Integrated Coastal Zone Management Method for Part of the South-Western Attica's Coastal Area

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Abstract

The coastal zone is a special geographical entity that operates as a complex, fragile system of natural and anthropogenic variables and thus requires special and careful treatment. The purpose of this study is to build a methodological approach for development and evaluation of management plans in the context of Integrated Coastal Zone Management (ICZM). In order to test the research hypothesis, a part of the southwestern Attica's coastal area was chosen as a case study. In this framework, methods and tools for identifying and evaluating strategic priorities and alternative policy scenarios are used. Emphasis is placed on decision support systems that manage qualitative and quantitative information (multicriteria evaluation) and the Regime method is implemented. The process is being completed via the aid of the Strategic Environmental Impact Assessments' methods.

Key words: Coastal Area, Environmental Impact Assessment Matrices, Multicriteria Analysis

JEL Classification: Q5, Q56, R5

1 Introduction

The term "coastal area" refers to the transitive space between land and sea. It is characterized by important biological, geophysical, aesthetic and cultural wealth, thus attracting many human activities and projects. The interaction of natural and human environment in these regions forms their complexity, which is often augmented by the number of people and organizations involved in their management and the fragmentation of responsibilities and spatial planning (Skrimizea et al., 2013). It is generally accepted that to address this complexity there is the need for an Integrated Coastal Zone Management (ICZM) in the sense of a spatially, institutionally and procedurally comprehensive approach for the management and reassessment of proposals and projects in such areas.

The aim of the study is to construct a methodological approach for the development and evaluation of operational plans in the framework of ICZM. To test the research hypothesis part of the southwestern Attica's coastal area ("Eirinis kai Filias" SEF stadium-Pikrodafnis stream) was selected as a case of study. Firstly, the study area is analyzed for the current state of its natural and human environment. This analysis builds the axes of intervention needed and organizes alternative policy scenarios. The Strategic Environmental Impact Assessment Studies' methodology guides scenarios' benchmarking and complements the multi-criteria method

Regime, according to which the appropriate alternative is selected. The whole of the process aims in specific and more general findings on the Integrated Management approach.

2 Coastal Zone: Importance and Problems Faced

Although the concept of coastal zone is intuitively understood, its definition is not easy and varies depending on the purpose of analysis and specificities of the area called to serve. For management purposes, coastal zone can be defined as an - of varying width - area of land and sea, whose limits depend on nature of the environment, management needs, activities hosted and opportunities available for environmental, economic and social development (Kousouris, 2009).

Coastal zones are areas of outstanding natural environment with significant biodiversity, unique ecosystems, precious natural resources and landscapes of aesthetic value. This natural background offers many opportunities for development of human activities in the primary, secondary and tertiary sectors of the economy. Thus, a coastal zone operates like a complex system in which the factors that cause variations and disturb the balance are socio-economic and physical subsystems (Fabbri, 1998). It is easy then to understand the sensitivity of coastal areas, which is formed by the interconnections and interactions of the elements constituting them.

The fragile natural environment combined with intense population pressure and multiple, not always mutually compatible, activities are probably the main sources of conflicts and problems. Pressures on coastal areas relate to pressures on quality, quantity and functioning of natural ecosystems (pollution, coastal erosion, habitat destruction, etc.), as well as pressures on the manmade and social environment due to competitive and unplanned uses (Dimopoulou et al., 2007). Especially in coastal areas of cities, the importance attributed to these areas increases the incentives for investment and development strategies, causing a rapid and often uncontrolled exploitation. Under these circumstances their carrying capacity is shortly being overburdened; natural resources are being polluted and degraded, landscapes are being destroyed and habitants' quality of life degrades.

3 The Rationale of the Integrated Coastal Zone Management

The Integrated Coastal Zone Management (ICZM) is one of the most widely known and applied policy and legislative instruments for coastal zones, used by policy makers worldwide and promoted by international organisations such as the European Commission (see for example the Council Recommendation on Integrated Coastal Zone Management of 2002, the Protocol to the Barcelona Convention on Integrated Coastal Zone Management, ratified by the EU in 2010, and the new EC's initiative on Maritime Spatial Planning and Integrated Coastal Management of 2013). ICZM is described as a multidisciplinary, dynamic process comprised of a set of tasks that aim at the sustainable development of coastal zones' natural and human environment. Therefore it constructs a comprehensive strategy for the management and governance of the coastal zones' physical, social, economic and institutional processes (Kostopoulou, 2002).

The main aspect of the ICZM, as a concept, process and instrument, is the enclosing of many forms of integration. McGlashan (2000) identifies four integrative directions: spatial, temporal, vertical and horizontal. Spatial integration refers to the needs of giving equal weight to both marine and terrestrial issues and examining the spatial distribution and overlaps of coastal zones' elements, outside the strict and not always realistic limits of the administrative boundaries. Temporal integration concerns the need of enclosing both short-term and long-term understanding of coastal zones' processes and the relating decisions' impacts. Vertical and horizontal integration refer to inter-institutional (e.g. international strategies, national government, local councils, planning office) and inter-sectoral (e.g. coastal defence, economic development, nature conservation etc.) cooperation respectively. Indeed, a major issue on the basis of the ICZM's rationale is inclusivity, according to the sustainability paradigm.

In practice the ICZM's rationale has been adopted in different ways around the world: at national or local level, through top-down or participatory approaches, to address specific environmental problems associated with economic activities or managing coastal vulnerability to climate change (Nobre, 2011). Regardless of the differences and the degree of maturity of each application common goal is to find the methodology that will meet the needs of each case and will approach the complexity of coastal ecosystems, within the limits set by the availability of data and institutional processes.

4 Integrated Coastal Zone Management Methods

According to some scholars the fundamental challenge of the ICZM is this of governance (objective, process and structures) and not of technology transfer or refined scientific knowledge (Turner, 2000). The governance issue and the argument of participatory methods for the promotion of the ICZM's vertical and horizontal integration are of course rather important. However, we perceive the development of appropriate, multidisciplinary methodologies as an equally important aspect of the ICZM that can not only provide scientific input, but also inform and guide the decision making process.

There are many different methodologies that can and are being followed for the application of the ICZM. A common basis of these methodologies is the adoption of a systemic rationale. Conventional methodologies study each environmental element individually. On the contrary, ICZM proposes a management methodology based on the relationships and interactions between the different factors forming the system of a coastal zone and the expected response of the whole (Kostopoulou, 2002). The above system thinking raises levels of uncertainty, which is also a commonly accepted peculiarity of Integrated Management (Fabbri, 1998). The unstable nature of socio-economic and environmental conditions and their complex interactions, as well as the long-term nature of management and the large number of stakeholders, require a methodology capable to be redefined and provide reversible and appropriately adaptive decisions.

Turner (2000) identifies three overlapping procedural stages in his ICZM methodology: the scoping and resources audit stage, the actual modeling stage and the evaluation stage. Approximately the same general framework is being followed by Fabbri (1998), who is identifying the screening phase, the scoping phase and the scanning phase, and also by the EC in the *Lessons from the EC's Demonstration Programme on ICZM* (1999). A fundamental step of

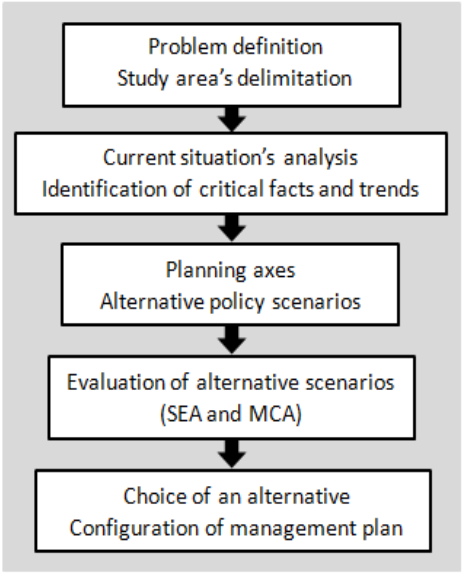
all the approaches is the systematic investigation and baseline description of the physical, economic and social structures of the coastal area and the interdependences formed between them. In addition, a trend scenario is being contrasted with the results derived from one or more alternative futures scenarios to address both uncertainties and the impacts of different policy choices and inform the decision making (Fabbri, 1998; Turner, 2000). Throughout this process, computerized systems with a user-friendly interface seem important for the integration and distribution of vast amounts of data and expert knowledge and to make the evaluations transparent and recursive (Fabbri, 1998).

Integrated Coastal Zone Management of South-western Attica's Coastal area

4.1 Methodological approach

Figure 1 describes the methodological approach followed in this study. This methodology follows the thrust of Strategic Environmental Assessment (SEA), Screening - Scoping - Scanning (Fabbri, 1998), and may be completed by inserting participatory processes towards a more objective result of the analytical techniques, in case of application in practice.

Fig. 1 Methodology



4.2 Identification of the study area

The urban area of Athens gradually expanded and recently reached the Saronic beach, incorporating some special uses of large scale (Olympic facilities, industrial and other facilities of the Air Force at the Faliro Delta, International Airport etc.), which became, or have the potential to become, major land reserves (MINENV, 2004). Currently, huge investments of touristic, cultural or recreational character are planned to take or have already taken place. The lack of proper planning during the expansion resulted in problems such as incompatible uses and strenuous activities, destruction of natural and aesthetic landscape, problematic access and circulation, significant pressures of economic interests and circumvention of the zone's public nature.

The study area belongs to the Northeastern coast of the Saronic Gulf. It includes the Faliro bay from the "Eirinis kai Filias" stadium (SEF) in Neo Faliro to the Parc of Floisvos in Palaio Faliro, the Edem beach and Pikrodafni stream. In terms of administrative division, the area belongs to the South Part of the Athens Prefecture (except from the SEF and Neo Faliro which belong to Piraeus Prefecture) and is part of the district of Neo Faliro and the municipalities of Moschato, Kallithea and Palaio Faliro. However, the area between the coastal highway (Poseidonos) and the sea is not taken into consideration in the municipalities' Master Plans and is only managed by occasional institutional arrangements.

The study focuses on the linear zone defined by Poseidonos Avenue and the shoreline, taking also into account the urban fronts of the coastal municipalities and a sea zone of 100 meters from the shoreline.

4.3 Current situation

At this point, the analysis of the current situation of natural and man-made environment variables is necessary, in order to understand and record the region's problems. Also, the spatial dimension has to be taken into consideration via the creation of thematic maps (for an example of such maps see Figures 2 and 3 in Appendix), which place the possible conflicts and attest interactions (Skrimizea, 2010).

The analysis of the study area's natural environment proves the gradual degradation of its variables and makes clear the need of taking appropriate measures. The natural terrain and aquatic ecosystems (sea and streams) are distorted, the coastal space is corroded and there is a tendency for further increase of pollution and abuse of the area. Despite the problems, the environment seems to maintain such self-protecting and regenerating mechanisms that create motivations for investments even under these circumstances.

The human environment's description could be summarized in the phrase "lack of identity". Huge, heterogeneous pieces of different land uses remain unconnected, failing to formulate one area of specific local or supra-local significance in the south of Poseidonos avenue. In parallel, the public nature of the coast is in danger. A series of major highways disrupt the continuity of the urban fabric and hamper human contact with the sea. Poseidonos avenue is the main issue as it separates entirely the coastal uses from the municipalities' first building blocks.

4.4 Planning axes

Table 1 presents the main axes and planning features. They have been concluded by the current situation's analysis and are resultants of its spatial, social, economic and natural variables.

Tab. 1 Planning axes and characteristics

1. Institutional Recognition of ICZM	2. Public Infrastructure Networks	Flood protection
		Irrigation works
	3. Reconstitution, Protection and Enhancement of Natural Environment	Sea and coastal environment
		Streams (Kifisos, Ilisos, Pikrodafni)
		Terrestrial environment
	4. Connection of Urban Fabric with the Coast	Accessibility
		Destination of identity

The first axis aims to ensure the institutional character of ICZM. It goes beyond the limits of the study area and is necessary for the proper application of the rest of the axes. According to it an integrated, flexible agency for the management of the coastal zone of Athens has to be established by state law. This body will follow a holistic, participatory and open process, as defined by the principles of ICZM. It will ensure consistency and continuity in policies and activities, and coordination between the different ministries and other stakeholders.

The second axis concerns the public infrastructure networks. The main issues of interest are two: 1) Dealing with the floods in Pikrodafni's stream and the low-height areas of Moschato and Kallithea 2) The ever growing demand for irrigation. The objective of the specific axis is to reclaim existing studies for the integration of the infrastructure work needed to face the problems.

The third axis emphasizes on the natural environment, which is quite degraded. In terms of nature, the situation has many similarities with this of the broader area of Athens with an important peculiarity: the strong presence of water, on which planning has to focus.

The last axis addresses the main regional and operational problem of the study area. The region on the south of Poseidonos avenue has been separated from the rest of the urban fabric, mainly due to the avenue itself and the presence of major spaces of unconnected land uses. The objective is to create a coast both accessible and interesting to the public.

4.5 Alternative policy scenarios

The alternative policy scenarios are being formed by the intervention strategies. In this case they will be structured on the third and fourth axis. This happens due to the fact that the first two are perceived as irreplaceable for the sustainable management of the region and indispensable for the integration of the rest. Thus, they cannot be negotiated in the strategies' alternatives, but only in a later, more technical and detailed level.

The first scenario focuses on mild and local level development, like the one taking place in the coastal park of Palaio Faliro and will probably satisfy the citizens of Kallithea and Moschato too. In such a case, the existing activities of local or supra-local character keep their position in the region's map and identity (taking into account the ongoing projects of Niarchos Foundation), attempting in parallel an opening to the local communities by ensuring open, public spaces and convey parts or entire buildings to municipalities, residents and their organizations. The emphasis is on the sea, which is treated as a natural element to be freely enjoyed, and not for commercial exploitation. The natural environment is being highlighted via sustainable activities that aim in the entertainment and raising of awareness of residents and visitors. The attempts to overpass Poseidonos avenue's barrier to the sea are simple and of small scale. The gateways to the coast increase via appropriate crossings, signage and simple design, which allows pedestrians' and bicycles' navigation to and along the coast.

The second scenario exploits the tendency of the city center to move south via Syggrou avenue, following the vision of the official top-down spatial planning. This scenario allows the current efforts for the creation of an area of supra-local interest to be continued, notably in the limits of Faliro Bay, where a pole of multifunctional activities is being created. Conference centers, concert halls and sport facilities function in conjunction with hotels developed in the beach fronts of their respective municipalities and accommodate visitors who are in town for occupational or recreational activities. Particular emphasis is placed on improving the accessibility of the region through gateways to the sea and further exploitation of the Floisvos marina, but also via a radical redesign of the road network. The undergrounding of Poseidonos avenue is an option.

4.6 Alternative policy scenarios' evaluation

4.6.1 Evaluation criteria and impact matrices

The development of appropriate criteria and indicators is necessary for the sustainable management of coastal zones. The indicators allow the systematization of natural, economic and social data in order to be edited through analytical procedures and decision-making processes (Fabbri, 1998). These criteria-indicators can be configured based on proposals for ICZM in international and European directives (EEA, 2005; IOC UNESCO, 2006), as well as other

existing studies, more or less related to the issue of coastal zone. For the purpose of this study the methodology of Directive 2001/42/EC on the assessment of the effects on the environment of certain plans and programmes was adapted appropriately and used. This methodology is useful as it emphasizes on the natural environment, responds to the scale of study and the qualitative nature of the data and guides the creation of impact matrices, which are necessary for the multi-criteria analysis.

Firstly, the probability of an environmental parameter (Directive's 2001/42/EC) to be affected of a policy scenario and the assessment of its positive or negative evolution are determined according to the Strategic Environmental Impact Assessments' method of the test questions (included in the "Handbook on SEA for Cohesion Policy 2007-2013"). In a second phase, the impacts per scenario are assessed and evaluated using correlation matrices. Specifically, the impact of each scenario is assessed in relation to the environmental parameters and to a number of features such as type, intensity, scope, timeline appearance, accumulation etc. The result is a concise and easy to understand table presenting the impact of each proposal on each environmental objective - criterion (Table 2 and Table 3). This methodology can complement and support the decision making process of Multicriteria Analysis (MCA) as it encloses a number of characteristics of the effects that cannot be accessed otherwise.

Two additional criteria were added for the purposes of this study. The criterion of "employment opportunities" is necessary as the two scenarios affect the sector a lot, while the criterion of "benefit diffusion" examines the local or supra-local importance of actions.

Tab. 2 Alternative 1 Impact Matrix

Criteria	Impacts	Notes
K1. Protecting biodiversity, flora and fauna	positive	The emphasis is on the environment with mild activities and awareness of residents.
K2. Improving quality of life and health of residents	positive	The natural environment of the coast is attributed to residents along with spaces for relating activities.
K3. Soil protection and reclamation	positive	The emphasis is on the environment with mild activities and awareness of residents.
K4. Protect water resources and qualitative / quantitative improvement	positive	The emphasis is on the environment with mild activities and awareness of residents.
K5. Improving climate and air quality	neutral	None special effect is expected.
K6. Protection and enhancement of physical assets	positive	Rising land values and strengthening of physical assets.
K7. Protection and promotion of cultural heritage	positive	Exploitation of existing cultural venues.
K8. Improving landscape aesthetics	positive	Improvement of the local landscape.
K9. Employment opportunities	positive	Limited new job positions.
K10. Benefit diffusion	positive	Benefits focus on local communities.

Tab. 3 Alternative 2 Impact Matrix

Criteria	Impacts	Notes
K1. Protecting biodiversity, flora and fauna	negative	The physical environment functions just as a receptor of economic activities.
K2. Improving quality of life and health of residents	positive	Quality of life improves with new spaces for recreational activities.
K3. Soil protection and reclamation	neutral	None special effect is expected.
K4. Protect water resources and qualitative / quantitative improvement	negative	The physical environment functions just as a receptor of economic activities.
K5. Improving climate and air quality	negative	The pollutants are increasing due to increased mobility.
K6. Protection and enhancement of physical assets	positive	Rising land values and strengthening of physical assets.
K7. Protection and promotion of cultural heritage	positive	Exploitation of existing and creation of new cultural venues.
K8. Improving landscape aesthetics	positive	The scenery improves with decisive and dynamic actions (eg. underground coastal avenue).
K9. Employment opportunities	positive	New jobs and investment opportunities.
K10. Benefit diffusion	positive	The benefit is of local and supra-local importance.

4.6.2 Scenarios' evaluation via Multicriteria Analysis

The two scenarios will be evaluated via the Regime method (DEFINITE software). Regime is a multicriteria evaluation method that elaborates mainly qualitative data. It belongs to a group of analytic methods used when some or all of the data is not available as quantitative information. This makes it particularly useful as it is very often that the decision-makers face such situations.

According to Regime, the two by two comparison of alternatives leads to the creation of a "regime", i.e. a vector consisting of + and -, where + means that I1 dominates I2 for the specific criterion (Politi et al., 2009). In this method it is possible to provide weights to the criteria, which thus are ranked in descending order of importance. The hierarchy decided for the criteria does not disclose whether a good yield of an alternative to a criterion is sufficient to compensate for a poor performance in another (Russi et al.). Sometimes it is not possible to conclude in an integrated assessment using only the above data. Subsequently, the probability of alternative I1 to be more important than I2 is calculated and it is according to this that the final ranking of all the alternatives, in order of decreasing probability, takes place (Citizen et al., 2009).

To sum up, Regime uses as input data an impact matrix and a series of weights to perform hierarchy to the criteria. The first contains information on the alternative's impacts in relation to the chosen criteria. The weights of the criteria reflect their relative importance and consist direct result of political choice. The data used in the application of the method is presented in Tables 2 and 3 (evaluation criteria), Table 4 (table of impacts) and Table 5 (hierarchy of criteria based on the priority assigned to each one of them).

For this study, the authors give priority to society, which is followed by environment and economy. The free access to the coast and the recognition of the coastal zone as an important public good emerge as the main evaluation factors. The protection and restoration of the environment follow, being rather important factors for the social and economic viability of the

area. The economy is placed last, but indirectly approached through the previous two sets of criteria.

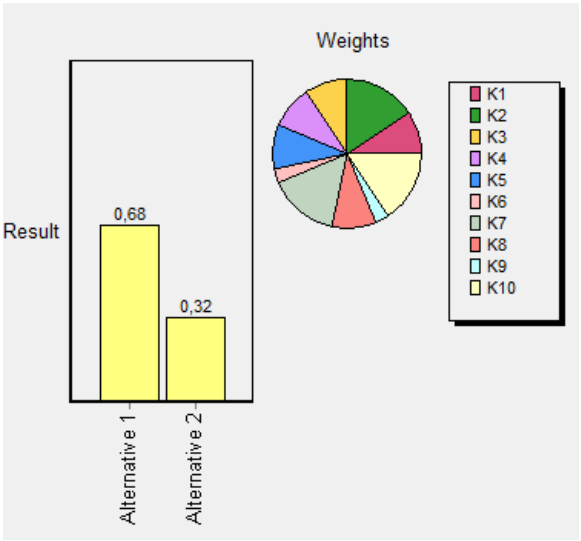
Tab. 4 Table of Impacts

	Alternative 1	Alternative 2
K1	++	-
K2	+++	+
K3	++	0
K4	++	--
K5	0	-
K6	+	++
K7	+	++
K8	0	++
K9	+	+++
10	+	+++

Tab. 5 Hierarchy of Criteria

Priorities of Criteria	Groups of Criteria
1. Society	K2, K7, K10
2. Environment	K1, K3, K4, K5, K8
3. Economy	K6, K9

Fig. 4 Alternative scenarios' evaluation



At this point the subjectivity of the process becomes clear and in this case leads to a simple selection of a suitable alternative, before even performing the MCA. Under real life conditions, and with the proper approach, this exact weakness of the process may result in a concomitant strength by bringing together stakeholders and guiding the procedures towards a more objective choice.

According to the information provided by the Tables and via the Regime Multicriteria Analysis, it has come out that the first scenario, concerning the gentle coastal zone management from which the local communities are the main beneficiaries, is the most suitable. The results obtained from the method's application are presented in Figure 4.

5 Conclusions

This paper argues on choosing an appropriate methodology for the implementation of Integrated Coastal Zone Management. ICZM perceives the coastal zone as a complex system of natural and human variables and requires methodologies capable of addressing interactions and uncertainties enclosed in such an approach.

In this framework, this study aims in the development of a methodology for the implementation of the integrated management's concept. Thus, it constructs one which is supported by the SEA procedures and MCA methods. Firstly, the alternative policy scenarios are being formed via both rational and systemic analysis of the coastal area. Secondly, the decision-making process integrates the strategic goals, providing the opportunity for resupply with new data that could improve the output.

The method we developed is a simple enough, user-friendly method that could be used to add a more scientific approach in the current policy making process taking place in the area of study. As already mentioned in the paper, the subjective character of the final decisions taken could not be avoided. However, after the whole of the preceded analysis, these decisions can be considered fully informed and thus potentially successful.

In this respect, it is important to note the potential to ameliorate the decision-making process, provided by the proposed methodology, by including additional planning tools and participatory procedures (mainly for the hierarchy of criteria). The latter are rather necessary to build the consensus needed and construct a method according to the modern conception of spatial and environmental planning.

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Appendix

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INTEGRATED COASTAL ZONE MANAGEMENT METHOD FOR PART OF THE SOUTH-WESTERN ATTICA'S COASTAL AREA
EIRINI SKRIMIZEA
ATHENS, OCTOBER 2010
FIGURE 1:
GREATER AREA'S TOPOGRAPHY
LEGEND:
0 - 4 m
4 - 8 m
8 - 12 m
12 - 16 m
16 - 20 m
20 - 24 m
24 - 28 m
28 - 32 m
32 - 36 m
36 - 40 m
40 - 44 m
44 - 48 m
48 - 52 m
52 - 56 m
60 - 64 m
64 - 68 m
0
100
250
500 m

NATIONAL TECHNICAL UNIVERSITY OF ATHENS
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INTEGRATED COASTAL ZONE MANAGEMENT METHOD FOR PART OF THE SOUTH-WESTERN ATTICA'S COASTAL AREA

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FIGURE 2:
LAND USES IN THE STUDY AREA

LEGEND:
- MIXED HOUSING WITH OTHER USES
- EXCLUSIVE HOUSING
- CORPORATE OFFICES
- LOCAL COMMERCE
- HYPERLOCAL COMMERCE
- CRAFTS
- INDUSTRIES
- WAREHOUSES
- ADMINISTRATION
- HEALTH CARE AND CULTURAL
- SECONDARY EDUCATION
- TERTIARY EDUCATION
- SPORTS
- ENTERTAINMENT
- PUBLIC TRANSPORT
- PARKING
- GREEN & PUBLIC SPACES
- FREE SPACE

0 100 250 500 m