REPAiR

REsource Management in Peri-urban AReas: Going Beyond Urban Metabolism

D3.6 Process Model Hamburg

Version 1.5

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Acronyms and Abbreviations

AG	Activity Groups
CDW	Construction Demolition Waste
CE	Circular Economy
CSR	Environmental related corporate social responsibility
D3.1	Deliverable 3.1_Handbook Integrated Analyses
D3.3	Deliverable 3.3_Process Model for pilot cases
D3.6	Deliverable 3.6_Process Model Hamburg
D6.4	Deliverable 6.4_First application of the decision model in all case studies
EMAS	EU's Eco-Management and Audit Scheme
FA	Focus Area
GAB	GAB umwelt service
GDSE	Geodesign decision-support environment
GW	Garden Waste
KW	Kitchen Waste
MFA	Material Flow Analysis
MSW	Municipal Solid Waste
NACE	European industry standard classification system (Nomenclature des Activités Économiques dans la Communauté Européenne)
OW	Organic Waste
PCPW	Post-Consumer Plastic Waste
PULL	Peri-urban living labs
SRH	Stadtreinigung Hamburg
SSCA-1	Secondary Socio-cultural Analysis
WCB	Waste-conscious Behaviour
WEEE	Waste of Electronic and Electrical Equipment
WP3	Work Package 3_Developing and implementing territorial metabolism based representation and process models
WP5	Work Package 5_Developing eco-innovative solutions and change strategies

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Publishable Summary

Deliverable 3.6 of Work Package 3 presents an integrated analysis of the case study in the Hamburg region within the REPAiR project with a focus on organic waste production and processing, and the transition to a circular society. The report comprises spatial and material flow analyses following the methodology proposed by Deliverables 3.1 and 3.3 of the REPAiR project. The Hamburg case study area consists of two focus areas, the district of Hamburg-Altona and the County of Pinneberg in Schleswig-Holstein. The report delivers spatial, material flow and social analyses for the focus area Hamburg-Altona and partially for the focus area Pinneberg. Embedded in the spatial-social context, the material flow analysis follows the same steps that have been exemplified in the Deliverable 3.3 for the two pilot case studies of Amsterdam Metropolitan Area and Naples Metropolitan Region. The structure enables the geolocation of the key activities and actors related to material flows to allow a spatial understanding of the actor network at the focus area level. This understanding is crucial for the development of suitable eco-innovative solutions that will be designed in future steps. The eco-innovative solutions aim at paving the way towards more circular city regions. Finally, this report reflects on the results of the spatial and material flow analyses with special attention to issues linking waste activities to their effects on space.

1. Introduction

This report - Deliverable 3.6 of Work Package 3 - presents an integrated analysis of the case study in the Hamburg region within the REPAiR project with a focus on organic waste production and processing, and the transition to circular societies. The report comprises spatial and material flow analyses following the methodology proposed by Deliverables 3.1 and 3.3 of the REPAiR projects (2018a; 2018b).

Chapter 2 is dedicated to the spatial, material flow and social analyses. Starting with the definition of wastescapes, it presents the different scales of the study, provides information on the map layers, data sources and graphics. Finally, it clarifies how the defined sample areas offer contexts that could enable potential eco-innovative solutions.

Chapter 3 presents the research results of the Hamburg case study. It starts with a spatial and socio-economic analysis, followed by a material flow analysis. The structure of the chapters follows the one of Deliverable 3.3 (REPAiR, 2018b), which is intended to guide the reader in grasping the socio-geographical context to better understand the case-specific flows and challenges.

A rudimentary spatial and socio-economic analysis on a national level precedes a detailed focus area level analysis. In Hamburg, the two focus areas are Altona and Pinneberg. A more detailed analysis of the former is covered in this report, whereas the analysis for the latter has been done partially because of issues with data gathering due to data protection policies. Embedded in this spatial-social context, the material flow analysis follows the same steps exemplified in the Deliverable 3.3 for the pilot case studies of the REPAiR project (2018b).

The structure enables the identification of key activities and actors with their geolocation related to material flows to allow a spatial understanding of the network of actors at the focus area level. This understanding is crucial for the development of suitable eco-innovative solutions. These solutions will be developed in future steps and they aim at paving the way towards more circular city regions.

Chapter 4 concerns a reflection on the case study in the Hamburg Region. It is divided into two parts. The first section draws the conclusions from the spatial analysis, while the second one focuses on the material flow analysis. Consequences of waste activities are explored and contextualised through the lenses of their interrelations with space. In particular, the topic of Wastescapes is addressed insofar as it applies to the Hamburg case study. The chapter also comments on the difficulties in finding and handling data. Furthermore, it deepens the definition of the sample areas and the enabling contexts as areas with the opportunity to be front runners and become models for the application of circular economy principles.

2. Spatial, Material Flow and Social Analyses

In this chapter, we apply the methodology explained on Deliverable 3.1 (REPAiR 2018a) and exemplified on Deliverable 3.3 (REPAiR, 2018b), regarding the spatial, material flow, and social analyses.

2.1. Task 3.1 | Spatial Analysis

2.1.1. Introduction

In D3.3, the methodology for integrated spatial, material flow and social analyses was applied to two pilot case studies: Amsterdam and Naples. The presented working method was considered as transferable to the follow-up cases. Therefore, we applied it to the two cases in the Hamburg Metropolitan Area: Altona and Pinneberg, although not yet completed for the latter.

The drafting of maps for the Hamburg case required intensive research on data that satisfy the requests of the pilot cases in D3.3. This task was the most time-consuming one due to three main issues:

- the German data protection policy, which precluded the access to certain pieces of information;
- the focus areas belong to two Federal States, i.e. Hamburg and Schleswig-Holstein; in several cases, information available for one was not available for the other;
- the time available for developing Deliverable 3.6 (D3.6) was substantially inferior than the one for the pilot areas.

Therefore, the list of maps that could be prepared is smaller than the ones for the pilot cases (see Section 2.1.4).

2.1.2. Wastescapes

Going beyond the material dimension of waste flows, REPAiR includes in its experimentations the category of Wastescapes (W1-W6), which will also be applied to the follow-up case of Hamburg. As defined in D3.3, Wastescapes are related to the spatial effects of waste flows on the landscape (i.e. residual spaces scattered in the peri-urban areas) and to the infrastructure configurations for its management. From a spatial, environmental, and social point of view, Wastescapes can represent challenging areas. They should be seen as processes rather than 'objects', emphasising the interrelations between socio-economic, spatial, material, and temporal dimensions. Therefore, to be spatially connected with the surrounding settlements and become accessible areas as public spaces, they need to be transformed and regenerated.

2.1.3. Scale definition

As stated in D3.3, the scales of representation on maps are relevant for Geodesign and should be chosen according to each topic to make it properly visualised and understood. To do so, it has been decided to work at the scale of the focus area for the spatial analysis.

According to the scale levels defined in D3.3, the Hamburg case has the following scales:

Table 2.1 - Scales in the Hamburg case study (HCU, 2018).

Country Scale	Germany
Region Area	Federal States of Hamburg and Schleswig-Holstein
Focus Area	District of Altona in Hamburg and County of Pinneberg in Schleswig-Holstein
Sample Area	Neighbourhoods of the Hamburger district of Altona: Rissen, Blankenese, Osdorfer Born, Ottensen, and Mitte-Altona Parts of municipalities in the county of Pinneberg (to be confirmed with stakeholders): Pinneberg, Quickborn, Wedel

The focus-area includes the County of Pinneberg in Schleswig-Holstein and the District of Altona in Hamburg. Its dimension is about 741 km^2 (County of Pinneberg 664 km^2 and the city-district Hamburg-Altona 77.4 km^2). See Figure 2.1. This intermediate scale allows an overview of the challenges and strategies and facilitates the talks to stakeholders with high capacity of understanding and managing the territory. To promote citizens' participation in the co-development of eco-innovative solutions and connect WP3 and WP5, a further scale level was introduced – the sample area. The sample areas involve parts of the eight municipalities of the county of Pinneberg plus neighbourhoods of the Hamburger district of Altona as shown in the Table 2.1.

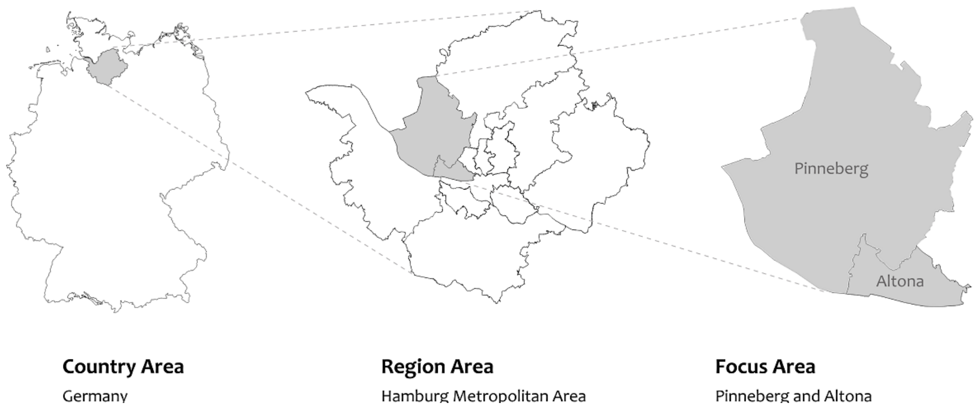


Figure 2.1 - Sequence of maps showing different scales of the Hamburg case (HCU, 2018).

2.1.4. Maps: informative layers, data sources and graphic

This D3.6 follows the same graphics and colours proposed for the pilots in D3.3. Posters are identified with the code CSTn.Title, where:

- C = case = Hamburg (H)
- S = scale = Region (R), Focus-Area (F), Sample (S)
- T = topic = General (G), Physical (P), Human (H), Waste-specific informative elements (W)
- n = number of the layer
- Title = Short text to name the layer

The list of the maps created can be found in the Annex 1 attached to this document. The maps are attached as a separated file (link).

The entire process has been described in an excel table. This file is divided into 5 different spreadsheets, namely:

- "Copy from Word": list of layers divided in the different maps as they have been received from the WP3 lead partner; here first information is provided on data availability
- "Questions and comments": it contains the remarks to all layers which have not been found
- "Layers order and specification": this is the most important sheet of the file because it contains the layers that have been generated for the case study of Hamburg; moreover, it provides information on source, date, format and further specification layer by layer; this has been done for the sake of clarity, so that it is always possible to trace back the decisions made for each element;
- "Actual layers divided in maps": this is the list of the maps with the indication of the layers used for their drafting;
- "Links": it contains the sources specification and their website links.

The spreadsheet can be found at this link.

2.1.5. Enabling contexts

D3.6 uses the definition of enabling contexts introduced in D3.3 as specific locations within the focus area that are more suitable for developing the eco-innovative solutions and strategies. The presented criteria are used to identify such areas and find reasonable links between spatial analysis and eco-innovative solutions, addressing the interest of PULLs towards the priority areas. As mentioned in the section 2.1.3, the WP5 activities with stakeholders developed in the PULLs provided the identification of priority areas as places with enabling context for the Hamburg case.

2.2. Task 3.2 | Material Flow Analysis

The material flow analysis and its mass flow data processing are explained in Section 3.4.

3. Results of the two Focus Areas in Germany

This chapter shows the results of the spatial and socio-economic analysis followed by the material flow analysis of the Hamburg Altona focus area. The socio-economic analysis for Pinneberg was only possible on county level due to data protection policies, and the material flow analysis for Pinneberg has been done partially and will be delivered after the deadline due to a delay in receiving data. A brief socio-economic analysis at the national level precedes a more thoroughly one at the focus area level.

3.1. Spatial and socio-economic analysis - Germany

3.1.1. Geographical situation and the natural environment

Germany is divided in five geomorphological zones: the North Sea and the Baltic Sea; the North German Plain; the Mittelgebirgsschwelle (Central Uplands); the South German Scarplands; and the Alpine Foreland and the Alps (Glaser et al., 2007).

3.1.2. Demography

The total population of Germany on 31.12.2017 was around 82.8 million people, of which 9.7 million (11.7%) do not have the German citizenship (Statistisches Bundesamt, 2018a). The population has been growing since 2011, the year of the last census (Statistisches Bundesamt Deutschland, 2018b). This growth can be partly attributed to the increasing number of births. In 2017, 784,901 babies were born, a little bit less than in 2016, but the number had been increasing before since 2011, when it was at 662,685 (Statistisches Bundesamt Deutschland, 2018c). Furthermore, the net migration rate has been positive since 2009. In 2017, it was at 416,080 (Statistisches Bundesamt Deutschland, 2018d). The life expectancy at birth was 75.68 years for men and 81.83 for women in 2017 (Statistisches Bundesamt Deutschland, 2018e). The genders ratio is 49.3% men and 50.7% women. (Statistisches Bundesamt (Destatis), 2018: 26)

In January 2016, 24% of the German population was under the age of 25. (Statistisches Bundesamt (Destatis), 2018: 32) In 2017, among the population older than 15 years, 3.6% were still in school education, 30.4% had a graduation from Hauptschule (secondary school ending after 9 years), 6.6% from polytechnische Oberschule (secondary school ending after 10 years in former GDR), 23.1% from Realschule (secondary school ending after 10 years), 31.9% had Fachhochschul- oder Hochschulreife (secondary school ending after

12 or 13 years qualifying for admission of a university or university of applied science), 4% had no school diploma. Over the last 10 years, there has been a clear trend towards higher school qualification with a growing percentage of people having a school diploma that permits access to study at a university or university of applied science. The percentage of people with a middle school level (Realschule) is also growing, while the number of people with the lowest school diploma (Hauptschule) decreases. Against this trend, the percentage of people without school diploma has slightly increased over the last years, which can be partly explained by immigration of people with low, not fully, or not yet acknowledged education. (Statistisches Bundesamt Deutschland, 2018f: 90)

3.1.3. Labour force

The labour force indicators for Germany developed rather well over the last years. The number of people in paid work (Erwerbstätige) was in 2017 at a high of 44.15 million, consisting of 39.86 million employees (employees with regular social insurance and low-income employees), and 4.29 million self-employed people. On the other hand, 1.62 million were unemployed. These figures were conducted in the frame of the Mikrozensus, the German micro census conducting statistics (Statistisches Bundesamt Deutschland, 2018g). In comparison to the figures above, the statistic of Bundesagentur für Arbeit (agency for employment) quantified the number of unemployed people (Bestand Arbeitslose registriert nach § 16 SGB III) at 2.38 million in December 2017. (Statistik der Bundesagentur für Arbeit, 2017)

3.1.4. Economy

The GDP per capita in Germany was 39,470 EUR per capita in 2017 and the growth rate has been at 2.2%. The German economy has been growing every year since the German reunification with the exception of 3 years (1993, 2003, and 2009). The share of the gross value in the different economic sectors in 2017 was 0.7% primary, 30.6% secondary, and 68.7% tertiary. The three sectors remained relatively stable over the last few years (Statistisches Bundesamt (Destatis), 2018: 331, 334).

3.1.5. Waste sensitivity

Currently, 14% of the raw materials used in German industry are recovered waste products, and the recycling rates for municipal and commercial waste is ca. 60%. (Nelles et al. 2016: 7-8). The current German waste policy follows the EU waste hierarchy, prioritizing the prevention of waste generation at the source and leaving disposal to be the last and final step (Directive 2008/98/EC). In addition to including the EU Waste Hierarchy rules, the 2012 Circular Economy Act (KrWG) set a final deadline of 2015 for mandated separate collection of biowaste by waste producers and the assigned waste management authorities.

According to the European Environmental Agency (2016), Germany is situated at the third place in terms of amount of kilogram of municipal waste generated per capita in 2014 (EEA 2016: 2). On the other hand, the same research results show that Germany is located first for what concerns recycling of municipal waste for the same year (EEA 2016: 3). The value of recycled municipal waste is circa 64% (EEA 2016: 5).

Some improvements can be done, especially in the attempt of reducing the amount of residual waste by fostering waste separation. A 2012 survey noted by Krause et al. (2014: 2) revealed that almost 40 million people (private households) in Germany do not have access to separate biowaste collection; Nelles et al. further pointed out that the national collection of organic waste has still not become a reality yet: “there are significant problems between the municipal and the private waste management companies” (Nelles et al. 2016: 14), especially with the yellow bin (packaging) and still a relative high percentage of the waste goes to thermal recycling processes (incineration), which is considered in the European Union not effective from an ecological perspective compared to material recycling.

Secondary Socio-cultural Analysis (SSCA-1) – Waste-conscious Behaviour (WCB) in Germany

In Deliverable 3.2 we outlined SSCA-1 (the first phase of the Secondary Socio-cultural Analysis) based on data obtained from Flash Eurobarometer 388. The elaborated composite index of Waste-conscious Behaviour (WCB) comprised an 11-item variable about various waste-related individual perceptions and attitudes. Accordingly, the WCB index used individual responses which later aggregated on national level (for details, please, see: Deliverable 3.2 of the REPAiR project. In the WCB-rank of the EU member states Germany’s score (7.65 from the 0–11 scale) was one of the highest mean values, much above the EU average (6.89). SSCA-1 then examined the WCB mean values also on regional level in order to find out if there are relevant spatial differences. In the case of Germany (Figure 3.1), the inquiry presented that there are significant regional differences, yet the used sample had just a moderate number of data, therefore reliability is somewhat doubtful. Still, it is worth to mention that our case study area (the Hamburg city-state and the state of Schleswig-Holstein) had the lowest WCB mean value scores (6.16 and 6.95, respectively) among the German regions (i.e. Stadtstaaten und Flächenländer).

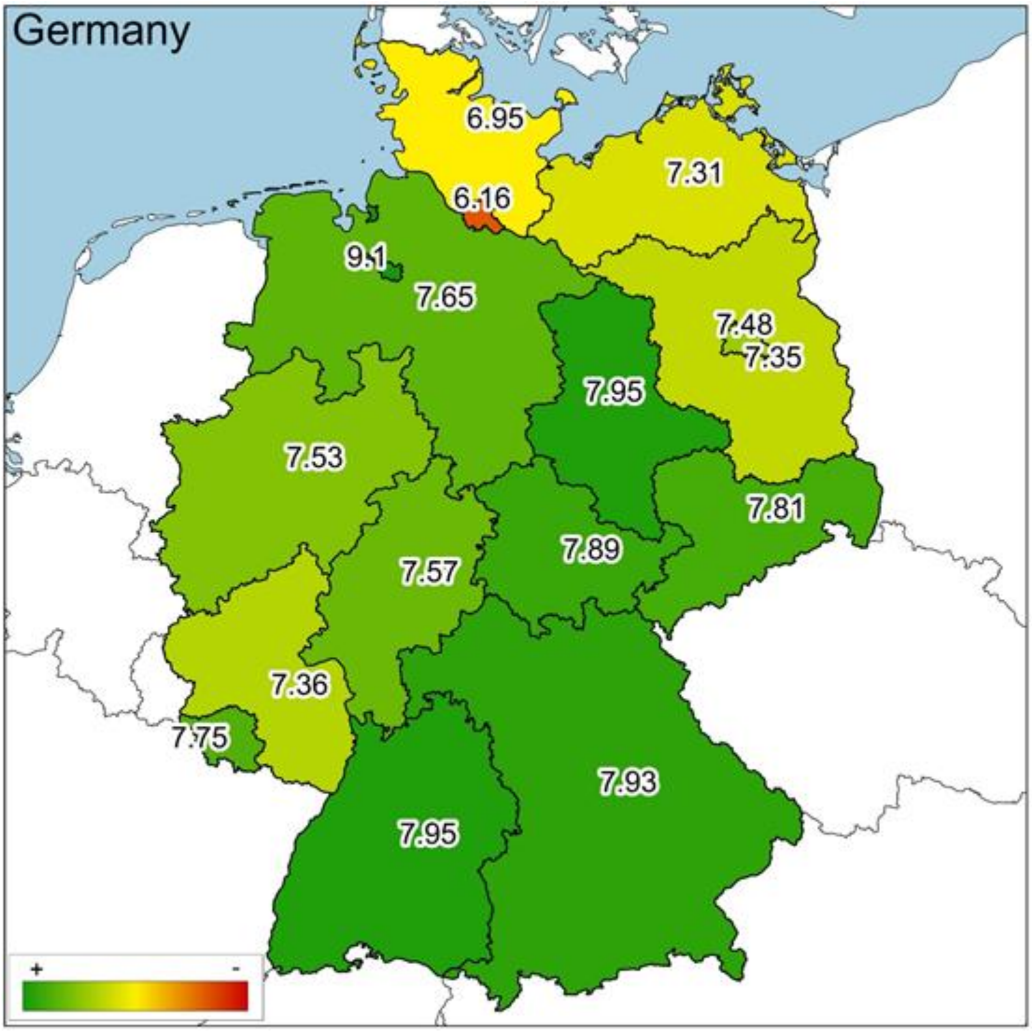


Figure 3.1 - WCB scores in the German regions (Authors' own elaboration based on data obtained from Flash Eurobarometer 388).

As it is described in the deliverable D3.2 of the REPAiR project, corporate environmentalism refers to the recognition and integration of environmental concerns into a firm's decision-making process, and it is one way how a business entity can address environmental issues (Banerjee 2002). The pro-environmental behaviours of a firm can be twofold. One of them is 'externally' regulated (by a meta-governmental, governmental, local governmental organisation). The other one – that is more important from the point of view of environmental consciousness - is self-regulatory mechanism. It is attributed to a variety of different motives (and as an interdependent phenomenon, 'understanding what really motivates corporate environmentalism is important for policymakers, since the effectiveness of government environmental policies depends in large part on how corporations will respond to them' (Lyon & Maxwell 2004: 16). The latter approach (self-regulatory mechanism) is usually manifested in the use of environmental management systems such as the EU's Eco-Management and Audit Scheme (EMAS) and the International Organization for Standardization's ISO 14001 quality management system (Hillarya &

Thorsenb, 1999; Neugebauer 2012). The first version of EMAS was issued in 1993 while the first version of ISO 14001 was launched in 1996.

'ISO 14001:2004 specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects. 'ISO 14001:2015 revised this management system including more strict regulations for firms applying for the certification. [www.iso.org]

Concerning the ISO database in 2016 Germany had 8192 ISO 14001:2004 certificates on 2,661 sites and 1,252 ISO 14001:2015 certificates on 512 sites. The number of firms (9,444) with (both type of) ISO 14001 certificate means that almost 8% of the ISO 14001 certificates can be found in Germany from Europe. The trend in these certificates shows an increase in Germany (Figure 3.2).

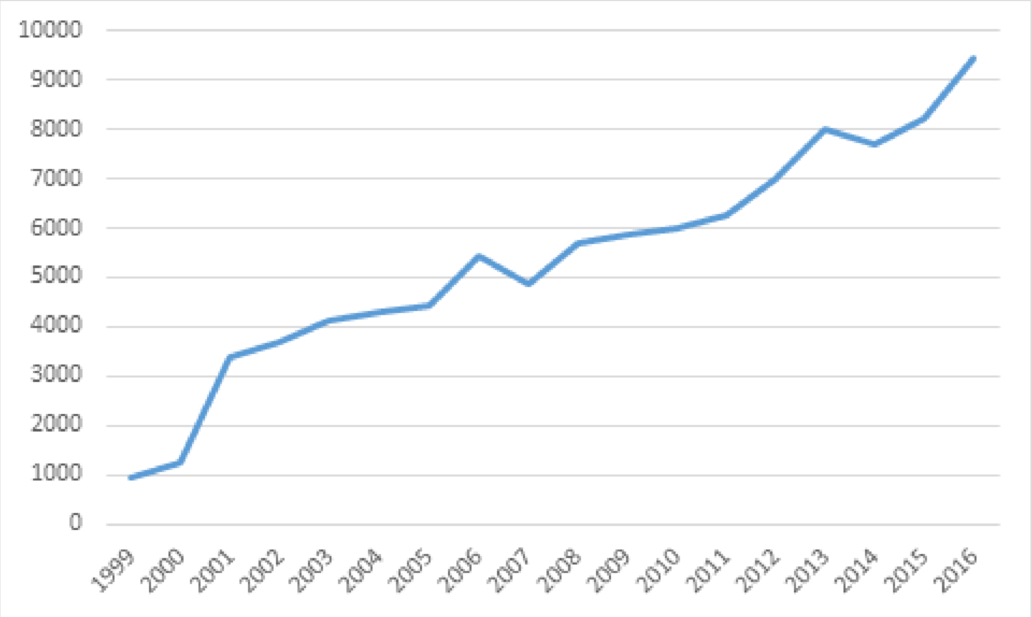


Figure 3.2 - ISO 14001 in Germany (1999-2016) (ISO, 2018).

Having regarded the EMAS database, 1,160 certifications are reported in 2017 in Germany, 11 of them from Hamburg, from several manufacturing sectors, including the waste management companies of Hamburg. However, we should say here that the role of EMAS was a bit different than in other countries (in Europe). Kollman and Prakash (2002) pointed out that 'the German government and German industry actively opposed the adoption of EMAS during the negotiations in the European Council. Because domestic German environmental law is generally more stringent than that of other member states and legal compliance is a prerequisite for firm participation, German firms felt they would have to do more to secure EMAS certification than firms in most other EU countries' (Kollman and Prakash (2002: 51). However, later on, the German government has been able to offer firms positive incentives to participate in EMAS (Kollman and Prakash, 2002) and German industry had become an enthusiastic supporter. 'The switch in the German government's perception is explained by their recognition that they were losing their role as an 'uploader of national policies to the European level' (Bracke & Albrecht 2007:619). This resulted in the fact that by the beginning of the 2010's Germany became by far the country with the highest total EMAS uptake (and the country with the seventh highest ISO 14001 certifications worldwide, and the fourth highest in Europe) (Neugebauer 2012).

As Bailey (2007) argues, since the 1970's Germany has sought to position itself as a global leader in environmental policy and after the reunification (with some lost), the country's environmental policy remained some of the most progressive in the world (Michaelowa 2003, Bailey 2007). The number and the increasing trend of the certification support this. Freimann (1999) called Germany the 'EMAS Land'.

In their research, Mueller et al. (2011) tried to reveal the behaviour and the reasons behind the choice of certificates (and environmental related corporate social responsibility (CSR)) of German companies. Their empirical results show that German companies have a rather conservative view on environmentalism that is probably induced by strong government regulations. Concerning Mueller et al. (2011) results, the issue of climate change is seen as the main reason for corporate environmental responsibility. Mueller et al. (2011) has also emphasised that many German companies that focus on environmental initiatives (in order to stay competitive) have invested in the conservation of resources (Mueller et al. 2011).

A summary of German use of EMS standards can be presented by the words of Neugebauer (2012). Investigating the drivers of standard adoption in her empirical research results (interviews) it is showed that in Germany 'ISO 14001 has become institutionalised to an extent where it is de-facto mandatory whereas EMAS is only implemented by firms that have an internal motivation to do so. The decision about EMAS is often made at the site level whereas ISO 14001 is decided about at the highest corporate level' Neugebauer (2012: 252).

3.2. Spatial and socio-economic analysis - Hamburg Region

As described in section 2.1.3, the case study area is located in the North of Germany. The city of Hamburg is situated in the centre of Hamburg Metropolitan Region, a volunteer political and administrative cooperation that involves four German Federal States (Hamburg, Lower Saxony, Mecklenburg-Vorpommern, and Schleswig-Holstein). The Hamburg Metropolitan Region plays no further role in the frame of REPAiR, since it extends itself far beyond the peri-urban area of Hamburg and is too large for a case study area in the sense of REPAiR.

In Figure 3.3, a map shows Hamburg and the directly neighbouring counties in Schleswig-Holstein north of the Elbe river and in Lower Saxony south of the Elbe. We refer to this area as Hamburg Region, although not officially. It should not be confused with the much larger Hamburg Metropolitan Region that was mentioned above. Highlighted in light green is the boundary of our focus area consisting of the Pinneberg County in Schleswig-Holstein and the district of Altona in Hamburg. The region in the sense of REPAiR is both Federal States Schleswig-Holstein and Hamburg.

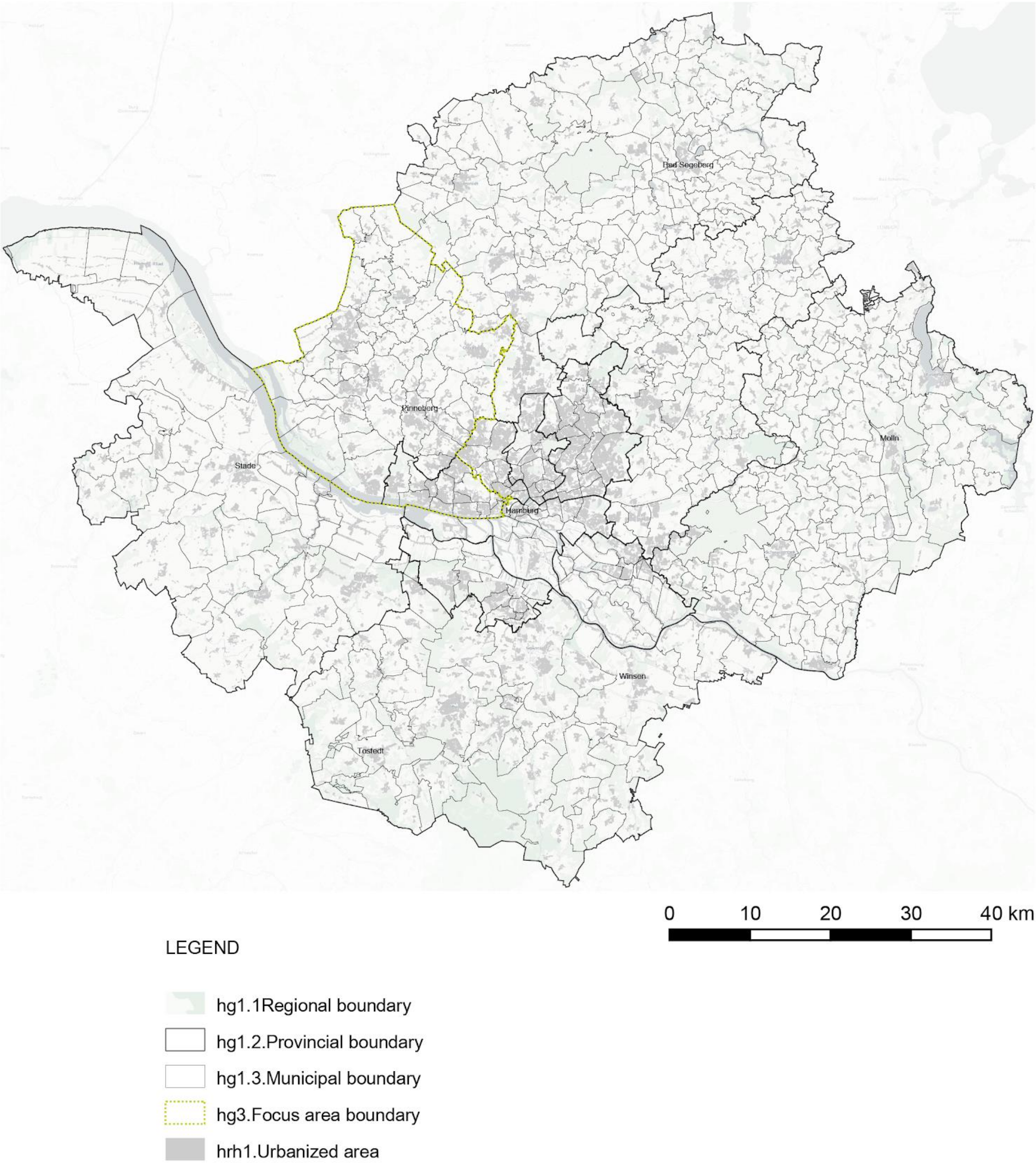


Figure 3.3 - HRH2.Administrative borders. Hamburg Region (link) (HCU, 2018).

The focus area in the sense of REPAiR is the Pinneberg County in the federal state of Schleswig-Holstein and the city-district Hamburg-Altona within the federal state Free and Hanseatic City of Hamburg. The Pinneberg County has a population of 307,471 inhabitants (31.12.2015) and covers an area of 664 km², the city-district Hamburg-Altona has 270,263 inhabitants (31.12.2016) and covers an area of 77.4 km^2 (Statistikamt Nord, 2017). The focus area Hamburg-Altona and County of Pinneberg is characterized by a very diverse structure of built areas (e.g. villages centres, detached house areas, social housing, retail, logistic) and open spaces (agricultural land, largest European area of tree nurseries, garden plant production, recreation areas, and natural preservation areas). It comprises urban, peri-urban and rural areas. The selection and delimitation of the focus area has been made already in the proposal phase for REPAiR together with key stakeholders such as Stadtreinigung Hamburg, the City of Hamburg and the county of Pinneberg. (Statistikamt Nord, 2018b,c). Figure 3.4 shows the map of the major types of the built environment in the Hamburg Region.

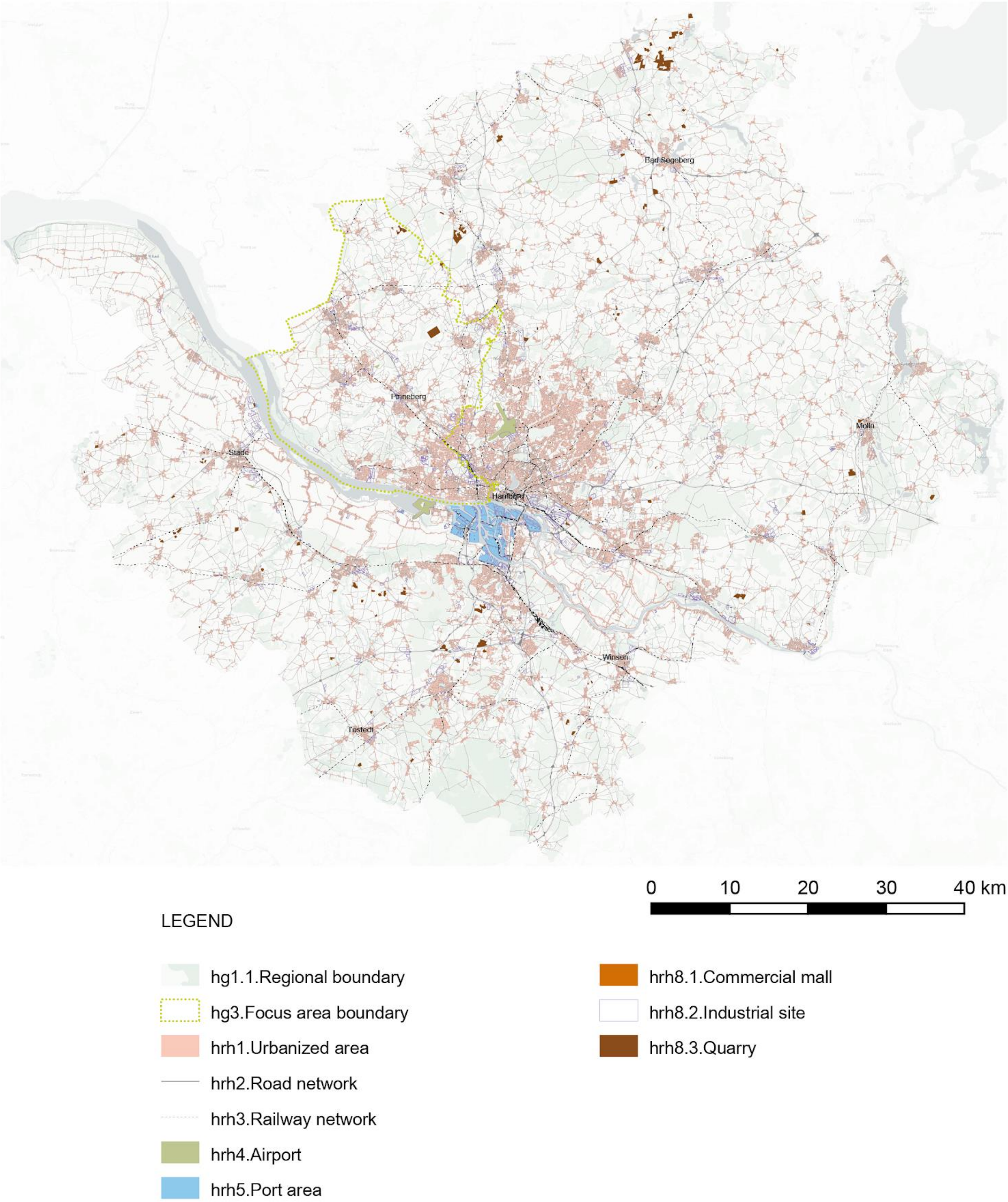


Figure 3.4 - HRH1.Built environment. Hamburg region (link) (HCU, 2018).

3.3. Spatial and socio-economic analysis - Altona

In this section, insights on the socio-economic aspects for the district of Altona are provided. Afterwards, the analysis zooms in to five sample areas: Ottensen and Mitte-Altona (in the sub-district Altona-Nord), Osdorfer Born (in the sub-district Osdorf), Blankenese, and Rissen.

3.3.1. Geographical situation and the natural environment

The district of Altona is one of the 7 districts (*Bezirke*) in Hamburg. As Hamburg is a City-State, its districts have similar powers to the ones of a municipality. They have their own council (Bezirksversammlung) elected every five years and they have their own administration responsible for different thematic on district level, like social affairs, economic development, environment, urban planning and public spaces management. With 270,263 inhabitants (Statistikamt Nord 2016), the Altona district has around 15% of Hamburg's population (the fourth biggest district in terms of number of residents) distributed on 14 quarters (in German *Stadtteil*, literally "part of the city"). The quarters are simply a statistical unit without any specific political power. However, as it will be described later in this document, these quarters present a rather diverse structure not only in terms of social and economic indicators, but also for what concerns the physical environment (see Sections 3.3.2 to 3.3.6).

The district of Altona is located in the North-West of Hamburg, at the northern margin of the Elbe river. It spreads from the East with densely built quarters (Altona Altstadt, Altona Nord, Ottensen) close to Hamburg city centre, to the West with more suburban quarters (Blankenese, Rissen) and to the North-West with large housing estates like Osdorfer Born. Table 3.1 shows the translation of some words from German to English that are useful for better comprehension of the content to be presented.

Table 3.1 - English translations from German vocabulary for spatial planning (HCU, 2018).

Words in German	English translation
Bezirke	District
Stadtteil	Quartier
Viertel	Neighbourhood
Baublock	Building block

The map in Figure 3.5 represents the built environment in the Focus Area. The County of Pinneberg is substantially less urbanised than Altona, although new developments are sprawling along the main train lines. Due to vast available space, many energy infrastructure and productive sites are located in the Pinneberg County. On the other hand, Altona district has smaller power plants and partly relies on the energy production of the neighbouring County of Pinneberg. It is important to notice that conurbation is present between both focus areas at the borders between Hamburg and Schleswig-Holstein.

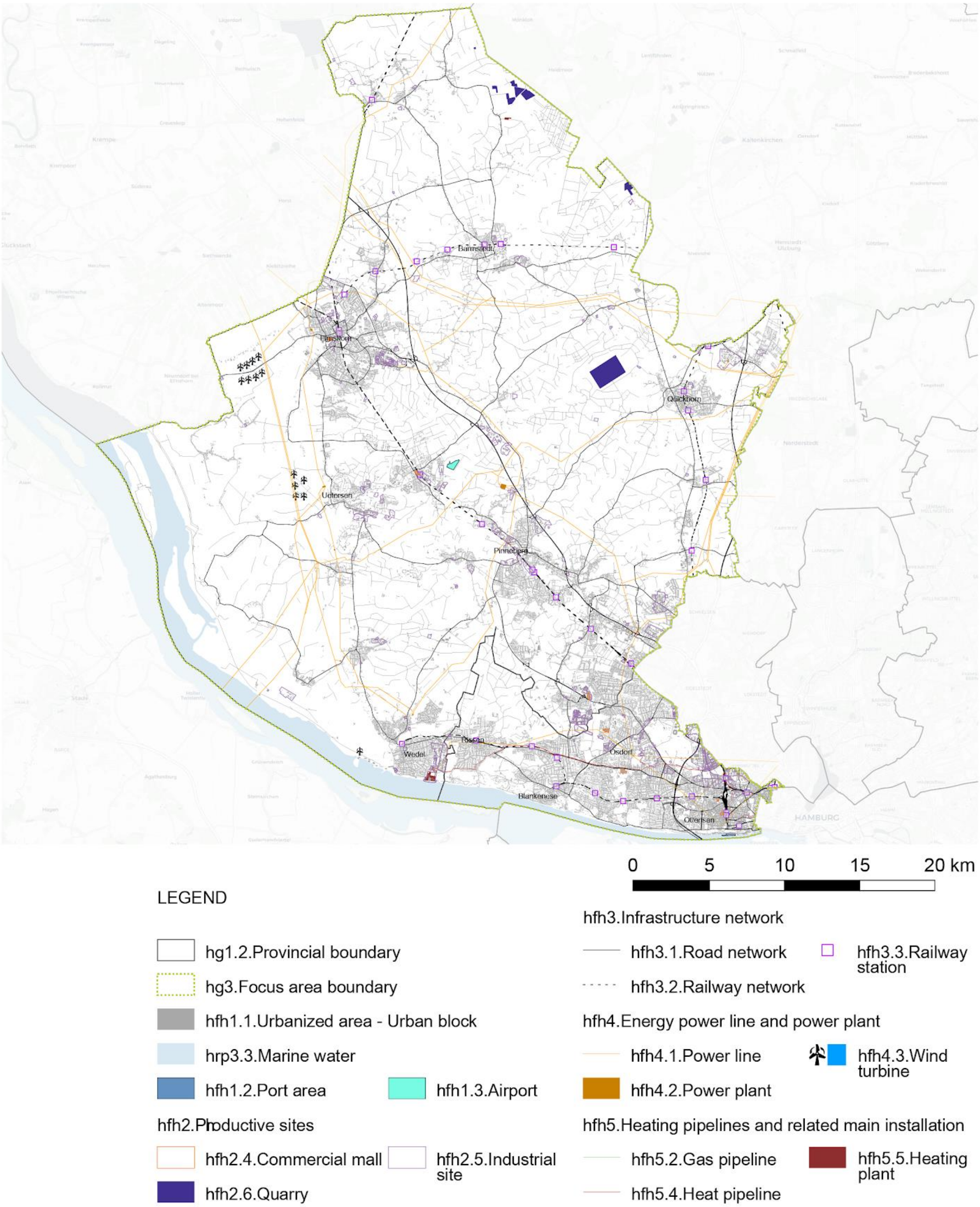


Figure 3.5 - HFH1.Built environment (link) (HCU, 2018).

An analogous analysis can be made for the green (natural and artificial) environment. The built environment in the county of Pinneberg accounts for 4.05% of the total surface, compared to 11.47% in Altona. The small percentage makes the area favourable for agricultural activities. The tree nurseries are one of these and can be seen in red in the map of Figure 3.6. In Altona, the need for urban agriculture is translated in the presence of many garden allotments: in Hamburg there are many located all over the city and they are well represented in associations, such as the Associations of Garden Friends (see REPAiR 2018c).

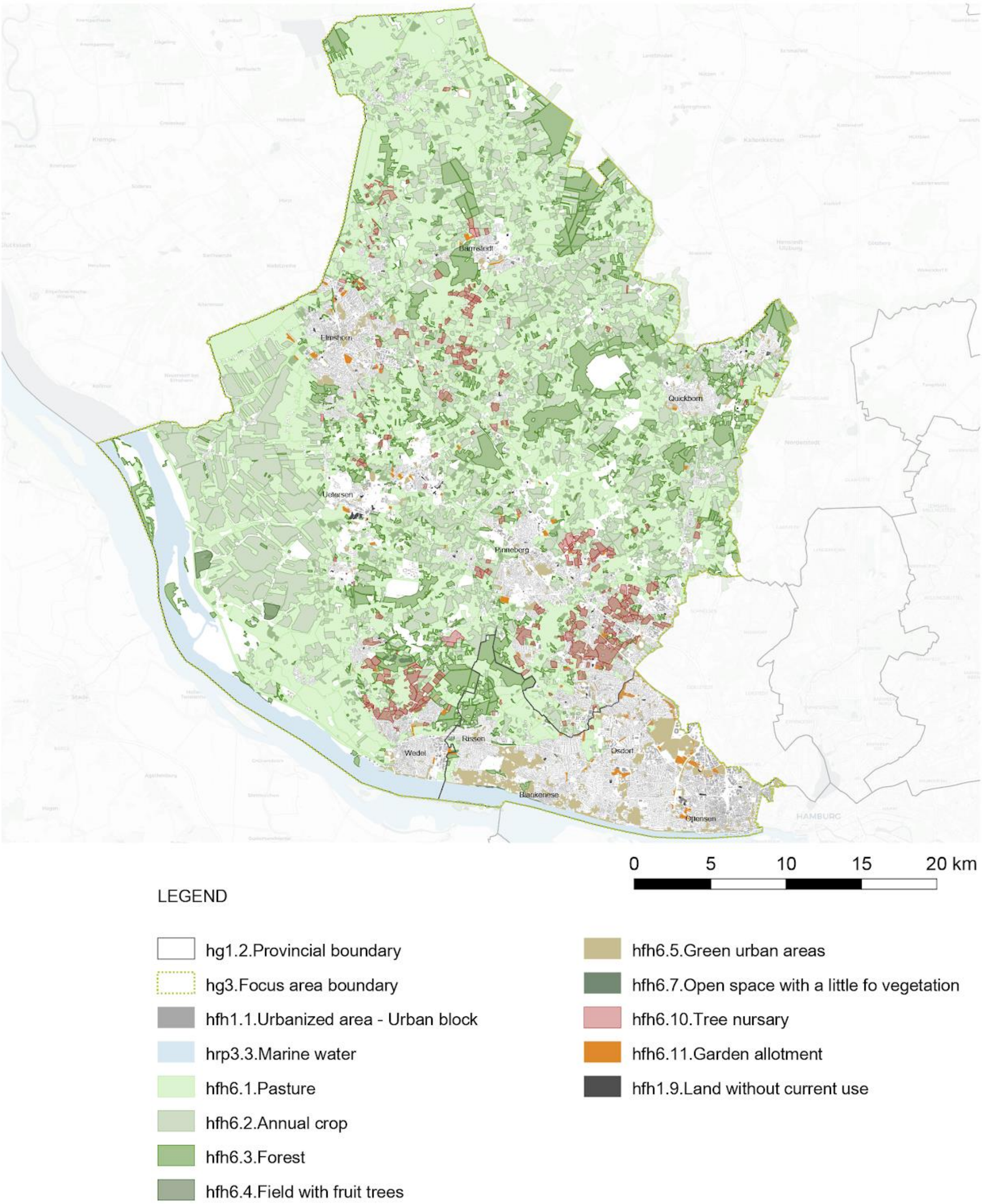


Figure 3.6 - HFH6.In the fields (link) (HCU, 2018).

3.3.2. Demography

Throughout this section, the sample areas will borrow the name of the quarters that encompasses them. For example, the name Ottensen will refer to the sample area located within the Ottensen quarter.

The population density in the sample areas reflects their challenges regarding waste management. In Ottensen, for instance, the population density is five times higher than the average of Hamburg, creating competition for space and making it more difficult to dedicate places for waste separation. On the other hand, Rissen is almost three times less densely populated than the average of Hamburg, making the waste collection less efficient. Table 3.2 shows the number of inhabitants and population density in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg.

Table 3.2 - Inhabitants and density in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Location	Inhabitants	Area in km^2	Inhabitants per km^2
Altona-Nord	22,137	2.2	9,981
Ottensen	35,370	2.8	12,654
Osdorf	26,140	7.3	3,605
Blankenese	13,407	7.7	1,733
Rissen	15,192	16.7	909
District of Altona	270,263	77.9	3,469
City of Hamburg	1,860,759	755.1	2,464

The sample areas have a proportion of inhabitants under 18 years old close to or above the average of the city of Hamburg, which is 16.2 %. This substantial ratio creates an opportunity for waste management. Young people tend to be more open to learn and cooperate with new procedures and might influence their older relatives to separate the waste using the four bins system, especially avoiding organic waste in the residual waste container. In some sample areas, the high proportion of inhabitants older than 64 years old may present a threat to eco innovative solutions, as older people tend to resist more to changes or not to have the energy to separate their waste in case it requires more mobility and longer walking distances. Table 3.3 shows the number of inhabitants and the proportion of age groups in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg.

Table 3.3 - Inhabitants and proportion of age groups in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Inhabitants	Children and adolescents under 18 years	Proportion of children and adolescents under the age of 18 in the total population in %	Residents over 64 years	Proportion of older residents over the age of 64 in the total population in %
Altona-Nord	22,137	3,482	15.7	2,239	10.1
Ottensen	35,370	5,567	15.7	4,756	13.4
Osdorf	26,140	5,229	20.0	5,910	22.6
Blankenese	13,407	2,488	18.6	3,652	27.2
Rissen	15,192	2,780	18.3	4,654	30.6
District of Altona	270,263	47,920	17.7	48,612	18.0
City of Hamburg	1,860,759	300,538	16.2	341,251	18.3

Table 3.4 shows the number of foreign inhabitants (people with non-German citizenship) and inhabitants with migration background (people with non-German citizenship and/or at least one parent with non-German citizenship) in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg. In the most populated sample areas, the percentage of inhabitants with migration background ranges between 26% and 39.2%. The high rate also represents a challenge to the waste management. People coming from abroad or being raised in a foreign family are usually used to other methods of dealing with domestic waste and might show some resistance in adopting the waste separation procedures proposed by the city. This data must be taken into consideration when designing eco innovative solutions.

Table 3.4 – Foreign inhabitants and inhabitants with migration background in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Foreign Inhabitants	Proportion of foreign population in total population in %	Inhabitants with a migration background	Proportion of inhabitants with a migration background in total population in %	Children and adolescents under 18 years with a migration background	Proportion of Children and adolescents under 18 years with a migration background in total Children and adolescents under 18 in %
Altona-Nord	4,168	18.8	7,959	36.0	1,800	51.7
Ottensen	4,616	13.1	9,189	26.0	1,897	34.1

Osdorf	4,522	17.3	10,230	39.2	2,930	56.0
Blankenese	1,091	8.1	2,295	17.1	629	25.3
Rissen	1,112	7.3	2,569	16.9	747	26.9
District of Altona	43,496	16.1	86,383	32.0	21,362	44.6
City of Hamburg	309,944	16.7	631,246	34.1	151,553	50.4

Table 3.5 shows some additional data concerning the household structure. Blankenese, Osdorf and Rissen are quarters attracting families. This is expressed by a higher number of people per household and a higher proportion of households with children. The lower proportion of single parent households with children in Blankenese and Rissen compared to the other quarters is an indicator for the rather bourgeois structure of the two quarters.

Table 3.5 – Household types in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Number of households	Average number of persons per household	Proportion of single person households on all households in %	Proportion of households with children on all households in %	Proportion of single parent households on all households with children in %
Altona-Nord	13,596	1.6	63.4	16.3	27.4
Ottensen	21,458	1.7	60.9	17.4	27.5
Osdorf	13,046	2.0	46.6	22.7	28.8
Blankenese	6,935	2.0	45.3	20.6	17.0
Rissen	7,742	2.0	45.3	21.3	18.9
District of Altona	14,575	1.8	53.5	19.7	24.9
City of Hamburg	1,021,666	1.8	54.4	17.8	25.6

Table 3.6 shows the natural demographic trend and migration. Blankenese, Osdorf, and Rissen have a higher number of deaths than new-born, which can be explained by the older population structure of these quarters. The negative net migration in Osdorf could be explained by the modest construction of new apartments (see below), resulting in insufficient offer of flats when compared to the demand. The negative net migration in Ottensen could be explained by the ongoing gentrification of the area resulting in a higher demand for living space per person.

Table 3.6 – Natural demographic trend and migration in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Number of newborn	Number of deaths	Immigration across border of area in 2016	Out Migration across border of area in 2016	Difference between immigration and outmigration across border of area in 2016
Altona-Nord	309	127	2,873	2,692	+ 181
Ottensen	510	203	3,763	3,900	- 137
Osdorf	255	321	3,208	3,569	- 361
Blankenese	93	106	1,236	1,148	+ 88
Rissen	118	256	1,278	1,037	+ 241
District of Altona	3,115	2,583	25,368	22,537	+ 2,831
City of Hamburg	21,233	17,116	106,257	89,352	+ 16,905

Table 3.7 shows the education infrastructure. The relatively high number of kindergartens and preschools in Ottensen is due to the high proportion of families with small children in the area and parents who work in Ottensen and bring their children to educational institutions in the area. The proportion of pupils in grammar schools compared to pupils in district schools on all pupils in secondary school (first phase class 5 till 9 or 10) in Blankenese and Rissen is much higher than in the other areas. This can be explained by the higher level of education in these two quarters, resulting in parents aiming for a similar or higher education level for their children.

Figure 3.7 - Education infrastructure in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Number of kindergarten and preschools for children from 3 years till start of schooling	Number of primary schools	Number of pupils in secondary school (first phase class 5 till 9 or 10; place of residence)	Proportion of pupils in district schools on all pupils in secondary school (first phase class 5 till 9 or 10; place of residence)	Proportion of pupils in grammar schools on all pupils in secondary school (first phase class 5 till 9 or 10; place of residence)
Altona-Nord	14	2	886	57.7	38.1
Ottensen	34	4	1,546	48.9	49.1
Osdorf	14	4	1,745	51.7	44.3
Blankenese	9	3	813	22.4	77.5

Rissen	7	2	959	33.3	65.9
District of Altona	199	36	14,424	45.7	51.8
City of Hamburg	1,062	222	93,367	51.4	45.1

Table 3.8 shows the medical infrastructure. The comparably high number of medical practitioners in Ottensen and Blankenese can be explained by the central function of both quarters, providing also services like medical infrastructure also for other quarters like Altona-Nord and Rissen, respectively. Another explanation is that medical practitioners and specialists prefer to have their practices where the population has a higher income. Therefore, quarters like Osdorf and Altona-Nord, that have a population with comparably lower income and education, are lacking such infrastructure.

Figure 3.8 - Medical infrastructure in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Number of medical practitioners (total)	Number of general practitioners	Number of dentists	Number of pharmacies
Altona-Nord	32	6	6	5
Ottensen	167	28	64	10
Osdorf	67	18	14	6
Blankenese	110	22	25	5
Rissen	33	7	16	4
District of Altona	846	200	252	63
City of Hamburg	4,823	1,303	1,678	410

3.3.3. Labour force

Throughout this section, the sample areas will borrow the name of the quarters that encompasses them. For example, the name Ottensen will refer to the sample area located within the Ottensen quarter.

Table 3.9 shows the number and proportion of employees with regular social insurance (place of residence) on all people in working age (above 15 and under 65). The low proportion in Blankenese and Rissen could be explained by a higher number of classic family models with one person (mainly women) not working and with a higher number of entrepreneurs and self-employed people, while the low proportion in Osdorf can be explained by the higher amount of unemployed people. Large disparities can be observed in the proportion of unemployed people and even more in the younger and older age groups. The disparities between the different quarters are even more significant regarding the proportion of social welfare recipients, especially in the younger age group.

Table 3.9 - Employees, unemployed people, social welfare recipients in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Employees with regular social insurance (place of residence)	Proportion of Employees with regular social insurance (place of residence) on all persons in working age (above 15 and under 65)	Proportion of unemployed on all persons in working age (above 15 and under 65)	Proportion of younger unemployed on all younger persons in working age (above 15 and under 25)	Proportion of older unemployed on all older persons in working age (above 55 and under 65)	Proportion of persons receiving social welfare (SGB II) on total population	Proportion of persons younger than 15 years receiving social welfare (SGB II) on total population younger than 15 years
Altona-Nord	9,610	57.0	7.2	3.3	9.2	12.3	20.5
Ottensen	14,798	57.4	4.4	1.5	5.5	6.3	8.9
Osdorf	8,302	52.4	6.6	3.7	5.6	13.9	25.5
Blankenese	3,574	46.3	1.9	0.3	2.2	0.9	0.5
Rissen	4,292	51.9	3.5	1.2	4.3	3.9	6.9
District of Altona	97,691	53.9	5.5	2.9	5.9	9.6	16.1
City of Hamburg	723,026	57.1	5.3	2.6	5.5	10.3	20.0

3.3.4. Economy

Throughout this section, the sample areas will borrow the name of the quarters that encompasses them. For example, the name Ottensen will refer to the sample area located within the Ottensen quarter.

Table 3.10 shows the number of residential building and flats, a comparison of both figures, and also the proportion of flats in detached and semi-detached houses on all flats. Altona-Nord and Ottensen are characterised by a structure mainly of houses with several floors and apartments, while in Blankenese and Rissen the predominant building types are detached and semi-detached houses. Osdorf is divided in two parts: Osdorfer Born, a large housing estate, and the rest of the quarter, consisting mainly of detached and semi-detached houses. The average apartment size and the average living space per inhabitant are lower in Altona-Nord and Ottensen than in Blankenese and Rissen; Osdorf is between both.

Table 3.10 - Residential buildings and flats, stock and construction, apartment size and living space in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Number of residential buildings	Number of flats	Number of flats completed	Number of flats in detached and semi-detached family houses	Proportion of flats in detached and semi-detached family houses on all flats	Average apartment size in m²	Average living space per inhabitant in m²
Altona-Nord	1,149	11,850	114	123	1.0	63.6	34.0
Ottensen	2,381	19,477	53	407	2.1	70.3	38.7
Osdorf	4,024	12,412	12	3,338	26.9	84.4	40.1
Blankenese	3,388	6,796	56	3,108	45.7	117.0	59.3
Rissen	3,736	7,386	37	3,469	47.0	100.9	49.0
District of Altona	37,542	134,141	861	28,965	21.6	81.0	40.2
City of Hamburg	249,198	938,592	7,081	187,893	20.0	76.0	38.3

Table 3.11 shows the total number and the proportion of social housing flats. Blankenese and Rissen have a very low proportion of social housing. Ottensen is close to the average and Osdorf and Altona-Nord are significantly above average. Due to the German legal framework, social housing flats are mainly constructed by private developers who receive subsidies and in return are legally bound to offer the flats for social housing rent prices. After a certain period (usually 30 to 40 years), this legal obligation ends and the owners (mainly large housing companies) are allowed to rent the flats at market prices. Even though the increase of rents is restricted, this phasing out of social housing flats is a major problem in many German cities. Particularly, because a large amount of social housing flats was built until the beginning of the 1980's and now are going to be phasing out of the price fixing. Since then, the construction of social housing was significantly decreasing. Therefore, the proportion of social housing flats will decrease over the upcoming years as can be seen on the last column of the table.

Table 3.11 - Social housing in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Number of social housing flats	Proportion of social housing flats on all flats	Number of social housing flats phasing out of social housing until 2022	Proportion of social housing flats phasing out of social housing until 2022 on all social housing flats
Altona-Nord	1,448	12.2	386	26.7
Ottensen	1,349	6.9	801	59.4
Osdorf	1,200	9.7	682	56.8
Blankenese	32	0.5	-	-
Rissen	178	2.4	124	70
District of Altona	10,501	7.8	3,392	32.3
City of Hamburg	78,956	8.4	19,081	24.2

Table 3.12 shows the average prices for real estate land, detached or semi-detached family houses, and condominiums. Some cells are empty due to low numbers of cases or a lack of reliable data. There are significant price differences between the more central quarters Altona-Nord and Ottensen and the highly attractive Blankenese compared to Osdorf and Rissen that are farther from the city centre and therefore have lower land prices. The price of condominiums in Osdorf and Rissen are significantly lower than in the other areas.

Table 3.12 - Average prices for real estate land, detached or semi-detached family houses and condominiums in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Average real estate land price in EUR/m²	Average price for a detached or semi-detached family house in EUR/m²	Average price for a condominium in EUR/m²
Altona-Nord	1,055	.	5,745
Ottensen	1,483	.	5,083
Osdorf	786	4,523	3,216
Blankenese	1,615	6,834	5,249
Rissen	604	4,027	3,870
District of Altona	.	.	.
City of Hamburg	625	3,539	3,965

3.3.5. Transportation

Throughout this section, the sample areas will borrow the name of the quarters that encompasses them. For example, the name Ottensen will refer to the sample area located within the Ottensen quarter.

Transport is a key element for Hamburg's economy. The city is well connected to many transport modes, including road, air, and water networks. Figure 3.7 shows the location of each type of mode in the focus areas of Altona and Pinneberg. As Figure 3.7 shows, Altona has a bigger coverage of metro and train services; meanwhile in the Count of Pinneberg these are concentrated on the main axis.

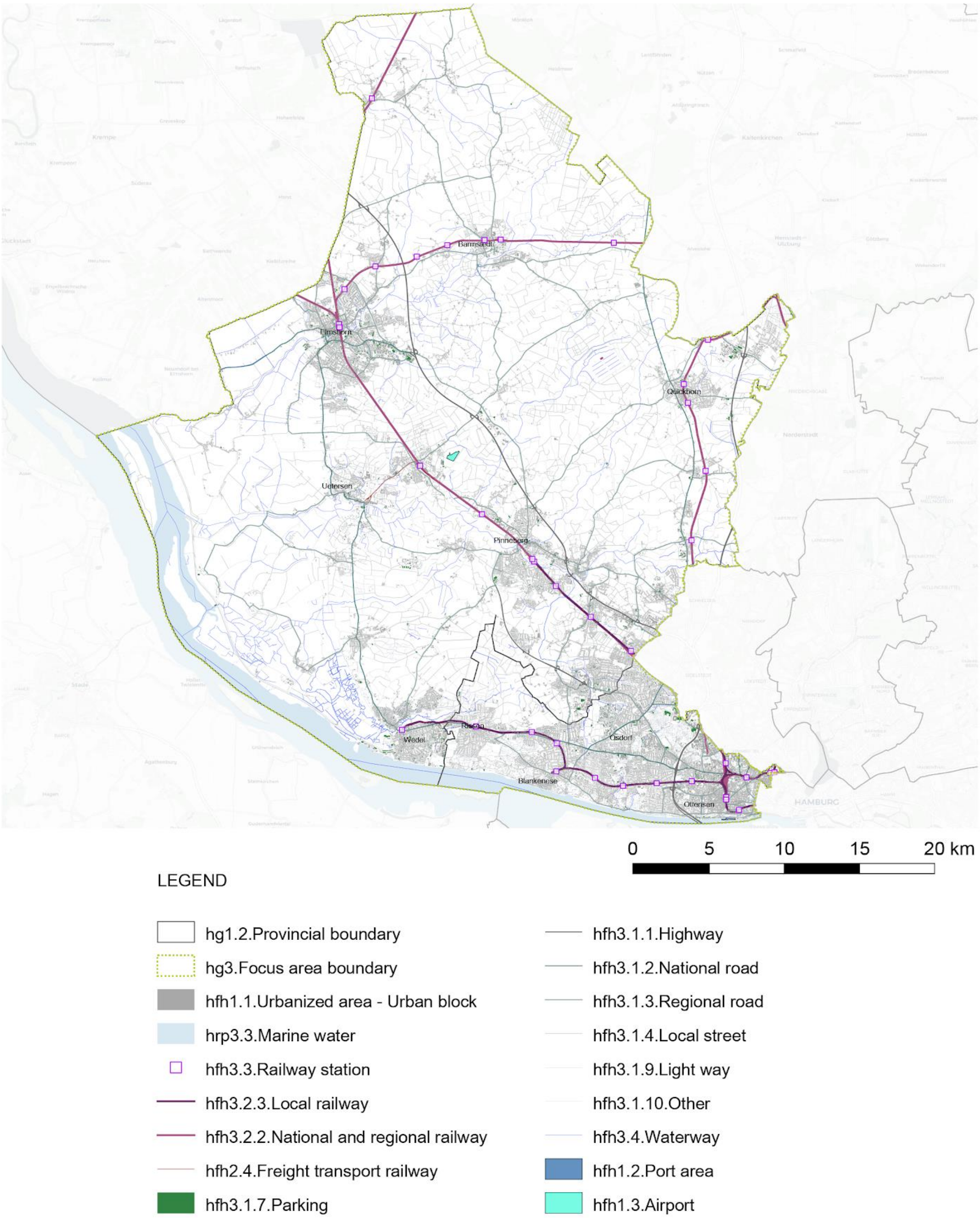


Figure 3.7 - HFH11.Transport infrastructures (link) (HCU, 2018).

Table 3.13 shows the number of private cars and their proportion per 1,000 inhabitants. There are significant differences between the more central quarters Altona-Nord and Ottensen, with a proportion of cars per 1,000 inhabitants clearly below the city and district average, and Blankenese and Rissen, which are above the average. Osdorf is close to the average of the district of Altona.

Table 3.13 - Number of private cars and their proportion per 1000 inhabitants in the quarters encompassing the sample areas, in the focus area, and in the city of Hamburg, 31.12.2016 (Statistik Nord, 2018).

Areas	Number of private cars	Proportion of private cars per 1000 inhabitants
Altona-Nord	5,220	236
Ottensen	9,810	277
Osdorf	9,167	351
Blankenese	6,621	494
Rissen	6,738	444
District of Altona	89,705	332
City of Hamburg	629,834	338

3.3.6. Wastescapes of Altona

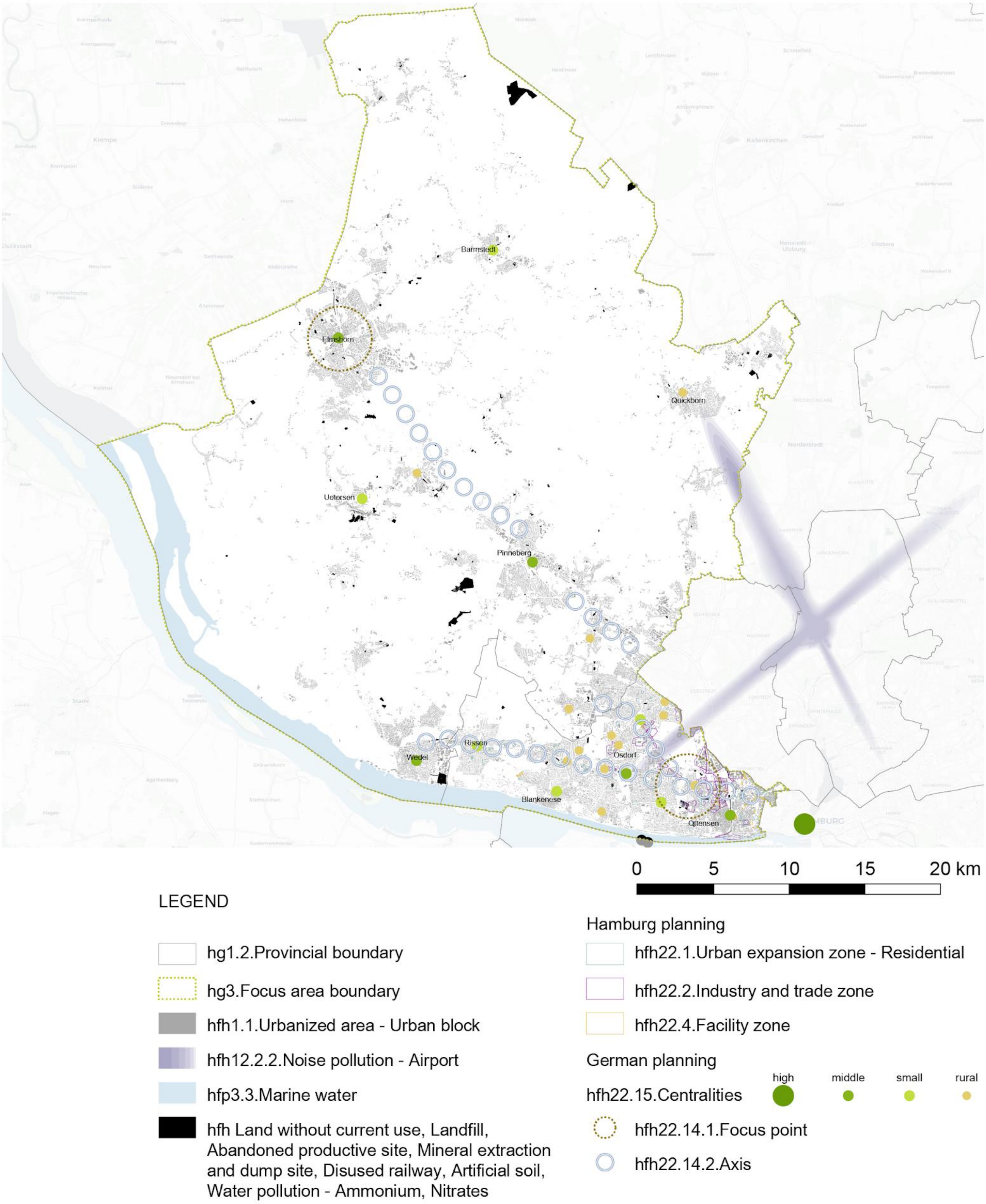


Figure 3.8 - HFH18.3.Wastescape versus planned expansion areas (link) (HCU, 2018).

The previous paragraphs and associated maps highlight specific physical characteristics and urbanisation processes related to the Hamburg region and the selected FA. This analysis resulted in the individuation of the so-called wastescapes, i.e. places on the territory which are either underused or impossible to be used (e.g. contaminated land). In Germany there is not a tradition in the analysis of such scapes, being the planning an umbrella framework which define generally the functions and the future development visions. When it comes to practical implementation of the visions, local and detailed plans are developed (B-Plan). The urban planning system of Germany and specifically of Hamburg, have been explained in D6.2 (REPAiR, 2018c). The lack of these data is also due to the zero-landfill policies applied in Germany at the end of the 90's. Moreover, the most current empty spaces within the city have already and implementation plan for the near future. Some areas in Hamburg are indeed contaminated, but those are situated in the South-East part of the state.

Therefore, the wastescapes have been individuated by collecting information at the European level from the Urban Atlas website: this is valid for the layers of "land without use" and "abandoned productive site", for instance. The proximity to the port area of the focus area is the reason for the presence of chemicals in the water, although concentrations are not high. The activities of the Hamburg airport are contributing to the noise pollution in the eastern part of the FA. The railways which now figure in the map of Figure 3.8 are currently disused, but a new development of the area which comprehends a re-organisation of the metro and trains traffic has already started.

As described in D3.3, "from an urban perspective, the construction of a Wastescape map visualises the unexpected results of urban growth though, unfortunately without providing additional information to the expert eyes of local urban planners and administrators" (REPAiR 2018b: 57). However, in a Circular Economy perspective the temporary and the long-term use of each of these areas can be important. The map will be than the base for discussion on solutions during the PULL meeting with the local stakeholders.

3.3.7. Development strategy & waste sensitivity towards circularity

The Free and Hanseatic City of Hamburg, as a federal state, is responsible for its waste management. Part of the Ministry of Environment and Energy (Behörde für Umwelt und Energie), the department for waste management (Abteilung Abfallwirtschaft) is the supreme agency for waste management in Hamburg. It is responsible for all ministerial and administrative duties concerning waste management and for controlling Hamburg's public waste management company Stadtreinigung (BUE, 2017). The organisation of waste management in Hamburg is defined in the law on waste management (Stadtreinigungsgesetz). By this law, the city-owned public waste management company Stadtreinigung Hamburg (SRH, Anstalt des öffentlichen Rechts) is responsible for the management of the waste coming from private households, street cleaning, winter service, and public toilets. Moreover, SRH owns and manages 12 recycling stations all over Hamburg (Hamburg.de, 2017a). By law, SRH is responsible for the collection and treatment of waste of private households precisely for the residual waste and the biowaste (Hamburg.de, 2017a). The residual waste is brought to two incinerators. One belongs entirely to SRH; the other one with a share of 45%. During the incineration, energy is produced in the form of heat. Part of the heat is converted to electricity. The energy is sent to Hamburg's energy supply system and to surrounding federal states (SRH, 2017). The biowaste fraction from households in Hamburg includes garden and kitchen waste. Once collected door-to-door, it is treated in the compost facilities of Bio- und Kompostwerk Bützberg (BKW), which belongs entirely to SRH, and used to produce biogas and supply households, and compost for agricultural purposes (SRH.de, 2017). Additionally, SRH has a contract with the dual system (see D6.2 on producer responsibility) to collect packaging waste (consisting of plastics, metals) and paper/cardboards through one of its subsidiary companies WERT GmBH (BUE, 2017). Waste from private households is therefore collected with a four-bin system separating residual waste, organic waste, paper/cardboards, and packaging waste. The bins are grey, green, blue, and yellow, respectively. This follows the Hamburg ordinance on recyclables (Hamburgische Wertstoff-Verordnung) of 2011. However, not all households - especially in dense urban areas - have the four-bin system. Therefore, SRH started the so-called recycling offensives over the last years to increase the separate collection (SRH, 2017: 29-30).

In some densely built areas of Altona, waste is still collected in pink plastic bags (Sackabfuhr) as there is lack of space to place bins/containers. In these areas the separation of biowaste and residual waste has not been done so far, calling for eco-innovative solutions. Additionally, the pink bags are not ideal for waste management and also present a problem of tidiness. Other recyclables are collected in depot containers in public spaces, for instance at roadsides. For biowaste, it does not seem to be a suitable solution, as tests with underfloor containers showed that people do not separate the waste properly. This seems to be a problem of social control.

In some areas where separate organic waste bins are disposed, especially in large housing estates, the organic waste bins are not always used properly. Despite information campaigns, there is still a need for convincing housing companies, facility managers and tenants of the advantages of a better waste separation.

Solutions for the aforementioned challenges require more cooperation between spatial planning on the one and waste management on the other side. At the moment waste management does not play a major role in spatial planning in Hamburg. This occurs in different fields; e.g. in the planning and situation of containers in public spaces or in the planning process of new housing estates and new quarters, where the topic of waste is often neglected.

In areas with detached houses, the bio-waste bins are mainly filled with garden waste, whereas the kitchen waste is predominantly thrown into the residual waste bins. This is a wasted opportunity as the kitchen waste holds greater value for biogas production other than the garden waste.

3.4. Material Flow Analysis of food waste in Altona

As described in the previous section, SRH is responsible for implementing the policies regarding waste management defined by the City of Hamburg. According to the interviews conducted with stakeholders in the region (WP6) and the PULL workshops in the co-exploration phase (WP5), the currently most urgent topic is the increase of the quantity and quality of biowaste collection.

In Hamburg, the residual waste bin is still filled up partly with recyclables. In particular, the percentage of compostable biowaste in the residual waste bins is rather high (35,8%) (Oetjen-Dehne & Partner Umwelt-und Energie-Consult GmbH, 2018), which precludes its reutilisation. Although SRH takes a variety of actions to achieve an increase of biowaste collection, challenges still persist. To solve them with eco-innovative solutions, a MFA focusing on Organic Waste (OW) becomes priority.

The MFA for the OW in Altona will be covered according to the steps proposed in D3.1, followed by interpretation and reflection.

3.4.1. Step 1: Determination of material scope

From the five REPAiR categories, i.e. Construction and Demolition Waste (CDW), Organic Waste (OW), Post-Consumer Plastic Waste (PCPW), Waste of Electronic and Electrical Equipment (WEEE) and Municipal Solid Waste (MSW), it was decided that the two material scopes for the Altona case study would be Kitchen Waste (KW) and Garden Waste (GW), both as a part of OW. The REPAiR definition of OW, adapted from the European Commission, is as follows: “biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants. It does not include forestry or agricultural residues, manure, sewage sludge, or other biodegradable waste such as natural textiles, paper or processed wood. It also excludes those by-products of food production that never become waste” (EC, 2016).

The definition for KW is the same as Food Waste (FW), which has been adopted from the EU Fusions project as “any food, and inedible parts of food, removed from the food supply chain to be recovered or disposed (including composted, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea)" (Östergren et al., 2014). KW is used instead of FW because the former is the translation from the Organic Waste Decree (BioAbfallVerordnung, BioAbfVO) of 2010, updated in 2017 by the city of Hamburg.

3.4.2. Step 2: Defining the material supply chain

A set of NACE codes were selected to represent the FW network, subdivided into Activity Groups (AG) of specific activities that act as nodes in the FW generation and treatment system. As in the deliverable D3.2, the AG 'H', standing for FW production by households, was introduced. The following AGs have been identified:

- P1 - Primary Production - outside Altona, but with a relevant role in MFA
- P2 - Processing and manufacturing
- W - Wholesale and logistics
- R - Retail and markets
- H - Food preparation and consumption at households - (not a NACE activity)
- WM - Waste Management - inside and outside Altona

Figure 3.9 illustrates the system diagram model of activities and flows that build the general system of the food value chain for the district of Altona.

A strong focus in the further work of the PULL Altona will be on the phase of waste separation, collection and processing as these were highlighted by the local stakeholders. The phase of retail and markets respectively food services (e.g. restaurants) and preparation and consumption in private households will be another focus emphasising the possibilities of food waste prevention.

SYSTEM DIAGRAM OF ACTIVITIES AND FLOWS

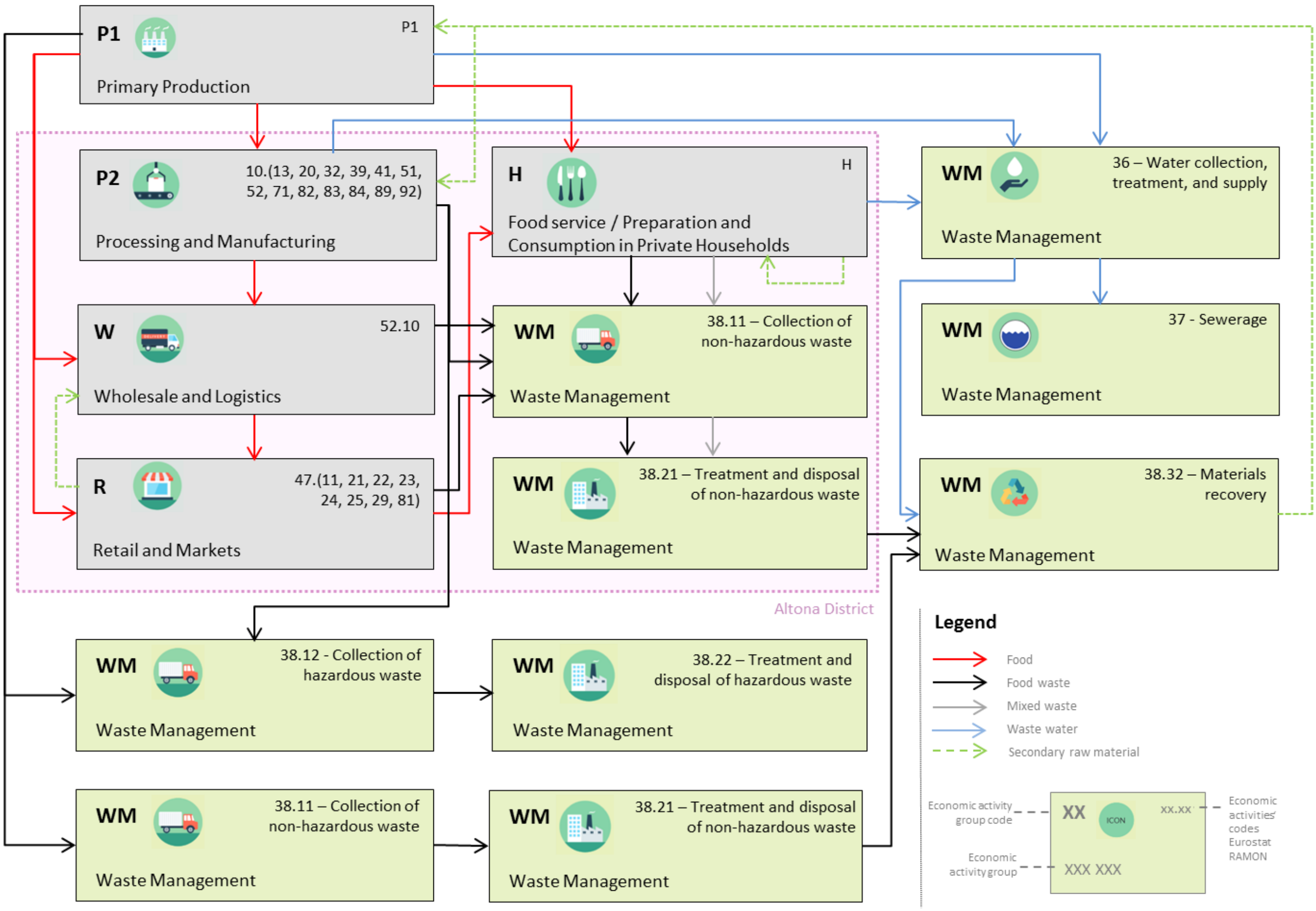


Figure 3.9 - The system diagram of activities and flows that build the system of the food value chain in the Altona FA (HCU, 2018).

3.4.3. Step 3: Selection of geographical area & spatial scales

For the Hamburg case study, the Focus Area (FA) corresponds to the administrative boundaries of Pinneberg County, in the Federal State of Schleswig Holstein, and Altona district, one of the 7 districts of the Federal City-state of Hamburg. There are 14 quarters in the Altona district, of which 5 encompass the sample areas to be studied with more depth: Rissen, Blankenese, Osdorf, Ottensen, and Mitte-Altona. As mentioned in chapter 2 of the Deliverable 3.3, the concept of using a smaller scale of the 'sample' area was introduced, cutting into the intermediate scale of the FA, to deepen the context and allow a better interaction with the local stakeholders (REPAiR, 2018b).

Figure 3.10 displays the different levels of boundaries and the cross-scale relations: Federal Republic of Germany; Hamburg region, which includes the entire Hamburg city-state and parts of the nearby federal states of Schleswig-Holstein, Niedersachsen and Mecklenburg-Vorpommern; the focus area composed of Pinneberg and Altona; and the 5 sample areas within Altona district. The sample areas will borrow the name of the quarters that encompasses them. For example, the name Ottensen will refer to the sample area located within the Ottensen quarter.

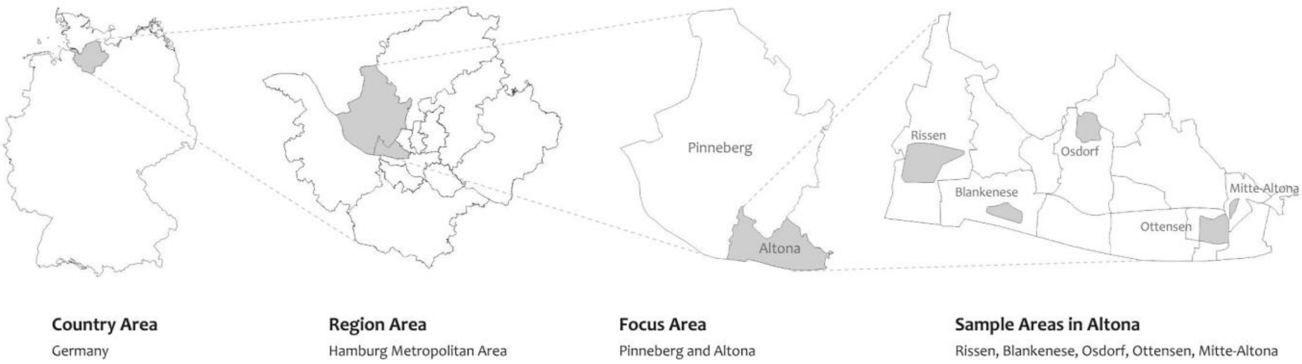
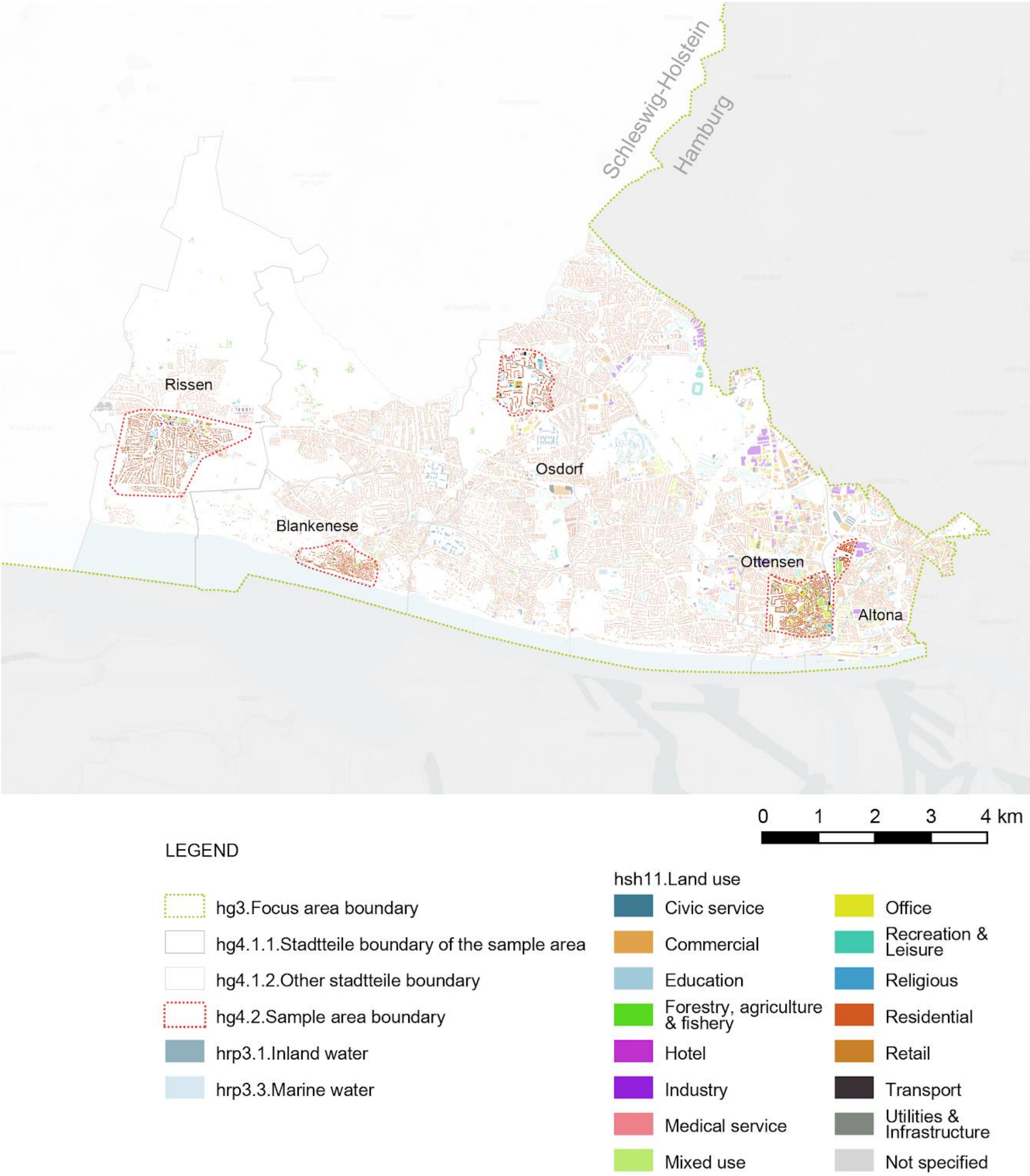


Figure 3.10 - Country area, region area, focus area, and sample areas in Altona (HCU, 2018).

With the sample areas defined, a series of urban and socio-demographic information were assessed to identify any relation with the waste generation within the sample areas.

For the urban assessment, the HafenCity Universität (HCU) Geoportal (2017) was the chosen source to provide updated information about building density and heights as well as the land use of Altona's sample areas. Since the data was collected as a shapefile, some data manipulation was possible so that the assessment could cover specifically the samples areas.

In the land use context of Altona's sample areas, 123 different land use typologies were identified, which were then grouped into 15 land use categories, which are illustrated below in the land use map in Figure 3.11. The parameters for such categorization are specified in a document found here (link).


Schleswig-Holstein
Hamburg
Rissen
Osdorf
Blankenese
Ottensen
Altona
0 1 2 3 4 km
LEGEND
hg3.Focus area boundary
hg4.1.1.Stadtteile boundary of the sample area
hg4.1.2.Other stadtteile boundary
hg4.2.Sample area boundary
hrp3.1.Inland water
hrp3.3.Marine water
hsh11.Land use
Civic service
Commercial
Education
Forestry, agriculture & fishery
Hotel
Industry
Medical service
Mixed use
Office
Recreation & Leisure
Religious
Residential
Retail
Transport
Utilities & Infrastructure
Not specified

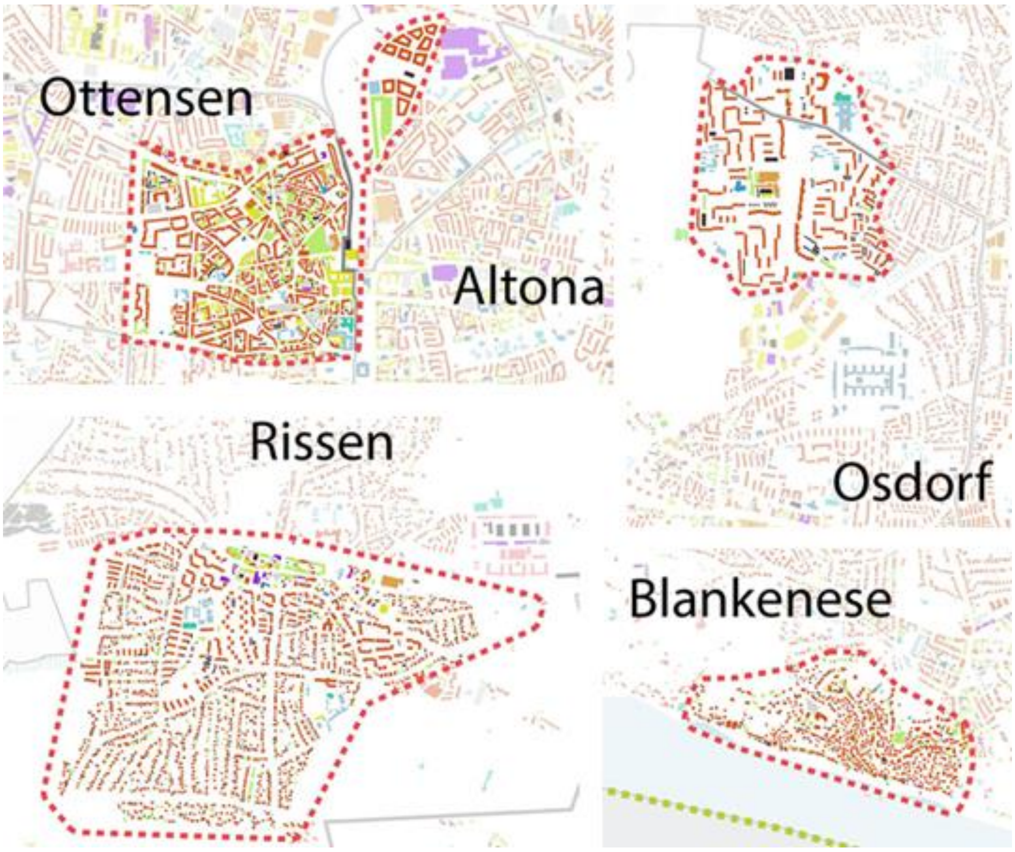


Figure 3.11 - HSH2.Land use (link) (above) and zoom in of the five areas (below) (HCU, 2018).

For complementing the visualization of the land use characteristics in Altona's sample areas, the Table 3.14 was created to represent the share of land use distribution within the five sample areas. This means the percentage of urban space used for different purposes. The calculation consisted in summarizing the square meters of all categorized buildings and distributing the proportions each land use category covers within each sample area.

Table 3.14 - Land use distribution in Altona's sample areas (Authors' own elaboration based on data obtained from HCU Geoportal, 2017).

[%] of land use type	Rissen	Blankenese	Osdorf	Ottensen	Mitte-Altona
Civic Services	0.34%	0.00%	0.14%	0.20%	0.00%
Commercial	1.96%	0.38%	5.88%	3.59%	0.00%
Education	3.42%	0.43%	14.57%	3.30%	6.96%
Forestry, Agriculture & Fisheries	0.14%	0.02%	0.00%	0.01%	0.00%
Hotels	0.13%	0.22%	0.00%	0.00%	0.00%
Industry	1.31%	0.00%	0.00%	0.56%	0.00%
Medical Services	0.00%	0.06%	0.00%	0.06%	0.00%

Mixed Use	10.89%	14.47%	4.09%	19.24%	34.64%
Offices	1.45%	0.68%	0.77%	11.28%	0.00%
Recreation & Leisure	0.82%	0.37%	3.06%	1.00%	0.00%
Religious	0.11%	0.00%	1.21%	0.61%	0.00%
Residential	72.50%	79.17%	60.98%	53.78%	54.59%
Retail	0.27%	1.11%	0.00%	3.49%	0.47%
Transport	6.36%	3.06%	9.26%	2.69%	1.99%
Utilities & Infrastructure	0.31%	0.05%	0.05%	0.18%	1.35%

By analysing the map and table of the land use distribution within Altona's sample areas, it is possible to notice some remarquing characteristics. For instance, Rissen and Blankenese present the highest share of residential area, while a considerable share of other uses can be found, due to the distance of these two areas from the services located in the inner city. In the case of Ottensen and Mitte-Altona, the strongest presence lays over the mixed uses due to its higher density and proximity to the city centre. Finally, Osdorf highlights itself by presenting the highest share of education and commercial uses, followed by transport utilities, and recreation and leisure.

Another factor that might affect the generation of waste is the building density (what in D3.3 is called urban density). The map HSH4.Building heights (link) represents the number of storeys of the buildings in the area. In addition, the Table 3.15 was created to relate the buildings' area with their respective number of storeys (link). This way it was possible to analyse the building density distribution within Altona's sample areas. The *percentage [%] of Altona* represents the share of space each sample area covers in the district of Altona. The *Building projection area* stands for the share of built area in the ground floor for each sample area. Finally, the *Total built area* refers to the share of total built area for each sample area, thus the sum of built area in the ground floor by building multiplied by the number of storeys of each building.

Table 3.15 - Building density distribution in Altona's sample areas (Authors' own elaboration based on data obtained from HCU Geoportal, 2017).

	Rissen	Blankenese	Osdorf	Ottensen	Mitte-Altona
[%] of Altona	3.2%	0.8%	1.2%	1.5%	0.2%
Building projection area [%]	14%	18%	18%	39%	33%
Total built area [%]	27%	40%	68%	131%	173%

The building density distribution above shows the density similarities and distinctions between Altona's sample areas. Rissen and Blankenese present relatively low density and mostly one to two storeys buildings due to its high share of private residential use. In the case of Osdorf, although it presents the same share of building projection area as Blankenese, its total built area is considerably higher once this sample area presents mostly three to more than eleven storeys of residential buildings, being Osdorf historically linked to social housing. Finally, Ottensen and Mitte-Altona were found to present the highest share of building projection and total built area, in spite of the distinction between those sample areas, once Mitte-Altona is a recently developed area while Ottensen encompasses a considerable portion of historical buildings.

For the socio-demographic assessment, the Statistikamt Nord Report (2016) provided data about Altona's quarters from the year of 2015. It is important to mention that the socio-demographic data collected covers as a whole the quarters of Altona, in which the sample areas are located. Therefore, it was not possible to present socio-demographic information exclusively from Altona's sample areas. With such information, a series of maps (HSH1.Social analysis - Overview) was generated (link) from which the following tables will be referring to. The data values were grouped into three main levels to be represented by three different colours. With the red colour representing higher levels, the yellow colour representing medium levels and the green colour representing lower levels.

Table 3.16 refers to the population distribution within Altona's quarters in which the sample areas are located. The *population density* relates to the number of inhabitants per square meter. The *Number of inhabitants per household* refers to the distribution of people for each household. The *Distribution of households with only one inhabitant* aims to illustrate the share of households with only one inhabitant.

Table 3.16 - Population distribution in Altona's quarters that encompass the sample areas. The colours refer to the maps in the Annex 2 (Authors' own elaboration based on data obtained from Statistikamt Nord, 2016).

	Rissen	Blankenese	Osdorf	Ottensen	Mitte-Altona (Altona-Nord)
Population density [inhabitants/km²]	< 2,000	< 2,000	2,000 – 6,000	> 6,000	> 6,000
Number of inhabitants per household	1.8 - 2	1.8 - 2	1.8 - 2	< 1.8	< 1.8
Distribution of households with only one inhabitant [%]	< 45	45 - 60	45 - 60	> 60	> 60

The figures from the table above make it possible to relate the population distribution with the building density within these quarters of Altona. Thus, in Ottensen and Altona-Nord, although the population density is less than two thousand inhabitants per square meter, these quarters present the highest share of one inhabitant per household, which relates to the fact that these quarters have also the highest share of building density area. The case of Osdorf represents the quarter with the highest population density.

Table 3.17 refers to the Inhabitants' age distribution within Altona's quarters, in which the sample areas are located. Therefore, the population was divided into groups of inhabitants older than 60 years and inhabitants younger than 18 years.

Table 3.17 - Inhabitants' age distribution in Altona's quarters that encompass the sample areas. The colours refer to the maps in the Annex 2 (Authors' own elaboration based on data obtained from Statistikamt Nord, 2016).

	Rissen	Blankenese	Osdorf	Ottensen	Mitte-Altona (Altona-Nord)
Population older than 65 years [%]	16 - 21	16 - 21	16 - 21	< 16	< 16
Population younger than 18 years [%]	16 - 19	16 - 19	> 19	< 16	< 16

In the five quarters, the population is rather homogeneous being the presence of elderly and young people not preponderant. An exception is Osdorf, which is known to host social housing mainly. Most probably, young couples with children decide to leave here for the low prices of housing. Elderly people and to some extent adult as well can refrain innovation and might pose themselves in opposition eventually to solutions which focus on behaviour changing, meanwhile younger people are supposed to be more open.

Table 3.18 refers to the Inhabitants' average income and unemployment rate within Altona's quarters in which the sample areas are located. Therefore, the *Average income* is measured in euros per year, while the *Unemployment rate* is measured in percentage.

Table 3.18 - Inhabitants' average income and unemployment rate in Altona's quarters that encompass the sample areas. The colours refer to the maps in the Annex 2 (Authors' own elaboration based on data obtained from Statistikamt Nord, 2016).

	Risse	Blankenese	Osdorf	Ottensen	Mitte-Altona (Altona-Nord)
Average income [EUR/year]	35,000 – 65,000	> 65,000	35,000 – 65,000	35,000 – 65,000	< 35,000
Unemployment rate [%]	< 4.11	< 4.11	4.11 - 7.41	4.11 - 7.41	4.11 - 7.41

The figures in the Table 3.16 can be related to the building density as well, once it is possible to notice that the denser, the lower the average income of the inhabitants of that specific quarter.

Finally, Table 3.19 aims to illustrate the migration background within Altona's quarters in which the sample areas are located. Thus, the *percentage [%] of population with migration background* stands for all that "persons who have immigrated [...] to the today Federal Republic of Germany after 1949, [...] all foreigners born in Germany and all persons born in Germany who have at least one parent who immigrated into the country or was born as a foreigner in Germany" (Statistisches Bundesamt Deutschland, 2018h). The *percentage [%] of foreign population*, instead, indicates all those people who do not fall in the previous category.

Table 3.19 - Migration background in Altona's quarters that encompass the sample areas. The colours refer to the maps in the Annex 2 (Authors' own elaboration based on data obtained from Statistikamt Nord, 2016).

	Rissen	Blankenese	Osdorf	Ottensen	Mitte-Altona (Altona-Nord)
[%] of population with migration background	< 20	< 20	> 30	20 - 30	> 30
[%] of foreign population	> 10	< 10	10 - 15	10 - 15	> 15

As shown in the Table 3.19, quarters like Rissen and Blankenese with a strong residential vocation, high distance from the city centre and characterised by high estate prices present a much lower percentage of foreign and migration background population, meanwhile in Osdorf (also linked to the social housing issue above discussed) and Ottensen together with Mitte-Altona figure more attractive and affordable. Certainly, the presence of foreign population poses challenges regarding information campaign for what concerns language barriers, for instance, element which must be considered when it comes to project realisation in such contexts.

3.4.4. Step 4: Defining case specific supply chain

The activities related to the food waste chain in Altona were defined in Step 2 and the geographical area is presented in Step 3. It is now possible to identify and describe the actors who generate, collect, and treat FW. This step will proceed separating companies (Activity Groups P2, W, R) from households (Activity Group H).

<u>Households in the FW chain</u>

Households contribute significantly to the FW and are the focus of the study in Altona district. However, they are not identified with NACE codes. The data used relates to the number of families, number of housing, and number of inhabitants according to the Statistics department for Hamburg and Schleswig-Holstein (Statistisches Amt für Hamburg und Schleswig-Holstein), which published the profile for each Hamburg neighbourhood in 2018, referring to data collected in 2016. Table 3.20 shows the population data for each quarter encompassing the sample areas.

Table 3.20 - Population data for Altona's quarters. (Statistisches Amt für Hamburg und Schleswig-Holstein, 2018).

	Rissen	Blankenese	Osdorf	Ottensen
Inhabitants	15,192	13,325	26,507	35,370
Households	7,742	6,935	13,046	21,497
People per household	2.0	2.0	2.0	1.7

<u>Companies in the FW chain</u>

The Orbis database was used to get all the possible actors who participate in the organic waste flow, which were then filtered using the NACE codes into activity groups and also selected according to the administrative boundaries. The resulting companies relevant to the organic waste in Altona focus area are presented in Table 3.21.

Some relevant NACE codes did not have actors registered in the focus area, for example the ones related to collection, treatment, and disposal of hazardous waste. Those are done by companies registered outside the borders of the Altona district.

The focus of the study in Altona district is the organic waste coming from households, specifically food waste (FW). Therefore, the AG for food service (F) has not been considered as it does not relate to the material flow of households, but only to commercial activities[1]. The AGs that were considered participate in the material flow of households, with companies that process and manufacture food, warehousing and storages, retail and markets selling food products, and waste management companies. The Table 3.19 shows the AGs with the corresponding number of actors for each NACE code identified in the Altona FA. Figure 3.12 shows a pie chart for the number of companies registered in Altona district per activity group.

[1] However, data related to commercial activities per se (e.g. gastronomy sector) are to be found in Hamburg.de (2018). These will be considered in the next project phases.

Table 3.21 - AGs with the corresponding number of actors for each NACE code identified in the Altona FA (HCU, 2018).

Statistical Classification of Economic Activities in the European Community

	P2 - Processing and manufacturing	**Count**
C-10.13	Production of meat and poultry meat products	7
C-10.20	Processing and preserving of fish, crustaceans and molluscs	6
C-10.32	Manufacture of fruit and vegetable juice	3
C-10.39	Other processing and preserving of fruit and vegetables	4
C-10.41	Manufacture of oils and fats	1
C-10.51	Operation of dairies and cheese making	1
C-10.52	Manufacture of ice cream	4
C-10.71	Manufacture of bread; manufacture of fresh pastry goods and cakes	11
C-10.82	Manufacture of cocoa, chocolate and sugar confectionery	3
C-10.83	Processing of tee and coffee	3
C-10.84	Manufacture of condiments and seasonings	3
C-10.89	Manufacture of other food products n.e.c.	12
C-10.92	Manufacture of prepared pet foods	1
Total		**59**

	W - Wholesale and logistics	**Count**
H-52.10	Warehousing and storage	7
Total		**7**

	R - Retail and markets	**Count**
G-47.11	Retail sale in non-specialised stores with food, beverages or tobacco predominating	52
G-47.21	Retail sale of fruit and vegetables in specialised stores	11
G-47.22	Retail sale of meat and meat products in specialised stores	3
G-47.23	Retail sale of fish, crustaceans and molluscs in specialised	8
G-47.24	Retail sale of bread, cakes, flour confectionery and sugar confectionery in specialised stores	4
G-47.25	Retail sale of beverages in specialised stores	16
G-47.29	Other retail sale of food in specialised stores	42
G-47.81	Retail sale via stalls and markets of food, beverages and tobacco products	2
Total		**138**

	WM - Waste management	**Count**
E-38.11	Collection of non-hazardous waste	1
E-38.21	Treatment and disposal of non-hazardous waste	3
Total		**4**

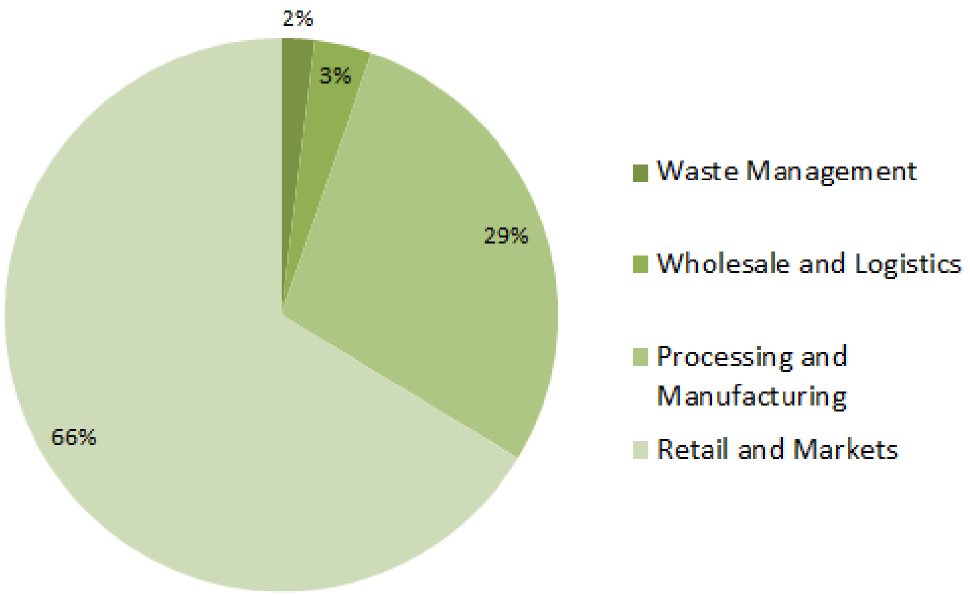


Figure 3.12 - pie chart with the number of companies registered in Altona district per activity group (HCU, 2018).

Figure 3.13 shows the map of Altona district with the location of each actor present on Table 3.19 and with the sample areas highlighted (red polygons). The colour of each actor corresponds to its AG.

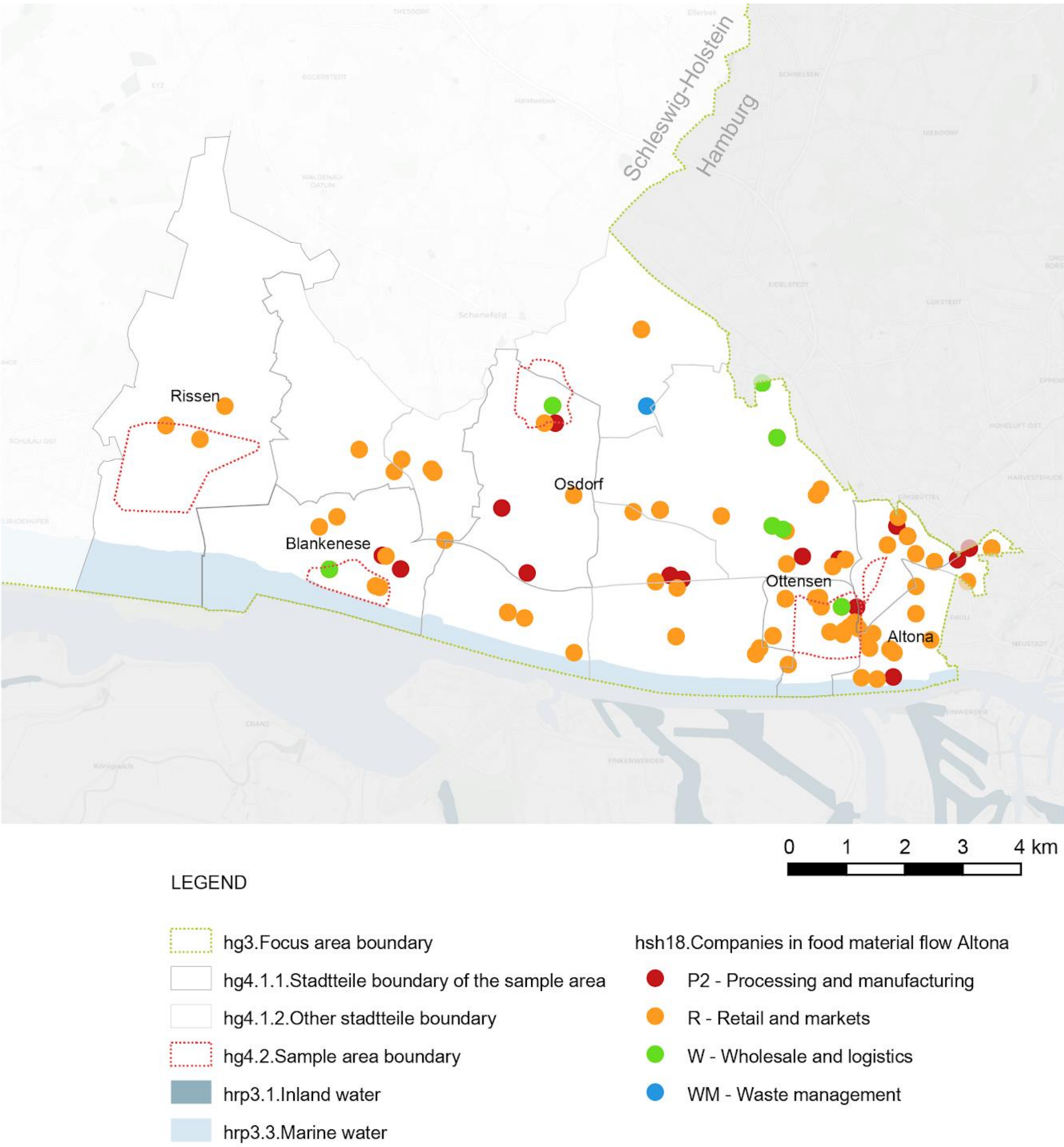


Figure 3.13 - HSH7.Companies in Food Material Flow Altona (link) (HCU, 2018).

3.4.5. Step 5: Activity-based mass flow modelling

Data Gathering

Process for defining the amount of waste produced in Altona

One of the most challenging information to find is related to the amount of waste generated by the households in Altona. The data available on the topic was in the form of a rather detailed study conducted by a consultancy company on behalf of SRH. The study consisted on an analysis of the waste generated in 22 house-buildings (4 different types in total, see Table 3.22). Relevant result of this analysis is, among others, the amount generated in a year per person divided in the different waste fractions according to the housing type. The values were used for the MFA but cannot be published.

Table 3.22 - Number of samples considered according to the housing types (Own from Winterberg, 2018).

Housing type in German	Housing type in English	Number of sample
Lockere Babuung	Single-family house	10
Mehrfamilienhäuser	Multi-family house	6
Kerngebiet	Mixed use	3
Großsiedlung	Large housing estate	3

With the confidential information on the amount of waste generated by a person in a year per housing type, the next steps were to divide the housing stock in Altona in these four categories and to define the number of inhabitants for each of them. It is important to notice that these analyses are referring to those households who have all the four bins, namely plastic, paper, residual and organic waste.

The explanation of these two steps follows. Afterwards, the third step about the calculation of the amount of waste generated in a defined area is described in a third section.

1. Defining the Housing Type

The ALKIS database for georeferenced information in Germany defines the housing types according the following categories: 1) Two-family house (*Doppelhaushälfte*), 2) Detached building block (*Freistehender Gebäudeblock*), 3) Detached single-family house (*Freistehendes Einzelgebäude*), 4) Multi-family block (*Gebäudeblock in geschlossener Bauweise*), 5) Multi-family house (*Gruppenhaus*), and 6) Row house (*Reihenhaus*). As the reader can notice, these types are not the same as the ones selected in U.E.C. Berlin (2018). The goal was therefore to match these categories from ALKIS with the ones from the analysis of the waste. This process has been done through the help of the working paper of Dochev et al. (2017) and reported in the excel table called Building type - methodology for the definition (link).

This first step ended with the generation of a shape file for each of the four housing types. The map in Figure 3.14 shows the location of the different housing types. The descriptions for all the typologies that are possible to find in the excel spreadsheet in the above link are the following:

- *Two-family house*: Twin-buildings, usually used for single family houses. Corresponds to the Einfamilienhaus – Doppelhaus
- *Detached building block*: Usually used for detached multi-family houses, this corresponds to the Mehrfamilienhaus- Einzelhaus
- *Detached single-family house*: Usually used for detached single-family houses, this corresponds to the Einfamilienhaus- Einzelhaus in the digital cadastre of Hamburg before the ALKIS was adopted
- *Multi-family block*: Corresponds to 'Mehrfamilienhaus - Wohnblock'
- *Multi-family house*: Corresponds to 'Mehrfamilienhaus - Gruppenhaus'
- *Row house*: Row houses, usually single-family houses. Corresponds to Einfamilienhaus – Gruppenhaus

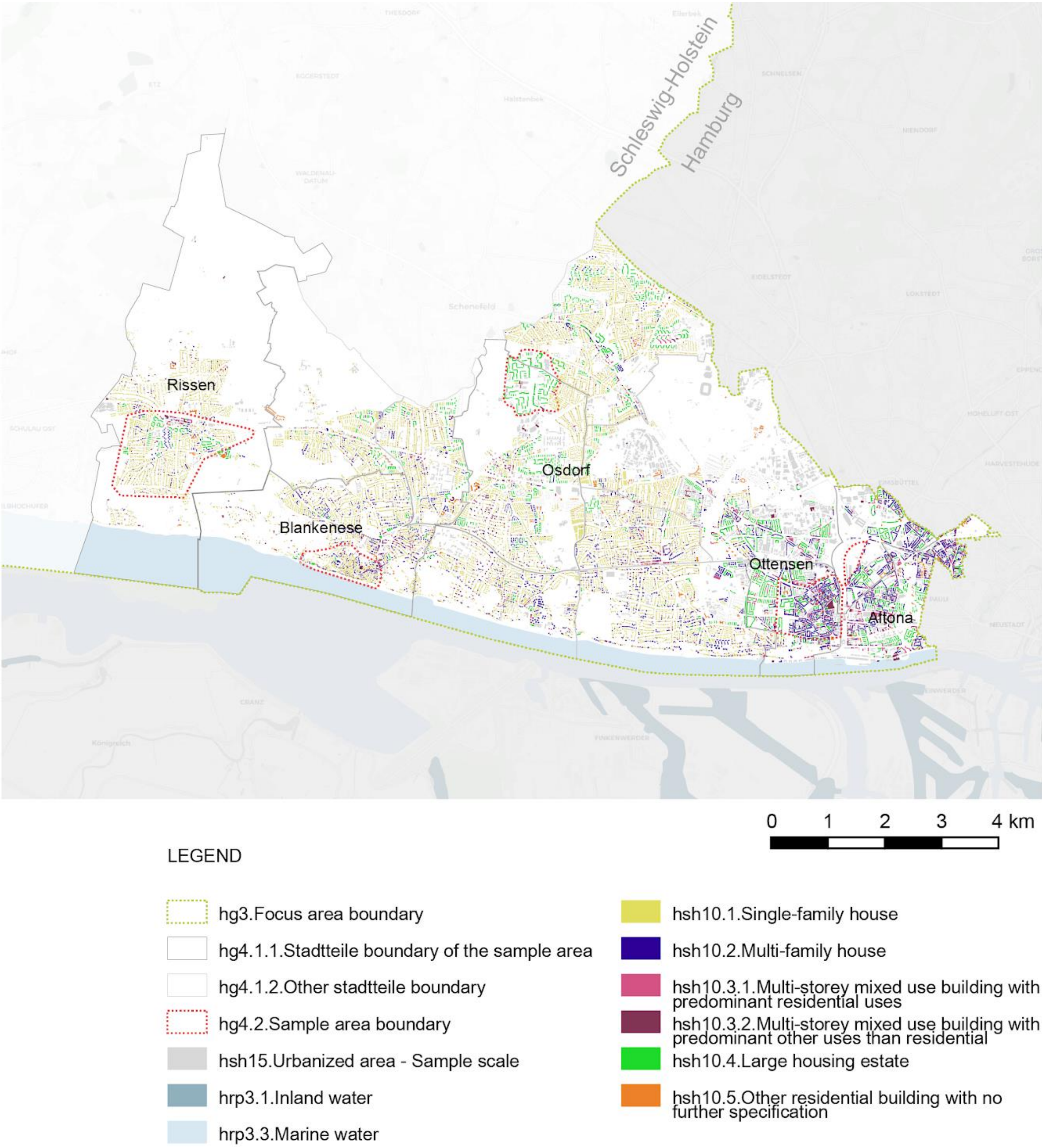


Figure 3.14 - HSH3.Housing construction type (link) (HCU, 2018).

2. Defining the number of inhabitants

Finding this piece of information was work intensive. Due to data protection policy, which in Germany is rather strict, the data collected are at the building block (*Baublock*) level: in Germany, a building block is commonly defined as an area limited by streets on all its sides and contains one or more plots. There are 1,283 building blocks in total in Altona. These blocks are therefore bigger than a plot, but smaller than a neighbourhood (i.e. the level of the sample areas). The information has been provided by the CityScience Lab of the HafenCity University, but the data is protected: an aggregated version of this information is therefore necessary for the purpose of this deliverable.

The shape file taken by the Geoportal of HafenCity University was merged with the information of the inhabitants per block. This file will be provided in a protected form for the insertion to the GDSE software.

3. Defining the amount

At this point, the information in hands of the Hamburg research team is the following: number of inhabitants per block and number and types of house-buildings per block. In other words, in this moment it is still not clear how many inhabitants per building types there are, what is fundamental to be merged with the analysis in Winterberg (2018).

For all 1,283 building blocks, the area of each building type has been calculated by multiplying the ground floor area by the number of floors and subtracting a certain percentage (which in Hamburg is 10%): this in order to exclude surfaces which are not inhabitable, such as walls, staircases and so on. From Engineeringtoolbox.com (2018) it is possible to find the average of km^2 per person in different rooms: it is a worldwide tool that can be applied in all cases, if, like in this one, no more precise data are available. Because of this generalist feature of the information, a further correction has been applied. This point is represented in Figure 3.15 below.

L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
Tot	Inhabitants per type (Theoretical)					Inhabitants per type (Percentage)					Inhabitants per type				
Inhabitants	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
104	107,10	0,00	3495,56	0,00	0,00	3%	0%	97%	0%	0%	3	0	101	0	0

Figure 3.15 - Extract of the excel file for the calculation of the inhabitants per block per housing type (HCU, 2018).

The calculation of the inhabitants according to the ratio of the m^2 per person in Engineergintoolbox.com (2018) gives the results in the cells M3:Q3. The total is equal to ca. 3,500 inhabitants. However, in L3, where the number of inhabitants is given per building block, the total of inhabitants for this block is only 104. Therefore, it was decided to calculate the share of the inhabitants in the form of percentage (R3:V3). Having 3% in type A against the 97% of type C, the real number of inhabitants results in 3 and 101 inhabitants for type A and C respectively (W3:AA3). For data protection policies, the authors are not allowed to share the excel file with the calculation.

4. Maps of waste generation

This Section explains the results of the method explained previously. The Table 3.23 shows the total amount of kitchen and garden waste generated per housing type. From the data (which derives from a calculation done with several approximations), some statements can be driven. The amount of kitchen waste generated is circa four times higher than the garden waste. The reason for that is the number of inhabitants in single-family houses (which are the ones who normally have gardens) is around 23 % of the total: indeed, the other categories have considerably less waste produced from gardens than from the kitchens, while for the single-family houses the trend is inverted in a 1 to 2 ratio.

Table 3.23 - Amount of kitchen and garden waste produced in Altona per housing type (HCU 2018).

Typology	Waste produced (t/a) - KW	Waste produced (t/a) - GW
Single-family houses	*3,845.7*	6,266.0
Multi-family houses	*4,422.0*	427.0
Mixed use	*5,780.7*	348.0
Large housing estate	*9,155.8*	260.3
Others	*792.8*	22.5
Total	*23,997.0*	*7,323.8*

The waste analysis is not meant to show only quantities. An interesting element is indeed the geolocation of the waste, i.e. where the kitchen and garden waste are generated. The following two Figures 3.16 and 3.17 report the results of the analysis just described for the kitchen waste and the garden waste generated in all the five housing categories respectively.

This is useful not only to understand where the waste is generated, but also as an easily readable tool for deciding upon actions aiming at specific areas. The data has been derived also for all the other fractions of waste. Information on organic waste is provided.

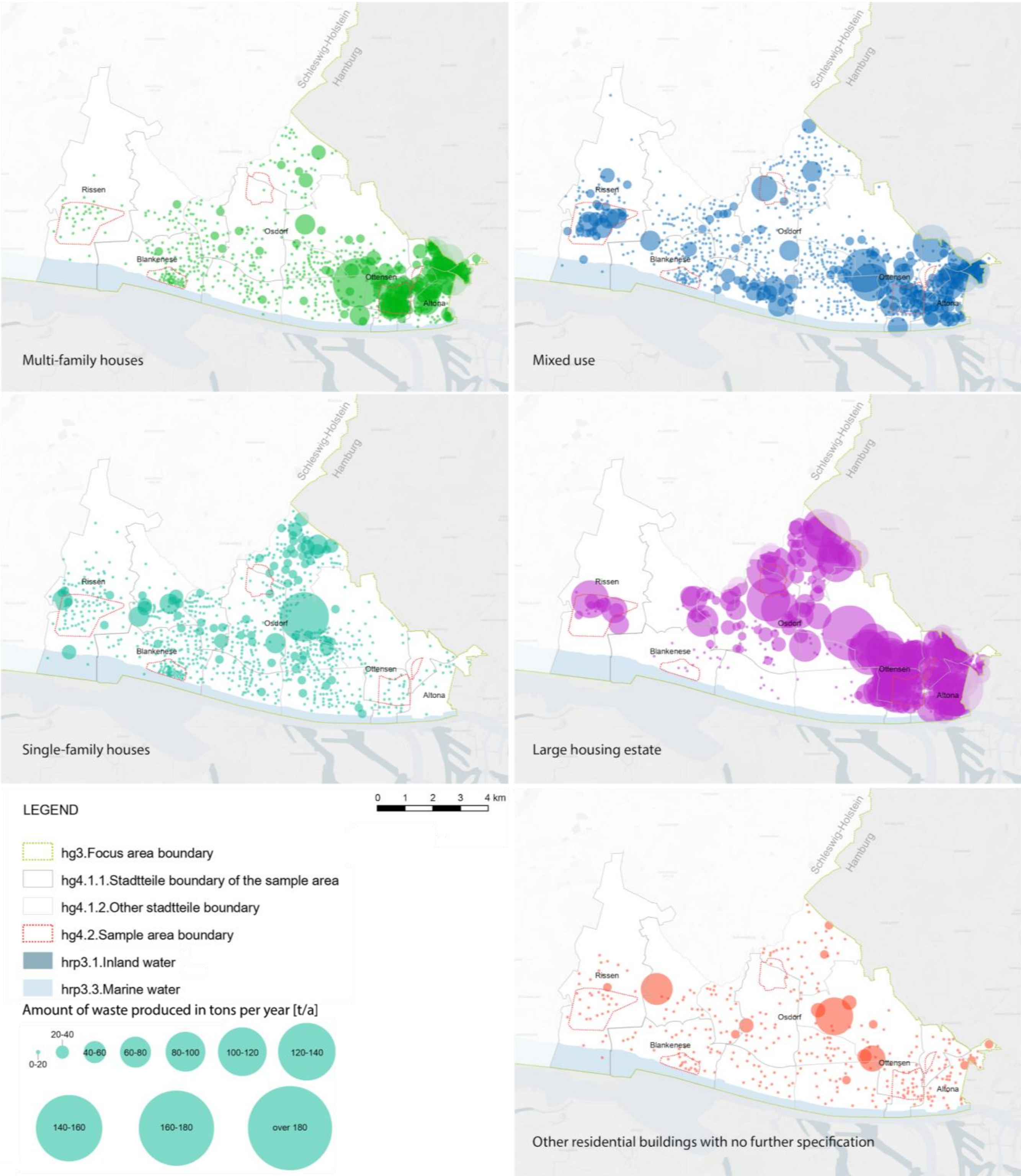


Figure 3.16 - HSH6.1.Kitchen waste generated - overview (link) (HCU, 2018).

Concerning kitchen waste, the results clearly show that most of it is generated in Altona, where a higher concentration of people lives. However, these are mainly the large housing estate or mixed-use buildings. A considerable amount is also produced in the northern part of the FA, where the large housing estates are located (Osdorfer Born). Most multi-family and single-family houses are situated in the western part, corresponding to Blankenese and Rissen.

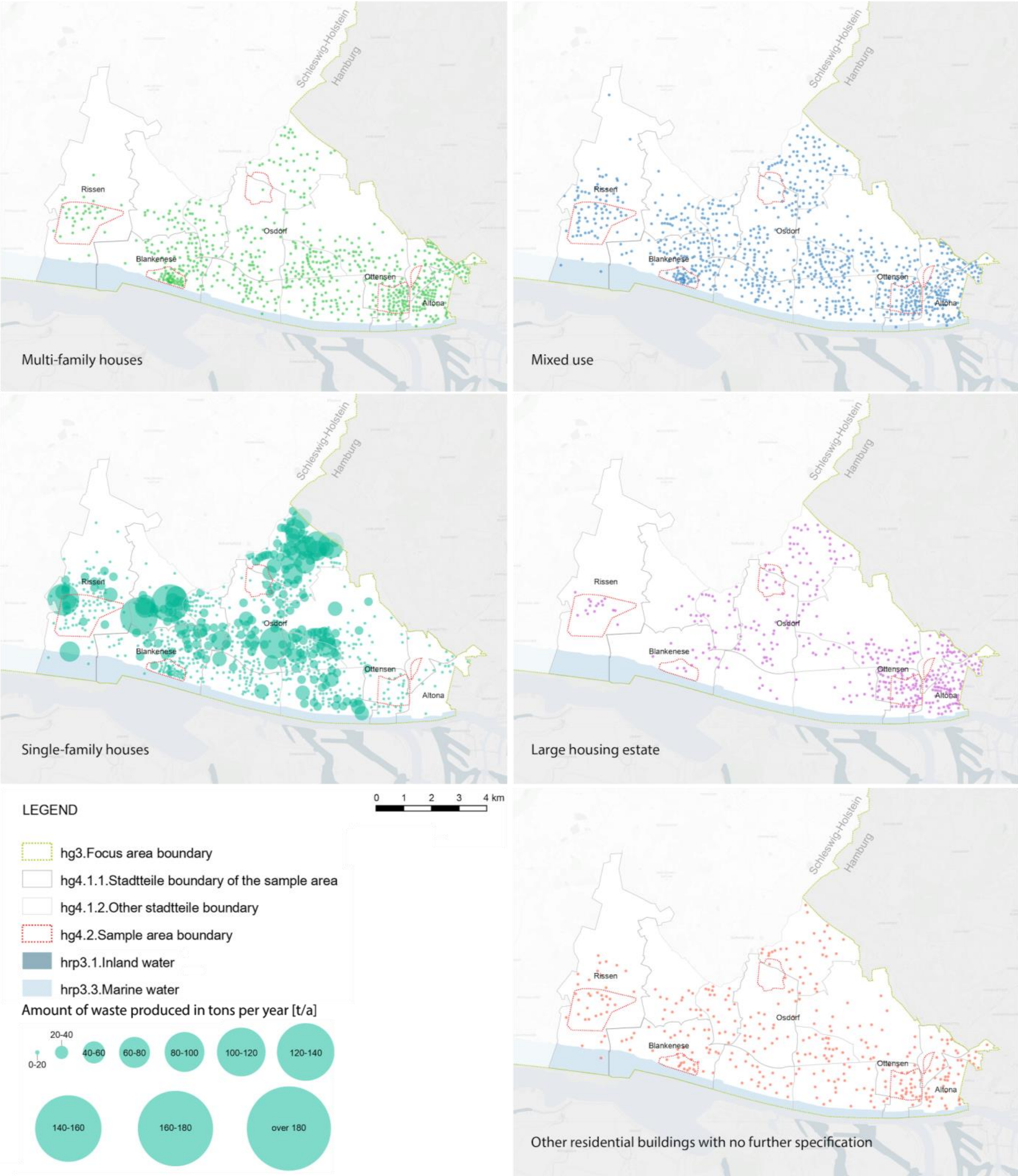


Figure 3.17 - HSH6.2.Garden waste generated - overview (link) (HCU, 2018).

A different scheme is the one for the garden waste. The garden is a typical characteristic of single-family houses and, in minor quantity, of large estates. As a matter of fact, generation of garden waste is to be led back to single-family houses, which is the case of Rissen, Blankenese and the northern part of Osdorf (Lurup).

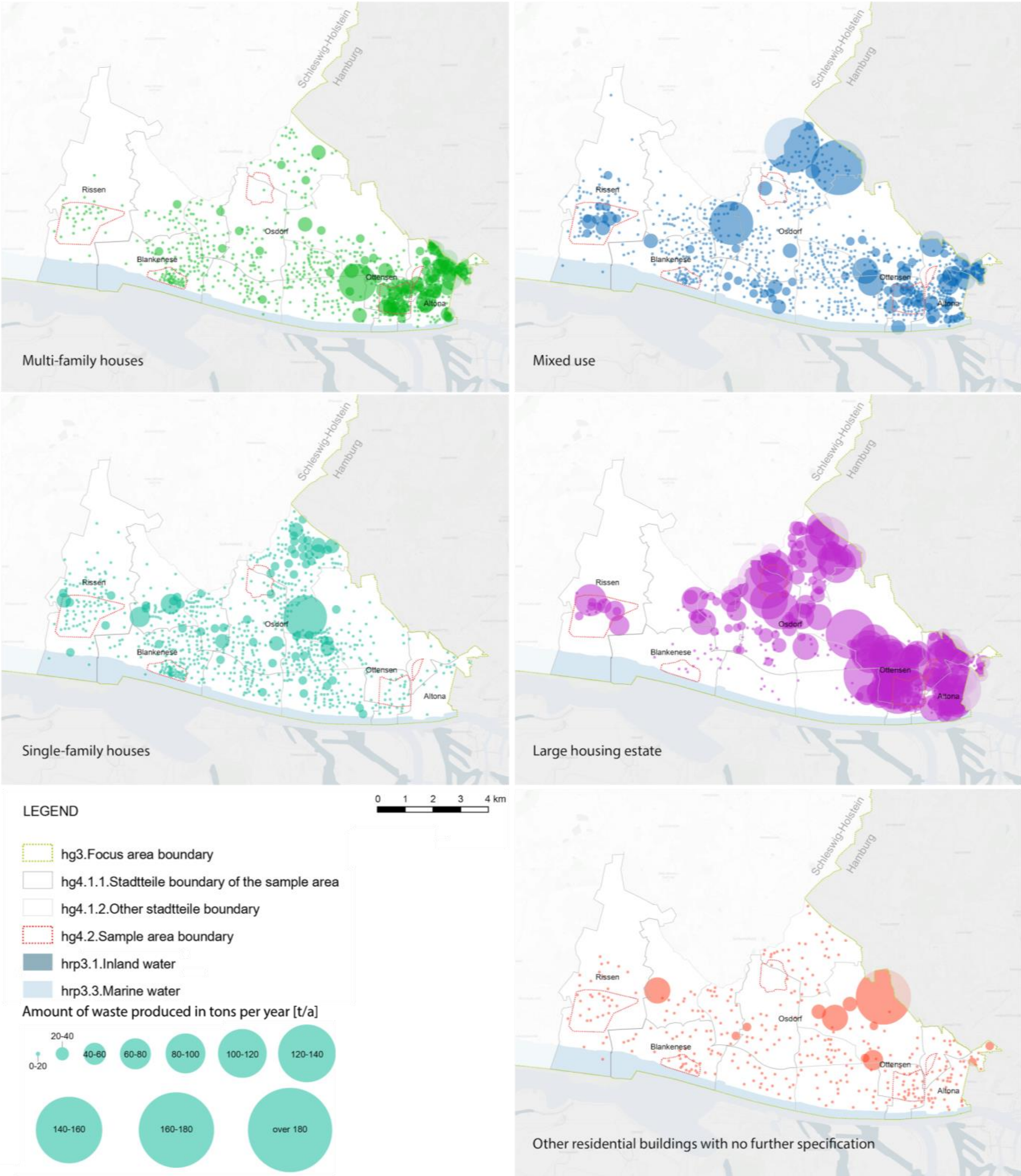


Figure 3.18 - HSH6.3.Biowaste thrown in the residual waste bin - overview (link) (HCU, 2018).

The last map in Figure 3.18 shows the amount of biowaste (i.e. kitchen waste plus garden waste) which is thrown in the residual bin, and therefore wrongly separated. As it is possible to see, the large housing estates account for the highest share. This is due to several reasons, like cultural issues. The data is related to households with the four bins (plastic, paper, residual and bio, together with glass). This means that the picture provided in the last three Figures 3.16-3.18 is rather optimistic, as in many cases bio bins are not present.

Material flow analysis of the food waste chain

As illustrated on the Deliverable 6.4 (REPAiR, 2018d), a rough MFA was developed according to document analysis and interviews with local stakeholders during the first PULL meeting Altona. In this sequence, as shown on Figures 3.19 and 3.20, the new simplified AS-MFA version displays an estimation of the amount of organic waste (OW) collected from bio-bins and residual bins from the quarters from Altona, in which the Sample Areas are located. Such diagram aims to complement the information displayed on the maps from Figures 3.16 to 3.18.

The source used for the estimation of OW values was provided by a master thesis about the organic material stream in Hamburg (Alimi & Arlati, 2018). Such study gathered all information of waste material flow related to the total population and companies related to waste generation per person in Hamburg, for the year of 2017, according to SRH and other sources.

Regarding the amount of waste collected from the leave bags and green waste per inhabitants in Hamburg, a rough estimation was done to fit the proportion of inhabitants in Altona. No further data could be found from these two waste typologies in specific to the case of Altona. Therefore, the focus was given to OW MFA process in Altona. From the same study held by Alimi & Arlati (2018) and from some private data, the amount of OW collected from bio and residual bins per inhabitants in Hamburg was taken as a parameter for a rough estimation to fit the proportion of inhabitants in each quarter of Altona, where the sample areas are located. As illustrated below, besides the estimated values, the OW material flow is displayed including the steps from waste collection to final product receivers.

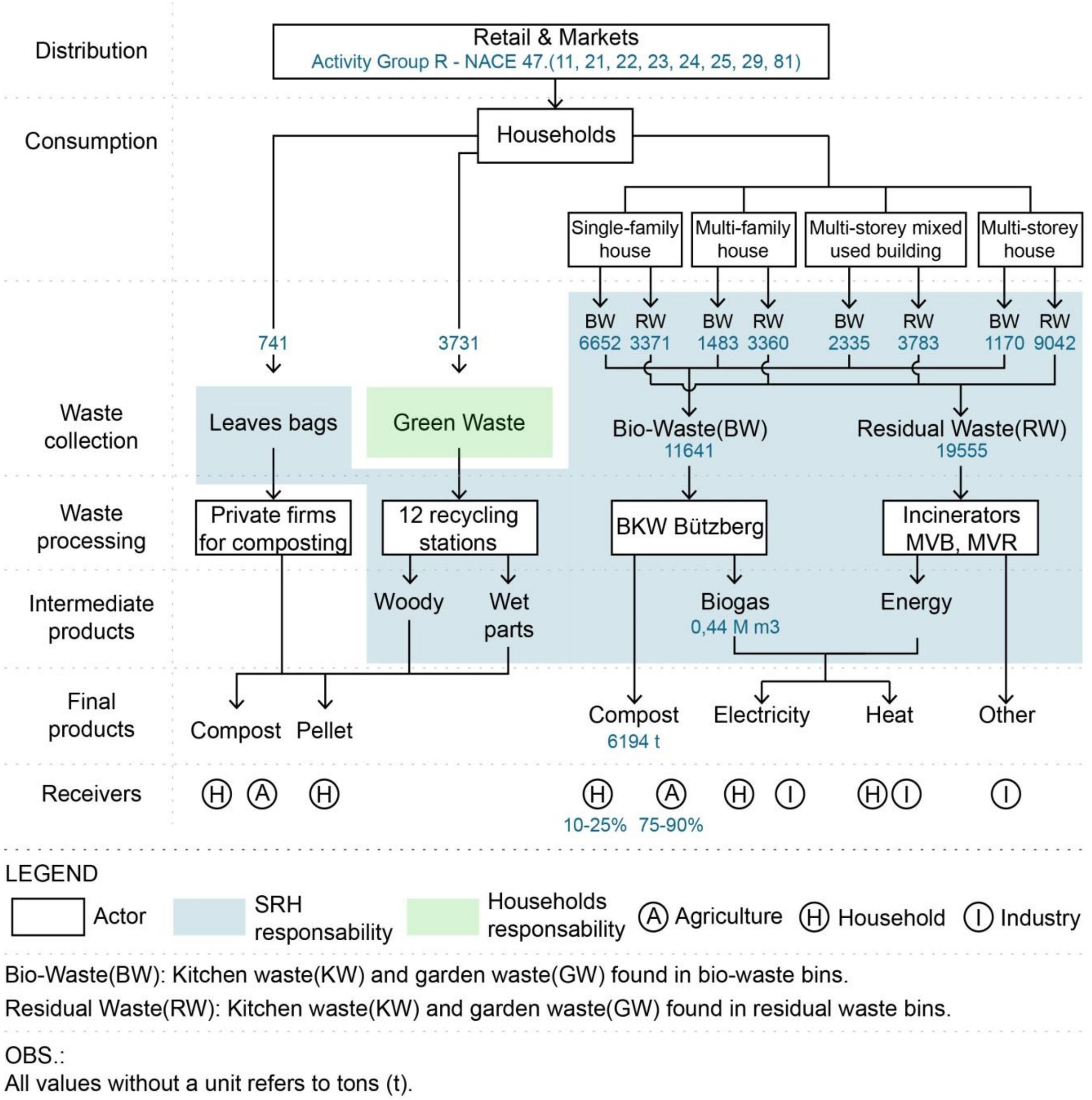


Figure 3.19 - Simplified AS-MFA for the households OW in Altona with estimated values (HCU Team 2018).

The scheme shows clearly that a part of the OW is collected together with the residual waste, which is then incinerated: this results in a loss of potential compost and biogas production. The estimated values, displayed on the AS-MFA for the households in Altona, made possible to observe a significant amount of KW and GW found in the residual waste bins. If such amount was to be disposed in bio-waste bins, the total amount of bio-waste would then go from 11.641 tons to 31.196 tons. Consequently, it would be possible to generate 16.599 tons of compost and 1,19 M m^3 of biomethane, which can provide 6.135 MWh of heat and electricity to supply 4.742 households with 2 persons living.

To complement the context of waste generation in the Hamburg case study, the table 3.24 shows the consumption expenditure of private households in Germany by purpose of use in current prices in 2017 in percentage of expenditures. The different sectors remained relatively stable over the last years. Interesting figures are the comparatively low shares of expenditure for food and soft drinks, and clothing and footwear. This information will be valuable for the identification and development of specific eco-innovative solutions. The HCU team will investigate on the question in how far consumers are willing to make savings in avoidable food waste and other consumer goods waste (e.g. cloths), if the share of expenditure is so little and therefore the possible financial incentives are rather low.

Table 3.24 - The consumption expenditure of private households in Germany by purpose of use in current prices in percentage of expenditures in 2017 (Statistisches Bundesamt (Destatis), 2018: 336).

Purpose of Use	Percentage
Food and soft drinks	10.6
Alcoholic beverages, tobacco and drugs	3.2
Clothing and footwear	4.6
Apartment, water, electricity, gas u. a. Fuels	23.7
Furnishings (furniture), apparatus, appliances a. equipment for the household as well as their maintenance	6.7
Healthcare	5.3
Traffic	14.8
Messaging	2.8
Leisure, Entertainment and Culture	9.1
Education	0.9
Hospitality and restaurant services	5.4
Other goods and services	12.8

The map in Figure 3.20 shows the location of the infrastructures related to waste handling, from incineration to recycling. Due to the policy of having the least landfills as possible, the presence of such infrastructure is low. The big centre in the middle of the map is the GAB recycling centre, which functions as a sorting facility and incinerator. Several waste recovery stations are also present in the area. Focusing on Altona, close to Osdorf there is one of the 12 recycling stations (Recyclinghof) in Hamburg. To such places, people can bring all the waste that is too big for their waste bins, such as bulky waste or wood waste. A smaller recycling station is located in Bahrenfeld closer to the city centre.

However, such infrastructure does not reach the entire area of Altona (meanwhile in the County of Pinneberg, almost every big centre has at least one station), as for Rissen and Blankenese. Potentials for smaller and decentralised plans have been already taken into consideration and will be explored with the local stakeholders during the next PULL meetings.

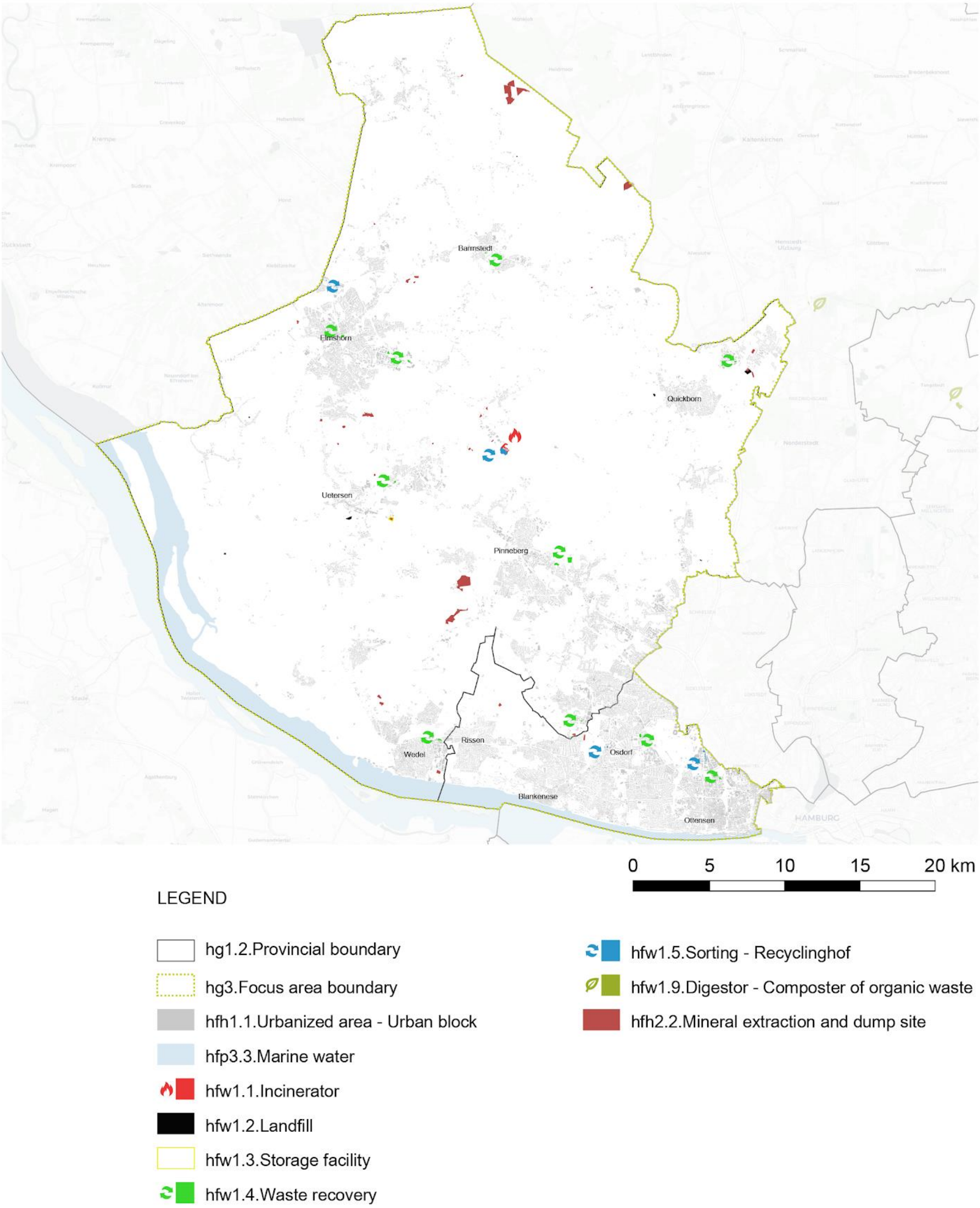


Figure 3.20- HFH13.Infrastructure of waste (link) (HCU, 2018).

3.5. Enabling contexts within the Altona case

The map in Figure 3.21 represents the enabling contexts for the part of Altona. This has been generated through the overposition of the wastescapes map and the one of the future developments. The most wastescapes in Altona are related to dump sites, land without current uses and to underused infrastructures (see the following link for the map about the analytical description of the wastescape).

The coloured dots represent the centralities (*Zentrum*). They indicate the importance of a settlement for what concerns services, economic importance, and identity. Besides, the future development areas are also indicated. As it is possible to notice, the five sample areas are all defined as centralities, although not all of them include development areas (such as Blankenese). However, the definition of such areas was also done together with the local stakeholders, which have strong interests in addressing them.

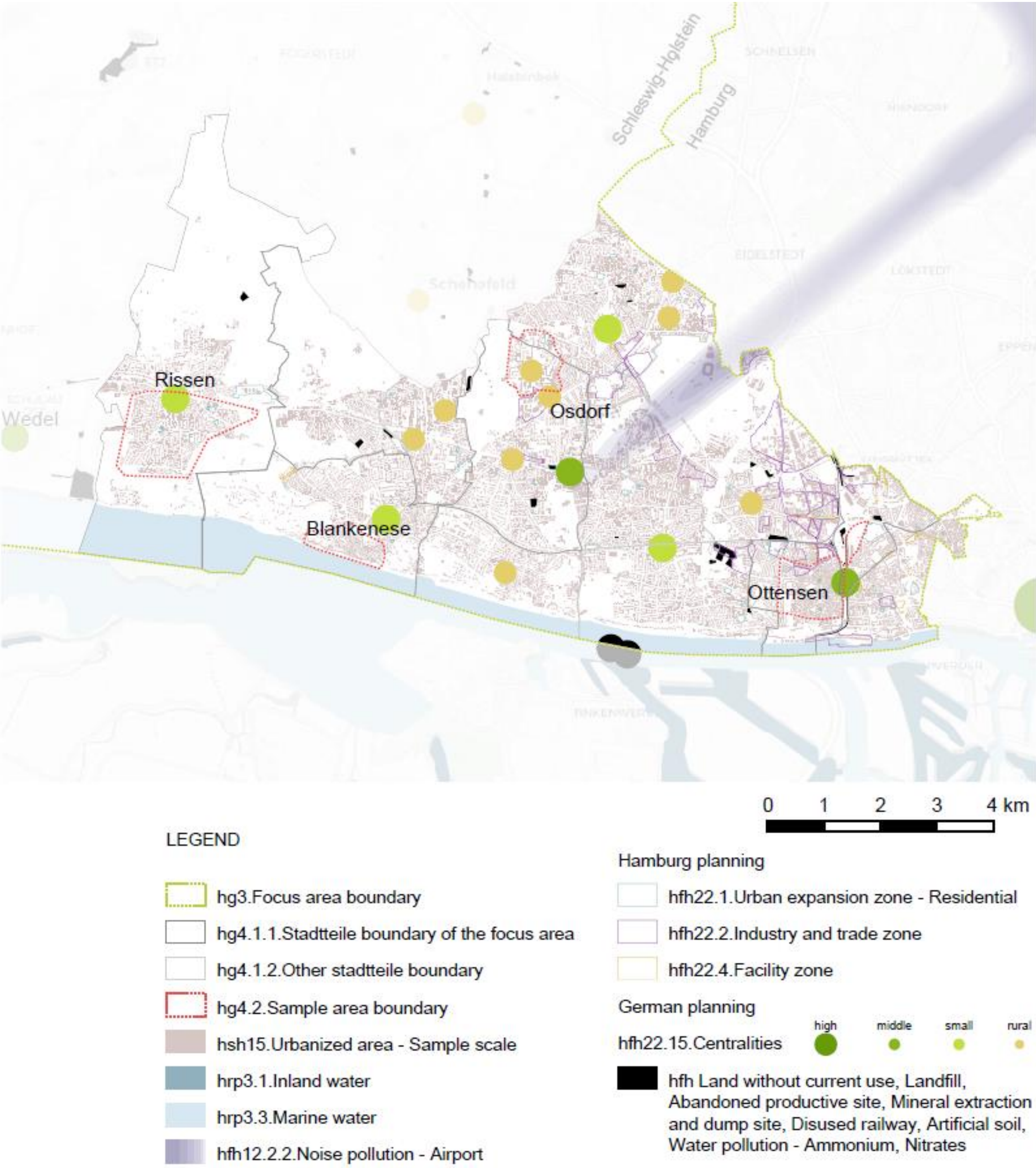


Figure 3.21 - HFH19.1.Enabling contexts in the sample areas Altona (link) (HCU, 2018).

3.6. Spatial and socio-economic analysis - Pinneberg

3.6.1. Geographical situation and the natural environment

The county of Pinneberg is characterised by a mosaic of land uses (e.g. villages centres, detached housing areas, social housing, retail, logistic) and open spaces (agricultural land, largest European area of tree nurseries, garden plant production, recreational areas, and natural preservation areas). The concentration of circa 200 tree nurseries and garden plant producers is rather unique. However, due to their proximity to Hamburg, many municipalities in Pinneberg County are attractive for new housing. Therefore, some tree nurseries are threatened by urban development of the surrounding settlements. The county of Pinneberg is located north of the Elbe river stretching to the North. The rivers Pinnau and Krückau and several smaller watercourses flow into the Elbe. It should be mentioned that Helgoland, the only German island in the open North Sea, is administratively part of the Pinneberg County.

3.6.2. Demography

Table 3.25 – Population in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Population (on 31.12. of each year (2005/2010: based on census 1987; then continuation based on census 2011)			
	2005	2010	2015	2016
Schleswig-Holstein	2,832,950	2,834,259	2,858,714	2,881,926
Pinneberg	299,392	303,481	307,471	310,653

Schleswig-Holstein and Pinneberg are both growing in population. Pinneberg is the most populated county in Schleswig-Holstein.

Table 3.26 – Population density in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Population density: Inhabitants per km² on 31.12. of each year (2005/2010: based on census 1987; then continuation based on census 2011)			
	2005	2010	2015	2016
Schleswig-Holstein	179	179	181	182
Pinneberg	451	457	463	468

Schleswig-Holstein and Pinneberg have both a growing population density. Pinneberg is one of the densely populated counties in Schleswig-Holstein, due to its situation next to Hamburg.

Table 3.27 – Proportion of foreigners on total population in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Proportion of foreigners on total population on 31.12. of each year (2005/2010: based on census 1987; then continuation based on census 2011)			
	2005	2010	2015	2016
Schleswig-Holstein	5.4	5.1	6.3	7.3
Pinneberg	7.2	7.1	8.4	9.5

The proportion of foreigners on the total population in Schleswig-Holstein is comparably low to the German average. Pinneberg is significantly above the average of Schleswig-Holstein. In Both Pinneberg and Schleswig-Holstein the proportion has grown.

Table 3.28 – Balance of natural population dynamics in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Balance of natural population dynamics: Difference between number of new-born and number of deaths in the year			
	2005	2010	2015	2016
Schleswig-Holstein	- 6,642	- 8,623	- 10,114	- 8,459
Pinneberg	- 475	- 693	- 720	- 555

Schleswig-Holstein and Pinneberg are both having a negative balance of natural population dynamics. This means that more people died than were born.

Table 3.29 – Difference between immigration and outmigration in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Difference between immigration and outmigration across border of Pinneberg County respectively the land of Schleswig-Holstein in the year			
	2005	2010	2015	2016
Schleswig-Holstein	+ 10,748	+ 10,823	+ 37,344	+ 32,481
Pinneberg	+ 1,592	+ 1,735	+ 4,025	+ 3,868

Schleswig-Holstein and Pinneberg are both having a positive balance of migration population dynamics growing in population. This means that more persons migrated into the areas than out. The higher number in 2015 and 2016 could partly be explained by the immigration of refugees.

3.6.3. Labour force

Table 3.30 – Employed persons at working place in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Employed persons at working place yearly average (Work group of Federal and State level on employment statistics, calculation August 2016)		
	2005	2010	2015
Schleswig-Holstein	1,251.8	1,304.7	1,355.3
Pinneberg	117.5	120.4	125.4

Schleswig-Holstein and Pinneberg are both having a growing number of employed persons at working place. These are persons who have their job in the area.

Table 3.31 – Proportion of Employees with regular social insurance (place of residence) on all persons in working age in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Proportion of Employees with regular social insurance (place of residence) on all persons in working age (above 15 and under 65) at 30.06. of each year			
	2005	2010	2015	2016
Schleswig-Holstein	46.2	50.3	55.1	55.6
Pinneberg	50.0	54.6	60.2	60.6

The proportion of employees with regular social insurance (place of residence, this means those persons living in the area) on all persons in working age has grown in both areas, Schleswig-Holstein and Pinneberg.

Table 3.32 – Unemployment rate on total civilian workforce in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Unemployment rate on total civilian workforce, yearly average (unemployment statistic of Federal Agency for employment, Bundesagentur für Arbeit)			
	2005	2010	2015	2016
Schleswig-Holstein	11.6	7.5	6.5	6.3
Pinneberg	10.1	6.1	5.2	5.2

The unemployment rate on the total civilian workforce has been shrinking in both areas, Schleswig-Holstein and Pinneberg. The rate is lower in Pinneberg than the average in Pinneberg.

Table 3.33 – Housing stock in residential and non-residential buildings (Statistik Nord, 2018d).

	Housing stock in residential and non-residential buildings (incl. Residences and dormitories) at 31.12. of each year forward projection based on census on buildings and housing 2011)		
	2010	2015	2016
Schleswig-Holstein	1,408,427	1,452,402	1,466,262
Pinneberg	142,875	148,998	150,592

The housing stock in residential and non-residential buildings has been growing in both areas, Schleswig-Holstein and Pinneberg.

Table 3.34 – Completed flats in residential and non-residential buildings (Statistik Nord, 2018d).

	Completed flats in residential and non-residential buildings (incl. conversion) in each year			
	2005	2010	2015	2016
Schleswig-Holstein	9,078	6,982	10,293	13,803
Pinneberg	1,346	1,143	1,293	1,593

The number of completed flats in residential and non-residential buildings had a low point in 2010 that could be explained with the economic crisis in the years before. Since then the number has been growing in both areas, Schleswig-Holstein and Pinneberg. The number of completed flats in proportion to existing flats in Pinneberg is higher than in Schleswig-Holstein and comparable to Hamburg.

Table 3.35 – Proportion of school graduates higher education (Statistik Nord, 2018d).

	Proportion of school graduates with higher education entrance qualification on all school graduates in the school year			
	2005	2010	2015	2016
Schleswig-Holstein	21.2	30.0	33.6	46.0
Pinneberg	25.9	36.4	39.1	48.1

The proportion of school graduates with higher education entrance qualification on all school graduates has been increasing over the years; the significant increase in 2016 could be explained with changes in the school system.

Table 3.36 – Proportion of school graduates higher education (Statistik Nord, 2018d).

	Proportion of school graduates without school-leaving qualification on all school graduates in the school year			
	2005	2010	2015	2016
Schleswig-Holstein	10.0	7.0	7.5	6.6
Pinneberg	9.0	5.2	6.0	6.0

The proportion of school graduates without school-leaving qualification on all school graduates in the school year has been shrinking compared to 2005, but since then it remained stable.

3.6.4. Economy

Table 3.37 – Average price for construction land (Statistik Nord, 2018d).

	Average price for construction land in Euro per m^2			
	2005	2010	2015	2016
Schleswig-Holstein	101.38	108.95	111.42	119.01
Pinneberg	162.29	177.87	240.87	204.57

The average price for construction land in Euro per m^2 has been increasing in Schleswig-Holstein since 2005, in Pinneberg it increased and then felt from 2015 to 2016. As the average prices are calculated based on all land sales in one year, the average price can be volatile between two years. The long-term trend is more important, showing the increase of prices and the almost twice as high prices in Pinneberg compared to Schleswig-Holstein.

3.6.5. Transportation

Table 3.38 – Proportion of Employees with regular social insurance (place of residence) on all persons in working age Proportion of persons commuting into the county / state on all employees with regular social insurance in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Proportion of persons commuting into the county / state on all employees with regular social insurance (work place in the county) at 30.06. of each year (for Schleswig-Holstein: commuters crossing state border)			
	2005	2010	2015	2016
Schleswig-Holstein	12.5	13.3	13.3	13.9
Pinneberg	36.5	37.8	37.2	38.0

The proportion of employees commuting into the county / state on all employees with regular social insurance (work place in the county with regular social insurance) has grown in both areas, Schleswig-Holstein and Pinneberg. The proportion in Pinneberg is higher, because the county has many enterprises with employees commuting from outside the county.

Table 3.39 – Proportion of Employees with regular social insurance (place of residence) on all persons in working age Proportion of persons commuting out of the county on all employees with regular social insurance (living place in the county) in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Proportion of persons commuting out of the county on all employees with regular social insurance (living place in the county) at 30.06. of each year (for Schleswig-Holstein: commuters crossing state border)			
	2005	2010	2015	2016
Schleswig-Holstein	20.2	21.1	21.6	21.6
Pinneberg	51.6	53.6	55.0	54.8

The proportion of employees commuting out of the county / state on all employees with regular social insurance (living place in the county / state) has grown in both areas, Schleswig-Holstein and Pinneberg. The proportion in Pinneberg is higher, because the county has persons living in the county and commuting to enterprises in Hamburg.

Table 3.40 – Difference between persons commuting into and out of the county / state in Schleswig-Holstein and Pinneberg in selected years (Statistik Nord, 2018d).

	Difference between persons commuting into and out of the county (employees with regular social insurance) at 30.06. of each year (for Schleswig-Holstein: commuters crossing state border)			
	2005	2010	2015	2016
Schleswig-Holstein	-74,431	-82,555	-97,133	-92,364
Pinneberg	-23,253	-26,839	-33,600	-32,622

The difference of the number of persons commuting into and out of the county is negative in both, Schleswig-Holstein and Pinneberg.

3.6.6. Wastescapes in Pinneberg

This Section can refer to Figure 3.8, where the map of wastescape is presented. Due to German planning system, areas which are underused or without current use are not present in any local or national database. However, data at European level were used and it has been identified that the area is characterized mainly by the presence of many mineral extraction sites and landfills.

3.6.7. Development strategy & waste sensitivity towards circularity

In Schleswig-Holstein the Federal State is responsible for the legal frame with the Ministry of Energy, Agriculture, the Environment, Nature and Digitalization

(Ministerium für Energiewende, Landwirtschaft, Umwelt, Natur und Digitalisierung MELUND) being the responsible ministry. Its State Agency for Agriculture, the Environment and Rural Areas (Landesamt für Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein LLUR), is responsible for the implementation of the legal frame and is controlling and monitoring the implementation by the counties on municipal level (Landesportal Schleswig-Holstein 2017a). The counties and larger cities are responsible for implementation of the waste management. In the case of Pinneberg County, the waste management is conducted by the Gesellschaft für Abfallwirtschaft und Abfallbehandlung mbH (GAB) (LLUR, 2017: 4-8).

The main waste fraction produced by the tree nursery is biowaste. According to the law the tree nurseries are responsible for the disposal of their biowaste and they have the right to do the disposal on their area. The disposal respectively further treatment is done in different ways: storage on the site, creation of compost, composting and production of gas, incineration. The biggest part is stored or incinerated directly on site, which is a rather problematic solution in terms of sustainability and energy recovery. It is also a problem due to the fact that many tree nurseries are located the peri-urban tissue of municipalities and their burning activities disturb the neighbourhood.

The current land use situation and the problems generated by the incineration activities have created a need for solutions to improve the situation and to make the waste management of tree nurseries more sustainable. The tree nursery association has an interest to support its member enterprises to become more ecological. The county of Pinneberg has the same interest; the county wants to keep the tree nurseries active and to support them for future challenges. The problematic behind this is, that once tree nurseries close down, their former areas could be changed into housing areas. The county would like to avoid this to prevent form further urban sprawl.

There is a need for more information about the waste management of the tree nurseries; so far only selective cases are known showing the huge variety of how they treat their waste. There is a need to involve the tree nurseries and to convince them of the advantages of a more circular way of waste management. Regarding the governance setting there is the challenge that the county and the tree nursery association do not have legal power to change the situation, but only can work as moderators and multipliers. The willingness of the tree nurseries and other actors to cooperate is thus crucial.

The law that allows the tree nurseries to dispose (incinerate, stock) their green waste on their sites might be changed in the future and will then confront them with the problem of green waste management. The price for green waste collection and treatment offered by service companies grew rapidly and became an economic factor. The conflicts with neighbours of the tree nurseries caused by the on-site green waste incineration grew considerably, due to the increase of settlements in the areas. Tree nurseries use relatively small amounts of compost. The green waste material and following materials (compost, wood) that they produce need to be used elsewhere. If tree nurseries should use compost in the future, this compost needs to be of very high quality due to the risk of plant illnesses.

3.7. Material Flow Analysis of green waste in Pinneberg

In Schleswig-Holstein, the federal state is responsible for the legal frame with the Ministry of Energy, Agriculture, the Environment, Nature and Digitalization (Ministerium für Energiewende, Landwirtschaft, Umwelt, Natur und Digitalisierung MELUND). The State Agency for Agriculture, the Environment and Rural Areas (Landesamt für Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein LLUR) is responsible for the implementation of the legal framework and is controlling and monitoring the implementation by the counties on the municipal level (Landesportal Schleswig-Holstein 2017a).

The counties and larger cities are responsible for the implementation of waste management. In the case of Pinneberg county, waste management is conducted by the Gesellschaft für Abfallwirtschaft und Abfallbehandlung mbH (GAB) (LLUR 2017: 4-8).

3.7.1. Step 1: Determination of material scope

The scope of Pinneberg's MFA is the garden waste generated in the tree nurseries, which consists of a woody fraction and a wet fraction. Both follow different procedures when it comes to recycling. Currently, the wet part is thrown away, while the woody one is often incinerated on the ground (see REPAiR 2018c).

3.7.2. Step 2: Defining the material supply chain

The supply chain of the tree nurseries activities links the provider of peat (soil needed for plant growth), the tree production, and the wholesale. One central concern is whether the compost coming from organic waste suffices the quality requirements for substituting peat. Nowadays, the tree nurseries still prefer the peat (with a small percentage of compost), mainly because of the threat impurities like plastic in the compost present - they might spread plant diseases. Stakeholders have mentioned that they import peat from Baltic countries. After production, tree nurseries deliver their products mainly to wholesale in Schleswig-Holstein, Hamburg, and also globally. Some other chains are linked to the tree nurseries, such as plastic and vase production. Although these are not part of the tree nurseries' waste stream, stakeholders have shown interest in not forgetting about them.

The results from the PULL meetings depicted a much more complex situation, as well as underlined mistakes. Green waste is not used to generate compost on site, because it does not entail the necessary quality to be used for the soil and it can attract insects which can spread illnesses to the plants. This waste is instead incinerated on site, or it is collected and treated by specialized companies contracted by the individual tree nurseries. The type of waste produced from the tree nurseries does not stop to these three categories but includes other materials, such as pots. Although these are not part of the organic waste, they represent significant challenges for the tree nursery owners. Tree nurseries have a rather low demand for compost, and they rather use other material e.g. sand. Furthermore, they use almost no peat.

Please see the tree nurseries' material supply chain in Figure 3.22.

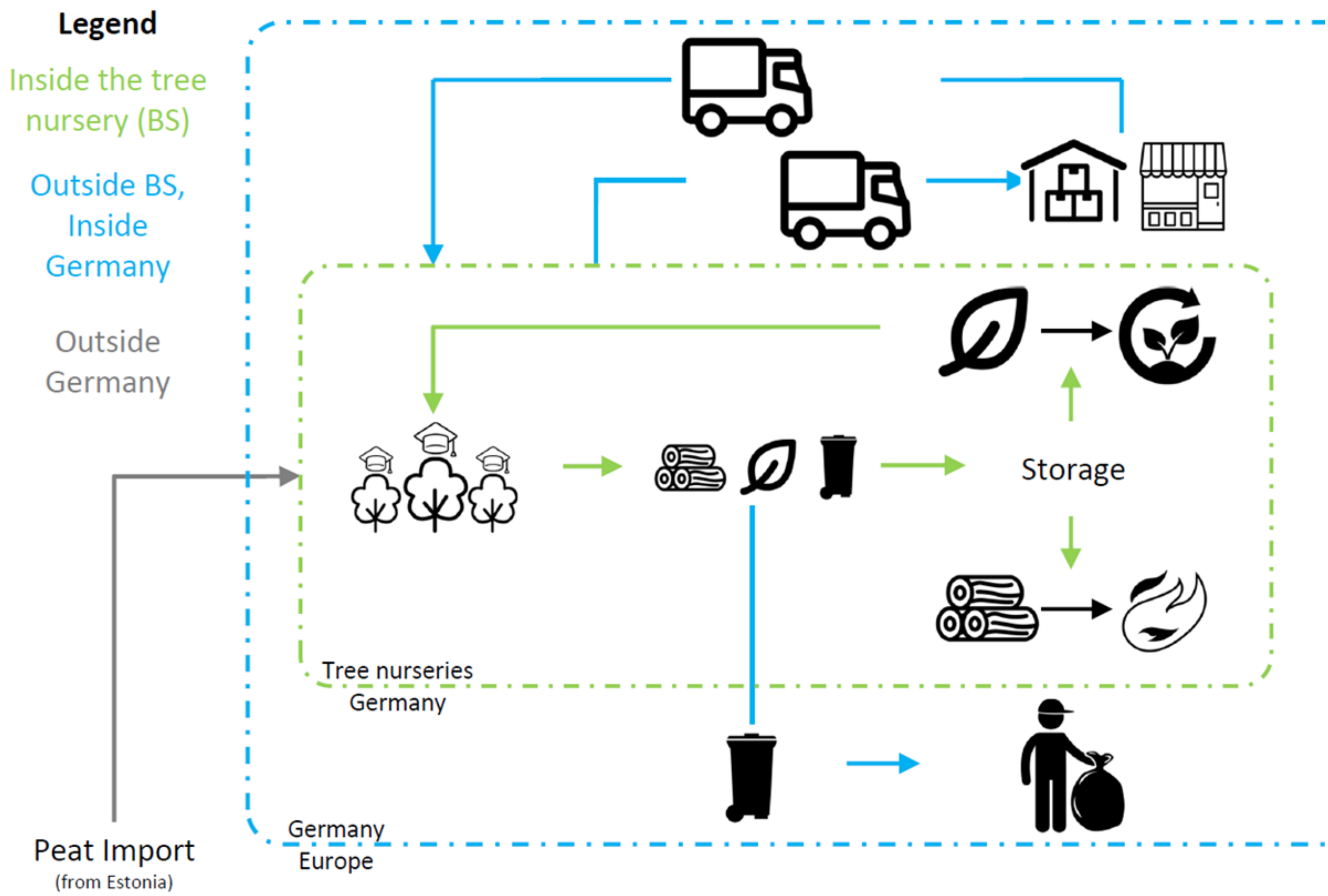


Figure 3.22 - Simplified AS-MFA for the tree nurseries in Pinneberg (HCU, 2018).

3.7.3. Step 3: Selection of geographical area & spatial scales

As mentioned above, the Focus Area includes the entire County of Pinneberg. The individuation of sample areas (i.e. the enabling contexts) will follow. Due to the difficulties in data collection, this step will be completed in 2019.

3.7.4. Step 4: Defining case specific supply chain

Due to the difficulties in data collection, this step will not be part of this deliverable and will be completed in 2019.

3.7.5. Step 5: Activity-based mass flow modelling

As mentioned on the Deliverable 6.4 (REPAiR, 2018d), a simplified AS-MFA was performed and presented during the first PULL meeting Pinneberg, as illustrated in Figure 3.23. The analysis was drafted according to the information gathered from the BdB SH and the County of Pinneberg. The representation of the flows was done with icons to render a more straightforward picture. No quantities are present due to the absence of data. The material flow analysis shows that tree nurseries receive peat (*Torf*) from outside Germany, mainly from a Baltic country. Moreover, this material is a non-renewable resource. These two facts tell that this practice diverts from circular economy (CE) principles. Internally, these producers generate three types of waste: wood waste, green waste, and plastic waste. Wood is directly incinerated on the ground, a practice still allowed by law. The green parts are reused to create compost on site. External companies are in charge of collecting plastic waste, after stipulation of contracts with the single tree nursery. The products of the nurseries are sent to wholesalers or to retailers to be sold: the unsold ones and the rests are brought back.

Due to the difficulties in data collection, this step will be completed in 2019.

3.8. Enabling contexts within the Pinneberg case

As already mentioned in Section 2.1.3, the enabling contexts of Pinneberg case must be defined with the stakeholders. However, the maps of the Wastescape (see Figure 3.8) shows an abundance of such areas along the borders between Hamburg and Pinneberg County, where most of the tree nurseries are located (cf. Figure 3.6), and along the major development axis. The next meetings with the local stakeholders will be used to define these in a more precise way.

4. Reflection & Conclusion

The scope of the present document is the spatial and material flow analyses of the Focus Area of Hamburg. The Hamburg case includes two parts of two different Federal States, which obeys to different legal (and therefore planning) frameworks.

The spatial and socio-economic analysis performed in Chapter 3.1 provides the territory of the District of Altona and the County of Pinneberg as two distinct realities in terms of built, natural and economic environment. However, they communicate due to the proximity through energy, transportation, and infrastructure services. The settlements at the borders are an example, representing a peri-urban environment that the REPAiR project aims to address.

One of the main differences between the two sub-cases is the presence of water, which in Altona is much more perceived due to the proximity to the Hamburg port area. Historically, Altona has always been linked to maritime activities (it was originally founded by merchants), which is still present in the famous fish market (Fischmarkt). On the contrary, the County of Pinneberg has developed a much stronger relation with the land, with the several tree nurseries as further confirmation of that. The built environment has been shaped consequently, resulting in an agglomeration of different settlement patterns in Altona (from the low dense Rissen to the structure of an inner city in Altona), and in scattered rural areas in Pinneberg.

Both sub-cases have good service provision also for what concerns the waste management, except the western part of Altona district (see Section 3.4.5). One of the goals of the analysis presented is the individuation of the so-called wastescapes, being these spaces “in-between” with no current specific use, both because of physical barriers, e.g. contamination, or for a lack of a political will, e.g. no planned uses. As explained, the concept of wastescape is rather difficult to apply in the German context, mainly due to its planning system (see Section 3.3.6). However, such areas have been identified as sites related to dumping activities and where the planned developments have not taken place yet.

The individuation of such areas, together with the one of planning issues, has led to the draft of the enabling contexts map (see Section 3.5). In this Deliverable, the map of the enabling contexts refers exclusively to Altona, as the part related to Pinneberg County remains uncertain. The enabling contexts of Altona are the five sample areas described extensively in this report and they represent sections of the territory with different patterns of the urban settlements (see Sections 3.3.2-3.3.5). This is also the case for the waste analysis, which has been performed exclusively for the Altona district, as well as the social analysis. The data for the Pinneberg County is just at County level.

Another crucial element of this report is the material flow analysis (MFA). Being the case of Pinneberg County related to the tree nurseries waste and due the lack of such data, which is unknown for the tree nursery association itself, the MFA has been performed only for Altona. The results from this analysis together with the waste and the social analysis have depicted a frame in which different social and built configurations contribute to a different waste geography, intended to be the definition of waste generation patterns across the area considered. It has been done according to four housing types for what concerns the organic waste (divided into kitchen and garden waste) and translated in the map of the amount of organic waste wrongly separated and therefore thrown in the residual bin.

Results have shown that most of the wrongly separated organic waste (i.e. garden and kitchen waste thrown in the residual bin) is generated in areas with high building density indexes together with the presence of high unemployment and low-income rate (Osdorfer Born). This can be linked to the high concentration of foreigners, who may struggle with a waste management system which is not self-explanatory to foreign persons, as well as language barriers. However, data about garden waste revealed a general incoherence in the correct separation behaviours also in those parts with higher income and less unemployment, especially related to single-family houses. The waste sensitivity map depicts a generally low interest towards waste issues for Hamburg compared to other Federal States (see Section 3.1.5).

All the results point to many opportunities for improvement concerning waste management issues. Local stakeholders have also shown a high interest towards finding eco innovative solutions that consider actions not only within the waste management part but also promoting end-of-pipe practices (e.g. zero-package shops).

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Annex 1 - List of maps

Regional scale

HRP1.Physical Morphology and Hydrography
HRP2.Natural Environment
HRH1.Built Environment
HRH2.Administrative, demographic and planning issues
HRH3.Waste Geography

Focus-Area scale

HFP1.Physical Morphology and Hydrography
HFH1.Built Environment
HFH2.Administrative, demographic and planning issues
HFH3.Degraded land
HFH5.2.Noise
HFH5.3.Light
HFH6.In the fields
HFH8.1.Water infrastructure
HFH8.2.Water in crisis
HFH9.Settlements in crisis
HFH10.Historic settlements and elements
HFH11.Transport infrastructures
HFH12.Energy infrastructure
HFH13.Infrastructure of waste
HFH15.Protected Natural areas
HFH16.Future vision already planned
HFH18.1.Wastescape. Analytical description
HFH18.2.Wastescape. Synthetic description
HFH18.3.Wastescape vs planned expansion areas
HFH19.1.Sample areas Altona
HFH19.2.Sample areas Pinneberg

Sample Area scale

HSH1.1.Unemployment rate
HSH1.2.Population older than 65 years
HSH1.3.Population younger than 18 years
HSH1.4.Population density
HSH1.5.Migration balance
HSH1.6.Distribution of population with migration background
HSH1.7.Distribution of households with only one inhabitant
HSH1.8.Number of inhabitants per household
HSH1.9.Average income
HSH2.Land use
HSH3.Housing construction type
HSH4.Building height
HSH5.Plot division
HSH6.1.1.Kitchen waste generated in single-family houses

HSH6.1.2.Kitchen waste generated in multi-family houses
HSH6.1.3.Kitchen waste generated in mixed use
HSH6.1.4.Kitchen waste generated in large housing estate
HSH6.1.5.Kitchen waste generated in other residential building with no further specification
HSH6.2.1.Garden waste generated in single-family houses
HSH6.2.2.Garden waste generated in multi-family houses
HSH6.2.3.Garden waste generated in mixed use
HSH6.2.4.Garden waste generated in large housing estate
HSH6.2.5.Garden waste generated in other residential building with no further specification
HSH6.3.1.Organic waste thrown in the residual bin in single-family houses
HSH6.3.2.Organic waste thrown in the residual bin in multi-family houses
HSH6.3.3.Organic waste thrown in the residual bin in mixed use
HSH6.3.4.Organic waste thrown in the residual bin in large housing estate
HSH6.3.5.Organic waste thrown in the residual bin in other residential building with no further specification
HSH7.Companies in food material flow Altona

The excel file related to the generation of the maps can be found at the following link.

The spreadsheet file for the building type categorisation can be found at the following link instead.

Annex 2 - Hamburg maps

All these maps can be found at this link in the pdf file with the name "Annex 1 - Hamburg maps".