

Water justice, scarcity and environmental flows. The case of Marseille

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Abstract

In the context of the present global ecological crisis, water emerges as one key element to take care of for avoiding a planetary ecocide. The link between water scarcity, justice and environmental flows is explored, opening to a more-than-human perspective and recognising the connection between water biopolitics and urban design. The Mediterranean context is identified as a hotspot for investigating these intertwined themes, with the city of Marseille as a relevant case study. The territorial scale water system is described in relation to water justice, present conflicts and future perspectives. Finally, the features of the urban area are presented in relation to issues and opportunities linked to possible transformations towards a more circular and just water metabolism for the city and the surrounding territory.

Keywords: urban political ecology; water biopolitics; ecological commoning

Introduction

An unprecedented anthropogenic water crisis is hitting the planet, with a responsibility for spatial design disciplines that is strongly related to distribution and justice, and that requires re-thinking some of our perspectives on water management. After exploring the global context and the Mediterranean region, the city of Marseille is investigated for its paradigmatic water system and challenges driven by growing scarcity. The choice of a city as study case is related to the fact that urban areas – albeit in connection with their ‘planetary hinterland’ (Brenner & Katsikis 2020) – are more than ever the hotspot of energy consumption and global warming generation, so that for imagining a more sustainable future we need to investigate urban environments and metabolism. More-than-human justice perspective is introduced starting from the concept of ‘environmental flows’, not only for taking ‘water’s side’, but also because in urbanism this perspective is emerging as a key “to avoid a planetary ecocide” (Fieuw et al., 2022). For a comprehensive understanding of the city’s ecologies and flows it is then fundamental to enlarge the scope of urban ecology studies to the territorial context (Grulois et al., 2018). For this reason, examining water justice issues with a spatial lens requires to embrace a wide enough area – in relation to water catchments – rather than concentrating on a ‘city proper’ close-up. At the same time, the shapes, the devices, the surfaces and the materiality of the city – and of landscapes and infrastructural systems – define the environment and the possible flows of water, other matters, and lives. For these reasons it is interesting to look at multiple scales, considering certain city spaces, the urban metropolitan area, and the wider territorial context.

Water scarcity in the global and Mediterranean context

In the context of the present ecological crisis and worsening global warming, addressing the issue of water justice, access and distribution is most compelling. Freshwater is a biologically necessary and irreplaceable substance for all terrestrial life, so that its access is universally considered a basic need and a fundamental human right. The attention towards this theme is underlined by its prominent involvement in international programmes and policies. Indeed, one of the Sustainable Development Goals (SDGs) agreed by the United Nations in 2015 is specifically dedicated to freshwater access (‘Goal 6: Ensure availability and sustainable management of water and sanitation for all’) and water availability is closely connected to most other SDGs’ themes², which

1 This paper and related research have been conducted during the Italian inter-university PhD course in sustainable development and climate change (link: www.phd-sdc.it)

2 Survival of life on Earth is undeniably linked to water, therefore any quest for sustainability needs to take its availability and quality into account. In particular, it can be argued that at least 14 out of 17 SDGs have strong connections with water distribu-

are dealing with food, health and equality, energy and goods production, ecosystems, sustainability and climate (UN, 2024a). Furthermore, one of the nine 'Planetary Boundaries' set for monitoring the anthropogenic pressure on the so-called Earth system is 'Global freshwater use' (Rockström et al., 2009), more recently reframed as 'Freshwater change' in order to "comprehensively reflect anthropogenic modifications of Earth system functions of freshwater changes"³ (Richardson et al., 2023). Also in this case many of the other 8 indicators have a strong connection with water depletion or with its renewal cycle, as on top of being related to the availability of freshwater for human consumption, they also affect climate regulation and ecosystems⁴.

Given this framework, when tracking the overall progress of the SDGs and the anthropogenic pressure on the Earth system it seems clear that present policies and actions are ineffective: the latest SDGs progress report states that "the world is severely off-track to achieve the 2030 Agenda" (UN, 2024b), and 6 out of 9 Planetary Boundaries were transgressed as of 2023, delineating a worsening trend compared to previous updates and reflecting "unprecedented human disruption of Earth system" (Richardson et al., 2023). If we look at the Freshwater change indicator, globally "Transgressions of both the blue and green water boundaries occurred a century ago", however according to this world-scale quantitative approach the control values haven't reached the 'High risk zone' yet (ibid.); moreover, looking at a more comprehensive perspective on water and sanitation actions' progress, the latest SDGs report by the UN (2024b) states that "None of the SDG 6 targets are on track to be met", with some of them improving too slowly and others stagnating or even regressing, including exposure to water stress. In the end, despite the recognition conceded by official international organisations and the academic world, "The world is facing an unprecedented water crisis. [...] one-quarter of the world's population [is] currently exposed to extremely high water stress annually" (Kuzma et al., 2023).

In the referenced documents the concept of 'water stress' refers to a condition in which water availability (also in terms of quality and ecological flows) cannot cover the "human and ecological demand" in a given moment; 'water scarcity' is instead the mid-term occurrence of a stress condition, a "consequence of anthropogenic impacts on the availability of water resources" happening when human exploitation of water exceeds the sustainable supply in a context (EEA 2021). Water scarcity is therefore directly linked to anthropic processes and their environmental pressures. For this reason, while drought events (essentially linked to precipitation deficit) can exacerbate water shortages, the concept of water scarcity is the preferred lens for investigating the territorial dynamics of dryness as linked to spatial transformations. It follows that understanding the relationship between water distribution, its depletion, and the climate-related dynamics that undermine its availability is of foremost importance - and it is fundamentally a matter of justice: "the scarcity at the heart of the global water crisis is rooted in power, poverty and inequality, not in physical availability" (UNDP, 2006, p.2).

The Mediterranean region is a particularly relevant study area for the relationship between global warming related tion and ecosystems, including: 1. No Poverty, 2. Zero hunger, 3. Good Health and Well-being, 5. Gender Equality, 6. Clean Water and Sanitation, 7. Affordable and Clean Energy, 8. Decent Work and Economic Growth, 9. Industry, Innovation and Infrastructure, 10. Reduced Inequalities, 11. Sustainable Cities and Communities, 12. Responsible Consumption and Production, 13. Climate Action, 14. Life Below Water, 15. Life on Land. On top of this, also Education and Peace (Goals 5 and 16) are cited as key elements in the UN 'World Water Development Report 2024: Water for Prosperity and Peace' (UN, 2024a)

3 "streamflow [is used] as a proxy to represent blue water (surface and groundwater) and root-zone soil moisture to represent green water (plant-available water). [...] The new green water component directly accounts for hydrological regulation of terrestrial ecosystems, climate, and biogeochemical processes, whereas the blue water component accounts for river regulation and aquatic ecosystem integrity" (Richardson et al., 2023)

4 "Global manipulations of the freshwater cycle affect biodiversity, food, and health security and ecological functioning [...]. Threats to human livelihoods due to deterioration of global water resources are threefold: (i) the loss of soil moisture resources (green water) due to land degradation and deforestation, threatening terrestrial biomass production and sequestration of carbon, (ii) use and shifts in runoff (blue water) volumes and patterns threatening human water supply and aquatic water needs, and (iii) impacts on climate regulation due to decline in moisture feedback of vapor flows (green water flows) affecting local and regional precipitation patterns." (Rockström et al., 2009). Freshwater use/change is therefore linked to: Climate change, Biogeochemical flows (and previously chemical pollution), Biosphere integrity (previously biodiversity loss), Land system change.

climate change, water scarcity and water justice. According to the 6th IPCC report (2023, p. 2253) “climate models consistently project regional warming at rates about 20% above global means and reduced rainfall (-12% for global warming of 3°C)”, so that the area can be considered a ‘climate change hotspot’, also “due to the high exposure and vulnerability of human societies and ecosystems to these changes”; the report particularly underlines the resulting water-related issues, for “rising temperatures trigger extensive [...] evaporation [which] leads to shrinking water resources on land, drier soils, reduced river flow, and significantly longer and more intensive drought spells”. Associated risks include “important and increasing water shortages, already experienced by 180 million people” and “growing demand for water by agriculture” (IPCC, 2023, p. 2254), on top of the reduction of all wet surfaces and related ecosystems. The projections draw the worrying picture of a region severely affected by water scarcity, with higher demand also due to an increasing population and mainly located in coastal areas, where sea level rise will entail additional scarcity dynamics linked to aquifers and soils salinisation and loss of terrestrial ecosystems (MedECC, 2020). The MedECC report (ibid., p 206) also notes that “future increase in human activities [...] may have more impact on water demand than climatic changes”, underlying the anthropic source of water scarcity, where (anthropogenic still) global warming is only a worsening factor.

Water (in)justice and biopolitics, a spatial perspective

In the Mediterranean, as elsewhere and globally, water availability is unequal at the regional scale – with around 73% of renewable freshwater resources held by northern countries (MedECC, 2020) – as well as within societies and territorial ecologies. Indeed, the IPCC (2023) observes how water and food scarcity affects disproportionately women and children in urban areas, and especially disadvantaged social groups. This inequality is worsened by ‘climate injustice’ (Otto, 2025), which links the impact of global warming and social injustice from the global to the local scale, as for example vulnerable communities can often afford to inhabit only the highest risk (and cheapest) areas: there is therefore a strong link between these dynamics and spatial justice issues (Soja, 2010). The unequal water distribution and quality that are provided (for example to low-income areas and informal settlements) are a form of social and spatial injustice, so that in the context of global warming and increasing scarcity, water justice (Boelens et al., 2018) becomes a central issue to climate, social and spatial (in)justice: water is so vital that “hydraulic infrastructures can shape social relations and mediate power” (Mukerji, 2022). Forms of social and spatial injustice are complex and rooted in the present socioeconomic and ecologic system of power – defined by Moore (2017) as Capitalocene – and its pervasive planetary production dynamics, linked to the exploitation of ‘nature’ (i.e. land, materials, flows) and lives (Brenner & Katsikis, 2020; Patel & Moore, 2020). These processes have consequences on spaces at different scales, bringing forward the political nature of spatial transformation. As Soja (2010) points out we are ‘spatial beings’, as we exist in space, shape and are shaped by space, therefore spatial transformations are inherently political, and they influence (in)justice relations. Territorial transformations linked to water become a crucial lens for investigating spatial justice, as much as the spatial perspective is fundamental for describing and tackling the theme of water justice.

While water control has always been a key concern for societies, growing scarcity dynamics are triggering novel social and geopolitical conflicts worldwide – and at the same time water deprivation is being used as a weapon (Secchi, 2010; UN, 2024a), as in this moment in the Mediterranean, within a long tradition of colonial territorial processes. It is important to notice that the use of water as a population control tool (hence biopolitical, in the Foucault’s sense) isn’t an incidental event, and it can be linked to the development of territorial rationales instead – which in certain contexts are constructed for and by colonial exploitation practices (Bandieramonte, 2013). Indeed water systems, in terms of infrastructures and governance, need to be “critically scrutinized in terms of their attempts at governing life and the distinctions they make between different forms of lives”, as water and its allocation is “inherently political and, more specifically, biopolitical” (Hellberg, 2018, p.1). Spatial design disciplines – and European urbanism in particular – take part in this biopolitical action, planning such infrastructures on top of defining populations’ spatial distribution and land use (Secchi, [2014] 2015), therefore ‘making space’ for humans and non-human lives and matters alike.

Water justice and environmental flows

The study of the relationship between water scarcity and spatial justice should not actually be restricted to the

human society, as freshwater is essential to all terrestrial life forms, and their survival (human species included) depends on the biosphere as a whole. From this point of view, it can be noticed that actions and projects related to water biopolitics often represent an example of multispecies injustice, as 'water justice' (and water distribution) are mostly linked to human needs and consumption. This is part of the same anthropocentric perspective entailed in the concepts of 'resources' and 'scarcity': these cannot be applied to the territory unless a human relationality is put in place (Dematteis, 2014). The two concepts are therefore relational – a 'resource' exists when it is functional to a demand, and it is 'scarce' only when there is not enough for satisfying a certain demand – and exist because of the dualistic society/nature 'metabolic rift' at the base of capitalist exploitation (Moore 2014). Forms of water (in)justice that go beyond human consumption can be searched in the concept of 'environmental flow', which since the 1980s has emerged to determine the 'minimum' river flows for maintaining the riverine ecosystem; the concept has since then evolved, and while initially it was limited to defining the minimum water stream necessary for the survival of a particular species, it came to encompass multiple aspects of a river's 'health', including indicators such as the interaction with the surrounding terrestrial environment, water quality, sediment presence, temperature and human pressures (Morrison & Bray, 2019). The point of view (which is the same of the mentioned notion of 'water stress' that also includes "ecological demand" – EEA 2021) expressed in the 'environmental flow' related literature is anyway anthropocentric and deterministic. In this literature, the river's 'health' is important because it is related to its 'direct and indirect' benefits for humans, which comprehend the 'Ecosystem Services' (ES) provided to human society (Gebreegziabher et al., 2023); the determination of what is the minimum flow for a river to be 'in good health' infers that the river should be measured and that a certain amount of water in it can be 'enough' or not for a function defined by humans.

It has been argued that a change in perspective by embracing multispecies justice is key to achieve also a fair society (Chao, 2022), therefore we need to enlarge the scope of spatial and water justice for a truly and comprehensively sustainable future. The yet more inclusive and open concept of more-than-human justice can enlarge justice's subjects from the biosphere to also include water itself. More specifically, a 'political ecology of things' perspective can foster an ethical behaviour towards the world as a whole, because harming one part of the interconnected 'web' means harming oneself; widening and changing the notion of self-interest may be a positive way to change our way to inhabit the planet, opposite to the "image of dead and thoroughly instrumentalized matter", i.e. resource to be exploited and consumed (Bennett, 2010, p. X). In this perspective, water and its agency should be regarded as a 'vibrant' matter with a value in itself that transcends the functions linked to anthropic processes: rather than calculating a minimum 'environmental flow' that is strictly functional to human processes, we may have to reflect on how to limit ourselves to a 'minimal extraction flow' while aiming at a 'non extractive metabolism' altogether as a form of care towards the water systems and related ecologies. Indeed human action can also be positive with regards to water ecologies, with actions that reinforce and extend the interaction between soil and water instead of letting it run off quickly; these practices (for example traditions linked to water retention and oases formation in dry climates) have aspects of circular metabolism, as sustainable use of freshwater allows for its renewal while keeping an ecological balance (Watson, 2019) in antithesis with linear extraction and depletion metabolic processes of modern western urban areas.

In recent decades, juridical systems around the globe have increasingly recognised water bodies' rights with the intent of protecting their ecosystems, as part of a wider trend that is granting legal rights to the environment. For example, New Zealand, India and Colombia have recognised a number of rivers as 'legal persons' – with a common feature, the existence of 'environmental water managers', human groups that advocates for the non-human subject's interests and rights (O'Donnell, 2018). In modern legal systems, water bodies can paradoxically weaken their stand by achieving such rights, for example with a "shift in language used to describe the aquatic environment, from a legitimate need for water to 'just another user' of water" (ibid.), therefore it's complicated to grant more-than-human water justice even when water bodies enter the society's juridical system of rights. Environmental water managers are part of broader and complex governance systems, often working within frameworks such as multi-actor river contracts, in which water use conflicts arise and are settled by stakeholders – with legal regulations often lacking some aspects of protection, for example in relation to groundwater pollution or the comprehensive dynamics of catchment areas. A universal perspective on water justice that would include

this matter in all its states and gradients as present in the 'critical zone' (Latour, 2014) may help protecting water more than the recognition of 'personal' legal rights of one single water body. Once water's necessity to all organisms is recognised and its existence is considered as a common good, a 'recommoning' (Geagea et al, 2024) approach in which water in all its forms is managed and taken care of collectively may be more effective than the single 'juridical' approach. A novel perspective, strongly connected to spatial justice (Soja, 2010; Swyngedouw, 2004), could include democratizing the water (eco)systems management, with city residents (of all kinds) take part with their own agency in relation to water – which can be linked to water retention, depuration, infiltration, and not only social governance and distribution – and stop being considered as mere 'consumers'.

Water scarcity or abundance? The case of Marseille

The worrying climate projections for the Mediterranean expect "future annual and summer warming rates are projected to be 20% and 50% larger than the global annual average, respectively" (IPCC, 2023, p 2237) which come together with lower freshwater availability. And although drier climates (and many worrying scarcity dynamics) are located on the south side of the sea, "summer warming is projected to be particularly strong in the north" side (ibid.), where societies and territories are built on the basis of water abundance coming from the Alps, now endangered. As glaciers are quickly disappearing, it becomes interesting to study the dynamics of water scarcity, extraction and injustice in a context on the north side of the Mediterranean, which will have to evolve and adapt its water uses and water-related spaces. The MedECC report (2020, p. 200) states that "for the Durance River in southern France, regulated by large reservoirs, decrease of mean annual renewable water resources has been demonstrated, with a decrease in summer low flows, associated with a greater pressure on water demand". The Durance, main tributary to the Rhone, is the river that provides freshwater to the whole arid Provençal coastal region where Marseille, the second city of France and main centre of the area, is located. This region is characterised by the lack of major surface water bodies and limited groundwater reservoirs, but paradoxically Marseille seems not to be affected by water scarcity even during the worst drought periods (Jean, 2011), thanks to the water infrastructure system constructed since the XIX century (Figure 1).

The city benefits from an abundant freshwater supply of the best quality (often proudly defined 'the best of France'), mainly coming through the Canal del Marseille, which since 1849 brings water from the Durance River to the city. The tradition of modern water infrastructures in this region, started with the Craponne Canal (1554-1559), built in order to introduce irrigation to the dry Crau plain. The 80km long Canal de Marseille was constructed after a centuries-long history of studies and proposals by many technicians, who tried to defy the complex region's orography for reaching Marseille and putting an end to its thirst (Jean, 2011). After a few projects that were trying to build a unique canal for both Aix and Marseille, finally the city took a historic decision in 1834, the titanic infrastructure had to be built 'at any cost'. The canal would indeed mark the city's history, landscape, architecture, and identity (ibid.), while also transforming the land uses of the surrounding territory with the introduction of widespread irrigation (Vidal-Naquet, 1993). The Canal de Marseille has undergone multiple modifications and technical improvements, but its substance hasn't changed to this day. The territorial water system instead has greatly evolved, especially in the second half of the XX century, with the construction of the Canal EDF (Electricité de France), the Canal de Provence, and several storage basins (constructed and managed by EDF) on the Durance and the Verdon, its main tributary (Jean, 2011). These infrastructures, which came after the 1955 law for the hydroelectric management of the rivers' system, on top of energy production and water distribution have the goal of regulating floods and drought effects by storing considerable amounts of alpine freshwater that can then be used during dry spells. At the same time, they have heavy consequences on the rivers' ecosystems, so that most of the water of the catchment area is now diverted from the riverbeds.

The EDF Canal's main function is hydroelectricity production, although it is also used as the main derivation from which other canals draw their water. The Canal de Provence is mainly distributing water to the coastal area urban centres, and to agricultural and industrial users as well, via a network that is mostly pressurised, making it extremely 'efficient' by minimizing leaks (ibid.). This system creates a total disconnection between the catchment areas and the territory: the Durance-Verdon system has most of its water subtracted, and the infrastructural system bypasses the surrounding landscapes for the benefit of anthropic consumption especially in urban areas,

while for example the smaller rivers of the Marseille area do not supply water to the city since the beginning of the XX century. This dynamic rises questions about water justice at the territorial scale, where the metropolitan area of Marseille is the main user of water and energy in the region: a concentrated abundance that creates injustice and scarcity dynamics for a wider territory.

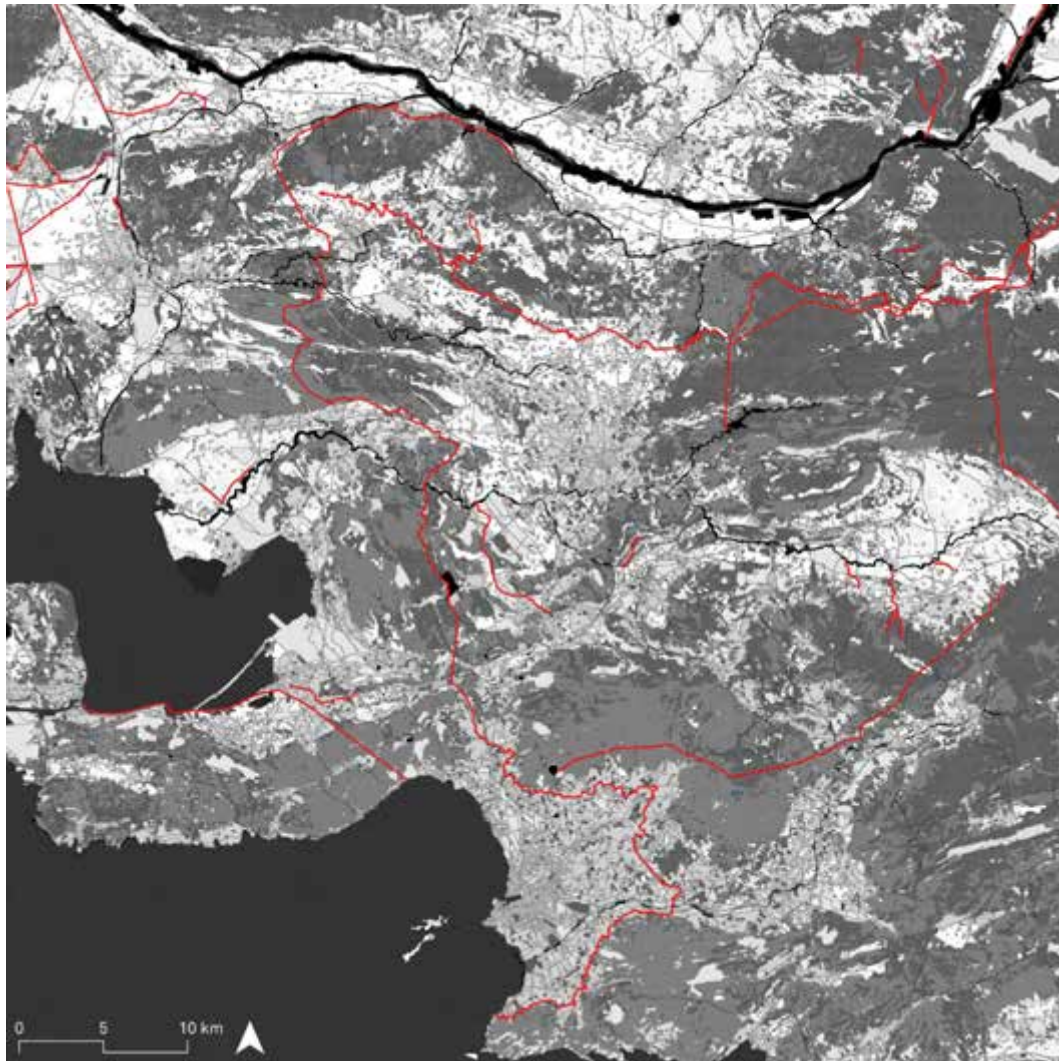


Figure 1. Systems of water in the territorial context of Marseille. Legend: urban areas, light grey; main water canals, red (EDF canal excluded, black); freshwater to sea water, from black to dark grey; forests to grasslands, from dense to light hatching. N. Russolo

Conflicts at the territorial scale

Already at the end of the XIX century, before the most substantial post-1955 works, the water abstraction imbalance gave rise to increasing conflicts, especially linked to the agricultural production. The irrigation issues during dry spells became very divisive, so that in 1907 a law established the 'Commission Exécutive de la Durance' (CED), with the goal of defining and regulating every (anthropic) water needs and rights along the river's course (Dumoullin et al., 2022). Thanks to the evolving negotiated distribution principles and to the large alpine reservoirs, human consumers' conflicts are basically not an issue anymore – although more than 70% of the irrigate surfaces are outside of the river basin. The Durance River instead, doesn't have a legal personality, lacking full representation for its environmental flows needs, which are regulated and protected by a complex governance system that since 2008 includes a river contract. The SMAVD (Syndicat Mixte d'Aménagement de la Vallée de la Durance) is the multi-actor institution responsible for the river contract and for the basin's monitoring and planning, comprehending

a vast array of stakeholders; the institution monitors and rules the allocation of water (SMAVD, 2020). While the SMAVD is working towards a better management of the Durance and its environmental needs⁵, the priorities of the river basin system are hydroelectric production – the EDF infrastructure produces here 35% of the region's energy, with 15 power plants between the highest Serre-Ponçon reservoir and the Étang de Berre, and 8 more in the basin (Dumoulin et al., 2022) – and human consumption, to the point that the infrastructures extract by far most of the Durance's water flow. This unbalance causes a heavy alteration of the river's hydromorphology, with a worrying biodiversity and ecological continuity loss, as 68 barriers are present along its course (Étang Nouveau 2013). The environmental flow of the Durance is connected to many ecosystems in a vast territory, starting from the large and complex riverbed and its alluvial plain and aquifer. As most of the water extracted from the river is discharged into the brackish Étang de Berre wetland via the EDF Canal, the environmental seawater/freshwater balance of the étang is heavily disrupted. The smaller inflow from the Durance to the Rhone is also substantially changing the main river's environmental flow in its last section, on which the Camargue delta system depends.

A few years before the establishment of the Durance river contract, a conflict that entangles human use, wetland advocacy and ecological survival questioned the artificial canals' system flows. The 'Syndicat professionnel coordination des pêcheurs de l'étang de Berre et de la région' (Coordination of the professional fishermen's union of the Étang de Berre and of the region) brought EDF to the European Court in 2003 because of the disturbance of the brackish environment of the Étang de Berre water body, winning a historic stance for the protection of the étang's ecosystem balance⁶. After the ruling, in 2006 EDF has modified the last part of the infrastructure so that one part of the freshwater goes back to the low Durance course in Mallemort (Figure 2); this was coupled with a better control of industrial and urban wastewater discharge, and has seen an improvement in flora and fauna in the étang (Étang Nouveau 2013).

The effects and perspectives of global warming are worsening existing conflicts and issues related to water scarcity and justice. In particular, with a temperature increase of 1 to 3°C, around year 2050 the Durance system (and therefore the whole PACA Region) is going to dispose of circa 30% less freshwater compared to 1980-2009 levels (Sauquet et al., 2015). At the same time water demand is supposed to increase consistently in the area because of a combination of rising evaporation and anthropic consumption (ibid.). One example of crisis moment, that is projected to become much more frequent in the next years, is represented by the 2022 drought, during which around 1200 water courses in France went dry, resulting in potentially irreversible habitat loss, on top of substantial damages to agricultural and hydroelectric production. (Bertrand et al., 2023). In the Durance river basin, an exceptionally dry period started in January of that year and transformed into a harsh drought coupled with heatwaves from April and throughout the end of the summer; in that period, the river lost around half of its water flow (SMAVD, 2023). In the aftermath of this dry spell the region's farmers denounced the fact that most of the system's water is still invariably discharged into the Étang de Berre: a foolish waste from their perspective, linked to the unequal territory's energy demand.

5 www.smavd.org – Among the objectives of the river contract, there are also “finding a new morphological balance for the riverbed” and “managing the alluvial plain by conciliating uses and resource's preservation” (SMAVD, 2020, author's translation)

6 The ruling of case C-213/03, Judgment of the court 15 July 2004 requires “prohibiting [...] the discharge into a saltwater marsh communicating with the Mediterranean Sea of substances which, although not toxic, have an adverse effect on the oxygen content of the marine environment.” Documentation available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:62003CJ0213>

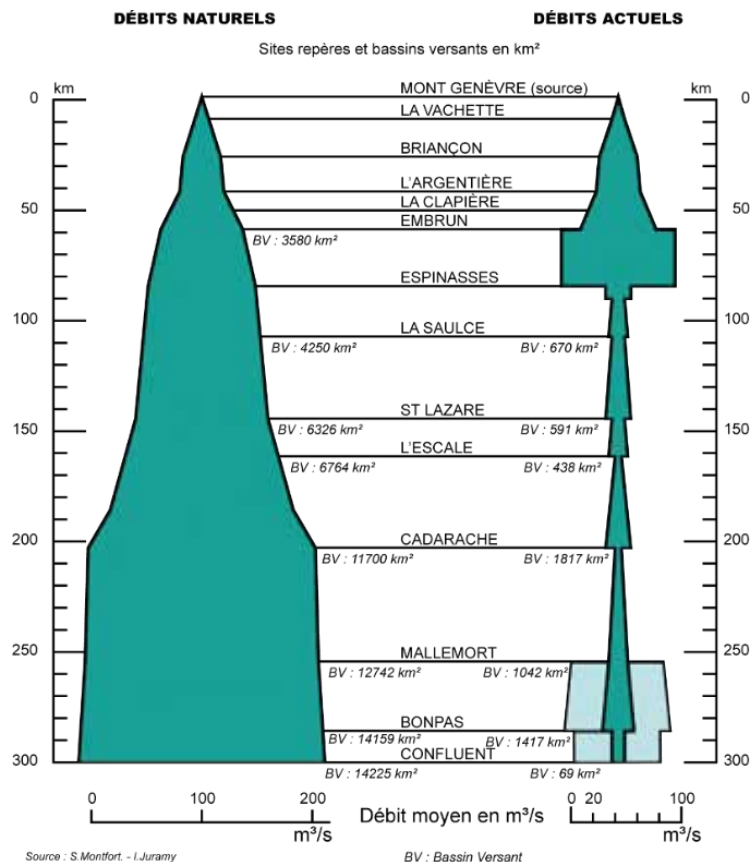


Figure 2. The flow diagrams show how more than 90% of the 'natural' average flow of the Durance has been diverted from its riverbed with the post-1955 EDF works (solid colour, original diagram from Juramy & Montfort, 1987). The lighter part of the right side diagram represents the 2400 million of m³/year flow returned to the Durance in Mallemort since 2006 (Étang Nouveau, 2013)

The extremely heavy withdrawals create imbalances that aren't limited to the distribution of freshwater. The weakened Durance stream struggles to transport sediments along its complex riverbed, so that water ecologies along its course are being additionally interrupted, and the lack of sediments' discharge into the Camargue delta through the Rhone is contributing to the coastal retreat of the low-lying brackish wetland; furthermore, silt discharge into the Étang de Berre is additionally unbalancing its environment (Balland et al., 2002). Another important aspect is linked to alluvial aquifers, which would normally be recharged by the river and give water back in its lower flow moments with a balancing effect on the ecosystem (Morizot & Husky, 2024); the Durance's alluvial aquifers – once a substantial freshwater reservoir – are suffering from depletion and from a rising pollutants' concentration, both due to the severely drained river (Étang Nouveau 2013).

Because of the heavy infrastructures and alterations, the Durance is classified as a 'Masse d'Eau Fortement Modifiée' (MEFM), and therefore according to the EU Water Framework Directive⁷ it must be restored to a 'good ecological potential' within 2027. This necessity raises questions about the priorities of the territorial water system, where the granted 'environmental flow' isn't enough for the river ecosystem: can the system move towards the perspective of a 'minimal extraction flow'? The issue of a different distribution in water uses for a more sustainable territorial footprint is very complex. To give one example, hydroelectric power is the 1st 'renewable' energy production in France and worldwide, and once the (environmentally costly and disruptive) infrastructure is built its footprint is very low. On top of that, hydropower doesn't suffer from the constant availability fluctuations

7 2000/60/EC of the European Parliament. Available at: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex-:32000L0060>

of wind and solar energy – until a prolonged drought, or structural water cycle modifications such as glaciers disappearance, arrive. In the perspective of a drier future for the region, a sustainable territorial metabolism project and river future requires re-thinking water and energy use, and therefore a negotiation of ‘new social alliances’ extended to matter (Secchi, 2011; Bennett, 2010) which should take into account degrowth propositions (Koller, 2020). The extractive paradigm of the Capitalocene for the Marseille urban/territorial water system is based on the existence of ‘cheap nature’ (Patel & Moore, 2020) at the regional scale, that involves artificial basins in the alps, impressive infrastructures, and heavily anthropized urban grounds that don’t take good care of the water of the urban area.

Urban water, spaces and ecologies

The relationship of Marseille with water has completely changed since the Canal de Marseille was completed, with a celebration that included the construction of the magnificent Palais Longchamp, and the abandonment of the city’s rivers for relying only on the territorial extractive infrastructure. With the alarming perspective of diminishing regional freshwater resources due to global warming (and the shrinking Alps’ glaciers) while scarcity dynamics driven by water consumption are being accentuated – for example due to a growing number of data centres in the city – the imperative is finding strategies towards a more sustainable urban ecology and water footprint. This means a change in the territorial water metabolism, abandoning the current linear/extractivist practices and looking for opportunities of circular dynamics (Grulois et al., 2018).

The main element of the Marseille local water system is the Huveaune river, often mistaken for a stream or a canal, or even unknown by the some of the city’s population. Its presence is linked to the only substantial valley which breaks the hills’ crown that surround the city. This morphological feature, together with the presence of other towns along the river, made it the preferential axis for mobility infrastructure and industrial development. The presence of water is of course a fundamental asset for manufactures, taking advantage of the river’s freshwater by consuming it, withdrawing it for plants’ cooling, and discharging waste. Indeed for many years, the urban water courses were used as untreated industrial wastewater collectors, with serious pollution consequences. In 1972, because of the high levels of pollution, the Huveaune was diverted towards Cortiou in the Calanques National Park, with a moveable dam stopping its course and a doubling of the underground canal that was already discharging urban wastewater in Cortiou; this presents multiple problems, especially in terms of ecological continuity (EPAGE HuCA, 2015), thus creating an even more radical disconnection between the city and its waters. On top of this, with an apparent paradox for a city deprived of water, Marseille often experiences flooding events in case of substantial rainfall, because of the highly sealed soils: only 12% of the ground in the metropolitan area’s urban spaces isn’t sealed and can support vegetation or water infiltration (agaM, 2020). As the precipitations quickly saturate the drainage network, the polluted water coming from rain and runoff is directly discharged into the sea together with the Huveaune, which re-gains its original riverbed as soon as it reaches a flow of 30 m³/s (EPAGE HuCA, 2015).

The presence of water courses within the urban area could be an occasion for rethinking the city-water relationship – in a different urban ecological perspective (Orff, 2016) that includes more-than-human water and spatial justice, where urban soils can be transformed to support life and interact with water. Once the pollution dynamics are halted, the urban rivers and their surrounding alluvial plains have the biggest potential for welcoming and expanding ecologies: giving more space to water and connected ecosystems could become part of a larger phytoremediation process for Marseille, where polluted urban surfaces now intoxicate water runoffs. The freshwater inflow from the Huveaune and the other minor rivers could be used for non-drinking urban water needs, starting to move away from the solely linear territorial scale metabolism that is now present. Revealing superficial water flows in connection to situated depaving of the urban ground may help managing rainwater (avoiding its total inclusion in the sewage system) and foster urban ecologies, also helping the creation of a better urban environment in response to a hotter climate⁸. At the same time, a new awareness of urban water, at present completely hidden from sight and discourse (Kaika, 2005) may help recognise the global

8 A number of EU-funded projects are experimenting on the relationship between water, urban comfort and the environment, for example Cool Noons <https://coolnoons.interreg-euro-med.eu/>

necessity of a new ecological balance with the larger territory related to flows – with possible connections to social movements interested in environmental justice that are already active in the city. In an urban area where spatial justice is a complex theme (ETH, 2020), citizen groups are advocating for river ecosystems to be preserved and restored, as with the Ruisseau des Aygalades, which crosses some of the most deprived neighbourhood in the north of Marseille. The project for a new park along the water course⁹ is going to positively transform the urban landscape, with the risk of a gentrification processes that must be controlled for avoiding the worsening of spatial injustice. Also the Huveaune River is interested by a project, this time at the metropolitan scale and essentially linked to active mobility, which also includes some river 'renaturation' sites, called Voie Verte de l'Huveaune (Huveaune greenway)¹⁰. The potential linked to wider action on water ecosystems suggests that the river spaces could undergo a more substantial transformation, linked to slowing down and reinforcing its flow and ecologies (Morizot & Husky, 2024). As for centuries Marseille has only counted on its groundwater reservoirs for its urban freshwater (Vidal-Naquet, 1993), by taking good care of water from the territorial and metropolitan scale to the materiality and pollution of urban surfaces the city aquifers may also come back as a tool helping the local water needs, in connection with the renewed city's rivers. A systemic change with the introduction of local water sources may configure a hybrid collaboration between centralised large-scale infrastructure and decentralised water systems (Wong et al., 2020), that can be an important occasion for designing a better urban environment while 'making space' for ecosystems.

An open ending

In the territorial context of Marseille, the main urban area is the biggest water consumer, therefore domestic and urban water-efficient measures including diffused building-scale reservoirs and recycling devices (Correljé & UNEP, 2008) could be an important contribution towards a more sustainable water footprint. These practices should be coupled with the described wider urban and territorial transformations that can take advantage of the local water presence in a regenerative way, in a new environmental and spatial justice perspective. The associations and citizen groups already present in the city, who are working on the themes of water and the environment, represent a great potential of social interaction and ownership in the perspective of a water recommoning process (Geagea et al, 2024), that may become a first step towards of a wider ecological commoning future for urban ecologies.

A re-design for better and comprehensive water justice will have to take into account the ground's materiality and relationship with the rivers, their alluvial aquifers and groundwater systems. On top of the spatial modifications, a successful strategy for a more sustainable urban water footprint will have to include the social and more-than-human justice aspects within a renewed governance. In this perspective, the city-centred water withdrawal from the Alps may find a new balance between urban water use and the territorial needs, starting to reconcile local ecologies with their water systems.

While water is a fundamental resource for a sustainable future, the current trend is of accelerating its consumption and depletion. We must be aware that the present global water crisis can't be solved by a small amount of water reuse, as it necessitates a radical change in the way 'resources' are extracted and consumed especially since the exponential increase of energy and goods production that happened during the XX century. Water is now widely extracted and consumed like many other externalities, but being a vital necessity, it should be managed like a universal 'commons' (Harvey, 2011). This perspective must enter the urban design discourse, as its availability is strongly connected with spatial justice for the society and beyond. In the Marseille area, water is locally present but for the last century it has not been part of the city's metabolism. There are possibilities for the metropolitan area to take advantage of local freshwater reservoirs for a new urban ecology, and these should be investigated in order to mitigate the water scarcity and injustice dynamics that affect the wider territory.

9 <https://www.euromediterranee.fr/projets/le-parc-du-ruisseau-des-aygalades>

10 <https://www.marseillechange.fr/voie-verte-huveaune/>

References

- agaM – agence d'urbanisme de l'agglomération Marseillaise (2020) Ville perméable, ville désirable: Quand l'eau refait surface. Regards Environnement, n°91. Agam, Marseille
- Balland, P., Huet, P., Lafont, E., Leteurtrois, J., Pierron, P. (2002) Rapport sur la Durance: Propositions de simplification et de modernisation du dispositif d'intervention de l'Etat sur la gestion des eaux et du lit de la Durance: contribution à un plan d'urgence. Paris : Ministère de l'Ecologie et du Développement Durable, Ministère de l'Agriculture, de l'Alimentation de la Pêche et des Affaires Rurales, Ministère de l'Équipement, des Transports, du Logement, du Tourisme et de la Mer, Ministère délégué à l'Industrie. Available at: <https://www.vie-publique.fr/rapport/25938- rapport-sur-la-durance-propositions-de-simplification-et-de-modernisat>
- Bandieramonte, V. (2013), "Land Use Rationalization: Infrastructures and colonization in Palestine" in Bandieramonte, V., Cavalieri, C., Guida, I., Kaveh, R., (a cura di), The next urban question, Officina, Roma.
- Bennett, J. (2010). Vibrant Matter: A Political Ecology of Things. Durham London: Duke University Press.
- Bertrand, N. et al. (2023). Retour d'expérience sur la gestion de l'eau lors de la sécheresse 2022. IGEDD, IGA, CGAAER, Ministère de l'Agriculture et de la Souveraineté alimentaire. Available at: <https://agriculture.gouv.fr/retour-dexperience-sur-la-gestion-de-leau-lors-de-la-secheresse-2022>
- Boelens, R., Perreault, T. and Vos, J. (eds) (2018) Water Justice. Cambridge University Press. Available at: <https://doi.org/10.1017/9781316831847>.
- Brenner N., & Katsikis N. (2020), Operational Landscapes: Hinterlands of the Capitalocene. Architectural Design, 90(1), 22–31.
- Chao, S., Bolender, K., Kirksey, E. (eds) (2022) The Promise of Multispecies Justice. Durham: Duke University Press.
- Correljé, A.F. and UNEP (eds) (2008) Every drop counts: Environmentally sound technologies for urban and domestic water use efficiency. Osaka.
- Dematteis, G. (2014) 'Dalla terra al territorio. Una ricerca tra geografia e urbanistica', in M. Bianchettin del Grano (ed.) suolo. letture e responsabilità del progetto. Roma: Officina edizioni, pp. 79–101.
- Dumoulin, P., Le Normant, C. and Samie, R. (2022) 'La Durance du future (France) : le projet R2D2-250, la démarche C3PO ou la modélisation prospective pour aider la décision', E3S Web of Conferences. Edited by C. Noret and L. Peyras, 346, p. 02004. Available at: <https://doi.org/10.1051/e3sconf/202234602004>.
- EEA - European Environmental Agency (2021) Water resources across Europe - confronting water stress: an updated assessment – EEA Report No 12/2021, Luxembourg: Publications Office for the European Union. doi:10.2800/320975
- EPAGE HuCA - Etablissement public d'aménagement et de gestion des eaux Huveaune Côtiers Aygalades (2015) Contrat de Rivière du Bassin Versant de l'Huveaune: Synthèse. Available at : <https://www.epagehuca.fr/espace-documentaire/contrat-de-riviere/>
- Étang Nouveau (2013) Étang de Berre, Durance, Crau Camargue. Saint-Chamas : L'Étang Nouveau. Available at : <https://letangnouveau.wordpress.com/wp-content/uploads/2013/12/dossier-durance-bis-juillet-2013.pdf>
- ETH (Eidgenössische Technische Hochschule) Zürich (with Something Fantastic). (2020). Migrant Marseille: Architectures of social segregation and urban inclusivity (M. Angélil & A.-C. Malterre-Barthes, Eds.). Ruby Press.

Fieuw, W., Foth, M. and Caldwell, G.A. (2022) 'Towards a More-than-Human Approach to Smart and Sustainable Urban Development: Designing for Multispecies Justice', *Sustainability* (Switzerland), 14(2). Available at: <https://doi.org/10.3390/su14020948>.

Geagea, D., Kaika, M. and Dell'Angelo, J. (2024) From austericide to recommoning: counter-imaginaries for democratizing water governance. *Ecology and Society*, 29(4), p. art8. Available at: <https://doi.org/10.5751/ES-15267-290408>.

Gebreegziabher, G.A. et al. (2023). Evolution and concept of environmental flows (e-flows): meta-analysis. *Water Supply*, 23(6), pp. 2466–2490. Available at: <https://doi.org/10.2166/ws.2023.120>.

Grulois, G., Tosi, M.C. and Crosas Armengol, C. (eds) (2018) *Designing territorial metabolism: Barcelona, Brussels, and Venice*. Berlin: Jovis.

Harvey, D. (2011) *The Future of the Commons*. *Radical History Review*, 2011(109), pp. 101–107. Available at: <https://doi.org/10.1215/01636545-2010-017>.

Hellberg, S. (2018) *The biopolitics of water: governance, scarcity and populations*. London New York: Routledge

IPCC (Intergovernmental Panel on Climate Change) (2023) *Climate Change 2022 – Impacts, Adaptation and Vulnerability: Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press. Available at: <https://doi.org/10.1017/9781009325844>.

Jean, M. (2011). *Les architectes de l'eau en Provence: De la Renaissance au XXe siècle*. Actes Sud.

Juramy, S. and Monfort, I. (1987) *L'Evolution des lits fluviaux : l'exemple d'une rivière aménagée, la Durance*. PhD Thesis. Aix en Provence: Université d'Aix-Marseille II. Available at: <http://www.theses.fr/1987AIX23001>.

Kaika, M. (2005). *City of flows: Modernity, nature, and the city*. Routledge.

Koller, S. (2021). Towards Degrowth? Making Peace with Mortality to Reconnect with (One's) Nature: An Ecopsychological Proposition for a Paradigm Shift. *Environmental Values* 30(3), June 2021: 345–366. Cambridgeshire: The White Horse Press. doi:10.3197/096327120X15916910310590.

Kuzma, S., M.F.P. Bierkens, S. Lakshman, T. Luo, L. Saccoccia, E. H. Sutanudjaja, & R. Van Beek. (2023). "Aqueduct 4.0: Updated decision-relevant global water risk indicators." Technical Note. World Resources Institute. Washington, DC
doi.org/10.46830/writn.23.00061

Latour, B. (2014) Some Advantages of the Notion of "Critical Zone" for Geopolitics. *Procedia Earth and Planetary Science*, 10, pp. 3–6. Available at: <https://doi.org/10.1016/j.proeps.2014.08.002>.

MedECC (2020) *Climate and Environmental Change in the Mediterranean Basin – Current Situation and Risks for the Future*. First Mediterranean Assessment Report [Cramer, W., Guiot, J., Marini, K. (eds.)] Union for the Mediterranean, Plan Bleu, UNEP/MAP, Marseille. DOI: 10.5281/zenodo.7224821

Moore J. W. (2014) *Toward a Singular Metabolism: Epistemic Rifts and Environment-Making in the Capitalist World-Ecology*. In Ibañez D. & Katsikis N., (eds), *New Geographies 06: Grounding Metabolism*, Harvard University Press.

Morizot, B., and Husky, S. (2024). *Rendre l'eau à la terre: Alliances dans les rivières face au chaos climatique*. Actes

- Sud.
- Morrison, R. and Bray, E. (2019) 'Environmental Flows', in Morrison, R. and Bray, E., Environmental Science. Oxford University Press. Available at: <https://doi.org/10.1093/obo/9780199363445-0116>.
- Mukerji, C. (2022) 'The Agency of Water and the Canal du Midi', in De Wolff, K., Faletti, R.C. and López-Calvo, I. (eds) Hydrohumanities: water discourse and environmental futures. Oakland, California: University of California Press.
- O'Donnell, E. (2019). Legal rights for rivers: Competition, collaboration and water governance. Routledge.
- Orff K. (2016), Toward an urban ecology, The Monacelli Press.
- Otto, F. (2025) Climate Injustice: Why We Need to Fight Global Inequality to Combat Climate Change. Vancouver: Greystone Books.
- Patel, R. and Moore, J.W. (2020) A history of the world in seven cheap things: a guide to capitalism, nature, and the future of the planet. London New York: Verso.
- Richardson K. et al. (2023), "Earth beyond six of nine planetary boundaries", in Science Advances, 9(37).
- Rockström, J. et al. (2009) 'Planetary boundaries: exploring the safe operating space for Humanity'. Ecology & Society. 14, 32.
- Sauquet et al. (2015) Projet R2D2-2050 Risque, Ressource en Eau et gestion Durable de la Durance en 2050. Lyon, Irstea - Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture. Available at : <https://hal.inrae.fr/hal-02601503v1/file/pub00044634.pdf>
- Secchi B. (2010) Extreme Cities. Water Conflicts. in Fabian L. & Viganò P. (eds) Extreme City. Climate Change and the Transformation of the Waterscape, Università luav di Venezia.
- Secchi, B. (2011). La nuova questione urbana: ambiente, mobilità e disuguaglianza sociali. CRIOS, n. 1. 2011, pp. 83-92.
- Secchi, B. (2015) [2014] La tradizione urbanistica europea. Culture e politiche. In Secchi B. (2015) Il futuro si costruisce giorno per giorno: riflessioni su spazio, società e progetto. Roma: Donzelli editore.
- SMAVD (2020) Bilan du Contrat de rivière du Val de Durance. Mallemort: SMAVD.
Available at <https://www.smavd.org/wp-content/uploads/2023/02/N%C2%B015-Annexe-1-Bilan-CRVD-pour-CRPACAV2.pdf>
- SMAVD (2022) Bilan hydrologique du bassin versant de la Durance : Été 2022. Mallemort: SMAVD.
Available at: https://www.smavd.org/wp-content/uploads/2023/01/BH_Ete2022.pdf
- Soja E. W., (2010), Seeking spatial justice, University of Minnesota Press.
- Swyngedouw, E. (2004). Social power and the urbanization of water: flows of power. Oxford ; New York: Oxford University Press (Oxford geographical and environmental studies).
- UN (2024a) UNITED NATIONS WORLD WATER DEVELOPMENT REPORT 2024: water for prosperity and peace. Paris: UNESCO.
- UN (2024b) Progress towards the Sustainable Development Goals. Report of the Secretary-General (A/79/79-E/2024/54).

Available at: <https://unstats.un.org/sdgs/files/report/2024/SG-SDG-Progress-Report-2024-advanced-unedited-version.pdf>

UNDP (ed.) (2006) Beyond scarcity: power, poverty and the global water crisis. New York, NY: UNDP (Human development report, 2006).

Vidal-Naquet, P. A. (1993). Les ruisseaux, le canal et la mer: Les eaux de Marseille. l'Harmattan.

Watson, J. (2019) Lo-TEK: design by radical indigenism. Cologne [Paris]: Taschen.

Wong, T.H.F., Rogers, B.C. and Brown, R.R. (2020) 'Transforming Cities through Water-Sensitive Principles and Practices', One Earth, 3(4), pp. 436-447. Available at: <https://doi.org/10.1016/j.oneear.2020.09.012>