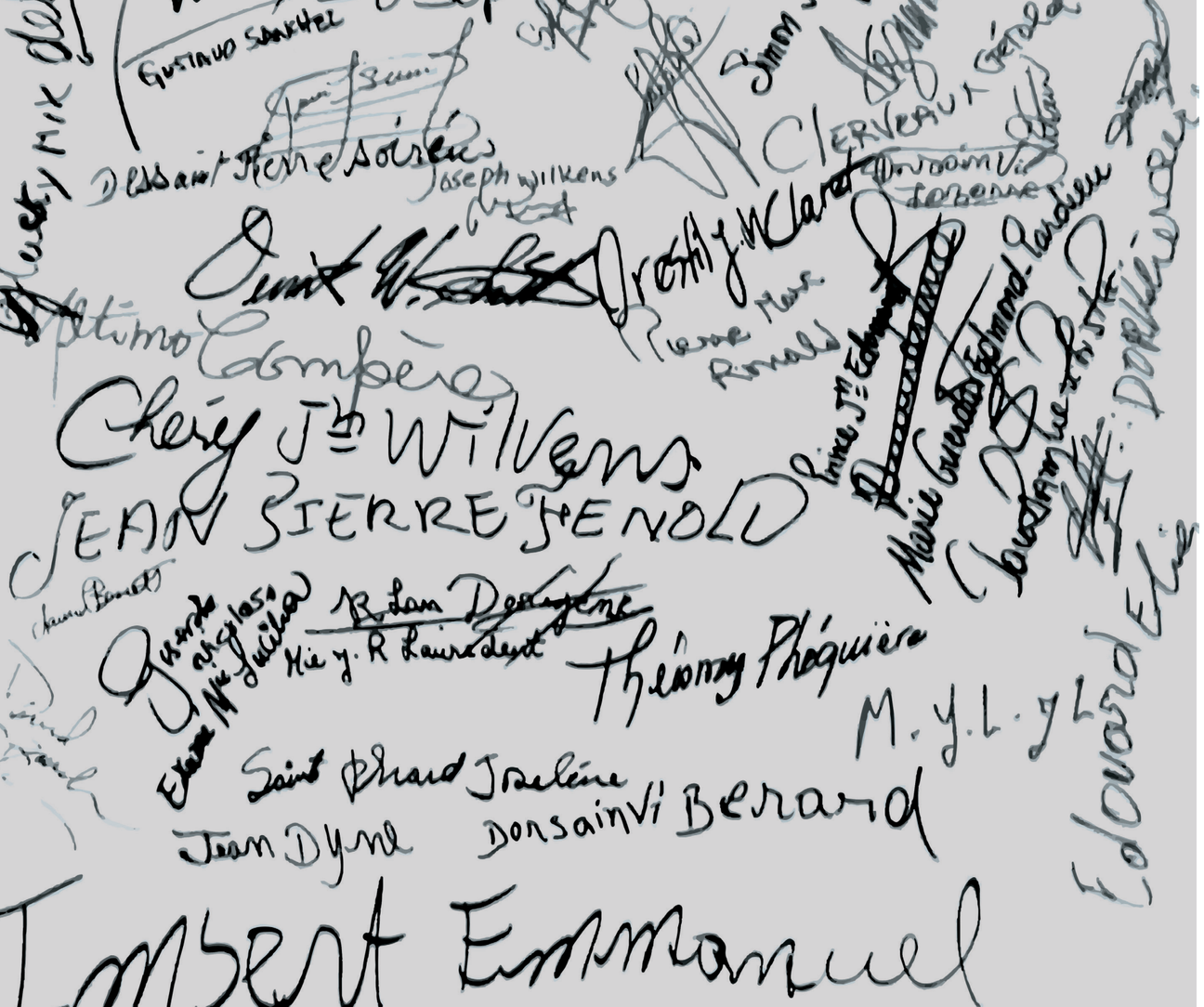
Arcahaie

Vision Report 11.30.14



HAITI: ARCAHAIE VISION REPORT

Developing Sustainable Traditions & Innovations in Architecture and Urbanism for the Region, Towns and the Rural Villages of Akayè (Arcahaie)



HAITI: Developing Sustainable Traditions & Innovations in Architecture and Urbanism for the Region, Towns and the Rural Villages of Akayè (Arcahaie)

Learning from the Past.
Forging the Future.
Empowering the Population.

Vision Report Editor
Sonia R. Chao, Principal Investigator,
Research Assistant Faculty and Director of the Center for Urban & Community
University of Miami School of Architecture

Submitted: November 30, 2014

The United Nations World Commission on Environment and Development (WCED) in its 1987 report Our Common Future defines sustainable development: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Haitian Proverbs

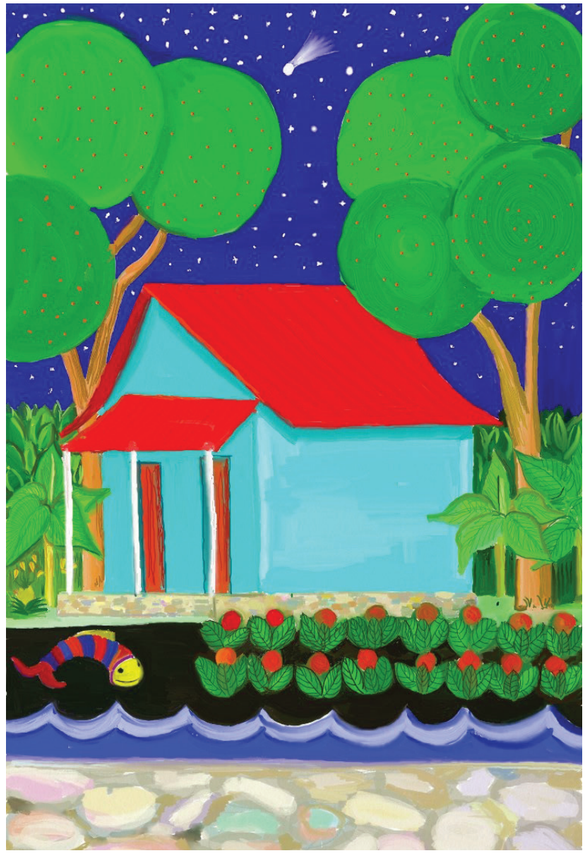
Bondye do ou. fe pa ou, M a fe pa M.
God says do your part and I'll do mine.

Men anpil chay pa lou.
Many hands make the load lighter.

Kay koule twompe soley soley men li pa twompe lapil.
A leaky house can fool the sun, but it can't fool the rain.

"The timeless task of architecture
is to create embodied existential metaphors,
that concretize and structure man's being in the world.
Images of architecture reflect and externalize
ideas and images of life…
Buildings and towns enable us to structure,
understand, and remember the shapeless flow
of reality and ultimately,
to recognize and remember who we are.
Architecture enables us to place ourselves
in the continuum of culture."
Steven Holl, Juhani Pallasmaaa, Alberto Perez-Gómez

Painting by: Armando Montero



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Center for Urban and Community Design

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UNIVERSITY OF MIAMI
SCHOOL of
ARCHITECTURE
CENTER for URBAN & COMMUNITY DESIGN



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Barr Foundation

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Initiative Funders

W.K. KELLOGG FOUNDATION®

The *W.K. Kellogg Foundation (WKKF)*, founded in 1930 as an independent, private foundation by breakfast cereal pioneer, Will Keith Kellogg, is among the largest philanthropic foundations in the United States. Guided by the belief that all children should have an equal opportunity to thrive, WKKF works with communities to create conditions for vulnerable children so they can realize their full potential in school, work and life.

The Kellogg Foundation is based in Battle Creek, Michigan, and works throughout the United States and internationally, as well as with sovereign tribes. Special emphasis is paid to priority places where there are high concentrations of poverty and where children face significant barriers to success. WKKF priority places in the U.S. are in Michigan, Mississippi, New Mexico and New Orleans; and internationally, are in Mexico and Haiti. For more information, visit: www.wkkf.org.

BARR FOUNDATION

Founded in 1997, the Boston-based *Barr Foundation* is one of the largest private foundations in New England. With assets of more than $1.4 billion and annual grantmaking of nearly $60 million, Barr's domestic grantmaking focuses on providing quality education, mitigating climate change, and enhancing cultural vitality. Since 2010, the Foundation has also been exploring opportunities for global investments, predominantly in rural areas of Haiti, sub-Saharan Africa, and India. In all of its work, the Foundation is guided by a set of core values that emanate from our founders, articulate our beliefs about what constitutes effective philanthropy, and describe how we carry out our mission of service. These include commitments to strive for excellence, to invest in leaders, to act with humility, to demonstrate curiosity, to adopt a long-term perspective, and to embrace risk. For more information, visit: www.barrfoundation.org.



Organizational Background

Center for Urban & Community Design (CUCD)
University of Miami School of Architecture

Incorporation Date
University of Miami: 1925; School of Architecture [University of Miami]: 1983; Center for Urban & Community Design [School of Architecture, University of Miami]: 1992.

Mission Statement
To foster a collaborative interdisciplinary approach that supports the preservation, retrofitting, and creation of resilient, sustainable communities and buildings. The Center for Urban & Community Design (CUCD) seeks to interface community and project needs with the core educational philosophy and goals of the School of Architecture by integrating research, teaching and service, encouraging inter-disciplinary thought and action in the areas of resiliency, sustainable design and development, historic preservation, and civic engagement, while aligning with the University's active commitment towards local and hemispheric neighbors and partners, and, by sharing knowledge, research, project activities and findings with students, faculty, design professionals, civic institutions and the general public.

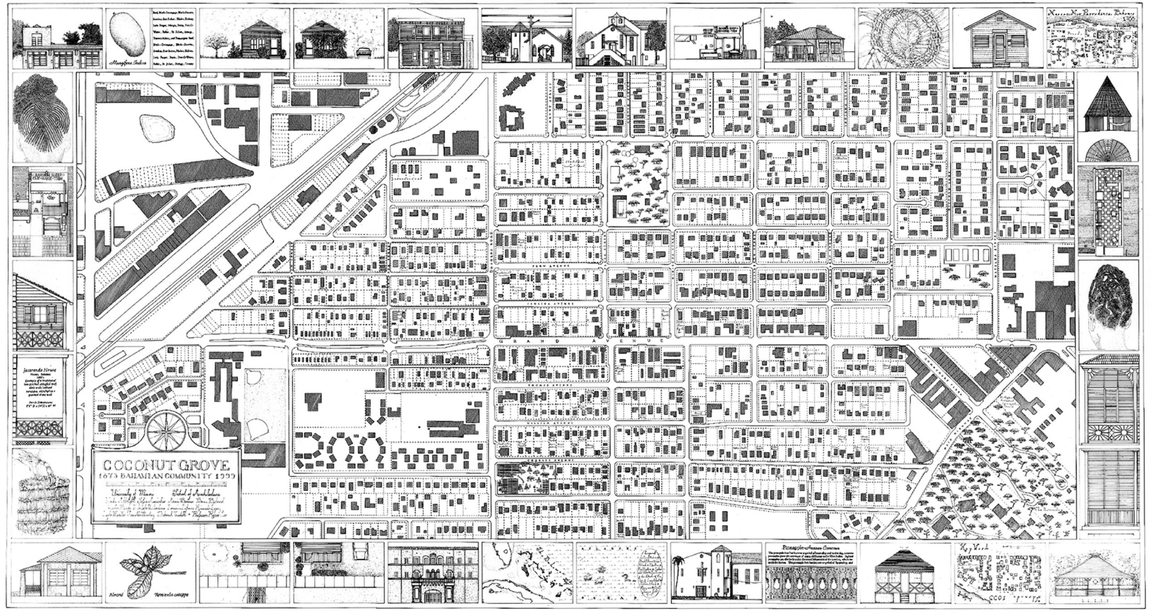
Brief Summary
The CUCD was founded in 1992 to respond to the social, economic and physical aftermath of Hurricane Andrew. From its inception, the CUCD has served as a community facilitator and the main conduit of its civic engagement has been academically-based community service. Since then, the Center has assisted or collaborated with faculty, alumni and students in investigations, publications and partnerships with communities; enabling each of these groups to directly engage neighbors and to promote sustainable design practices.

The CUCD serves communities worldwide, in support of the School's mission to prepare students for professional leadership. Its core values encourage the design of buildings and communities that are environmentally responsible, socially equitable, and economically viable.

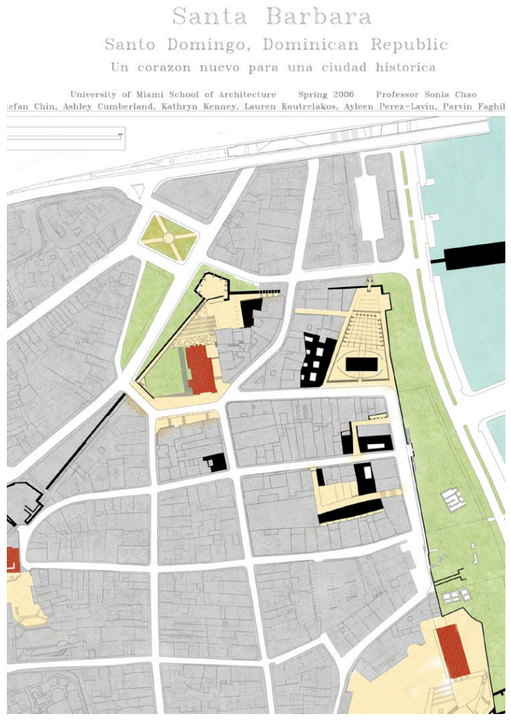
The charrette process has been an effective method for delivering its services, in particular to disenfranchised communities. The CUCD furthermore sponsors lectures and symposia, supporting the dissemination of and investigations within the interrelated fields of sustainable design, which are often viewed as separate by the general public and professional community. Thus in an innovative manner, the CUCD has married sustainable design fields, at all scales, and it has applied this academic knowledge in the community by strategically collaborating with non-profit organizations, governments, citizen groups, the public school system, and/or professional associations. The Center continues to develop forums to examine and discuss the environmental, social, and physical challenges of sustainable design and resiliency in temperate and sub-tropical climates.

Organizational Overview
Name Center for Urban & Community Design (CUCD)
Type Academic
Host Organization University of Miami
Host Department Architecture
Director Sonia Chao

Who We Serve
Across the sub-tropical/tropical belt; in particular, South Florida, Caribbean Basin and Latin America; Communities & leaders striving to achieve sustainable

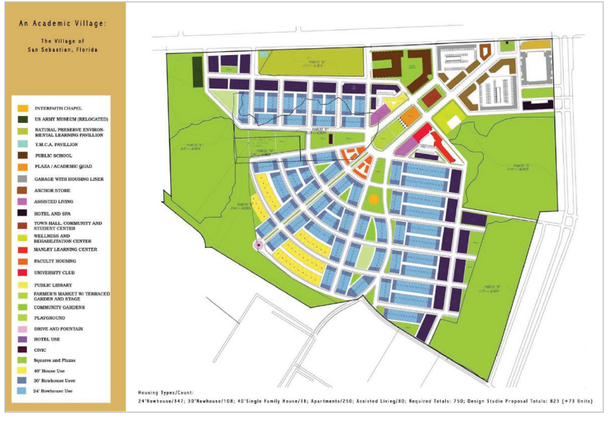


Coconut Grove Map (Miami, Florida), University of Miami School of Architecture, Professor Rocco Ceo



Santa Barbara, Santo Domingo, Dominican Republic
Charrette and Masterplan

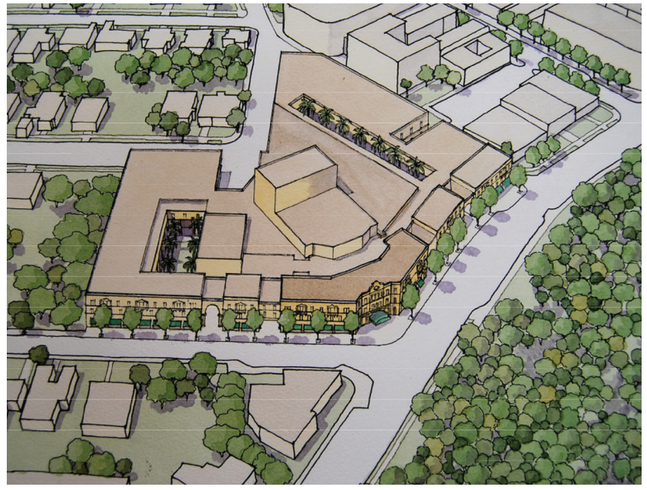




San Sebastian, Florida
Charrette and Vision Plan



Riviera Neighborhood, Coral Gables, Florida
Charrette and Vision Plan



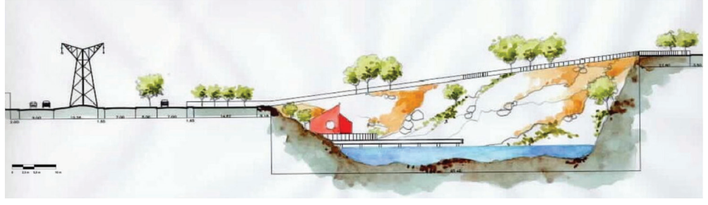
Coconut Grove Playhouse Charrette



The CUCD hosts an annual food drive CanStruction effort to collect canned goods. The University of Miami School of Architecture students and staff collaborated by participating in competing teams. All cans used during the event were donated to Camillus House, a non-profit agency that provides humanitarian services to poor and homeless men, women and children in Miami-Dade County.



Coconut Grove Playhouse Charrette

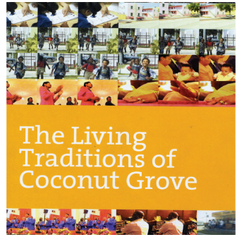


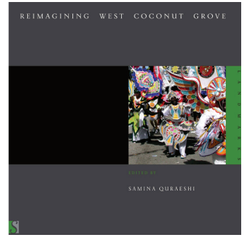
Menchaca Charrette













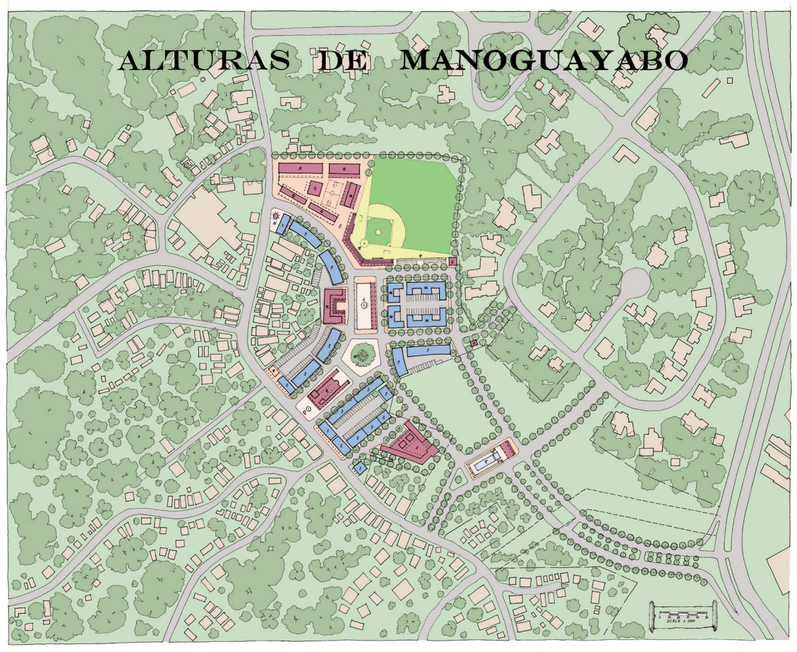


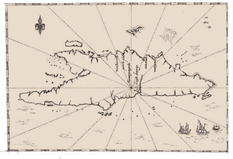






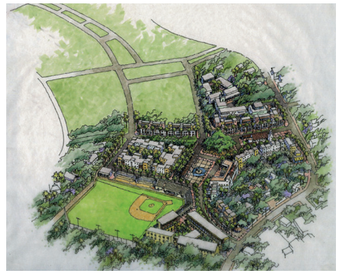
CUCD Publications





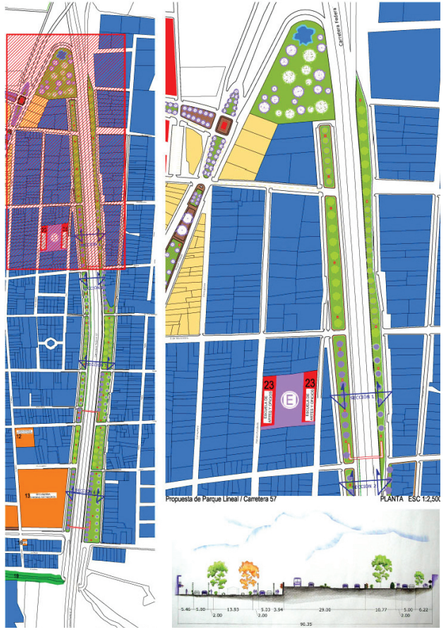
A Existing Elementary School
B Baseball Academy
C Library
D High School
E Baseball Stadium with Market
F Bullpen/Batting Cages
G Locker-rooms
H Ice Cream Shop
I Quisqueyana
J Gascuenza
K Cultural Center
L Neighborhood Plaza
M Ovando
N Public Garden
O Gazebo
P Police Office
Q Church Plaza
R Community Church
S Health & Rehabilitation Clinic
T Community Pool

Building Type	Number of Bedrooms	Interior m2 per unit	Exterior m2 per unit	Number of buildings	Number of buildings w/commercial	Sub-Total Units
Quisqueyana	3	63	14	8	8	24
	4	63	14	4	0	16
	2	49	14	1	1	3
	2	49	14	3	0	12
Gascuenza	3+1	79	41	16	0	64
Ovando	4+1	125	60	2	0	8
	3+1	95	55	4	0	16
					Totals	143





Manoguayabo, Santo Domingo
Charrette, Masterplan and Renderings



Santa Rosa, Mexico
Charrette, Masterplan and Renderings



A CUCD symposium held in 2007, *Under the Sun: Traditions and Innovations in Sustainable Architecture and Urbanism* led to a publication funded by the National Endowement of the Arts in 2012 (pictured on page 19 with other CUCD publications).

development goals or those addressing adaptation or resiliency challenges due to Sea Level Rise and its impacts; Disenfranchised communities/ neighborhoods, historically significant and/or environmentally fragile/ vulnerable communities.

We Work With
Government agencies, authorities & officials/ Non-profits/ International organizations (NGOs)/ Foundations/ Community Development Corporations/ US & International Universities/ Neighborhood Associations

We Are
Size Varies, 1 to 5 or 6-10 (Academic Faculty, Staff, Students)

What We Do
Building and Sustainable Design Initiatives (Urban and Building scale); Neighborhood-specific Affordable Housing Design Guidelines; Urban & Regional Designs; Research on Urban Codes & Guidelines, Historic Preservation Research & Design Guidelines, and, Research on the relationship between Climate Change, Sea Level Rise (SLR), and Architecture and Urbanism; Adaptation, Resiliency and Risk Reduction

Expertise We Offer
Urban Sustainability; Suburban retrofitting; Historic Preservation; Resilient Design, Urban Design; Urban Form-based Codes; Development & Revitalization; Affordable Housing; Technical Assistance/Capacity Building

Where
Worldwide

How
Participation is structured for: faculty, students, alumni, interns, or other part-time or limited term participants and consultants. SoA Students can earn IDP hours.

Focus Areas
Community Engagement; Historic Preservation; Sustainable & Resilient Design; Research & Capacity Education.

Tools & Products
Charrettes, Research, Grants, Publications, Code & Design Guidelines; NCARB/IDP Intern Supervision, Conference Presentations & Collaboration with SoA Faculty, Students, Alumni, and with UM Office of Civic and Community Engagement.

Typical Duration & Timing of Initiatives
Varies (Between 1 semester - 18 months is typical)

Goals
The Center seeks to - interface community and project needs with the core educational philosophy and goals of the School of Architecture; integrate research, teaching, and service, encouraging interdisciplinary thought and action in the areas of preservation, sustainability/ resiliency and civic engagement; align with the University's active commitment towards local and hemispheric neighbors and partners, and, share knowledge, research, project activities and findings with students, faculty, design professionals, municipal institutions and the general public.

Projects in 2013-2014
- W.K. Kellogg Foundation & Barr Foundation: Haiti Initiative
- National Endowment for the Arts: Under the Sun Publication
- OCCE and CUCD: Overtown Historic Resources Research & Mapping Project
- Miami-Dade Housing Finance Authority: Design Guidelines
- J. P. Morgan Chase Foundation & Jessie Ball DuPont Foundation: Allapattah Charrette

Sample of Prior Projects (2005-2012)
Coconut Grove Playhouse Rehabilitation Charrette; Santo Domingo: Santa Barbara Historic District; Town of Lake Park: Downtown Revitalization, Masterplan & Design Guidelines: Habitat for Humanity; Case Study House - Pre-fabricated Affordable Housing for North Dade; Turning Point Baptist Church and Community Center; Haiti 2010 Charrette.

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What is a Charrette?

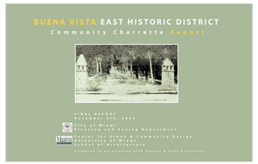


The Charrette process brings together people and experts from various disciplines to identify and address the concerns of the project at hand. It is an opportunity for everyone with an interest in the site to work in a collaborative environment within compressed work sessions and give immediate feedback to the designers.

It is in these short feedback loops that the community can voice their opinions and multidisciplinary professionals can identify supportive and opposing opinions that can then be crystallized into feasible plans.

What is a Vision Report?





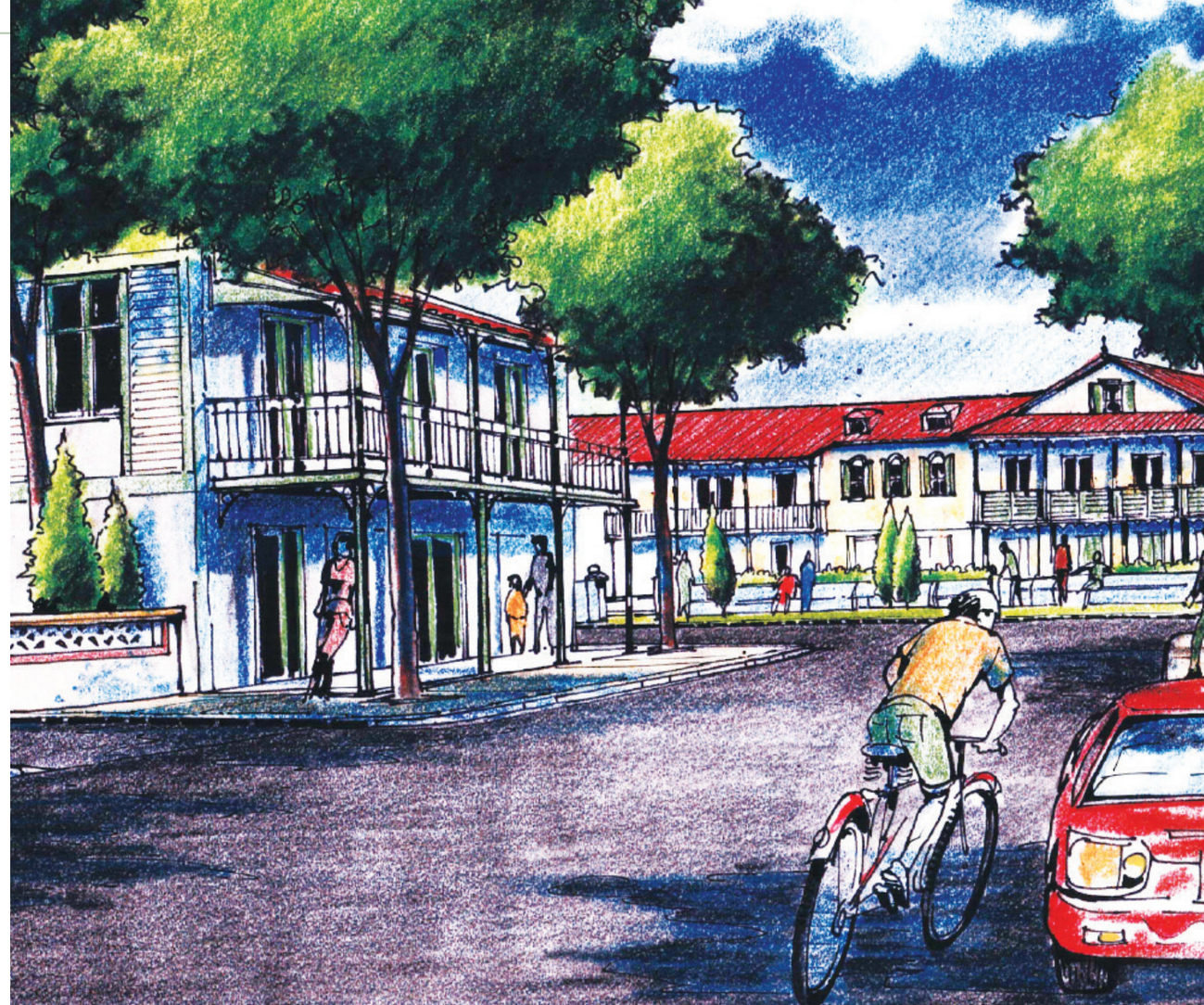








A Vision Report summarizes the knowledge gathered during the charrette process, derived from research, analysis, pre-charrette and charrette meetings to provide recommendations based on those findings, which in turn identify site and/or building design criteria that can lead to the cohesive and viable implementation of ideas, in such manner that considers, complements, and relates to the needs of a community, while promoting respect for the built and natural contexts surrounding the project site.



Purpose of this Vision Report?



The purpose of this report is to summarize the knowledge gathered during the Haiti Initiative, derived from research, analysis, pre-charrette and charrette meetings with community members, as well as post-charrette sessions, additional consultations with community stake-holders and supplementary drawing production, to provide recommendations based on those findings. The recommendations identify site and building design criteria that can lead to the cohesive and viable development of the Akayè's Lowlands, in a respectful, complimentary and relational manner to natural, built, and cultural contexts. Each recommendation can positively contribute to the character of the region, and aims to achieve a balance between economic development, the protection of natural resources, social equity, resiliency, and an improved quality of life for all citizens.



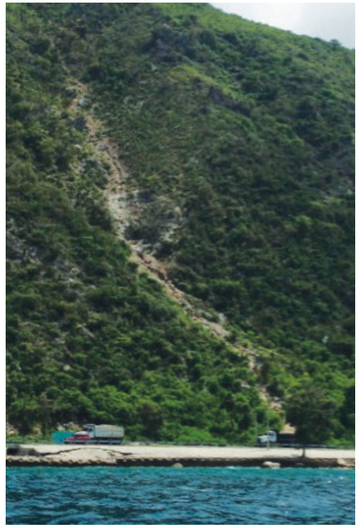












Haiti Initiative: Introduction

Sonia Chao, AIA, University of Miami, School of Architecture Research Assistant Professor, and UM/SoA Center for Urban & Community Design (CUCD) Director

Study Area: Akayè Lowlands Sub-region
The Akayè Commune, comprised of 408.73 km^2, in the West Department, is approximately 32 kilometers from Port au Prince, and has a population of 118,501 (2009) with a density ratio of 290/km^2. It presents diverse needs and opportunities. This region is rich with natural beauty, as well as cultural and religious heritage, often a fusion of African and French influences. There are many self-trained artists and craftsmen in the region; their art often a naïf depiction or storytelling of daily life experiences. The region's coast attracts tourists, as does the annual celebration, on May 18th , commemorating the 1803 creation of the Haitian red and blue flag by heroine Catherine Flon, on the last day of the Congress of Arcahaie, and before Haiti or Ayiti in Creole, becomes the hemisphere's second Republic in 1804.

Geographically, the region is divided into two major zones: the Highlands, with a steep chain of mountains, is dotted by many villages, some densely populated, and, the Lowlands, consisting of the coast and the delta plain, which hosts the capital town of Arcahaie with its population of 14,702 (2009), several villages and hamlets. Known as "Haiti's Breadbasket", the region is defined economically by its agricultural activity. The National Highway is the umbilical cord that connects the region to Port au Prince to the south and St. Marks to the north.

This Initiative's study focused on the region's coastal delta plain sub-region, located between the town of Arcahaie and the Cote des Arcadins and addressed multiple concerns including: regional interconnectivity and opportunities for economic revitalization; eco, cultural and agro-tourism strategies; civic buildings and spaces, and guidelines for sustainable and secure building practices. Three settlements, of diverse scale and character, were selected as Case Study sites: Arcahaie (Town scale), Corail (Neutral/Rural Scale), and Luly (Village scale). Regional scale recommendations benefit communities in both the Lowlands and the Highlands.

Mission of the Haiti Initiative
The mission of the Haiti Initiative was to identify design strategies capable of catalyzing positive change in the region while respecting and embracing the history, natural and built resources, and character of the Region. The Initiative's integrated method addressed the needs of delta/coastal communities and the resulting Vision Report is a 'road map' for the sub-region's sustainable development as well as a guide for private, public, and philanthropic investment in the areas, with attainable actions recommended for both short-term and long term implementation.

The Central Role of Community Engagement
In recent decades, well intended NGO's, professionals and government agencies have proffered solutions, some leading to punctual successes in healthcare, education, housing, or job creation; however, most have proven unsustainable. Few of the imported initiatives are ingrained into Haiti's cultural heritage, nor in its professional or social infrastructures. They typically do not address in a holistic manner the complex and intertwined needs of the common Haitian and so their successes are frequently limited. Furthermore, many models are not easily duplicated without a constant external revenue stream. In fact, some initiatives end entirely with the departure of the NGO.

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The lessons learned seem clear: initiatives that are not informed by local experts at the front end of a project, those that do not include local communities in the decision-making process nor train and create partnerships with Haitians for long-term project implementation are limited in scope, impact, and longevity. A viable prototype is needed-- one that connects traditions and innovations with experts and communities; one that is comprehensive, can be readily duplicated and is culturally connected.

The goal of this project was to create a sustainable, holistic model. Thus, from its inception, an integrated, interdisciplinary, multi-faceted tactic was employed; one in which the sustainable methods and innovative thinking were conceived with and informed by local citizens, traditions, experts, and realities.

Based on the notion of civic engagement and responsibility, the principal vehicle of the Haiti Initiative was the participatory tool of the mini-charrette public workshop, pooling together resources and ideas, while increasing the likelihood of local ownership of ideas and a commitment towards the subsequent realization of project goals. Communities were involved in envisioning their future and with their valuable input; the Design team addressed specific and general needs -- from the regional, town, and individual levels. Through capacity-building (awareness building and training) sessions, participants were provided with added tools so they can later more effectively partner with each other, civil society, NGO's, and government, in forging long-term implementation goals. Local coordinators and liaisons aided greatly in all these efforts, by securing the participation of local stakeholders.

Breakdown of Initiative Activities

The major project activities centered on four pre-charrette phase trips. Each served to document site conditions, assets and needs, as well as permit the Design Team to dialogue directly with local leaders, civil society, and citizens. Various formats, including meetings, focus sessions with local institutions and communities, and mini-charrette public workshop sessions with stakeholders allowed the Design team and the Local Coordinators to gather facts, data, and insights from diverse viewpoints.

Overview

With generous support from the W.K. Kellogg Foundation and the Barr Foundation, the project began with an organizational trip to Haiti in July, 2013 for a Kellogg Foundation grantees meeting. A subsequent "reconnaissance trip" at the end of August 2013 allowed the entire Design Team to visit sites across the Commune's Lowlands, by land and sea. The team met with local government and community leaders and residents, with Foundation officers in situ, and commenced documentation efforts to understand better the differing physical needs, risks, and potentiality of each area within the Lowlands study area.

Overall, six (6) Design Team trips to Haiti took place (2013: *Pre-charrette Phase:* August/September, October, December, and 2014: *Charrette Phase:* March; *Post-Charrette Phase:* June, and October). On two additional occasions, a representative of the Design Team attended a W.K. Kellogg Foundation grantee meeting in Haiti (July and December 2013). Additionally, in 2012, two members of the Design Team traveled to meet local stakeholders and learn of their needs in order to define the Initiative's focus.

During the Design team trips, as well as during the initial pre-award 2012 trip, numerous meetings per trip were sustained with local leaders, non-profit service providers, and potential project collaborators. Three mini-charrette public workshops were hosted, with a range between 60 to 76 participants signing in. Over the course of the Initiative, the participation of women and their voice grew. There were seven capacity-building sessions, at least one per Design Team trip, with a similar number of attendees.
In June, community roundtable sessions were co-hosted with Youthbuild International to better define community needs for a Vocational Center capable of serving the entire region.

During the mini-charrette workshops, taking place during Trips 2, 3, and 4, a SWA[O]T session (a methodology to evaluate the strengths, weaknesses, assets [opportunities], and threats) was held to increase community engagement, identify common ground goals, and to profit from direct feedback.

As a result of these SWA[O]T sessions, the following [unedited] ideas from residents and leaders came about:

Arcahaie

- University satellite - focused on computer science and development
- Museum of the History of the Flag and Haitian Revolution
- New industries
- Clean historic buildings
- Clean streets and introduce landscaping for shade
- Introduce a Farmer's Center
- Fix the market area and its surroundings
- Provide a sports center
- Convention center
- Kid's center
- Micro-credit banks
- Hotel
- Port and Marina improvements
- Sell only local products

Corail

- Reconstruct National Road
- Make Corail a tourist attraction
- Re-connect to National Highway
- Re-connect bridges on Colonial Road
- Sports center improvements
- Clinic/Hospital or small health center
- Technical school - nursing
- Museum - Lakou
- Education programs
- Repaint, rehabilitate, and improve streetscape
- Agricultural Center - banana tourism and textiles
- Colonial University
- Understand water problems - seasonal challenges and household necessities
- Bring "self-respect" slogans
- Restore and improve market
- Introduce sustainable energy options

Luly

- Water quality threat
- Trash disposal
- Clean drinking water
- Fish market needed
- Sports center at existing open field
- Introduce an Arts center
- Fishing capacitation/school center needed
- Small-scale hotel or bed and breakfasts
- Bridge on Colonial Road
- Clean up coastlines
- Restrooms and public baths
- Information Tourism Center

To complement the input of residents and civil society, the participation of local civic leaders was also attained and their knowledge of the needs and mechanics of each place brought great depth to discussions. After each trip, a presentation of the Design Team's findings was made to foundation officers, at either debriefing sessions in Haiti and/or meetings in Miami. In addition, a dialogue with the

Komin Akayè gen yon distans 32 kilomèt ak Pòtoprens, nan depatman Lwès. Li gen twa zòn prensipal ladan: zòn lakòt, zòn plenn ak zòn montay; chak nan zòn sa yo gen nesesite pa yo e yo gen kapasite pa yo. Pwojè sa a santre sou zòn plenn ki bò lakòt, ki ant vil Akayè a ak Kot dèz Akaden. Pwojè sa a k ap sèvi ak metòd kote tout aktivite ladan konekte ap reponn a nesesite moun ki rete nan zòn bò lakòt yo epi pwogram nan ap sèvi kòm plan global pou devlopman dirab nan zòn sa a. Pwogram sa a ap sèvi tou kòm yon gid pou lòt moun ki vle envesti nan zòn sa yo men ki pa enterese fè kòb pou tèt pa yo. Moun nan zòn sa yo pral chwazi aktivite yo kapab reyalize tousuit ak aktivite yo kapab reyalize pi devan.

Valè tan pwojè a ka dire:
1ye jiyè 2013- 30 novanm 2014

Kote pwojè a ap fè / zòn pou rechèch yo:
Koray, Kot dèz Akaden ak vil Akayè nan komin Akayè, Ayiti

Sijè, chan etid pou pwojè a:
Zòn ki kab jere tèt yo ak Desen achitekti ki dirab; epi ki gen plan sante, plan edikasyon, ak plan pou anviwònman an

Rezilta pwojè a moun kab wè:
Yon dosye sou devlopman dirab, yon gid pou envestisman piblik, envestisman prive, ak envestisman pou moun ak òganizasyon ki pa enterese fè pwofi pou tèt pa yo, epi yon apwòch ki sèvi ak estrateji ki dirab, epi 'Gwoup plan pou bati rapid'

Finansman:
W.K. Kellogg Foundation ansanm ak Fondasyon BARR

Kote ki resevwa sibvansyon an:
University of Miami School of Architecture Center for Urban & Community Design (CUCD)

Anketè prensipal pwojè a:
Sonia R. Chao, Asistan rechèch epi Direktè Center for Urban & Community Design, University of Miami

Design Team:
Sonia Chao, Jaime Correa, Steve Fett, Armando Montero, John Onyango, Gustavo Sanchez-Hugalde, Derrick Smith, Max Zabala

Kòdonatè lokal:
Gilda Charles

UNIVERSITY OF MIAMI
SCHOOL of ARCHITECTURE

Ayiti

Planifikasyon pou avni zòn Akayè a (Arcahaie)

Pran leson sou sa k pase deja.

Fòje sa k pral vini.

Ede popilasyon an vin endepandan.

Ayiti

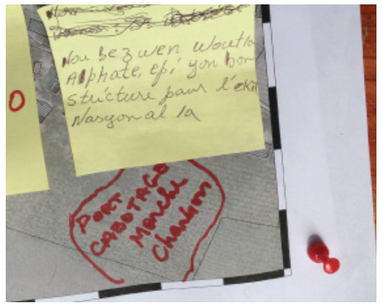
Ayiti: Planifikasyon pou avni zòn Akayè a (Arcahaie)



Opposite page:
Initial invitation to communities to participate in the initiative

Initial project description submitted to local leaders and civil society members
















• PLANIFIKASYON POU AVNI AKAYE
• PREZANTASYON FINAL
• ECODA UNIVERSITY OF MIAMI
• F. KELLOGG F. BABB HOAS
UNIVERSITY OF MIAMI
PALAIS MUNICIPAL ARCAHAIE




Universite

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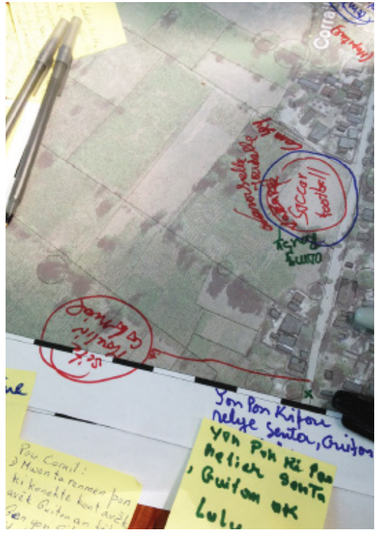


















Haitian Comité Interministériel d'Aménagement du Territoire (CIAT) was established during the "reconnaissance trip", in a further effort to garner insight, as well as to interest leaders, providers and / or others in the region and the Initiative goals. Periodic updates of the Initiative's progress were shared via emails or phone conversations as well.

Visioning Process

PRE-CHARRETTE PHASE

Research, Capacity Building, Community Consultations, Meetings and Mini-charrette Workshops

Key activities to the Visioning Process included an initial phase of research, data compilation, capacity building, and community consultations. This phase lasted eight months. Activities included numerous field trips, site documentation, the structuring of community engagement with local coordinators, capacity building sessions, as well as several public workshops/ mini-charrettes, SWA[O]T sessions, and, meetings with leaders in government and civil society. Through research, community engagement, and data analysis undertaken during the research and pre-charrette phases, the Initiative team laid the foundation for the charrette phase that followed. Locals shared their ideas and at times drew those out as well. (See Appendix) In turn, the Design teams vetted their evolving concepts and designs with the communities at each mini-charrette session/workshop and received positive and constructive feedback.

In parallel, during this period, the Design Team and Research Assistants completed both research and the creation of base drawings needed for later phases of the Initiative. The product of those efforts was a 615 page Haiti Initiative Akayè Resource Manual - a resource meant to assist the Design team in the present and to be helpful to others in the future as well. Local Coordinators assisted with research tasks but more importantly, collaborated with the Local Liaison and the Communication Liaison, establishing and maintaining ties and dialogue with locals, as well as organizing all Initiative sessions sustained across the region.

Over the same timeframe, conversations between the Design Team, CIAT, as well as Youthbuild International garnered needed input and interest in the Initiative's budding proposals. By the end of this phase, the Design team had a good handle on topics of concern, on expectations, potentialities, and challenges.

CHARRETTE PHASE

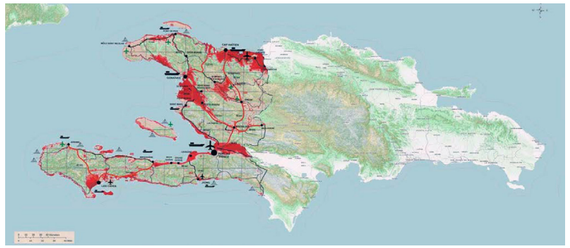
Capacity Building, Community Consultations, Meetings, Mini-Charrette, Technical Charrette

The charrette phase centered on receiving additional community input (March mid-term mini-charrette) and the technical refinement of ideas (May, in-house technical charrette) that had emerged during the previous mini-charrette sessions/trips. At the mid-term mini-charrette held in March, Arcahaie's communities were asked to again review the work in progress and to further inject their ideas into the designs as the Design Team prepared to head into the in-house technical charrette. The week-long technical charrette included the Design Team, professional consultants, historians, collaborators, University of Miami School of Architecture undergraduate and graduate students, CUCD Graduate Research Assistants, and everyone focused on the refinement of concepts and on initiating the production of final drawings.

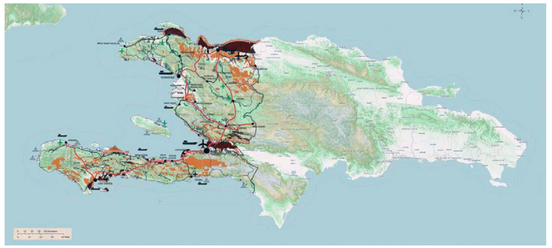
POST-CHARRETTE PHASE

Community Consultation, Drawing Production, and Vision Report

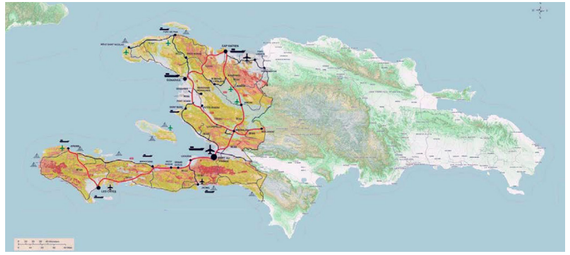
During the post-charrette phase, two trips took place, both for community consultation purposes. During the



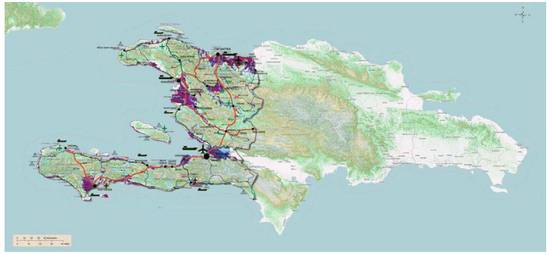
Liquifaction Hazard Zones



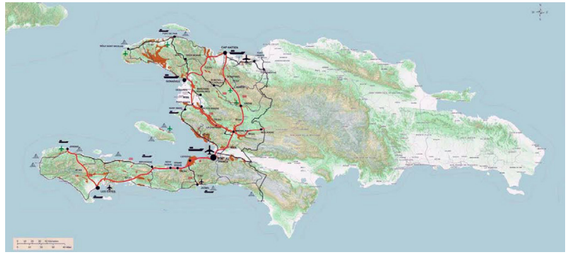
Multi-Hazard Zones



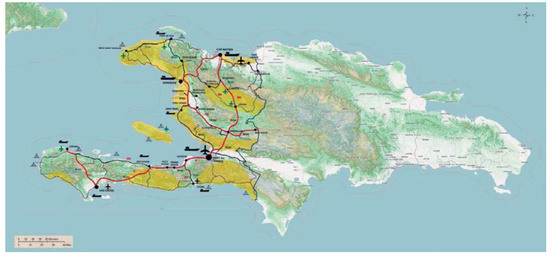
Landslide Hazard Zones



Flood Hazard Zones



Flood Hazard Zones



Drought Hazard Zones













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final trip to the region, the Design team again shared the evolving recommendations with the communities and their leaders to ensure that these had remained in line with the communities' aspirations and vision, as well as to receive their final approval and input, prior to submissions to the two sponsoring foundations.

The resulting Haiti Initiative Akayè Vision Report presents the community's vision, with site-driven architectural and urban designs -- at the regional, town or building scale. The Vision Report is a 'road map' for the sustainable redevelopment of the Akayè Commune's lowland - the coastal and delta plain sub-region. Despite the focus of this Initiative being on the Lowlands, many of the recommendations address issues affecting the Highland communities as well.

Design Challenges

Natural Environment

Deforestation in Haiti, which is tied directly to the production of charcoal, is a severe ecological problem that directly contributes to air pollution and soil erosion. If one chose to ignore the climatic repercussions of deforestation, chances are that nonetheless, the present and growing economic consequence grabs attention. In a region such as Akayè, which is economically dependent on agriculture, soil erosion is an increasing problem, affecting soil quality and thus crop yields. Food security is a mounting concern in the region, as crop yields diminish, soil quality is reduced, productivity is stymied, and population numbers rise.

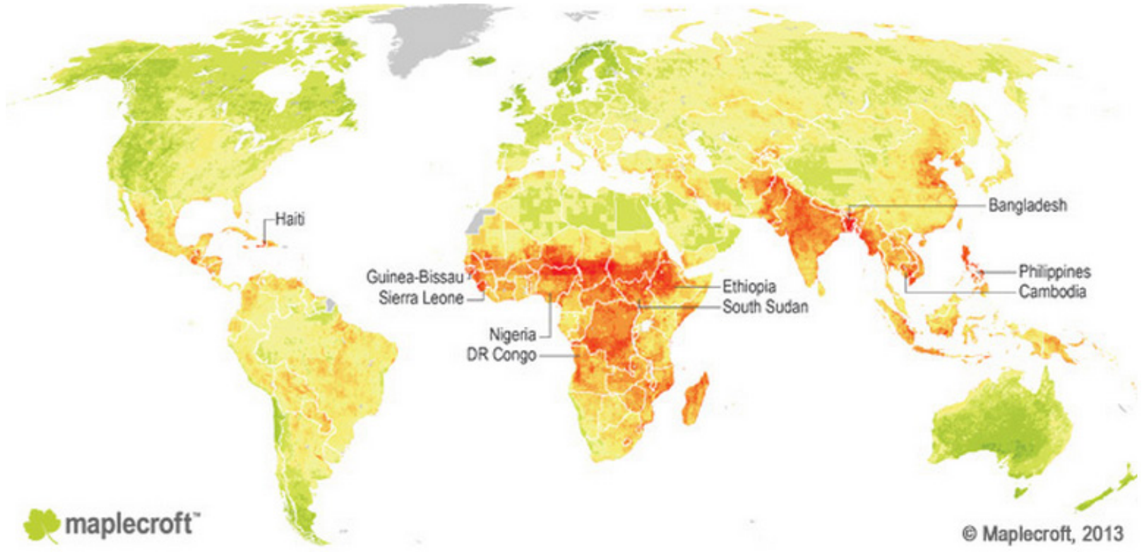
Not only is land being scarred but the sea is also suffering consequences, with run-off adding pollutants and refuse that negatively impact water quality and marine life. In addition, the decimation of coastal mangroves and over-fishing in shallow waters is leading to an added loss of marine life. In the long-run, this represents yet another reduction of food sources for the coastal populations of the region and a present-day unhealthy ecosystem. Be it from deforestation in the highlands that exacerbates flooding in the plains, or be it from the destruction of coastal mangroves sanctuaries that host the seeds of marine life and that protect communities from coastal erosion, and Sea Level Rise, the depletion of the region's natural resources is a growing threat to humans, crops, flora and fauna, which climate change will worsen.

Settlements and Infrastructure Deficiencies

A lack of regional and local infrastructure networks hinder progress across the board, impacting economic growth, health, and the general welfare of residents in the Akayè Region. These disconnections or deficiencies include unreliable or inexistent electrical and potable water supply networks, waste disposal systems, pedestrian and vehicular connectivity. Given the region's proximity to overpopulated Port au Prince, Akayè's population numbers will undoubtedly continue to swell and the already serious difficulties being experienced daily will undergo exponential propagation; potentially leading to significant health and economic crises.

In recent years, the rural character of the region, including the scale of its increments and their authentic architectural character, is giving way to the importation of homogeneous, walled-off, mechanically dependent housing compounds and insidious sprawl development. Land tenure issues further complicate planning, construction projects, and the identification of available parcels for services.

Regionally-scaled healthcare and higher education services are direly needed across the entire region, from the highlands to the lowlands. Too often pregnant women from the Highlands die on route to a clinic in the Lowlands. Children perish from a simple infection or a mosquito bite, and farmers involved in an accident die… all, needlessly. Clinics are rare and there is no trauma ward serving the



Rank	Country	Category
1	Bangladesh	Extreme
2	Guinea-Bissau	Extreme
3	Sierra Leone	Extreme
4	Haiti	Extreme
5	South Sudan	Extreme

Rank	Country	Category
6	Nigeria	Extreme
7	DR Congo	Extreme
8	Cambodia	Extreme
9	Philippines	Extreme
10	Ethiopia	Extreme

Legend
Extreme
Low
No data

Climate Change Vulnerability Index 2014. Source: www.maplecroft.com

overall region. Multiple clinics with complimentary services near the intersection of the main National Highway and roads leading to the highlands are needed, as well as in other under-served areas such as Corail.

In similar fashion, there is no University serving this entire region. Youth must travel either to Port au Prince or to St. Marks for a higher education. To aggravate matters, in the Highlands currently there is no high school, thus youth regularly forego an education past middle school or attempt living away from home on their own- often leading to other problems such as drugs, gangs, or teen pregnancy. A University level institution is warranted, as are other forms of education, such as vocational training.

Another major challenge for the people of Akayè is that job sectors are limited. Expanding activities into new forms of agriculture and tourism could be a simple, immediate, and profitable transition. Existing agriculture activities are thwarted by a lack of processing plants, refrigeration, and distribution facilities, thus a high proportion of crops are lost before they ever get to market.

The region is lacking cultural venues and its historic resources are often in a state of decay. Public beaches are few, compact and lack functioning amenities. For these main reasons, Akayè's economy wanes, its natural resources are dwindling, educational opportunities are very limited, and public health and social welfare are at risk.

Goals and Principles

The goal of this Initiative has been to develop a roadmap of feasible and implementable solutions to these and other design challenges, with the aim of proposing a path to sustainable development, based on the principles of social equity, economic development, resiliency, and environmental protection.

In recognition that the design challenges and their needed solutions are complex and require a variety of actors and timelines to address and solve them, this Initiative has been broken down into three distinct categories: Regional scale, Town Scale and Building Scale. This breakdown can also be understood as Long-term, Mid-term and Short-term goals, or also as interventions where the typical means for implementation lie within central and local governments (regional), with local government, business cooperatives, and civil society (town), or finally, with civil society and citizens (building).

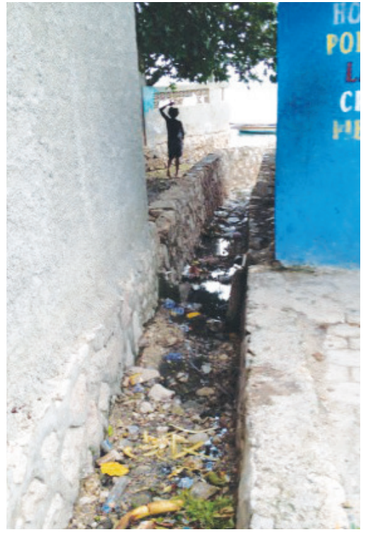
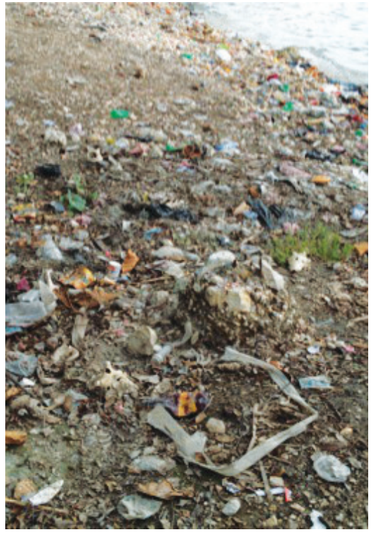
Focus Topics for Regional, Town and Building Teams

Regional Scale Team

The regional team focused on identifying ways of improving infrastructure systems, healing the scars of deforestation, controlling flood waters, suggesting sustainable forms of energy, locating emergency shelters, as well as indicating ideal nodes for economic activity, and regional centers with educational, healthcare and/or transportation provisions that are best positioned to serve the region at large. Special Districts are pinpointed, be they for waste management purposes or for research facilities. Thus a system of roads and infrastructure networks, pedestrian path and bike linkages, complimented by water taxi systems, an enhanced main port and smaller docks, and distribution and exchange centers are proposed. These can lead to interconnectivity between villages, tourism poles, and economic centers. Strategically located 'regional' educational, transportation, and healthcare facilities, as well as processing and warehousing uses are also proposed. These functions engender security, public health, social welfare, economic prosperity, and greater job opportunities. An important recommendation of this team is that growth not be sprawl, but rather compact and primarily as extensions of existing settlements or along main roads. This more compact approach permits a predictable understanding





of growth and reserves the highest amount of land for the main function of the region: agriculture. Additional types of tourism, including eco-tourism, cultural, and new sustainable agricultural activities can catalyze the region. This team proposed a new industrial center near the foot of the highlands to open up new job sectors and a new town, north of Luly to accommodate existing residents, and eventually new ones as well. Finally, the introduction of sustainably-minded initiatives, such as hydro-electric power dams, wind farms, the conversion of waste into bio-mass or building materials, bamboo farms, and, the protection of natural resources will lead to the overall prosperity, health, and security of the region.

Town Scale Team

At the heart of any healthy community is its civic life. With the insight of participating residents and leaders during the multiple local planning workshops, this Initiative identified place-making strategies around existing or proposed clinic, schools and other public/civic structures within town centers, precisely with the intention of activating public life, increasing a sense of 'pride of place' and suggesting where much needed services can be located in order to serve the greatest swath or the most under-served of residents. In addition, at the scale of towns, mid-term solutions for sustainable and renewable energy sources are proposed. Sites for new public spaces, markets, exchange hubs, commerce, recreation, parks, or docks are also identified, in some cases enhancing or completing already existing spaces. Strategies address community needs while being mindful of natural resources, economic development, and cultural traditions. Furthermore, the introduction of alternate forms of tourism, based on agriculture, ecology, sustainability as well as the preservation of culture, heritage, the celebration of the birthplace of the country's flag, and the traditions unique to rural areas are proposed, with the aim of widening the pool of potential tourists to the area, and spurring micro-businesses.

Building (Family) Scale Team

Adequate housing is a countrywide concern. Lay people with limited constructive knowledge, tools, or resources construct most housing. To date, the prevailing adoption of climatically indifferent prototypes reduces the quality of life of inhabitants, rendering buildings hot, humid, and dependent on mechanical systems that are expensive to run. Mixed-use and residential building typologies were designed in concert with residents and the result are 'easy-building plan sets.' They take into consideration local climate, day-lighting, and cross-ventilation, to improve living conditions, and reduce expensive mechanical dependencies. Plan sets address a variety of family needs and provide user-friendly graphic descriptions of attuned housing types and construction methods that respond to natural risks and climatic needs while incorporating readily available regional materials or innovative alternatives. A section of the report focuses on resilient design, identifying sustainable, low-technology energy, water, and sanitation systems; hydro-generation opportunities; and identifies sustainable urban agricultural practices. The Design team addressed with non-profit providers in Haiti the potential for developing a 'certificate program' or the possibility of establishing a vocational school focused on building construction systems that can train a skilled workforce for larger projects, potentially catalyzing local economies.

The Syncronization of Needs, Resources and Expectations: Arcahaie Vision Plan

Sonia Chao, AIA, University of Miami, School of Architecture Research Assistant Professor, and UM/SoA Center for Urban & Community Design (CUCD), Director; Gustavo Sanchez-Hugalde, Architect, Urban Designer and CUCD Research Affiliate; and Max Zabala, Architect, Urban Designer and CUCD Research Affiliate

The design of cities lies among human civilization's greatest achievements, with each new increment a historical reflection of the aspirations of its people. Often, settlements have arisen spontaneously, the product of happenstance, as is often the case in rural areas. On other occasions, they have followed inherited layouts or patterns. Commonly, in the Caribbean's coastal towns where colonizers first landed, this is the case.

Across time, in sliding degrees, architects, engineers, politicians, religious leaders, and/or public health officials have guided a town's envisioning process, focused on spatial form, the interactions between humans, nature and the built environment, commerce and/or defense. In general terms, the unique dialogues across history, between human beings and their architecture, town planning practices, and the natural realm, provide valuable lessons capable of guiding the present thinking of architects and planners alike. Discerning the various strands of an urban realm's DNA, including both past and present place-making strategies, often evidences the repercussions of the unchecked consumption of natural resources on the one-hand, and on the other, the value of time-honored planning strategies, which promote self-sufficient, compact, mixed-use, walkable communities.

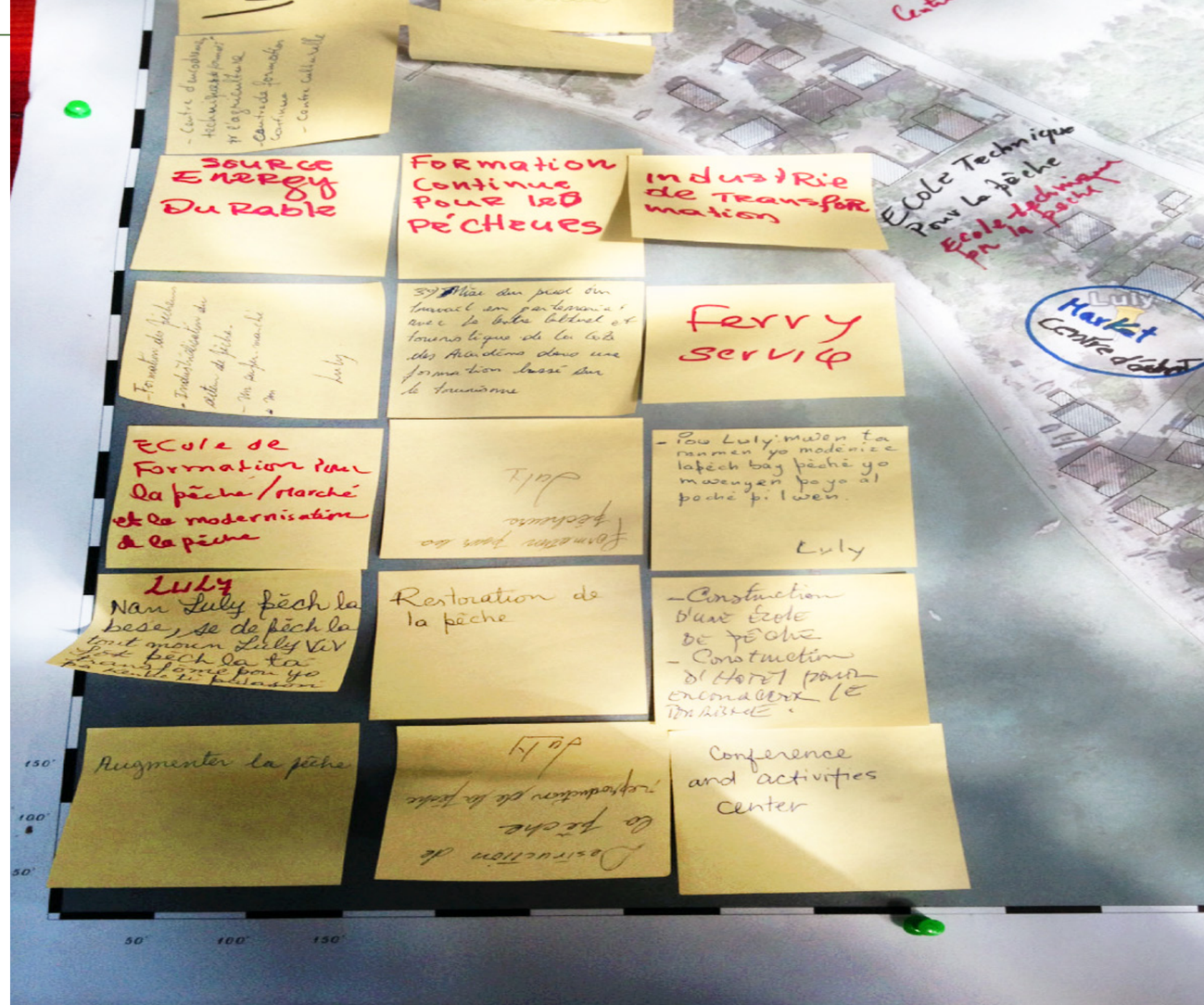
Many of Haiti's rural towns, villages, and hamlets are examples of sustainable development patterns, which in their genetic coding contain all the basic elements needed for a viable and vibrant community. Several such examples are found in the Commune of Arcahaie. (For related information, reference the Town Scale Section of this report.)

Communities also need to be buttressed by adequate social, economic, cultural and infrastructure networks or systems, which can in turn catalyze economic development, protect human life, and enhance the overall quality of life of the population.

The Features and the Needs of the Commune of Arcahaie
"Haiti's Breadbasket"

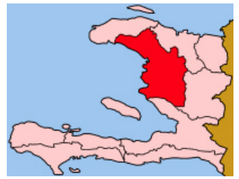
The commune (region) of Arcahaie is located 32 kilometers NW of Port au Prince, and is 393.6 km squared. In 2003, the population of this commune amounted to 102,639 residents. Originally, Arcahaie was known as Kayaha, and later as Akaha during the French colonial period. At present, there are six sub-divisions to the region: Montrois, Fond-Baptiste, Boucassin, Des Vases, Matheux, Delices, and one quarter named Quartier Saintard. The area is further understood as two distinct sections: the Highlands and the Lowlands. (Prophete, 2008)

The commune's Lowland is vulnerable to floods, due to the steep mountains that back up onto the delta. The rate and intensity of floodwaters has increased over the years, primarily due to deforestation. Frequent floodwater events are the primary concern related to natural disasters, given that the steep mountain chain serves to protect the territory from hurricanes (when they follow their usual easterly track), and the region is also sufficiently distant from the two major fault lines that bookend the country. That said, due to the quality of the sub-soils, the region's Lowlands are also vulnerable to Liquefaction, in particular, should an

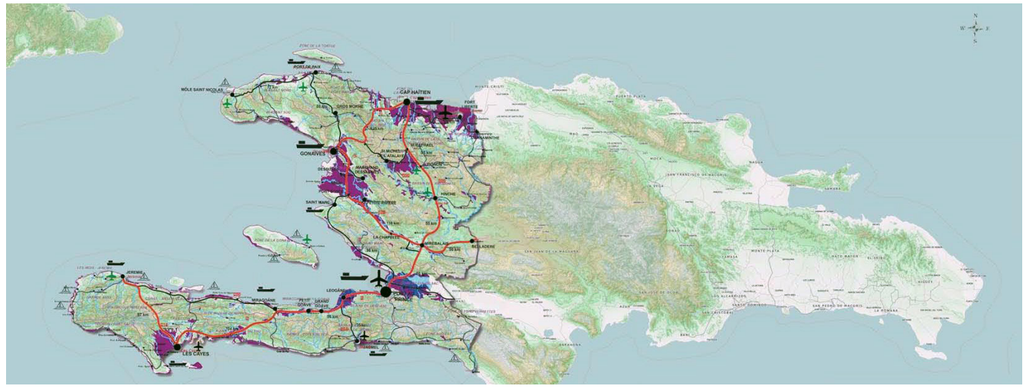




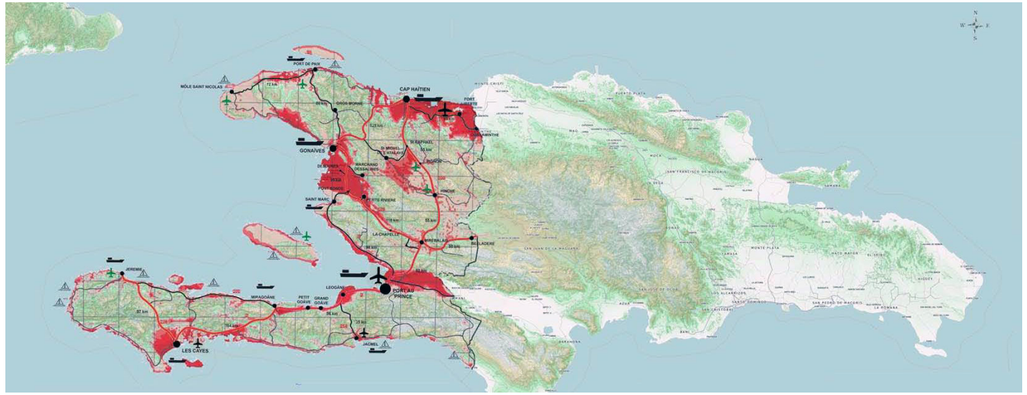
Many of Haiti's rural towns, villages, and hamlets are examples of sustainable development patterns, which in their genetic coding contain all the basic elements needed for a viable and vibrant community. Several such examples are found in the Commune of Arcahaie.



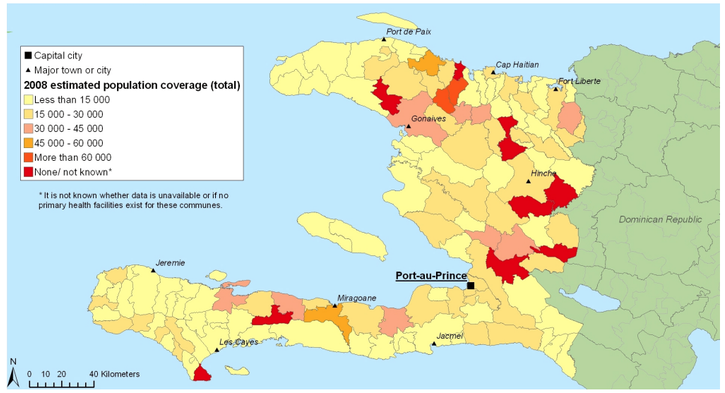
Commune of Arcahaie
"Haiti's Breadbasket"



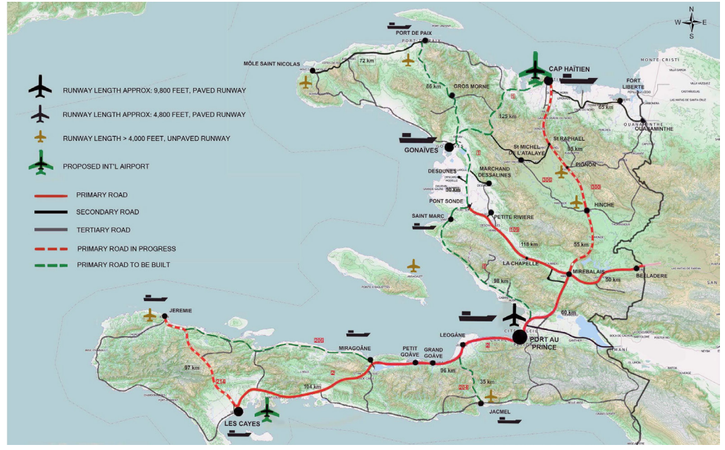
Regions Most Susceptible to Flooding. Source: Haiti 2010 Charrette/CUCD



Lowlands Vulnerable to Liquefaction. Source: Haiti 2010 Charrette/CUCD



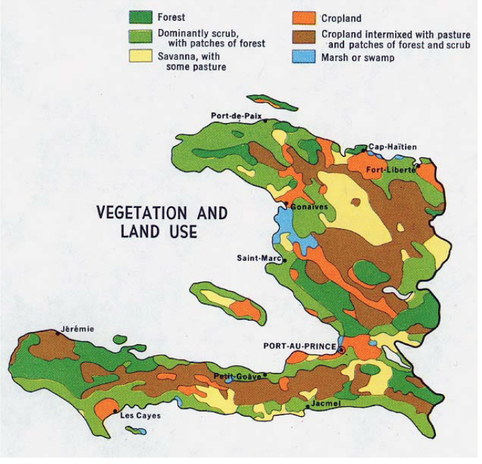
Population covered per primary healthcare facility. Source: United Nations Stabilization Mission in Haiti (MINUSTAH GIS), UNFPA, PAHO Haiti Health Facilities master list. Map production: Public Health Information and Geographic Information Systems (GIS) World Health Organization



Existing National Infrastructure Networks. Source: Haiti 2010 Charrette/CUCD



Arcahaie Region is the birthplace of a nation and its flag.



Vegetation and Crop Land-use Map. Source: Haiti 2010 Charrette/CUCD

earthquake event transpire along the minor fault located near Cabaret.

Although services and infrastructure across the entire region are in general either outdated, in need of repair, or non-existent, the Highland communities are particularly suffering from a lack of adequate access roads, healthcare, and higher education facilities, placing an added burden on already depleted civic resources located in the Lowlands.

Despite the commune's proximity to the capital, the region is served by only one main road, the National Highway. It traverses the entire length of the commune, and acts as the umbilical cord between the capital and St. Marks, while serving to connect the outlying towns and villages along the way. Secondary roads are often rubble and/or dirt, making passage to the mountain communities particularly unsafe at some key junctures.

The region's identity is tied to a significant historical event that took place near the present village of Corail. In this area, the first flag, marking the Haitian peoples' independence from France was created and flown. Historic sites include the Dessalines monument, the house of Catherine Flon, and the area of Grann Giton. There are also a sprinkling of other historic sites associated with the sugar mill industry across the region, including one near Montrois and another near Corail. In more recent decades, tourism offerings have scattered along the coastline, and typically set up as all-inclusive destinations.

For centuries, the fertile soils of Arcahaie, resulting from the delta that predominates the Lowlands, has resulted in this region being known as "Haiti's breadbasket." Agricultural crops include sugar cane, bananas, mangoes, tobacco, coffee and fishing. Agriculture is the main economic engine for the entire commune. Yet, farmers are increasingly facing challenges due to poor soil quality, frequent floodwaters, and a lack of distribution networks, options, and venues. "Three-quarters of the population depend on agriculture for food or for cash crops" and the agricultural sector employs about two thirds of Haiti's work force. (Icart, 1999) Farming is typically characterized by numerous small plots of land, averaging slightly over one hectare per family, on which crops are grown for consumption, and others for sale. Few farms exceed 12 hectares. Often, Haitians employ a unique agriculture method called arboriculture, which combines fruit trees and various roots, particularly the manioc plant (the traditional bread stable replacing grain culture). Crops are cultivated with simple hand tools, as the plow or animal power is very rarely employed due to the cost. (Reference Town scale section of this report for related information and recommendations.)

Case Study Sites: Arcahaie, Corail and Luly

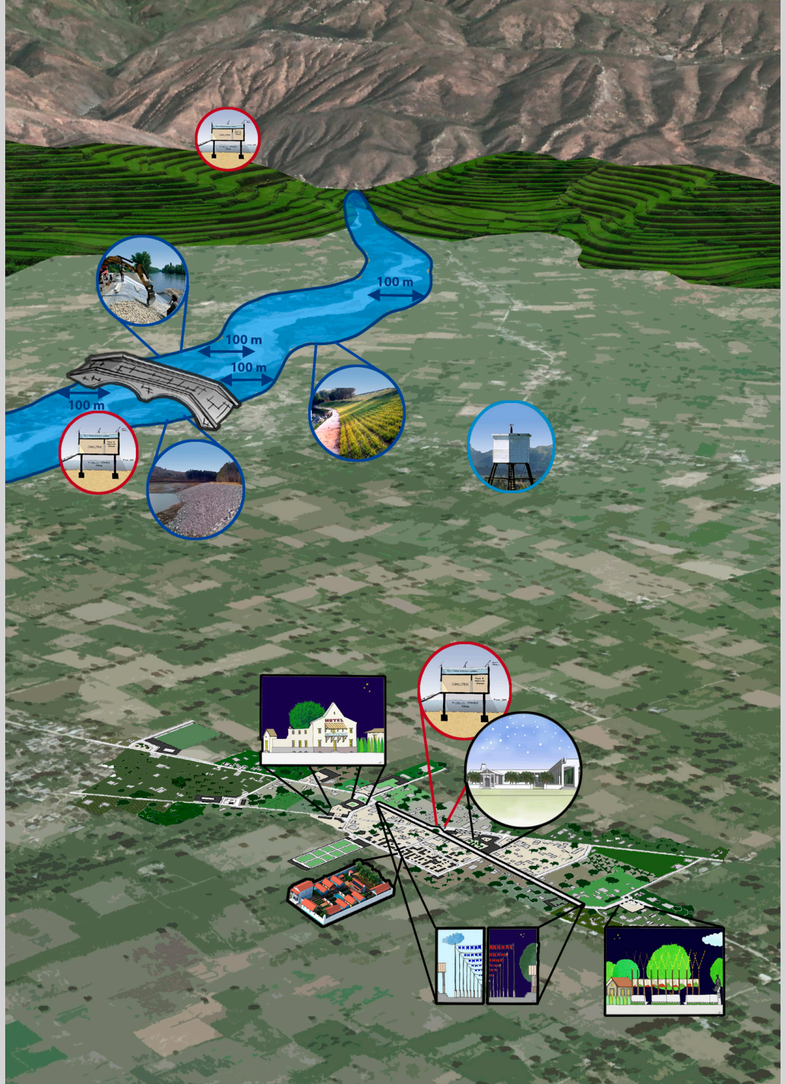
The region has three main types of settlements; formal, neutral and informal.

Arcahaie is an example of a coastal historic town, with a formal urban grid defined by its pattern of streets and blocks and it has a variety of building types. It's urban layout is the product of the French 'arpent' system combined with formal (grid) town-planning strategies common to civilizations across the globe and history. There are civic buildings and public spaces. The town's prevailing identity is defined by the many abutting Ti-kay wood-frame structures and its Victorian Style structures as well. If a significant number of these historic buildings were properly and sympathetically rehabilitated, they can become a marketable 'district' and, the source of local prosperity, with new tourism related activities and businesses.

Corail is an example of a linear settlement, neither formal or informal in its overall character. It stretches along a



Overview of Recommendations within or surrounding the town of Arcahaie



Overview of
Recommendations
within or surrounding the
rural settlement of Corail



Overview of
Recommendations
within or surrounding
the Village of Luly

road that traverses agricultural fields. It currently lacks sufficient civic functions or adequate public spaces. Once prevalent Lakous, and their chorus of Ti-kay dwellings, are slowly disappearing and being replaced by masonry, walled-off compounds. Those tall garden walls serve the purpose of securing the private compound, but they also debilitate public life. New civic buildings and spaces, the rehabilitation of existing public spaces and monuments, as well as more porous garden walls along the length of the roads, can inject new life into this rural community.

The last type of settlement can be found in Luly, which is situated at the geographic mid-point of the region. It lies on a sloped terrain and has a high population density. This fishing village's overall form and organizational DNA is organic, contrasting Arcahaie's formal grid layout. Luly is a web of Lakous and primarily pedestrian paths, with few intersecting roads. The village can profit from some organizational clarity, public functions, and the introduction of much needed infrastructure. Coastal natural resources are at risk in this area and thus locals must re-evaluate current fishing practices to preserve habitats and ensure that over-fishing does not deplete the community's main revenue source in the near future. Given its close-knit social fabric and its waterfront setting, the village is well positioned to evolve its fishing industry and generate a broader mercantile economy, by introducing complimentary functions and businesses, while protecting natural resources.

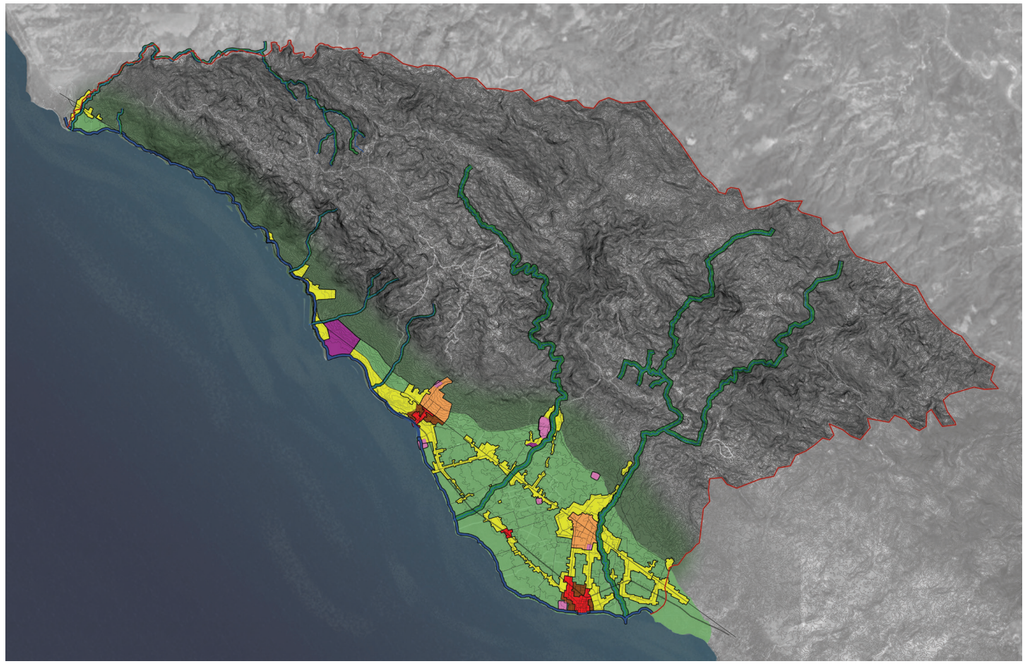
The Town scale section of this Vision Report provides specific recommendations for each of these Case Study sites, which can be replicated in other communities that share similar characteristics. Yet, the goals and aspirations of any given local community are tied to those of neighboring towns and villages, and that is where a regional plan can provide a coordinated vision for all.

The Purpose of a Regional Plan

In the case of the Commune of Arcahaie, the region's agriculturally tied identity needs to be reinforced, and that economic-base protected as well as expanded, in a sustainably-minded manner. Furthermore, the relationship between the natural realm and the built one is to be predicated upon a respect for the environment, a nurturing of the agricultural economy, and an understanding that unbridled sprawl consumes and depletes both. This signifies a need for predictable and sympathetic growth within the region, and of its towns and villages, in an orchestrated and coordinated manner. The introduction of a variety of much needed infrastructure systems is also paramount to the region's growth, prosperity and for public health reasons as well. A roadmap that guides the implementation of those goals is vital.

A Regional Plan precisely serves as the main tool to ensure those goals. A Regional Plan delineates areas for urban and rural growth and thus establishes a roadmap for predictable growth. It also identifies the combination of infrastructure systems needed to safeguard the long-term survival and protection of natural resources as well as agricultural lands, and those required to increment the prosperity of industry, education, and culture. A Regional Plan's overlapping and complimentary strategies make it possible for government leaders - local and central - to coordinate efforts, prioritize initiatives, and in the end, as the strategies are implemented, permit citizens in the region to succeed and to construct a better future for themselves and their families, precisely thanks to those coordinated and focused regionally-scaled and complimentary strategies.

Conceptually, regional planning mediates between central (national) and sectorial or town plans, and can provide a structure for the coordination and mutual adjustment of local plans and projects, while providing local populations a



Proposed Arcahaie Region Vision Plan



The relationship between the natural realm and the built one is to be predicated upon a respect for the environment, a nurturing of the agricultural economy, and an understanding that unbridled sprawl consumes and depletes both.



A Regional Plan delineates areas for urban and rural growth and thus establishes a roadmap for predictable growth.

greater voice in the envisioning of their region. Thus, regional planning can perform the vital function of intersecting between national (central) policies and resources, and local planning needs and objectives. Furthermore, it can create the armature within which all activities can be coordinated, with beneficial results for a wider segment of the population.

Regional planning takes into account the fact that daily activities routinely result in people moving across municipal lines, be it for work related activities, shopping, recreation, access to services, or the pursuit of an education. For these reasons, without planning for regional-scale determinants such as natural corridors, transit systems, institutional needs, and designated urban or regional nodes/ centers, even the best local planning efforts by a singular town may not reach their economic and social possibilities.

By definition, a regional plan is multifaceted, multidimensional, based on a strong foundation of collaboration, cooperation, and prioritized objectives for the greater, common good. In rural areas, regional planning is especially important and can be the driver of change, prosperity, and economic development. For these reasons, regional planning is essential, for it operates at a scale that can relate the interconnected layers of people's lives. It does so by taking into account the extended needs of a community in relationship to a larger network of settlements, to the natural resources that host them, and to the infrastructure systems required to make them truly viable. The planning of singular towns or villages is an important pursuit, which regional planning adds to and in great measure sustains.

Whereas through their hard work every citizen has the right to pursue a better quality of life for themselves and their families, they should do so with deference to the overall health of the community, the environment, as well mindful of social values, and traditions. A basic requisite for a successful and vibrant region is citizen participation and responsibility. By engaging with, joining in conversations and partnering in efforts with government entities, citizens can help to expedite collective goals leading to progress. Collaboration is thus essential. Respecting the agreed upon laws and their enforcement are also critical. Whereas government's classic role is to bolster a citizen's pursuits for economic prosperity, social justice, and security, by providing the infrastructure systems needed to secure the overall health, welfare, and safety of all members of society, and the protection of natural resources for everyone's benefit as well - on the other hand, it is every citizen's responsibility to follow the rules and regulations. It is that combination which leads to making the 'Vision' a realization.

The Arcahaie Vision Plan: Regional Scale, Town Scale and Buildings Scale = Long-term, Mid-term and Short-term Initiatives

The Arcahaie Vision Plan is a comprehensive set of recommendations that weaves together three main scales of development: the Regional Scale, Town Scale, and Building Scale. Each of these scales implies differing timelines, be they short-term, mid-term or long-term interventions, that can also be thought of as small, medium and large scale projects that can in turn be taken on by central/national governments, by local governments, local cooperatives and NGO's, or by individual citizens. Each of these scales has its own inherent set of goals and focus but they also inform and interact with the other scales, in ideally, complimentary and orchestrated ways. The Arcahaie Regional Vision Plan pulls these scales and their objectives together, and proposes a coherent direction for progress that responds to the different needs of communities, the realities of the environment and the aspiration and needs of its people both presently and as they look to a better future for their children.

The Arcahaie Regional Vision Plan - An Inclusive Process

Regional Planning cannot be successfully achieved in a vacuum, in an enclosed and private environment, away from the study area nor can it be complete without the essential input and buy-in of local residents and business owners alike. Therefore, in this effort the active engagement of local leaders, non-profits, and citizens was sought and it guided the visioning process. Best practices, professional expertise, local traditions, contemporary and future needs as defined by locals, all come together to form a new vision that allows everyone in the Lowlands of Arcahaie to understand, the predictable manner in which their region can potentially grow. That change will be over an extended period of time, and it will be incremental, but with perseverance and, collaboration between central, local governments, and local leaders and citizens, it will lead to a cohesive and sustainable environment for current and future generations.

The Arcahaie Regional Vision Plan: SWAT (Strengths, Weaknesses, Assets, and Threats) Assessment

The following recommendations are the product of numerous public meetings, sessions, workshops, and site visits in addition to a preliminary research phase, consultations with local leaders, consultants and the benefit of professional, academic expertise and the incorporation of professional best practices. The ideas and concepts were incubated and developed from concerns, requests, and suggestions from the general public, as well as local leaders.

During the different site visits and public workshops the general population, local leaders, and the design team identified the following strengths, weaknesses, assets or threats:

- the lack of adequate institutions (i.e. the need for additional higher education institutions, as well as a wider spectrum of offerings, including high school, vocational school, research centers, and university satellites and the need for additional healthcare institutions/clinics to address maternity, surgical, and specialized needs, such as infectious diseases.)
- the lack of adequate infrastructure systems (vehicular and maritime transportation systems, flood water controls, potable water, sewer systems, garbage collection, electricity, etc.)
- the lack of emergency shelters in the region;
- the poor condition and growing risks to the natural environment;
- deforestation, conservation concerns and procedures;
- the adverse impact of sprawl development and its consumption of natural and agricultural lands;
- sluggish economic development and a lack of jobs;
- potential growth sectors for industry, manufacturing, agriculture/aquaculture and tourism;
- the role of tourism and its connectedness to the region's agricultural identity and their collaboration in the protection of the region's natural resources on land and sea;
- current, and desired quality of life factors;
- and a battery of approaches to counteract the current situation.

The Arcahaie Regional Vision Plan: Implementation Phase - Strengthening Partnerships for the Long-haul

The Arcahaie Regional Vision Plan comprises a series of recommendations that require further collaboration among central and local governments, non-profit, citizen groups, citizens, and professionals/technicians to define the parameters and tools for implementation and its forthcoming phases. Without the concerted and continuous cooperation across the entire spectrum of leaders, interest groups, and citizens, any vision is dead in its tracks, no matter how well the initial envisioning process may have catalyzed interest, commitment and given a face

to the input and aspirations of the communities. A clear structure, with perhaps a Steering Committee composed of members from each of the interest groups, leaders, institution, and citizen groups can help to keep the goals moving forward and this structure can create an armature for the on-going cooperation needed to implement the Vision Plan, no matter who is in office or what political party is leading. Additionally, in this manner, each group is invested and has a voice. This partnership is not meant to weaken the role of leaders nor institutions but rather to empower them with an added army of allies willing to collaborate with them to expedite actions.

The Arcahaie Regional Vision Plan - Four Main Objectives
The Arcahaie Regional Vision Plan has four main objectives: Climate Resiliency, Social and Economic Development, Improved Quality of Life, and Environmental Conservation and Reparation.

I. CLIMATE RESILIENCY
The Arcahaie Regional Vision Plan goal is to reduce the region's acceleration of, or exposure to, the effects of Climate Change.

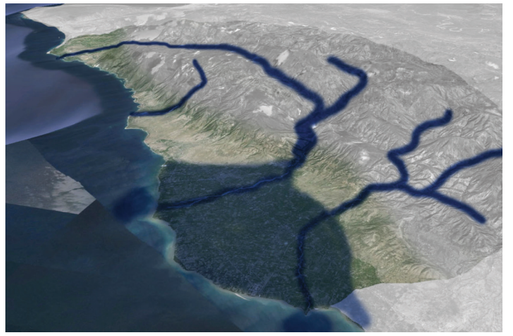
Goals:
- reducing the risk to and adverse impact of flooding, soil and coastal erosion, and deforestation on people, property and wildlife habitats;
- striking a balance between the natural behavior of the delta water flows, its relationship to coastal erosion, and its impact on settlements, human and animal life, arable lands, and built property;
- promoting and providing alternative solutions for clean water, basic sewer infrastructure, alternative energy sources, that tread lighter on the land and create new job opportunities in renewable energy markets.

The Arcahaie Regional Vision Plan - Actionable Items
1. Deforestation and Erosion
Due to past and current deforestation activities and its resulting erosion along the face of the steep mountains, once fertile soils are rendered unproductive by increased amounts of sedimentation that accompany the accelerated and copious amounts of rainwater traveling down to and across the plains. The resulting added sedimentation settles across the plains or winds up in the ocean, increasing the ground level height of the ravines. During rain events, the natural drainage ravines overflow their embankments and this in turn results in the inundation of agricultural fields, homes and towns. This flooding causes loss of lives, agricultural crops and vegetated areas, as well as the destruction of the built environment, and ocean pollution. To reduce these risks, several elements and control features should be implemented, some at the Regional Scale, other at the Town Scale, and other at the Building Scale.

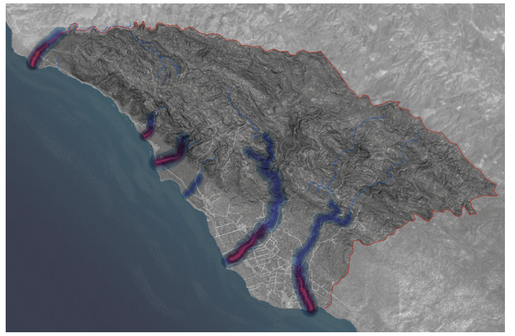
2. River Bed Restoration
Natural drainage should preserve its original path, by restoring the proper depth of the ravine waterbed. Furthermore, the ravine waterbed sediments could be an ideal aggregate material for construction.

3. River Embankment Reinforcement
As part of the riverbed restoration, in some instances it will be required to reinforce the natural embankments where the path turns. (Strategies for embankment reinforcement are further explored in the Engineering report section.)

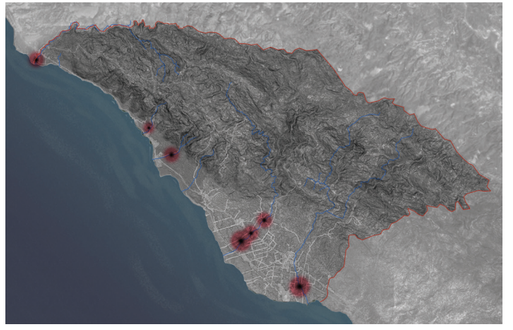
4. Coastline Restoration and Management
a. Mangrove deforestation is to be avoided because it not only impacts the eco-system which hosts a variety of species, they also protect the land during natural disasters such as hurricanes or from sea level rise.



I./1. Deforestation and Erosion



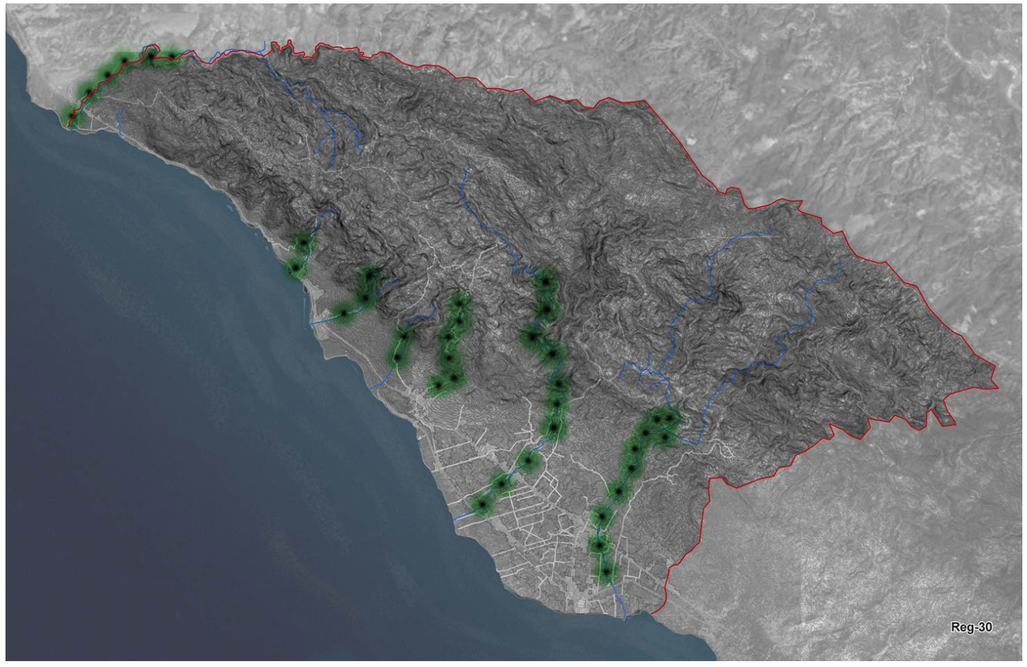
I./2. River Bed Restoration



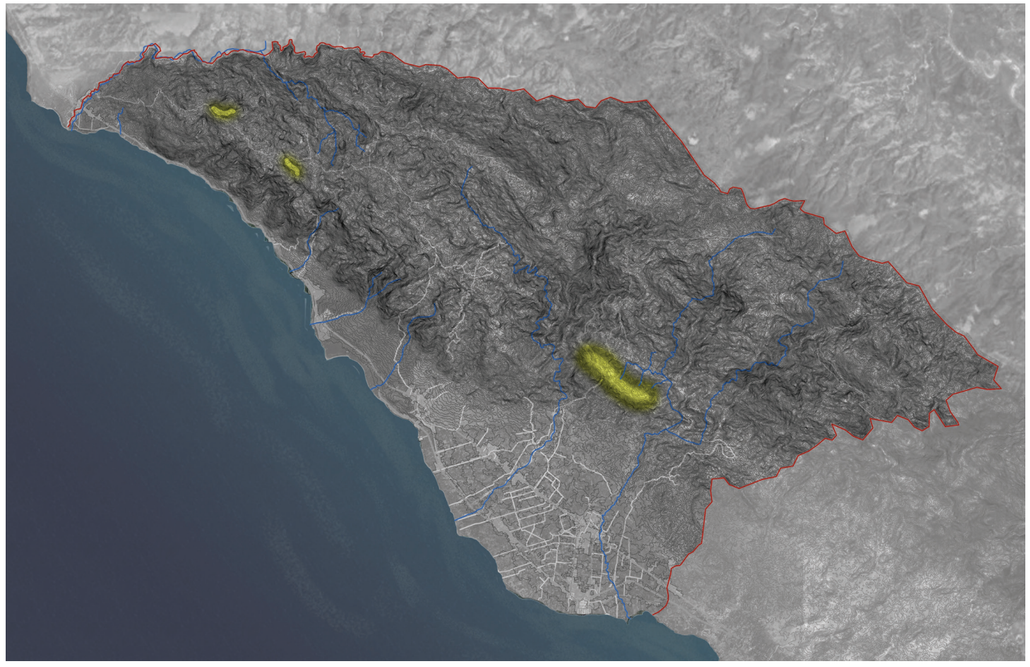
I./3. River Embankment Reinforcement



I./4. Coastline Restoration and Management



I./5. Flood Prevention - Proposed Flow Control Locations



I./5. Flood Prevention - Proposed Location for Wind Farm

b. Proper Mangrove preservation is to be promoted to avoid coastline erosion and loss of land.
c. Privatization of ocean front is to be avoided and
d. Public access to ocean front is to be promoted and where possible recuperated.

5. Flood and Erosion Prevention and Proposed Check Dam Locations

a. Check dams of different scales are recommended on branches of drainage but they are not recommended at the main ravine that should be embanked and have a nonstop water flow.
b. At the convergence of multiple branches of drainage ravines in the highlands, a check dam of bigger dimensions and capacity may be implemented.
c. Check dams have the capacity to control larger rain events, to provide water storage for irrigation and potable uses, and the potential for energy generation.
d. These interventions provide the possibility to acquire a highly sophisticated water management with very low tech requirements of development, and have the potential to completely re-shape the land and the economy of the region.

6. Natural Disaster Emergency Shelters - General Location and Area of Service

a. Given the frequency at which natural disasters strike in the region, and keeping in mind a recent MIT study suggesting the need for Natural Disaster Emergency Shelters in the delta regions of the nation, these facilities should be provided across the Lowlands of Arcahaie in particular, as they are at the highest risk. These structures can have multiple uses, and serve residents found within a radius of approximately 2.5 kilometers.
b. The shelter should be elevated above the 100 year flood plain, accessed by a ramp in order expedite access and thus to preserve the lives of people and their livestock . Each shelter should be outfitted with a secure storage room with emergency related food provisions, potable water and first-aid resources.
c. The shelter should be self-sufficient, with rain water collection cistern, and solar panels for energy generation on the roof.
d. The lower level open porch is a public shaded area, that can be used as determined useful and that would not obstruct the easy access to the upper shelter in an evacuation. The elevated shelter can be used daily for gatherings and events, during non-emergency periods.

7. Renewable Energy Source - Proposed Location for Wind Farm

a. There is the potential in the region for large scale Renewable Resource Wind Energy Generation. These locations are approximate and should be further developed as long term solution.
b. Other alternatives for energy generation at the Town Scale and the Building should be considered in the short and mid-term of development. (These recommendations are further analyzed and/or developed in the Engineering Report Section.)

II. Social and Economic Development

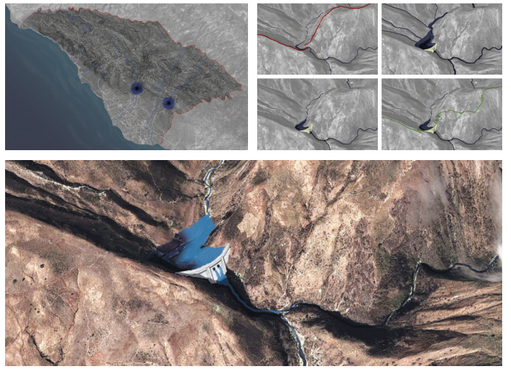
The Arcahaie Regional Vision Plan goal is to realize the social and economic potential of the region and of its people.

Goals:

- facilitating the development needed to support the region's business, tourism and agricultural sectors and clusters with adequate infrastructure provisions;
- maintaining and strengthening inter-regional connections by improving access to economic opportunities and diversity;
- providing for job sector growth, small business



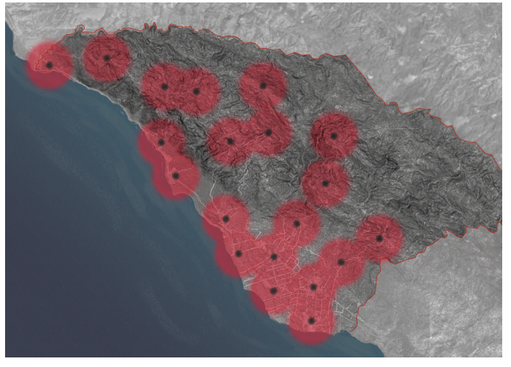
I./5. Flood and Erosion Prevention



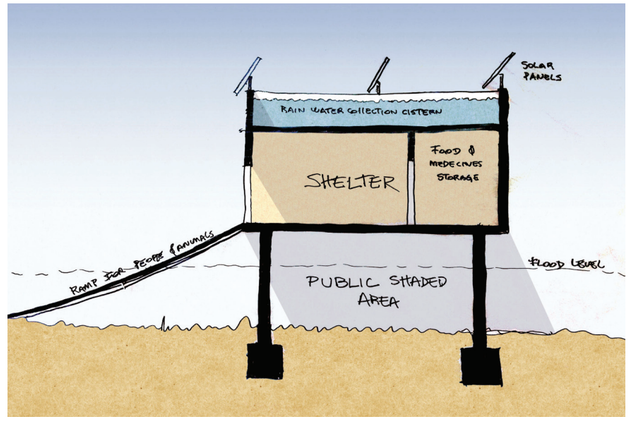
I./5. Check Dam Locations

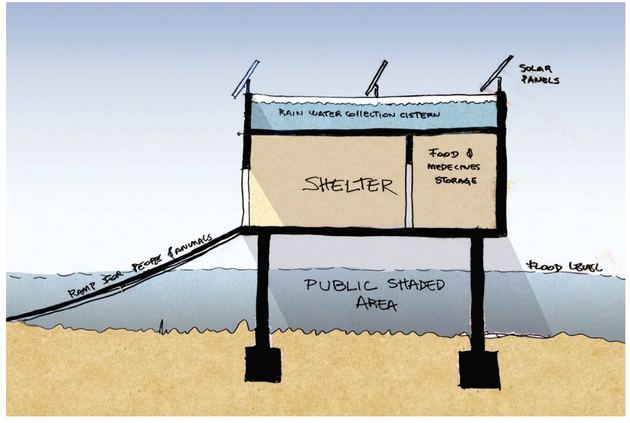


I./5. Check dams have the capacity to control larger rain events, to provide water storage for irrigation and potable uses, and the potential for energy generation.

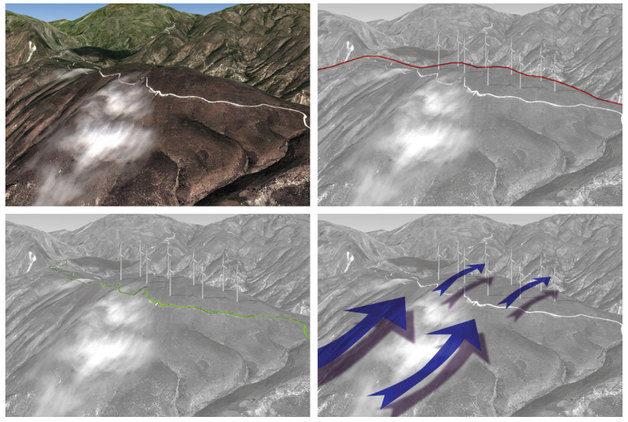


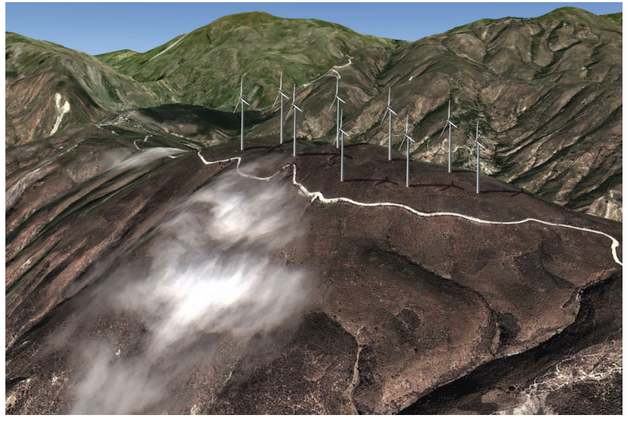
I./6. Natural Disaster Emergency Shelter General Locations and Areas of Service





I./6. Natural Disaster Emergency Shelter
Source: MIT Report / Leslie Voltaire





I./7. There is the potential in the region for large scale Renewable Resource Wind Energy Generation.

development, and improving employee skills;
- ensuring adequate and sustainable transport infrastructure, by land, water or both; and,
- proposing the addition of safe pedestrian and cycling networks.

The Arcahaie Regional Vision Plan - Actionable Items Overview

a. New Regional poles are conceived as serving the larger region; they should be constructed near the main intersection into Arcahaie and also the main intersection leading into Luly where population densities are greatest and existing roads facilitate access.

b. The region needs a major commercial market hub, equipped with refrigeration warehouses and a food processing center to increment jobs and agricultural activities while reducing crop losses. If located along the National Highway near the intersection leading into Luly and centrally located to highland communities as well as the vast agricultural lands that surround the area, this new hub can compliment the port-side market recently built in the town of Arcahaie, which in turn can serve as a staging ground for seabound exports to other regions or eventually other neighboring countries, while it caters to local residents and prospective tourists as well.

c. Build an arterial road for heavy truck traffic connecting Port au Prince, Arcahaie and Luly and the proposed industrial center, by the foot of the mountains approximately half-way between these last two communities.

d. Introduce new job sectors, related to construction materials, bamboo farming, food processing, while expanding offerings in the Eco-tourism and Agro-tourism sectors, as well as the mainstream hospitality and tourism offerings.

e. A network of new pedestrian trails in the Lowlands, and hiking and biking trails as well as zip-line activities in the mountains, can generate new micro-businesses, such as rentals while augmenting or connecting tourist attractions.

f. Expand arable lands. Terracing the foothills of the mountains, all along the region, can provide new areas suitable for reforestation and agriculture, thus expanding the capacity of this industry while affording large scale general benefits, such as water management, erosion and flooding controls, not to mention, restoring nature's balance in the region.

g. Promote and nurture new job sectors in alternative energy, green industries and the recycling of trash and biowaste matter. In all cases, these sectors tread more lightly on the planet's resources and result in a healthier environment as well as a more reliable source of energy and more affordable building materials, as recycled materials for construction are derived from what is currently a nuisance: used plastic and paper or bio-waste. Specialized small businesses can be created and incentivized to collect the trash while others can process the material for re-use. As this sector grows, the current dependency on coal derived from wood, would be reduced and hopefully soon eliminated, at once generating healthier air quality and the reforestation of the region.

1. Road Infrastructure

Existing Network

The existing road network in the Region of Arcahaie is incomplete and in different stages of development. The Main Highway is a high-speed road that has little or no change in its section when crossing populated areas, but, the highway is mostly paved. Some roads shown in this diagram are currently a clearing, which may be used as a roadway , others are simple dirt roads, and a few are paved roads. Some smaller bridges have been destroyed over the years due to flooding, and in some locations they are much needed, but have never existed. The old train track has been completely abandoned as mass transit, and is currently being used as a road way, and/or pedestrian path. As for the mountain villages, they have very little connectivity with the main highway or between each other.

Proposed Network

a. Road Infrastructure recommendations are framed in the context of completing the current network of thoroughfares, and improving connectivity in areas where access is limited, such as in the case of a new loop road that can connect the higher areas of the agricultural plain with the main artery of the region, the National Highway, as well as the Historical Road through the Town of Arcahaie.

b. Thoroughfare design is handled at the Town Scale for most of the thoroughfares. The following Regional Scale recommendations should serve as general guidelines for development.

- As the shared setting for most buildings, thoroughfares provide the constant potential for community interaction. As such, thoroughfares must be carefully designed for a pedestrian friendly environment, while allowing for vehicular capacity.
- Pedestrian character is formed by a combination of frontage and streetscape. But, these alone cannot create a pedestrian friendly environment unless the velocity of vehicular movement is also designed and controlled. The posting of speed limits is ineffective unless the speed of cars is continually monitored.
- The velocity of vehicular movement is influenced by physical factors. Some of these factors include the width of lanes, the provision of parking lanes, the centerline radius, and tighter turning radiuses.

2. Road Infrastructure - River Crossings

a. To promote connectivity across the region, most main roads should connect across the existing ravines. The type of water crossing will differ, depending on the speed of implementation, capacity requirements, connectivity needs, location and available of funds and based on the short, medium and long-term needs for development.

b. Some of the different types of water crossings are further analyzed in the Engineering report section. Diagrams in this section illustrate some of the potential crossings to be addressed.

3. Road Infrastructure - Proposed Water Taxi System

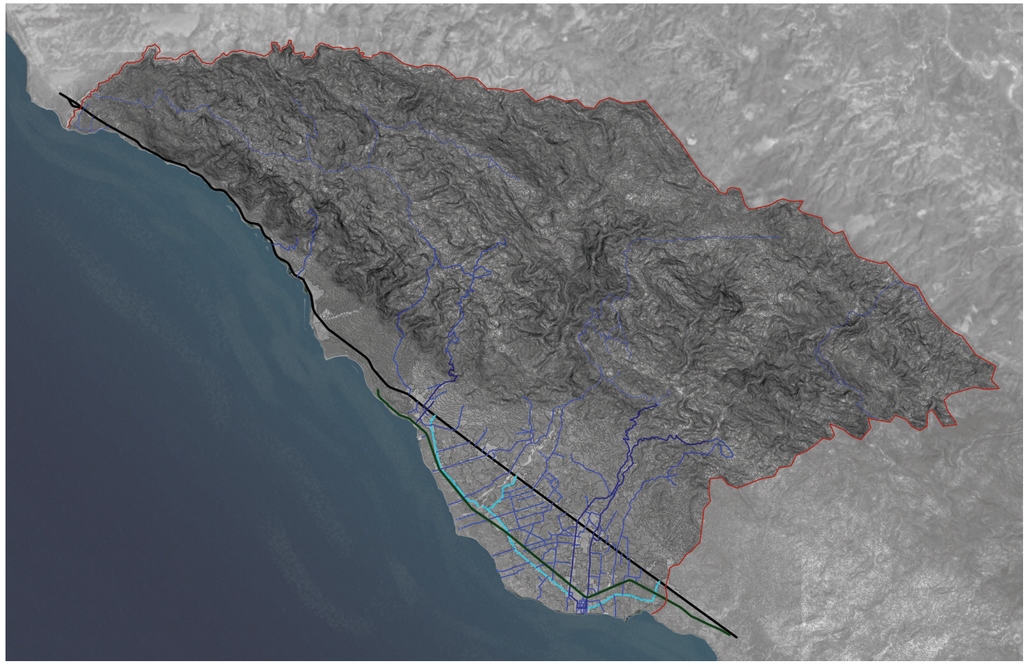
a. Because of the limited road and pedestrian connectivity the use of the ocean as an alternate route is suggested for a convenient and inexpensive water taxi system. It can complement tap-tap services in the region.

b. A water taxi system should be implemented to link the various settlements of the coastal region of Arcahaie. This will facilitate access to facilities, services and job opportunities.

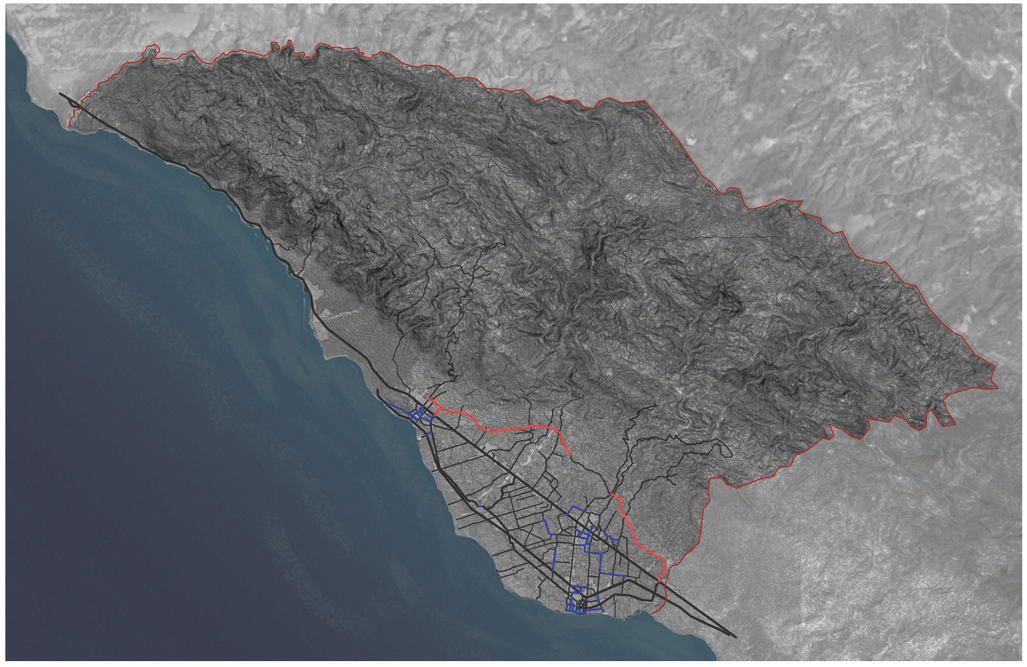
4. Road Infrastructure - Proposed Commercial Water Taxi

a. It was understood during all of the public meetings and site visits to the Region that there is a large capacity for food production in different locations of Arcahaie. However, the difficulties for distribution, storage, and exchange of goods are mostly due to logistical/transportation problems. These hurdles include: the lack of an adequate road network for the transportation of goods, few options for distribution and export, a lack of cold storage locations, as well as few and un-organized exchange centers.

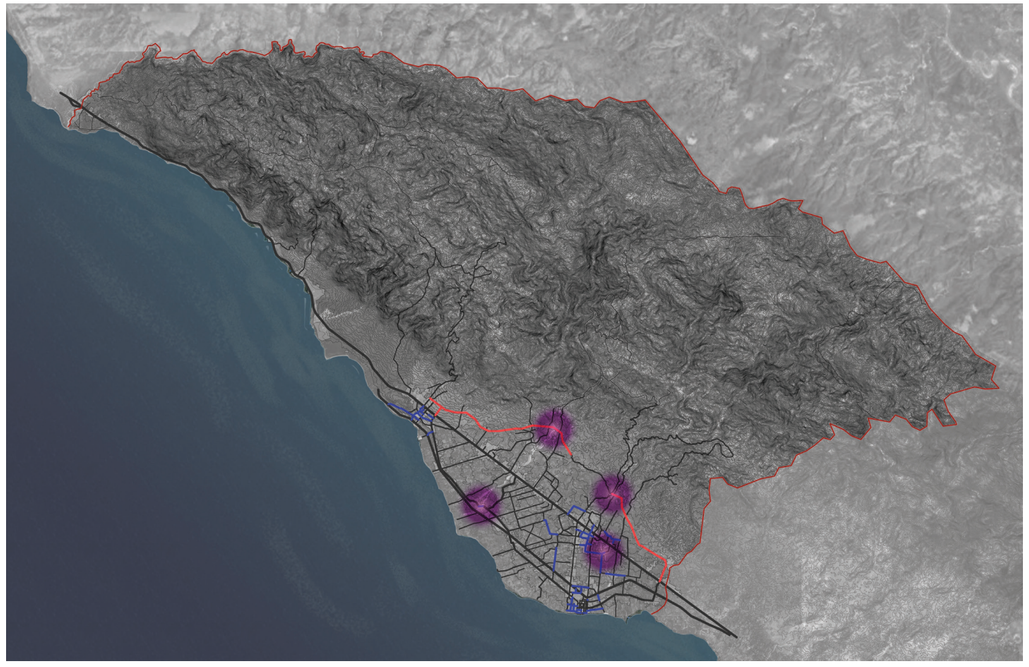
b. A major issue is the long distances required to move products, which is further aggravated by the



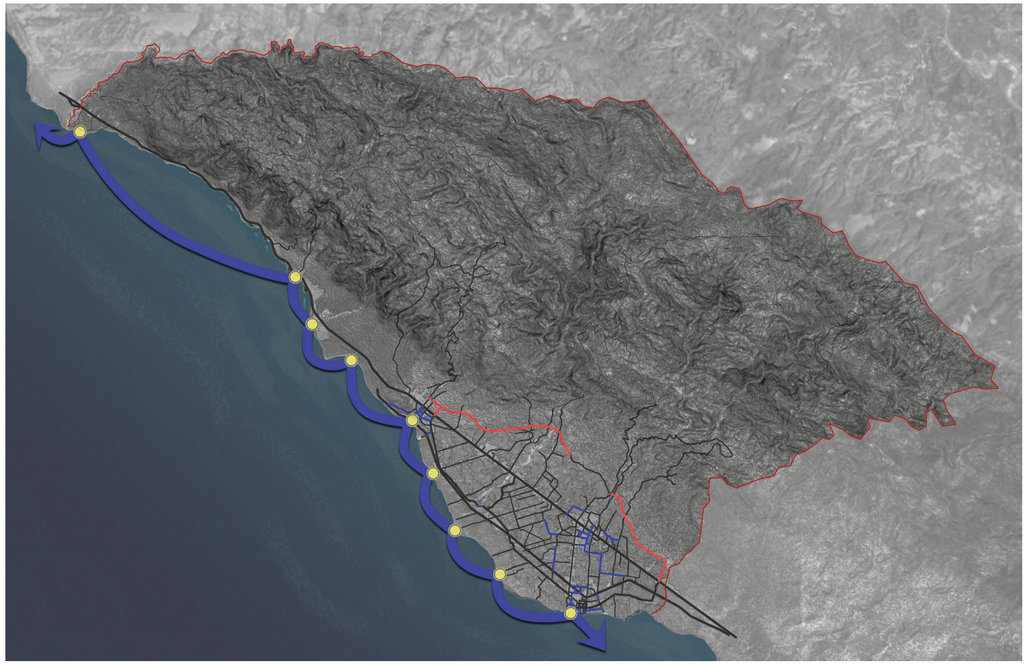
Road Infrastructure - Existing Network



Road Infrastructure - Proposed Network



Road Infrastructure - River Crossings



Road Infrastructure - Proposed Water Taxi System

lack of proper transportation and refrigerated or dry storage facilities.

c. In addition to the improvement and expansion of roads across the terrain, a regional commercial water taxi network should be implemented to link the three major areas where commercial activity is nascent. Furthermore, at those same locations product storage and distribution centers should be either introduced, maintained or expanded, as the case may call for. Products from the mountain regions should be transported down on improved roads, to the market in Arcahaie or to the proposed main market/exchange hub in Luly. From those exchange points, products can be move to any of the three proposed waterfront distribution and storage locations. One such waterfront distribution and storage facility can be located near or in Montroius, one by the proposed dock at Luly, and another one in the existing port-fronting market of the town of Arcahaie. The three distribution and storage centers will be linked via the highway, and if built, also by the proposed arterial road, as well as the commercial water taxi route. Waterfront distribution and storage sites with dedicated piers can complement the larger venue at the Luly Regional Center and the Arcahaie Waterfront Market. These waterfront facilities can have their own piers built for ease of loading and un-loading of products. The commercial water taxi can also connect with Port-Au-Prince and St. Marks, as well as other regions of Haiti, or even international locations, thus facilitating the import and export of goods.

III. IMPROVED QUALITY OF LIFE

The Arcahaie Regional Vision Plan goal is to improve the quality of life for the people of the region.

Goals:

- ensuring development (new and redevelopment of existing) fulfills the fundamental principles of sustainable communities;
- providing a well-designed living environment, adequately supported by social, economic, cultural, institutional and infrastructure networks;
- promoting social cohesion by improving access to education, health, work, services and other facilities, especially for those who are in under served, densely populated, and/or remote locations;
- maintaining cultural diversity across the region;
- promoting the regeneration and renewal of existing disadvantaged areas; and,
- increasing community involvement in the implementation of the Arcahaie Vision Plan at the local level.

The Arcahaie Regional Vision Plan: Actionable Items

1. The Arcahaie Regional Vision Plan - Proposed Land Use Map

A Regional Vision Plan permits leaders and their agencies to set priorities and to envision the development of the Commune over time. Regional plans have long-term goals and objectives, and are intended to serve the region's entire population, with the aim of coordinating and orchestrating development in a coherent manner for a given region that is to the benefit of all residents. That long-term optic is essential to the overall health, prosperity, and economy of the entire Commune.

a. The Arcahaie Regional Vision Plan addresses the voiced concerns of local citizens and leaders and directly responds to them with implementable recommendations. The first step to achieving their goals is to formalize this instrument and adopt its recommended strategies into central and local planning efforts.

b. The most useful tool of a Regional Vision Plan is the Land Use Map. It is an overview of strategies and illustrates existing and recommended patterns



Road Infrastructure - Proposed Commercial Water Taxi

of development for an entire region, so as to guide predictable growth for the overall area. The main sectors of a region are broken down into two main categories: Natural Preserve Sectors and Settlement Sectors, whether they be urban or rural.

2. Settlement Sectors - Urban Sectors

a. In the Arcahaie Regional Vision Plan, existing settlements, which currently have urban characteristics and population densities, or have that potential are assigned as 'Urban Sectors'.

b. Urban Sectors have already been developed and are subject to successional development or are in need of protection, repair, or completion. Population in these sectors is expected to continue to grow and thus place even greater burdens on an infrastructure that is already weakened or absent altogether. Therefore, these sectors should be a high priority for development and infrastructure improvements.

c. The characteristics of a given Urban Sector have been defined by several variables, including topography, siting, period of its foundation, surrounding natural features, and social customs. In general terms, towns and villages possess the largest number of inhabitants. There are formal and informal settlement patterns; in one the patterns of growth are unpredictable and are organic, in the other, typically, growth patterns and building increments are identifiable and predictable.

d. In the Region of Arcahaie, three different typical urban patterns have been identified and serve as case study sites, which in this Vision Report are further analyzed and developed as Redevelopment Case Studies in the Town Scale section. In addition, in the Building Scale section of this report, complimentary building types and scales are paired up with each type of community and its size (i.e. urban to rural building types/ formal to informal). The concept suggests that just as a fisherman has specific tools to use in a coastal habitat, different from those a hunter utilizes in the mountains, or for that matter, just as a coastal mangrove is different in its function and features from a rainforest or savannah, so too a logical relationship exists between the scale of a town, its organizational character, identity, and the size, and type of buildings that are introduced to it.

e. Each increment should in fact add to the overall character of a settlement and not deteriorate from its overall identity. This signifies that there is a connectedness between the regional, town, and building scales, and also an appropriateness of relationships related to place; whether one is considering types of roads, the intensity of uses, kinds of economic activities, or the character and size of individual buildings.

3. Settlement Sectors - Urban Growth Sectors

a. Urban Growth Sector designation has been assigned to areas that can support mixed uses by virtue of their proximity to an existing town, village, hamlet, or in areas where agriculture is not feasible.

b. Urban Growth Sectors need to project the growth requirements of the region for the next thirty years. Those projected requirements should include the balancing of deficiencies, land uses or services, which may be scarce or needed for growth.

c. The urban growth or extension to an existing town, village, or hamlet needs to be sensitively orchestrated, with the aim of ensuring that additions to that settlement accommodate its scale and character with the introduction of needed public facilities and/or infrastructures, complimentary uses, walkable streets, while not overburdening existing systems or networks, nor negatively impacting natural resources. (In this report, the Urban Growth Sectors have been further developed at the urban design level in the Town Scale section and at the architectural level in the Building Scale section.)

d. The predominant urban and architectural character and scale of existing communities are to be respected, leading to a feeling of wholeness and a unified sense of place.

e. Permeability and connectivity are to be enhanced, enabling new green spaces, as well as pedestrian and cycling routes.

f. Public transportation is to be introduced or enhanced as may already be needed and also as population numbers increase.

4. Settlement Sectors - Rural Sectors

a. Rural Sector designation has been assigned to Consolidated Agricultural Settlements or areas that can support limited growth to ensure and to serve agricultural uses.

b. These Rural Sectors should be developed in a village or hamlet pattern, respectful of those meaningful historic patterns that are linked to a rural Haitian identity.

c. In remote sites, Water and Wastewater infrastructures may need to be resolved at the building scale until such time as regionally-scaled interventions are designed, economically feasible, and implemented. (Refer to Engineering Report Section for recommendations.)

5. Settlement Sectors - New Town Development

a. A new coastal town is feasible along the stretch of land between Luly and Montrois. If such a development is pursued, it should be conceived of as a largely self-sufficient, sustainable design, projecting a strong sense of "place" and identity that is sympathetic to its agricultural and rural context.

b. The new town morphology should resemble existing walkable urban villages in the region.

c. The design should be harmonious and with a clear collective identity based on historical precedents of the region.

d. The new town's layout should incorporate public spaces, plazas, and include a waterfront public promenade and/or beaches intended for the collective use of all of the Commune's residents.

e. The design should be compact, with good public transportation (land options and water taxi), and provide excellent walking and cycling routes.

f. The new town should include a healthy mix of uses (i.e. residential, commercial, small-scale hospitality, civic buildings, and a variety of housing options (rental, urban, rural).

g. The new town should be surrounded by agricultural fields, restore coastal mangroves and preserve natural resources.

h. The new town should plan for sustainable drainage and reuse of rainwater and grey water systems.

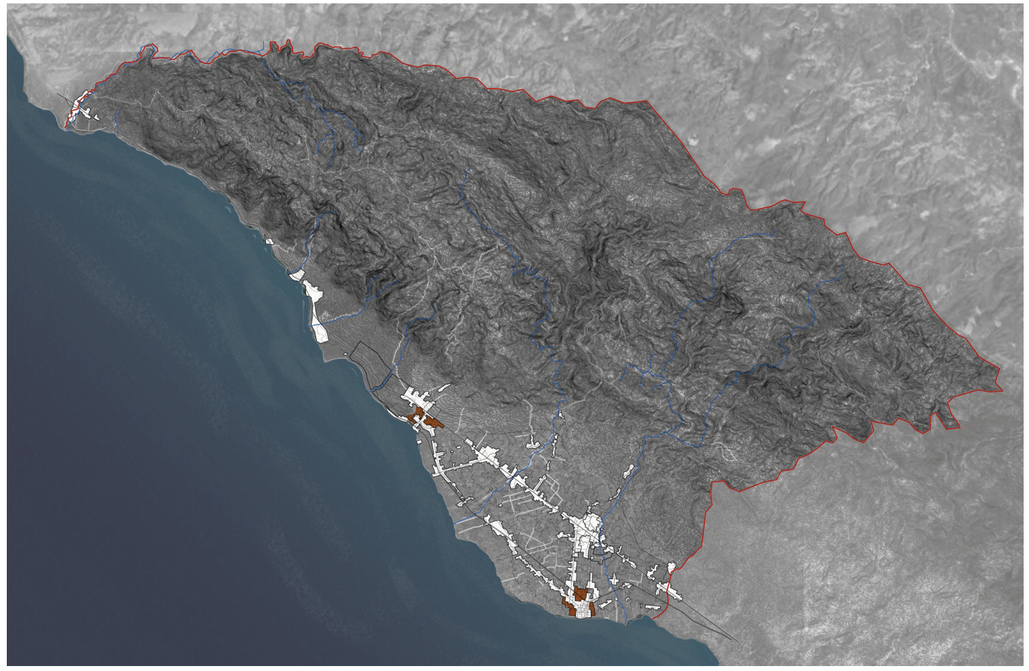
i. Green space should be located and managed to meet ecological, recreational and landscaping needs and be fitted with community facilities.

j. To ensure it's own self-sufficiency and sustainability, the new town should grow some of its own food, supplementing the agricultural activities in the region.

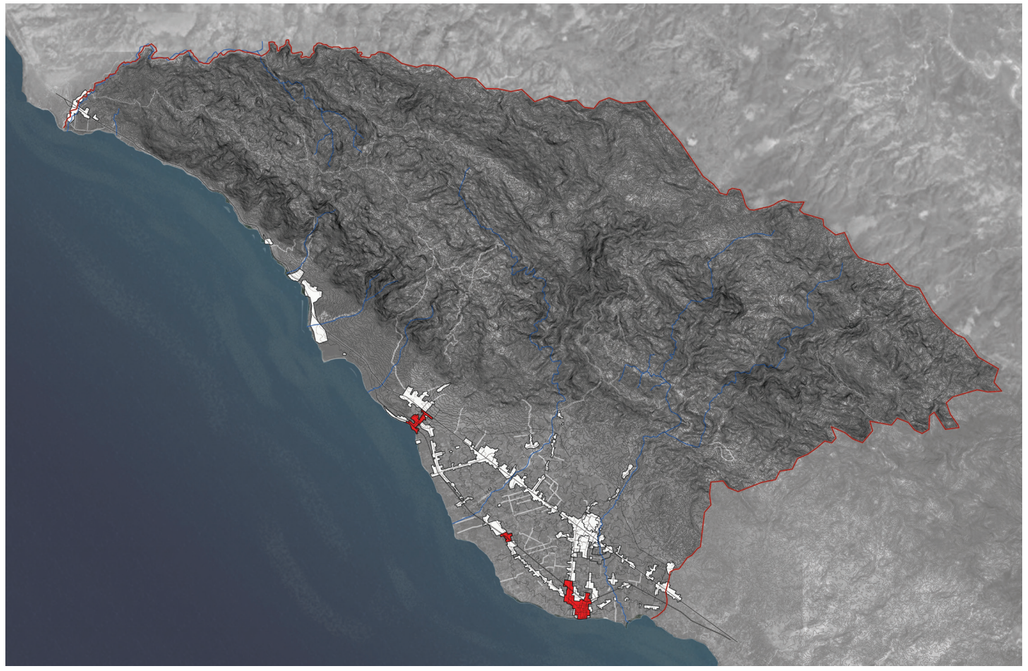
6. Settlement Sectors - Special Districts

a. Special Districts should be assigned to areas with services or infrastructure that, by their intrinsic size, function, or configuration, cannot be incorporated into the urban fabric.

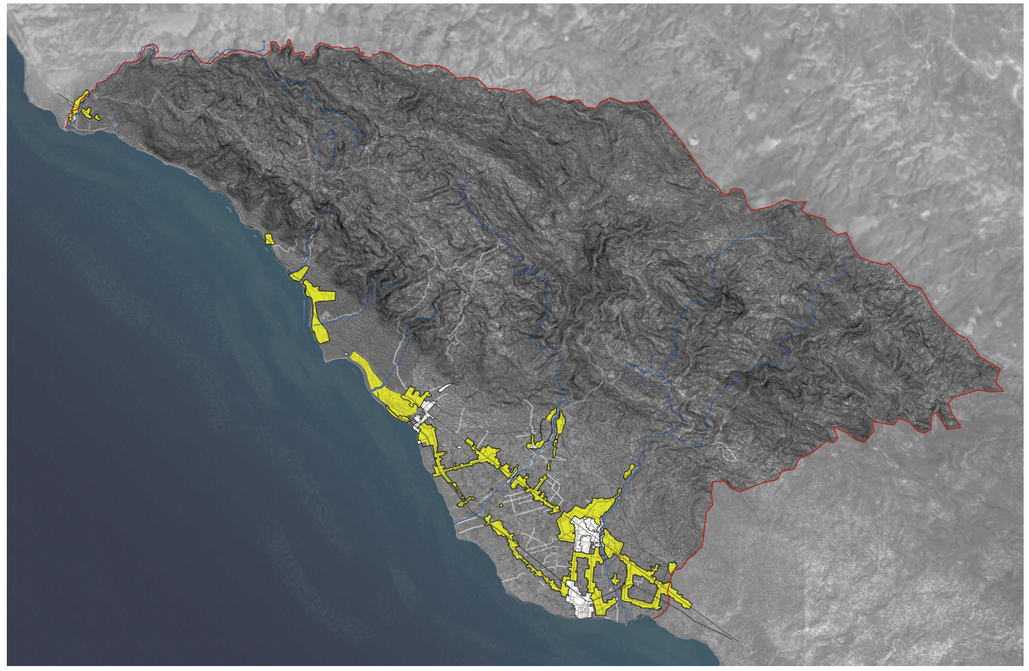
b. The Special District Map in this report shows



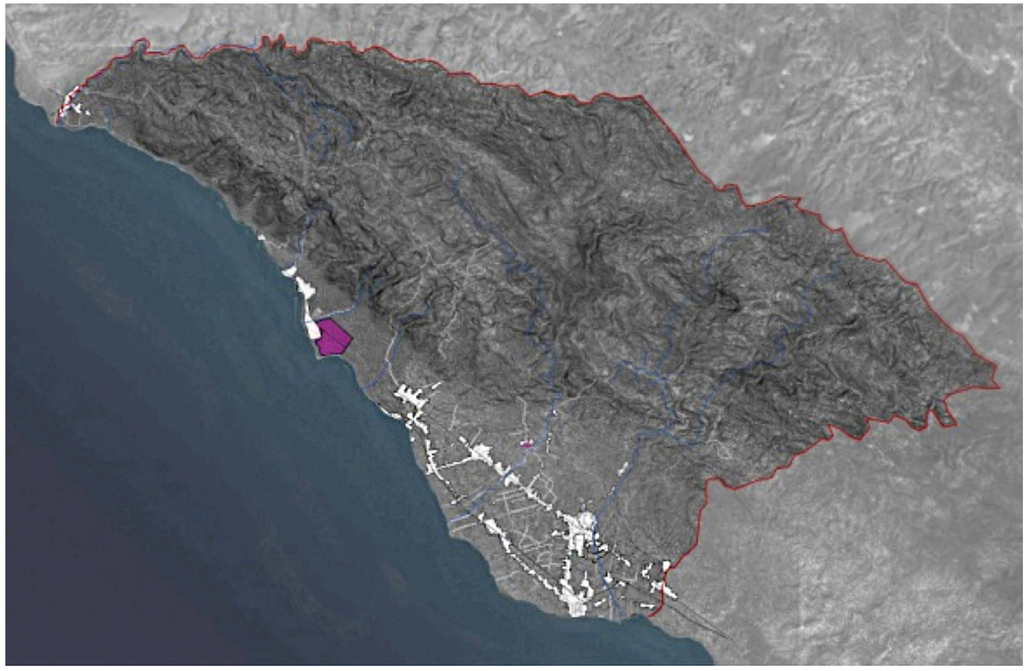
Settlement Sectors - Urban Growth Sectors



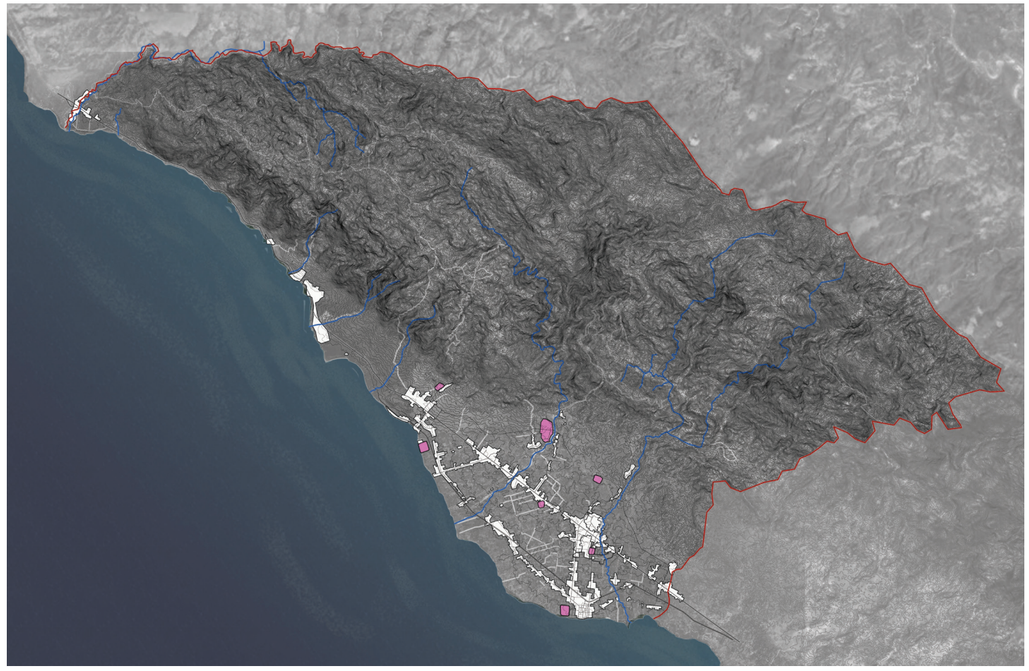
Settlement Sectors - Urban Sectors



Settlement Sectors - Rural Sectors



Settlement Sectors - New Town Development



Settlement Sectors - Special Districts



Settlement Sectors - Regional Node Sectors

potential special districts related to the major infrastructure services, such as:

- Areas for Storage and Purification of Potable Water
- Areas for Waste Water Treatment

Some other special districts may be:

- Specialized Facilities, such as a Marine, Aqua-ponics & Fisheries University Research Center being proposed on an abandoned mega-mansion site on the outskirts of Luly.

And, as may be needed:

- Industrial enterprises emanating noise, vibration, or smell beyond the boundary of its site
- Prisons except as accessories to police stations
- Scrap yards for the processing, storage and disposal of waste materials, including recycling collection centers
- Cell phone towers
- Mineral extraction or mining

7. Settlement Sectors - Regional Node Sectors

a. Regional Node Sectors have been assigned to areas that can support Mixed Use by virtue of proximity to an existing or planned regional transportation network (main highway).

b. Due to the accessibility to a main highway, and connections to the mountain villages these Regional Nodes can become centers of distribution for import, export, storage and exchange of goods and services, creating places that generate jobs and social order at the service of the region's overall population.

c. These Nodes are also intended to allocate major educational and medical facilities for all residents of the Commune of Arcahaie.

d. The Engineering report calls for the these Regional Nodes to be the located where major infrastructure systems are most needed, near high population density locations, so as to serve as large a percentage of the population as possible, both presently and in the future.

e. An illustrative representation of potential character of these nodes have been developed in the Town Scale section. (See: Arcahaie and Luly Regional Centers)

A. Two New Regional Centers

a. Ideally, situated along the Main National Highway, in the areas where the highest population densities already exist, and where the highway intersects with secondary routes that lead to the under served communities in the Highlands near Luly and near Arcahaie, situate two Regional Centers, each with complimentary uses that can serve a broad sector of the Commune.

b. At the intersection where the Main National Highway meets the main road leading down into the town of Arcahaie, a new *Arcahaie Regional Center*, can formalize the existing ad hoc outdoor market, shading a new main public plaza under a canopy of large trees to make shopping more pleasant and comfortable. The main *Market Plaza* can be equipped with water troughs and benches for use when the market is in session or when it simply functions as a large civic open space for the use of residents and/or for public functions. Facing the main road, and heralding the main entrance into the town of Arcahaie, a new watertank-tower topped off with photovoltaic panels, is intended to serve the needs of the Arcahaie Regional Center. It can be placed across the street from a new covered bus stop, with a new neighboring rest-stop that should include public bathrooms. This general area is an ideal location for a small bed & breakfast inn. Over time, new buildings facing the streets around the *Market Plaza* can take on a commercial character, including shops and cafes. A neighboring existing school can be fitted with a new smaller plaza to make child pick-up and drop-off more convenient and safe. A new civic building can complete the *Arcahaie Regional Center Main Plaza*, and that structure can perhaps be a new church with ancillary buildings.

c. Nearby the *Arcahaie Regional Center* an Emergency Shelter can be constructed. It should be built on stilts, with habitable space above the 100 year flood plain criteria, and it should be constructed sturdily to withstand seismic or hurricane events. When not in use during emergency events, the Emergency Shelter can host other functions, such as a Resource Center and/or the offices for an Agricultural or Energy Cooperative to serve neighboring farmers. Emergency Shelters should be identifiable from a distance, thus a distinctive color or architectural feature can make them easily recognizable.

d. The *Luly Regional Center* can accommodate other uses, including a large healthcare facility with a maternity ward, trauma unit, and infectious diseases wing; a multi-purpose vocational center; a market/exchange hub with refrigeration warehouses, loading docks, and a food processing center; a small police sub-station, and a smaller public green park. Given that at this general location, commuters frequently transfer between tap-taps (private transportation providers) heading north and those heading south or into the hinterlands, a covered bus station with neighboring rest-stops outfitted with public restrooms should be provided. Eventually, over time, neighboring parcels surrounding the new regional market/exchange center and along the main highway, can take on a commercial character to compliment these facilities and take advantage of their central and prominent location.

e. Other Civic functions/buildings can be added to this general area over time as may be needed by the residents.

f. The healthcare facility should provide at a minimum a Level V adult and pediatric trauma unit/services, including, initial evaluation, stabilization, diagnostic capabilities, and transfer to a higher level of care. It may provide surgical and critical-care services and at a minimum have on-call a trauma-trained nurse and physicians available upon patient arrival in the Emergency Department. Given the frequency of infectious diseases in the region in the past decade in particular, an infectious disease ward is recommended. A third ward, dedicated to pediatrics and to maternity services and delivery needs is highly recommended, especially because there are no such facilities in all the Highlands and one of their three main access roads leads to this location.

g. The region sorely needs higher education facilities including, high schools in the Highlands, as there are currently none; a centrally located regionally-scaled vocational center that can train skilled laborers and crafts people; and, a coupling of satellite university facilities that can capitalize on the agricultural, and marine settings to offer specialized programs, that in turn can complement and support growing job sectors and the general livelihood of local communities.

h. A new Multi-purpose Vocational School can help anchor the *Luly Regional Center.* Such a facility can train local residents in trades that are connected to current or future job sector engines, such as the tourism, healthcare, green energy, and construction industries. Preparing a ready-workforce allows these industries to prosper and in turn, generate greater job offerings. International NGO's, local providers and leaders can together define the programming of a new multi-purpose Vocational School, and devise a partnership for its long-term operation.

i. In the general vicinity of the *Luly Regional Center* there should be another Emergency Shelter. It should be constructed on stilts, with habitable spaces above

the 100 year flood plain criteria, and built to withstand seismic or hurricane events. It can double as a Meeting Hall that can accommodate large lecture classrooms; host meetings and festivities for local providers; and, perhaps provide meeting rooms for Agricultural or Energy Cooperatives at the service of neighboring farmers, or for church groups or other institutions.

j. A University satellite can be located in the Town of Arcahaie and another located across form the *Luly Regional Center.* These facilities could permit a greater number of local residents to reach their educational goals and capacity, thereby allowing them a broader spectrum of job opportunities. An on-site wing of residential dorms can be considered, if over time it is deemed needed.

k. Highland communities urgently need an operating and staffed highschool as well as a functioning and staffed clinic. Public/Private partnerships may make these goals viable in the short-term.

B. Water Infrastructure - Potable Water Storage and Service Area

a. Potable water is essential for a healthy society, and in the Region of Arcahaie access to potable water is limited.

b. Alongside rain water management methodologies explored in this section, purification and storage tanks need to be located and planned for in advanced.

c. The region of Arcahaie has a rough topography in the mountains, but the plains have a much subtler topography, which may limit water pressure. For ideal water pressure, there should be an elevation difference of 40 meters from the closest service location, therefore purification and storage may not be in direct proximity to the service areas.

d. Large regional potable and distribution systems are expensive and have long periods of implementation. Other methods have been explored for short and mid-term development stages. (These methods are further explored in the Engineering Report section.)

C. Wastewater Infrastructure - Wastewater Treatment and Service Area

a. For long-term centralized waste water systems, the location of the treatment plants need to be identified and planned for in advanced.

b. Ideally, wastewater treatment plants are located a minimum of 150 meters away from a urban boundary, at an altitude lower than the service area.

c. In the region of Arcahaie, the best locations for wastewater treatment plants are closest to the coastline, therefore the proper design of wastewater treatment plants are crucial to avoid ocean pollution and degrading of potential tourist destinations.

d. There are several systems and methods of wastewater treatment that could be implemented in the short, mid and long term. (These systems are further explored in the Engineering Report section.)

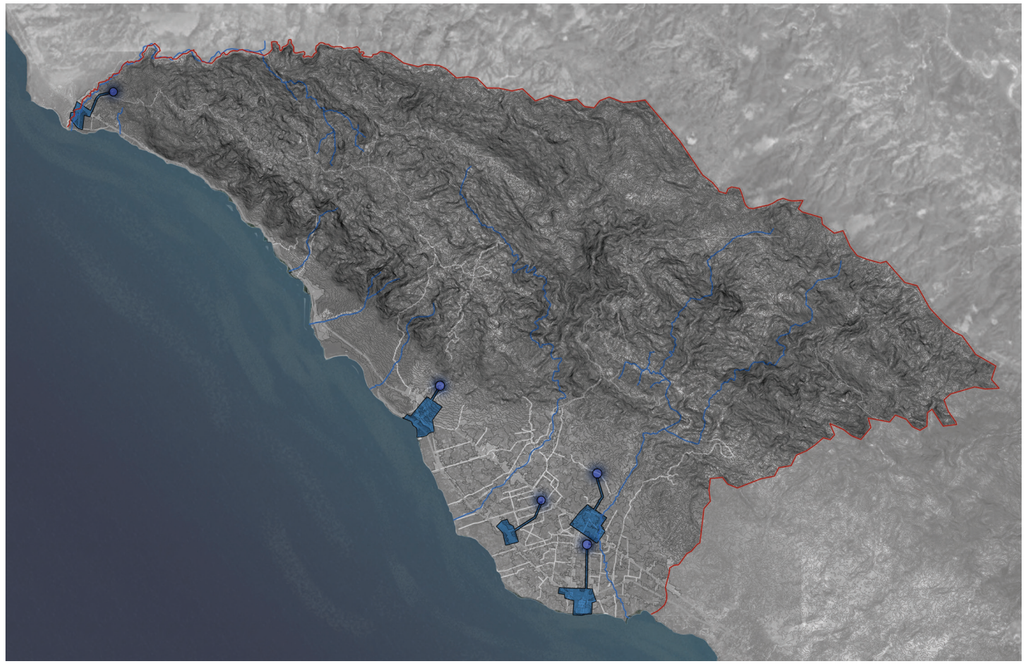
IV. THE ARCAHAIE REGIONAL VISION PLAN GOAL IS TO IMPROVE AND CONSERVE THE REGION'S NATURAL RESOURCES THROUGH ENVIRONMENTAL CONSERVATION AND REPARATION

Goals:

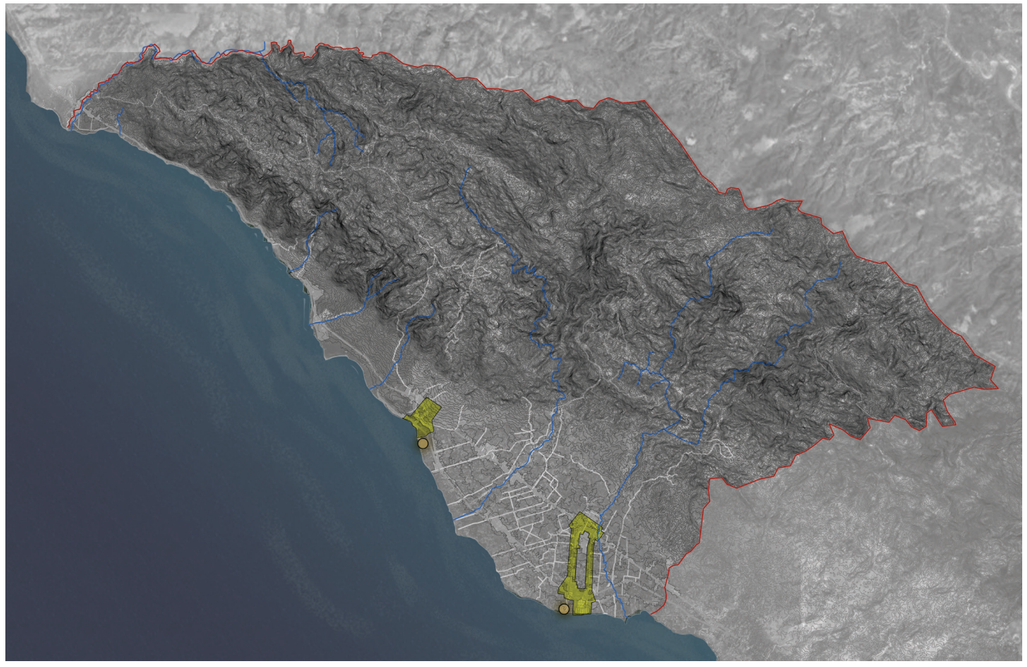
- ensuring the protection and enhancement of the region's environmental assets, including the built and historic environment, it's natural landscape, as well as its coastline, rivers, streams, and waterways;
- codifying appropriate location and intensity of urban or rural growth developments, thus truncating the possibility of sprawl and its correlated and unwanted consumption of arable lands or other natural resources;
- promoting the reuse of previously developed land (infill



Water Infrastructure - Potable Storage and Service Area



Water Infrastructure - Potable Storage and Service Area



Wastewater Infrastructure - Wastewater Treatment and Service Area

or brownfield sites) and;

- seeking environmental gains by the protection of undeveloped land and, where appropriate, supporting and enhancing biodiversity through the protection of habitats and species and creating new habitats in areas that have been wounded by deforestation, coastal or soil erosion;
- setting aside and providing a thorough network of accessible, multi-functional green spaces for the use and benefit of the citizens of the region; and,
- encouraging water reclamation strategies, and the recycling of waste products to generate a cleaner environment as well as new job opportunities in emerging green economies, whilst increasing the sustainable management of waste and of water resources.

The Arcahaie Regional Vision Plan - Actionable Items

1. Coastline Management

a. Proposed 100m coastline setback for mangrove restoration, dune protection and/or public beach access. Encroachments only for fishing and civic related activities.

b. Proper urban setback for urban allocation is more than 100m from the coastlines in order to avoid flooding on rain events, sea level rise impacts and/or vulnerability towards tsunamis.

2. River Embankment Reinforcement

For the sake of protecting human life from flooding hazards:

a. Require that new buildings in the Lowlands construct all habitable areas in any structure above the 100 year flood plain criteria.

b. Enforce a 100m setback from the centerline of the riverbed.

c. Avoid Building Encroachments (urban or rural buildings or settlements) within the 100m setback.

For the sake of restoring natural vegetation or protecting agricultural lands from flooding hazards:

a. Identify and map all Ravine Overflow Protection Locations as well as all sites needing Riverbed Restoration.

b. In areas alongside a ravine's path, restore naturally vegetated corridors or limit agricultural crops to those that can withstand the impact of occasional flooding.

3. Natural Preserve Sectors - Setbacks and Buffers

a. Natural Preserve Sector shall consist of areas that should be, but may not yet be permanently protected from development.

b. This includes setbacks or buffer zones from existing ravines and the waterfront and reforestation, to prevent flooding hazards and to preserve their conditions as natural corridors for the overall health of the environment as well as the population.

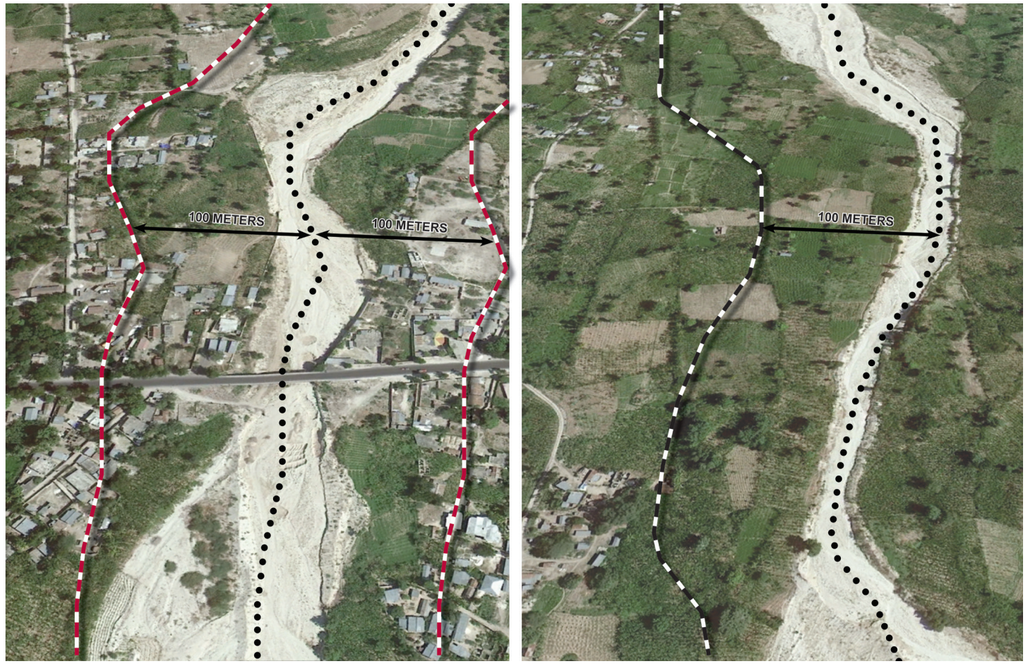
c. Larger ravines, formed from multiple branches of natural drainage, should require a minimum of 100m setback from its center to protect life and property.

d. Smaller ravines should require a minimum of 50 meters setback from their centerline.

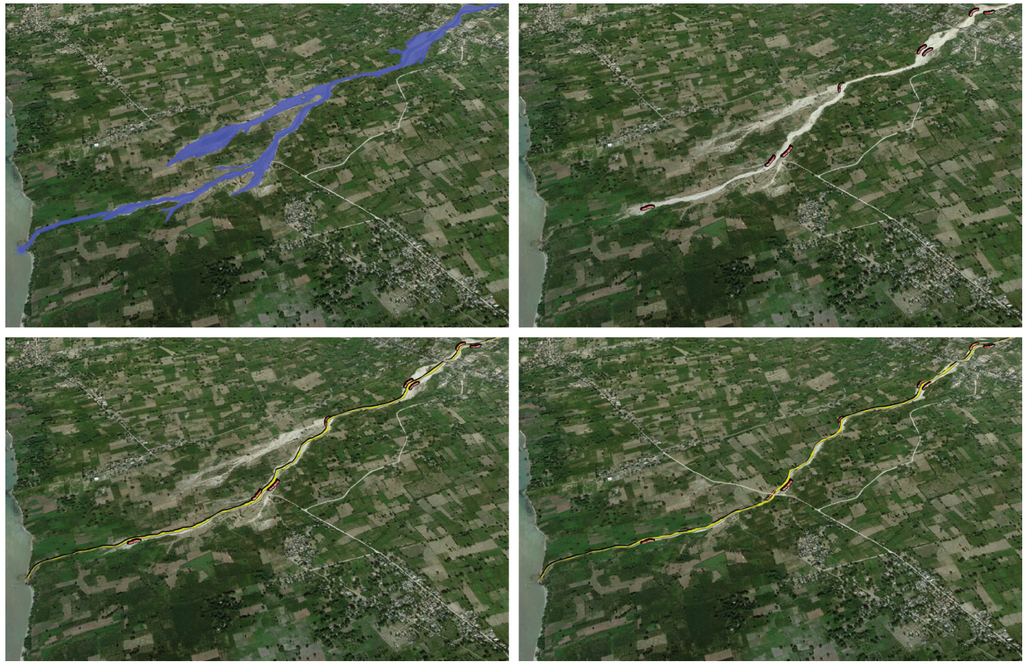
e. Due to the real threat of sea level rise worldwide, a setback of 100 meters from the natural coastal edge should be required. This setback also promotes public and unrestricted access to the ocean, along with the restoration of mangroves, where appropriate, along the coast. Aside from the mangroves' capacity to stabilize waterfront soils and to protect inland areas from sea level rise, an additional reason to promote mangrove restoration along the coastline, is that it creates the potential for a sustainable marine aquaculture, which not only can expand fishing capacities if properly managed but also motivates nature-seeking tourists to explore the region. (Refer to Town-Scale Agrotourism



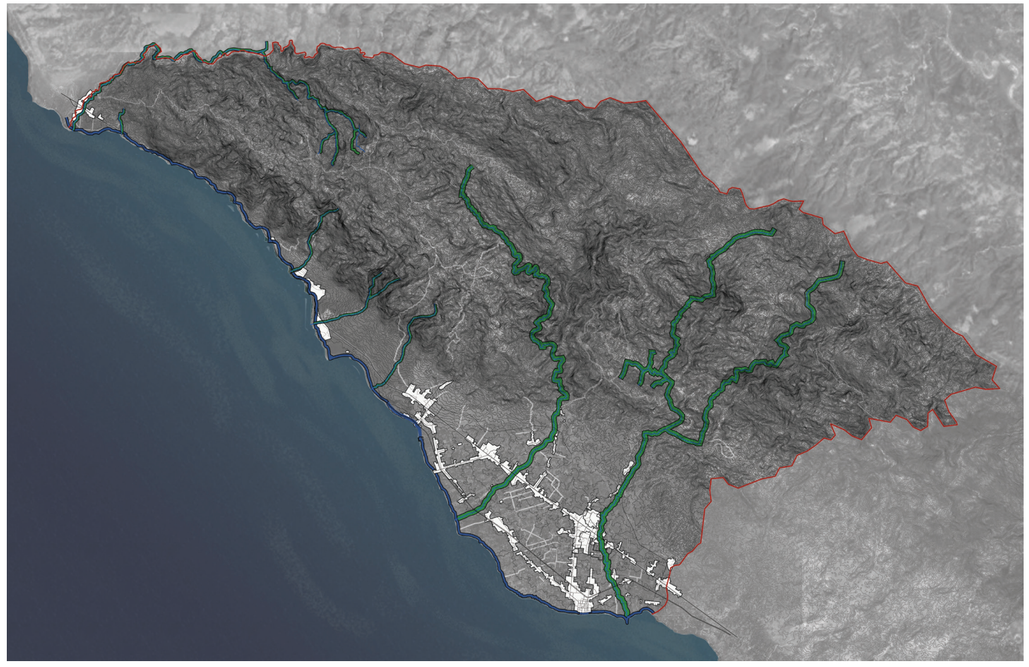
Coastline Management - Coastline Setbacks



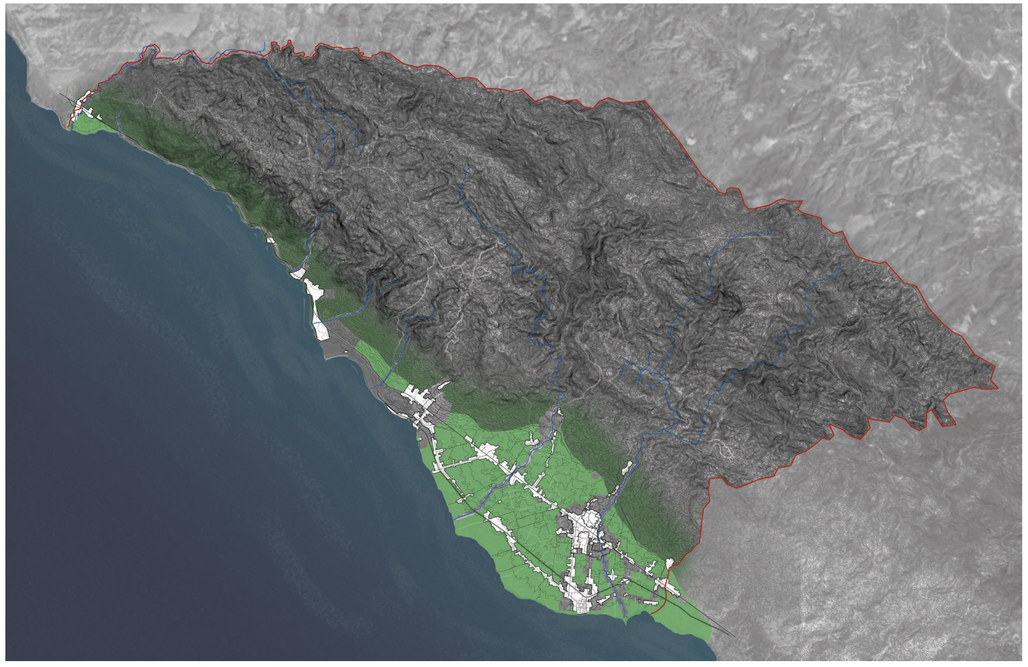
River Embankment Reinforcement



Ravine Overflow Protection Locations



Natural Preserve Sectors - Setbacks and Buffers



Natural Preserve Sectors - Agricultural Reserves

Sub-Section of this report for more information.)

f. These setback recommendations require further collaboration between the central and local government and their respective governing agencies, with local and/or international Not-for-Profit organizations, citizen groups, civil society, and environmental technicians to determine how to best implement these strategies, identifying case by case applicability and specific dimensions of the setback throughout the coastline and ravines. The final dimensions of setbacks would be determined by a combination of determinants, including: topography, soil conditions, ownership, accessibility to public beaches, and flood risk.

4. Natural Preserve Sectors - Agriculture Reserve

The Arcahaie region has a unique situation with not only the option to secure food for its population, but also to export to other regions, as well as to international markets potentially.

a. The delta plains, Lowland region is constantly threatened by flooding and erosion, primarily due to man-made deforestation of the mountains. Introducing terraced farming all along the foothills of the mountains will increase farming activities, stabilize soils, and slow the movement of water down into the delta plain. This strategy needs to be coupled by a rehabilitation of the natural eco-systems across the region so there is a balance between agricultural activities that provide food and economic opportunities with natural preserves that sustain the health of the overall natural realm.

b. Cities, towns and villages that hope to thrive in the long run must secure and enlarge their productive farm belts in such a manner as to minimize their impacts on their host natural environment. As the costs of energy climbs, long-distance food sourcing will become increasingly untenable, and urban areas without an agricultural hinterland will have difficulty feeding themselves within their means. Thus proper farming techniques, crop cycling, protection of soil quality and efficient and reliable irrigation systems are needed.

c. Properly preserved and managed Agricultural Sectors may also be a great potential for Eco-tourism, Agro-tourism, and can host 'Volun-tourism' to the region. (Refer to the Agrotourism Section of this report.)

d. These strategies are best accomplished at the regional level by allocating Agriculture Reserve Sectors and Re-vegetation Sectors. The Re-vegetation Sector must include all native ground cover, shrubs and trees, and also may be suitable for slope agriculture through terraces, which also prevents flooding and erosion, after control of water resources is achieved.

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Overview of Vision Report Regional Team Recommendations

Commune of Arcahaie Engineering Report

Joseph DeLuca, Civil Engineer, Paul Crabtree & Associates and CUCD Research Affiliate

Flood Control and Erosion Control: Historical and Current Conditions

The Arcahaie region of Haiti contains two distinct geological areas. The Highlands are mountainous terrain with steep slopes and ravines, which create high velocity rainwater flows and transport of significant sediment. Many areas have been impacted by deforestation or de-vegetation, which has increased the peak flows of rainwater and transport of sediment. The major issues associated with rainwater events in the Highlands are washout of critical roads connecting residents with coastal towns critical to the agricultural economy and loss of topsoil, which reduces short-term and long term agricultural output.

The coastal Lowlands of the region rests on a large alluvial fan that has formed over thousands of years from the deposit of sediments eroded from the highlands. Rainwater flows from the Highlands in rivers and natural drainage ravines. There are two rivers on the fan, the Riviere Aubry and the Riviere de Mathdeux. Stream flow is intercepted at the base of the mountain range on both rivers by a sophisticated network of irrigation ditches to distribute water to coastal plain agriculture. The scale of this irrigation network is sufficient to dry up the rivers from the base of the mountains to the coast during dry periods. During significant rainfall events in the Highlands the rivers and dry drainage channels from the base of the mountains to the coast become raging torrents of water, debris and sediment. Satellite photography clearly shows that the major river channels leave their banks spreading flood waters over agricultural and urban areas. The flooding is the cause of numerous deaths and also significant economic impact to agriculture as shown in Figure 1. The primary cause of flooding based on land-based and aerial imagery is sediment deposits building up in river and drainage channels, which is typical of alluvial fan areas, where streams change their courses over time creating the alluvial fan.

Hurricanes also cause flooding along low lying coastal areas. Building construction should account for these conditions.

Recommendations for Flood and Erosion Control

Regional

1. Provide sandbags to the region [Federal Government]
2. Rehabilitate major river channels by removing sediment, stockpiling the material for levees, construction projects and coastline restoration. [Local projects]
3. Construct check dams and erosion control features in Highland ravines, and install armored low water crossings on rural roads where washouts occur. [Local projects].
4. Complete a regional comprehensive engineered flood study to identify flood zones and remediation areas. [NGO or Federal Government Funded]
5. Highland re-vegetation of denuded and deforested areas by aerial seeding or other methods. [Federal Government]
6. Construct flood control dams at strategic points on river channels and drainages that can also serve as irrigation water storage and hydropower sites.[Federal Government]

Town, Village and Hamlet

7. Utilize sandbags to control floodwaters in channels within the urban areas.
8. Create or restore drainage channels along natural drainage courses though urban areas and limit building in and near the channels.



Figure 1 Major Drainage Channel Overtopping. Example of Interventions.

9. Retrofit streets as underground infrastructure is installed to provide additional rainwater carrying capacity utilizing modified street cross sections and high curb heights. Utilize porous pavers where possible to increase infiltration.

Rural
10. Construct check dams and erosion control features in Highland ravines, and install armored low water crossings on rural roads where washouts occur. [Local projects].

Building Scale
11. Build new Civic Buildings with finished floor levels 0.5 meters above existing grade.
12. Build new homes with finished floor elevations 0.3 meters above existing grade.
13. Relocate Civic facilities out of flood prone areas when possible.

Details for Recommendations
This section provides images and diagrams as examples for the recommendations.

Sandbagging
The purpose of sandbagging is to increase the carrying capacity of a specific length of river or drainage channel that has a history of overtopping during storm events.

Check Dams
Check dams are used to detain water and collect sediment. A series of check dams in a ravine or stream channel can reduce the peak flow in a storm event and reduce the transport of sediment downstream that damages channels and property. The principle characteristics of various check dam types are shown in the table below. Pictures are also provided of the various categories of check dams. For streams or ravines with large flows and high velocities rock or concrete check dams are recommended.

All check dams should have a central weir to allow water to flow freely and regulate the level of water retained behind the check dam. Check dams should be constructed at a lower level than the ravine banks to prevent overtopping of the ravine or river bank in a storm event. Check dams should not be used on slopes greater than 15%. For slopes steeper than 15% other erosion control methods should be utilized.

Small Dams for Flood Control, Water Storage and Hydropower
The Riviere de Matheux and Riviere Aubry are the rivers in the region. A geotechnical and hydrologic study should be completed to locate acceptable small dam sites - typically located at foothill locations. The steep slopes of the river channels eliminate the potential for large dams on higher slopes. Dams could provide flood control, increased water for irrigation and domestic uses, as well as moderate hydropower. Increasing irrigation in the lowlands can also provide aquifer recharge for wells and reduce saltwater intrusion into the aquifer. Climate change could be expected to change weather patterns, but it is not clear whether altered weather patterns would benefit or harm this region, but providing dams to manage and store rainwater can be beneficial whether rainfall amounts increase or decrease. While many regions of the world have reduced dam construction to protect rivers and river deltas, the short distance between the dams and the coast provide a very unique condition where the benefits of a dam far out-weigh the environmental impacts. The regional maps of the overall report show some potential locations for small dams and reservoirs.

Potable Water: Historical & Current Conditions
In rural areas of Haiti those people without access to a municipal system get their drinking water primarily from unprotected wells (5%), unprotected springs (37%) and rivers (8%). In urban areas those without access to an improved

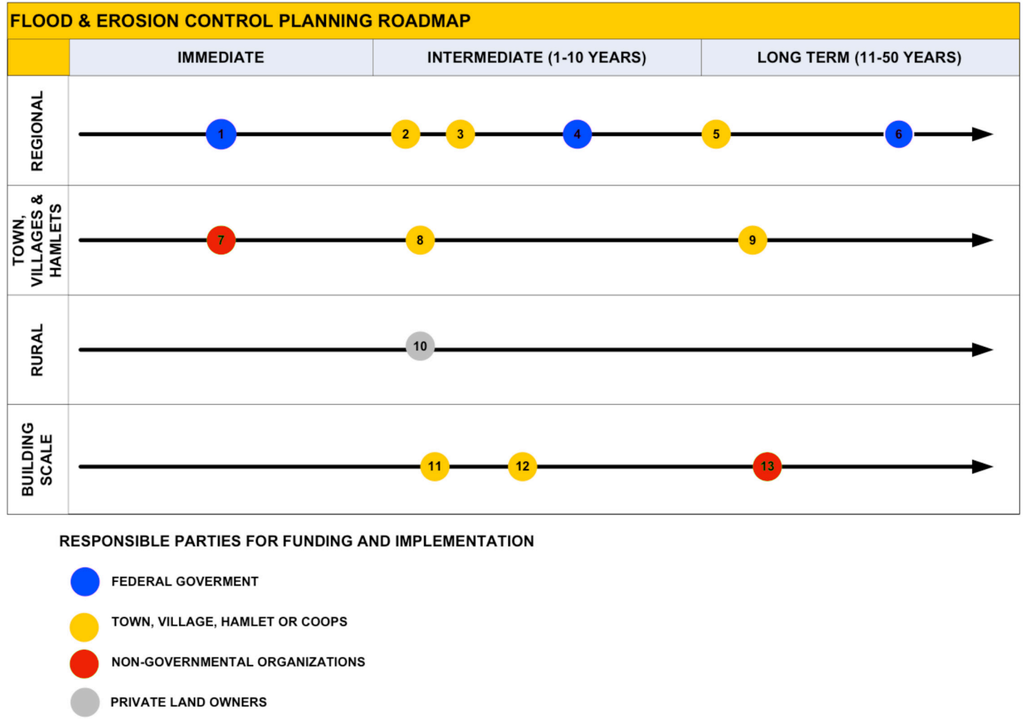
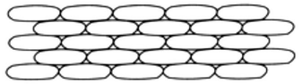


Figure 2 Flood & Erosion Control Planning Roadmap

RECOMMENDED METHOD FOR SANDBAG DYKING

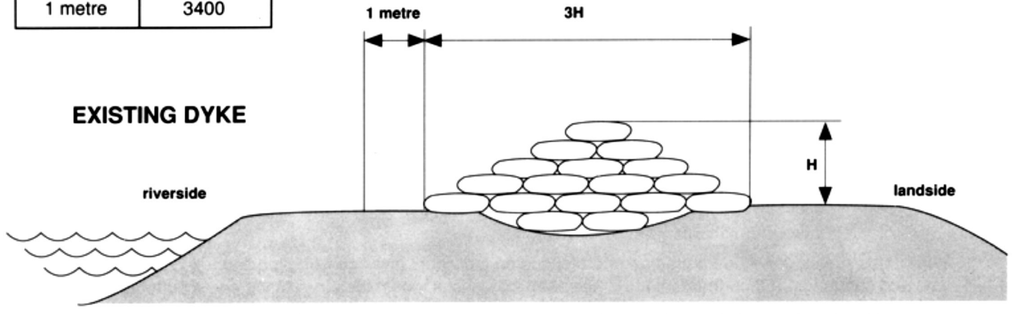
Bags Required for 100 Linear Feet of Dyke	
Height Above Dyke	Bags Required
1/3 metre	600
2/3 metre	2000
1 metre	3400



PLAN OF BOTTOM LAYER



METHOD OF LAPPING SACKS



Strip sod before placing bottom layer

Bonding trench, 1 sack deep by 2 sacks wide

1. Alternate direction of sacks with bottom layer, i.e. bottom layer lengthwise with dyke, next layer crosswise.
2. Lap unfilled portion under next sack.
3. Tying or sewing of sacks not necessary.
4. Sacks should be approximately one-half full of clay, silt or sand.
5. Tamp thoroughly in place.

Figure 3 Sandbagging Channels Detail

Characteristic / Type	Expected/ Designed Service Life (years)	Main Material Components Used as Embankment	Water retention Effectiveness	Frequency and Cost of Maintenance (RM)	Relative Capital Cost (RM)*	Ease of Construction
1. **Short-term**	< 1 years	a) Earth/sand - without bags	Poor	High	Low	Easy
		- fill in bags	Poor	High	Low	Easy
	< 2 years	b) Timber logs	Poor (Average – if layer of impermeable sheet is provided)	High	Average	Average
2. **Medium-term**	2 to 5 years	a) Loose stones/rocks	Poor (Average – if layer of impermeable sheet is provided)	High	Average	Easy
		b) Stacked rocks or Gabion type	Poor (Average – if layer of impermeable sheet is provided)	Average	Average	Easy
3. **Long-term**	> 5 years	a) Precast Concrete Stacked Blocks	Good	Low	High	Average
		b) Precast Concrete Post-Panel System	Good	Low	High	Difficult
		c) Cast-in-situ Concrete	Very Good	Low	High	Difficult

Figure 4 Principle Characteristics of Check Dam Types



Figure 5 Sand Bag Check Dam



Figure 6 Timber Check Dam



Figure 7 Loose Stones Check Dam

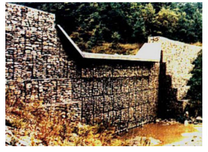


Figure 8 Gabion Check Dam



Figure 9 Cast Concrete Block Check Dam

source got their drinking water primarily from “bottled water” (20%), from carts with drums (4%) and unprotected wells (3%). Water in bottles or in small plastic bags is treated, bottled and sold by local private companies, often using reverse osmosis for treatment [Wikipedia]. Bottled water is also imported, especially in the aftermath of disasters such as the 2010 earthquake. Reverse Osmosis is expensive and energy intensive, and bottled water also creates a large volume of trash which is a major regional problem.

Water borne diseases are one of the major causes of illness in the country. As population pressures increase without improved sanitation, the incidence of water borne diseases and deaths will increase. Access to clean safe water is one of the prime necessities of improved living and economic conditions.

Recommendations for Access to Potable Water Timeline Roadmap

Regional

1. Develop national water quality standards based on World Health Organization Standards or USA Environmental Protection Agency Standards and uniform licensed testing lab services.
2. Develop a low interest loan program for water infra-structure development to local towns, villages and hamlets.
3. Develop strategic water reservoirs to provide reliable unpolluted raw water sources to communities.

Town, Village and Hamlet

4. Distribute family or Lakou unit water filter kits and provide training.
5. Install neighborhood wells with treatment and limited storage to provide safe potable water at central neighborhood standpipes. These installations should be solar powered so as not to depend on generators and fossil fuels.
6. Develop a centralized community water source, treatment and storage system located to provide gravity pressure to the community with trunk mains to neighborhood standpipes and services to key Civic buildings.
7. Complete the water infrastructure network by increasing the capacity to provide services to all private and public buildings with a grid of gravity mains and service lines.

Rural

8. Distribute family water treatment kits and training in their use and maintenance.
9. Private development of individual or Lukou wells. These wells will not require water treatment if the groundwater is not polluted. Wells should be encased in steel or plastic and be a minimum of 15 meters deep to the first casing perforations.

Building Scale

10. Provide site specific wells with treatment and storage for key civic facilities such as schools and hospitals.

Details for Recommendations

Family Unit Sand Water Filter Treatment [Immediate]

An immediate impact on health improvement and reduction in death rates can be achieved for areas without access to safe water or where bottled water is too expensive by providing sand filter units that can purify spring, well or surface water.

The filter is sold in several configurations. A single complete unit is US$60. A single demo unit is US$34. A pallet of 15 complete filters is US$850 ($56 ea.). A pallet of 50 filter bodies only is US$1,700 ($34 each). A full 40’ sea container of 2,250 filters bodies is US$76,500 ($34 each). This does not include shipping from Grand Rapids, Michigan or any applicable customs duties, taxes and clearance fees. If import taxes are waived, pallet or shipping container

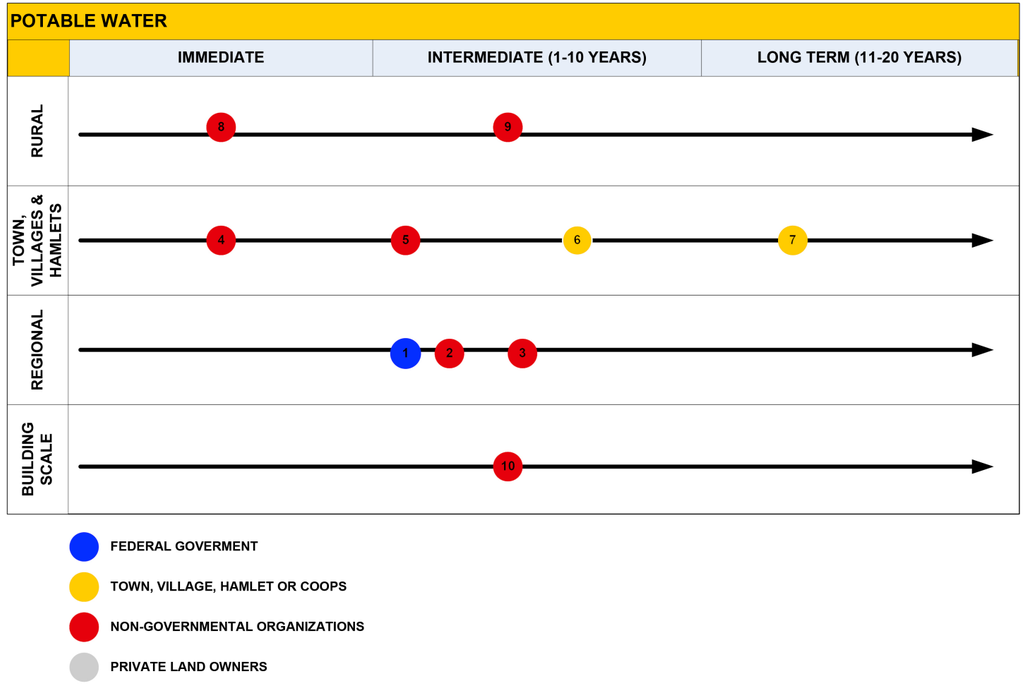


Figure 10

quantities should be able to be delivered to Haiti for $60.00 USD per unit shipping included.

The filter units have a useful life of 10 years and can produce 47 liters per hour intermittent use. A unit will supply a family of up to 8-10 persons with its daily potable water needs for a cost of $0.03 per day. Maintenance and operational instructions can be provided in Creole.

See Appendix B for detailed specifications.

Sunspring Membrane Solar Powered Water Treatment [Immediate]

For hospitals or schools an immediate solution for safe drinking water is a well with water treatment. One recommended solution is a solar powered treatment unit that powers the well pump and treatment in a single package. The Sunspring is a company that packages the GE Zeeweed membrane technology into a self-contained package which includes:

- 1 GE Ultrafiltration Membrane Module
- 2 Solar Modules
- 4.5 gpm pump
- Pre-Filter
- Raw and finished water plumbing
- 24” Diameter Aluminum Diamond Plate Enclosure (Additional 4’ required on top for solar panels)
- Installation and training manual
- Maintenance Kit
- Tool Kit
- Automatic Backwash and Solar Controller

This unit will produce 10,000 - 20,000 liters per day, enough for 70 - 140 persons at 150 liters per person per day. The unit is self-contained and only needs to be mounted to the ground and connected to a well. This unit requires a higher training level and maintenance than the sand filtration units.

Centralized Well and Groundwater Treatment

At the stage where the community is prepared to provide potable water service to individual homes and the whole community with a trunk main or a main grid, this is considered a Centralized water system. Centralized water systems may utilize ground water or surface water.

Groundwater Treatment typically consists of a source well, pre-filtration cartridges or bags, post-filtration cartridges or bags and chlorine disinfection prior to storage. (See Figure 13). The cost of a groundwater system for a school, hospital or neighborhood standpipe using small pressure tanks for storage is approximately $25,000 USD. The cost of a municipal groundwater well system serving 1,000 persons having a large gravity storage tank without the cost of the distribution mains is approximately $150,000 - $350,000 USD.

Prior to committing to a groundwater source system a test well should be drilled and the following tests performed:

- A pump test to determine if the well will support the required demand. A well field of multiple wells can be used if the cones-of-depression for the wells is less than the well separation distance. A minimum of 160 meters is recommended.
- A water quality suite of tests should be performed to determine the raw water quality and the treatment steps that will be required. For this region water salinity is of special concern, salinity tests should be performed after a 24 hour well pump test to determine if the well draw down has cause high salinity water to migrate to the well.
- The well should be situated away from surface and groundwater pollutant sources. It is recommended that septic systems, pit toilets, and other wastewater sources be a minimum of 300 meters from the well if possible. Industrial and agricultural uses and pollutant sources



Figure 11 Hydraid Sand Water Filtration Unit



Figure 12 Sunspring Membrane Water Treatment Unit

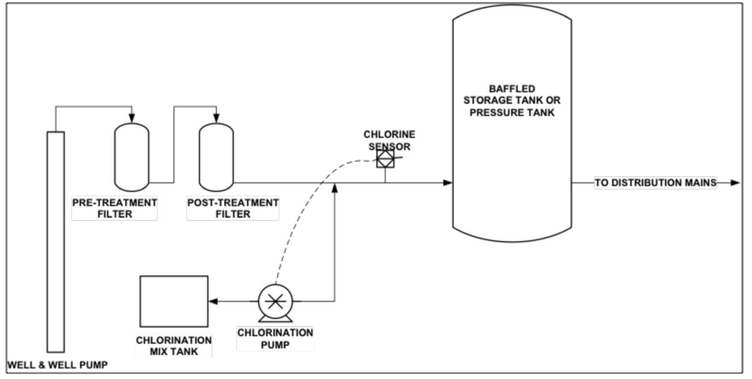


Figure 13 Groundwater Potable Water Treatment Schematic

should also have large separations from the well. Wells should be constructed per the following guidelines (See Figure 14 & Figure 15):

- The well should be encased with steel or plastic pipe.
- The well casing should be grouted with concrete grout to 10 meter depth.
- The well top should have a water proof seal with a screened air vent.
- The well should be drilled to 30 meters to the first well casing perforations if possible to prevent surface pollution reaching the raw water intake. If hard pan or rock is reached prior to this depth and the first casing perforations are at 15 meters or more it is acceptable to treat the well as groundwater if the water quality tests are negative for surface influence. If not the treatment train should be designed for surface water. The Figure on the opposite page shows an example of a properly installed well.
- The well casing should be covered with a minimum of a 2 meter diameter concrete cap as shown in Figure 13.

Water treatment should include (see Figure 13):

- A 10 micron pre-treatment filter.
- A final filter capable of 3.5 log removal of bacteria, viruses and cysts.
- A chlorination unit utilizing diluted bleach capable of producing treated water with 1-5 parts per million chlorine treatment. (see Figure 16).
- A pressure tank to provide a small storage volume to prevent rapid cycling of the well pump or a large storage gravity tank (see Figure 17).

The long term solution for urban areas is Surface Water Treatment: The treatment process for surface water is much more complex than for ground water as shown in the schematic in Figure 18.

Surface water plants require large capital investment, engineering and specialized construction skills. Typically a one to two year planning and engineering phase occurs prior to construction. A moderate sized plant for a town of 5,000 to 10,000 persons will have a capital cost in the range of $2.50 USD to $5.50 USD per liter of treatment capacity per day with storage. Two to three days is optimal. These costs do not include water mains for distribution. Water mains typically cost in the range of $150 USD to $200 USD per meter installed for 225 mm pipe size.

Federal support in the form of grants or low interest long term loans will be required for the design and construction of centralized water treatment, storage and distribution systems for urban communities. This approach should be the long term goal for the region - providing water to each building or lot.

Wastewater Sanitary Services

Historical & Current Conditions

There is no evidence that the area has been served by any form of organized waste water collection and treatment services. It appears that the majority of homes, civic buildings and businesses are not served by on-site wastewater systems.

The available information indicates that much of the human waste is deposited untreated on the surface, into streams or garbage dumps. This has resulted in high rates of waterborne illnesses and vector borne diseases. The soils and groundwater have been polluted by wastewater products and by-products due to these practices. The level of pollution is likely directly proportional to the population density in an area. There are some existing pit toilets and septic systems in use; however it appears that the culture is not very accepting of pit toilets, which indicates previous designs did not perform well.

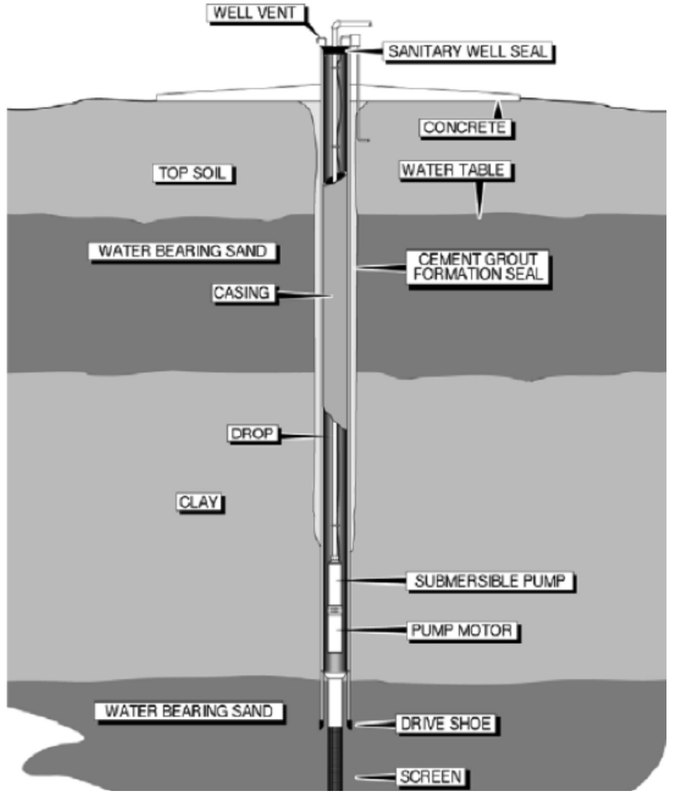


Figure 14 Water Supply Well Construction

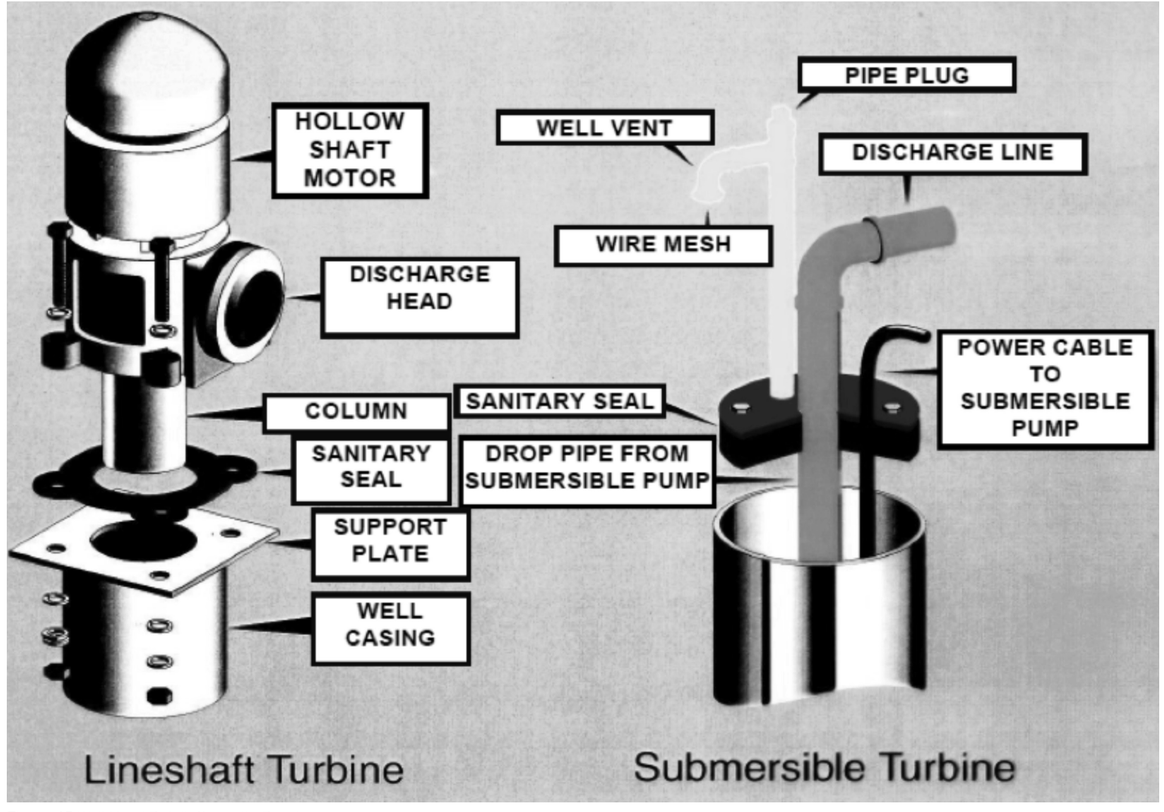


Figure 15 Well Head Detail (Opposite Page)

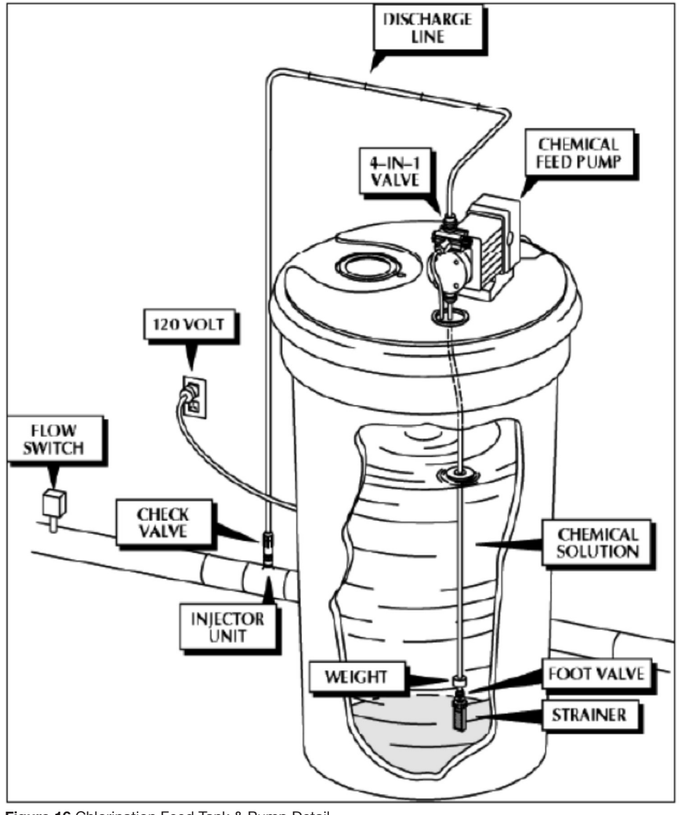


Figure 16 Chlorination Feed Tank & Pump Detail

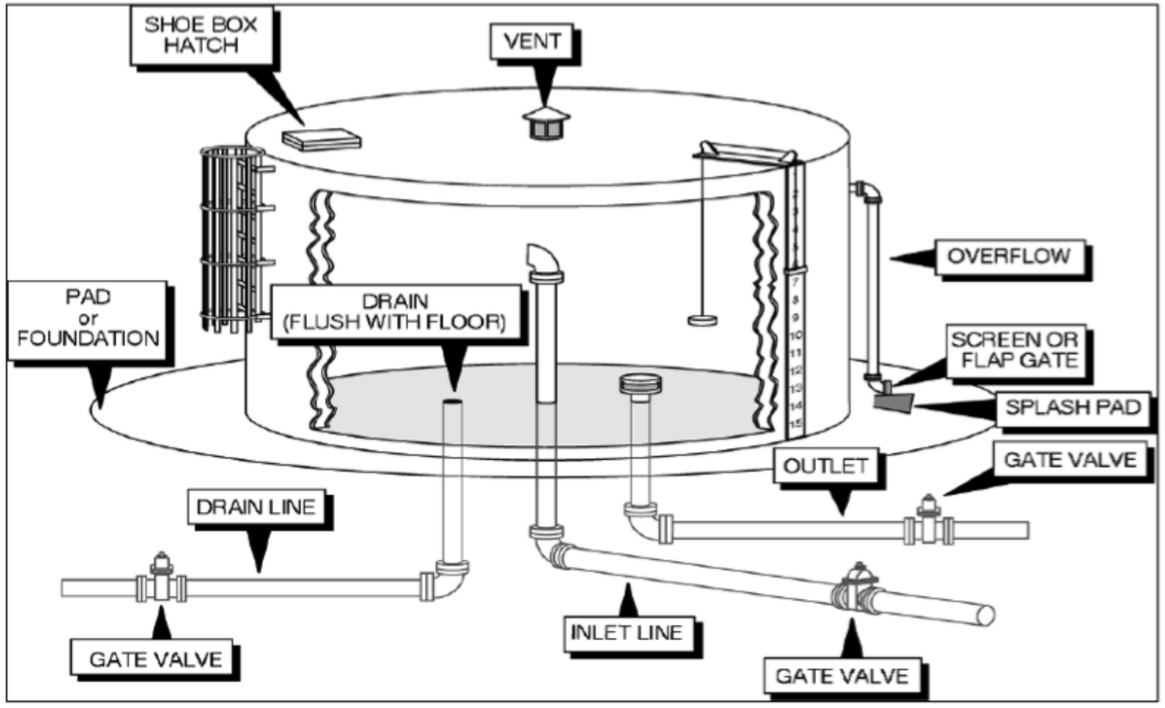


Figure 17 Ground Mounted Community Storage Tank

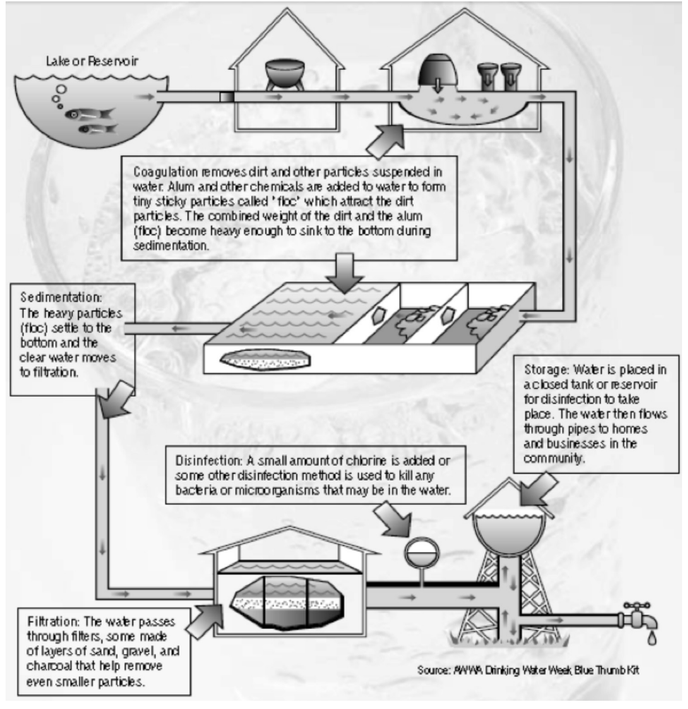


Figure 18

Human feces may contain a range of disease-causing organisms, including viruses, bacteria and eggs or larvae of parasites. The microorganisms contained in human feces may enter the body through contaminated food, water, eating and cooking utensils and by contact with contaminated objects. Diarrhea, cholera and typhoid are spread in this way and are major causes of sickness and death in disasters and emergencies. Some fly species (and cockroaches) are attracted to or breed in feces, but while they theoretically can carry fecal material on their bodies, there is no evidence that this contributes significantly to the spread of disease. However, high fly densities will increase the risk of transmission of trachoma and Shigella dysentery. Intestinal worm infections (hookworm, whipworm and others) are transmitted through contact with soil contaminated with feces and may spread rapidly where open defecation occurs and people are barefoot.

These infections will contribute to anemia and malnutrition, and therefore also render people more susceptible to other diseases. The intestinal form of schistomiasis (also known as bilharzia), caused by parasitic worm species living in the veins of the intestinal tract and liver, is transmitted through feces. Its complex lifecycle requires the feces to reach water bodies where the parasite larvae hatch, pass a stage in aquatic snails and then become free-swimming infective larvae. Infection occurs through skin contact (wading, swimming) with contaminated water. Children are especially vulnerable to all the above infections, particularly when they are under the stress of disaster dislocation, high-density camp living and malnutrition. While specific measures can be taken to prevent the spread of infection through contamination by human feces (e.g. chlorinating the water supply, providing hand-washing facilities and soap); the first priority is to isolate and contain feces. It is critical to institute a sustainable system of wastewater treatment in the region to reduce illnesses and deaths. Additionally it is an economic necessity to improve sanitary conditions if tourism and agricultural exports are to be pursued. [W.H.O. Environmental Health in Emergencies and Disasters]

Given the total lack of centralized wastewater treatment in the region and the lack of available funding for its construction it is likely that these services can only be expected in the long term plan range of ten to fifty years. Therefore immediate and intermediate plans must be executed to reduce the current health risks due to the lack of sanitary facilities.

The greatest challenges to implementation of sanitary services are:

- The cost of construction.
- The cultural preference of defecation outside to use of pit latrines.
- The lack of space for construction of on-site sanitary services.
- Education regarding health risks due to unsanitary conditions.
- Education on the operation and maintenance of sanitary facilities.
- Training for construction of sanitary facilities.

For all on-site systems, this report recommends the separation of gray water [sinks, clothes washing, showers] disposal and black water [human solid waste] disposal, this reduces the cost and complexity of the solution to the critical sanitary and health concerns associated with human waste. It is recommended that gray water be disposed of in seepage pits as described in and black water be treated as described in this report.

Two types of latrines are recommended to meet immediate needs for sanitary facilities: Improved Ventilated Pit Latrine and the Double Vault Compost Latrine. The Double Vault Compost Latrine is better suited for rural areas with agricultural uses for the compost.

The intermediate recommendation is the construction of septic systems for new construction and retrofit of existing homes where sufficient land space is available. This technology is well suited for the transition to indoor bathrooms which is highly desired by the populace based on the information gathered during onsite Charrettes.

The long term solution in urban areas is the construction of sewers and wastewater treatment plants with treated effluent being discharged into the ocean, or recycled for irrigation water and other uses. At a minimum it will take 3-5 years of planning and 3-5 years of construction even if the funds were available today to provide central sewer and wastewater treatment in an urban area such as Arcahaie.

Recommendations for Wastewater Treatment and Roadmap

Regional

1. Education on the health and economic risks of non-sanitary conditions.
2. Training on the construction and operation of septic tanks, ventilated improved dual pit latrines and double vault composting latrines.
3. Integration of wastewater treatment construction and maintenance into the local trade school curriculum.
4. Development of funding in the form of grants and loans for the construction of sewer and wastewater treatment plants for urban areas.

Towns, Villages and Hamlets

5. Install Improved Ventilated Pit Latrines and Double Vault Compost Latrines.
6. Install septic tanks with infiltration fields for new and existing civic buildings.
7. Provide public toilets near markets and tourism centers.

Rural

8. Install Double Vault Composting Latrines.

Building Scale

9. Design new structures for indoor bathrooms and septic systems where space allows.
10. Install Improved Ventilated Pit Latrines or Double Vault Composting Latrines for all homes or Lakous.

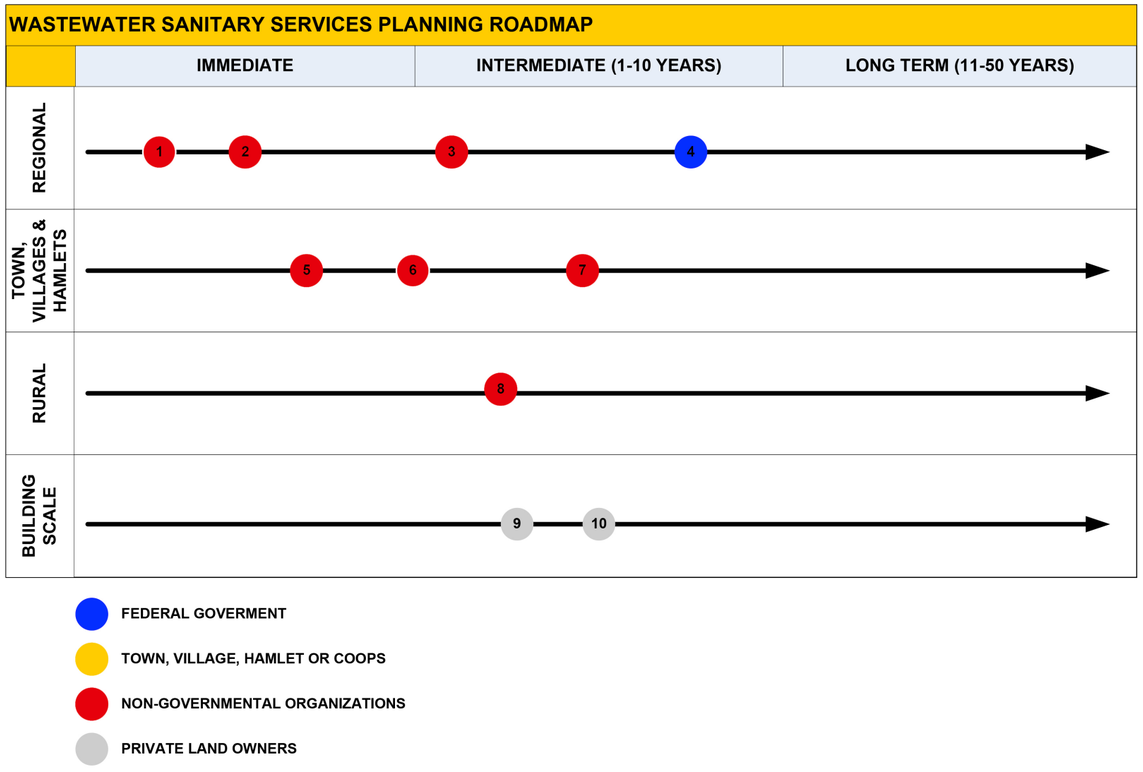
Wastewater Implementation Details

Ventilated Improved Pit Latrine

(Immediate and Intermediate Urban Environments)

The technology: Ventilated Improved Pit (VIP) latrines are designed to reduce two problems frequently encountered with traditional latrine systems: bad odors and insect proliferation. A VIP latrine differs from a traditional latrine by having a vent pipe that is covered with a fly screen. Wind blowing across the top of the vent pipe creates a flow of air which draws out odors from the pit. As a result, fresh air is drawn into the pit through the drop hole and the superstructure is kept free of smells. The vent pipe also has an important role to play in fly control. Flies are attracted by light and if the latrine is suitably dark inside, they will fly up the vent pipe towards the outside light, where they are trapped by the fly screen and die of dehydration. Female flies, searching for an egg-laying site, are attracted by the odors from the vent pipe, but are prevented from flying down the pipe by the fly screen at its top. VIP latrines can also be constructed with a double pit. The latrine has two shallow pits, each with its own vent pipe, but only one superstructure.

The cover slab has two drop holes, one over each pit, but only one pit is used at a time. When one becomes full, the drop hole is covered and the second pit is used. After about two years, the contents of the first pit can be removed safely and used as soil conditioner. The first pit can be used again



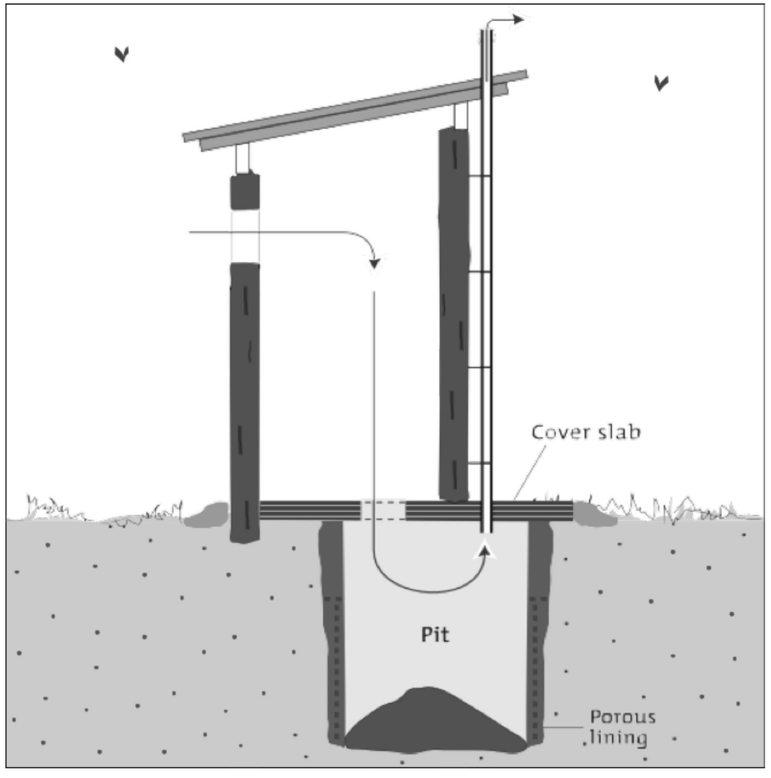


Figure 19 Ventilated Improved Pit Latrine

when the second pit has filled up. This alternating cycle can be repeated indefinitely.

Initial cost: A single-pit VIP family latrine costs US$ 70 - 400, while the double-pit VIP version costs US$ 200 - 600. These costs include materials (60 - 80%), transportation (5 - 30%) and local labor (10 - 25%). Actual costs will depend on the pit volume; the quality of the lining, slab and superstructure; whether materials are available locally; and local prices.
Area of use: Household and community level in rural and urban areas.

Main O&M Activities
Operation of pit latrines is quite simple and consists of regularly cleaning the slab with water and disinfectant, to remove any excreta and urine. The door must always be closed so that the superstructure remains dark inside. The drop hole should never be covered as this would impede the airflow. Appropriate anal cleaning materials should be available for the latrine users. Non-biodegradable materials, such as stones, glass, plastic, rags, etc. should not be thrown into the pit, as they reduce the effective volume of the pit and hinder mechanical emptying.

Every month, the floor slab should be checked for cracks, and the vent pipe and fly screen inspected for corrosion or damage, and repaired if necessary. The superstructure may also need to be repaired (especially light leaks). Rainwater should drain away from the latrine. When the contents of the pit are 0.5 m below the slab, a new pit should be dug and the old one covered with soil. Alternatively, the pit could be emptied mechanically.

Where latrines are used by a single household, O&M tasks are implemented by the household, or by hired labor. If several households use the latrine, arrangements have to be made to rotate the cleaning tasks, to avoid social conflicts.

If pits are not emptied mechanically, they can be emptied manually, but only after their contents have been left to decompose for about two years. Otherwise, new pits must be dug when a pit is full. If double-pit latrines are used, the users need to understand the concept of the system fully to operate it properly. User education has to cover topics such as the reasons for using only one pit until the time for switch-over; the use of excreta as manure; and the need to leave the full pit for about two years before emptying. The users must also know how to switch pits and how to empty them, even if they do not do these tasks themselves. If these tasks are carried out by the private (informal) sector, the workers have to be educated about the system and its operational requirements.

Actors and their Roles

Actors	*Roles*	*Skills Required*
User.	Keep the latrine clean, inspect and perform small repairs, empty the full pit and switch to the new one, dig a new pit and replace the latrine.	*
Local unskilled labor (sweepers/ scavengers).	**D**ig pits, transfer structures, empty full pits in double-pit systems, perform small repairs, and solve small problems.	Basic skills.
Local mason.	Build, repair and transfer latrines.	Technical skills.
Health department.	Monitor latrines and the hygienic behavior of users; educate users in good hygiene practices.	Highly qualified.

* *Simple (often requires gender-specific awareness-raising and training activities to change behavior and build capacity).*

O&M Technical Requirements

Activity and Frequency	*Materials and Spare Parts*	*Tools and Equipment*
Daily		
Clean the drop hole, seat and bucket; superstructure.	Water, soap.	Brush.
Monthly		
Inspect the floor slab, vent pipe and fly screen.		
Every 1 - 6 Months		
Clean the fly screen and the inside of the vent.	Water.	A twig or long flexible brush.
Occasionally		
Repair the slab, seat, vent pipe, fly screen or superstructure.	Cement, sand, water, nails, local building materials.	Bucket or bowl, trowel, saw, hammer, knife.
Depending on size and number of users.		
Dig a new pit and transfer latrine slab and superstructure (if applicable).	Sand, possibly cement, bricks, nails and other local building materials.	Shovels, picks, buckets, hammer, saw, etc.
Switch to the new pit when the old pit is full.		Shovels, buckets, wheelbarrow, etc.
Empty the old pit (if applicable).	*By hand:* water. *By mechanical means:* water and spare parts for the machinery.	*By hand:* shovel, bucket. *By mechanical means:* equipment for emptying the pit.

Potential Problems
- The quality of the floor slab may be poor because inappropriate materials were used in its construction, or because the concrete was not properly cured;
- Inferior quality fly screens are easily damaged by the effects of solar radiation and foul gases;
- Badly-sited latrines can get flooded or undermined;
- Children may be afraid to use the latrine because of the dark, or out of fear of falling into the pit;
- If the superstructure allows too much light to come in, flies will be attracted to the light coming through the squat hole and may fly out into the superstructure, which can jeopardize the whole VIP concept;
- In latrines that rely on solar radiation for the air flow in the vent pipe, rather than on wind, odor problems may occur during the night and early morning hours;
- Leakage between pits occurs because the dividing wall is not impermeable or the soil is too permeable;
- In hard soils it may be impossible to dig a proper pit;
- Pits should preferably not reach the groundwater level and must be 15 - 30m from ground and surface water sources;
- VIP latrines do not prevent mosquitoes from breeding in the pits;
- VIP latrines cost more to construct than simple pit latrines and the community may not be able to bear the higher costs;
- Cultural resistance against handling human waste may prevent households from emptying their own pit latrines, but usually local labor can be hired to do the job.

Sources: Smet et al. (1988); Wegelin-Schuringa (1991); Franceys, Pickford & Reed (1992).

Double-Vault Compost Latrine
(Immediate & Intermediate Rural Environments)

The Technology
The double-vault compost latrine consists of two vaults (watertight chambers) to collect the feces. Urine is collected separately, because the contents of the vault should be kept relatively dry. Initially, a layer of absorbent organic material is put in the vault, and after each use the feces are covered with ash (or sawdust, shredded leaves or vegetable matter) to reduce smells and soak up excessive moisture. The organic material also ensures that sufficient nitrogen is retained in the compost to make it good fertilizer. When the first vault is three- quarters full, it is completely filled with dry, powdered earth and sealed, and the contents allowed to decompose anaerobically. The second vault is then used and when it is three-quarters full, the first vault can be emptied (even by hand) and the contents used as fertilizer. The vaults should be large enough to keep the feces long enough for them to become pathogen-free (at least two years). A superstructure is built over both vaults, and each has a squat hole that can be sealed off. The latrine can be built anywhere, since the vaults are watertight and there is no risk of polluting the surroundings. Where there is rock or a high water-table, the vaults can be placed above ground. A ventilation pipe keeps the aerobic system active, which is essential for composting. Double-vault latrines have been successfully used in Vietnam and Central America (El Salvador, Guatemala, Honduras, Nicaragua).

Main O&M Activities
Initially, some absorbent organic material is put into the empty vault (layer of ashes or lime) to ensure that liquids are absorbed and to prevent the feces from sticking to the floor. After each use, or whenever available, wood ash and organic material are added. When urine is collected separately it is often diluted with 3 - 6 parts of water and used as a fertilizer. Water used for cleaning should not be allowed to go into the latrine as it will make the contents too wet. When the vault is three-quarters full, the contents are levelled with a stick, the vault is filled to the top with dry powdered earth, and the squat hole is sealed. The second vault is then emptied with a spade and bucket, after which the vault it is ready for use. The contents dug out of the second vault can be safely used as fertilizer. To help keep down the number of flies and other insects, insect-repelling plants (such as citronella) could be grown around the latrine. Potential users of a vault latrine technology should be consulted extensively, to find out if the system is culturally acceptable, and if they are motivated and capable of operating and maintaining the system properly. The project agency will need to provide sustained support to ensure that users understand the system and operate it properly.

Sources: Winblad & Kilama (1985); Franceys, Pickford & Reed (1992).

Actors and their Roles

Actors	*Roles*	*Skills Required*
User/ house-hold.	Use latrine, remove urine, help keep latrine clean, inspect and perform small repairs, help to empty the pit and switch over to the new pit.	*
Local mason.	Build and repair latrines.	Technical skills.
Local pit emptier.	Empty the pit and switch over to the new pit, check the system and perform small repairs.	Technical skills.
External support organization.	Investigate whether the double-vault technology is appropriate, monitor users' O&M and hygienic behavior and provide feedback, train users and local artisans.	Highly qualified.

* *Simple (often requires gender-specific awareness-raising and training activities to change behavior and build capacity).*

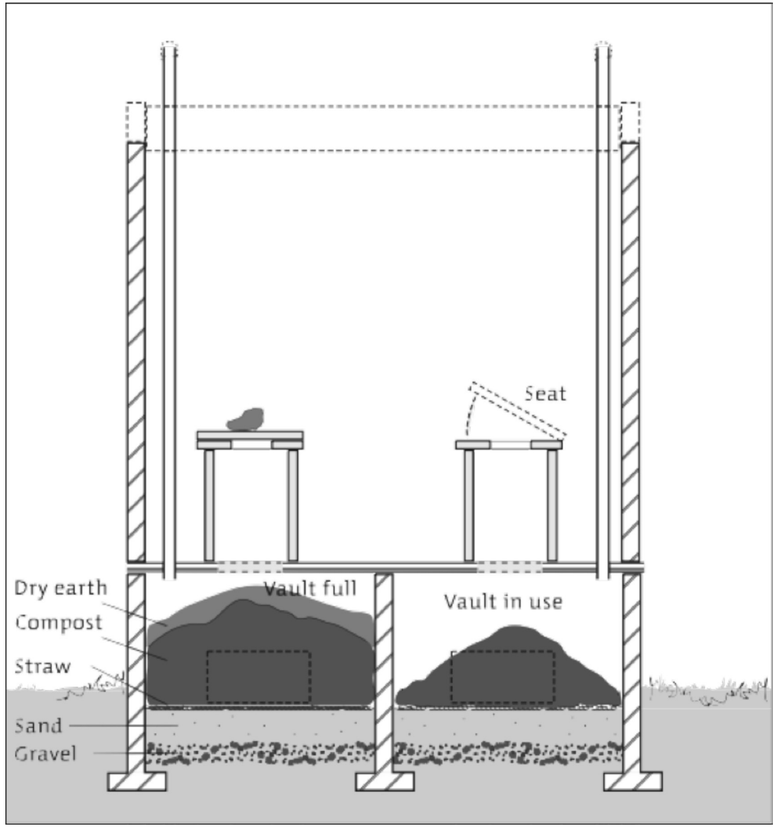


Figure 20 Double-vault compost latrine

O&M Technical Requirements

Activity and Frequency	*Materials and Spare Parts*	*Tools and Equipment*
Daily		
Clean the toilet and super-structure container. Empty the urine collection pot.	Water, lime, ashes.	Brush.
After each defecation or whenever available.		
Add ashes orother organic matter.	Wood ashes and organic material.	Pot to contain the material, small shovel.
Monthly		
Inspect the floor, superstructure and vaults.		
When necessary.		
Inspect the floor, superstructure and vaults.	Cement, sand, water, nails, local building materials.	Bucket or bowl, trowel, saw, hammer, knife.
Use humus as fertilizer.	Humus.	Shovel, bucket, wheelbarrow.
Depending on size and number of users.		
Close the full vault after levelling and adding soil.	Water, absorbent organic material.	Shovel and bucket.
Empty the other vault, open its squat hole and add 10 cm of absorbent organic material before using.		
Store the humus, or use it directly.		

Potential Problems

- Users do not understand how to operate the system properly and leave the latrine contents too wet, which makes the vault malodorous and difficult to empty;
- Users are too eager to use the latrine contents as fertilizer and do not allow sufficient time for the compost to become pathogen-free;
- The double-vault compost latrine can only be used where people are motivated to use human excreta as a fertilizer;
- The double-vault compost latrine is not appropriate where water is used for anal cleansing.

Septic Tank and Aqua Privy

(Intermediate & New Construction Urban & Rural)

The Technology

Septic tanks and aqua privies have a water-tight settling tank with one or two compartments. Waste is flushed into the tank by water from a pipe that is connected to the toilet. If the septic tank is under the latrine, the excreta drop directly into the tank through a pipe sub-merged in the liquid layer (aqua privy). If the tank is away from the latrine (septic tank), the toilet usually has a U-trap. Neither system disposes of wastes: they only help to separate the solid matter from the liquid. Some of the solids float on the surface, where they are known as scum, while others sink to the bottom where they are broken down by bacteria to form a deposit called sludge. The liquid effluent flowing out of the tank is as dangerous to health as raw sewage and should be disposed of, normally by soaking it into the ground through a soak-away, or by connecting the tank to sewer systems. The accumulated sludge in the tank must be removed regularly, usually once every 1 - 5 years, depending on the size of the tank, number of users, and kind of use. If sullage is also collected in the tank, the capacity of both the tank and the liquid effluent disposal system will need to be larger.

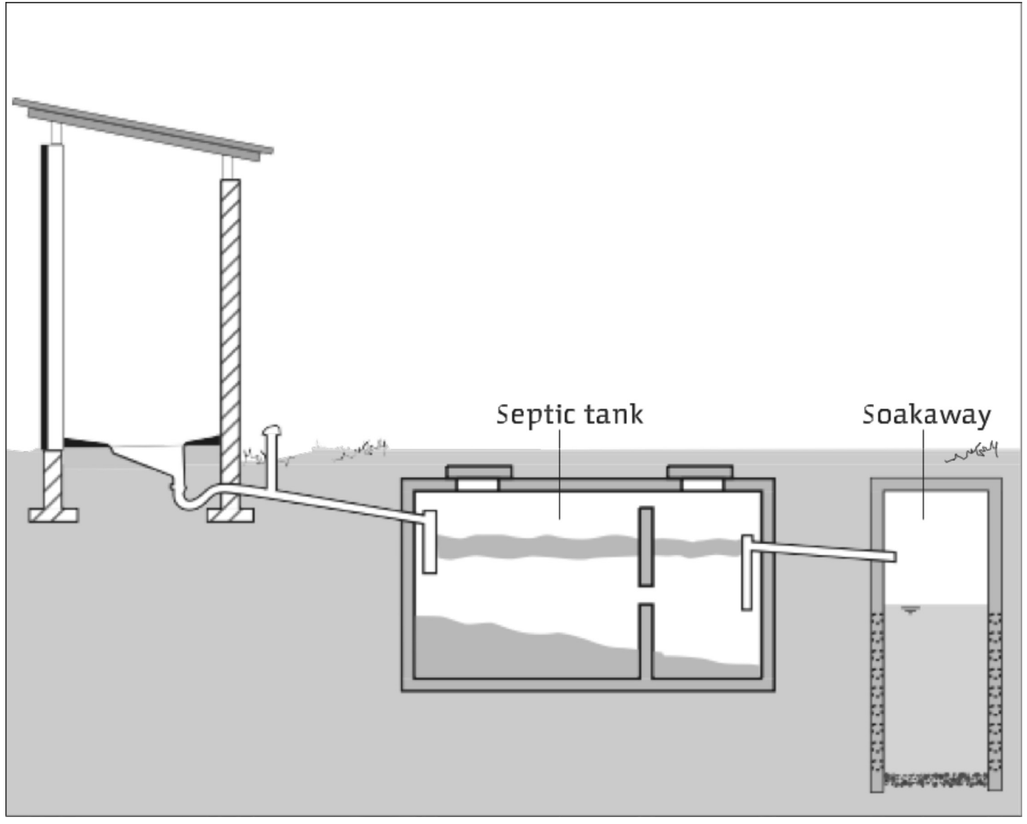


Figure 21 Septic tank

If the soil has a low permeability, or if the water table is high, it may be necessary to connect the tank to a sewer system, if available.

Every tank must have a ventilation system to allow methane and malodorous gases to escape. The gases are generated by bacteria during sewage decomposition, and methane in particular is highly flammable and potentially explosive if confined in the tank. Septic tanks are more expensive than other on-site sanitation systems and require higher amounts of water. Aqua privies are slightly less expensive and need less water for flushing.

Initial cost: US$ 90 - 375 (including labor and materials).
Area of use: In rural or urban areas where water is available.
Water needed per flush: 2 - 5 liters, if a pour-flush pan or aqua privy is used.
Sources: Kaplan (1991); Wegelin-Schuringa (1991); Franceys, Pickford & Reed (1992).

Main O&M Activities
Regular cleaning of the toilet with normal amounts of soap is unlikely to be harmful, but large amounts of detergents or chemicals may disturb the biochemical processes in the tank. In aqua privies the amount of liquid in the tank should be kept high enough to keep the bottom of the drop pipe at least 75 mm below the liquid level. A bucket of water should be poured down the drop pipe daily to maintain the water seal, and to clear scum from the bottom of the drop pipe, in which flies may breed. Adding some sludge to a new tank will ensure the presence of microorganisms and enhance the anaerobic digestion of the excreta. Routine inspection is necessary to check whether de-sludging is needed and to ensure that there are no blockages at the inlet or outlet. The tank should be emptied when solids occupy between one-half and two-thirds of the total depth between the water level and the bottom of the tank. Organizational aspects involve providing reliable services for emptying the tanks, ensuring that skilled contractors are available for construction and repairs, and controlling sludge disposal.

Actors and their Roles

Actors	*Roles*	*Skills Required*
User.	Flush the toilet, keep it clean, inspect vents, control contents of the tank, contact municipality or other organization for emptying when necessary, and record dates tank was emptied.	Basic skills.
Sanitation service.	Empty the tank, control tank and vents, repair if needed.	Technical skills.
Agency.	Monitor the performance of the tank and the teams that empty it, train the teams.	Highly qualified.

O&M Technical Requirements

Activity and Frequency	*Materials and Spare Parts*	*Tools and Equipment*
Daily		
Clean the squatting pan or seat or container	Water.	Brush, water and shelter.
Monthly		
Inspect the floor, superstructure and vaults.		
Regularly		
Ensure that the entry pipe is still submerged (for aqua privies).	Water.	Stick.
Occasionally		
Unblock the U-trap.	Water.	Flexible brush or other flexible material.
Repair the squatting pan or seat, U-trap or shelter.	Cement, sand, water, nails, local building materials.	Bucket or bowl, trowel, saw, hammer, knife.
Annually		
Control the vents.	Rope or wire, screen materials, pipe parts.	Scissors or wire-cutting tool, pliers, saw.
Every 1 - 5 Years		
Empty the tank.	Water, fuel, lubricants, etc.	Vacuum tanker (large or mini), or MAPET equipment.

Potential Problems
- Many problems arise because inadequate consideration is given to liquid effluent disposal;
- Large excreta flows entering the tank may disturb solids that have already settled, and temporarily increase the concentration of suspended solids in the effluent;
- If the water seal is not maintained in an aqua privy, the tanks will leak and cause insect and odor problems;
- This system is not suitable for areas where water is scarce, where there are insufficient financial resources to construct the system, or where safe tank emptying can-not be carried out or afforded;
- If there is not enough space for soakaways or drainage fields, small-bore sewers should be installed;
- Aqua privies only function properly when they are well designed, constructed and operated;
- Septic tank additives (such as yeast, bacteria and enzymes), which are often sold for “digesting scum and sludge” and for “avoiding expensive pumping”, are not effective.

Indoor Bathrooms with Septic Tank & Infiltration Field
(Schools, Public Buildings, New Home Construction)

The Technology
This technology is best suited for indoor bathrooms with a plumbed water source. The indoor plumbing should be properly vented and all fixtures should have plumbing traps to prevent odors from entering the living space. The system consists of a water tight two compartment septic tank and an infiltration field. The septic tank provides primary treatment and the infiltration field provides secondary treatment and disinfection.

This technology is recommended for new home construction, schools, public buildings and market place restrooms where the groundwater is at least 1.5 to 2.0 meters deep. Sizing and diagrams are provided for single family homes and a typical multi-family Lakou. Sizing for other facilities must be determined based on the size of the facility and the wastewater loading. The sizing is based on black water waste only (Toilets) assuming grey water (sinks, bath tubs, showers) waste is sent to a grey water seepage pit. This technology requires more land space than previously described technologies, but offers a higher level of treatment to preserve the quality of the groundwater.

Main O&M Activities
The only required maintenance activity is removal of sludge from the septic tank. This maintenance should be completed approximately every five years. This maintenance requires the use of a pump truck to remove the sludge and to transport it to a safe disposal site. A safe disposal site could

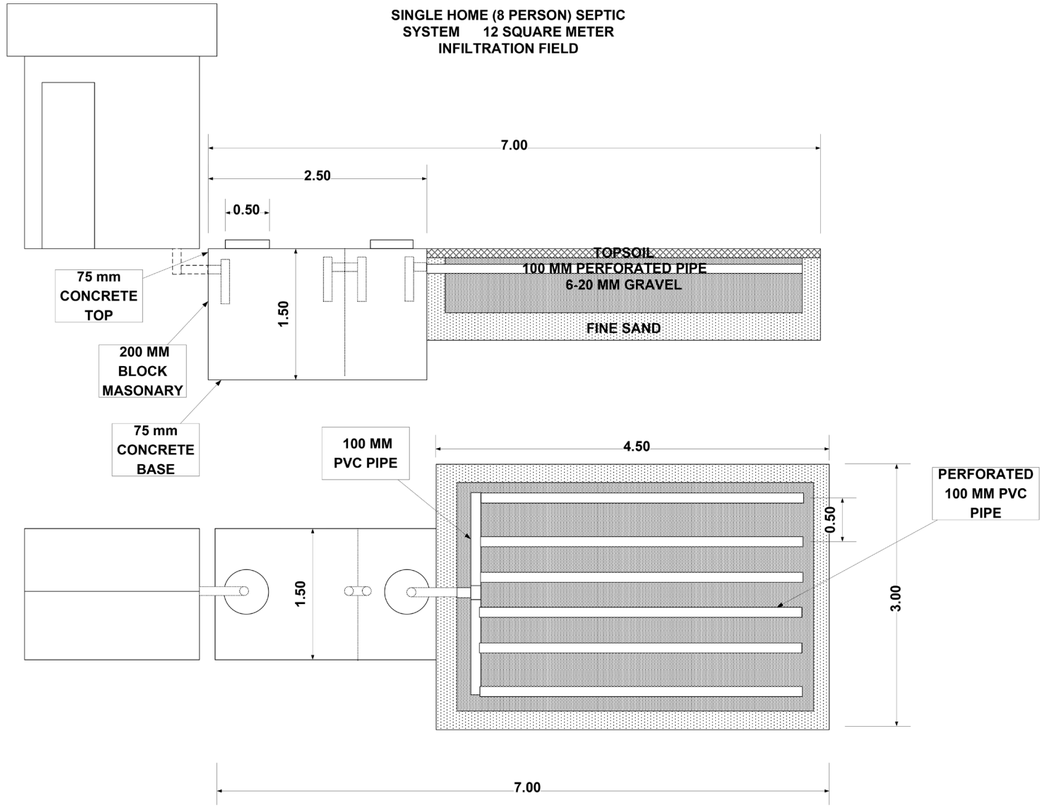


Figure 22 Single Family Septic System

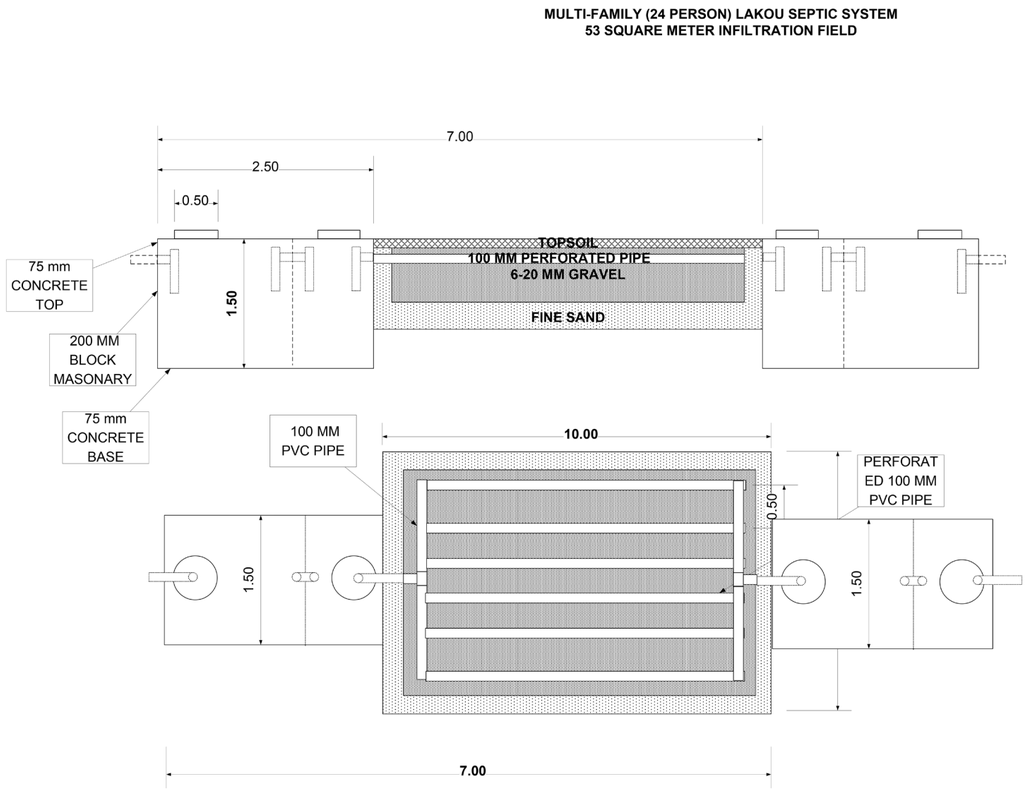


Figure 23 Multi-Family or Lakou Septic System

be a composting facility, a wastewater treatment plant or a barge to take the sludge out to sea. Thus one barrier to this technology is the lack of septic tank pumping services, however this could be a new industry for the region.

Central Sewer & Wastewater Treatment for Urban Areas
(Arcahaie, Luly, Saint Meddard, etc.)

The Technologies and Economics
The long term solution for sanitary services in the urban areas of the region is central sewers and centralized wastewater treatment plants. The cost of wastewater treatment on a per capita basis declines exponentially with the size of the wastewater treatment plan on the basis of cubic meters treated per day. The reliability of plants also increases as the size of a plant increases due to the professional nature of the operators of large plants and the availability of funds to maintain and operate the plant.

Sewer collection systems when possible should be gravity mains. In areas of high groundwater it is critical to construct watertight collection systems to minimize infiltration of groundwater into the collection system. High levels of groundwater infiltration can overload the wastewater treatment plants hydraulic capacity. Sewer collection systems are typically constructed of PVC pipe or concrete pipe. The majority of the mains are 225 mm with some larger trunk mains where flow volumes require. Manholes are typically spaced 150 meters apart to facilitate sewer main cleaning and are constructed of concrete. Sewer main construction costs for 225 mains, is approximately $100 USD per meter, with manholes costing approximately $1,500 USD each.

The lowest cost and simplest wastewater treatment system to operate are lagoons. Some lagoons require no energy at all to operate. These lagoons are called facultative lagoons and require large land area. Aerated lagoons require energy to operate and require less land area. A very effective compromise between the two in an area with consistent wind along a coast is an aerated lagoon using wind aerators. The skill level for operation of a lagoon system is low, the operation cost is low and the energy use is low or none. Lagoons survive earthquakes and hurricanes well.

The alternative if sufficient land is not available for lagoons is activated sludge technology. This technology utilizes concrete tanks or trenches and large amounts of aeration in the form of pumps to provide oxygen to the processes. This class of technology has numerous forms and vendors, but the general process is the same. This technology requires high operator skills, has higher operation costs and uses a significant amount of electrical energy. These systems are more susceptible to earthquake damage and hurricane damage.

It is recommended that planning for a central sewer and wastewater treatment facility begin as soon as possible for the largest urban area in the region which is Arcahaie. The framework for the first phase of preliminary planning would require:
- Identification of the service area boundary
- 0.5 meter topography of the service area
- A reasonably accurate +/- 20% estimate of the service area population

A preliminary study would provide the following as a first step to achieving the goal of central sewer collection and central wastewater treatment:
- A wastewater treatment technology recommendation
- Preliminary sizing of the wastewater treatment plant for cost estimation
- Identification of plant sites and necessary land area required for the plant

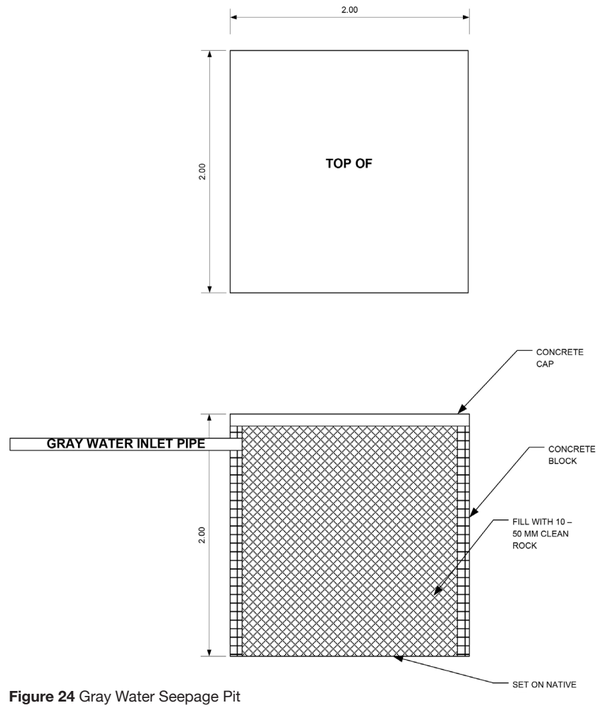


Figure 24 Gray Water Seepage Pit



Figure 25 Aerial Image of a Partial Mix (Aerated) Lagoon (40 hectares)



Figure 26 Aerial Image of an Activated Sludge Plant (5 hectares)

- Capital cost estimates for the sewer collection system, treatment plant.
- Operation cost estimates for the systems and recommended methods of funding plant operation via service fees.

In the USA, the timeframe from preliminary studies to final construction for a project of this scale including funding is approximately 10 years.

Energy

Historical & Current Conditions

Energy resources in the region are nearly non-existent. Charcoal is the primary fuel for cooking and is the major cause of de-forestation in the country. Electricity is primarily supplied by diesel generators. Fuel for vehicles and generators is expensive as all fossil fuels are imported. Some limited solar photovoltaic is being used in the region for decentralized energy in small businesses, churches, schools and hospitals. The lack of an energy infrastructure is a major limiting factor for economic development and increased prosperity for the populace. Agriculture and fishing revenues are limited due to lack refrigeration. Industries and tourism need energy to operate.

Recommended Technologies and Roadmap

1. The use of fossil fuels should be limited due to the cost and lack of local sources, however fossil fuels are recommended for cooking. The use of charcoal should be replaced with kerosene, white gas or liquefied petroleum fuels due to the high environmental impact of charcoal. Solar Ovens are also being utilized and are recommended.
2. Small wind generation and solar photovoltaic are recommended for the immediate and intermediate term for electrical power for homes, businesses and public facilities.
3. Solar hot water is recommended where hot water is required for sanitation, food processing and other industrial processes.
4. Agricultural biomass and trash incineration should be utilized for industrial processes and energy.
5. Tidal generation, hydropower and large wind power should be utilized to develop a central energy grid for urban areas. Pumped Hydro energy storage can be utilized for energy storage and is compatible with the water resource management and flood recommendations for dam construction. Wind maps show the Highlands have average wind speeds compatible with large wind generation.
6. Methane gas should be utilized to power mechanical wastewater treatment plants.
7. Solar street lights for lighting public areas. There is a local manufacturer of solar street lights in Haiti; the lights incorporate phone charger stations.

Transportation Improvements

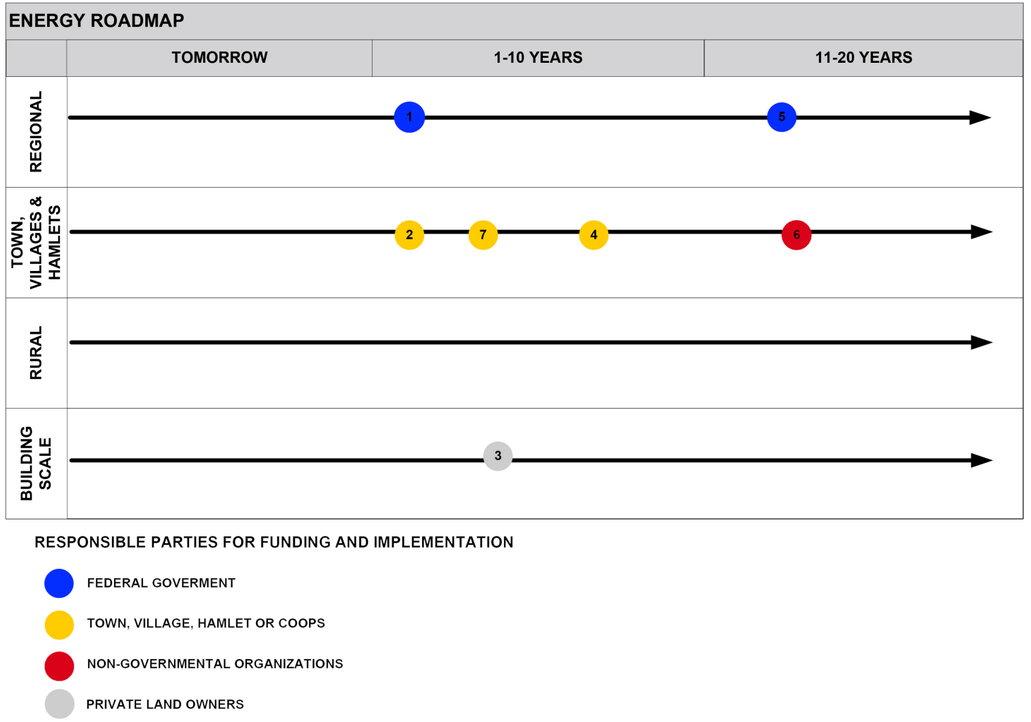
Historical & Current Conditions

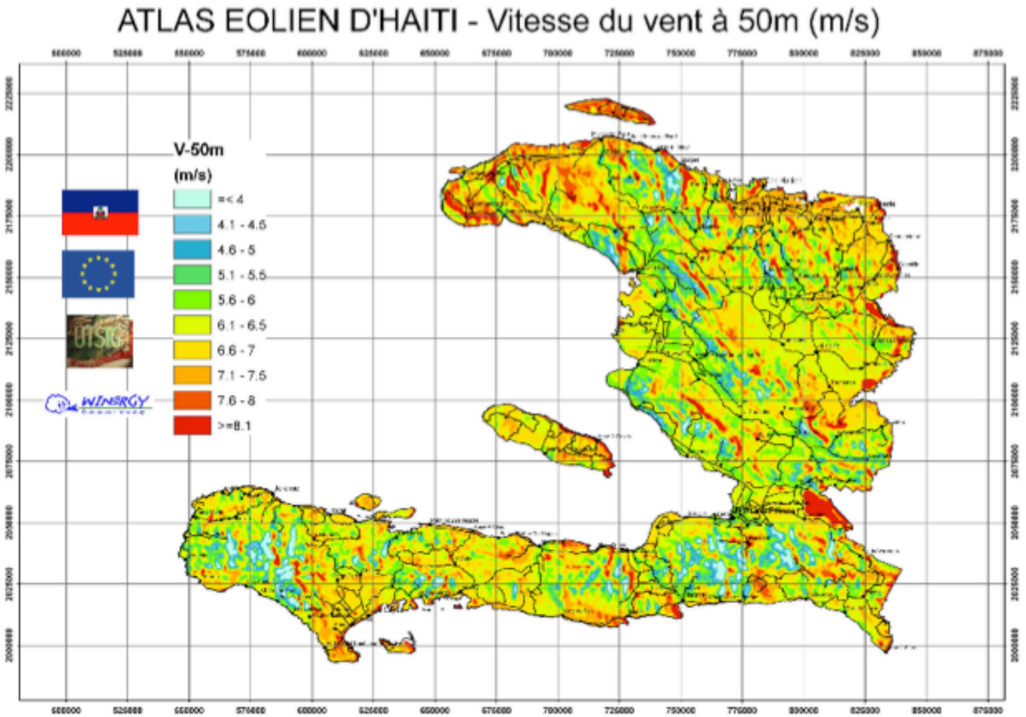
The region has an existing network of highways, streets, rural roads and trails (see transportation map). The transportation map shows existing transportation elements and proposes new linkages and connections to the system. Transportation routes in the lowland area have maximum grades of 3-5% typically and the only major barriers are rivers, streams and dry washes. In the Highlands slopes of 15% are typical and roads must use maximum slopes to achieve elevation, cross many washes & ravines and use tight curves to complete switchbacks. Rainfall in the Highlands regularly washes out roads. Soil conditions combined with rainfall often create dangerous conditions on these roads.

Recommendations for Transportation

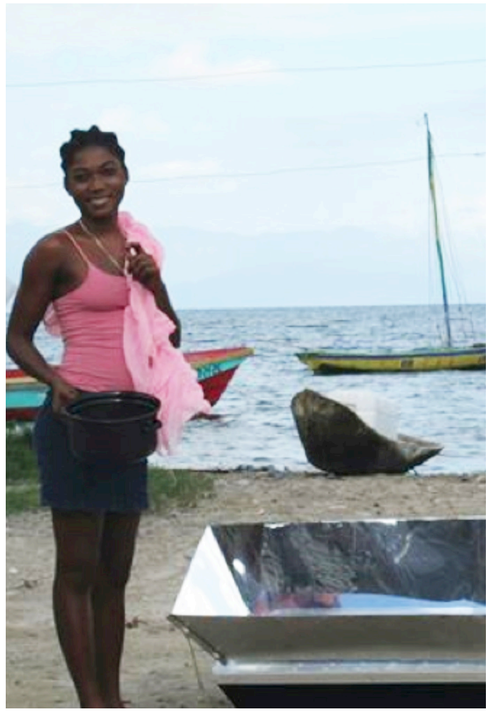
This section of the report is limited to recommendations for the Highlands roads and rural non-paved roads in the Lowlands. The purpose is to provide recommendations to improve conditions for transportation on existing and proposed roads based on the topographic and geologic conditions.

1. The proposed solution for rural roads crossing washes





Wind maps show the Highlands have average wind speeds compatible with large wind generation.



The use of fossil fuels should be limited due to the cost and lack of local sources, however fossil fuels are recommended for cooking. Solar Ovens are also being utilized and are recommended



Partners in Health Clinic at Thomonde. Small wind generation and solar photovoltaic are recommended for the immediate and intermediate term for electrical power for homes, businesses and public facilities.





The LAMP-CELL is the latest solar street light designed and manufactured in Haiti by ENERSA. It has a cell phone charging station which can recharge 8 cell phones at the same time, up to 50 per day.

or ravines that experience wash outs from rainfall events is low water crossings. Low water crossings are a lower cost alternative to a bridge. The term low water crossing indicates that during storm events the crossing is designed to be overtopped by the stream flow. There are two main categories of low water crossings, non-vented and vented crossings. Non-vent crossings are suitable for dry washes where there are only flows during storm events or the stream flow is low enough to drive through or walk through safely. Vented low water crossing are better suited for crossings where the stream flow in normal conditions is too swift and deep for crossing by vehicles or pedestrians. Crossings can be hardened to prevent wash out with rocks, concrete blocks or poured concrete.

2. Mountain roads in steep terrain are subject to erosion, landslides and rockslides. Some native soil conditions also cause roads to become very slippery when wet. Figure 28 shows a typical mountain road section properly constructed to minimize erosion, landslides and rockslides from storm events. Roads should be crowned to drain the roadway and should be surfaced with a material that does not become slippery when wet. A drainage ditch should be provided on the uphill side of the road with culverts to drain the runoff under the roadway. The Traveled Way should be a minimum of 6 meters to allow two vehicles to pass with a 1 meter shoulder on each side of the traveled way.



Figure 26 Unvented Concrete Block Hardened Low Water Crossing



Figure 27 Picture of Vented Low Water Crossing

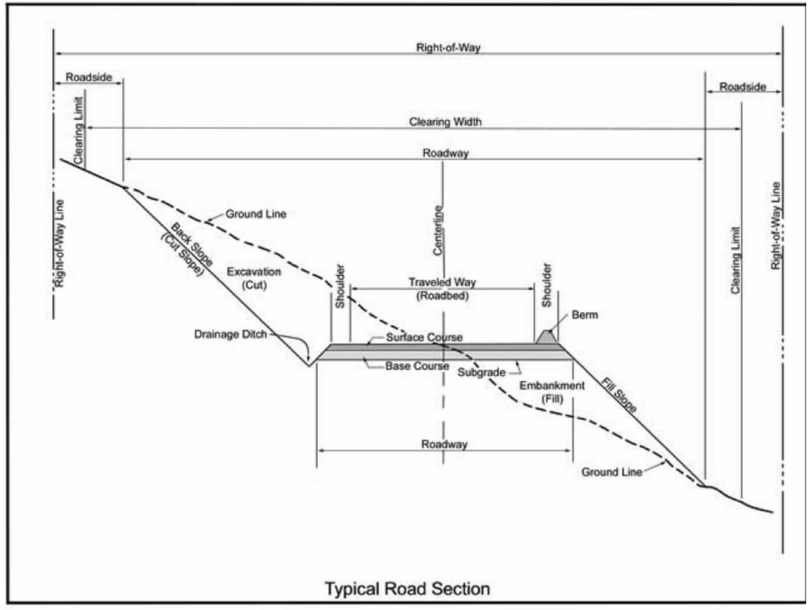


Figure 28 Typical Mountain Road Section

Agrotourism in Arcahaie and the Cotes des Arcadins

Armando Montero, Lecturer, CUCD Research Affiliate, Research Affiliate, University of Miami School of Architecture

Introduction

Despite a history of oppression, poverty and disasters, both manmade and natural, the people of Haiti find themselves at the door of a new beginning. Whether they open the door and step through or not is wholly in their power. An old Haitian proverb reminds us that… *Moun ki bezwen deyò, chache chemen pòt (he who must go out, search for the door).*

Struggle is nothing new to the Haitian people who fought hard to gain their independence from France. After defeating the French and Loyalist forces, General Dessalines in the Declaration of Independence stated “We have dared to be free, let us be thus by ourselves and for ourselves” (1). Haiti’s motto “L’Union Fait La Force” can once again herald the way to sustainable economic development across all social classes, striking a blow at chains that shackle the dreams and desires.

The tumultuous history of socioeconomic and political problems in Haiti, compounded by recurring natural disasters, continues to oppress the livelihood of the vast majority in the country. Most critical is the ongoing crisis of food security with 44.5 percent of the population being undernourished (2) despite a steady increase in the food supply since 1992 due to imports. A country that once led the world in coffee, sugar, tobacco, and cocoa exports now is heavily dependent on imports and foreign aid. Haiti’s crop yields are among the lowest in the Caribbean and Latin America. Farms are small, usually less than one acre in size, and barely produce enough to feed the farm’s family. Currently less than 40 percent of the national food requirements are produced domestically, and agricultural exports account for only 5 percent of total production (3). Increases in productivity are possible but numerous factors, both natural and man-made, work against the Haitian farmers.

The typical farmer tends to his crops somewhat isolated from any form of technical assistance or cooperative effort. He faces the threat of natural disasters such as storms, drought, floods, earthquakes, and disease, with little but antiquated tools and technology. More than half of the landmass of Haiti is composed of steep slopes, in excess of 40 percent gradient, limiting cultivable land to 28 percent (3).

Deforestation due to the country’s reliance on charcoal continues to precipitate erosion of fertile soil, further diminishing agricultural productivity. Lack of access to farm credit hinders the ability to purchase seed and invest in technology that would boost production and strengthen resiliency. If the farmer manages to overcome the many obstacles, and produce a small surplus, he/she still faces competition from lower priced foreign imports such as rice. The isolated agricultural regions are also poorly served by infrastructure. Post-harvest losses, caused by the inability to deliver produce quickly before it spoils further cuts back on production. Central processing plants that could handle and transform produce before spoilage are scarce, and refrigeration in rural areas is practically nonexistent. Hungry, and looking for subsistence, many flee to the urban centers with hopes of survival. By 2013, despite the great losses of population due to the 2010 earthquake, more than 56% lived in urban areas (4) where government, health, education, and relief organizations reside. A lack of adequate services in rural areas continues to fuel the exodus.

Humanitarian aid to Haiti stepped up immediately after the earthquake. Well intentioned, governments, foundations, and individuals have donated millions of dollars creating whole economies centered on relief workers and NGOs. By 2013, three years after the earthquake that devastated the country, 1.4 billion dollars had been donated by the US and its citizens to Haiti. As of 2014, total funding from all sources is over 3 billion dollars of this $327,630,198 has been funded as food aid (5).

Not all aid is beneficial for long-term recovery and development. Humanitarian and emergency relief aid is necessary at the time of crises but it cannot create lasting economic development. Charitable gifts and donations, by well-meaning organizations, often lack a fundamental understanding of the history, culture, and society of the place. Driving from Port au Prince to Arcahaie solar panels are for sale in the markets, perhaps the result of a technology implanted without adequate training and education as to its value, and how it can best be used. That donation, which may seem rational to a Foundation abroad, does not address the needs of a family looking to feed itself or their simply not knowing what to do with solar power. Consequently, solar panels are sold in order for families to place food on the table - a priority for most.

When looking at the sprawling tent cities surrounding the capital of Port au Prince, evidently, housing continues to be a priority. Yet, interestingly, not far from the capital, are new developments, featuring modest modern housing, placed on isolated lots, reminiscent of typical American suburban plans. These projects are mostly empty, because although tectonically superior to informal building practices, they lack the sensitivity to the cultural forces and traditions that shape vernacular Haitian town plans, and more particularly, the family dwelling unit. This includes ignoring unwritten cultural taboos. There is a place for everything in Haiti and everything has its place. Additionally, religious beliefs and traditions often dictate where things go.

In like manner, at a larger scale, projects are funded, constructed, and operated until either a lack of operational training or maintenance catches up, or the project is abandoned as it awaits another influx of money to arrive. For example, a tilapia farm can be funded, beautifully constructed and for a while prove productive, but it may well end up abandoned if upfront funding dollars do not include workforce training and facility maintenance.

It is true that Haiti still needs much help. There has been some progress, yet much needs to be done, particularly in areas of rebuilding and infrastructure. Efforts need to be shifted however towards educating and training the people, to wean the country from foreign aid and recreate the sustainable self-sufficient country that Haiti once was and can be. The hardships and struggles of Haiti provide important lessons in charting a new path for the country. Many speak of recovery after the earthquake, however it is a new course, a new culture, and the state of collective mind, that need forging from the ashes and rubble of the devastation. Created not solely from external influences and resources, but uniquely crafted from the raw and beautiful material, culture, and history that is everywhere in Haiti, especially in the Commune of Arcahaie.

The Lay of the Land

Arcahaie is a land of great natural beauty, but it is not without its share of problems. It is like a rose surrounded by thorns. Lack of forestation and ground cover have degraded the soil by exposing it to the elements, causing the loss of valuable nutrients needed to support prospering vegetation. With heavy rains, whatever is left of the exposed soil erodes, exacerbating the rate of nutrient loss, and rendering it incapable of sustaining substantial vegetative

growth. With erosion, the soil's ability to percolate water becomes less effective resulting in greater runoff, more erosion, and higher potential for dangerous flash floods and landslides. Bare soils give up carbon to the atmosphere rather than storing it, contributing to climate change - a force that Haitian farmers will also have to contend with at an escalating rate.

With strategic interventions, the problems that face Arcahaie can be transformed into viable sustainable solutions. Change is necessary for the survival and prosperity of the people of Arcahaie. The rubble of destruction can be turned into houses; the floodwaters that kill so many can be diverted into irrigation systems and hydroelectric power, and the refuse that is everywhere, recycled into construction materials and compost to nourish the soil. Everywhere there is opportunity to change either a problem or a liability into an asset.

In many ways, Arcahaie is inspiring. The lack of electricity, water and sewer and other public services has not dampened the Haitian spirit or the smiles on people's faces. In many ways, the quality of social life is good if not better than in many affluent societies. Lacking the gadgetries of modern society, Haitians sit at the front of the house and talk with family and neighbors in the evenings; a drastic counterpoint to the new mores of America's society.

Economic growth in Arcahaie can improve the quality of life for those who reside in the area, as long as recognized as a fundamental value. To sustain a new economy, no economic interest can be above the reverence of life, not only human life but all life forms, including the lives of plants, animals, oceans, the soil, as well as, all the people. Every action matters. Even small changes are often felt worldwide - like planting a garden - *Sa ou plante se li ou rekolte (what you sow is what you will harvest)*. The survival of the country depends heavily on the services of the total ecosystem. This lesson needs to be clearly etched into the minds of the young and old alike, if there is to be a bright and healthy future for the country.

Max-Neef, a prominent Chilean economist, lays down five postulates and one fundamental value, all which must be adhered to in order to achieve a sustainable economy. These are:
1. The economy is to serve the people and not the people to serve the economy
2. Development is about people and not about objects
3. Growth is not the same as development and development does not necessarily require growth
4. No economy is possible in the absence of ecosystem services
5. The economy is a subsystem of a larger finite system - the biosphere - hence permanent growth

The people of Arcahaie are looking for change in order to create opportunities and rise above mere subsistence. A new economy needs to be forged. Ultimately, to achieve productive change, it is necessary to look inward and take inventory, carefully noting the region's assets and liabilities, with minds emotionally freed from the past, and with an eye on the future. Only then can a vision uniquely Haitian be realized, one engulfed with the spirit of Arcahaie - the same spirit that created a flag that all Haitians united under as free men and women.

Agriculture is an integral part of Arcahaie - it is like a second language to the majority of the population and a fundamental aspect to its economic development and regional prosperity. The young people of Arcahaie are themselves the seeds for the future crop. In Arcahaie, there are good seeds to plant and the soil is fertile.

The fundamental processes of agriculture, selecting the crop, preparing the soil, planting the seeds, nourishing the crop, and harvesting the fruits, can also be applied to economic development. However, it is also important to understand that sustainable agriculture can only be achieved through sustainable practices. Likewise, a sustainable economy is also based on sustainable principles.

What do we Plant? - A Conversation with the Community
In open forums, conducted throughout the Commune of Arcahaie, the people of the region have spoken eloquently and with clarity about the many problems they have faced in the pre and post-earthquake eras.

In the agrarian sector, the need for training and education in new technologies is deemed as very important. Farmers seek alternatives to traditional methods employed for centuries. Current techniques go back to a time when the soils were rich in nutrients, the crops hardy, and well suited for the environment. There is interest in new techniques that enrich soil and conserve water; both are crucial to the area.

In workshop sessions, members of the fishing industry expressed a need for training in new techniques. Fishermen still rely on row boats and primitive fishing methods, which limit their activities to near shore. Consequently, those waters have been dramatically overharvested. Breeding populations of reef fish are dwindling and making it more difficult to get a day's catch.

Across all sectors of agriculture, there is a need to adequately store and process harvests. Many participants spoke of the need for 'processing plants' to handle surplus crops, near the source, before harvests spoil. Refrigeration is also a vital component, particularly in the fishing industry. Reliable and accessible electricity and refrigeration are essential to the growth and prosperity of the various fishing and agricultural industries in this region.

Soil degradation and access to water are of great concern to the farmers in the area as well. Although there is commonly adequate rainfall, the inability of the soil to hold water, creates drastic swings between drought and flood conditions. Farmers do not see the irrigation ditches and canals that deliver water to the different areas as reliable or able to meet their needs.

Farmers also spoke of the lack of support from agencies and access to technology and credit necessary to revise the antiquated systems they are using in order to maximize crop yields. Much of this is caused by centralization of government and services in Port au Prince. During the earthquake centralized governmental agencies like Ministère de l'Agriculture des Resources Naturelles lost paper-based registries, archives and official documents, as well as important staff needed to service the territory. For the typical farmer, acquiring information, buying land, and registering ownership can take months or years.

Infrastructure is also a concern for all. Roads are poor and dangerous, particularly within, and to and from the mountains. Utilities are not consistent, if available at all. There are no structured sewage or water treatment facilities, there is a very scarce, and at times sporadic, distribution of electrical power, and the lack of these services negatively affects farmers and their crops.

Lastly, some citizens elaborated on the need for public spaces for recreational purposes. While others spoke of their fears that public beaches are in danger of being privatized, as development expands along the coast.

Tourism
The major tourist destinations in the region are the all-inclusive waterfront resorts. These resorts usually are developed as a response to the lack of amenities or security

in the surrounding community creating a walled-in paradise where all the needs of a traveler are met without going outside the walls. Visitors to these facilities rarely leave the safety and security of the resort compound. Armed sentinels at the entrance reinforce the perception of a lack of safety outside the walls. Unfortunately, although all-inclusive resorts destination play an important role in attracting visitors to the region they are also exclusive and limit the potential for direct tourist spending and interaction with the local people in the community.

In general, it is believed that there is a potential for increased tourism in the area, benefiting the already established resort hotels located along the coast. However, the potential for small-scale hospitality operations currently is being overlooked. Education and training in this sector would be necessary to accomplish it. In the region, Eco-tourism and Agro-tourism opportunities have been seldom given consideration. While the potentialities of eco-tourism were embraced by meeting participants representing some of the local resort hotels, farm based agro-tourism was not cited. And, yet, “today’s tourists are willing to pay for the preservation of the natural and social environment they seek to explore. Agrotourism is a softer way to develop sustainable tourism in rural areas and also acts as farm tourism; agro-tourism is seen as a kind of rural tourism related to agriculture. Visitors become acquainted with the cultural landscape, local products, traditional cuisine and the daily life of the people, as well as the cultural elements and the authentic features of the area, while showing respect for the environment and for tradition. Agrotourism mobilizes the productive, cultural and developmental forces of an area, contributing to the sustainable, environmental, economic and social development of the rural zones.” (Faganell, 2011)

In parallel, to the needed introduction and nurturing of new opportunities that possess a natural synergy with the rural character of Arcahaie, there is also to need to address head-on some of the region’s obstacles to progress and prosperity. Both observations in the field and discussions with locals reveal a lack of attractions and shopping or dining opportunities catering to tourist. For tourist visiting the area, public transportation is unreliable, and emergency medical treatment is nearly nonexistent. Sanitation is dismal, trash is just about everywhere - along roads, in public spaces, beaches and in the coastal waters, and the perceived threat of disease is high. These issues conspire to slow the growth of the tourism industry in the region. Furthermore, to expand and refine this industry, a trained workforce is necessary to meet higher standards of services and better maintain those venues.

Growing an Agricultural Economy

What to plant depends on the season and the needs of the farmer. No one single crop can sustain a village or the Commune for any amount of time. Multiple crops offering differing nourishments are necessary for complete and balanced nutrition of the body. Furthermore, to sustain human growth and development you need to nourish the needs of the body, the mind, and the soul. The needs of settlements, in this case the Commune of Arcahaie, parallels the needs of the human body. Arcahaie needs nourishment and diverse efforts need to be undertaken to move the Commune into a sustainable economy - a fully functioning healthy body.

By carefully listening to the people, noting their needs one can begin sorting the seeds that are to be planted to attain desired results. Four essential categories (crops) are proposed to fill the needs of the region. But it is the citizens that must plant and care for the seeds in the soil they will restore.

Crop 1

Addresses deficiencies in food security. Solutions that improve crop yield and diversity are important. Improvement and access to distribution systems and processing of food are necessary. Fundamental is education in sustainable agricultural techniques that are applicable at a small scale by the average farmer on small parcels of land. Soil conservation and enrichment strategies are essential in increasing crop yield as are improved water management strategies.

Arcahaie’s coastal areas can yield a bounty of seafood if properly managed. Mangrove areas although few need to be restored and protected. Education on the importance of conserving the fisheries is key to the success of the industry. As with agriculture, new methods of production need to be instigated including aquaculture projects that can produce shrimp, fish, crayfish, and conch in sufficient quantities and relieve the stress currently placed on the population of fish on the inner reef.

Crop 2

Addresses deficiency in health care services and infrastructure. Improved access to health care clinics and emergency centers will not only benefit the population but also serve tourist and guests to the area. Along with clinics, hospitals and emergency centers projects that improve sanitation and potable water supply are fundamental to disease control. Better road conditions improve safety and reduce the fatality caused by accidents.

Crop 3

Addresses deficiencies in civic pride. Social identity and the need for belongingness raises the mind and spirit. This is mostly achieved through institutions that strengthen family, social networks, and that work for a common goal. The development of civic and social spaces and the creation of area festivals that highlight the assets of the region help forge solidarity and increase tourism and economic development. Educating residents on the importance of maintaining the public realm clean and nurturing the sense of public stewardship is essential in achieving civic pride.

Crop 4

Addresses deficiencies in education, training and entrepreneurship. To best serve the people they must learn to serve themselves. By developing educational opportunities, increasing knowledge and fostering the creative and entrepreneurial spirit the people of Arcahaie thereby achieve mastery and independence, leading to total freedom and self-sufficiency.

Preparing the Soil

Traditional farming techniques involved plowing the soil with a mold-board plow pulled by teams of oxen or other draft animals and depending on soil conditions a farmer could plow one acre per day. The work was arduous. The soil was cut deeply with a blade and flipped or turned over simultaneously. The technique has been applied almost identically throughout the world. It is as primitive as cutting and bleeding a person to cure an illness and gain a favorable response.

Today we understand that deep plowing land eventually degrades the quality of soil reducing crop yields over time, accelerating erosion due to poor drainage, and reduces the ability of the soil to store carbon thereby releasing it to the atmosphere. It also requires more irrigation due to its inability to hold moisture and the soil requires heavy supplementation of fertilizers and other chemicals, mostly trucked-in to the farm, to maintain an acceptable level of crop yield. Certainly, this is not as sustainable as one might think. Modern farming practices also commonly exploit nature.

Sustainable agriculture above all increases the quality of the soil organically, using natural processes within the

boundaries of the farms through recycling or conversion of waste and by-products into compost and loam. It grows soil. Sustainable agriculture is most effective when it is small scale and diverse so that synergies can be developed between different plant and animal systems. It draws from the place and benefits the place.

Preparing the soil for socio-economic growth and a sustainable economy is much like planting crops. Haiti has suffered under the plow cutting deep furrows not only into soil but also the bedrock below. The plow has left bitter memories of pain and suffering for generations past. Many times throughout its history Haiti has been plowed. The very surface of the social, economic and political soil turned over, what little grew on the surface tilled under, painfully exposing the soil and its diminishing nutrients to the winds of time eroding its ability to sustain itself.

Sustainable economic growth, like agriculture, builds the socio-economic soil. It is organic relating to the place and it promotes the development of people over the development of goods. It fosters creativity and endorses entrepreneurship from the bottom up. Like compost that enriches the soil using decayed organic material, the decay of social, political, and economic values in Arcahaie provide the necessary nutrients to spur economic growth. Each problem presents an opportunity.

Preparing the socio-economic soil requires the examination of its condition noting the positive qualities and the negatives. It entails correcting deficiencies in needs of the population so that ideas can flourish without stress and yield maximum results that are sustainable and will lead to self-actualization and freedom for all.

It's not rocket science, it's common sense. Maslow's theory of human needs formulated in 1943 stated that people are naturally motivated to achieve certain needs. He identified five motivational needs and divided them into two categories, basic needs and growth needs. Although well publicized yet often criticized, they are included here as the list of essential nutrients necessary for growth and development.

The categories of motivational needs from lower level needs to higher-level needs are:
1. *Biological and physiological needs* - air, food, drink, shelter, warmth, sex, sleep
2. *Safety needs* - protection from elements, security, order, law, stability, freedom from fear.
3. *Social needs* - friendship, intimacy, affection, and love; from work group, family, friends, and romantic relationships
4. *Esteem needs* - achievement, mastery, independence, status, dominance, prestige, self-respect, and respect from others
5. *Self-actualization needs* - realizing personal potential, self-fulfillment, seeking personal growth and peak experiences

The basic needs (physiological, safety, love, and esteem) motivate people when un-met and the desire to fulfill the need grows the longer the need is denied. Growth needs generally are satisfied by actions leading to self-actualization. The hierarchy of needs requires that the most fundamental of the basic needs be satisfied before progressing to higher-level needs.

Economic growth is not sustainable unless it is brought to life through the efforts and sacrifice of its beneficiaries and not through monetary or material donations. The gift of material goods makes people dependent - knowledge can make them free.

Grow Soil = Grow the Economy
A priority for all of Arcahaie is the conservation and rehabilitation of its soil and water. Without these efforts,



Medieval Plowing Woodcut drawing (Public Domain, 1)

the welfare of the population cannot be sustained. Food security will continue to diminish and flooding disasters will be more severe, this being the only way the land can communicate its need to restore a balance.

Terracing

To grow food farmers need arable land, water, and seeds to plant. All of which are very limited. Arcahaie benefits from a relatively flat alluvial plain at the base of the mountains that produces forty five percent (45%) of the plantains and bananas consumed in Port-au-Prince. It is approximately 10 percent of the total land area in the Commune. The remaining 90 percent is on sloping land in the mountains and often difficult to farm.

The steep slopes and lack of vegetation cause water to run off the mountains collecting in the rivers and streams that work their way to the plains. Most of the surface water that normally flows down the rivers in Arcahaie is diverted for agricultural use. During heavy rain events the rivers overflow creating dangerous floods and sending sediment laden water out to sea. Often these floods are catastrophic, which threaten life and crops.

Recommendations listed in the Regional Engineering Report suggest that river channels be rehabilitated by removing sediment. Also recommended is the use of check and flood control dams to alleviate flooding issues. These interventions can improve the availability of irrigation to crops in the region.

In the mountains of Arcahaie terrace farming can address the need for sediment and flood control. Terrace farming is a sustainable practice that has been used in the Far East and the Americas for centuries. Terraces can be designed to slow the flow of water, catch sediment, and create valuable flat land on steep slopes that can be placed into production. Terracing of the highlands will alleviate problems throughout the watershed, preventing silting of irrigation canals downstream, allowing better infiltration into the soil, and the recharging of aquifers in the plains.

With the support of the International Fund for Agricultural Development (IFAD), a German NGO Welthungerhilfe, and the World Food Program, a coalition of farmers in the valley of Nan Carré in the north west department, worked together to rehabilitate their watershed (7). The approach addressed the rehabilitation comprehensively, treating the upper watershed and the lower irrigation canals that serve the plains as one system. Repairing and cleaning out the irrigation canals to reestablish flow and terracing the upper watershed to reduce erosion and retain water restored the system and increased crop yields and farmers' incomes drastically.

Farmers, without adequate irrigation, were planting one or two crops a season. Lack of irrigation and storm damage, including floods, would result in poor yields. After the rehabilitation, according to the IFAD report, farmers are planting as much as 4 crops resulting in higher yields and greater incomes. Lessons from the success of this project can be applied in Arcahaie.

Terraces not only improve water and soil management but in many parts of the world they have added to the picturesque landscape of the countryside. Terraced farm lands like those supporting the ancient Incas in Machu Pichu or the Hani rice terraces in China are seen as marvels of ingenuity worthy of seeing. For Arcahaie, a vast landscape of terraced farmlands could become part of an agro and ecotourism corridor through the region.

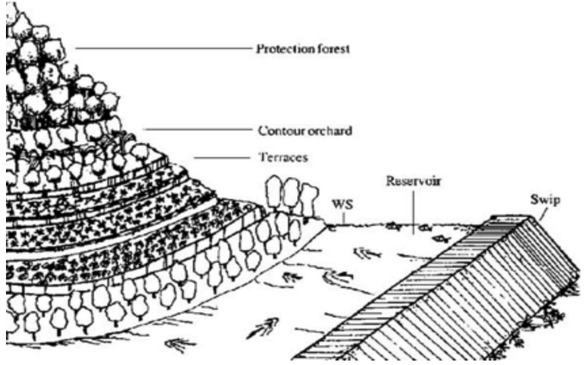
Bench terraces are the oldest form of terraces and are used in steep terrains. They form level strips of earth and steep vertical faces. There are different systems of terrace farming. Some as seen in the Far East are wet systems



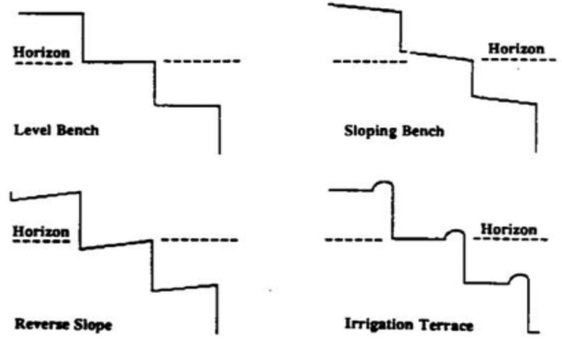
Example of Devastating Impacts of Flooding (Associated Press)



Examples of Bench Terracing in Peru and China. (Montero)



The combination of Protection Forest, Contour Orchards, Terraces, Reservoirs, and Swip are typical in Soil and Water Conservation efforts in upland farms (Ideas for Action IRR, 1992)



Various Common Terracing Methods (Ideas for Action IRR, 1992)



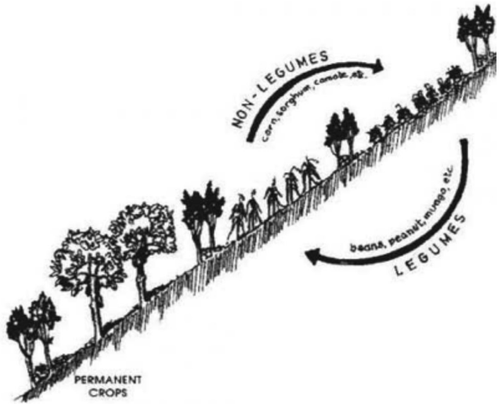
Preparing the Soil (Ideas for Action IRR, 1992)



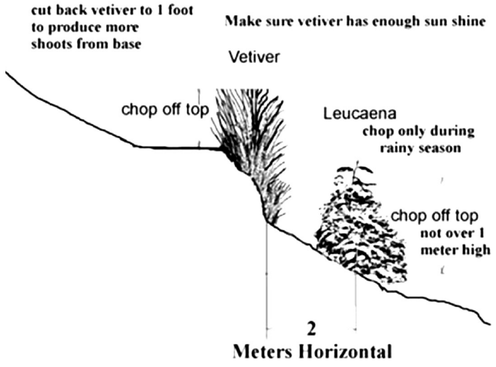
Rows of Nitrogen Fixing Plants (Ideas for Action IRR, 1992)



Crop Rotation (Ideas for Action IRR, 1992)







Increasing Crop Production over time (Ideas for Action IRR, 1992)

predominantly used for cultivation of rice while some are dry beds used for cultivating grains and other crops. They either retain and absorb water and prevent sediment runoff or they divert water into drainage and irrigation canals. Systems recommended depend on the slope of the land and the soil conditions with many combinations possible.

Slope Agriculture Land Technology

The Food and Agriculture Organization of the United Nations has developed the Slope Agriculture Land Technology (SALT) method of cultivation for areas prone to erosion and slope instability. It enables farmers to stabilize and enrich the soil and grow food crops (7). One advantage of the SALT system is the ability to grow soil from the residue of the crops and the use of the cuttings from the nitrogen fixing plants like Leucaena a small fast growing tree in the legume family. Particularly useful in soil remediation, high protein cattle fodder. It's capable of biomass production in the range of 2,000-20,000 kg/ha/yr and wood production of 30-40 m3/ha/yr. Combined with Vertiver its effective at reducing erosion and sediment runoff.

Preparing the Soil and Planting Nitrogen Fixing Plants

The systems suggests planting hedgerows of nitrogen fixing trees along the contour lines of a slope. The distance between the rows are determine by the vertical difference between the contours. Rows should be spaced to create intervals of not more than one meter in height to create effective erosion control.

Cultivation differs on alternate strips of land with some being permanent crops, some being medium term crops and some being short term crops. Crops are rotated and some strips are left fallow.

The nitrogen fixing crops need to be cut regularly and used as green manure to enrich the soil. Tilling the soil is kept at a minimum and only as necessary to plant seeds.

As the system matures, sediment and compost build up a rich layer of good soil increasing crop production. The SALT technique may be used with other terracing systems to retain or divert water as needed. It is recommended that terraces be designed that can respond to climate change. A number of studies suggest that resilient crops be considered that can adapt or withstand the forces of climate change. One such crop is mango, which in 2011 generated $11 million of income as a crop (9).

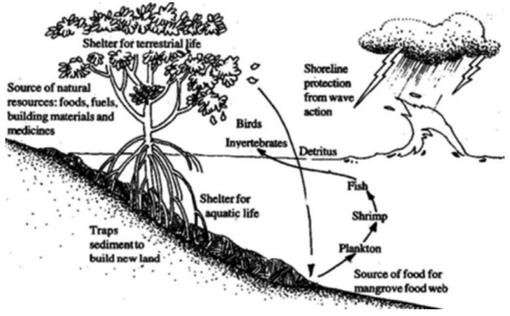
Protecting Mangroves = Growing Fish = Plant a Fish = Grow the Economy

Restoring and protecting the mangrove forests along the Cote des Arcadins is a necessary step in the recovery of the marine ecosystems and fisheries in the area. Mangrove forests provide a natural barrier from storm surges and high winds associated with tropical storms and hurricanes. Their system of branching aerial roots anchored to the bottom provide stability and resistance against winds and tidal surges.

Mangroves protect the coast from soil erosion by diffusing the wave action at the shoreline. The dense roots trap sediments which in time helps build up the land by accretion. Without mangroves, sediments and pollutants from land would flow through to the near shore reefs damaging corals and causing degradation of the ecosystem. Mangroves provide food and shelter for varied species of fish and crustaceans as well as birds and other animals. The community that thrives in mangrove forest is rich and diverse forming a complete balanced ecosystem. The leaf detritus produced by the mangroves along with the sediment it captures are the main contributor to the community food chain from microscopic to predator. Bacteria decomposes the detritus thereby releasing valuable nutrients into the water that is



Typical Mangrove Forest (www.mangrove.net)



A diagram showing a mangrove tree's vital role in ecology, and in coastal-hazard mitigation (IIRR 1993)



Section View of a Typical Mangrove Habitat (National Geographic.com)

used by other organisms at the beginning of the food chain. The complex root structure provides very important nursery areas for juvenile species of reef fish and hunting grounds for some predator species. Many of the reef fish spawn in the mangrove habitats and the juveniles seek the relative safety of the root structure. Without the habitat survival rate among the juveniles is greatly reduced. With reduced juvenile survival comes reduced catch for fishermen. Among the many species that are affected are members of the snapper and grouper families, which are highly sought after by local fishermen.

Perhaps of greatest value is the mangrove's ability to store carbon dioxide. In a study published in Nature Geoscience, Daniel Donato of the US Agriculture Department's Forest Service stated that mangroves store two to four times the carbon that tropical rainforest can store in the thick muck that surrounds the tree. This densely packed sediment made of silt or mud is very oxygen poor.

Recommendations for Arcahaie Commune

It is recommended that the mangrove forest be restored along the coast of Arcahaie, emulating the efforts made to protect the coastal community by Fabien Cousteau's Plant a Fish Organization. Cousteau's organization, Plant a Fish, "re-plants" crucial aquatic species of plants and animals in stressed environments to make a positive impact. In the Bay of Bainet, Plant a Fish has helped develop a mangrove tree nursery. Such an effort not only helps restore the environment, but it also provides necessary jobs to the community.

What little are left of the mangroves in Arcahaie are in fact in danger. The trees are being aggressively cut for use in the charcoal industry – yet another casualty of the lack of economic sustainability by many of the families in the region and the need for immediate survival.

Aquaculture = Grow Fish = Grow the Economy

With 70 percent of the Earth's surface being water and a burgeoning human population competing for choice habitable land we need to look to the oceans as a source for our sustainable food. As fish stocks decline the demand for farmed seafood is on the rise. Traditional aquaculture has made substantial contributions to the food supply, but not without an environmental cost.

Aquaculture will NOT solve the problems caused by overfishing. Restrictions need to be imposed on size, as well as limits of catch, if populations of fish, particularly on the inner reefs along Arcahaie, are to recover. If this is not undertaken in the near future, the local economies will be very negatively impacted.

Aquaculture can take pressure off native populations and allow for recovery, if done in concert with restrictions on fishing and proper enforcement. There is no doubt: the coast of Arcahaie is fished-out. Reefs are void of fish yet abound in beautiful corals.

For aquaculture to work in Arcahaie, it needs to be part of the total regional picture. It needs to partner with other industries to holistically address environmental problems. It needs to be environmentally sustainable and contribute to the social and economic recovery of the area. Projects in aquaculture should demonstrate both economic value and environmental value for without one the other will not thrive.

Good Stewardship leads to a Healthy Economy

There is worldwide interest in responsible and sustainable aquaculture. The Aquaculture Stewardship Council (ASC) founded in 2010 is emerging as the world's leading certification and labeling program for responsibly farmed seafood. ASC's primary role is to manage the global standards for responsible aquaculture. ASC evolved from



Mangroves near Arcahaie - fishermen working near the mangroves. Evidence of recent harvesting of mangroves - existing mangroves in the background. (Google Earth)





Severe erosion of Arcahaie shoreline from wave action due to deforestation of the mangrove habitat. This is one of many negative impacts that result from deforestation and it has long-lasting impacts.

aquaculture dialogues conducted by the World Wildlife Fund (WWF). Low technology extensive aquaculture is well suited for the coast of Arcahaie. Sustainable both economically and environmentally good projects will contribute to the economic development of the region.

According to *Greenpeace International*, sustainability in aquaculture can only exist if it:

- Is continually moving towards plant-based feeds originating from sustainable agriculture;
- Does not use fishmeal or fish-oil-based feeds from unsustainable fisheries and does not represent a net loss in fish protein yield;
- Does not use wild-caught juveniles;
- Only cultivates species that are native in open water systems, and then only in bag nets, closed-wall sea-pens or equivalent systems (if there is cultivation of non-native species, it must be restricted to land-based tanks);
- Does not result in negative environmental impacts in terms of discharges and effluents to the surrounding areas;
- Does not result in negative effects to local wildlife (plants as well as animals) or represents a risk to local wild populations;
- Does not use genetically engineered fish or feed;
- Uses stocking densities that minimize the risk of disease outbreaks and transmission;
- Does not deplete local resources, for example, drinking water supplies, and mangrove forests;
- Does not threaten human health, and,
- Supports the long-term economic and social well-being of local communities.

The Queen Conch (Lambi)

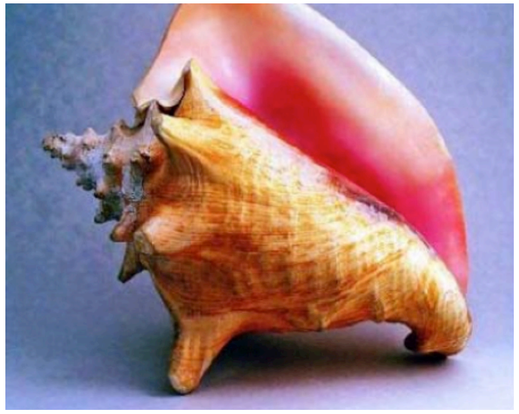
The potential for aquaculture development both land and ocean based in Arcahaie is substantial. It can become a major Agrotourism component for the region. The Cote des Arcadins along with its beautiful beaches is well protected by the Ile de la Gonâve offshore. In most places the shallow waters near shore drop off quickly to deep reefs and beyond to depths in excess of 2,000 ft. The availability of calm protected waters makes the coasts along the Commune ideal for ocean farming as well as recirculating saltwater aquaculture installations on shore, which are closed loop systems that recirculate and filter sea water with minimum effect on the environment.

Conch Farming

One potential aquaculture project can be the establishment of a Queen Conch (Lambi) Farm. Conch has been a staple of the Caribbean diet before the days of Columbus. Within the last century it went from subsistence food to delicacy and is growing in popularity. The conch population is being decimated, in many places including Haiti it is considered over fished according to assessments by NOAA Fish Watch. The Queen conch has been declared by the International Union for Nature's Conservation as a Commercially Threatened Species by the Convention on International Trade in Endangered Species (CITES). With continued pressure on the species as a food source and its decline in population, it is very important to introduce new management measures and aquaculture development.

New developments in aquaculture in the 1980's led to the establishment of the first commercial conch farm in the Turks and Caicos. The Caicos Conch Farm, located in Providenciales, operates on 10 acres of oceanfront land with 48 onshore ponds and 65 acres of seabed with 150 holding pens. They are able to raise in excess of two million juveniles onshore in forty-eight ponds and transfer them to seabed pens for final grow out.

Female Queen conchs can lay 400,000 eggs nine times



Example of Queen Conch (http://www.nmfs.noaa.gov)



Caicos Conch Farms (Google Earth)



Overfishing of juvenile conch is evidenced along the shoreline, in particular in the fishing village of Luly. (Montero)

Items	Actual ($)	Changes	Expected ($)
Ponds			
Sales Revenue	100,000	Survival 100↔95%	95,000
Seed ($0.24/OE)	12,000	no change	12,000
Shipping ($0.50/lb)	1,666	no change	1,666
Feed ($0.46/lb)	13,182	127lbs/m ↔190lbs/m	19,721
Labor	30,767	no change	30,767
Fuel ($1.87/gal)	11,930	Reduced by 30%	8,351
Supplies	6,907	no change	6,907
Total Operating Costs	76,452		79,412
Revenues-Operating	23,548		15,588
Cages			
Sales Revenue	100,000	Survival 100↔95%	95,000
Seed ($0.24/OE)	12,000	no change	12,000
Shipping ($0.50/lb)	1,666	$0.50/lb ↔ $0.25/lb	833
Feed ($0.46/lb)	13,800	($0.46 ↔ $0.36)	10,800
Labor	8,050	($5.00/hr ↔$2.50/hr)	4,025
Fuel ($1.87/gal)	—	—	—
Supplies	3,139	no change	3,139
Total Operating Costs	38,655		30,797
Revenues-Operating	61,345		64,203

per year. In the wild the eggs hatch into microscopic larvae called Veligers that drift in the current for two to three weeks, eventually settling to the sea bed as post larval juveniles to grow. Survival rate in the wild is minimal. Veligers become part of the food chain for other swimming creatures. Once transformed the juveniles with their small and fragile shells become easy prey for crabs, sharks, groupers, and other mollusks.

Research at the Caicos Conch Farm and at FAU's Harbor Branch Oceanographic Institution has demonstrated survival rates for pond raised juveniles at more than 95%. The potential to relieve pressure from the wild population by farm raising conch and the ability to restore the population in the waters in Arcahaie is there for the taking.

It has been argued that aquaculture of conch is expensive and not profitable and that it takes too long to grow out as compared to other species of fish and it is capital intensive. A large portion of the cost in conch production is in the hatchery. In some instances, it may be more feasible for new farmers to skip the hatchery component of the farm and buy juveniles at different stages from an established hatchery like the Caicos Conch Farm. In 2001, a feasibility study was made using different scenarios for the grow-out of juveniles purchased from hatcheries in a 20-pond or 20-cage culture facility. The analysis was based on historical costs at the Caicos farm including labor. The results ranged in gross margins from as high as 67 per cent for cage grow out to full size 16 cm in 19 months to as low as 15 per cent for pond grow out to full size 16 cm. It is important to note that Labor Costs in the Turks and Caicos at the time of the report were $5(US) per hour. In places like Haiti, considering current wages, the labor cost could be significantly reduced, making the venture more profitable.

Because conch development is slow usually taking 4-5 years to grow to a favorable market of size of 16 cm a faster turnaround was needed and found. The Caicos Conch Farm has been successful carving a niche in the marketing for smaller juveniles at 2 years. They call it sea escargot and it sells at 4 times the going price for wild caught conch. All of it is exported to the U.S.

The Caicos Conch Farm has survived and it is looking to expand. To ease some of the difficulties they have rethought the business plan. Short term goals include increasing and diversifying production. To leverage their capacity they plan to market juveniles for grow out to farmers who can then sell them on the market once grown or selling back at a profit to the Caicos farm. They will also be raising fish in offshore cages each estimated to produce 70 metric tonnes of fish a year. The cages will be placed outside the reef line where currents can flush the waste produced by the dense population of fish.

Other developments in Conch aquaculture are on the horizon. In the wild on rare occasions, about 1 in 1,000, conch produce pearls. Of these very few are of gem quality. Those that are of gem quality are in high demand bringing in prices comparable to diamonds. At FAU's Harbor Branch Oceanographic Institution, Drs. Héctor Acosta-Salmón and Megan Davis, have developed a technique to culture conch pearls. They have produced more than 200 cultured pearls using the techniques they developed.

The newly developed technique for culturing pearls in Queen Conch does not require sacrificing the conch to harvest the pearl. There is a 100 per cent survival rate and it will produce another pearl after the first pearl is harvested. HBOI has been working with the Gemological Institute of America (GIA) to conduct extensive laboratory testing of the Queen conch cultured pearls. The GIA has affirmed that several of the pearls they examined are truly top quality gems. Culturing the pearls using this technique means a high percentage of pearls produced by the population. To put it in perspective a conch cultured conch pearl can bring in excess of 400 time the price of the meat and the conch can produce multiple pearls before being sacrificed.

Feasibility of Queen Conch Grow-out Facility

Conch is a stable-food in the diet of most Haitians, certainly of those living in coastal regions. Arcahaie has a significant number of conch fishermen supplying this demand. As a result, conch is tied to the economic prosperity of the Arcahaie region. It is prudent to find ways of protecting that livelihood in the very short-term for the sake of the region's long-term economic health.

The development of the conch industry in Arcahaie can reap additional benefits, greater than the gross profit it can generate. Conchs are vital to the biodiversity of the ocean and are an essential part of a natural food chain. All things in nature are attached. One cannot extinguish one species without some effect on others. If one looks at the holistic and sustainable picture and the synergies that can be created the profits albeit not monetary are there.

For Arcahaie conch aquaculture means having the ability to produce large amounts of conch meat for consumption and export the potential for a cultured conch pearl industry and the restoration of the native conch population.

The U.S. demand for conch is currently not met due to restrictions on harvesting the product worldwide. The United States imports approximately 78% of the conch meat available in the international trade. The estimated market demand for conch in 2010 was 1,500 tons annually. Approximately 460 m.t. was imported into the United States in 2004, with the majority exported from the Turks and Caicos Islands. This figure is down from a high of 2,260 m.t. in 2003 when the Dominican Republic and Honduras contributed more than 50% of the supply to the U.S. Due to the endangered species designation of conch only 500 m.t. were available for export from the Caribbean marketplace.

If Conch aquaculture is diversified to include fish species such as cobia, grouper or snapper it can increase exports to the U.S. The U.S. imports 90% of the seafood it consumes. In 2012, those imports totaled 14 billion dollars. But, what is even more important is that 50% of those imports came from aquaculture farms. The oceans cover more than 73 percent of the surface of the earth. It is only logical that more sustainable aquaculture practices be developed to feed the growing population. Arcahaie's geographic location can make Haiti a viable player in the world farming of the seas. Worldwide aquaculture harvests for 2013 exceeded 58 million metric tons with a total value well in excess of 100 billion dollars.

Fin Fish Farming

Deep water and strong currents near shore in Arcahaie creates a favorable environment for sustainable fish farms by reducing the environmental impact often associated with fin fish aquaculture. Cobia pictured above has been successfully farmed in ocean cages and are a good candidate for aquaculture in Arcahaie. They are large pelagic fish that can grow up to 2 meters long and reach 150 pounds in weight.

Shrimp Farming

Shrimp farming was historically a small scale business of farmers along the coasts of Southeast Asia. Over the years, it has advanced in technology, particularly in stocking shrimp at very high densities. This comes with a series of drawbacks; the most crucial is the impact on the ecosystems surrounding the farm. High densities create high volumes of toxins and waste that affect the adjacent wild populations.



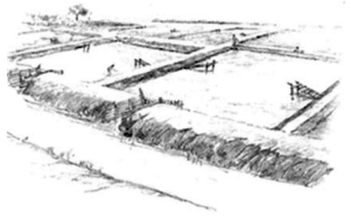
Cobia Ocean Cage Farming
(NationalGeographic.com)



Off the Caribbean coast of Panama, fish farmer Brian O'Hanlon is building a large-scale hatchery to support a new type of offshore aquaculture. (NationalGeographic.com)



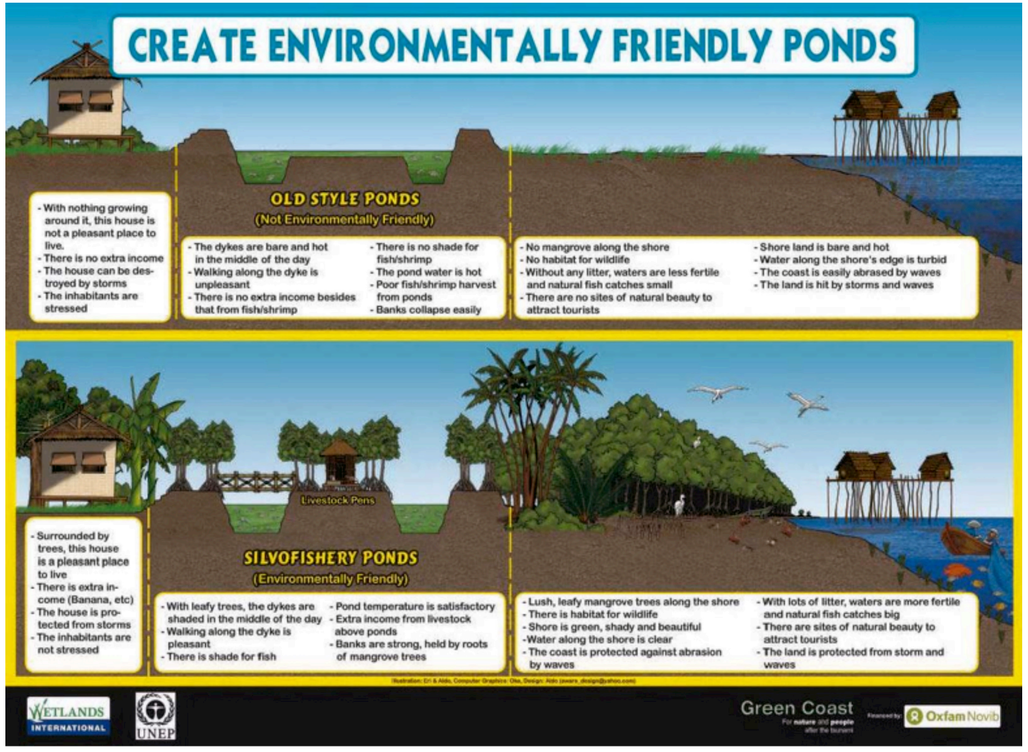
From millions of eggs, only a few thousand fish survive. Juvenile cobia are raised in indoor tanks until they are large enough to be transferred to the open ocean. (NationalGeographic.com)



Small-scale Shrimp Farm
(www.orissafisheries.com)



(www.orissafisheries.com)



(Sustainable Aquaculture (www.wetlands.org)

Hatching and raising shrimp for commercial sale can be done in both freshwater and saltwater environments. There are various scales of production, each requiring higher technology as desired output per hectare increases. In most underdeveloped countries, where land cost is not a significant factor, and the cost of technology is not within the reach of the farmer, a more sustainable approach is adopted, and it is known as “extensive aquaculture”.

Extensive aquaculture, relies more on the natural forces and events such as tides, wet and dry seasons, and moon phases to produce, rather than artificially emulating them through technology to achieve desirable results. In shrimp farming, natural currents and tides are used to flood and drain fields to provide nutrients and capture shrimp. In some areas, shrimp are raised in ponds during wet seasons and alternated with rice in dryer seasons, and still in other places, such as Southeast Asia, shrimp freshwater shrimp, and rice coexist symbiotically in the fields. Extensive aquaculture uses the natural process and develops synergies with the ecosystem it helps sustain.

For the small farmer, low cost of production and low labor is a key benefit of extensive aquaculture. The environment also benefits. Shrimp farms, in many parts of the world, are placed near estuaries naturally inhabited by shrimp. Farmers often protect the estuaries and further develop them by planting mangroves or other native plants. They become the guardians of the ecosystem they are helping to protect. Shrimp feed and thrive on the nutrients collected by the mangrove forest so additional food, heavy fertilizers or chemicals are not required in the process. These systems not only yield healthier more flavorful shrimp but also a healthier ecosystem. Protected for the shrimp nurseries the mangroves will also support a myriad of other life beneficial to the reefs the fishermen, and the region. In these extensive farms, ponds are not drained, instead farmers catch shrimp as they naturally mobilize during lunar cycles.

If looking at extensive low technology aquaculture systems, that is to say systems with low stocking densities per square meter, the areas along the Arcahaie/Cote des Arcadins coast where rapidly diminishing mangrove forests remain, should be a target for this activity provided that mangrove stock is replanted and used as an integral part of the bio-filter, and water conditioner for waste water. In this way, the mangroves are protected, and a new shrimping industry can thrive.

Land-Based Shrimping

The proximity to the ocean for the coast of Arcahaie makes it ideal for the production of saltwater shrimp on land-based ponds. These could be located near shore in areas that can be economically fed by water from the ocean. The easiest and less expensive system would use tidal flows to fill and drain water from the ponds. Mechanical pumps can also be employed but at a cost of installation, operation and maintenance.

Education and Research: Aquaculture University and Research Center - International Institute of Marine Fisheries and Science

Property is available along the coast of Arcahaie, suitable to establish an International Institute of Marine Fisheries and Sciences, a place for training, higher learning, and research. The work of the institute can lead the efforts in establishing an aquaculture industry in the region and improve fisheries for Haiti. It can teach the local fishermen to become future sea farmers, as well as guardians of the environment. Sustainability and financial success go hand in hand in this industry. It is the perfect “teach a man to fish” opportunity and one desperately needed. This research center is understood as beneficial for the entire commune, but also, as being in the nation’s best interest.



Government held property South of Luly can be converted into aquaculture research and education facility (Google Earth)

One particular site for this research center, according to field sources, is located just south of Luly. A government-confiscated property, previously owned by an extradited drug lord, now sits empty. It is a large waterfront parcel and consists of a compound of buildings and an ample basin that is sheltered, offering quick access to offshore research areas. In addition, there is enough surrounding land to accommodate ponds, hatcheries and other facilities. These features would make for an ideal setting, and if the right operational partner were secured, the research facility could become a world class educational center.

This initiative can be a collaborative effort, including universities and research facilities throughout the Caribbean and the world. Leading universities in this field, such as the University of Miami Rosenstiel School of Marine and Atmospheric Science, Florida Atlantic University Harbor Branch Oceanographic Institute, University of the Virgin Islands, and private research ventures such as the Caicos Conch Farm could collaborate. Haitian university students could have ready-access to field experience and education in topics related to aquaculture and aquaponics; industries that are so vital to the nation's progress, economic growth, and preservation of its natural resources.

Bio Fuel and Medicinal Algae

There are opportunities for Arcahaie to be a prime location for the processing of biofuels through aquaculture. Algae can be easily grown in ponds. Open land, with clear view to the sun is not rare, in and in the Arcahaie region, years of deforestation have produced near desert scrub conditions, which are ideal to grow algae and harvest solar energy.

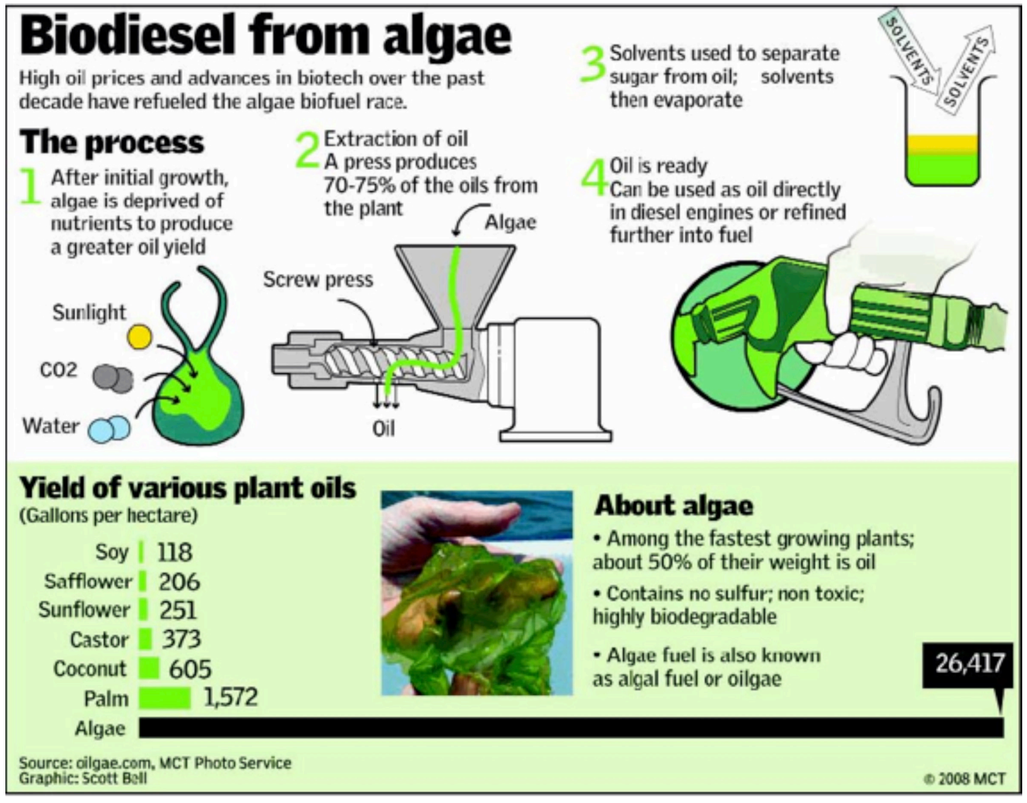
The requirements for algae growth are rudimentary - sunlight, food in terms of CO2, and water. Given these conditions, algae can produce in excess of 50% of their weight in oil. It is also one of the fastest growing plants. The oil can be used in making biofuels and other products across a number of industries including pharmaceuticals, and beauty products. Rudolf Diesel credited to be the inventor of the high compression diesel engine, acknowledged that the engines could run on vegetable oil instead of fossil fuel. With most of the motor vehicles, generation plants, and other machinery in Haiti running on diesel fuel, Haiti's ability to extract oil from algae could provide a viable and sustainable alternative to fossil fuel, and, be part of the attraction to Eco-tourist.

Aquaponics for Mid and Small-Scale Sustainable Farming

Aquaponics is a system of food production that combines aquaculture, raising aquatic animals, with hydroponics, cultivating plants in water or without soil. It is an ancient practice lost over the ages giving way to the conventional "plow and till" farming. The Aztecs were among the civilizations that developed cultivations on artificial earth rafts in the fertile water.

Aquaponics was limited to small scale use, but has recently seen an increase in commercial installations. There are many benefits to aquaponics over conventional farming that is particularly useful to farmers in Arcahaie. Aquaponic systems can help mitigate the existing problems of soil degradation, water supply, and available arable land. The technology can be applied at a subsistence (individual) level or at a commercial scale. It can be constructed using materials readily available in the area and it is highly adaptable.

Aquaponics is more efficient than conventional cultivation. It is a closed system that uses 90% less water, it is less labor intensive to maintain harvest crops, and it is capable of producing both animal protein and vegetables in the same system. An aquaponics system can grow up to 4 times more food per acre than other systems of food production. An aquaponics system covering 500 square meters (1/8 acre .05ha) can produce up to 5 metric tons of fish and 5



(oilgae.com, MCT Photo Service)

metric tons of vegetables or biomass per year.

The vegetables and the fish along with the grow media perform in symbiosis. Water containing rich nutrients derived from fish excretion are circulated and nitrified by bacteria in the grow beds. The plants absorb the nutrients in the waste and return clean water back to the fish and the process starts all over. Because chemicals cannot be used in a system containing fish, aquaponics is truly organic by nature.

Many designs and ideas for the construction of the system can be found online. Generally, they fall into three categories and all include a fish holding tank or pond.

1. *Nutrient Film Technique (NFT)* - is common to most commercial hydroponic systems and is used in aquaponics systems with some adjustment. Nutrient rich water from the fish tank is filtered through bio filters and then is circulated in a thin film or sprayed by the roots of the plants in small measured quantities. The nutrients are taken from the water, which then returns to the fish.
2. *Deep Water Culture (DWC)* - involves using floating rafts usually of Styrofoam with holes that fit mesh pots over constructed water channels. The plants' roots hang down into the water and take up nutrients. Water flows from the fish tank through a filtration system, and through the water channels to feed the plants before returning to the fish.
3. *Filled-Media Bed System* - uses containers to hold a growing media usually gravel or other material with a large surface area. Water is pumped into the media bed filling it to approximately 1 to 2 inches from the surface. A non-mechanical device, like a syphon,+* drains the water once it reaches its level. The process takes from 15 - 30 minutes to cycle, depending on the design. The flood and drain systems makes oxygen available to the roots.

After many years of experimentation, the media bed systems are proving to be cost effective, and reliable with little maintenance. The typical depth of the media is 10-12 inches. Success in the tropics has been demonstrated, growing a variety of crops in these systems. Among the plants that can grow in these systems are: herbs like basil and oregano. Another benefit of media bed systems is that larger plants can be grown in the media that need structure to support the roots. Crops can include: Taro, Okra, Carrots, Lettuce, Tomatoes, Peppers, Broccoli, Cabbage, Bok Choy, Cucumbers, Rice, Eggplant, Kale, Melons, Radishes, Squash, Strawberries, Swiss Chard.

Nutrient Film Technique (NFT systems)
Plants in a NFT system sit in channels of PVC pipes. A thin film of nutrient rich water from the fish tank flows by gravity down the pipes, providing plant with the food and oxygen necessary to thrive. Two main configurations exist, both with many variables. The simplest method is to have the channels located above the tank so water is pumped from the tank to the channels and flows back to the tank by gravity. The reverse system allows water to flow from the tank to the channels by gravity, and then pumped back to the tank.

In aquaponics, NFT systems require additional bio-filtration. This is due to the lack of volume of water and surface area needed for nitrification bacteria to convert ammonia from the waste into nitrates that can be used by the plants. This is not necessary in Filled Media Bed systems. The gravel in these systems provide the necessary surface area for the bacteria, and also filter solids that would otherwise clog other systems. Pipe sizes in aquaponics need to be larger than those used in hydroponic systems where fish wastes and solids are not in the system.

Although NFT systems are an option in aquaponics they require more maintenance at the filters than the media bed systems.



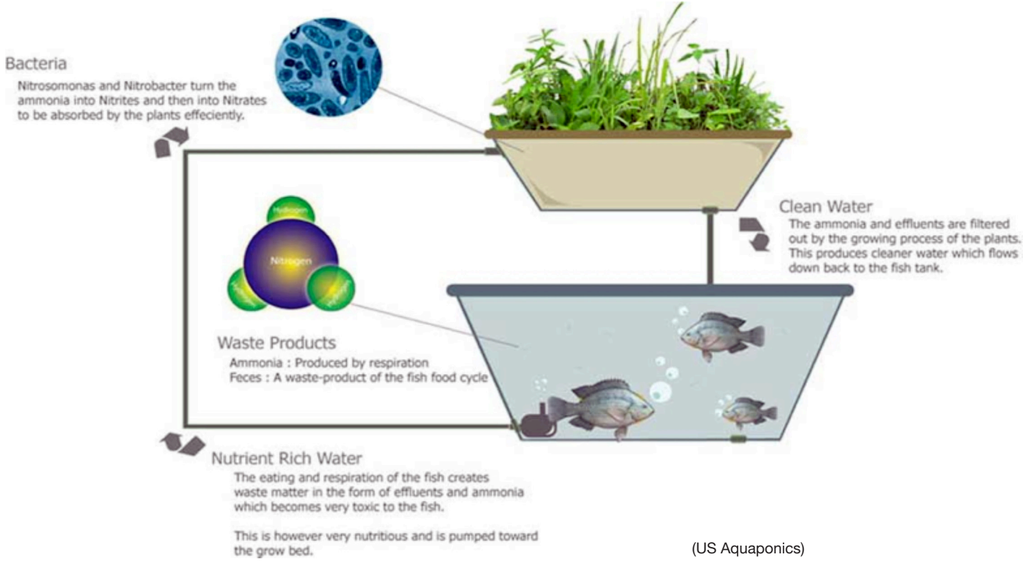
Aztecs growing crops on rafts
(image in public domain)



NFT System - Backyard Aquaponics



Vertical aero-ponic NFT system (Pond Trade Mag.)



(US Aquaponics)

The University of the Virgin Islands Aquaponics System
The University of the Virgin Islands has long been recognized as a leader in tropical aquaponics and offers weeklong courses focused on aquaponic techniques. Dr. J.E. Rakocy designed a system of tanks, filters, clarifiers, and degassers to feed long raft systems in the field. (See: Appendix for more detailed information.)

This system has been carefully documented over the years and has demonstrated the viability and suitability of aquaponics systems in the tropical climate. Its location in St. Croix, Virgin Islands not far from the ocean, parallels the conditions found along the coast in Arcahaie making it a good archetype (example) for small to medium scale commercial aquaponics systems for the region.

UVI System Design for a Land Area of 0.05 ha
Components:
- Four fish rearing tanks,
- 7.8 m3 each, two cylindroid-conical clarifiers,
- 3.8 m3 each, four filter tanks,
- 0.7 m3 each, one degassing tank,
- 0.7 m3, six hydroponic tanks,
- 11.3 m3 each, total plant growing area,
- 214 m2, one sump,
- 0.6 m3, base addition tank,
- 0.2 m3, total water volume, 110 m3

Typical Production Outputs
Tilapia - 5 metric tons annually, 580 kg. every 6 weeks, 160 kg./m3/year
Stocking rate:
Niles - 77 fish/m3; Reds - 154 fish/m3
Leaf lettuce - 1,404 cases annually, 24-30 heads/case, 27 cases/week
Basil - 5 metric tons annually
Okra - 2.9 metric tons annually

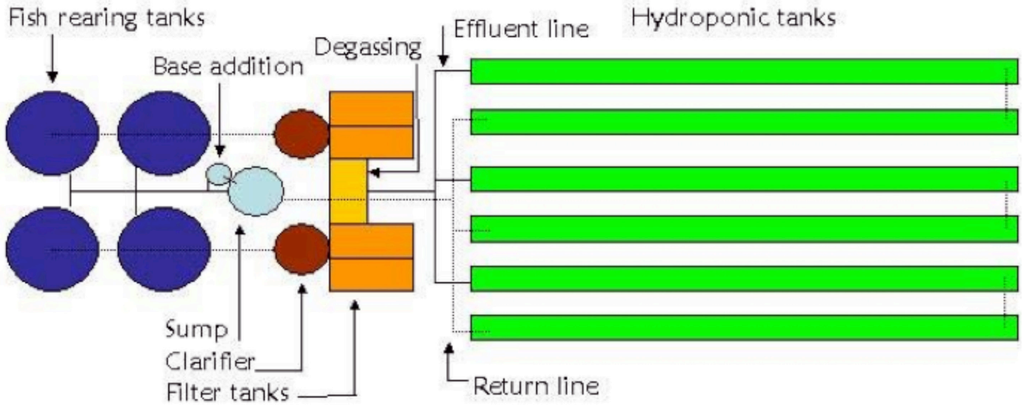
Media-Filled Bed System
In a media-filled bed system, plants are grown in a tank or container that is filled with gravel, perlite, or another media, instead of conventional soil. The media serves to increase the surface area necessary to nitrifying bacteria in the process of converting ammonia to nitrate. The media also helps support the root structure of plants, allowing the culture of larger plants, which are not possible to grow in other systems.

These beds are flooded and drained at 15-minute intervals with water from the fish tank. Water enables efficient treatment by the bacteria, and the uptake of nutrients by the plants. Some using this system have found it beneficial to add worms to the media beds to aid in the breakdown of solid materials caught by the media.

The media-filled bed system is the most practical system for small-scale farmers in Arcahaie. It has the fewest components, is easiest to operate, and has the lowest maintenance of all the systems. It is particularly useful for subsistence (individual) farming in family Lakous. A simple system, properly managed, can provide a family the large part of the vegetables and protein needed. Depending on the size of the system, enough food can be produced to sell the surplus at the market.

Hybrid Systems
Backyard farmers have had varying degrees of success experimenting and hybridizing systems. The most successful are those taking a holistic approach, understanding their gardens as a free standing ecosystem. By incorporating not only the aquaponics component, but also raising animals, such as chickens or ducks, and using earthworms to compost by-products, recycling waste, as well as using renewable energy, such as photovoltaic power, to run the system, they realize the highest yields at the lowest costs.

The UVI Aquaponic System





UVI Aquaponics raft system (http://ag.arizona.edu/azaqua/ista/ISTA9/PDF's/RakocyUVICourse.pdf)



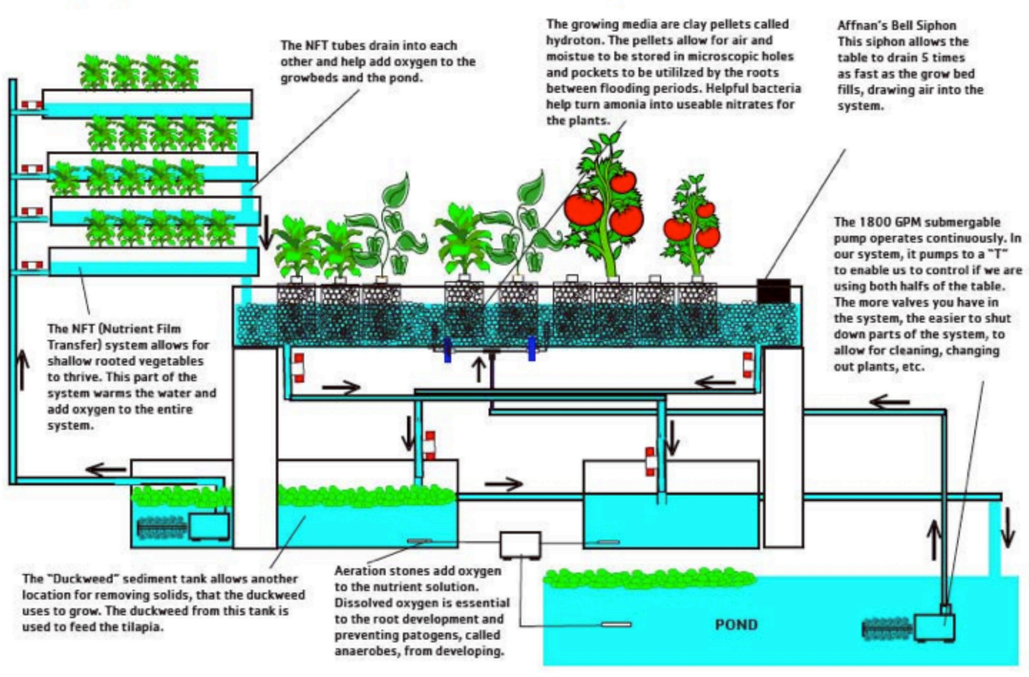


Radishes growing in raft system (livingaquaponics.com)

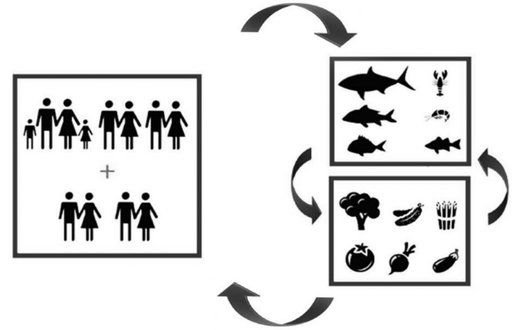


Media Filled Bed System (portablefarms.com)

Conversion from Hydroponic Ebb and Flow to Aquaponic NFT & Ebb and Flow System Plan



Aquaponics - Quick Reference Gallery





Aquaponics NFT system using water bottles (Bangladesh Agricultural University)



Construction of an above ground fish tank in South Africa Creating a pond (Healthy Children Healthy Future / INMED Partnerships for Children)



Media Bed System, South Africa (backyardaquaponics.com)



Readily available gravel and small stones used as growing media (INMED Partnerships for Children)



Readily available gravel and small stones used as growing media (INMED Partnerships for Children)



Readily available gravel and small stones used as growing media (INMED Partnerships for Children)



Medium scale system in Venda South Africa (INMED Partnership for Children)



Example of a backyard aquaponics system in Uganda (homelandsproductions.com)

The systems are modular and thus scalable and can meet the needs of the larger resort hotels, provided they have enough land to develop. These Gardens of Eden can solve food security, increase the quality and consistency of the local food supply, and create a market for Agrotourism and gastronomy in the region.

Home Grown Fish Food - A Sustainable Approach

A major component in aquaponics gardens is the amount of feed required by the fish in the system. Commercially prepared feed is expensive for the farmers in Haiti. On the other hand, underfeeding directly affects the size and quality of the fish, and undermines the market value of the product. Fortunately experiments in other countries, for example Kenya, have shown that fish food can be produced inexpensively by the farmer, using readily available ingredients like taro and cassava leaves, rice bran, wheat or cassava flour, salt, and hot water. Minimal tools are needed to make feed from these ingredients. All that is needed to produce pellets is a hand operated meat grinder.

Much of the biomass that is wasted after harvest is high in protein, beneficial to the fish, and can be used in making feed. Trees common to the region like Chaya or Moringa are known for their high protein and vitamin content and overall nutritional value. Education and training is all that is needed.

The Arcahaie Agro-tourism "Bed & Breakfast" Network: *'Gardens of Eden'* for Haiti's Economy

In an aquaponics system, the farmer feeds the fish, the fish waste feeds the plants, the plants and fish feed the farmer/guests, and it all starts again - totally sustainable, using less than 10% of the water used in conventional farming. No chemicals or fertilizers are utilized in production, resulting in organic, healthy food. These farms can be small and because they are a complete and whole cycle, can become the *Gardens of Eden* for Haiti.

Aquaponics, in fact, can be incorporated into small-scale tourism projects, and can be part of the attraction for agritourist. In Arcahaie, small inns, such as 'Bed and Breakfast' projects, can easily combine either local agriculture fields, and/or an aquaponics system with fruit trees, and small livestock to provide guests with fresh organic food during their stay.

A 'Bed and Breakfast' industry can thrive across the Arcahaie region, given the beauty of its natural landscape and the potential for complimentary activities and/or cultural heritage sites.

The following example was developed to accommodate both urban and rural sites. Two sample sites are illustrated; one is in rural Corail at a significant intersection, and the other illustrates an urban infill site, within the proposed Historic District of the town of Arcahaie, both in the Commune of Arcahaie. The design can be replicated, adapted, and adopted across the entire region. Local architects or engineers can assist with any needed adjustments that the terrain, lot size, more or less programming, or adjacent uses might require. This project assumes a narrow and deep lot, but it can be adapted to other lot shapes and sites across the region. It is crucially important that for the sake of the health and welfare, of both innkeepers, eventual employees, and visitors to the inn, that the water supply source and the waste disposal (latrine) be located as far away from each other as possible. If the lot is on a sloped site, the water supply source should be located uphill from the waste disposal (latrine) on the site. (For more detailed and related information, refer to the Engineering Section of this Vision Report.)

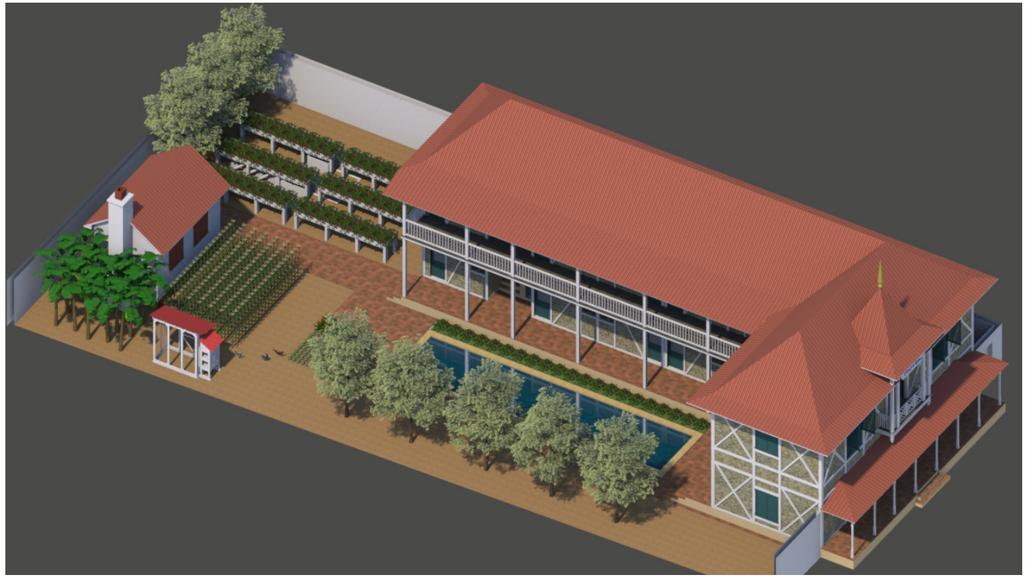
This 'typical' design incorporates all the elements for a sustainable farm, and it focuses on attracting tourists interested in an authentic experience, as well as to offering local farmers with an additional revenue stream.



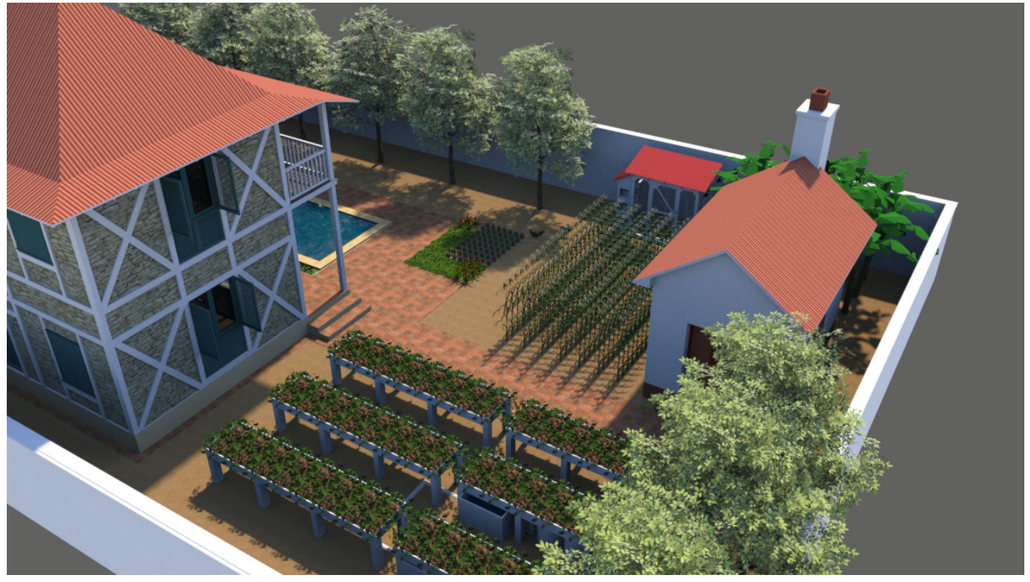
Street View, assuming an urban site, within Arcahaie's proposed Historic District.



Typical Site Plan for Bed & Breakfast



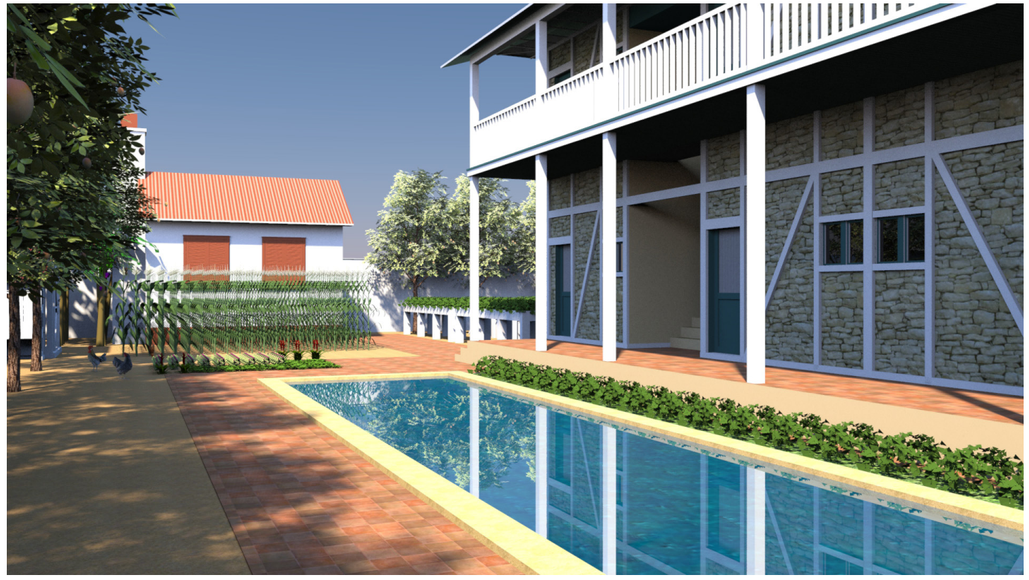
Aerial View of Proposed Bed & Breakfast Inn, illustrating fruit trees, raised beds and aquaponic features



Aerial View of Bed & Breakfast



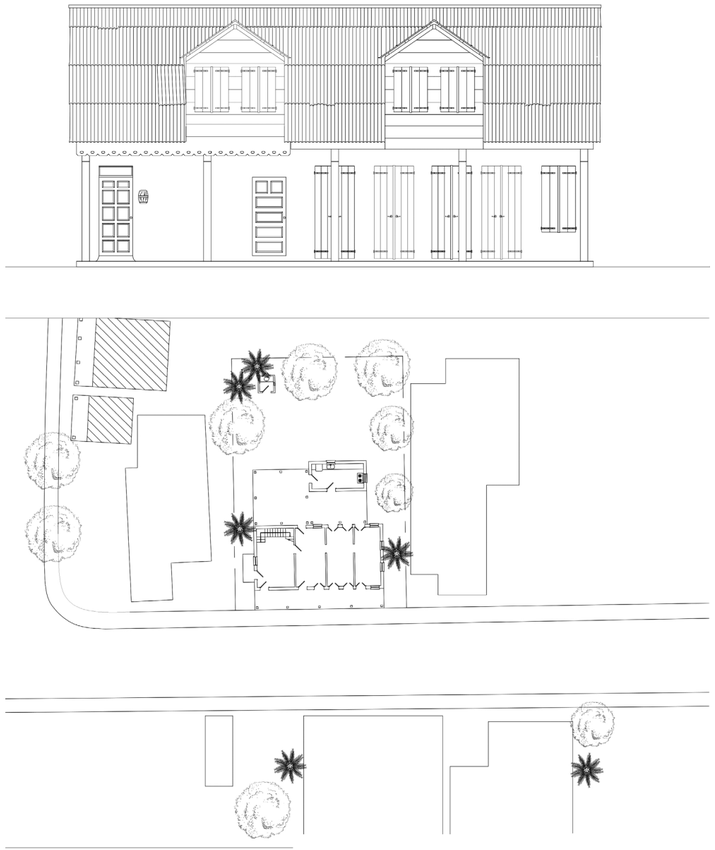
Courtyard View illustrating raised beds



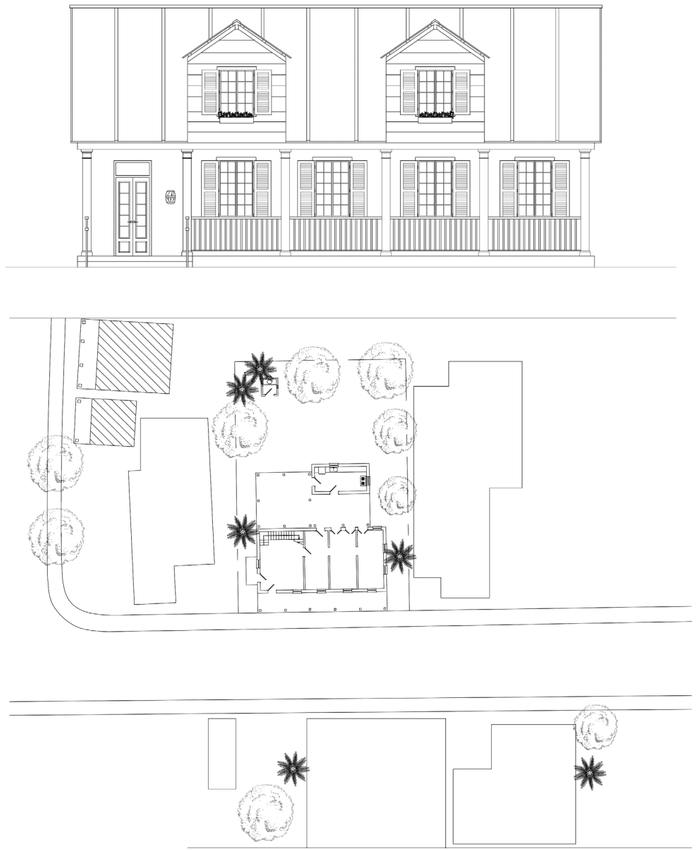
View of Courtyard



View of Courtyard from Second Floor



Existing Building within
Proposed Historic District



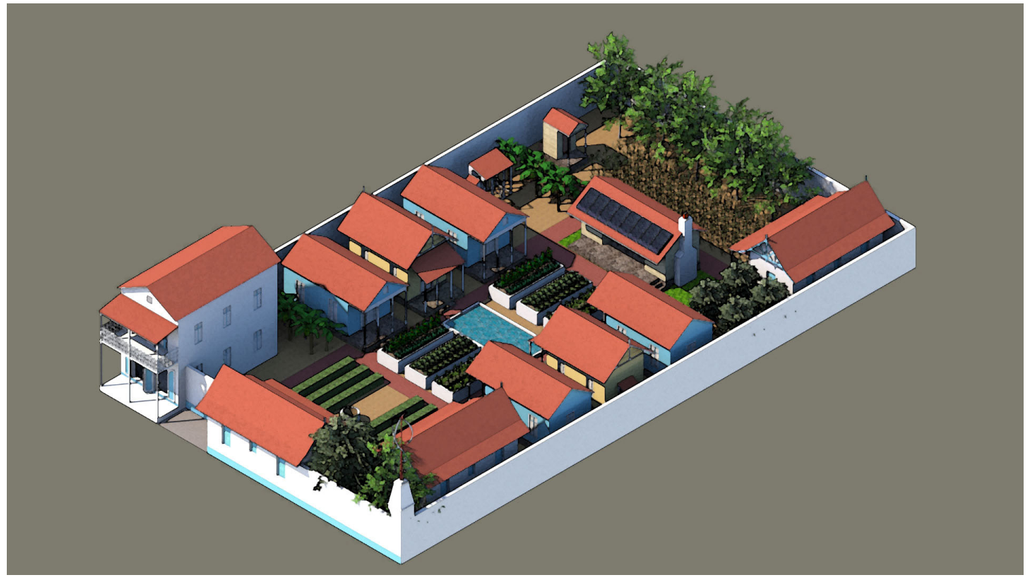
Example of a commerce-friendly, sympathetic rehabilitation of a historic builiding.



Street view of live/work unit, illustrating commercial store and wind-generated power. New buildings can add to the overall marketable image of the historic district.



Courtyard view illustrating raised beds, solar panels, and Lakou dwellings. These separate buildings can cater to tourists, renters, or an extended family.



Aerial view of Lakou



Street Elevation

The typical design developed and herein illustrated includes:

- A long wing with two floors of rentable rooms (can be 1-3 floors);
- A common lobby/dining area, where the innkeepers/ owners and the visitors can socialize, and/or dine on the ground floor of the street facing building. In urban areas, the dining area, could serve the general public as well if room permits, and could include outdoor dining in the courtyard or under the covered back porch;
- Housing for the innkeepers/owners above the lobby/ dining room;
- A series of sustainable, agricultural systems in the courtyard and backyard;
- An “Out-building”, with: a kitchen, an area for storage, as well as separate bathrooms and showers, depending on the size of the bed & breakfast inn.

Agrotourism

The creation of an organized Agrotourism industry in Arcahaie can play a critical role in the sustainable economic development of the entire Commune. Arcahaie’s economy is mainly dependent on income derived from agricultural production, and tourism occurring along the narrow coast at beach resorts. The resorts and hotels often support the surrounding agricultural sector by buying produce and other food staples from farmers and fishermen, yet tourist and farmers rarely interact.

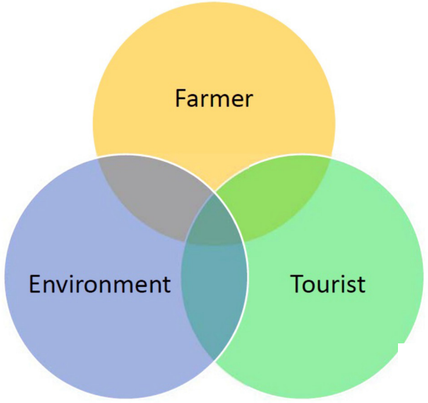
The large beach resorts, with their typical all-inclusive packages, are partially a response to the lack of structured tourism venues outside the walls of the resort, as well as the perceived lack of security, and lawlessness outside the resort. That perception, evidenced by the usual armed guards posted at the gates of the resorts, magnifies the feeling of insecurity, poverty, and economic hardship that lies outside their walls. The residual dream of what high end tourism was about, and of an era that included Club Med as a standard, has largely dimmed.

Nonetheless, the vestiges of that era persists in the region’s beach-fronting hotels, which offer the more affluent tourist, both national and international, all the amenities, albeit at a lower standard than commonly obtainable throughout the Caribbean. Because of their lower standards, currently they are not competitive with offerings available around the Caribbean at similar price-points. The Cote des Arcadins resorts are nonetheless catering to a specific sector of the tourism market, and as such serve a vital purpose. With some venue modifications, workforce training, and these larger hoteliers supporting other forms of local tourism and accommodations-such as agro and ecotourism, which would in turn help to highlight the agricultural, rural character of the region as well as its natural resources and features, collectively, the overall local industry could thrive. Agrotourism lies at the intersection of the farmer, the tourists, and the landscape, and embraces the traditions, history, art, and culture of the place.

It has become a viable economic engine in developing countries lacking the sophisticated infrastructure of top tourist centers and its popularity worldwide is growing.

The Inter-American Institute for Cooperation on Agriculture (IICA) has been promoting agrotourism in the Caribbean since 2005 as part of its Hemispheric Program to strengthen links between tourism and agriculture through research, training and small business development.

Agrotourism is tourism which takes advantage of the rural culture and natural resources as a tourist attraction. It is similar to ecotourism except that its primary appeal is not the natural landscape but the agricultural landscape with its history and culture. Agrotourism activities, including participating or observing farming and fishing activities;





sampling local foods and culinary traditions, exploring the rural landscape and agro-diversity and enjoying the history, festivals, and cultural traditions of the region or town.

By diversifying options for tourist, agrotourism can improve Haiti's competitiveness in the tourism sector and by making agrotourism economically viable for the farmer, more sustainable agricultural practices would develop in the region.

Sustainable economic growth for the Commune of Arcahaie can be accomplished through the union of agriculture and tourism. A union of the town, the sea and the countryside intrinsically linked to create the necessary opportunities for economic development and prosperity to the region. Agrotourism in Arcahaie is proposed as a hands-on experience in agricultural production that offers an opportunity to get involved in taking care of fish and plants.

New Agrotourism Models

The central idea behind Agrotourism is to get the tourists involved in the agricultural process. Visitors are given an opportunity to work in the fields alongside real farmers and wade knee-deep in the sea with fishermen, hauling in their nets or simply exploring, and taking in the natural beauty of the farmlands and coastline.

Agrotourists expect a real life experience not a scripted play or choreographed show. Like conventional tourists, there are many classes of agrotourist, from the backpacker to the wealthy retiree not willing to forgo some basic luxuries - like running water or a private bathroom. In general, agrotourists are more resilient by nature and are willing to sacrifice some level of comfort and luxury to trek off the beaten path.

To meet tourist requirements across all sectors, including agrotourism, new hospitality models need to be created that will broaden the available choices across all economic strata, and room and board options. These new models attempt to encourage farmers and small landowners to participate in the development of an agrotourism sector, by opening their doors to tourists interested in seeing the beautiful landscape of rural Arcahaie.

Education, training and the development and adoption of minimum quality standards are indispensable in creating lasting and sustainable success no matter what type of venue one is referencing. Not all farmers would be interested and not all would be capable of operating an agrotourist venue. But, for those capable of hosting guests, it could represent a considerable increase to their farm income. To put it in perspective, let's remember that the average worker in Haiti makes less than 5 dollars a day. Based on the rates charges by the local resorts, a simple clean room with gracious family hospitality could bring an additional 20 to 40 dollars per day. The equivalent of 4 to 8 days of work. That can have a considerable impact on the quality of life of any farming family in the region.

Creating a Revolving Loan Fund and/or Tourism Economic Development Grant Fund

Facilitating the expansion and remodeling of current properties requires funding. It is recommended that a funding source be established that would allow interested parties to obtain the funds necessary to remodel and expand their properties to house future guests. The return on that investment would be greater than a similar investment in crop production, and would contribute exponentially to the economic development of the region.

Clearly the major concerns of tourists in Haiti need to be addressed. Countless studies point to the perception of instability, corruption, and insecurity, all based on some level of truth, although mostly exaggerated. The development of agrotourism can happen but needs to be interwoven with other economic development strategies outlined in this report.

Three prototypes are offered in this report that can be feasibly injected into the fabric of the existing landscape. All three models emphasize sustainable strategies. Two of the three highlight not only renewable energy resources but also self-contained food production systems (aquaponics), soil creation strategies, biofuel production and use, among other strategies.

The three projects are categorized as:
1. The Adaptive Reuse and Preservation of Historical Buildings in Arcahaie in the Proposed Historic District.
2. A rural or urban12 - room hotel/inn for new or adapted mid-size offerings.
3. The extension and redevelopment of a family Lakou, intended for smaller-scaled offerings within a family's residential compound.

The Lakou and 12 room hotel/inn projects proposed for use anywhere in the Arcahaie region, solve the problem of the need for more economical room and board options for guest to the region. These projects also showcase new agriculture and aquaculture technology for the area, thus having a bi-lateral benefit. In these projects, visitors will be able to see the sustainable and highly efficient production of food, including protein and vegetables, on a relatively small footprint, through the use of aquaponics.

In the typical family Lakou setting, a guest can learn how to grow vegetables in the aquaponics system, take care of fish, experience the flavor of delicious Haitian cuisine, cooking fresh fish, and attend local cultural events. The residents of the house can use the products of the aquaponics system for themselves, their guests and/ or sell them at market. Moreover, the household generates additional profit by renting the guest rooms to tourists. A "win-win" all around for families and for the economic development of the entire region.

Nourishing the Crop - Sustainable Initiatives for the People

Nutrients and water, light and air are necessary for plants to grow. Likewise quality food, clean water Light and air are needed for human subsistence.

According to World Health Organization estimates, more people in the developing world die each year from conditions related to indoor air pollution - mostly from inefficient, solid-wood-burning stoves than tuberculosis or malaria.

In the year 2004, indoor air pollution from solid-fuel use was responsible for almost 2 million annual deaths and 2.7% of the global burden of disease. This makes this risk factor the second biggest environmental contributor to ill health, behind unsafe water and sanitation. Needless to say, that a substantial portion of those figures are generated in Haiti, where the use of charcoal predominates. This underlines that the use of charcoal is not only unhealthy for the planet, as it contributes to deforestation and thus accelerates climate change, but it is also contributing directly to the death of human beings. A serious effort to combat this ill is called for.

Clean Air

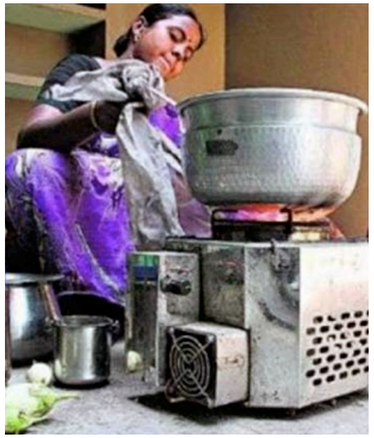
Some viable alternatives to charcoal are being adopted worldwide and can be introduced to or expanded in Haiti. These include: Biochar from stoves, biomass pellets, and Algae oil fuels.

Learning More

The following topics are identified as potentially applicable to assist with economic growth and or with improving the



According to World Health Organization estimates, more people in the developing world die each year from conditions related to indoor air pollution - mostly from inefficient, solid-wood-burning stoves than tuberculosis or malaria.



New gasifier stoves such as the one above sell for around US$25 in India. Many burn wood pellets, and use a fan for better combustion. Gasifiers can also burn coal, crop wastes, charcoal and dung.

quality of life of residents and should be further studied by experts in the respective fields to identify local adaptability, opportunities, and obstacles to local implementation:

- Clean Water (Moringa Filtration, Safe Wells, Rainwater Collection, and Water Filtration Systems)
- Food Security
- Composting Toilets - Green Manure
- Clean Energy Alternatives (Solar Heating, Solar Ovens, Photovoltaic, Wind Power, Micro-Hydro Generation, Wood Gas, Bio Gas, Biomass Pellet, Fuel Gasifier Power Generation

Harvesting the Fruit, Replanting Seeds, Planning for Tomorrow

A farmer that collects all the fruit for themselves, and does not reserve a portion to replant will only eat one harvest. In like manner, the analogy can be made that planning for the future of the entire region includes reinvesting in youth, providing a range of readily available educational & healthcare options, engendering economic opportunities, building and maintaining infrastructures systems, and social welfare that can facilitate self-actualization, an improved and prolonged quality of life, as well as regional prosperity. These are the needed 'seeds to be sown,' alongside the aforementioned agricultural and ecotourism and agrotourism initiatives because *"Sa ou plante se li ou rekolte"…. "what you sow is what you will harvest."*

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Town Plans: Seeds for Civic Life

Case Study Sites: Arcahaie - Corail - Luly

Jaime Correa, Associate Professor in Practice, CUCD Research Affiliate, University of Miami School of Architecture

Humanity is responsible for the creation of its own urban and rural environments. The commitment to take care of our delicate and profoundly complex ecosystems is one of the greatest contemporary challenges. Despite the glitz and the debilitating chaos of mass culture and its corresponding disrespect for long standing traditions, every move we make has positive, negative, or neutral outcomes; as a consequence, the conventional arrow of time seems to be incorrect: the present is the result of our past actions and the future is being crafted in the present. In effect, the future is now.

A new civilization will blossom from this understanding; a civilization which will act from the present and which will be able to act responsibly, to clarify, to define, and to give integrity to human purposes and organizations through the creation of appropriate urban forms and communities of purpose; communities where both place and space will mingle to produce beautiful, meaningful, and unique human environments. But no such principles will be forthcoming without the recognition of our existing reality.

Haiti is not immune to globalizing trends - be they stylistic, constructive, financial, political, social, or digital. Neither is it exempt from global urban and building trends that place greater value on what is modern, fashionable or of the *zeitgeist* instead of what is historical and culturally anchored. In a world where cities, large or small, start to lose their identity and are increasingly more generic, their sameness - the derivative of its incongruent spatial and architectural choices - everything has equal value, and thus by extension, they are giving birth to a devalued society.

The advent of readily accessible technologies have brought great prosperity and connectivity to places that lacked it in the past, but, they also have the capacity to alienate and homogenize entire segments of society, making human face-to-face contact potentially obsolete and affecting the way we as humans interact. In parallel, as a civilization, we have lost purpose and meaning in life. Anxiety and discomfort are the agonizing qualities troubling our current society. Neighbors fighting neighbors, alcoholism and drug dependency, criminal behavior, increasing suicidal rates and environmental degradation are just symptoms of greater human problems.

The irresponsible exploitation of natural landscapes is rampant and a detriment to local and global peoples alike. The fertility of those lands and the health of entire eco-systems are being diminished, while contributing towards climate change. Lastly, the loss of physical clarity between what is city and what is countryside, is in great measure due to unbridled sprawl developments, which consume open land and agricultural fields. Resources and identity are vanishing.

Any of these recurrent symptoms here described can or have surfaced in Haiti. As part of its changing global reality, the region of Arcahaie is also under threat and, if unchecked, its unique resources and material culture may become part of its past history. The projects about to be described represent carefully detailed proposals which will define, clarify, and give integrity to three urban areas within the region: Luly, Corail, and Arcahaie.

The drawings in the following pages are the result of an 18 month long study. These are not personal interpretations of needs or standard interventions without human or ecological concerns. These drawings were produced after a lengthy process stamped with a carefully designed methodology, including: archival research, historic documentation, site visits, inclusion of the vast experience of faculty and consultants, and of great value, the advice of citizens and organizations dealing with day-to-day activities in each of the three areas of study.

The town team was composed by Jaime Correa - urban designer and Associate Professor in Practice/Coordinator of the Master in Urban Design, Steven Fett - Architect and Lecturer, and Armando Montero - Architect, Lecturer, and Specialist in Agriculture and Tourism. The members of the team toured the Arcahaie region during four visits. The first was a trip to see and understand; the second trip served to document opportunities, meet with citizens to learn about the strengths, weaknesses, assets, and threats to their communities, and impart preliminary ideas & work progresses; the third trip involved further sharing ideas with citizens and in return receiving their collective input and visions and, the fourth trip served to present the team's recommendations for closing input and approval from the community before these became final and were submitted to funders and local leaders.

A Moral Imperative

There are geometrical consequences to everything produced in the physical and natural environments. Unfortunately, modern men have been trained to disregard these rules and to proceed within the framework of aesthetic theories, thus denying scientific evidence, and ignoring human needs and the limitations of the natural environment to sustain us. Great urbanism and architecture cannot be generated without a deep understanding of the meaning of existence and its life-giving geometries - geometries which may vary from locality to locality.

Our first task in the Region of Arcahaie was to discover the hidden generative rules that make up the Haitian urban and rural environments particular to this area. In our professional experience, and irrespective of the standard systems of land distribution, the three case-study sites (Luly-Corail-Arcahaie) were selected because they are three different scales of urbanism (S-M-L) and three unique responses to the geometries of the place (Informal-Neutral-Formal).

Our second task was to dispel the uncertainty that certain political, industrial, economic, and sociological dimensions are absolutely necessary to produce places of greatness and beauty. Self-empowerment and a desire for immediate action can make 'dreams' come true. The design team reminded participants that their own country's political history was altered by similar examples of local courage and leadership. The team also provided examples of other places and cultures where "bottom-up" endeavors became the moral imperative of the land and where generative collective actions opened up new possible built worlds.

Economy - Politics - Construction - Urbanism - Design

During the first and second visits to the study areas, the town team realized that, in addition to design, the fields of economy, politics, construction, and urbanism played an essential role in the psyche of the Haitian people.

In the field of economy, understanding the question of how different flows of money play a particular role in the way things are shaped is fundamental - particularly regarding the role of non-profit organizations and the lack of perceptual ownership caused by the charitable idea of "giving without expectations."

In the field of politics, there is an underlying question regarding the decision making processes and the size and hierarchy of the groups of individuals involved in the transformation of their hometowns.

In the field of construction, citizens demanded a response to the problem between the actual physical structure of any proposal and the process of building it. The roles of the people involved, the sequence of decisions necessary to take projects to their ultimate states, and the particular operations necessary to fulfill the requirements of each proposal for rehabilitation or new construction are essential elements to be considered.

In the field of urbanism, the relationship between form and meaning is essential. In partnership with our design team, citizens as well as Initiative sponsors all agreed that the dialogue between traditional objectives and new projects can possess and acquire intrinsic or extraordinary properties, which can deliver meaningful subconscious messages that reinforce a sense of place.

In the field of design, citizens wanted to be heard and understood. They emphasized that, in the past, "policies and planning" were simple administrative words without any real meaning in their lives.

In design, in urbanism, construction, politics, or in the field of economy, there is an intrinsic need to change. Apparently, the processes in place are not satisfying the needs of the populace at the rate needed - and the proof is often found in their physical surroundings and evidenced by their day-to-day realities. Unless those processes change, real change will not occur.

Self-empowerment, capacity building, and education are therefore the most pressing necessities in Haiti. For as long as typical citizens succumb to the current mindset that *"some kind of help"* is going to come from somewhere, both change and progress will be slow in coming. The real contemporary challenge is to create small communities of interest that with their own two hands can implement a variety of small, medium, and large projects. A Haitian proverb avows: *" God has stated, do your part and I'll do mine."*

Hidden Generative Structure

Haiti is entrenched in a French colonial tradition of land distribution still affecting the urban and agricultural areas along its major coastlines. The region of Arcahaie falls within this time tested process and its territories present important evidence of the kind of land survey system called "French arpent" or "Rag-system".

An arpent was the unit of length used by the French to measure lot units along the coastlines of their Caribbean and Gulf of Mexico territories. An arpent was the equivalent of approximately 180 French feet - 192 English feet or 12 rods of 16 feet each. An arpent represented the typical length of the anchor chain of any French sailboat.

In the absence of any other tools, this unit of measurement determined the typical width of the land given to a member of the French army. The length of the lot was established by the amount of land that the property owner would be able to walk between sunrise and midday - a sustainable measure generated by practical agricultural reasons; as a consequence, young people would walk 200 - 250 arpents while older soldiers might cover 60 - 80.

An aerial view of this type of land distribution presents similar patterns with those of a used comb or an old piece of clothing - reason why it is also known as the "rag-system". Because of their perpendicularity to the coastline, some lots show rectangular configurations and some have rhomboid configurations - this is the effect of two sides which do not have starting points along the same parallel lines.

The formal configurations of Arcahaie, Corail, and Luly are entrenched in this tradition. Arcahaie, Corail, and Luly present evidence of former arpent land distribution in their respective morphogenesis. Although their genetic configuration is due to the arpent system, each condition presents unique emergent behaviors.

In the case of Luly, the smallest one of the three case study sites, the arpent system is ignored at the village proper; the traditional system is replaced with complex informalities based on human perception, mythological and animist conceptions of space, and social hierarchies represented by various building scales and public/social spaces. It is only at the village edges where the arpent distribution evidence is clearer.

Corail is almost a fork on the road; located along a connective corridor, it traverses agricultural French arpents in a diagonal configuration. The irregularities of the residential "Lakou" family compound were appropriate to lots which met the main road with acute angles and awkward geometries. The presence of the railroad helped determine its center and produced opportunities for an informal market and a central source of water distribution.

Arcahaie's grid system is the result of multiple divisions of the original arpent system. Its skinny blocks and public square give the city an urban character which is reinforced by its waterfront market, its central place of worship, its interspersed civic buildings and monuments, and its rural cemetery.

Preliminary Notes on Urban Geometry

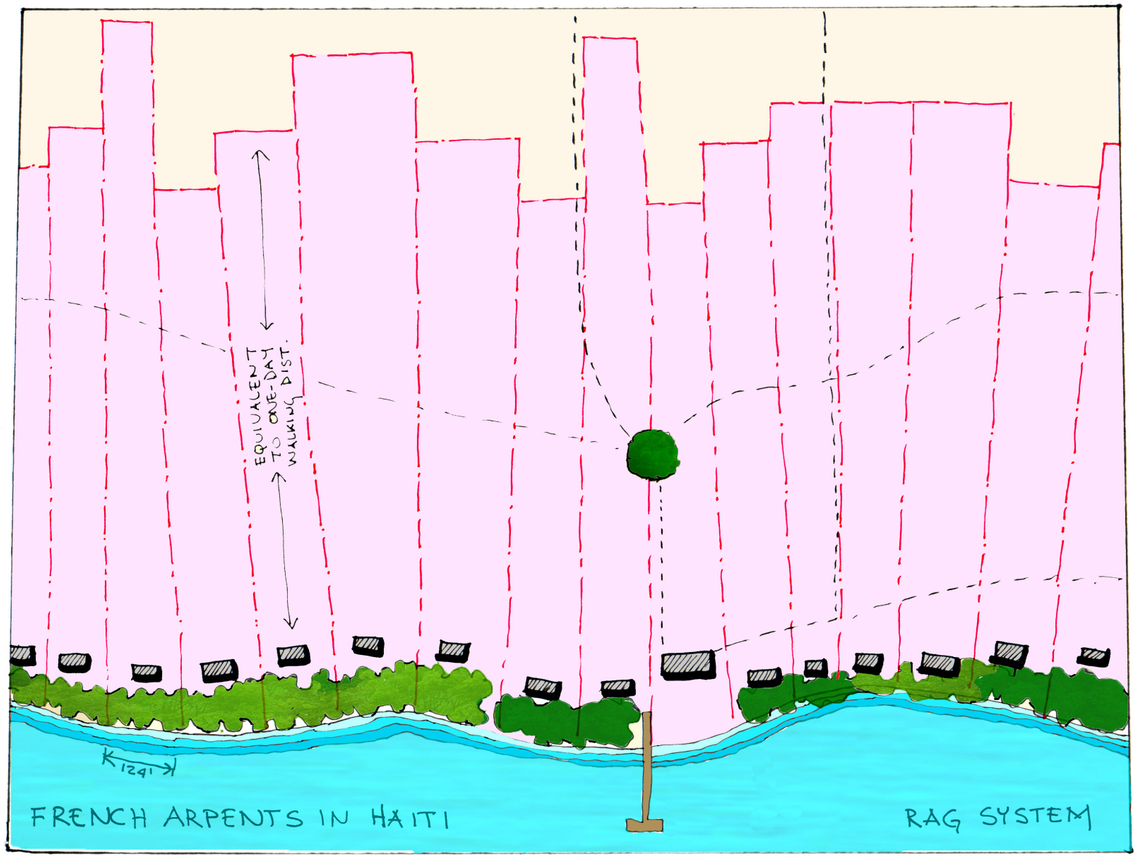
For thousands of years, communities at large followed objective and pragmatic principles of design and construction in the creation of architecture and urbanism. Their lovely character and their natural order was, by no means, the result of the whims of a radical leader but rather, the product of innumerable iterations, of trial and error, and therein lay their wisdom and relevance.

In traditional communities, an imitative natural geometric structure was the central reason for the production of architecture and urbanism. The spirit of the place *(genius-loci)* was manifested through architecture and town design from a purely rational perspective; and, mathematical terms helped humans make sense out of this conundrum.

Many architects and urban designers have attempted to define the specific characteristics that create memorable and significant urban spaces and architecture (see Christopher Alexander's four volumes "The nature of order", D'Arcy Thompson's book "On growth and form", or Nikos Salingaros' "Principles of urban structure" and "A theory of architecture" for further clarification).

A collection of these principles could be summarized as:

1. **Clarity of figure/ground relationships:** as opposed to amorphous blobs and vague shapes, good architecture and urban design displays regularity and legibility of form, compactness, and a certain degree of internal symmetry.
2. **Centers, inner calm and balance:** nodal points and the identification of structural hierarchies are fundamental to the production of great urban places and architecture. There needs to be a balance between emptiness and fill to create perfection and unity.
3. **Differences in scale:** objects of architecture and urban space are always part of a larger entity and contain smaller and smaller levels of understanding. Sight terminations and location of higher elements must be carefully studied.
4. **Clear boundaries and contrast:** to attain any type of


EQUIVALENT TO ONE-DAY WALKING DIST.
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FRENCH ARPENTS IN HAITI
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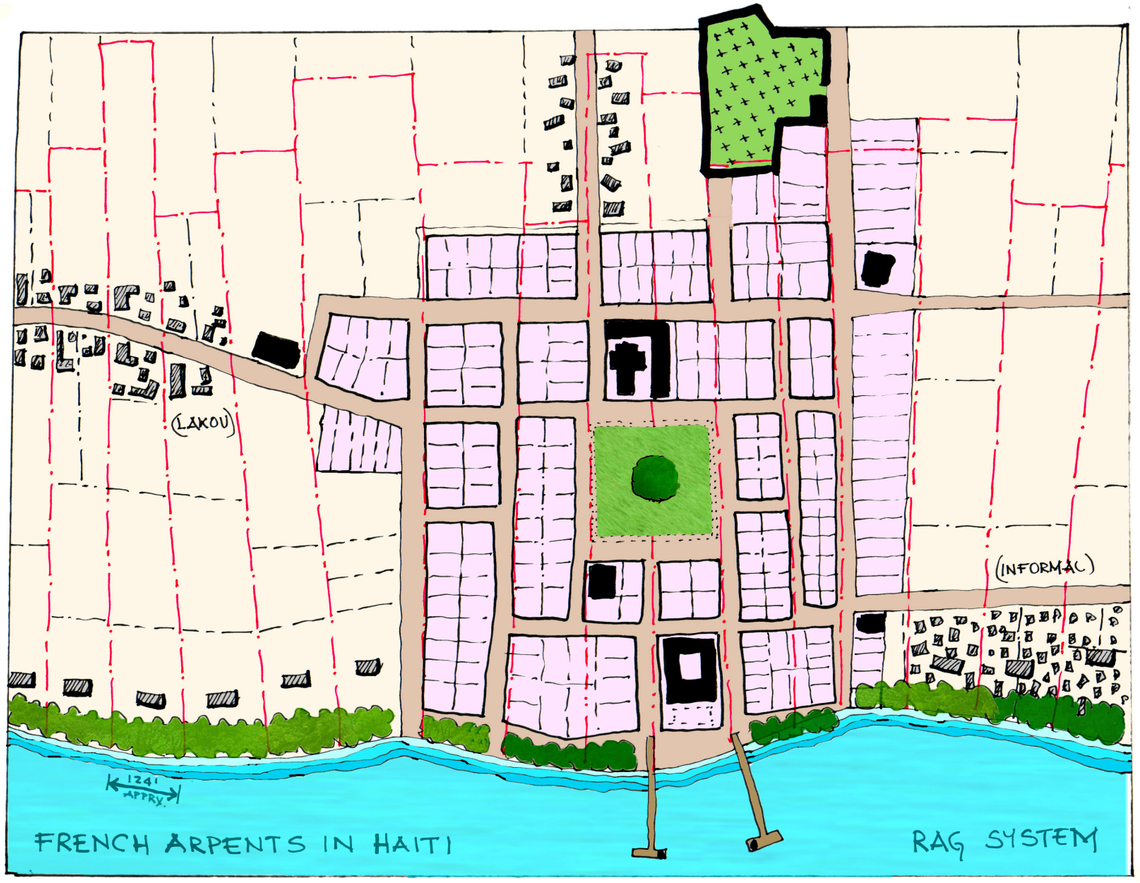
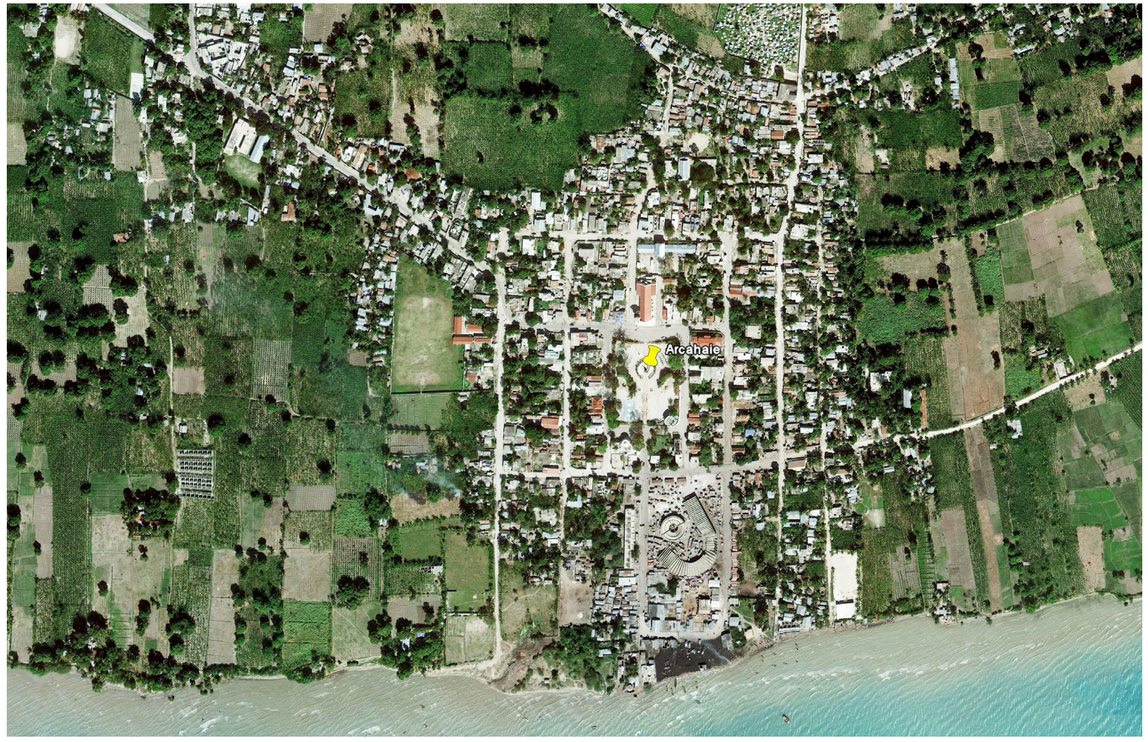

(LAKOU)
(INFORMAL)
1241 APPRX.
FRENCH ARPENTS IN HAITI
RAG SYSTEM

legibility it is necessary to produce intelligible boundaries between objects of perception. Contrast creates differentiation and emphasizes boundaries or borders.
5. **Slight irregularities:** mechanical repetition is boring and without life. Objects of beauty contain fields of differentiation, adaptive or natural irregularities, and/or a certain degree of relaxedness.
6. **Repetition and redundancies:** objects of beauty repeat over and over with a sense of order; what may be repeated is also the kind of relationships or intervals between objects of perception. Redundancies generate resiliency in communities and higher object functionality.
7. **Ambiguities:** field interlocking, figure-ground reversals, and fluctuations of meaning are just a few of the ambiguities necessary for the production of beautiful objects of architecture and urbanism.
8. **Solidity and acceptance of gravity:** everything is pulled to the center of the earth by the law of gravity; denying this simple fact produces incertitude, stress, and/or anxiety in any human mind. Solid objects must be connected to the ground and must celebrate when the earth meet the sky.
9. **Connections and networks:** in a world of processes and systems, everything is connected to everything else, except sometimes. Interlocking connects two areas and makes them truly inseparable.
10. **Cultural uniqueness:** the involvement of local people and the roles played by traditional means of production is of paramount importance to the production of places of beauty and human understanding.

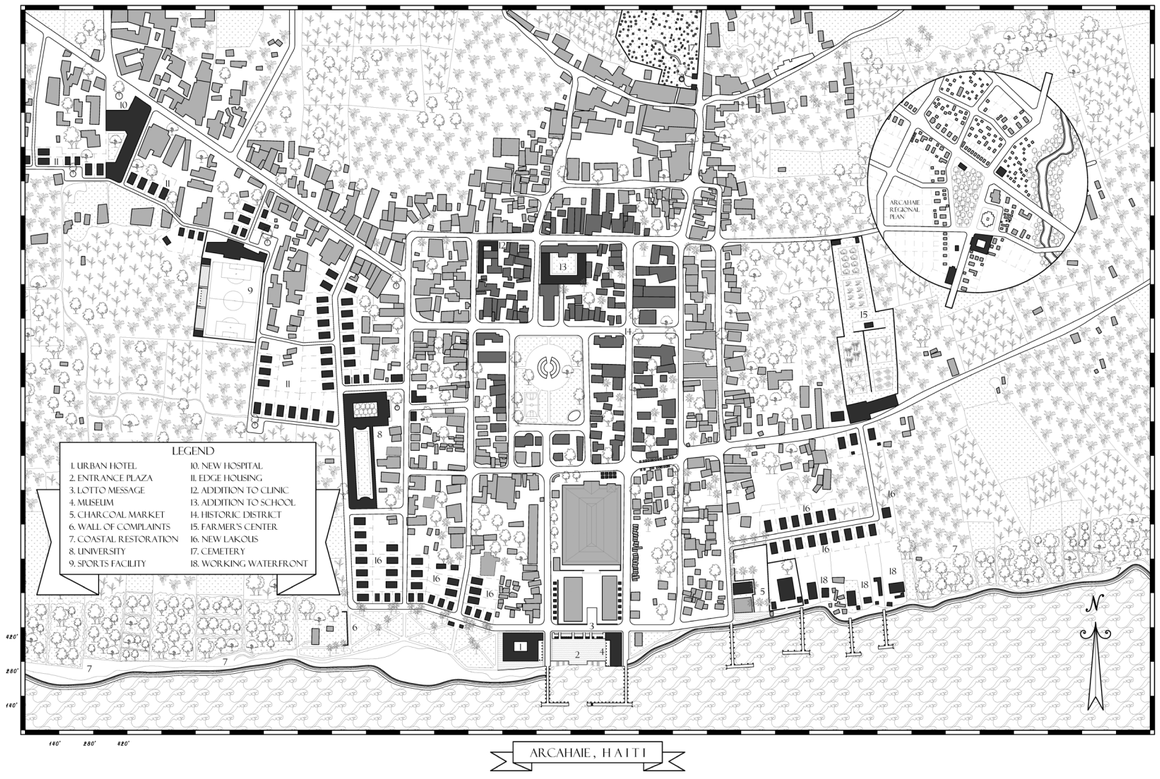
The investigation and proposals presented in the following pages make use of these ten properties through the production of design iterations varying from place to place. It is certainly true that industrialization and technology produce all kinds of things very cheaply, efficiently, and quickly but, that does not necessarily imply that the new objects of consumption or the neo-intellectual advances are lovely, filled with life, or meant to create human environments of comfort and beauty. A rediscovery of geometry is therefore fundamental in the production of new development and in the rehabilitation of existing urban places and spaces.

Town Plans: Seeds for Civic Life

Case Study Sites: Arcahaie - Corail - Luly

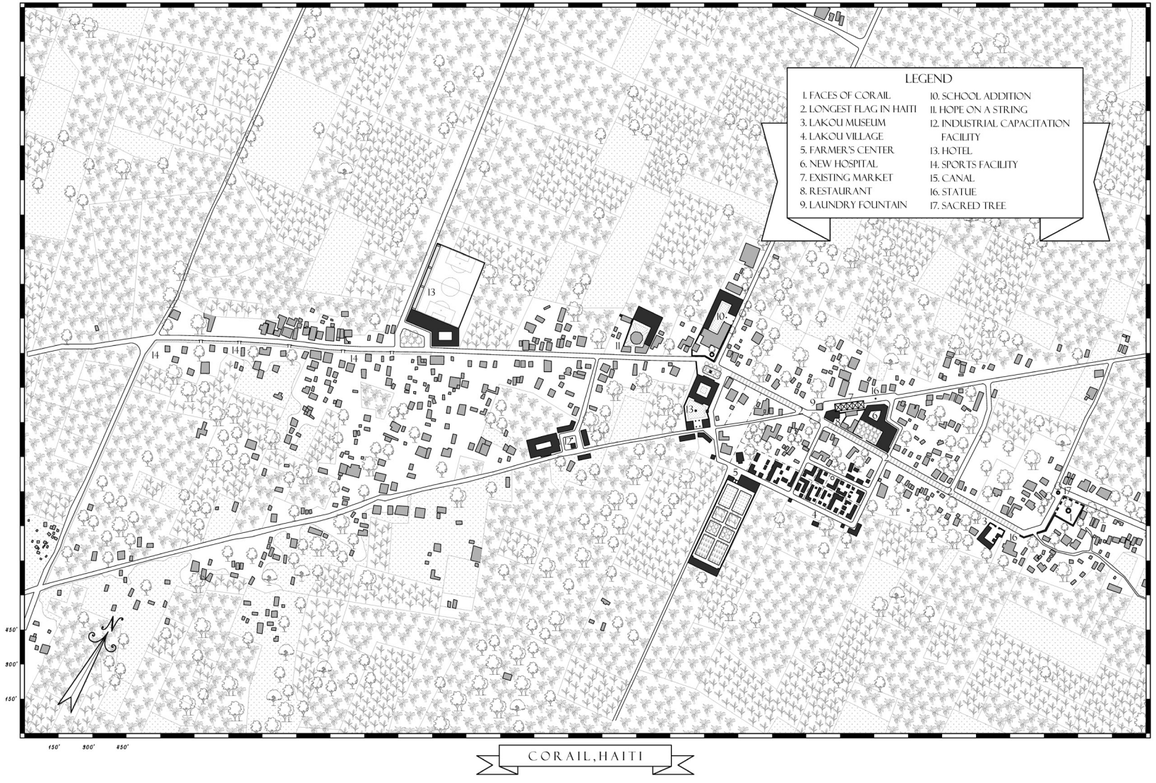


Aerial view of Arcahaie, 2012. (Google Earth)



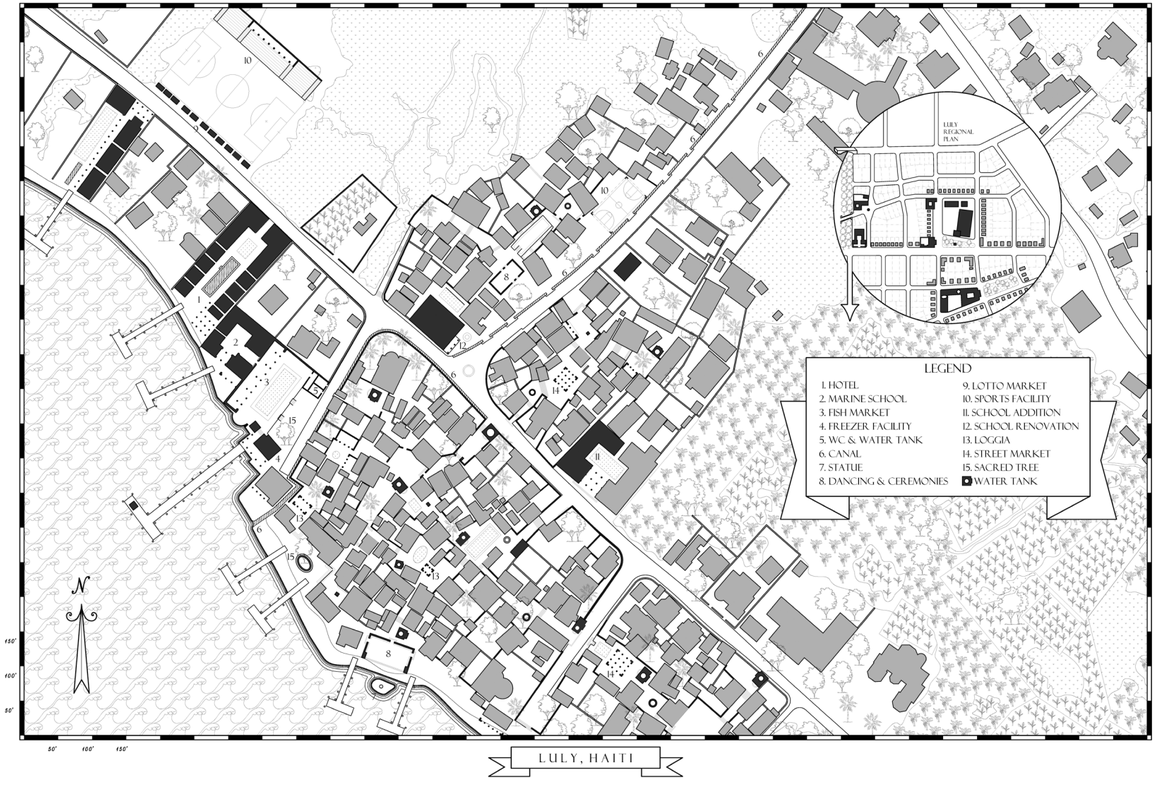


Aerial view of Corail, 2012. (Google Earth)





Aerial view of Luly, 2012. (Google Earth)



Proposals for the Town of Arcahaie

The town of Arcahaie presents the typical pattern of French arpent land distribution and land development; a pattern which is initially determined by the location of a small boat landing dock at the center and arpent segments, of irregular lengths, surrounding this point. In further iterations, this initial position becomes the appropriate location for a regional market as well as the waterside entry to a new settlement.

The town is the result of further land subdivisions and land speculations generated by the success of the regional market. The original arpent subdivisions are further segmented, almost parallel to the water line, in order to incorporate a network of roads and produce a system of blocks and lots with higher development potential. As a result, the block system tends to be either rectangular (generating lots of approx. 75 - 90 feet in depth) or square; the block lengths vary in accordance with topographic or road network circumstances.

The fractal segmentation of blocks into lots becomes smaller and smaller until it forms urban lots with enough space between buildings (for ventilation purposes) and/or large partitions reserved for public uses and civic buildings i.e.: church, city hall, central square, etc.

The configuration of the town proper has characteristics shared with similar French settlements in the Caribbean and the Gulf of Mexico. At its new center, typically a location where several rural roads meet, a central square would be located and surrounded by relatively large commercial and/or residential buildings, a church, a parochial school, and a city hall. On the periphery of the town proper the founders would locate uses that, either by their intrinsic function or their noise and activity, would affect the health and peace of its citizens i.e.: cemetery, hospital, market, etc.

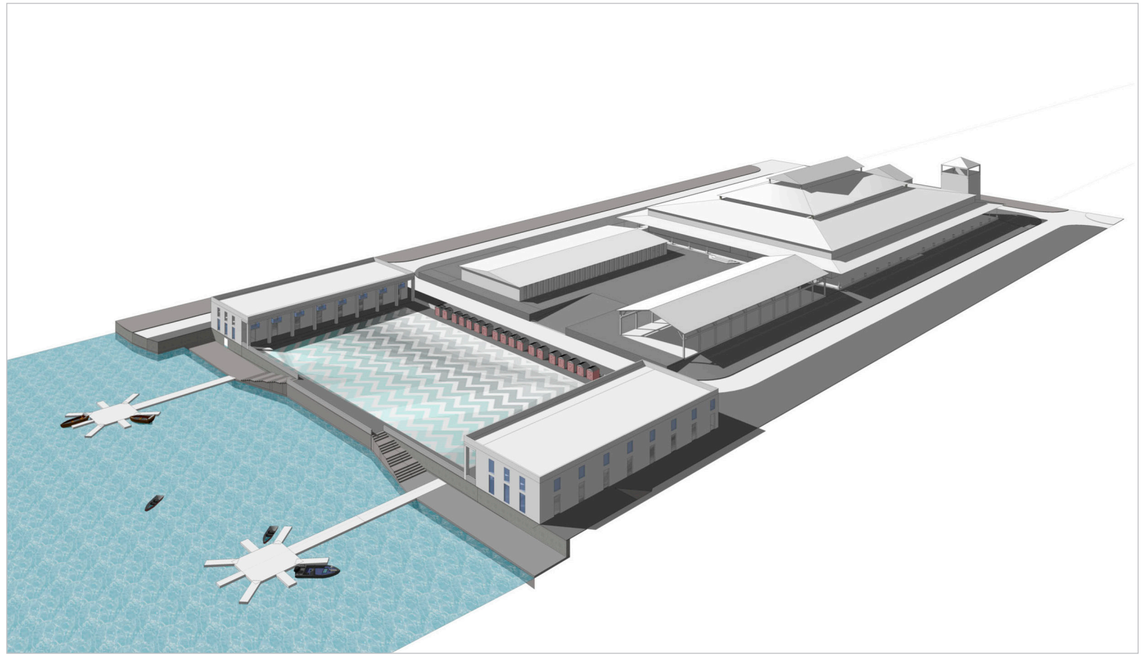
Meanwhile, the boundaries between agricultural areas and the town proper are fully thickened and clarified by the introduction of peripheral roads which do not traverse the areas of agricultural production except as walking paths. The closeness of agriculture to compact urbanism produces an economy of landscape where man-made green areas were present only at selected locations i.e.: the central square, a social gathering area, a water source, etc. The rest of the town was treeless due to its close proximity to the nature. If a town resident wanted to see nature, he/she would walk no more than two blocks to be in complete communion with an unspoiled landscape.

Any intervention in the town of Arcahaie must take into consideration these geometries, locational assemblies, and development features to preserve its uniqueness and to facilitate the development of cultural continuity. In addition, a clear assessment of contemporary needs is also required to bring order to the urban structure and to satisfy the current lack of services and urban infrastructure (assessment of needs which was developed as a collaborative effort between the town team and residents of Arcahaie during our second and third visits to Haiti.

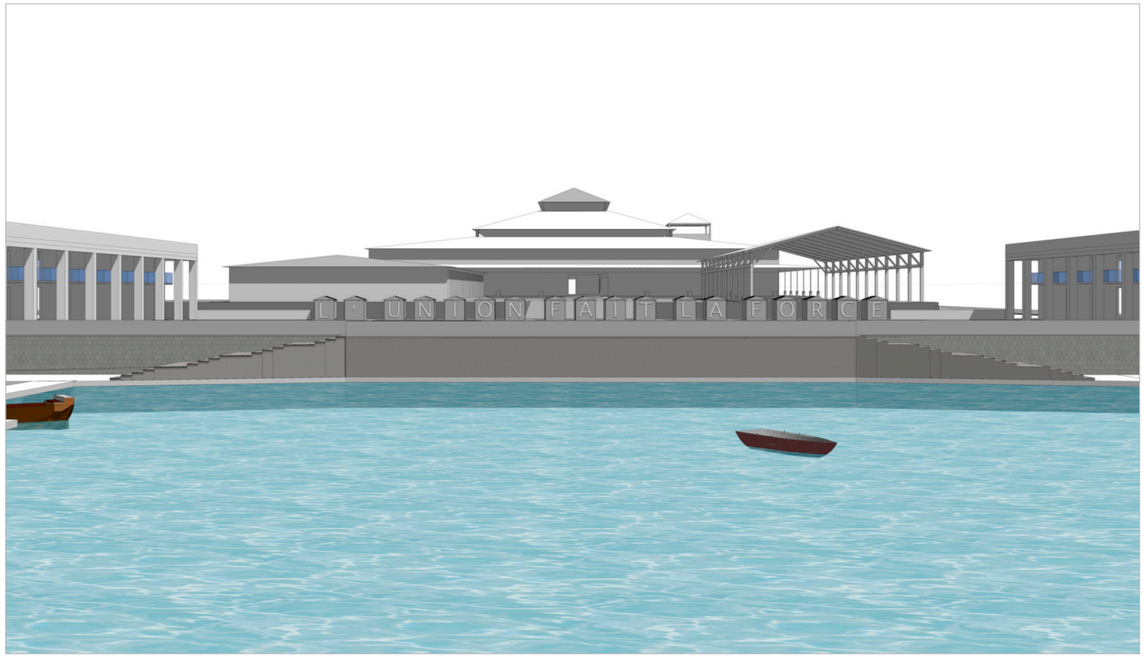
The proposals about to be described are the result of this assessment of needs. Particular attention must be placed on the descriptive nature of the interventions to understand the geometrical and locational choices as well as the significance of their particular patterns. The following urban and rural interventions provide a range of projects for new construction and the rehabilitation of historic areas, landscapes, public space, and buildings:

1. Waterfront Plaza: as a point of entry, the Town of Arcahaie does not present a great face to the waterfront. This proposal appropriates the waterfront block with a public space consisting of water and land areas. The



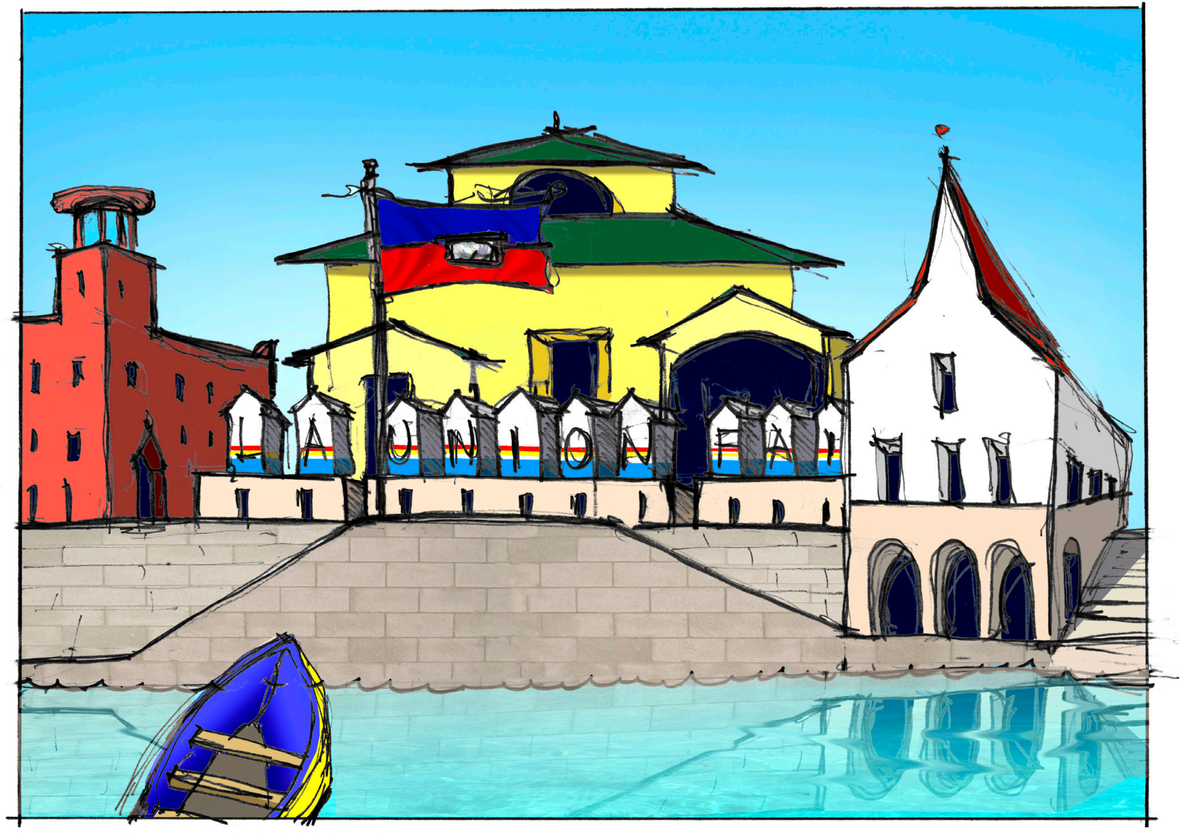


Axonometric view of entire waterfront complex, including existing market, proposed regional museum, hotel, waterfront park and new piers.

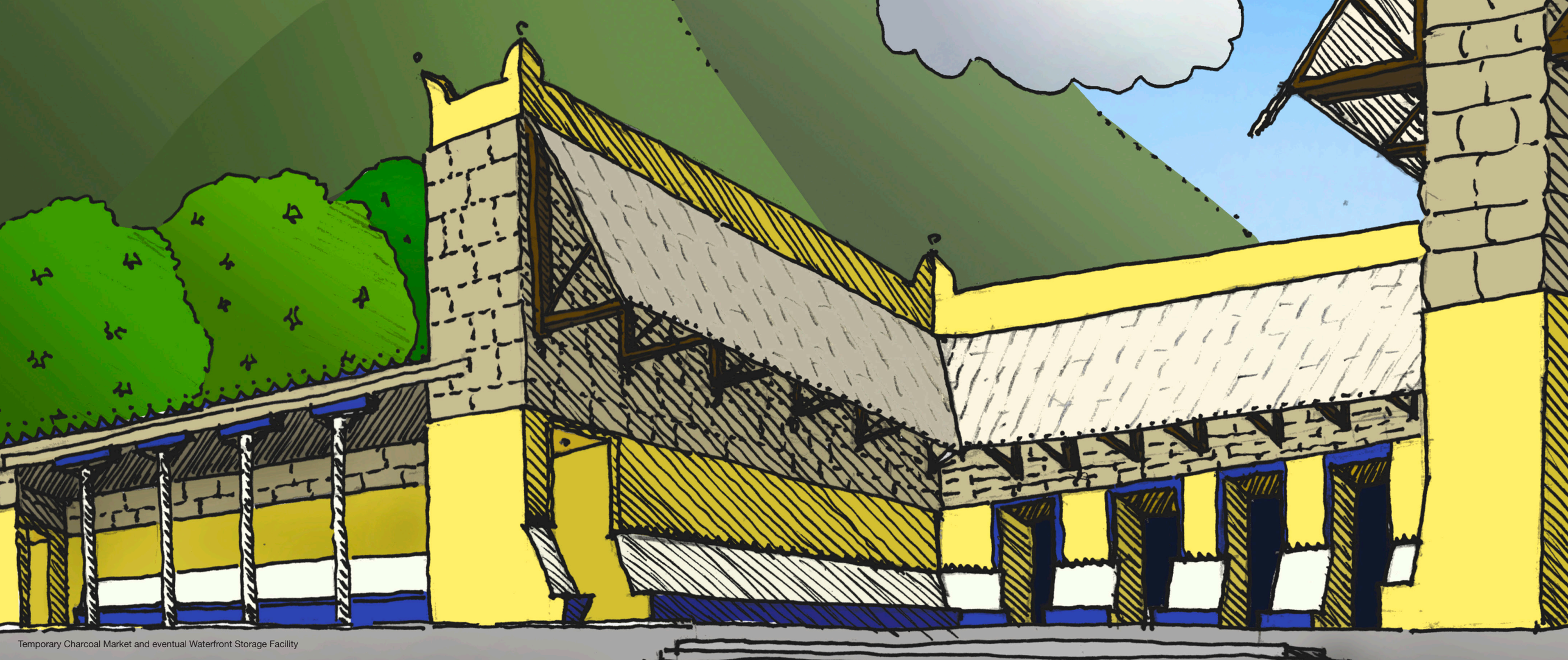




Arcahaie Existing Waterfront Market Scene



Proposed Facelift for Arcahaie Waterfront Port at Market



Temporary Charcoal Market and eventual Waterfront Storage Facility

water area is configured by the extension of two streets into the waterfront; two new docks enclose a small harbor for loading and unloading of goods, for tourist yachts, fishermen boats, or for water taxis. The land area utilizes the former coal market block and proposes the enclosure of a new waterfront plaza with: a commercial plinth on the north, crowned with a set of oversized lotto cabins - spelling the slogan imprinted under the coat of arms of the Haitian flag "*the union makes the force (l'union fait la force)"* thereby heralding that this region is the birthplace of the new nation - a museum building on the east, and a small hotel on the western side.

2. Regional Museum and Hotel: a regional museum displaying the history and development of the Arcahaie region and a small hotel would serve the tourist community arriving to the city from Port-au-Prince or other regions of Haiti. The hotel would flank the entrance to the central historic district and the hotel would serve as the gateway to a formal waterfront park. The hotel does not turn its back on the town, but rather acts as an integral contributor to its urban fabric and life.

3. Waterfront Park: a park provides a place for locals and visitors to stroll and socialize. It is also the culmination of the waterfront landscape restoration proposed by the Regional Team.

4. Wall of Complaints: the waterfront park begins/ends with a screen-like type of wall where political images or social slogans may be painted or projected on its flat surface. A raised platform serves as a traditional lectern or place to publicly denounce, complain about or celebrate everyday national, community or family issues - a fine democratic tradition which has endured for centuries in may African settlements, as well as cities such as London and Rome.

5. Waterfront Landscape Restoration: a buffer of approximately 100 meters should be preserved and replanted with the same type of landscape found along the unspoiled coastlines of Haiti. This landscape intervention should be implemented in an incremental fashion, and should make evident the arpent distribution of land subdivisions along the coastline.

6. New Coal Market: notwithstanding the fact that coal must be acknowledged as an unsustainable energy resource, the existing coal market must be relocated to an area with more natural surveillance - an area where coal pollutants may be better contained, re-used, and recycled. As more planet-friendly (that in the long run are also more profitable) alternatives emerge, the coal market will no longer be needed as such, thus this market can evolve into a secondary waterfront market, with a focus on the exportation of local goods to other destinations.

7. Working Waterfront: lots adjacent to the new coal market could be re-utilized as potential waterfront businesses with storage facilities and with the capacity for deliverance of goods and services.

8. Lakou Compound: a new city edge will be formed with a conglomeration of Lakou(s) on individual lots (see Urban Lakou proposals produced by the Building Team). The Lakou model remains the fundamental layout on plots.

9. Farmer's Capacitation Facility: a capacitation facility to provide technical schooling to farmers in the region. This facility could also act as an experimental laboratory for new sustainable agriculture with its obvious agro-tourism ramifications.

10. Regional Market Reconfiguration: the recently constructed regional market would be regulated for hygiene and its location and activities would be fixed to the existing block - without informal street spillovers.

11. Flag Memorial: the existing flag memorial would be reinforced with Lotto Cabins marching in rhythms along the main street. These cabins would frame the monument and could serve to give a clearer baroque approach to the site.

12. Historic District: the nomination of a new historic district, surrounding the main plaza and some of the side streets, would be accompanied by the restoration of its



buildings and natural landscapes. This living district and its current material culture would become an important tourism attraction in the area of Arcahaie. It can be enlivened with small shops, cafes and bed & breakfasts. Any new additions to the district need to be sympathetic to both the scale of buildings, lot increments, and to the district's prevailing architectural character.

13. Addition to Parochial School: an additional wing, forming a courtyard, would be added to the parochial school in the back of the church, thus allowing it to serve a greater number of students.

14. Addition to Existing Clinic: the so-called "Cuban Clinic" is in tremendous asset in this community but, it urgently needs to expand, if it is to keep pace with the community's needs. This proposal advocates for an expansion, with additional square footage perhaps being attained on adjacent lot sites.

15. Regional University: a regional university is proposed on the edges of the town proper so that local students are not forced to leave the region in order to receive an education. This university, can either be a satellite of institutions in the capital or can be a new independently run operation. The proposed site would be approached from the city on the east and accessed through a small plaza surrounded by university administration buildings or student housing. The rear of the university building would face the unspoiled agricultural areas as a reminder of the past and as an opportunity for students of natural and agricultural sciences. The university would consist of a head and tail type of building design. The head containing a small academic courtyard; the tail fronted with a series of classrooms surrounding a graduation lawn. The university would have a recognizable tower at the scale of the city.

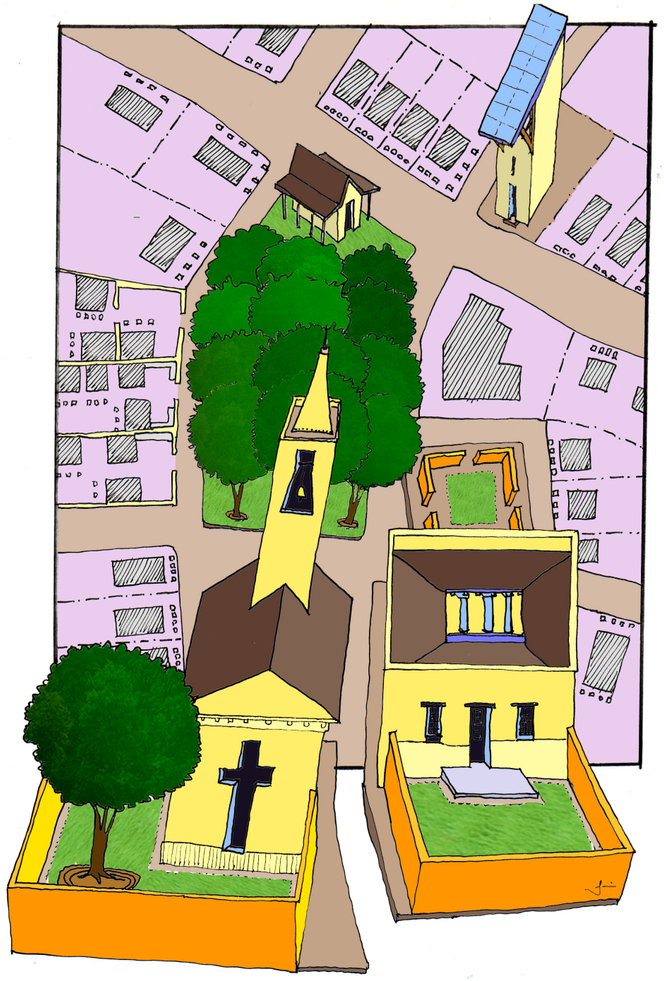
16. Re-definition of Urban Boundaries: the lack of a definite boundary between city and country side is repaired with peripheral roads carefully traced along existing property lines. All properties along the peripheral roads have residential frontages on the opposite side of extensive agricultural areas occupying traditional French arpents.

17. New Sport Facilities Field and Stadium: respecting the locational tradition of large infrastructure on the edges of the city, a new sport facility is added on the western boundary. This new sports facility consists of bleachers, a professional soccer field, and a small building with a gym and after school care sport facilities.

18. New Hospital: to create competition and redundancy, two essential characteristics found in communities with high degrees of resiliency, a new hospital can be located at the intersection of the westernmost entrance and the old national highway. This facility would put the Town of Arcahaie on the health map of Haiti and its centralized placement can not only serve residents in the lowlands, but also those communities in the highlands. A small plaza would front the main entrance to the hospital and a tower element would announce its location within the regional context.

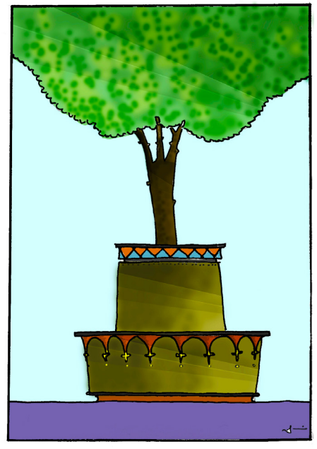
19. Cemetery Improvements: new entrance gates and thicker outside walls are proposed to provide greater legibility and differentiation between the city of the dead and the city of the living.

20. Highway Entrance Reconfiguration: the existing informal market at the intersection of the national highway and the main road into Arcahaie would be reconfigured. This new regional node would include: a water-tower with signage, topped by solar panels marks the entrance into Arcahaie; a covered bus stop, shelter and public rest stop on the main highway accommodate travelers; a central plaza with water-trough and benches, covered by a grove of tall fruit trees, under which the market can function more comfortably; the addition of individual shops surrounding the plaza can activate commercial activity; a smaller square in front of an existing school accommodates parents and children waiting to enter or exit the school; a new church, and a new small temporary lodging facility for individuals in transit or alternatively an emergency shelter, complete the repertoire of this intervention.



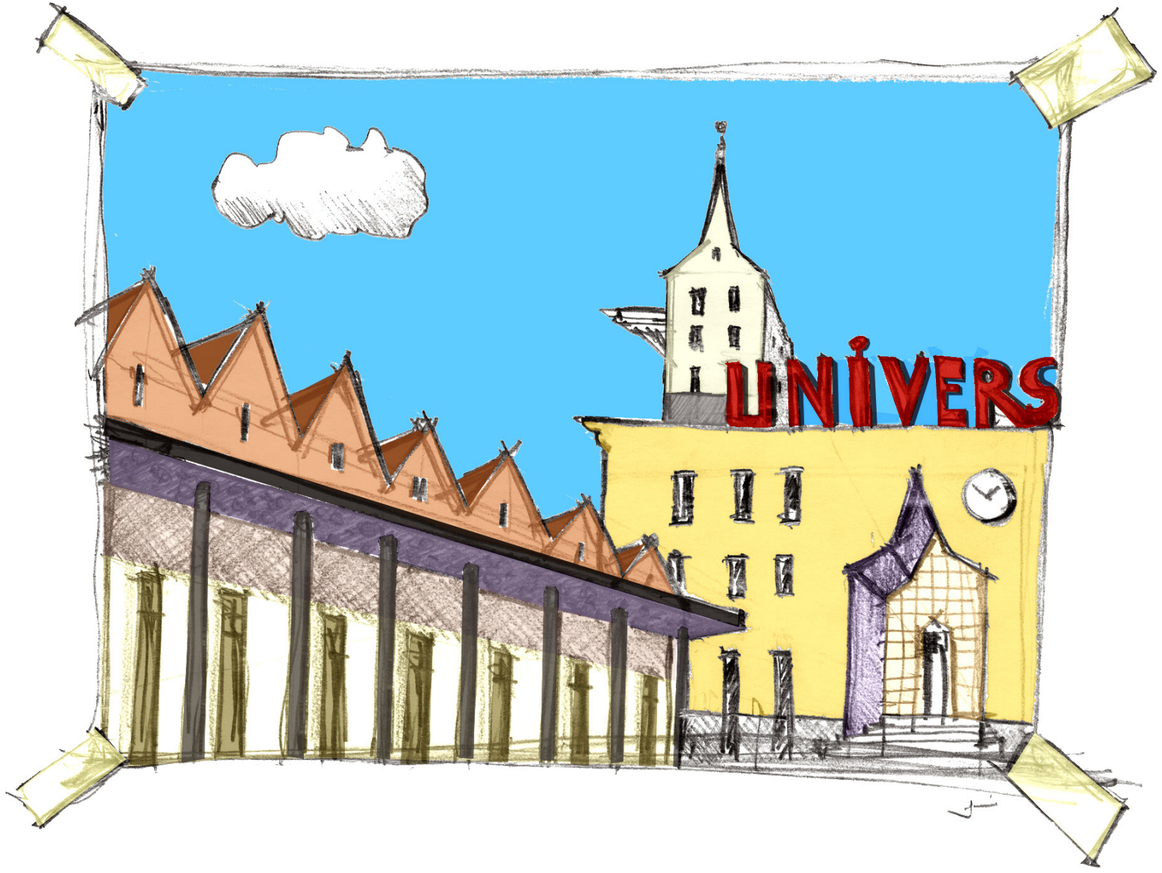
Proposed Arcahaie Regional Center at National Highway Intersection

Practical Urban Furniture with Bench and Tree



21. Agricultural Preservation: all areas around the town proper are to be preserved as agricultural areas in perpetuity. This decision requires the demarcation of non-negotiable urban growth boundary lines and brings numerous sustainability and livability advantages. Sprawl is not an option.

The projects described above are by no means exhaustive. Cities are in continuous flux and an idea of permanence or fulfillment is nothing but a vague concept that cannot correspond with the real nature of an urban place. At the time of writing, the proposals here identified are a direct response to the problems pinpointed by local residents and assessed by the design team and its consultants. The Town of Arcahaie will continue its march along the arrow of time and, undoubtedly, new challenges and opportunities will arise. Nevertheless, the solutions proposed above should open doors, generate debate, and spawn new bottom-up methodologies with the capacity to fulfill future needs and solve similar problems.



Proposals for the Corail Settlement Corridor
Corail is configured as a connective corridor along the old national highway. Located at the intersection of a former railroad line, Corail presents the typical geometry of an access strip with a long north-south shape, no clear urban block structure, deep lots, a market square at the intersection of the two principal means of transportation (railroad and road), and a certain dependency on the infrastructure and civic facilities of its adjacent neighbors.

Due to the disposition of its connective character, Corail has a rather arbitrary orientation towards the traditional arpent system of land distribution. As a result, the side lot lines meet the corridor proper in a diagonal manner - with its obvious functional and building placement consequences at acute angles.

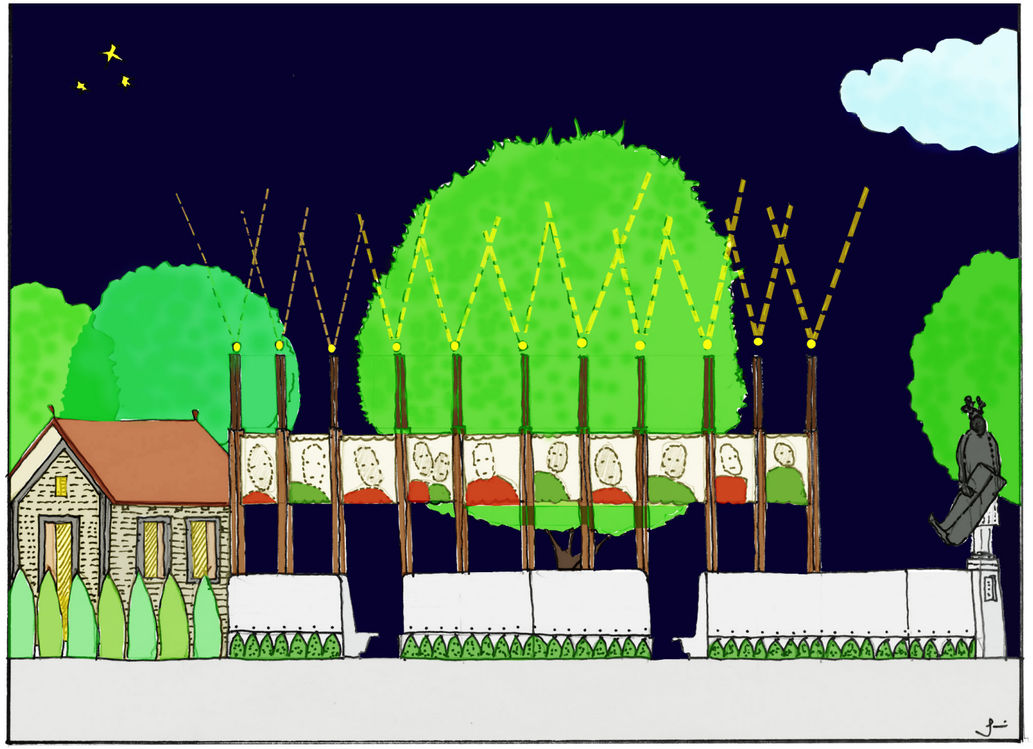
The lot configuration is the outcome of a multiplicity of fractal speculative subdivisions and segmentations of the original arpent units. In their traditional form, lots contained a family *"Lakou"* unit - a compound of buildings surrounding a central space and occupied by an extended family clan. This traditional residential and community form, however, has been replaced by monolithic residential units with flat roofs and a system of columns and beams in poured concrete.

There is an absence of identifiable urban spaces. The central square is a simple fork in the road with a cast iron market and a source of water - used by residents to do laundry or collect water for their personal use. The town market is only active once or twice a week. As a corollary of this condition, the lack of commercial activity is overwhelming for residents who are forced to walk, or drive, long distances just to get basic necessities. As a consequence of this condition, a certain amount of informal commerce occurs in "Lotto Cabins" along the corridor.

In addition to what is visible from the corridor, Corail also has a complex system of pathways connecting the residential units in the front with smaller units in the rear, large agricultural areas, rural Lakou(s), and the ocean coastline on the west. This system of pathways can be easily exploited to create a clear boundary between city and country side and to prevent the sprawling encroachment of residences into thriving agricultural areas.

The urban design proposals for Corail took into consideration the residents assessment of needs produced during the second and third visits of the Town Team, as well as the geometric and social factors described above.

The following projects summarize an immediate iteration of the development potentials for Corail:
1. Southernmost Entrance Marker: as the most traveled road, the southernmost section of the old national highway strip must be celebrated at the entrance of the Corail corridor. A "sacred" tree will mark this moment in the plan. Surrounded by a decorated bench, this tree would become a monument to the robust and rising spirit of the Arcahaie region. This node becomes the first of several 'public rooms' along the road - places that augment socializing, gatherings and shared identity.
2. Faces of Arcahaie - Square and Monument to Catherine Flon: the first bend on the road affords opportunities for a new public space. The proposal includes a social gathering space flanked by steel posts displaying photographic canvases with the real "Faces of Arcahaie". This is an opportunity to reward honor students, community organizers, and local heroes. The monumental square would be faced inward and a giant shade tree would occupy its center. A low wall would bind the site with a continuous bench along its perimeter. The wall continues to the corner of the site and ends with a statue commemorating Catherine Flon and her first version of the Haitian flag.



Plaza of Hope, Children of Haiti

3. The Longest Flag in Haiti: to bring greater notice to the birthplace of the nation's flag, starting at the location of the Catherine Flon memorial site, a series of posts and canvases will roof the corridor with the longest flag in Haiti. The canvases can be made of readily available materials and illustrate the handsomeness of local crafts. Dyed in the colors of the nation's flag it become a tourist destination but more importantly, a fitting tribute to the important event that occurred in this location. A side benefit, is that the canvass draping over the street would also shade the space below it and thereby automatically lower the micro-climate and make it a more comfortable pedestrian environment. This simple move can bring national and international attention, create a sense of patriotic pride, and generate tourism and agro-tourism.

4. Lakou Museum: nearby the location of the memorial and on the east side of the road, an existing *Lakou* will be restored as a living museum. This small family compound will attract tourism and will serve to educate urban dwellers on the challenges and opportunities of the typical rural life in Haiti.

5. New Clinic: a new clinic is proposed adjacent to the central market. The clinic provides a gathering space along the street corridor and follows a Caribbean tradition of head and tail layout, where the 'head' is occupied by a courtyard building that houses the main functions of the clinic and the 'tail' houses additional services and outpatient facilities.

6. Market Square Main Building: to respond to the lack of a permanent commercial facility, if rehabilitated, the building at the corner of the existing market square would provide a great location for a small convenience store with a residential unit in the back (a so-called "work/live" *Lakou*).

7. Addition to Existing School: the existing school needs more space. This proposal shows a potential configuration for the expansion of the existing structures within the existing property. A system of courtyards would produce a new academic center and create a real sense of community and wholeness.

8. New Entrance Plaza and Hotel: adjacent to the existing school, there is a dirt road which is now used by motorcycles as a means of regional entry to the main corridor. This proposal advocates for the formalization of this road as a potential new automobile entry to Corail. If realized, this move would provide excellent opportunities for a small bed & breakfast hotel and for a new entrance plaza. The B&B hotel, as proposed, should focus on organic agriculture and agro-tourism and should display the typical characteristics of the handsome mansions of rural Haiti. In this case, the typical Haitian residential house section has been flattened and presented as the façade of the building; a courtyard, containing a small pool, a hidden garden, and a loggia would provide access to the agricultural areas in the rear.

9. Farmer's Capacitation Center: in the rear of the hotel, there is an opportunity to locate a medium size farmer's capacitation center. These grounds would provide a venue for hotel visitors, local residents, and regional farmers to learn agricultural and fish-culture techniques *in-situ* and to experiment with new crops and crop yielding methods. This capacitation center can also become home to a local Agricultural Cooperative run by local farmers.

10. New Lakou Neighborhood: the capacitation center will be surrounded by a new neighborhood composed of a multiplicity of *Lakou* units. These units could be managed by the capacitation center itself or by a non-profit cultural organization focused on affordable housing or sustainable forms of living. At the same time, these units will provide a remedial edge between city and countryside and will prevent the sprawling of Corail into adjacent agricultural areas - a danger which may come as a result of its own success.

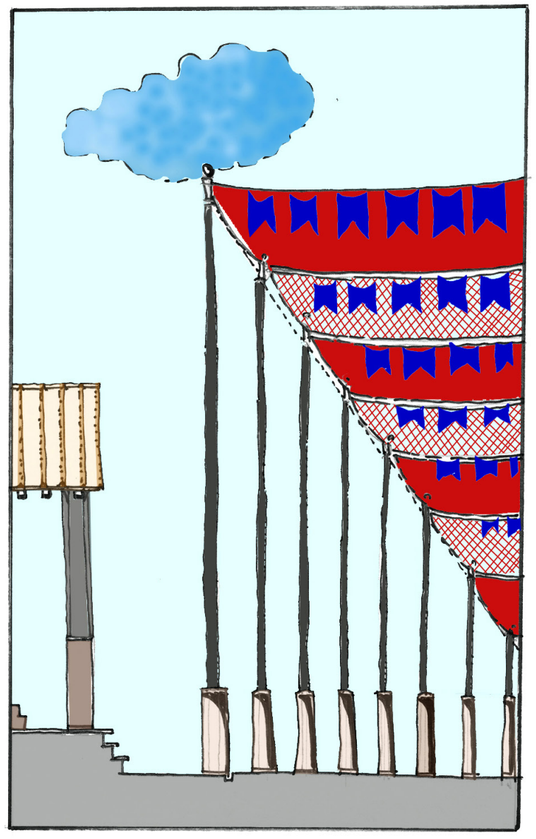
11. Industrial and Digital Capacitation Center: in the same spirit of the farmer's center, an industrial and digital capacitation center will allow the region to keep up with the latest global technologies. The purposeful location of this center was selected on the basis of its adjacency to the old railroad tracks - one of the first symbols of industrialization in Haiti. Students will come to learn and get empowerment from notions about the past, present, and future of a new nation.

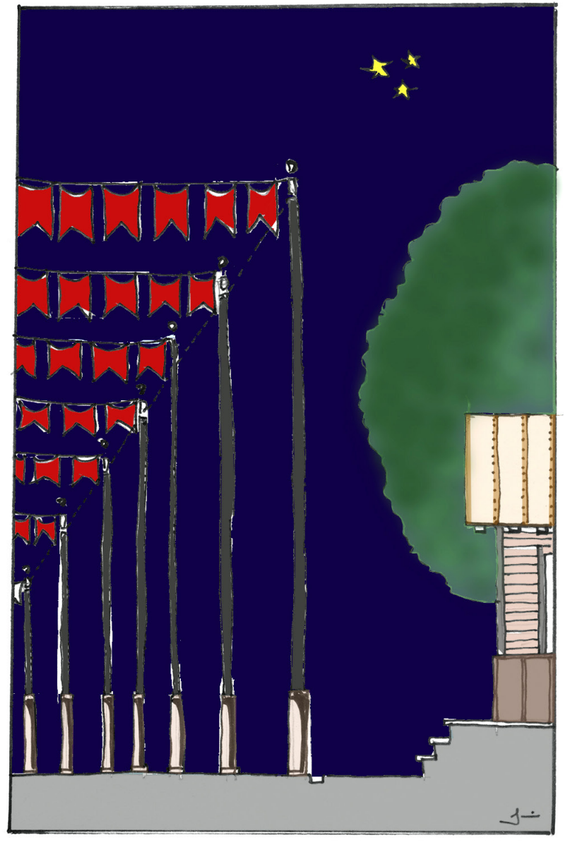
12. Addition to Hope on a String: a local non-profit organization, already established on this site, has a tremendous need for expansion. The proposal includes the completion of a courtyard with new building structures surrounding the existing circular structure in the center of the compound.

13. Reconfiguration of Sport Facilities: adjacent to an existing semi-professional soccer field, a new northern entrance to the site is proposed. This entrance can incorporate shops, and be flanked by new complimentary sport facilities containing a small gym. Additionally, rooms for a child day-care center and an after-school center for youth can be incorporated. To accommodate audiences comfortably, a group of bleachers would define the northernmost edge of the site.

22. Agricultural Preservation: all sites around the settlement proper would be preserved as agricultural areas in perpetuity. This decision, similar to the one proposed in the Town of Arcahaie, would entail the demarcation of non-negotiable urban growth boundary lines and would bring unique sustainability and livability benefits to the region. Sprawl development is not an option.

The emergent effect of the conglomeration of these redevelopment projects creates local differentiation and a strengthened sense of community, place, and character. None of the proposals here advocated are meant to solve pressing political problems; nevertheless, they bring hope by providing a development road map and timely opportunities for self-sustainability and growth. Perhaps more importantly, some of these proposals can be achieved directly by collective citizen groups in collaboration with local leaders, and actively engaged non-profit providers.





The Longest Flag of Haiti in Corail



Proposed Bed and Breakfast

Proposals for the Village of Luly

The village of Luly is an informal coastal community configured by a multiplicity of perceptual and socio-physical urban conditions and geometries. It is embedded in the gently sloping topography of the central Arcahaie region - condition which provides breathtaking views of the ocean; Luly is also surrounded by agricultural areas with unlimited potential.

The small village of Luly is completely severed from the National Highway. Only a local road bound by an adjacent drainage canal, without much grandeur (approx. 16 feet in width), joins the small fishermen's village with the main highway corridor on the north-east. As a consequence, from a marketing standpoint, it suffers from a lack of connectivity to business resources. Fishermen and their families are forced to depend on steady clients or walk long distances to set up informal road huts in order to sell their goods and services to transient visitors.

Although the traditional land tenure system can also be read in the overall configuration of this village, the denser urban structure of the settlement proper is totally informal and has an almost complete disregard for the arpent system of land distribution - excepting the agricultural borderline properties which are clearly demarcated by French traditions.

As a typical informal village, issues of land tenure are fuzzy and the lack of any type of legal evidence forces residents to constantly negotiate and re-negotiate the status of their properties as well as the boundaries and dimensions of their personal space on the basis of tradition, oral history, or "he said, she said" procedures.

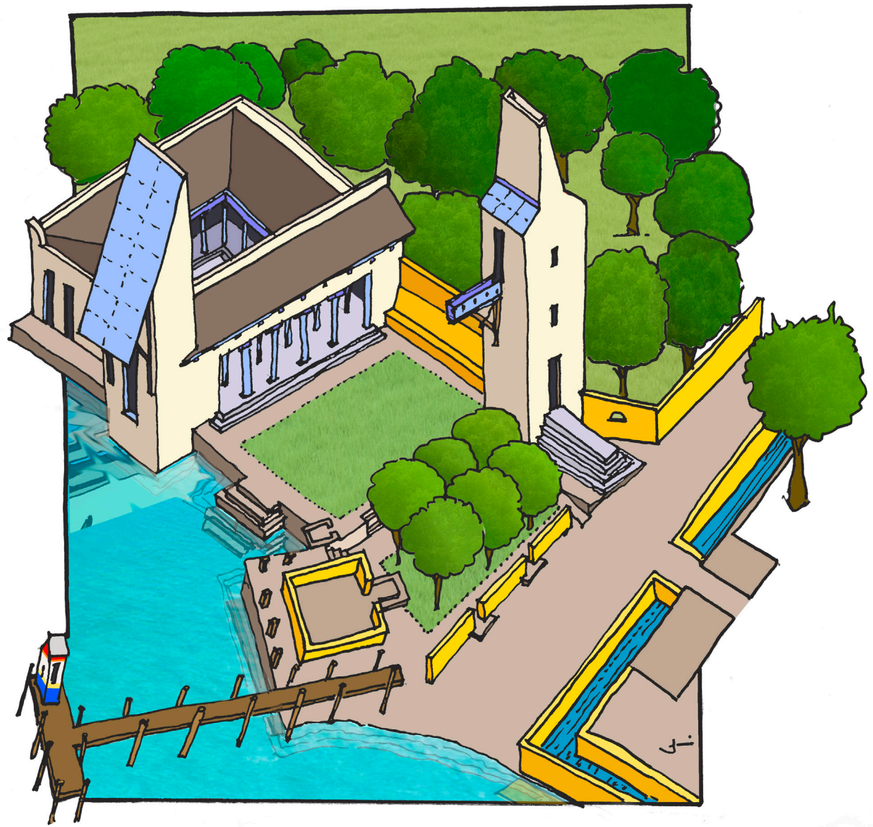
Water and sewage infrastructure is lacking and a super-abundance of conch trash and physical dereliction is present in every corner of the small informal village. Human necessities are taken care with total disregard for privacy or appropriateness of location. For human and fish productivity conditions, solving the water problem has become the fundamental goal in the minds of its residents.

Informal settlements tend to lack clear boundaries and public spaces. Their picturesque qualities require mental citizen maps for traversing them and become difficult for visitors and strangers. Citizens expressed their desire to create more spatial legibility and to become part of the regional tourism network.

The following projects summarize the scope of interventions proposed for the informal fishermen's village of Luly:

1. Waterfront Plaza: an identifiable place of arrival and a symbolic community center are still missing in this informal fishermen' village. Therefore, a new central waterfront plaza, located on the available site at edge of the informal settlement along the coastline, can serve as an entry from the water side and a terminus or destination from the land side. On the waterside, boats are welcomed by a 'light' beacon, equipped with solar panels, representing a new era of energy independence and the potentiality of clean energy; on the land site, the plaza would be anchored by a water tank tower serving the new market, that in turn, underlines the community's connectedness to water, nature and to its region's beauty. The topography of the site divides the plaza into two sections: the lower section, adjacent to the entrance to the informal settlement, is covered with shade trees, and can serve as an informal market; the higher side of the plaza is left clear of obstructions and connects the plaza buildings and space directly with the water of the ocean with gentle steps and a new wooden pier. This coupling of public spaces becomes the heart of the village, which gives life to its economic and social activities.

2. Fish Market: a much needed fish market can be placed on the westernmost side of the plaza. The market proposal is configured as a Greek *Stoa*, with closely spaced pilasters



Proposed Luly Fish Market with Pier

on the outside and loosely fitted columns on the inside - columns that in turn, define the spacing for each one of the market stalls.

3. Water Tower: this monumental building will celebrate the collection of rainwater and the storage of water by gravity in a sealed underground cistern. The building structure can house a public laundry facility and bathrooms for men and women - with showers, restrooms, and lockers.

4. Fishing Capacitation Center: the market loggia can give access to the fishing capacitation center in the rear of the structure. This building can house a trade school for technical improvement and experimentation on issues dealing with marine biology, boat making, arts and crafts, etc. - a curriculum based on the actual needs of the day-y-day necessities of a fishing village.

5. Bed and Breakfast: a new B&B hotel is proposed on one of the original arpent system lots on the west side of the village. It does not turn its back on the village but rather adds to its public life and actively engages the street it fronts.

6. Sports Complex Reconstitution and Temporary Market: the existing sports complex can be reconfigured. A system of natural bleachers can be carved into the existing topography and a linear system of "Lotto Cabins" can formalize a temporary market at the southernmost edge of the soccer field.

7. Sports Hotel: across from the sports complex, a new sports oriented hotel is proposed. This hotel, like the fishermen's plaza, has dual functions for the benefit of locals and of tourists. On its northern side, with the presence of the soccer field, potential biking paths and horseback riding trails, etc., it can augment and/or promote land sports; on the southern side, it can provide water sport facilities and small craft rentals.

8. Community Cells and Water Tanks: to address the needs for fresh water and also urban legibility that can be more inviting for tourists as well as lead to a well-woven network of paths, the informal community is rethought as a series of small community cells or clusters, of approximately ten family units per cell. The cell is centered on a public sacred gathering space, with a communal water tank that serves the homes in that particular cell. Small loggias, benches, special landscape, features can also supplement the overall character of each unit within the cell. This idea can help towards the decentralization of community decisions at the day-to-day level. In addition, a "village council" with representatives from each cell can come together to deal with larger decisions at the general village level. Plans herein suggest locations, but the demarcation of these urban spaces and the location of the water tanks must be carefully crafted by locals, in order to respect well-established informal and/or implicit land tenure organizations.

9. Local Markets and Loggias: a collection of two or three cells can generate a potential site for a small local market unit. These markets are represented in the plans as square colonnades in the tradition of the markets found in the center of any French *bastide* (new town).

10. Social Gathering Spaces: on the edges of the informal village, a multiplicity of social gathering spaces may occur. These can used as community gathering spaces or as informal commercial areas.

11. Pedestrian Networks: a series of connective walls and fences can define the legibility of the pedestrian networks. Each family cell should be completed by or surrounded by a wall or a fence with casual entrances and building frontages. This combination of buildings and garden walls in turn define a network of paths and pedestrian ways. It is at the intersection of these paths where a new idea of public space, that can include the local markets and loggias described, may occur.

12. Addition to Existing School: the existing schools should be expanded to form complete educational units. The proposals here included emphasize the creation of safe courtyards as the preferred building typology for schools.

13. School Building Reconstitution: an existing corner building, in need of rehabilitation, has been identified by the



Proposed Luly Regional Center at National Highway Intersection. Regional Center includes a clinic, vocational school, distribution center, market plaza, police sub-station, university satellite, and new Luly entrance tower.

community as a potential site for a new local school, day-care center, after-care youth facility, and/or an adult capacitation building. All these services are sorely needed in Luly.

14. Agricultural Preservation: all sites around the fishermen' village must be preserved for agricultural purposes in perpetuity. This decision, similar to the one proposed in the Town of Arcahaie and the corridor of Corail, entails the demarcation of non-negotiable urban growth boundary lines and brings unique sustainability and livability benefits to the region. Sprawl development is not an option.

15. New Regional Center: the entrance to the Village of Luly is the perfect location for a regional center. The intersection between the main national highway and the roads that lead to Luly on one side, and to the mountain villages on the other side, has the potential to serve a large swath of this densely populated and severely under-served area. As such, the proposal advocates the reconstitution of this area as a new regional settlement, with services that can address the needs of many. A new regional distribution center, equipped with packing and refrigeration facilities, will be complimented by an adjacent market plaza and commercial buildings. This area would be connected also to a new proposed loop road, where truck traffic can easily arrive at the regional distribution center without congesting the main national highway. Additional uses around the new public plaza, would include a small police sub-station, and closer to the main intersection leading to Luly, a new tower signals to visitors the entrance to the fishing village, and a multi-purpose vocational school and a clinic, ideally fitted with a maternity ward, can be located nearby on neighboring sites to serve local residents near and far. A small technical university is also proposed. Because this area becomes a new job center, additional housing is suggested on the either side of the main national highway. The main national highway can be lined with 'work-live' *Lakou* compounds. In each, their shop can front directly onto the road and in this manner amplify commercial activity along the main spine of the region and in turn, partake in its economic vitality.

The small Village of Luly could be seen as the perfect paradigm intervention for the political, economic, and social reconstitution of small informal areas in Haiti. Separating a village into small family cells is not new to the Haitian condition; in fact, this tradition is entrenched in the well-tested *Lakou* family compound system of Haiti. This new political system based on that traditional model can decentralize the decision-making processes and create communities of interest where differentiation and competition may generate emerging opportunities and unique market conditions for each particular location.

A Pledge for Bottom-Up Urbanism and Architecture

Each of the town plan proposals for the Arcahaie region are a synthesis of the critical difference between art and science. While art is about the creation of objects of meaning and desire, science is an attempt to identify generative processes. The projects here presented are embedded in both worlds: the world of making things (art) that are connected to and reflect a people, as well as in the realm of identification of those things of generic value (science).

Beside the ultimate pragmatic purpose of any proposal for buildings, cities, or public spaces in the Arcahaie region, a more generic goal was at the root of this investigation: *"the production of particulars containing universals"*. From a scholarly perspective, nothing with a self-contained value was worth our time. Making things with a universal goal and understanding the particulars of those universals is what motivated the solutions for our case-studies. If there is a problem in today's world, it is because both art and science are never seen as part of the same phenomenon. Art is taken for granted and never considered as a serious endeavor; science, on the other hand, has become a new metaphysical reality that explains our existence in ways hardly comprehensible for normal intellects. But, both art and science are not split nor do they need to be so.

In addition to the proposals for the Arcahaie region, the Town Team recognizes and attempts to address some of the most pressing issues in contemporary architecture and urbanism in Haiti. The team intended to make it explicit that the art and science of making objects of beauty also require a certain spiritual/esoteric approach to understanding what makes something meaningful and functional. In the process of finding those spiritual/esoteric qualities, a great degree of freedom is of the essence; freedom which, in the struggling environment of the poorest of the poor in Haiti, cannot be attained from the top-down, and may be absolutely dependent on the bottom-up empowered actions of individuals.

The formulation that Haitian citizens and groups of families should be taking control and designing their own environments may be a radical concept to contemporary scholars, and yet, totally obvious to those struggling for empowerment at the bottom of the economic chain. When pondering the notions of change, adaptation, and resiliency, one cannot help but to consider the fact that these biological phenomena are repeated over and over by the builders of traditional environments across history - with more care and constancy than in any of the standard and regulated industrial places we've produced over the course of the last century; their personal perception, geometric intelligence, and their congruence between beauty, truth and goodness is not acquired in an academic environment, but transferred from generation to generation as an ancient idea of wisdom and practicality. This is the ground where they should stand and this should be their precise bottom-up point of departure. Whether these proposals are built or not will be up to the people of the region. In their collective hands lies their future. This is a roadmap for change which they partnered in conceiving. Together with the Town-scale Planning team, there has been set a standard for inquiry and debate. The ballgame has changed. The community has been given a voice, their vision captured, drawn, and with this Vision Report, delivered in its final conceptual form so that it can serve as a roadmap. A new day for human freedom, liberation, and for the creation of places of meaning and humanism has arrived. Arcahaie's citizens and leaders are ready and willing to make that happen. And, with the same tenacity and self-determination with which their ancestors changed the course of the country's history before them, the people of this region will once again succeed at achieving their goals.

Union does make the force.

A New Civic Infrastructure

Steven Fett, Architect, Lecturer, CUCD Research Affiliate
University of Miami School of Architecture

Two critical aspects of prosperous modern civilizations are access to quality healthcare and education. This fundamental belief is what shaped the University of Miami design team's approach to planning in the region of Arcahaie. When tasked with proposing a new civic infrastructure for Haiti, the team focused its efforts on the design of a regional clinic and a vocational school. Both would be immediately used for their stated programs - a place to heal and a place to learn. Additionally, their presence could also serve as catalysts for the greater good of the region as symbols of community and hope.

The Corail Clinic

The clinic in Corail is intended to service the region of Arcahaie. The program of the clinic is anchored by three wards, a male, a female, and a pediatric. Each is able to accommodate approximately 30 patients at one time. An emergency room with some surgical capabilities is also proposed. This would be very useful as most medical emergencies require a trip to larger medical facilities in Port-au-Prince. Additional uses included in the clinic's design are a dentistry, consultation rooms, blood labs, an X-Ray (radiology) room, and a tuberculosis ward.

This program is very much influenced by the recently built clinic in LaColline, Haiti designed and built by Partners in Health (PIH) a non-profit organization dedicated to providing free health care for the poor. The PIH methodological approach to health care in Haiti is to locate smaller, cost-effective, well-built, well-maintained, and well-run facilities in decentralized regions of the country where access to high-quality care is scarce.

This approach has two primary positive consequences. First, it reduces the travel distance needed for many patients to receive adequate care by not requiring a trip to a major health care facility, typically a great distance away. Shorter trips typically result in more frequent trips, and thus becomes a more preventative approach to health care. The second advantage to decentralizing high quality care to service more rural areas is the effect it may have on the load of the higher trauma level facilities in the major cities. In other words, if injuries, ailments, and treatment for infectious diseases can be treated locally, the emergency rooms in regional hospitals can be used for more serious patient conditions.

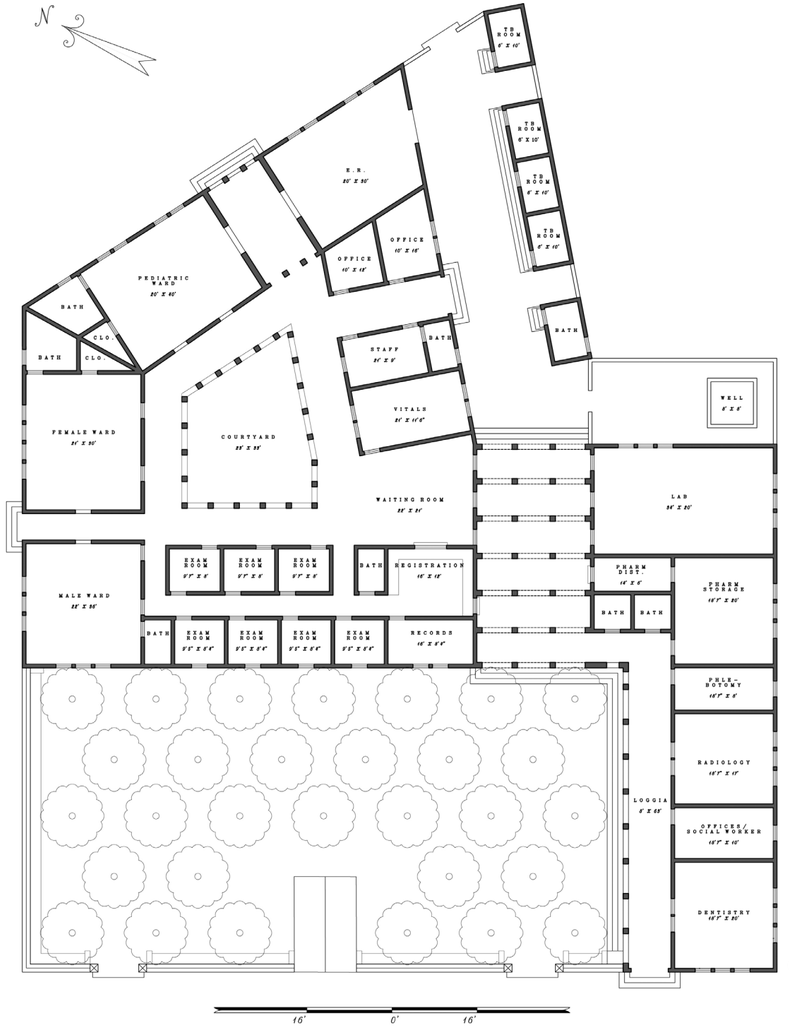
The building itself is designed around two primary garden spaces. The courtyard acts as a centering device by which patients, staff, and visitors circulate around. A courtyard in warmer climates, such as Haiti, helps break up the mass of the building, and allows the rooms adjacent to it to have windows on both sides, thus allowing for cross-ventilation. This is especially important in a facility that will be housing many sick patients with airborne viruses. At the center of the courtyard is a garden with a pond and landscaping. The presence of life at the center of the building is meaningful and potentially therapeutic for the patients and the families who accompany them. It also provides a welcome relief from the hot sun.

The courtyard is also the location of an underground cistern. Shed roofs direct rainwater into a gutter at the perimeter of the internal, open-aired space. This water can in turn be collected, stored, filtered, and reused.





View of Public Plaza fronting clinic, covered by a grove of trees and surrounded by a bench.



Clinic Floor Plan

The second garden space is located at the front of the building. This garden can be used by the visitors waiting, or by the general public. This public space is meant to act as a plaza, and is a civic offering to the town of Corail. A stone bench is built in to a low perimeter wall that formalizes the space. A grid of citrus trees fill the garden and have the dual purpose of providing shade and nourishment for the hospital's staff and patients, and the residents or Arcahaie.

Civic buildings can have significant social impacts in a town. They become centers of activity and gathering. Rather than isolating the clinic from the town, the proposed design embraces this reality and provides a dignified, elegant, relaxing space that will help foster a sense of civic pride. Haitians have a strong sense of individual pride, what often lacks is a collective investment in the idea of "Town." The Corail clinic can be a place where the sick are treated and the healthy support them by providing energy and vitality in the neighboring garden, inspiring them to recover quickly and join the fun.

Luly Youth-Build Academy

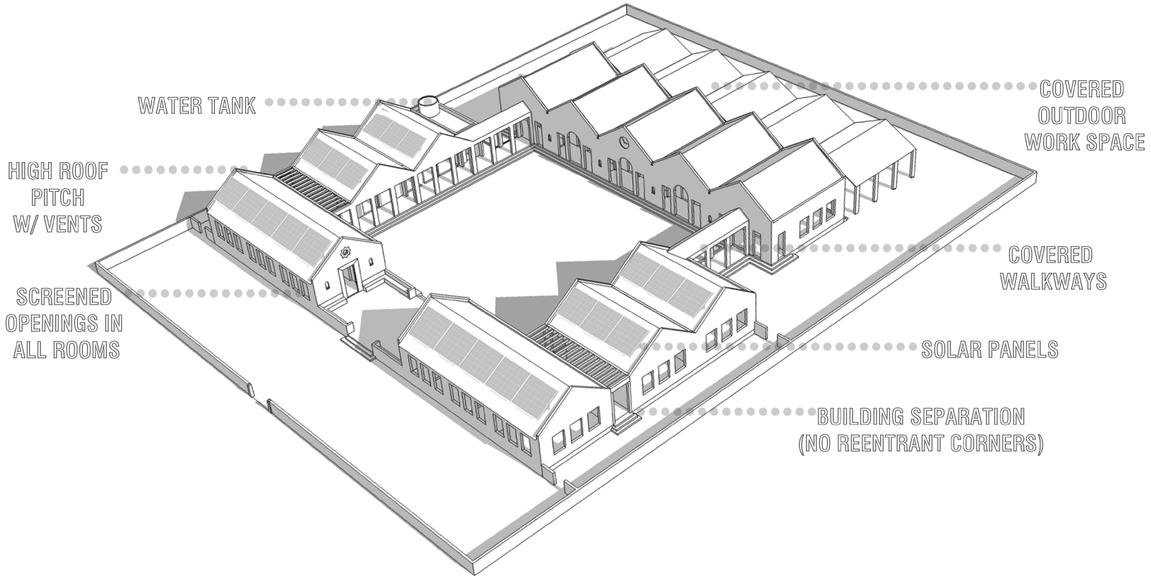
A vocational school in Luly would meet a dire need, vocalized in public meetings during the University of Miami's trips to Haiti. Bright kids, with a lifetime of possibilities ahead of them, told members of the team, one after the other, that after high school their options for continued education were extremely limited. Advanced education at the university level is only achievable if students are able to move to Port-au-Prince, or beyond, and for many, this is unrealistic. The logistics of travel and the responsibilities at home prevent countless capable students from advancing their education. Furthermore, those who can pursue higher education in Port-au-Prince often leave Arcahaie permanently in pursuit of better opportunities elsewhere. The limited access to vocational and university education starves the region of growth. Many have expressed a desire to stay in Arcahaie, but feel that if there were more opportunities for higher education, they would be better equipped to help the region prosper.

Youth Build, a non-profit organization that provides education, job skills and counseling to at risk youth has been an integral part of the planning and design process. Youth Build is an ideal partner who has previously built educational facilities in Haiti. Their experience and knowledge of vocational education, coupled with the skills of the University of Miami's design team and their collective understanding of the inherent value that properly designed civic buildings have on the community should produce a project that will have an immediate and lasting impact on Arcahaie. A Youth Build vocational school in the region would also establish a great deal of credibility and good will. Repeatedly planned projects that fail to materialize eventually spurn belief and local support. This comprehensive project will have more success, and will generate more support if something is built in the region fairly quickly that can serve as a model project. The vocational school is a great candidate to start effecting change in Arcahaie.

The program of the vocational school originates from an existing school that youth build opened in Haiti a few years ago. The design of the building, like the clinic, focuses on an open aired outdoor space. This courtyard has dimensions of approximately 85 feet by 85 feet. Surrounding the space are groupings of gable-ended structures containing one room each. The gable end is perhaps the most primitive and memorable architectural form. Ask anyone to draw their image of a school house and regardless of age, ethnicity, or education, most probably he/she will draw a square with a pointed roof and a door in the center. When designing civic buildings, the form of the building should provide an idea of its purpose. Here this ubiquitous form is repeated for each classroom - each with its own unique subject taught



View of proposed Vocational School near Luly and along National Highway.



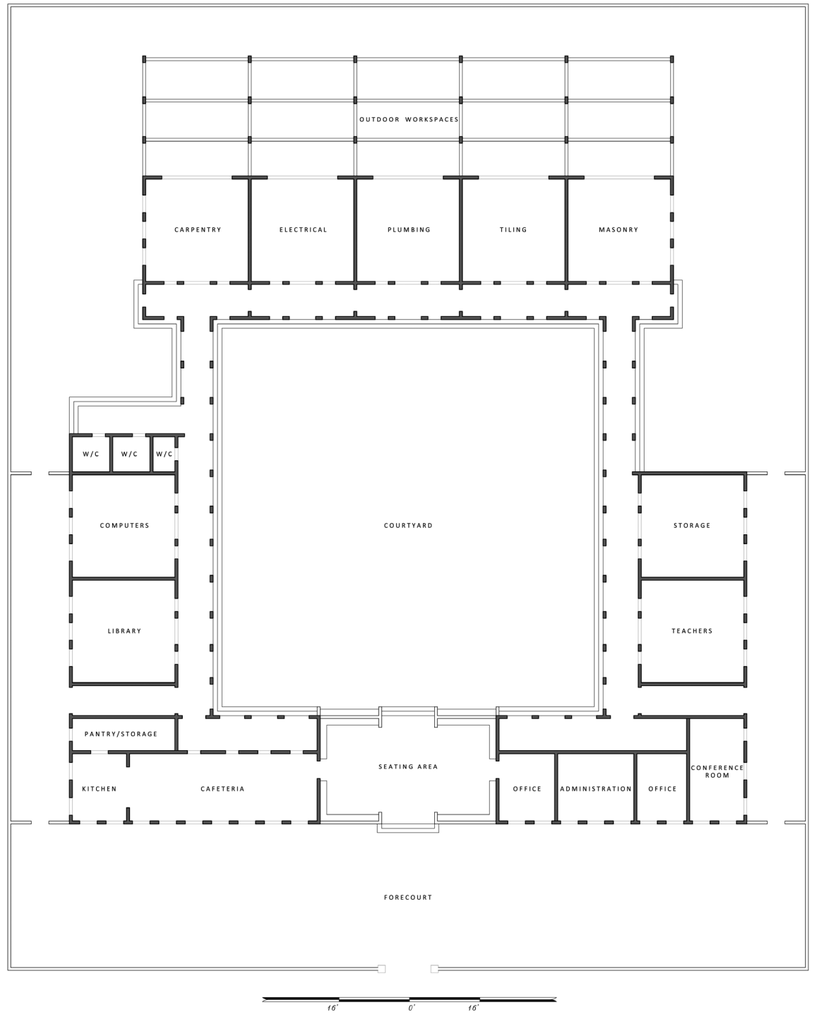


View of proposed Vocational School near Luly and along National Highway.

within. Connecting the classrooms and support spaces of the school is a colonnade. This circulation device also provides shade for the students and relief from the rain. The side-wings use a post and beam configuration, while a “Serlian” motif (a larger arched central opening flanked by two smaller openings with flat beams) is repeated on the rear classrooms. These rooms are designed to house classrooms with access to outdoor spaces beyond by means of large, operable doors. Collectively, the indoor classrooms and outdoor labs should provide ample space for multiple classes to occur simultaneously.

The school also has a relatively large kitchen and cafeteria. These spaces could be used as training rooms and could even include a small local restaurant. The kitchen staff could cook meals for the students and the community. This engagement with the town would help to define the school as a building built by and for the community and could teach students methods of healthy cooking and business management.

The design presented in the included graphics is admittedly idealistic. A site for the school has not yet been selected; however, members of Youth Build and the University of Miami have been back to Haiti since the workshop in search of a location and have returned with solid leads. When a site is eventually chosen, the design should be modified to respond to unique site conditions such as existing topography, landscaping, and site specific climatic data.



The Haitian Home, Yesterday, Today & Tomorrow

Derrick Smith, Architect, CUCD Research Affiliate,
University of Miami School of Architecture

As stated in the original grant proposal, inadequate shelter is a countrywide concern in Haiti as lay people, with little constructive knowledge and resources, build most of the housing stock in the country. This hinders the quality of life of the average family in the Arcahaie region as well. This study and ensuing Vision Report addresses this issue and provides resources to help local families improve the constructability of their homes, providing building templates and details that marry contemporary conveniences with structurally sound designs and culturally significant building traditions.

In close partnership with the citizens of the region, enlisted through the workshops and capacity building process, including SWAT analysis, discussion sessions and public meetings, as well as research on the part of the team, a better understand of local traditions, needs and aspirations was secured. There were several site documentation visits across the region and local participants wrote, drew, and described how buildings were currently used as well as defined a vision of how dwellings can meet evolving needs and expectations.

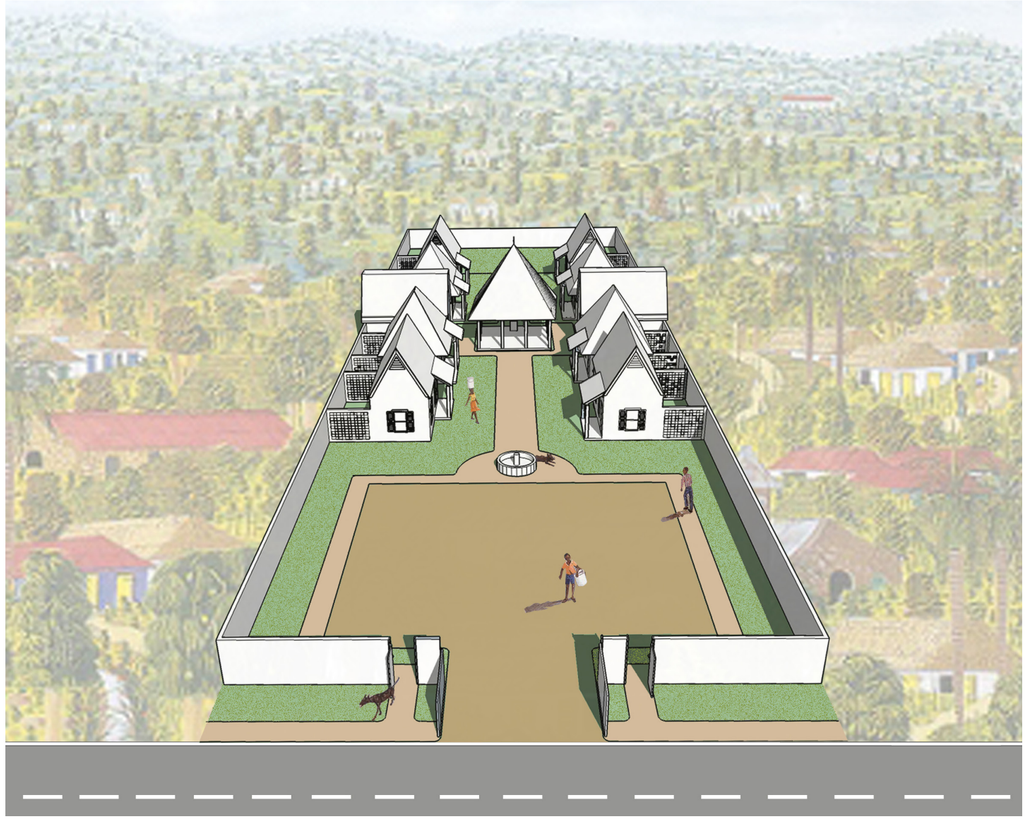
The proposals herein produced are a true reflection of that straightforward collaborative process.

The multiple designs are intended to meet the needs of diverse sites (from urban to rural), programming variables, family economies, while addressing current physical constraints imposed by the natural environment and infrastructure realities, social customs, and lastly, addressing constructability issues, in light of the battery of natural disasters that can potentially impact the region at any given time. And, whereas the proposals underline the importance of the traditional Lakou model, in and of itself a microcosm of community and a reflection of the strong bonds within Haiti's family networks, they also illustrate the flexibility of that composition of buildings to accommodate different combination of uses, as well as different architectural expressions - from vernacular to contemporary. That said, given the desire to increase tourism in the commune, and the undeniable attraction that Vernacular and Gingerbread/Victorian architecture have for visitors, - both national and foreign - local residents and governments may want to consider how they can incrementally promote and reinforce the dignified DNA of the region's historic architectural expressions. The region's unique picturesque and romantic appearance can be incrementally reinforced and by growing that distinctive image also grow tourism opportunities and numbers.

Phases of the Design Process: Researching and Documenting Yesterday, Understanding Today and Envisioning Tommorrow

Historic Documentation, Yesterday

The first phase of work was to document and study traditional building types of the Caribbean region in general, and more specifically those found in Haiti and in this region. By doing this, knowledge was gained regarding what building types are most appropriate, practical, and sustainable in the region's hot and humid tropical climate, and which, reduce dependency on costly mechanical systems too. This research also led to an understanding of prevailing building customs, techniques, styles and the availability of local building materials. This research and documentation process established a basis for projecting an architectural/building imagery that reflects the history of the region, which to date has defined Arcahaie's unique sense of place and identity.



View of Typical Lakou

Embracing Important Lessons from the Past
Many sustainable design strategies already exist in the logical design of traditional Haitian buildings. These include: orienting structures and rooms to take advantage of prevailing local air flows and maximizing daylight; strategically placing open/shaded porches on southern and eastern facing sides of a building, to shield structures from direct heat gain, while extending livable areas; increasing interior room heights, with at times clearstory openings, to allow for internal room heat to rise and escape efficiently; aligning operable, vertically oriented windows to promote cross-ventilation that naturally cool spaces; lifting buildings off the ground to reduce the impacts of flood waters on interior spaces; using local materials to reduce construction costs, and, locating fresh water well heads uphill from waste-water systems, and at a maximum distance from each other, to avoid contamination that results in health problems. As the region's residents look to build new structures or repair existing ones in the future, these traditional and sustainable design strategies should continue to underpin their constructive choices, irrespective of the architectural style that drape over it.

The issue of looking at and using elements from traditional building types as a basis for new construction was researched, documented via multiple site visits, and discussed with the local residents.

Linking to traditional building types helps to reinforce a community's cultural identity, which in turn can lead to an increase in tourism, and participating citizenry agreed that embracing traditions was positive for other reasons as well, including an observed capacity for historical structures in the region to better survive catastrophic weather events.

Residents also asserted that while these valuable lessons and buildings from the past should continue to be embraced and preserved, buildings need to address contemporary needs and modern conveniences as well.

Building Traditions, Identity, and Economic Development Opportunities
Arcahaie has a strong tradition of daub and wattle and wood vernacular buildings, both typically found across the Caribbean. In this region, they are found commonly in rural as well as urban areas, including the town of Arcahaie and the village of Corail. Gingerbread/Victorian architecture, found prevalently in the town of Arcahaie, is also sprinkled across the region. Art Deco style concrete buildings, built in the 20th century are also pervasive, with significant civic structures incorporating this language, as evidenced in the town of Arcahaie's city hall, library, post office and the church fronting the main town square. This style of architecture is also seen in houses and many family mausoleums in the main cemetery.

The assemblage of these architectural building traditions have resulted in a distinctive identity for the region which can be either increased or diluted, depending on the quality and character of new and rehabilitated buildings.

For example, if a grouping of buildings were 'sympathetically' restored in the town of Arcahaie, perhaps commencing along one street or a few adjacent blocks, and some of those structures included uses such as shops, restaurants, and bed & breakfast inns those interventions would result in a vibrant 'historic district'. In turn, that district could be marketed as a destination and attract more tourists and revenue to the region, which over time could spread to other parts of the town and together they would complement the commercial activities already existing around the port. Similar concepts could be followed in other villages and hamlets, such as Corail and Luly with like benefits.

Cultural Values, Modern needs, and Place-making Strategies
As for building types, the traditional Haitian 'Lakou' is pervasive in the region and it is a handsome demonstration of savvy sustainable design principles.

The Lakou site design model is simply the orchestrated grouping of buildings, which house an extended family on one plot of land. The placement of buildings within the plot adapt to family size, overall land dimensions and location, the plot's relationship to a street, as well as to its urban or rural context. Each building is typically narrow; one or two rooms deep and between one and three bays wide, thus efficiently permitting for natural lighting and ventilation.

In a rural setting, structures are placed loosely around open shared courtyards, with vegetation, hedges and mature tall trees interspersed and surrounded by planted agricultural fields. Within a more densely populated areas, such as a town, village or hamlet, lots may be smaller, thus the Lakou can become a fully walled compound, defining the family property for the purposes of security and privacy, while potentially accommodating a commercial use, fronting the street.

Typically in rural settings, there is one larger structure that represents the main or original house, with multiple smaller buildings that act primarily as sleeping quarters for the extended family. Cooking usually takes place in the open courtyard. A barn building for animals and equipment as well as a smaller free-standing outdoor toilet or latrine (which is positioned on the lowest point of the plot and when the slope of the land permits, to the rear of the property far from the street) are common place. For health safety reasons, drinking water wells are placed at a far distance from the latrine, and again depending on the slope of the terrain, are usually found in street facing courts.

Creating a Space for Micro-businesses within a Plot
An additional structure housing a small shop or office facing the public streets where pedestrian or vehicular traffic occur are currently less common on plots, but this complimentary use could very easily be introduced to existing Lakou's to increase commercial activity.

These street-fronting shops or offices can generate a micro-business economy that can benefit local families as well as activate the public realm/street with pedestrian activity.

A Sustainable Model of Cultural Significance
Lakou's represent an efficient use of the land, as they house multiple families on a plot, and because they yield higher densities that means that more land is left available for agricultural purposes.

During public workshop sessions, residents were asked if the Lakou tradition was valued, viable and desirable in the future. There was strong consensus that this was in fact an important part of their cultural identity, which they value and will continue.

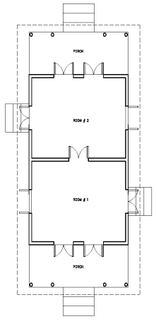
A Traditional Strategy with Innovative Applications and Potentialities
Today, the term Lakou does not have to be limited to the extended family as its layout can also be used to describe the idea of a compound with a garden wall that defines the residential property, whether it has only one single family house, multiple family houses or even a new combination of uses, including residential, commercial, hospitality, and/or income producing rental units.

The Lakou compound in general can additionally be used in a town setting for schools, businesses, government offices, even a night club. It is very versatile.

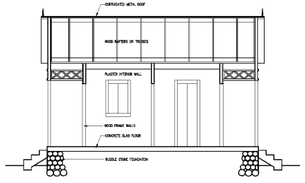








FLOORPLAN



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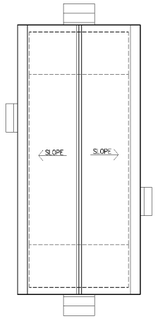
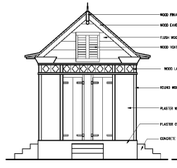
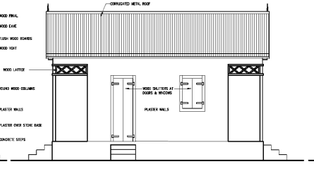


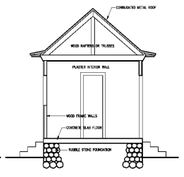
ROOFPLAN



FRONT ELEVATION



SIDE ELEVATION



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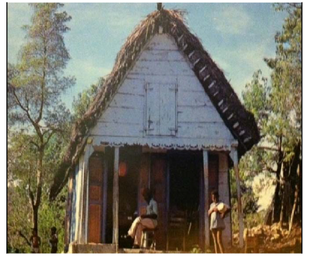
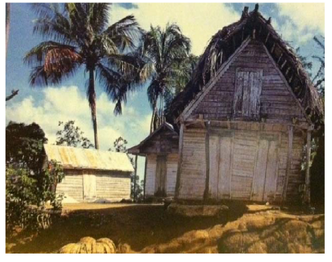
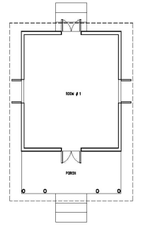
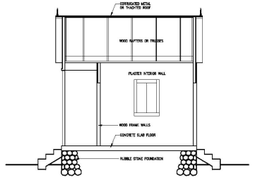








FLOORPLAN



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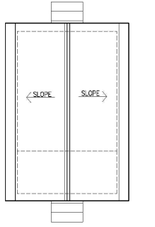
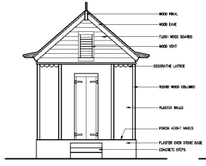


ROOFPLAN



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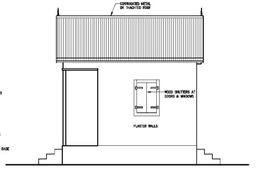

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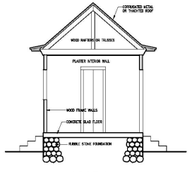

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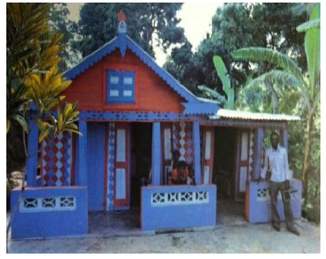
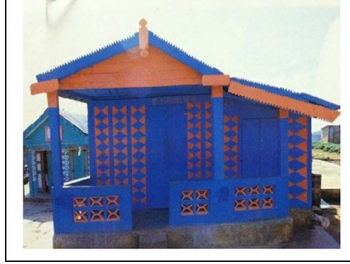
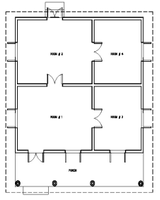
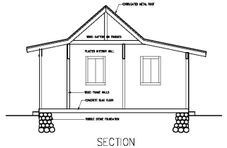








FLOORPLAN



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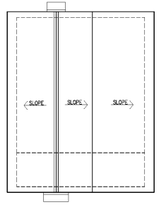

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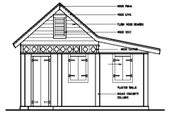

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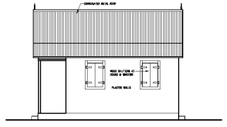

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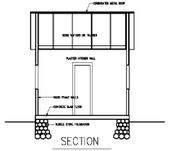

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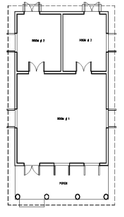
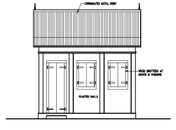


FLOORPLAN



SIDE ELEVATION



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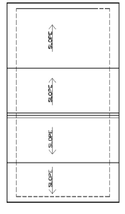
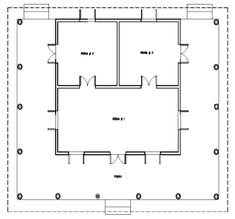


ROOFPLAN

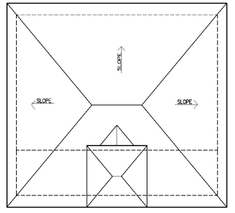
A.2 HAITI, ARAYIT







FLOORPLAN



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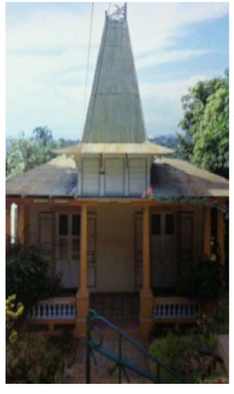

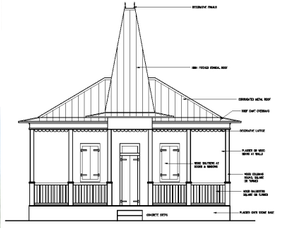

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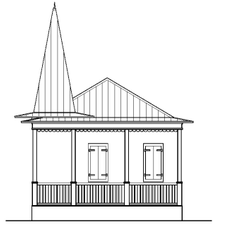

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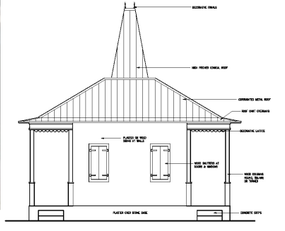

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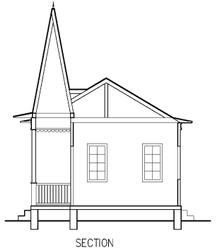
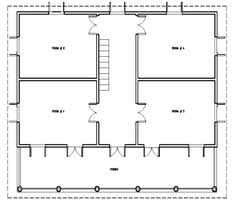


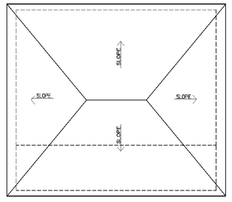
SECTION

A.3 HAITI, ARAYIT



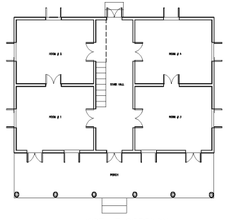


2ND FLOORPLAN



ROOFPLAN





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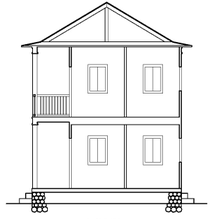
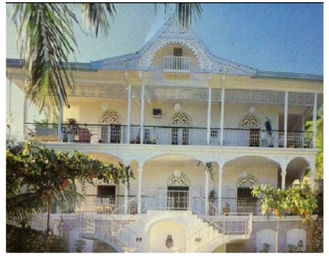


SECTION





FRONT ELEVATION



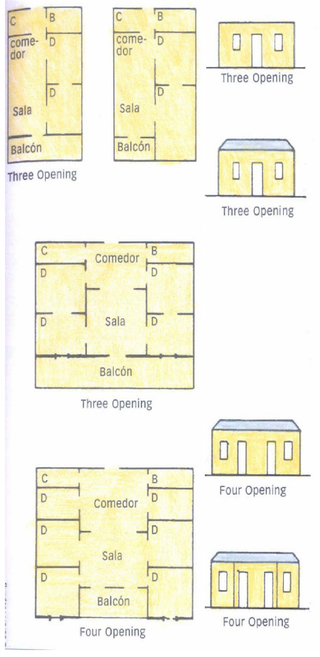
SIDE ELEVATION

A.4 HAITI, AKAYE















A.5 HAITI, AKAYE



The Relationship between the Public and Private Realms
The Lakou's front perimeter garden wall and street facing or fronting porches become the predominant features of the compound, which can positively contribute towards public life in adjacent streets. If attractively designed, with a degree of visual permeability that allows not only for greater cross-ventilation, but also visual contact between residents and passers-by - be they children playing, potential clients, friends or neighbors – the garden wall becomes an important element of any town, village or hamlet. This dialogue between the Lakou and the public spaces of the community they are located in is important so that residents are not segregated from each other nor from public life.

While serving their function of providing security and privacy for the resident, street fronting garden walls should be appropriately proportioned in height as well, according to the width of the public right-of –way they front upon. In this manner, the street does not become overwhelmed by tall, looming blank walls, that would otherwise result in uninviting streets and/or public spaces.

What is vital is that the syncopation of porches, commercial uses, and garden walls fronting streets promote pedestrian circulation and thus expand public life, while reinforcing a sense of community. Solid, tall, endless walls would by contrast have the opposite effect and could in fact contribute towards barren streets and public spaces, potentially eroding public life as well as public safety.

Building a House, Today
This section of the Vision Report presents information intended to help the people of Arcahaie to build a house for themselves. The drawings indicate the components and the technical requirements to construct well, and result in safe, comfortable, attractive structures that can meet contemporary personal needs and aspirations, while adding to the overall identity of the whole settlement.

These recommendations and designs are the product of the input received at the public workshops, research, and professional expertise. Workshop participants provided the design team with a list of positive and negative issues related to building a house in the region today, their living needs, and some of the infrastructure problems to overcome.

As part of this Easy-Build Section, a step by step outline of the complete house building process from start (pre-construction) to finish is outlined, in an effort to provide useful information and strategies in response to needs -and concerns.

Vocational Education Opportunities:
Local Building Traditions & Crafts
Across the entire region, there are very good examples of the work by local artisans and their craftsmanship and this should be celebrated as well as promoted as a growing job sector, in particular in light of national and regional objectives to attract tourism to the region, which in turn would require an increased, trained workforce to build new or to restore existing buildings and destinations.

Increased vocational educational opportunities can focus on building and artisan trades, resulting in a broader offering of skilled building workers, trades and craftspeople. That would increment employment opportunities. In turn, the fruits of the trained workforce's labor would expand and enhance the overall image of the Arcahaie region, rendering it with a distinctive character that adds to the uniqueness of the place.

Examples of current arts, crafts and building trades include:
a. stone masons that produce very beautiful rubble stone walls (but they must be more properly reinforced);

b. local metal craftsman build striking entry gates and decorative grills;
c. artists produce vibrant decorative broken tile or painted wall murals, and other artisans create decorative open concrete panels or blocks that are a practical and handsome addition to many garden wall.
d. The technique of weaved fiber panels is very characteristic of many areas in the region and is prevalently seen as garden walls and porch enclosures. This handsome craft can potentially grow into additional applications, including doors, windows, canopies, room dividers, ceiling finishes, gates, and furniture, especially if accompanied by or translated into other materials. The introduction of bamboo farms in the region, which yield quick-growing wood harvests in less than three years, could permit this industry to expand and find many new and sustainably-minded as well as desirable products and markets.

The Haitian Home, Tomorrow

Initiative meetings included a very broad segment of the local Haitian community, and the large number of women and of young people taking part spoke to their desire to have a voice in shaping the vision for the future of their community.

These participants indicated that there was a need for reliable floor plans that could guide them in their efforts to build their own home.

To ensure that their needs, would be met, and understood, they were asked to actually draw or list what were the rooms they felt they would like to have in a modern home. This inclusive process, over the course of various meetings, yielded 75 lists with rooms either described or illustrated in simple diagrams/plans, many of which placed the house within the enclosed Lakou /compound walls, with gardens surrounding the house. Various sessions were sustained regarding ideal plans, compositions, and, building elements as well as on how the traditional house in the region had slight variations, in response to topography, context, micro-climate, and/or community identity.

As consensus was built, it became clear that there were several building elements that are needed at a minimum, including, a front porch, at least 2 rooms - one of which is dedicated to sleeping- with an outside kitchen within or by the Lakou's courtyard and finally, an exterior toilet. Another request was that the initial components of the house lend themselves easily to future expansions, as the family grows and/or as personal finances expand.

The majority of the plans for a single-family or main house, which were also drawn or described by the residents included a front porch, living room, dining room, 3 bedrooms, an indoor kitchen and bathroom. The question of the location of the kitchen was a topic for discussion because some residents prefer its location outside, in or by the courtyard, as is typical in the traditional Lakou, because it can potentially serve a current or future extended family within the compound. Other participants indicated a desire to have the kitchen inside, as a modern amenity. Other requests included the incorporation of garages, high ceilings, and a sense of open space, the latter two in direct relationship to making spaces naturally cooler or to accommodating large family gatherings.

Based on the plan diagrams generated and discussions sustained, a number of sample floor plans are provided herein. They directly respond to the prevailing requests voiced. The floor plans also include several alternative front elevation drawings to afford residents a choice of decorative architectural styles as may suit them, and as may also help to reinforce the identity of their particular neighborhood or town.

Finally, the *Easy-Build* plans were also informed by general conversations with residents on the following topics:
1. There is a collective goal to preserve agricultural land and limit how much and where buildings and houses are placed in order to avoid sprawl and the degradation of natural resources, thus compact housing types that require less land are desirable. The Lakou model becomes the most efficient way to reach this goal.
2. In general, buildings that are well detailed and mindful of earthquake design strategies, can have multiple stories, yet local residents strongly indicated that they should not be more than 3 stories tall.
3. In more urban areas, the side yard house can work on narrow lots of land and can provide a single dwelling, two or three stacked dwellings, or a combination of one ground floor shop with one or two dwellings above.
4. To accommodate new residents in the region the Lakou model can be utilized to create a grouping of small dwellings for renters who cannot build their own house. Long narrow lots, that are bookended by parallel streets, can also include a main house on one end, and the grouping of renter dwellings around a communal Lakou at the other end.
5. The Lakou model can also be used in agricultural areas, in the same manner as it has been employed to date, or it can additionally incorporate a small bed & breakfast building or unit, to expand the family's revenue generating activities and provide authentic Eco or Agro-tourism offerings in the region.
6. The issue of flooding and sea level rise due to climate change logically suggests that buildings, in particular dwellings should be raised off the ground and placed on perforated foundation walls whenever they are located within the delta flood plain and/or are on coastal sites. Flash floods are very common natural disasters in this region and one of the primary causes linked the loss of human life, livestock, and material goods in the region. The simple choice to lift habitable spaces/buildings above the 100 year flood plain criteria can save many lives and much money. Local governments should adopt tools or mechanisms to incentivize local residents to build in this safer manner.
7. The use of alternative and sustainable building materials, such as bamboo, in combination with light gauge metal, are an alternative to traditional wood framing, because the raw materials can potentially be more readily and affordably available. Due to its inherent strength, bamboo is desirable for building as well as furniture construction. Bamboo farming could become a new industry in the region, resulting in job creation and spin-off industries as well.
8. Sustainable building design systems should be encouraged and can include:
    a. gutters and downspouts with above ground water barrels for rainwater collection;
    b. in ground cisterns with sand filters for water reclamation;
    c. rooftop water tanks for water storage and pressure;
    d. as the terrain permits, small efficient septic tank systems for waste collection;
    e. solar kitchens to reduce reliance on charcoal;
    f. gravity fed solar collectors for hot water;
    g. and, when budgets permit, photovoltaics and wind turbines for electricity production.
9. The possibility for the house to be built over time, in stages as well as the use of locally harvested materials are both economically and environmentally sound practices.
10. To reduce a family's household expenses related to energy consumption, the following passive design elements can reduce solar heat gain and increase comfort:
    a. Wide porches, in particular on the eastern and southern sides of a building;
    b. tall floor to ceiling heights in rooms, to permit warm air to naturally travel up, preferably towards clearstory (high) windows;
    c. operable, vertical window openings, aligned across rooms to promote cross-ventilation and natural daylighting- preferably with clearstory windows above

to allow hot air to escape;
d. elevating buildings above the ground and placing them on perforated foundation walls, so that breezes can naturally cool the underside of the building;
e. louvers on window, doors or around a porch can permit cross-ventilation and natural daylighting while providing a degree of privacy and security, and if they are operable, built sturdily and can be securely shut, they can also be very helpful in protecting a structure during a hurricane event. To achieve this last goal, when closed they must rest within the frame of the opening and not lay on the face of the wall;
f. the strategic placement of trees on the western and southern facing sides of a building can help to cool the micro-climate around the structure and thus create a more comfortable temperature in the area;

11. houses can have decorative gardens and as well as vegetable gardens, which on smaller parcels can be in compact raised beds and in more urbanized areas, a plot of land can be set aside for a shared community garden;
12. yards can provide a place to hang laundry out of public sight, and,
13. small buildings/barns for small domestic animals can be provided.

Decentralizing Oversight

One issue often mentioned at public workshops regarded public oversight and guidance. Local and national leaders can address this need by decentralizing services, broadening or creating local building departments that can more readily provide locals with direction, and can expedite plan approval, permitting, quality inspections, and enforcement. This is currently handled primarily from Port au Prince and translates into long delays or no inspections and the latter means that unsafe structures can be placing in peril the lives of innocent bystanders, and neighbors, as well as its user.

Resources for Building Safer Structures

In addition to the recommendations found within this Vision Report, the United Nations and NGO's have created user friendly information booklets that provide good descriptions regarding the principals and the constructive details for earthquake and hurricane resilient houses.

The information can be readily found on the internet and downloaded without a fee.

Resources

Rebuilding 101 Manual, Rebuilding Strategies for Haiti March 2010, (http://openarchitecturenetwork.org/node/6719/oanattachments)
Earthquake Resistant Housing (http://humanitarianlibrary.org/resource/earthquake-resistant-housing-0)

These resources are most useful if the layperson can access them. A local building authority or a public library can provide much needed access to such information.

Construction Methods & Cost Estimating

A list of typically available construction materials and their current costs in the region follow. This information is in great measure thanks to the collaboration and knowledge of an active local participant who is familiar with the construction industry in the region.

Concrete block is a common method of construction today. Thus this report addresses the correct ways to construct concrete buildings with a focus on construction techniques and methods that currently weaken many existing structures and make their residents very vulnerable to earthquakes and hurricanes. There are several major safety concerns resulting from: inappropriately poured concrete foundations; rubble stone foundations which lack proper steel reinforcing; inappropriate placement, size and number of steel reinforcing bars, and their inadequate cement encasing; the presence of air pockets in poured concrete which greatly weaken its strength; and lastly, since it is less expensive to make concrete blocks on site vs purchasing precast blocks, the quality of that home-made building material.

In Earthquake Zones, Simple Forms are Best

Other general principals of safe construction are simple rectangular plan form as they perform best in an earthquake. Additionally, correct foundation and plinth size are important to ensure a building's stability, and short width vertical openings (aligned vertically in multistory walls) are going to also lend to a build's overall capacity to survive an earthquake with less damage. Of great importance is that a building has a well poured-concrete frame with appropriate steel reinforcing. The inclusion of interior 'shear walls' in a building is paramount as they will help stabilize the overall structure when it is shaking, and therefore help it to remain standing. Simply put, in a rectangular building, an interior shear wall(s) is (are) placed perpendicular to the exterior's long walls.

Completing the *Easy-Build* Plans

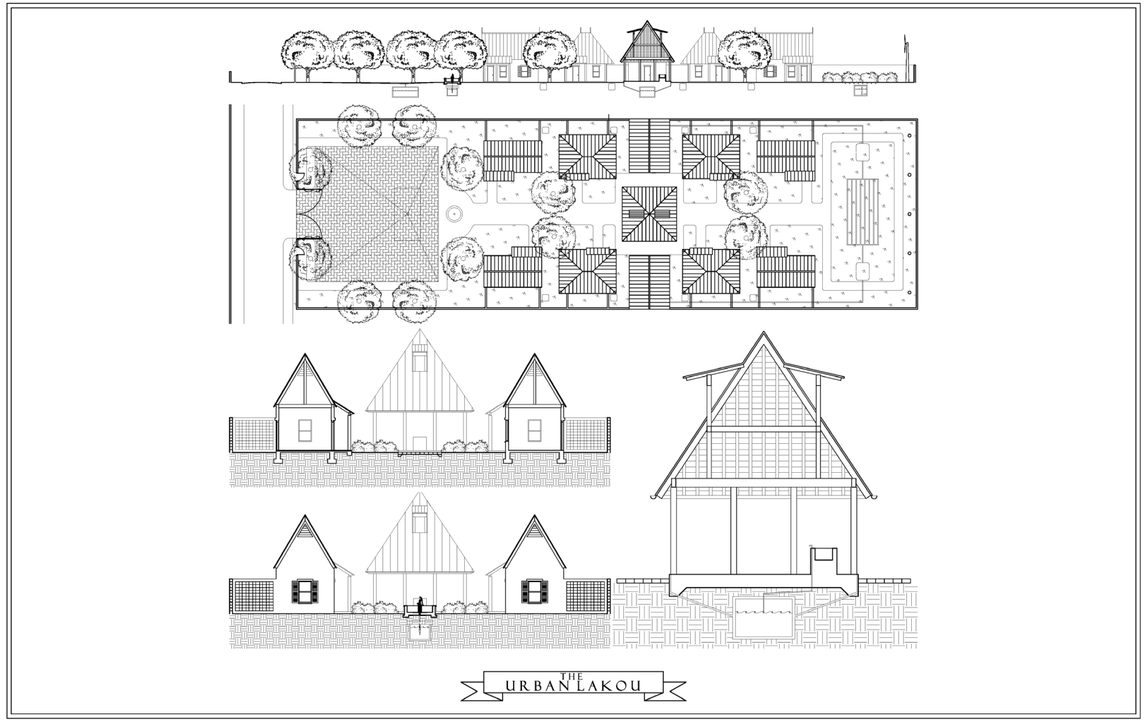
As a note to the users of the *Easy-Build* plan sets section, it should be clear that in addition to these design sets, a full set of construction drawings, produced by a local architect or builder, that include structural, electrical, plumbing and mechanical drawings, for these designs would best serve the goals of building safety. The *Easy-Build* plans need to be adjusted by a local architect or engineer to accommodate the specificities of a real site's topography, landscape features, plot dimensions, and its relationship to streets or existing buildings.

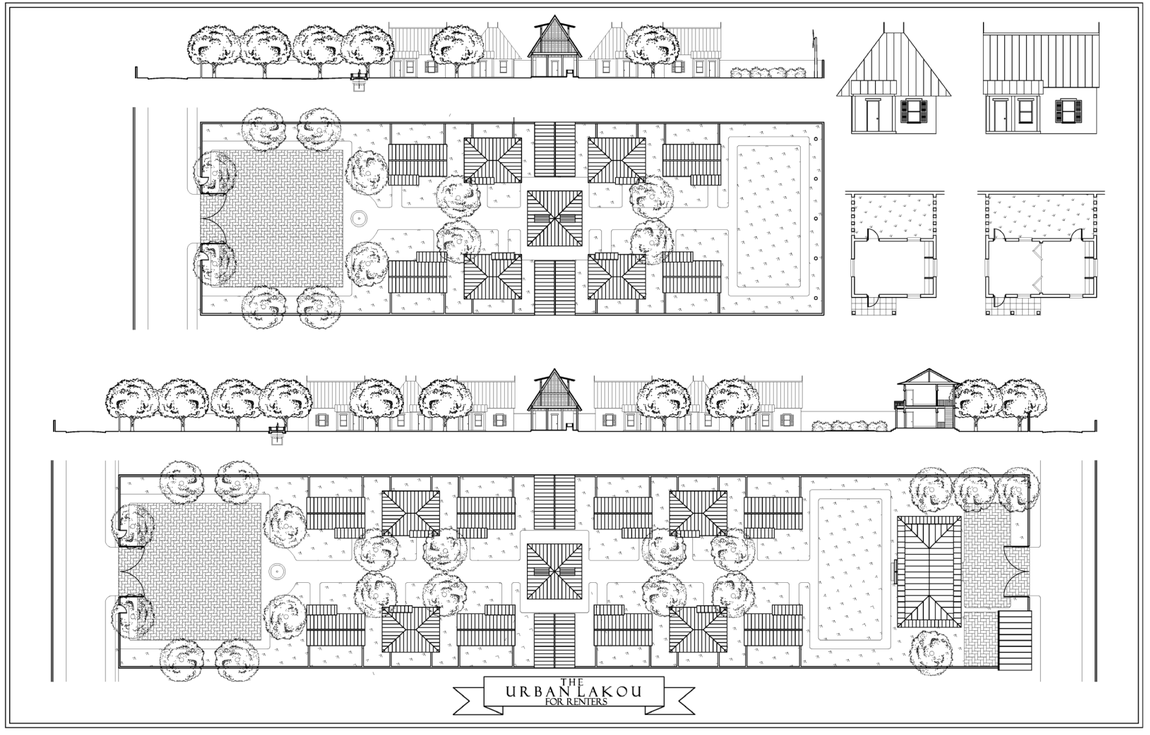
The Arcahaie Region *Easy-Build* Plans

This *Easy-Build* plan section should be seen as a reflection of the desires of the people of the Arcahaie region who closely collaborated in the conceptual designs. These plans recognize the ultimate goal of any family to have a house that is safe, secure, handsome, and well-constructed. The plans found in this section offer Arcahaie's families with designs that are centered around comfortable indoor rooms and outdoor spaces, while reflecting their aspirations for modern conveniences.

The variety of proposed site plans and dwelling sizes also speak to the array of needs in urban and rural sites, and several designs take into account a family's present needs/possibilities, while considering the dwelling's logical future expansion as the family grows.

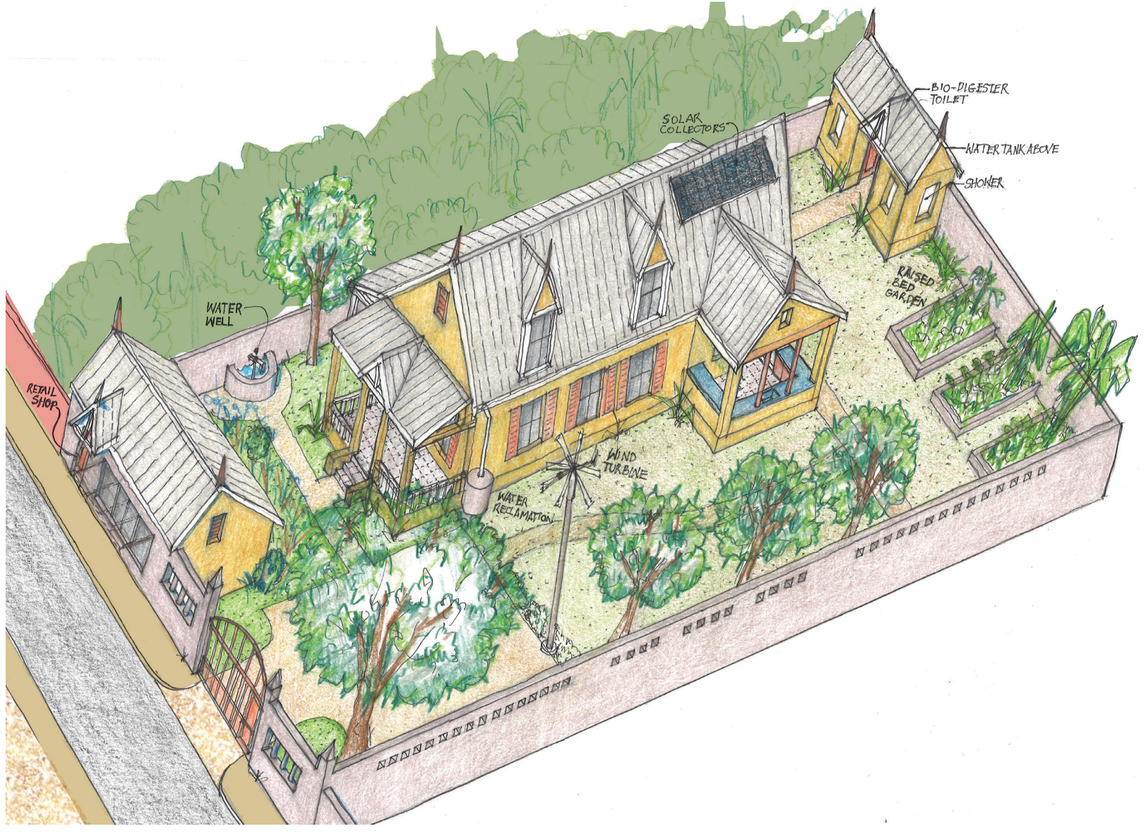
In turn, and irrespective of whether families use these *Easy-Build* Plans, Arcahaie's residents expressed that they are well aware that each home that is built by a family is in fact one segment of the region's overall identity and image. For this reason, residents recognize that personal choices in the design of their building can contribute to the overall architectural character that makes the area a unique place, and which additionally can attract visitors as well.


THE
URBAN LAKOU


THE
URBAN LAKOU
FOR RENTERS

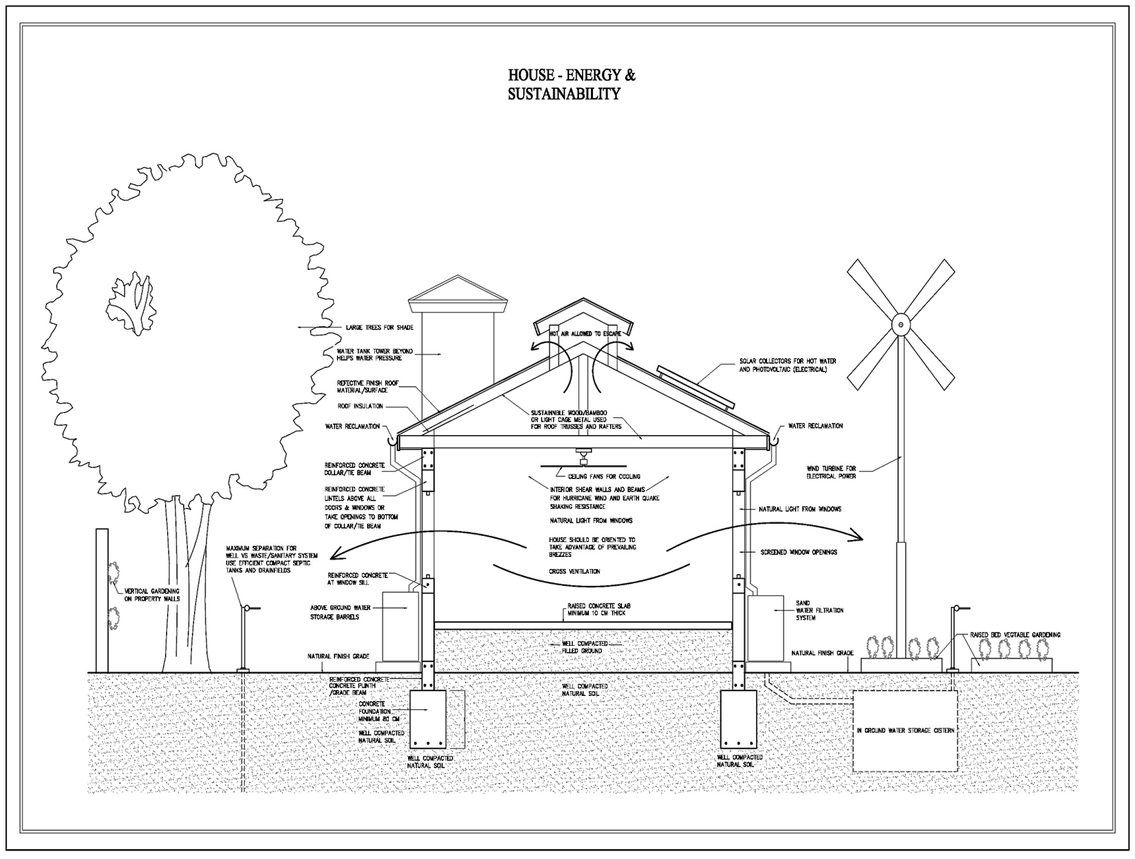


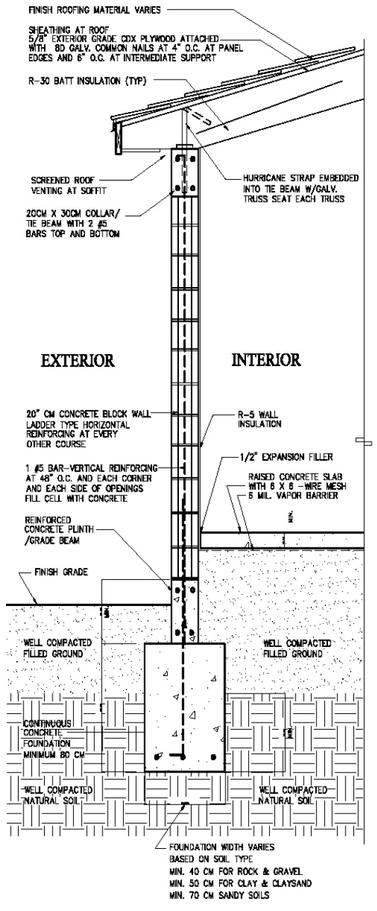
Lakou Kitchen



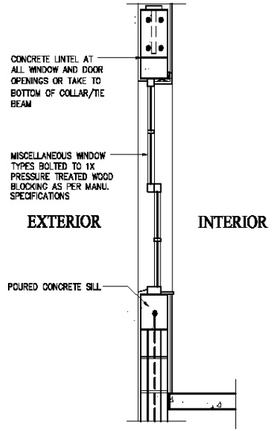
Single Family Lakou


LAKOU STREET/FRONT WALLS
RUE
RUE VIEW

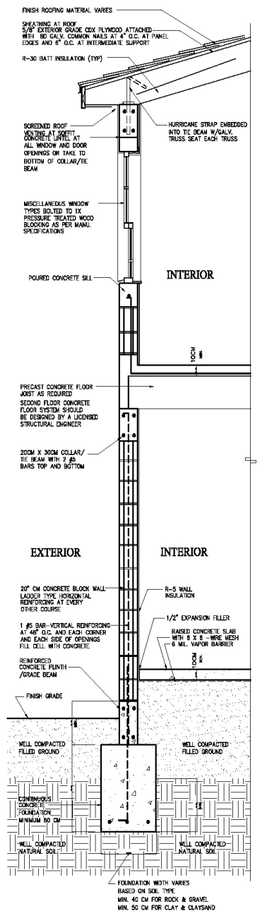

HOUSE - ENERGY &
SUSTAINABILITY
LARGE TREES FOR SHADE
WATER TANK TOWER BEYOND HELPS WATER PRESSURE
REFLECTIVE FINISH ROOF MATERIAL/SURFACE
ROOF INSULATION
WATER RECLAMATION
REINFORCED CONCRETE COLLAR/TIE BEAM
REINFORCED CONCRETE LINTELS ABOVE ALL DOORS & WINDOWS OR TAKE OPENINGS TO BOTTOM OF COLLAR/TIE BEAM
MAXIMUM SEPARATION FOR WELL VS WASTE/SANITARY SYSTEM USE EFFICIENT COMPACT SEPTIC TANKS AND ENVIRFIELDS
VERTICAL GARDENING ON PROPERTY WALLS
REINFORCED CONCRETE AT WINDOW SILL
ABOVE GROUND WATER STORAGE BARRELS
NATURAL FINISH GRADE
REINFORCED CONCRETE CONCRETE PLINTH /GRADE BEAM
CONCRETE FOUNDATION MINIMUM 85 CM
WELL COMPACTED NATURAL SOIL
HOT AIR ALLOWED TO ESCAPE
SUSTAINABLE WOOD/BAMBOO OR LIGHT CASE METAL USED FOR ROOF TRUSSES AND RAFTERS
CEILING FANS FOR COOLING
INTERIOR SHEAR WALLS AND BEAMS FOR HURRICANE WIND AND EARTH QUAKE SHAKING RESISTANCE
NATURAL LIGHT FROM WINDOWS
HOUSE SHOULD BE ORIENTED TO TAKE ADVANTAGE OF PREVAILING BREEZES
CROSS VENTILATION
RAISED CONCRETE SLAB MINIMUM 10 CM THICK
WELL COMPACTED FILLED GROUND
WELL COMPACTED NATURAL SOIL
SOLAR COLLECTORS FOR HOT WATER AND PHOTOVOLTAIC (ELECTRICAL)
WATER RECLAMATION
WIND TURBINE FOR ELECTRICAL POWER
NATURAL LIGHT FROM WINDOWS
SCREENED WINDOW OPENINGS
SAND WATER FILTRATION SYSTEM
NATURAL FINISH GRADE
RAISED BED VEGTABLE GARDENING
IN GROUND WATER STORAGE CISTERN



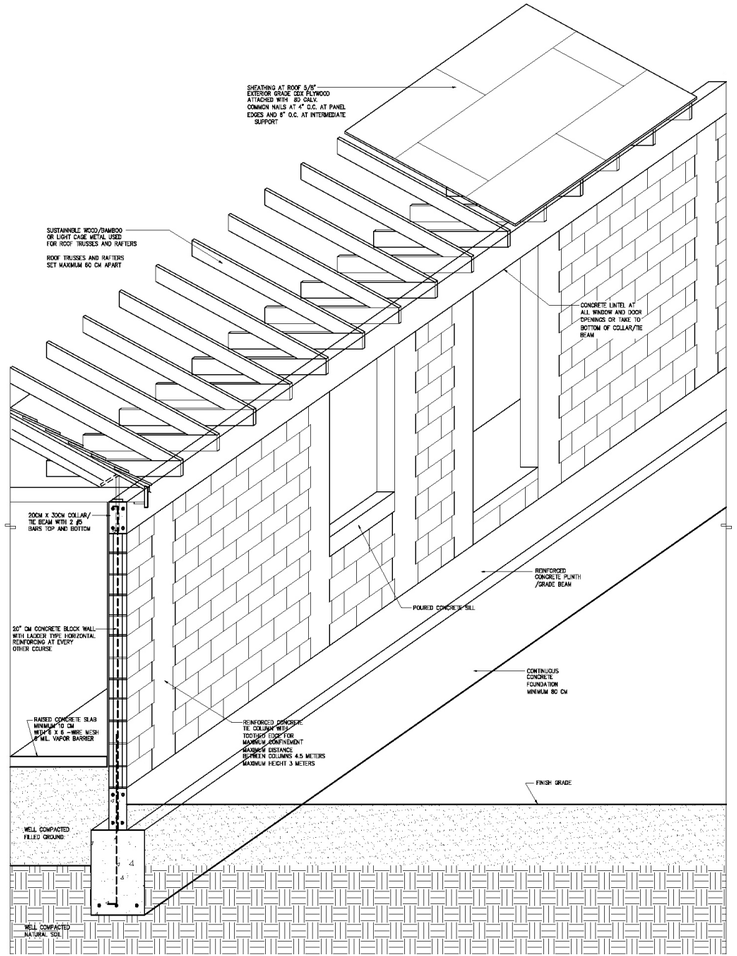
1 STORY REINFORCED MASONRY WALL SECTION



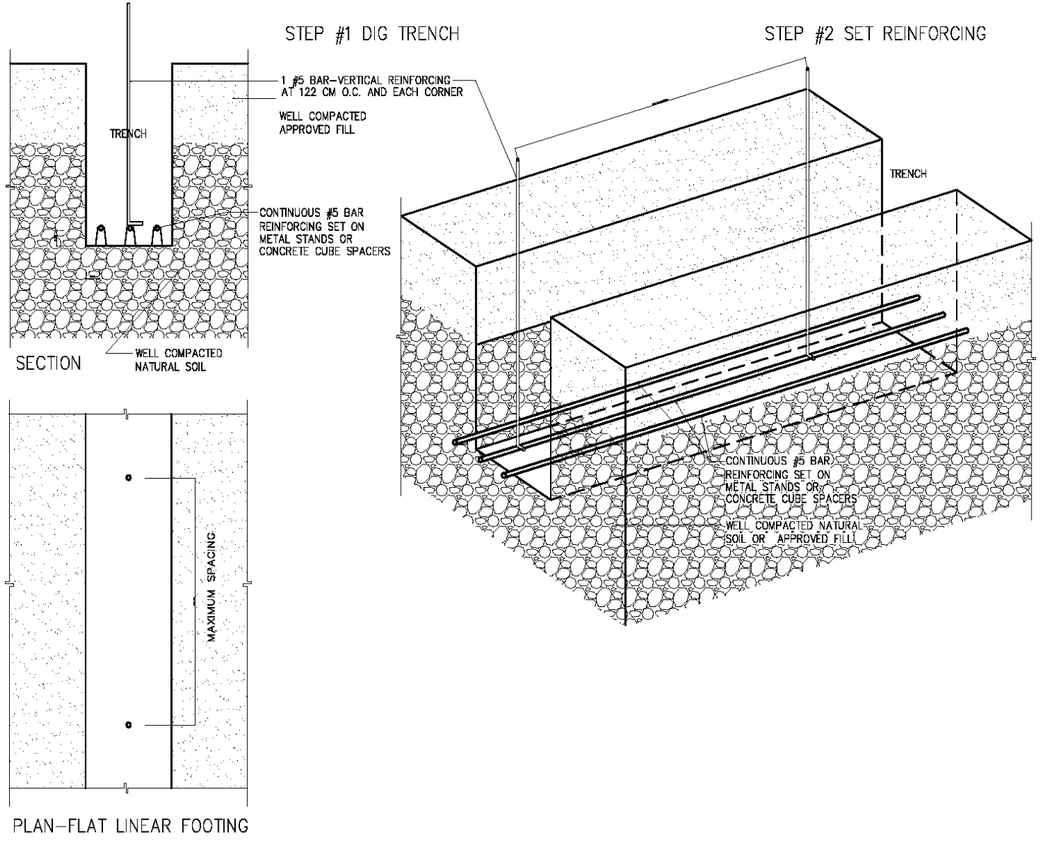
WINDOW DETAIL

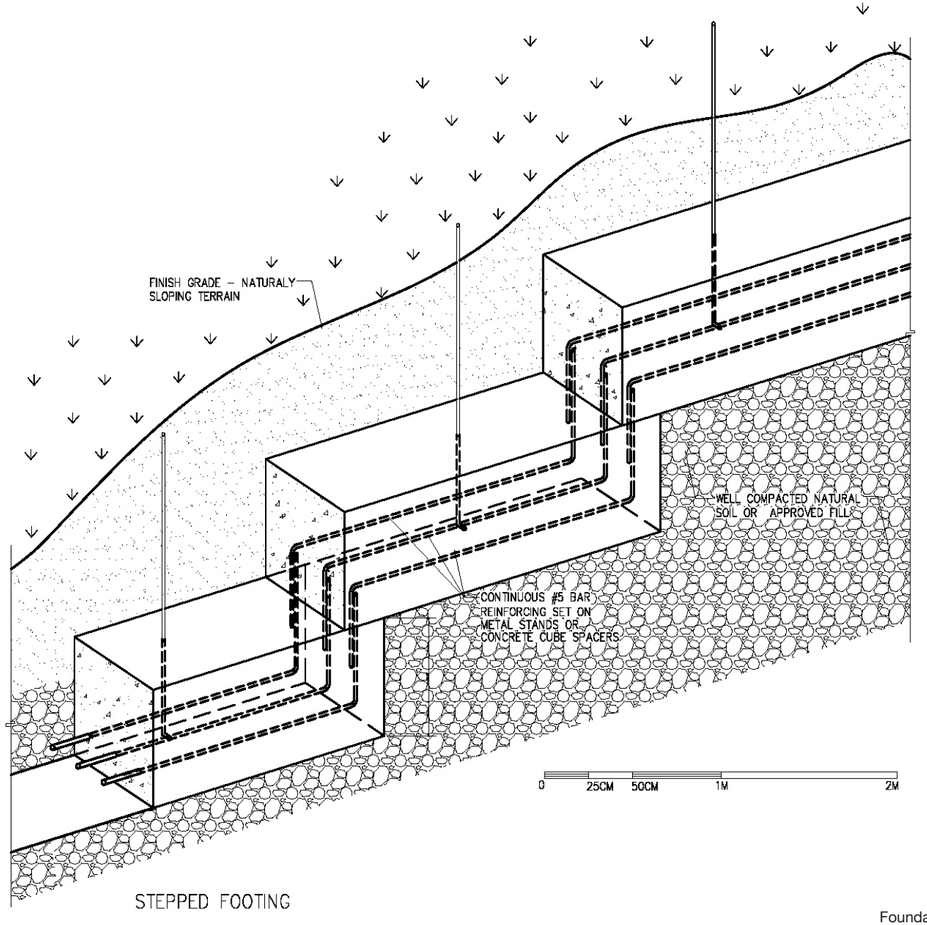


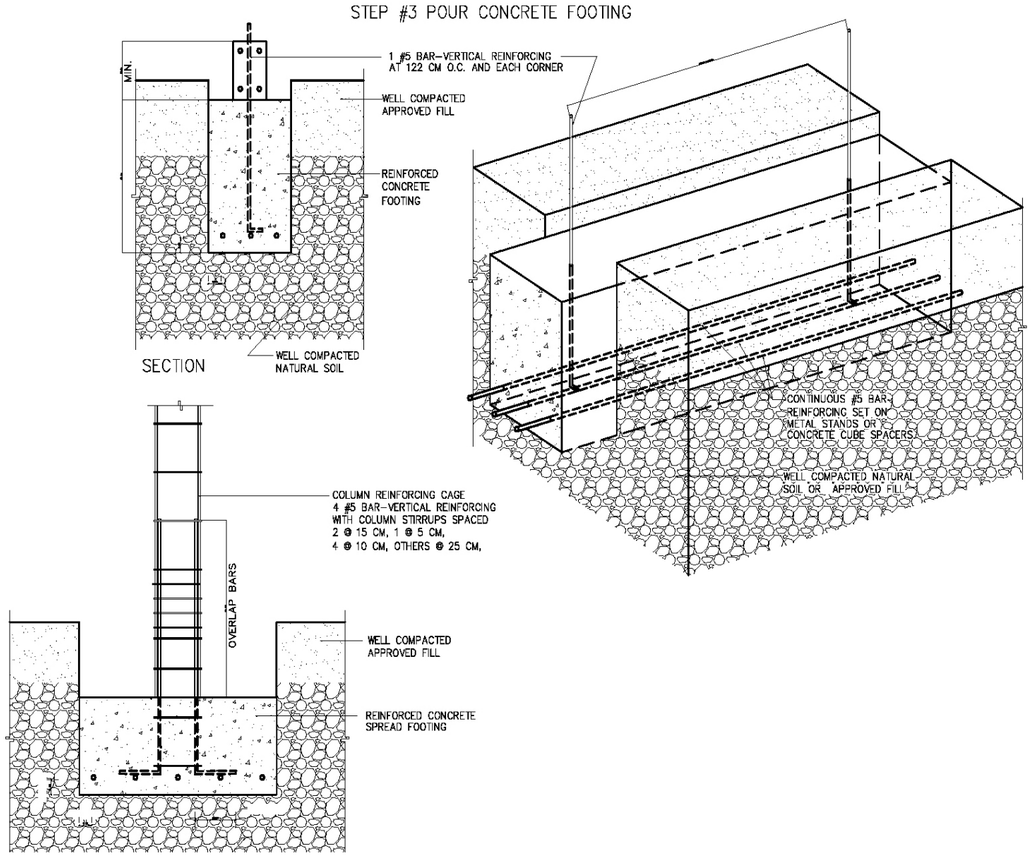
2 STORY REINFORCED MASONRY WALL SECTION

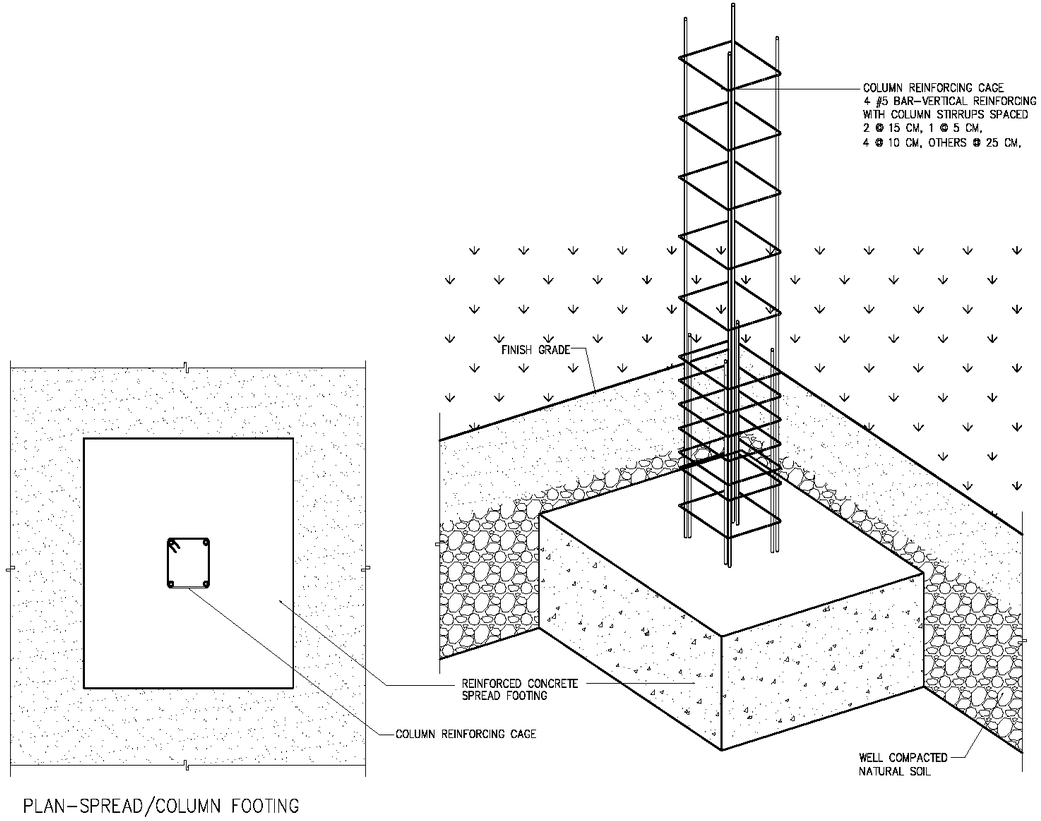


Residential Construction Detail
Wall Sections

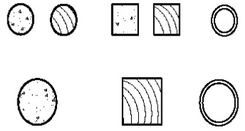

STEP #1 DIG TRENCH
STEP #2 SET REINFORCING
1 #5 BAR–VERTICAL REINFORCING AT 122 CM O.C. AND EACH CORNER
WELL COMPACTED APPROVED FILL
TRENCH
CONTINUOUS #5 BAR REINFORCING SET ON METAL STANDS OR CONCRETE CUBE SPACERS
WELL COMPACTED NATURAL SOIL
SECTION
TRENCH
CONTINUOUS #5 BAR REINFORCING SET ON METAL STANDS OR CONCRETE CUBE SPACERS
WELL COMPACTED NATURAL SOIL OR APPROVED FILL
MAXIMUM SPACING
PLAN–FLAT LINEAR FOOTING


FINISH GRADE – NATURALY SLOPING TERRAIN
WELL COMPACTED NATURAL SOIL OR APPROVED FILL
CONTINUOUS #5 BAR REINFORCING SET ON METAL STANDS OR CONCRETE CUBE SPACERS
0
25CM
50CM
1M
2M
STEPPED FOOTING



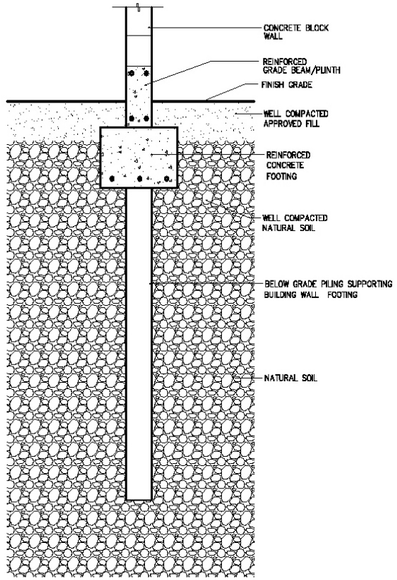


PLAN–SPREAD/COLUMN FOOTING

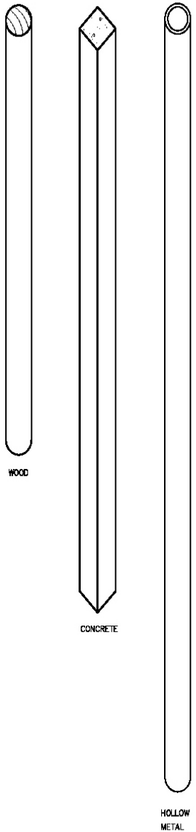


PILING PLAN SHAPES

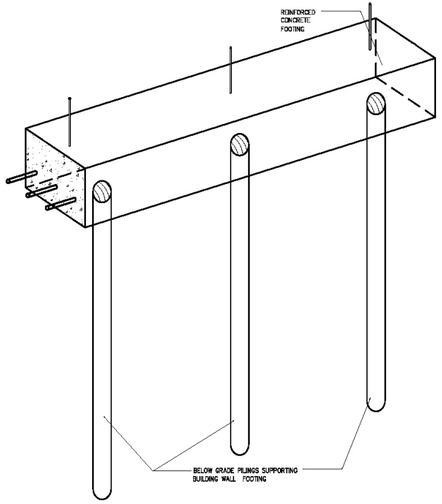
PILINGS CAN BE ROUND OR SQUARE AND CAN BE MADE FROM WOOD, CONCRETE OR METAL. THEY ALSO CAN BE OBTAINED IN A VARIETY OF SIZES BASED ON REQUIRED LOAD TO BE SUPPORTED AND SOIL CONDITION



BELOW GRADE PILINGS

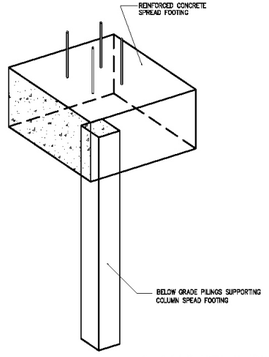


LENGTH / HEIGHT BASED ON REQUIRED NEED

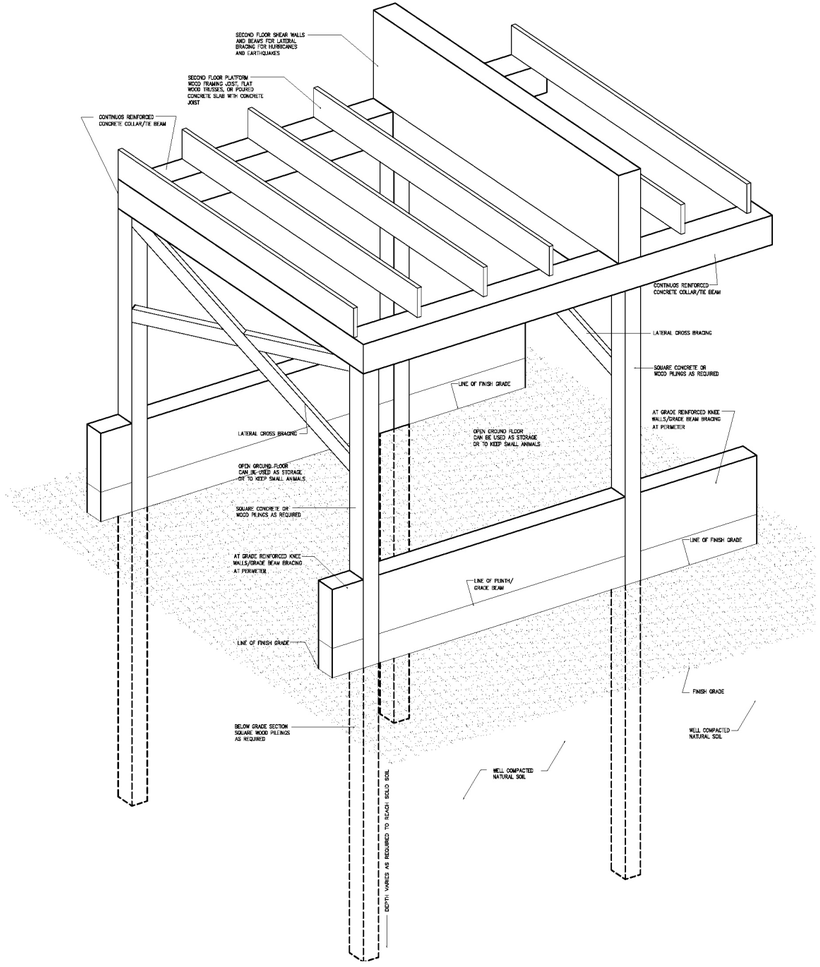


FLAT LINEAR FOOTING

BELOW GRADE PILINGS

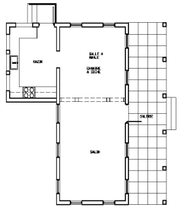


SPREAD/COLUMN FOOTING



Foundation Pilings

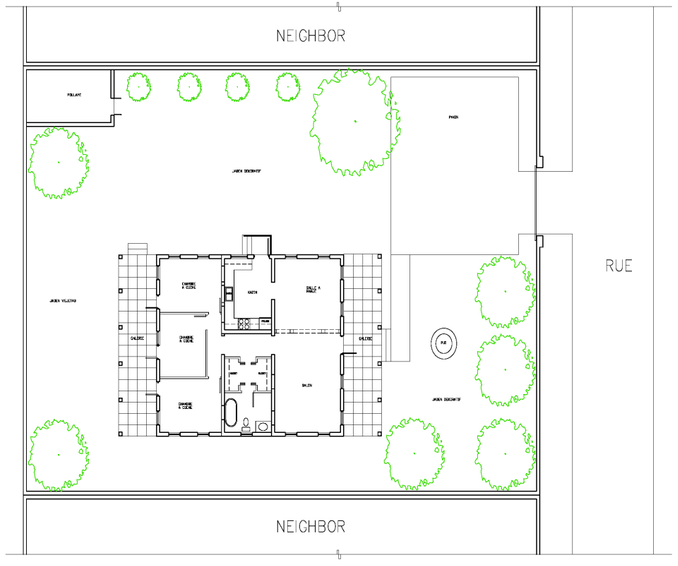
TOWN SINGLE FAMILY LAKOU
RESIDENTIAL STREET



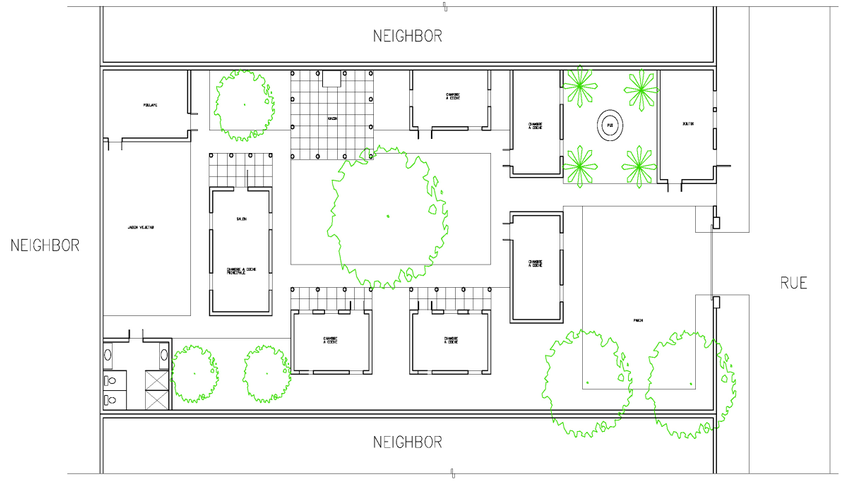
PHASE 1 FLOOR PLAN



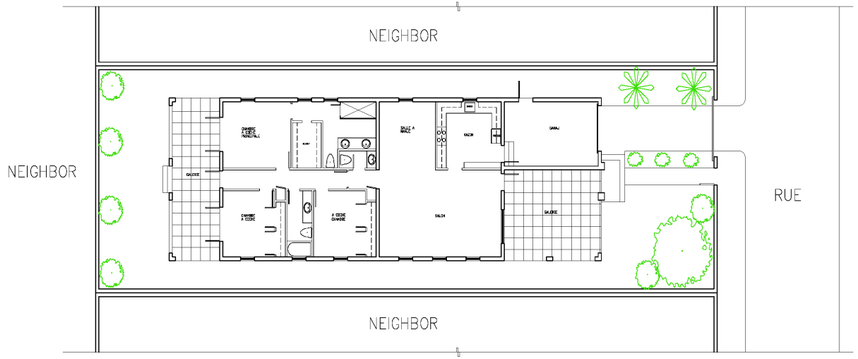
PHASE 2 FLOOR PLAN

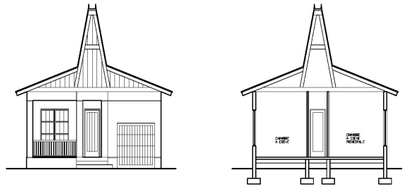


TOWN EXTENDED
FAMILY LAKOU



TOWN CENTER
SINGLE FAMILY LAKOU

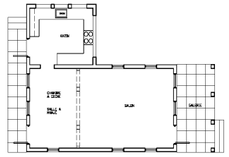




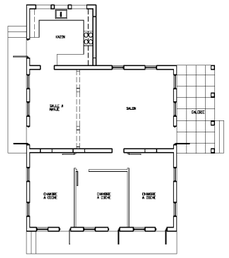
CROSS SECTION

0 5 15 20 25 30

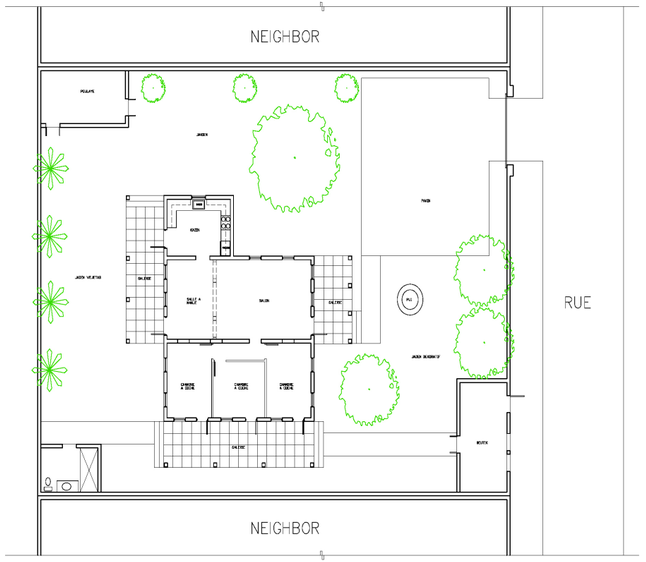
TOWN SINGLE FAMILY LAKOU
RETAIL STREET



PHASE 1 FLOOR PLAN



PHASE 2 FLOOR PLAN



0 5 15 20 25 30

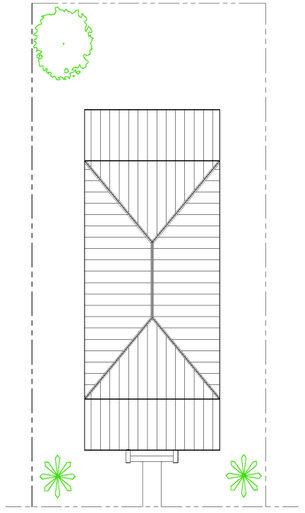
2 BEDROOM HOUSE



FIRST FLOOR PLAN





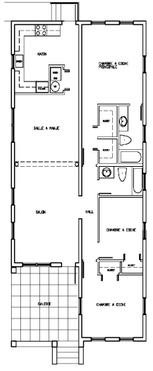


SITE PLAN

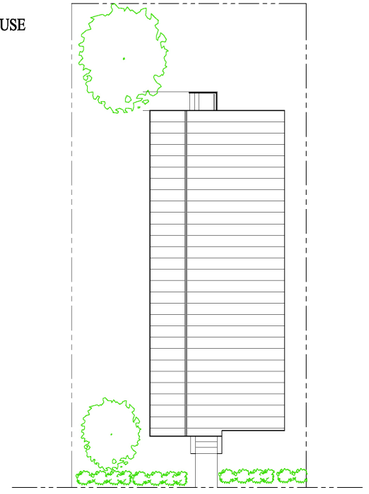
RUE

0 5 15 20 25 30

3 BEDROOM HOUSE



FIRST FLOOR PLAN



SITE PLAN

RUE

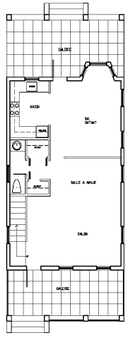






0 5 15 20 25 30

3 BEDROOM HOUSE
2 STORY



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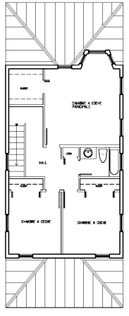
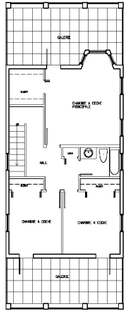


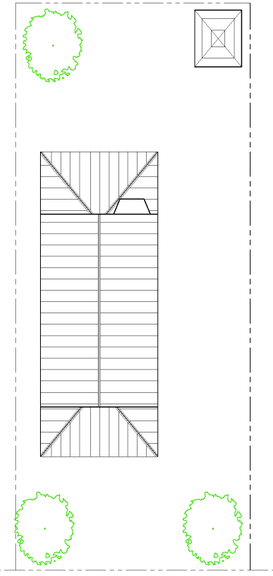
SECOND FLOOR PLAN



ALT. SECOND FLOOR PLAN





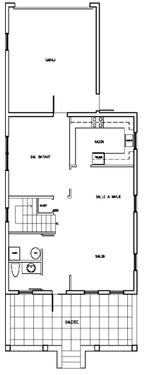


SITE PLAN

RUE

0 5 15 20 25 30

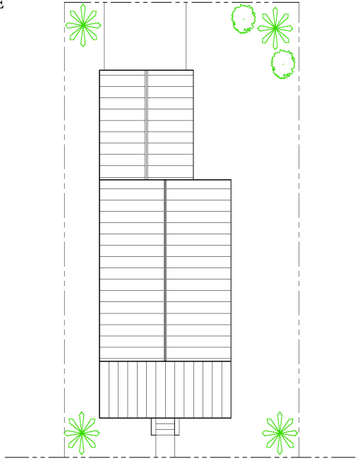
5 BEDROOM HOUSE
2 STORY



FIRST FLOOR PLAN



SECOND FLOOR PLAN



SITE PLAN

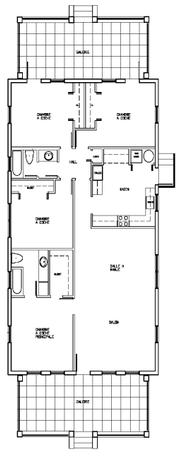
RUE





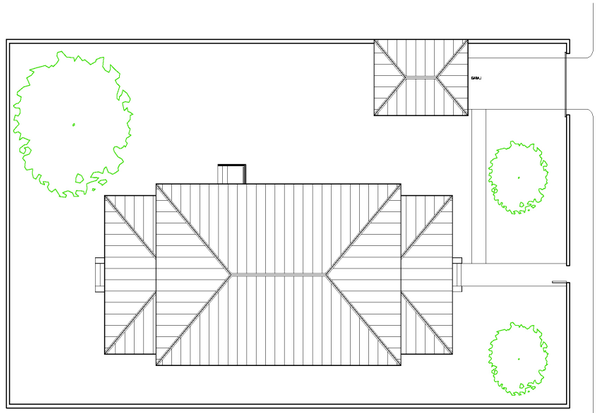


0 5 15 20 25 30



FIRST FLOOR PLAN

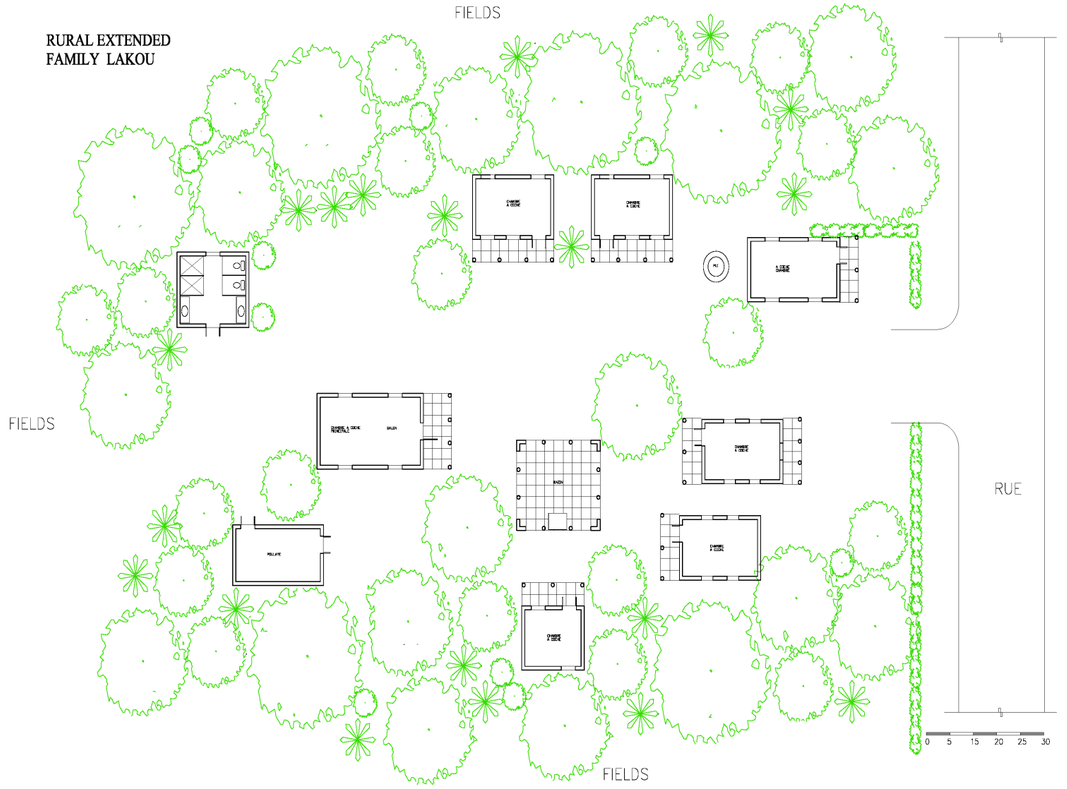
4 BEDROOM HOUSE



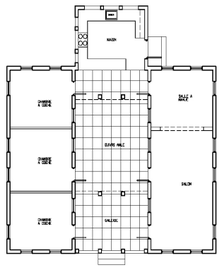
SITE PLAN



RURAL EXTENDED FAMILY LAKOU



OPEN COURT HOUSE



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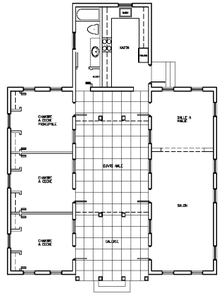
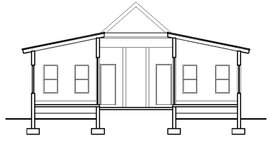
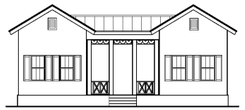


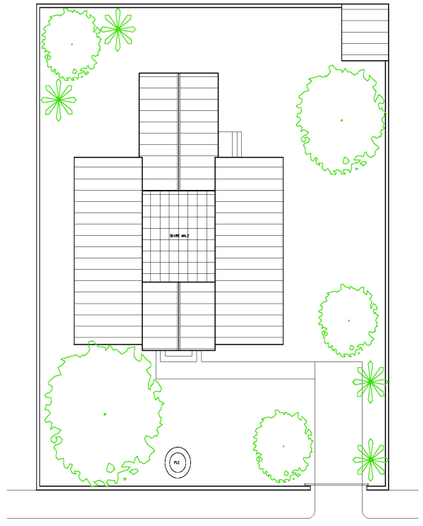
ALT. FIRST FLOOR PLAN



CROSS SECTION





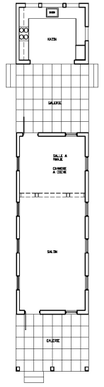


SITE PLAN

RUE

0 5 15 20 25 30

RURAL HOUSE RAISED ON STILTS



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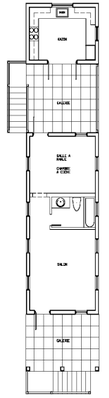
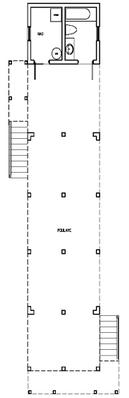
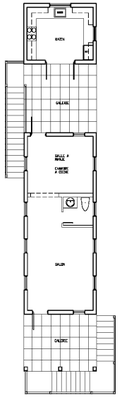


FIRST FLOOR PLAN



FIRST FLOOR PLAN



SECOND FLOOR PLAN

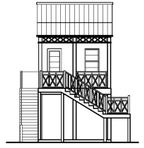




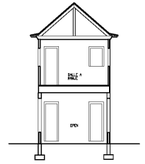








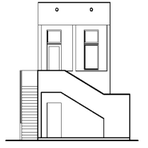
Construction on stilts is recommended in the Delta Plain/Lowlands region. This drawing illustrtes how all Easy-Build houses can be adapted to accomodate stilts and protect residents from flood waters.

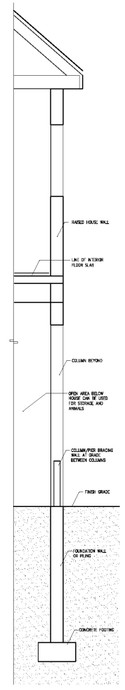


CROSS SECTION









WALL SECTION

0 5 15 20 25 30

Resilient Building Design: Construction Methods for the Commune of Arcahaie

John Onyango, Assistant Professor, University of Miami School of Architecture and Center for Urban & Community Design (CUCD) Research Affiliate

2011 and 2012 may well be remembered as the point at which the "average person" on the American continent developed a good understanding of climatic scale impacts in the form of extreme weather events (Institute for Sustainable Communities, 2012). In the U.S. 14 extreme weather events were experienced, most of which also impacted Haiti and caused damage in the US that exceeded $1billion (2011). The impacts of the more recent tropical storm Sandy included over two million households in the state of New Jersey, where 72,000 homes and businesses were destroyed, and resulted in loss of human life. Storm surge and flooding affected a large swath of the state.

As a direct result of the growing frequency of these extreme weather events, climate change adaptation and resiliency has rapidly moved up the policy agenda for many local governments, which is a shift from the previous years when the focus was on mitigation. Climate change adaptation in this context refers to "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderately harm or exploits beneficial opportunities." Climate change "mitigation" as used here means an action designed "to reduce the sources or enhance the sinks of greenhouse gases" associated with global climate change. Although efforts are now under way in industry and at every level of government to incorporate adaptive responses into existing climate change initiatives, the Haiti generally lags behind in international efforts on climate adaptation (Institute for Sustainable Communities, 2012).

As Klein and Nicholls (1999) point out, these biophysical changes result in socio-economic impacts such as loss of land infrastructure and coastal resources as well as declines in associated economic, ecological, cultural and subsistence values.

Hurricane season of 2008 was the cruelest ever experienced in Haiti with four storms--Fay, Gustav, Hanna, and Ike--dumping heavy rains on the nation. It is estimated that the four storms killed at least 793, with 310 missing; it injured 593, destroyed over 22,000 homes, and damaged another over 80,000 (USAID, 2008). The impact was quite significant with over 800,000 people were affected [approximately 8% of Haiti's total population]. The cost of the damage to the country amounted to almost 5% of the GDP.

Figures 1 (a-f) of the Atlantic storms reveal that most of the storms over the period 2007-2012 had direct or indirect impact on Haiti. Therefore designing and constructing a resilient built environment demands an in-depth understanding of the expertise and knowledge of how to avoid and mitigate the effects of threats and hazards (Hamelin and Hauke, 2005; Little, 2004). Singh and Cohen (2014, p.1) point out that "…resilience-building measures include flood control, integrated river basin management, reforestation, promotion of wood-energy alternatives, adoption of new crop varieties and farming practices, reduction in cultivation of steep slopes, and creation of non-farm livelihood options…."

The definition of resilience is rooted in ecological systems and means that a system's components are expected to have the ability to remain or perform within defined and

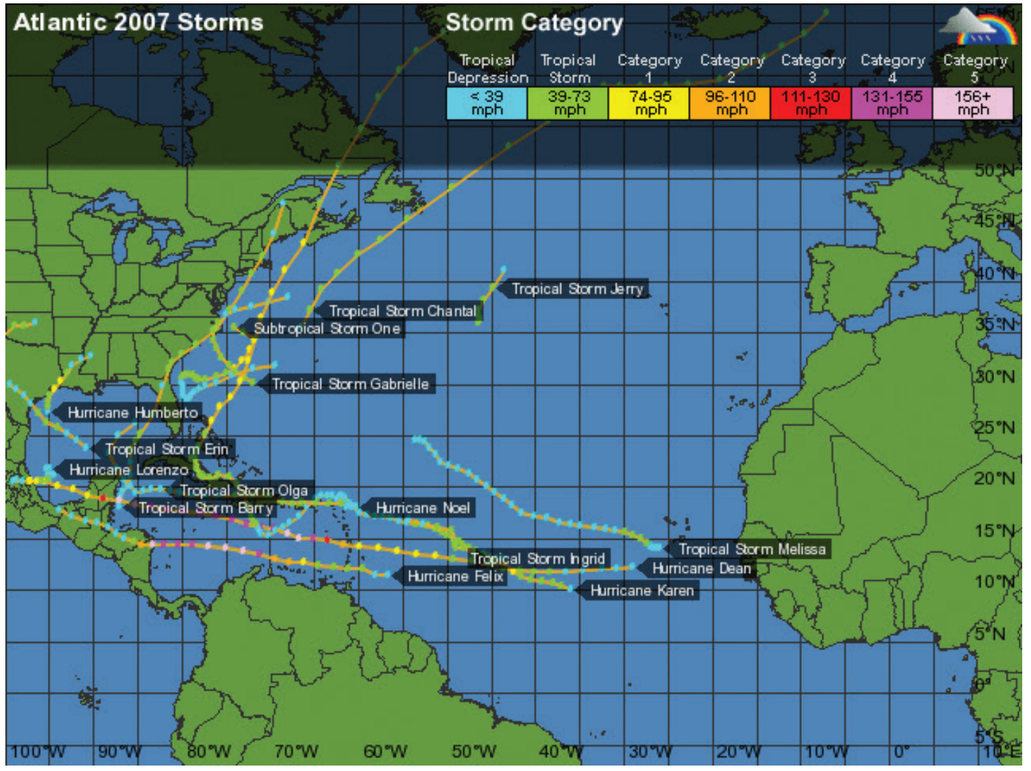


Figure 1a Atlantic Storms 2007-2012, Source: *The Weather Channel (2014)*

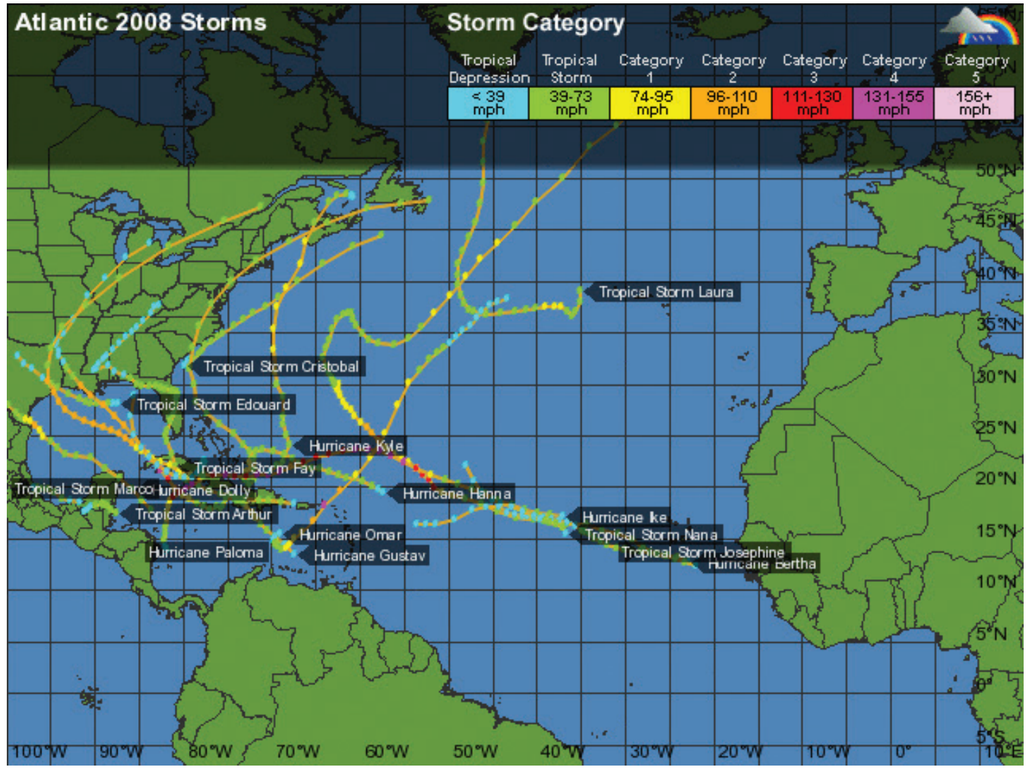


Figure 1b Atlantic Storms 2007-2012, *Source: The Weather Channel (2014)*

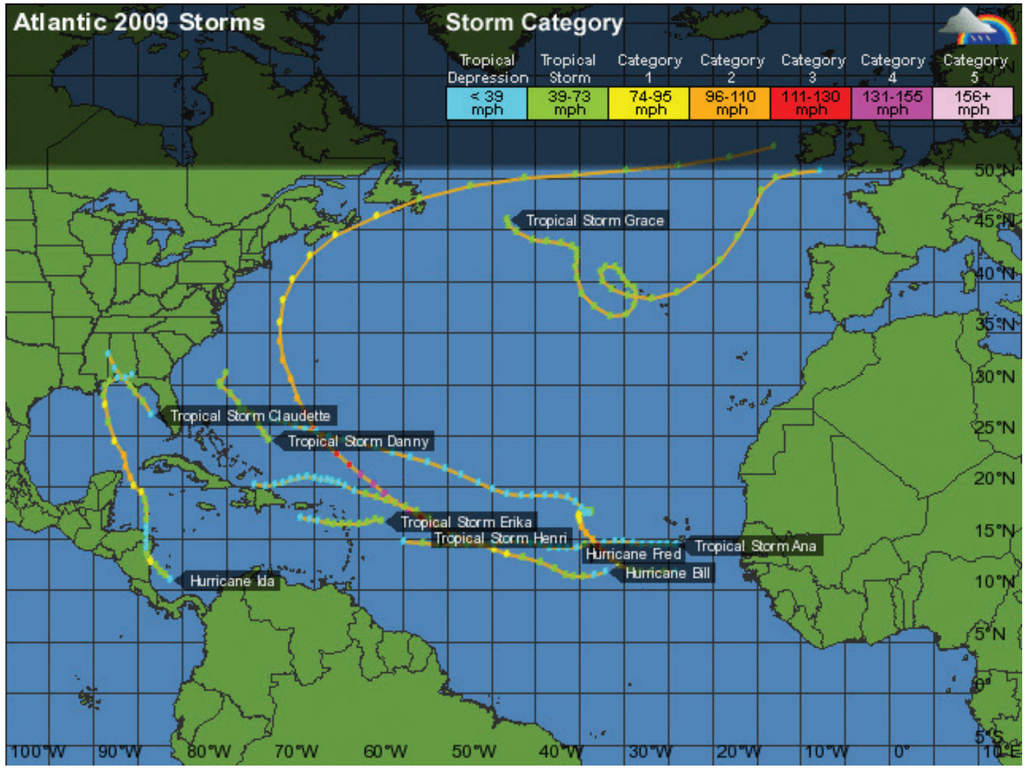


Figure 1c Atlantic Storms 2007-2012, *Source: The Weather Channel (2014)*

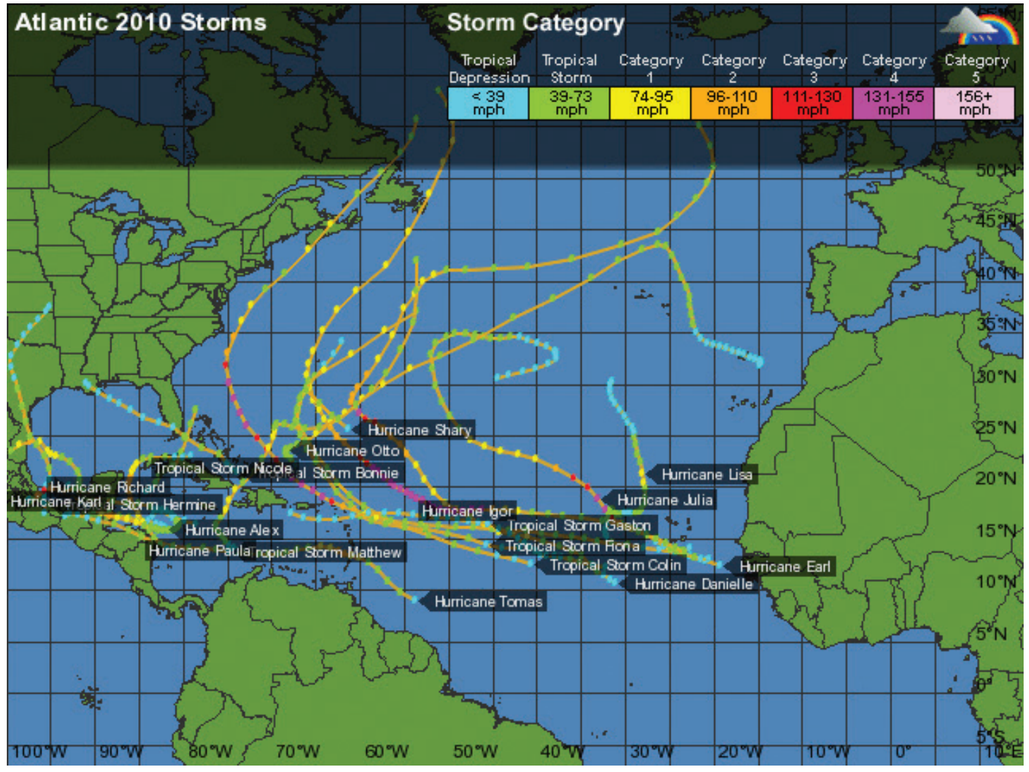


Figure 1d Atlantic Storms 2007-2012, *Source: The Weather Channel (2014)*

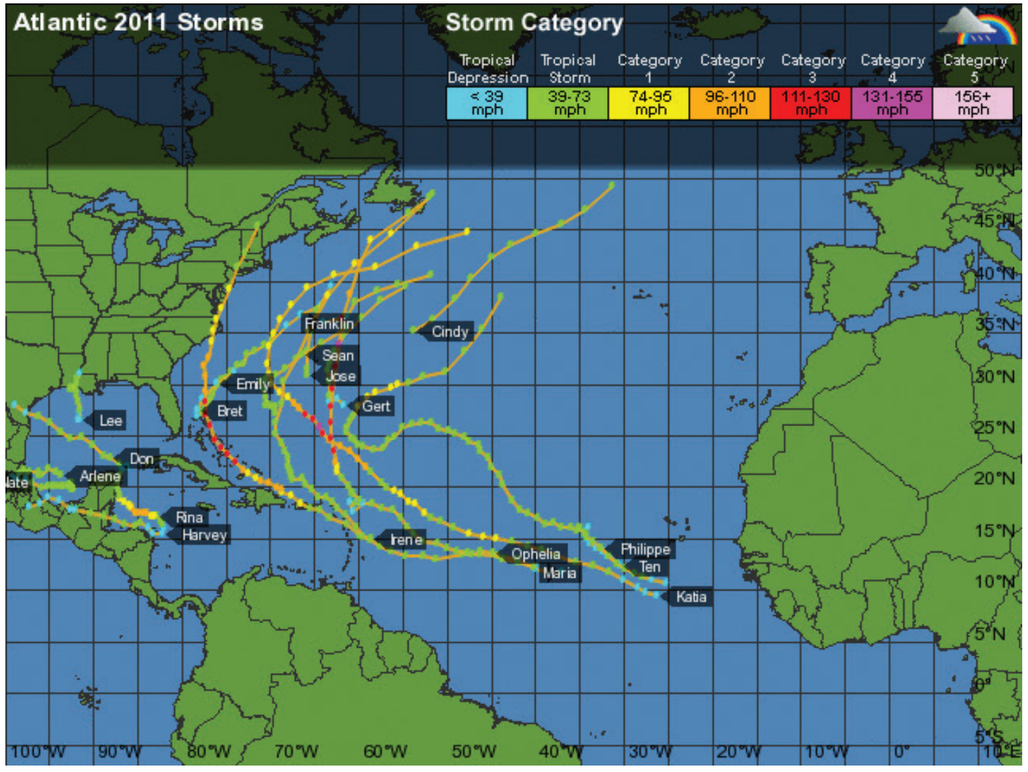


Figure 1e Atlantic Storms 2007-2012, *Source: The Weather Channel (2014)*

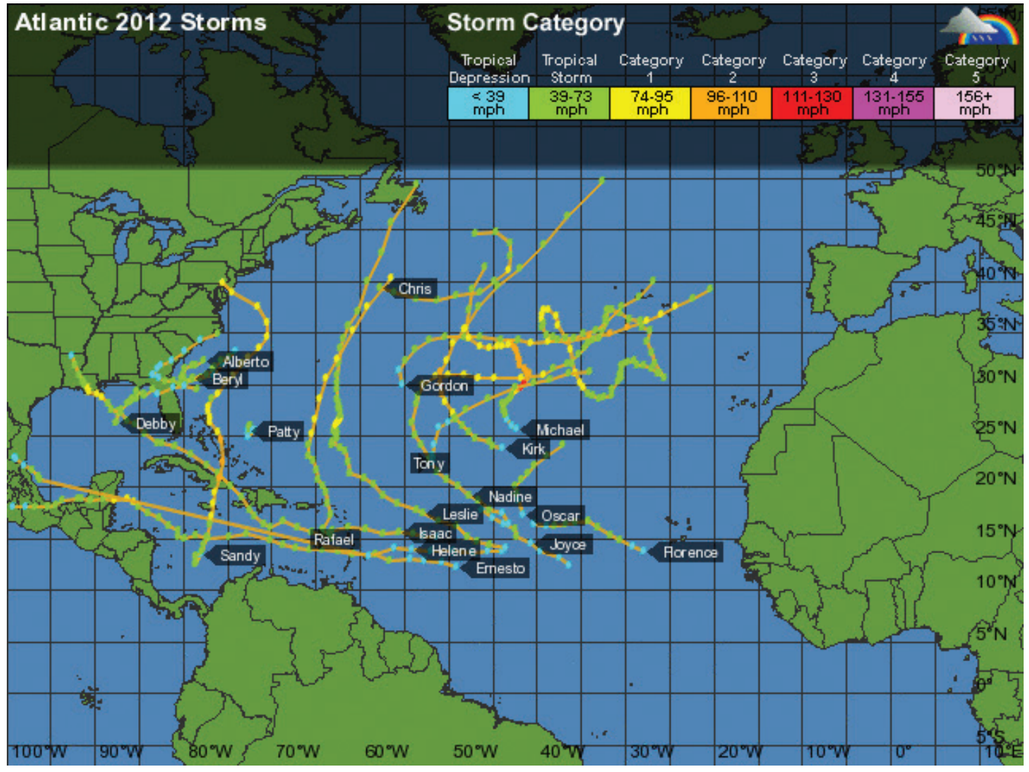


Figure 1f Atlantic Storms 2007-2012, *Source: The Weather Channel (2014)*

recognizable limits despite the impact of disturbances (Holling, 1973). Resilience and sustainability are intricately tied together as pointed out by Mileti (1999) as the ability of a locality to "tolerate - and overcome - damage, diminished productivity, and reduced quality of life from an extreme event without significant outside assistance." Other definitions suggest that resilience indicates the capability of a system to sustain a level of functionality or performance over a time period and the temporal integration of the functionality of a system from the time of occurrence of a disaster to the end of the recovery period [Bruneau et al., 2003; Cimellaro et al. 2010].

Bosher (2008, p. 13) argued that "…a resilient built environment should be designed, located, built, operated and maintained in a way that maximizes the ability of built assets, associated support systems (physical and institutional) and the people that reside or work within the built assets, to withstand, recover from, and mitigate for, the impacts of extreme natural and human-induced hazards…" According to Resilient Design Institute (2013) resilience at the building scale could be achieved if we adhere to strategies, which allow for buildings to be designed and constructed withstanding natural hazards emanating from sever storm, flooding and other impacts caused by climate change or any other cause. Haiti is ground zero for a lot of these natural disasters. Of importance is that the critical infrastructural systems should be able to withstand these extreme events.

The strategies should be based on anticipated future climatic conditions as opposed to current practice of relying on historical data. The building should be designed to rely on passive systems of cooling/ heating such that any disruptions on energy infrastructure should not severely compromise the living conditions. Therefore approaches that harvest the sun, wind, and rain at source are critical in addition to use of energy recovery systems from human and animal waste. The buildings need to be built to be durable while at same time have interior materials that will dry out quickly to assist in minimal resilient, or recovery time period. The detailing and construction inspection of these buildings are very important. Traditional and vernacular design should be promoted as they create sense of pride of community as well as provide source of income and skill generation for the local communities.

The report will examine resilient design from holistic perspective giving examples of good practice.

Building Design

In principle, all buildings constructed using masonry system should be constructed such that reinforced concrete columns confine all masonry walls. This ensures that that a rigid cage structure is built that has few joints as possible, braced to resist forces from extreme events such as earthquake, floods and winds during hurricanes. All openings must also be braced/ confined with reinforced concrete columns and beams (at header and sill levels). [Figures 2 and 3]

If the building is or contains more than a single story/ floor, then the load path should be simple and clear. The columns confining and bracing the building should be aligned vertically (one on top of the other). Likewise all load-bearing walls should be aligned vertically to avoid eccentric loading conditions. [Figure 4]

Things to avoid:
1. Too many unrestrained cantilevers
2. If building in phases, avoid leaving reinforcements bars exposed for longer periods that would results in results and reduction in its effectiveness.
3. Avoid many irregular shaped plans, not only are they

expensive, but ineffective against seismic loads.
4. Vertical walls need to be restrained and braced at no more than (10' to 12': [3.0m to 3.6m max]).

Foundations
Most foundations we saw during the visit to the site were very shallow, unrestrained and made of large round rubble rocks. The rocks are useful as hardcore or backfill, but not very good as aggregate for reinforced foundations nor as masonry walls. They are too bulky for aggregate to have the right mixture and too round such that eccentric loadings and stresses are introduced on the unrestrained walls which would lead to failure. Suggested typical wall to roof details are illustrated in Figures 8, 9 and 10.

Roof Structures
The Roof structure (timer typically) should be anchored to the ring beam to mitigate against uplift from winds during storms as well as restraints during earthquakes. [Figures 11, 12 and 13]

Alternative Building Materials: Bamboo and Adobe
Bamboo is the largest of the grasses with over 1600 species of available worldwide, and thirty-three percent grows in Latin America (Adams, 1998). It grows very quickly and could be easily be planted in Haiti and used as a replacement construction material. Bamboo is unique in that it is strong in both tension and compression and the tensile strength remains the same throughout the age of the bamboo plant, while its compressive strength increases, as it gets older. This makes it suitable for use in building construction.

It can be combined with adobe to reinforce the walls and can make elegant buildings as illustrated in Figures 15, 16, 17 and 18). Adobe can be used as rammed earth in conjunction with bamboo reinforcement. The walls of rammed adobe are built from a mixture of earth that is compacted in layers between forms. The layer of earth is approximately 6" (15 cm) deep, a process that continues as each form is filled, another form is placed above it. The forms can be stripped off as soon as the form above is begun, as the compressed earth wall is self-supporting immediately.

Rammed Earth Wall Thickness in Inches	*Maximum Wall Height*
12[1]	6' - 0" (without bond beam)
12[1]	8' - 0" (with bond beam)
18	10' - 8"
20	11' - 4"
22	12' - 0"
24	12' - 8"

Table 1 Rammed Earth Wall Height To Thickness Ratio (Source: http://www.nmcpr.state.nm.us/nmregister/xii21/14.11.11NMAC.htm)

The construction material is a balance between clay, sand and aggregate with some cement added as binder material to stabilize the walls. The cement content is around 6% of total weight of the earth.

Recycled Fibers and Materials
Opportunities do exist to use recycled fiber in different forms, especially those that are currently seen as garbage; plastic bags, plastic bottles, banana fiber, paper among others. They can be collected and recycled as building materials.

Plastic and Glass Bottles
TThe idea of using recycled plastic bottle that would otherwise have gone to landfill came Andreas Froese who in 2001 founded ECO-TEC (http://www.eco-tecnologia.com). In Haiti, plastic bottles are a big polluter on the water streams, beaches and on the streets. [Figure 19]

The wall construction relies on a masonry unit system and as such would need to have rigid reinforced concrete frames to protect the building against seismic activities in places like Haiti.

Construction process starts with the collection of lots of recycled bottles (generally 1/2 liter to 2 liter coke soda or water bottles would do etc.) These need to have their tops intact, as they will be filled with dry soil, a saving as one would not need to purchase the raw material. A plastic funnel, which could easily be made from one of the recycled bottles, is useful when placing soil into the bottles. Other materials necessary are galvanized steel chain link fencing, wire ties, chicken mesh and cement and sand to make plaster. It is estimated that a modest 3-room house would need about 8000 1/2 L bottles.

The foundation system is laid out as in typical building and the filled plastic bottles laid in rows with a small gap of about 1.5 – 2.0 cm between. Every bottle is tied to one another to create a network, with one tie at the neck and another tie at the base of the bottle. Agricultural twine (sisal or nylon) is widely available, though it is best to use galvanized chain link fencing material.

The wall construction begins with a bed of 1" (2.5cm) thick cement-sand mortar on foundation wall of regular masonry (stone, brick, or concrete). The filled up bottles are then laid interchangeable with a gap of about 2.5 cm between. Cement sand mortar will typically be of ratio 1:2.5 or 1:3 (cement-sand). The bottles are then covered with a layer of mortar to level of 2.5cm above the first layer of bottles before laying the second layer. This process is repeated until 3 or 4 maximum courses are completed per day. The following day, the next 3 to 4 layers are added till the wall reaches the desired height of no more than 10' - 0" (330cm). The next step is to tie the bottles together in triangulated form to ensure that are acting together as a wall. Alternatively the chain-link fence is laid across the wall and wire ties used to tie to ends of the bottle tops as indicated in drawing. The wall can be left unfinished or plaster/rendered as desired. Water should be poured on the walls for at least 3 to 5 days to allow mortar to cure and covered with gunny bag/ plastic to preserve or prevent quick drying. [Figure 21]

Plastic Bags
Discarded plastic bags are a major environmental hazard in many parts of the developing world. It is difficult to handle, is widely available in shops as they are very cheap, and are discarded on the street, water streams without much regards to the impact on the environment. The good news is that they can be collected and recycled as cheap building material that can be used as block masonry. The process starts with collection of plastic off the street, from homes, businesses and sent to collection center. At the collection center or yard, they are compressed into building blocks with a nominal size of 8" x 8" x 16" that weigh a mere 1.5 pounds as opposed to 35 to 55pounds for regular CMU block. Thanks to invention of the UBUBTU-BLOX (Lacey, 2010) compression machine which it is fairly simple to make and to use. [Figure 22] Just like the other building systems for Haiti, it is recommended that the recycled plastic block walls be used as masonry between reinforced concrete rigid/ bracing columns and beams and the walls finished in cement plaster render.

The walls are constructed on concrete slab on grade that is at least 8" (20cm) above ground or whatever level is suitable depending on expected flood water line. The slab will have #4 or #5 r-bar rods anchored onto the slab and extending at least 16" (40cm) above the slab level at 8" (20cm) on centers. The first two layers of the UBUBTU-Blox block

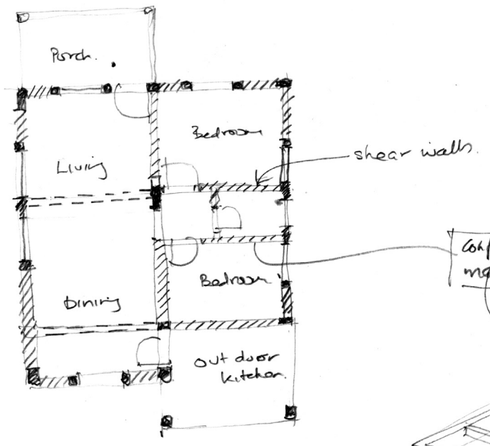


Figure 2 Example of simple plan (illustrates locations of shear walls, columns).

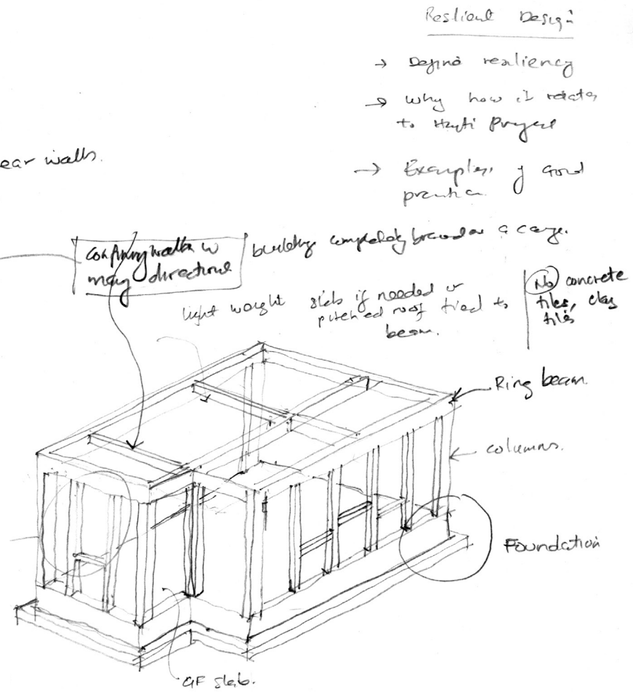
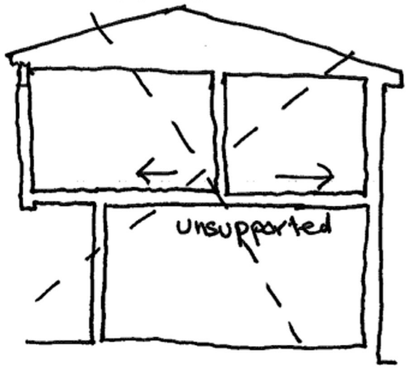


Figure 3 Axonometric of Simple plan (illustrates locations of beams, columns that form caged buildings. The infill walls can be made out of concrete masonry units (CMU), alternative materials like adobe masonry, compressed recycled plastics, rubble etc.).



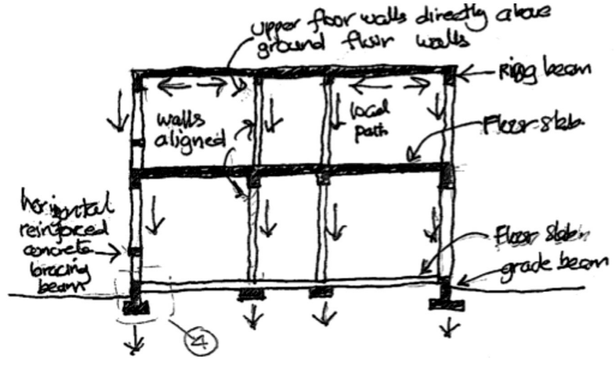


Figure 4 Load Path diagram for multi-story residential building.

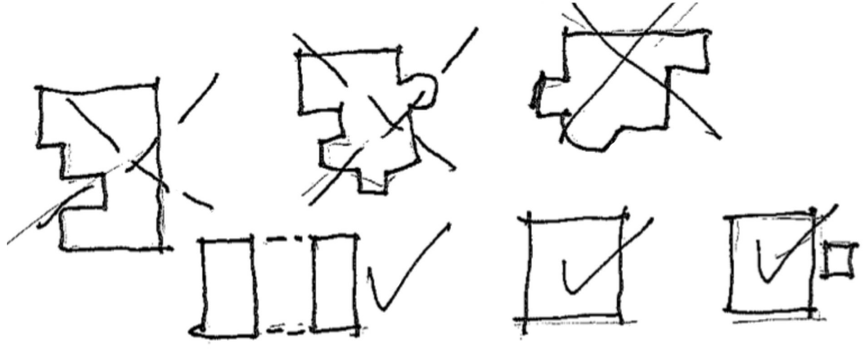


Figure 5 Simple Shaped Plans

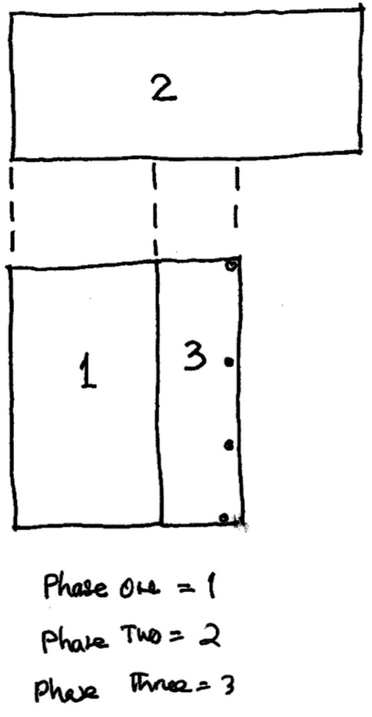


Figure 6 Outdoor Phased Development

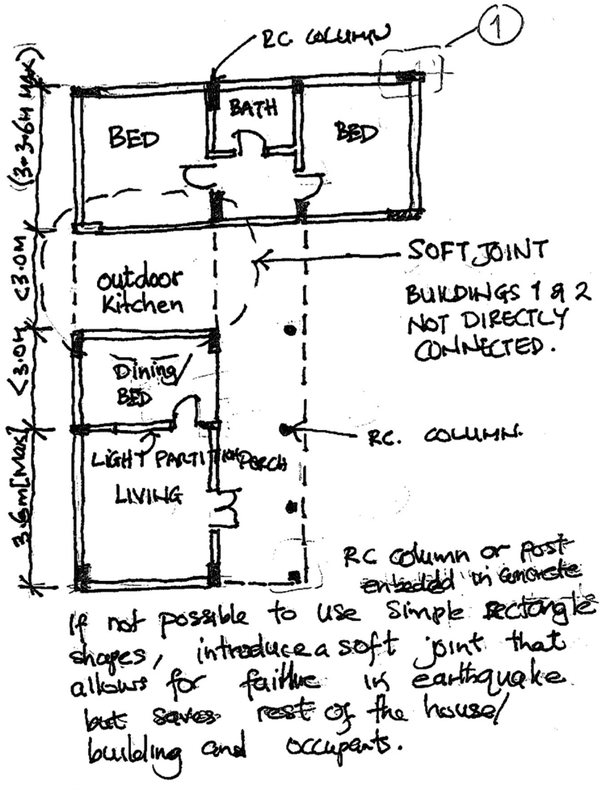


Figure 7 Example of simple phased development of single storey house with verandah. Take note of location of soft joint (outdoor kitchen, used to separate the two building blocks and mitigate against seismic damage during earthquakes. If it is not possible to use simple rectangular shapes, introduce a soft joint that allows for failure in earthquakes, but saves the rest of the house/ building and occupants.

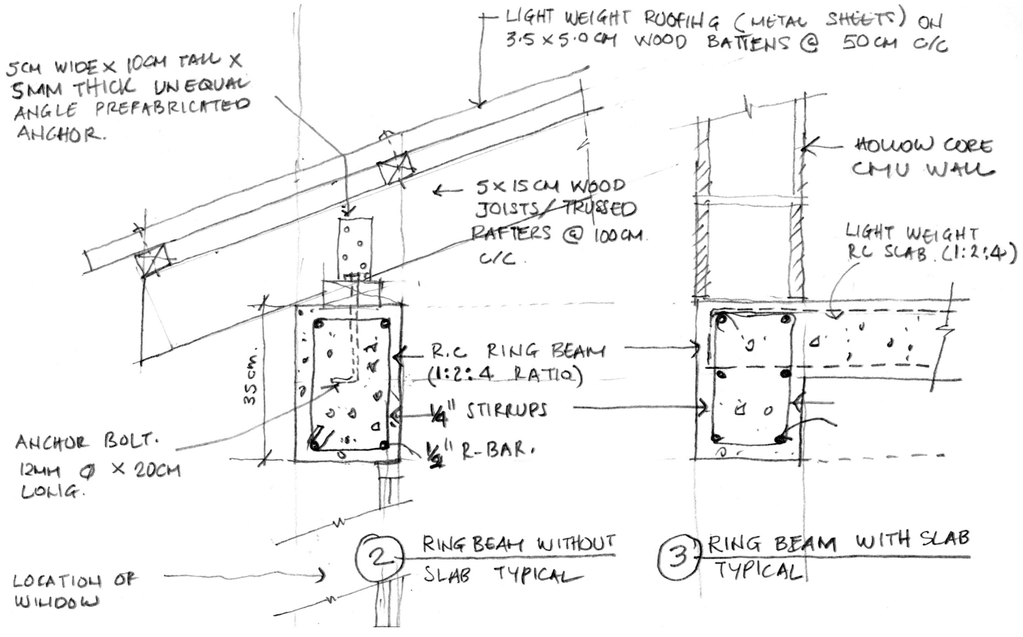


Figure 8 Roof detail at ring beam without slab
Figure 9 Detail at ring beam with slab (for typical 2 story building)

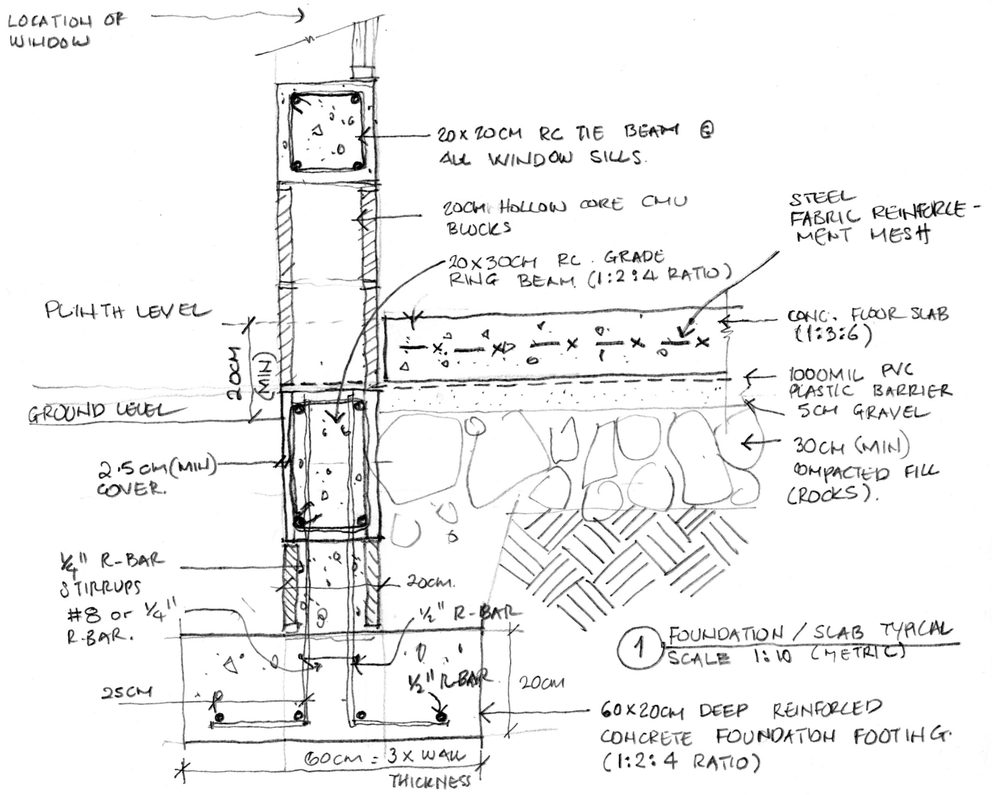


Figure 10 Detail at lower wall and foundation. Note the reinforced bracing beam at seal level as well at lintel/ ring beam that is tied to confining columns at both sides of the openings (windows and doors as indicated in Figures 2 & 3).

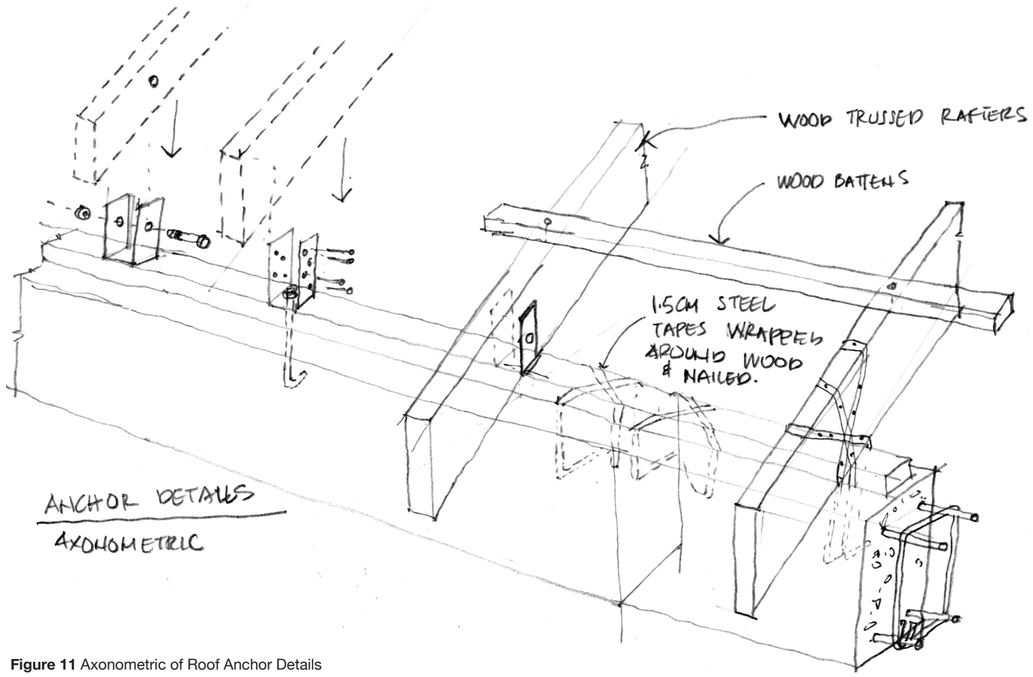


Figure 11 Axonometric of Roof Anchor Details

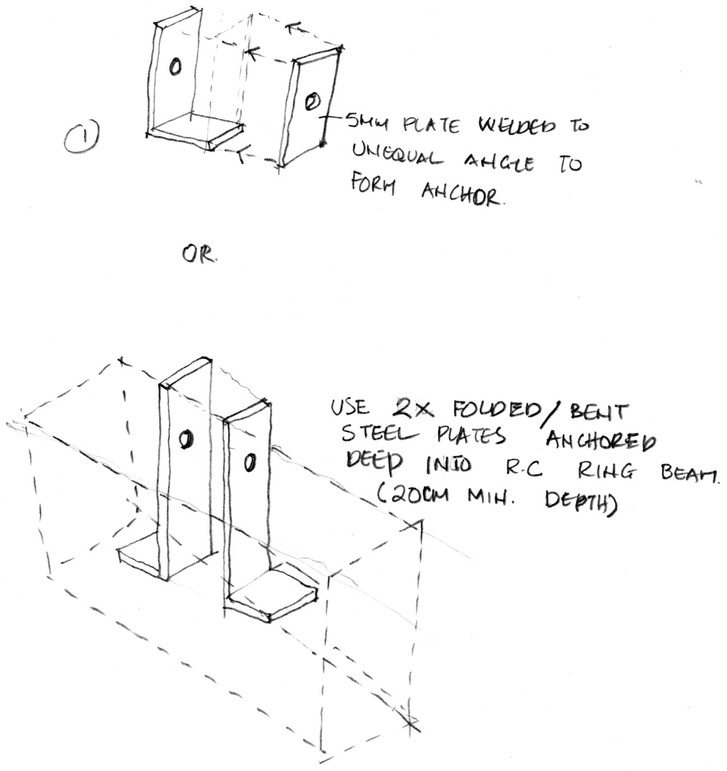


Figure 12/13 Alternative Anchor Details

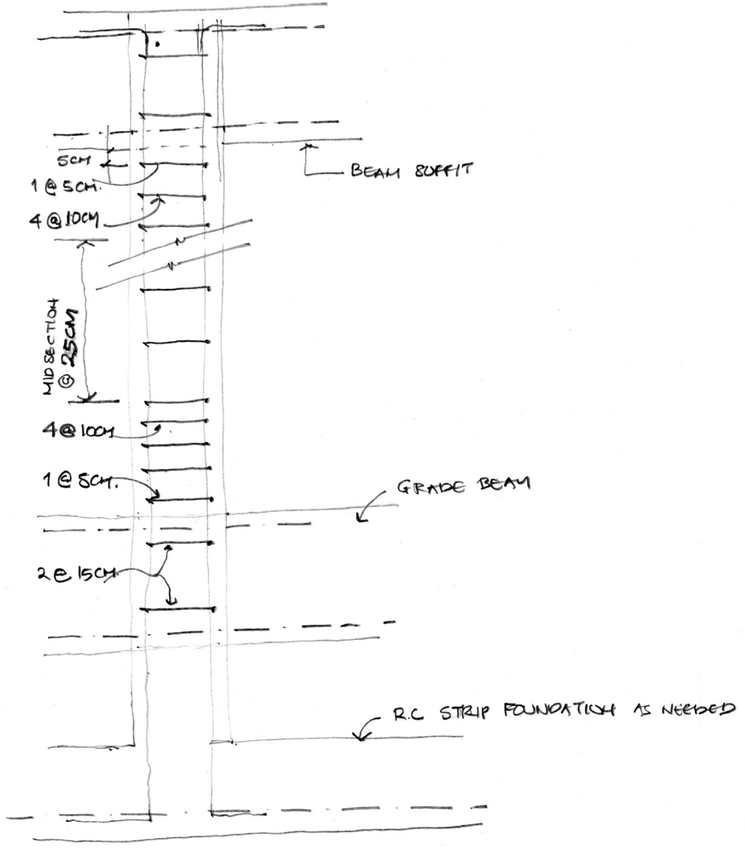


Figure 14 Typical Reinforcement in Columns

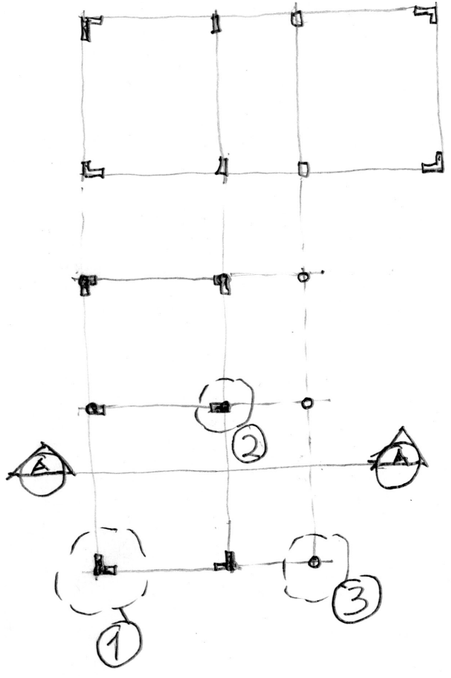


Figure 15 Typical plan of house with bamboo as main structure.

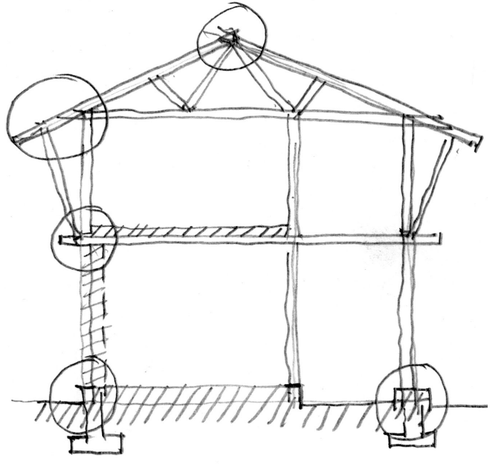


Figure 16 Typical schematic section of bamboo house.

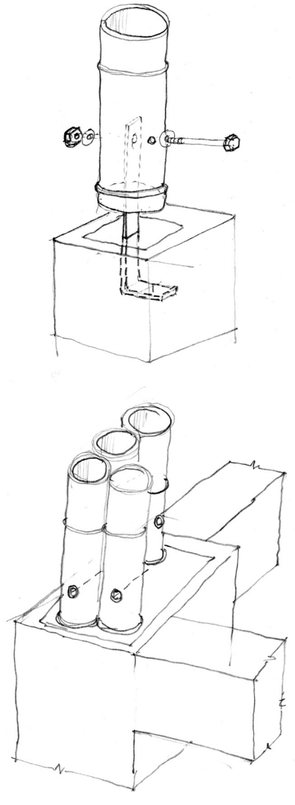


Figure 17/18 Bamboo Footing Detail

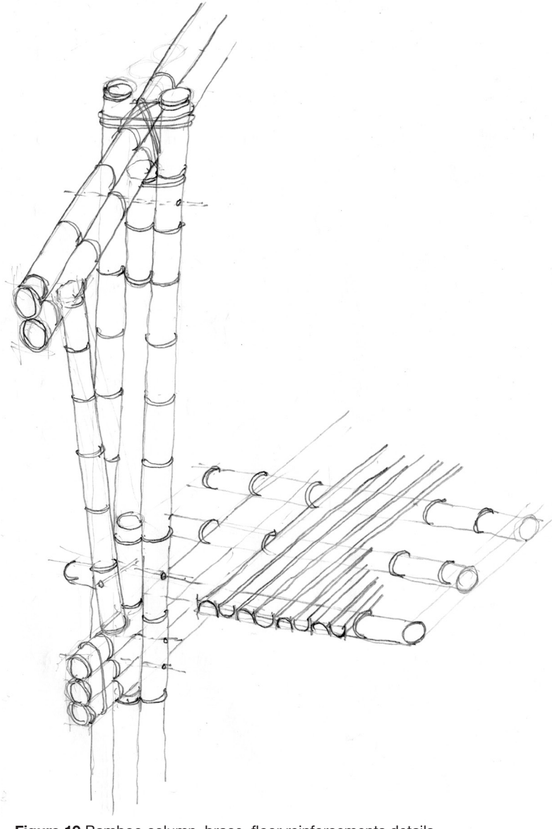


Figure 19 Bamboo column, brace, floor reinforcements details.

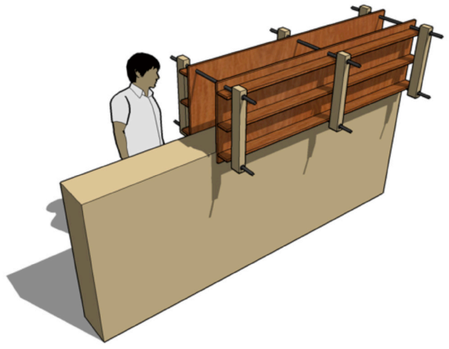


Figure 20 Wall with compressed adobe.



Figure 21 Wall with glass bottles.



Figure 22 Making UBUBTU-BLOX.



Figure 23 UBUBTU-BLOX walls.

units will be laid such that 2 bars pierce through them. When constructing course number 3 and 4 new #4 r-bars are added to tie the bock units together as illustrated in Figure 24. This process is repeated until the wall reaches the desired height of no more than 10'-0" (330cm). At each course, the blocks could alternatively be tied with twin, or wire mesh to the wire straps coming from the r-bar of the columns. The walls are finished by placing and tying chicken/ poultry mesh to the blocks then applying 1" (2.5cm) thick cement-sand plaster. Stucco lath is used around windows, doors, and corners for added strength. The wire netting and lath are typically held against the blocks by wire ties through the blocks or "U" shaped pins into the blocks.

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Estimating Construction Costs

Jackie Génard, Architect and CUCD Research Affiliate

The strategies proposed in the Easy-Build Kit section address growing concerns over current building construction practices in the region, which are often precarious. The constructive principles of the Easy-Build sets can be readily applied to new construction, rebuilding, or renovation efforts for upgraded safe structures.

To arrive at those recommendations, the Building team underwent a methodic analysis of precedents, sustained significant work-sessions with community members and local building experts.

The following phases of work resulted in the 'Easy-Build' Kits:
1. Identification of the family needs
2. Analysis of existing conditions
   a. The existing compound - the Lakou
   b. The existing housing types
3. Consulting locals on strategies to address family needs

The following general categories were developed as recommendations:
   a. Proposed Compound – the "new" Lakou
   b. Proposed housing types
   c. Estimated cost for specific prototypes
   d. Alternate types of housing and approximate cost

I. Identification of family needs
The community workshops held during the several trips made by the project team in order to address the need of the community and their liking presented a peculiar phenomenon of several of the residents diverting from the original definition of a typical less-urban home in Haiti.

Originally, a home was referred to as being a series of rooms, people have a three to four-room home. However, the community expressed the need of redefining the homes, now wanting the rooms within the homes to be built with a purpose.

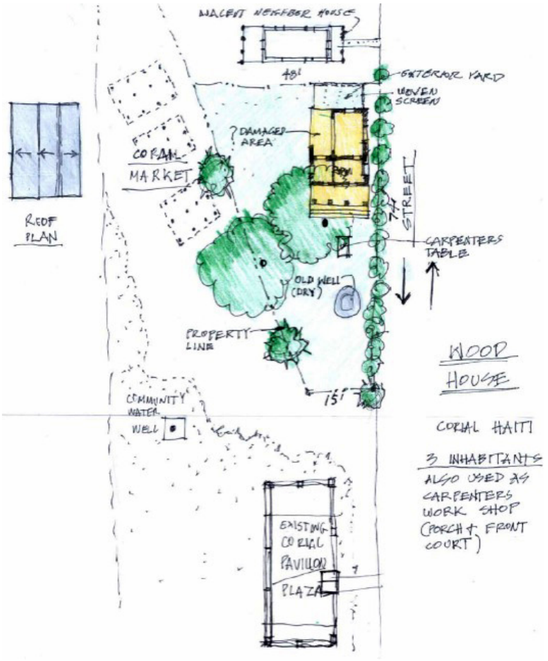
A sheet of paper was given to each participants of the workshop to communicate their vision of their town. Each participants input revealed to the team sets of well-defined labeled plans bearing the following information:
- Rooms with a purpose
- Bathrooms inside the house
- Individual kitchens
- Multiple bedrooms
- More modern types of housing from traditional

The old mindset of having a house with multiple rooms, grew quickly into having a house with two to three bed-rooms, an indoor kitchen and bathroom, a living room and a dining room. This model of house is less typical In the region.

II. Analysis of the Existing Conditions
The Existing Compound - The Lakou
The existing Compound is commonly referred to as the lakou. It is a vernacular compilation of housing sharing a common space. It may be defined as any of the following:
- One occupied by one single family with extended relatives within the same ensemble (multiple homes within the same compound),
- One occupied by different families, independent from one another (configuration remains the same, multiple homes within a same compound), or
- One occupied by one large single family (one dwelling per compound).



Multi-family lakou



Single family lakou

The Existing Housing Types
The existing vernacular housing composition vary throughout the region and ca be classified across a transect as follows:

- Rural
- Urban
- Sub-Urban

The Rural Composition
Made with primarily available resources, these buildings embody sustainable design principles. However, commonly due to a lack of proper maintenance, the building structures were not as safe as needed. These structures were primarily constructed out of wood frame and either wood or clay finish.

Urban and Sub-Urban Composition
The sub-urban to urban composition include wood frame vernacular constructions, but also examples of CMU masonry structure, with tin roof or light slab roof, and at times poor ventilation systems, due to small or fixed window openings.

These houses may have a high floor slab, or may just be sitting on a simple foundation. However, the foundation of the structures reveal the opportunity for the building team to create a construction ready build kit based on the constructive systems they are already familiar with to improve constructability and their quality of life.

III. Strategies to address the needs
Following the identification of the family needs, the team's challenge was to identify how to address those needs using best architectural and building practices, while considering the use of, and access to very limited resources. Along with the needs expressed by the residents came the necessity to buttress the identity and the uniqueness of the community. It became evident to prioritize and cross-pollinate those goals and the possibilities.

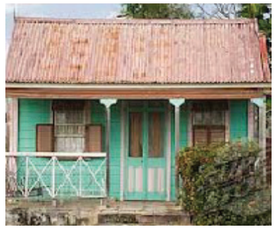
1. Cross ventilation possibilities
2. Possibilities for attached kitchen and attached bathrooms
3. Possibilities for attached bathrooms and detached kitchens
4. Infrastructure to handle the capacity for the bath waste
5. Infrastructure connectivity: shower/flushable toilet
6. Possibilities of keeping the Lakou concept even with indoor kitchen options
    a. As single family
    b. As a multi-family

IV. Recommendations: Proposed Housing Types
Ensuing consultations and explorations to address community needs, the team responded with a series of building proposals. The building prototypes address rural to urban areas of the region, keeping the uniqueness of the Lakou as either a single family compound or a multi-family compound or other use combinations. The Easy Build design kits include several alternatives, approximate cost, and construction methodologies. Each family home includes specific rooms (bedrooms, living and dining rooms), a kitchen, and a bathroom. The buildings are of: Concrete block with tin roof and Concrete block with slab roof.

The following options were included for locations where flooding may occur in areas such as Corail or Luly. Elevated concrete block with tin roof and Elevated concrete block with slab roof.

Estimated Building Cost
Current Base Cost is approximate and varies between $41 USD to $51 USD/square foot.
(At time of estimating building 1, USD yielded 45 HTG. Square footage quote is established on based current construction cost of $41/ sq. ft.)

Approximately 1,845 HTG/square foot
Size vary between 600 square feet and 1000 square feet



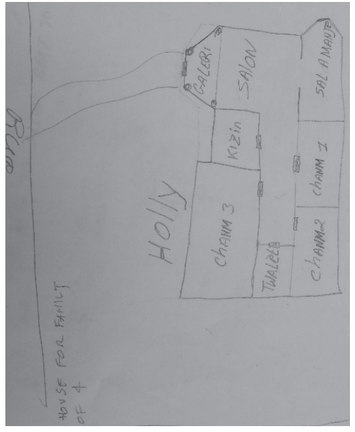
Rural Composition



Rural Composition



Urban and Sub-Urban Composition





Example of Sketch drawn by a workshop participant and a subsequent sketch by a Building Team member.

Interpretation of the sketch by Team Member: Derrick W. Smith

Rural to Urban Development Proposal Building Cost

Option 1
Proposed: CMU Block frames with metal tin roof
- Concrete Block
- Metal or wood framing for roof
- Tin roof

Priced at 41 USD/ sq. ft. - 1,845 HTG/ sq. ft.
Size vary between 600 square feet and 1000 square feet
Cost vary between 24,600 USD and 41,000 USD
Approximately 1,107,000 HTG to 1,845,000 HTG

Option 2
Proposed: Concrete CMU Block frames with Concrete slab roof
- Concrete Block
- Metal or wood framing for roof
- Reinforced light concrete slab roof

Priced at 41 USD/ sq. ft.- 1,845 HTG/ sq. ft.
Size vary between 600 square feet and 1000 square feet
Cost vary between 24,600 USD and 41,000 USD
Approximately 1,107,000 HTG to 1,845,000 HTG

Option 3
Proposed: Elevated CMU Block frames with metal tin roof
- Concrete/ pilings
- Concrete Block
- Metal or wood framing for roof
- Tin roof

Priced at 51 USD/ sq. ft. - 2,295 HTG/ sq. ft.
Size vary between 600 square feet and 1000 square feet
Cost vary between 30,600 USD and 51,000 USD
Approximately 1,377,000 HTG to 2,295,000 HTG

Option 4
Proposed: Elevated CMU Block frames with metal tin roof
- Wood pilings
- Concrete Block
- Metal or wood framing for roof
- Concrete roof

Priced at 51 USD/ sq. ft. - 2,295 HTG/ sq. ft.
Size vary between 600 square feet and 1000 square feet
Cost vary between 30,600 USD and 51,000 USD
Approximately 1,377,000 HTG to 2,295,000 HTG

Proposed Compounds
In keeping with the original settings of the “Lakou”, the team proposed a more sustainable option to include accommodation for septic tank to be later connected to a sewer system.

The proposed compound kept the vernacular settings of either a muti-family or a single family setting as illustrated respectively.

The proposed compounds will be accommodated with water and septic elements with the well positioned away from the septic tank; an area for livestock as typically observed in the “lakou”, and an area for organic gardening of herbs and spices.

A prototype of the “lakou” in the less rural area suggest a retail component to the Lakou facing the street, leaving the rest of the compound a completely private area for family business.

The lakou would take different shapes based on the arpent (land measurement) that governs its form - some more longitudinal than others, some more compact than others.



Rural to Urban: Option 1

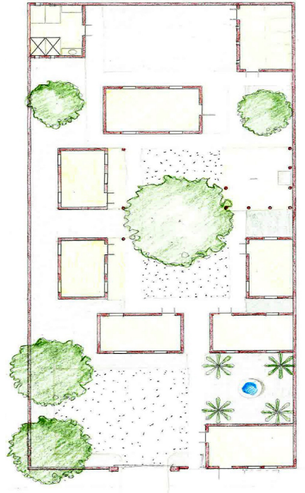


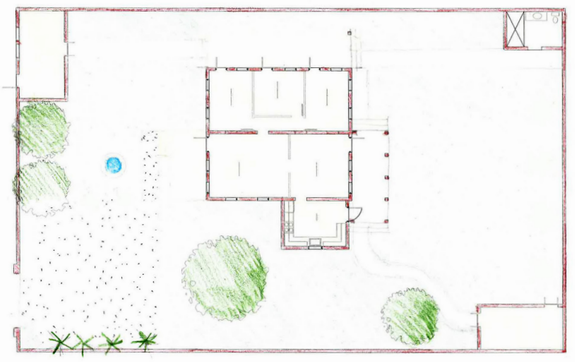


Rural to Urban: Option 2

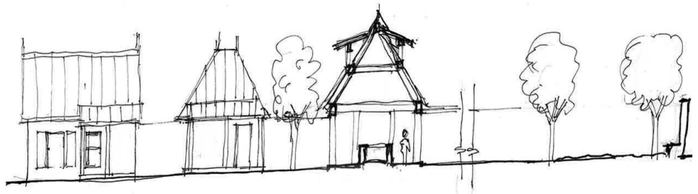


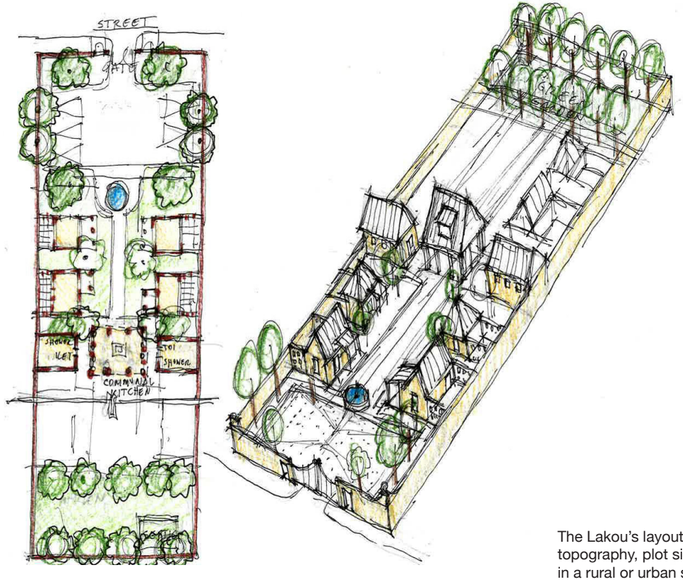
Rural to Urban: Option 3 and 4



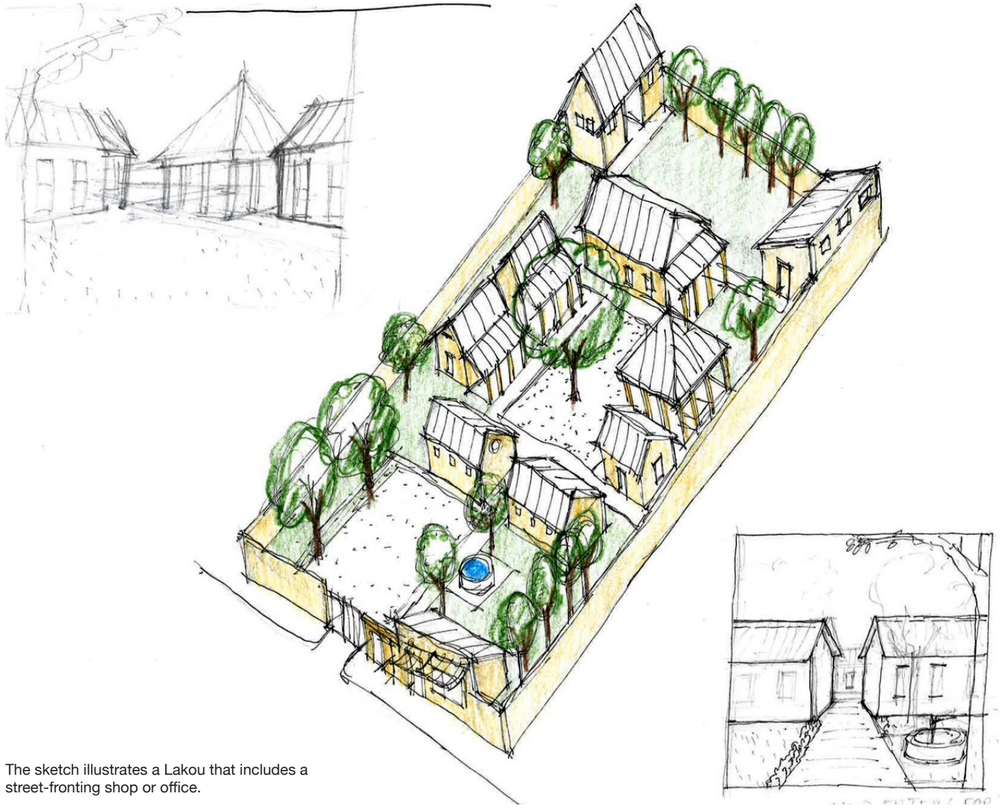


Rural to Urban: Proposed Compounds





The Lakou's layout will be determined by various factors, including topography, plot size, family size and needs, uses and whether it is in a rural or urban setting.



The sketch illustrates a Lakou that includes a street-fronting shop or office.

Nevertheless, the proposed “lakou” will promote a more liveable family unit, better sanitary condition, and potable water for the compound. It is not design to prescribe a new or imported way of life for the community; rather, a well attuned, and enhanced Haitian home design, with improved features to increase the quality of life for the users overall. The illustrations (on the previous two pages) are variations on the type, reinterpretations surely, but nonetheless, intergrated and contributing to the character of the community as a whole. All designs are based on the input of the local community participants in the building session charettes. Designs can be adapted to rural areas, as well as to a more urban areas within towns, with frontage and lot size determining site distribution and layout of buildings.

Sustainable Development Alternative
Proposal Building Cost
In an effort to provide locals with Resilient options that can take advantage of alternative building materials or are raised above flood plains, the following options were examined:
Cost vary approximate 10 to 20 USD/ square foot
Approximately 1,845 HTG/ Square foot
Size vary between 600 square feet and 1000 square feet

Option 1
Proposed: Light frame wood structural shell with coco-leaf roof. Using sustainable materials such as

- Available wood and existing wood weaving system for exterior walls framing
- Roof structure, and sheeting using locally grown wood materials, covered with
- Sidings made with weaving wood materials covered with local clay then painted over.

Size: 600 square feet at 10 USD/ sq. ft.
Total cost: 6,000 USD/ 270,000 HTG

Option 2
Proposed: Light frame wood structural shell with Tin roof

- Using available wood as siding and interior partitioned walls
- Tin metal sheets above wood beam frames
- With wood finish

Size: 600 to 800 square feet at 15 USD
Total cost: 9,000 to 12,000 USD/ 405,000 to 540,000 HTG

Option 3
Proposed: Light frame wood structural shell with clay finish and Tin roof

- In some instances foundation would need to be raised to above water level on wooden piles

Size: 800 to 1000 square feet at 20 USD
Total cost: 16,000 to 20,000 USD/ 720,000 to 900,000 HTG



Sustainable Development Alternative: Option 1



Sustainable Development Alternative: Option 2



Sustainable Development Alternative: Option 3a



Sustainable Development Alternative: Option 3b

















Modern Examples of Vernacular Typologies

Haiti Initiative: Planning for the Future of Arcahaie *Construction Materials Cost List Guide (Amounts may vary)*		
Items	*Cost in Gourdes*	*Equivalent in US*
3x3x5m³ of Sand (white)	4500	102. 27
3x3x5m³ of Sand (black)	7000	159.09
3x3x5m³ of ground Sand (white)	8500	193.18
3x3x5m³ of Rock	3500	79.54
3x3x5m³ of gravel	4500	102.27
1 Bloc (size 10)	25	0.57
1 Bloc (size 15)	30	0.68
1 Bloc (size 20)	40	0.91
1 line Iron 1/2	360	8.18
1 line Iron 1/4	450	10.24
1 line Iron 5/8	750	17.05
Ligature string (100 lbs)	2900	329.55
Wood		
2x4x16	500	11.36
2x2x14	450	10.23
2x4x12	400	9.09
1x4x14	250	5.68
1x12x16	750	17.05
1x6x16	450	10.24
Ordinary Nail chest	1500	34.09
nail for Sheet metal	1700	38.64
Screw for sheet metal (100 unit)	2000	45.45
1 Cement bag	320	7.27
6 ft of sheet metal	200	4.54
12 ft of sheet metal (more solid)	900	102.27

Items	*Cost in Gourdes*	*Equivalent in US*
Pluming Tube (Tuyau in French)		
4 inch x 10	240	5.54
3 inch x 10	230	5.23
2 inch x 10	130	2.95
Curve 4 inch	75	1.71
Tee 4 inch	110	2.5
2 inch	25	0.57
Tee 2 inch	35	0.8
Tube sch40 1 inch	500	11.36
Tube sch40 ¾ inch	175	3.98
Tube sch40 1/2 inch	150	3.41
Bushing 4 inch x 2 inch	100	227
Electric materials Per Unit (screw ¾)	*30*	*0.68*
Curve ¾	5	0.11
Andy box	30	0.68
Sexio box	30	0.68
Outlet box	30	0.68
Electric string size 12 (china) 500 ft	1500	34.09
Electric string size 14 (china) 500 ft	1200	27.27
Electric string size 12 (USA) 500 ft	4000	90.90
Electric string size 14 (USA) 500 ft	3000	68.18
Switch S	20	0.46
Plug	20	0.46
Safety switch	1000	22.72
Paints		
5 gallons acrylic	1050	23.86
1 gallon gloss	600	13.634

Action Plan

Sonia Chao, Principal Investigator
CUCD Director

The Charrette-based model provided the forum for true civic engagement as well as the cross-pollination of ideas among academics, professionals, leaders, civil society, and citizens. The Haiti Initiative Akayè Vision Report and Plan is a roadmap to sustainable development in the region. It respects the will of the people of Akayè and through drawings provides shape to their aspirations for the region.

Communities, civil society, and local leaders engaged in envisioning their future throughout the past 18 months of the Haiti Initiative are now with this report being handed over the baton to move ideas and concepts forward; entrusted with forging the long-term enactment of their Vision.

Common regional, town, and building scale priorities have been identified. A Vision has been outlined.

Challenges are large in scale or scope and they are diverse. Thus no singular entity or institution can affect all the change that is needed - not alone. A special coalition of individuals and/or organizations, with representatives from every segment of each of the communities is warranted. These individuals and organizations must share a common goal and agree to work together, understand, advocate, lead, and address core issues.

Priorities and Next Steps

The Haiti Initiative Akayè Vision Report and Plan addresses the voiced concerns of local citizens and leaders and directly responds to them with implementable recommendations. The first step to achieving their goals is to formalize this instrument and adopt its recommended strategies into central and local planning efforts.

Initial strides have already taken place within the Commune. At the mid-term mini-charrette held in March, all the community participants attending the closing presentation signed a poster indicating their support of the Initiative's design and planning proposal. They had taken full ownership of the Vision. It is their Vision.

During that same trip, those same participants formed a grassroots community organization: ECODA, intended to collaborate with local government leaders to make the Vision a reality in the years to come. Since their foundation, ECODA has met systematically to lay out strategies and begin to tackle the implementation of the Vision Report recommendations. They have begun with the Vocational School, meeting with Youthbuild International representatives and local government leaders to further define programming needs and to identify potential sites for the building. If nothing else, this Initiative has served to bring community activists together. This is a phenomenal beginning.

"Men anpil chay pa lou."
"Many hands make the load lighter."

United, the peoples' voice is louder, and thus they are in a better position to work hand in hand with local and central government and other members of civil society to expedite the realization of their Vision and to construct change. "L'Union Fait la Force." "Unity Makes Strength." That 'union' can be further nurtured and strengthened, with the active and consistent support of central and local government, and further capacity building and financing of Initiatives by public, private, and philanthropic groups.



Local Liaison, Local Coordinators and three of eight CUCD Design Team Members in front of Signature Poster, March 2014.

The establishment of two other grassroots groups, one focused on energy and another on agriculture - an Energy Cooperative and a Agriculture Cooperative- are highly recommended. In particular, Cooperatives can help women of the region have greater participation in economic development. A Cooperative can better negotiate prices, organize capacity building sessions on innovative (farming or energy producing) techniques, sales, accounting, and develop business plans for their long-term growth and success. An Agriculture Cooperative can partner with public, private and/or philanthropic groups to construct greatly needed refrigeration, processing and warehousing facilities, while an Energy Cooperative can also seek partnerships to introduce sustainable energy alternatives- from the scale of buildings to the scale of the region. Over time, either of these Cooperatives can develop sub-groups focused on different branches or specializations. ECODA is now positioned to collaborate with government, NGO's, private, public and philanthropic groups on the construction of civic buildings and spaces. In parallel an Energy Cooperative can focus on forging the implementation of energy independence, and an Agriculture Co-op can focus on the health of the region's natural resources, farming practices, and the economic stability and development of agriculture, including the introduction of sustainable farming practices, agro-tourism and eco-tourism. The three grassroots organizations can partner with each other to catalyze change and to support each other as needed.

Through this Initiative, the planning and design priorities of the people of Akayè have been defined and the Design team's recommendations illustrate best practices for their realization. These recommendations are in tune with central government's urban codes and international standards aiming towards sustainable and resilient development. Moving forward, local building officers, with some additional funding from central government can more closely and effectively work with residents to ensure that each increment of development in the region supports the people's overall vision for the region as documented in this Vision Report. Providing residents with information 'apriori' can make future construction efforts run smoothly and in accordance with safety standards. Closer supervision of building efforts across the region will safeguard against the construction of unsafe buildings.

The next steps following this Initiative include building stronger relationships between grassroots groups, citizens, and all levels of government. Ongoing, open channels of communication are key.

In the short term, after review and approval of these recommendations by corresponding government agencies, a Financial analysis (Pro-Forma) by local and central governments, of regional and town scale proposals is deemed indispensable as a first step. Further consultation with local communities, ECODA and other members of civil society in the region, existing or emerging, is central to progress, so as to define priorities for the Implementation phase, and together strengthen collaboration and accelerate decision-making.

As is, the Commune is underserved severely by infrastructure networks and educational and healthcare services. The bilateral benefit of planning and constructing new infrastructures and facilities in this region now is that it can over time more readily host larger population numbers, while fostering economic stability and improved educational and health standards in the present.

Immediate Action Needed

The Haiti Initiative Design team recommends that the construction of direly needed infrastructure networks (water, electricity, waste disposal, and roads) be prioritized alongside public health and education facilities, beginning with potable water, waste disposal. Without clean water and the proper disposal of waste, epidemics are never too far away.

Given that they are largely absent altogether, new infrastructure networks can jump directly to 21st century sustainably-minded alternatives, including wind-farms and the generation of hydro-electric power - that can in turn both aid in reforestation and the abatement of floodwaters. In the meantime, with the facilitation of civil servants and philanthropic groups, residents and businesses should be encouraged to utilize solar ovens and to build above the 100-year flood plain levels.

The protection of all natural resources - at sea, the shore, the plains or the mountains- are closely tied to the general health and prosperity of the region, and only when this is recognized across the board by everyone, everyday, will positive change to the region take off and be attainable by all of Akayè's residents.
« Sa ou plante se li ou rekolte »

Given the serious impact of flash floods on human life and property, reforestation of the mountain regions and of the coastal mangroves needs to be addressed as soon as possible. The terracing of the foothills of the mountains can greatly aid in slowing the rate of floodwaters while increasing arable land, and introducing innovative farming practices or crops, such as bamboo farms, thus expanding economic development as well. Mangrove restoration affects marine life, coastal erosion and protects communities from sea level rise and other natural menaces.

Public health and education are paramount. At the scale of civic buildings: a network of Medical Clinics across the region is needed immediately to serve both the Lowland and the Highland communities. Without access to higher education, the residents of the region cannot prosper. Thus, the construction of higher education facilities in both the highlands, and a regional vocational school, university satellites and research institutes in the Lowland is the key to a brighter future.

Low Hanging Fruit

Thanks to the interest of Youthbuild International to build a multi-purpose regional vocational center in the region, this goal would seem attainable in the near future. Vocational training can expand the region's workforce and certificate programs can make their students desirable employees.

The financing, long-term staffing and maintenance plans of each recommendation needs consideration in the present, as does the identification of partners for their implementation and long-term success. These civic projects are fundamental to the overall health and prosperity of the region.

Innovation and Sound Business Practices with Long term Impacts

The expansion of the tourism industry into non-mainstream alternatives can also represent new job opportunities and spin-off micro-businesses. Develop Agro-tourism and Hospitality Standards. Increase marketing of the region and institute a regional network of new activities, on and off shore as well as in the highlands to attract non-conventional tourists. Enable activities and groups that can lead to entrepreneurship and self-realization. Support start-ups with technical assistance and/or financial opportunities, such as seed money or lines of credit for key activities such as bamboo farms, terracing of the mountains, and bed & breakfast.

New industries, including waste disposal to bio-mass, trash recycling into building materials, and bamboo farms for construction are new industries to the area that can speed

up the recuperation of the region's environmental health, while generating new job sectors as well.
Regionally scaled civic and business centers along the National Highway can additionally serve to catalyze economic development across the territory, as can the construction of needed refrigeration, processing, warehouses, and distribution centers for agricultural goods.

Sympathetic Sustainable Development
A new coastal town, north of Luly, can host current and new residents to the region, while acting as a tourism pole, if well-conceived and constructed. To be clear, this should not be a walled-off community for the elite, but rather a mixed-use, walkable, real Haitian town, for the people of Arcahaie, with a range of businesses, services, and housing types, while reserving the coast for public use by all. A public-private partnership may be an ideal scenario for implementation.

The Future of Akayè
With a 'Vision Plan' in hand and on-going technical assistance made available, local leaders, civil society, and citizens at large, can harvest sustainable growth and economic self-sufficiency.

As any farmer will proffer, an abundant harvest requires care, responsibility, patience, and perseverance in the face of natural or manmade obstacles. A good dose of collaboration will go a long way too. The Implementation phase of this Vision Plan, the vision of the people of Akayè, will be no different.
« *Bondye do ou. Fe pa ou, M a fe pa M.* »

Haiti Initiative:
Executive Summary

Sponsoring Foundations
W. K. Kellogg Foundation
Barr Foundation

Grantee
Sonia Chao, Principal Investigator
Center for Urban & Community Design

CUCD Design Team

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Local Liaison
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Building Systems
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Haitian Historic Resources
Boukman Mangones
Shulman + Associates

Consultants

Civil Engineering and Sustainable Infrastructure
Joseph DeLuca
Crabtree Group, Inc.

Graphic Design
Anthony Calzadilla

Project Location/Study Areas
Akayè Commune: Lowlands (Coastal Plain sub-region between Cote des Arcadins and the Town of Arcahaie); Case Study Sites: Town of Arcahaie, Corail and Luly.



Project Duration
July 1, 2013 - November 30, 2014

Project Topics/Areas
Sustainable Community Development; Architectural Design; Including Health, Education, Environment
Easy-Build Design Sets for resilient construction.

Tangible Project Outcomes
A “Vision Plan” that acts as a road map to sustainable development -- a guide for public, private, and philanthropic investment.

Project Background
I. General Predicament
Natural disasters have mercilessly pounded Haiti over recent decades. Perhaps equally burdensome have been the unsustainable choices made by twentieth century politicians, architects and planners, contributing in no small measure to the current grievous physical and social disparities. The lack of services, infrastructure, education, and economic vitality, as well as the unhealthy living conditions found extensively across the island, bear witness to those unwise decisions. Miraculously, the Haitian spirit pervades nonetheless.

II. Historical Context
Haiti gained its independence in 1804 after a 13 year slave revolt making it the first free black republic in the world and the second independent state in the western hemisphere. These notable accomplishments changed the course of European colonies in the new world. Rallying behind the motto “L’Union Fait La Force,” the Haitian people fought to bring about change in their lives with courage tenacity and most importantly unity. The people of the Akayè region were the first to abolish slavery in the colonial new world and gain their independence.

III. Main Characteristics of Study Area
The Akayè Commune, 32 kilometers northwest of Port-au-Prince, in the West Department is divided into the coastal plains, and the highlands. The Commune is subdivided into 6 sub-sections and encompasses an area of approximately 2,500 km2. Due to the region’s varied landscape, from coastal mangroves to mountain top forests, there are various micro-climates along that natural transect, and as a result there is rich biodiversity.

The region’s capital is the town of Arcahaie; equipped with several civic buildings and public spaces, including the recently completed waterfront market. The town is laid out in a formal grid that is overlaid onto a French arpent system, and its architectural palette includes a range of interesting examples of wood-frame vernacular, Victorian gingerbread, to a more contemporary Art Deco style. Parcels are typically narrow and have multiple dwellings/buildings that result in a compact, high-density urban fabric.

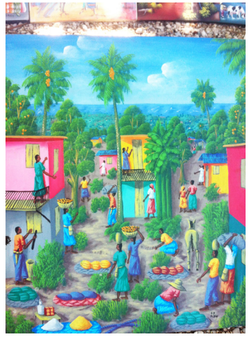
There are villages and hamlets sprinkled around the region, yet the population lives primarily in rural settlements, both in the coastal plains and in the highlands. Due to the historically fertile soils of the alluvial plain, the Akayè region is known as “Haiti’s Breadbasket”; traditionally, agriculture has been the engine driving the economy, and in more recent decades, tourism has played a growing role in its economic development. Additionally, the variations in topography throughout the region engender different microclimates resulting in rich biodiversity. Yet, those majestic steep mountains that form the backbone of the region also result in reduced arable lands, as well as flash floods.

The region lacks a network of roads, bike paths and pedestrian paths. There is one main road, the National Highway, which connects the settlements in the plains to the city of St. Marks to the north, and metropolitan Port



Source: Akáye Artist, Saint Leur Dorsainuil


Source: Akáye Artist, Saint Leur Dorsainuil


Source: Richard Bernard, Montrouis


Source: Richard Bernard, Montrouis

au Prince to the south. Secondary, often unpaved roads, connecting coastal settlements or the highland villages intersect the National Highway. The highway is often narrow and does not offer pedestrian's a safe paved path, thus the road is the site of fatal accidents as well as traffic congestion at main intersections.

The region lacks infrastructures. In general, the commune is under-served and offers its residents and businesses few basic infrastructure networks, including electricity, potable water, and waste water disposal. As a result, the quality of life is lowered, and the capacity of local citizens to rise above poverty is difficult.

The region wants for services. There is a lack of access to adequate healthcare and educational services; in the highland region, the situation is particularly dire. A lack of doctors and clinics in remote areas result in needless fatalities. Youth in search of a high school education have no option but to leave their families behind, and for better or worse, often worse, fend for themselves, resulting in teen pregnancies and drug addiction or gang affiliation. There is no college or University in the entire region, although several high schools in the lowlands refer to themselves as such.

Natural resources are at risk. Mangrove and highland deforestation, overfishing, and current agricultural practices, are scarring the land and in some instances, making the terrain, and thus its people, more vulnerable in the face of Sea level Rise and Climate Change, not to mention the increasing impact of these on economic development.

Refuse is everywhere. For as meticulously clean as private houses and private parcels are, the public domain is often overwhelmed with litter; far and wide from the coasts, to the open water gutters, channels, streams, to beaches and public streets, trash abounds. It is a public health-risk and underlines the lack of infrastructures or for that matter of 'pride of place'.

A land of risks. Luckily, the region has not seen the direct hit either of earthquakes or of hurricanes although it has experienced skirmishes with both. In the case of a direct hit, in either of those situations, the prevailing, poorly built structures would cave in and result in countless deaths. In the present, floods are already frequent natural occurrence, and because in the coastal plains the structures are not typically built above the 100-year flood plain level, every year, many humans perish. Losses also extend to agricultural crops and livestock, resulting in additional economic stresses.

Tourism offerings can evolve and include micro-business opportunities for residents. Traditional and vernacular buildings should be protected as well as imitated, as they create a sense of community pride and as an assemblage provide sources of income and skill generation for the local communities. This would result in an expansion of current tourism offerings in the region, which to date have been primarily focused on all-inclusive destinations, that limit trickle down benefits for local economies and families, as well as limit direct tourist spending or interaction with the local people in the community.

Agriculture is integral to the character and prosperity of Arcahaie. The backbone of the region's economy is agriculture. Yet, in recent decades, Haiti's Breadbasket has suffered losses due to soil erosion, flash floods, reduced crop yield, mono-crop practices, and inconsistent irrigation systems.

Residents ask for a better quality of life. Residents deserve access to food, clean water, and safe shelter; furthermore, if they are to prosper, they also need education, healthcare, public transportation, and a good paying job.

A region blessed. On a positive note, the region is naturally beautiful and it is culturally rich. The landscape is verdant, topography is breathtaking and just a mile off shore, the waters are deep and populated with marine life.

A vibrant cultural heritage is legible at every level of society. The commune is at the center of Haitian culture because it was the birthplace of the Haitian flag and thus of an independent nation. Every year, Haitians travel to the region to celebrate this milestone. The region is also a center of deep-rooted religious traditions, and is a treasure trove of talented artist and craftspeople. Full of natural beauty, history, art, and culture Akayè is fraught with economic opportunity.

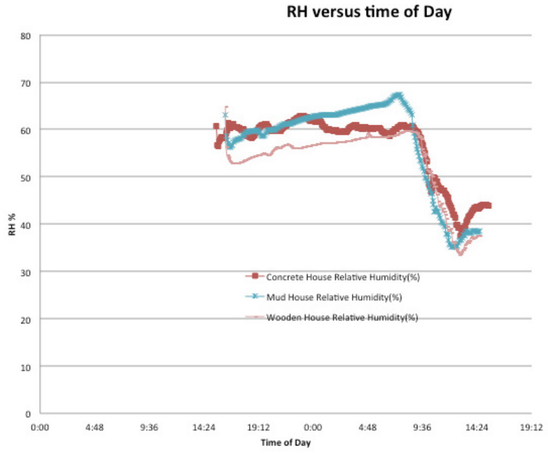
IV. Concerns Voiced by Local Residents, Civil Society and/or Local leaders

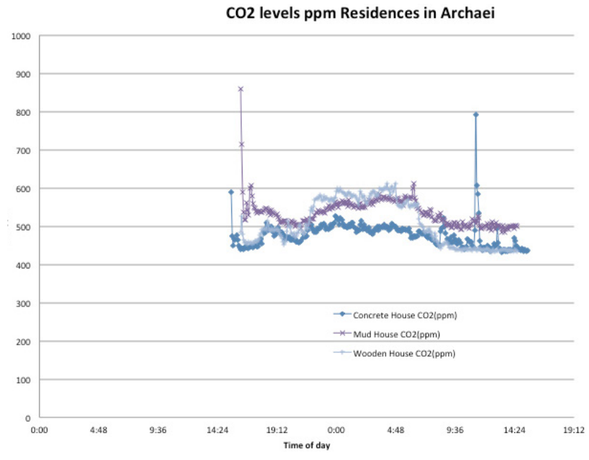
1. A lack of regional and local infrastructure networks hinder progress, impacting economic growth, health, and the general welfare of residents. These disconnections or deficiencies include: reliable electrical and water supplies, as well as safe pedestrian trails and modernized vehicular roads. A lack of potable water and limited topic-related educational initiatives have resulted in cholera outbreaks and numerous deaths. An insufficient network of paved roads limits commerce and trade.
2. Agriculture drives the economy. Farming tools are basic and feed and fertilizers are limited. Current agricultural practices do not benefit from affordable low-tech innovations that could lead to greater yields, crop variety, and year-round harvests. The highland's often-steep terrain coupled with flooding in the plains present multiple challenges. Long distances to markets, exchange hubs, or ports result in rotted crops.
3. Agri-tourism, cultural-tourism or Eco-tourism are viable economic development tools, which are not presently put into practice in the Commune.
4. Regional healthcare and educational resources currently under-serve the commune's communities. There is no clinic or even a doctor or nurse permanently stationed in some areas, only the intermittent presence of an NGO backed provider. Consequently, the infirmed must often travel long distances to reach medical assistance.
5. Local learning facilities are structurally basic and offer only an elementary level education. Highland children pursing a middle or high school education must abandon their families as young as the age of 12 and move to towns in the plains, where the only higher education facilities are located, placing a burden on their physical and social infrastructures that result in frequent instances of drug and child abuse as well as a very high rate of teen pregnancies and gang-related crimes.
6. Adequate housing is a countrywide concern. Lay people or masons with limited constructive knowledge, tools, or resources construct most housing. An inadequate number of machines, construction tools and building materials exacerbate the housing crisis as well as the quality of construction. Structural and material deficiencies present a hazard for both the residents of the building and their neighbors, made evident during the frequent periods of inclement weather and/or major weather events. At the heart of any healthy community is its civic life. Public spaces and civic buildings are largely missing in communities such as Corail and Luly and the traditional l' kou precedent has been at times lost at the scale of parcels and building designs.

Haiti Initiative

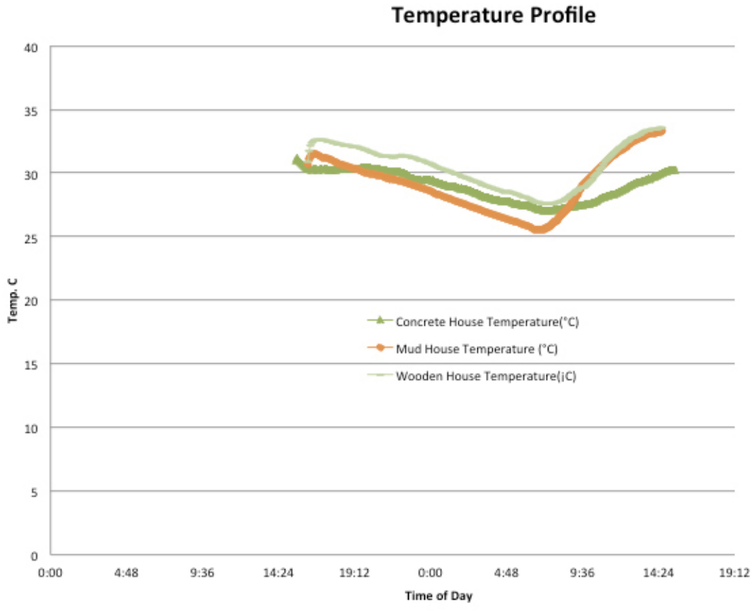
I. Haiti Initiative: Theory of Change

Opportunities and responsibility run hand in hand. With strategic interventions by each citizen, and the support of private, public and philanthropic sectors, opportunities abound, and today's adversities can mutate into viable, sustainable keys for change; unlocking the shackles of poverty and despair, by converting the rubble of destruction into the foundation for a region's prosperity; trash into recycled construction





Design Team (Building Scale) Analysis of Thermal Performance of Local Buildings, comparing concrete, mud and wood constructions.



Graph on opposite page, top left: The results from the house built using concrete blocks had better ventilation rates with lowest CO^2 levels, however all three houses were well ventilated.

Graph on opposite page, top right: Results indicate that wooden house had a better humidity control in comparison to other two.

The mud house controlled temperature swings much better than the other two housing types.

materials or compost to nourish the soil; a lack of wastewater disposal into biofuels; depleted soils into sustainable crops; steep mountains into stepped terraces for agricultural crops; deforestation into fields of thriving flora and fauna; and flood waters into hydroelectric dams and irrigation systems.

The seeds of change are in the hands of the people of Akayè, every day. If Creole is the region's principal language, and French is its second, then agriculture is surely its third language. Overwhelmingly, the population is in tune with, and understands, the fundamental role of agriculture to its economic development and regional prosperity. For this reason, the citizens of Akayè are themselves the seeds for the region's future crop of prosperity. Thankfully, they know all too well that life imitates nature- thus, sowing seeds while saving seeds for a future crop, nourishing soil, protecting crops, and harvesting the land's yields, parallel how the region can prosper and reach economic development. This concept is at the root of sustainable development.

'Significant Change' is possible as long as each resident, business, and government, at all levels, recognizes the interconnectedness of manmade and natural systems, and by each owning their contributions to those cycles, for the betterment or the worsening of the region's health and the population's long-term well-being and prosperity. The future of the children of Akayè depends on each single action taken by every single individual, each day. Those children will reap the harvest that their parents and grandparents sow for them, and for this reason, each action actually does matter. When this mindset has taken over, only then, will a healthy, vibrant, and long-lasting economy thrive.

II. General Initiative Objectives

a. Creating a Community-Owned Vision Plan through true civic engagement and community participation;
b. Increasing Female and Youth participation in community process and decision-making;
c. Learning and Analyzing the region's Strength, Weaknesses, Assets and Threats (SWA[O]T;
d. Consulting local leaders, civil society, citizens, and experts;
e. Proposing Implementable Initiatives for the short-term (Building Scale), mid-term (Town Scale) and long-term (Regional Scale);
f. Increasing Local Participants in Community Building and Development (meetings with the local leaders, engaging CIAT, etc.); and,
g. Disseminating Findings and Recommendations.

III. Breakdown of Study Area

There are three distinct but interrelated areas of overall study, each with a myriad of concerns and potential as well as opportunities for private, public and philanthropic investments. This proposal focuses exclusively on the following areas within the Lowland sub-region:

a. *Coastline:* [i.e. Cote des Arcadins, Luly] - Tourism, new settlements, ports, commerce, education, and economic development.
b. *Plains Villages:* [i.e. Corail]- Place-making, education, civic buildings, sustainable agriculture, economic development and guidelines for sustainable and secure building practices.
c. *Urban core:* [i.e. Arcahaie - Historic Town] - Eco-Cultural tourism, port revitalization, urban Infill and urban fabric preservation and restoration.

IV. Breakdown of Team Goals

A. Regional Scale

a. Identify opportunities for climate mitigation, resiliency, and eco-friendly economic development.
b. Promote social and physical interconnectivity between villages.
c. Develop a network of feasible roads and alternate paths and connections for vehicles, pedestrians and bikes.
d. Encourage infill development and discourage green-field development to protect arable land and natural resources.
e. Identify sustainable, compact and walkable urban and rural settlement patterns.
f. Identify the best locations for 'regional' educational and medical facilities - using need based, population density data.
g. Identify opportunities for regionally scaled public spaces and job centers, such as regional markets, exchange hubs, industry, and special districts.

B. Town Scale

a. Identify existing or proposed schools and other public buildings in a given village center around which complimentary uses can be added to enliven civic life and/or provide needed services or public spaces.
b. Identify local educational, health clinics, recreational, and other prospects for civic buildings and/or spaces.
c. Propose housing and commercial opportunities (repair and new construction).
d. Identify and propose public infrastructure and road networks.
e. Promote local histories and foster travel/tourism opportunities through architecture and town planning that celebrate Haitian culture.
f. Propose sustainable and renewable energy sources.
g. Promote urban agriculture, fish culture, local trades, and/or other sustainable economic activities.

C. Individual Family Scale

a. Identify typical family needs and develop easy building planning set options.
b. Propose housing types and construction methods that respond to natural risks, local climatic needs, customs, and incorporate readily available regional materials.
c. Identify sustainable, low-technology energy, water, and sanitation systems.
d. Identify sustainable urban agricultural practices.

V. Deliverables

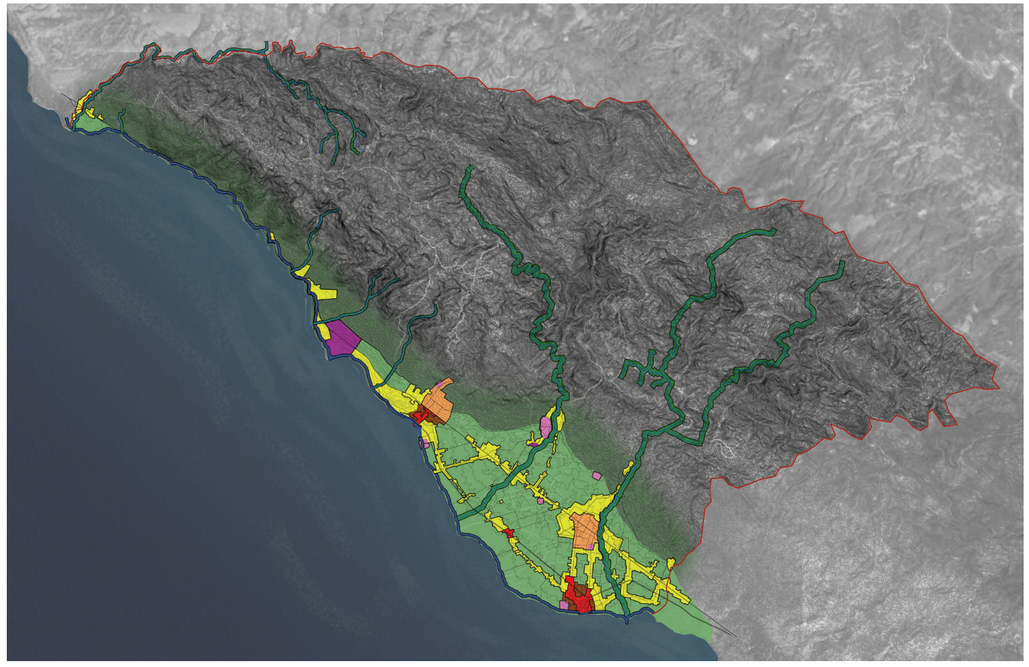
a. *Regional Team:* Regional Plan; Infrastructure Recommendations (Long term, Mid-term, Short term).
b. *Town Team:* Agro and Eco-Tourism Recommendations; Town Planning Principles, Case Studies: Arcahaie, Corail, Luly; Civic Building Templates: Clinic, Vocational School.
c. *Building Team:* Easy-Build Kits; Resiliency Recommendations; Construction Cost Estimates.

The Arcahaie Vision Plan - An Overview

Regional Scale Recommendations

I. Regional Plan: A Regional Plan provides an overview of strategies and illustrates existing and recommended patterns of development for an entire region, so as to guide predictable and sustainable growth.

a. The Regional Vision Plan permits leaders and their agencies to set priorities and to envision the development of the Commune over time.
b. Regional plans have long-term goals and objectives, and are intended to serve the region's entire population, with the aim of coordinating and orchestrating development in a coherent manner for a given region that is to the benefit of all residents. That long-term optic is essential to the overall health, prosperity, and economy of the entire Commune.
c. The Arcahaie Regional Vision Plan addresses the voiced concerns of local citizens and leaders and directly responds to them with implementable recommendations.



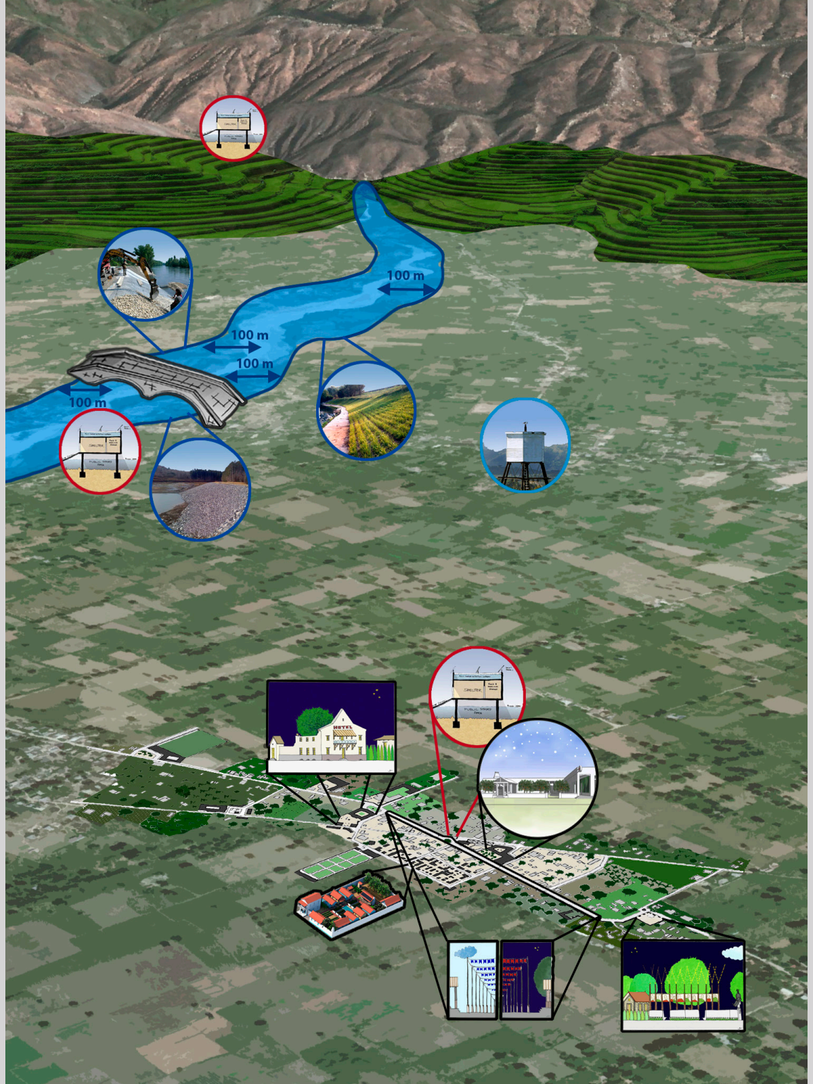
Proposed Regional Plan



Overview of Vision Report Regional Team Recommendations



Overview of
Recommendations
within or surrounding
the town of Arcahaie



Overview of
Recommendations
within or surrounding the
rural settlement of Corail



Overview of
Recommendations
within or surrounding
the Village of Luly

d. The first step to achieving their goals is to formalize this instrument and adopt its recommended strategies into central and local planning efforts.

The main sectors of the Region are broken down into two main categories: Natural Preserve Sectors and Settlement Sectors, whether they be urban or rural. The aim of the plan is to preserve agricultural and natural lands and eliminate the possibility of sprawl development.

a. In the Arcahaie Regional Vision Plan, existing settlements, which currently have urban characteristics and population densities, or have that potential are assigned as 'Urban Sectors'.

b. Urban Sectors have already been developed and are subject to successional development or are in need of protection, repair, or completion.

c. Population in these sectors is expected to continue to grow and thus place even greater burdens on an infrastructure that is already weakened or absent altogether. Therefore, these sectors should be a high priority for development and infrastructure improvements.

II. The Four Main Objectives of the Arcahaie Regional Vision Plan

The Arcahaie Regional Vision Plan has four main objectives: Climate Resiliency, Social and Economic Development, Improved Quality of Life, and Environmental Conservation and Reparation. The Vision Report subdivides objectives into topics, with 'Actionable Items' in each instance.

a. Climate Resiliency
   1. Deforestation & Erosion
   2. Riverbed Restoration
   3. River Embankment Reinforcement
   4. Coastline Restoration and Management
   5. Flood and Erosion Prevention and Proposed Check Dam Locations
   6. Natural Disaster Emergency Shelters - General Location and Area of Service
   7. Renewable Energy Source Proposed Location for Wind Farm

b. Social and Economic Development

Road Infrastructure
   1. Existing
   2. Proposed
   3. River Crossings
   4. Water Taxi System
   5. Commercial Taxi System

c. Improved Quality of Life

The Arcahaie Regional Vision Plan Proposed Land Use Map, Settlement Sectors are;
   1. Urban
   2. Urban Growth
   3. Rural
   4. New Town Development
   5. Regional Node Sectors/Regional Centers

Special Districts
   6. Water Infrastructure
   7. Potable Water Storage and Service Area
   8. Wastewater Infrastructure - Wastewater Treatment and Service Area

d. Environmental Conservation and Reparation
   1. Coastline Management
   2. River Embankment Reinforcement
   3. Natural Preserve Sectors - Sectors and Buffers
   4. Natural Preserve Sectors - Agriculture Reserve

III. The Arcahaie Regional Vision Plan - Actionable Items

a. Coastline Management

1. Proposed 100m coastline setback for mangrove restoration, dune protection and/or public beach access. Encroachments only for fishing and civic related activities.

2. Proper urban setback for urban allocation is



Coastal Management

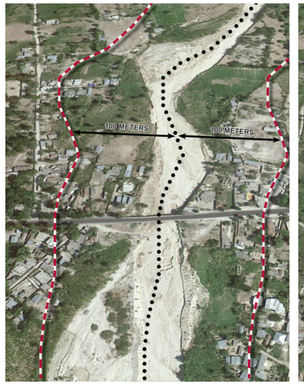
more than 100m from the coastlines in order to avoid flooding during rain events, sea level rise impacts and/or vulnerability towards tsunamis.

b. River Embankment Encroachment
For the sake of protecting human life from flooding hazards:
1. Require that new buildings in the Lowlands construct all habitable areas in any new structure above the 100-year flood plain criteria.
2. Enforce a 100m setback from the centerline of the riverbed.
3. Avoid Building (urban or rural buildings or settlements) Encroachments within the 100m setback.

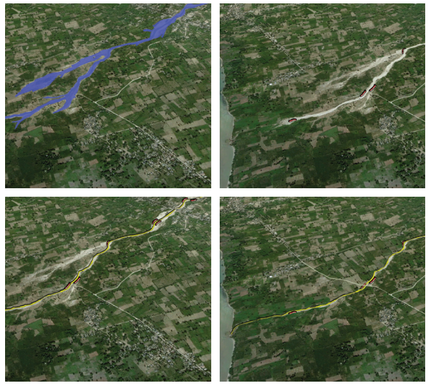
c. River Embankment Reinforcement
For the sake of restoring natural vegetation or protecting agricultural lands from flooding hazards:
1. Identify and map all Ravine Overflow Protection Locations as well as all sites needing Riverbed Restoration.
2. In areas alongside a ravine's path, restore naturally vegetated corridors or limit agricultural crops to those that can withstand the impact of occasional flooding, such as rice fields.

d. Natural Preserve Sectors - Setbacks and Buffers
1. Natural Preserve Sector shall consist of areas that should be, but may not yet be permanently protected from development.
2. This includes setbacks or buffer zones from existing ravines and the ocean front, for reforest-ation, to prevent flooding hazards and to preserve their conditions as natural corridors for the overall health of the environment as well as the population.
3. Larger ravines, formed from multiple branches of natural drainage, should require a minimum of 100 meter setback from its center to protect life and property.
4. Smaller ravines should require a minimum of 50 meters setback from its center.
5. Due to the real threat of sea level rise worldwide, a setback of 100 meters from the natural coastal edge should be required. This setback also promotes public and unrestricted access to the ocean, along with the restoration of mangroves, where appropriate along the coast. Aside from the mangroves capacity to stabilize waterfront soils and to protect inland areas from sea level rise, an additional reason to promote mangrove restoration along the coastline is that it creates the potential for a sustainable marine aquaculture, which not only can expand fishing capacities if properly managed but also motivates nature-seeking tourists to explore the region.
6. These setback recommendations require further collaboration between the Central and Local Government and their respective governing agencies, with local or international Not-for-Profit organizations, Citizen groups, and Environmental Technicians to determine how to best implement these strategies, identifying case by case applicability and specific dimensions of the setback throughout the coastline and ravines. The final dimensions of setbacks would be determined by a combination of determinants, including: topography, soil conditions, ownership, accessibility to public beaches, and flood risk.

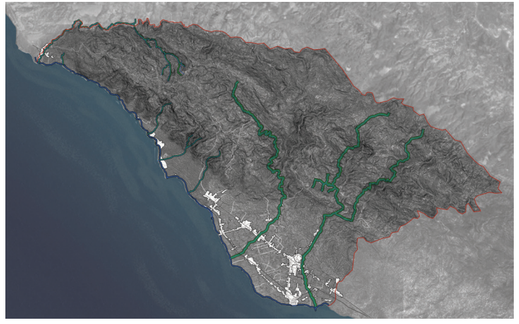
e. Natural Preserve Sectors - Agriculture Reserve
The Arcahaie region has a unique situation with not only the option to secure food for its population, but also to export to other regions, as well as to international markets potentially.
1. The delta plains, Lowland region is constantly threatened by flooding and erosion, primarily due to man-made deforestation of the mountains.



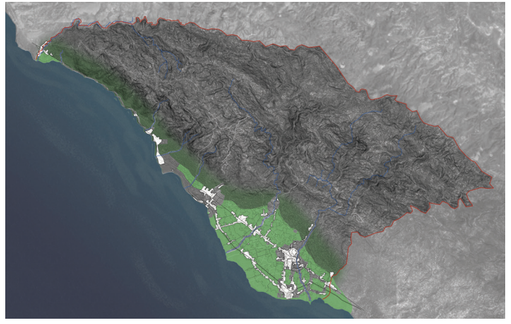
River Embankment Encroachment



River Embankment Reinforcement



Natural Preserve Sectors - Setbacks and Buffers



Natural Preserve Sectors - Agriculture Reserve

Introducing terraced farming all along the foothills of the mountains will increase farming activities, stabilize soils, and slow the movement of water down into the delta plain. This strategy needs to be coupled by a rehabilitation of the natural eco-systems across the region so there is a balance between agricultural activities that provide food and economic opportunities with natural preserves that sustain the health of the overall natural realm.
2. Cities, towns and villages that hope to thrive in the long run must secure and enlarge their productive farm belts in such a manner as to minimize their impacts on their host natural environment. As the costs of energy climbs, long-distance food sourcing will become increasingly untenable, and urban areas without an agricultural hinterland will have difficulty feeding themselves within their means. Thus proper farming techniques, crop cycling, protection of soil quality and efficient and reliable irrigation systems are needed.
3. Properly preserved and managed Agricultural Sectors may also be a great potential for Eco-tourism, Agro-tourism, and can host Volun-tourism to the region.
4. These strategies are best accomplished at the regional level by allocating Agriculture Reserve Sectors and Re-vegetation Sectors. The Re-vegetation Sector must include all native ground cover, shrubs and trees and also may be suitable for slope agriculture through terraces which also prevents flooding and erosion, after control of water resources is achieved.

f. Regional Poles
1. Regional Poles should be constructed near the main intersection into Arcahaie and also the main intersection leading into Luly, where population densities are greatest and existing roads facilitate access to and from the Highlands as well. New Regional poles are conceived as serving the larger region.
2. The region needs a major commercial market hub, equipped with refrigeration, warehouses, and a food processing center to increment jobs and agricultural activities while reducing crop losses. If located along the National Highway near the intersection leading into Luly and centrally located to highland communities as well as the vast agricultural lands that surround the area, this new hub,can compliment the port-side market recently built in the town of Arcahaie, which in turn can serve as a staging ground for seabound exports to other regions or eventually other neighboring countries, while it caters to local residents and prospective tourists as well. A secondary dock and storage facility can be located near Luly as well.

g. Building Infrastructure
1. Build an arterial road for heavy truck traffic connecting Port au Prince, Arcahaie and Luly, the two proposed Regional Centers, and the proposed Industrial Center/town by the foot of the mountains, approximately half-way between these last two communities.
2. Develop a network of new pedestrian trails in the Lowlands, and hiking and biking trails, as well as zip-line activities in the mountains, which can generate new micro-businesses, such as rentals, while augmenting or connecting tourist attractions.

h. Flood Control and Economic Development
1. Expand arable lands. Terracing the foothills of the mountains, all along the region, can provide new areas suitable for reforestation and agriculture, thus expanding the capacity of this industry while affording large scale general benefits, such as water management, erosion and flooding controls, not to mention, restoring nature's balance in the region.
2. Introduce new job sectors, related to construction materials, bamboo farming, food processing, while expanding offerings in the Eco-tourism and Agro-tourism sectors, as well as the mainstream hospitality and tourism offerings.
3. Promote and nurture new job sectors in alternative energy, green industries, and the recycling of trash and biowaste matter. In all cases, these sectors tread more lightly on the planet's resources and result in a healthier environment as well as a more reliable source of energy and more affordable building materials, as recycled materials for construction are derived from what is currently a nuisance: used plastic and paper or bio-waste.
4. Specialized small businesses can be created and incentivized to collect trash while others can process the material for re-use. As this sector grows, the current dependency on coal derived from wood, would be reduced and hopefully soon eliminated, at once generating healthier air quality and the reforestation of the region.

Infrastructure Recommendations

General Overview

The subject study region area consists of two distinct geologies: Lowland flat plains that are productive irrigated agricultural land with several medium to small urban enclaves, and Highland mountainous areas non-irrigated farmland that takes advantage of the generous rainfall in the higher elevations. In both areas potable water, wastewater and energy infrastructure is nearly non-existent. In the Highlands transportation infrastructure consists of primitive dirt roads that are dangerous, steep and subject to frequent flood washouts. The Lowlands is bisected by the national highway route 1 and has a network of rural roads and streets. A significant percentage of the population lives in the Lowlands. There are no formal population estimates for the subject areas. The population of Arcahaie is approximately 102,000 and the majority of the population lives in urban towns, villages and hamlets. The major preventable causes of disease and death are waterborne and vector borne illnesses and flood events. Charcoal is the primary fuel source for cooking and the primary cause of deforestation in the country.

The strategies in this section of the report are developed into priorities for three timelines: Immediate, for those strategies that can be implemented by locals and NGOs with no Federal support; Intermediate, for those that can be implemented in 1-10 years with NGO support and limited Federal support; Long Term, for those strategies that can accomplished in 11-50 years with significant NGO and Federal support.

Recommendations

I. Water Resources Supply and Quality

a. The most logical water resource plan is to investigate the construction of dams on the existing rivers to reduce flood events.
b. Increase the availability of water for domestic use and irrigation and potentially provide small hydropower.
c. The topography is steep in the Highlands which eliminates the possibility of large reservoirs. A series of small dams is a more likely scenario.
d. Increased irrigation can recharge the aquifer and reduce saltwater intrusion as well as improve groundwater quality.

II. Flood and Erosion

a. Remove drainage sediment from major drainage channels and hardened low water crossings on road washout locations as immediate actions.
b. Construction of small check and sediment dams

and aerial re-vegetation as intermediate actions.
c. Study potential construction of major flood control dams on the Riviere Aubry and the Riviere de Mathdeux as long term actions.

III. Potable Water

a. Immediate action should be taken as the highest priority to provide safe and affordable drinking water to the majority of the population who are at risk of disease.
b. The recommendation for immediate action is to provide a common sense low cost sand filter water treatment system that will provide potable water access to each family or Lakou unit across the region. The common design will facilitate efficient training, education, and distribution. The estimated cost per family or Lakou unit is $60.00 USD shipped to Haiti, if import fees are waived. A small number of these units are already being distributed by an NGO in Haiti with success.
c. The life of the units is estimated at ten years. The estimated cost for the region is $300,000 USD for 5,000 units each serving 10-20 persons for a total of 50,000-100,000 people.
d. Intermediate recommendations are on-site wells with filtration and chlorination treatment and limited storage for civic buildings, schools and neighborhood standpipes.
e. Long term recommendations are centralized water systems with distribution mains and large storage reservoirs or tanks for provision of water to neighborhood central facilities and eventually house and Lakou services.
f. The intermediate and long term recommendations require engineering and additional planning to develop capital costs and operational costs.

IV. Wastewater Sanitation

a. The recommendations for immediate action are a regional education of the populace on the health risks and death rates due to poor sanitary practices; training, maintenance and standard designs for construction of Ventilated Improved Pit Latrines, which would be more acceptable to the population (estimated cost $200 - $400 USD per home or Lakou; and septic systems for civic buildings such as hospitals and schools, at $3,000 - $10,000 per site.
b. Intermediate recommendations include retrofits of existing homes and Lakou with compact septic systems at $800 to $1,500 per unit; installation of public toilet facilities at marketplaces, bus and other transportation stops and public service buildings.
c. The long term recommendation is to plan, engineer and construct central sewer collection and wastewater treatment systems for the Town of Arcahaie and other urban areas. These systems should provide primary and secondary wastewater treatment to World Health Organization Standards. Assuming a population of 100,000 for Arcahaie the cost of a sewer collection system is $20,000,000 USD and a wastewater treatment plant is $31,000,000 USD. The total cost for sewer and wastewater treatment is approximately $280 USD per capita.

V. Energy

a. Based on the current lack of energy infrastructure and the projected long term struggle to install a national infrastructure in Haiti it is recommended that the regional strategy be developed based on distributed energy production in the immediate and intermediate term.
b. The long term recommendation is a Wind/Solar national energy grid.
c. A small wind or solar unit for a household or Lakou is likely in the range of $1,000 - $2,000.
d. It is further recommended that efforts be primarily focused on renewable energy resources such as solar, wind, tidal and biomass. Haiti is well suited for hydropower, solar photovoltaic, and wind energy.
e. Recent infrastructure improvements in the region funded by NGOs are utilizing solar and wind.
f. The region has significant agricultural waste biomass that could be utilized for energy generation.
g. The trash problem could be solved by incinerating trash in the biomass energy generation facilities.
h. The priorities for energy are power for water and wastewater treatment, hospitals, schools and other critical services.

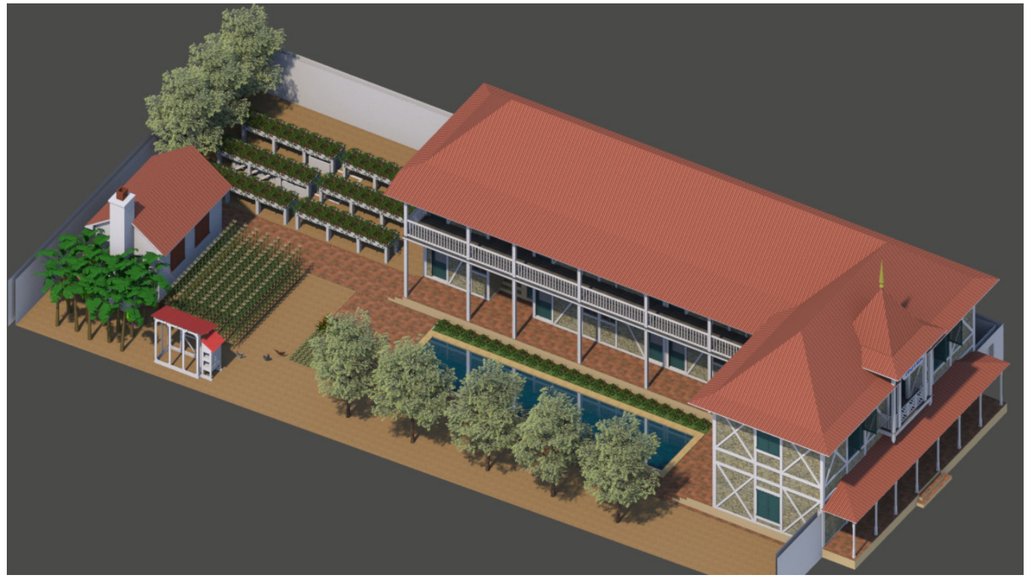
VI. Transportation

a. The most critical transportation need in the region is an affordable and timely freight service to move agricultural products to the Port Au Prince Market using the Town & Villages as collection hubs.
b. The freight system can be by highway or waterway.
c. The second most critical transportation need in the region is a reasonable road system into the Highlands so that Highland farmers can transport their goods to the Town & Village freight hubs.
d. Agriculture is the main economic engine of the region and its main limitation is transportation to market.
e. Tourism will also require an improved transportation system.
f. It is recommended that the primary personal mode of transportation continue to be walking, bicycle or motorbike; limiting the demand for fossil fuels and keeping personal transportation cost low.
g. Highland roads should be improved to reduce flood damage and provide a smoother, more durable driving surface.
h. Commercial docking areas should be constructed at each Coastal Town and Village to facilitate waterway freight and transportation.
i. Small scale biodiesel and ethanol utilizing agricultural waste products should be considered to provide an affordable and renewable fuel source for transportation.
j. Small scale decentralized energy production would lower transportation costs.

Town Scale Recommendations

I. Sustainable Economic Development - Agrotourism, Ecotourism: The future of every community lies in capturing the passion, energy, and imagination of its own people. The role of government and of NGOS's or local non-profit providers is to facilitate education opportunities that can lead to self-realization, and support start-ups with technical assistance or financial opportunities such as seed money or lines of credit. Because of on-site investigation, research compiled, and concerns voiced by local stakeholders, it is clear that needs are great and complex, thus an integrated, comprehensive intervention is needed to improve food security, economic development, protection of natural resources, and the social welfare for Arcahaie's residents.

a. Social Development
   1. Create a Community of Facilitators to advise residents on Haitian entrepreneurship opportunities, education options, technical issues, and potential funding.
   2. Engage locals with consistency and ask: What do you need, what can you do?
   3. Support those that seek help to activate the community.
   4. Develop Vocational Education and Training Programs.
   5. Provide training and education in Agrotourism Development.
   6. Seek and form partnerships with universities worldwide, to focus on programs and projects, involving agriculture, aquaculture, and tourism.
b. Economic Opportunities in Agriculture



Aerial View of Proposed Bed & Breakfast Inn, illustrating fruit trees, raised beds and aquaponic features

and Aquaculture
1. Establish an Agricultural Cooperative.
2. Establish a Regional Market Structure with adequate Refrigeration, and Food Transformation Facility.
3. Build and Operate a Regional Fish Market and Processing Plant.
4. Creating a Revolving Loan Fund and/or Tourism Economic Development Grant Fund.
5. Support Rice Farming, using System of Rice Intensification (SRI) (Re: Cornell University Model).
6. Promote & Facilitate a Conch (Lambi). Aquaculture Facility.
7. Promote & Facilitate shrimp aquaculture - on-shore and in mangroves.
8. Promote & Facilitate ocean net-pen fish farms.
9. Promote & Facilitate closed system land-based fish farms.
10. Investigate the potentiality for Australian Red Claw - Farms Commercial Scale Aquaponics Systems.
11. Promote & Facilitate Small-Scale Subsistence Aquaponics Systems.
12. Promote & Facilitate Certified Organic Crops.

c. Tourism Development
1. Develop Agrotourism and Hospitality Standards and Ranking System.
2. Encourage adoption of the plan by creating a national marketing plan to promote properties that meet or exceed the standards.
3. Provide hospitality training and start-up funding for new or adapted medium-size (~12 room) Bed and Breakfast inn enterprises.
4. Facilitate and provide start-up funding for the Adaptive Reuse and Preservation of Historical Buildings in Arcahaie, within the proposed Historic District of the town of Arcahaie.
5. Assist farm families in developing accommodations for agrotourism that meet adopted hospitality standards.

d. Industry
1. Promote & Facilitate Banana bagasse adaptive reuse. Banana fiber can be made into fabric that is much sought after in global markets. Banana fiber can also be used as reinforcement in concrete construction.
2. Promote & Facilitate Biomass pelletizer factory to replace charcoal used in fuel.
3. Promote & Facilitate Biomass pellet stove manufacturing plant.
4. Attract foreign manufacturing facilities to open shop in the areas thereby creating jobs.

e. Environmental
1. Address soil erosion and watershed problems.
2. Promote & Facilitate terraced farming and gardens in Highlands for water management as well as increased productivity.
3. Promote & Facilitate Retention ponds for irrigation and aquaculture.
4. Promote & Facilitate Soil rebuilding projects.
5. Promote & Facilitate composting agricultural waste.
6. Promote & Facilitate Composting Toilet (SOIL).
7. Promote & Facilitate Composting and Holistic Planned Grazing to enrich the soil and reverse desertification.
8. Promote & Facilitate Wood Gas Generator.
9. Promote & Facilitate Biogas Collection.
10. Promote & Facilitate Banana adaptive reuse.
11. Promote & Facilitate Algae Biofuel Production.

II. Towns Plans

Case Study Sites: Arcahaie, Corail and Luly

The following urban and rural interventions provide a range of projects for new construction and the rehabilitation of

historic areas, landscapes, public space, and buildings:

A. Arcahaie

a. Waterfront Plaza: Appropriate the waterfront block with a public space consisting of water and land areas, including street extensions, two new docks to enclose a small harbor for loading and unloading of goods, for tourist yachts, fishermen boats, or for water taxis. Reuse former coal market block with a new waterfront plaza consisting of a commercial plinth on the north, with a row of oversized lotto cabins - spelling the slogan imprinted under the coat of arms of the Haitian flag “the union makes the force (l’union fait la force)” thereby heralding that this region is the birthplace of the new nation,- a museum building on the east, and a small hotel on the western side.

b. Regional Museum and Hotel: a regional museum displaying the history and development of the Arcahaie region and a small hotel would serve the tourist community arriving to the city from Port-au-Prince or other regions of Haiti. The hotel would flank the entrance to the central historic district and the hotel would serve as the gateway to a formal waterfront park. The hotel does not turn its back on the town, but rather acts as an integral contributor to its urban fabric and life.

c. Waterfront Park: a park provides a place for locals and visitors to stroll and socialize. It is also the culmination of the waterfront landscape restoration proposed by the Regional Team.

d. Wall of Complaints: the waterfront park begins/ ends with a screen-like type of wall where political images or social slogans may be painted or projected on its flat surface - a fine democratic tradition which has endured for centuries in many African settlements, as well as cities such as London and Rome.

e. Waterfront Landscape Restoration: a buffer of approximately 100 meters should be preserved and replanted with the same type of landscape found along the unspoiled coastlines of Haiti.

f. New Coal Market: notwithstanding the fact that coal must be acknowledged as an unsustainable energy resource, the existing coal market must be relocated to an area with more natural surveillance - an area where coal pollutants may be better contained, re-used, and recycled.

g. Working Waterfront: lots adjacent to the new coal market could be re-utilized as potential waterfront businesses with storage facilities and with the capacity for deliverance of goods and services.

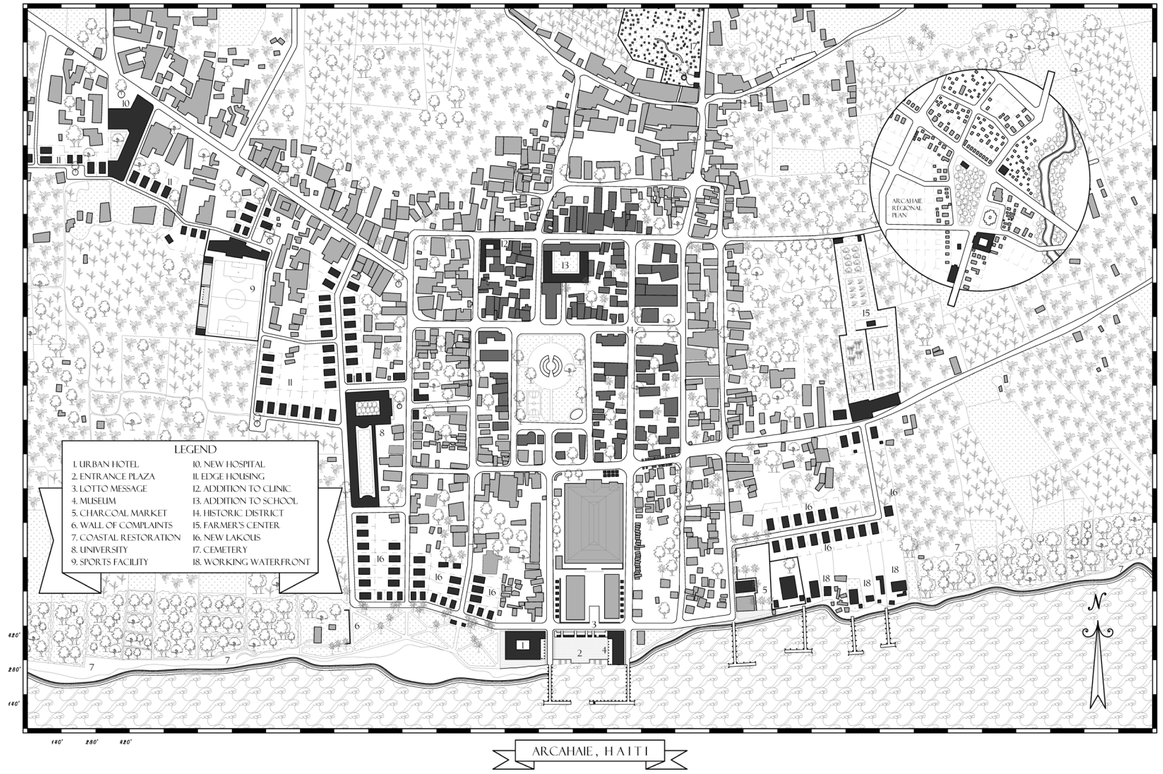
h. Lakou Compound: a new city edge will be formed with a conglomeration of Lakou(s) on individual lots (see Urban Lakou proposals produced by the Building Team). The Lakou model remains the fundamental layout on plots.

i. Farmer’s Capacitation Facility: a capacitation facility to provide technical schooling to farmers in the region. This facility could also act as an experimental laboratory for new sustainable agriculture with its obvious agro-tourism ramifications.

j. Regional Market Reconfiguration: the recently constructed regional market would be regulated for hygiene and its location and activities would be fixed to the existing block - without informal street spillovers.

l. Flag Memorial: the existing flag memorial would be reinforced with Lotto Cabins marching in rhythms along the main street. These cabins would frame the monument and could serve to give a clearer baroque approach to the site.

m. Historic District: the nomination of a new historic district, surrounding the main plaza and some of the side streets, would be accompanied by the restoration of its buildings and natural landscapes. This living district and its current material culture



Proposed Arcahaie Town Plan

would become an important tourism attraction in the area of Arcahaie. It can be enlivened with small shops, cafes and bed & breakfasts. Any new additions to the district need to be sympathetic to both the scale of buildings, lot increments, and to the district's prevailing architectural character.

n. Addition to Parochial School: an additional wing, forming a courtyard, would be added to the parochial school in the back of the church, thus allowing it to serve a greater number of students.

o. Addition to Existing Clinic: the so-called "Cuban Clinic" is in tremendous asset in this community but, it urgently needs to expand, if it is to keep pace with the community's needs. This proposal advocates for an expansion, with additional square footage perhaps being attained on adjacent lot sites.

p. Regional University: a regional university is proposed on the edges of the town proper so that local students are not forced to leave the region in order to receive an education. This university, can either be a satellite of institutions in the capital or can be a new independently run operation.

q. Re-definition of Urban Boundaries: the lack of a definite boundary between city and country side is repaired with peripheral roads carefully traced along existing property lines. All properties along the peripheral roads have residential frontages on the opposite side of extensive agricultural areas occupying traditional French Arpents.

r. New Sport Facilities Field and Stadium: respecting the locational tradition of large infrastructure on the edges of the city, a new sport facility is added on the western boundary. This new sports facility consists of bleachers, a professional soccer field, and a small building with a gym and after school care sport facilities.

s. New Hospital: to create competition and redundancy, two essential characteristics found in communities with high degrees of resiliency, a new hospital can be located at the intersection of the westernmost entrance and the old national highway.

t. Cemetery Improvements: new entrance gates and thicker outside walls are proposed to provide greater legibility and differentiation between the city of the dead and the city of the living.

u. Agricultural Preservation: all areas around the town proper are to be preserved as agricultural areas in perpetuity. This decision requires the demarcation of non-negotiable urban growth boundary lines and brings numerous sustainability and livability advantages. Sprawl is not an option.

B. New Regional Center / Highway Entrance Reconfiguration (Arcahaie)

a. The existing informal market at the intersection of the national highway and the main road into Arcahaie would be reconfigured. This new regional node includes:

b. A water-tower with signage, topped by solar panels marks the entrance into Arcahaie.

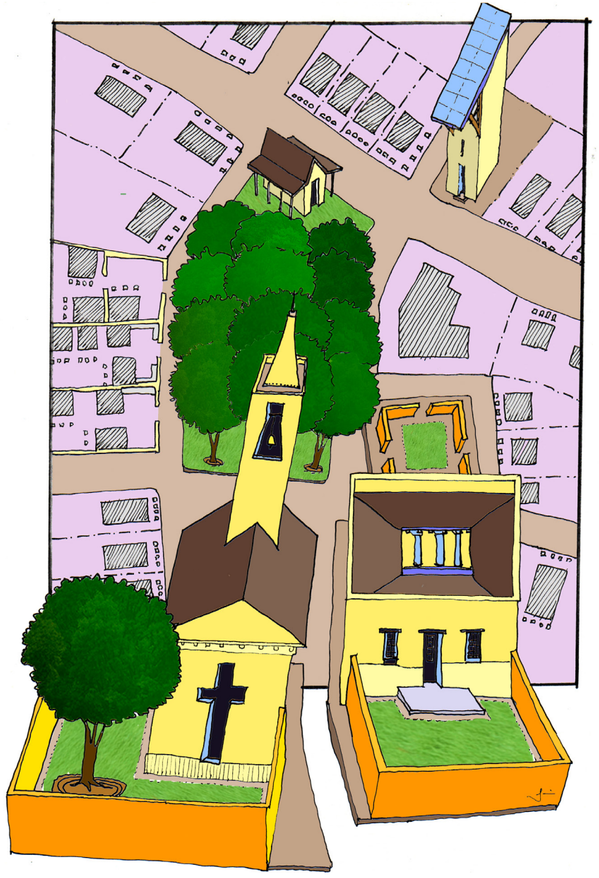
c. A covered bus stop, shelter and public rest stop on the main highway accommodates travelers.

d. A central plaza with water-trough and benches, covered by a grove of tall fruit trees, under which the market can function more comfortably.

e. The addition of individual shops surrounding the plaza can activate commercial activity.

f. A smaller square in front of an existing school accommodates parents and children waiting to enter or exit the school.

g. A new church, and a new small temporary lodging facility for individuals in transit or alternatively an emergency shelter, complete the repertoire of this intervention.



Proposed Arcahaie Regional Center Highway Entrance Reconfiguration

C. Corail

a. Southernmost Entrance Marker: as the most traveled road, the southernmost section of the old national highway strip must be celebrated at the entrance of the Corail corridor. A “sacred” tree will mark this moment in the plan. Surrounded by a decorated bench, this tree would become a monument to the robust and rising spirit of the Arcahaie region. This node becomes the first of several ‘public rooms’ along the road – places that augment socializing, gatherings and shared identity.

b. Faces of Arcahaie - Square and Monument to Catherine Flon: the first bend on the road affords opportunities for a new public space. The proposal includes a social gathering space flanked by steel posts displaying photographic canvases with the real “Faces of Arcahaie”. This is an opportunity to reward honor students, community organizers, and local heroes. The monumental square would be faced inward and a giant shade tree would occupy its center. A low wall would bind the site with a continuous bench along its perimeter. The wall continues to the corner of the site and ends with a statue commemorating Catherine Flon and her first version of the Haitian flag.

c. The Longest Flag in Haiti: to bring greater notice to the birthplace of the nation’s flag, starting at the location of the Catherine Flon memorial site, a series of posts and canvases will roof the corridor with the longest flag in Haiti. The canvases can be made of readily available materials and illustrate the handsomeness of local crafts. Dyed in the colors of the nation’s flag it become a tourist destination but more importantly, a fitting tribute to the important event that occurred in this location. A side benefit, is that the canvass draping over the street would also shade the space below it and thereby automatically lower the micro-climate and make it a more comfortable pedestrian environment. This simple move can bring national and international attention, create a sense of patriotic pride, and generate tourism.

d. Lakou Museum: nearby the location of the memorial and on the east side of the road, an existing Lakou will be restored as a living museum. This small family compound will attract tourism and will serve to educate urban dwellers on the challenges and opportunities of the typical rural life in Haiti.

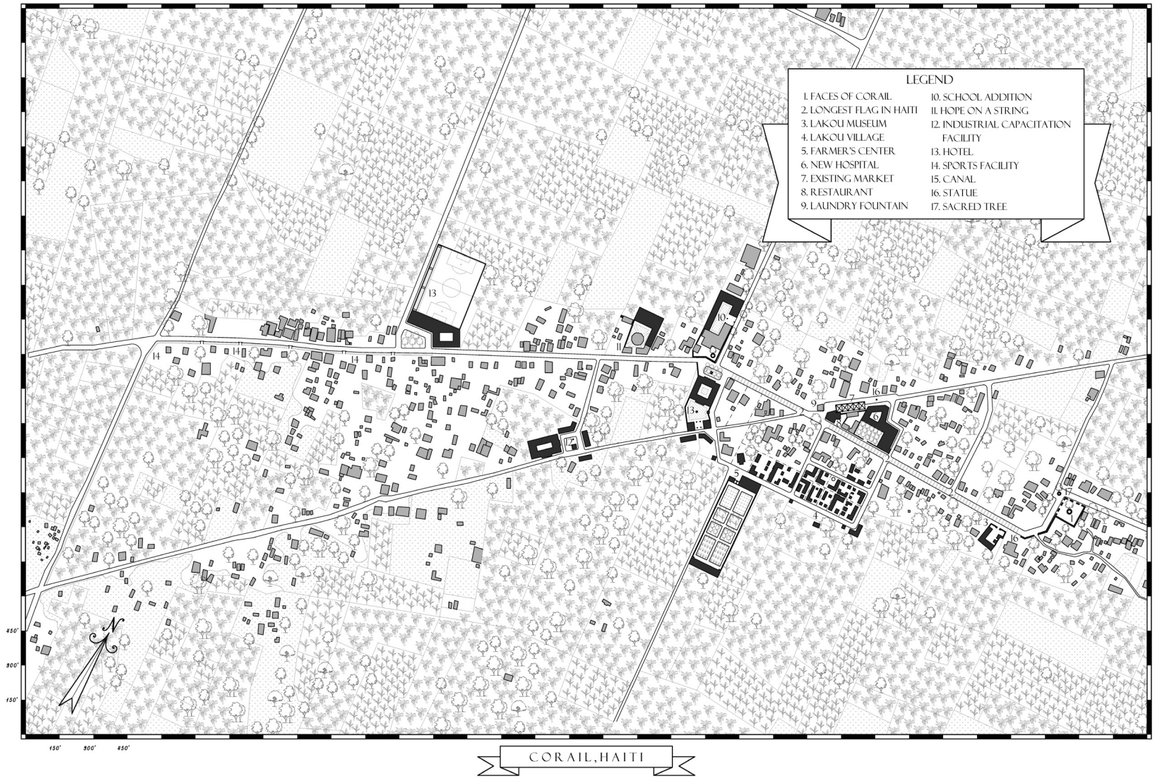
e. New Clinic: a new clinic is proposed adjacent to the central market. The clinic provides a gathering space along the street corridor and follows a Caribbean tradition of head and tail layout, where the ‘head’ is occupied by a courtyard building that houses the main functions of the clinic and the ‘tail’ houses additional services and outpatient facilities.

f. Market Square Main Building: to respond to the lack of a permanent commercial facility, if rehabilitated, the building at the corner of the existing market square would provide a great location for a small convenience store with a residential unit in the back (a so-called “work/live” Lakou).

g. Addition to Existing School: the existing school needs more space. This proposal shows a potential configuration for the expansion of the existing structures within the existing property. A system of courtyards would produce a new academic center and create a real sense of community and wholeness.

h. New Entrance Plaza and Hotel: adjacent to the existing school, there is a dirt road which is now used by motorcycles as a means of regional entry to the main corridor. This proposal advocates for the formalization of this road as a potential new automobile entry to Corail. If realized, this move would provide excellent opportunities for a small bed & breakfast hotel and for a new entrance plaza.

i. Farmer’s Capacitation Center: in the rear of the



Proposed Corail Town Plan

hotel, there is an opportunity to locate a medium size farmer's capacitation center. These grounds would provide a venue for hotel visitors, local residents, and regional farmers to learn agricultural and fish-culture techniques in-situ and to experiment with new crops and crop yielding methods. This capacitation center can also become home to a local Agricultural Cooperative run by local farmers.

j. New Lakou Neighborhood: the capacitation center will be surrounded by a new neighborhood composed of a multiplicity of Lakou units. These units could be managed by the capacitation center itself or by a non-profit cultural organization focused on affordable housing or sustainable forms of living. At the same time, these units will provide a remedial edge between city and countryside and will prevent the sprawling of Corail into adjacent agricultural areas – a danger which may come as a result of its own success.

k. Industrial and Digital Capacitation Center: in the same spirit of the farmer's center, an industrial and digital capacitation center will allow the region to keep up with the latest global technologies. The purposeful location of this center was selected on the basis of its adjacency to the old railroad tracks – one of the first symbols of industrialization in Haiti. Students will come to learn and get empowerment from notions about the past, present, and future of a new nation.

l. Addition to Hope on a String: a local non-profit organization, already established on this site, has a tremendous need for expansion. The proposal includes the completion of a courtyard with new building structures surrounding the existing circular structure in the center of the compound.

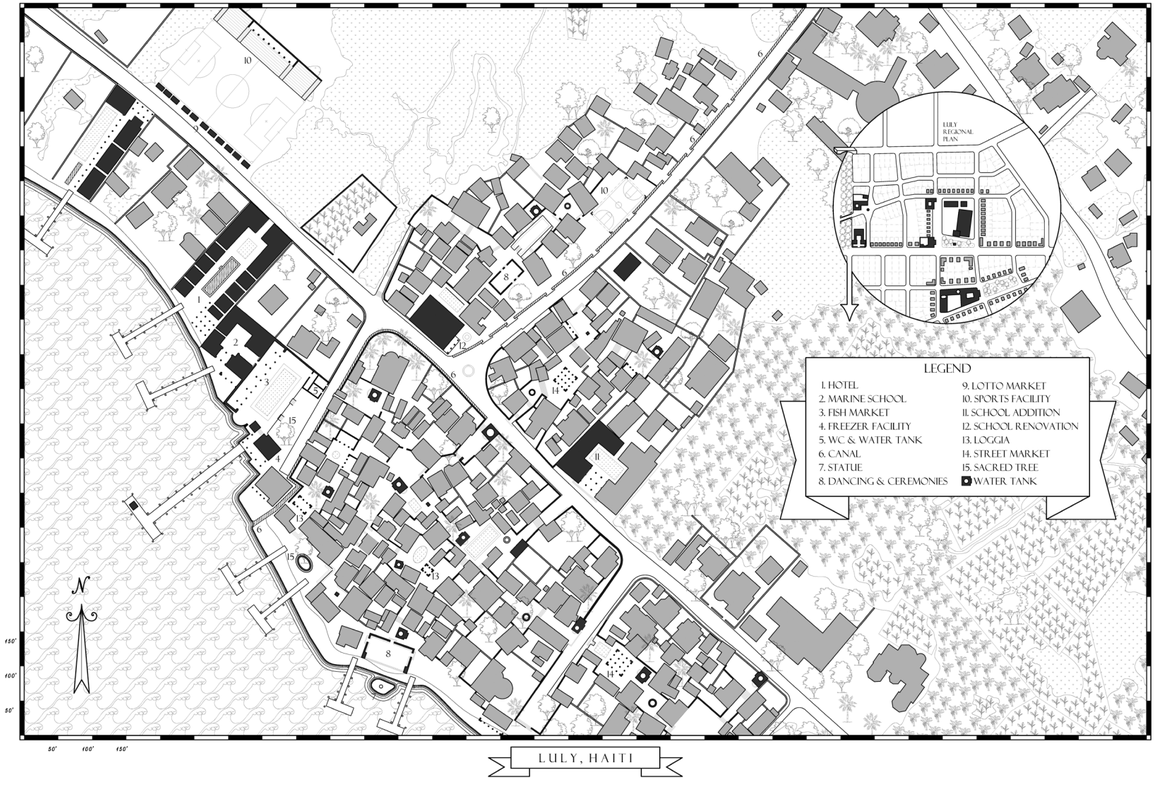
m. Reconfiguration of Sport Facilities: adjacent to an existing semi-professional soccer field, a new northern entrance to the site is proposed. This entrance can incorporate shops, and be flanked by new complimentary sport facilities containing a small gym. Additionally, rooms for a child day-care center and an after-school center for youth can be incorporated. To accommodate audiences comfortably, a group of bleachers would define the northernmost edge of the site.

n. Agricultural Preservation: all sites around the settlement proper would be preserved as agricultural areas in perpetuity. This decision, similar to the one proposed in the Town of Arcahaie, would entail the demarcation of non-negotiable urban growth boundary lines and would bring unique sustainability and livability benefits to the region. Sprawl development is not an option.

D. Luly

a. Waterfront Plaza: an identifiable place of arrival and a symbolic community center are still missing in this informal fishermen' village. Therefore, a new central waterfront plaza, located on the available site at the edge of the informal settlement along the coastline, can serve as an entry from the water side and a terminus or destination from the land side. On the waterside, boats are welcomed by a 'light' beacon, equipped with solar panels, representing a new era of energy independence and the potentiality of clean energy; on the land site, the plaza would be anchored by a water tank tower serving the new market, that in turn, underlines the community's connectedness to water, nature and to its region's beauty. This coupling of public spaces becomes the heart of the village, which gives life to its economic and social activities.

b. Fish Market: a much needed fish market can be placed on the westernmost side of the plaza. The market proposal is configured as a Greek Stoa, with closely spaced pilasters on the outside and loosely fitted columns on the inside - columns that in turn,



Proposed Luly Town Plan

define the spacing for each one of the market stalls.

c. Water Tower: this monumental building will celebrate the collection of rainwater and the storage of water by gravity in a sealed underground cistern. The building structure can house a public laundry facility and bathrooms for men and women - with showers, restrooms, and lockers.

d. Fishing Capacitation Center: the market loggia can give access to the fishing capacitation center in the rear of the structure. This building can house a trade school for technical improvement and experimentation on issues dealing with marine biology, boat making, arts and crafts, etc. - a curriculum based on the actual needs of the day-by-day necessities of a fishing village.

e. Bed and Breakfast: a new B&B hotel is proposed on one of the original Arpent system lots on the west side of the village. It does not turn its back on the village but rather adds to its public life and actively engages the street it fronts.

f. Sports Complex Reconstitution and Temporary Market: the existing sports complex can be reconfigured. A system of natural bleachers can be carved into the existing topography and a linear system of “Lotto Cabins” can formalize a temporary market at the southernmost edge of the soccer field.

g. Sports Hotel: across from the sports complex, a new sports oriented hotel is proposed. This hotel, like the fishermen’s plaza, has dual functions for the benefit of locals and of tourists. On its northern side, with the presence of the soccer field, potential biking paths and horseback riding trails, etc., it can augment and/or promote land sports; on the southern side, it can provide water sport facilities and small craft rentals.

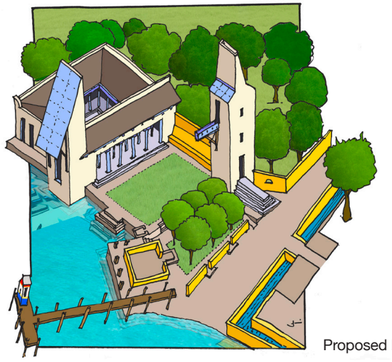
h. Community Cells and Water Tanks: to address the needs for fresh water and also urban legibility that can be more inviting for tourists as well as lead to a well-woven network of paths, the informal community is rethought as a series of small community cells or clusters, of approximately ten family units per cell. The cell is centered on a public sacred gathering space, with a communal water tank that serves the homes in that particular cell. Small loggias, benches, special landscape, features can also supplement the overall character of each unit within the cell. This idea can help towards the decentralization of community decisions at the day-to-day level. In addition, a “village council” with representatives from each cell can come together to deal with larger decisions at the general village level. Plans herein suggest locations, but the demarcation of these urban spaces and the location of the water tanks must be carefully crafted by locals, in order to respect well-established informal and/or implicit land tenure organizations.

i. Local Markets and Loggias: a collection of two or three cells can generate a potential site for a small local market unit. These markets are represented in the plans as square colonnades in the tradition of the markets found in the center of any French bastide (new town).

j. Social Gathering Spaces: on the edges of the informal village, a multiplicity of social gathering spaces may occur. These can used as community gathering spaces or as informal commercial areas.

k. Pedestrian Networks: a series of connective walls and fences can define the legibility of the pedestrian networks. Each family cell should be completed by or surrounded by a wall or a fence with casual entrances and building frontages. This combination of buildings and garden walls in turn define a network of paths and pedestrian ways. It is at the intersection of these paths where a new idea of public space, that can include the local markets and loggias described, may occur.

l. Addition to Existing School: the existing schools should be expanded to form complete educational units. The proposals here included emphasize the



Proposed Luly Waterfront Plaza



Proposed Luly Regional Center at National Highway Intersection. Regional Center includes a clinic, vocational school, distribution center, market plaza, police sub-station, university satellite, and new Luly entrance tower.

creation of safe courtyards as the preferred building typology for schools.
m. School Building Reconstitution: an existing corner building, in need of rehabilitation, has been identified by the community as a potential site for a new local school, day-care center, after-care youth facility, and/or an adult capacitation building. All these services are sorely needed in Luly.
n. Agricultural Preservation: all sites around the fishermen' village must be preserved for agricultural purposes in perpetuity. This decision, similar to the one proposed in the Town of Archaie and the corridor of Corail, entails the demarcation of non-negotiable urban growth boundary lines and brings unique sustainability and livability benefits to the region. Sprawl development is not an option.

E. New Regional Center (Luly)

a. The entrance to the Village of Luly is the perfect location for a regional center. The intersection between the main national highway and the roads that lead to Luly on one side, and to the mountain villages on the other side, has the potential to serve a large swath of this densely populated and severely under served area.
b. The proposal advocates the reconstitution of this area as a new regional settlement, with services that can address the needs of many.
c. A new regional distribution center, equipped with packing and refrigeration facilities, will be complimented by an adjacent market plaza and commercial buildings.
d. This area would be connected also to a new proposed loop road, where truck traffic can easily arrive at the regional distribution center without congesting the main national highway.
e. Additional uses around the new public plaza, would include a small police sub-station, and closer to the main intersection leading to Luly, a new tower signals to visitors the entrance to the fishing village, and a multi-purpose vocational school and a clinic, ideally fitted with a maternity ward, can be located nearby on neighboring sites to serve local residents near and far.
f. A small technical university is also proposed.
g. Because this area becomes a new job center, additional housing is suggested on either side of the main national highway.
h. The main national highway can be lined with 'work-live' Lakou compounds.
i. In each, their shop can front directly onto the road and in this manner amplify commercial activity along the main spine of the region and in turn, partake in its economic vitality.

III. A New Civic Infrastructure

Two critical aspects of prosperous modern civilizations are access to quality healthcare and education.

A. Corail Clinic

a. The clinic in Corrail is intended to service the region of Arcahaie.
b. The program of the clinic is anchored by three wards, a male, a female, and a pediatric. Each is able to accommodate approximately 30 patients at one time.
c. An emergency room with some surgical capabilities is also proposed, reducing emergency trips to facilities in Port-au-Prince.
d. Additional uses included in the clinic's design are a dentistry, consultation rooms, blood labs, an X-Ray (radiology) room, and a tuberculosis ward.
e. The building itself is designed around two primary garden spaces.
f. The courtyard acts as a centering device by which patients, staff, and visitors circulate around.
A courtyard in warmer climates, such as Haiti, helps break up the mass of the building, and allows the



View of Entrance to Proposed Corail Clinic

rooms adjacent to it to have windows on both sides, thus allowing for cross-ventilation. This is especially important in a facility that will be housing many sick patients with airborne viruses.

g. At the center of the courtyard is a garden with a pond and landscaping. The presence of life at the center of the building is meaningful and potentially therapeutic for the patients and the families who accompany them. It also provides a welcome relief from the hot sun.

h. The courtyard is also the location of an underground cistern. Shed roofs direct rainwater into a gutter at the perimeter of the internal, open-aired space. This water can in turn be collected, stored, filtered, and reused.

i. The second garden space is located at the front of the building. This garden can be used by the visitors waiting, or by the general public. This public space is meant to act as a plaza, and is a civic offering to the town of Corail. A stone bench is built-in to a low perimeter wall that formalizes the space. A grid of citrus trees fill the garden and have the dual purpose of providing shade and nourishment for the hospital's staff and patients, and the residents or Arcahaie.

j. Civic buildings can have significant social impacts in a town. They become centers of activity and gathering. Rather than isolating the clinic from the town, the proposed design embraces this reality and provides a dignified, elegant, relaxing space that will help foster a sense of civic pride.

k. Haitians have a strong sense of individual pride, what often lacks is a collective investment in the idea of "Town." The Corrail clinic can be a place where the sick are treated and the healthy support them by providing energy and vitality in the neighboring garden, inspiring them to recover quickly and join the fun.

B. Regional-scaled Multi-purpose Vocational School

a. A vocational school in Luly would meet a dire need, vocalized in public meetings during the University of Miami's trips to Haiti.

b. Bright kids, with a lifetime of possibilities ahead of them have extremely limited education options after high school.

c. Advanced education at the university level is only achievable if students are able to move to Port-au-Prince, or beyond, and for many, this is unrealistic.

d. The limited access to vocational and university education starves the region of growth.

e. The immediate construction of a multipurpose vocational school is a great candidate to start effecting change in Arcahaie.

f. Youth Build International, a non-profit organization that provides education, job skills and counseling to at-risk youth has been an integral part of the planning and design process and is an ideal partner with previous experience building educational facilities in Haiti.

g. The program of the vocational school originates from another Youthbuild facility and it was refined in consultation with local residents and civil society members.

h. The design of the building, like the clinic, focuses on an open aired outdoor space, a communal space of approximately 7200 sq. ft.

i. Surrounding the space are groupings of gable-ended structures. The ubiquitous form is repeated for each classroom - each with its own unique subject taught within.

j. The form of the building provides an idea of its purpose.

k. Connecting the classrooms and support spaces of the school is a colonnade.



Entrance View of Proposed Regional Multi-purpose Vocational School

Building Team Recommendations

I. The Haitian Home, Yesterday, Today & Tomorrow

a. Building Design Principles
1. The multiple designs proposed are intended to meet the needs of diverse sites (from urban to rural), programming variables, family economies.
2. Designs address current physical constraints imposed by the natural environment and infrastructure realities, social customs.
3. Designs address constructability issues, in light of the battery of natural disasters that can potentially impact the region at any given time.
4. The proposals underline the importance of the traditional Lakou model, in and of itself a microcosm of community and a reflection of the strong bonds within Haiti's family networks.
5. The Lakou model illustrates the flexibility of that composition of buildings to accommodate different combination of uses, as well as different architectural expressions - from vernacular to contemporary.

b. Increasing Cultural Tourism
1. Given the desire to increase tourism in the commune, and the undeniable attraction that Vernacular and Gingerbread/Victorian architecture have for visitors, - both national and foreign - local residents and governments may want to consider how they can incrementally promote and reinforce the dignified DNA of the region's historic architectural expressions.
2. The region's unique picturesque and romantic appearance can be incrementally reinforced and by growing that distinctive image also grow tourism opportunities and numbers.
3. Create or restore beautiful buildings that will be loved, maintained and which contribute to a marketable community identity.

c. Passive Design Methods for Resilient Buildings
1. Orient structures and rooms to take advantage of prevailing local airflows and maximize daylight;
2. Strategically place open/shaded porches on southern and eastern facing sides of a building, to shield structures from direct heat gain, while extending livable areas;
3. Increase interior room heights, with at times clearstory openings, to allow for internal room heat to rise and escape efficiently;
4. Align operable, vertically oriented windows to promote cross-ventilation that naturally cool spaces.
5. Lift buildings off the ground to reduce the impacts of flood waters on interior spaces.
6. Use local materials to reduce construction costs.
7. Located fresh water well heads uphill from waste-water systems, and at a maximum distance from each other, to avoid contamination that results in health problems.

d. Connections to Place and Adding to Community Identity & Prosperity
1. Link to traditional building types helps to reinforce a community's cultural identity, which in turn can lead to an increase in tourism.
2. The traditional Haitian 'Lakou' is pervasive in the region and demonstrates great flexibility and savvy sustainable design principles with useful application in the 21st century.
3. The Lakou site design model is simply the orchestrated grouping of buildings, which house an extended family on one plot of land, capable of adapting to family size, overall land dimensions, location, a variety of uses, from an urban to a rural context.
4. Lakous can incorporate street-fronting shop or office to increase commercial activity, generating a micro-business economy that benefits local

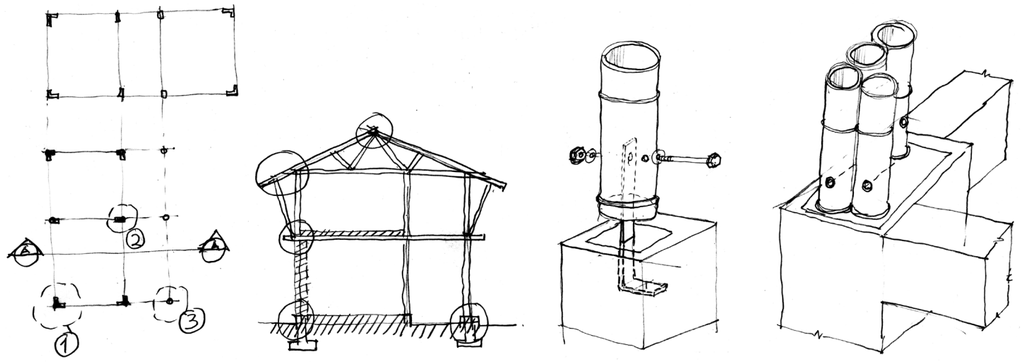


families and adds to public life.
5. Lakous are not limited to the extended family as its layout can also be used for multiple family houses or even a new combination of uses, including residential, commercial, hospitality, and/ or income producing rental units.
6. The garden wall becomes an important element of any town, village, or hamlet and with a greater degree of visual permeability increases cross-ventilation, creates safer streets, and propagates community interaction.
7. Increased vocational educational opportunities can focus on building and artisan trades, resulting in a broader offering of skilled building workers, trades and craftspeople, incrementing employment opportunities.
8. The section 'Easy-build Sets' offers a number of sample floor plans and include several alternative front elevation options to afford residents a choice of decorative architectural styles as may suit them, and as may also help to reinforce the identity of their particular neighborhood or town.

II. Resilient Construction

a. Methods
1. Design and build structures to cope with severe weather events including flooding, hurricanes, and earthquakes; anticipated to increase from a warming climate.
2. Place critical systems to withstand flooding and extreme weather events. In Flood plains, place habitable spaces above the 100-year flood plain level.
3. Build to withstand future climatic conditions as much as possible.
4. Incorporate passive design principles in buildings to maintain livable conditions in the event of extended loss of power (passive survivability).
5. Optimize the use of on-site renewable energy.
6. Harvest rainwater.
7. Use Local or Recycled Materials for Construction.
8. The Building Frame and Shape: All buildings constructed using a masonry system should be constructed such that reinforced concrete columns confine (frame or brace) all masonry walls and openings.
9. If the building is or contains more than a single story/ floor, then the load path should be simple and clear.
10. The columns confining and bracing the building should be aligned vertically (one on top of the other).
11. All load-bearing walls should be aligned vertically to avoid eccentric loading conditions.
12. Foundations should be deep and stable.
13. Roof Structures should be well anchored and braced.
14. The Roof structure (timer typically) should be anchored to the ring beam to mitigate against uplift from winds during storms as well as restraints during earthquakes.

b. Alternative Building Materials
1. Bamboo is the largest of the grasses with over 1600 species of available worldwide. It grows very quickly and could be easily planted in Haiti and used as a replacement construction material.
2. Around the world, Adobe is used as rammed earth in conjunction with bamboo reinforcement. The walls of rammed adobe are built from a mixture of earth that is compacted in layers between forms. The construction material is a balance between clay, sand, and aggregate, with some cement added as binder material to stabilize the walls.



c. Recycled Fibers/ Materials: Plastic Bags & Bottles, Banana Fiber, Paper
1. Opportunities do exist to use recycled fiber in different forms, especially those that are currently seen as garbage.
2. The resulting building materials perform as well as standard offerings.
3. Plastic bags, plastic bottles, banana fiber, paper can be collected and recycled as building materials generating new job sectors, reducing the cost of building materials, and cleaning up the public domain all at once.

IV: Construction Cost Estimates

The Vision Report includes construction cost estimates based on data received from a local Building Construction Retailer. Costs may vary by season and location within the region. For estimates, see corresponding section for breakdowns by building construction type.

List of Participants

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Jean Guillaume	Dejean	Ingénieur			3787-6042	Sargect4215@yahoo.fr				
Jean Guilloux	Maxilien	Justice	Juge de Paix	Cabaret	3738-8038					
Jean Gustave	Saint Louis	Nationale de Luly	Directeur	Luly	3718-2530	gustave103@yahoo.fr				
Jean Herne	Jadné	CESCA (Centre educatif socio-culturel de l'Arcahaie)	President	Bassin Maheé		jadneherne@yahoo.com		X		
Jean Holly	Lima			Digue Matheux						
Jean Holly	Succes	Education		Pont-Matheux	3752-4067					
Jean Jordany	Pierre	IPDA	Coordonateur	Hostin	3375-5920	ecojordanypie@gmail.com				X

Prenom	*Nom*	*Organisation / Institution*	*Titre*	*Zone d'implantation / Localite*	*Telephone*	*E-mail*	*29 - Aug.*	*1 - Sept.*	*17 - Oct.*	*13 - Dec.*
Jean Joseph	Ciné	RACADAMA			3158-8023					
Jean Jules	Ronald				3626-5434				X	
Jean Lefabre	Sully	MOPAV			3621-2600					
Jean Léon	Vincent	Avocat			4601-3421					X
Jean louis	Pierre Paul	Agriculture							X	
Jean Louis	Marie Yves-lise	Santé			3600-7320			X	X	
Jean Luccerne	Edouard	Organisation			3609-1157					X
Jean Luvoriste	Ferdinand	OBECA	Vice Presi-dent	Arcahaie	3621-6558					
Jean Marie	Fortilus	CNHUNH	Relation Publique	Saintard	3114-2725	cnhunh2009@yahoo.fr				
Jean Mario	Darismé	OJATMA	Vice Presi-dent	Bassin Mahée	3743-3660					
Jean Mario	Moléon	HOAS (Hope on a String)		Corail	3889-8821					
Jean Mariot	Pierre	IDEJEN / Youth Build			3454-3161	jmpierre@idejen.org				
Jean Mary Claret	Orestil	Etudiant			3281-6498	orestil78@gmail.com				X
Jean Max	Louis	Mairie Arcahaie		Arcahaie						X
Jean Miranda	Saint Louis			Merotte	3687-3898					
Jean Nicke	Alcinous	Eglise de J. Christe	Diacre	Corail						
Jean Philippe	Devariste	Ing. Agronome			36134383	jeanphilippedevariste@ yahoo.fr				
Jean Pierre	Daniel	Plombier			4648-1077					
Jean Pierre	Aboutou	Justice								
Jean Powell	Humbert		Comptable	Corail	4857-6036	humbertjnpowell@Yahoo.fr				X
Jean Raguastins	Charles	Ajedia	Gestion	Thomas	3723-4485					
Jean Renaud	Delcy	Gevehan				Reno@hotmail.fr				
Jean René	Verna	ADECCO	Coordonateur	Conte	3797-3866					
Jean Rildens	Simervil	HOAS (Hope on a String)	Professeur	Pont- Matheux	3752-1582					
Jean Roger	Dorsainvil	Sion	Directeur	Montrouis	38100253	dorsainvil.jeanroger@yahoo.com				
Jean Ronald	Casséus	Construction		Pont-Matheux	4445-1099					
Jean Ronald	Chéry	HOAS (Hope on a String)		Corail	3616-8974					
Jean Samson	Edouard	ANV/Groupe 500 / Coordonnateur UM	Professeur	Pont- Matheux	37657285/ 32480485	jeansamsonedouard@yahoo.com		X	X	
Jean sinvillus	Térasil	Agronome			3763-0455	terasil@hotmail.fr				
Jean Wilgar	Carmelien	ODECOCA(Organisation pour le developpement de la communaute Corail Arcahaie)	Porte - Parole	Corail	3743-1940			X		
Jean Willer	Marius	Education				fwiller@hotmail.com				
Jean Wilmac	Joseph	Secteur Educatif			3190-3351	wilnacjoseph@yahoo.fr				
Jean Wilnac	Joseph	Beslhy	Directeur	Matheux	3759-3926					
Jean Wilner	Néus	Organisation			3713-0274					
Jean Wilvens	Chery	Education			3640-8408					
Jean Woodly	Hyppolite	Genie Civil			3638-0649	jeanwoodly@yahoo.com				
Jean-Francois	Wilson	Ex-mayor l'arcahaie / RACADAMA			3642-6366				X	
Jean-Louis	Pierre Paul	Agricole			3272-3098				X	
Jean-louis	Marie Yves-lise	Sante			3600-7320	marieyvelisejeanlouis@ yahoo.fr			X	
Jean-louis Henri	Marie Jourline	University of Miami	Coordonnatrice		3740-9781	j-jourline@hotmail.fr		X	X	
Jeannot	Pierre	Elève		Arcahaie	3671-4348					
Jerome Pierre	André	Technicien		Mitan	3290-0312					

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Jimmy	Compère	Leader religieux			4470-3715					
Jn Marie	Chery	Photographs								
Joachin	Phillippe				4411-0446					
Joachin	Buther									
Jocelyn	Alténor	AJAC			3782-3078					
Jocelyn	Marckenson			Corail	4657-5673					
Johanne	Plaisimon	HOAS (Hope on a String)		Corail	4634-4303					
John	Onyango	UM	Professeur	Miami						
John Ernerto	Leger				44823723	leger.ernerto1@hotmail.com				
Johnny	Zema	Ing. Agronome			31539557	zemajohnny@yahoo.fr				
Jonas	Pierre-Canel	Agriculture			3135-5804					
Joselène	Saint Phard	Infirmière		Pont-Matheux	3668-8017	Joselne-saintphard@yahoo.fr				
Joseph	Janis	CRADD	Coordona-teur	Labarre	3761-9355	Janisjoseph974@yahoo.fr				
Joseph	Smail	Gevehan				Josemailla2013@yahoo.fr				
Joseph	Jean Wilmac	Secteur Educatif			3190-3351	wilnacjoseph@yahoo.fr	X			
Joseph	P. Wilfrid	Deputation	Chauffeur	Arcahaie	3715-3849			X		
Joseph	Wisner	KOJW		Williamson	3632-5724					
Joseph	Lucien	Technicien		Corail	3659-5072					
Joseph	Sadrack	Technicien		Corail	4821-7126					
Joseph	Marie Roseline	Esteticienne		Pont-Matheux	4825-0739					
Joseph	Louissaint	Electricien			3782-6199					
Joseph	Pierre Abraham	Agriculture			4298-6696					
Joseph	Velouse	HOAS (Hope on a String)	Professeur	Corail	3798-4617				X	
Joseph	Marie Judette	MBA/Financial planner			3842-3772				X	
Joseph	Bénissaire	Huissier			3766-3155				X	
Joseph	Michecar	CRANHA (Collectif de reflexion et d'action pour une nouvelle Haiti)	Membre	Membre	3871-1674	josephmariemichecar@yahoo.fr				
Joseph	Jules	Mayor Arcahaie			3792-3448 / 3206-0102				X	
Joseph Dopèse	Jean Francois	Bourg		Organisation	3730-2690					
Joseph Fernil	Jean Baptiste	L'Eglise Eben Ezer	Diacre	Corail	3774-8533					
Joseph Isaac	Aristille			Merrotte						
Joseph Jean Robert	Romain	Médecin			3762-7573	Jeanrobert.romain@yahoo.fr				
Joseph Mésac	Chéry	HOAS (Hope on a String)		Labarre	3777-4878					
Joseph Wilguerre	Sainteliat	CEMI/RDR	XPasteur	Robergeau	3625-0887	jsainteliat@yahoo.fr				
Joubert	Larochelle			Corail	3748-8445					
Jude	Louis		Journaliste	Merotte	3732-9075	ljude11@yahoo.fr				
Jude	Orémus	HOAS (Hope on a String)		Arcahaie	3881-7807					
Jules	Joseph	Mayor Arcahaie			3792-3448 / 3206-0102					
Jules Ernst César	Georges	Education			3616-4664					
Julien	Saint Charles	Genie civil		Robergeau	3680-4540					
Juliette	Eliezer	Agronome			3868-5483					
Junior	St-vil	traducteur			38023119					
Karl	Brutus	Journaliste (RNH)		P-au-P	3719-4056	Karlbrutus99@yahoo.fr				
Karl-Lenine	Casséus	Agriculture			3645-1262					
Kawas	Charles	Chimiste								
Kémy	Edouard	Agricole			3437-1088					
Kenia	Edouard	Infirmière		Pont-Matheux	3437-2476					
Kercius	Gerard	JODEP								
Kerline	Jeannot	UNITRANSFERT	Comptable	Mahee	3797-1687	kerlinejeannot@yahoo.fr				
L'herisson	James	Student			3888-9231				X	
Larochelle	Joubert			Corail	3748-8445					
Larochelle	Gerald	Mayor Arcahaie			3750-0103 / 4033-7387				X	
Larochelle	Marie Jourdelle	Education			3616-8690				X	
Larra	Berry	HOAS (Hope on a String)								
Laudy	Lucate	Education / Justice			4715-8831					
Lauredent	A-Léonell	Education			4858-8609				X	

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Laurédent	Marie Jose	Union College	Superv. Peda-gogique	Arcahaie	3797-3838			X		
Laurent	Widnerson	Etudiant			3777-5591				X	
Laurent	Anderson	Etudiant			3769-1391	Lauson17@yahoo.fr			X	
Laurie	Benett	Youth Build			617803-6776					
Lazarre	Roosvelt	Education			3611-7765				X	
Lazarre	Dorsainvil	Organisation / J.A /	Coordona-teur	Corail	3742-5735/ 3742-5737					
Léon	Dioliphete	Technicien		Corail	4683-9689					
Lesly	Voltaire	Architecte/Urbaniste		Pétion Ville	3457-7229	Ivoltaire@yahoo.com				
Lesly	René	Organisation		Bourg	3185-1269					
Lexy	Alfred	OPDPP	Professeur	Montrouis	3766-6882	lexyalfred@yahoo.fr				
Lindsay	Aime	Musée Ogier-Fombrun	Guide	Montrouis	4792-6887					
Lisena	Fils-Aimé									
Lorisner	Constant	Construction batiment		Robergeau	3632-0869/ 3766-5109					
Loriston	Hughes Gabriel				3782-3301			X		
Loubens	Pierre-Canel			Mahotte	3639-6485					
Louinel Louis	Brevet									
Louis	Romaire	PNH			3870-4806					
Louissaint	Joseph	Electricien			3782-6199					
Lucate	Laudy	Education/Justice			4715-8831				X	
Lucien	Joseph	Technicien		Corail	3659-5072					
Luckenson	Silencieux	HOAS (Hope on a String)		Corail	3776-2812	Djlueky@yahoo.fr				
Luckensy	Cheriel	Always	Directeur		3844-3775					
Luders	Augustin	Organisation		Mérotte	3722-7983					
Lunique	Francois	Foundation Kellogg			781-2151215					
Lunique	Henrilus	Etudiant			3665-2986	henrilunique@gmail.com				
Luthan	Pierre	Etudiant			3792-7226	luthanp@yahoo.com				
Mackenson	Joseph	HOAS (Hope on a String)		St-Médard	3867-3804	mackensonjoseph57@yahoo.fr				
Manès	Dambreville	Elève		Arcahaie	3609-6372					
Manoucheca	Louis	HOAS (Hope on a String)		Corail	4639-7215					
Marc	Joseph	Etudiant		Bourg	4692-1294					
Marc	Joseph	ECODA		Arcahaie						
Marc André	Pierre Canel	HOAS / Etudiant			3676-2793/ 3676-2793	Marcnicolas55@yahoo.fr				
Marc Ronald	Pierre	Santé			3892-9800					
Marc Sony	ST Hilaire				37985458					
Marcellus	Rouby	Organisation			3102-2349	marcellusrouby@yahoo.fr			X	
Marckenson	Jocelyn			Corail	4657-5673					
Marguerite	Fils-Aime	Marchande		Saintard	47951220					
Marie	Saint Fleur	City of Boston								
Marie	Timmer	FHEDINC			3680-4579	Mariegerald2005@yahoo.com				
Marie Ancie	Armand			Hostin	3774-5940					
Marie André	Polynice	Organisation			3145-1395					
Marc Ronald	Pierre	Santé			3892-9800					
Marc Sony	ST Hilaire				37985458					
Marcellus	Rouby	Organisation			3102-2349	marcellusrouby@yahoo.fr			X	
Marckenson	Jocelyn			Corail	4657-5673					
Marguerite	Fils-Aime	Marchande		Saintard	47951220					
Marie	Saint Fleur	City of Boston								
Marie	Timmer	FHEDINC			3680-4579	Mariegerald2005@yahoo.com				

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Marie Ancie	Armand			Hostin	3774-5940					
Marie André	Polynice	Organisation			3145-1395					
Marie Asmathe	Imbert	Infirmière		Corail	3713-526					
Marie Bettie	Talien	MFASA(Mouvman fanm Akaye pou sove agrikilti)	Infirmiere	Corail	3754-9031					
Marie Gertrude	Cazeau			Matheux						
Marie Gertrude	Irlan	CESCA (Centre educatif socio-culturel de l'Arcahaie)	Membre	Bassin Mahée	4216-6604					
Marie Guerda	Edmond	Droits Humains			3885-7341	guerdaedmond@yahoo.fr				
Marie Guerla	Anilus			Corail						
Marie Jocelyne	Tito	Education			3768-6453					
Marie José	Laurédent	Union College	Superv. Peda-gogique	Arcahaie	3797-3838					
Marie Josette	Dorigène	Organisation								
Marie Jourdelle	Larochelle	Education			3616-8690					
Marie Jourline	Jean-louis Henri	UM	Coordon-natrice		3740-9781	j-jourline@hotmail.fr				
Marie Judette	Joseph	MBA/Financial planner			3842-3772					
Marie Lauture	Pierre Canel	AFDL (Asosyasyon fanm pou devlopman Luly)		Luly	3745-9259					
Marie Louinine	Gilles			Saintard	3410-8389	Lounee1@hotmail.com				
Marie Louise	Joseph			Corail	3836-6784					
Marie Lucilia	Exumé	Entrepreneur			3706-5217					
Marie Marjorie	Saint Surin			Marie Arcahaie						
Marie Marlène	Nicolas	HOAS (Hope on a String)		Corail	3142-3403					
Marie Meritane	Dorneus	Souvenir			3897-3605					
Marie Michaelle	Dugué	Institution Mixte Emmanuel Baptiste	Directrice	Saintard	3791-9524					
Marie Michelle	Destina	Nationale de Luly	Institutrice	Luly	3618-6499					
Marie Mirlande	Carmelien	Ecole Bethmiflore	Directrice	Pont Calebasse	4471-1964					
Marie Mona	Honoré	Organisation		Corail	4758-0320					
Marie Myrlande	Etienne			Luly	3883-6799					
Marie Phédna	Phédé	HOAS (Hope on a String)			3601-9763					
Marie Roselande	Destine	Ecole Nle du Drapeau	Enseignante	Arcahaie	3648-4979	woosterfils@yahoo.fr				
Marie Roseline	Joseph	Esteticienne		Pont-Matheux	4825-0739					
Marie Rosemine	Gessé	MFASA (Mouvman fanm Akayè pou sove agrikilti)	Secretaire	Corail	3890-0093					
Marie Yves-lise	Jean Louis	Santé		Corail	3600-7320					
Marius	Jean Willer	Education				fwiller@hotmail.com				
Marjorie	Delius	SHALEM	Cordon bleu	Corail	3768-0300					
Max	Zabala	UM		Miami	305-7108431	max@oskistudio.com				
May	Emma	UM							X	
Melchior	Antoine		Ex-Depute	St. Medard	3762-2635	antoinekev@yahoo.fr				
Merline	Marcellus	JMAA		Merotte	3918-8901	merlinemarcellus@yahoo.com				
Mervil	Wilderson			Arcahaie	3688-4230			X		
Michael	Altidor	Haiti Fond			3779-1660					
Michecar	Joseph	CRANHA (Collectif de reflexion et d'action pour une nouvelle Haiti)	Membre	Hostin	3871-1674	josephmariemichecar@yahoo.fr				
Michel	Eliacin	ECODA		Arcahaie						
Michele	Christophe	Education et Juridique			3118-6043					
Mickenson	Joseph	HOAS			3688-4320					
Mie Hermione	Eugene				37935388					
Miguel	Timogène	Ing. Agronome			37856595	migueltimogene@yahoo.fr				
Milot	Joseph P.			Ti Bois						

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Mireille	Fombrun	Sculpteur / Directrice Musée			4693-3018	mireillefombrun@hotmail.com				
Miselie	Hilaire	Professionnelle		Pont-Matheux	3894-1948					
Moise	Pierre Canel			Mitan	3609-0747					
Moleon	Renel	Agriculture			3814-8266				X	
Moliere	Succces		Securite	Arcahaie	3499-4299					
Mona	Dort	Sion	Enseignante	Montrouis	3795-5603					
Monasse	Ferdinand	Organisation			3228-3819					
Mondesir	Yvenson				4751-1483	Yvenson-mondesir@yahoo.com				
Monique	Petit Frère	Citoyenne								
Monord	Ronald	Professionnel		Robergeau	3805-1891					
Morleron	Quene	Religieux			3875-8379	quenemorleron@yahoo.com			X	
Mubenson	Registre	Technicien			3855-2740					
Myrtil	Nadège	AJPM	Vice Presi-dente	Merotte	3225-3661					
Mystil	Valessa	Constructeur			3616-2088	PUSHON15@yahoo.fr				
Nadège	Fils-Aimé			Hostin	3845-5818					
Nadège	Myrtil	AJPM	Vice Presi-dente	Merotte	3225-3661					
Nadège	Fils-Aimé			Hostin	3845-5818					
Nathalie	Edouard	Comptable		Pont-Matheux	3889-6994					
Nelly	Innocent	Artiste Local / HOAS (Hope on a String)	Membre	Corail	3767-2512					
Nerlange	Joseph	RAFPA								
Nestor	Gilbert				3671-7103					
Nestor	Salrick		Technicien		3768-1629					
Neus	Chavannes	Technicien		Robergeau	3717-9599					
Neus	Wilkenson				3717-7039					
Nicolas	Guerda	UM				nguerda@miami.edu	X	X	X	
Nicole	Fombrun	Tourism								
Nirva	Fils-Aimé			Hostin	3726-4995					
Noël	Cecile	Santé / Education			4805-2323	infohaiti@onevisioninH.org			X	
Noel	Francisco	Health / Education			3173-0065				X	
Noicius	Omestil	Citoyen		Arcahaie						
Oles	Rivil	SHASSEDH								
Olivier	Antoinise	Eglise	Membre	Merotte	3790-8995					
Onyango	John	University of Miami								
Oremus	Jude	Etudiant			3881-7807				X	
Osmy	Edouard	Organisation			3640-3320	edouardosmy@yahoo.fr				
Osny	Michel	Ing- Agro-		Port-au-prince	4288-3095					
P. Clautaire	Senat	APEMI (Association des pecheurs de Mitan)	Directeur	Mitan	3697-3314			X		
P. Gardy Arold	Saint Louis	St. Francois de sales	Professeur	Robert	3729-2887					
P. Hermane	Rémédor		Notaire		3600-4261					
P. Ronald	Fleurius	HOAS (Hope on a String)		Corail	3627-3142					
P. Wilfrid	Joseph	Deputation	Chauffeur	Arcahaie	3715-3849					
P. Clarel	Pierre Canel	Cath		Ville	3135-5804					
P. Reynald	Davilus	Elevage			42591835					
Parnel	Jean Louis	Chargé de mission pour la Gonâve	Consultant Vice déléga-tion	Marie Arcahaie	3765-1044	jeanlouis2004@yahoo.fr				
Paula Michel	Louis									
Phenel	Destravil	CESCA (Centre educatif socio-culturel de l'Arcahaie)	Administra-teur	B. Mahee	3750-4906			X		

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Phégière	Théosmy	Agriculture			3616-7672					
Pierre	Billy Watson	Genie Civil		Corail		Billywatson27@yahoo.fr				
Pierre	Jean Mariot	IDEJEN/Youth Build			3454-3161	jmpierre@idejen.org				
Pierre	Ronel	Technicien		Corail	3653-6112					
Pierre	Yvenel	Genie Civil			3107-1794					
Pierre	Jean Mariot	Youth Bild/IDEJEN			3454-3161				X	
Pierre	Staphania	Organisation		Corail	46921749				X	
Pierre	Luthan	Etudiant			3792-7226	luthanp@yahoo.com			X	
Pierre	Honoré	Vesner	Technicien		3731-2472					
Pierre	Jean	Etudiant		Arcahaie	4874-7306	jpierre68@fav.edu				
Pierre	Noel	Haiti Fund	Directeur		3861-8663					
Pierre Abraham	Joseph	Agriculture			4298-6696					
Pierre André	Ajax	ODECOCA (Organisation pour le developpement de la communaute Corail Arcahaie) Leader Politic	Coordona-teur	Corail	3160-9221	Pa070345@sol.com				
Pierre Canel	Décembre	CRH (Croix Rouge Haitienne)	Vice-President	Ville	3726-2334	pierrecaneldecembre@gmail.com				
Pierre Canel	P. Clarel	Cath		Ville	3135-5804					
Pierre Dejean	Antenor	Nationale du Drapeau	Directeur	Centre-Ville	32551685					
Pierre Dieudonné	Jean	Organisation		6ème Matheux	4708-9887					
Pierre Dominique	Eugène	Justice et paix	Animateur	Chemin de fer	3639-7791					
Pierre Fenold	Jean	Agricole			3730-6040					
Pierre Franck	Geffrard		Directeur du Lycée		3626-7393					
Pierre Gerald	Jean			Corail	4643-1130					
Pierre James	Clément	SEJA	Coordona-teur	Hostin	3766-7592	seja2000@yahoo.fr				
Pierre Jonas	Imbert	Bailleur			3777-4318	Pierre.imbert@barrfounda-tion.org				
Pierre Jouvert	Lovinsky	Education		Corail	3604-8282					
Pierre Julio	Joseph	Mairie Arcahaie	Maire Adjoint	Carrefour Poy	3838-7204					
Pierre Karl	Moreau	AIPA (Association irrigant plaine de l'Arcahaie	Directeur	Arcahaie/ Cabaret	3628-8892	pierrekarlmoreau@yahoo.fr				
Pierre Louicite	Jacques									
Pierre Luxon	Revange	Electricien			3705-8728/ 3439-0251					
Pierre Molie	Saint Aime		Cultivateur	Arcahaie	4453-3163					
Pierre Paul	Benjamin			Hostin	3834-4973	pierrepaulbenjamen@yahoo.fr				
Pierre Paul	Jean louis	Agriculture								
Pierre Roland	St-Phard	Enseignant		Bassin Mahée	3691-0017					
Pierre Ronald	Desrosiers	Etudiant			3609-8731					
Pierre Rously	Altidor	Organisation		Corail	48243768					
Pierre Sainvil	Dorsainvil	AJAM	Coordona-teur	Mahotte	3120-5066	sainvildorsainvil@yahoo.fr				
Pierre Smith	Jean Louis	CESCA (Centre educatif socio-culturel de l'Arcahaie)	Délégué	Bassin-Mahée	3811-6728	jeanlouispierresmith@yahoo.fr				
Pierre Soireus	Dessaint	Catholique - JILAP		Arcahaie	3765-9465					
Pierre St-Phard	Michel	HOAS (Hope on a String)			3665-5316					
Pierre Tanès	Sanon			Hostin	3921-8653					
Pierre Willy	Riviere	ASSO								
Pierre-Canel	Jonas	Agriculture			3135-5804				X	
Pierrilus	Stobens Blaise	CNEH/AESM	Instituteur	Saint Marc	3293-6395/ 3705-9066	pstobensblaise@yahoo.com		X		
Placide Jacob	Dumervil			Port-au-prince	4470-8014	jacobdumervilplacide@yahoo.fr				

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Point-du-jour	Rulx	IDEJEN			4748-2324	rulxpdj@hotmail.com			X	
Poliscar	James Guerdy	Plombrie		Robergeau	3640-9473/ 332-2864				X	
Prince	Jean Edouard	OHASSEP	Secrétaire générale	Ponce	4764-1936			X		
Quéné	Morleron	Religieux			3875-8379	quenemorleron@yahoo.com				
Quésly	Olyssé	Etudiant			3172-2507					
Ramongue	St-Cyr	peche		Luly						
Registre	Mubenson	Technicien			3855-2740					
Rémédor	P. Hermane		Notaire		3600-4261					
Rémédor	Joseph	Lycee Arcahaie	Censeur	Arcahaie	3645-2868					
Rene	Wilner	RACADAMA/Protection Civil	Porte - Parole	Saintard	3194-0044	racadamaaction@yahoo.fr	X	X	X	
Rene	Silotte	La Croix Rouge		Merotte	3874-3793					
Rénel	Moléon	Agriculture			3814-8266					
Renette	Décembre	La Flore	Directrice		3726-9689					
Renéus	Faniole	HOAS (Hope on a String)	Participant	Corail	3171-3993	fanibeyou@yahoo.fr				
Résolus	Avius				3472-9204					
Revange	Pierre Luxon	Electricien			3705-8728/ 3439-0251					
Revange	Dumann	Organisation			375-3181				X	
Ricardo	Joseph	Etudiant		Arcahaie	3660-7343	Ricardojoseph09@yahoo.fr				
Richard	Douyon	Rebati SM			159-246-05-31					
Rigaud	Stanley	Health			954-868-2385	SRiga001@Fiu.edu			X	
Rigaud	Felix	HOAS (Hope on a String)	Manager	Corail	4892-4807	felix@hopeonastrnh.org			X	
Rigaud	Susen	Tourism			954-829-1249				X	
Rivelino	Exume	OMENHA	Directeur	Montrouis	4417-8558	r.exume@hotmail.com				
Roberman	Simon	Technicien			3809-0793					
Robert	Gué	G-Tech	Directeur	Saintard	3840-2922					
Roberto	Annelus	Ing. Agronome			36109284					
Roger	Pierre-Louis	Susen			3783-9751					
Rogeste	Balthazar	CESCA (Centre educatif socio-culturel de l'Arcahaie)	Chargé de relation pub.	B. Mahee	3640-8354	rogestebalthazar@yahoo.fr				
Rogles Junoir	Charles	Citoyen		Arcahaie						
Roland	Jean Joseph	Citoyen		Arcahaie	3720-6622					
Romain	Joseph Jean Robert	Médecin			3762-7573	Jeanrobert.romain@yahoo.fr			X	
Romaire	Louis	PNH			3870-4806					
Romil	Rene	CFAM								
Romil	Rene	CFAM								
Ronald	Jean Jules				3626-5434					
Ronald	Monord	Professionnel		Robergeau	3805-1891					
Ronel	Pierre	Technicien		Corail	3653-6112					
Roosvelt	Lazarre	Education			3611-7765					
Roosvelt	Eliassaint	Etudiant		Port-au-prince	3674-9597					
Roph -Clyn	Datismé	Organisation			3745-4642	rophclyn@yahoo.fr				
Rose-Andrée	René	CESCA (Centre educatif socio-culturel de l'Arcahaie)	Porte-Parole	Bassin Maheé	3775-2506	roseandjie@yahoo.fr				
Rosegladia	Demesyeux			Hostin	4643-0858					
Roselin	Joseph	MFASA (Mouvman fanm Akayè pou sove agrikilti)	Membre	Corail	3739-3705					
Rosemonde	Mathieu	ACJPA	Rel. Publique	Centre- Ville	3783-8551	roselove27@live.com				

Prenom	Nom	Organisation / Institution	Titre	Zone d'implantation / Localite	Telephone	E-mail	29 - Aug.	1 - Sept.	17 - Oct.	13 - Dec.
Rouby	Marcellus	Organisation			3102-2349	marcellusrouby@yahoo.fr				
Rulx	Point-du-jour	IDEJEN			4748-2324	rulxpdj@hotmail.com				
Sadrac	Marcellus	JMAA	Secrétaire générale	Merotte	3611-3810	kouman27@hotmail.com				
Sadrack	Joseph	Technicien		Corail	4821-7126					
Sainjuste	Jean Claudel	Agricole			3719-3492				X	
Saint -louis	Jean Gustave	Education		Lully	37182530				X	
Saint Phard	Joselène	Infimière		Pont-Matheux	3668-8017	Joselne-saintphard@yahoo.fr				
Saintilmon	Darrow	Etudiant			3696-9846	darrowsaintilmon@yahoo.fr				
Saint-juste	Emmanuel				3762-8994				X	
Salrick	Nestor		Technicien		3768-1629					
Salva	Jacques Muller	Technicien		Corail	3694-5673					
Salvain	Jeanjean			Fond Baptiste						
Samson	Carlin	Ingénieur		p-au-p	3795-4124	Samson-Carlin@yahoo.com				
Samuel	Edouard	Org/Etudiant		Robergeau	4833-6308					
Samuel	Févrius	Organisation		Robert	3669-7472	jmaarcahaie@yahoo.fr				
Samuel Whistler	Paul	Pasteur		Arcahaie	3664-1167	paulsamuelwhistler@yahoo.fr				
Sarah	Quessa	Education								
Seide	Velos	Etudiant			4616-5076	veloseseide@yahoo.fr			X	
Seliscar	Dens Smith	AJDEC		Montrouis	4479-3335	dondycress@yahoo.fr				
Serge	Lamothe	GREFOS (Groupe de recherche de formation et de service)	Coordona-teur	Arcahaie	3722-3895	ggrefos@yahoo.fr				
Serge	Dorvilien				38806819					
Shelta	Bolivar	Institution Souvenir	Maitresse	Arcahaie	4447-1480					
Silotte	René	La Croix Rouge		Merotte	3874-3793					
Silviane	Demesyeux	HOAS (Hope on a String)			4866-3321					
Simon	Jean Barthelemy	OHASSEP	Relationiste	Ponce	3801-6413	barthelemyohassep@yahoo.fr		X		
Simon	Alain Jean Bernard	Comptable		Pont-Matheux	3664-1194	salainbernard@yahoo.fr				
Simon	Roberman	Technicien			3809-0793					
Slovenie	Edouard	HOAS		Arcahaie	3947-2912					
Smail	Joseph	Gevehan				Josemailla2013@yahoo.fr				
Sophia-Nika	Villière	HOAS (Hope on a String)		Corail	4868-3854					
Sophonie	Simervil			Pont-Matheux	3393-4376					
Spédo	Saint Surin	HOAS (Hope on a String)			3810-1657	SpedoSaintSurin@yahoo.fr				
Sr Elida	Vixamar	Religieuse		Saintard	4847-9942	elidavixamar@yahoo.fr				
Sr Micheline	Duré	Religieuse		Saintard	3861-7300	Dure.micheline@yahoo.fr				
Stanley	Rigaud	Health			954-868-2385	SRIga001@Fiu.edu				
Staphania	Pierre	Organisation		Corail	46921749					
Starlin	Datismé	Tourism			3860-7014					
Stéphane	Chéry	Agronome			3665-9545					
Stéphanie	André	Ecolière		Lully	3610-4844					
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Sther-Phania	Desilien	HOAS (Hope on a String)		Corail	4472-4560					
Stobens Blaise	Pierrilus	CNEH/AESM	Instituteur	Saint Marc	3293-6395/ 3705-9066	pstobensblaise@yahoo.com				
Succces	Moliere		Securite	Arcahaie	3499-4299			X		
Succes	Jean Frantz	Normalien			3833-4699	succesfrantz@yahoo.fr				
Succes	Jean Holly	Education		Pont-Matheux	3752-4067					
Sully	Jean Lefabre	MOPAV			3621-2600				X	
Susen	Rigaud	Tourism			954-829-1249					
Ted	Sanon	Traducteur		Robergeau						
Théosmy	Phéjère	Agriculture			3616-7672				X	
Thomas	Jean Claude	E-JC	Secretaire	Corail	3656-0322					
Timmer	Marie	FHEDINC			3680-4579	Mariegerald2005@yahoo.com			X	
Tito	Marie Jocelyne	Education			3768-6453				X	
Ultimo	Compère	Ex-Sénateur			3881-1368					
Valessa	Mystil	Constructeur			3616-2088	PUSHON15@yahoo.fr				

Prenom	Nom	Organisation / Institution	Titre	Zone d'implantation / Localite	Telephone	E-mail	29 - Aug.	1 - Sept.	17 - Oct.	13 - Dec.
Vélos	Séide	HOAS (Hope on a String)			4616-5076					
Velouse	Joseph	HOAS (Hope on a String)	Professeur	Corail	3798-4617					
Venante	Benjamin									
Venita	Archille	Téchnicienne Laboratoire			3823-7438	Varchille@yahoo.com				
Verna	Jean Rene	ADECCO	Coordona-teur	Conte	3797-3866			X	X	
Vernet	Azor	Etudiant		Saintard	3617-5906	vernetazor1203@yahoo.fr				
Vincent	Jean Léon	Avocat			4601-3421				X	
Viola	Delus				36314644					
Violette	Larochelle	HOAS (Hope on a String)		Corail	3269-7879					
Watson	Delva	HOAS (Hope on a String)		Corail	4634-4252					
Webens	Jean Paul	Cuisine Luloise					X	X	X	
Webens	Marcellus		Universite	Hostin	3688-9291	webspierre@yahoo.fr				
Webert	Rochelin	Education								
Webin	Jean Jacques			Arcahaie	3734-3283					
Widnerson	Laurent	Etudiant			3777-5591					
Wilbens	Beauvoir	Citoyen		Lully	37283128					
Wilcame	Eglaus	Organisation		Arcahaie	4315-9449	wilcameeglaus@yahoo.com				
Wilderson	Mervil			Arcahaie	3688-4230					
Wildon	Villière		Etudiant	Merotte	3882-7215	wildonvilliere@yahoo.fr				
Wilfort	Joseph			Corail	3735-5941					
Wilfrid	Dalzon	CFET (Centre de forma-tion et Enc. Technique)			3478-6061	wdalzon@gmail.com				
Wilkenson	Louis								X	
Wilkenson	Neus				3717-7039					
Wilkenson	Louis									
William	Delva	HOAS (Hope on a String)	Formateur	Corail	4857-6187	delvaw@yahoo.fr				
William	Cadet	Construction			3100-9019					
William	Delva	HOAS (Hope on a String)	Formateur	Corail	4857-6187	delvaw@yahoo.fr				
Wilner	Ferdinand			Williamson	4802-5768					
Wilner	René	RACADAMA/ Protection Civil	Porte - Parole	Saintard	3194-0044	racadamaaction@yahoo.fr				
Wilnick	Beauvoir	Génie Civile		Lully	3737-1831					
Wilson	Jean François	Mairie	Maire	Arcahaie	3642-6366			X		
Wilson	Dameus	Ing.Agronome			47465796	Wilsondameus@yahoo.fr				
Wilzie Betty	Adolphe			Bourg	3822-7768					
Wisly	Exumé	Technicien		Pont-Matheux	3640-8213					
Wismy	Louis	Avocat		Merotte	3181-9311	lwismy@yahoo.fr				
Wisner	Joseph	KOJW		Williamson	3632-5724					
Wolcking	Alexandre	Eglise Communautaire	Pasteur	Conte	3607-8744					
Yolande	Févrius	Marchande		Arcahaie	36164585					
Yolene	Edouard		Pasteur	Robergeau	3625-0887					
Yvecar	Saint Phard	MFASA (Mouvman fanm Akayè pou sove agrikilti)	Coordona-trice	Merotte	3895-2834					
Yvelie	Souffrant	Ecolière			4886-3942					
Yvenel	Pierre	Genie Civil			3107-1794					
Yveno	Ixé	HOAS (Hope on a String)		Saintard	4034-5184					
Yvenson	Mondesir				4751-1483	Yvenson-mondesir@yahoo.com				
Yves	Saint Phard			Mitan	3834-9116					
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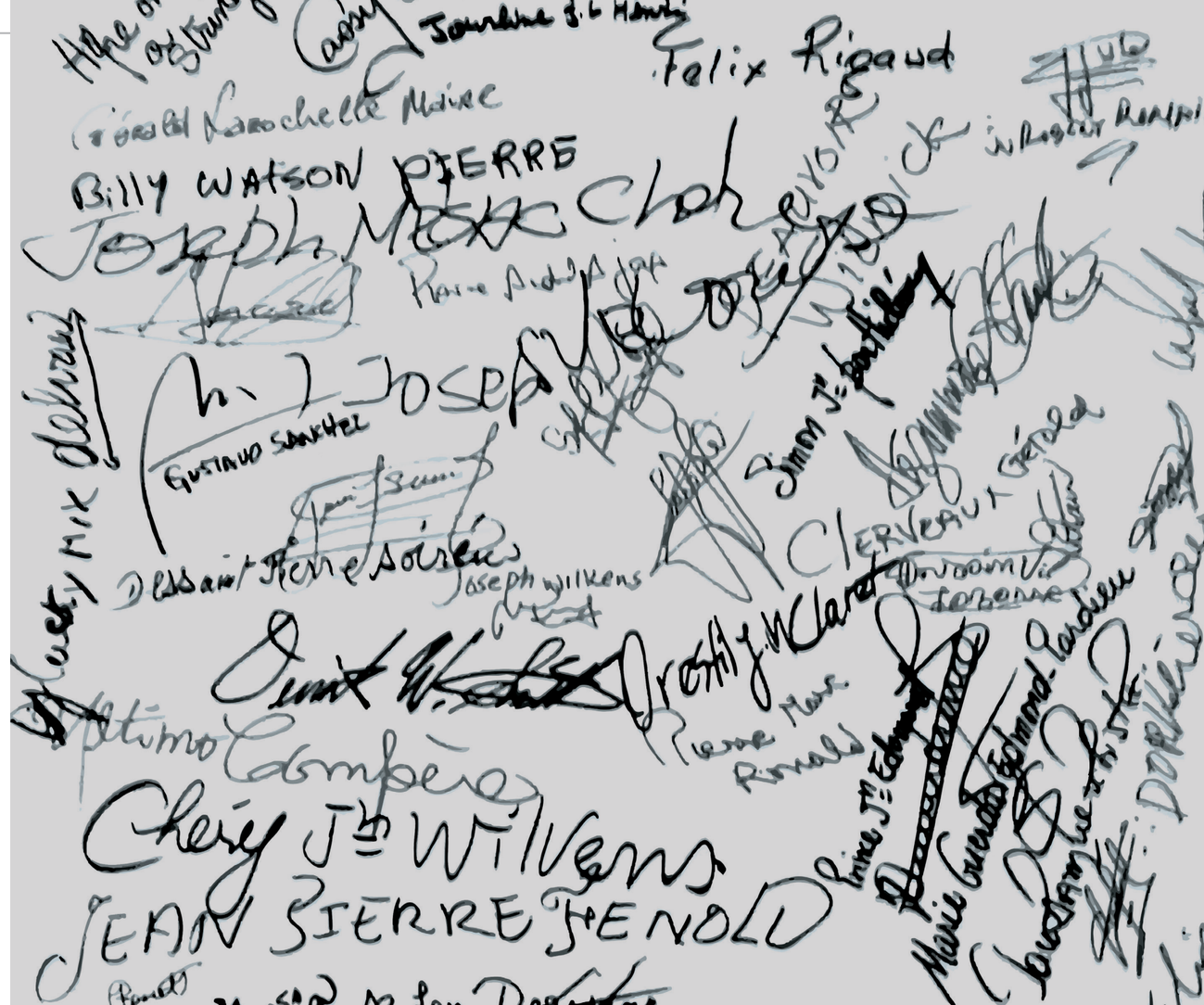
Yvio	Gilot									
Zicot	Jean	AFDF	Etudiant	Arcahaie	3284-0468	zicot@yahoo.fr				

List of NGO's Serving Arcahaie Region
Haiti Initiative Reference Manual

The Appendix items listed above, can be viewed online at:
www.arc.miami.edu/community/center-for-urban-community-design



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