DEPARTAMENTO DE CIÊNCIAS E ENGENHARIA DO AMBIENTE
DEPARTAMENTO DE GEOGRAFIA E PLANEAMENTO REGIONAL

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BACHELOR´S IN ARCHITECTURE

A REGENERATIVE URBAN PLAN FOR FONTE DA TELHA

MASTER IN SUSTAINABLE URBANISM AND SPATIAL PLANNING

Universidade NOVA de Lisboa
November, 2023

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To Marco, who has never wavered at my side, a solid rock in many storms.

To Jean, who is my beacon in a vast universe.

To mom, who has never given up.

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My gratitude is to all of those who contributed even in a minor part in this demanding 2 years' experience, the culmination of an adaptation process to a new life, a new country, a new professional phase which is yet to commence, and in that sense, I have to say thanks to FCT/FCSH NOVA University for creating the vessel for that to happen; to Professor José Carlos Ferreira, who understood how I envision and act towards objectives, offering his appropriate and targeted support and guidance when needed. To Professor Catarina Jóia, to whom I owe the greatest of patience, and collaboration, without her input I could have not completed this work.

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To all of you, again, thank you.

Yours truly,

Aixa.

"Nature's first green is gold, her hardest hue to hold."
(Robert Frost)

ABSTRACT

Due to Fonte da Telha´s location, which is placed in a secluded area at the most southern edge of the Almada municipality, bordered by the Atlantic Ocean to the west, and the Costa da Caparica fossil cliff to the east, this strip of land, that is naturally conformed by a dune system, has experienced an unregulated and uncontrolled expansion of urban settlements in the last few decades; mainly driven by tourism activities and by construction development of illegal genesis. With this current scenario, this work proposes a sustainable urban planning model to remedy the impacts of disorderly anthropogenic land expansions and occupation in coastal communities in Portugal, using as targeted area Fonte de Telha and its immediate surrounding in Costa de Caparica.

Furthermore, this study and analysis of the current occupied land area forms the baseline to compare the existing spontaneous model, which is putting at risk the necessary coastal ecological balance that mitigates climate change impacts, such as ocean rise and biodegradation; and replaces it with a new urban strategic groundwork that integrates a regenerative based approach as part of the solution, incorporating it as a main framework the sustainability and long term feasibility of the fishermen community, recognizing them as the major stakeholders who have occupied the area for generations, by implementing this social component as part of the main driven principle in the land reclamation process.

This work supports its proposal and findings in a simple methodology in the conformation of a detailed site analysis in the outlined area, based on existing scientific data, complemented with the extraction of Geospatial Opensource mapping, specially focused on understanding all the natural components, and always in consultation of the existing urban planning tools literature relevant for the analysis. This process ultimately arrives at a diagnostical summary of the issues at hand, and with this, the recognition of the possible solution where most of the strategies will be based on restoring or supporting the natural habitat, and adapting the human settlement by controlling its density, its impact and development; and to place the exiting fishermen community at the centre of the changes, to give propriety to their relevant needs and educating their way on asserting their natural environment and making them participant of the regenerative solutions.

The plan progresses with a simple scheme, to put in motion elements of design importance to just not arrive at a sustainable threshold, but to regenerate the damage done to the area framed within the Theory of Living System. These solutions are implemented into the energy sourcing, the use of agricultural land, the forming of an eco-regenerative village

spatial plan, and how the anthropogenic pressure can also be integrated into the plan to provide a final regenerative execution.

Keywords: Portuguese littoral; human settlement; coastal risk; coastal vulnerability; coastal erosion; coastal management; circular economy, fishing communities, regenerative urban planning.

RESUMO

Pela localização da Fonte da Telha; que se situa numa zona recatada no extremo sul do concelho de Almada, delimitada a oeste pelo Oceano Atlântico e a este pela Arriba Fóssil da Costa da Caparica; esta faixa de terreno, naturalmente conformada por um sistema dunar, conheceu nas últimas décadas uma expansão desregulada e descontrolada de aglomerados urbanos; impulsionado principalmente pelas atividades turísticas e pelo desenvolvimento da construção de génese ilegal.Com este cenário atual, este trabalho terá como objetivo propor um modelo de planeamento urbano sustentável para remediar os impactos das expansões e ocupações entrópicas desordenadas do solo em comunidades costeiras em Portugal, usando como área-alvo a Fonte de Telha e o seu entorno intermediário na Costa de Caparica.

Além disso, este estudo e análise da atual área terrestre ocupada constitui a base para comparar o modelo espontâneo existente, que está a colocar em risco o necessário equilíbrio ecológico costeiro que mitiga os impactos das alterações climáticas, como a elevação dos oceanos e a biodegradação; e substitui-o por uma nova base estratégica urbana que integra uma abordagem de base regenerativa como parte da solução, incorporando como quadro principal a sustentabilidade e a viabilidade a longo prazo da comunidade de pescadores, reconhecendo-os como os principais intervenientes que ocuparam a área durante gerações, implementando esta componente social como parte do principal princípio orientador do processo de recuperação de terras.

Este trabalho apoia a sua proposta e resultados numa metodologia simples na conformação de uma análise detalhada do local na área delimitada, com base em dados científicos existentes, complementada com a extração de mapeamento Geoespacial Opensource, especialmente focado na compreensão de todos os componentes naturais, e sempre em consulta com a literatura existente sobre ferramentas de planeamento urbano relevante para a análise. Este processo chega, em última análise, a um resumo diagnóstico das questões em questão e, com isso, ao reconhecimento da solução possível, onde a maioria das estratégias se baseará na restauração ou apoio ao 'habitat' e na adaptação do assentamento humano, controlando a sua densidade, seu impacto e desenvolvimento; e colocar a comunidade de pescadores existente no centro das mudanças, para dar adequação às suas necessidades relevantes e educar a sua maneira de afirmar o seu ambiente natural e torná-los participantes das soluções regenerativas.

O plano avança com um esquema simples, para colocar em movimento elementos de importância de 'design' para não apenas chegar a um limiar sustentável, mas para regenerar os danos causados à área enquadrada na Teoria do Sistema VivoClick or tap here to enter

text.. Estas soluções são implementadas no fornecimento de energia, na utilização de terras agrícolas, na formação de um plano espacial eco-regenerativo da aldeia e na forma como a pressão antropogénica também pode ser integrada no plano para proporcionar uma execução regenerativa final.

Palavras-chave: litoral português; assentamento humano; risco costeiro; vulnerabilidade costeira; erosão costeira; gestão costeira; economia circular, comunidades pesqueiras, planeamento urbano

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ACRONYMS LIST

AAE - Avaliação Ambiental Estratégia (Enviromental Strategic Evaluation)

AFN - Autoridade Nacional Florestal (National Forests Authority)

APA, I.P. - Agência Portuguesa do Ambiente, I.P. (Portuguese Environment Agency)

CE - Comissão Europeia (European Commission)

CMA - Câmara Municipal de Almada (Almada Municipality)

DEGAS - Departamento de Estratégia e Gestão Ambiental Sustentável (Department of Strategy and Sustainable Environmental Management)

DGOTDU - Direção-Geral do Ordenamento do Território e Desenvolvimento Urbano (General-Direction of Territorial Planning and Urban Development)

DRAP - Direção Regional de Agricultura e Pescas (Regional-Directory of Agriculture and Fisheries)

EIA - Estudo de Impacto Ambiental (Environmental Impact Study)

ERSAR - Entidade Reguladora dos Serviços de Águas e Resíduos (Regulatory Entity for Water and Waste Services)

ICNF - Instituto de Conservação da Natureza e das Florestas (Institute of Nature and Forest Conservation)

IPIMAR - Instituto de Investigação das Pescas e do Mar (Fisheries and Marine Research Institute)

INE - Instituto Nacional de Estatística (National Institute of Statistics)

LNEG - Laboratório Nacional de Energia e Geologia (National Laboratory of Energy and Geology)

MAOT - Ministério do Ambiente e Ordenamento do Território (Ministry of the Environment and Spatial Planning)

MAOTDR - Ministério do Ambiente, Ordenamento do Território e Desenvolvimento Regional (Ministry of the Environment, Spatial Planning and Regional Development)

PDMA- Plano Diretor Municipal da Almada (Almada Director Municipal Plan)

POC-ACE – Programa da Orla Costeira Alcobaça-Cabo Espichel (Coastal Pogram Alcobaça-Cabo Espichel)

POOC Sintra-Sado - Plano de Ordenamento da Orla Costeira **Sintra-Sado** (Coastal and Shoreline Ordinance Plan)

PPFT – Plano de Pormenor Fonte da Telha (Detailed Plan for Fonte da Telha)

REN – Reserva Ecologica Nacional (National Ecological Reserve)

1. INTRODUCTION

A significant proportion of the human population inhabits seaside littorals across the world, based on UN data released in 2017 during the Ocean Conference in New York; "More than 600 million people (around 10 per cent of the world's population) live in coastal areas that are less than 10 meters above sea level and nearly 2.4 billion people (about 40 per cent of the world's population) live within 100 km (60 miles) of the coast" [1].

These populations, that gravitate towards this direct connection and interaction with the ocean, are presented with higher level of risks and challenges due to the effects of climate change. Furthermore, the impacts of these anthropogenic pressures have morphed and changed these swathe areas of land, negatively intervening into balanced ecosystems, that as result have aggravated the natural defence composition of such environments [9].
Notably, when these coastal developments are founded in spontaneous and unregulated growth, the repercussions of these human actions are amplified in terms of degradation effects on existing natural habitats and bio communities [5], [6].

Such is the case of Fonte da Telha (Figure 1), initially a small coastal fishing community located in the municipality of Almada, Portugal, with an exact date of its initial habitation unclear, but with records from the Almada Municipality mentioning initial settlement in the mid 19th century [33]and the Plano Pormenor de Fonte da Telha citing the beginning of the 20th century [11], when some fishermen from Costa de Caparica decided to move south and dedicate to seasonal fishing as a new economic activity [15].
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Figure 1— Fonte da Telha Location-Almada Municipality. July 2023.Source: Thesis Author

This pursue resulted in a gradual settlement that was also accompanied by private investment on the purchasing of Agricultural land alongside the seaside spontaneous village conformation. However, due to anthropogenic pressures caused by the expansion of the tourism activities in the 1960´s, Agricultural land turned into lots being built as secondary vacation residences, the town began its expansion in both terms of population and built environment [4], [15]. Along this process, and due to unregulated planning, the development started threatening the natural ecosystem by creating environmental degradation due to construction without proper planning; as it is the result in most of any unregulated urban expansions, and specifically in this case, threatening the dune system and the bases of the fossil Cliff.

1.1. **Theme Context**

Fonte da Telha, like many other areas around the world with similar genesis and urban growth pattern, has experienced several negative impacts due to unregulated development. This is visually identifiable, when most of the houses and buildings sit in the main dune cord (Figure 2), disrupting the natural eco balance in terms of land defense against the ocean and the species ecosystem [9].

Figure 2- Dune Land Occupation- Fonte da Telha Norte. June,2023. Source: Thesis Author

Additionally, and considering the site location and physical conformation, the area is nested in a terrain that presents several constraints, which include:

- Zoning restrictions due to the built environment being placed in an area of a natural reserve denomination (REN-NER) [14]

- Geographical hazard exposure due to the features that conform the natural limits of the location; a cliff to the east of the existing main constructed environment and the dune system with the ocean to the west creating a risk pressured land strip in which all the human activities occur.

Furthermore, and in recognition of the challenge, the municipal authorities attempted to actively correct the prevailing unregulated built expansion. This was exhibited during the demolitions that occurred in the late 80´s and early 90´s, when at the time 908 residences were of illegal genesis and in their majority were second residences [15]. However, due to the lack of urban management plan, the illegal constructions reoccurred, therefore the Almada municipality authorities proceeded to develop a thorough assessment to provide a tool for urban planning management of the territory, and enacted the Plano de Pormenor de Fonte da Telha (Figure 3), approved in 2015 [15] , which intent was to provide a planning framework for urban restructuring of the area; considering the reversal of the impacts to the natural habitat, enforcing existing official zoning and to prioritizing the conservation of the fishing community that settled in the area back in the late 1800´s , early 1900´s, but due to the lack of proposals or incentives for the removal of the existing population, the plan was not able to be fully enforced as the public consultation did not give full passage of its controversial demolition and removals provisions.

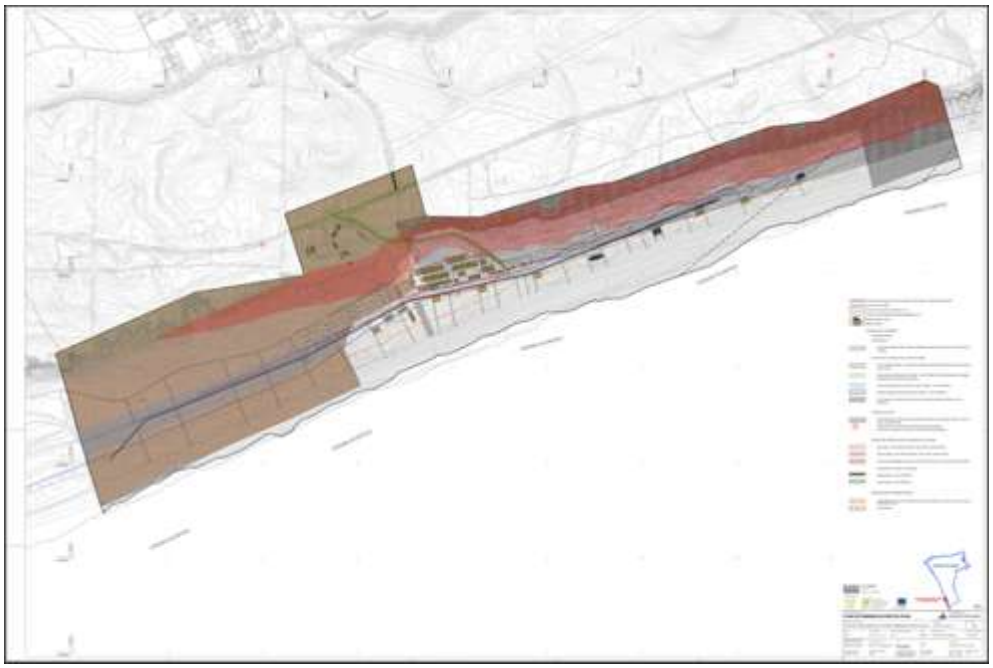


Figure 3- Conditioning Plan- Plano Pormenor de Fonte da Telha. March, 2015.Source: Camara Municipal da Almada

1.2. **Challenges and Objectives**

As previously mentioned, Fonte da Telha natural and built scenarios are confronted directly, and are not complementing one another. This is certainly triggered by the anthropogenic pressure and presence in the zone, that has evolved into impacting both scenarios with repercussions that can be assessed in both terms of observation and previous analysis of the sector; the results of this unplanned human activity imposition is exposed in terms of environmental degradation of the natural habitat, overburden and improvised infrastructure that cannot process the overload, urban sprawl configuration that tends to spontaneously settle in terms of clusters, making it difficult to serve, hence creating uneven distribution of the resources from the state and the government and further perpetrating socioeconomic inequality, and exposing all the area occupants to the effects of coastal erosion and increased risk of flooding.

One of the main challenges this work faces is the ability to respond with a pragmatic and feasible proposal which can give appropriate response to all the issues above mentioned, and that could appropriately safeguard and maintain the presence of the social component of the study, which in the case of Fonte da Telha is the fishing community that has been inhabiting it for over a century. Also, the project needs to consider the "lessons learned" approach from the previous unsuccessful attempts to remediate the impacts of the unregulated settlement; it is important to note that just physically removing the buildings has proven to be a non-sufficient strategy; focusing solely on developing an urban plan that does not provide integrated solutions to the community and sense of belonging has also failed to be executed.

Furthermore, the main objective of this project is to study and analyse existing and projected data in terms of high impacts in this coastal community, especially referenced to environmental degradation, coastal erosion, sea level rise and anthropogenic pressure, which,

as result, have brought an unbalanced social and urban setting, that is expanding without any management tools, highlighting the inability of the administrative authorities to respond to basic urban principles and provide sustainable solutions. Therefore, the project will form the basis of a resilient and regenerative approach on re-developing the Fonte da Telha urban configuration.

Due to the complexity of the intervention, there are other secondary, but equally as important targets to consider in the development of the project, which are also in need to be either responded to, or to be assessed within the strategies:

- Ecology based tools to respond to aggressive impacts to the natural habitat to allow existing fishing population to be sustained.
- Utilize the concepts developed within the regenerative theory of living system as a conceptual framework to outlined the proposal scheme in terms of pattern integration with a system that is supported outside its physical limits.
- Addressing existing energy poverty, and energy demand growth projection to have a sustainable community.
- Circular economy-based approach to generate the least impact possible as the project generates growth in the adjacent areas.
- Intervening in the existing built environment and outlining new dwelling opportunities.
- Strategic and well-defined green infrastructure to produce a balanced urban interconnected scheme.

All the above-mentioned objectives are outlined and presented in the Regenerative Urban Plan for Fonte da Telha, with a space planning that becomes part of a system and with solutions that may give a new vision for the area.

1.3. **Methodology Approach & Work Structure**

To produce the work presented, the methodology implemented is based into:

1. Analysis of exiting data in reference to the study area defined within the work, in terms of scientific and contextual publications for literature review implementation, governmental urban planning tools, both implemented or proposed; and generation of detailed physical data from digital tools such as QGIS with support of the Digital Elevation Models (DEM), to obtain an accurate depiction of the existing elements within the work and create a thorough Analysis.
2. Incorporation of previously developed surveys and quantifiable social data to create a pivotal structure that defines the intervention and has as at the center of the solution the anthropogenic framework to dissipate existing pressures within the area of the work.
3. Elaboration of a diagnostic based on data collection and findings to organize and structure all the flows exercising pressure or dissipation elements, this is comprised in a SWOT chart that presents all the advantages and challenges for the area and to assist in the recognition of the best implementation strategy for the solution.
4. Development of a proposal based on a regeneration-based philosophy and design that will apply different solutions thru a system that combines returning "polluted, degraded or damaged sites back to a state of acceptable health

through human intervention" with biophilic designs that reconnect people to nature [30].

5. Evaluation of the proposal to assess feasibility and implementation prospects within an economic and operational scheme, additionally a dynamic evaluation and discussion session within the key social group of the work in Fonte da Telha (Fishermen Community) that mainly interacts within the regenerative design solution, to obtain feedback data regarding interpretations and viability of the alternative path of implementation thru the proposal presented, in leu to previous plans developed for the area.
6. Conclusions based on existing state of the study area, the regenerative design proposal, and its evaluation and discussion process from the conceptual and philosophical origin into possible implementation.

Within the methodology before mentioned, the structure of the work is delineated below and shown on Figure 4:

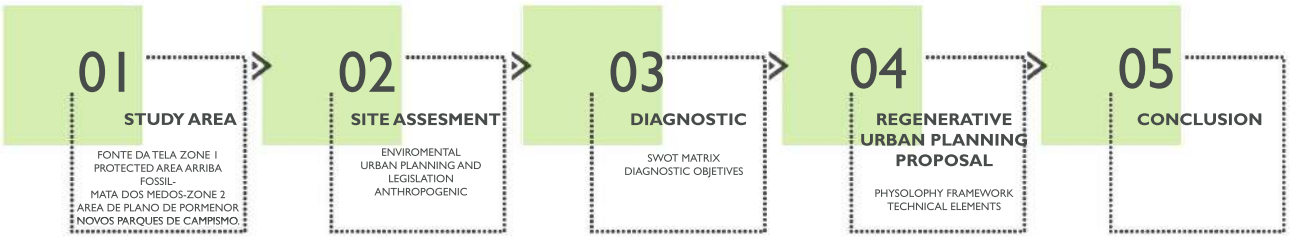


Figure 4-Methodology & Work Structure-. August 2023. Source: Thesis Author

1. Introduction, where the foundation of the theme is presented, with an overview of the objectives and challenges are being addressed, with consideration and elaboration of the main areas the project is engaging.
2. Comprehensive Site Assessment which includes a broad characterization section of the work including all relevant data gathering, which are part of both the geophysical aspects, existing and proposed urban planning instruments and social composition of the area of study of Fonte da Telha.
3. Diagnostic and Strategic Assessment, with a summarization of the results in terms of relevant characteristics (Strengths, Weaknesses, etc.) to outline the processes to be followed, such as objectives for the proposal.
4. Regenerative Urban proposal, which describes the philosophy theory framework as well as detailing the technical program to efficiently present a solution for the area.
5. Proposal Evaluation, with a conclusive analysis in both terms of measures encompassed within the plan and project, with evaluation in situ with the fisherman community of Fonte da Telha.

2. LITERARY REVIEW: REGENERATION BASIC PRINCIPLES AND THE THEORY OF LIVING SYSTEMS

2.1. Basic Concepts and Examples

For the purpose of the work , and to present a context where the proposal is sustained within the implementation of a human centric approach in accordance with The Living System Theory, the basic principles in understanding regeneration, urban regeneration, and nature based solutions are in need of being outlined; The word "regeneration" is derived from biology, referring to "the process by which an organism selfrepairs, replaces, and grows a lost or damaged tissue structure" [39] Therefore, if this term is framed within placing a city as an organism, it accompanies the development and transformation of economic models, lifestyles, cultural innovations, and other factors, is always facing the challenge of new birth and decline during the development process. [39]

The term "Urban Regeneration" is derived from the biological interpretation. "Urban Regeneration" is gentler than the conventional renewal and reconstruction. It gets rid of simply discussion about the technical treatment of space with space theory. Its real goal is not only to replace old spaces with new ones, but also to focus on the long-term goal, to properly repair the internal order of urban development from a regional perspective, and to achieve sustained prosperous development vitality through integration and regeneration. According to UN-habitat "Urban regeneration brings back underutilized assets and redistributes opportunities, increasing urban prosperity and quality of life. Urban regeneration initiatives are complex, lengthy and run the risk of gentrifying private space or privatize public one." [31]

Within this broad concept of urban regeneration, that can refer to several ways of regenerating and urban space; i.e. Socio economic regeneration, built environment regeneration, cultural regeneration, etc., an example of an integrated approach where several strategic areas strategies were implemented can be seen in the city of *Seoul (Republic of Korea)* which experienced a major decrease in residential and commercial activity in its downtown, where small plots, narrow roads, and high land prices made development too costly. From 1975 to 1995, Seoul lost more than half its downtown population, while substandard housing for mostly squatters and renters was more than twice the city's average. Seoul launched the Cheonggyecheon revitalization project to redevelop an 18-lane elevated highway into a revitalized stream with green public space totaling 16.3 hectares,

dramatically increasing real estate values and the variety of uses for the downtown areas. And revitalizing the city population and economy. [40]

Another example can be seen in The City of Essen, located in Germany's former industrial heartland, the Ruhr Metropolitan Area, reinvented itself from a gray, industrialized city to a green city with a high quality of life. While the urban landscape is still spotted with relics from its coal and steel past, hundreds of hectares of green space have been created over the past decades through the conversion of disused factory buildings and mining facilities. [41]

Several strategies were implemented, including recovering the former site of the Krupp cast steel factory, for example, was transformed into a 230 hectares green belt stretching from the city center, while the adjacent industrial wasteland was turned into an 11 hectares add-on to the Krupp Park. A gradual implementation of blue and green infrastructure was incorporated in to the restoration of the river Eschem, implementing an integration of nature to the city life, thru its main waterbody making a remarkable regeneration comeback as a city and becoming the European Green capital in 2017. [41] In this aspect both regenerative projects presented have at their center the pivotal aspect of nature-based solutions for regenerating and reinvigorating an urban realm. It is worth highlighting that these strategies are fundamental for this work, and in it is understood that city parks that connect people to nature, provide recreational space and islands of biodiversity. Mangroves, dunes and healthy reef systems that protect coastal cities from storm surges, natural food system provide long term sustainable strategies as well as heathy social interaction. Henceforth, some specific strategies for natured based solutions are as follows:

- Forested catchments that provide clean water and store carbon.
- Urban wetlands that increase water infiltration and reduce flood risks.
- Urban and peri-urban farms that reduce food miles and connect people to the food they eat.
- Parks, tree-lined streets, green roofs and building facades that mitigate the urban heat effect and accelerate water drainage while reducing noise pollution, air pollution, and energy demand for cooling. [41]

Understanding these previous outlined concepts, in most instances are referred or implemented to cities or urban settlements of considerable scale, it is necessary to define the **urban intervention** of the size of Fonte da Telha, "most commonly, the "city" refers to "urban settlements", where urban implies non-rural. However, while the United Nations Department of Social and Economic Affairs (2014) was widely quoted, reporting that 54 per cent of the world's population now lives in urban areas, the same report acknowledged that "there is no common global definition of what constitutes an urban settlement" and indeed "the urban definition employed by national statistical offices varies widely". it is argued that given the availability of affordable clean energy technologies as well as the need to reconnect humans with the environment on which we live, the fundamental separation between urban and rural areas is inappropriate and that food systems can and should be integrated with the built environment". [31]

It is worth noting then that the project is based first and foremost in the initial concepts of a city, the original Greek and Roman concept of the city as simply “a community of citizens” [31] this is therefore the concept adopted to develop the proposal, the citizens at the center of the project are the fisherman community. In this level of intervention then, of a scale of a village there are several examples of villages/town urban regeneration.

In the case of Fonte da Telha we can applied the concept of Urban Village; which is defined differently from several perspectives. From the location and spatial characteristics, it is a village in the urban planning area or the urban-rural junction area, which is called "village in the city". From the social structure and demographic characteristics, the urban village area in the city is usually a mixture of citizens, villagers and a large number of floating population. It is often a gathering place for floating migrants and an important transition site for them to change into urbanites. From the land element characteristics, urban villages are often villages that have been requisitioned a lot of cropland, lost their productive farmland, and dominated by collective construction land [39], within this Urban Village Concept to determine the scale of the intervention, there are several study cases that have been implemented specially in mainland China, where the multilevel, multi-level and multi-stake holder approach have been utilized to develop an Urban Village regeneration plans for the area of Shenzhen, creating a system that strives to sustain this way of life in the villages as a whole, in specificity the example of the Village of Nantou, in this intervention the strategy was to implement a human centric approach, by reviving the traditions and cultural aspects of the village, implementing and restoring natural food producing area within the village and re building the inner center of the village to reclaim population lost , with affordable housing solutions. [38], in this context, the Regenerative Urban Plan of Fonte da Telha proposal will support its development from these experiences and its scheme and implementation will incorporate patterns and strategies developed within the Theory of Living Systems.

2.2. **Sustainability, Regeneration and The Theory of Living systems.**

The evolution of sustainability concepts and practices have brought, within its development, a search for an approach that does not only conform to minimize the impacts to the environment by human actions, but to implement systems and technologies that aim to reverse in an integrated fashion all the harm done to the habitat, primarily by the built environment, but ultimately by human settlements and activities [30]. This systematic approach does not leave the human component out of the framework, but on the contrary, it places it as a major stakeholder in controlling the process and co-evolving alongside with nature, and in which terms both benefit from this symbiotic integrated plan. In this sense, the regenerative approach outreaches to the elements of self-healing and self- organizing

properties observed in natural living systems, which at the end influence how urban space and plan are thought out as well as architecture.

Henceforth, to be able to provide a well-structured regenerative system solution, it is necessary to have an understanding based on the capacity of the ecosystem of the place, to maintain its essential functions and processes, and to be able to sustain and retain in a long-term scheme, its biodiversity, and ecosystems [26]. This is to completely contradict a merely technical and an engineered fragmented sustainable design thinking that only provides an immediate short-term solution, to stall degradation, but without implementing nature integration and a Living & whole system pattern thinking. This pattern of thinking evolution is demonstrated below on figure 5, where a conventional and fragmented approach does not envision a holistic solution, not conveying solutions that can address existing depleted condition.

This evolutionary sustainable design thinking has its initial steps at the end of the 19th century and beginning of the 20th century where ecological based design was first addressed by Ebenezer Howard with the issuance of the Garden Cities of Tomorrow (1902) previously published ed as *To-morrow: A Peaceful Path to Social Reform* 1880, and this was re-enforced by Patrick Guedes a biologist who in 1915 determined the cities were living organisms and its unsustainable growth could be addressed understanding its natural landscape context in order to advance solutions. This last theory influenced urban planning design during the 20th century and gained strong traction at the close of it. Among this history timeline, it is important to mention that in the early 70´s system theorist Charles Krone developed "living systems thinking as a developmental technology for consciously improving systems thinking capacity" [28] that uses systemic frameworks to understand complex wholes within which people are participants rather than observers. [30]So, in other words, the human component instead of being parallel or adjacent to this becomes part of it, always with the objective of self-improvement.

The progression on this holistic system theory directly influenced the basics of the Regenesis Collaborative Group, which based and reinforced the previously developed scheme by Krone that illustrated 4 stages or levels of work within a regenerative process: starting from the operation and maintenance aspect and arriving at the regenerative design work. This gives a structure in any field where human activity is involved to think and program for matters that are rather technical, but always thinking about the evolutionary element as a core principle within the design to achieve a truly regenerative plan. [28]

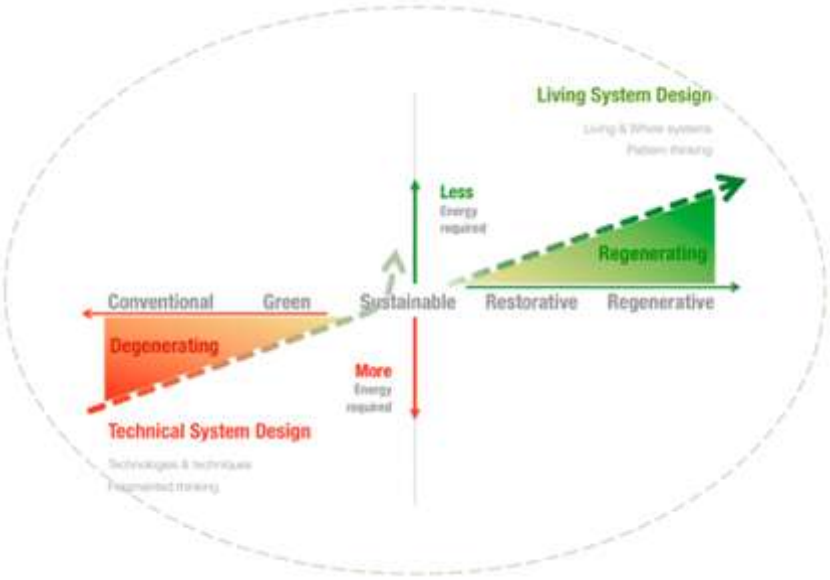


Figure 5- Trajectory of Ecological Design. Conventional to Regenerative Practice Source:(Reed, 2007).

With the theory evolving rapidly during the 20th century on the understanding of living systems, it is paramount to highlight the process of beginning to be interconnected and influencing the regenerative development and design, therefore, in 1969, "Design with Nature" [31]by Ian Mc Harg initiated the implementation of an ecological base land use design, rooted in the knowledge on how nature and its systems work. This theory created a rippled effect of influencing the way how urban planning is needed to be perceived and in technicality informed the Geographic Information Systems, which is a center resource for urban planning, and ecological development. [30]

During the late 1970´s Bill Mollison and David Holgren, both Australians, developed for the first time the concept of ***permaculture***, formed by a composed and contracted word between permanent agriculture and permanent culture [31]. Integrating in this sense the human factor within the nature processing of food production, further advancing the notion of a self-sustainable eco community devoid of the industrial processes and benefitting both men and nature. Most of this nature-based concept was drawn thru the observation and adaptation that indigenous communities practiced to become self- sustainable which resulted in showing a case where man-made ecosystems can suffice human needs, without perpetrating the damage that industrial processes incur [31].

For the first time in the 1980´s, the insertion of the regenerative concept to be applied to land use and planning was promoted by Robert Rodale. Which referred to go beyond a sustainability threshold, and to be able to propose both renewal and a regenerative threshold. His work was more developed in relation to the agricultural field not the built environment, however his practices did influence greatly John Tillman Lyle work in the *"Design of Human Ecosystem"*. This work was a new iteration that set precedent to the "application of

regenerative methodology to all systems that support life" [30]. This work assigned a responsibility to designers in terms of their understanding of the ecological order operating at various scales and generate a link with this understanding to human values, if we are to create durable, responsible, beneficial design" [25]

Expansion of the theory of generative design experienced a full development through the 1990´s, but it was in 1996 that *Regenerative Design for Sustainable Development* was published by John Lyle, it was the first encompassing publication that gave practical implementation strategies from the theory of regenerative systems. Later, he founded the Center for Regenerative Design at California State Polytechnic University, Pomona to experiment with this concept and technologies. His approach to these practices were to view human as co-evolving in nature to achieve a regenerative design, in a circular perpetuating motion, and considered that linear design implementation was the main source of degradation of natural systems. [28]

Additionally, the Regenerative Collaborative Development Group commenced outlining regenerative development strategies and technologies that set the foundation on how to implement these concepts, that originally evolved from an eco-centric approach, and where the human interaction was limited to a regenerative development. [28], as shown on Fig. 6.

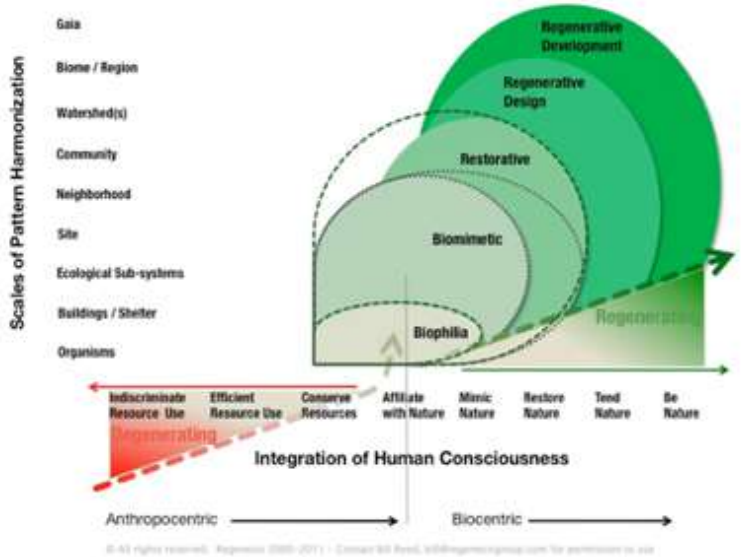


Figure 6- Levels of Ecological Strategies for Sustainability.2011. Bill Reed [30]

Analysing the two previous figures, for the Area of Fonte da Telha, the work attempts to utilize the goal of surpassing the sustainable stage and strive to move beyond this threshold in pursue of a regenerative design and at all possible a regenerative development. However, it is worth mentioning that, within the proposal, there are elements in reference to restorative measures that have a finite involvement of human interaction, but always trying to make these implementations within a regenerative framework, i.e., beach dune restoration.

The methodology that both regenerative design and development involve is the mixture of adapted and proved antic technologies, blending them with new ones, to secure a self-healing future. This is expressed in the areas related to energy, food supply, water resources, built environment, social components, and economy, to achieve:

- Health improvement in both human and natural communities.
- Creating and Re-incorporating any surplus assets and energy to generate self-reliance.
- Creating spaces of deep social connection between humans and the natural environment, to assert that management of the evolutionary aspect of the development and design evolves in consonance with the principle "humans is nature."

In terms of regenerative development, projects need to understand the potential of a place conceptualizing the right relationship to it, [30] the benchmark and goals are measured in the capacity on continuous growth and still supporting nature and humans alike, develop strategies where partnerships are formed toward achieving a common goal of a regenerated space, and be a catalytic instrument which creates harmony between human and nature patterns tracking its evolving process.

Furthermore, the different Levels of work and capacities assessed in a regenerative living system design scheme for built environments defined by Charles Krones as shown on Fig. 7 are as follows [30]:

- Operational level
- Organizational/Maintenance level
- Evolving Level
- Regeneration Level

Operational Level goals/Existence: This is the area related to functional programmatic effectiveness that sets the foundation to make the design operable and in a pragmatic scenario, it relates to infrastructure, energy and materials which are efficiently used and re-used to achieve a rooting system of the place.

Organizational/Maintenance capacity goals: Organizational and maintenance level focuses on "who" a place is and addresses two dimensions—what is core to how this place works as a living system what can be disturbed and what cannot, allowing the system to take form, this level relates to the built environment and how can present a distinctiveness within the system.

Evolve/Restorative Level: This is the level where the human intervention is focused within a frame in time, the nature-human interaction is defined by activities with ending timeframes, and never to be dealt with again. This evolutionary level allows systems to grow back again.

Regenerate Level: This refers to the systemic capacity of a place that with integrated human intervention achieves perpetual generation to harness health in humans and

nature alike, this means supporting human and nature creativity and provide space for both to thrive.

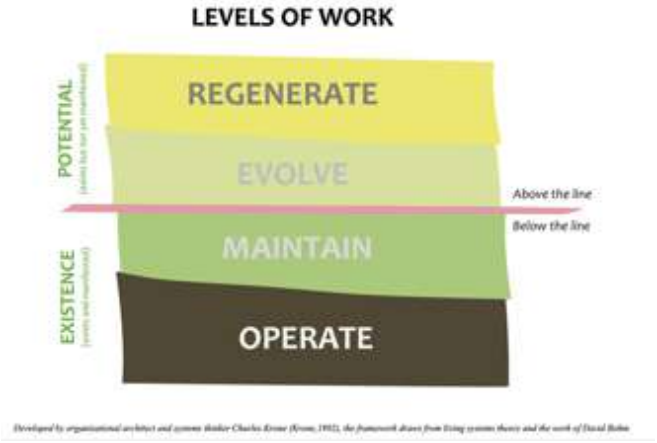


Figure 7-Levels of Work by Charles Krone based on the Living System Theory.1992. [29]

It is based in this framework that the proposal for Fonte da Telha is founded, in the practical implementation from the different levels of work in consonance with the Living System Regenerative Design Theories and concepts.

3.
COMPREHENSIVE SITE ANALYSIS

To develop any effective urban planning solution for the area, a thorough site analysis needs to encompass a variety of issues related to the natural land configuration, the built environment within it, and its immediate surrounding. In the case of Fonte da Telha, and especially because of the histography of governmental intervention both executed and planned, this chapter details all aspects, including the social data available.

The implementation of boundaries for this study are focused on acting on a primary area of intervention, but at the same time, the limits of the work articulates lands adjacent to it, necessary to create a supporting network pattern, to appropriately root a solution that could evolve in a swatch of possible areas of iteration and growth with the opportunity of rendering the proposal, as a regenerative urban plan applicable for the foreseeable future.

1. Geographical Context and Intervention Limits

The limits allocated for the study area have been framed within an assessment dedicated to elaborate a simplified juxtaposition of several planning tools developed for the area, with different frameworks and objectives, such as Plano de Pormenor de Fonte da Telha, Plano de Ordenamento da Orla Costeira Sintra-Sado, Programa da Orla Costeiro-Alcobaça-Cabo Espichel, Plano de Pormenor dos Novos Parques de Campismos, and Plano de Ordenamento Da Paisagem Protegida da Arriba Fóssil da Costa de Caparica. Understanding these elements and their levels of interventions, gives a strategic overview of the land in and around the main area of study (Fonte da Telha); but above all, it assists in understanding the historical feasibility and implementation of the projected interventions by this work.

Therefore, as a starting point: the area delimited by the Plano de Pormenor de Fonte da Telha was the main consideration for intervention, however, this was proven non-sufficient within its own process, as later data shows that the main considerations for the plan did not move forward with the community, rendering it with insufficient strategies to become executable; under this perspective and by further analysis, the expansion of the study area will pursue innovative ways to incorporate the positive impact considerations from the other plans, for a complimentary scheme.

With this vision, and as shown on fig. 8, there are two additional areas (zones 2 and 3) that provide support to the main area of intervention. These before mentioned areas are intervened with lesser intensity within the plan presented in this project, but with strategic involvement to expand opportunities in execution and implementation.

Legend:

Costa da Caparica Fossil Cliff

Total Area of Work Intervention

1 Primary Urban Area of Intervention (Fonte da Telha)

2 Connecting Natural Reserve (Reserva Botânica Mata de Medos)

3 Supplementary Urban Area of Intervention. (Pinhal de Aroeira)

Figure 8 -Areas of Interventions-THESIS NAME. July, 2023. Source: Thesis Author

The total area of intervention encompasses approximately 386 hectares, in which 114 hectares will represent the major area of intervention within the Fonte da Telha administrative boundary, geographical delimitations for the Total Area of Work Intervention are to the north and south: the natural reserve of Mata Nacional dos Medos, to the east the urban area known as Aroeira and to the west the Atlantic Ocean. Additionally, it is important to mention that the Fossil Cliff is placed within the North-South Axis of the total area of intervention, topographically creating a rift that separates Fonte da Telha from the rest of the other two areas, making integration and community pattern development a challenge.

3.2. **Historic and Anthropogenic Framework**

Fonte da Telha was originated by a settlement of a small fishermen community that moved from the Costa da Caparica in the early decades of the [33] century (See fig.9 & 11), to practice as a mean of sustenance the seasonal fishing based on the "Valenciana Frames" [23]. which is deemed still nowadays as a sustainable fishing method [14]; additionally the built system implemented by this community of fishermen were the cabanas, which were of simple conformation and with the use of existing surrounding materials. These cabanas were usually made from wood or from vegetation materials (See Fig.10), with a medium to high level of adaptation to the environment [34] but with the characteristics of a temporary building due

to rapid levels of degradation. Their floorplan usually was formed by a square or rectangular shape, and with roof with high pitch slopes.

Figure 9- A Fonte da Telha (Costa de Caparica, Praia do Sol) Cruz Louro. 1937. September 2016. Source: Mar-da-Costa.blogspot.com

Figure 10 & Figure 11 - Construções Primitivas em Portugal. June 2020 Source: Etnográfia Press

According to population data, by the mid-50s there were about 30 buildings in the area [11] [14],with mainly placement on the main dune system at the lower area near the beach, and just a few buildings on a higher elevation (see fig. 12), this settlement included the Fiscal Guarda Post on the top of the cliff. Out of necessity the stablished dwellers of this area expanded their occupation to the agricultural land adjacent to the beach.

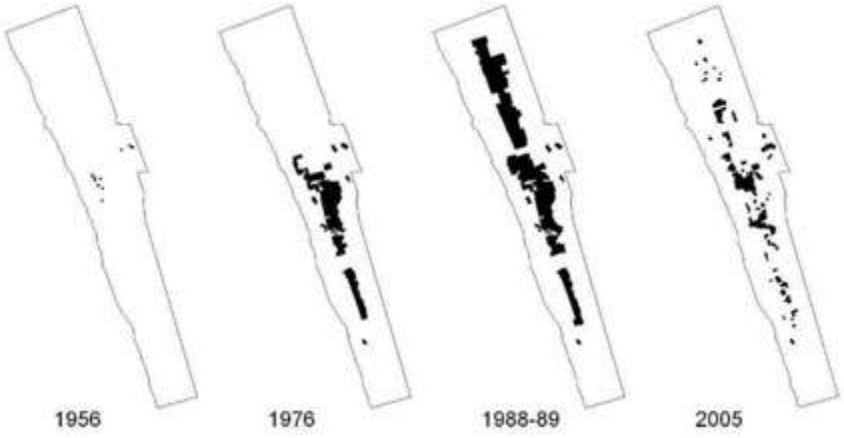


Figure 12-Land Occupation Evolution in Fonte da Telha. March 2011. Source: Estudo de Caracterização, Diagnóstico Prospetivo e Definição dos termos de Referência para a Elaboração do Plano de Pormenor de Fonte da Telha

This minor occupation of a fisherman community established a precedent of lack of governmental intervention and/or punitive measures, therefore between the mid 60´s and the mid 70´s Fonte da Telha experimented an exponential growth, especially of secondary vacation residences built either on illegal lots without any permits or in most cases utilizing agricultural land to build new permanent structures. Numbers and statistics from the era assert a change in population density from 17 dwelling units per hectare to 45 dwelling units per hectare as seen on figure 13 [11].

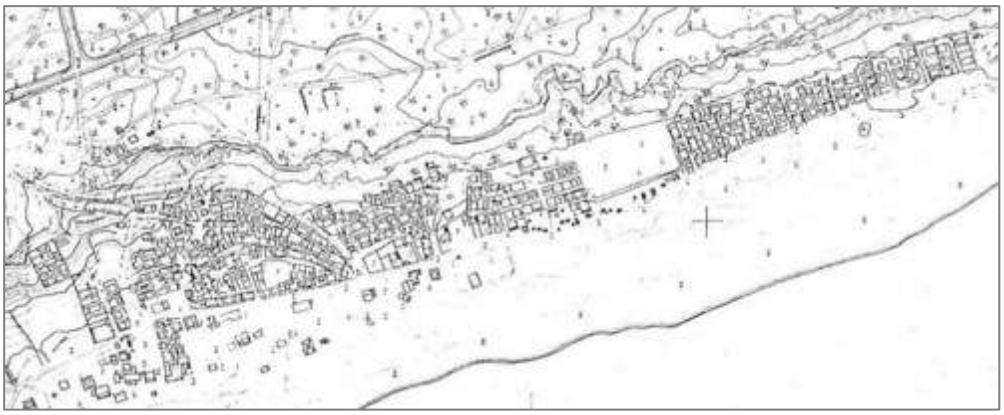


Figure 13-Land Occupation in Fonte da Telha in 1976. March 2011. Source: Estudo de Caracterização, Diagnóstico Prospetivo e Definição dos termos de Referência para a Elaboração do Plano de Pormenor de Fonte da Telha

Non existing planning for the area led to a forceful evolution of the illegal land occupation, accelerating the construction dynamics without any vision for planned infrastructure, awareness of environmental impacts and risks, or the establishment of a functioning community, resulting with a built environment of 907 clandestine buildings by the end of the 80´s, which in most cases were secondary residences [4]. At this stage the Almada´s City Hall decided to intervene by demolishing the illegal houses in between the late 1980´s and early 1990´s [11], and just preserving majorly the dwelling units that belonged to the

fishermen families. State of affair remained so unsupervised in terms of planning and legislation that **developers** in the area generated unapproved Lot plans for what was called Quinta A and Quinta B (See Fig. 14).

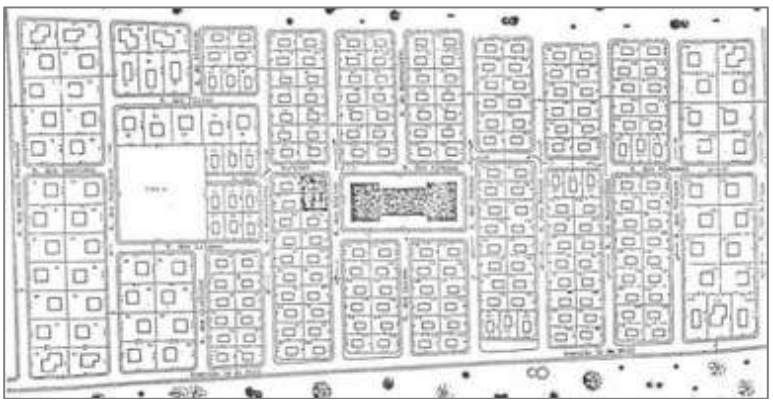


Figure 14- Lot Definitions Quinta B in 1982. March 2011. Source: Estudo de Caracterização, Diagnóstico Prospetivo e Definição dos termos de Referência para a Elaboração do Plano de Pormenor de Fonte da Telha

During this exponential growth in anthropogenic pressure of the area, very limited planning was being crafted or implemented, and by the mid 2000´s the Almada City Hall, started developing planning tools that could be utilized to diffuse this pressure, and put a halt to the environmental degradation in the sector; however, all the plans that encompassed the area as of August 2023 such as Plano de Pormenor de Fonte da Telha or POC-ACE (Programa da Orla Costeira - Alcobaça-Cabo Espichel) have not been implemented, or have been partially implemented, perpetrating a continuation of disorderly growth, illegal tourist accommodation schemes, degradation of the natural ecosystem, insufficient and improvised infrastructure and the re-developing of residential units. As consequence of all these activity fluxes, the original inhabitants (the fishermen) of the area have been mainly displaced from having an area where they can sustain their way of life and benefit from a place where they developed a natural relation with the environment.

3.3. **Site Characteristics**

Due to its location, Fonte da Telha and its surrounding area possess a concentration of relevant natural characteristics that highlight the importance on the balanced interaction of its elements with human activity, which translates to the significance of its ecosystems and the essence of its context in terms of a sustainable future for the area, and its prevalence as an adaptation barrier to climate change and sea level rise. Therefore, it is important to understand first what territorial planning instruments are in place that support or delay its sustainable development, and analyze all relevant scientific data derived from a site characteristic evaluation, in order to obtain a thorough understanding of what are the physical attributes of the area at the moment, its importance, its interaction with the existing built environment, and at the center of this dynamic, the relevance of the human connections and impacts to the site, which determines the course of action for the subsequent proposal presented in this work (see fig.15).

Figure 15- Fonte da Telha South End Existing Conditions. June 2023: Source: Thesis Author

Adhering to this before mentioned methodology parameter, the analysis was performed first into a legal and territorial planning instruments in terms of physical attributes obtaining environmental and geophysical information from an open data source software (QGIS) which was used to extract all relevant computations from a Digital Elevation Model (DEM) model, such system was relevant for the majority of the parameters assessed, in conjunction in some cases with complementary information available from the Plano de Pormenor de Fonte da Telha Geological Report, the Slope Instability Susceptibility Mapping of Almada County for the National Ecological Reserve (REN) and additional scientific articles which gave a multi-source input which broadened the scope and possibility of the results.

As previously determined in section 2.1, the study area is established by 3 zones for the purpose of obtaining a plausible solution to the unregulated human activity pressures being exhorted into the specific area of Fonte da Telha-**Zone 1** , where most of the solutions proposed in this work are implemented due to its eco sensitivity and anthropogenic intervention; however, the majority of the environmental and geophysical gathered data pertains to the sector as a whole, reserving a more detailed characterization in terms of built environment and social data to Zone 1.

3.3.1. Urban Planning and Territorial Management Framework.

The area of the work is located at the southern edge of the municipality of Almada as previously mentioned in the introductory chapter, and within its administrative boundary the project area belongs specifically to the Charneca de Caparica Parish (Freguesia). In this context, the territorial planning tool that organizes and manages all aspects related to urban and rural planning in the municipality is The Municipal Master Plan of Almada (PDMA), which was approved by the Municipal Assembly of Almada on July 18, 1993 and ratified by

Resolution of the Council of Ministers n.º 5/97, of December 5, 1996, and its following amendments [4]

.

Due to publication of 4 plans that did not correspond to what it was approved, new ratifications and legal compliance of those plans were executed, henceforth after verifying their compliance with the legal and regulatory provisions in force, they were enabled by Council of Ministers Resolution n. º 100/98, published in the Diário da República, 1st Series-B, on August 4, 1998. Additionally, regularization of Titles for ownership and operation was enacted by Decree-Law n. º 165/2014, of November 5, this became a legally binding documentation which petitioned such certificates to be furnished or applied for, by both individuals and organizations, this included plots that had administrative easements or public utilities restrictions. This triggered a subsequent amendment to the PDMA and published through Public Notice no. 511/2017, in the 2nd series of the Diário da República [7]

Notably and most importantly, as a result of the POC-ACE program being enacted by the Council of Ministers Resolution No. 66/2019,of the 11th April 2019, the PDMA was amended once more, in order to adapt to the rules and regulations relating to the protection and safeguard regimes of the POC-ACE, this was established in the Declaration No. 50/2019, of August 8th, 2019, AND in compliance with the Legal Regime of Territorial Management Instruments-RGJIT as known for its acronyms in Portuguese-(Decree-Law No. 80/2015, of May 14) which determined the obligation to update the Municipal Land Management Plans (PMOT) which contain provisions that are not in compliance or incompatible with the norms of the Special Territorial Planning Programs (PEOT) [7] Also, in the same legal context of complying with RGJIT processes, a new amendment was issued to incorporate within the PDMA the Declaration no. 78/2021 which incorporated the norms related the issuance of protected status for the "Protected Landscape of the Fossil Cliff of Costa da Caparica" (**PPAFCC**) Decree-Law nº168/84 de may 22nd [6], that in essence safeguards its geomorphology and restrict or curve all activities in order to maintain undisturbed this area of natural interests and biodiversity; see figure 16.

POPPAFCC

The Planning Plan for the Protected Landscape of the Fossil Cliff of Costa de Caparica its relevant to the project due to the information and zoning assigned to the areas of complementary interest within the proposal and how it has structured its classification and its areas of intervention, so it is valuable to detail the POPPAFCC two scopes:
1. To identify and delineate the territory covered by the POPPAFCC
2. To define the protection policies to be applied with its defined territory.

Moreover, the protection policy assessment lays out two zoning types, the definition of the protection regime, and the highlighting of specific intervention areas [6]. With these two areas of development of the plan, it moves its guidelines to classify different areas based upon their conservation value and the compatible activities that are complementary to the vision of conservancy structured in the plan. In this sense the classifications area as follows:

1) Total Protection.
2) Partial Protection I.
3) Partial Protection II.
4) Complementary Protection I.
5) Complementary Protection II.

The classification before mention contains different levels of rules that restrict in extent the buildability or human intervention of the area, i.e. Type I, total protection, does not allowed any building or edification where is marked on the synthesis Map.

The Specific Intervention Areas (AIE for its acronyms in Portuguese) are defined by the level of interest, real or potential, for the conservation of heritage they are denominated under, taking into consideration the possibility of being subject to strong anthropogenic action, therefore they require special measures of protection, recovery, or rehabilitation.

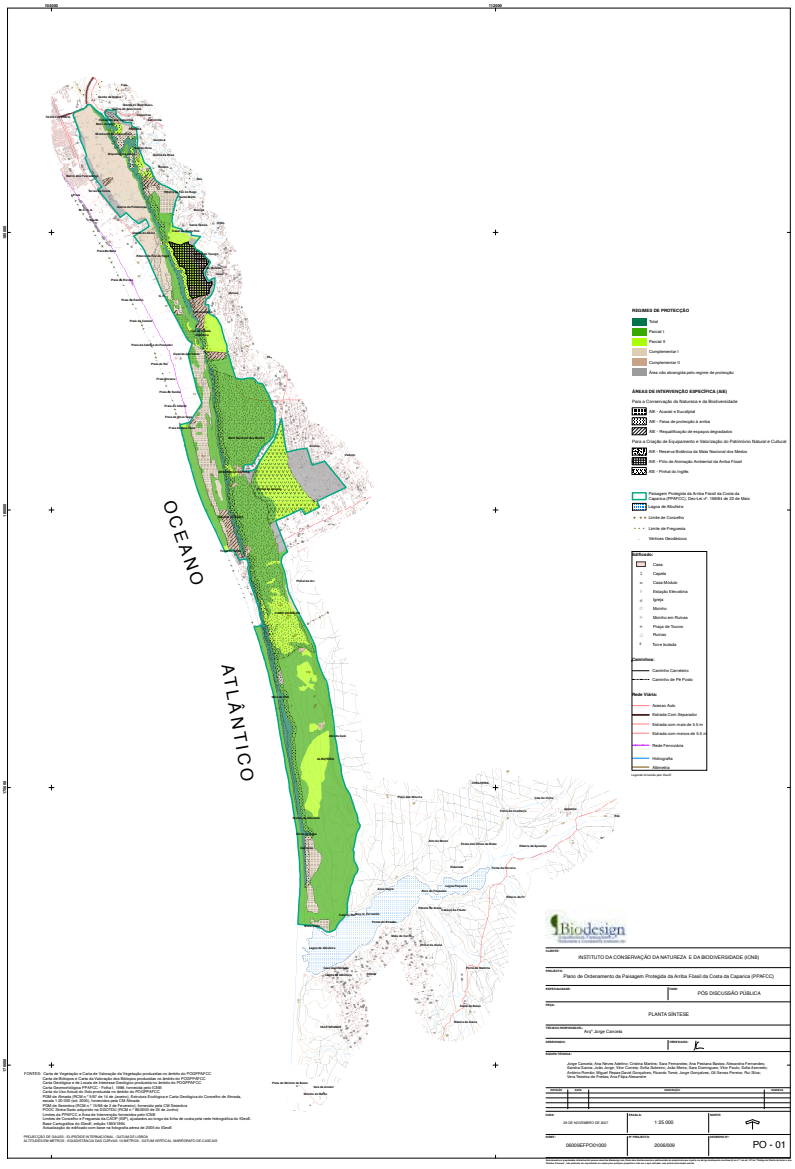


Figure16- Synthesis Plan- POPPAFCC. 2006: Source: ICNB/Biodesign

The following areas of interest are denominated as follows:
Natural and Biodiversity Conservation:
AIE - Acacial and Eucalyptus.
AIE – Arriba protection strip.
AIE – Requalification of degraded spaces for the Creation of Equipment and

Areas of Urban Equipment Potential and valuation of the Natural and Cultural Heritage:
AIE – Botanical Reserve of the National Forest of Medos.
AIE – Arriba Fóssil Environmental Animation Pole.
AIE – English Pine.

The Pinhal do Inglês area, which will receive the new campsites projected in the POLIS plan [11] is entitled to an AIE (Specific Intervention Area) with the aim of programming the occupation of Pinhal do Inglês for this purpose, this land is of private ownership and the zone is classified as partial protection type II. Which is an area envisioned of complementary attributes in terms of the project proposal.

PROGRAMA DE ORLA COSTEIRA ALCOBAÇA-CABO ESPICHEL

As previously mentioned within the PDMA histography process, one of its last amendment iterations is the incorporation of the measures and classification enforced by the POC-ACE, which in principle and structure develops a territorial and spatial instrument to manage all the coastal areas which include land, sea, and hydric resources where existent, which supersedes and integrates the areas covered by the previous POOC Alcobaça – Mafra, Cidadela – São Julião da Barra and Sintra-Sado.

In this scope and as an area of interest for this works the POC-ACE proceeds to consider in compliance with article 10 of Decree-Law no. 159/2012, of the 24th of July, that "beaches must be object of valuation and qualification, in particular those that are considered strategic for environmental and tourist reasons and, in this context, be subject to classification and measures that discipline uses and activities" [11].Which is represented in a territorial model developed by the POC-ACE. (See fig. 17)

The strategic vision and implementation of the plan is to first reutilize delimitations and classification categories for beaches from previous POOC plans, also complying with the terms of article 10 of Decree-Law no. 159/2012 of the 24th of July; reclassify some of them based on "its environmental characteristics, the degree of infrastructure, its insertion.
in the territory and conditions of use" [6], and secondly to a new territorial model that will give a more defined description, policy, and protection along the different coastal areas extension in Portugal. In terms of definition the beach classification levels are as follows:

- Type I – urban beach.
- Type II – peri urban beach.
- Type III – semi-natural beach.
- Type IV – natural beach.
- Type V – beach with restricted use.

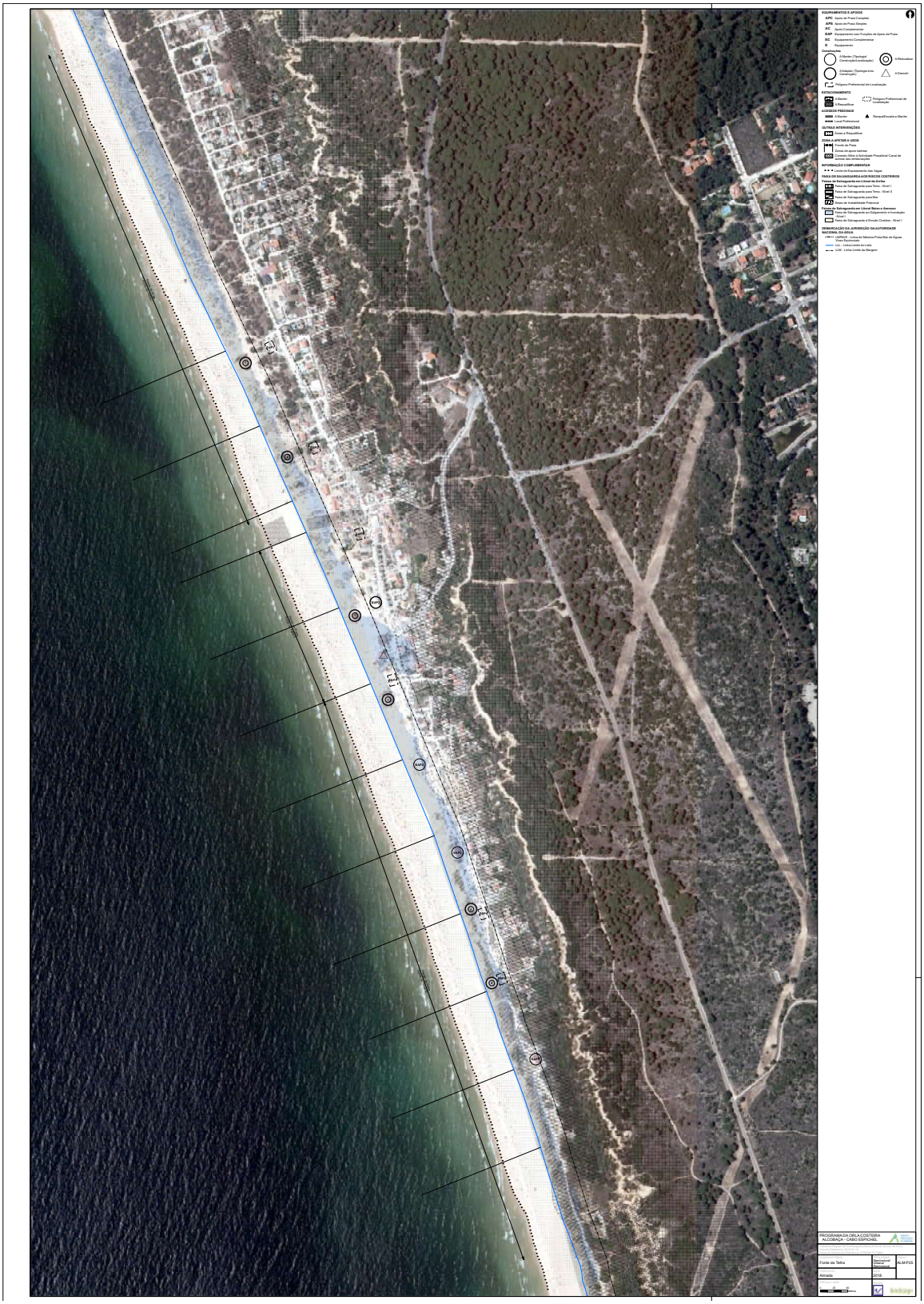


Figure 17- POC-ACE-Fonte da Telha I, II and III. 2018: Source: POC-ACE/Biodesign

In the specific case of Fonte da Telha, the POC-ACE first determines in its territorial map that Fonte da Telha beach is divided in three main Area, Fonte da Telha I which encompasses the north part of the beach, Fonte da Telha II which refers to the central section of the beach, and Fonte da Telha III which is formed by the southern edge of the beach. In this determination of sub areas, the POC-ACE delineates the Fonte de Telha Beach I and III are Type III seminatural, and then the Fonte da Telha II is reclassify as a Type I. Within these parameters it is defined that the first two areas will be more restricted in the development of construction and intervention and the central section. This map is accompanied by proposal summaries that articulate directly with the Plano de Pormenor de Fonte da Telha (PPFT) in its proposed actions, restrictions, and protection implementations. Part of these proposal synthesis include the new urban equipment to be removed or added, areas for parking spaces, reiterates the demolition of most of the buildings and confirm relocations outside of the Fonte da Telha, details of each section of this documentation can be seen in the Annex section.

Additionally, the POC-ACE implements thru is territorial models expressed in maps new safeguarding strips for both land and sea, the determination and classification of those strips are related to the level, hierarchy, and origin of hazardous conditions, putting in place a scale of risks transformed into visual cues and limitations within a territory; assessing for the Low sandy coasts the projected horizons by 2050 as level I benchmark, and projected horizon 2100 as level II, and for the Arriba Coastal is measured in terms of soil instability .

The different safeguard strips classifications are below:

1. **Low Sandy Coastal Safeguard Strip:** Framed on environmental dynamics.
   - 1.1. Erosion Safeguard Strip (Level I & II)
   - 1.2. Ocean Overtopping Safeguard Strip (Level I&II).

2. **Arriba Coastal Safeguard Strip:** Sensitive area in terms of Erosion-Fossil Cliff
   - 2.1. Sea Safeguard Strip
   - 2.2. Land Safeguard Strip (Level I)
   - 2.3. Land Safeguard Strip (Level II).
   - 2.4. Area of Potential Instability.

Detailed in the map for the Area is found that the levels of the low land safeguard strips were only benchmarked for the projected horizon of 2050, and in the case of the Arriba Coastal safeguard strips.

RESERVA ECOLÓGICA NACIONAL (REN)

The National Ecological Reserve (REN) is a network of protected areas which was created by Decree-Law No. 321/83, of the 5th of July [37] with the aim of protecting certain areas whose biophysical structure is necessary for the ecological stability of the territory. They are usually areas with ecological sensitivity value and areas subject to natural risks such as

water lines, coastal areas, slopes with large slopes. REN sets conditions for the occupation, use and transformation of land in areas included in this network [37]

The delimitation of areas belonging to REN is carried out on two levels: the strategic level, at national and regional level, and the operational level, at municipal level. The national scope is the responsibility of a National Commission created for this purpose, the National Commission of REN, in collaboration with the Commissions for Coordination and Regional Development (CCDR)13. The regional strategic guidelines are ensured by the CCDR corresponding to each region, in articulation with the municipalities of that same region [37]. Areas identified as belonging to REN, at a municipal level, become part of the conditional blueprints of the Municipal Plans for Spatial Planning and Special Plans for Spatial Planning.

In Fonte da Telha and in the Costa de Caparica, all the natural coastal systems are protected by the REN denomination, this includes the dune systems, the beaches, the woods surrounding urban areas, and all the areas related to the Fossil Cliff, which includes the foothill, the exposed wall, and the top area, in this natural reserve denomination construction.

PLANO DE PORMENOR DE FONTE DA TELHA

As complementary urban planning intervention plan, The Fonte da Telha Detailed Plan, also known as PPFT, was prepared under the Decree-Law No. 380/99, of September the 22nd, which established the territorial management regime, [37] this precisely constitutes the territorial planning instrument for the project most active intervention area, however, this plan was never implemented since it did not pass the public consultation due to the most polemic provisions referenced to demolition and relocation of almost all of the buildings within the area of intervention. This plan sets the specific foundations for the area, and they are broad in scope and interventions, it considers development needs for the sector to function in terms of infrastructure, highlights the importance of the fisherman community and determines the protection action to be ensued to preserve the dune system and the Arriba Fossil Cliff.

3.3.2. **Biophysical and Environmental Context**

The Biophysical and environmental section, as previously mentioned was mostly obtained by sourcing data from QGIS through a DEM model, this pursue of information was based on obtaining basic attributes such as hypsometry, inclination, sun exposure, water features, etc. that will give an overview on how the natural framework is established, what are the existing elements to be usufruct for the proposals, which ones generate hazards or

risks, to implement adaptation or mitigation measures; or simply to form a base of extensive understanding on how the natural habitat is relevant and conformed in relation to the human activity interaction.

3.3.2.1. **Hypsometry**

As shown on fig.18, the terrain area of study for zone 1 has a topography with hypsometry curves maintained at a low elevation in comparison to sea level(1-19Meters), which allows the development of the beach extension and the coastal dune system, abruptly interrupted as it geomorphology escalates to a steep profile with a substantial level difference between zone 1 and zone 2 , which is at full display in the appearance of the Costa da Caparica fossil cliff, where the elevation variation of 110 meters in height evolves in an horizontal distance of approximately 100 meters, creating a rift or natural spatial separation (cliff wall) between zone 1 and zone 2, but at the same time creates landmark views from the cliff vantage point into the ocean.

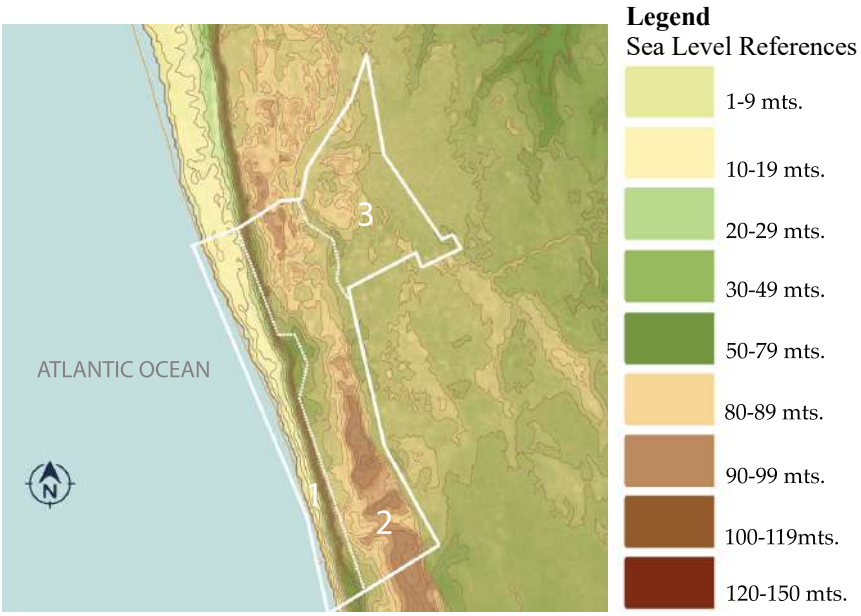


Figure 15.

Figura 18- Hypsometry - Zone 1,2,3. August 2023: Source: Thesis Author

As a contrast, and regarding the level difference between zone 2 and zone 3, is less prominent, as the levels are maintained between 90 meters to 100 meter above the sea level, creating a gentler difference between level curves, which present a more homogenic terrain than the notable level difference between Zones 1 and 2.

3.3.2.2. **Slopes**

In reference to the slopes (See fig. 19), it is observed that the area that conforms the beach and its dune system possesses slopes with inclinations between to 15-30%, this is a reflection of the Sand beach area meeting the coastal dune system, which naturally has a notable inclination to conform a protection barrier against the ocean [11]; in the area adjacent to the limits of zone 2 the slopes are of a high percentage of inclination in the average of a 30-60%, which represents mainly the geological morphology of the Arrábida Fossil cliff in the North, Central and South Area for Fonte da Telha, where the cliff is more prevalent, to lightly subside the slope inclination to the north of Fonte da Telha with a slope percentage in some areas of 5-10%. Subsequently, the area between zones 2 and 3 presents several edges of 30-35% inclination; however, zone 2 has most of those slopes, whereas zone 3 has a more significant presence of lower slope percentages (5-10%), especially in its northern part.

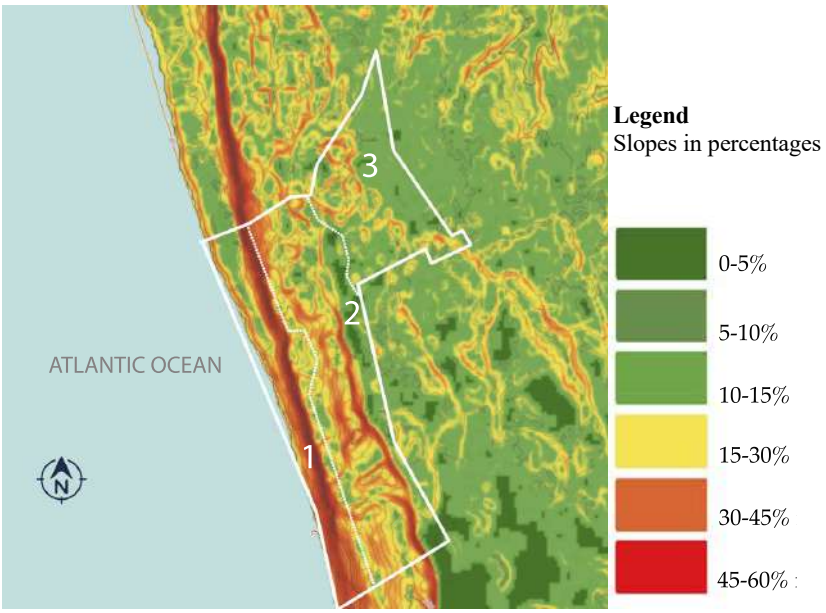


Figura 19- Slope Map Zone 1,2,3. August 2023: Source: Thesis Author

3.3.2.3. **Sun Exposure and Insolation**

In reference to the sun exposure (see fig. 20), the majority of zone 1 and 2 present high level of sun exposure from the west where hardly there is not natural shading or built barrier, This is simply the case because the land distribution of the project is in the axis North West-South East (lengthwise), making the strip of land mostly facing the sun under an east-west exposure. This is mitigated in most part of zone 2 and zone 3 by extensive tree shades conformed by the Mata de Medos and the Pinhal de Aroeira, which also has a sun exposure direction coming from the east and northeast projection.

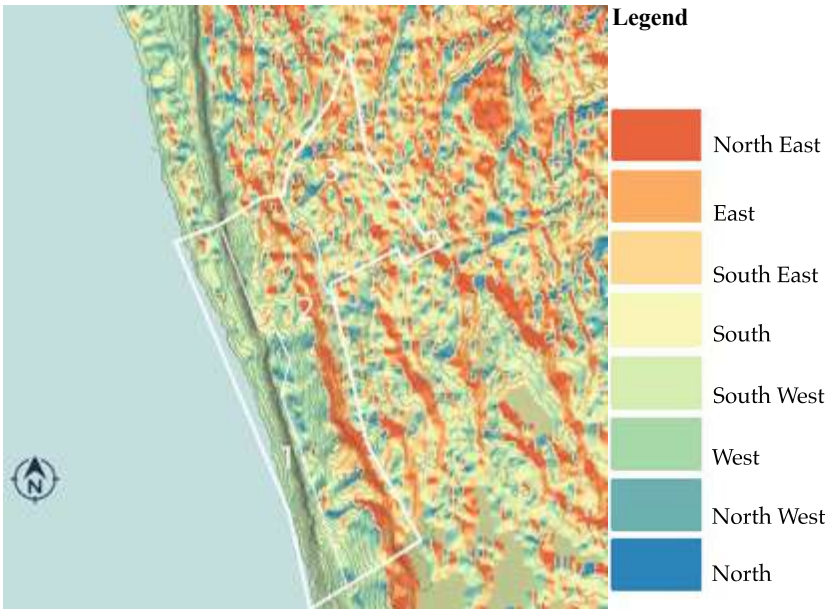


Figura 20-Sun Exposure Aspect -Zones 1,2,3. August 2023: Source: Thesis Author

Additionally for this study, the analysis performed in the area in terms of solar dynamics, relates not only on assessing where most of the sun exposure is coming from for the three zones, but assessing their insolation potential. Which is a measure of the solar energy that is incident on a specified area over a set period of time. And for this analysis determined or set in kilowatt-hours per square meter (kWh/m^2) per day. This data is relevant to understand the energy self-reliance potential of the intervention, in terms of both, best location and design solutions to attempt the best energy collection results and output of Photovoltaic panels.

The sun insolation potential as shown on fig.21 were measured in both equinoxes, to obtain the average spread of area and intensity, since the sun is at a 45–47-degree angle extending its beam spread by about 30% and decreasing its intensity between 30 to 40% in comparison to a 90 degree exposure that only occurs in the North Pole in the summer solstice for the northern hemisphere. In the case of the data collected in terms of insolation for the area, it is notable to mention that during the spring equinox the solar radiation can reach up to 8KWh/m2, placing the project zone in the very high category determined by the Global Horizontal Solar Irradiation Scale by the World Bank Group and furthermore, with a factor of up to 4 KWh/m2 during the fall equinox the area places itself on the high category, making the incorporation of a photovoltaic panels strategy a key component to be considered into the proposal for the area.

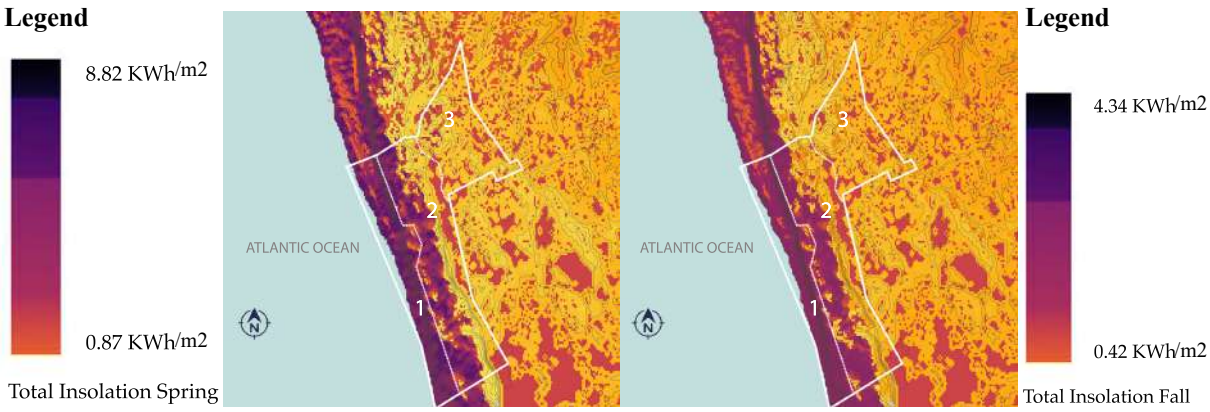


Figure 21- Sun Insolation Fall & Spring Equinoxes- Map Zone 1,2,3. August 2023: Source: Thesis Author

3.3.2.4. **Wind Exposure and Windward Effect**

In data collected for a yearly average from 2012 to 2022 (see fig. 22), the prevalent wind direction for the Area of Fonte da Telha is from the Northwest to Southwest direction, averaging between 8-12 knots in speed (approx. 14 to 22 Km/h) 60% of the year, which is considered under the Beaufort Scale Categories 3 & 4, representing ranges between gentle breeze to moderate Breeze; with a 20% wind speed of 12-17 knots (approx. 22 to 34 Km/h), placing this percentage between categories 4&5, from moderate breeze to fresh breeze; and, ultimately, having a 10% wind speed incidence yearly of 17-23 knots (34 to 46 Km/h), categories 6&7 between strong breeze and near gale.

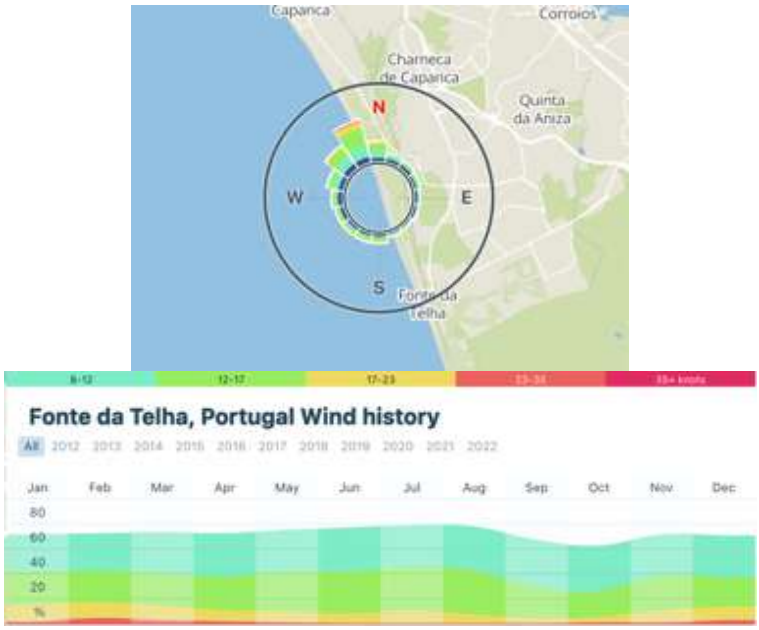


Figure 22- Wind Speed & Direction- Years 2012 to 2022. Map August 2023: Source: Windapp.com

The above-described data becomes very relevant to understand the wind GIS based analysis in terms of General Wind Exposure and Wind Effect Index. In both cases simultaneously the index scale is expressed in terms of 1 being the benchmarking factor, where above one there is exposure and below one the terrain is guarded from exposure [14].

This will inform the proposals in term of properly placing elements to respond and guard to this natural characteristic and take advantage of it when necessary. For Figure 23, the Wind Exposure Index presents the terrain vulnerability in terms of affectation to wind speed in general, therefore the map shows that the terrain on zones 1 and 2 are presented with a medium to high wind exposure, deeming zones 1 and 2 as exposed sites and area 3 being of a medium level exposure.

As a term of reference, the Wind Effect Index shown in fig.24, extrapolates the exposure to prevailing winds in terms of any value below 1 will indicate being shadowed or protected from wind exposure, and any value above 1, is exposure to the wind, therefore, by analysing the results in the map, the zones 1 and 2 are highly exposed to the prevailing wind direction which can result on higher levels of terrain erosions, in terms of assessment the area of the project is highly exposed to prevailing winds affectation.

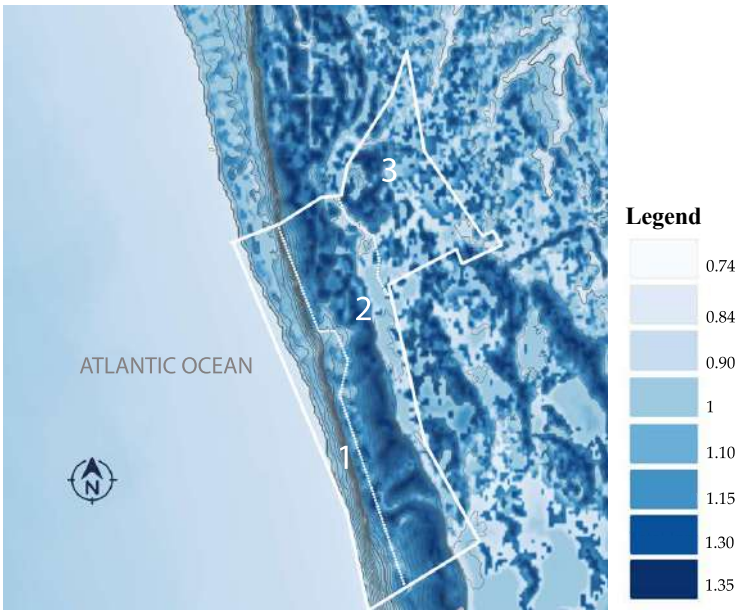


Figure 23 -Wind Exposure Index- Map Zone 1,2,3. August 2023: Source: Thesis Author

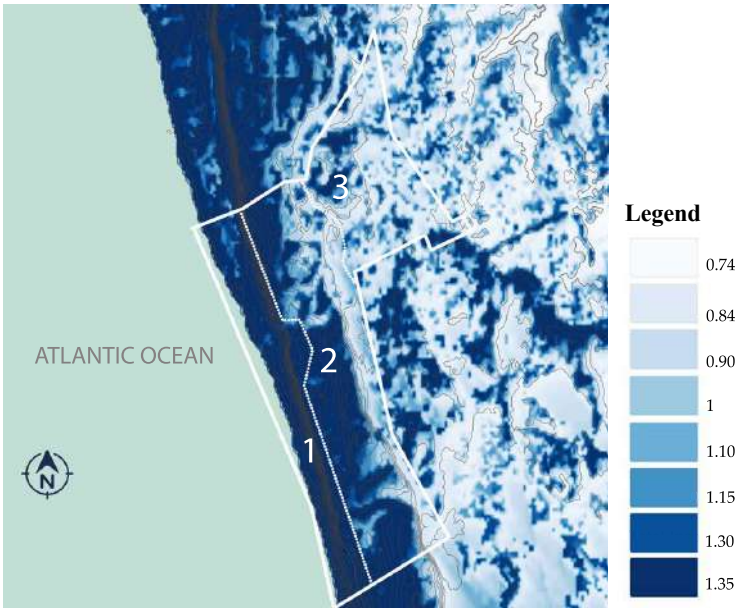


Figure 24- Wind Effect Index- Map Zone 1,2,3. August 2023: Source: Thesis Author

3.3.2.5. **Hydrology/Streams.**

The presence of the Costa da Caparica Fossil Cliff in this area, the proximity to the ocean and the natural slopes conformation, as it can be seen in fig 25, generates a series of well-defined streams in terms of flow accumulation are towards the ocean, which becomes the natural network channel that will empty out water during rain events. Additionally, it is important to highlight the need to perform a juxtapose evaluation this aspect of the terrain, in conjunction with soil conformation and a landslide probability assessment to obtain a delineation on high-risk areas and prevent any type of zoning for human activity or built environment where is marked by the resulting of high risks areas.

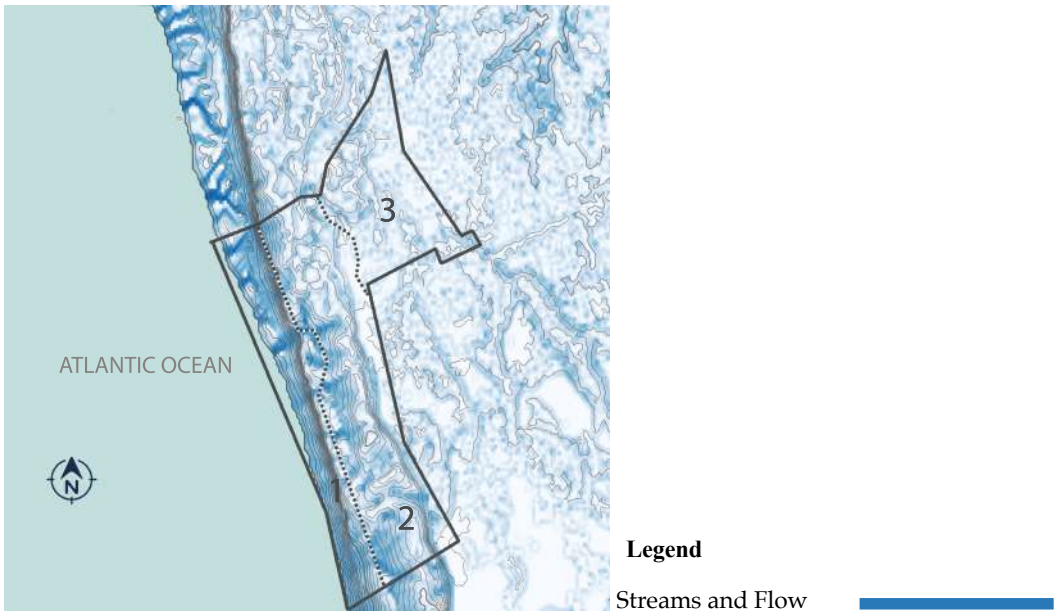


Figure 25- Stream and Flow- Map Zone 1,2,3. August 2023: Source: Thesis Author

3.3.2.6. **Flooding Risk**

In relation to the flooding risk assessment of the area, the initial evaluation is delimited to zone 1, since it is located on an a costal land in which its natural defense and adaptation system (the coastal dune sands) have been intervened and degraded by human activity (See fig. 23); regarding the other 2 areas, no data of a high flooding risk was found at the time of this work, henceforth, prioritizing the data input allocated on zone 1 is the basis of this appraisal. Therefore, the flood risk was analysed in the map presented on fig.26 under the basis of ocean encroachment projections due to climate change in terms of time progression

prediction. The foundation of the data relates to a creation and implementation of a costal monitoring system managed the Hydrologic Tejo Region (issued in 2013) [13], which implemented calculation methods for 2-time lapse horizons, 1 in 2050, and another one for 2100. Both calculations were based on an assessment on both elevation and horizontal variances in correlation the maximum sea level.

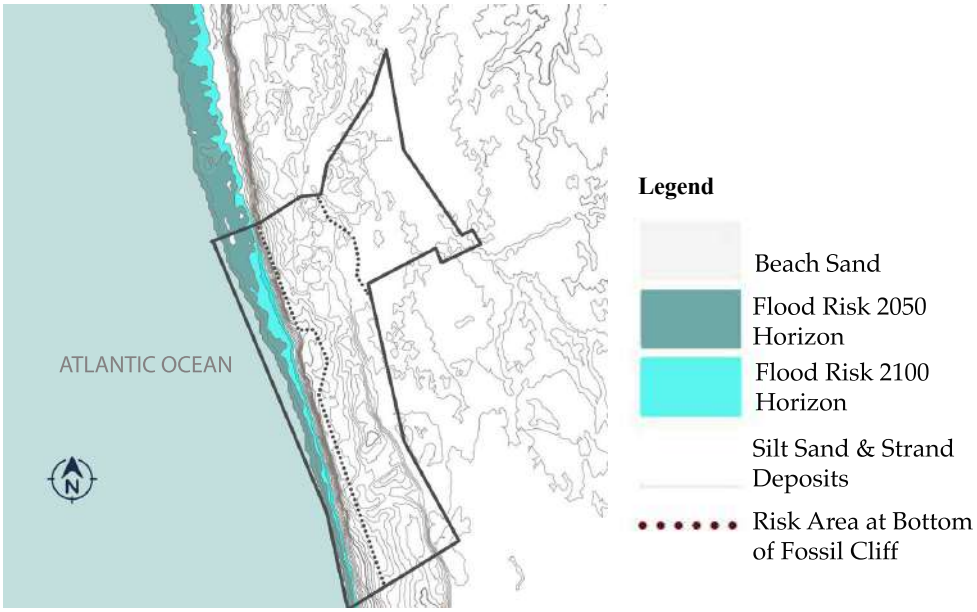


Figure 26- Flooding Risk Map Zone 1. August 2023: Source: QGIS software

With this projected data represented in the map in fig. 26, the assessment under that report is that by the year 2050 the maximum level of recoil achieved in a storm will be 17 meters and in the 2100 will be 19 meters; with a Maximum Sea Level for 2050 to reach 10 meters and by 2100 50 meters. [13]. It is also worth mentioning that the impact of such flood risk projections will be analyzed in a greater detail in section 2.3.4, where anthropogenic and natural risks are analyzed as a group of different factors generating multilayer pressure dynamics.

3.3.2.7. **Soil Type and Landslide Risk**

As previously referred in the Wind Effect Analysis, the prevailing winds interacts in a high-level wind effect index with the Fossil Cliff in Fonte da Telha, therefore it exhorts erosion pressure in its conformation, which do poses risks to any structure or activity located near its ridge, its exposed wall, or the foothill formation [2]. To the north part of Fonte da Telha, the cliff retreats from the sea, therefore the interaction with this erosion process is minimized in comparison to the south edge of Fonte da Telha, area in which the cliff is active and engaged in a more direct dynamics with the erosion process. This is outlined by the POOC Sintra-Sado which add Safeguard strips in both its ridge and its foothill to the ones previously established, which considered the landslide movement info from 1947 onward. [2]

Moreover, these safeguard strips are expressed in terms of setbacks of a 20 mts distance on the foothill and a 40 meters setback at its ridge [16].See fig. 27.

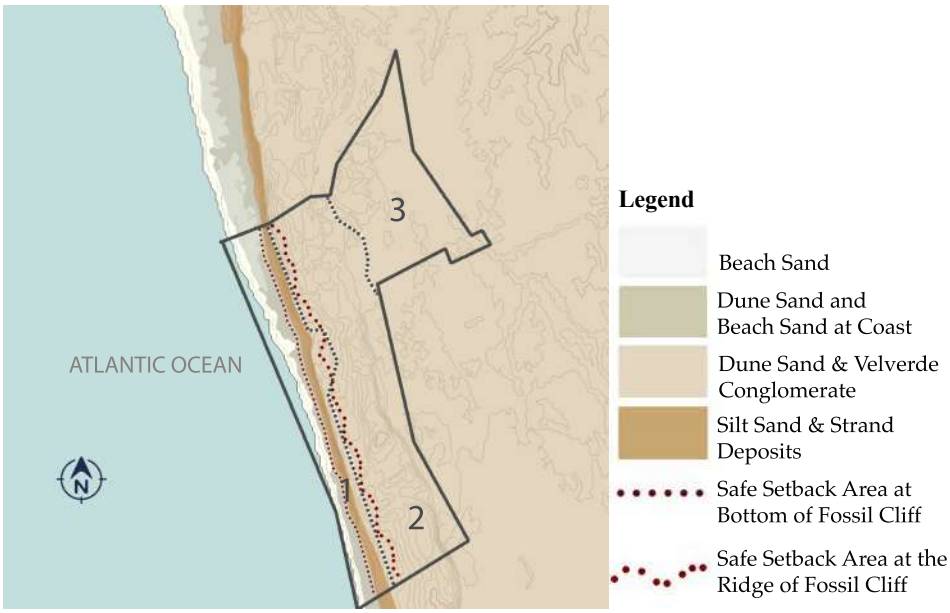


Figure 27- Soil Type and Landslide Risk Map Zone 1,2,3. August 2023: Source: Thesis Author

Furthermore, and in terms of unforeseeable risks, the variable nature of the cliff can be accentuated by extreme events such as earthquakes, heavy rain occurrences or by high continuous levels of erosion. In the aspect of heavy rain events and the streams and flows noted in fig.21, it can be assessed that a major flow specially in the south edge of the cliff (Fig. 28) can bring a substantial amount either of debris or landslide, therefore this area as well noted in both Plano de Pormenor de Fonte da Telha and the POC Sintra-Sado and POC-ACE will be of a high risk and consequently deemed not usable to be part of an active part of the proposal.

Figure 28- The Arriba Fossil Cliff of Fonte da Telha-Central and South Edge. June 2023. Source: Thesis Author

Of Mio-Pliocene age, the fossil cliff is made up of detrital and occasionally carbonated formations and its morphology evolved through the action of meteorological agents [2] , formed the presence of intense wind erosion and rainfall, and especially impacted in events of torrential runoff, due to the existent drainage alignments, and assisted partially by water infiltration, which is favored by some of the lithologies present. The friable nature of both the upper Plio-Pleistocene soils as well as its Mio-Pliocene ravined front, is associated with the chipping and collapse of masses of blocks, left in a cantilever situation which creates a very unpredictable high-risk area at its foothill [2].

3.3.2.8. **Biodiversity**

Defining the limits of the area of intervention for the project with the inclusion of a strong biodiversity presence, is a basic principle and framework to layout the foundations of the project intervention, envisioning how to integrate urban and natural spaces with a sensible solution, henceforth this vision encompass not only the coastal Area of Fonte da Telha which is part of the intervention limits within the POC-ACE and a REN denominated zone, but also includes The Mata Nacional dos Medos which was classified by Decree-Law nº 444/71, of the 23th October, as a Botanical Reserve [36].See fig.29.

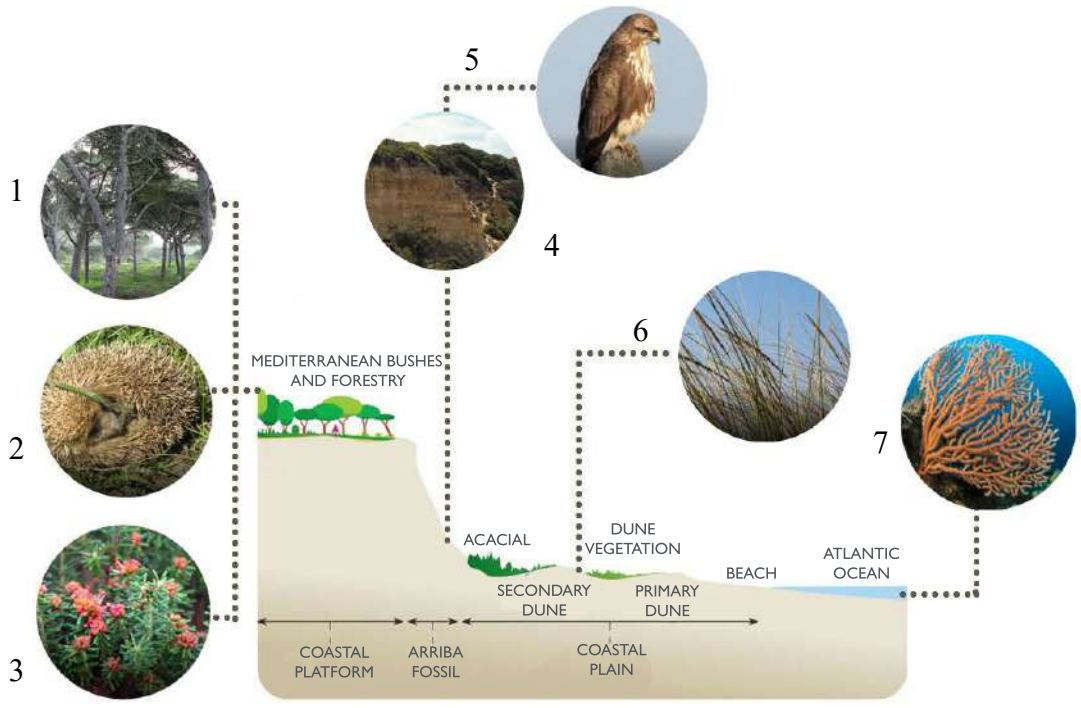


Figure 29-Sample of Biodiversity Species and Habitats Illustration-Zones 1&2 August 2023: Source: Thesis Author with Images from different sources.

1 Stone Pine (Pineus Pina) Wood Flora Matas dos Medos
2 Common Hedgehog (Erinaceus Europaeus)
3 Portuguese-Crowberry (Corema Album)
4 Arriba Fossil
5. Euroasian Buzzard (Buteo-Buteo)
6 European Marram Grass (Ammophilia Arenaria)

7 Soft Corals at "Lagoon Stone"-Fonte da Telha.
Sources for all images: 1-6: https://natural.pt/protected-areas/
7.- https://www.portugaldive.com/

The Mediterranean forestry was initiated under the rule of King D. João V, in the 18th century, with the intention of preventing the advancing of the dune sand into the higher agricultural land, therefore it could be used as a natural barrier by planting stone pines (Pineus Pina) and creating a tree blanket to fixate the sand and delay its advancing or stopping it. This Anthropogenic intervention converted into a natural habitat is now an important part of the Municipality of Almada natural heritage that promotes areas for leisure and recreation and that nests a variety of flora and fauna that make this area biodiverse and complements the lower ground of the dune system.
The prevalent banned for hunting assist with a fauna protection strategy that creates an area of refuge for some threatened species such as the peregrine Falcon and the long tail bat, the botanical reserve also house mammal species such as the common hedgehog and birds of prey as the buzzard [15]. In reference to the existing flora, one the most prevalent species are the before mentioned stone pine, the beach Sabina, the black hawthorn, and the strawberry, complemented by aromatic plants such as sage, rosemary, thyme.

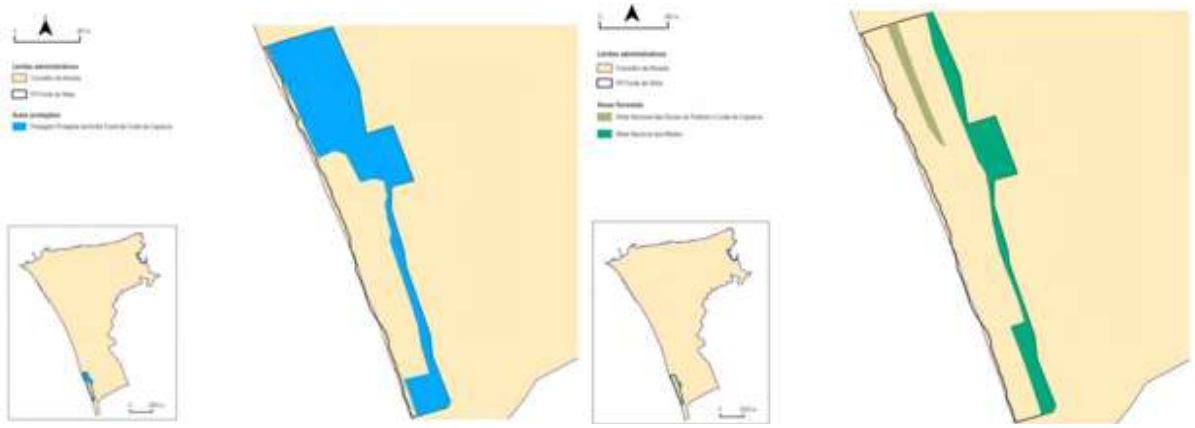


Figure 30 - Area of POPPAFCC Implementation Protected Status. **Figure 31 -** Existing Forestry Zone in Fonte da Telha. Source: POPPAFCC from ICNB Biodesign (2007).

In reference to the zone 1 of the project, placed within the administrative limits of Fonte da Telha, there is an overlap of different habitats and protected areas that intersect, rendering a natural biodiversity scheme of species and spaces. As shown on Figures 30 and 31, there is an overlay between the protected landscape of the Fossil Cliff of Costa da Caparica classified by the Decree-Law No. 168/84, of May 22, the West edge of the Mata do Medos Botanical Reserve and the southern portion of Mata Nacional das Dunas de Trafaria e Costa de Caparica. As a result, flora and fauna already considered in the previous paragraphs of this section are also present in zone 1, and due to the coastal conformation of the land there are new additional species shown prevalence such as Marram Grass, Acacias, and in terms of Fauna several bird species that hibernate and/or nest in the area are present such as the Red Perdix (Alectoris rufa) or a Garça Real(Ardea cinerea). [16]

Furthermore, the designation as REN (National Ecological Reserve) Fonte da Telha has environmental regulatory protection in terms of natural spaces and biodiversity, this applies to the dune systems and its importance to climate adaptation, and the protected landscape of the Arriba Fossil mainly due to its exceptional geological, geomorphological and landscape value, therefore, REN is a biophysical structure that integrates all the areas that, due to their ecological value and sensitivity or their exposure and susceptibility to natural risks [35], and in this sense construction shall not be permitted in these areas, which is not being complied with in the zone as seen on fig. 32.

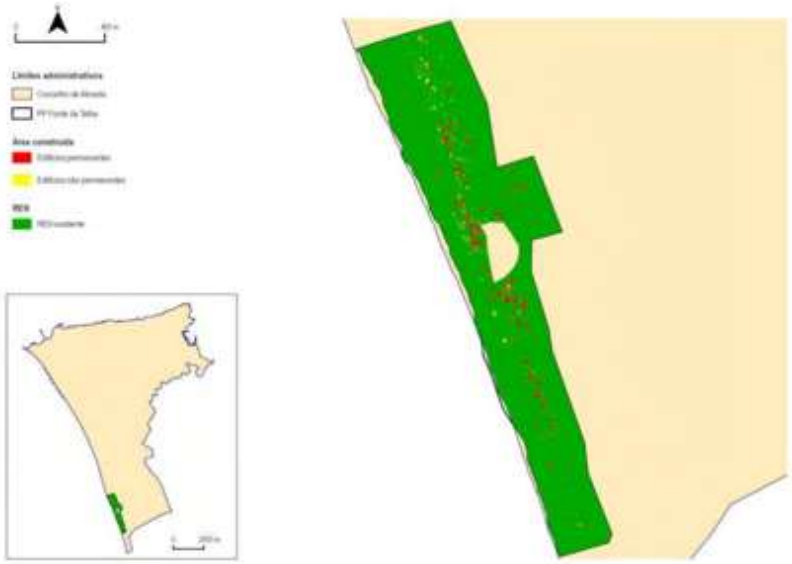


Figure 29

Figure 32- Existing Built Construction on National Reserve Ground 2015: Source: CMA (QP,2011); PDM ALMADA (CMA/DEGAS,2011)

3.3.3. **Land Use and Zoning**

Existing Land Use and Land Zoning map (Figure 33) shows that the area is majorly occupied by green spaces which are protected by either a REN (Natural Reserve Area), Decree-Law No. 166/2008, of August 22th; or by spatial planning urban area. At the moment, in zone 3, the land use is at 100% protected grassland area, that has been pre-zoned by the POLIS plan to be a relocation zone for the permanent camping dwellers located further north, and which, at the time of this work, remains as privately held land; zone 2 is majorly a green connecting buffer only occupied by pedestrian path and walkways within the Botanical Reserve of Mata de Medos and the protected Landscape of the Arriba Fossil, with just one governmental/service building (GNR Post) at the junction of zone 1 and 2, and a few main vehicle roads that traverse the area. Moreover, when zone 1 is analysed, it is observed that the Land use is determined only by scarce buildings occupation, without any zoning for such

structures being allocated, just a greenfield area mostly at the foothill of the Arriba Fossil cliff and connecting roads on top of the costal dune system.

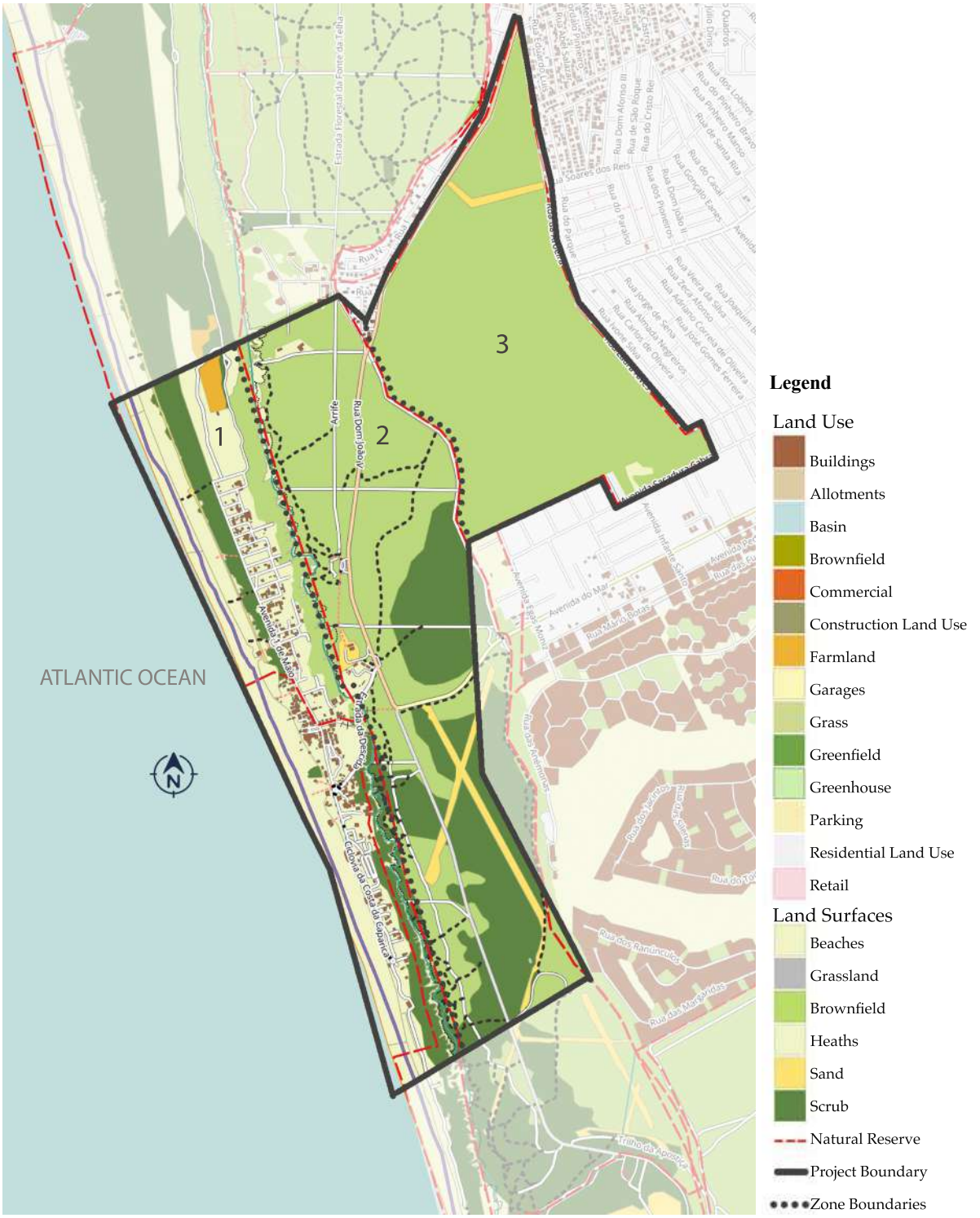


Figure 33- Land Zoning for Zones 1, 2 & 3. June 2023. Source: QGIS Software

3.3.4. **Existing Infrastructure**

One of the main indicators of a sustainable community is how well developed and thoughtfully conformed is the operating infrastructure, how well it protects its natural surroundings, what is the quality of the natural resources available on site after human intervention. In the case of specifically zone 1-Fonte da Telha, the existing infrastructure lacks presence. At the time of the development of this work, the most updated data found was located in the AAE do Plano de Pormenor of Fonte da Telha, according to these documents it is confirmed the absence of an existing robust infrastructure in several areas of high importance to the community.

Furthermore, the PPFT, exhorts the implementation of several measures to secure infrastructure in the area since it is non existing or precariously existent-Fig.34&35-, outlined below in table 1 a summary is found to showcase the data presented in both the AAE do PPFT and the PPFT released in 2015, of the state of integration and presence of each one of the urban infrastructures needed for a community to properly function and to prevent all source of pollution being of waste management, light pollution, or water runoff.

Figure 34& Figure 35- Existing conditions for Electrical Infrastructure. July 2023-Fonte da Telha, Source: Thesis Author

The envisaged reconfiguration of all the infrastructure system by the PPFT requires a considerable amount of investment for execution and implementation, to achieve a standard operating level in terms of an urban settlement and a tourist destination. This is now a pressing issue that needs immediate attention due to the degradation impact on natural ecosystems resulting from several sources of pollution that are left untreated or not routed properly. i.e., pollution of the quality of the beach water due to untreated wastewater runoff, pollution of the ocean thru a non-sufficient waste management plan that is not able to cover the demand and therefore releases solid waste onto the beach, ocean, or natural reserve.

Table 1- Existing Infrastructure Sumarization-Planned Intervention based on PPFT – Source: AAE de Plano de Pormenor de Fonte da Telha & Plano de Pomenor de Fonte da Telha. 2015.

Infrastructure	Existing	Projected by PPFT	Comments/Description
Waste Water	No	Yes	Non Existing/ Plan Proposal Included New Development of the system including Treatment Plant and grid
Storm Water	No	Yes	Non Existing/ Plan Proposal Included New Development of the system
Potable Water	Yes	Yes	Existing but insufficiently provided/Plan Proposal Included New connection to same inlet and distribution
Solid Waste Management	Yes	Yes	Existing but insufficiently provided/Existing plan is managed by the Camara Municipal de Almada.
Electricity	Yes	Yes	Existing but with insufficient Load/ Plan proposal to go underground.
Public Lighting	Yes	Yes	Existing but with insufficient Load/ Plan proposal to comply with light pollution parameters

The solid waste management system for Fonte da Telha is responsibility of the Camara Municipal de Almada Health Department, which oversees maintaining waste collection urban equipment, the maintenance of public spaces, and transportation of waste to the recycling facility or to the designated Seixal Landfill.

However, the municipality's solid waste management system is currently the responsibility of the multi-municipal company AMARSUL – Valorização e Importação de Resídos Sólidos, S.A., which has a concession to operate and manage the service for some municipalities on the south bank of the Tagus for a period of 25 years. years (from 1997), namely, the municipalities of Almada, Seixal, Alcochete, Barreiro, Moita, Montijo, Palmela, Sesimbra and Setúbal. AMARSUL has the following competences:

- Management of the Seixal landfill.
- Selective collection and transport of recyclable materials deposited in ecopoints;
- Treatment and recovery of urban solid waste (MSW) [4].

As shown on Figure 36, most of the solid waste collection is of common waste origin, and under indication by the AAE de PPFT all waste is sent to recycling, contributing with an approximately 7.2% on the amount of recycling done within the Municipality of Almada which is equivalent to 9 tons per year. This guarantees the lifespan of the landfill; this scheme is more sustainable than the previously applied, due to conventional methods of not recycling and waste; and by using that methodology shortening the landfill use expectancy, it is still not achieving nor proposing a new objective of generating a path for either upcycling or a creation of a path for a circular economy.

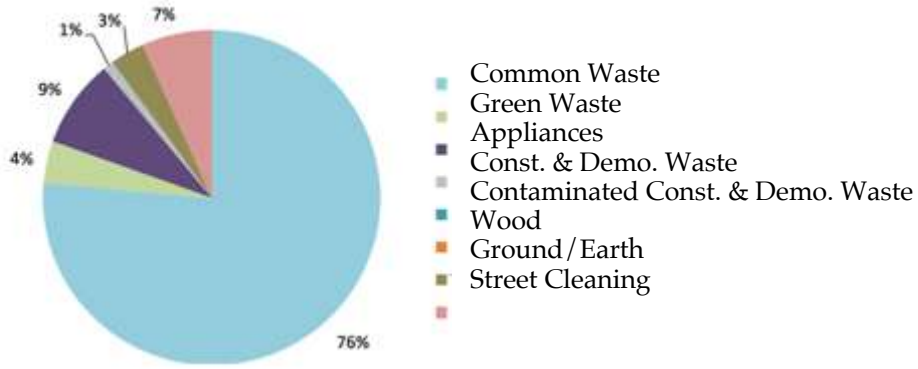


Figure 36- Solid Waste Management Estimation by Type-Fonte da Telha, 2015. Source: AAE Plano de Pormenor de Fonte da Telha.

In refence to table 2, the summarization of basic public health infrastructure was at the time of the data of no robust presence, since the only item to be perceived as full coverage is only distribute partially, with illegal connectivity to several of the building in the areas, (residentials and commercial) therefore control, expansion, improvement of the potable water network is at best precarious [11]. Additionally, and analysing the other aspects of the table it can be concluded that the rest of the infrastructure needed to obtain a minimum operating sustainability environment is non-existent or of very little presence or spread.

Table 2.— Infrastructure Sustainability Index Synthesis – Source: AAE de Plano de Pormenor de Fonte da Telha,2015.

Indicator	Existing Condition	Year of Collected Data	Source
Potable Water Quality	99.78%	2011	ERSAR
Potable Water Supply Rate (%)	100%	2011	CMA (DEGAS)
Wastewater System Coverage Rate	0%	2011	CMA (DEGAS)
Rainwater Coverage Rate	0%	2011	CMA (DEGAS)
Recycling Rate and Upcycling Value	Recycling: 7,2% of total waste 9,3% of Common Waste Upcycling Value: 0%	2010	CMA (DEGAS)
Waste Disposal Equipment Non recyclable per 1000 inhabitants	71 non recyclable equipment per 100 inhabitans	2011	CMA (DEGAS)

3.3.5.**Transportation and Mobility**

In terms of transportation and mobility, this document outlines the existing road infrastructure in which all the transportation method existing in the area can occur. This interpretation of existing condition is a collection of merged information through empiric means (use of the transportation system during site visits) and complemented with Information provided from the DEM model and QGIS. As depicted on figures 37 and 38, the area of the work is connected directly by different levels of roads hierarchy, the primary road that connects and traverse zones 1 and 2 with Costa de Caparica on the axis north-south is N-377, also known as Rua Dom Joao V; on the axis east-west the project zones connect to Aroeira by a secondary road named Av. Do Mar that also extends to the area called Belverde, both road merge into tertiary road that compensates the level difference between the Arriba Fossil and Fonte da Telha beach road is named Descida da Fonte da Telha, which interconnects with the road built in 2020, that is also a tertiary road with double dead ends named Av. 1 de Maio which traverses Fonte da Telha from North to South and sits on the coastal dune system.

Figure 37 & Figure 38 Transportation and Mobility-Zone 1,2&3. June 2023. Source: Thesis Author-Software QGIS

This road was part of a debated approval process not accepted or reviewed by the Portuguese Environment Agency (APA) and was justified within the Decree-Law 97/2018 that gives administrative competence to the Camara Municipal de Almada to manage all the beaches and coastal areas within its territory, and which subsequently legally framed the road construction within the (POC-ACE) as Fonte da Telha being designated as a Urban or seminatural beach, and in fulfillment of Article 11.º - Type III - semi-natural beach: 2 – Road accesses and parks and parking areas must be delimited and have permeable or semi-permeable pavement." The road was built with semipermeable bituminous material. The remaining roads of Fonte da Telha are made from compacted dirt, which also conforms all

the parking spaces that exist in the area, which are filling all the voids lefts after the forced removal of previous residential units.

Relating to the mobility of the area, the connection mostly relies on single user cars, which, during summer months, generate a high level of traffic and congestion; "according to the Study on Transport and Parking for Praia da Fonte da Telha, it is estimated that the maximum occupancy on a weekend day is around 10,000 people, in the summer season" [11]
This level of occupancy in conjunction with a two no-end street generates city like situation in an area where most of the land is nature or open space. Furthermore, and analyzing other methods of Public Transportation, the area is being served by 5 Carris Metropolitana, lines which are mentioned below on Table 3, all of these lines offer weekday and weekend day service [35], while some of the lines provide a more frequent service in the summer during music festivals and events, however in no sufficient fashion to cover the demand in the high summer season.

Table 3-Bus Lines Connecting Fonte da Telha– Source: https://www.tsuldotejo.pt/index.php?page=viajar. Accessed on August 28. 2023

Bus Routes- Fonte da Telha

3012	Cacilhas (Terminal) - Fonte da Telha
3030	Fonte da Telha - Monte da Caparica (FCT)
3521	Cruz de Pau - Fonte da Telha
3522	Fonte da Telha - Paio Pires (Centro)
3523	Fonte da Telha - Paio Pires (Quinta Flamância), via Seixal (Terminal Fluvial) e Foros de Amora (Estação)

In the areas of soft mobility ,the Municipality of Almada is projecting new bicycle lanes that will connect Cacilhas and Trafaria with Fonte da Telha, at the time of this report the connection is still being developed, and it will be done at the beach level, however the connections coming for the Arriba Fossil and N-377 has not been developed, according to the POC-ACE, a strategy needs to be developed to obtain this connection, especially to give a response to bringing bicycle up to N-377.

Furthermore, and in alignment with the recommendation from POC-ACE, POLIS, PPFT and the POC-Sintra Sado, the DEM model highlights the projected Light rail/Tram line prowhich is to have its final stop at the north end of Fonte da Telha, which will increment points of intermodality, which now are not present in the area.

3.3.6.**Natural Risks and Anthropogenic Processes Hazard.**

Based in the Over wash and Ocean Flooding in Portugal: with the case Study in Fonte da Telha [13] An edification inventory was produced (See fig. 39), to be able to determine the use of the existing structures in the area and therefore gauge the permanence occupancy aspect of the possible affected area, then this information was simply overlayed with the projected flooding lines for the Projected 2050 and 2100 horizons, this gave a percentage of affected structures of 70%, with most of the permanent occupied structures being of residential use. See table 4 for detail. In this aspect it can be conclude that the risk of flooding is high for the next century, and looking at the existing urban conformation where all structures are spread out, therefore in a flooding event the effects will be unrestricted or deviated by any protective structure. In other words Anthropogenic processes such as Land Use changes, removal of protective ecosystems such as the dune systems when they interconnect with natural hazards, amplify the effects and consequences [13].Additionally, and as previously mentioned, due to very high erosion patterns affecting the Arriba Fossil Cliff, especially on his south edge, there are very high risk of landslides in mass, and this is reflected in the classifications of risk given by the POC-ACE in its territorial model map.

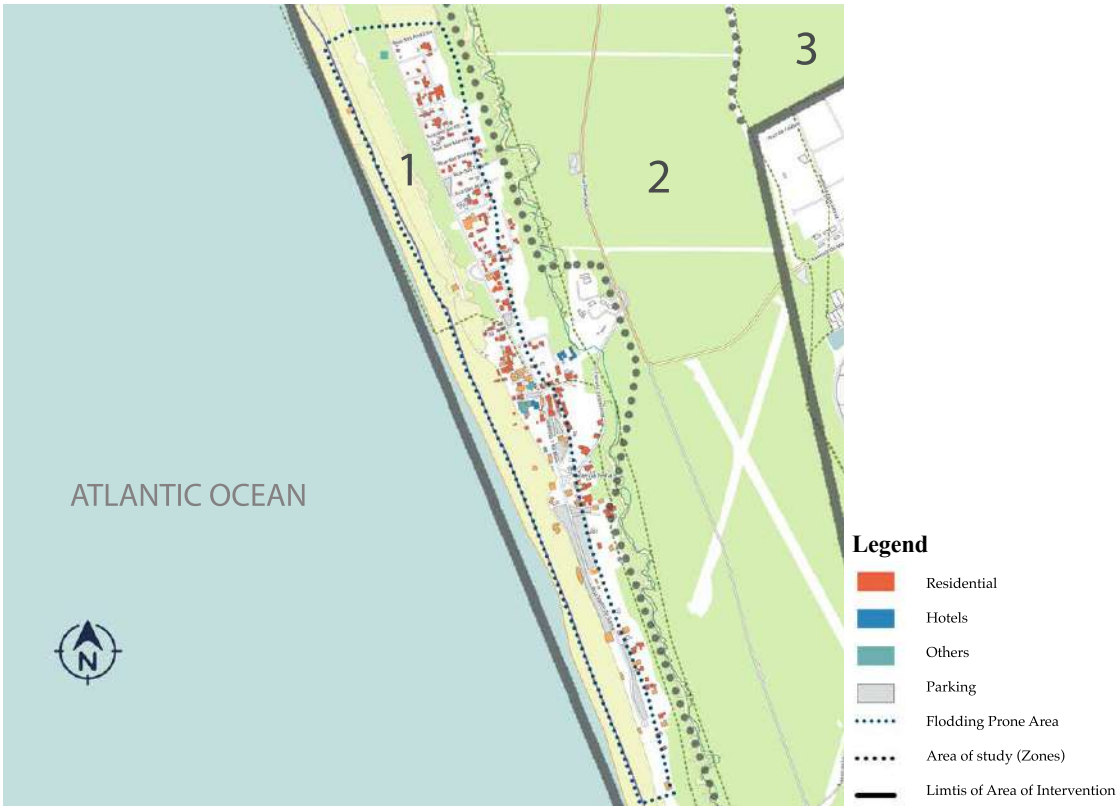


Figura 39- Exposed and Non-exposed built elements in Fonte da Telha. Source: Thesis Author. Software QGIS and Overwash and Ocean Flooding in Portugal: Case of Study Fonte da Telha, Costa de Caparica. 2022

Also, it is necessary to consider that there are anthropogenic hazards [9] affecting Fonte da Telha, with the most impactful being the environmental ones that can be classified in two major categories the solid waste creation polluting land and the ocean in a continuous stream, and specially of plastics with due to location are in direct contact with the Ocean. However, it is valuable to mention that according to the PPFT there is in place a waste collection system, however, recycling is insufficient, and upcycling is non-existent, the amount of urban equipment does not cover the needs especially in the summer months when the occupation in the area rises to up to 10,000 people a day [11]. Moreover, the absence of a wastewater system in a residential area with high influx of tourism activity as mentioning in the AAEE of the PPFT, creates a pollution hazard that can percolate to land and ocean water and create a health risk for both local and visitor population.

Table 4— Accounting of Exposed and Non-Exposed elements in Fonte da Telha. Source: Overwash and Ocean Flooding in Portugal: Case of Study Fonte da Telha, Costa de Caparica. 2022.

Element Type	No. Elements	No. Inside Flood Area	No. Outside Flood Area	Affected (%)
Residence	167	109	58	65.27
Restaurant/ Coffee Shop	32	27	5	84.37
Parking	192	9	0	100
Hotel	2	0	2	0
Other	2	1	1	50
Total	222	156	66	70.27

Figure 40- A fisherman holds a net sewing tool. Fonte da Telha. August 2023. Thesis Author

3.3.7.**Social and Demographic Data**

At the time of this work, the area of Fonte da Telha did not show any population data directly from the census that was executed in 2021, it only represented the population data of the county of Charneca de Caparica e Sobreda, therefore the following analysis is based from the Census number performed in 2011 (Table 5) [15] , which did have a breakdown of a detailed social and economic information, in it is concluded that the total population at the time was 405, in which the majority of the population belonged to the 25-64 bracket, with children between the ages of 5 and 9 years old being the smallest proportion within the population. Additionally, it can be noted that, out of the 319 residential units 100% were of illegal genesis, and considering that 175 people were employed, back in 2011 the prospects of the areas in terms of development were not in the sustainable in term of economic growth.

In this sense, and due to the lack of available verifiable data, the conclusion on these aspects is by empirical observation, reversing the trend of the economic stagnation of the area, the uptick in the tourism industry is giving way to a renewed in a relevant economic growth, however, the distribution in terms of employment and benefits to the resident community are hard to assess at the moment of this study.

Table 5- Socio-Economic and Sustainability Data for Fonte da Telha- Source PPFT. 2015

Indicadores	Situação Atual		Ano	Fonte
Estrutura etária população residente (n.º)	Grupos Etários (anos)	N.º residentes	2011	Censos 2011, INE.
	0-4	19		
	5-9	14		
	10-13	20		
	14-19	28		
	20-24	27		
	25-64	220		
	+65	77		
Edifícios segundo o tipo de utilização (n.º)	Edifícios Clássicos: 319 Exclusivamente Residenciais: 300 Principalmente Residências: 15 Principalmente Não Residenciais: 4		2011	Censos 2011, INE.
Edifícios de génese ilegal (n.º)	319		2013	CMA
Espaços não impermeabilizados (ha e % em relação à área total do PP)	58,59ha de área permeável (69% do total da AI do PP) - 3,59ha de área totalmente impermeabilizada - 22,30ha de área parcialmente impermeável		2012	CMA
Densidade do edificado (n.º/km2)	3,77 Edifícios por hectare		2012	CMA
Ações de ordenamento urbano concretizadas no âmbito dos IGT´s em vigor (N.º)	0		2013	CMA
Sazonalidade Turística (n.º de visitantes na época balnear)	2018 Utentes			POOC Sintra-Sado
População empregada por setor de atividade (n.º; %)	Setor primário: 51 empregados Setor Secundário: 16 empregados Setor Terciário: 108 empregados		2011	Censos 2011, INE.
Embarcações de pesca licenciadas (n.º)	n.d.		n.d.	n.d.
Empresas por setor de atividade (n.º; %)	Setor Primário: sem dados Setor Secundário: 30 empresas Setor Terciário: sem dados		2011	QP, CMA.
Equipamentos de apoio às atividades económicas (n.º e localização)	10 Apoios de praia Edifícios de apoio à pesca		2013	CMA

3.3.7.1. **Previous Surveys**

During the Diagnostic Phase for the Plano Pormenor de Fonte da Telha [11], there were surveys executed to look at the social conformation of the population. In these, the data were of particular significance in already showing a new trend, that was already being re-initiated regarding increment of population and not being part of the Fisherman community. See table 6 below. In it, 51% of the population was dedicated to other forms of economic activity but were not part of the fisherman community.

Table 6- Family Conformation and Time of Residence in Fonte da Telha. Source: ELABORAÇÃO DO ESTUDO DE CARACTERIZAÇÃO, DIAGNÓSTICO PROSPECTIVO E DEFINIÇÃO DOS TERMOS DE REFERÊNCIA PARA A ELABORAÇÃO DO PLANO EQUIPA TÉCNICA.2011

	Famílias	Indivíduos	Dimensão do agregado familiar						Anos a residir na Fonte da Telha								
			1	2	3	4	5	>5	<5	5-9	10-19	20-29	30-39	40-49	50-59	>60	ns/nr
Comunidade piscatória	70	215	8	17	18	18	7	2	5	6	11	16	13	10	5	3	1
Restante população	86	218	19	32	13	16	4	2	10	4	10	14	27	8	6	1	6
População total	156	433	27	49	31	34	11	4	15	10	21	30	40	18	11	4	7

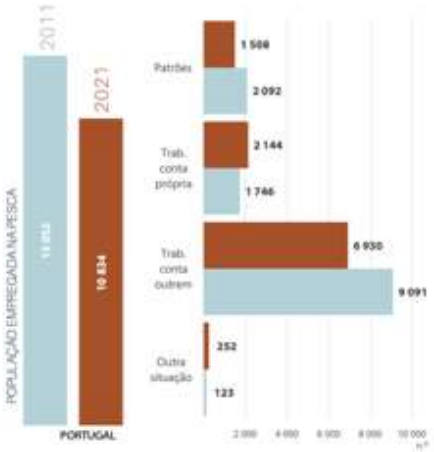
Fonte: Quaternaire Portugal – Inquérito realizado às famílias residentes na Fonte da Telha -tratamento QP (2010)

In this sense, it can be concluded that the fisherman community was at the time of the survey being outnumbered and by analyzing the data, the more numerous families were not part of the fisherman community. Therefore, if we combined the amount of people and the number of residential units by the time of the conclusion of the PPFT, we can determine that the inhabitants with the right of staying in Fonte da Telha will require between 70 to 100 dwelling units to cover the demand for the proposal.

3.3.7.2. **Fishing Economic Outlook.**

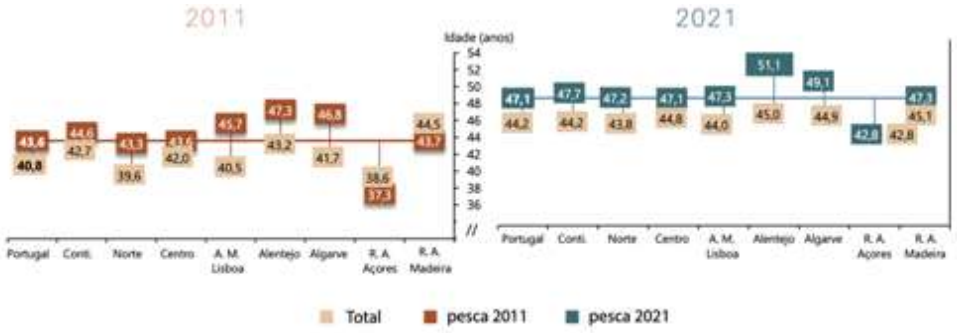
To analyse the major economic activity for the inhabitants who are rightful dwellers of the area, and that is protected by the government as a cultural asset, is essential to understand the basic dynamics and the true sustainability outlook this population faces. The source of information obtained in this aspect relates to nationwide data, not specifically to the area of Fonte da Telha, and is based by the Estatistica de Pesca published by INE in 2023 [8], in it is firstly observable that in the last decade that the population in this economic activity has decreased by approximate a 25% rate, as seen on Table 7, with only a marginal increment in terms of percentage under independent worker activity.

Table 7- Resident Population Involved in the fishing Economic Activity. ESTATÍSTICAS da PESCA. INE .2022



Additionally, in comparison the medium age of the population in the Lisbon Metropolitan Area is the 47.3, and has not decreased nor increase in a decade, making the activity not being replenish by a younger generation [8]. See Table 8 Below

Table 8-Employed Resident Population Median Age in the fishing Activity, Source NUTS II.2021



This dynamic becomes more relevant when the number as total in metrics tons are analysed, In the report before mentioned, It shows a decrease of catch in one decade (From 2012 until 2022) from 151343 tons to 121069. And with a reduction of prices in the fish catch and a marginal gain in crustaceous and molluscs [8]. All this scenario has an additional structure where the fishing activity is government regulated in term of prices and market [8]. With this economic backdrop in general, it can be concluded, that regardless of the protection of this cultural trade, the economic sustainability of this population is in question.

4. STRATEGIC DIAGNOSTIC, SWOT MATRIX, AND OBJECTIVES

The purpose of this diagnostic is to outline the basis in need of response to move forward with a proposal for the area of Fonte da Telha, after highlighting the most relevant aspects in the SWOT matrix found by a previous site assessment and as it is shown below on figure 41.

Figure 41 -SWOT matrix. September 2023. Thesis Author

Subsequently, these diagnostic elements are hierarchized in terms of consideration for elaborating the main pillars of execution of the urban plan proposal, and how on their own progression and history, the area justifies a new approach that might relate to a nature-based solution and that searches to reverse the damage done to the ecosystem.

Under consideration of the elements previously mentioned, this diagnostic aims to itemize the relationship between the unauthorized urban development, coastal dynamics, environmental degradation, and the possible effect that these variables can induce in the social aspect of the fishermen community. At a first glance, the site analysis and SWOT matrix data reveal that a direct causal relationship between the urban development and biodegradation phenomena is directly linked, and this occurrence is due to the fact that, along the years, Fonte da Telha coastal area has not been protected of pollution, illegal built environment, land appropriation over the dune system, and unregulated tourism economy. But in a secondary layer of consideration, the social fabric that is connected to the genesis of the area is also under pressure, the fisherman community having a protected status under their cultural heritage way of fishing (Xavega Fishing Art) [23], and being considered rightful occupants of the area, finds itself without any recourse on protecting their economy, and a way of living in Fonte da Telha [23], to have a sustainable future. And in this sense, the juxtaposition of all these elements highlights the inefficacy of spatial planning tools enacted.

As previously mentioned, the considerations of outmost importance for the coastal town of Fonte da Telha and its surrounding environment after being summarized in the SWOT matrix are as follows:

- The sprawling of illegal settlements in both residential and tourism use needs to be addressed, as it is creating a new iteration of environmental degradation, pollution, and overloading the capacity of the ecosystem with the human activities in the area.
- The local fishermen population is lacking a viable solution to sustain their way of life, so the proposal previously presented in the PPFT and the POC-ACE of keeping them in the area without a full consideration of what is to have a healthy environment to thrive, is an insufficient plan of action that does not provide an alternative for the population to move, relocate or integrate themselves in the environment that surrounds them.
- The inexistence of a well-planned infrastructure is giving way to the increment on pollution for both land and sea; this is particularly noticeable in the way residues are being handled, the lack of sewage system for a population that has occupied the space for decades, and, at the time of this dissertation, being aggravated by the increment in density in both permanent and visiting population.
- The lack of control and enforcement in the area, in what refers to the existing regulations and the developing of new effective one, creates a perfect scenario of abuse of the land use, the exploitation of the resources, and allows for the anthropogenic pressure impact to be greater.
- The area has a high potential of developing a sensible approach to tourism, with a general interconnected plan that respects the natural habitat that conforms the area; there are multiple factors that contribute to this process, such as the Costa da Caparica

fossil cliff, the forestry of Mata dos Medos, the ocean, the dunes system. It is compilation of natural elements with an extensive habitat that can be enjoyed in a symbiotic relation with humans. Currently, there are some existing tourism-focused plans for the Matas of Medos.

- Mobility is an area that calls for a new approach in Fonte da Telha, in terms of public transportation frequency and options, soft mobility offer, intermodal connection, and a regulatory framework to restrict the use of individual based automotive transportation, to minimize and mitigate the damage that this flux generates, in terms of air and sound pollution, since it is most used to access the coastal part.
- The iteration of the previous spatial and social ailment of the area, which keep repeating and that are outlined in the historic timeline of the settlement, present an opportunity to envision a new way to find a solution that can attempt to integrate multiple and circular approaches to protect the immediate environment, and to stabilize the unregulated growth. As a principle, the solution cannot just be overseeing a stop to the transgressions that are implemented in the area, but it needs to find a way to reverse this damage, and to insert some of the surrounding elements to make the ecosystem stable, and with that maintain a possible strategy to adapt to climate change.

Undoubtedly, the aims of the proposal are to address the detailed elements before mentioned, with a pragmatic representation, in terms of actions to be implemented. These factors shall be inserted within a regenerative design theory framework to yield a spatial planning which has a target projection of reversing the harm done to the ecosystems of the area.

OBJECTIVES

- To create a spatial plan that is an integrated system and in which the restoration and regeneration of the depleted area for both nature and humans is addressed, returning them into a healthy ecosystem; set on the foundations of regenerative living system design and development theories.
- To implement at the operational level solutions in term of infrastructure, energy solutions and functionality at a minimum within a sustainable level, but at all possible with a surplus of production or re-use to generate a cycle of self-reliance.
- To provide a built environment that achieves a sense of place and that becomes an integrated feature into the nature of the site, assisting to achieve its potential.
- To utilize renaturation strategies to integrate both nature and human habitat, especially in areas where risks need assessment, to mitigate the effects of climate change and to make the human factor better guarded against this man made.
- Implementing the basic principle defined within the regenerative design concepts, where “human is nature” and in that sense give the fisherman community the front stage to manage the transformation of the town of Fonte da Telha. Allowing them to be participant and the major stakeholders within this transformation to release the anthropogenic pressure that is depleting the area.

5. A REGENERATIVE URBAN PLAN FOR FONTE DA TELHA UNDER THE THEORY OF LIVING SYSTEMS.

5.1. Resilient Transformation: Built Operation and Maintenance.

As elaborated in chapter 2, the urban proposal of Fonte da Telha is based in the outlined levels of work within the theory of living system regenerative design, the use of the different elements that are the practical strategies within this framework and those of applicability for the project; thus, the proposal is initially looking beyond the administrative boundaries of Fonte da Telha, and outreaches the implementation of a system within the limits of the project defined in chapter 1, which are divided in the three zones shown on Fig. 42.

Therefore, the plan aligns itself first and foremost with the main principles of regenerative design and development shown previously on fig.41, and under that scope, the design implementation in any of the built environments cannot go below the sustainability threshold, which can be translated but is not limited to:

- All buildings and infrastructure within the project need to be NET zero at a minimum, preferable NET positive.
- All energy sources shall be locally produced with photovoltaic panels as the sun exposure and isolation factors assessment in section 1, demonstrate the capability to produce sufficient energy to have a daily surplus, especially if roof surfaces are utilized for this purpose.
- All buildings shall harvest and reuse rainwater to minimize the effects of using the public water sources.
- Blue and green infrastructure are mandatory design principles for all sites to take advantage of water streams for consumption, irrigation, or flood prevention.
- Renaturation practices shall be applicable in all ecosystems found to be degraded due to human occupation, such as dune system reforestation principles developed for the Costa de Caparica [27]:
- Development of Permaculture practices are addressed in Fonte da Telha to re-implement part of the liveable scheme the area had when the first settlers arrive, who lived of fishing and agriculture.
- Passive design is mandatory for all residential building, to mitigate the use of energy consumption.
- Materials used in the project, shall be of low or zero carbon emissions.
- Agricultural Irrigation system shall be powered by the renewal energy resources obtain thru the photovoltaic panels

Figura 42- Regenerative Plan Proposal for Fonte da Telha. Land Use. Sept. 2023. Thesis Author

- Exterior materials shall be of High Solar Reflection Index to mitigate Heat Island Effect, this include pavers for walkway, bicycle lane and roads, which should be of pervious composition to avoid water runoff, and water source pollution.
- Soft mobility such as walkways, and bicycle lanes interconnecting all nodes and areas.

All the before mentioned practices and requirements just form the basic elements to safeguard the fulfilling in material terms of a regenerative plan, because it contains in it the elements of fulfilling the level of operation necessary to achieve a resilient, self-reliable transformation.

The level of work that covers the maintenance bracket is related to the sense of place and what can, and cannot be touched, and how it needs to be executed; it inserts its first connection on how humans and nature interact in a spatial realm, and in that sense, the zoning (see fig.42) illustrates which is firstly viewed as a system that extends beyond the administrative boundaries of Fonte da Telha, and it touches several layers related to the Evolution Level of Work and the Regeneration level of work, complying with the way of thinking and working for the living system theory. The content of the land use proposal is as follows:

Zone 3-Node A:

- Private and Public Partnership Development on area shown, promoting cooperation, as land is owned privately, but zoned for the relocation POLIS project.
- Underground Parking lot to allow the control of vehicles entering in the area and providing a transportation scheme managed by the municipality/locals or both.
- Governmental and civil buildings to allow for emergency systems.
- Low-density healthy diverse typology housing to relocate the population not allowed to stay at the coastal zone 1. This contentious point is under the umbrella of lowering the effect of what is defined as illegal settlements for the population who cannot afford dwelling units, so that the residential area can be inclusive, covering different social realities, but can also be differentiating and attractive to the local community.
- Medium size retail serves the population not only of Fonte da Telha, but also the surrounding population.
- It provides the first new modal method of transportation with an aerial lift possibility, to minimize impact of volume on the ground and to allow the view which is one of the strengths of the area.

Zone 2-Node B:

- Intermodal point for bicycles and aerial lift, as well as walkway to the coastal zone 1.
- Area of refuge, observation, or leisure.
- Punctual retail for the area of refuge.

Zone 2-Node C:

- Intermodal point for bicycles and aerial lift, as well as walkway to the coastal zone 1.
- Area of refuge, observation, or leisure.
- Punctual retail for the area of refuge.
- Vehicle control enforcement.

All these three nodes are always interconnected by soft mobility path and integrate the exploring in nature walkways that interconnect all the aerial lift stops are.

Fonte da Telha Zone 1:

The Fonte da Telha zone 1 land use plan is the main focal point of the regenerative urban planning design, containing more elaborated aspects that cover the essence of the regenerative living system approach, since it does not end with the construction or design of the last building, it prepares the path for activities to occur and be decided by the local remaining community that involve the regeneration of the habitats. To elaborate further, the Zone is presented with structure described below.

General Interconnected Components:

- Connected elevated or pervious walkway on the dune systems (see fig.45).
- Urban Equipment related to sustainable buildings that provide public facilities or retail connected by the walkways (restaurants, cafes, among others).
- Expansion of the bicycle lane to connect directly to the Costa de Caparica.
- The completion and reactivation of the Tram line that connects Costa de Caparica and Fonte da Telha.
- Beach Dune nourishment along the whole extension of the plan.
- Agricultural land at both ends of the plan to indicate, beginning and end of the village.

Zone 1 Node D:

- Civil Building that will count for visitor information, small clinic, and administrative office for the Almada Municipality in Fonte da Telha.
- Urban Equipment that will provide Beach services.

- Retail area at entry.

Zone 1 Node E:

- Fisherman Housing Village with passive house design standards and with different modules and layout adapted to topography.
- Fisherman Drydock Area to safeguard and maintain the economic activity.

Zone 1 Node F:

- Fisherman Housing Village.
- Farmers Market and Civic Center to allow catch and fresh produce sale.
- Tram Final Stop and Retail associated with it.
- Area for developing a composting Program.
- Upcycling center to develop a circular economy program.
- Permaculture land to restore and recuperate the soil and provide healthy food.

Zone 1 Node G:

- Area for developing a composting program.
- Permaculture land to restore and recuperate the soil and provide healthy food.
- Hospitality economic activity to be managed and directed by the local community thru an integrative process solution.

All these detailed land uses of proposed for Fonte da Telha will be further elaborated under the evolution and regenerative levels of work.

5.2. **Renaturation: Implementation and Evolution**

For the regenerative plan of Fonte da Telha, there are 3 specific areas with a prospect of renaturation. In other words, an attempt to return these swatches of land to condition similar to its previous habitat, and they belong to the sector that correlates to restorative design and to the evolutive level of work; these areas are of particular importance, because they could become, along with the local community, interactions in elements of a circular economy, or simply be part of a climate change mitigating system to be maintained. Furthermore, the areas that are programmed for the renaturation activities are:

Zone 1: Permaculture - Agricultural Use:

The production of food in conventional urban planning is hardly ever addressed [31]. A systems approach would require the incorporation of food as an essential part of the planning system to make the plan self-sustainable and reliable.

Recently there have been new works presenting new theories for regenerative agriculture (Massy,2017) who itemizes its principles such as [30]:

- Maximising the capture of solar energy by fixing as many plant sugars as possible via photosynthesis.
- Improving the water cycle, maximising water infiltration, storage and recycling in the soil.
- Improving the soil-mineral cycle by creating healthy soils that contain and recycle a rich lode of diverse minerals and chemicals; and
- Maximising biodiversity and health of integrated, dynamic ecosystems at all levels

That is the aim of the area of Permaculture/agricultural land use within the plan, so it can fully align with the level of work in restoration of the soil. See location on fig. 43.

Zone 1-Beach and Dune Nourishment:

The aim is to continue and extend the plan traced for this process already in motion in Costa de Caparica, and under an integrative process approach, utilize this activity to initiate a trend of eco-tourism, where visitors can stay in the village if they assist with the process of beach and dune restoration. The execution of this process is of high importance in because is the natural protection barrier the local community must mitigate the risk of flooding from the ocean.

Zone 1 - Renaturation Buffer.

The aspirational goal is to replace any vegetation lost right at the edge of the cliff base to thicken the protection against possible flooding or landslide, accompanied by natural water basin to take advantage the natural water sources that can be use in the irrigation of the agricultural area.

Figura 43- Regenerative Plan Proposal for Fonte da Telha. Spatial and Built Enviroment. Sept.2023. Thesis Author

5.3. **Regeneration: A community of Practice**

There is no regenerative design or development occurring, if the human factor is not integrated with nature and its intrinsic flows; in order to achieve a symbiosis between nature and humans, within the theory of the living systems, the humans are leading the way in a never ending cycle of regeneration, seemingly integrated into the habitat, collecting the benefits nature has to offer and, as a token, reversing damage done or assisting to the perpetuating of the regenerative cycle of nature [30]. Henceforth, Fonta da Telha is in the position to have an advantage in implementing this type of community dynamic. At the time of the work, the population is under stress due to the economic unviability of just being sustained by the fishing trade, with a depleted habitat, and with lack of understanding or informed options to reverse this trend and thrive as a community; and with an informal tourist economy overtaking the space, they are per a decree of intangible human patrimony poised to have.

In this sense, the Regenerative Plan for Fonte da Telha creates several spaces in the operational, maintenance, and evolutionary levels, that can possibly open new ways of developing their livelihood in a more balanced interaction with the nature surrounding them. Analysing previous attempts at solving the complex situation between the anthropogenic pressure and the degraded environment presented in the PPFT, the possible solutions just resorted to the removal of all occupants, and a provision of an isolated compacted residential cluster for locals to inhabit, this was proven unsuccessful. This resolution and previous responses to the problem are being envisioned from a conventional approach, where a mere technical and fragmented proposal is presented. To the contrary, under the Regenerative Living System Design, to attain a correction of the natural and human systems, a community of practice dynamic needs to occur; to have an offer valuable enough for stakeholders to actively participate in the transformation for their future and their own sustainability as a community.

It becomes, therefore, fundamental to answer the questions "What Is a community of practice?" and "How are practical elements being developed for this to take root and flourish in charting the course to a regenerative future in Fonte da Telha?". In practical terms, and to re-structure the spatial plan, the housing options do not need to be a threat with fragmented built environments that are perceived as a confinement and eradication effort. The housing area needs to be first adapted to the landscape, be safe of threats, surrounded by activities that commence a positive regenerative cycle, such as the agricultural activity areas; and ultimately send a clear message that the inhabitants of the area are the fishermen community, and do not allow predatory construction practices in the town. It is necessary to give this community a stage, a voice to evolve; they are the rightful occupiers of the land, so the insertion of them leading the transformation is just suitable in the terms of a Living system approach. Hence, the residential area of the proposal adapts to the land formation, creating different single-family typology that do not create a cluster, but occupy the land in such fashion that the negative spaces are either zoned with nature-based solutions or sensible built interventions. This is particularly important to avoid illegal re-population, especially if the local stakeholders understand the benefits of maintaining the spatial planning model.

Additionally, the plan also provides spaces and built environments to execute community driven activities, such as a:

- civic center/market
- main square
- educational training center
- a small health clinic
- and an area exclusively dedicated to the execution of their fishing trade (see fig.44).

On envisioning this evolving pattern, it is worth mentioning that the scheme behind this new planning is to head towards a regenerative approach that provides a healthy urban planning. "According to research by public health professionals, the built environment has an important role to play in supporting human health. In a review of the literature in the field of Healthy Urban Design by Kent et al. (2011), three key interventions were identified that could support human health. These are: getting people active, connecting, and strengthening communities and providing healthy food options" [30]. This subject specifically is why agricultural land use is of key importance(see figure 44), as it can extend throughout time, and additionally supporting with allocated land use for practicing the fishing trade, to include an autonomy on a way the community benefits from the catch, and is a regenerative approach to develop it. There is an additional argument to be made in this aspect: if the fishing technique is protected as an intangible patrimony, it also needs to be viable economically to further continue the practice, and, in this sense, laws and regulation shall have a tenure that address this aspect to the regional and national level.

Figura 44- Proposal Aerial View . Sept.2023. Thesis Author

Another topic consideres relevant within a community of practice is the element of transferring from a linear economy to a circular one, which is becoming very relevant in order to achieve carbon neutrality, and "which received the support of the European Parliament Briefing (2016), EIB (2015) and numerous major banks and corporations" [32], and defined by the following:

"Looking beyond the current "take, make and dispose" extractive industrial model, the circular economy is restorative and regenerative by design. Relying on system-wide innovation, it aims to redefine products and services to design waste out, while minimizing negative impacts. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural and social capital. "[32]

By following this concept, the land development model is designed based on Life Cycle Assessment, system thinking as previously outlined and the target of zero waste by creating upcycling centres and composting areas in the project.

Figura 45 Proposal Views-Passadiço-Urban Equipment Area.

In terms of social development tools for a regenerative community of practice traits it can be seen in table 5 below [30]. Therefore, in all the tools the initial point is flexibility and adaptation to new concepts and ideas; this is why appropriate educational and debate spaces are important to provide, and this is the only way to create self-awareness of the risks and potentials, and subsequently all other tools will form within this framework.

Table 5 – RCD frameworks and tools for sustainable community development. (e.g., Bastianoni et al., 2019; Benne & Mang, 2015; Boyle & Kay, 2008; CLEAR, 2017; duPlessis & Brandon, 2015; Mang & Reed, 2012; Reed, 2007; Regenesis, 2016)

Criteria	Description
Living	Flexible and adaptable, integrating new knowledge as it becomes available
Relational	Making clearer patterns of dynamic, life-giving relationships both across and within scales
Integrative	Qualitatively and quantitatively considering ecological and sociocultural dimensions of living systems
Developmental	Growing the capacities of communities to work with the complexity of living systems so they can be conscious regenerative catalysts
Grows will, knowledge, capability	Developing the will, knowledge, and capability to act in alignment with the principles of regenerative living systems by increasing understanding of and care for place, developing holistic systems thinking capacities
Deeply participatory & easy to use	Inhabitants of a place and stakeholders collaborate in a co-creative process from inception throughout the life of a place

And to bring this concept and the possibility of implementation with the community from Fonte da Telha; the community could discuss the possibility of autonomy with the fishing activity, diversifying to agriculture, and participating in the hospitality service with outside public/private investment, upcycling, participation in the beach nourishment as labor force, composting program inclusion, among others.

6.

CONCLUSIONS

As elaborated along the development of this work the coastal town of Fonte da Telha is under anthropogenic pressure due to the establishment of an illegal settlement that created an unbalanced ecosystem, and as result, is transferring this unbalance into the social and economic fabric of the fisherman community, the only group allowed to remain inhabiting the area, and in this sense placing the intervention within and urban regenerative with a human centric approach is the step forward to mitigate the main force perpetrating the degradation. It is of high relevance that the status quo in the area allowed by the prevailing authorities, and that reinforces a culture of disregard of any environmental considerations to be stopped, to prevent the further damage to the ecosystem, increasing the exposure and hazards associated to climate change impact for this coastal communities. Under this perspective the educational and social/cultural appropriation strategy with the Fisherman community is paramount to attain long term regenerative objectives.

Furthermore, and in technical terms, the existing infrastructure systems are non-sufficient to serve the needs of the town´s population, deepening the economic disadvantage and opportunity to a healthy productive life of the community, as well as to exponentially increment the polluting risks and health hazard levels. It is the local government responsibility to respond to these needs and challenges being with just a public funded or public/private venture to make the process more agile; as it is necessary to implement the solution on a timely matter, not doing so will further deteriorate the eco-systema and its inhabiting at all levels; (nature and humans alike).

It is worth to reflect specifically in the enacted spatial planning tools, such as the Almada PDM and the POC-ACE, which are at the moment of this work not addressing the element of community re-enforcement necessary for the area to be restored, and to thrive; the main stakeholders -the fisherman community- need the sufficient administrative and educative instruments to take ownership of its town, under guidance of a regenerative panning tools, in order for them to prevail, economically, socially and educationally. The planning and spatial tools need to be the vehicle and vessel where positive implementations come to occur, it does not atter how deep in theorical terms, and in multilayer juxtaposition a same concept or tool is referred, if these are not feasible or to implement, and don´t integrate an existing problem or situation that considers several components inserted into the conflict or problem, which is the case of the Fonte da Telha.

The regenerative spatial plan proposed is supported by a regenerative theory that pursues different stages to reverse the trend from unsustainable developing practice, to become first sustainable by addressing operation and maintenance components, transforming into a resilient and renatured space, to optimally becoming a regenerative hub, based on a community that interacts actively with the nature that surrounds them, and finding the right path to be self-determined and self-reliance in almost all aspects of its needs. Incorporating elements that go back to understanding that humans are nature, and within this envelope there is a human centric approach that relies in a nature educated society to guide this regeneration process, that attends to the multilevel physical and societal patterns that are being

created within the proposal, guiding it to a stage where the human component woks alongside the nature surrounding it, benefiting from it but at the same time reversing the damaging trend of its ecosystem due to a fragmented technical development in the area where regularly the concept of space is not view as the sense of belonging, once the community understand that they have a mindful comprehension of their space, and their ownership is attained thru the developing of the regenerative proposal, projected changes will be long lasting in terms of eco-system restoration, social and cultural integration, breaking the cycle of anthropogenic damage to the area and mitigation strategies to climate change impacts.

Additionally, the proposal outlined is also evaluated in terms of being compared to previous similar experiences in coastal communities around the world, in both design and practical terms. However, it is also gauged on the specific successful strategies used along the detailed implementation of solutions, yielding as a result a more agile approach to implement substantial spatial planning ordinances. The resulting proposal, could be further developed and evaluated by the fisherman community, which at the time of the elaboration of the work due to lack of resources and time constrains was not feasible to execute, this opens up an opportunity to start an input to adjust any areas or zone within the program and give the community their first look at a possible future for Fonte da Telha.

7.

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