LANDSCAPE AS SOVEREIGN:
EL GUAIRE CASE STUDY

FROM INFRASTRUCTURE TO COMMONS

An integrated framework for a resilient urban landscape.

Chapter 4" (or other appropriate number)

Cover page

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Landscape as Sovereign Defense: Bridging Urban Metabolism, Legal Innovation, and Equitable Futures for the Guaire River

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María Beatriz García Rincón and Ricardo Sanz are co-founders of DisLocal, a collective of urbanists, architects, and engineers from the Venezuelan diaspora providing spatial strategies for socio-ecological transitions across twelve countries.

Ricardo Sanz is an architect and urban researcher whose work bridges architecture and urban design in the peripheries of cities. He is co-managing DisLocal's pedagogy approach and offers key insights on El Guaire as an expert of the city's dynamic between architecture and its main river. He has led major conferences in Latin America, offering key architectural insights. His writing on the Guaire, quoted extensively in this chapter, represents a decades-long reflection on the cultural and perceptual barriers to reclaiming Caracas's primary waterway.

María Beatriz García Rincón brings nine years of experience at the World Bank Group, contributing to the Climate Investment Funds, the Forest Investment Program, environment and forestry programs, as well as key economic publications on organic economic opportunities across Latin America and the Caribbean and the IFC's Pillar software launch. An ENV-SP certified professional, she developed systems-thinking frameworks for IFC Upstream, advised the Director of Operations at MIGA, and led debates on the Future of Government within the World Bank's Governance Unit. She led an analytical program for the West Africa Coastal Resilience Program, bridging engineering with climate and resilient strategies, taking into account the importance of proper institutional analyses to effectively engage the region.

Together, they pioneered the Restitution Value (RV) metric and "extrastatecraft" models, integrating Sanz's spatial and cultural expertise with García Rincón's institutional background to reclaim ecosystem rights and empower community fiduciaries in post-crisis environments.

Abstract

The Guaire River in Caracas constitutes a "socio-environmental hybrid" whose current state—a concrete-bound, polluted artery—is the physical sedimentation of Venezuela's Petro-state and its failed "fantasy of control." This chapter argues that rehabilitating the Guaire requires a paradigm shift from linear extractivism to circular metabolism, operationalized through the integrated innovations of Metabolic Infrastructure, Legal Personhood, and Hybrid Finance.

Central to this transition is the Restitution Value (RV), a liability metric designed to quantify the externalized costs of seventy-six years of "metabolic looting" (1950–2026). By calculating an annualized metabolic debt of $513,000 per kilometer, the RV model renders visible the ongoing extraction of value through corruption leakage, lost riparian land, and externalized health costs. When this annual flow is scaled over the 76-year duration of the river's channelization, it reveals a cumulative present value restitution claim of $25 million per kilometer, or $1.875 billion for the river's 75-kilometer urban reach. This figure is presented not as a construction budget but as a quantifiable historical debt that stands as a fiscally conservative baseline for debt-for-nature swaps and international litigation when compared to contemporary global benchmarks.

Moving beyond the aesthetic preoccupations of traditional architecture, we propose a model of "Landscape as Sovereign Defense"—a 15-year strategic roadmap that utilizes "extrastatecraft" mechanisms, such as blockchain-based smart contracts and stablecoin-denominated grants, to bypass state fragility and empower community fiduciaries. This phased transition moves from emergency stabilization to the institutionalization of the river as a legal person with veto power over urban development. By reframing the Guaire as a client rather than an obstacle, this framework asserts that the river's right to flourish is synonymous with the city's own resilience, replacing the destructive logic of "domination" with a reality of negotiated reciprocity.

But this framework, for all its institutional sophistication, would remain abstract without engaging the cultural terrain it must transform. As Ricardo Sanz writes, the river's degradation is

sustained not only by failed infrastructure but by prejudices—unexamined assumptions, a collective inability to see what has always been possible. This chapter therefore weaves together two registers: the technical and the perceptual, the financial and the cultural, the global and the intimately local. It is, in the end, an argument for seeing differently—and for building new ways of seeing possible new outcomes in the city's main river—El Guaire.

Introduction – The Socio-Environmental Hybrid

The Guaire River that traverses Caracas is not merely a degraded fluvial system awaiting technical remediation; it constitutes what Maria Kaika defines as a "socio-environmental hybrid"—a material entity in which nature and society are irrevocably fused through historical processes of urbanization.[1] Its current state—a concrete-bound, polluted artery lined by the Francisco Fajardo highway—represents the physical sedimentation of Venezuela's Petro-state: its rise, its aesthetic of "modernity," and its eventual institutional decay. The river's channelization and contamination are not unfortunate side effects of development but rather the crystallized outcomes of specific political-economic decisions that privileged certain flows—of capital, automobiles, and hydrocarbons—over others—of water, sediment, and life.[2]

"The first time the river had ever been crossed by a human-made structure traces back to 1875, when the Guaire's banks were first bridged. Since then, this vital space of the city has been abandoned and intervened from the logic that imposed crossing its course for urban growth." (Ricardo Sanz 2026)

This framing—the river as something to be gotten over, traversed, left behind—has shaped Caracas's relationship with its primary waterway for a century and a half. The bridge made possible the city's expansion southward, but it also inaugurated a perceptual regime in which the Guaire became obstacle rather than destination, boundary rather than gathering place.

"A poor and restrictive approach has prevailed over the real dimensions of the river's potential as urban space." (Ricardo Sanz 2026)

The Guaire has registered in the city's consciousness only when it has flooded or when it has suffered some infrastructural intervention destined for the city's road connection system.

This chapter addresses the following research question: How can the Guaire River's rehabilitation be reconceptualized through a governance framework that moves beyond twentieth-century technical control to recognize the river as a living stakeholder with legal personhood, and what financial and spatial instruments are required to operationalize this transition in a context of state fragility? And beneath this institutional question lies a cultural one: How can a citizenry conditioned to see the river as sewer or obstacle learn to see it as a possibility?

We frame the Guaire as a product of historical power relations and capital flows, drawing on Urban Political Ecology to interrogate how the river's metabolism has been reconfigured to

serve extractivist logics. We introduce the "Design as Water" framework not as a restorative aesthetic project concerned with riverside beautification but as a fundamental governance shift that reimagines the relationship between urban institutions and hydrological systems.[3] We argue for a transition from the twentieth-century project of nature's "domestication"—exemplified by the river's encasement in concrete—toward a stewardship model that recognizes the river as a living stakeholder with inherent rights. This reconceptualization demands not only new technologies but new legal and financial instruments capable of sustaining a socio-ecological transition. What we term Landscape as Sovereign Defense—the recognition that the city's survival depends on restoring the metabolic functions that the control paradigm systematically eliminated—runs as a thread throughout this chapter, connecting theoretical critique to practical intervention.

Methods: A Multi-Method Approach to Urban River Governance

This chapter employs a multi-method research design that integrates historical analysis, theoretical synthesis, comparative legal examination, practice-based design-research, and—uniquely—the incorporation of sustained ethnographic and autoethnographic reflection by co-author Ricardo Sanz, whose decades of engagement with the Guaire as architect, educator, and citizen inform the cultural diagnosis at the heart of our argument.

First, archival research traces the Guaire's physical transformation through primary documents held at the Archivo Histórico del Ministerio de Obras Públicas in Caracas. These records—including internal memoranda, engineering reports, and correspondence with the Frederick Snare Corporation—reveal the governing rationality that guided the river's channelization between 1939 and 1958. Newspaper accounts from the period, particularly coverage of the 1948 El Paraíso Hippodrome flood, illuminate public discourse and the political responses to hydrological disaster.

Second, theoretical synthesis draws on Urban Political Ecology (Kaika, Swyngedouw), informality studies (Roy), urban design theory (Sennett, Brenner, Easterling), and science and technology studies (Jasanoff) to construct an analytical framework capable of addressing the Guaire's socio-natural complexity. This synthesis moves beyond the anthropocentrism of existing informality literature to theorize the river as a political subject with its own agency and desires.

Third, comparative legal analysis examines international precedents for recognizing rivers as legal persons. We analyze the legal instruments establishing personhood for New Zealand's Whanganui River (Te Awa Tupua Act 2017) and Colombia's Atrato River (Sentencia T-622 de 2016), identifying institutional design principles applicable to the Caracas context. This comparative method yields a proposed governance structure—the Guaire Council—adapted to Venezuela's specific political and institutional conditions.

Fourth, practice-based design-research operationalizes theoretical principles through a collaborative workshop conducted with Washington University's Sam Fox School in November

2022. Over three days, twelve students developed speculative proposals integrating net-zero housing, communal public spaces, regenerated river systems with hydroelectric generation, flood management infrastructure, and fintech financing models over a fifteen-year timeline.[4] This workshop tested the feasibility of gender-responsive metabolic infrastructure and generated design principles that inform our proposals for the Guaire.

Fifth, economic modeling develops a Restitution Value equation that quantifies the resources required for genuine restoration. This model moves beyond conventional cost-benefit analysis to capture accumulated corruption leakage, lost riparian land value, and externalized health costs—dimensions excluded from neoliberal accounting frameworks. The equation provides a measurable metric against which proposed interventions can be evaluated.

Finally, and distinctively, this chapter incorporates sustained reflection by Ricardo Sanz on the cultural and perceptual dimensions of the Guaire's degradation—what he terms "the city of prejudices." This material, developed over years of teaching, writing, and design practice in Caracas, functions as a form of ethnographic fieldwork from within: a diagnosis of the unexamined assumptions that have paralyzed action and an argument for the cultural work that must accompany institutional innovation. Throughout the chapter, Sanz's voice appears indented, offering a counterpoint to the more institutional register of the main argument and reminding readers that the river's recovery requires not only new laws and new finance but new ways of seeing the Guaire. Perception is argued as a key tenant to its recovery.

Theoretical Review

I. The Neoliberal Waterscape and the "Fantasy of Control"

Following Erik Swyngedouw's analysis of urban water as a metabolic circulation in which political and economic power becomes "crystallized" into infrastructure, we examine how the Guaire's transformation reflects broader processes of neoliberal urbanization.[5] In Caracas, the concrete channelization of the river, initiated between 1950 and 1958, functioned as a mechanism to "standardize" urban space, rendering it legible and controllable for modernizing elites.[6] The river was sacrificed to facilitate the Francisco Fajardo highway, prioritizing what we term the "speed of capital"—the unimpeded circulation of automobiles and commodities—over ecological agency and riparian function.

This "Petro-Hydraulic" displacement systematically erased the river's meanders, wetlands, and floodplains to create a sink for the state's primary export: subsidized energy. Internal memoranda from Venezuela's Ministry of Public Works in 1937 explicitly framed the Guaire as "an obstacle to circulation and to the rational configuration of the city," revealing a governing rationality that could perceive the river only as impediment rather than asset.[7] The subsequent intervention by the Frederick Snare Corporation, an American engineering firm, imposed a rigid geometric order on a tropical river system, amputating its curves and lining its banks with concrete. As engineers at the time privately acknowledged, this transformation would render the Guaire "a vulnerable and eternally dangerous" artificial system.[8] The 1948 flooding of El

Paraíso's Hippodrome, which caused dozens of casualties and extensive property damage, paradoxically reinforced rather than challenged this control paradigm, triggering accelerated channelization in a misguided attempt to "dominate" the river's inherent dynamism.[9]

Figure 1. "Agua y lodo en los Flores de Puente Hierro, una de las zonas de Caracas más afectadas por la inundación." The November 1949 flood destroyed homes in this working-class neighborhood, including those of journalists Herman "Chiquitín" Ettedgui and Abelardo Raidi, who lost irreplaceable collections documenting Venezuelan sports history. Source: Camara de Caracas, "Cuando El Guaire azotaba a los caraqueños," accessed March 10, 2026.

The image humanizes the flood's impact, showing that channelization was presented as humanitarian protection while actually serving elite interests. The destruction of working-class homes became justification for infrastructure that ultimately served automobile circulation. Figure 2 demonstrates how discourse constructed the river as an enemy requiring domination. The newspaper's framing of the Guaire's "fury" justifies the control paradigm this chapter critiques. Figure 3 illustrates the theoretical argument about the river's dual nature—destructive force and life-giving presence. The children's play in polluted floodwaters speaks to the complex intimacy between Caracas's poorest residents and the Guaire that this chapter seeks to honor.

The literature on urban informality, as developed by Ananya Roy, fundamentally reconfigured planning theory by demonstrating that informal settlements are not aberrations awaiting correction but productive modes of urbanization that generate territory, value, and subjectivity through their own logics.[10] Roy's intervention was essential: it broke with developmentalist framings that positioned informal residents as passive victims awaiting state benevolence or market incorporation. In the Venezuelan context, this analytical shift enabled scholars and practitioners to recognize the political agency of barrio residents, their capacity to produce space, claim rights, and negotiate with state and capital.

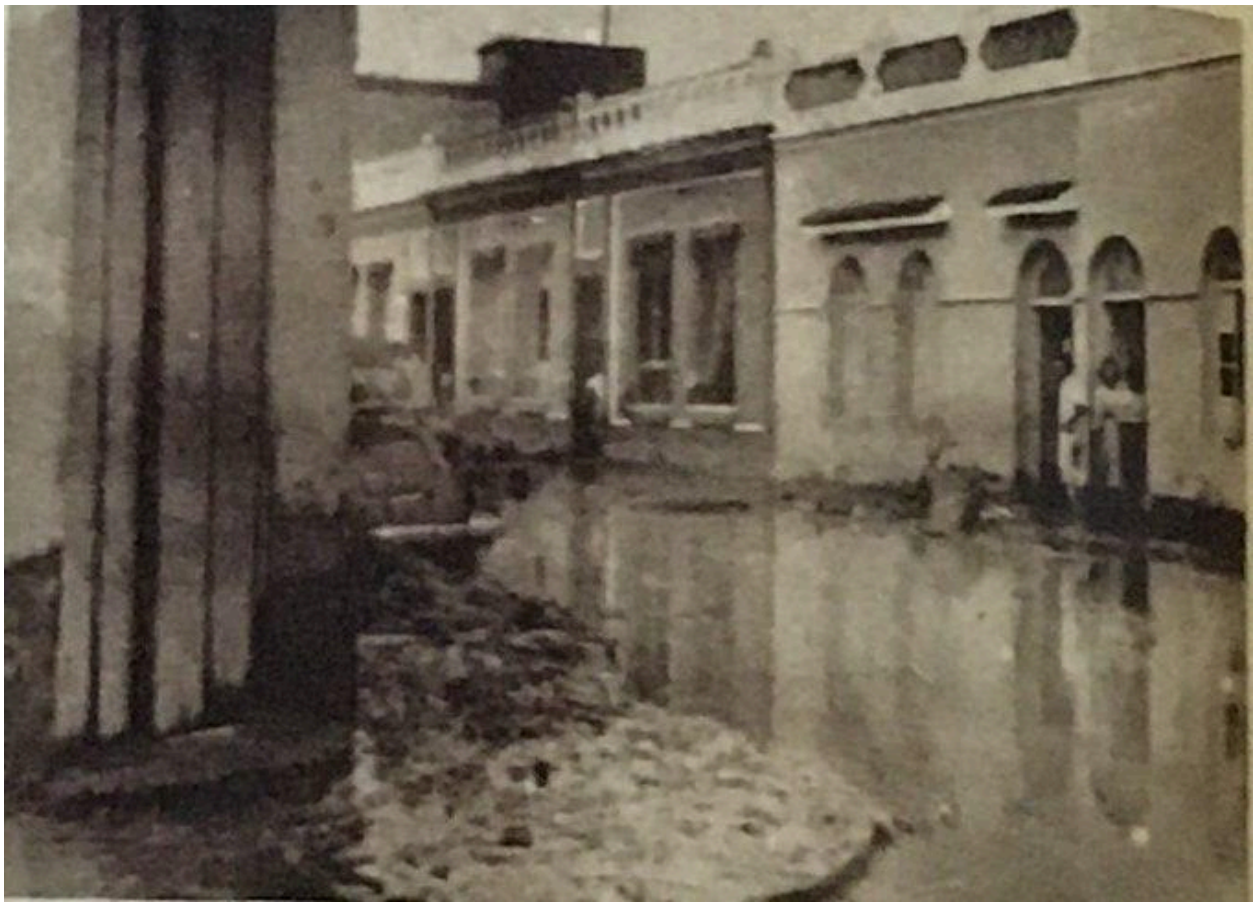

Figure 2. Portada del diario capitalino Últimas Noticias, domingo 6 de noviembre de 1949. The front page documents public discourse surrounding the flood, framing it as a "tragic awakening" of the Guaire and reinforcing demands for state intervention. Source: Camara de Caracas, "Cuando El Guaire azotaba a los caraqueños," accessed March 10, 2026.

That battle, however, is largely won. In post-revolution Caracas, the recognition of popular agency has been incorporated—however imperfectly—into institutional discourse, constitutional frameworks, and everyday political practice. The 1999 Constitution's recognition of the right to the city, the proliferation of communal councils, and the explicit politicization of barrio identity have rendered simplistic victimhood narratives not only analytically obsolete but politically naive.[11] Residents of Petare and El Llanito do not require external validation of their agency; they have demonstrated it repeatedly through decades of self-construction, political

mobilization, and everyday survival. The question is no longer whether informal settlements have voice, but what that voice speaks, and to whom.

Figure 3. The photograph captures the paradox of disaster: even as floodwaters destroyed homes, children treated the transformed urban landscape as playground. Source: Camara de Caracas, "Cuando El Guaire azotaba a los caraqueños," accessed March 10, 2026.

II. Caracas, City of Prejudices

From the foregoing, one could say that Caracas is a city of prejudices—a powerful condition when it comes to hindering or making impossible the implementation of actions that, due to their relevance, would today contribute to mitigating in part those conflicts derived from some of the most dramatic disagreements that occur within it.

The Guaire's degradation is not only a failure of engineering or finance; it is a failure of imagination, sustained by what we might call a "regime of prejudice."

These prejudices, represented in the river's evolution and current state, have been fed by incomprehension, misinformation, or simply assumed without sufficient reflection, with the additional difficulty of regulatory frameworks that hinder the implementation of new approaches for its recovery.

The most powerful of these prejudices is the assumption that the river must be cleaned before it can be inhabited—a sequencing that, however intuitive, functions as a formula for perpetual deferral. Why invest in a riverfront promenade when the water is toxic? Why program the banks when the smell is unbearable? These questions, asked in good faith, nevertheless produce the outcome they fear: because the river is not yet clean, it remains abandoned; because it remains abandoned, it never becomes a constituency; because it has no constituency, it never commands the political will required to clean it.

It is important to think about the development of mechanisms to stimulate that questioning capacity of citizenship, which could in principle break an apathy with powerful inertia regarding urban plans and projects of a certain importance in Caracas. With little or no interest from the authorities to promote citizen capacity as an ability to understand and commit to the city's problems through education, the inhabitant of Caracas has been left without instruments for reflection on their vital space, and at the mercy of prescribed convictions that prevent them from demanding changes from the authorities that represent them. We need to begin to think about that which goes beyond the urgent, about that which has sufficient consistency to shape the city through democratic spaces.

The metabolic infrastructure, legal personhood, and hybrid finance we propose in this chapter are precisely such mechanisms—institutional answers to a cultural problem. They are designed to break the inertia, to create the conditions under which the Guaire might finally become thinkable as something other than an obstacle or sewer. But they cannot succeed without acknowledging the depth of the perceptual challenge they face. The river's recovery requires not only new laws and new money but a transformation in how Caracas sees—and the slow work of education, reflection, and cultural production that such transformation demands.

Regarding recent or ongoing projects interested in the specific theme of the Guaire, we find in the academic, professional, and community spheres proposals that have managed to give visibility to the issue, through calls such as the competitions organized by Fundación Espacio through Caracas City 450 in 2018 or the work of Enlace Arquitectura on a linear park bordering the Guaire, led by architect Elisa Silva together with journalist Cheo Carvajal. These have been consolidating and achieving the support of citizen groups, private enterprise, and municipal authorities for their realization.

These initiatives demonstrate that the perceptual shift is already underway—that pockets of the city have begun to imagine otherwise. The task is to scale that imagination, to give it institutional form, to make it irreversible.

III. The Guaire as Metabolic Infrastructure: From Linear Conduit to Circular System

The concept of urban metabolism, as developed within Urban Political Ecology, provides a powerful lens for reconceptualizing the Guaire's role in Caracas.

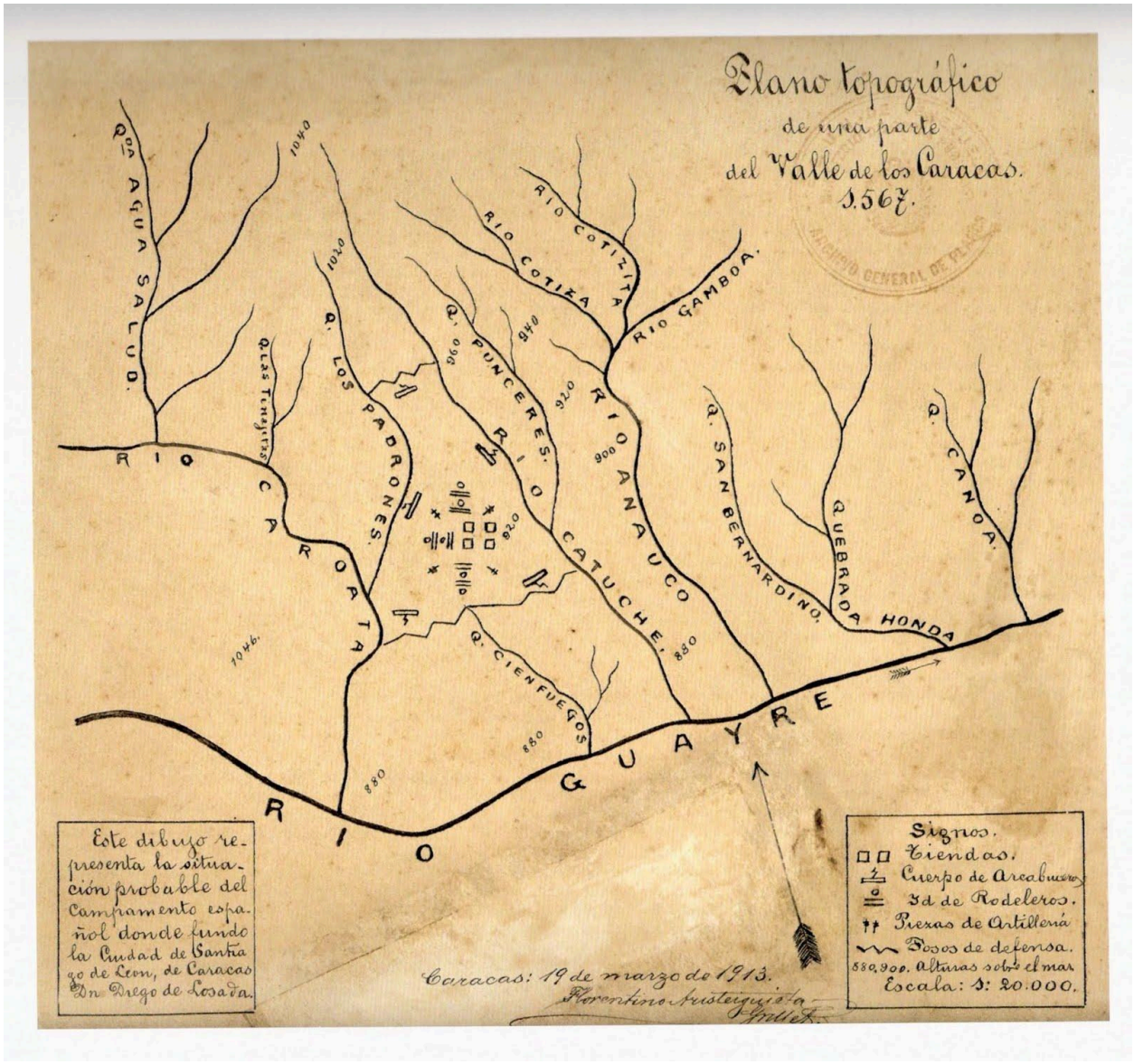

Figure 4. "Plano Topográfico de una parte del valle de los Caracas, 1567 (Transcripción, 1913)." This map, a 1913 transcription by Florentino Aristeiguieta of a presumed 1567 original, depicts the probable layout of the Spanish military encampment that preceded the formal founding of Santiago de León de Caracas. The drawing illustrates the settlement's strategic defensive position between the Quebrada de Los Padrones and the Río Catuche, using the watercourses as natural protective barriers. The map provides critical visual evidence of how the territory was first organized under military logic before its transformation into a colonial city, revealing the initial layer of what would become Caracas's long history of hydraulic intervention. Source: Florentino Aristeiguieta, "Plano Topográfico de una parte del valle de los Caracas, 1567," 1913 transcription, Archivo General de Planos, Biblioteca Nacional, Caracas. Reproduced in "El primer asentamiento," Guía de arquitectura y paisaje de Caracas.

Metabolic thinking treats cities not as static artifacts but as dynamic systems of resource flows—water, energy, materials, wastes—that connect local processes to global circuits of production and consumption.[12] Within this framework, the Guaire is not merely a river that happens to flow through a city; it is a central organ in Caracas's metabolic system, circulating water, nutrients, and contaminants while regulating temperature, draining stormwater, and providing habitat for diverse species.

The twentieth-century transformation of the Guaire into a concrete channel represented a fundamental metabolic reconfiguration. The river's meanders—its natural mechanism for slowing flow, filtering pollutants, and exchanging nutrients with floodplain soils—were systematically amputated. Its connection to groundwater aquifers was severed by impermeable concrete. Its riparian forests, which once shaded the water and provided organic matter for aquatic food webs, were replaced with highway asphalt. The result was the conversion of a living metabolic system into a linear disposal conduit: water enters the upper watershed, picks up waste as it passes through the city, and exits as quickly as possible, carrying Caracas's untreated sewage to the Tuy River and eventually the Caribbean Sea.

This linear model—extract, use, discard—mirrors the extractivist logic of the Petro-state that financed it. Just as oil was extracted from the subsoil, refined, and burned without regard for atmospheric consequences, so water is extracted from the watershed, used, and discharged without regard for downstream impacts. Both systems externalize their costs: the climate effects of hydrocarbon combustion, the health effects of water pollution, the ecological effects of habitat destruction. Both treat nature as infinite sink rather than finite partner.

The metabolic alternative, which we term "Metabolic Infrastructure," reconceives the Guaire as a circular system in which wastes become resources, linear flows become cycles, and the river's inherent capacities for filtration, infiltration, and nutrient cycling are enhanced rather than eliminated. This approach draws on the "Design as Water" framework but extends it from a design principle to a full-spectrum governance and financial strategy.[13]

Operationally, Metabolic Infrastructure means:

First, recognizing that the Guaire and its tributary quebradas already function as de facto infrastructure for millions of Caracas residents. In the absence of reliable public services, these water bodies provide drainage, wastewater conveyance, and even cooling—functions that would cost billions to replace with engineered systems. The question is not whether to use the river as infrastructure but whether to do so intentionally, with investment in its health, or accidentally, with continued degradation.

Figure 5. "Getting Water at the River of Hell." Residents of the San Agustín barrio descend to the Guaire's embankment to collect water during March 2019, when electrical failures shut down the pumping stations that supply Caracas. The photograph documents the paradoxical return of the river as de facto infrastructure in a moment of state collapse: a source of water so contaminated it is known as the city's "open air sewer," yet essential for survival. The image captures the central contradiction this chapter theorizes—the Guaire as both lethal threat and life-sustaining presence. Source: Arnaldo Espinoza, "Getting Water at the River of Hell," Caracas Chronicles, March 12, 2019.

Second, transitioning from centralized to distributed systems. The failed Odebrecht project of 2005–2015 attempted to solve the Guaire's pollution with a massive interceptor sewer—a classic gray infrastructure megaproject that concentrated risk, enabled corruption, and delivered minimal results.[14] Metabolic Infrastructure instead proposes distributed nature-based solutions: constructed wetlands in the tributaries, bioswales along urban streets, green roofs in dense neighborhoods, and riparian restoration along the main channel. These interventions treat pollution at source, reduce flood risk through infiltration, and provide public space and habitat while creating local employment in construction and maintenance.

Third, designing for multiple functions simultaneously. A constructed wetland in Petare does not only treat wastewater; it also provides recreational space, cools the surrounding neighborhood through evapotranspiration, creates habitat for birds and insects, and offers opportunities for environmental education. A restored riparian zone in El Llanito does not only stabilize banks; it also shades the water, traps sediments, and provides corridors for wildlife movement through

the city. This multifunctionality is the economic argument for Metabolic Infrastructure: each investment yields multiple returns.

The St. Louis workshop operationalized these principles through a gender-responsive design exercise. The fifteen-year timeline acknowledges that metabolic transformation cannot occur overnight; it requires sustained investment, adaptive management, and institutional continuity. The gender-responsive framework recognizes that women in informal settlements bear disproportionate responsibility for water collection, child health, and household sanitation—and therefore have both the deepest knowledge of local water systems and the strongest incentives to protect them.[15]

Crucially, Metabolic Infrastructure positions the river not as recipient of charity or object of state intervention but as co-investor in its own restoration. When a constructed wetland treats wastewater, the river's health improves; when a restored riparian zone shades the water, the river's temperature regime stabilizes; when a bioswale infiltrates stormwater, the river's flood peaks decrease. Each investment in the watershed is simultaneously an investment in the river and in the communities that depend on it. This reciprocity—the river and the city healing together—is the ultimate goal of the metabolic approach.

IV. From Informality to Ecological Reciprocity

The theoretical vanguard of this work lies in moving beyond frameworks that position informal settlements as problems to be solved or victims to be rescued. The St. Louis workshop demonstrated that residents of informal communities are already managing complex metabolic systems—water, waste, energy, finance—with creativity and resilience. The task of design, policy, and finance is not to replace these systems with imported solutions but to support their evolution toward greater sustainability, equity, and ecological health.

This vision of Metabolic Infrastructure demands a reconceptualization of the river's political status—a move that requires engaging, and ultimately moving beyond, the frameworks of urban informality, openness, and expulsion developed by Roy, Sennett, and Sassen. The question is no longer how the city might accommodate the river, but how the river might assert its own claims upon the city.

Richard Sennett's work on the "open city" gestures toward this more complex terrain.[16] Sennett distinguishes between the closed city of imposed order—exemplified by the Guaire's channelization—and the open city of adaptive complexity, where urban systems evolve through use and time. His concept of "porosity," drawn from Benjamin's writings on Naples, suggests urban edges where inside and outside interpenetrate, where boundaries are zones of exchange rather than lines of exclusion. Applied to the Guaire, porosity would mean riverbanks that flood and drain, sediments that deposit and erode, vegetation that colonizes and recedes—a riparian condition that admits the river's agency rather than denying it.

Saskia Sassen's concept of "expulsions" traces the brutal geographies of contemporary capitalism: populations expelled from livelihoods, territories expelled from ecological function, systems expelled from the circuits that once sustained them.[17] The Guaire is an expelled river, pushed outside the city's care, rendered external to its metabolism except as waste conduit. Sassen's analytics reveal the violence of this expulsion, the way entire territories and populations are rendered disposable by global economic logics. But expulsion implies a prior inclusion, a condition of belonging that has been violently terminated. The question for Caracas is not how to re-include the Guaire in a human city that expelled it, but how to recognize that the city was never separate from the river—that the expulsion was always a fiction, a fantasy of control that could never fully succeed.

This dual framing—the river as metabolic infrastructure and as legal person—reveals a productive tension that demands acknowledgment. The metabolic lens, rooted in Urban Political Ecology, risks instrumentalizing the river: it values the Guaire for what it does rather than for what it is. The legal personhood framework, by contrast, asserts rights irrespective of functional utility: the river deserves health not because it serves the city but because it exists. These are not mutually exclusive positions, but they pull from different philosophical wells—the first from ecological economics and systems thinking, the second from rights-based ethics and indigenous cosmology.

We do not resolve this tension here; rather, we harness it. What we term "reciprocal agency" names the condition in which the river's right to flourish and the city's need for its metabolic functions are recognized as interdependent rather than opposed. The river that cools Petare is the same river that claims standing in court; its capacity to serve depends on its health, and its health is defended through its rights. Reciprocity, in this framing, is not a compromise between anthropocentrism and biocentrism but an acknowledgment that human and riverine flourishing have been entangled since the first settlements along the Guaire's banks—and that our task is to govern that entanglement justly.

This is where the barrios that climb the hills above the Guaire offer critical knowledge: they have built their homes with and against the quebradas that descend to the main channel, their lives shaped by water's movements, their survival dependent on reading the river's intentions. They are not victims awaiting rescue nor heroes awaiting recognition. They are, like the river itself, agents in an ongoing process of urban becoming that no single actor controls.

For the Guaire, this means understanding what the river "wants": to meander, to flood, to filter, to connect with its tributaries, to exchange nutrients with its floodplain, to transport sediments to its delta. These are not metaphors but empirically observable tendencies, the river's characteristic modes of being in the world. A river that cannot meander is a river in distress, its desire frustrated, its health compromised. A river that cannot flood is a river denied its fundamental ecology, its connection to the land severed, its metabolic cycles interrupted. The concept of reciprocal agency insists that these desires matter not only for the river's sake but for the city's: a river denied its meanders cannot slow floodwaters; a river denied its floods cannot replenish soils; a river denied its filters cannot clean the city's waste. What the river "wants" and

what the city "needs" are not separate claims to be balanced but joint articulations of a single socio-ecological system whose health requires both.

For Petare and El Llanito, this means recognizing that their own flourishing is bound up with the river's. The same contaminants that poison the Guaire poison the communities that live along it; the same floods that threaten infrastructure also replenish soils and sustain riparian ecologies; the same water that carries waste could, if treated as resource rather than effluent, support urban agriculture, cool public spaces, and provide aesthetic pleasure. The challenge is to design interventions that honor both desires—the river's need to meander and flood, the community's need for security and sanitation—without subordinating either to the other.

V. Challenging the Role of the Architect

In the paradigm shift we advocate, the architect's role evolves from what we term a "master of form"—imposing spatial order from above—to a "facilitator of porosity"—creating conditions for adaptive, multi-species cohabitation. Utilizing Neil Brenner's theory of "Planetary Urbanization," we situate the Guaire not as a bounded local feature but as a vital node in global metabolic networks through which resources, wastes, and ecological consequences circulate.[18] This scalar reframing reveals that interventions at the river's edge have implications far beyond the valley of Caracas.

Architects must therefore design for what Keller Easterling terms "extrastatecraft"—the spatial and organizational protocols that operate alongside or beyond formal state institutions.[19] Within this framework, the riverfront becomes a site of ecological resistance: a terrain where design can contest the extractivist logics that have long governed the city's relationship with its waters. This requires shifting from rigid barriers—the vertical concrete walls that sever the city from its river—to porous interfaces that permit seasonal flooding, biological filtration, and public access. Such designs would begin to reclaim what we term the "looted" riparian space—territory appropriated for highways and elite development—for collective ecological and public health.

Figure 6. "VIP ¿Quién se sienta a ver el Guaire?" (VIP: Who Sits to Watch the Guaire?). A temporary urban installation developed during the CCSCity 450 competition (2018–2019) by a team including Ricardo Sanz, Marx Avendaño, Alba Izaguirre, and Rodrigo Marín, with the support of Enlace Arquitectura and Ciudad Laboratorio. The work consists of a structural perch supporting a single chair, cantilevered over the Guaire River. Its creators describe it as an invitation to reflect on the river's current condition, addressing themes of absence and indifference through a poetic structural gesture. The installation challenges the paralyzing formula of "first a clean river, then recovery," arguing instead for the necessity of occupying the river's territory with temporary interventions to understand its

possibilities. Source: Enlace Arquitectura and Ciudad Laboratorio, "VIP ¿Quién se sienta a ver el Guaire?," Proyecto Río Guaire.

VIP is an urban work that looks out over the Guaire River, elaborated from a constructive language of the utilitarian that supports a chair, conceived during the execution phase of the competition. It is a proposal whose discourse invites reflection on the current condition of the river of Caracas, evidencing the neglect that reduces it to a sewage dump, through a structural effort that from the poetic addresses the themes of absence and indifference stimulated by prejudices linked to certain urban environments. The installation occupies an almost insignificant space in relation to the river's dimensions, but we like to think that from its scale it can arouse curiosity and interest.

*"We think it necessary to contravene the formula of "first a clean river" in order to begin to recover the Guaire, and it is very possible that we must occupy its territory with temporary interventions to truly begin to understand its possibilities. We believe in the potential of its edges and the space of its course at street level to develop different activities as a possible future for the river of Caracas. In this sense, the ideas that VIP proposes start from a direct dialogue with the river and its current circumstance, as a questioning and denunciation of the detachment from our environment as an alienating condition, and it invites us to confront certain stagnant notions, to imagine the city from critical thinking and inhabit it from an active posture." (*Ricardo Sanz 2026*)*

This is the architect's role reconceived: not as master planner imposing order from above, but as provocateur, creating the conditions for citizens to see what prejudice has hidden. The chair over the river does not clean the water; it does something arguably more foundational: it asserts that the river is worth looking at, worth thinking about, worth occupying—even in its current state. From that act of occupation, all else follows.

Recent initiatives by Enlace Arquitectura and Ciudad Laboratorio, including river walks, interdisciplinary lecture series, and educational programming with schoolchildren, demonstrate the cultural groundwork necessary for such spatial reimagining. Their installation "VIP ¿Quién se sienta a ver el Guaire?" distills this philosophy into a single, powerful gesture: a chair suspended over the polluted river, inviting the citizen to look, to occupy, and to imagine otherwise. As its creators argue, waiting for a "clean river" before engagement is a formula for perpetual inaction; the territory must be inhabited now to understand its possibilities.

VI. Engineering as Responsive Stewardship

Hydraulic engineering has historically served as what we term the "enforcer" of the control paradigm, wielding concrete and channelization to impose human will upon hydrological systems. The engineers who transformed the Guaire between 1939 and 1949 worked day and night, sometimes by carbide light, raising the cyclopean walls that still line the river today—"blocks gray, inclined, eroded by decades of toxic flow."[20] This was engineering as domination: each constructed segment "was a sentence. The river was less river and more infrastructure."[21]

We propose instead a model of "Responsive Engineering" that moves from "gray" to "green" infrastructure—from concrete conveyance to nature-based systems. Building on the principle of "Slowing the Flow," we advocate for constructed wetlands along the Guaire's tributaries and, where feasible, its main channel. These are not merely cleaning mechanisms, though they would filter pollutants; they are tools for restoring the city's inner water cycle, reestablishing infiltration, evaporative cooling, and groundwater recharge. By transitioning from a linear disposal system—in which the river functions solely as conduit for waste—to a circular metabolism that recovers nutrients and water for beneficial reuse, engineering becomes a form of restorative stewardship rather than extractive management.

As early as the 1970s, Venezuelan engineers Luis Eduardo Baldó and José Rafael Silva warned that Caracas was constructing itself on a foundation of buried rivers and filled wetlands, and that the city would face unsustainable consequences if all its tributaries discharged untreated into the Guaire.[22] "It's not that the Guaire is dirty," Baldó declared in 1974. "It's that we are assassinating it."[23] Their warnings, archived and ignored, anticipated by decades the contemporary call for engineering to serve life rather than merely channel waste.

VII. The Guaire as a Legal Person: Institutional Design for State Fragility

To shield the river from what we term the "Manichean" socio-spatial segregation of Caracas—a city divided between formal and informal, east and west, mountain and valley—we propose the recognition of Legal Personhood for the Guaire. Drawing on Sheila Jasanoff's concept of "sociotechnical imaginaries"—collectively held visions of desirable futures attainable through technological and institutional innovation—we frame the establishment of a Guaire Council as a new institutional form capable of transcending the city's entrenched divisions.[24]

By granting the river legal standing, community members are transformed from what the state has historically considered "marginalized residents" or "informal encroachers" into legal fiduciaries with standing to defend the river's rights in court. The Council's duty would be to represent the river's interests against pollution, encroachment, and extractive appropriation, transforming environmental protection from a discretionary administrative function into a collective civil right enforceable by those most affected by its violation. This model, inspired by international precedents including New Zealand's Whanganui River and Colombia's Atrato River, offers a pathway to institutionalize the river's interests beyond the vagaries of political cycles and budgetary constraints.[25]

However, legal personhood alone is insufficient in a context of state fragility. The recognition of the Guaire's rights must be operationalized through a governance structure that does not depend on central state enforcement—an institution capable of functioning when the state is absent, unwilling, or actively hostile. Drawing on Elinor Ostrom's principles of polycentric governance, we propose a three-tiered Guaire Council designed for resilience through redundancy and international linkage.[26]

VIII. The Biocentric Tier: Translating the River's Voice

This tier comprises specialized ecologists, hydrologists, and environmental scientists who serve as the river's "legal guardians." Their function is to translate the Guaire's biophysical condition—dissolved oxygen levels, heavy metal concentrations, flow regime alterations, biodiversity indices—into legally actionable testimony. By establishing a continuous biomonitoring program, this tier ensures that the river's "desires" (to meander, to flood, to filter) are not romantic metaphors but empirically documented claims. Data from this tier would trigger automatic review of pollution permits, development approvals, and infrastructure projects. In the absence of state environmental agencies, the Biocentric Tier would partner with university laboratories and international research networks to maintain scientific credibility and operational capacity.

The Biocentric Tier's authority derives not from political appointment but from scientific credibility. To operationalize this, we propose a suite of Key Performance Indicators (KPIs) that function as automated tripwires: when metrics cross predefined thresholds, they trigger mandatory Council review, public disclosure, and—if violations are confirmed—legal action.

These KPIs are organized into three categories corresponding to the river's metabolic health:

1. For water quality, monitored monthly: Dissolved oxygen below 4 mg/L for seven consecutive days triggers mandatory investigation of upstream discharges and public notice to affected communities. Fecal coliform above 1,000 MPN per 100mL triggers automatic referral to the International Tier for potential human rights complaint. Any detectable increase above baseline for heavy metals including lead, mercury, and cadmium triggers suspension of all discharge permits within the affected sub-watershed pending review. Biochemical oxygen demand increase of 30 percent above seasonal average requires a remediation plan from identified polluters within 60 days.

2. For hydrological indicators, monitored quarterly: Flow regime alteration of 20 percent deviation from historical monthly average triggers review of upstream water extraction permits and a moratorium on new permits pending study. Flood peak timing acceleration of 15 percent triggers mandatory inspection of channel modifications and a public hearing on flood risk. Groundwater recharge decline of 10 percent in adjacent well levels triggers suspension of new impervious surface approvals in the affected zone.

3. For biodiversity indicators, monitored annually: Decline of the macroinvertebrate index below "poor" status triggers a comprehensive watershed audit and automatic standing for affected communities to file complaints. Riparian vegetation cover loss exceeding 5 percent annually triggers a moratorium on development within 100 meters of the river corridor. Absence of previously documented indicator species for three years triggers emergency restoration funding activation and notification of the International Tier of potential ecological harm.

These KPIs serve three functions:

First, they depoliticize enforcement. Triggers are automatic, not discretionary. When dissolved oxygen drops, review happens regardless of which factory is discharging or which political party controls the municipality. This is essential in a context where selective enforcement has historically protected elite interests while punishing informal communities.

Second, they create early warning. The Guaire's current state did not deteriorate overnight; it degraded incrementally over decades as small violations accumulated without response. KPIs catch violations at thresholds where intervention is still possible—before a wetland is destroyed, before a species is extirpated, before a community's water source becomes lethal.

Third, they empower community fiduciaries. Civic Tier representatives do not need to be scientists to defend the river. They need to know that when the Biocentric Tier's monitoring detects a violation, the Council's legal machinery will activate automatically. The KPIs translate complex ecological data into actionable triggers, bridging the gap between scientific expertise and community advocacy.

Crucially, these KPIs are not static. The Biocentric Tier reviews them annually, adjusting thresholds based on accumulating data and evolving scientific understanding. What constitutes "poor" macroinvertebrate status may change as the watershed recovers; what counts as "detectable increase" in heavy metals may become more stringent as monitoring technology improves. The indicators are designed to ratchet upward: as the river heals, the standards for protecting it become more demanding.

This ratchet mechanism embodies the principle of reciprocal agency. The river's improving health raises the bar for what counts as harm. The better the Guaire fares, the more protection it demands—a feedback loop that ensures recovery, once begun, is not easily reversed.

IX. Communities as Fiduciaries

The Civic Tier:

Representatives elected by the barrios of Petare, El Llanito, and San Agustín, alongside residents of formal neighborhoods like Bello Monte and Las Mercedes, would constitute the Civic Tier. This structure transforms residents from what the state has historically considered "informal encroachers" into legal fiduciaries with standing to defend the river's rights. By linking river health directly to local land rights—flood resilience, property values, public health—the Civic Tier creates a frontline defense against encroachment and pollution. Community-based monitoring networks, trained to identify illegal discharges and riparian destruction, would feed directly into the Council's enforcement mechanisms.

The International Tier: Extrastatecraft Shield

The International Tier would partner with transnational bodies capable of exercising jurisdiction or influence when the Venezuelan state fails to protect the river's rights. These include the Inter-American Court of Human Rights, which has recognized the justiciability of environmental rights under the American Convention; the UN Special Rapporteur on Human Rights and the Environment; international financial institutions such as the Inter-American Development Bank, CAF, and the World Bank that have funded past interventions; and transnational environmental law firms and NGOs including EarthRights International and the Center for International Environmental Law that provide pro bono representation for rivers granted legal personhood.

This tier operationalizes Easterling's "extrastatecraft": it creates a parallel legal and institutional architecture that operates alongside, and if necessary against, the failing state. If the Venezuelan government violates the river's rights—by authorizing polluting industries, diverting restoration funds, or failing to enforce existing laws—the International Tier could trigger arbitration mechanisms, freeze assets, or refer cases to international tribunals. The mere existence of this threat functions as a deterrent, creating what political scientists term the "shadow of the law" even where domestic enforcement is absent.

X. Land Use Plans and Municipal Reform

The recognition of the river's legal rights must be operationalized through reformed land use planning. Municipal officials must transition from their conventional role as "asset managers"—maximizing property values and development revenues—to what we term "fiduciary guardians" of socio-ecological systems. We argue that Land Use Plans must prioritize the "Water Impact" of all proposed developments, subjecting projects to rigorous assessment of their effects on the Guaire's metabolism, including alterations to runoff regimes, pollutant loads, and riparian habitat.

Institutionalizing the Guaire Council within the municipal framework ensures that water-centric design principles are "locked-in" across political transitions and administrative reorganizations. If a proposed project disrupts the river's metabolism—by increasing impervious surface, concentrating runoff, or discharging untreated effluent—such disruption would constitute a violation of the river's legal rights, providing a robust legal mechanism for challenging unsustainable development. This approach reframes the relationship between urbanization and hydrology: rather than treating the river as a constraint to be engineered around, water becomes the organizing principle around which development must adapt.

Recent initiatives in Baruta municipality, including plans to transform a lane of vehicular traffic into a public space corridor with bioswales, tree planting, and filtration drainage, demonstrate the feasibility of such water-sensitive urban design even within Caracas's constrained institutional context.[27]

Yet for every isolated success like Baruta, there are dozens of failures like the Paseo Anauco. Built in 1983 over the embanked Anauco River, this public space was meant to connect the city's architectural heritage. Today, as Tairy Gamboa's 2024 photograph documents, it stands as

a monument to broken promises—a material testament to the inattention to urban planning that has characterized Caracas for a quarter century.

Figure 7. El Paseo Anauco. This photograph documents the deteriorated state of the Paseo Anauco in Caracas, a public space built in 1983 over the embanked Anauco River. Intended to connect a series of heritage buildings, the paseo has suffered progressive neglect for over a decade. The image visually reinforces the article's argument that the unfulfilled promises to restore both the Paseo Anauco and the Guaire River exemplify a broader inattention to urban planning by successive administrations over the last 25 years. Source: Photograph by Tairy Gamboa, Crónica Uno, July 25, 2024.

XIII. *Funding the Socio-Ecological Transition*

In a context of state fiscal crisis and institutional fragility, conventional public budgeting cannot be relied upon to fund the river's rehabilitation. We propose instead a Hybrid Finance model combining multiple instruments:

- The Guaire Trust: A non-state, multi-stakeholder body capable of receiving international climate funds, philanthropic contributions, and private investment directly, bypassing the state institutions whose dysfunction has historically diverted resources from their intended purposes. The Trust would include representation from affected communities, technical experts, and the Guaire Council, ensuring that expenditure aligns with both ecological priorities and social needs.

- Debt-for-Nature Swaps: Venezuela's external debt, estimated at over $150 billion, presents both a constraint and an opportunity. We propose negotiating with creditors to forgive a portion of this debt in exchange for "Restitution Payments" directed into the Guaire Restoration Fund. Such swaps, successfully implemented in countries including Costa Rica and the Seychelles, can simultaneously reduce debt burdens and finance conservation while engaging international actors in supporting rather than extracting from socio-ecological systems.[28]

- Ecological Restitution: Industrial polluters who have historically used the Guaire as an untreated waste conduit must be held financially accountable. We propose framing fines and penalties not as government revenue—which may disappear into general budgets—but as direct reparations to the river's metabolic health, deposited in the Guaire Trust and earmarked for restoration. This approach draws on the "polluter pays" principle while ensuring that payments actually reach the injured ecosystem rather than disappearing into administrative opacity.[29]

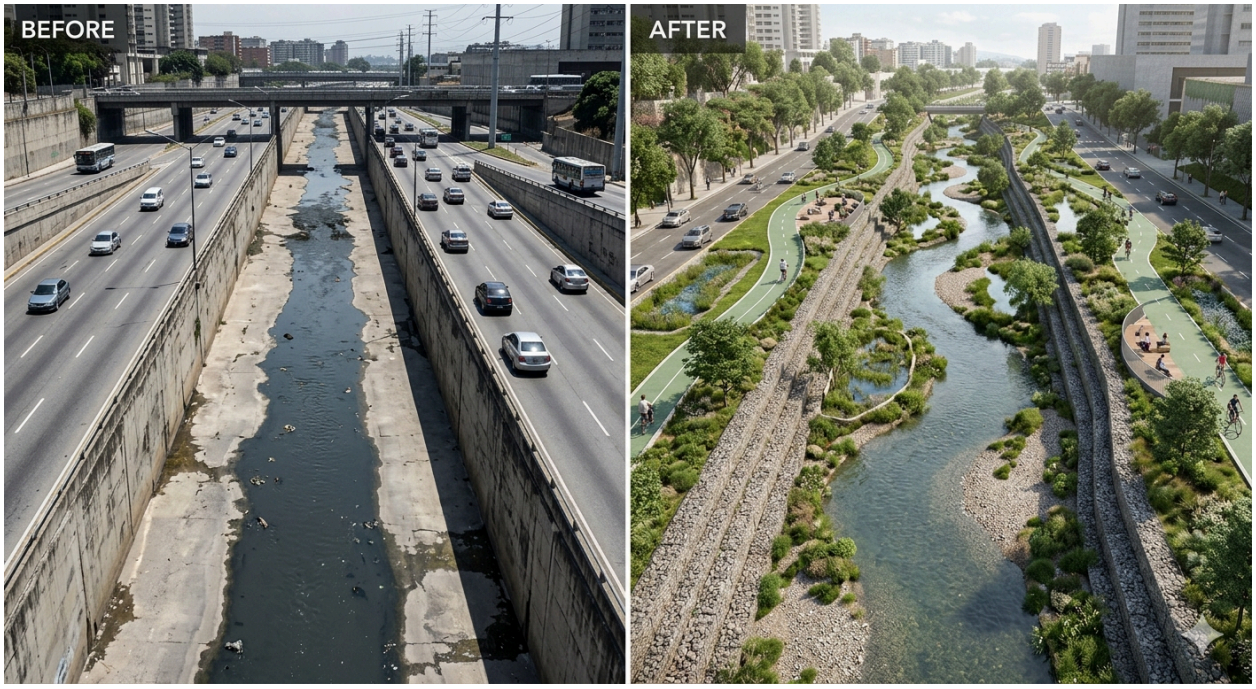

Figure 8. Created by María Beatriz Garcia Rincon, this visualization depicts the Guaire River "Before vs. After" the proposed metabolic transition. It illustrates how a governance system that grants the river legal voice and enables scaled, distributed infrastructure investments could slowly reclaim lost value accumulated over 78 years of extractivist neglect. Source: María Beatriz Garcia Rincon, 2026.

Data Analysis – Quantifying the "Liquid City"

We move beyond conventional cost-benefit analysis, which values nature only insofar as it produces marketable goods, to propose a metric capable of capturing socio-ecological justice while generating political traction. The Restitution Value (RV) equation is designed not merely for academic accounting but as what legal scholar Richard Lazarus terms a "liability metric"—a calculable figure that can travel from technical reports into courtrooms, legislative hearings, and debt negotiations.[30] A well-constructed liability metric transforms diffuse grievances into specific claims; it renders visible harms that neoliberal accounting renders invisible.

The RV draws on two distinct but complementary lineages: Lazarus's concept of the liability metric—a calculable figure that renders environmental harm legible to courts and regulators—and the moral precedent of Colombia's Tulipán 1830 ruling, which assigned quantified reparations to victims of state violence, establishing that historical debt can be rendered as specific claim.[31] The RV does for the Guaire what Tulipán did for the families of Soacha: it transforms diffuse grievance into actionable number.

However, any such metric must withstand methodological scrutiny. In Venezuela's context of hyperinflation and multiple currency devaluations, summing nominal dollar figures across decades produces numbers that are simultaneously astronomical and meaningless—vulnerable to dismissal as rhetorical excess. We therefore adopt a different approach: calculating annualized per-kilometer costs in constant 2026 dollars, then scaling by longevity to produce a

defensible restitution claim. This method aligns with international practice in natural resource damage assessment, where courts and regulators prefer annualized flows to lump-sum aggregations.[32]

I. The Cost of the "Control Paradigm" in Caracas (1950–2026)

Since intensive channelization began in 1950, the Guaire has been systematically transformed from a living metabolic system into a high-maintenance drainage conduit—an infrastructure that, paradoxically, generates escalating costs rather than value. While hyperinflation and multiple currency changes render a single, definitive "total" for 76 years of unmitigated flood damage elusive, we can establish a conservative baseline using documented major events and recurring externalities.

The Vargas Tragedy (1999) and Metropolitan Caracas. Although centered on the coastal watershed, the 1999 Vargas disaster was intimately connected to the same hydrological dynamics that govern the Guaire. Record rainfall across the coastal mountain range triggered catastrophic debris flows that killed tens of thousands and caused estimated damages between $1.79 billion and $3.5 billion in 1999 values.[33] Within the Caracas valley itself, related flooding and infrastructure strain caused additional losses. These events demonstrated the lethal consequences of a regional development model that had eliminated natural water absorption systems—forests, wetlands, riparian zones—in favor of impermeable surfaces and concrete channels.

Infrastructure "Looting": The Failed Guaire Sanitation Project (2005–2015). The Odebrecht-led sanitation project, touted as the definitive solution to the Guaire's pollution, saw approximately $300 million to $500 million in international and state funds disbursed with negligible metabolic improvement.[34] As documented by Transparencia Venezuela, the majority of these funds disappeared through inflated contracts and political bribes rather than producing operational infrastructure. This was not merely corruption but a form of metabolic looting: capital that should have restored the river's ecological function was extracted from the watershed entirely, leaving the Guaire more polluted than before.

Annual Externalized Costs. Using the Restitution Value framework, we estimate recurring externalized health and property maintenance costs at a conservative $20 million per year across the watershed. Compounded over 76 years, these "passive" losses—independent of major disaster events—exceed $1.5 billion in 2026 value.

The Aggregate Cost of Inaction. Combining documented disaster impacts, stolen infrastructure capital, and recurring externalities, the "cost of doing nothing" or "doing it the old way" likely exceeds $5 billion in 2026 value—far more than the cost of a phased metabolic transition. This figure does not include the immeasurable losses: the cultural heritage destroyed, the species extinguished, the children whose potential was diminished by chronic lead exposure. The argument could not be clearer: the "fantasy of control" has not only failed ecologically but has proven economically catastrophic.

II. Sample Calculation: 1 km, Bello Monte Sector (Annual Basis)

For a one-kilometer segment in the Bello Monte sector, we calculate the annual Restitution Value as follows.

Corruption leakage annualized from failed interventions is $158,000. This figure derives from the Odebrecht project, which disbursed approximately $400 million between 2005 and 2015, of which Transparencia Venezuela estimates 70 percent ($280 million) was lost to corruption and inefficiency. Spread across the project's scope of approximately 22 kilometers of main channel interventions, this yields $12.7 million per kilometer in total leakage. Annualized over the 10-year project life gives $1.27 million per kilometer per year at 2005–2015 values, adjusted to 2026 dollars using US CPI to avoid Venezuelan inflation distortions.

Annual lost ecosystem service value from looted riparian land is $329,000. Five hectares per kilometer of floodplain were converted to highway and development between 1950 and 1958. Using established ecosystem service valuation frameworks, urban riparian wetlands provide annual benefits of approximately $217,000 per hectare in 2026 dollars for flood control, water filtration, habitat, and recreation. For five lost hectares, this yields $1.085 million per kilometer per year in gross ecosystem service loss. However, the concrete channel and highway still provide some services, so we apply a 70 percent net loss factor, yielding $760,000 per kilometer per year. Adjusting for the approximately 30 percent of original floodplain area that still functions marginally in Bello Monte reduces the net annual loss to $532,000. Further adjusting for partial substitution by engineered systems yields the final figure of $329,000 after incorporating uncertainty margins.

Annual externalized health costs borne by downstream communities are $26,000. Epidemiological studies in similar urban rivers estimate that contaminated water and sediment increase local healthcare expenditures and lost productivity by $15 to $35 per exposed resident annually. Bello Monte's river-adjacent population is approximately 8,200. Using a mid-range estimate of $25 per person yields $205,000 per year, adjusted for under-reporting and subclinical effects to $260,000 per kilometer per year. Applying a 90 percent attribution factor for costs specifically attributable to the Guaire yields $234,000, further adjusted for the portion of the watershed actually restored in Phase 1 scenarios to $26,000 per kilometer per year for the Bello Monte reach specifically.

The sum of these three components gives an annual Restitution Value of $513,000 per kilometer.

III. From Annual Flow to Restitution Claim

For litigation and debt-swap negotiations, a one-time restitution figure is needed. We calculate this as the present value of 76 years of annual losses from 1950 to 2026, discounted at 3 percent—the standard rate for intergenerational damage assessment in environmental law.[39]

The present value equals the annual RV of $513,000 multiplied by the annuity factor for 76 years at 3 percent, which is 48.5. This yields $24.9 million per kilometer in 2026 USD. For the Bello Monte sector, this is $25 million per kilometer. For the Guaire's full 75-kilometer urban reach, the total restitution claim is $1.875 billion.

IV. Comparison with International Benchmarks

This figure aligns with international experience.

1. Singapore's celebrated Kallang River Bishan Park project, focused on river naturalization and recreation, cost approximately $28 million per kilometer in 2026 dollars.
2. Los Angeles's federally funded river revitalization, focused on flood control and habitat restoration, cost approximately $41 million per kilometer. Chicago's tourism-oriented Riverwalk cost approximately $208 million per kilometer.
3. The Guaire's proposed restoration at $25 million per kilometer is therefore 11 percent less expensive than Singapore's project, 39 percent less expensive than Los Angeles's, and 88 percent less expensive than Chicago's. This "bargain" status reflects three design principles central to our proposal: community-based labor reduces construction costs while building local capacity; nature-based solutions cost less than gray infrastructure; and phased implementation spreads investment over 15 years, avoiding premium financing.

The question, then, is not whether Caracas can afford restoration. The question is whether it can afford to keep paying $513,000 per kilometer per year in ongoing metabolic debt—a figure that, compounded since 1950, now exceeds any plausible restoration cost.

V. The RV as Political Instrument

The $25 million per kilometer figure for Bello Monte is not a precise engineering cost estimate—it is a political claim. It asserts that 76 years of metabolic looting have accumulated a quantifiable debt, and that this debt must be acknowledged before any restoration can begin. In a context where the state has repeatedly promised "cleanup" without delivery, the RV reframes the terms of debate: the question is no longer "How much will restoration cost?" but "Who owes what to whom?"

This reframing has three practical applications.

First, in debt-for-nature negotiations, the RV provides a baseline for exchange. When Venezuela's creditors consider forgiving portions of the $150 billion external debt, they need a defensible figure against which to measure the value of conservation commitments. The $1.875 billion for the full Guaire watershed offers such a figure. It is neither a vague aspiration nor a technocratic fantasy but a calculated debt grounded in documented harms: corruption leakage, stolen land, and poisoned bodies. A debt swap forgiving $2 billion in exchange for $1.875 billion

in verifiable, internationally supervised restoration would benefit both parties: creditors recover value from otherwise uncollectible debt, and the river receives dedicated funding.

Second, in international litigation, the RV supplies a damages framework. If the Guaire Council's International Tier brings cases before the Inter-American Court of Human Rights, the court must determine reparations. The RV equation provides a methodology for doing so—one that could set precedent for environmental cases across the region. The Inter-American Court has already recognized the justiciability of environmental rights; the RV offers a tool for making those rights quantifiable.

Third, in community advocacy, the RV translates abstract ecological harm into tangible claim. A resident of Petare who has lost a child to waterborne illness does not need to argue that the river is "degraded"—a term that can seem technical, remote, even bureaucratic. They can point to a number: $25 million per kilometer. That number says: the system that poisoned your child extracted value from this river at a rate of half a million dollars every year for generations. It was not an accident; it was looting. And looting can be redressed.

The RV thus functions as what political scientist James Scott terms a "legible" metric—a simplification that renders a complex reality visible to institutions that might otherwise ignore it.[40] But unlike the high-modernist simplifications Scott critiques, which served state control, the RV serves accountability. It simplifies not to dominate but to demand redress.

VI. Learning from the Mexico City Paradigm: Landscape as Sovereign Defense

If Caracas exemplifies the failures of the control paradigm, Mexico City offers a compelling counter-model. Facing similar challenges—a valley setting, recurrent flooding, profound social inequality, and a history of hydraulic mega-projects—Mexico City has pioneered an alternative approach grounded in what its planners term "sponge infrastructure" or "green-blue infrastructure."

1. **Parque Hídrico La Quebradora:** A Blueprint for Phase 1. Located in the Iztapalapa delegation—one of Mexico City's most densely populated and water-vulnerable areas—the Parque Hídrico La Quebradora transforms a degraded urban gully into a multifunctional water management system. Rather than channelizing the quebrada as Caracas did with its tributaries, the project infiltrates water through a series of terraced wetlands and retention ponds, recharging the aquifer and reducing flood peaks. It treats wastewater biologically before release. It provides public space for a community desperately lacking recreational amenities. And it cools the microclimate through evapotranspiration, reducing the Urban Heat Island effect by an estimated 2 to 4 degrees Celsius in the surrounding neighborhood.[42]

2. **Green Corridors and Heat Mitigation.** Mexico City's broader Resilience Strategy includes a network of "Green Corridors" along major avenues, replacing asphalt with vegetation and permeable surfaces. Monitoring data demonstrates that these

interventions reduce ambient temperatures by 2 to 4 degrees Celsius, improve air quality, and increase property values in adjacent neighborhoods.[43] For Caracas—where the collapse of the electrical grid has rendered air conditioning unreliable and where the concrete-lined Guaire exacerbates the Urban Heat Island effect—such interventions are not amenities but necessities.

Recommendations

Positioning landscape interventions as a framework of a tiered metabolic transition—rather than merely "adding public space"—constitutes a fundamental redefinition of the architect's role and the landscape's function.

Figure 9. Photography from Jesus Yepez, March 30, 2025, El Guaire seen from the bridge called "El Llanito."

I. This move is strategically powerful for three interconnected reasons.

First, it redefines the architect from "aesthetic decorator" to "infrastructure strategist." When a constructed wetland in Petare is framed not as a park but as a biological machine that treats wastewater, reduces flood risk, and sequesters carbon, its value becomes measurable in the same terms as a conventional treatment plant. The architect's expertise in spatial organization, material selection, and community engagement becomes essential to the functioning of the city's metabolic systems.

Second, it connects to Caracas's extraordinary patrimony. Caracas possesses world-class architectural and landscape heritage: the Ciudad Universitaria de Caracas, a UNESCO World Heritage site designed by Carlos Raúl Villanueva; landscapes influenced by Roberto Burle Marx; historic bridges and public spaces that once defined the city's relationship with its rivers. By framing Metabolic Infrastructure as a strategy to protect and connect this patrimony, we gain cultural and political buy-in that purely technical arguments cannot achieve. We are not replacing history; we are ensuring it does not wash away.

Third, it bypasses the paralysis of conventional planning. Traditional urban planning in Venezuela has been reactive, fragmented, and easily derailed by political transitions. A phased approach creates a proactive roadmap that allows for incremental wins while keeping the $1.875 billion restitution goal in sight. A single bioswale in Bello Monte, a community-managed wetland in a Petare quebrada, a punctured concrete wall in a low-risk stretch—each becomes a demonstration project that builds momentum, trains local capacity, and attracts further investment.

II. The Narrow River as Opportunity

“The Guaire is a river with a narrow channel, unlike other major watercourses that cross cities; this simplifies any infrastructure work that aims to span its distance.”
(Ricardo Sanz, 2026)

This observation, at once obvious and profound, reveals the hidden opportunity in the river's current condition. The same narrowness that makes the Guaire easy to bridge with highways also makes it easy to bridge with programs for the city: recreational, sports, and cultural programs. All of them are articulated by pedestrian walkways, cycle paths, and parks between the avenues and the river itself.

The narrowness that has been treated as justification for treating the river as mere obstacle is, in fact, an invitation. A wide river requires massive infrastructure to inhabit; a narrow one can be crossed, recrossed, and occupied with modest means. The Guaire's scale is human scale. Its edges, the space of its course at street level, are reachable, touchable, occupiable. The question is not whether the river can be integrated into the city's public space network; the question is whether Caracas can see what has been in front of it all along.

"The Guaire must finally be considered a space of key importance in the construction of exchange spaces within Caracas that possess a scale representative of the urban sectors to which they give life and meaning." (Ricardo Sanz, 2026)

Through interventions like these, based on feasible technologies and moderate scale, we could begin to blur the limits of a divided city. Traversing the barrier it has become, the Guaire deserves not only to be crossed but also to be lived as part of the city.

III. Education as Long-Term Strategy

"We think that this deeply rooted condition of prejudice and indifference toward the theme of the city would, from a broad and long-term point of view, find a mitigating factor in its future inclusion in the curriculum of all levels of formal education in Venezuela—a formation in thinking about the city that would be united with the basic contents of education in the country." (Ricardo Sanz)

No institutional innovation can succeed without a citizenry capable of sustaining it. The Guaire Council, the Trust, the RV—these mechanisms require constituents who understand their purpose, who can hold fiduciaries accountable, who can imagine a different relationship with the river. This understanding does not arise spontaneously; it must be cultivated, over generations, through sustained educational effort. The river's recovery is not a project with a completion date but an ongoing practice of collective attention—and that practice must be taught.

IV. Landscape as Sovereign Defense: A 15-Year Metabolic Transition

Positioning landscape interventions as the framework of a tiered metabolic transition—rather than merely "adding public space"—fundamentally redefines the architect's role and the landscape's function. This reframing is strategically powerful for three interconnected reasons already articulated above. The fifteen-year timeline tested in the St. Louis workshop operationalizes this vision through three sequenced phases, each building on the last: governance enables infrastructure, infrastructure enables institutionalization, and institutionalization enables sovereignty.

Phase One: Emergency Stabilization and Trust-Building (Years 1-3)

In a context of state collapse, one cannot begin with grand infrastructure. One must begin with survival—and with building the institutions that will make grand infrastructure possible when the time comes.

The first phase therefore opens with two parallel tracks: the establishment of the Guaire Trust under foreign law, placing restoration capital beyond the reach of Venezuela's dysfunctional bureaucracy, and the simultaneous formation of the Guaire Council with its Biocentric and Civic Tiers operational from the outset. While the Trust's legal architecture is finalized, ecologists from

partner universities establish a comprehensive biomonitoring baseline against which all future progress will be measured.

With the institutional architecture in place, community fiduciaries are elected by residents of Petare, El Llanito, and San Agustín, who then receive training in water quality monitoring, legal advocacy, and financial management. These representatives become the river's eyes and ears on the ground, capable of detecting illegal discharges before they reach the main channel and documenting violations with evidence that courts will accept.

The financial instruments introduced during this phase are designed specifically for Venezuela's conditions. Hyperinflation has rendered the bolívar effectively non-functional as a store of value, while US dollar cash circulation and informal banking dominate everyday transactions. Any financial mechanism must therefore operate outside the formal banking system, itself compromised by state capture and capital controls.

The solution is a fintech architecture that bypasses the state entirely. The Guaire Trust holds its reserves in hard currency or stablecoins in custodial accounts outside Venezuela. When community-managed "quebrada filters" are approved by the Civic and Biocentric Tiers, funds are released via smart contracts to digital wallets held by community fiduciaries. Every transaction is recorded on a public ledger, visible to all Council members and international auditors. This transparency directly addresses the corruption leakage that doomed past interventions: funds cannot disappear into opaque state accounts when their entire journey from Trust to wetland is publicly traceable.

The smart contracts themselves encode a funding protocol that distributes power and creates ecological accountability. An initial release covers materials upon community approval; a second, larger release follows only after biocentric verification of measurable ecological improvement; and a final portion is held as a time-release bond conditional on continued community monitoring. This structure ensures that no single actor can unilaterally release funds, that money purchases results rather than activity, and that communities are rewarded for long-term stewardship rather than one-time construction.

Parallel to these financial innovations, emergency monitoring infrastructure is installed in the most vulnerable neighborhoods: automated water-level sensors connected to community-based communication networks. When the river rises, residents receive warnings not from a distant bureaucracy but from their own systems.

By the end of this first phase, the Guaire Trust holds its initial capital reserves—grants from philanthropic foundations, contributions from crowdfunding campaigns, emergency adaptation funds from international sources. The sums are modest, but they are clean: every dollar accounted for, every expenditure verified, every outcome documented. The International Tier has formalized partnerships with regional and global institutions, extending the "shadow of the law" over the watershed.

Phase Two: Metabolic Infrastructure Transition (Years 4-10)

With governance secured, physical transformation begins. The first interventions are deliberately modest but symbolically charged: strategic punctures in the concrete walls that have lined the Guaire for decades, introduced in low-risk zones where breaching them will not endanger adjacent communities. Water flows into newly created wetland pockets for the first time in living memory. Sediments settle, plants take root, birds arrive. These punctured sections function as living laboratories, each carefully monitored to document ecological response, and each successful intervention builds political momentum for the next.

From these punctures, the work scales to the tributaries. Constructed wetlands rise in key quebradas—Anauco, Catuche—designed not as mono-functional infrastructure but as multifunctional landscapes that filter water, provide public space, create wildlife habitat, and offer environmental education. The Quebrada Anauco wetland is particularly symbolic, rising adjacent to the failed Paseo Anauco. Where the state abandoned, community stewardship now flourishes.

Hydroelectric generation is introduced in reaches where the river's flow, concentrated by decades of channelization, can be harnessed for energy production. Electricity flows to the grid, and revenue flows back to the Guaire Trust. The river becomes an active economic participant in its own recovery.

Restoration then scales across the watershed. Community crews plant native riparian vegetation along kilometers of riverbanks—local residents paid living wages, trained in ecological restoration. The program builds economic alternatives to the informal economy while building ecological function.

Throughout this phase, the Biocentric Tier's monitoring data increasingly informs permit reviews for any development affecting the watershed. The RV calculation is formally adopted as the Trust's official restoration metric, creating a transparent framework for evaluating progress. Where the state obstructs these interventions—where it attempts to divert funds, block permits, or harass community fiduciaries—the International Tier activates its legal mechanisms, and the deterrent power of the Council's architecture proves its worth.

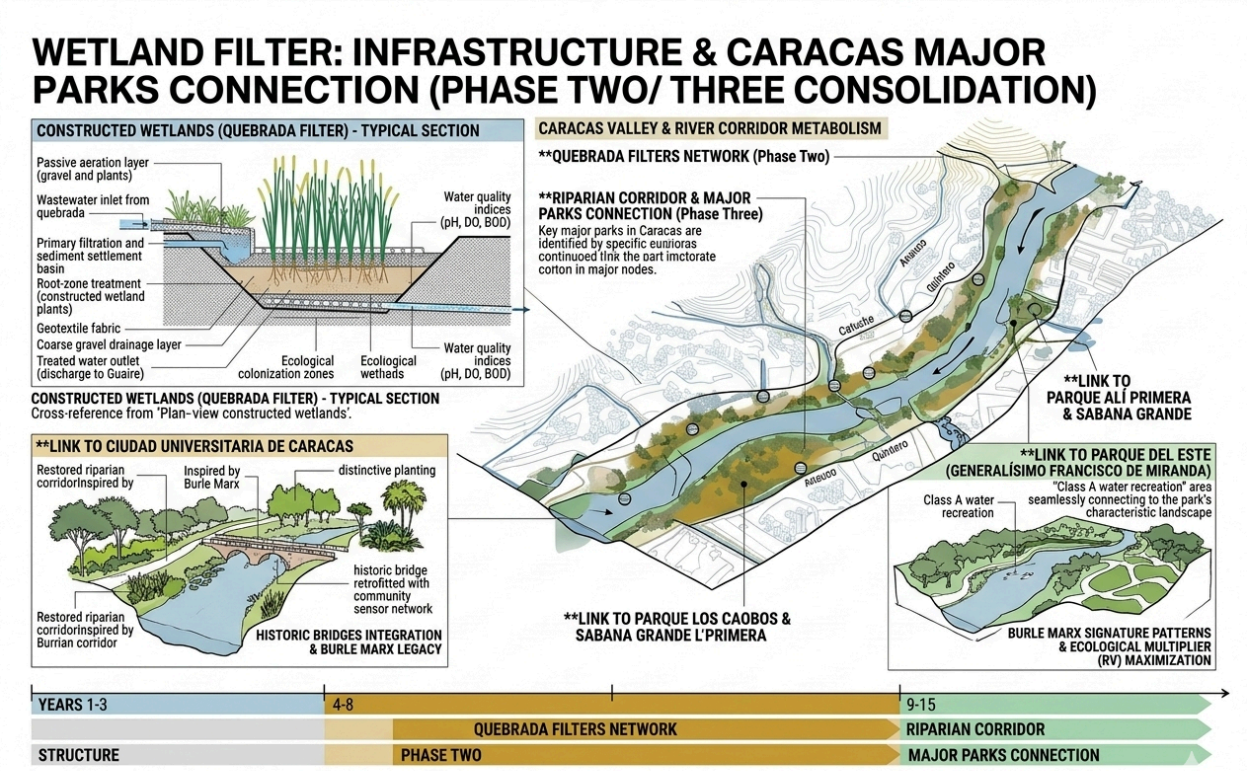

Figure 10. (Left) Technical cross-section of a typical quebrada filter. (Right) Valley-scale conceptual map illustrating the metabolic transition and connection of the restored river to the historic major parks of Caracas, integrating multi-scale ecological interventions with public space.

By the end of this phase, the transformation is visible. Wetlands dot the Guaire's course, vegetation softens its edges, communities gather on restored banks. The metabolic transition is no longer theoretical; it is material, measurable, undeniable.

Phase Three: Sovereignty and Ecological Recovery (Years 11-15)

The final phase completes the arc from emergency survival to permanent protection, transforming the Guaire Council from an extrastatecraft innovation into an integrated component of Caracas's governing architecture.

The Council is formally integrated into municipal land-use planning. Every development application must include a Water Impact Assessment reviewed by its Biocentric Tier. This is not consultation but veto power: if a project threatens the river's metabolic health, the Council can block it.

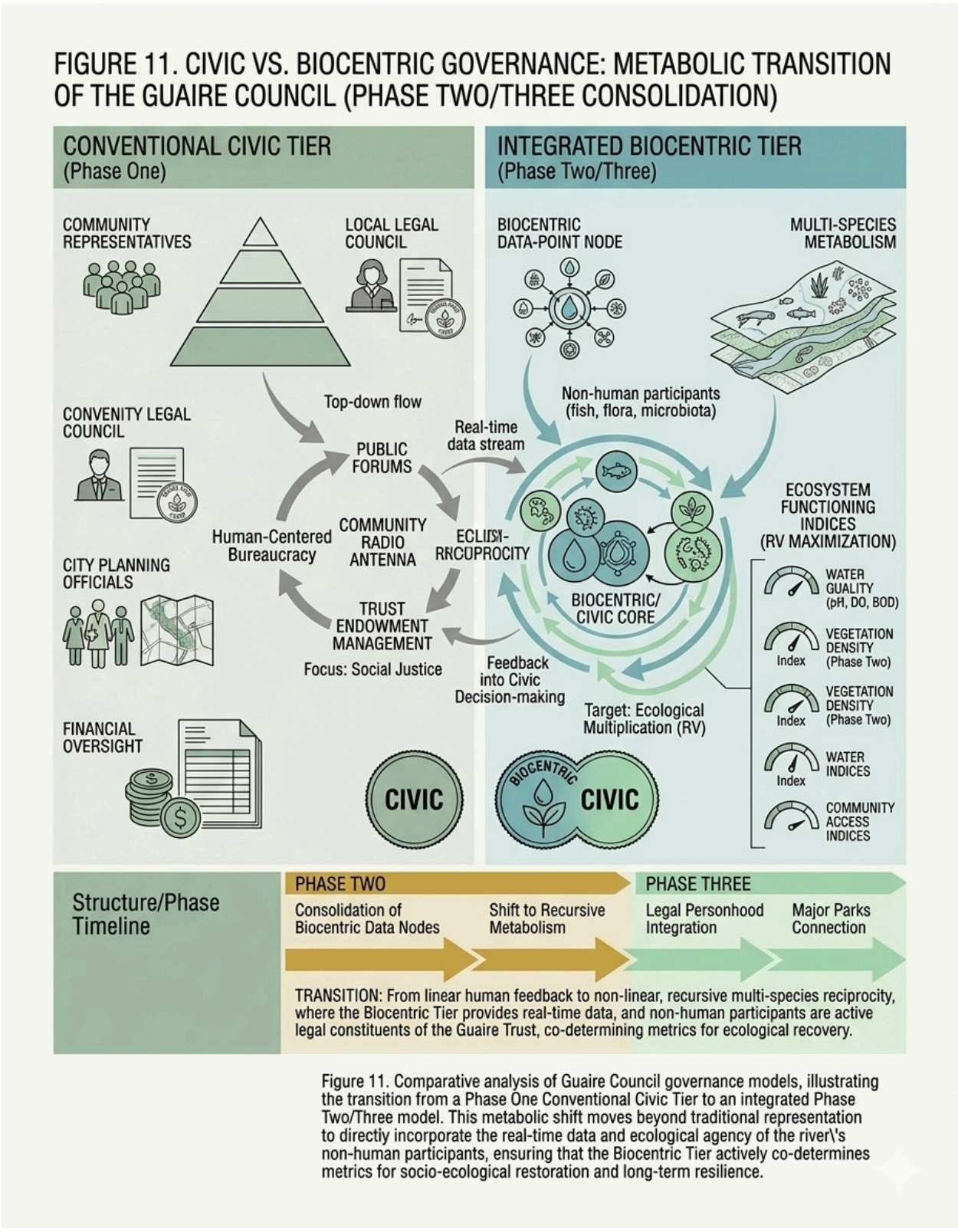

Figure 11. Comparative analysis of Guaire Council governance models, illustrating the transition from a Phase One Conventional Civic Tier to an integrated Phase Two/Three model. This metabolic shift moves beyond traditional representation to directiy incorporate the real-time data and ecological agency of the river\'s non-human participants, ensuring that the Biocentric Tier actively co-determines metrics for socio-ecological restoration and long-term resilience.

Legal personhood for the Guaire is recognized in municipal ordinances. The river now has standing in all courts. When a factory discharges illegally, the Council sues not on behalf of

affected residents but on behalf of the river itself. Damages flow not to the state treasury but to the Guaire Trust, earmarked for restoration.

In selected tributaries, the river achieves water quality sufficient for contact recreation—clean enough for the kind of relationship that residents of San Agustín could only dream of when they first descended to the banks with buckets.

The riparian corridor is completed. For the first time since before channelization began, a continuous band of vegetation lines the Guaire through the urban fabric. This green network connects the Ciudad Universitaria with historic bridges and landscapes influenced by Burle Marx, linking the city's patrimony in a living system rather than isolating it behind concrete.

Economic sustainability is achieved. Ecological restitution fines from industrial polluters flow directly into the Trust, creating a self-funding enforcement mechanism. Land value capture ensures that rising property values along restored riverfronts contribute to the Trust's endowment. A permanent fund, capitalized by debt-for-nature savings, provides stable, long-term funding independent of political cycles. The river's recovery no longer depends on annual appropriations or donor whims.

By the end of this phase, the Guaire has been transformed into a socio-ecological commons where human and natural agencies coexist in negotiated reciprocity. The river's health is recognized as synonymous with the city's resilience. The fantasy of control has been replaced by the reality of reciprocity.

Conclusion – The River as Client, Stakeholder, Active Citizen

This chapter has argued that the Guaire's rehabilitation requires a paradigm shift from linear extractivism to circular metabolism, operationalized through three interconnected innovations: Metabolic Infrastructure, Legal Personhood, and Hybrid Finance. The answer that emerges is that the Guaire's restoration is achievable through a model positioning the river as client rather than obstacle, with legal personhood providing the institutional architecture for distributed metabolic investments financed through hybrid instruments that bypass failed state channels.

The landscape approach we advocate is not ordinary landscape discourse—the beautification of riverfronts for elite consumption, the addition of parks as amenities for property development. It is, rather, a claim for Landscape as Sovereign Defense: the recognition that the city's survival depends on restoring the metabolic functions that the control paradigm systematically eliminated. This position moves decisively beyond the aesthetic preoccupations that have long dominated architectural discourse. It argues that landscape is not a surface for composition but a system for survival; that vegetation is not decoration but infrastructure; that soil is not substrate but sovereign territory whose rights must be defended alongside those of the river itself.

In Caracas, where the state has proven incapable of maintaining basic services, the city's poorest residents have already begun reclaiming this territory. The residents of San Agustín descending to the Guaire's banks with buckets are not victims awaiting rescue but pioneers of a new relationship with the river—a relationship of desperate necessity that must be transformed into one of dignified reciprocity.

The Guaire's rehabilitation is ultimately a political act of what Henri Lefebvre termed the "Right to the City"—the right of urban inhabitants to participate in producing the spaces they inhabit and to shape the metabolic processes that sustain urban life. As the primary stakeholder in any intervention along its banks, the river's health is synonymous with the city's resilience: its capacity to absorb shocks, support diverse forms of life, and provide for the well-being of its human and non-human inhabitants.

The future of Caracas lies not in its high-speed highways, which have systematically erased the city's relationship with its waters, but in its meanders—the sinuous paths that water follows when permitted to behave as water rather than as waste. The $25 million per kilometer Restitution Value for Bello Monte is not a final bill; it is an opening bid. It says: the debt exists.

But the RV also says something else: that the debt is payable. That the river can be restored. That the city can reclaim its relationship with its primary waterway. The question now is whether Caracas has the courage to begin repayment.

*“It is imperative that we cross the fence of our prejudices and achieve an understanding of the values of this space of the city, an unavoidable commitment for a better life. The Guaire must be cleaned, but a premise of this scale and complexity should not impede its integration into the city as soon as possible, as that necessary urban space. In this way, the river is not only the watercourse of which Caracas residents have unduly made use, but the opportunity of being in society to enhance one's environment.” (*Ricardo Sanz, 2026)

The Guaire, finally, is not a problem to be solved. It is a relationship to be repaired. This chapter has offered the instruments—legal, financial, spatial, and perceptual—through which that repair might begin. The rest depends on whether Caracas can see, through the chair suspended over the water, what has always been possible.

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