

THE ARCHITECTURE OF WATER INFRASTRUCTURES

Strategies for Urban Growth in the Haitian-Dominican Border

by

Luisa de Lucena Schettino

Bachelor of Architecture

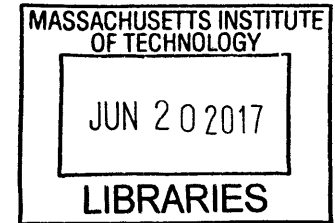
Pontifical Catholic University of Rio de Janeiro, 2014

Submitted to the Department of Architecture
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Architecture Studies

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SMArchS Architecture & Urbanism Thesis
Luisa de Lucena Schettino

Advisor: Rania Ghosn
Reader: James Wescoat

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Abstract

The uneven and underexplored landscapes of the border zone between Haiti and the Dominican Republic has become a promising frontier for capital accumulation, attracting industrial activity to the island's overlooked regions. This thesis focuses on the most populous border crossing in the island, where the implementation of a free trade zone in 2004 catalyzed rapid population increase on the Haitian side, and urban infrastructures were unable to keep up with the fast pace of informal growth. At this site, the borderline coincides with the River Massacre, a major source of water in the region, threatened by the current patterns of urbanization.

Given the scenario of industrial expansion and increased migration to Ouanaminthe, investments in affordable housing are at the core of planning strategies to accommodate urban growth. The proposal sees the opportunity for a territorial strategy that integrates housing and water infrastructures to address uneven urbanization. While the zone exists in isolation to the urban fabric of both cities, its existence provides the opportunity to weave an alternative spatial order, countering the reproduction of spatial and social injustices.

By seizing infrastructure's ability to act directly on the city, architecture mediates the complex flows of water and people to build a sustainable urban future. Water is drawn as the layer 0 to accommodate the diverse program, staging the sites for affordable housing units, public open spaces, industrial and agricultural activities. Essential to this scheme are aqueducts that position water not at the edge, but at the center of urban development. Together with other infrastructural artifacts, the aqueducts are mechanisms that forge new individual and collective identities.

Thesis supervisor: Rania Ghosn

Title: Assistant Professor of Architecture and Urbanism

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This thesis is dedicated to my family, who have selflessly encouraged and supported me to complete this milestone.

BIOGRAPHY

Luisa Schettino received her professional degree in Architecture and Urbanism from the Pontifical Catholic University of Rio de Janeiro, Brazil, in 2014. As an undergraduate, she was awarded a grant from Brazil's National Council for Scientific and Technological Development for an academic exchange at the University of California, Berkeley.

Prior to MIT, Luisa accumulated 3+ years of professional experience in architectural practices in Rio de Janeiro. As a SMArchS urbanism candidate at MIT, she was a teaching assistant for Professor Rafi Segal and a Research Assistant at the Center for Advanced Urbanism. She also received a grant from MIT MISTI Mexico for a 2-month internship with Professor Jose Castillo (Harvard GSD).



THE ARCHITECTURE OF WATER INFRASTRUCTURES

Strategies for Urban Growth in the Haitian-Dominican Border

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1. Introduction

This thesis addresses uneven urbanization in riverfront border cities. While water issues are typically approached through the disciplinary domains of engineering, through infrastructure, architecture can act directly on the city to anticipate alternative spatial orders. The concept of “borderscape” provides a multidimensional and multi-sited understanding of nation-state borders to challenge pre-conceived notions of closed territorialities. The case study between Haiti and the Dominican Republic relies on a systematic analysis and ground observations conducted in January 2017.

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The uneven interdependencies found at the border mirrors the island’s asymmetrical development. A binational perspective, however, is insufficient to fully describe the border’s complex geographies. To understand the forces that shape the selected site for investigation, the analysis here is organized in four sections, downscaling from the international study of the island, to the border, the northern corridor and, finally, the site.

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The proposal is a territorial strategy that integrates housing and water infrastructures to address uneven urbanization. By seizing infrastructure's ability to act directly on the city, architecture mediates the complex flows of water and people towards a sustainable urban future. Water is drawn as the layer 0 to accommodate the diverse program, staging the sites for affordable housing units, public open spaces, industrial and agricultural activities.

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To move from the systematic and anonymous urban infrastructures, the proposal draws from the specificities of the site. The lessons learned demonstrate how the private motivations shaping the border region today can supply the urban needs of border populations.

116 Achievements and Future Work

ILE DE ST. DOMINGUE

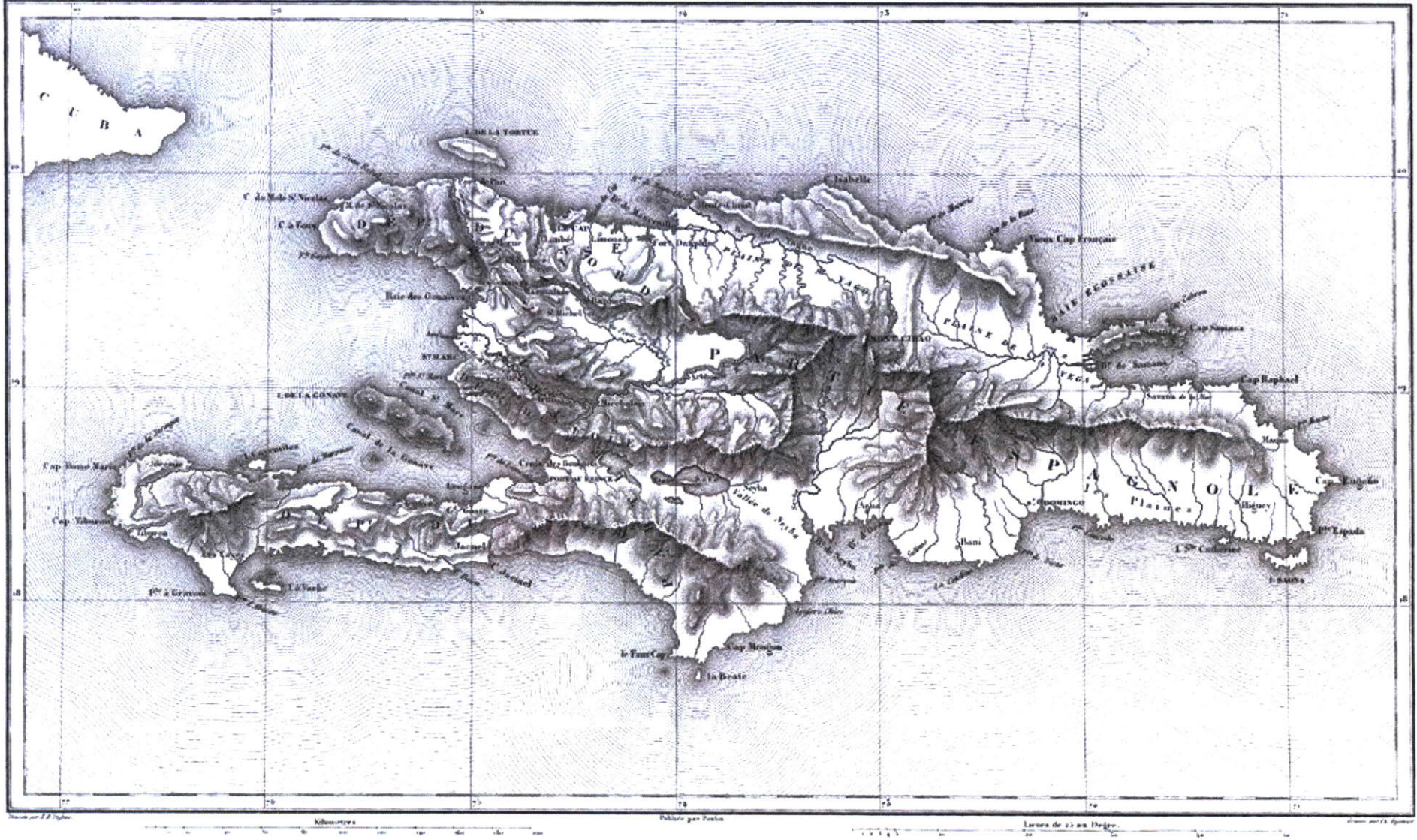


Fig 01. Engraved topographic map of Hispaniola island by french cartographer Auguste Henri Dufour, 1859.

CHAPTER 1 INTRODUCTION

1.1 Watery Borders

This thesis proposes that the architecture of infrastructure address uneven urbanization in riverfront border cities. Innovative solutions for the degradation of transnational watersheds is an opportune investigation, considering that more than a third of international borders are delimited by rivers and streams.

1.2 The Agency of Architecture

High rates of urbanization make new investments in water infrastructures indispensable. While issues of water are typically approached through the disciplinary domains of engineering, we suggest that architecture should too address the performative processes integral to urban water. This is because architecture, rather than offering technical solutions that most likely obey the status quo of urbanization, has the ability to anticipate alternative spatial orders.

1.3 Notes on the Border

As architects and urban designers, we work with the definition of boundaries, frames, walls – systems that delimit what is inside and outside, private or public. “Borders” are therefore part of our vocabulary and toolset, although we rarely reflect on the agency of architecture to manipulate modern nation-state borders. The concept of “borderscape” allows us to explore the multidimensional and multi-sited understanding of political borders to challenge pre-conceived notions of closed territorialities, and support a transfrontier design strategy.

1.4 Scope of Thesis and Methodology

The case study between Haiti and the Dominican Republic is approached by a systematic analysis, downscaling from the international study of the island, to the borderland, the northern region and, finally, the site. The research relies on mapping as a design investigation strategy and ground observations conducted during a site visit in January 2017.





1.1 WATERY BORDERS

*The obvious limitation of rivers as boundaries is that water is transitory. The paradox inherent in conceiving of water flowing between two states as a territorial boundary is that the passage of the water is necessarily temporary, while sovereignty imports the notion of permanence.*¹

*Sitting on the banks of the shallow riverine waters separating the northern border towns of Dajabon of the Dominican Republic and Ouanaminthe, Haiti, one can see children wade, market women wash, and people pass from one nation to another. They are apparently impervious to the official meaning of this river as a national boundary that rigidly separates these two contiguous Caribbean island nations. Just as the water flows, so do people, goods, and merchandise between the two countries, even as the Dominican border guards watch stationed on a small mound.*²

The challenges imposed on urban life by rising sea levels, recurrent floods, drying reservoirs and contaminated water sources reminds us that the future of cities is inseparable from the future of water. If water problems were mostly a concern of developing countries, in this century it has become globalized³, affecting major urban conurbations in the Northern and Southern hemispheres. As the world population increases – the UN DESA report expects an increase of 2.4 billion people by 2050 – water availability is projected to decline in many regions (UN WATER).

In addressing the global water crisis, issues related to transnational water resources multiply. Historically, political boundaries have followed physical features for a number of reasons. The always evolving morphology of natural water features and the difficulty in defining the median lines of shifting water bodies, raises problems regarding the precise demarcation of borderlines.⁴ But despite the inherent complications of fixing limits over fluid forms, more than a third of international borderlines today are settled along watercourses.⁵ This strategy translates into the alarming figure that over 40% of the world's population resides in shared river basins.⁶

Further, specially in the context of scarcity, complications arise as what would be ideally managed as a unit falls under the domain of diverging regimes.⁷ Almost inevitably, shared waters advance international disputes concerning water use, quality and management.

(Notes)

1. Prescott and Triggs, International Frontiers and Boundaries.

2. Derby, "Haitians, Magic and Money."

3. Swyngedouw, Social Power and the Urbanization of Water, p.8

4. Boggs, "Problems of Water-Boundary Definition."

5. Donaldson, "Paradox of the Moving Boundary: Legal Heredity of River Accretion and Avulsion," p.155

6. Ingram, Laney, and Gillilan, Divided Waters," p.6



Fig 02. International Riverbasins of the World
(Source: Transboundary Freshwater Dispute Database Dataset/USGS Global GIS 2003)

As climate change and population growth intensifies problems of water scarcity worldwide, both increased conflict and cooperation in transnational watersheds can be expected.⁸ Challenges related to transboundary waters are not new or small, and the moment is opportune for innovative solutions.

The Mexico-US border, sharing over 2000km of river boundaries⁹ and having conjointly created, in 1944, the International Boundary and Water Commission, provides several interesting case studies and a long historical record of water disputes. The creation of “water banks” to address issues of uneven consumption, the construction of binational sewage treatment facilities to improve water quality in shared rivers and shared water reclamation projects illustrate some of the work achieved under IBWC.

Being already highly urbanized, the Mexican-American border allows us to foresight strategies to avoid conflict and increase cooperation in less developed border regions. In a much smaller scale, the borderlands of Haiti and the Dominican Republic begin to mirror the conditions found there: uneven population growth, differences in infrastructure development, disparities in water consumption for agricultural use, and different degrees of environmental protection are some of the similar circumstances that intensify the challenges of administrating transboundary waters.

7. Ibid p.4

8. Brochmann and Gleditsch, “Shared Rivers and Conflict – A Reconsideration.” p.379

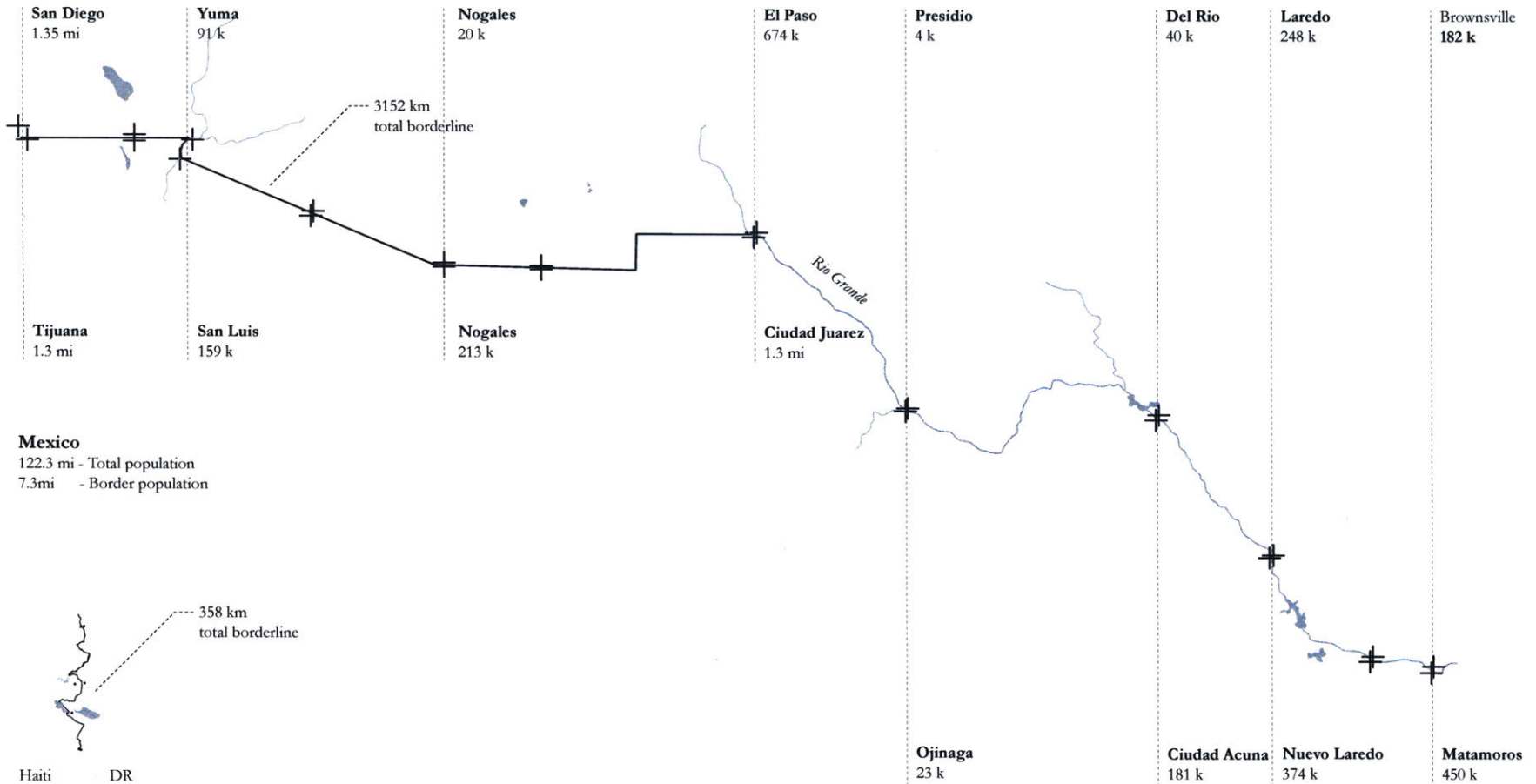
9. International River Boundaries Database, Durham University

Fig 03. Border scales: Mexico-US border crossing cities and international waters (Source: US Census Bureau and INEGI)

Chapter 1

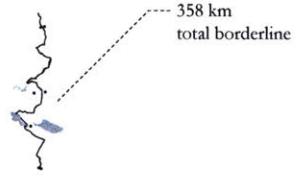
USA

318.9 mi - Total population
7.3 mi - Border population



Mexico

122.3 mi - Total population
7.3mi - Border population



Haiti DR

0 100km

1.2 THE AGENCY OF ARCHITECTURE

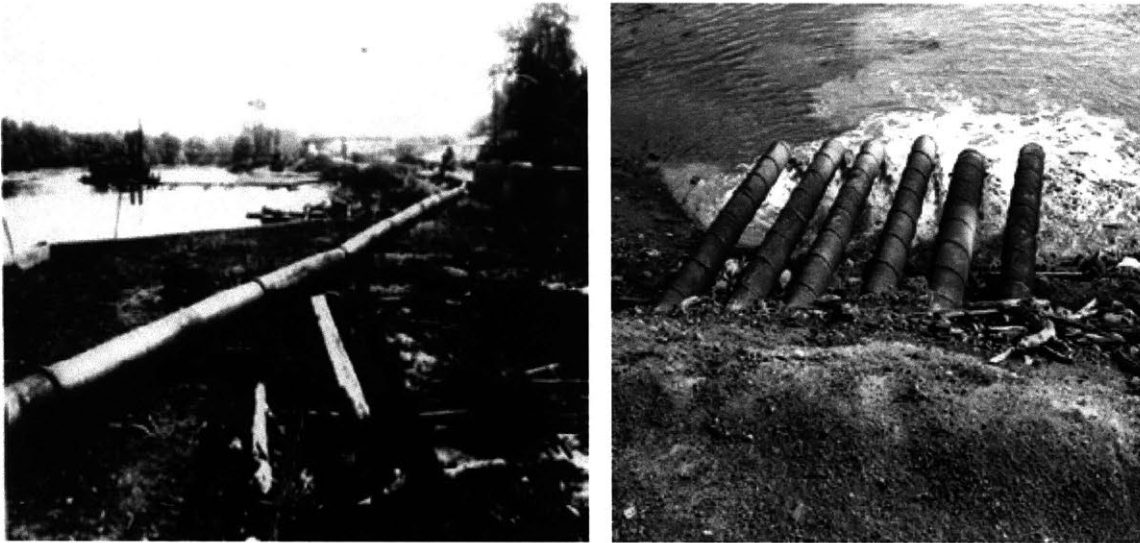


Fig 04. The Great Pipes Monument; The Fountains Monument. Side view. (Photo: Robert Smithson)

As I walked north along what was left of River Drive, I saw a monument in the middle of the river – it was a pumping derrick with a long pipe attached to it. The pipe was supported in part by a set of pontoons, while the rest of it extended about three blocks along the river bank till it disappeared into the earth. One could hear debris rattling in the water that passed through the great pipe.¹⁰

This thesis proposes a framework that reads water as a key organizational device of the territory, calling architecture to reengage with the project of the city. Seeing that the ambitions of urbanization reduce water to a commodity, subordinated to the expansionist logic of the *urbs*, we argue that a new scheme is necessary to counter the reproduction of social and ecological injustices reinforced by urban water systems.

Before reaching our faucets, water is captured in rivers, stored in reservoirs, pumped, adjusted in treatment plants and piped through the city, if not already used by households, agriculture or industry and recycled before being returned to nature. Water is crucial to our daily activities, yet we are largely unaware of how it ends up in our homes. In a scenario of scarcity, however, the invisibility of the infrastructural framework that supports urban life comes to light.

(Notes)

10. Smithson, "The Monuments of Passaic." p.54

The absence of water reveals the condition of cities, which historically have been dependent on the mastering of natural waters. And as argued by Gleick, modern cities prospered only when the technological advances that guaranteed access to clean water were coupled with the effective removal of wastewaters to large populations.¹¹ For Swyngedouw, the process of urbanization is closely tied to what he calls the “urbanization of water”, this is, the transformation of an essential good into a commodity that became organized in a complex system of social, political, economic and ecological networks¹². Participating in the political project of urbanization, water was detached from its natural representations to become a silent agent shaping the territory. It reflects social inequality, ethnic struggles, the monopoly over natural resources, and, in sum, the power relationships that determine the geographies of urbanization¹³.

In this sense, despite their pragmatic character, water infrastructures do not operate under a neutral technical frame¹⁴, but “as with other urban goods and services, (...) is part and parcel of the political economy of power that gives structure and coherence to the urban fabric”.¹⁵ We can argue that urban infrastructures in general solve more than a technical equation to sustain urban life; they obey the capitalist project that drives urbanization. In this sense, to engage with urban water and the underlying questions of urban infrastructure provides the opportunity to challenge the status quo of urbanization.

The paradigm of water infrastructures

In his analysis of infrastructure through the lens of technopolitics, Larkin traces the concept of infrastructure originating in the modern visions for progress that followed the Enlightenment. Railways, electricity, telecommunications, efficient removal of wastewaters... Such technological advances, grounded on the ideals of liberalism, had deep effects on the renderings of new city forms¹⁶.

In his seminal essay “The Natural History of Urbanization”, Mumford debates how these technological improvements allowed an ever-expanding network of infrastructures to draw an amorphous territory, overriding the specificities, limits and forms of nature. According to him, our relationship with nature shifted from one of “symbiosis and dominance” to a total “displacement of nature”, where urban development frees itself from the constraints of the natural limitations of the land¹⁷. That results in an inverted condition,

11. Gleick, “The Future of Water.” p.236

12. Swyngedouw, Social Power and the Urbanization of Water. p.30

13. Ibid. p.2

14. Larkin, “The Politics and Poetics of Infrastructure.” p.330

15. Swyngedouw, Social Power and the Urbanization of Water.

16. Larkin, “The Politics and Poetics of Infrastructure.” p.332

17. Mumford, “The Natural History of Urbanization.” p.384-388

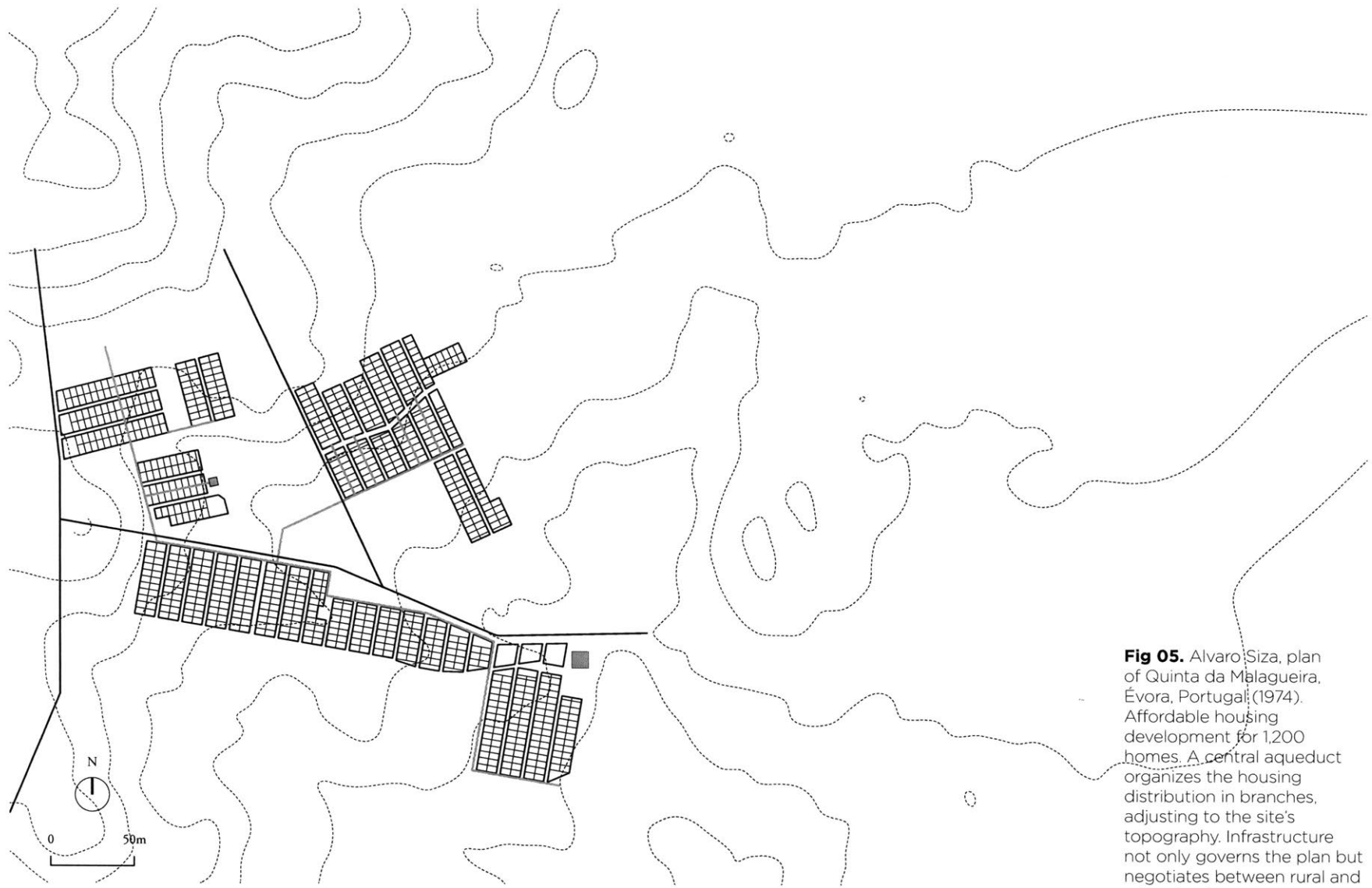


Fig 05. Alvaro Siza, plan of Quinta da Malagueira, Évora, Portugal; (1974). Affordable housing development for 1,200 homes. A central aqueduct organizes the housing distribution in branches, adjusting to the site's topography. Infrastructure not only governs the plan but negotiates between rural and urban landscapes, private and public spaces.

in which cities are no longer “islands” amidst a field of green, but became the field itself, confining nature to patches within an artificial landscape. In line with Mumford’s observations, Picon describes: “the city stops being in the landscape, as a sort of monumental signature, to become, progressively, in and of itself, landscape”¹⁸.

Urban water participates in this paradigm. Where the population demands exceed the availability of local resources, the infrastructural net of water supply is pushed beyond the administrative boundaries of cities, extending the ecological footprint of urban growth.¹⁹ Following the modernist arrangements of mobility infrastructures, urban water therefore reinforces the open-ended territory, in a network of pipes and pumps that supports urbanization and supersedes nature.

Water as Nomos

We argue however, that if water can behave in such expansionist character, it also holds the ability to restore the qualities of the *nomos* and our relationship with the natural environment. Urban streams, lakes, creeks, and also dams, aqueducts and irrigation canals are elements that can frame and define space, providing physical limits to the city. However, confined to concrete channels or hidden below grade, water is often abstracted from any relation to its surroundings, reduced to H₂O – “not water, but a stuff which industrial society creates”²⁰ In such, the meanings and symbols associated to water are lost as it comes to represent simply a device for progress in modernity.

To draw water as a “layer 0” for structuring the territory is therefore to reinstate its qualities as a legible artifact, aware of the specificities of place, of the physical anatomy of the territory and the ecologies of nature. If the *nomos* addresses the idea itself of a measure against the unmeasurable²¹, water as a return to the *nomos* offers a representation that can juxtapose what Aureli defines as the managerial logic of urbanization²². In this project, making urban water visible means both to restore the phenomenality of water, and, most importantly, to allow a different political order to come to surface. Further, while this strategy accepts urbanization, it is critical of the ecological and social injustices produced by modern engineering techniques²³.

18. Picon and Bates, “Anxious Landscapes.” p.67

19. Swyngedouw, Social Power and the Urbanization of Water. p.37

20. Illich, H₂O and the Waters of Forgetfulness., p.7

21. Giudici and Vittorio Aureli, “The Nomos of the Earth: Rethinking the Architecture of the Territory.” p.5

22. Ibid. p.9

23. Dicks, “A Phenomenological Approach to Water in the City.”, p.418

Why Architecture

By mapping flows, understanding the mechanisms that bring water to the city and reading the natural systems that interact with the artificial network of urban water, architects can affect the reality of the territory, by drawing on the scale of the building or that of urban infrastructures. In this sense, infrastructural urbanism, or architecture as infrastructure, goes beyond redeeming the “very large scale” and the “material practices” under the domain of engineers.²⁴ It is in turn about structuring the city via a different logic, capable of acting across multiple scales and introducing an alternative order all together.

We can therefore argue that while architecture as a discipline has been marginalized in the development of the city, it still holds the necessary instruments to engage with the problems affecting the scale of the city and the territory: “mapping, projection, calculation, notation, and visualization are among architecture’s traditional tools”.²⁵ Further, as a generalist and critical discipline, architecture can mediate between ecology, economy and politics to position itself within the urgent issues that arise from urbanization.

It is in this context that the Brazilian office MMBB situates “Watery Voids”, a conceptual project for São Paulo that claims for architecture the responsibility to reimagine who benefits from the public investments in infrastructural projects. With the recurrent floods affecting crucial mobility nodes in the city’s center, the government of São Paulo is dedicating large amounts of public money to the construction of retention pools throughout the metropolitan area, many of them located within informal communities. Though the pools assist the population that transits in the city’s core, it adds no value to the areas where they are physically located. The project therefore imagines how reservoirs can be adapted to function as public spaces which are temporarily filled with water during rains: soccer fields, open plazas or skate parks are suggested examples for incorporating an infrastructural object as a structuring element of the peripheries²⁶. By doing so, the proposal attempts to subvert the highly selective logic of “hydraulic citizenship”, a form of belonging to the city enabled by social and material claims made to the city’s water infrastructure²⁷. Further, rather than proposing an alternative to the centralized, top-down infrastructural practice that predominates in water management, MMBB demonstrates how architecture can change the status quo of urban water while still operating within those systems. Under this light, a new political dimension is added to the stretching of water infrastructures, one that is different from the exclusionary forces that drive urbanization. In transforming the retention pools

24. Allen, “Infrastructural Urbanism.”, p.50-53

25. Ibid., p.51-52

26. de Mello Franco, “Filling the Voids with Popular Imaginaries.”

27. Larkin, “The Politics and Poetics of Infrastructure.”, p.545

28. de Mello Franco, “Filling the Voids with Popular Imaginaries.”, p.85

into a public amenity, “Watery Voids” also provides a new relationship between citizens and water²⁸, as both are invited to share the spaces of infrastructure.

Living with water

For Illich, “dwelling” and “living”, once synonymous, came to represent different meanings. “To dwell means to inhabit the traces left by one’s own living” and by dwelling one shapes the environment, he argues. However, in our modern existence, we have lost the ability to leave our traces on urban space²⁹. The house and the spaces of work have become anonymous, no longer signifying the identity of those that occupy them. Drawing from Illich, Dicks argues that water has the ability to restore such connectedness to place. By letting water appear in cities, we are reminded of the continuity of its flows, and of the interdependence of water consumption and water availability³⁰. It is important to note, however, that the phenomenality of water through urban infrastructures is not dependent on its visibility. Dicks illustrates this point by suggesting that the aqueducts of Ancient Rome, in being named after the rivers and reservoirs that supplied them with water, tied urban water qualitatively to its origin, and thus approximated households, industry and agriculture to the landscapes of water extraction³¹.

In conclusion, in dealing with the territory and the pressing environmental challenges that threatens the sustainability of urban life, architecture inevitably will have to address the issues of water management and urban water infrastructures. From Bogotá to São Paulo, Los Angeles to Ho Minh City, urban managers are confronted with the hydrological dysfunctions that have accompanied urbanization. More than offering a technical solution, architecture has the ability to interpret the multiple economic, political, social and cultural layers that structure the city. In this view, it can critically position water within the dynamics that give form to the territory. In the contemporary city, water is trapped in the homogenous field of infrastructural containers and conduits controlled by the status quo of the *urbes*, and thus has lost its ability to give structure and legibility to the urban landscape. Positioning itself critically within the scenario of climate change and environment degradation, architecture has no alternative but to “challenge the present economic and political asymmetry that characterize the reality of many urban territories”³². We have attempted to demonstrate that while urban water is subject to the politics that manages such conditions; it can provide a privileged lens for architecture to structure the future of the city.

29. Illich, H2O and the Waters of Forgetfulness., p.10

30. Dicks, “A Phenomenological Approach to Water in the City”, p. 425

31. Ibid, p.425

32. Giudici and Vittorio Aureli, “The Nomos of the Earth: Rethinking the Architecture of the Territory.”, p.9



1.3 NOTES ON THE BORDER

Fig 06. Border marker is covered by the rising Lake Enriquillo, at the Malpasse/Jimani crossing. 2011 (Photo: Listin Diario, edited by LS)

As architects and urban designers, we work with the definition of boundaries, frames, walls – systems that delimit what is inside and outside, private or public, and the list goes on. These systems, as Alejandro Zaera-Polo argues, are not merely physical constructs but also a social and political one - “the building envelope forms the border, the frontier, the edge, the enclosure and the joint: it is loaded with political content”.³³ Borders – and the agencies that come with them – are therefore part of our vocabulary and toolset, although we rarely reflect on how the buildings and cities we design relate to borders of other nature

This section will provide the theoretical framing for investigating the rapidly urbanizing border cities between Haiti and the Dominican Republic, to provide design strategies that are critical of the status quo of these borderlands.

Semantics

Border, frontier and edge are commonly used interchangeably to describe a dividing line, when they in fact bring different meanings and connotations. The frontier implies there is something beyond – or a limit to be pushed and challenged, hence it speaks to territory but also to more general concepts, such as knowledge, e.g. “the frontiers of knowledge”³⁴. If the frontier is a blurred domain that is expected to be pushed and redefined, the edge is imagined as a sharp limit, not necessarily at the “front” – it is “a line where an object begins or ends”³⁵, hence the use of the word in geometry to describe the segment where two planes meet. Interestingly, the precise quality of the edge lends to the word the idea of a fine threshold, an attribute which border and frontier do not carry.

“Border” in English is adapted in mid 14th century from the French “*bordure*”, describing the edge of a shield, and “*bord*”, the plank or side of a ship.³⁶ Later, a geopolitical connotation is added to “border” as it substitutes “march” – a term in old French and German meaning to mark out and delimit.³⁷ The very notion of border as a territorial boundary is therefore borrowed from the verb that describes “the tramping of feet”, and the movement across frontiers – in Old French “*aller de marche en marche*”, to go from land to land.³⁸ In this sense, intrinsic to the definition of border and territorial demarcations is measurement through movement and presence on the land. When we speak of border today, however, it is not the echo of our feet, but the view of

(Notes)

33. Zaera-Polo, “The Politics of the Envelope: A Political Critique of Materialism.” p.76

34. Mezzadra and Neilson, *Border as Method, Or, the Multiplication of Labor*. p.18

35. In Miriam Webster Online - <http://www.merriam-webster.com/dictionary/edge>

36. Skeat, *Concise Dictionary of English Etymology*.

37. Ibid.

38. Ibid.

a subdivided globe that comes to mind, where the abstract drawing of the earth as two dimensional lines is detached from a bodily experience.

We have naturalized the image of territorial borders as lines on maps, with its color codes and symbols³⁹, yet as the social scientist Paola Cuttita investigates in his reading of borders as points, lines and zones, the linear border was not simply invented and imposed, but rather morphed from a tangible zone into an abstraction as our notions of community, land and power evolved⁴⁰.

Cuttita differentiates between two types of anthropic borders: territorial and non-territorial ones. State borders and borders of private real estate properties define the range of territorial borders, their main attributes being that they can be “marked and physically reproduced on the earth’s surface”. Non-territorial borders, on the other hand, produces connections and boundaries that are not necessarily contained within a contiguous space – these are social borders related to culture, religion, language, identity, economic situation, among others.⁴¹ In this project, when referring to border or boundary I am referring to the nation state border. The multiple divides generated and affected by this political partition will be analyzed through the concept of borderscapes, discussed in the next section.

The modern geopolitical border results from the emergence of the nation state in 17th century Europe, when territoriality became a prerogative for national sovereignty. By the 20th century, the wide acceptance of this model of political organization, enforced by colonialism and the technological advances of cartography, state borders had proliferated from Europe to the rest of the world.⁴² Cuttita argues that before linear borders fragmented every piece of land above sea level, “frontier zones”, rather than sharply defined borderlines, guaranteed the protection of political communities. These zones of varying widths, or “fuzzy frontiers”, were fringe areas between territories, uninhabited or scarcely populated – the border in this sense occupied the space which was necessary to separate neighboring territorial units. Citing the German geographer Friedrich Ratzel, Cuttita contends that the reduction of zonal borders to lines results from: “the increased ability to exploit the soil, the higher interest in the direct control over the possibly largest portion of land, the augmented skills in measuring and representing – and, therefore, in controlling and ruling – the territory itself.” In other words, the linear form of borders are a consequence of the “triumph of territoriality”⁴³, where control of land becomes the basis for power.

39. Mezzadra and Neilson, *Border as Method. Or, the Multiplication of Labor.*, p.3

40. Cuttita, “Points and Lines.”, p.35

41. *Ibid.*, p.34

42. *Ibid.*, p.28

43. *Ibid.*, p.28

Yet, rather than experiencing borders as a sharp line, zonal borders are still the perceived dimension of borderlines, since the transitioning between sovereign territories is felt as a graduated transition rather than as a sharp frontier.⁴⁴ Even when walls, natural features or border markers make visible the territorial edge, the perception of the border is extended to the empty fields, the spaced border controls, or the bilingual signs along an international road. The border is also embodied in us, as individuals, “portable” and “punctual” borders, constantly displacing the closure of territories as we move across frontiers.⁴⁵

Borderscapes

Expanding on this notion that political borders as fixed fine lines exist merely as a representation, we will argue that borders transcend spatial/territorial definitions and produce shifting landscapes. More recently in political geography, in the arts and other disciplines of the social sciences, the term *borderscape* has gained increased traction in investigating this condition

Different approaches have appropriated the term to describe: a) an area that extends beyond territorial boundaries, being constantly transformed and redefined by transnational flows; b) the physical implications on the land promoted by demarcations of sovereignty and c) the cultural representations of a border region⁴⁶. However different these appropriations, they all seem to recognize that borders produce a unique “scape”, worth viewing from its own systems and logics.

For the purposes of this project, we will adopt the first approach, following Chiara Brambilla’s understanding that “the borderscapes concept brings the vitality of borders to our attention, revealing that the border is by no means a static line, but a mobile and relational space”. In her essay for *Geopolitics*’ 2015 issue “Borderscapes: From Border Landscapes to Border Aesthetics”, Brambilla demonstrates how the borderscape notion advances previous approaches in border studies, such as the move from border as fixed territorial divides to “bordering” as dynamic processes, and from border as an objective representation to “border landscape” as signifying systems beyond the visual dimension^{47 48}. What “borderscapes” can offer is therefore a step beyond these positions, since it speaks to the “productive understanding of the processual, de-territorialized and dispersed nature of borders” and to the “changing scenarios of globalized contemporaneity as well as the major changes

44. Ibid., p.35

45. Ibid., p.36

46. dell’Agnese and Amilhat Szary, “Borderscapes.” p.7

47. Brambilla, “Exploring the Critical Potential of the Borderscapes Concept.”

48. dell’Agnese and Amilhat Szary, “Borderscapes.” p.7

49. Brambilla, “Exploring the Critical Potential of the Borderscapes Concept.”, p.22

affecting it, including transnational flows and migration”.⁴⁹

While the fusion of “border” and “landscape” might imply the accumulation of the subjectivities associated with both ideas, producing further complications rather than clarifications⁵⁰, Brambilla argues that “borderscape” is not merely the synthesis of these two concepts, as the removal of “land” and the maintenance of the suffix “scape” avoids the ambiguities associated with landscape, and allow for a more focused approach on border studies. Concerned with the practices of making, or shaping, of borders, borderscapes originate not in the interpretation of visible space, but in the understanding of the “complex web of interactions that are not immediately visible and inscribed in the relationship between space, lived experience and power”.⁵¹

If the modern geopolitical border is predicated on a world divided into national territories, in which borderlines are imagined as a stable and concrete thing, the borderscape concept offers, alternatively, a multidimensional and multi-sited understanding of borders, where both space and time are constantly acting on bordering and debordering processes⁵². This notion leads us back to the origin of the word “bord” in French, in which boundaries were defined by “marching”, and to Cuttitta’s understanding of “open territorialities”, where the action of individuals continuously displaces and redefines space, allowing multiple borders to coexist, and thus challenging the idea of a closed and homogenous territoriality⁵³. In this context, territory becomes relational and cannot possibly be contained within a bounded area. Rather, territories are defined by codes and habits, which in adding meaning to a space creates a place we can identify ourselves with.⁵⁴ In displacing the fixed, physical border, we can argue that “borderscapes” build on the idea of “border thinking” launched by Walter Mignolo.⁵⁵ Although Mignolo grounds his theory on the production of knowledge and the rejection of a European centrality in a post-colonial world (not speaking specifically to international boundaries), the proposed shift in perception of center-periphery forces us to interrogate our assumptions about how borders function⁵⁶. The focus on a view from the periphery means to “look at the struggles and adaptations that the imposition of a border causes in the regions bisected by it (...), rather than focusing on the rhetoric and intentions of central governments”.⁵⁷ Under this strategy, borderscapes speak of both sides as a unit for investigation, rejecting a perspective centered in one nation and the idea of inside versus outside.

50. dell’Agnese and Amilhat Szary, “Borderscapes.”, p.5

51. Brambilla, “Exploring the Critical Potential of the Borderscapes Concept.”, p.23

52. Ibid., p.27

53. Cuttitta, “Points and Lines.”, p.36

54. Janz, “The Territory Is Not the Map.”, p.394

55. Mezzadra and Neilson, *Border as Method, Or, the Multiplication of Labor.*, p.18

56. Sheren, *Portable Borders.*, p.128

57. Baud and Van Schendel, “Toward a Comparative History of Borderlands.”, p.212

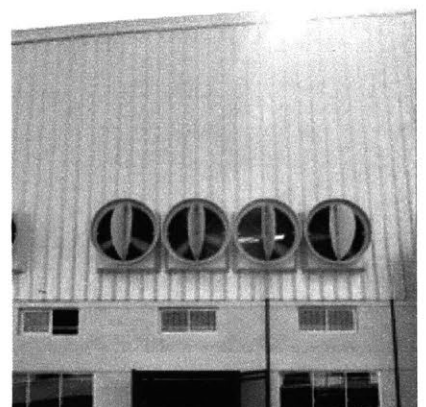
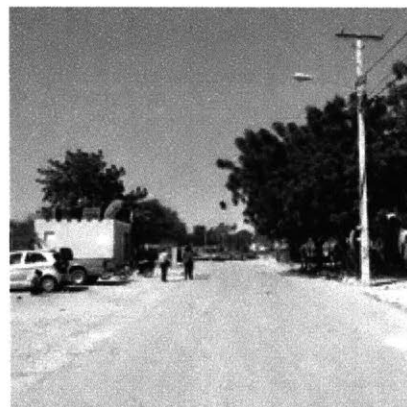
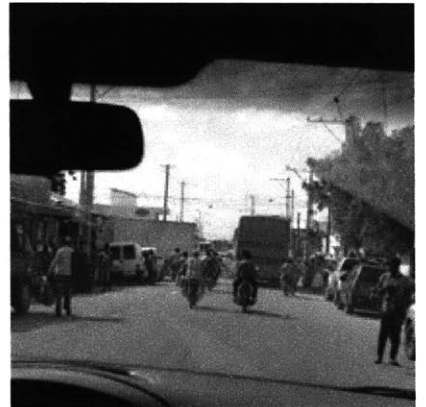
1.4 SCOPE OF THESIS & METHODOLOGY

This thesis is a design research thesis, in which the first part is dedicated to laying out the theoretical framework that will inform the research and design processes. Questions related to the agency of water in guiding urbanization, the call for architecture as infrastructure and the symbolic constructions associated to nation-state borders are raised.

The second part attempts to map the historic and current conditions that define the emergence of the border region as a site of financial investment opportunities, specially for foreign direct investment. In this section, mapping the case study between Haiti and the Dominican Republic is approached by a systematic analysis, downscaling from the international study of the island, to the borderland, the northern region and, finally, the site. The difficulties of comparing quantitative and spatial data across both nations, given differences in measurement and methodology, means that significant effort was placed into the interpretation of multiple studies into clear graphics. Further, the research relies heavily on ground observations conducted during a visit to the island in January 2017. Over the course of ten days, important information was obtained in interviews with Jorge Ovalles and Shaney Peña Gomez, professors of architecture at PUC-MM Santo Domingo, who have worked extensively on Hispaniola's border region. In visits to CEBQ in Santo Domingo (the Haitian-Dominican Council for Border Development), I had the opportunity to learn first-hand of the ongoing projects, challenges and future goals of the organization. Four border crossing cities were visited: Anse-a-Pitres/Pedernales, located on the island's southern coast, in the occasion of which I was accompanied by architecture students of PUC-MM developing their thesis on the area, and Ouanaminthe/Dajabon, the site of investigation. In the latter, I was lodged at the visitor's center located inside the international free trade zone (CODEVI), which allowed me to experience the dynamics of the campus. For security reasons my travels were always based from the Dominican side of the island, meaning that my understanding of the place was inevitably biased.

Based on recent reports produced by international agencies (AIA, IDB, UNDP, among others) and the observations raised by this thesis, the proposal projects itself into the future of Ouanaminthe and Dajabon in the scenario of industrial expansion and population growth. The design proposal, while ambitious in its vision, is therefore carefully grounded on context and realistic strategies. Finally, the conclusion foresees the adaptations that might be necessary in maintaining the relevance of the proposal by assuming that, at this site, change is the norm.

Fig 07. Travelling from the southern to the northern border.



CHAPTER 2 SCALES OF ANALYSIS

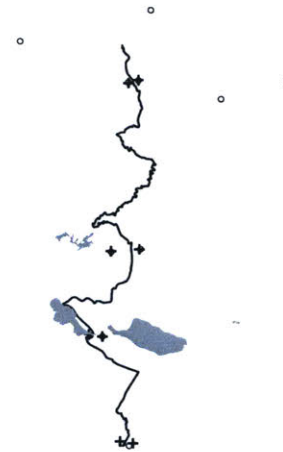
2.1 The Island

The uneven interdependencies found at the border mirrors the island's asymmetrical development. Comparative water statistics at the scale of international datasets makes evident the "water gaps" between both countries. Today, the greatest population is found on the coast, but the emergence of binational economic corridors motivates the development of the central region. The border therefore appears as an opportunistic site to address the disparities which maintain a twofold insularity in Hispaniola.



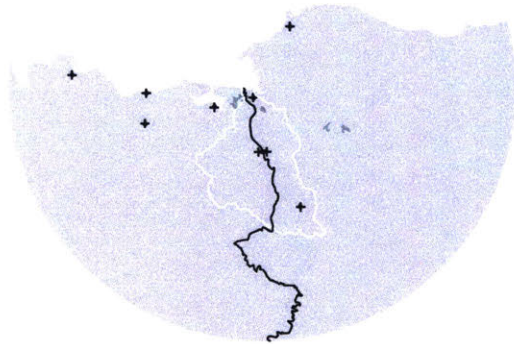
2.2 The Border

Since colonialism, the border has been both the ground for defining national identities and creating a hybrid space. The island's physical geography makes the reading of the border region as a unified system an impractical strategy. The four border crossing cities are therefore crucial nodes for intervention, emphasizing the East-West integration of Hispaniola. The creation of a bi-national public-private initiative in early 2000 recognizes these four sectors as prime sites for industrial activity.



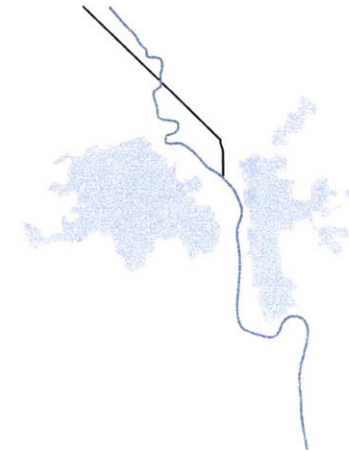
2.3 The Northern Region

In the last two decades, border tensions intensified in the social and political spheres while economic integration was incentivized by the opening of the border. In the corridor connecting Cap-Haitien to Santiago de Caballeros (important cities to Haiti and the DR), capital finds its new “spatial fix”. The fertile soils of the northern region have already made this an important site for agricultural activity to both countries. Today, binational arrangements and cheap labor promote the movement of free trade zones installed in Santiago to Haiti.



2.4 The Site

The cities Ouanaminthe and Dajabón have always relied on mutual interdependencies for its existence. Since the embargo on Haiti in 1991, exponential population growth on the Haitian side reinforced the spatial asymmetries between Haiti and the DR that are identified on the national level. Uneven development is particularly manifest in urban water systems, threatening the quality and availability of shared water resources.



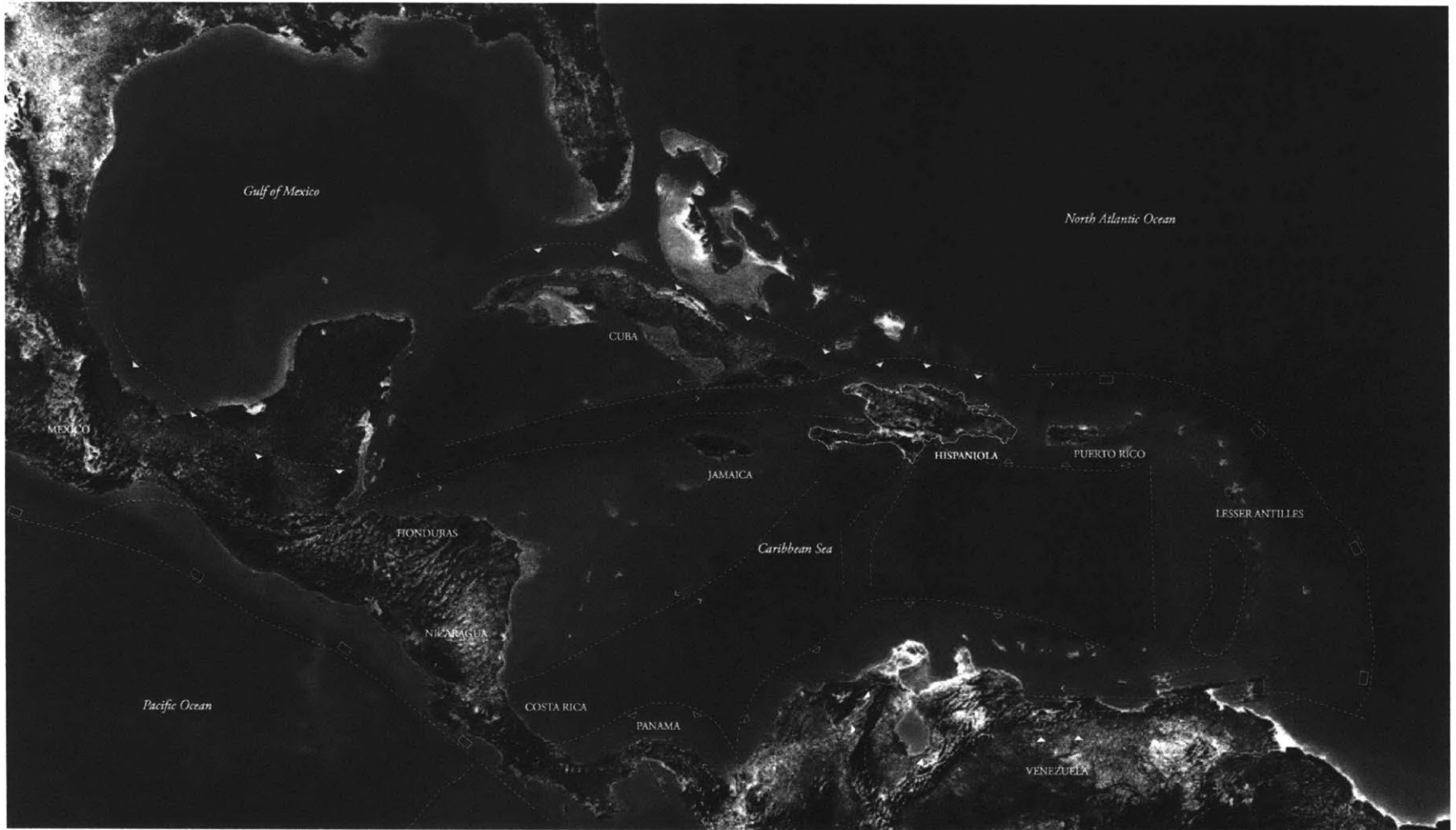
2.1 THE ISLAND

The Caribbean region is marked by the dual conditions of water. As a field, water stitches insular economies within a common region - the archipelago, defined most prominently from a political and economic perspective, favors regionalism and networks of commerce and exchange. As a boundary, however, water draws discrete islands, supporting specificity and isolation. Despite cultural tangencies between Caribbean nations, language is a factor that encourages each island to behave as a unit - there are six official languages spoken in the region, and several other indigenous and creole dialects.

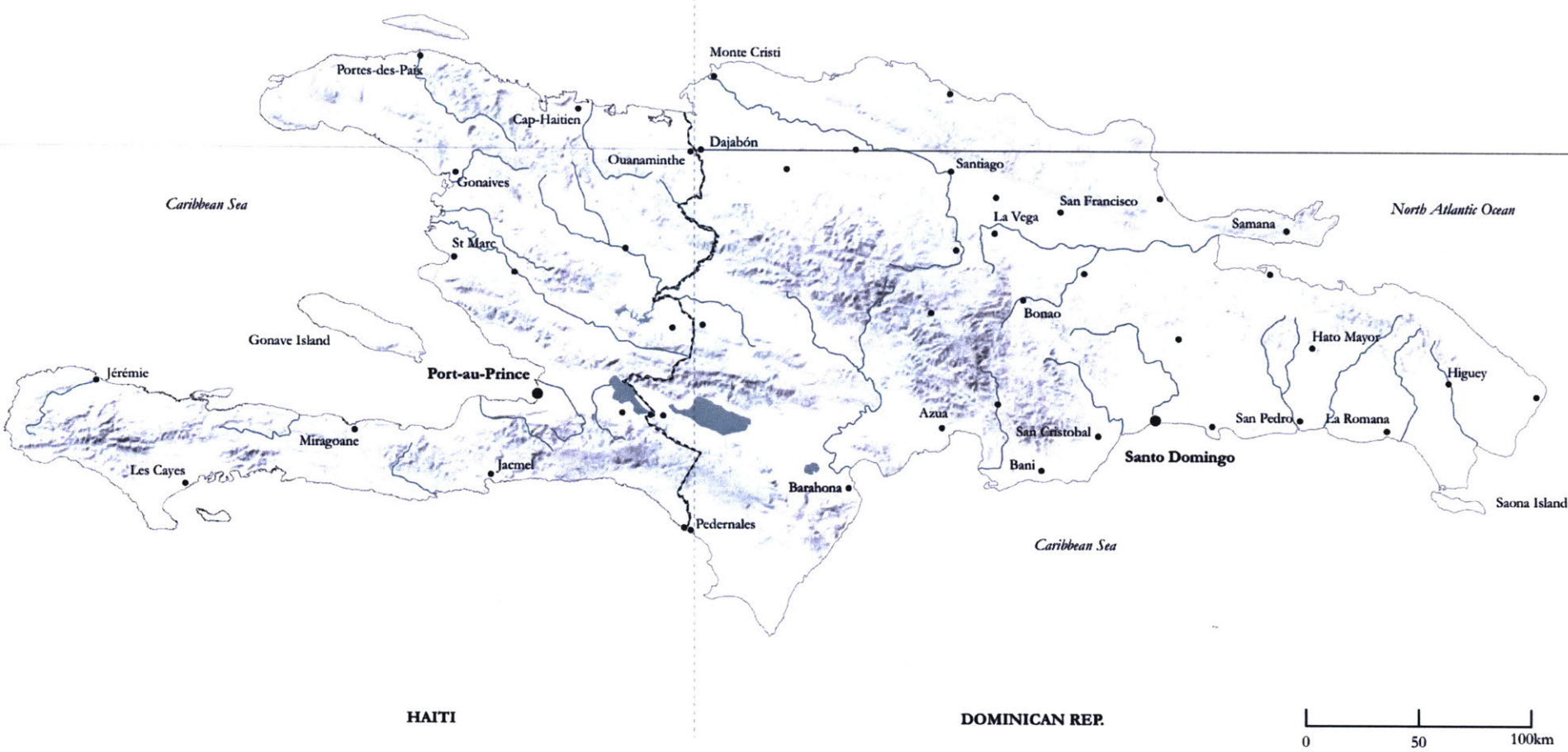
But the complete encircling of land by water is not a necessary condition for defining insularity. Haiti and the Dominican Republic, sharing the island of Hispaniola, recreates the distinctive inside vs. outside condition of island nations from within. As will be argued, inland waters play an important role in this divide.

*Over 700 islands, 30 territories and four mainland countries define the edges of the Caribbean region. European colonialism played a significant role in defining the economic, cultural and social aspects of the region.

Fig 08. The Caribbean plate and its territories. (Source: MapSnapshot, edited by LS)



The Architecture of Water Infrastructures



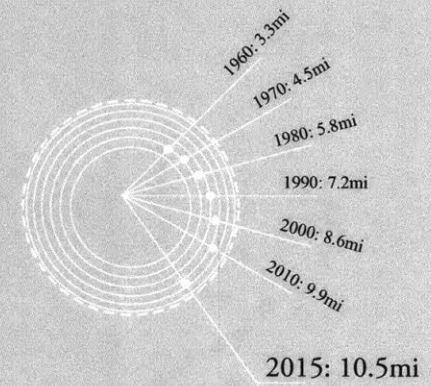
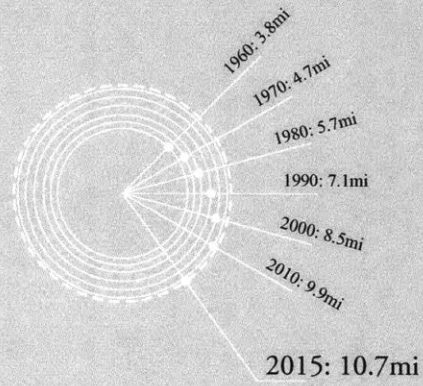
The island of Hispaniola is divided from North to South between the Dominican Republic and Haiti. The convoluted histories of these two countries, one a former Spanish colony, the second colonized by the French to become the first (and only) independent state founded by a slave revolt, has shaped an island with diverse cultures, identities, ecologies and economies.

Before zooming into the towns Ouanaminthe, Haiti, and Dajabón, DR, the sites of investigation, this chapter provides a comparative analysis at the national scale.

Fig 09. Hispaniola: relief, main rivers and cities.

The Architecture of Water Infrastructures

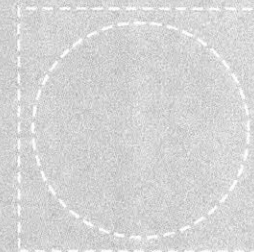
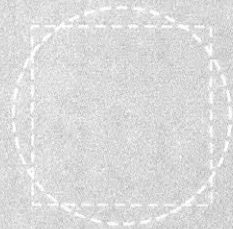
Population



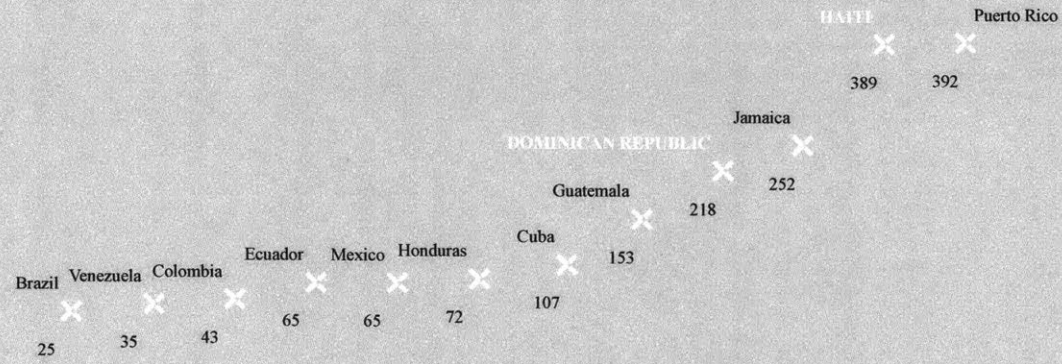
Surface Area



Population/
Surface Area



Density
pop/km2



Development
Indicators

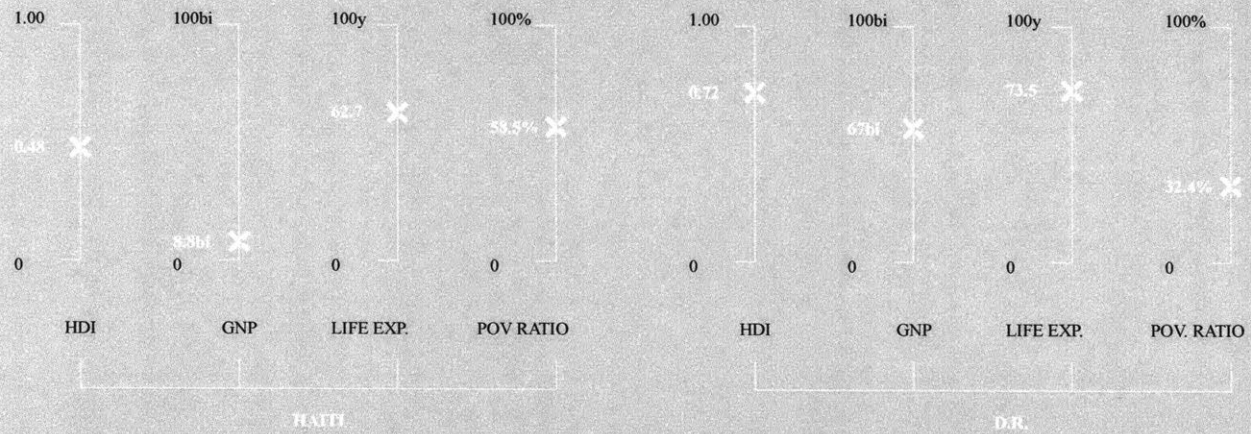
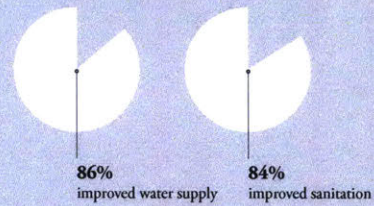
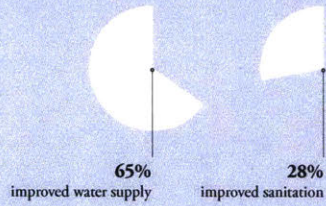


Fig 10.

The Architecture of Water Infrastructures



81 MW
30% of national energy production derives from hydropower

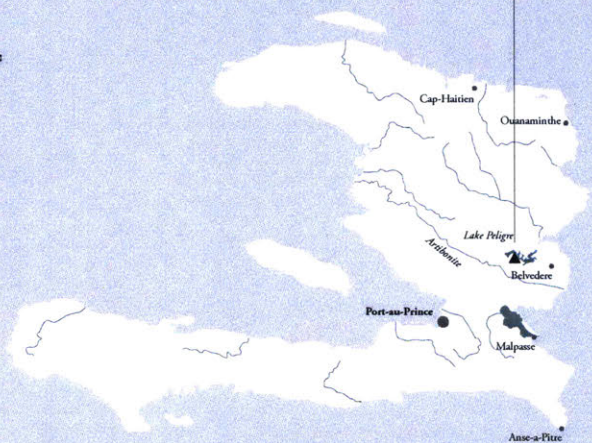
469 MW
14% of national energy production derives from hydropower

1410 mm/year average rainfall



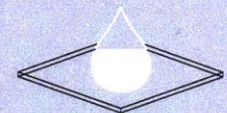
27 750 km² land surface

10 603 000 population 2015



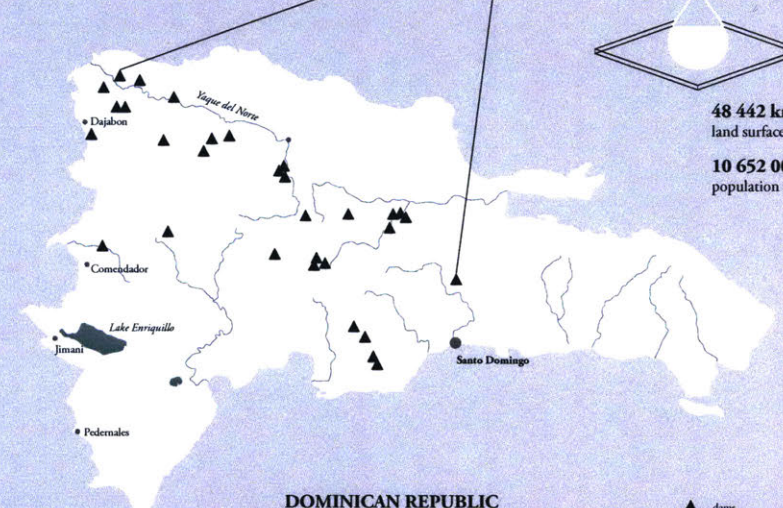
HAITI

2083 mm/year average rainfall



48 442 km² land surface

10 652 000 population 2015



DOMINICAN REPUBLIC



Water Footprint of National Production (million m³/year)

- green 7430
- blue 243
- grey 55

(Mekonnen et al 2015)



Water Footprint of National Production (million m³/year)

- green 8389
- blue 1191
- grey 957

(Mekonnen et al 2015)

- ▲ dams
- lakes
- rivers

UNEVEN DEVELOPMENT

Haiti and the Dominican Republic, home to a population of approximately 10 million people each, share a single island in the Caribbean, yet present significant differences related to water availability and management. The DR, with its Gross National Product almost 80x that of Haiti, has about 56 municipal wastewater treatment plants, while Haiti, with no functioning piped sanitation system, built its first sewage treatment facility in 2011 only. Inevitably, the socio-economic disparities between Haiti and the DR reflect in its water statistics. While comparative water research at the scale of international datasets has its limitations⁵⁸, mapping the “water gaps” between both countries is a necessary step towards establishing a common framework for collaboration.

Collaboration is fundamental given that despite both countries receive enough rainfall to supply its annual water needs⁵⁹, water scarcity has been an issue affecting both nations. Considering that over 50% of their international borderline coincides with rivers and streams⁶⁰, the dispute over transboundary waters is a central topic in current debates. Efforts such as the creation of the Dominican-Haitian Bilateral Commission, the Frontera Verde Programme and the Transboundary Natural Resource and Management and Restoration Project exemplify the importance – and the willingness from both parts – in addressing mutual concerns through bilateral initiatives.

Until today, water disputes in the island have not been contentious and water resources have not served as a weapon of war. The economy of both nations, however, are still largely dependent on its agricultural activities (Haiti: 20% of GDP and DR 11% of GDP), and ensuring access to freshwater resources remains pivotal for economic stability in the context of climate change.

Further, water, as we know, is fluid and porous, and transverses boundaries. The cholera outbreak in Haiti after the 2010 earthquake illustrates why the responsibility for guaranteeing the development of access to safe water supply and sanitation is in the interest of both Haiti and the Dominican Republic. Resource inequities lead to poverty, health-burdens and induce migration⁶¹. Given the recent changes in citizenship policies in the DR and the escalating tensions between both nations regarding migration policies, addressing the water gap in the island is increasingly relevant as a strategy to avoid conflicts both directly and indirectly associated to water.

(Notes)

58. Wescoat, "Comparative International Water Research.", p.61

59. Mayne et al., *Haiti Now.*, p.288

60. International River Boundaries Database, Durham University

61. Gleick, "Water and Conflict: Fresh Water Resources and International Security.", p.92

Fig 10 (previous page). Surface area, population density and main socio-economic indicators for Haiti and the DR. Differences encourage each country to behave as if it were on its own island. (Source: World Bank, 2015)

Fig 11. Visualizing water datasets. (Sources: UN Water, FAO, Mekkonen et. al)

TRANSFRONTIER CORRIDORS

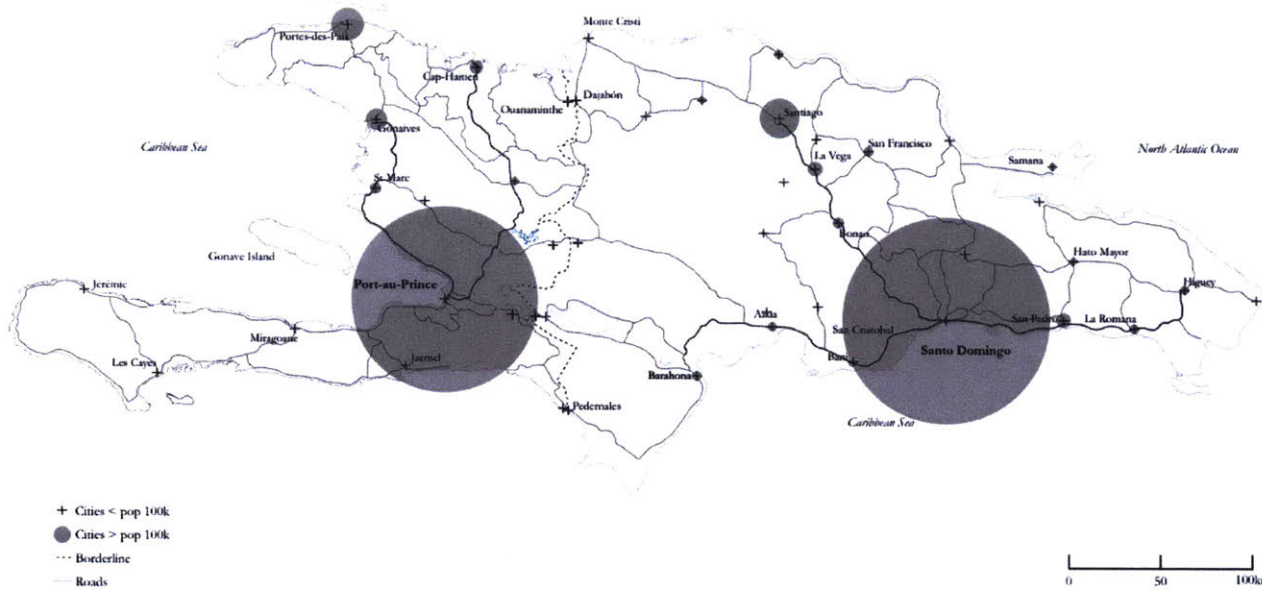


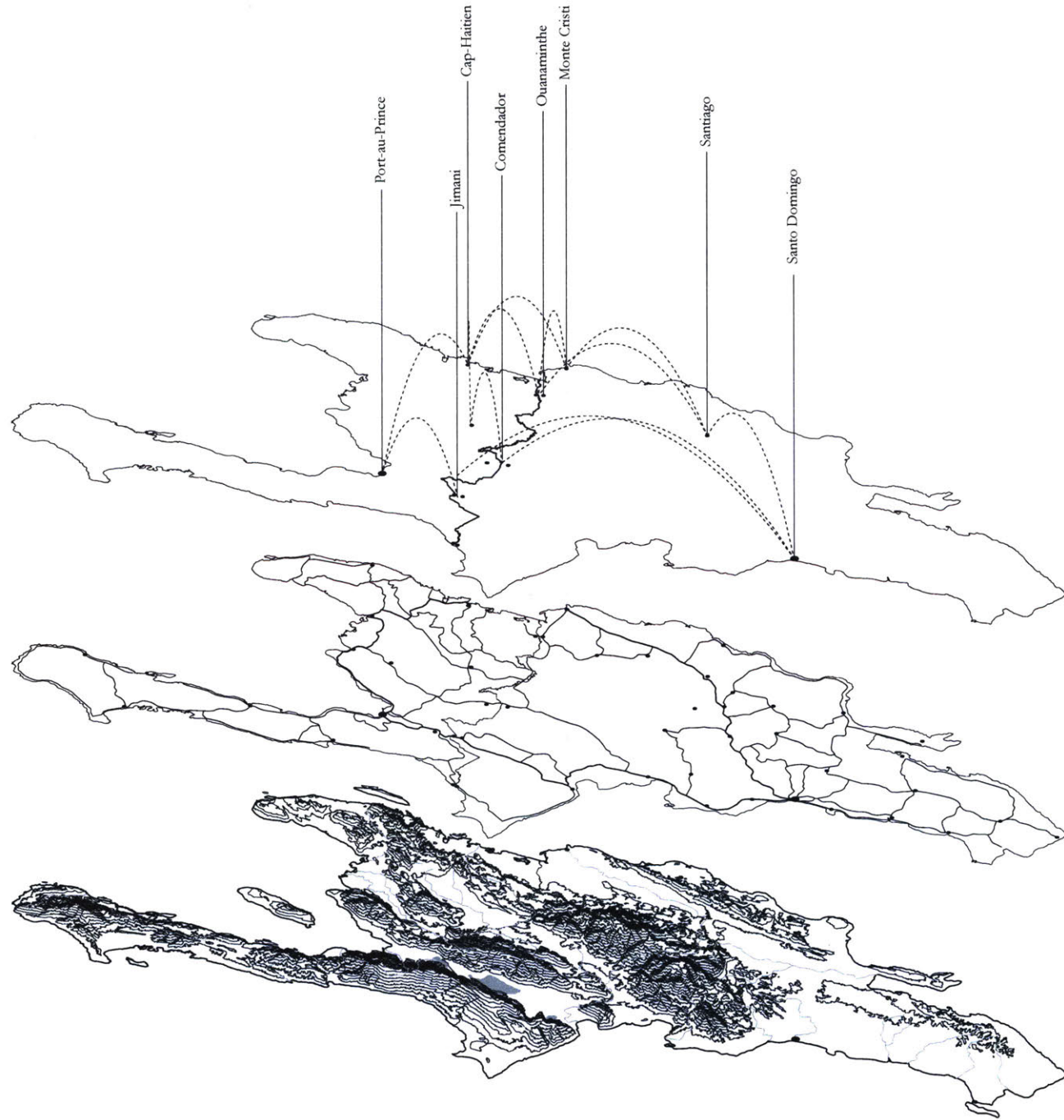
Fig 12. Urban agglomerations relative to population size (adapted from Poschet)

Fig 13 (right). Binational economic corridors and main nodes

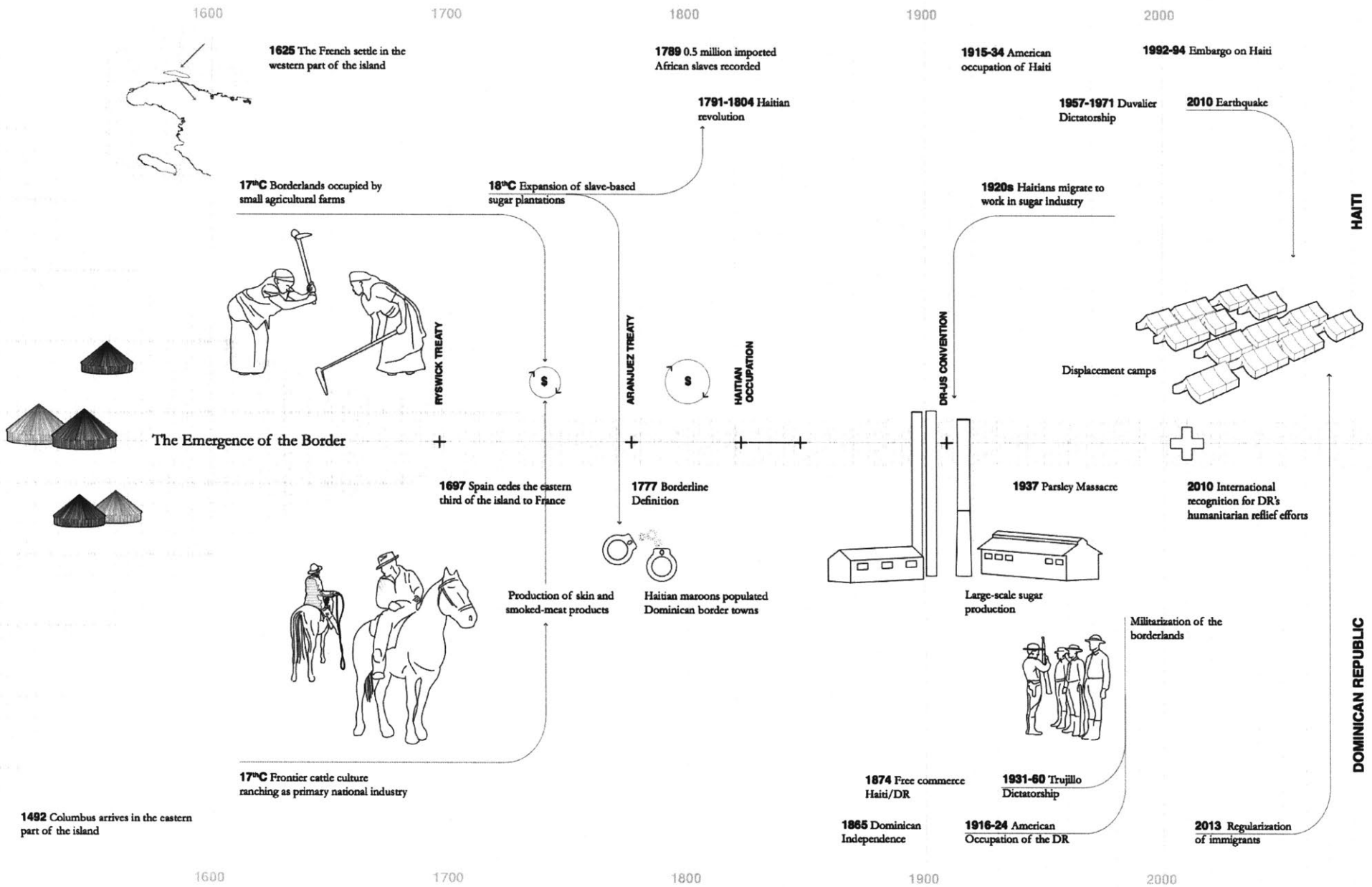
While the greatest urban conurbations in Hispaniola concentrate along the coast, the border is perceived as a no-man’s land, poorly integrated to the rest of the mainland by road infrastructures. In this sense, despite the relative proximity of border crossing cities to main urban centers, travel times increase the distance (real and imagined) between border and coastal populations. This isolation is also emphasized by the island’s steep topography, which runs parallel to the North-South divide and impedes greater connectivity among border cities and district capitals. In this sense, with the economic opening of the frontier in the 1990s, binational economic corridors that operate horizontally have emerged. Dilla Alfonso argues that, increasingly, a transfrontier urban network is shaped by movements of capital. While the corridor connecting Port-au-Prince and Santo Domingo accommodate the greatest flows of trade, it is the one between Cap-Haitien and Santiago, cutting through Ouanaminthe/Dajabón, that has seen more advanced spatial change and urban growth.⁶²

(Notes)

62. Dilla Alfonso, Stervins, and Antoine, *La Frontera Dominico Haitiana*, p.183



The Architecture of Water Infrastructures



DEFINING THE BORDER

This section begins to analyze how the borderline as a political and territorial divide shapes the condition of “twofold insularity” perceived between both nations today⁶³.

Fig 14. Timeline of historical events that shaped the border region.

The pre-Columbian Hispaniola island was organized in chieftancies (*cacicazgos*) by the Taino indigenous people. Although historians have produced maps suggesting linear boundaries between these chieftancies, territoriality at this point was not geographically demarcated.⁶⁴ The settling of the Spanish in the eastern coast of the island, with the arrival of Columbus in 1492, and later, the occupation of the western part by the French⁶⁵, initiates the convoluted history of modern state formation and border definition promoted by colonialism.

Throughout the 17th and 18th century, the island’s rough terrain and the inaccessibility of the hinterlands supported a relatively porous frontier and relations of mutual interdependence.⁶⁶ The Spanish occupation of the land was primarily based on cattle ranching, while the French developed intensive slave-based plantations, being sugar their biggest export. The prosperity of colonial Haiti in comparison to the sparsely populated Dominican provinces helped establish Haitian border markets and commercial relations between Dominican border towns and Haitian urban centers. Despite the definition of a borderline in the 1777 Aranjuez Treaty, the loosely controlled frontier favored illegal cattle trade as well as the escape of runaway slaves into the Spanish colony.⁶⁷

In the first half of the 19th century, the dividing line was temporarily suspended. After the Republic of Haiti emerged in 1804 out of a slave revolt against the French colonial powers, it unified the island from 1818 to 1844, and after another period of Spanish occupation, the Dominican Republic finally declared its own independence in 1865. Derby suggests that the resentment following the Haitian unification was determinant in establishing a sentiment of national difference at the border.

The national rhetoric and the effectiveness of the borderline were sharpened throughout the American occupation of the Dominican Republic (1915-1935) and Haiti, which lasted 10 years longer (1916-1935). In their attempt to halt contraband at the borderland, the strict control of customs and the militarization of the frontier changed border dynamics as it simultaneously separated the two populations and united them by a shared feeling of resistance.⁶⁸ The Americans also influenced the division of labor across the frontier as

(Notes)

63. Poschet, “Across the River.” p.58

64. Paulino, *Dividing Hispaniola*. p.13

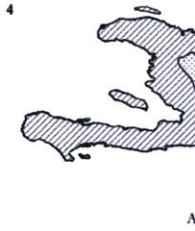
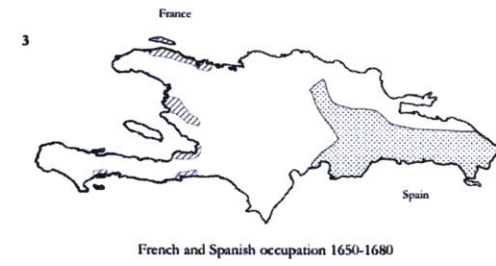
65. The French settled first in the small island of Tortuga, around 1625. They slowly took advantage of Spain’s retreat, settling on the western part of Hispaniola and proclaiming it a colony in 1665. (Poschet)

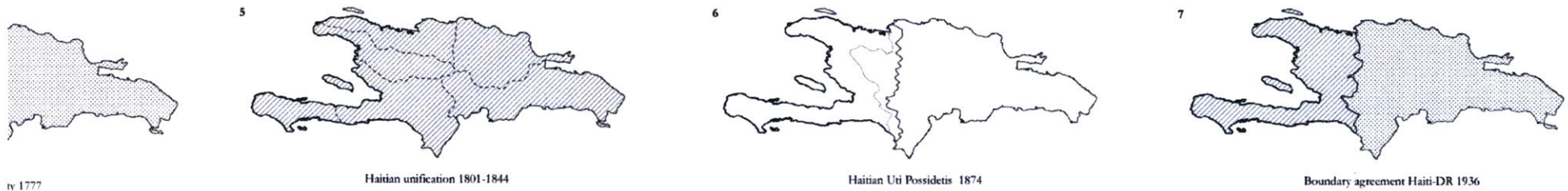
66. Derby, “Haitians, Magic and Money.” p.494

67. Ibid. p.497

68. Ibid. p.499

The Architecture of Water Infrastructures





69. Poschet, "Across the River," p.62

70. Derby, "Haitians, Magic and Money," p.502

71. Poschet, "Across the River," p.62

72. The precise number of individuals killed is unknown - estimates vary between 15,000 and 30,000.

73. Baud and Van Schendel, "Toward a Comparative History of Borderlands," p.222

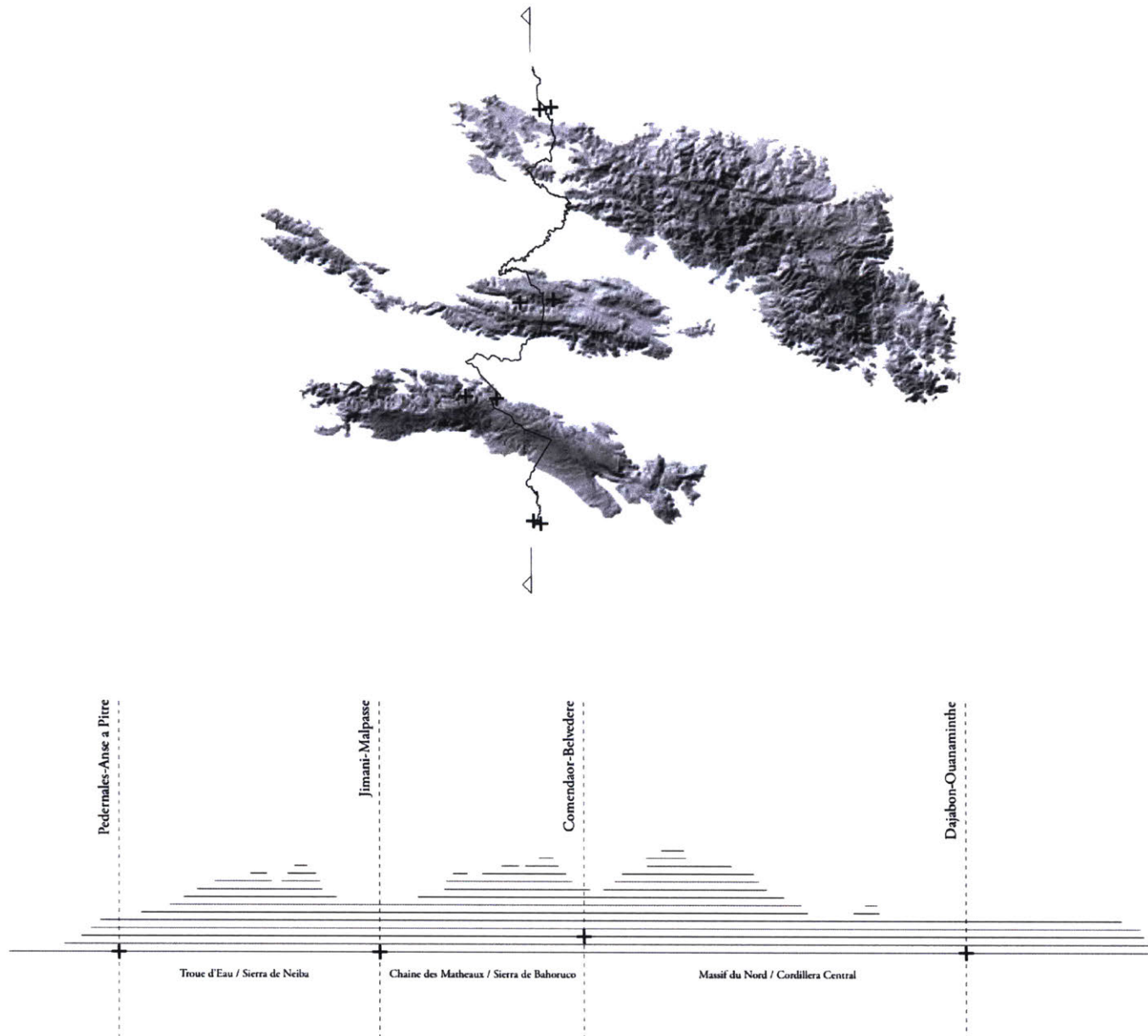
their substantial investment in sugar plantations in the Dominican Republic became dependent on the cheap Haitian workforce, initiating the immigration patterns still present today.⁶⁹

Following the American influence, the period of the Rafael Trujillo dictatorship in the DR (1930-1961) heightened what some scholars define as the "Dominicanization of the border", where anti-Haitianism was promoted as a means of securing the border region and solidifying a national identity for the Dominican population. On the ground, this meant transmitting prejudice in school manuals and newspapers⁷⁰ and investing in infrastructure to upgrade border cities: schools, churches (Catholicism as opposed to Voodooism), administrative buildings, military posts, roads and monuments.⁷¹ No site, however, experienced more dramatically the imposition of difference as Ouanaminthe and Dajabón, where Trujillo's ethnic cleansing strategies culminated, in 1937, in the mass murder of Haitians and individuals of Haitian descent living on the Dominican side of the border.⁷²

We have attempted to outline the highlights of the changing nature of the Haitian-Dominican political borderline. After the building-up of the divide during Trujillo's regime, periods of border opening to facilitate economic exchange alternated with policies for closure, such as the embargo on Haitian imports from 1992-94. What we see therefore is that despite the geographical boundary remaining mostly unchanged since the Aranjuez treaty, multiple systems have continuously recreated how the border is perceived and operated. In this sense, the border behaves as a "changeable spatial unit", unrepresented by territorial maps, yet nevertheless always informed by its political representation.⁷³

Fig 15. The history of the line (adapted from Moya Pons)

Fig 16. (left) The border landscape of the Cordillera Central on the Haitian side (Source: Google, edited by LS)



2.2 THE BORDER

Given that the economic opening of the frontier happened relatively recently, the four pairs of border crossing cities occurring along the North-South divide are still shifting from passage points adjacent to an international traffic route to sites that actively engage with commercial activities.

From the northern to the southern coast, the border traverses ecologically diverse landscapes, meaning that a different natural environment is found at each crossing. Further, the island's topography makes the reading of the border region as a unified system an impractical strategy. The border crossing cities therefore behave disconnected from one another, occurring in the valleys between mountain ranges and closer to the coastal plains.⁷⁴ Nonetheless, these four sites share some generalized conditions, including: significant deforestation on the Haitian side, smuggling of wood and charcoal to Haiti, increased militarization on the Dominican territory and pendular movement of people from Haiti to the DR.

These cities are the places where the interdependencies and contrasts found in the island at the national scale are experienced in daily life. In this sense, it is the uneven social, economic and political circumstances between both nations, rather than the specificities of each border crossing, that largely define the asymmetrical exchanges shaping life at the border.⁷⁵

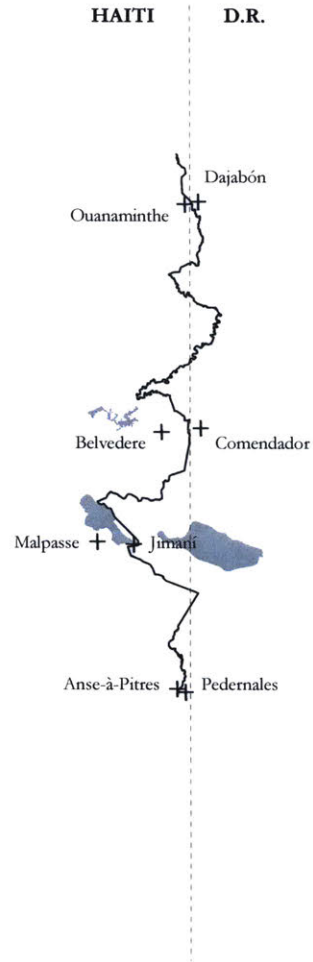
Ouanaminthe and Dajabón is an important passage for the northern region, and the only crossing where two urban settlements meet. The other sites, although being strategically located, remain small villages with little economic significance.

(Notes)

74. Vargas. "Traded Space.", p.69

75. Dilla Alfonso, Stervins, and Antoine. *La Frontera Dominico Haitiana.*, p.34

Fig 17.
Topographic incidents
and border crossing cities
(adapted from Vargas)



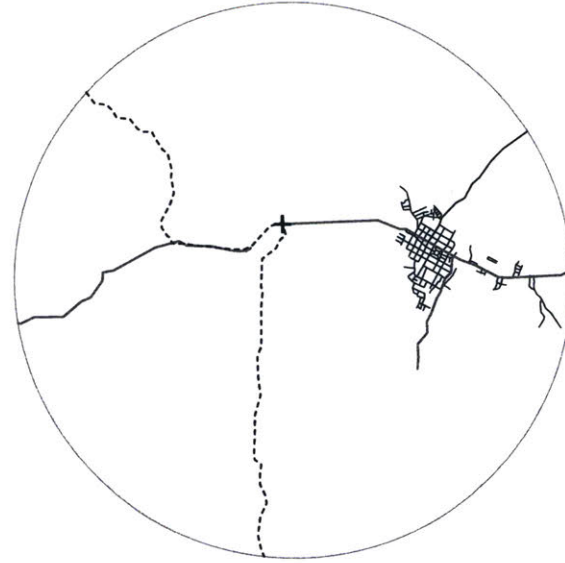
Since border regions hardly represent simply the intersection of two different nations, a binational perspective is insufficient to describe the border between Haiti and the Dominican Republic. Indeed, the conditions found there occasionally contradict national behaviors, as discussed by Lauren Derby in her sociological study of the Haitian-Dominican borderlands.

Fig 18-22.
Four border crossings and populations .

Ouanaminthe
109 594 pop
(2003)



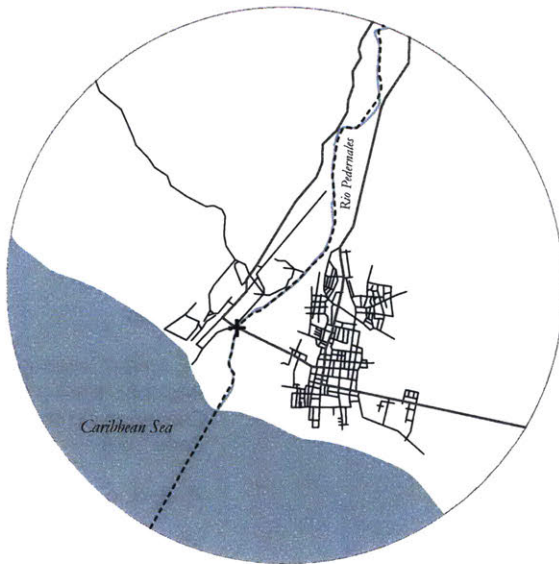
Dajabon
28 071 pop
(2010)



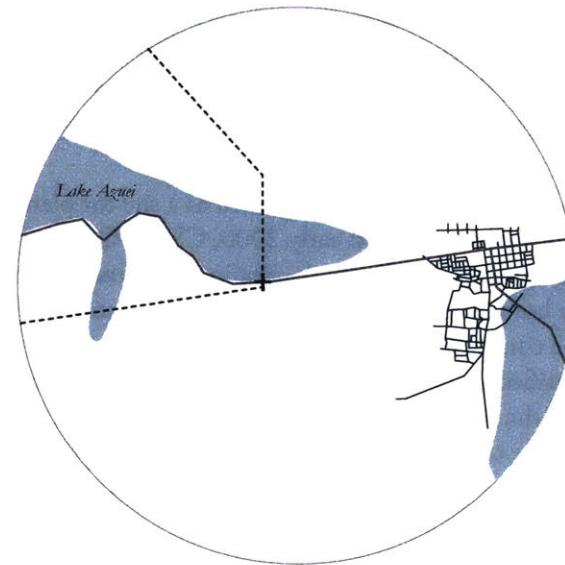
Comendador
25 924 pop
(2010)



Anses-a-Pitres
30 000 pop
(2015)



Pedernales
24 291 pop
(2010)



Jimani
16 510 pop
(2010)

BORDER DEVELOPMENT

In 2013, The United Nations Environment Programme (UNEP) published an extensive report on the border region in an attempt to boost bilateral cooperation for sustainable practices. The researchers divided their studies into four areas, namely the transnational watersheds of the River Massacre, Artibonite, the Lakes Azuei and Enriquillo and the Pedernales River (fig 24). The main issues affecting all four watersheds include environmental degradation, soil erosion, the extraction of wood for the production of charcoal (charcoal represents 76% of Haiti's energy needs), the illegal contraband of natural resources (including charcoal, fuelwood and marine resources), poverty, illegal migration and food insecurity.⁷⁴

Although the border region is bisected by important water bodies, weak governance and the deterioration of natural ecosystems has resulted in water scarcity and pollution becoming a major hindrance for development. The lack of basic infrastructure in the poor border provinces leads to river and streams – fundamental to small agricultural farms and the supply of urban water - being severely contaminated as they become sites for solid waste disposal, laundries, bathrooms and latrines.⁷⁵ Further, the combination of soil erosion with the intensification of short and heavy rains due to climatic changes increases the risk of floods in these watersheds.⁷⁶ Addressing water challenges in the border zone demands bilateral cooperation, however, Integrated Water Resource Management and Sustainable Land Management are absent in both countries. Decentralized initiatives from NGOs, academia and the private sector therefore play an important role in addressing the challenges identified in the transboundary watersheds.

Historically, the border region has been neglected as a site for planning and development. The creation of a bi-national public-private initiative in early 2000, CEBQ Quisqueya, attempts to incentivize socioeconomic growth throughout border provinces by developing bi-lateral projects that generate employment and income to both sides of the border. The projects range from alternative agro-industrial models to renewable energy projects, such as the construction of dams for hydroelectric power and wind farms. The four potential zones for investment identified by CEBQ coincide with the four binational watersheds and their border crossings. Figure 24 highlights the projects under investigation by CEBQ. Currently, of the proposed developments, only the free trade zone complex in Ouanaminthe and Dajabón is operational.

(Notes)

74. UNEP, "Haiti-Dominican Republic: Environmental Challenges in the Border Zone.", p.8

75. Ibid., p.77

76. Ibid., p.73

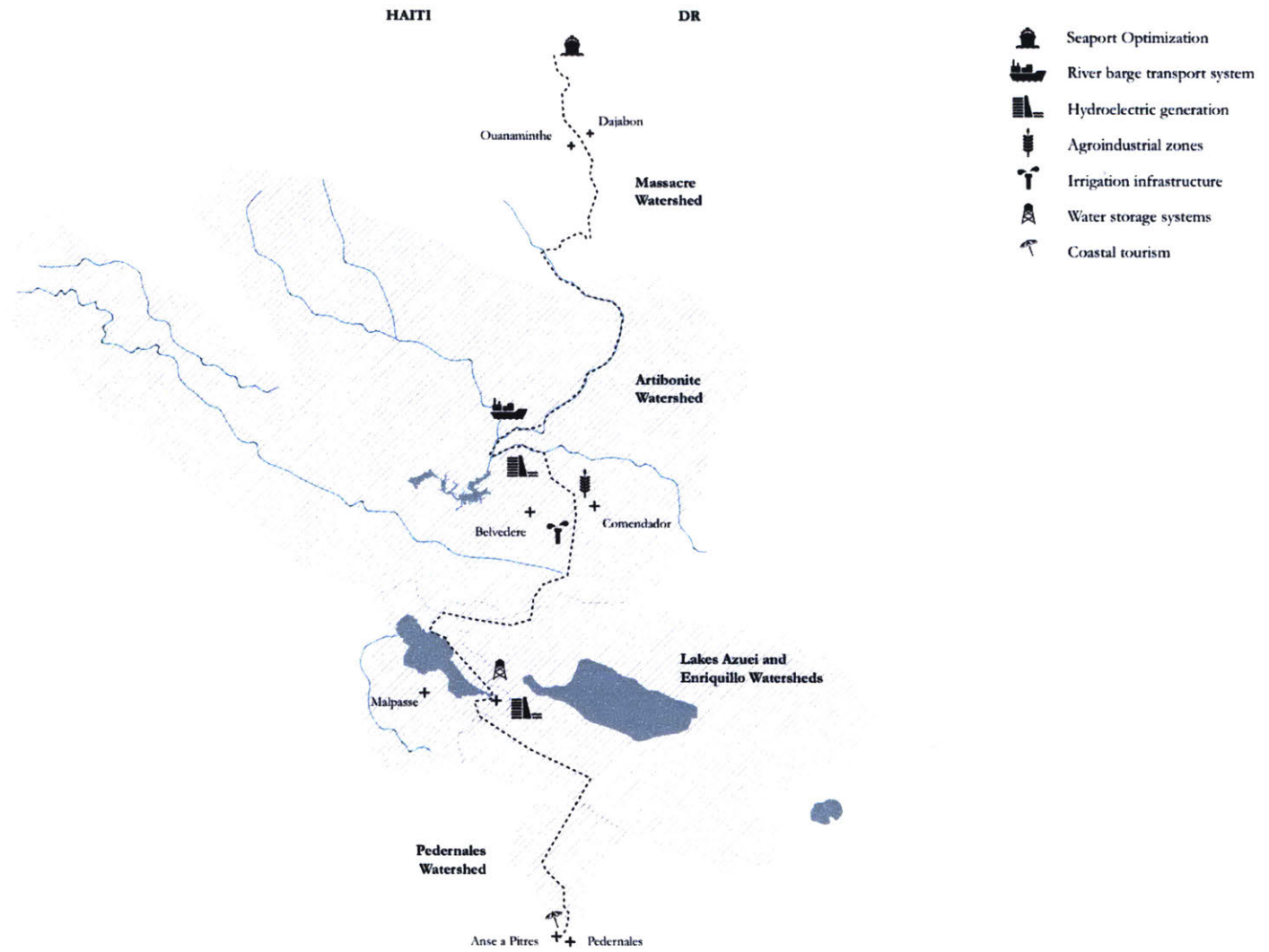


Fig 23. Transnational Watersheds and CEBQ's projects for the border region

2.3 THE NORTHERN REGION

The implementation of CEBQ's first pilot project, a free trade zone in the northern border, responds to a larger trend that reorganizes the location of textile industries in the island. Free trade zones in Haiti and the DR have existed since the 1960s, promoted by US trade policies and late Cold War geopolitics.⁷⁷ Haiti fully embraced the export-oriented model, outpacing other countries in the region. Industries concentrated in the Port-au-Prince region, and by the 1980s manufacturing exports represented 58% of the country's total exports. A series of political events in the 1990s, however, including the coup d'état of President Jean-Bertrand Aristide in 1991 and the OAS trade embargo in the same year, severely affected the assembly sector, so that employment in these zones fell from 46,000 to 5,000 by 1995.⁷⁸

In the DR, garment exporting zones expanded in the 1980s in the Cibao region (north of the country) absorbing the labor force from the declining sugar industry.⁷⁹ In 2005, however, with the end of the Multifiber arrangement between US and Circum-caribbean, manufacturing largely moved to Asia. In Santiago, where most industries concentrated, employment fell from 40,000 to 18,000 in the 2000s.

Facing crisis, Dominican and US capital sought new spatial arrangements of accumulation. While the global factory is a stage that has passed for the DR, it is still presented as a development imperative for Haiti.⁸⁰ The agreement to build the CODEVI free trade zone in the border between Ouanaminthe and Dajabon was signed in 2001 with the support of both Haitian and Dominican governments, as well as the WB's IFC, through a 41.4 million dollar financing package.

Further, in the aftermath of the 2010 earthquake, the development of free trade zones in the northern region became part of international efforts to recover Haiti's economy.⁸¹ It is under these circumstances that the expansion of zones in the Cap-Haitien-Ouanaminthe corridor are planned, absorbing the demand previously fulfilled by operations in the Cibao.

These zones are being built as isolated campuses, physically segregated from the existing city fabric, nevertheless impacting directly the region's sensitive resources and thwarting development gains.

(Notes)

77. Werner, "Global Displacements.", p.28

78. *ibid.*, p.35

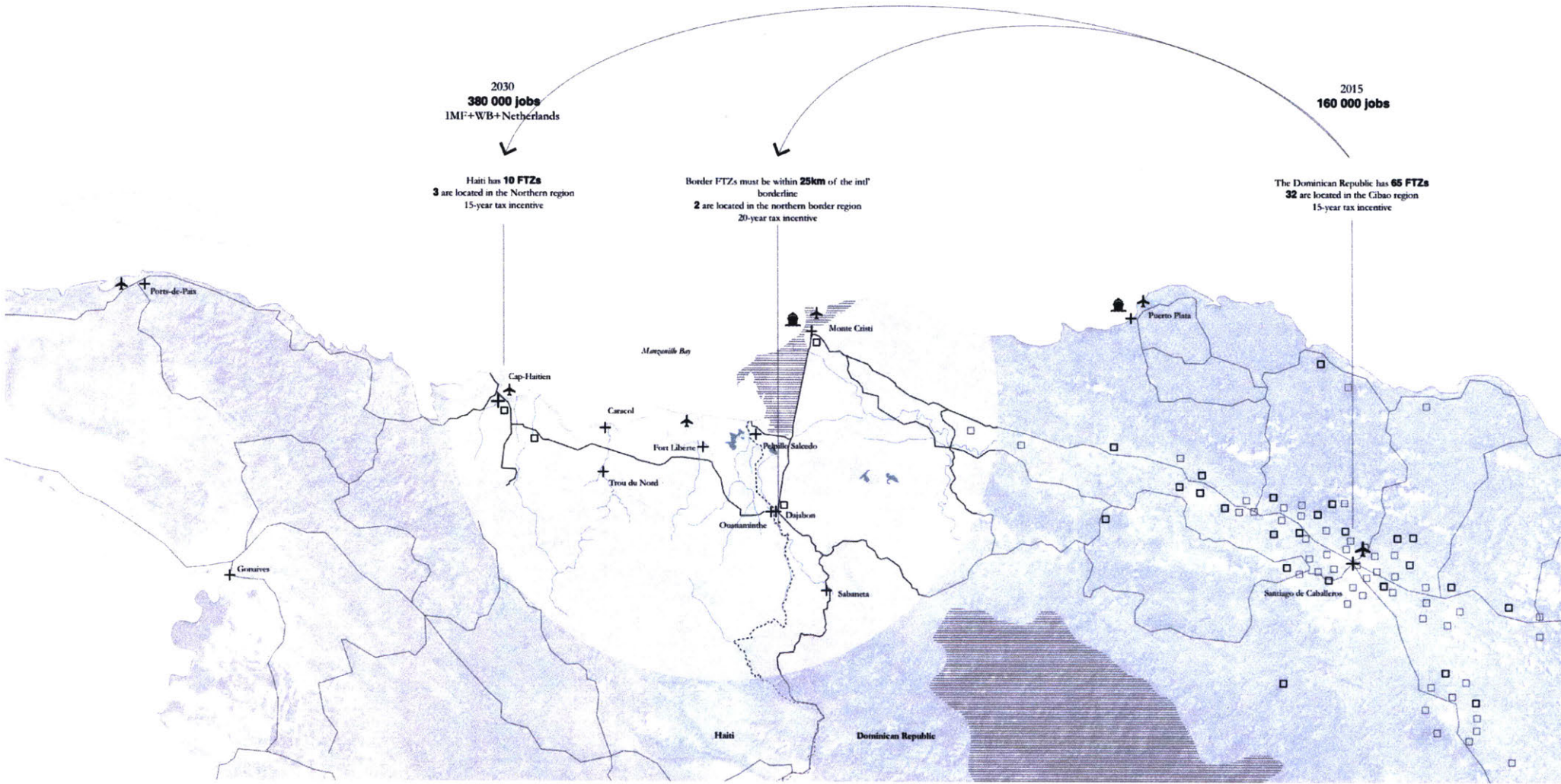
79. *ibid.*, p.29

80. Werner, "Coloniality and the Contours of Global Production", p.1582

81. AIA and IDB, "Cumulative Impact Assessment for Regional Development in the Cap-Haitien to Ouanaminthe Urban Corridor.", p.1

Fig 24. (right) Free trade zones in the Santiago de Caballeros region and prospects for the Cap-Haitien-Ouanaminthe corridor.

Chapter 2



THE MASSACRE WATERSHED

In the northern region, the international borderline coincides with the Massacre River, shared by the departments of Ouanaminthe, Haiti, and Dajabón, DR. As the urban population, particularly on the Haitian side, grows rapidly, the pressing challenges regarding water supply and sanitation in this binational watershed must be urgently addressed.

The River Massacre is the main source of water for agricultural and urban use. Its current state of degradation can be explained, among other factors, by the following:

1. Deforestation throughout the watershed for the production of charcoal;
2. Illegal sand mining from the river bed;
3. Inadequate (or inexistent) infrastructures for waste management, sanitation and wastewater treatment;
4. Untreated sewage disposed into river;
5. Excessive extraction of water for irrigation;
6. Pollution from international market and industrial park;

This has resulted in soil erosion, water course drying, significant changes in channel morphology, water pollution, reduced water retention and increased risk of flash floods. The contamination of Massacre's waters is particularly alarming when considering that surface water accounts for almost a third of the population's drinking water source and 65% of the water for bathing and cooking.⁸² Despite the significance of in depth analysis of the River Massacre and its tributaries for the development of this region, no long-term comprehensive data exists covering the Massacre Watershed.⁸³

The aerial image of the border between Haiti and the Dominican Republic visibly marked by contrasting landscapes is a familiar one. The satellite imagery below speaks of the historical development of the island. Land on the Haitian side is divided in small, irregular plots, with scattered trees and disconnected pathways – an inheritance of the distribution of extensive plantation properties following the Haitian Revolution.

The Dominican part has larger plots, organized in a more geometrical form, and served by a network of roads – a pattern influenced by the fact that Colonial Santo Domingo was largely based on a cattle ranching economy, where the large open grazing ranches allowed the occupation of the territory with a low population density.⁸⁴ Today, Haitians in the borderlands are largely dependent on small scale agriculture, while in the DR, specifically in the Massacre region, the bigger plots gave room to mechanized agriculture on a larger scale. These contrasting land uses suggest an uneven competition for water, and water shortages have different effects on each population group. Interviews in the UNEP report suggest, for example, that on the Massacre River there are four water extraction points on the Dominican side and none in Haiti.⁸⁵ Further, the watershed's catchment area is mostly within Dominican territory, and clean water taken upstream is contaminated by time it reaches Haitian land.

(Notes)

82. Morel et al., "Revegetation and Transboundary Natural Resources Management Project: Phase I Massacre and Pedernales Watersheds."

83. UNEP, "Haiti-Dominican Republic: Environmental Challenges in the Border Zone.", p.77

84. Derby, "Haitians, Magic and Money.", p.497

85. UNEP, "Haiti-Dominican Republic: Environmental Challenges in the Border Zone."

The following maps, comparing land cover classifications from 1986, 2001 and 2011 illustrate how the encroaching of the urban footprint on agricultural land has an effect that reaches far beyond the limits of urbanization.

The water budget analysis indicates the possibility of achieving water balance in the watershed if water resources are used efficiently (given the overall water surplus throughout the year). To achieve this, water conserving design solutions should be considered in planning to accommodate urban growth.

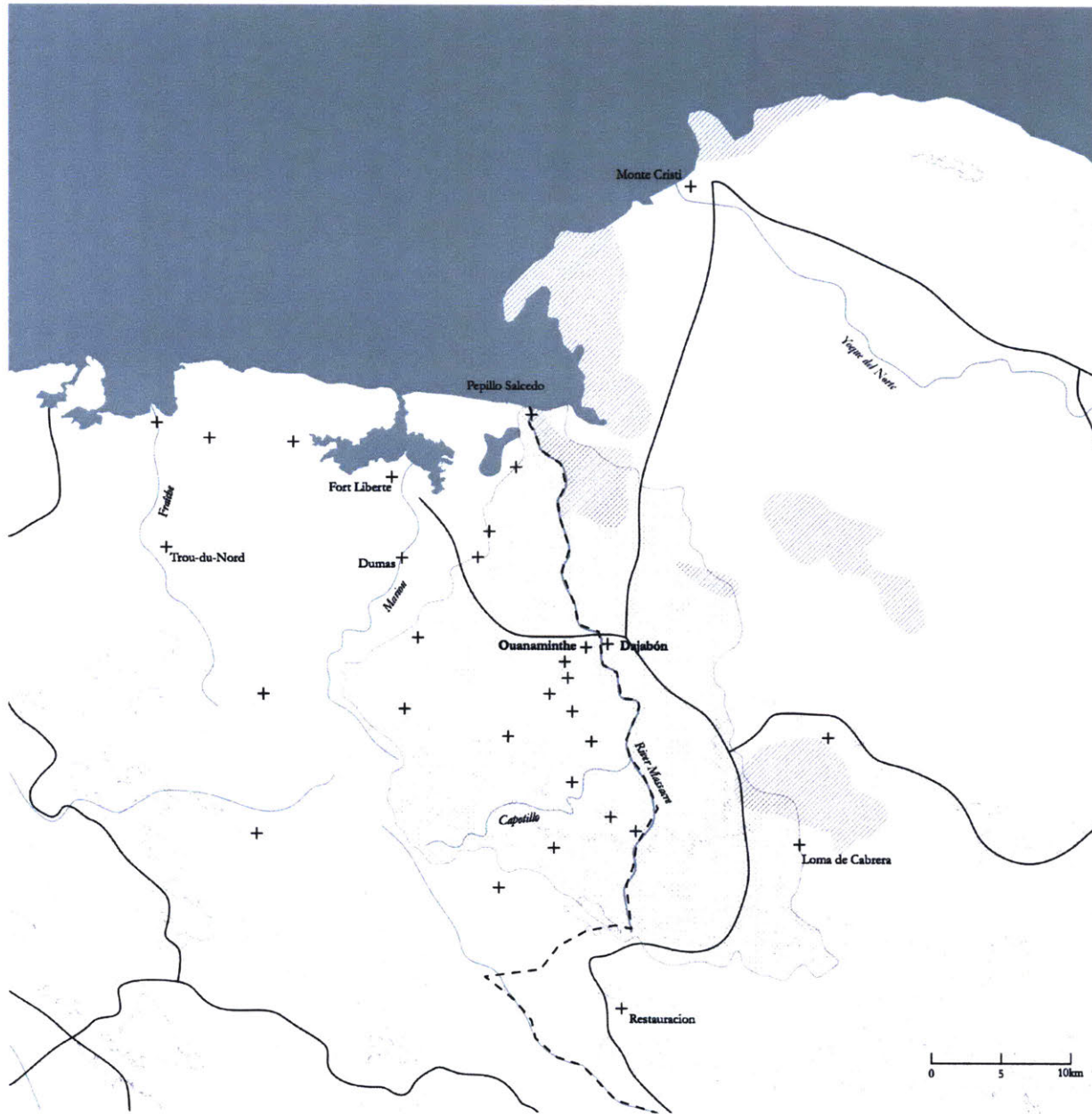







Fig 25. Massacre River Watershed

Fig 26. (right, top) Water budget diagram for the Massacre Watershed (Source: WebWIMP Water Balance Calculator)

Fig 27 (right, below) Main source of Drinking Water in Massacre Watershed (Source: CIESIN)

858km²
 annual precipitation 750-2000mm
 Haiti pop 170 000
 DR pop 62 000

-  Massacre watershed
-  Protected area
-  Rivers and streams
-  Main roads
-  Urban agglomerations

Chapter 2

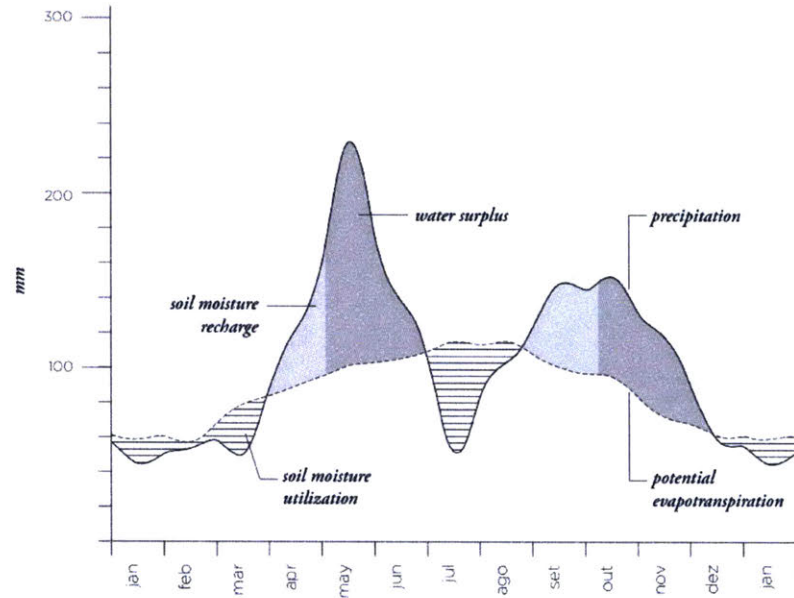
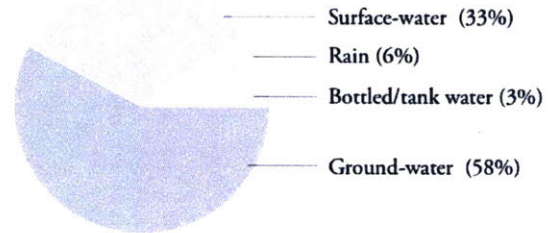


Fig 25. Massacre River Watershed

Fig 26. (right, top) Water budget diagram for the Massacre Watershed (Source: WebWIMP Water Balance Calculator)

Fig 27 (right, below) Main source of Drinking Water in Massacre Watershed (Source: CIESIN)





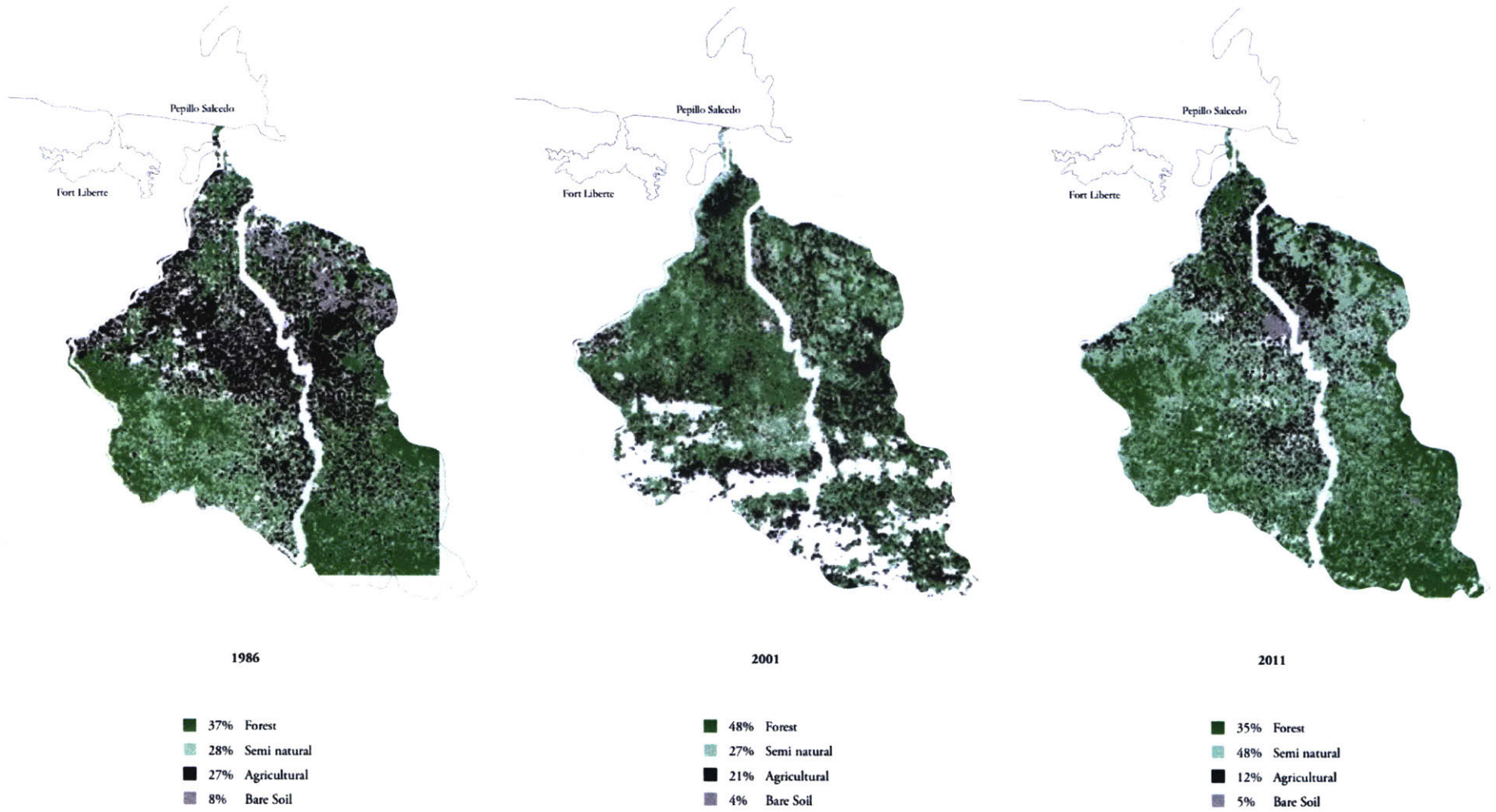


Fig 28 (left). Agricultural fields north of Ouanaminthe and Dajabon (Source: Mapsnapshot)

Fig 29. Evolution of landcover classification for the Massacre Watershed (Source: CIESIN)

2.4 THE SITE

Since the embargo on Haiti in 1991, the two border towns Ouanaminthe, Haiti, and Dajabón, DR, have been transformed into an important commercial corridor for the northern region of Hispaniola island. In a decade, the provincial rural town Ouanaminthe multiplied its population approximately four-fold.⁸⁶ Increasingly, this is a strategic site for bi-national movements, as more than 30% of the officially registered trade between Haiti and the DR transits through its customs. The local dynamic here is greatly influenced by the presence of an international market located in Dajabón, which takes place twice a week and allows Haitians free passage across the border.

In Haiti, the commercialization of “pepe” (or second-hand clothes), mostly imported from the US, became so widespread that it has contributed to the decline of the country’s textile industry, favoring the production on the other side of the border. Pepe is the main product sold at Dajabón’s informal market, where approximately 2 million USD are exchanged each week. Fast-fashion’s loop closes a little more than a kilometer away, where garment factories in the free trade zone prepares its exports for Europe and the US.

The establishment of CEBQ’s free trade zone in this border, in 2004, catalyzed a new wave of migration into Ouanaminthe, today a city of approximately 150,000 inhabitants, while Dajabón remained a small town of 25,000.

In a condensed space, these cities reproduce the social and spatial asymmetries that characterize the rift between both nations. One side densely populated and unsupported by urban infrastructures, the other benefitting from improvements in services given its integration in regional circuits of subsistence and accumulation.

(Notes)

86. Werner, “Coloniality and the Contours of Global Production”, p.1585

87. Poschet, “Across the River”, p.63

Fig 30 (right) A synthesis of agents shaping the site.

Chapter 2

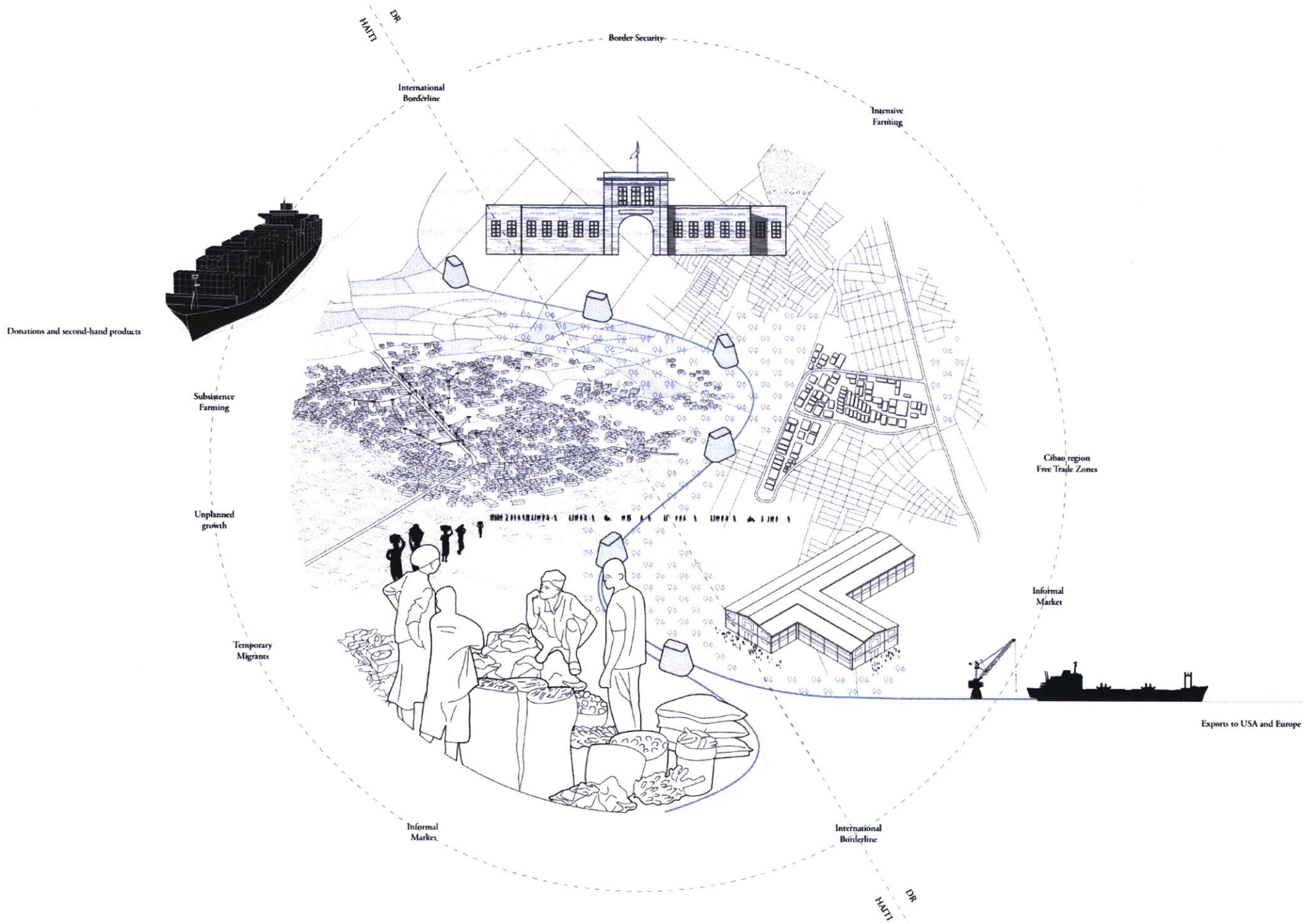


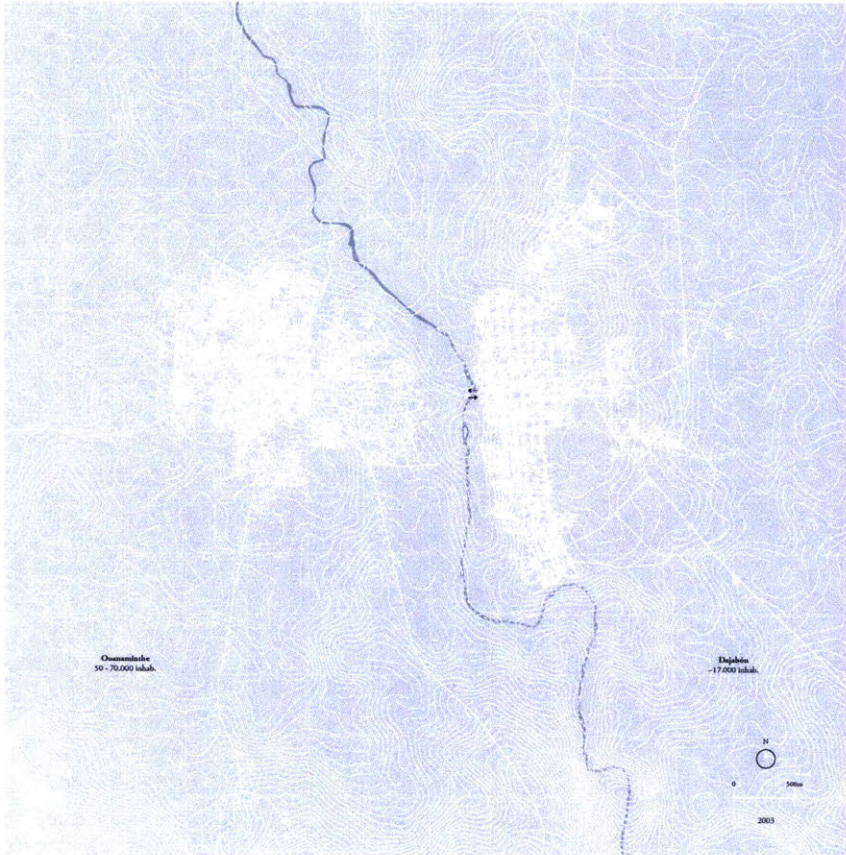


Fig 31 Ouanaminthe (left) and Dajabon (right), 2003 (Google Earth)

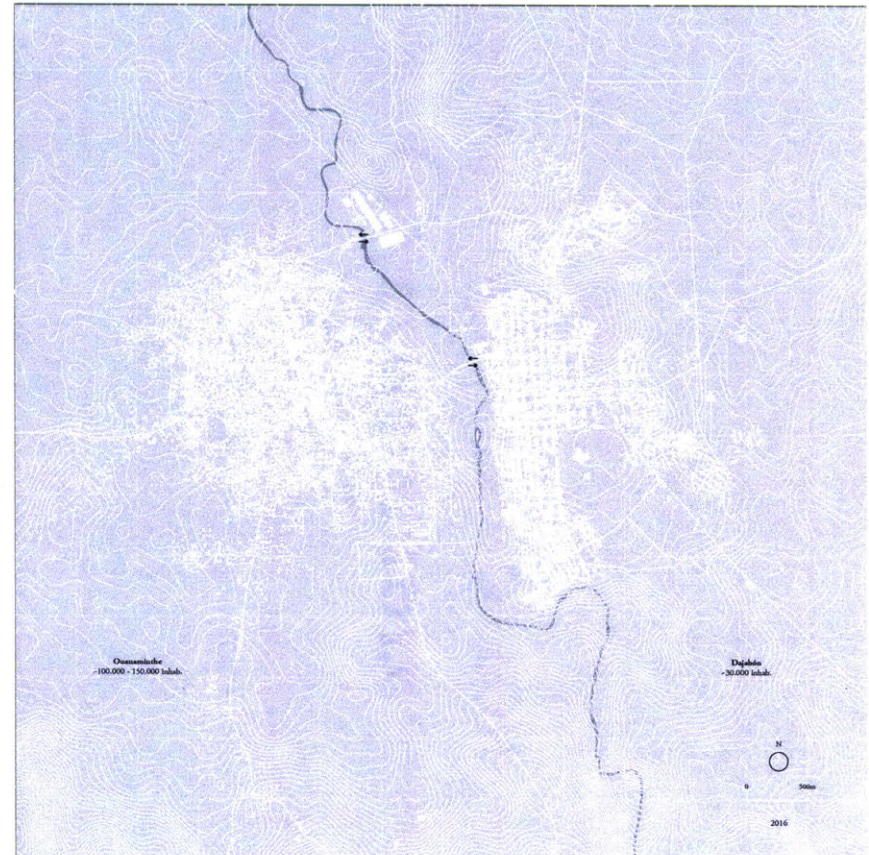


Fig 32. 2016. Urban growth follows the implementation of the FTZ (Google Earth)

2003



2016



2030

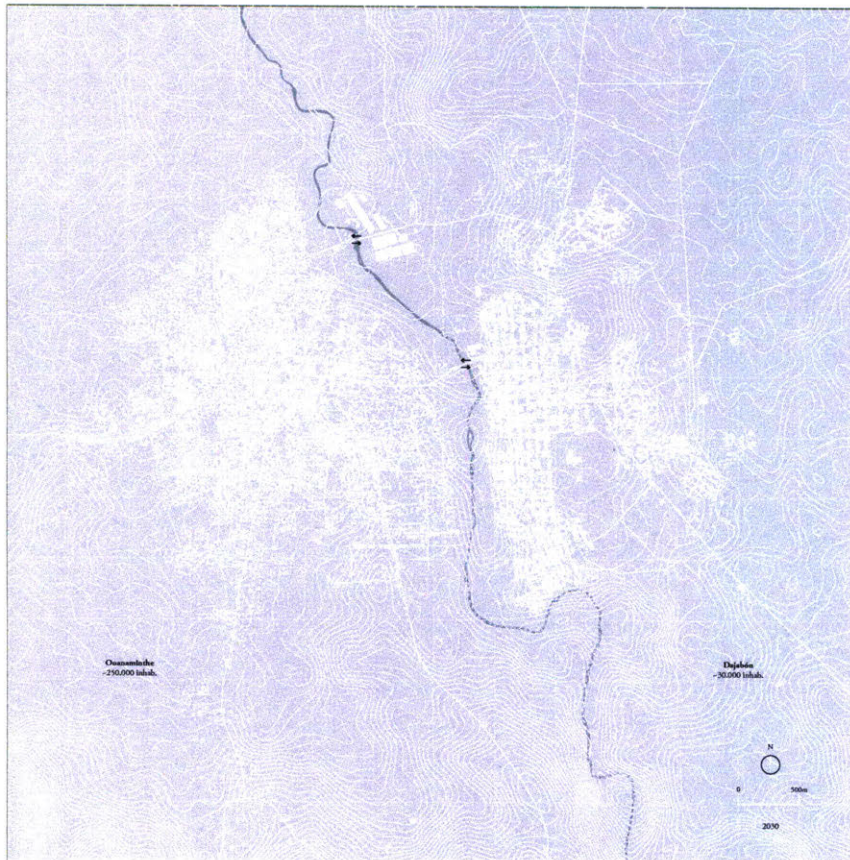


Fig 34. Projection of the urban footprint in Ouanaminthe for the year 2030, according to IFC's "Integrated Economic Zones in Haiti" report (2011), current population density and patterns of land appropriation.

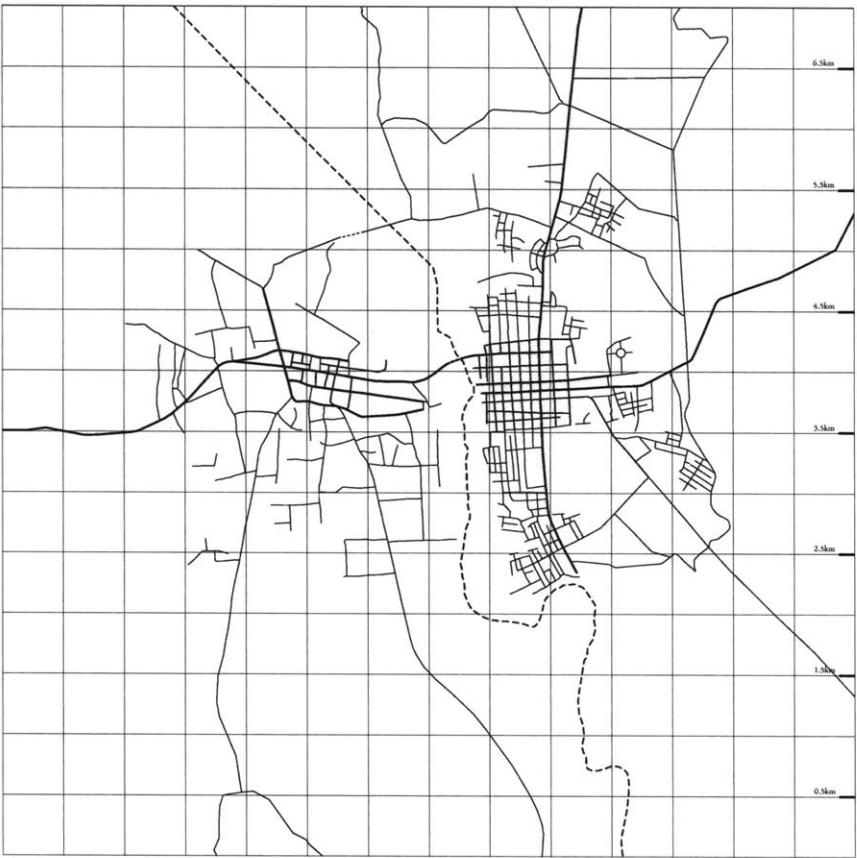
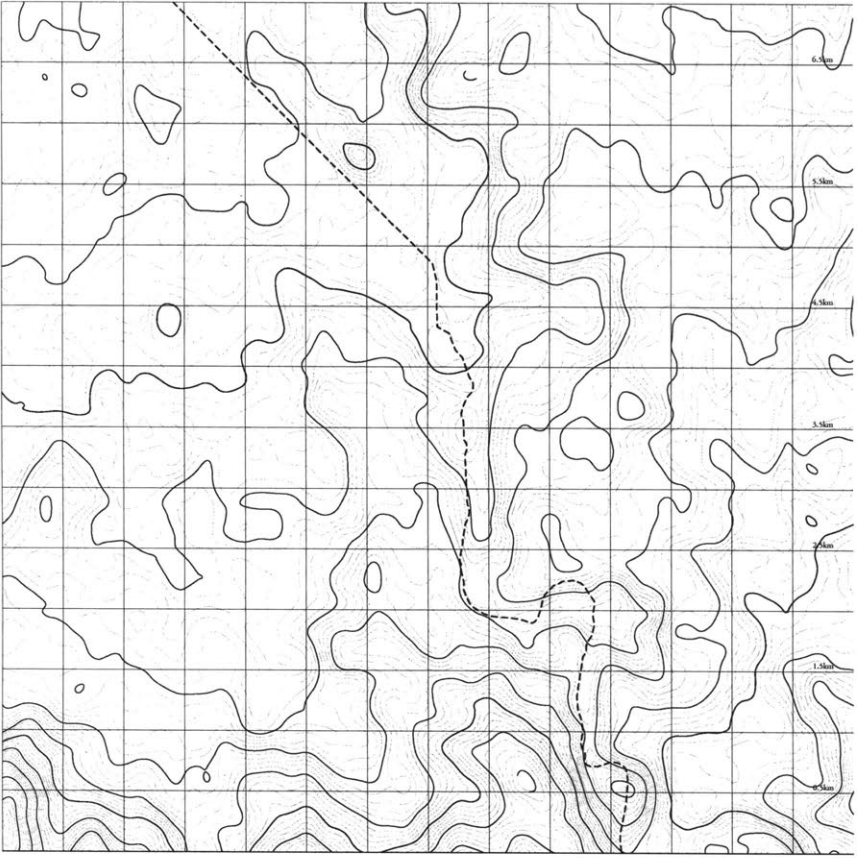
As capital continues to find fertile ground in this site - 70 million USD should be invested in the next years to expand industrial operations in the free trade zone alone-, we can expect urban sprawl to further encroach on Ouanaminthe's agricultural land.

Following growth rates of previous years, and considering that Ouanaminthe has already surpassed its population projections for 2030 (USAID/AIA), the city should reach a population of 200,000 within the next decade.





Fig 33. 2017. The free trade zone and the different patterns of urban growth (Source: Google Earth)



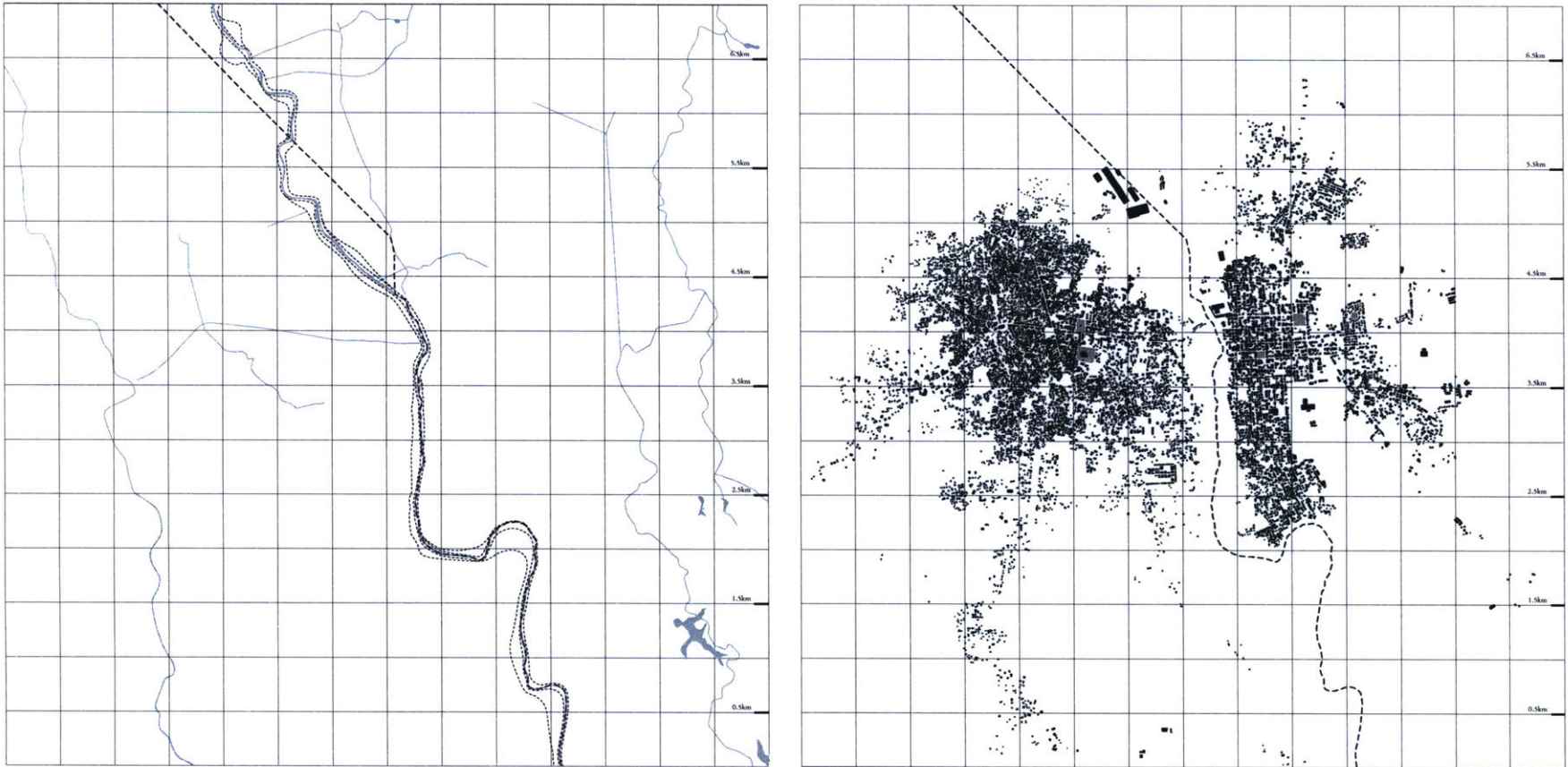


Fig 34-37. Site analysis: topography, street network, water systems and building footprint.

CONNECTED WATERS

The improved participation of Ouanaminthe and Dajabón in binational economic activities impacted differently the infrastructural support in place on each side. Rapid urban growth had a crippling effect on the already deficient infrastructures on the Haitian city, while Dajabón, with a fifth of the population in Ouanaminthe, took advantage of an increased municipal budget to improve its services.⁸⁸

Again, urban water becomes symptomatic of uneven growth: most residences in Dajabón are reached by piped water supply and 82% have access to drinkable water (Poschet, 2007), while households in Ouanaminthe rely on individual and community wells, as well as on the waters of the Massacre (washing clothes in the river is not uncommon).⁸⁸

The region's rich groundwater resources and its high water-table means that informal developments readily find access to water, while the inexistence of appropriate water drainage and treatment facilities leads to the contamination of ground and superficial waters. In Haiti, since access to improved water sources is lacking, urban and rural populations are largely dependent on groundwater, a resource which is threatened by deforestation, pollution and its overexploitation.⁹⁰

Neither of the cities have sanitary sewers or centralized water treatment facilities, so that wastewaters either drain through open channels into the River Massacre or are treated in individual septic tanks. As the cities give its back to the river, the Massacre is perceived as a site for waste disposal, and the interconnectedness between the availability of clean water and the disposal of wastewaters goes unnoticed.

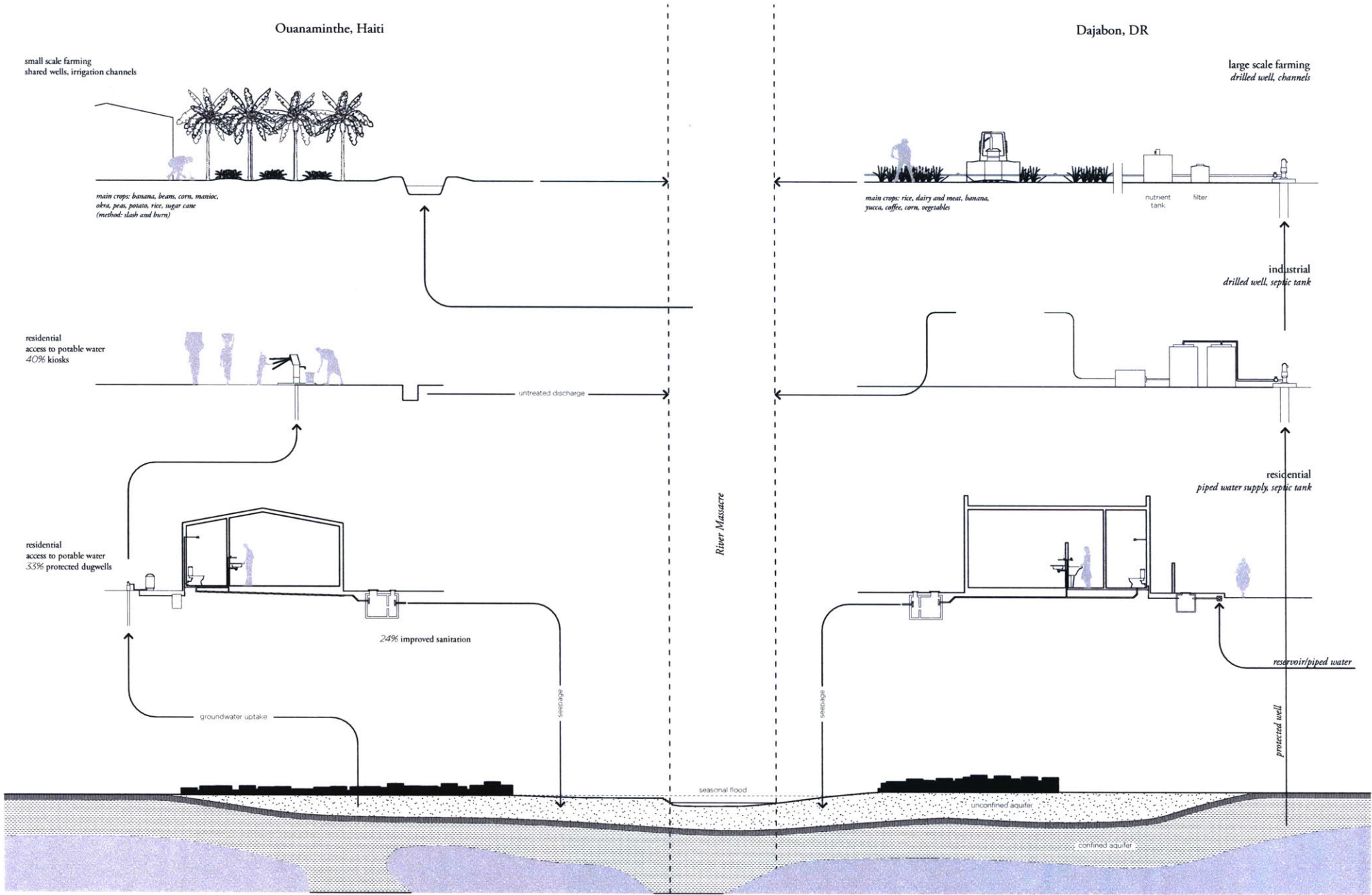
(Notes)

88. Werner, "Coloniality and the Contours of Global Production in the Dominican Republic and Haiti.", p.1585

89. Poschet, "Across the River.", p.66

90. Adamson, Jean-Baptiste, and Miner, "Summary of Groundwater Resources in Haiti.", p.153

Fig 38. Access and disposal of water in Ouanaminthe and Dajabon



ON THE GROUND



Fig 39. The official border crossing, from Dajabon

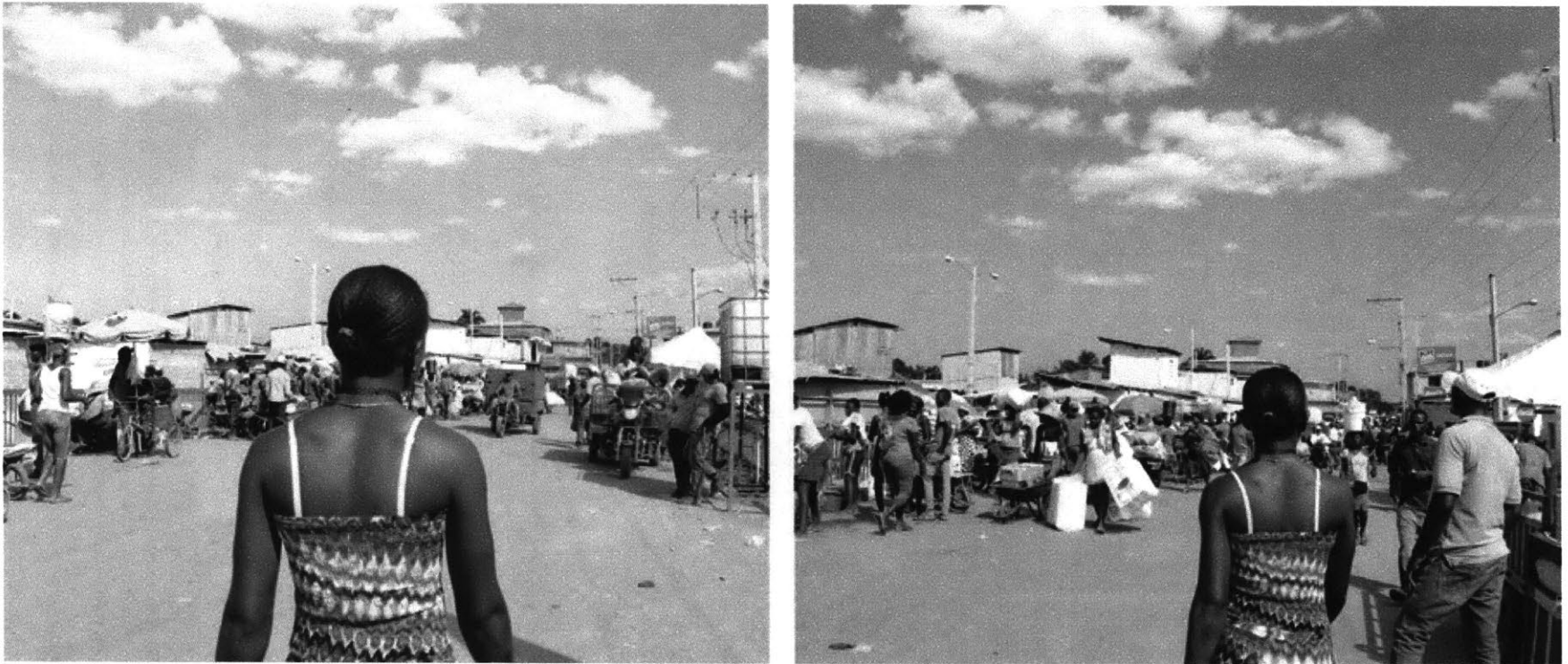


Fig 40. The official border crossing, from Ouanaminthe

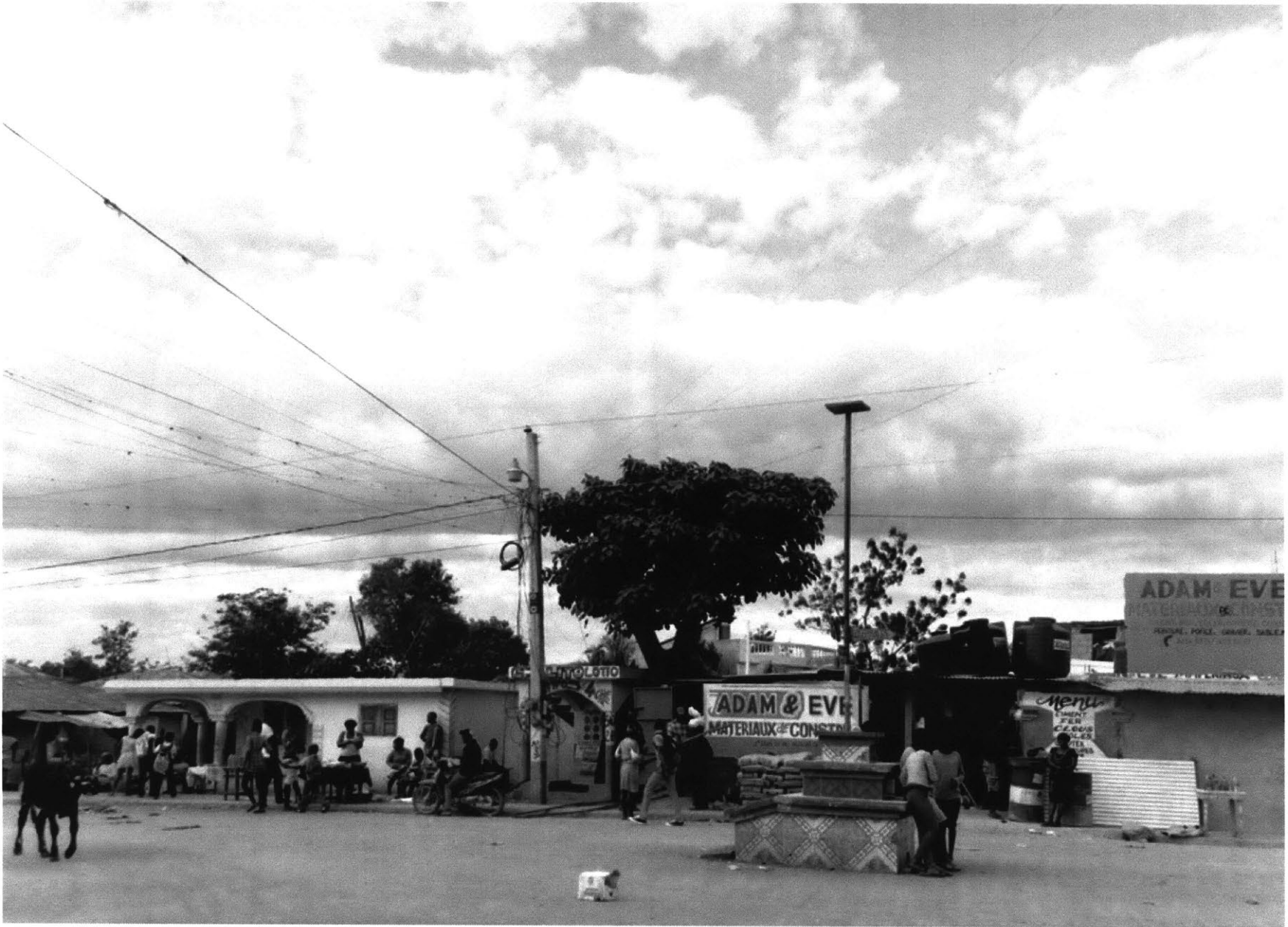




Fig 41 (left) Ouanaminthe's central zone.

Fig 42 Ouanaminthe, new housing along the road to the Free Trade Zone.

THE ZONE

Free trade zones, free ports, industrial estates, among other “special zones” proliferated in the second half of the 20th century with the widespread acceptance of liberal market principals. As spaces that are nonconforming to the typical consistency of nation-states, they have been analyzed under Agamben’s concept of “spaces of exception” and Augè’s “non-place”.⁹¹ Disputing the notion that these zones remove the jurisdictional apparatus enforced by the border, Mezzadra and Brett clarify that these are not spaces of “legal voidness”, but of “competing norms and calculations”.⁹² In such spaces, the state - which typically exercises full control of its territory – is forced to accommodate external regulations. The Zone exists under a dual condition, dependent both on the increasingly homogenous surface for global capital rendered by globalization, and the maintenance of socio-economic differences that favors the movement of goods and services.⁹³

The free trade zone as an enclave, noncommittal to its surroundings, is not a new phenomenon. It typically exists in strategic geographic locations, where regulatory incentives, cheap labor and infrastructural networks coincide.⁹⁴ In the Haitian-Dominican example, the zone reinforces the ethnic division of labor which has historically shaped the economy of the border region.⁹⁵ Currently, the factories in CODEVI employs today 9,000 people, being 96% Haitians, and additional 7,000 job openings are expected by the end of 2017. The creation of employment opportunities impacts directly the form and pace of urbanization at the border, as it is evident in the satellite imageries discussed.

This thesis therefore understands that rather than delivering the expected long-term improvements in its host country, often developing economies, the zone often catalyzes problems related to environmental degradation and informal growth. As exemplified in the case studies of the Mexican-American “maquiladoras”, the expansion of FTZs can initiate a problematic urban dynamic where the added demand for land triggers heavy real estate speculation, and reduces the availability of land for affordable housing, marginalizing the labor force to the informal areas of the city.⁹⁶

Further, it is important to consider the existence of FTZs as temporary, given the volatility of capital as it moves to find its new “spatial fix”. In this sense, while the presence of FTZs might accumulate more disadvantages than benefits,⁹⁷ its removal can also bring crippling effects.

(Notes)

91. Agnew, “Borders on the Mind.”, p.5

92. Mezzadra and Neilson, *Border as Method.*, p.208

93. *Ibid.*, p.62

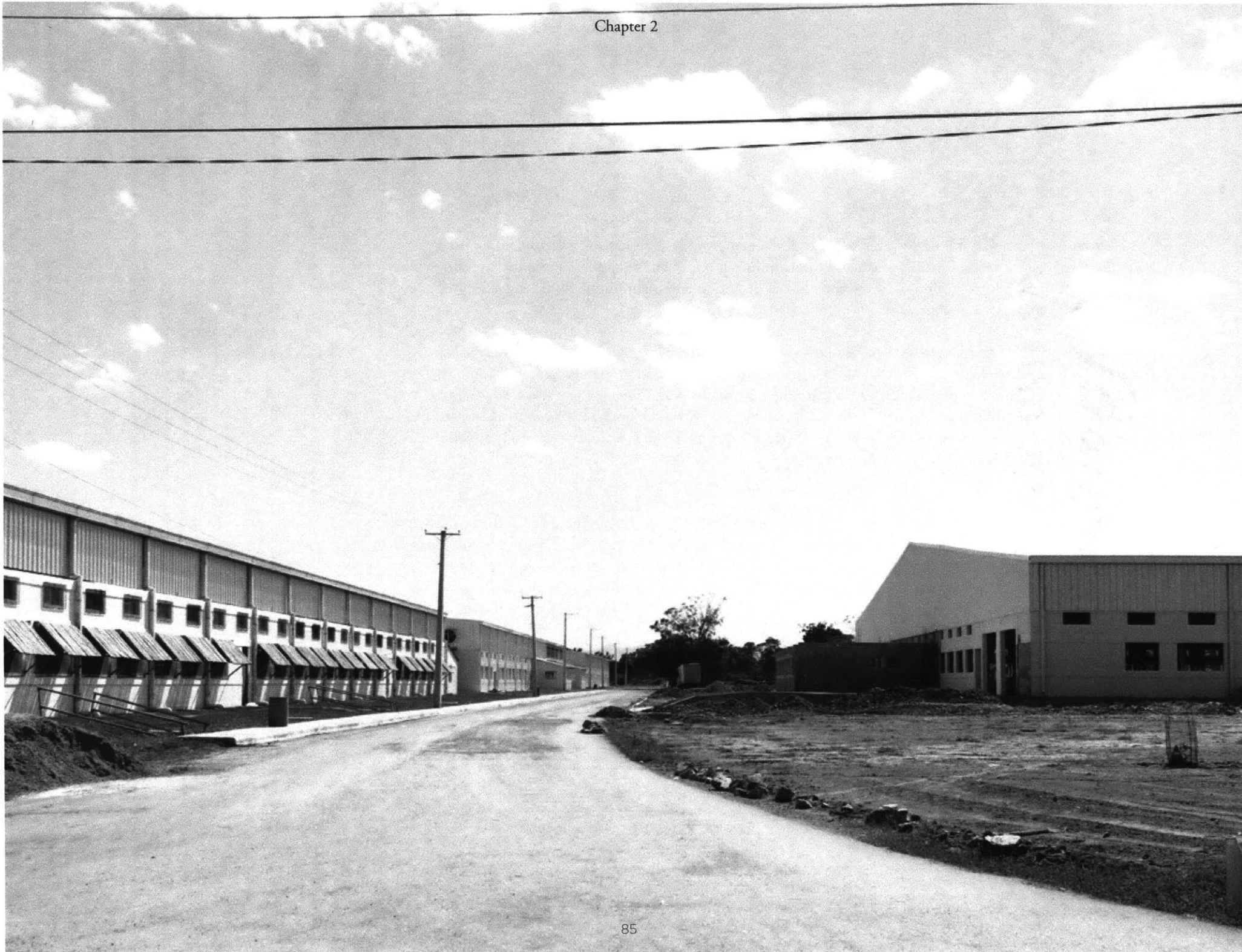
94. Easterling, *Extrastatecraft.*, p.25

95. Lauren Derby highlights two examples occurring in the first decades of the 20th century: the sharecropping system in the Dominican frontier, in which large cattle ranchers employed Haitians for day labor; and the sugar industry propelled by the American occupation in the Dominican Republic, dependent on Haitian cane cutters.

96. Acosta, “Migration and Urbanization in Northwest Mexico’s Border Cities.”, p.446

97. Easterling, *Extrastatecraft.*, p.33

Fig 43 The CODEVI Free Trade Zone in Ouanaminthe



THE INTERNATIONAL MARKET

At the frontier, time and temporality are regulative devices employed as methods of control and filtering mobility across nations.⁹⁸ The case of Haiti and the Dominican Republic is not an exception where the waiting in border control, the interruption of travel, the cases of detention and institutional bureaucracies introduce a space of other temporal arrangements.

The presence of the bi-national market on the Dominican side of the border has defined an intermittent boundary, which allows Haitians to cross without passport or visa throughout market days. But rather than being erased, the border is temporarily displaced from the new bridge where the customs office is located, to one block into Dajabón – the new limit which cannot be trespassed. When the bridge becomes too busy, the shallow waters of the Masacre River is crossed by foot. Attempts to stay in the Dominican Republic are inhibited by the militarization of the area and the fact that public transportation in the DR is controlled by the military and passes through multiple checkpoints.⁹⁹

Given that the market is on Dominican territory, the temporal opening of the border affects differently each population. While Haitians are regularly crossing over to Dajabón, Dajabón residents find no reason to visit Ouanaminthe, and few of them know their neighboring city. Further, the retraction of the border does not modify the uneven power relations that shape daily life at this site. The control of the border and the market by the Dominicans allows arbitrary and discriminatory practices against Haitians, who might have to resort to bribes or discrepant taxes to complete their commercial activities.¹⁰⁰

(Notes)

98. Mezzadra and Neilson, *Border as Method, Or, the Multiplication of Labor*, p.114

99. Poschet, "Across the River.", p.68

100. *Ibid.*, p.68

Fig 44 Inside the international market in Dajabon, built in 2005, and funded by the EU





Fig 45 The bridge that crosses to the free trade zone





Fig 45 The bridge that crosses to the international market in Dajabon



CHAPTER 3 THE ARCHITECTURE OF WATER INFRASTRUCTURES

The proposal is a territorial strategy that integrates housing and water infrastructures to address uneven urbanization. While the zone exists in isolation to the urban fabric of both cities, investments in housing that are catalyzed by its existence provides the opportunity to weave an alternative spatial order, countering the reproduction of spatial and social injustices.

By seizing infrastructure's ability to act directly on the city, architecture mediates the complex flows of water and people to build a sustainable urban future. Water is drawn as the layer 0 to accommodate the diverse program, staging the sites for affordable housing units, public open spaces, industrial and agricultural activities. Essential to this scheme are aqueducts that position water not at the edge, but at the center of urban development. Together with other infrastructural artifacts, the aqueducts are mechanisms that forge new individual and collective identities. The intention is to reimagine the meaning of shared waters, which becomes understood not only as the "material stuff" that draws the limits of territorial boundaries, but is instead present in all aspects of daily life.

Fig 46 Proposal: weaving meaningful links



3.1 HOUSING AN ALTERNATIVE AGENDA

Haiti's affordable housing crisis is a persistent challenge which was severely aggravated by the 2010 earthquake, when 1.5 million people were left homeless in addition to the country's pre-existing housing deficit.¹⁰¹ Investments in affordable housing are therefore at the core of urban planning strategies, and the international community as well as financial institutions have focused reconstruction efforts in improving the housing sector. The World Bank's extensive Post-Disaster Needs Assessment (2010) provides an estimate of reconstruction spending based on sectoral demands.¹⁰² Considering that housing concentrates the biggest losses, it is the sector that requires most significant investments. Water and sanitation infrastructures, on the hand, which in its current state exposes the population to vulnerable living conditions (threatening particularly health and food security) receives only 1% of rehabilitation needs.

In the scenario of expanding free trade zones in the Cap Haitien-Ouanaminthe corridor, and considering the internal displacement of people from the capital to the area, the region's housing demand is expected to be fulfilled by FTZ-related residential housing. According to IFC's projections for the development of integrated economic zones in Haiti (2011), 400,000 housing units should be provided to attend job creation and economic growth in the region, with financing from the US as well as international donors.¹⁰³

Given the urgency in addressing the pollution and depletion of water resources in the Ouanaminthe-Dajabon crossing, the proposal uses investments in affordable housing to support an alternative agenda. In this view, rather than drawing housing as a layer that sits upon a neutral infrastructural base, water infrastructures become the integral component to guide housing strategies.

(Notes)

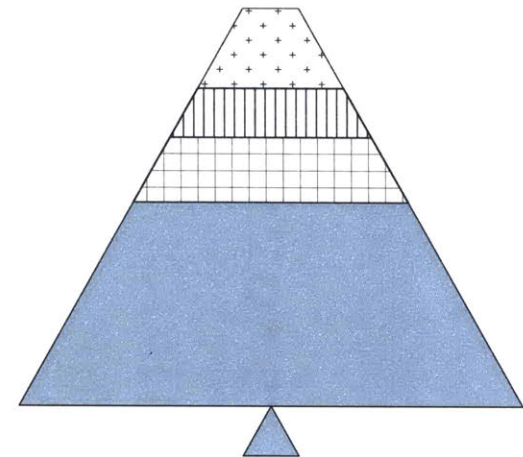
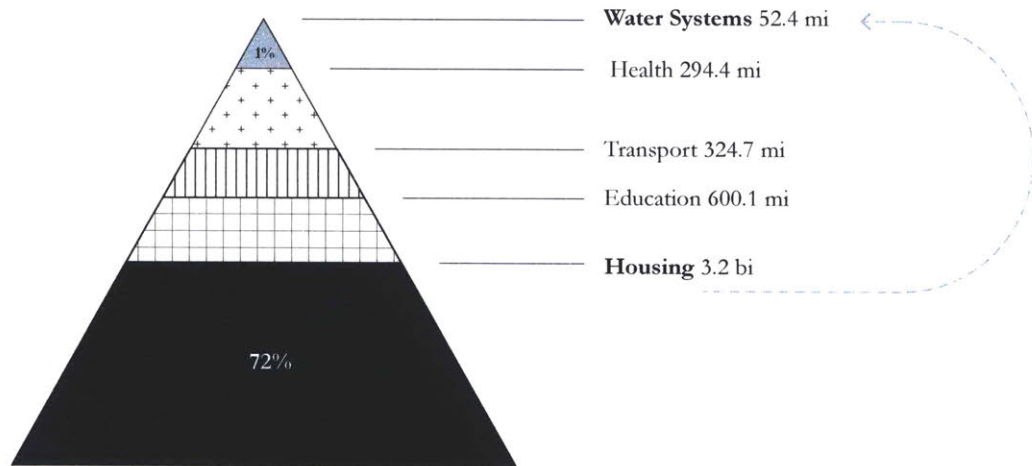
101. Habitats for Humanity, "Country Profile 2016 - Haiti."

102. World Bank, "Haiti Earthquake PDNA (Post-Disaster Needs Assessment)."

103. International Finance Corporation, "Integrated Economic Zones in Haiti.", p.7

Fig 47 (left). Proposal: using the Haiti's PDNA housing budget to support water infrastructures

Haiti Earthquake PDNA, 2010 (USD)



Water as the Supporting Component

HOUSING DEMANDS ON THE SITE

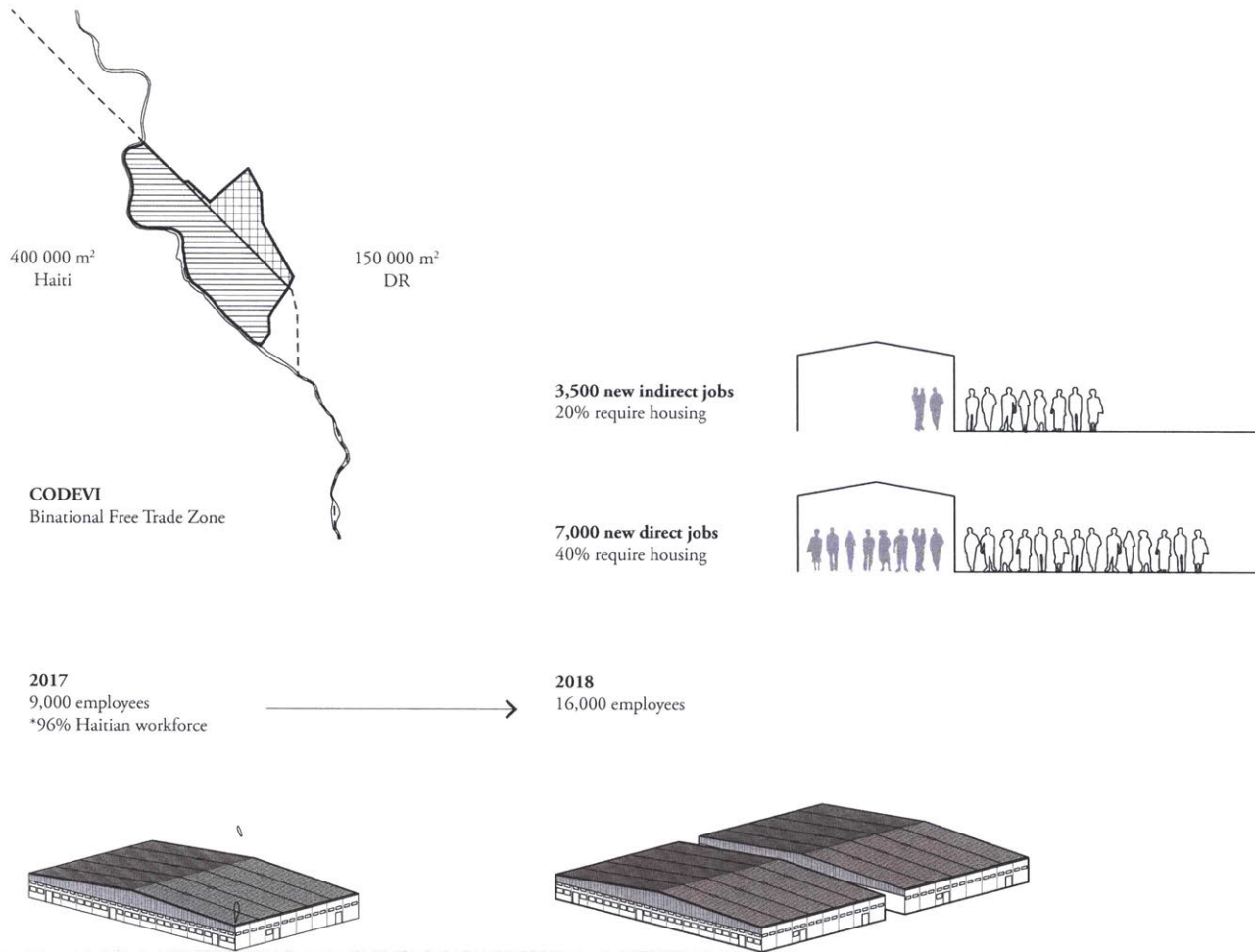
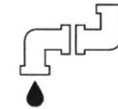


Fig 48 The expansion of the FTZ and housing needs estimates.

The parameters that define housing demand in IFC's projections for the northern region guides the estimates for the expansion of CODEVI's free trade zone. When numbers are translated spatially, we find that for each hectare of industrial land, approximately 8 hectares are necessary to fulfill the housing demands generated by increased employment. The proposal therefore attempts to accommodate the housing needs created by the 7,000 new openings.

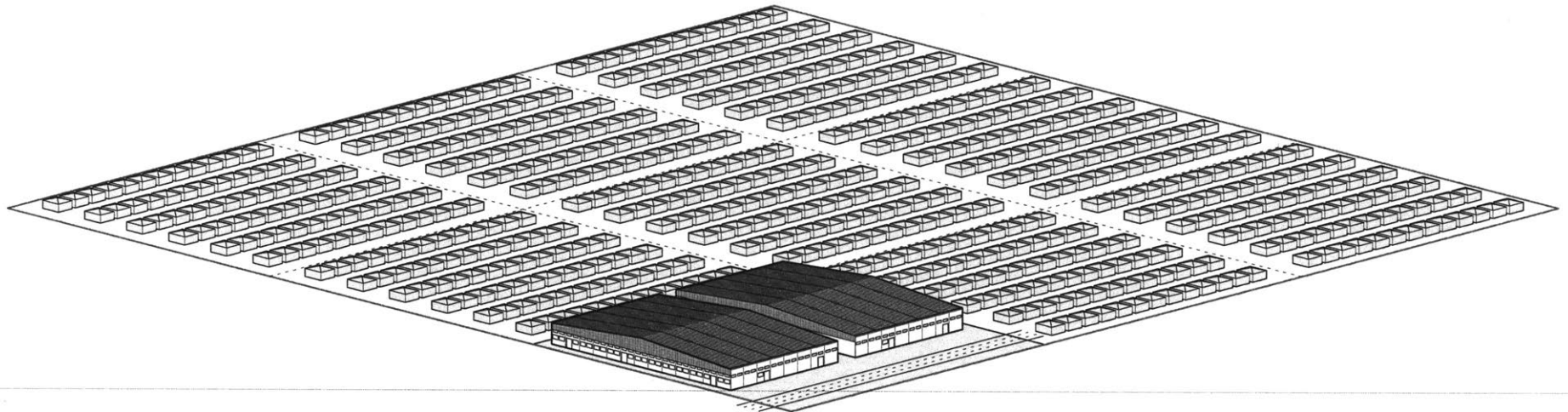


Water Demand
45 L/person/day
*considering access to piped water



Housing Demand
1.2 workers/household
4 pax/household
density: 40 h.u./ha

2875 housing units
Industrial Land : Residential Land
1 : 9 ratio



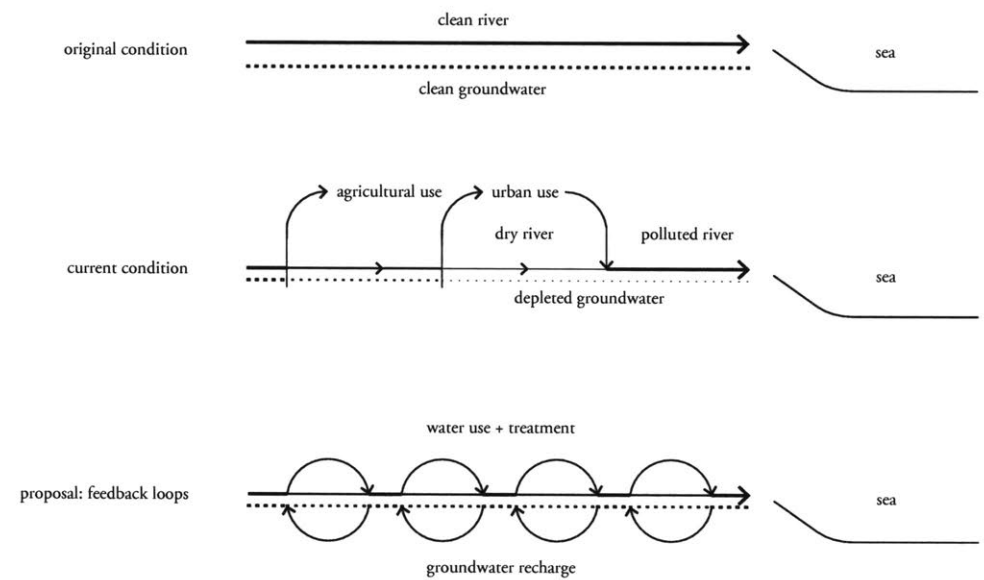
WATER SCALES AND STRATEGIES

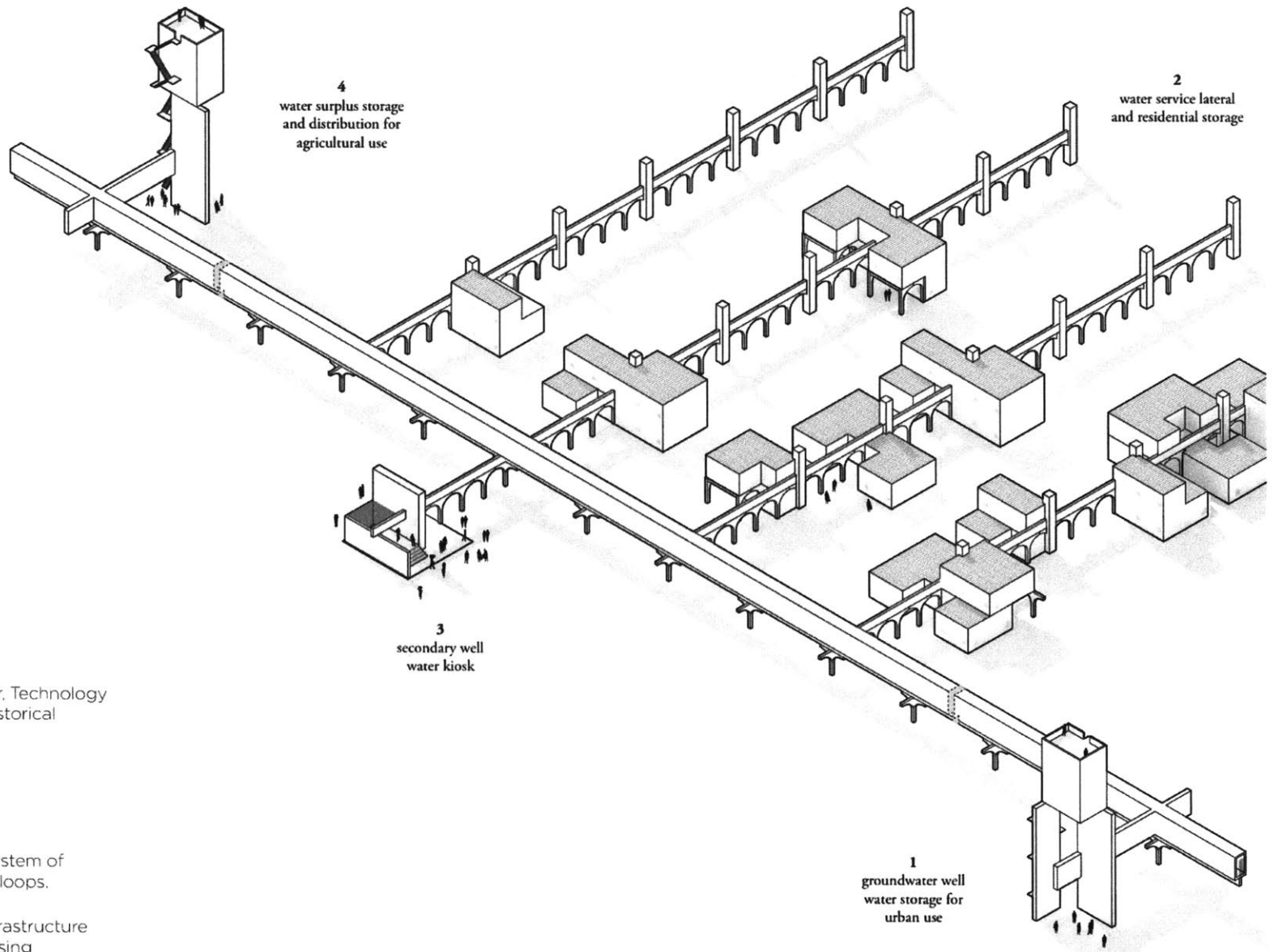
Traditional urban infrastructures, following the ubiquitous and expansive logic of the grid, favors urban sprawl. In designing water infrastructures, the project rejects the concept of the total network to adopt a system of closed feedback loops, where water is repeatedly extracted and returned to the river Massacre, as it is used and recycled in soft engineering systems. In his analysis of traditional water infrastructures, Antoine Picon argues that “small-scale, interactive feedback loops”, in working with smaller distances, provide more efficient strategies for managing water in cities.¹⁰⁴

Further, while returning the Massacre to a naturalized state is beyond the ambitions of this proposal, the strategy of recycling wastewaters successively, through extensive sewage treatment systems, helps to regulate the flows of the river and support groundwater equilibrium throughout the site.

The infrastructural support that guides the housing development is composed of a series of groundwater wells and a central aqueduct that feeds the lateral distribution of water. The elevated water structures proposed become the structural support onto which the housing units aggregate. In groupings of four, the 8x12m parcels share a water tank which maintains the water pressure throughout the system, and stores harvested rainwater for communal use. This strategy allows water to reach a second storey, promoting a greater urban density than that the currently found in Ouanaminthe today, where one-storey houses are

predominant. Modular structures in pre-fabricated concrete provides a solid framework for both the incremental housing typologies proposed and the raised water systems. Further, more than existing as technical artifacts that provide form and rhythm to the urban fabric, the infrastructures of water create the opportunity for public encounter.





(Notes)

104. Picon, "Water, Technology and Society A Historical Overview.", p.37

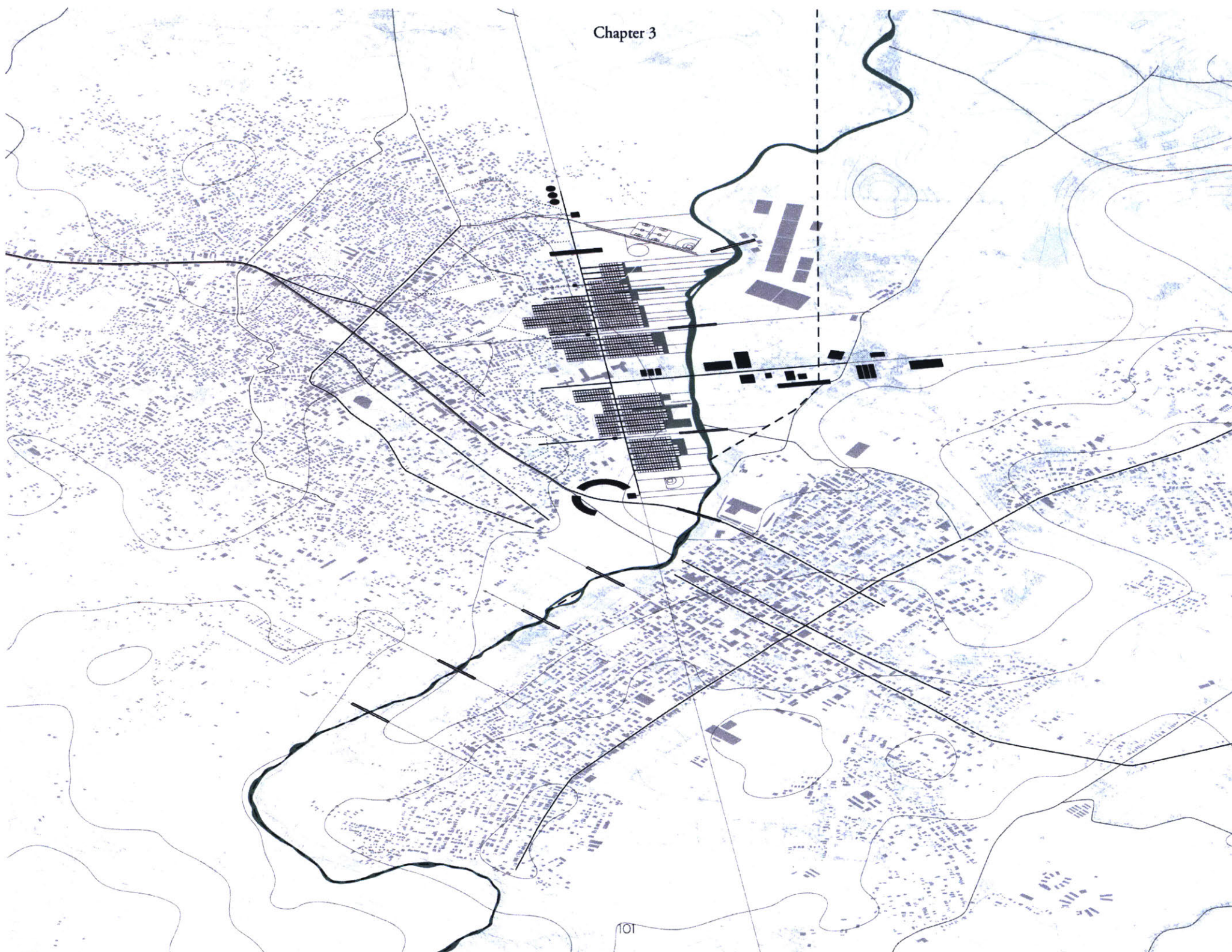
Fig 49 (left) A system of closed feedback loops.

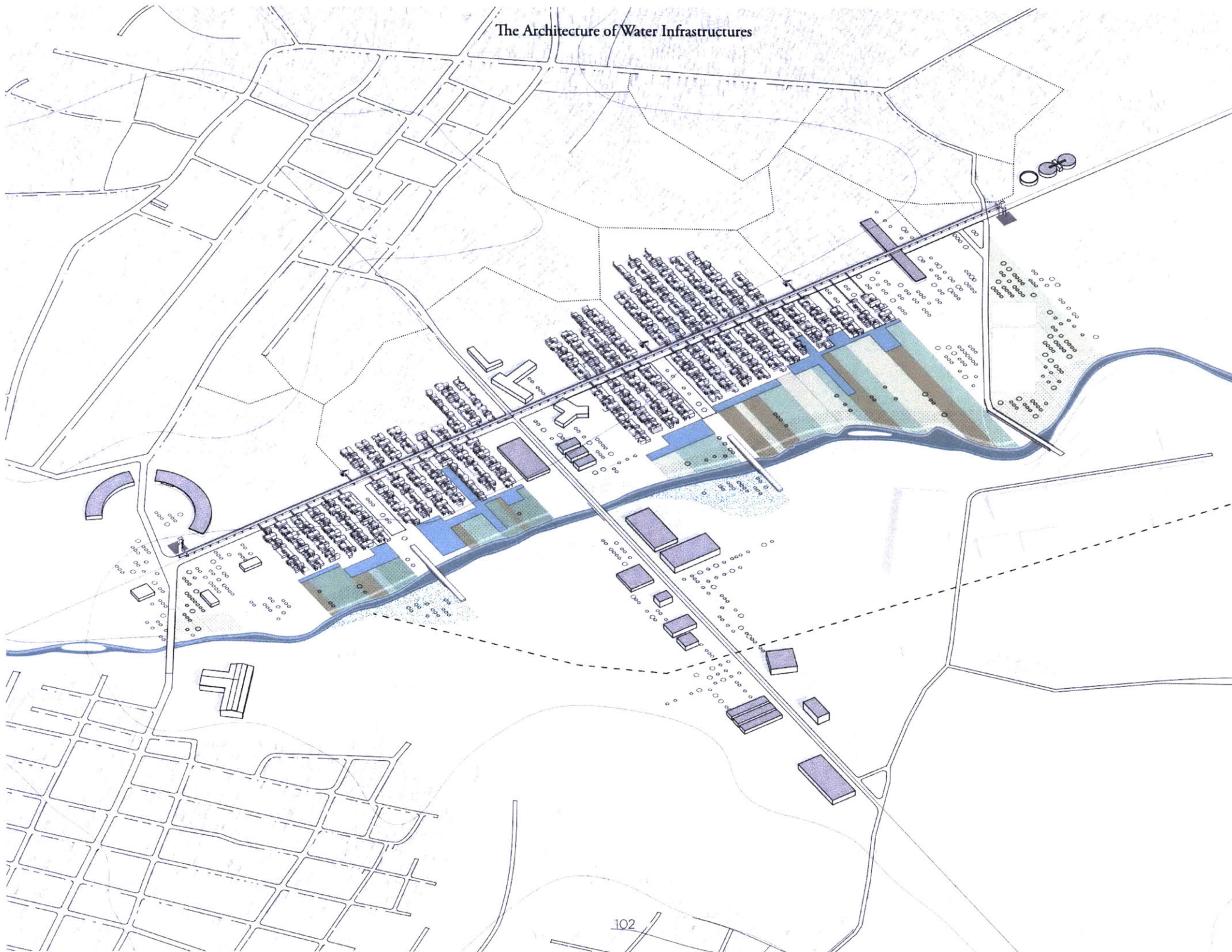
Fig 50. Water infrastructure artifacts and housing development

3.1 TERRITORIAL STITCH

Running parallel to the River Massacre, the selected site for intervention is located between the two existing border crossings. The overall plan is structured by two axes. The vertical axis is defined by the aqueduct and housing units, and occupies the liminal border zone on the north of Ouanaminthe, where urban expansion begins to take place informally. The horizontal axis connects Ouanaminthe's city center to the existing free trade zone, and to the northern neighborhoods of Dajabón that are being developed by the fragmentation of agricultural land. The construction of weirs upstream of the intervention and throughout the project retains surface waters to promote groundwater recharge. In periods of low tide, these structures serve as footbridges connecting both sides.

Fig 51. Birds-eye view of the selected site and intervention





The site's topography and the constraints imposed by the Massacre's floodlines delimits the areas that can be occupied by housing units. The development is structured on the basis of the grid that derives from the housing parcels, and marks the rhythm of pedestrian streets, the location of community wells and the maintenance of small agricultural plots along the riverbed.

Fig 52. Axonometric drawing of the general plan



The proposal is governed by the distribution and recycling of water. The water service laterals occurring every 30 meters intercalate with open spaces between housing units, where storm water is drained. Reed bed treatment ponds receiving wastewaters from houses, as well as raingardens that filter surface runoff before discharge into the Massacre, mark the transition between the urban footprint and the agricultural fields.

Fig 53. Axonometric drawing of the general plan and water systems

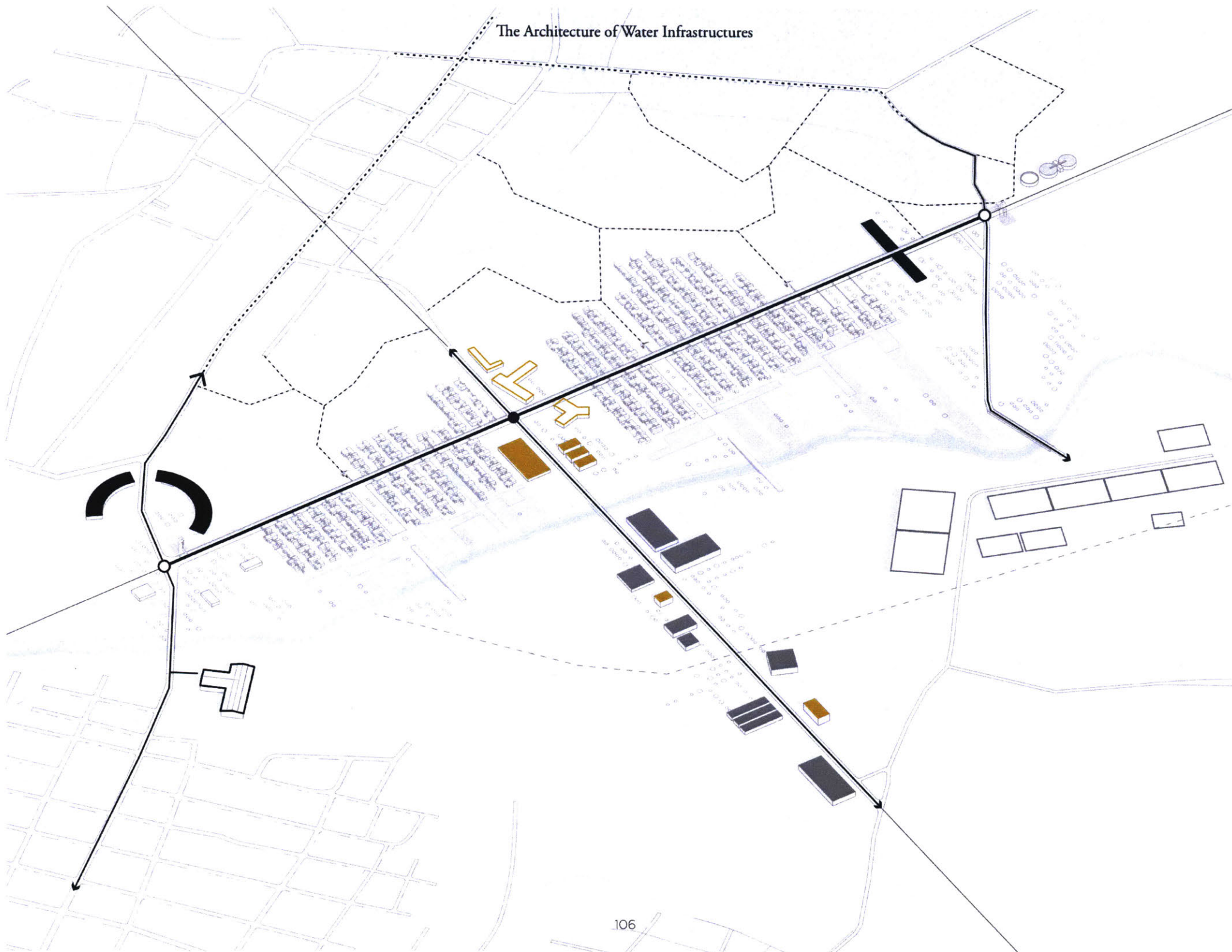


Fig 54. Anchors and connections

- 01 Dominican Market (existing)
- 02 Haitian Market
- 03 Food Market
- Free trade zone (existing)
- Free trade zone expansion
- Public and institutional buildings (existing)
- Public and institutional buildings (proposed)
- Existing border crossing
- Proposed border crossing

Today, flows of people mostly occur from Haiti to the Dominican Republic, since both the international market and the free trade zone are located on the Dominican side of the river. The plan is therefore anchored by two landmark buildings that motivate flows in the opposite direction.

With the construction of a market on the Haitian side already being considered by public authorities, a new market for the commercialization of Haitian goods is proposed. The typology of the Haitian market indicates the access to Ouanaminthe and defines the site of the first groundwater well. At the other edge, a linear typology next to the free trade zone acts as a stoppage, and accommodates a covered food market. The proposal for the food market is informed by the food stalls that already occupy the margins of the Massacre, where workers typically spend their lunch breaks.

The axis perpendicular to the aqueduct creates a third border crossing which breaks the seclusion of the free trade zone. Its location is determined by the existence of larger typologies, including public amenities and schools, on the Haitian side. In contrast to the more densely occupied residential zone, the warehouses and industrial structures exist as islands in a green landscape, opening up views to the river. By structuring the growth of industrial activity in correspondence to the existing vocations found in Ouanaminthe, other functions such as sports facilities, cultural venues, etc., can occupy the spaces of industrial use if the free trade is relocated elsewhere in the future. The intention is that the expansion of the free trade zone creates lasting functional links between both cities.

The Architecture of Water Infrastructures



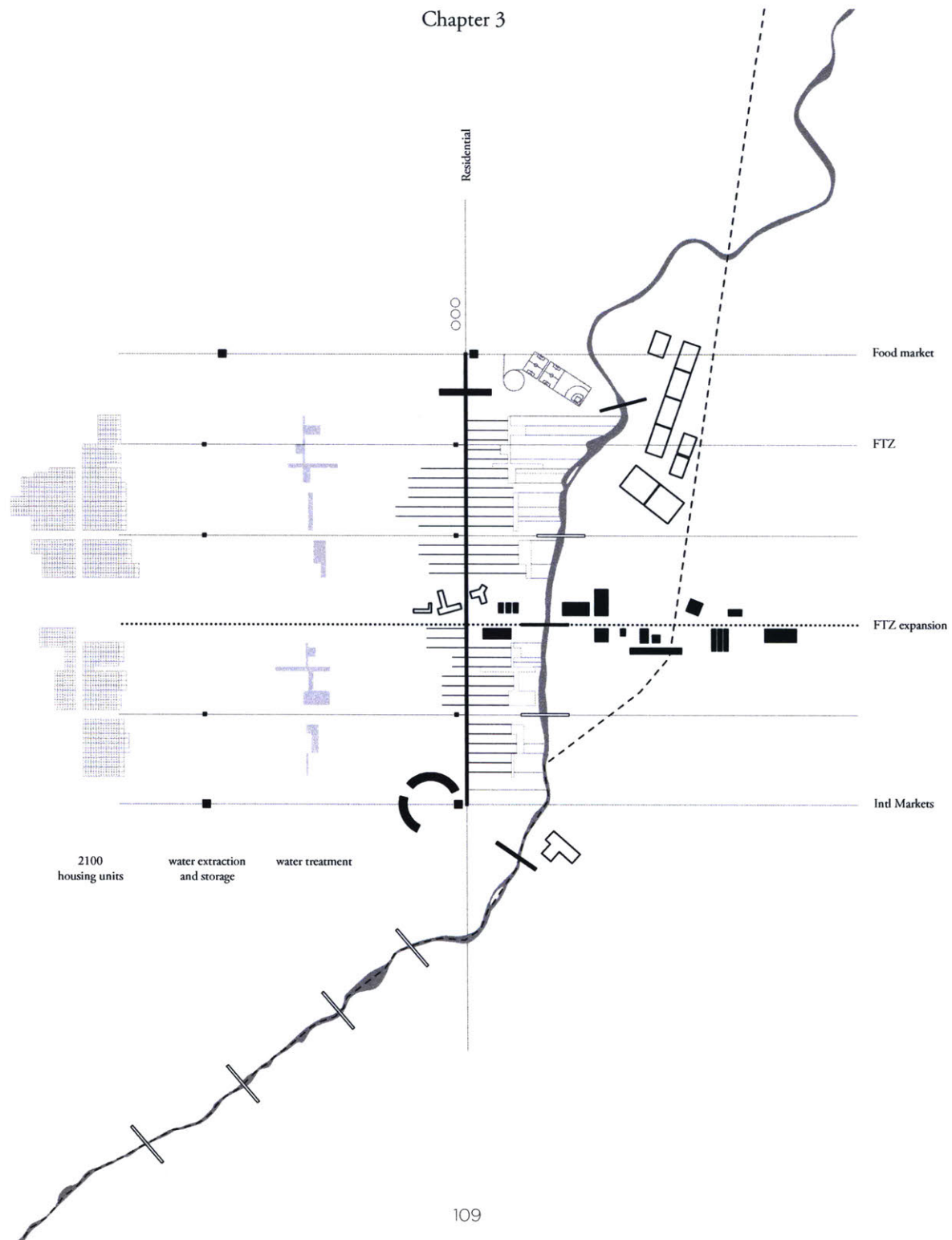


Fig 55-56. Structure and Organizational layers

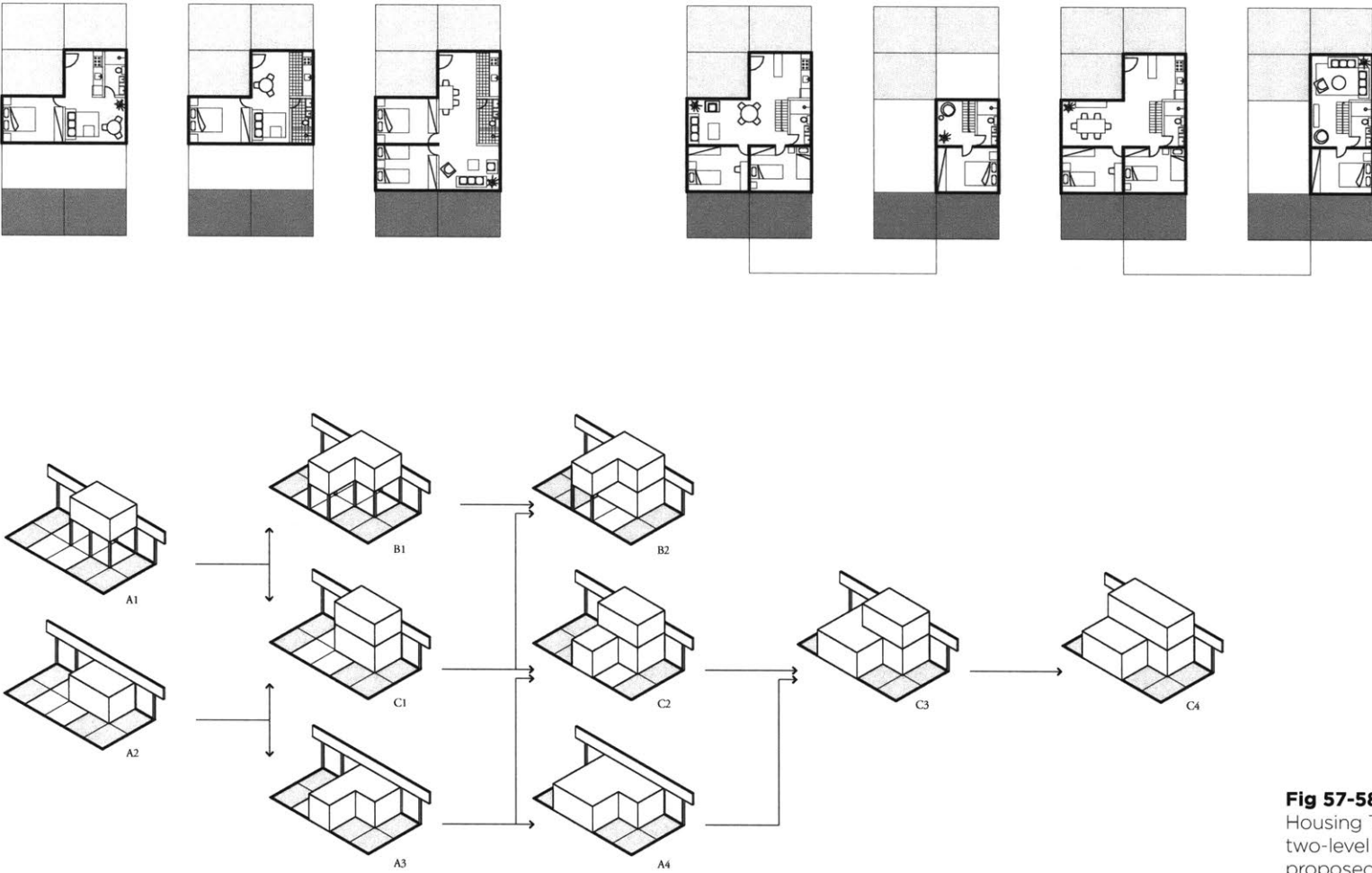
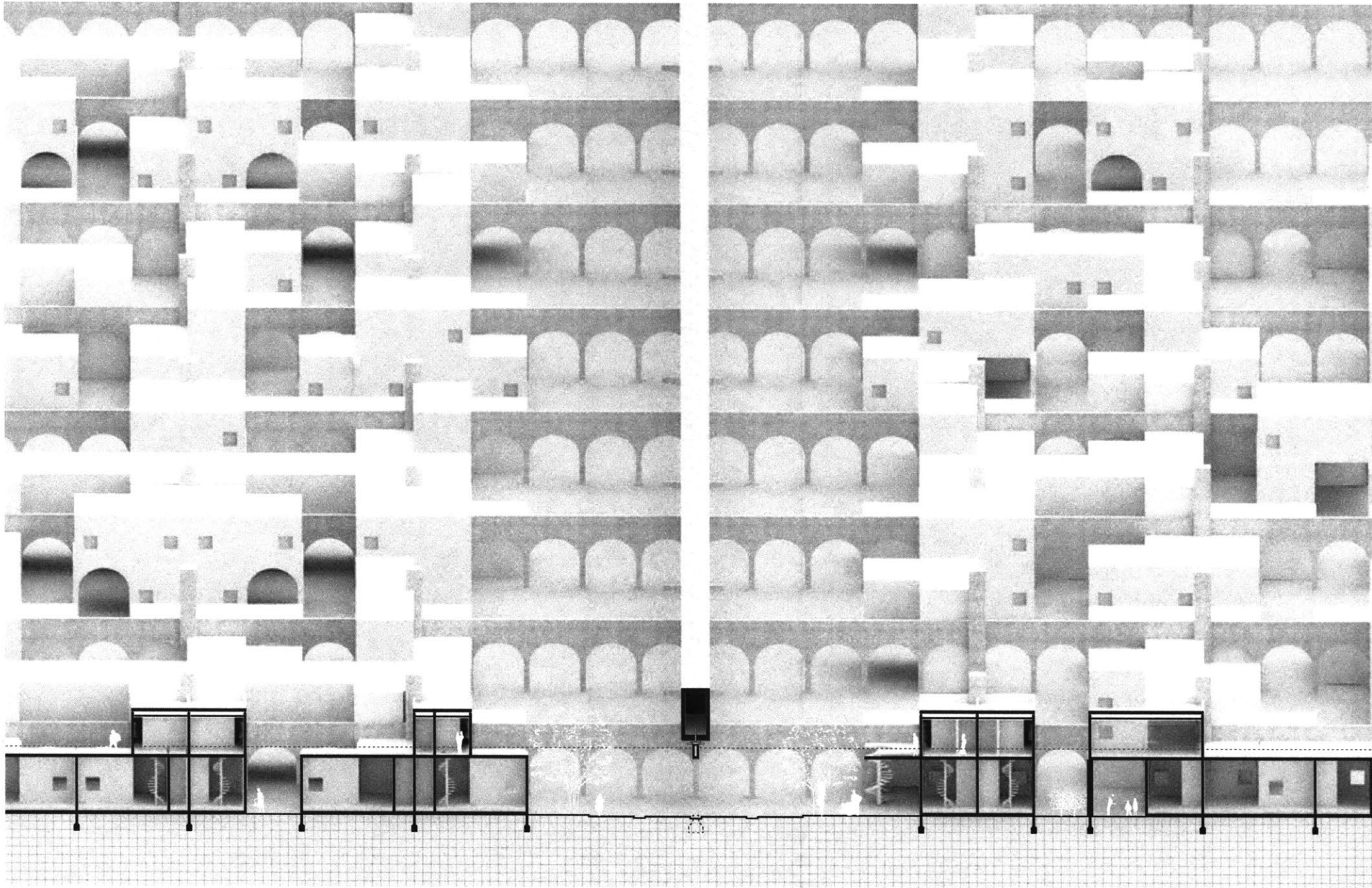
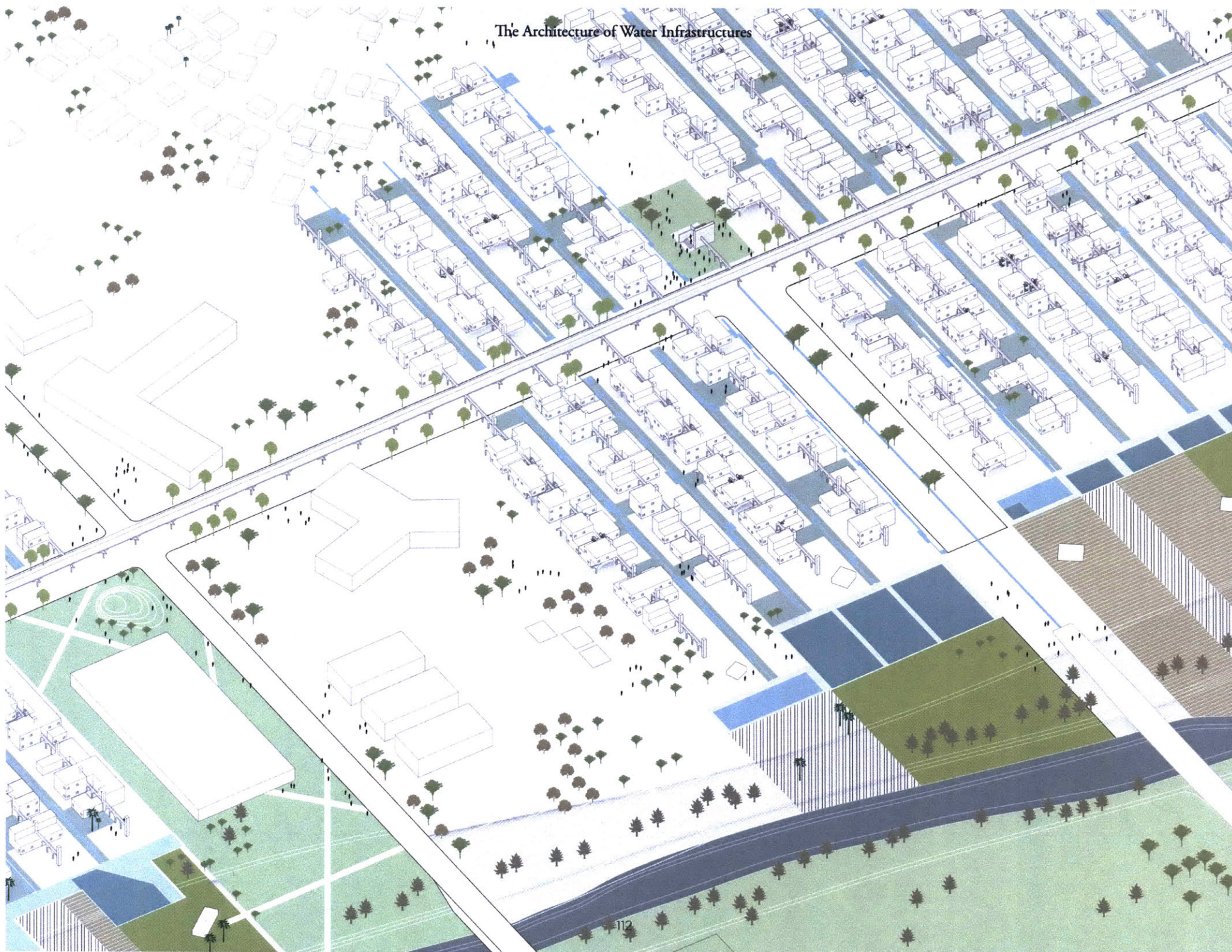


Fig 57-58. Incremental Housing Typologies. The two-level housing typologies proposed accommodate incremental growth, favoring density over sprawl. The units range from 36m² to 96m², and can be split to accommodate one or two families. In all arrangements, 50% of the parcel is left open to allow adequate light and continuous water drainage in bioswales, throughout the block.



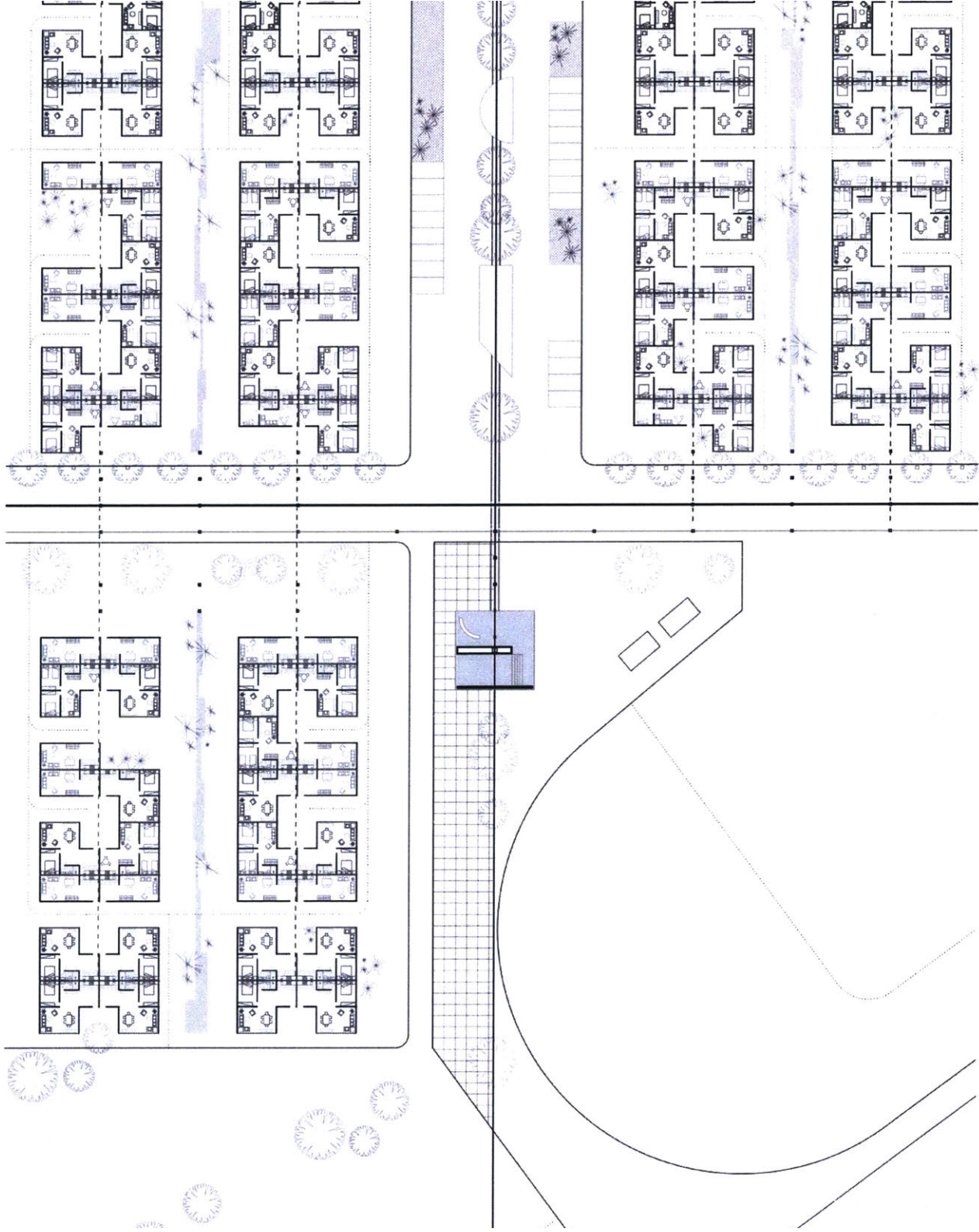
The Architecture of Water Infrastructures

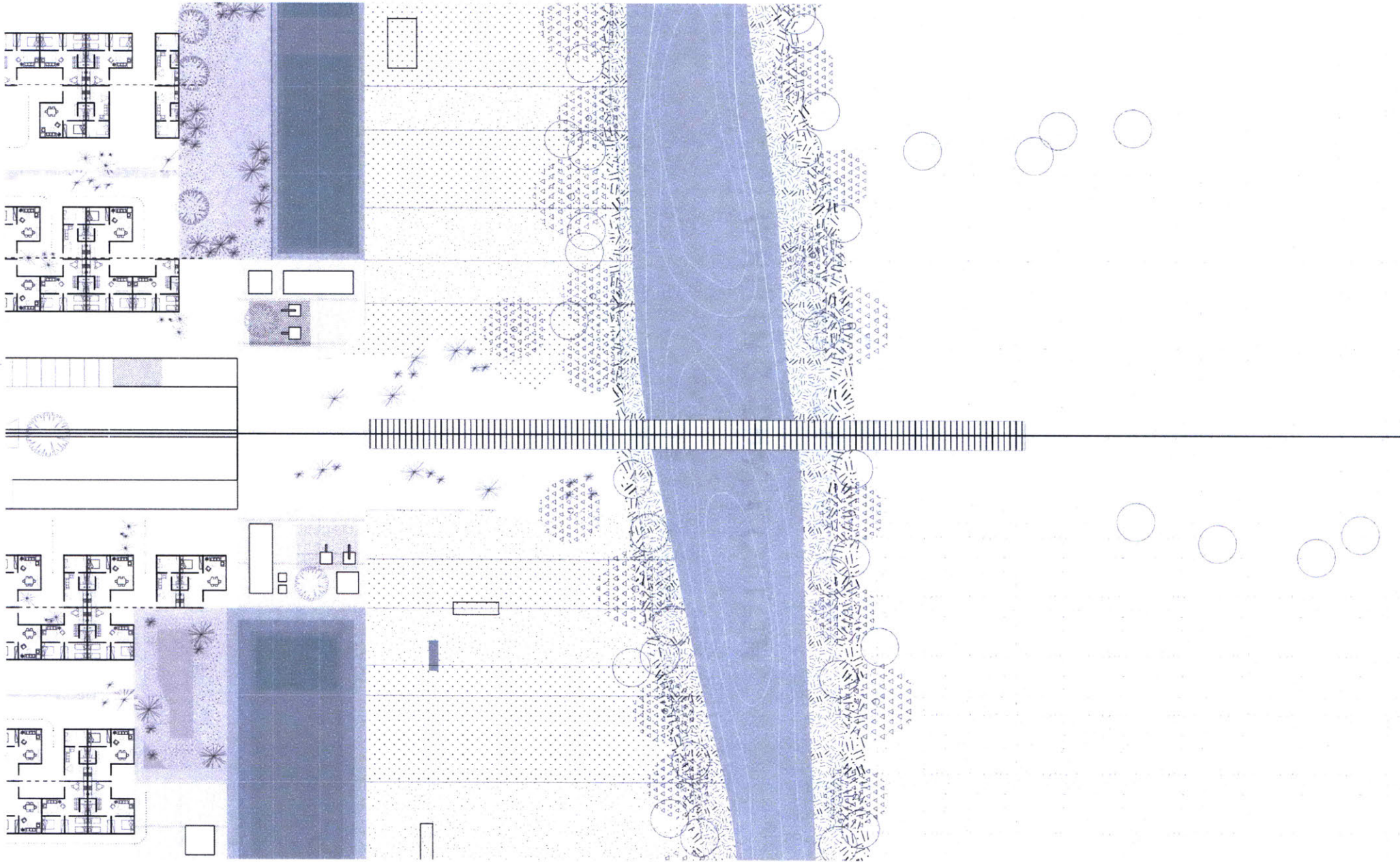


Water adopts a new symbolic role within the city, as infrastructure mediates natural resources and urban and agricultural needs. As a system, these interventions provide not only functional links but, more importantly, a sense of belonging together.

Fig 59. Axonometric view.
zoom-in

The Architecture of Water Infrastructures





CHAPTER 4 CONCLUSION

Border cities are spaces of flows – of people, capital, labor and trade. Indeed, the paradox of the border is that its very existence incentivizes movement across it. While life at the edge is volatile and uncertain (and highly sensitive to agents beyond its control), this thesis envisioned urban water systems as structures of permanence, providing the backbone for the urbanizing frontier between Ouanaminthe and Dajabón.

Given the absence of public authority in cities that are at the edge of development, we attempted to take advantage of the private motivations that shape the site today to coordinate public services. A series of inversions therefore determines the design: i) architecture as infrastructure, ii) investments in affordable housing as a means to guarantee water supply and sanitation, as well as places for public encounter iii) from a linear approach to urban water systems to a series of feedback loops.

To operate on these two cities, the study traversed different scales and themes, positioning architecture within the complex social, political and economic forces that shape the border region. Our hypothesis was that, in finding generalized conditions, the proposed interventions would be systematically readapted in the island's remaining border zones. What we found, however, was that the particularities found at the site were determinant in drawing an architecture of infrastructure that rejects the commonplace the anonymity and pragmatism of urban infrastructures. In this sense, while the lessons learned in this project are valuable, and demonstrate how foreign direct investment can be redirected to serve a more ambitious agenda, the achieved proposal is site-specific, and not directly scalable to other sites.

The urban proposal illustrated in this book shows a specific moment in time, where the increased demand in housing generated by 7,000 new jobs in FTZ is supplied along the 1400m infrastructural axis. The project, however, does not represent a fixed vision. While the linear arrangement provides a structure for urban growth, its functioning is not dependent on the existence of all parts. From the housing unit to the block and the neighborhood, the system behaves as a responsive framework, that grows in phases and according to demand. Alternatively, the failure or incompleteness of one sector does not jeopardize the functioning of the whole. Resiliency, in this sense, is what guarantees permanence.

Fig 60. (previous page) detail of housing development, groundfloor plan

Fig 61. View from Dajabon towards new Haitian market



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