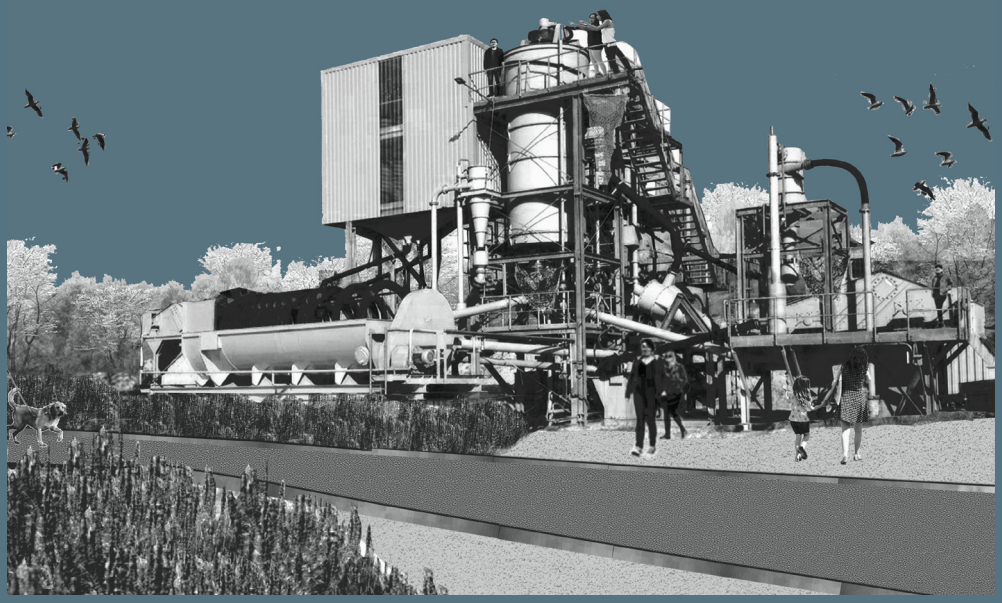

REVIVING THE DEGRADED

Planning the unplanned spaces in unproductive landscape

Purvi Sanil I 4911563

https://www.delpher.nl/nl/boeken/view?identifier=mmkb:leufkens-blustoren-staatsmijn-maurits/685/?keys=&tid=&index=4&page=0&over=1

Master Thesis:
Reviving the degraded,
Planning the unplanned spaces
in unproductive landscape
Parkstad, Netherlands

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External committee member:
Ir. Krik van Ees
Department of Architecture

TU Delft

Source: https://www.demijnen.nl/collectie/foto/hub-leufkens-staatsmijn-hendrik-0/685/?keys=&tid=&index=2&page=0&over=1

Abstract

Parkstad is a shrinking region especially after the closing of the mines, the social and economic impact was huge. Another major problem which still can be experienced today is the degraded landscape which was left behind.

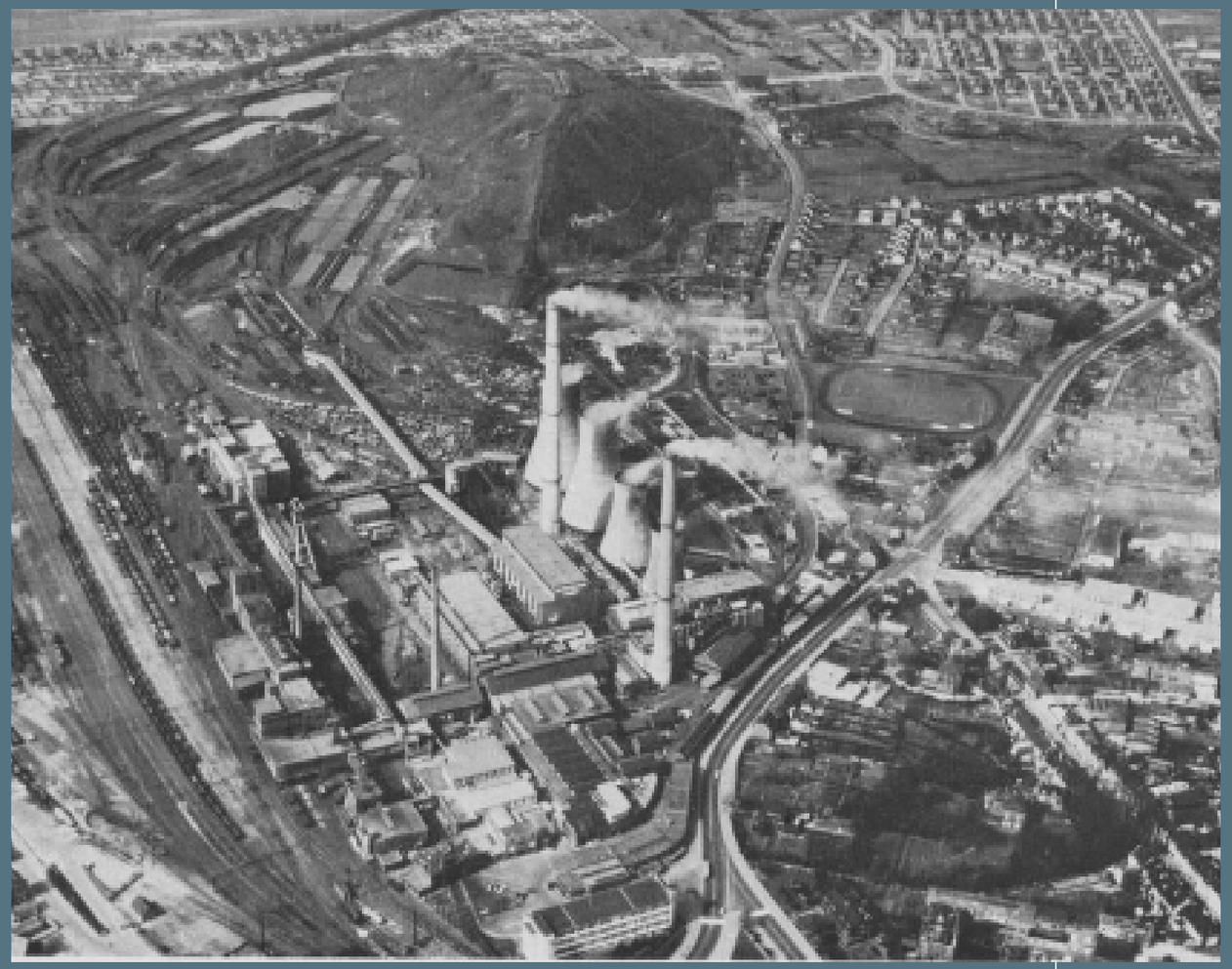
By seeing the operational landscape as inseparable from the urban fabric, and linking them again in a functional as well as aesthetic way a new metabolic system could emerge improving the quality of life and making the region adaptive and resilient.

Within the new urban metabolism, the themes of water, agriculture, energy, waste and material flows can be treated decentrally. It is applicable in the current situation as they offer a lot of options for reusing waste nutrients, extracting raw materials from waste and improving environmental performance.

Interconnecting these flows can result in adaptive and resilient strategies. These can also be adapted to the changing needs of the population and functions of Parkstad.

The focus is on three water strategies in three different locations which are the core of a new green connection adding quality and new perspectives for the people and future developments in Parkstad.

Contents



Oranje nassau 1,1899

Source: https://repository.tudelft.nl/view/MMP/uuid:99bd9b89-d6f2-4207-bb0d-3281b3446a82

01

INTRODUCTION

Landscapes all around the planet have become symbols of our thirst for the planet's natural resources. The year 2010 had the highest use of raw materials, and according to a 2011 United Nations Environment Programme (UNEP) report, and depletion and exploitation is going to increase rapidly by the end of 2050. As world is increasing in population alteration in landscapes might affect communities.

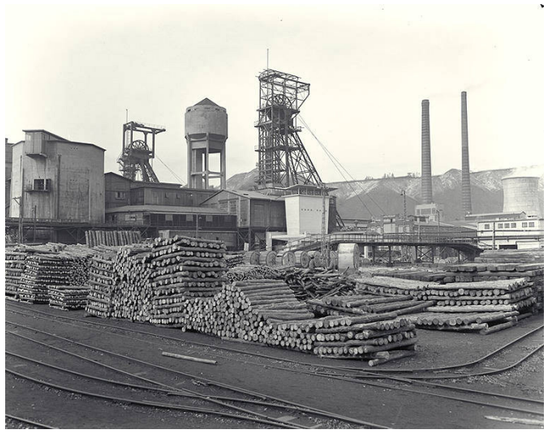
3.2 billion people's wellbeing are affected due to degradation of land and ecosystems. There is reduced ecosystem services which are essential for food and agriculture, that also includes freshwater, energy, and habitats for fish also. (UNEP)

This report focuses on Parkstad, Limburg region to improve quality of the water, water treatment methods by creating an operational and productive landscape. The reuse of waste nutrients from the water and soil in order to develop a sustainable landscape. The design will be developed in different scales, where intervention on regional scale would impact at the neighbourhood level and the other way round.

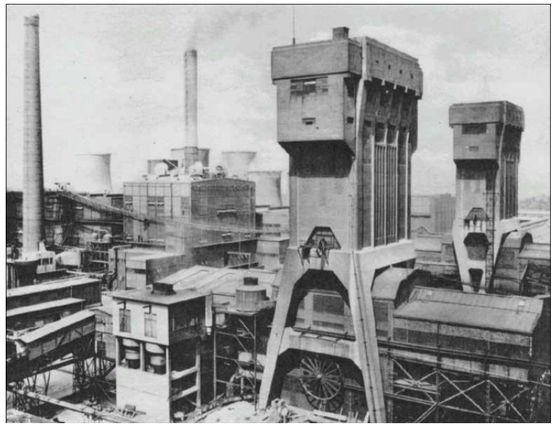
The design addresses the spatial solution to improve the quality of water within the fragmented spatial structure. Water management is an important issues all around the world, due to a significant increase in climate change and concentrated in extreme events, which pose difficulties in water catchment and reuse. So, the purpose of this project is to revive the polluted land by closing local life cycles for food and energy production with duck weed farming and aquaponic system.

Parkstad location

Industrial city- Julia (1926 - 1974)
Source: https://www.demijnen.nl/mijnen/mijn/mijn-julia



Industrial city- Wilhemina, 1903
Source: https://www.tudelft.nl/en/ceg/about-faculty/departments/geoscience-engineering/sections/resource-engineering/links/coalmining-in-the-netherlands/former-mining-companies/state-mines/



Industrial city- Maurits (1923 - 1967)
Source: https://www.tudelft.nl/en/ceg/about-faculty/departments/geoscience-engineering/sections/resource-engineering/links/coalmining-in-the-netherlands/former-mining-companies/state-mines/

1.1 Context

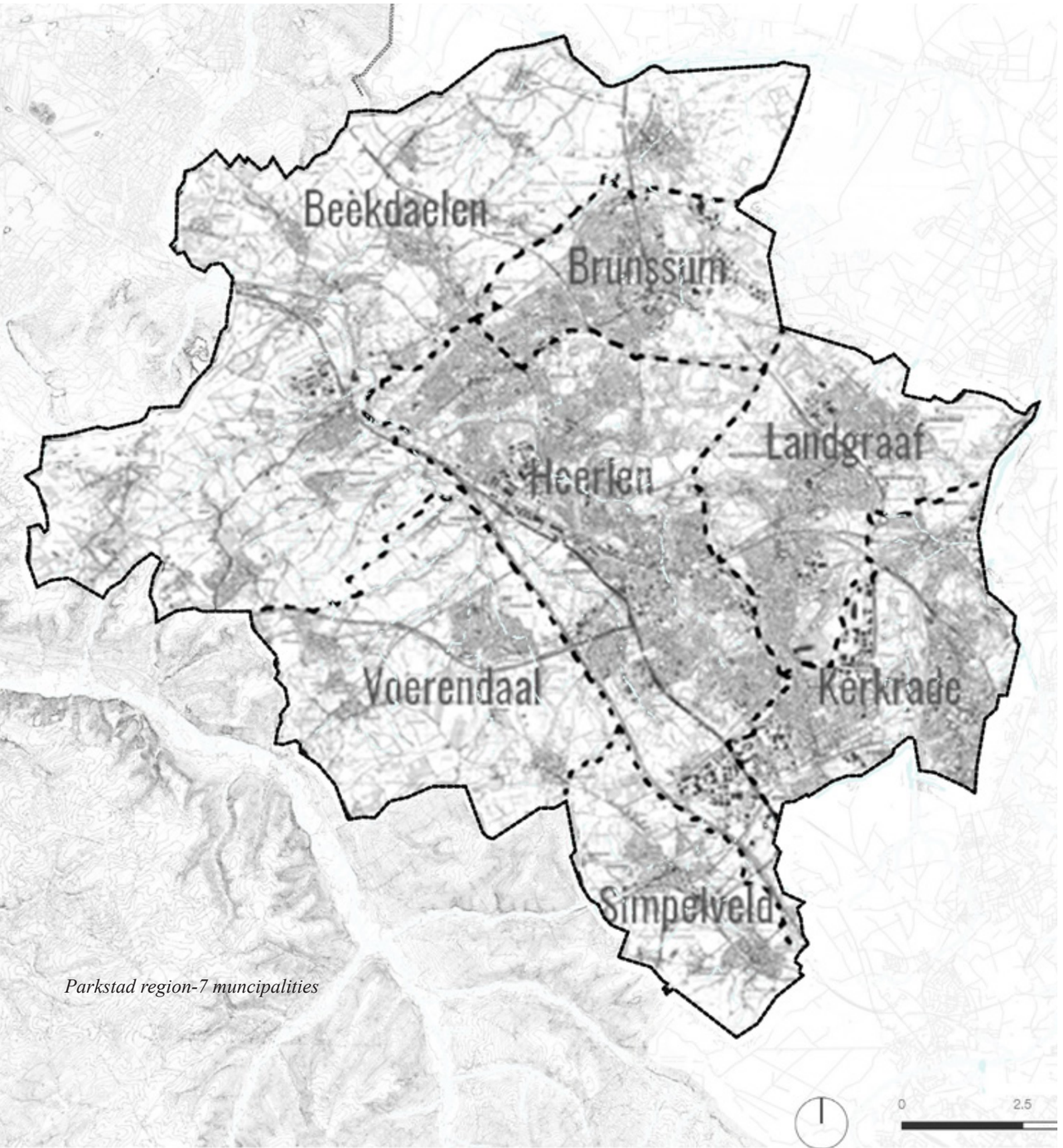
Netherlands has coal deposits in the Limburg region which is in the southern part of the country. Coal mining defined the character of South Limburg. Economy, natural system and even the social structure was developing around the mine pits.

During shift in economy, industrial estates have faced changes in functional demands. Start of the century intensive coal mining (lignite) was developing the region rapidly.

Depletion of land energy resources resulted in a millions tons of coal production. Exploitation of natural resources resulted in dramatic change in economy in the region.

It is not surprising, when coal mining was declared to close down under the government, the companies and the surrounding residents were devastated. Which led to an economic fall down.

Today, Parkstad, Limburg, is facing a social and economic crisis due to termination of mining activities. Heerlen's economy and population is shrinking with vacant buildings are increasing each day. Most of the construction above the mining pits have been removed to erase the dark identity of the region.



Parkstad region-7 muncipalities

Closure of coal mining led to the decline of the economy of the area. The region is also suffering from building vacancy and a decreasing population since the closing of the mining industries. The reviving of the landscape is required for the development of social and economic issues in the region. Recultivation of the blue-green infrastructure is for the betterment.

The ‘resilience’-cycle shows that periods of decay and reconstructions follow each other naturally. The grow towards maturity is followed by decay and demise, after which growth can begin again. The concept of panarchy (Holling etal. 2002)

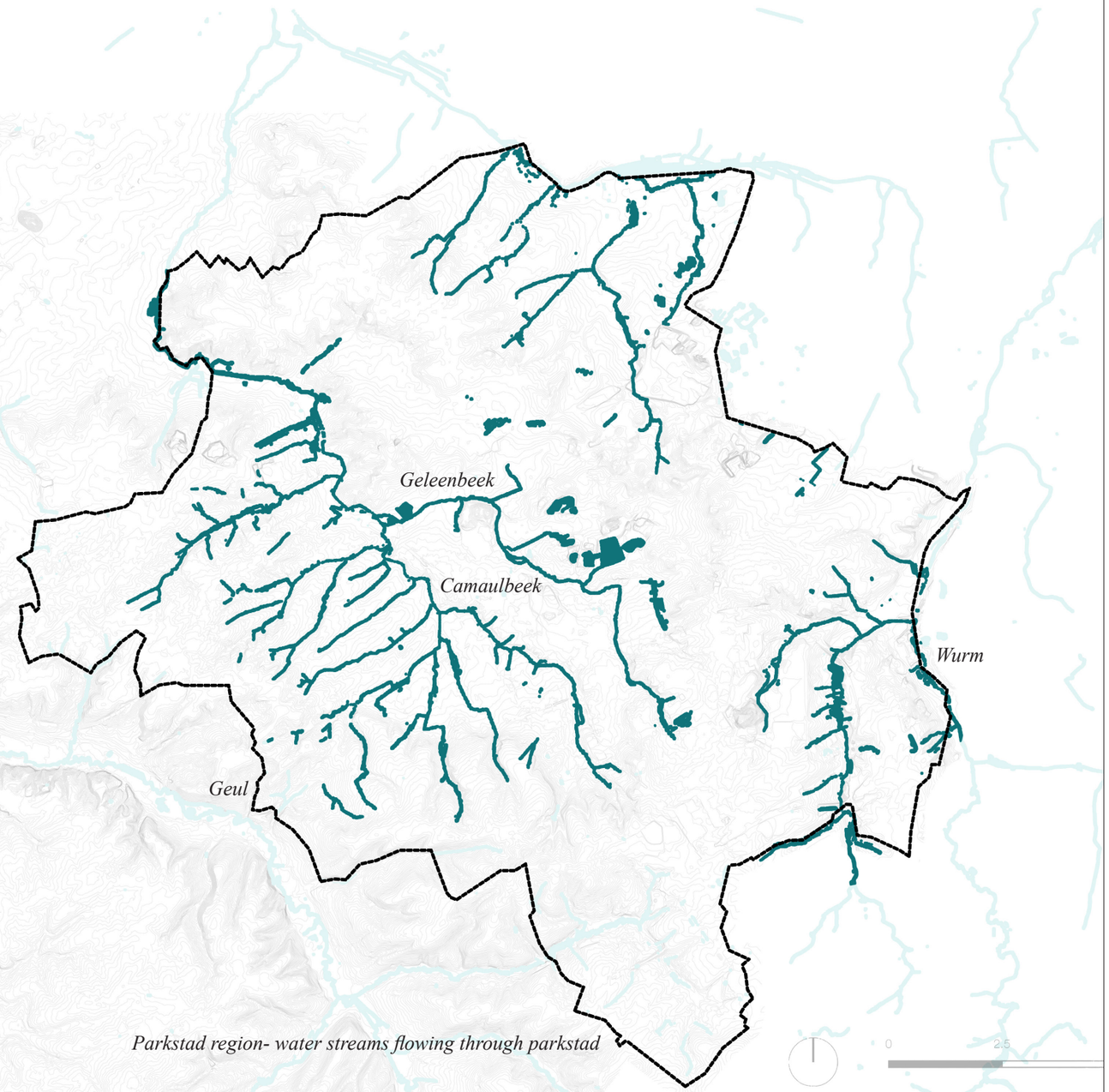
Economy is important in structuring of the urban fabric and also the waste could be looked in different perspective by creating productive, operational landscape. The nutrients from water could be used for producing energy and food for the cattle. Water and landscape could be turned into a more operational landscape to develop the area in multiple ways such as providing high quality water producing energy and improving spatial quality for the region by making the water structure more accessible and useful to the neighbourhood and integrating it into their daily life’s of the inhabitants.

Parkstad has a hilly landscape with right now many unproductive areas after the post-mining and intensive agricultural activities resulting a degradation of the ecosystem and the natural structure creating fragments in the urban fabric. Due to human activities the quality of water and soil has turned bad and the neighbourhoods are disconnected to it. This led to shrinkage of economy and population of the region.

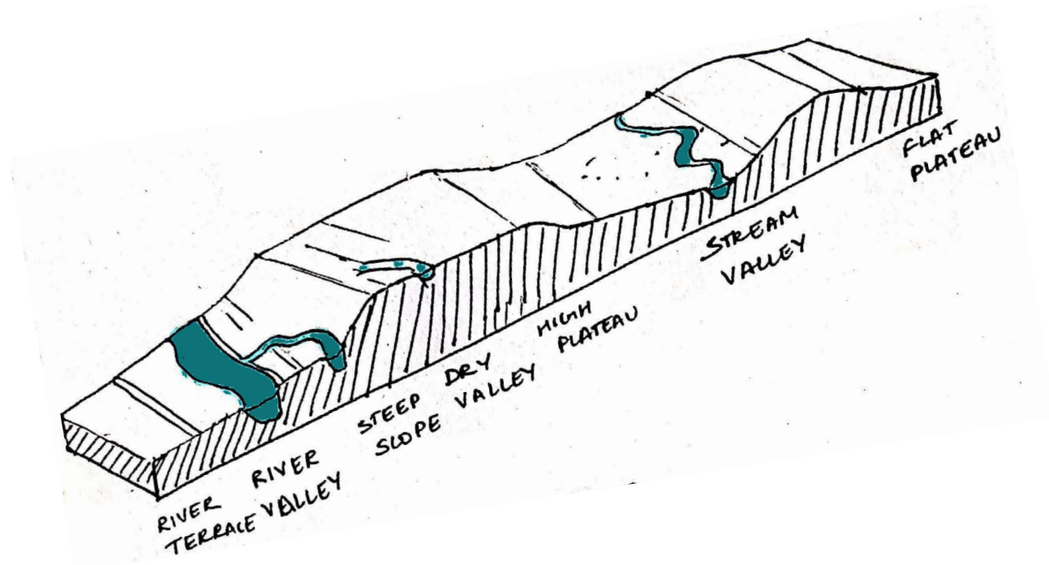
Among other things, due to the climate change droughts have increased in this region. Also the mine water is rising creating soil subsidence. Open extraction pit mining in Germany has lowered the ground water table. During the summer most of the brooks have brooks have dried. This has resulted in pressure on water extraction pits for drinking water.

This led to fragmented region, where the landscape defines its boundaries. As urbanization spread abandoned mining and agriculture activities have degraded soil and water in the region because of which it is unproductive and polluted.

Current energy crisis, such as the rising energy consumption in the world and the depletion of fossil fuels in the near future, offers new opportunities for the Parkstad area. Consumption and production can be better coordinated so that waste is reduced. Has there is lot of potential of renewable energy sources in the region like mine water project for heating.



Parkstad region- water streams flowing through parkstad



Typological section through the region

Sectional map - data from google earth

The river Maas and river Rhine flow across the whole region. They and their tributaries, cutting through plateaus, form series of valleys, which characterize the hilly landscape. There are three coal bearing areas in the region, where the industry boomed with the extraction of coal. Urban areas expanded along the rivers and in the coal belts, while other parts of the region remain in the pre-industrial pattern with scattered villages.

There is different characteristics, from river valleys with its terraces and slopes in west and in Parkstad it is mainly brooks and streams. Parkstad has a different topography compared to the rest of Netherlands. It is located at the edge of the plateau, with a small basin in the centre. The core quality of the region is undulating landscape.

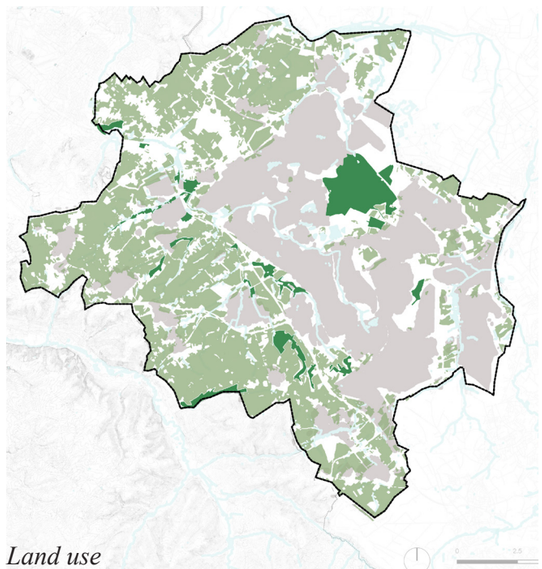
Reviving the degraded
Introduction

Parkstad region- Degraded landscape
Source: https://www.internationale-bauausstellungen.de/geschichte/2013-2020-iba-parkstad-parkstad-in-bewegung/

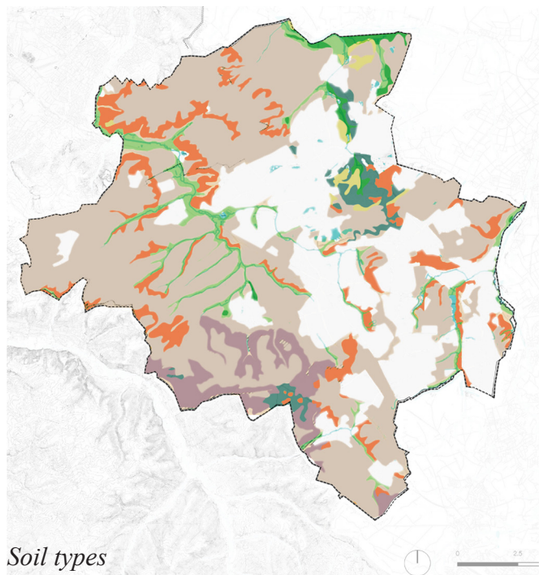
Land use pattern

Parkstad has mostly been cultivated. Mainly for agriculture use, remaining are occupied by urban development, leaving only patches as nature reserve areas. There is a disconnect between the agriculture patches and development in the urban area.

Legend
- Nature reserve
- Agriculture area
- Urban area



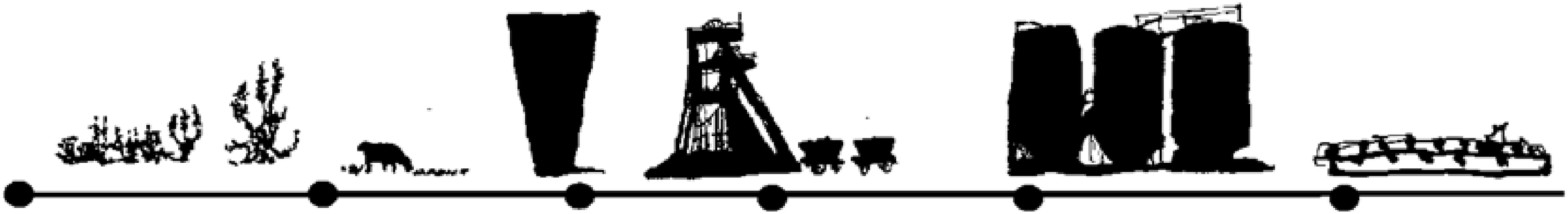
Land use



Soil types

Dust particles of the North Sea bottom that were blown away, settled down to the ground in the lee of the hills in Zuid-Limburg, during the ice age. Very different from rest of the Netherlands, Zuid-Limburg consists of Loess soil mainly. It is the most seasoned soil of the nation. Loess is rich and subsequently very fruitful (JRC,2010).

Legend
- Loess soil
- River clay soil
- Maasterras deposits
- Marine soils
- Sandy soil



Timeline showing the activities taken place in the region

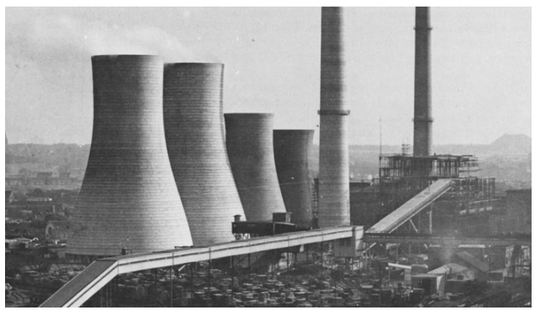
Source: https://repository.tudelft.nl/islandora/object/uuid%3A1ab8425d-4a64-4999-98db-57b26a64205b?collection=education

Parkstad region developed through different activities from header fields to agriculture, and then the mining. So once the government rules and the coal mining stopped, Sand mining also started taking place for economical reasons.

Currently, none of the coal mining activities are ongoing. So the shafts and other built are demolished removing the identity of the region.

Most of the places were crowded previously and then currently it's shrinking mainly due to shift from previous agriculture landscape to the demolition and eradication traces of the industrial heritage.

So this is the Panaroma currently, there is no certain identity for this region because most of the coal mining equipments are demolished



Source: https://www.demijnen.nl

Castles from the medieval period around Parkstad region

Source: https://heerlenmijnstad.nl/winkels/kasteel-hoensbroek

Historically this region is an import area since the Roman period. Many settlements are found because it was close to Dusseldorf in Germany has it was one of the important centers. Also many castles can be found from the medieval period.

One of the typical characteristics of them are the formal gardens and the fish ponds. These fish ponds were series of pond system which was used for economic and also for recreational purpose. But during the industrialisation as there was rapid growth in development most of the ponds was closed.

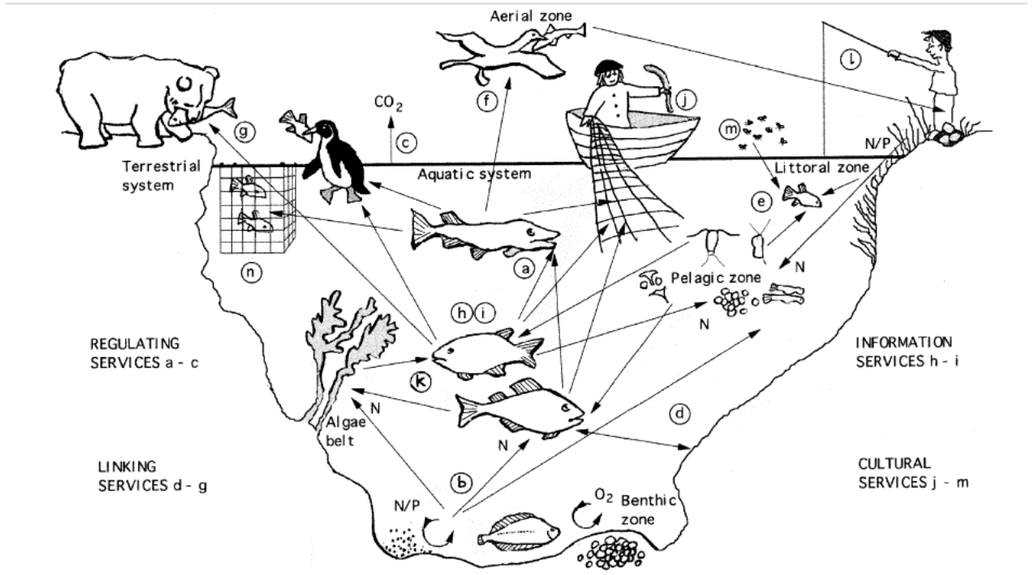


Fig. 1. Illustration of ecosystem services generated by fish populations: Fundamental ecosystem services: Regulating services include (a) top-down effects regulating population dynamics and nutrient availability, (b) bioturbation in or near sediments, and (c) carbon exchange. Linking services include active transport of nutrients, carbon and energy between the pelagic and (d) hard and soft bottoms, and (e) the littoral. Linking services also include passive transport of nutrients between ecosystems when fish eggs, fry, juveniles, adults, and carcasses are preyed on by (f) birds, and (g) mammals. Demand-derived services: Information services include fish as indicators of (h) ecosystem health, recovery and resilience, and (i) environmental recorders. Cultural services include fish as (j) goods, (k) for purifying water, (l) for recreation, (m) for mitigating the spread of diseases, and (n) for aquaculture.

In 1995, almost 70% of the world's major fish resources were fully- to overharvested, or depleted (World Resources Institute, 1996). Capture fisheries not only reduce the abundance of targeted stocks with cascading responses in the food web and with consequences in other ecological and fishery dependent systems, but also impact an array of other species, including mammals, as bycatch (Dayton et al., 1995; Steneck, 1998).

Source: McIntyre P.B., Jones L.E., Flecker S.A., Vanni M.J. (2007) "Fish extinction alter nutrient recycling in freshwaters."

Effects of Fish Extinction on Ecosystems

Nitrogen and phosphorus are crucial nutrients in aquatic ecosystems as most organisms at the base of the food chain rely on them. Considering that the recycling of nutrients is directly influenced by fishes, an American team of scientists has recently investigated the impacts of fish extinction on nutrients recycling processes. Their results highlight the complexity of predicting the consequences of extinctions from species-rich animal communities. Nevertheless, the importance of exploited fish species in nutrient recycling suggests that overfishing could have particularly detrimental effects on ecosystem functioning.

Heerlen was one of the dominant fortified towns in South Limburg under the Roman commonwealth and served as a transit town between Cologne and Tongeren.

Majority of settlements were situated along the brooks and also strategically along trading routes. In the medieval time, there were a lot of castles which were built across the strategic point, which were also the connector trading routes.

Shrinking
Degraded landscape
Unemployment
Vacancy

Fragmentation
Spatial segregation
Fragmentation in ecological network
Urban and rural fragmentation

Water issues
Polluted water
Open pit mining
Drying out streams
Drinking water extraction

1.2 Problem Statement

Parkstad is a fragmented region, where landscape defines its boundaries. Abandoned mining and ongoing agriculture activities have degraded soil and water in the region because of which it is unproductive and polluted.

The objective is to create a new identity or image of the region through the landscape. By seeing the landscape as inseparable from the urban fabric, a new metabolic system can emerge improving the quality of life.

Vacancy

Degraded landscape

Unemployment

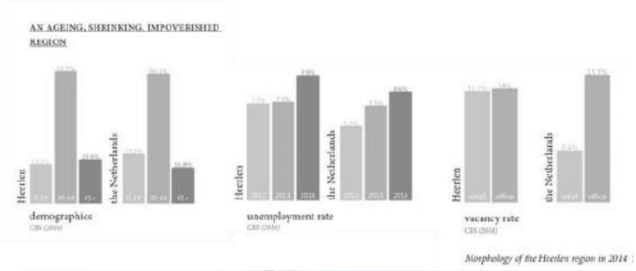
Source: https://www.bbc.com/news/uk-24330111

Shrinking region

Shrink in the economy and population of this region has led to social issues.

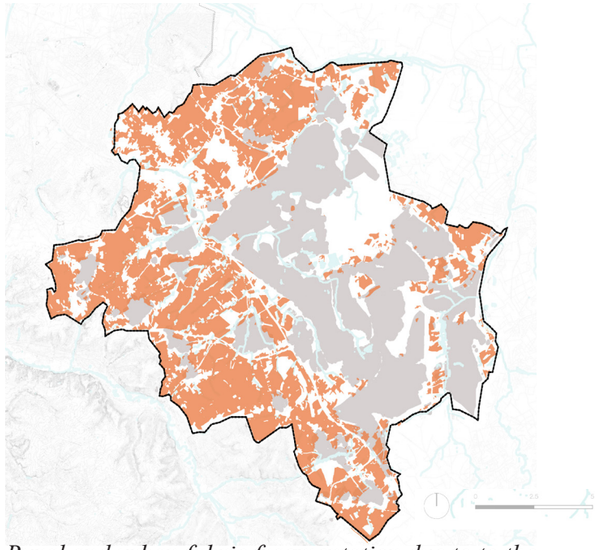
Different activities led to the degradation of the land and has resulted in unproductive area. After closures of coal mine, economy drastically declined. Lack of job opportunities resulted in people vacating and shifting to different regions and cities. Further leading to a decline in economy and population.

Due to the fall in economy , commercial buildings are vacant as they are not able generate minimum revenue. This has led to number of vacant stores and building lined up on the streets. Few of them are demolished so that it could be used for innovative development to attract growth in the region.



Morphology of the Heerlen region in 2014

Source: https://heerlenmijnstad.nl/winkels



Rural and urban fabric fragmentation due to to the polluted areas and infrastructure

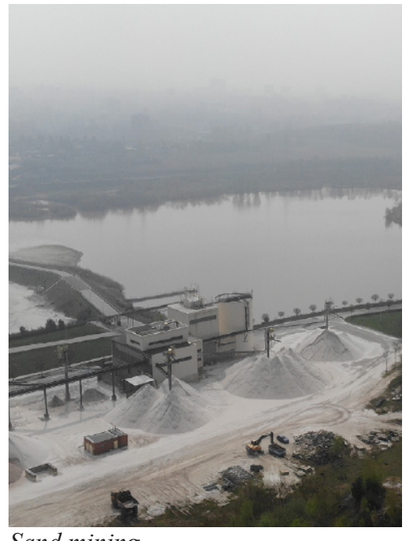
Missing green network

Fragmentation

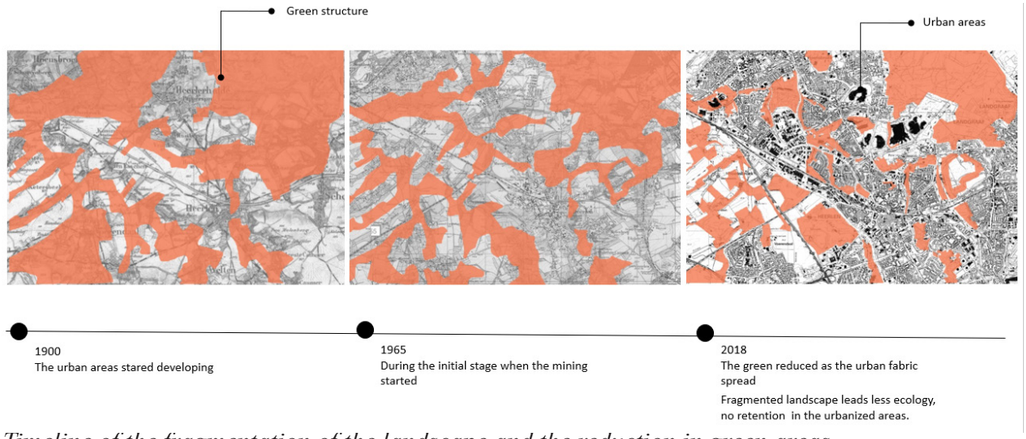
The fragmentation of this region can be explained in three aspects. Infrastructure separates the urban and rural areas. Parkstad region can be roughly divided into two parts, the agriculture area/ rural and the urban area.

In the agriculture part, the logic of space is still clear and can be easily perceived. But space structure in the urban part is worse. As there was rapid growth, urbanization spread all around. Most of the neighbourhoods do not have a landmark or identity. It is because the urban area has experienced several transformation, from the agricultural landscape to the industrial landscape and now into the post-industrial landscape.

Source: https://repository.tudelft.nl/islandora/object/uuid%3A1ab8425d-4a64-4999-98db-57b26a64205b?collection=education



Sand mining
Source: https://www.internationale-bauausstellungen.de/geschichte/2013-2020-iba-parkstad-parkstad-in-bewegung/



Timeline of the fragmentation of the landscape and the reduction in green areas.

The initial settlements in this region were in agriculture fields. Later industrial towns and colonies were developed near mine shafts. These colonies did not merge along with the existing agricultural settlements.

As coal was mined at different locations, the colonies were isolated from each other as well. They only merged into each other with the boom of industry and the expansion due to the growth. When the operations stopped due to government rules, new settlements were built at the former coal sites. They were like isolated enclaves in the previous urban pattern, with no relation to the surroundings.

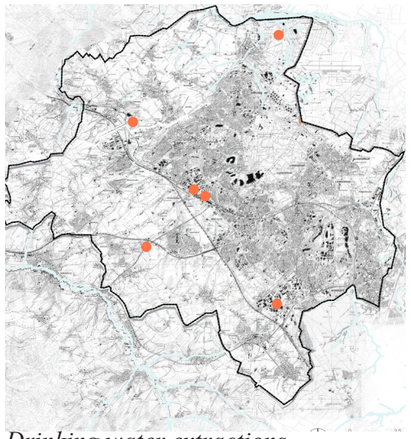
This resulted in irregular expansion and unpredicted rambling of urban development. What illustrates in the spatial experience are the fragmented patches of urban space lacking a clear urban structure for people to understand.

Open spaces fenced from neighbourhood for privacy and safety reasons.

Source: https://heerlenmijnstad.nl/winkels

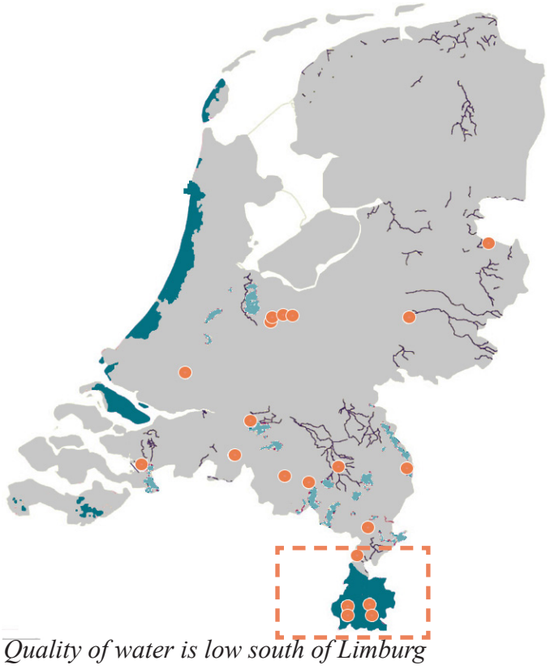
The fragmented patches of green open space, mainly they are unplanned which used to be a continuous green structure in the Parkstad region. Due the expansion of urban development, this green spaces have been eventually disturbed, interrupted, maintained and even taken over. Resulting in many open green patches in the urban system, that are separated by infrastructure or urban settlements. They are mainly leftover, abandoned places of construction, with intention to be designed for public use.

As a result, there is no green structure in the region to connect different urban areas and to interweave the Parkstad region into the landscape fabric. The urban developments and the ecological areas are not interconnected. Since the urban areas grew rapidly during urbanization, green spaces were neglected and not maintained. Urban areas do not coordinate well with the open space and the green space is not shared by its surroundings.

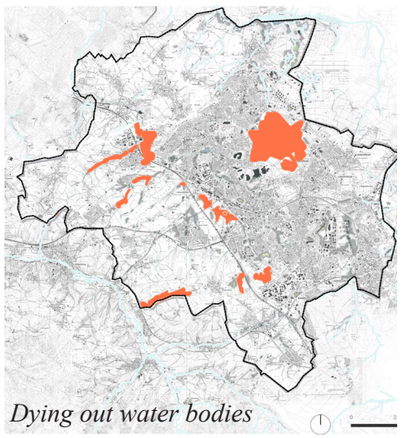


Drinking water extractions

During rainy season, urban areas experienced flooding in certain parts due to heavy storms.



Quality of water is low south of Limburg



Dying out water bodies

Due to climatic changes, droughts increased during summer seasons.
As a result, it affected the farmers with low water levels across the agriculture fields and streams.

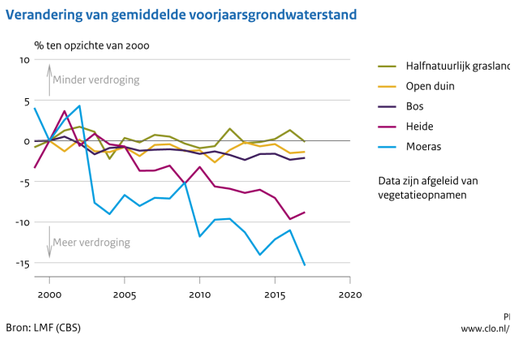
Good quality of water

Generally inadequate

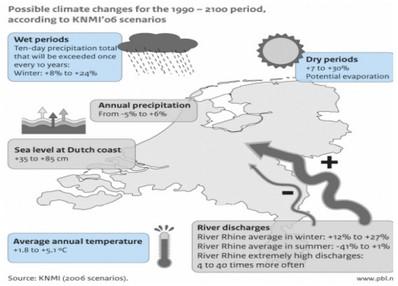
Ground water dependent nature

Ground water dependent surface

Drinking water extraction



Open pit mining
Source: https://www.gettyimages.nl/fotos/open-pit-mine?mediatype=photography&phrase=open%20pit%20mine&sort=mostpopular



Due to climatic changes, droughts increased during summer seasons.
As a result, it affected the farmers with low water levels across the agriculture fields and streams.

Water issues

Water is one of the main concern of the modern world. The biggest challenges being the pollution due to different activities and it is also affecting the ground water depth.

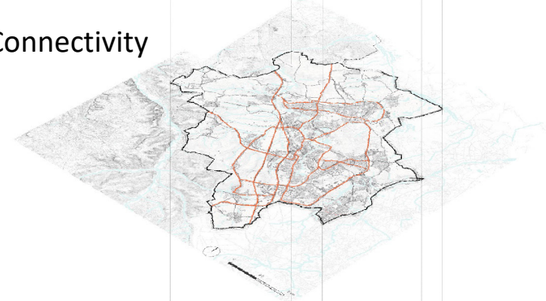
Open-pit mining in Germany has affected the groundwater table level in the region. As result, lowering the groundwater table to 250-300 meter.

Drinking water in this region is extracted from underground pits and due to open-pit along with dry summer seasons will have extreme negative effects for the coming years. Hence increasing the chances of water scarcity in such regions and the main source being the aquifers.

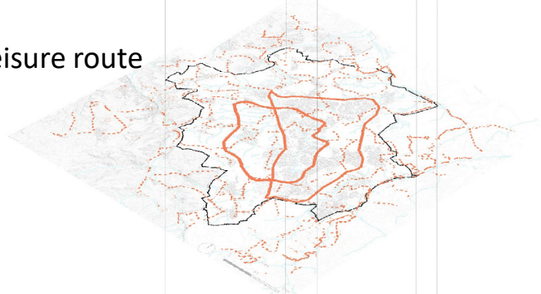
INFRASTRUCTURE

Historical route

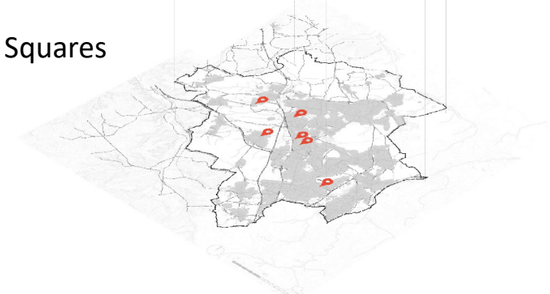
Connectivity



Leisure route



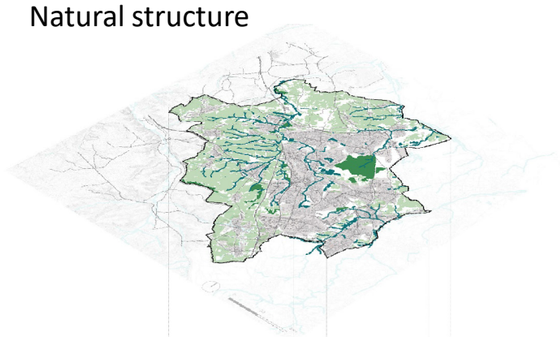
Squares



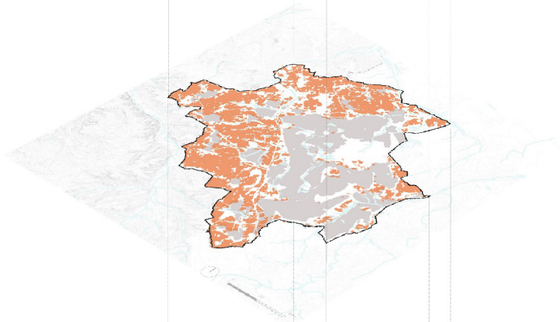
DISCONNECTED CYCLE NETWORK

GREEN SYSTEM

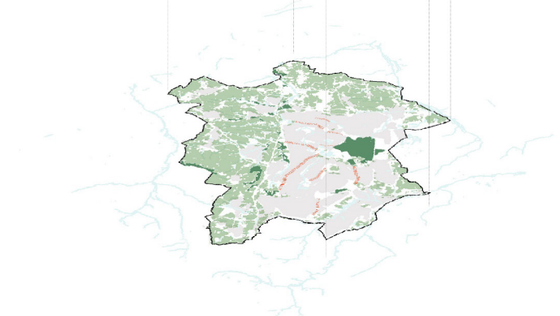
Natural structure



Agriculture



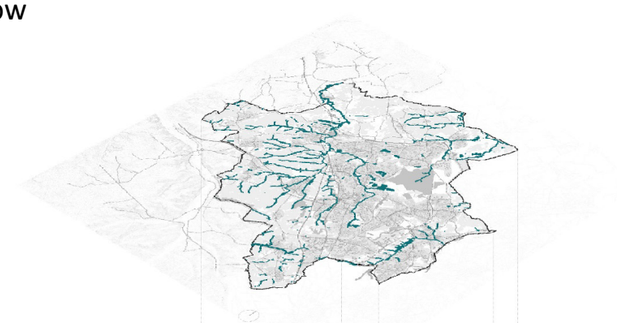
Fragments



FRAGMENTED GREEN STRUCTURE

BLUE SYSTEM

Water flow



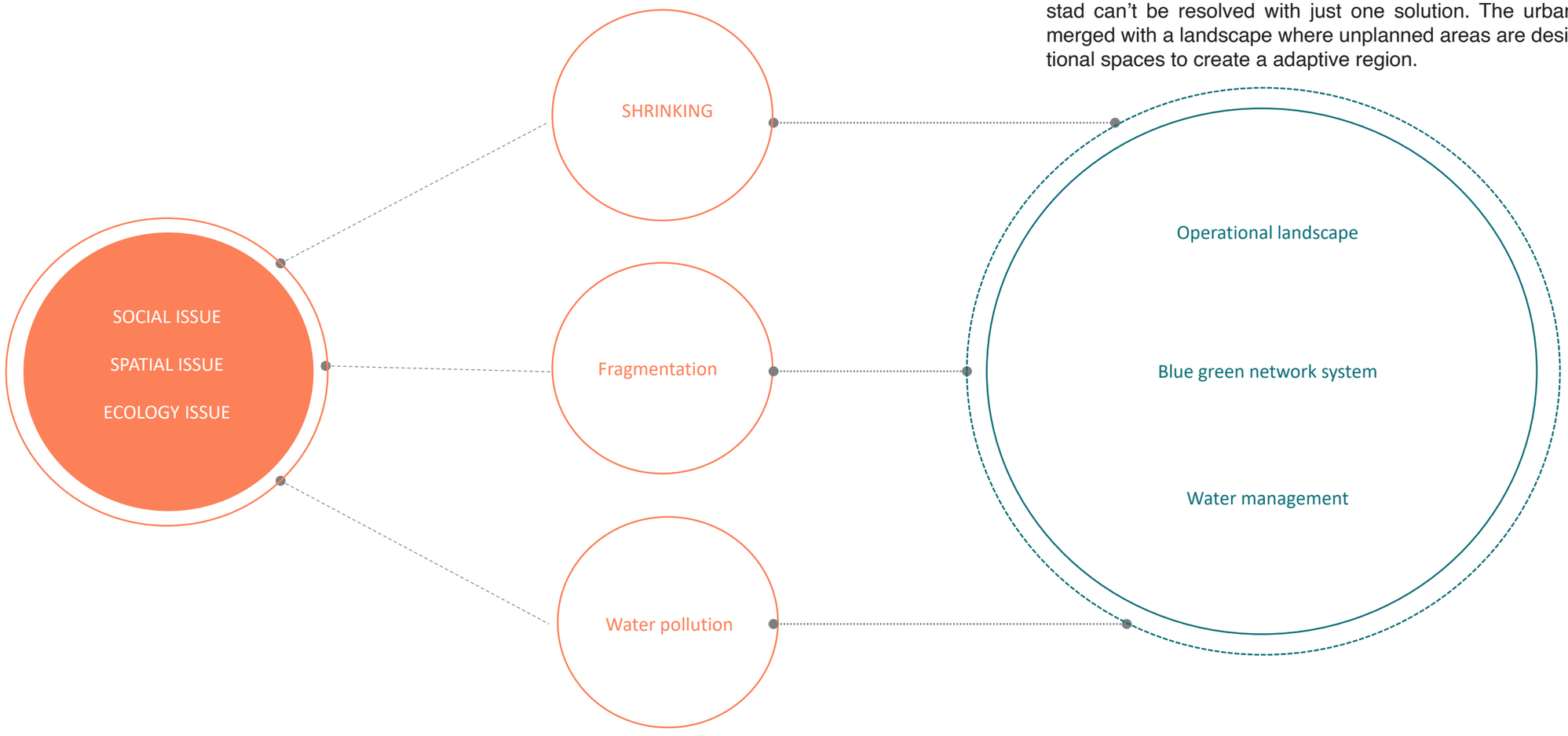
Polluted

POLLUTED AND DRYING OUT

1.3 Research Question

What are circular water design strategies and the related spatial framework for the degraded and fragmented landscape to reduce water pollution (mine, agriculture, waste) in Parkstad?

1.How to integrate the fragmented region and improve spatial quality?
2.How can waste nutrients in water and soil be used to develop sustainable landscape?
3.Explore the spatial design principles for making the area adaptive and resilient.
4. Explore the potential of network structure to improve the quality of water.
5. How can the principles be used in the design of similar situation?

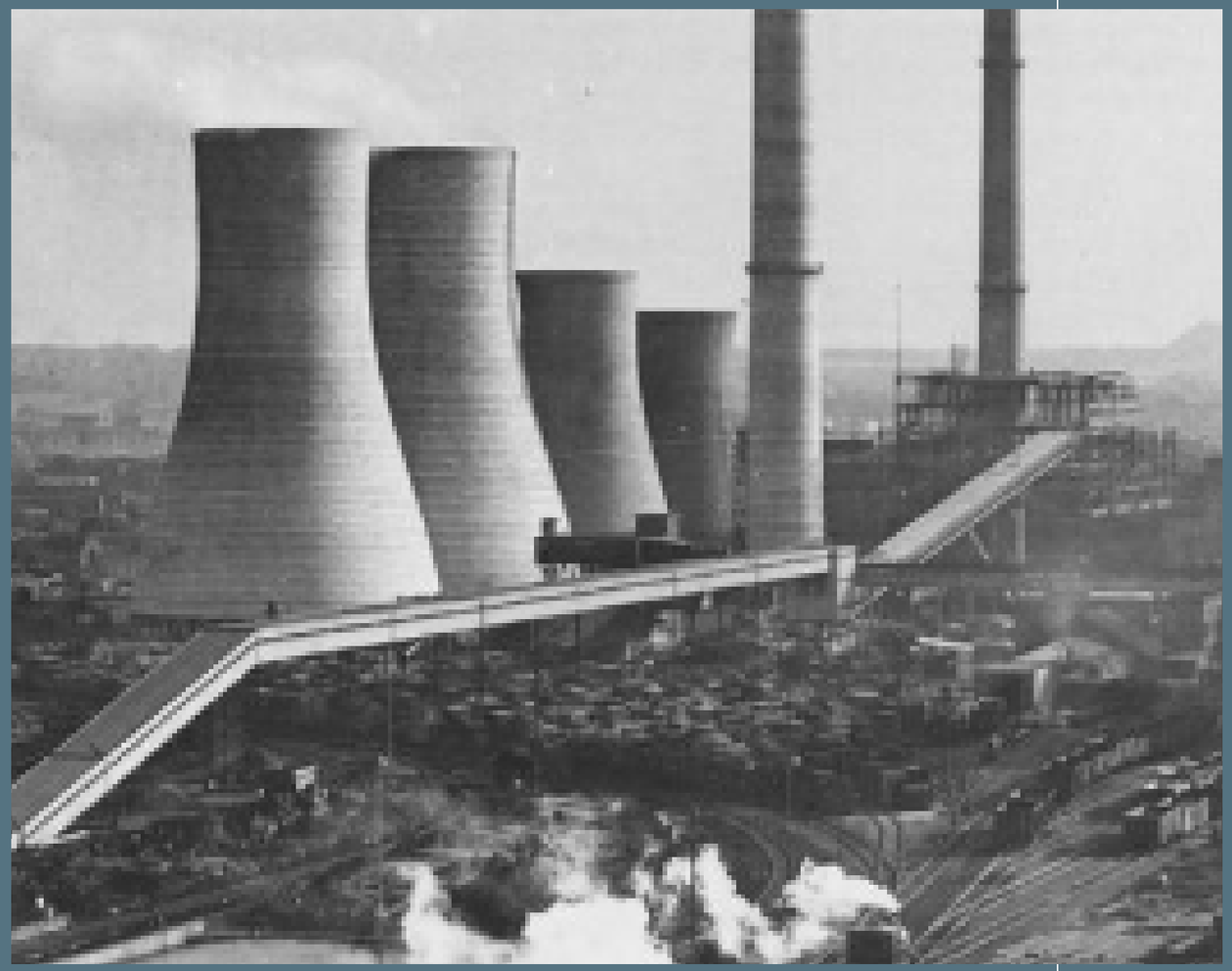


Objective

The goal is to improve the socio-economic conditions by using the waste nutrients to create an operational landscape and a more resilient system. This network system should be multi-functional with improved spatial structure considering social and ecological value, hence solving the current issues. Infrastructure of blue and green structure should be integrated into the landscape system to develop the area and generate sustainable economy.

There is need to alter how we approach a design and intervene in the natural system which are adaptable and resilient for the redeveloping systems which are sustainable.

Operational landscapes can be proposed in order to design resilient and adaptable region. Developing the region as a whole system, where change can be constant further leading to better growth. Current challenges, in Parkstad can't be resolved with just one solution. The urban fabric has to be merged with a landscape where unplanned areas are designed as multifunctional spaces to create a adaptive region.



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02

METHOD

UNDERSTANDING

study

PROBLEM ANALYSIS

RESEARCH QUESTION

MAPPING OF URBAN AND NATURAL SYSTEMS
Historical development
Landscape formation
Infrastructure
Biodiversity
Land use
Vulnerability

FIELD WORK
documentation, observation

SPATIAL ANALYSIS

TOWARDS CLOSED CYCLES
(Dobbelsteen, 2008)

ECOLOGICAL CONDITIONS
(Tjallingii, 1998)

SWARM PLANNING
(Roggema, 2012)

RESEARCH FRAMEWORK

formulate

DESIGN PRINCIPLES

design elaboration

MACRO
(regional scale)

MESO
(city scale)

MICRO
(neighbourhood scale)

PROPOSAL

Methodology framework

2.1 Methodology framework

The methodology framework explains the research and design methods which are relevant to support the main objectives of the research, which further enhances the socio-ecological resilience, production and integration of the region.

The research is mainly based on literature study to understand challenges and opportunities of the degraded land, in order to make it resilient and adaptive. These principles can be used in Parkstad region

The main aim of the literature review lies in understanding how these theories interconnect to analyse the waste nutrient flows and helps towards creating a resilient and adaptable region through design.

The method for designing is mainly based on circular water management for creating a productive landscape.

Literature review

case studies

analysis

mapping

design

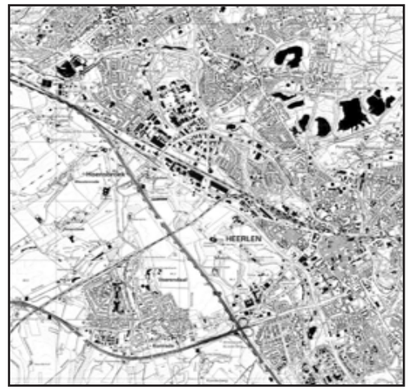
spatial design

design adaptive energy planning approach

Designing through scales

Designing through scales gives better understanding of the site and leads to efficient design. From Macro scale to micro scale with different intervention is different scale to mainly design for the local and the residents.

Macro
Focused on Parkstad region, t o integrate rural and urban parts. Interventions are water catchment areas creating blue and green network.



Meso
Re-organizing the water system to integrate the urban fabric and connecting all the unplanned spaces and design in multifunctional areas.

Micro
Development of the degraded land next to a neighbourhood.
Design will consist of purification, aquaculture and further connecting it to the neighbourhood and hydrophilic park.

Important structures of the the public space
Source: https://en.wikipedia.org/wiki/Landschaftspark_Duisburg-Nord

Landschaft park, Duisburg Nord, Germany

As Mau explains, “In order to produce a place or a cultural entity in the past, it was about fixing it and making it solid and defining it for all time. Our project is really the opposite: it’s about designing it to be changed, designing it to be evolving, but to make the design so robust that it sustains itself through that evolution, like any other living thing” (Czerniak,2001)

Important structures of the the public space
Source: https://www.designboom.com/architecture/turenscape-shanghai-houtan-park-best-landscape-project-at-waf-2010/

Shanghai Houtan Park, China

The park is built on former industrial site. Currently it acts as a ecological flood control with series of wetlands and urban agriculture. It elaborates a living system where ecological infrastructure is tmulti-functional its is ecological water treatment as well as it controls the flood.

The cases are explored based how the landscape is restored from different activities and pollution. Understanding spatial characteristics and logic in order to regain economy and develop the area.

Freshkills parkland, USA

Sydney Park Water Re-Use Project, Australia

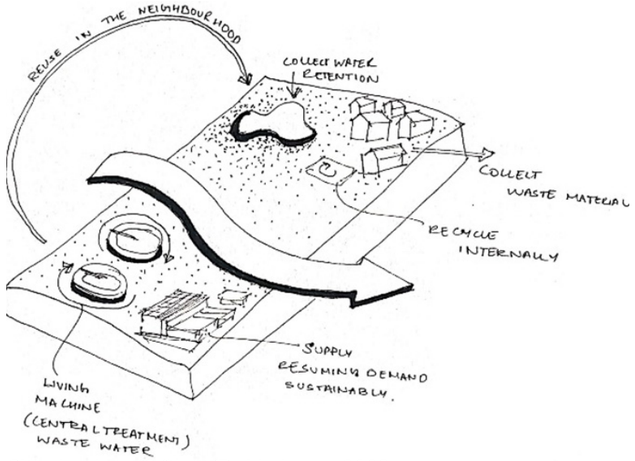
2. 2 Towards closed cycles - new strategy steps inspired by the cradle to cradle approach (Dobbelsteen 2008)

It is good for projects in larger scales, such as districts, regions. Different flows and cycles can be interconnected like energy, water etc.

It also enhances step-by-step strategy for sustainability. The main is in the supply of sustainable assets that are closed technical cycles, and yield of absorbable waste. Overall, they are considerably more perplexing than materials or items alone, however, because of this multifaceted nature they additionally empower to close vitality, water cycles through interconnections. This led to create the opportunity to translate Cradle to Cradle to a large-scale strategy. (Dobbelsteen 2008)

Main stages in the new strategy are
1. Reduce the demand
2. recycle internally
3. collect waste water and materials
4. process waste water and waste material in a central treatment plant
5. re-use the waste
6. supply the resuming demand

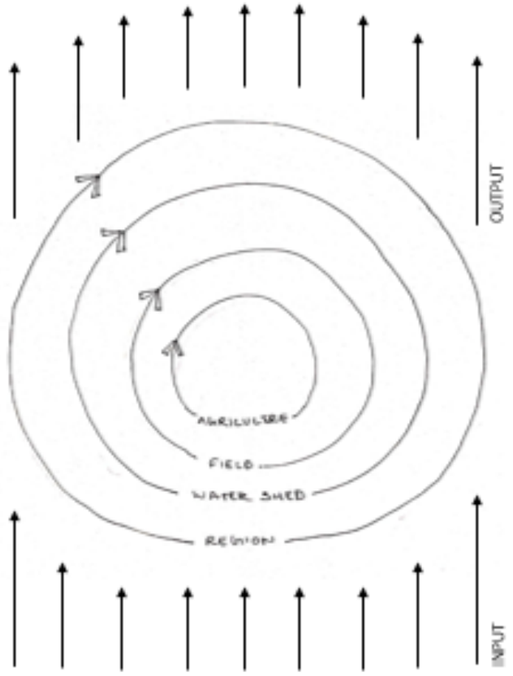
Based on the new steps strategy there is reduction of the demand and the waste flows are recycled



Sketch adapted from (Dobbelsteen 2008)

and in the end resulting in supply of renewable resources

The new steps strategy rethinks to adapt and fit it better in developing world. Empowering a superior inclusion of requests by maintainable assets and conforming to the “squander rises to food” rule. When utilizing this system, the C2C theory can be stretched out to a bigger scope than simply the item and include different streams than just materials. The last image of such a framework is progressively perplexing, however the fundamental strategy is straight forward. (Dobbelsteen 2008)



Sketch adapted from (Tjallingii 1998)

2.3 Ecological conditions and planning strategy (Tjallingii 1998)

Based on the input-throughput-output perspective, the Ecodevice Model explains connection between flows and areas.

The model lets you define the flows in the area, the quality, how can it be improved, retained within the region, by reusing and anlyzing the outflow also. It sets system boundaries where the metabolism can be analyzed and taking into consideration the interconnection of the other systems.

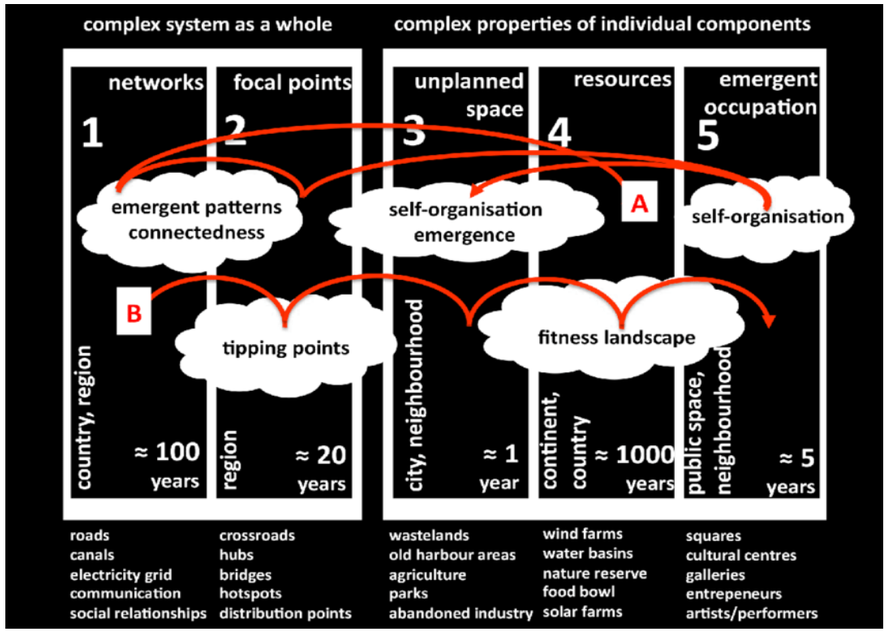
Usually the administration boundaries of water boards have developed over time so it may not coincide with the borders of the water body basins . The analysis through systems approach will give a better understanding of the system to develop the model.

Currently Parkstad has a linear water flow that cannot handle water pollution. Unplanned spaces can transform into a circular water chain by increasing the water infiltration, adapting phytoremediation and reusing the available water resources. Integrating planning and design of water with technical an d ecological aspects as part of the natural system.

The above differentiations of subsystems in the constructed condition are consequently found in spatial and flows. Numerous different boundaries conceivable, that are each similarly legitimate. Breaking down the assembled condition with an environments approach assists with taking a few to get back some composure on the intricate trap of causal connections.

Mainly focusing on decentral solution for system boundaries and focusing smaller scales to have an effective design that can develop through all the scales.

According to the model one the main guiding principles for sustainable projects is to close cycles through different scales. Flows strategies needs to be combined with spatial organization.



Sketch from (Roggema 2013)

2.4 Swarm planning by Rob Roggema -Resilient planning

This approach to adapt non-linear processes and self organization, has swarms are able to adapt for environmental changes making it highly resilient.

Understanding spatial systems as flexible and complex networks in the region. Roggema introduces the theory of swarm planning which mainly based on adaptive capacity as the important strategy for designing diversity and resilience in different systems.
Based on the theory landscapes will be able to increase resilience and simultaneously also give possible structures that are spatially appealing .

In the context of emergent spatial patterns a network can be created in the unplanned spaces for restoring the area. Then the system will be able to develop resilience.

Based on the theory, the fitness landscape is the natural layer which is the ecological system. The natural process develops into emergent patters in the unplanned areas which will take time to develop (Tillie 2014)

Swarm planning resulting spatial designs and further choices. It also creates opportunity to increase

the adaptive capacity with spatial planning.

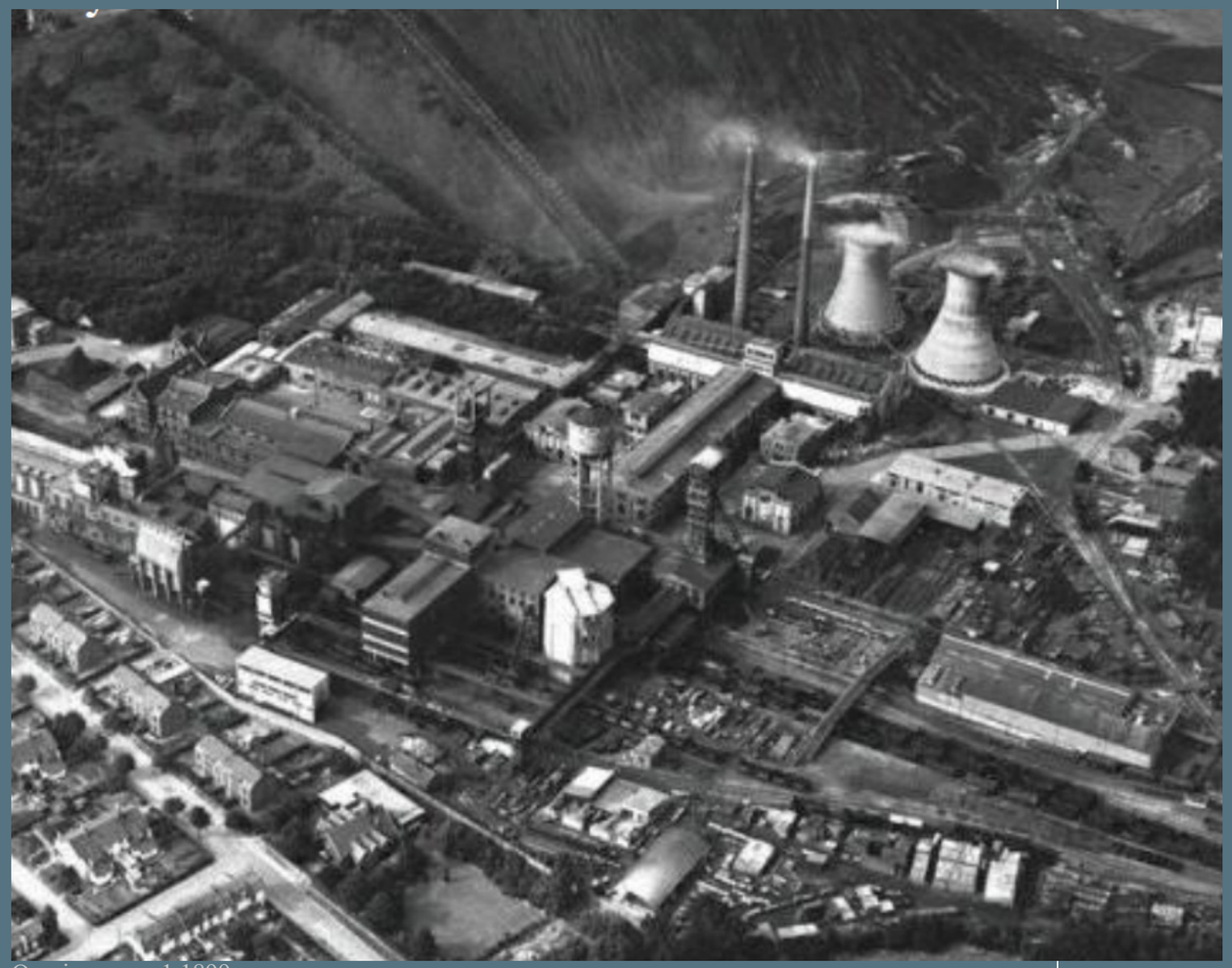
Using theory resulted in the prevention of droughts impacts, harvesting rainfall, robust ecological structure, local renewable energy supply.

It also creates climate resilient by mitigation or adaptation of climate change , and enabling all different elements of process to emerge.

Parkstad also has many unplanned spaces. Using the swarm planning theory proposed structure can include flexibility, where ”unplanned” space can be allowed for sudden extreme rainfall or ecological extension to restore the region.

Operational landscape can be goal of the sustainable development for resilient growth of the Parkstad.

Integrating urban and landscape system into the process of nature can form a new kind of resilient landscape. Waste nutrients could be reused and absorbed by the plants for the growth. The region can be more adaptive and resilient for change.



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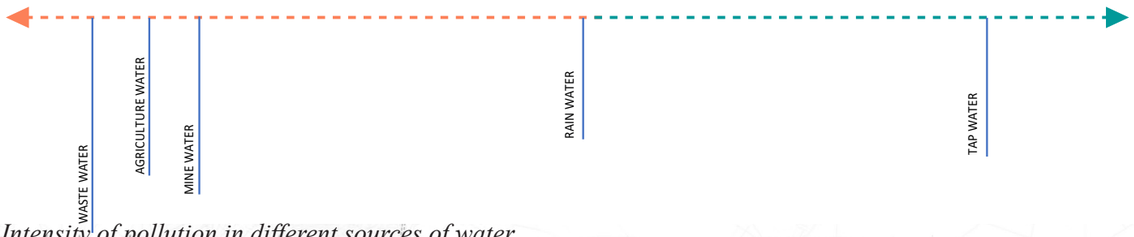
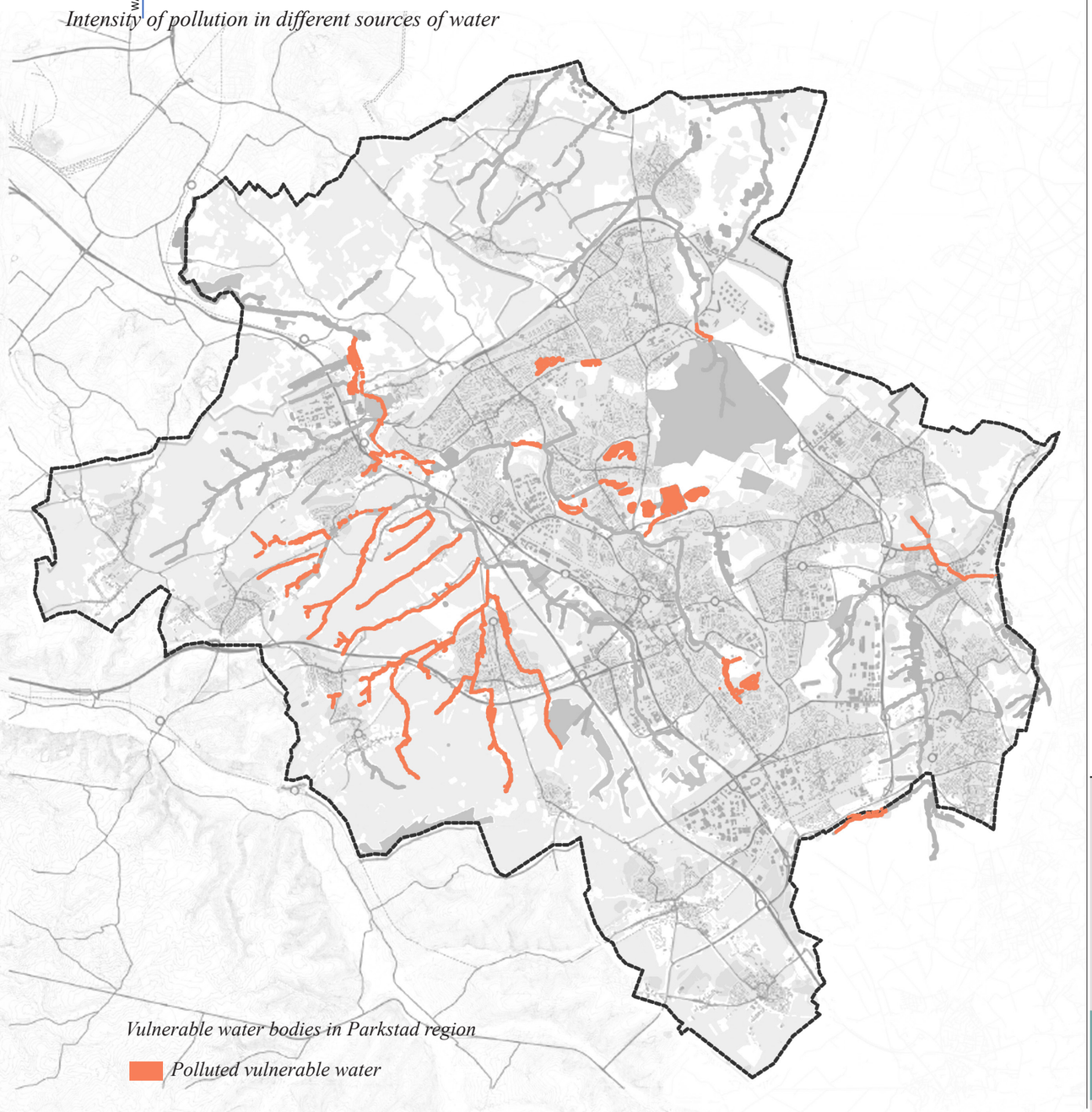
03

ANALYSIS



Intensity of pollution in different sources of water



Vulnerable water bodies in Parkstad region

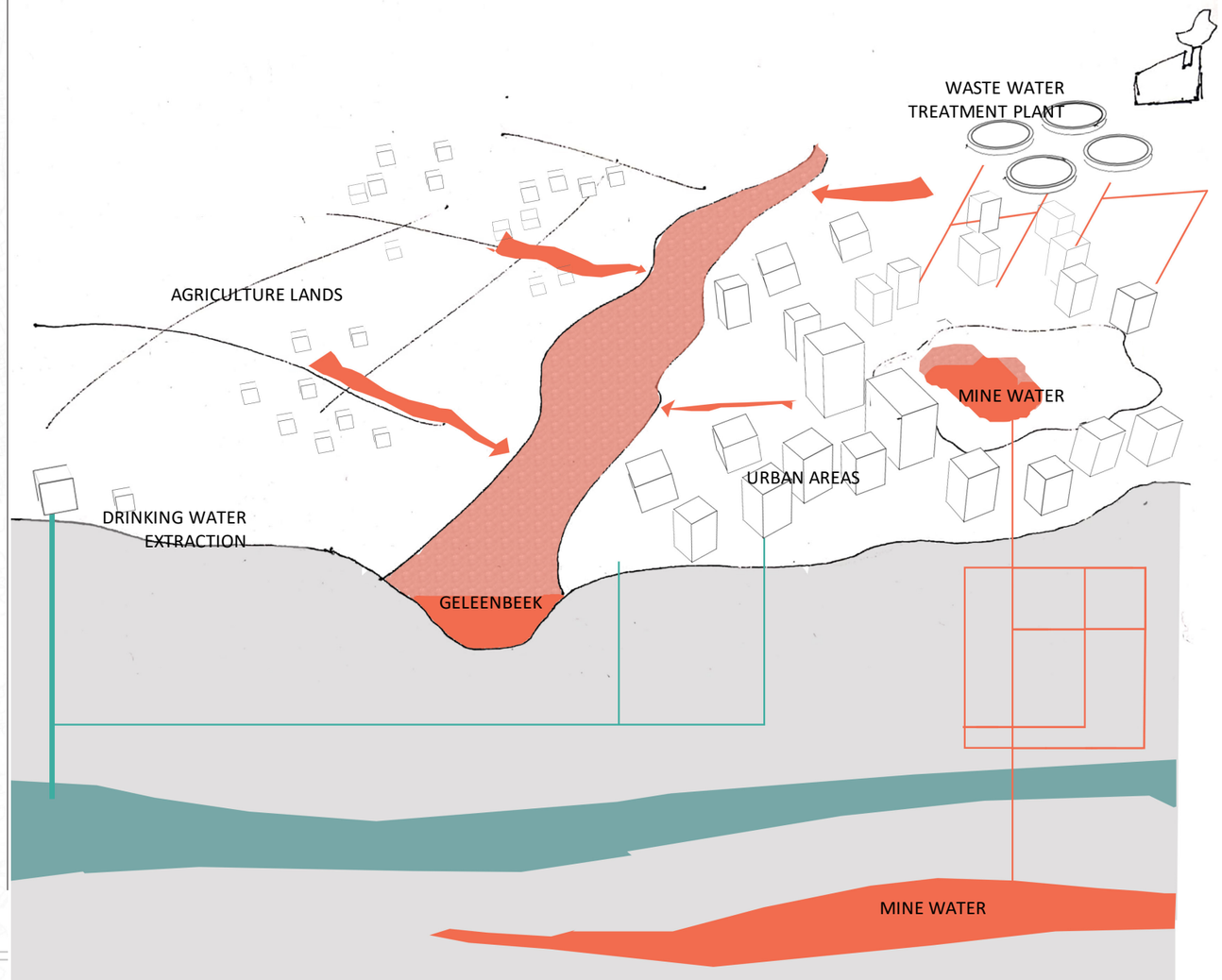
Polluted vulnerable water

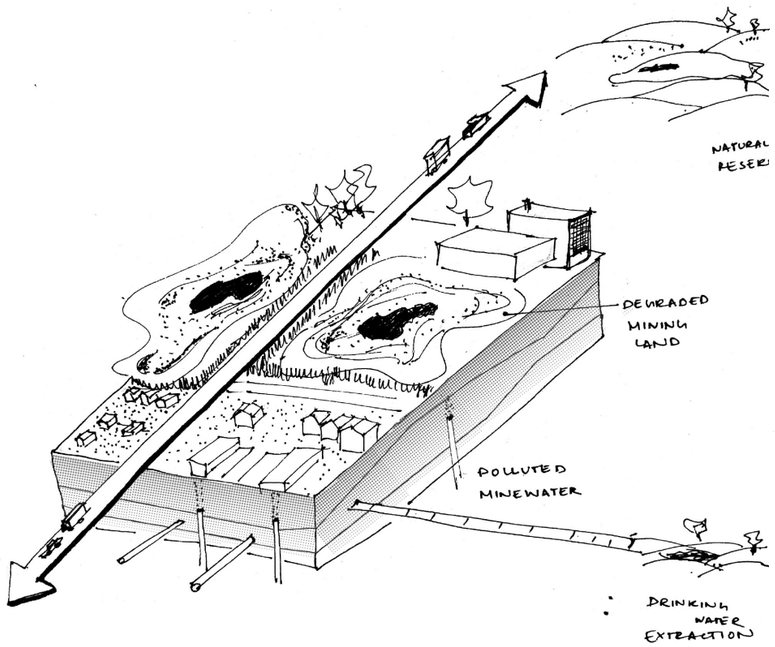
3.1 Water analysis

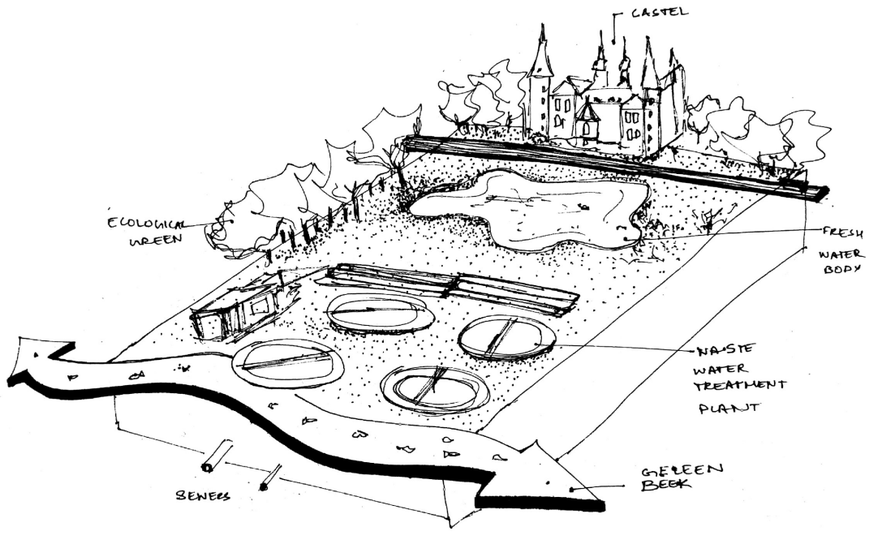
Natural system are the streams where the quality of water is not adequate and there is also droughts. The ecology is scarce and also fragmented due to degraded land water. Most of the region is an open area is agriculture.

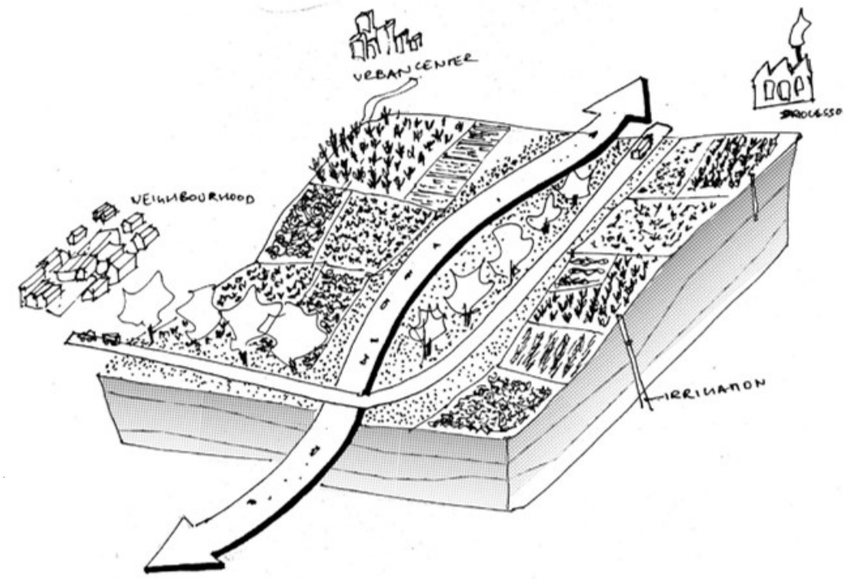
Vulnerable water bodies and catchment areas are affected due to different reasons. Mainly near the agriculture fields and the ones connected to the mining sites.

Graphic depiction of how the aesthetic perception of water differs to contamination









Mine water

Generally contains heavy metals or additives used in mining industry. Rising mine water can lead to an increase in groundwater level in the overburden. Due to this groundwater is at risk.

Less recreation value

Waste landscape

Waste Water treatment plant

N, K and P there are main nutrients contained in wastewater. Mainly includes bacteria, viruses and protozoa, oils and greases which are runoff from streets, parking lots and roofs.

Waste landscape

Unproductive

Water pollution

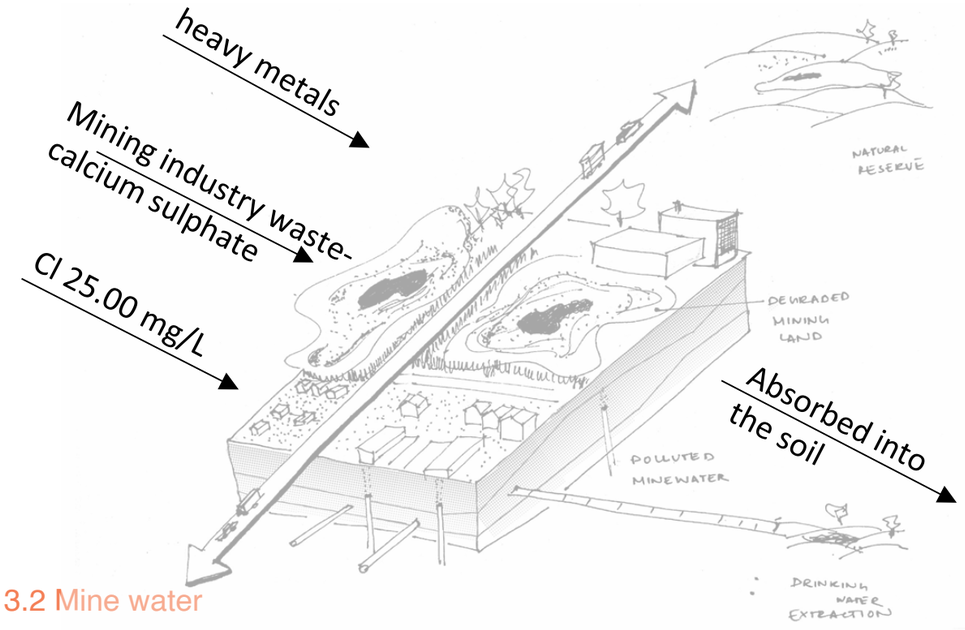
Waste water in agriculture area

NHy and NOx are atmospheric depositions,
Cd, N and P are present in inorganic fertilizers, and animal manure contains Cu, Zn, N and P.

Water pollution

Waste landscape

Demolition waste

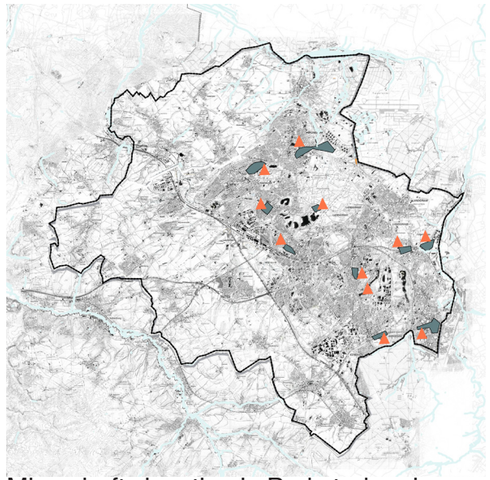


3.2 Mine water

Generally contains heavy metals or additives used in mining industry. Rising mine water can lead to an increase in groundwater level in the overburden. Due to this groundwater is at risk.

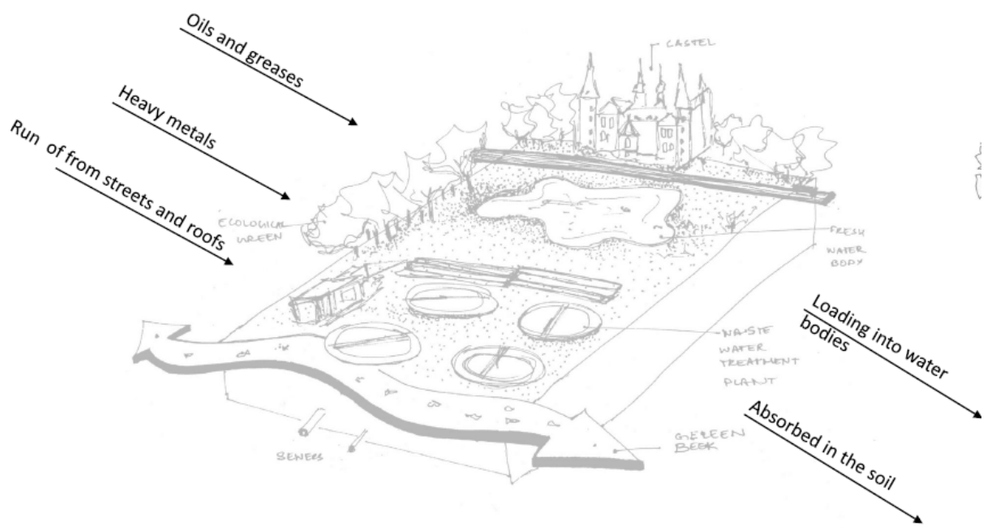
Sulphate and chloride are biggest threat for the ground water quality with iron content as well and major cause for pollution.
Currently the risk of mine water infilrtering into the drinking water supply is high.

There is a prediction that the rise of mine water into the aquifers are a threat given the limestone formation naturally neutralizes all contents. Relatively, the aquifers are vulnerable to infiltration by hydrological gaps horizontally.



Mine shafts location in Parkstad region

Mine tower
Shafts



3.3 Waste water in treatment plants

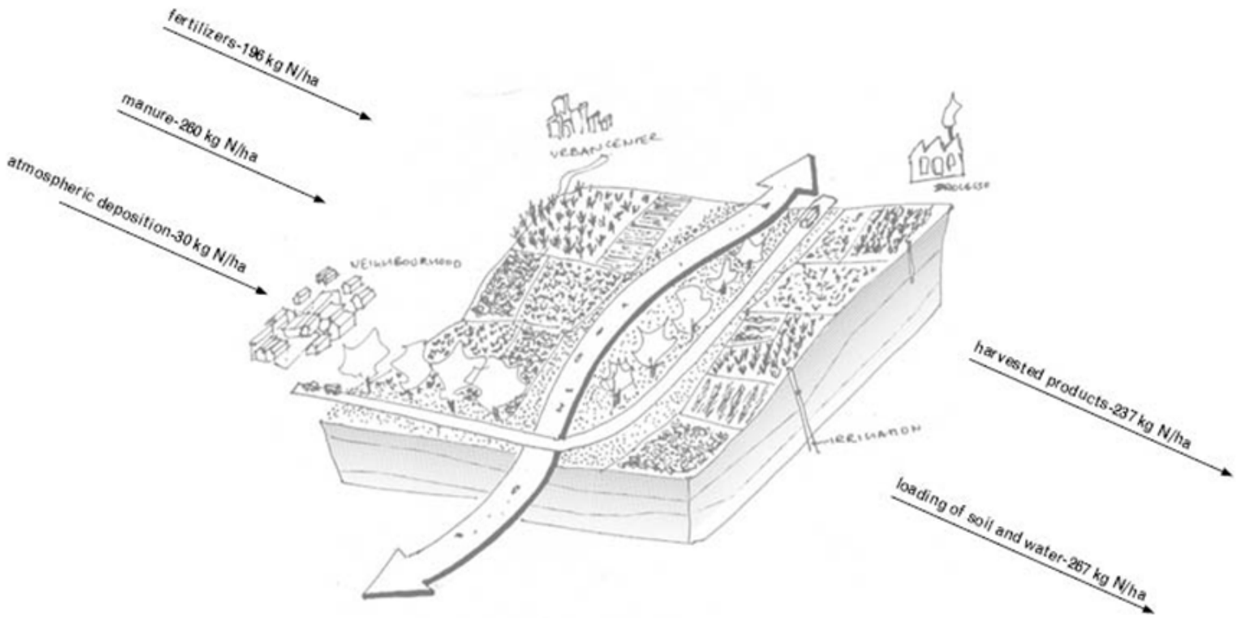
The wastewater usually contains many bacteria and pathogens. It also contains oils and greases. The waste water treatment plant receives water from surrounding areas. the wastewater is chemically treated.

N, K and P there are main nutrients contained in wastewater. Mainly includes bacteria, viruses and protozoa, oils and greases which are runoff from streets, parking lots and roofs.

Currently the treated water from the treatment plant flows into the brook polluting it as well with the toxic contaminants.

Waste water treatment plants location

Polluted vulnerable water
Water treatment plants

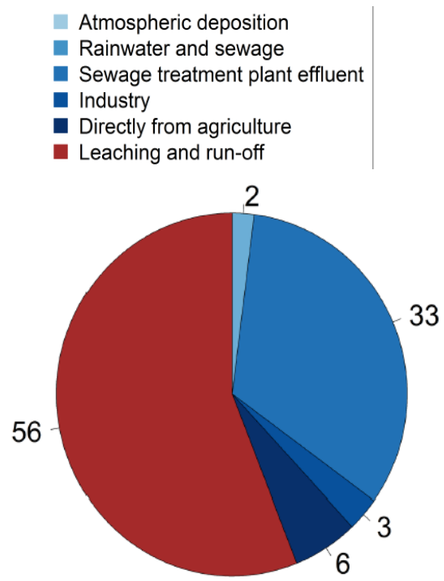


3.4 Waste water in agriculture area

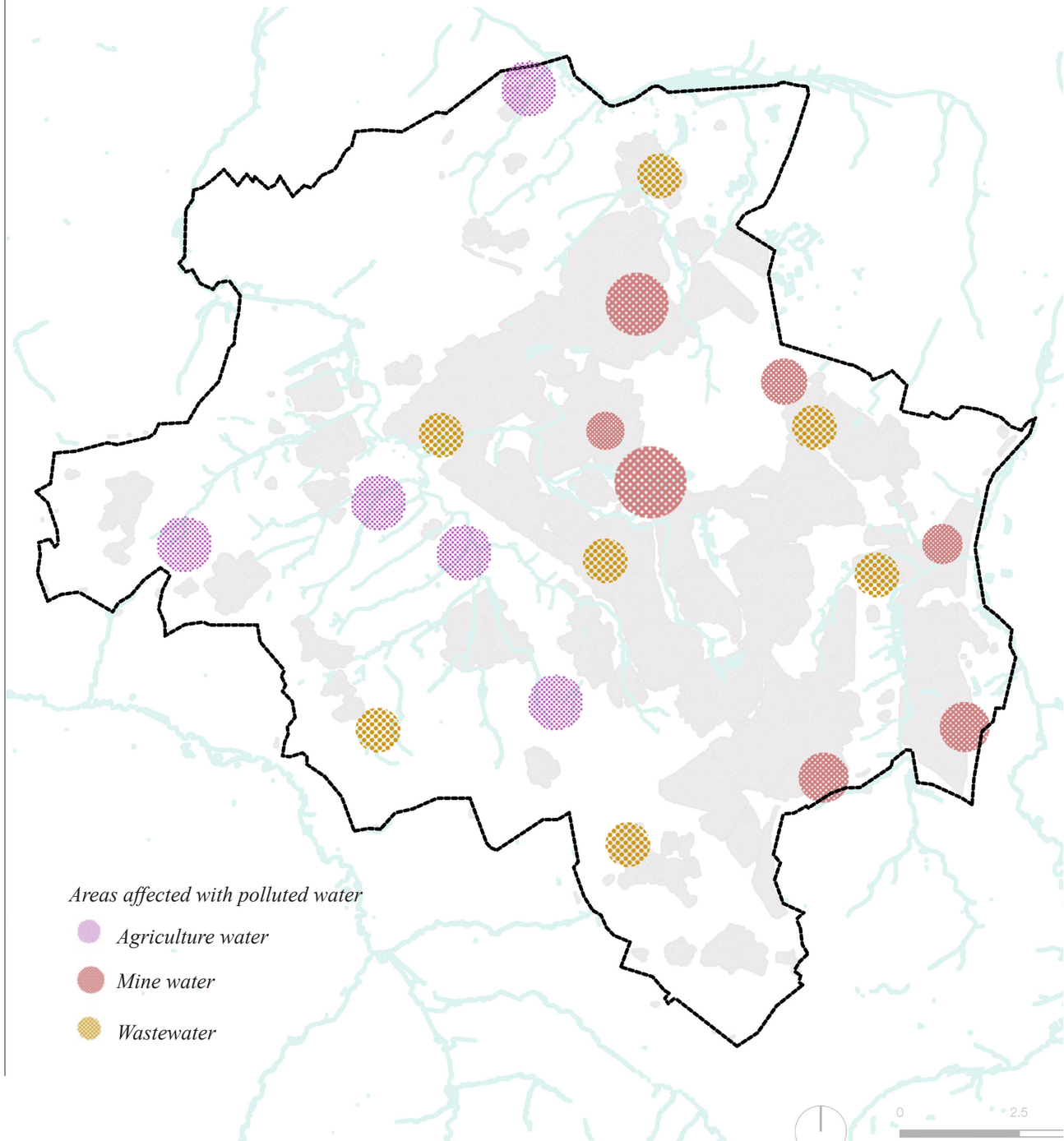
Concentration of nitrate and phosphate is increasing, Production or yeild will reduce.

NHy and NOx are atmospheric depositions, Cd, N and P are present in inorganic fertilizers, and animal manure contains Cu, Zn, N and P which pollutes the soil and that results in contamination of water.

This affects the productivity of the soil and due the mass production and current agriculture techniques loess soil is degraded.



Source of value : oenemaetal,1997



Reviving the degraded

Analysis

Spatial quality of these areas, mainly is polluted and very low ecology

Mine water

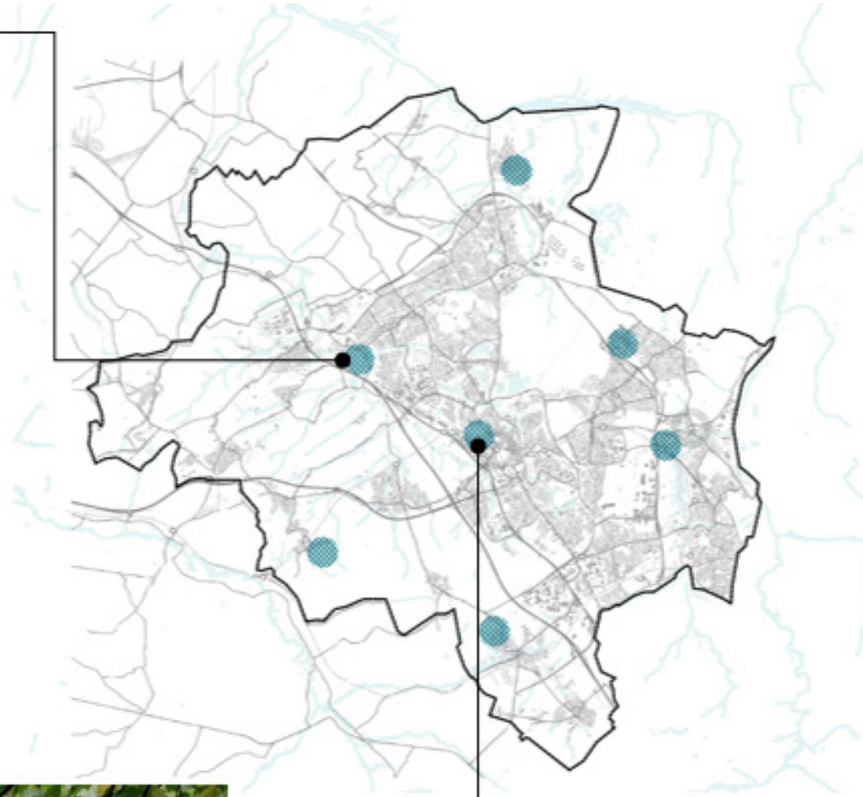
Demolished building area

Mining area

Reviving the degraded

Analysis

waste water treatment plants

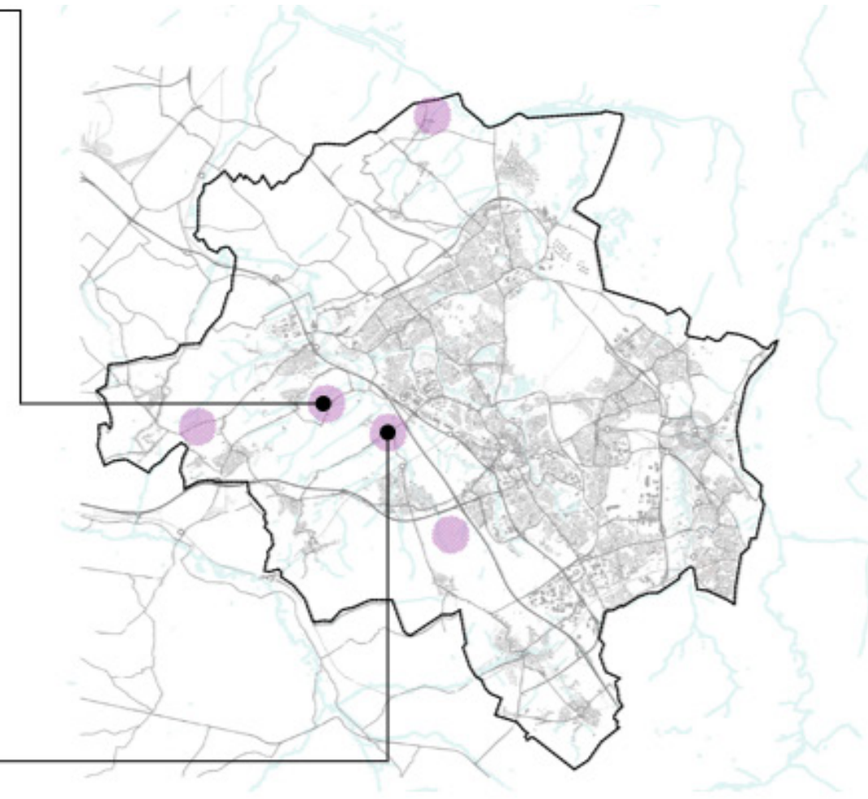


Vast open spaces that are unplanned areas next to the water treatment plant.

Fenced areas for water treatment facility. Patches of area are unused and lowing lying areas clogged with water and it is not used efficiently.

Reviving the degraded

Analysis



Most of the agriculture fields are unproductive due intensive farming techniques. The soil is not nutrient rich and currently only one kind of crop are mainly grown. This degrades the soil and leading to polluted water as well.

Source: https://www.google.co.uk/maps/@52.0146399,4.3756382,14z

The stream drying due to peak summer and lowering of ground water. ecology value is low.

Water consumption : 107 L/cap/ day

For 1000 people how much?

Source:https://www.waternet.nl/ons-water/drinkwater/gemiddeld-waterverbruik/

Rainwater potential: 880mm/yr

Source: https://www.clo.nl/indicatoren/nl050806-jaarlijkse-hoeveelheid-neerslag-in-nederland

Energy for water production and distribution: 33.060 kWh(+/- 12 households) 0.47kWh/m3 drinking water produces

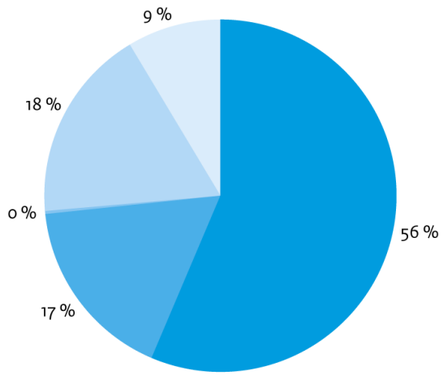
Source:http://publicaties.minienm.nl/documenten/op-weg-naar-een-klimaatneutrale-waterketen

Energy for water treatment?

There is lot of energy wasted on the production of water. Energy spent for water is unescessary. Incase water is stored and reused and the energy could be reduced for the production.

Natural process that is active processes will not need as much energy as much energy required for conventional treatment.

Beregend areaal land- en tuinbouw, 2016



Bron: Wageningen Economic Research

Minimaal éénmaal beregend
- Akkerbouw
- Tuinbouw
- Fruit
- Veehouderij
- Overige land- en tuinbouw

Active treatment

- Water treatment plants
- Chemical treatment

Passive treatment

- Constructed Wetlands
- Algae (Isola – duck weed)

Active method are chemical treatment/ manmade process which is induced to purify the water. whereas is passive treatment is natural process to treat the water.

3.6 Water treatment process

There are various methods for the treatment of wastewater which is mainly categorized into chemical(active) and biological (passive).

The conventional method is the chemical treatments in waste water engineering. It is also called an active process in which continuous energy is required to maintain the continuity the process.

On the contrary passive that is biological treatment process requires minimum maintenance. It takes place with natural process and continuously works ones the system is set in place.

There are different kinds of biological treatments as well. In this project a series of system with wetlands and duck weed farming could be used.

Duckweed treatment ponds re-

Source: https://www.gettyimages.nl/fotos/open-pit-mine?-mediatype=photography&phrase=open%20pit%20mine&sort=mostpopular

moves certain amounts of heavy metals. and it absorbs the waste nutrients like N, K and P. It also captures the bacteria and pathogen in the end purifying the water.

Duck weed can harvested and fed to the cattle or fishes as well. However it can also used for biomass production.

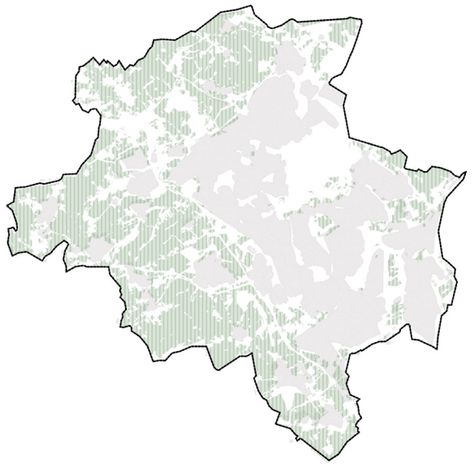
Currently biomass energy is not taken into account , Though it has a high potential due to availability of resources. Parkstad region is very green , so there is an abundancy of biomass crops if well maintained .

Duckweed can be used for biomass production. It can flourish in the canals. It has versatile qualities in sizes and nutrient composition. It can be harvested , processed and harnessed in various uses.

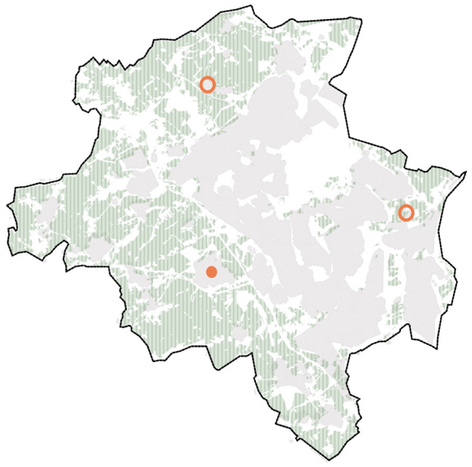
It has many benefits in food , energy and environment. It can used as fish food .It used to generate biogas

In 2013, British Petroleum (BP) published an Energy Outlook 2030 report, in which it predicts the world will require almost double its current energy supply by 2030 to sustain its economic and population growth; there is an increasing gap between GDP and energy consumption. Domestically-produced cost-effective biofuel will be pertinent for the conservation of energy, decline of fossil fuel use, and fulfilment of future energy needs.

If duckweed is used for the purification of water. Then the production of duckweed is high and the biomass production will increase.



Biomass potential areas it can generate around 10% of the energy



● Biomass power station
○ Potential biomass power station

Reviving the degraded

Analysis

Demolition of structures

Source: https://repository.tudelft.nl/view/MMP/uuid:99bd9b89-d6f2-4207-bb0d-3281b3446a82

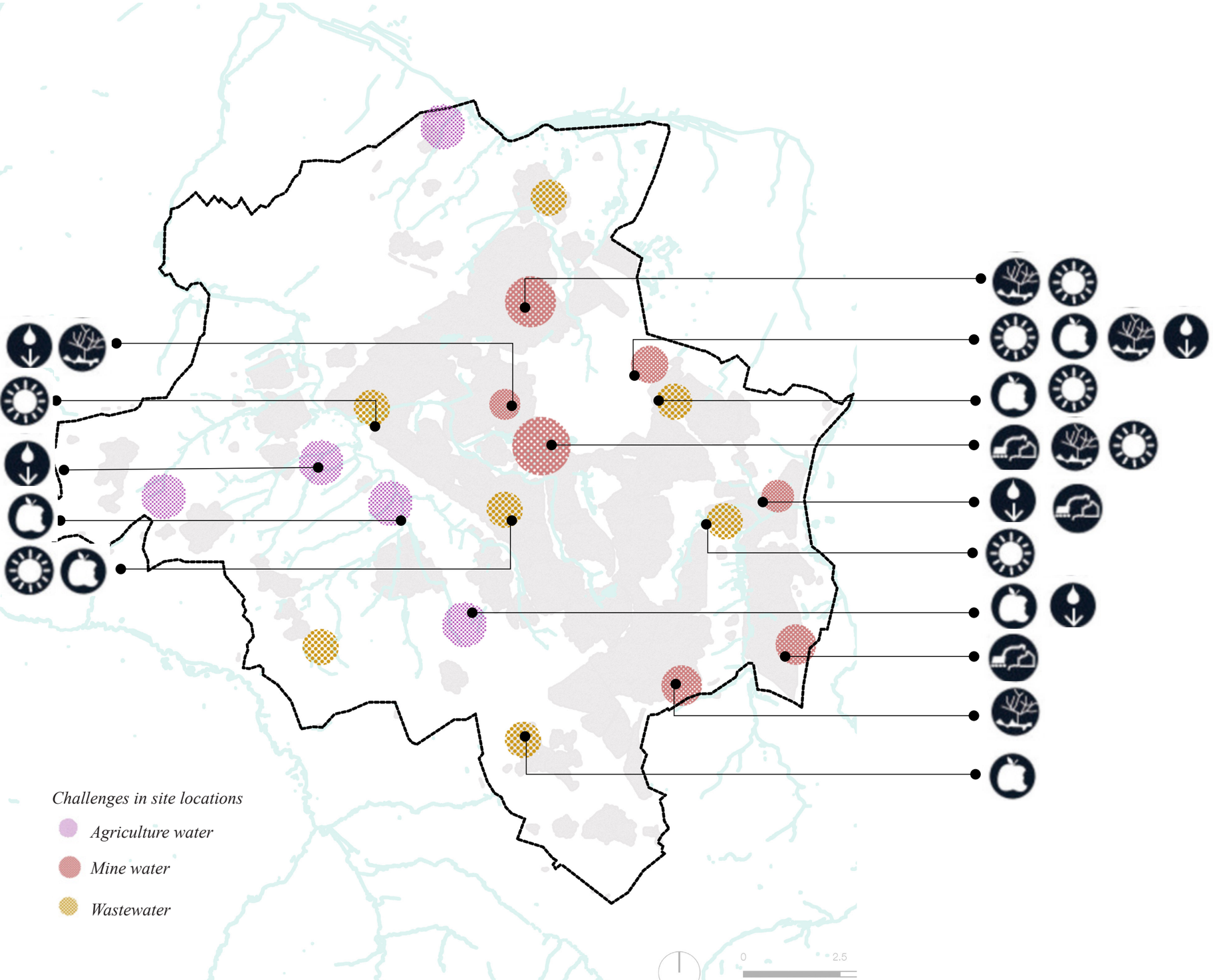
04

CHALLENGES AND OPPORTUNITIES

Reviving the degraded

Reviving the degraded

Challenges and opportunities



Site conditons in different locations ahave different problems

Water pollution

There is different sources of pollution it could be agriculture, mine water and waste water.

Less recreation value

No leisure activites for residents or tourists. No facilities for local to gather or have diverse outdoor activities.

Waste landscapes

Land is unsed and left abandoned due to different reasons. There is no purpose and creates a negative space

Demolition waste

Due to closure of mines, all the building and shafts are demolished create a lot of waste.

Unproductive

The land is not fully utilized to the maximum due to efficiency.

4.2 Design Principles

The main principles are, providing quality of living and working environments. Finding ways to create future- proof living environments, integrating structure and lastly the efficient use of natural resources.

Creating operational landscapes is one the solutions for the rapidly growing world. As the world is developing rapidly there is need for change in the way we design and think. Monofunctional spaces are not efficient and over time they will reduce the value and development will decline. So, multifunctional spaces have to be developed has they compliment and there would be a significant growth.

Designing strategy

The goal is to create operational landscape. To achieve it, The future landscape system should not be single aimed , spaces need to be multifunctional. Different aspects can be involved in the new system, so that it can contribute to sustainable development of the region.

In case of Parkstad ,the proposed structure should firstly resolve spatial issues. Simultaneously it can then develop the ecology and alternate sources of income.

I mainly focused into water issues that can reorganize the water

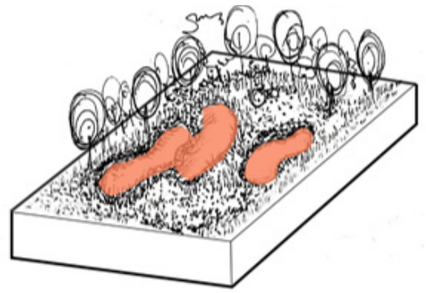
structure and integrate into the urban and landscape fabric.

Purification of the polluted water is also one of the biggest issues of the region. Different sources of water have different nutrients and toxic content. The decentral purification would be a ideal situation by using natural systems like wetlands and duckweed farming to benefit the ecology as well. Duckweed farming absorbs nutrients from water and then it can be harvested to produce biomass energy or else can also be used as feed for fish or the cattle. Creating and developing it economically.

Creating blue and green network system. Using the current water structure to purify and strengthen the ecology with integrating the unplanned spaces. This can lead to new green- blue structure with retentions ponds, canals and previously separated water bodies.

The unplanned and open spaces will also connect most of the isolated green patches. Based on the blue system , green structure can be generated.

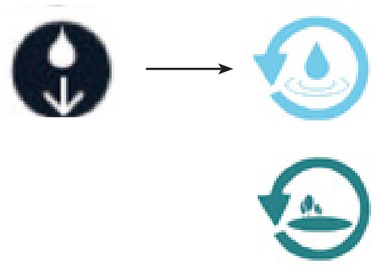
The new blue and green structure, interweaves different parts through the whole region previously fragmented paths forming a resilient area.

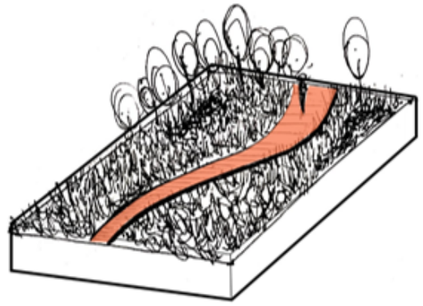


Design for adaptability:

Synergies and mitigate conflicts among existing and proposed functions to reduce environmental impact.

Reusing waste and purifying the existing
- Adapting to the context

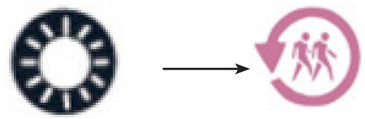


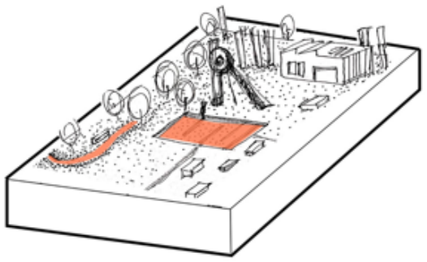


Create places for people:

The places to be well- used and attractive for healthy living

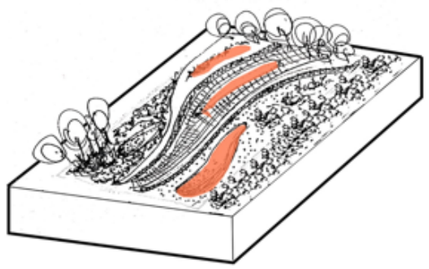
To improve social quality
Connect neighbourhoods





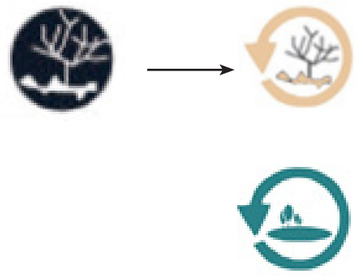
Protect industrial Heritage:

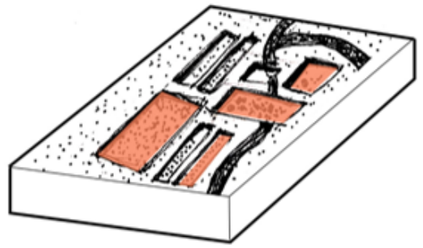
Respond to site and the context.
To create identity for the area and to protect the culture it is important to conserve the industrial heritage to create it as landmark also.



Design resilient landuse:

Conservation to and enhance diversity in landscape.
To adapt for climate change in the developing and rapid growing world. Storing water to reduce droughts and reuse it.

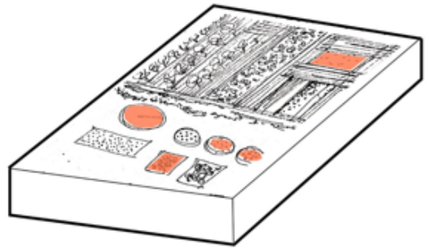




Continuity and ease of movement:

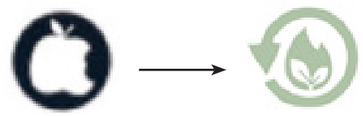
Encourage continuity and multifunctional spaces, encouraging the utilization of unplanned areas.and promoting accessibility and local permeability.

To make it easily accessible and connected

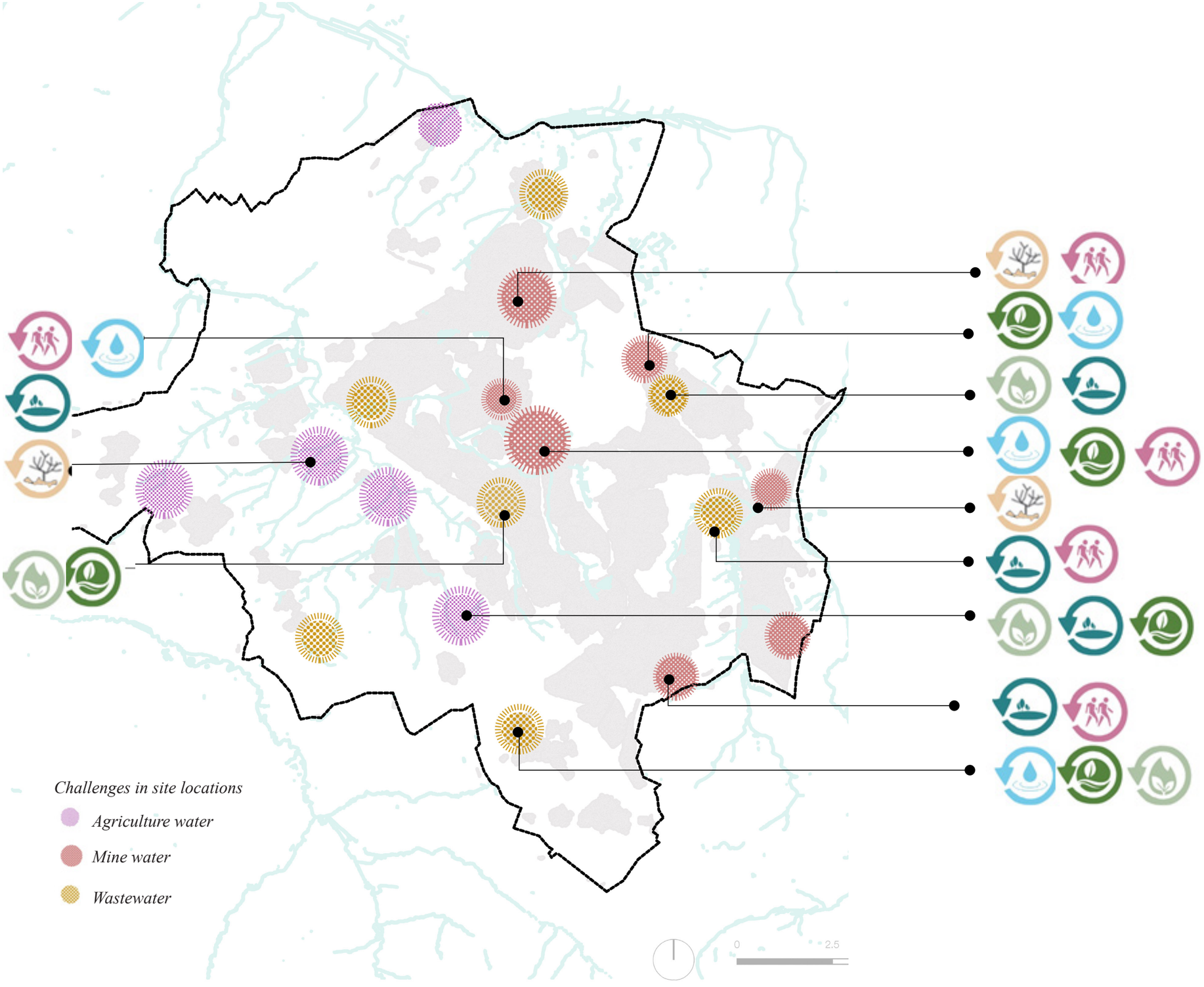


Multifunctionality + Diversity:

To enhance economy.
Production of the area and develop the area. Creating diverse and multifunctional spaces makes the area resilient and more adaptable for changes.



Reviving the degraded
Reviving the degraded
Challenges and opportunities



4.3 Potential

Each area has different potentials because of varying contexts and situations.
Design of green spaces relates to people and gives them a sense of attachment.

Water purification

Pollution in water could be treated naturally to develop the land.

Recreation

Places for people to socialize and also have multipurpose.

Local circular production

Production of food and water for and by the community where the waste could also be reused.

Ecological value

Increasing the ecology by creating the right conditions.

Energy production

Production of renewable energy in decentral is more efficient in the developing world.

Retention of water

Increasing the retention of the landscape so the ground water can be recharged and reused by the residents.

Hendrik BRUNSSUM State Mine

Source: https://www.demijnen.nl/mijnen/mijn/staatsmijn-hendrik

05

DESIGN PROPOSAL

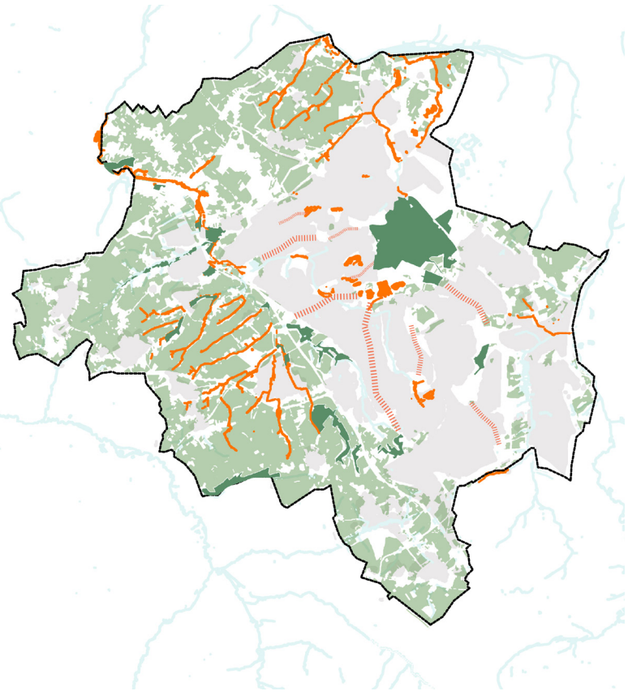
5.1 Regional scale

The missing green network especially in the urban areas and die to the degraded and unused area. Streams with bad quality of water affects the surrounding land .

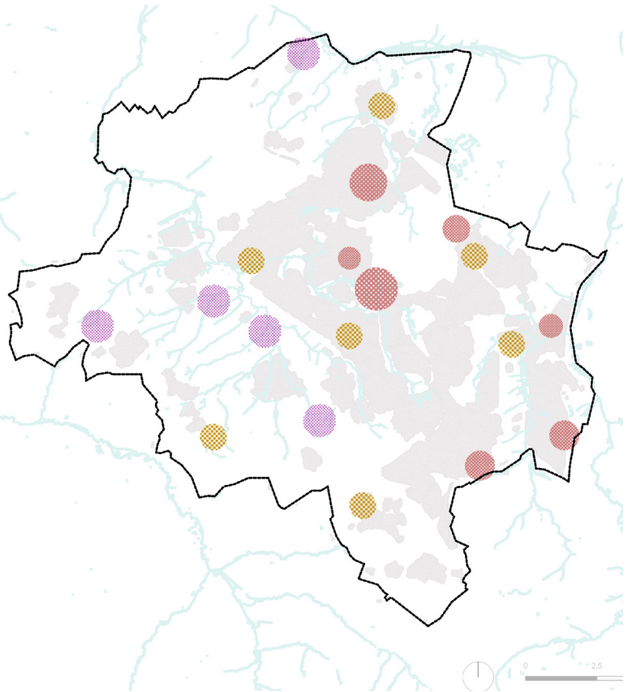
Unplanned spaces overlap in the region with main challenges, it can be developed into potential sites.

Unplanned spaces can be seen as pattern as ecological network could develop.

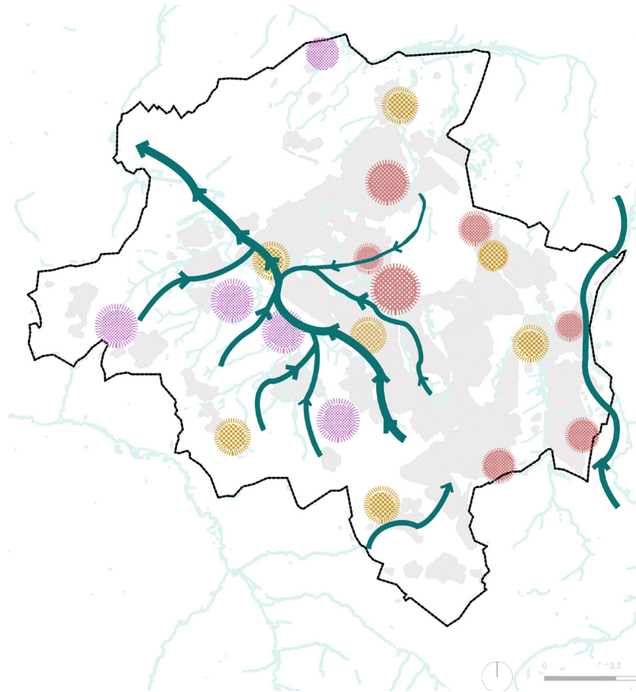
Ecological network can be strengthened with the blue structure where the water is collected, filtered.



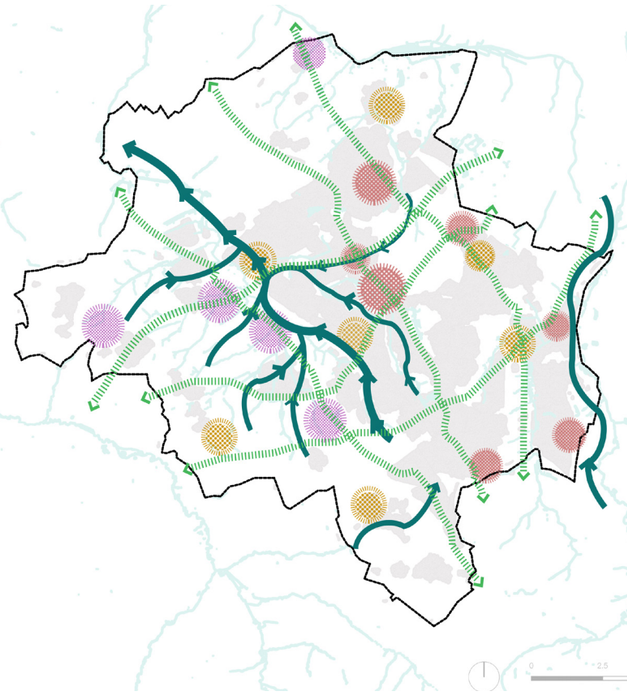
Agriculture
Ecological areas
Vulnerable areas



Mine water location
Wastewater location
Agriculture vulnerable water



Brooks
Built
Water bodies



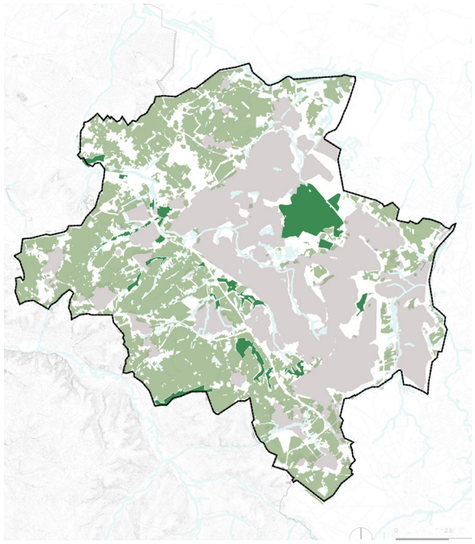
Ecological network
Built

Main squares connected to the leisure trail

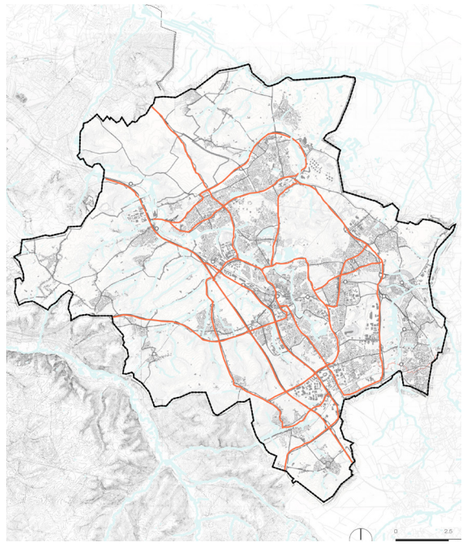
Parkstad region requires to reconnect the rural and the urban fabric.

Main intervention is the cycle route along the region called the leisure trail. It flows through different landscape and terrain crossing historical heritages and industrial mining shafts.

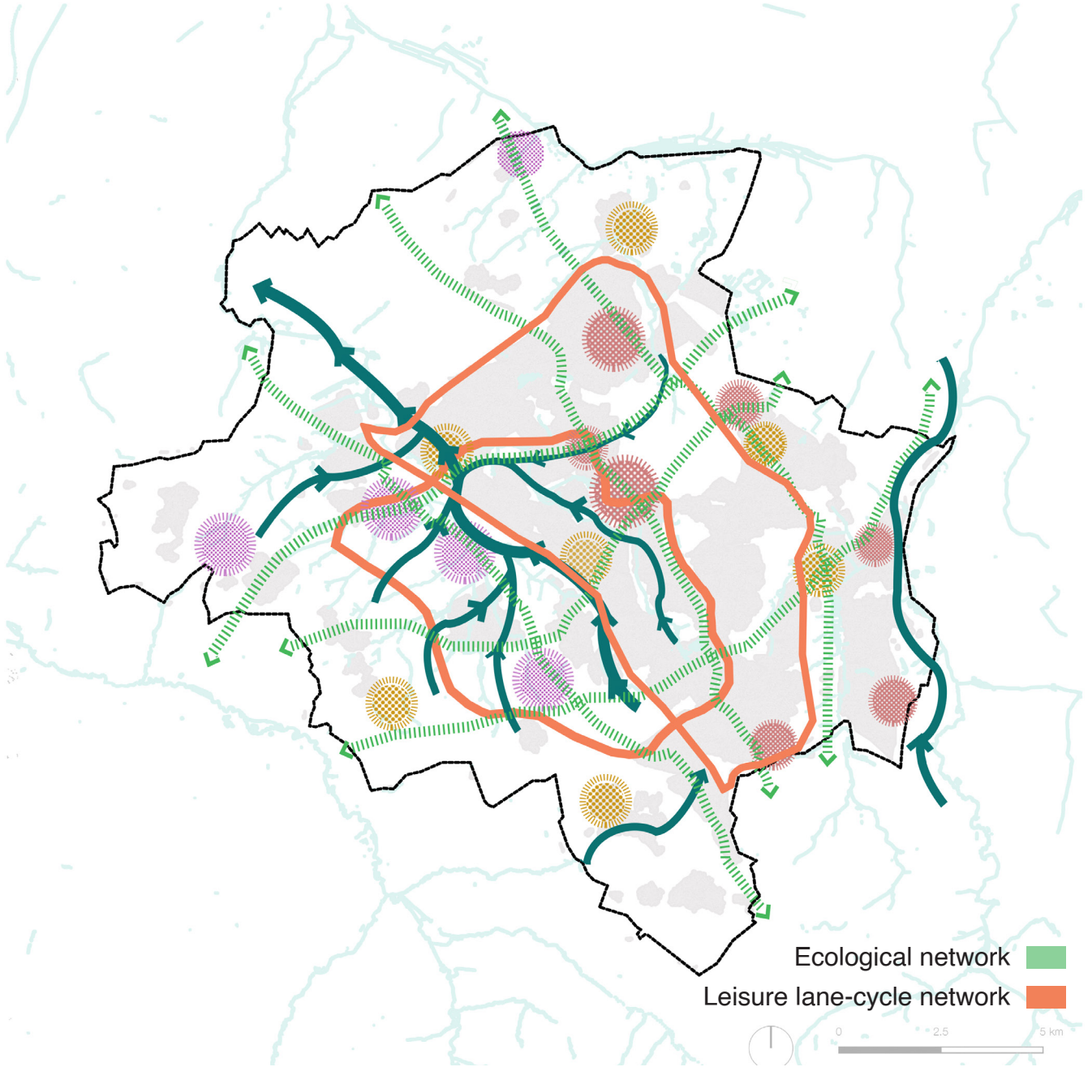
Leisure trail binds the region through the leisure trail and different plazas. This invites tourists to explore the region but also for the inhabitants to have healthy living.



Current green structure is fragmented and ecology value is low in the region



Cycle routes along different landscape and heritage sites.

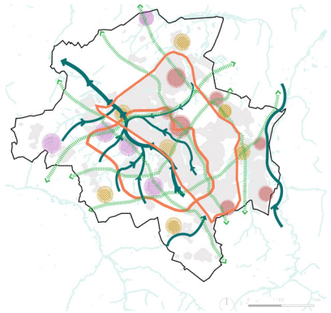


Spatial master plan

Based on the swarm planning theory, the main intervention is in the small scale and they lead to emerge to a pattern and the brook system could create the adaptable and strengthen these patterns, creating an ecological structure running through all these regions and the cycle network, which was, based on the historical strategical routing. This could be developed, which connects all the unplanned spaces. The cycle network is leisure lane and connected with an ecological structure, historical hot spots and gathering squares. There's unproductive lands, having a cycle route, going through all these different landscapes to experience it so that even the locals are easy accessible, and also it enhances, the route for the visitors.

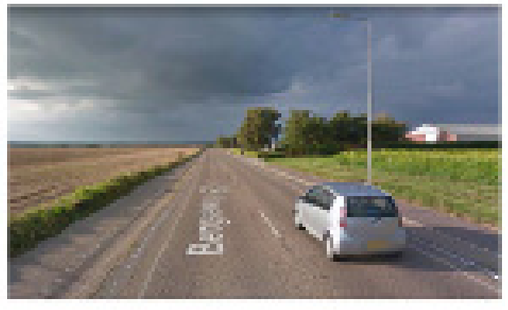
EXISTING SPATIAL QUALITY

Leisure lane is cycling route connecting different landscape, historical hotspots and main squares in the region to integrate the region.



Not pedestrian friendly where the highways cut through and ecology is low due to the industries and factories around.

Highways cut through the ecological network fragmenting the ecological spaces. The wildlife and ecosystem habitats are disturbed. Proposing cycle network and creating the ecological corridor for integration.



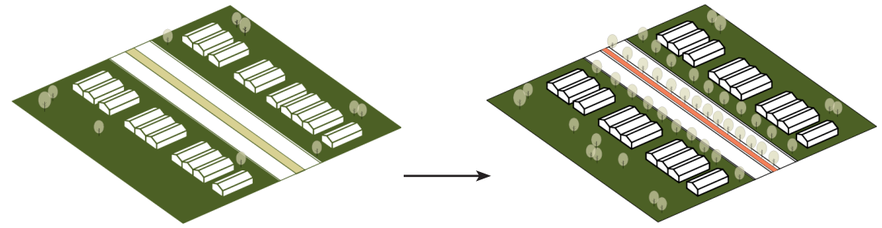
Continuous stretch of agriculture patches not connected through cycle paths.

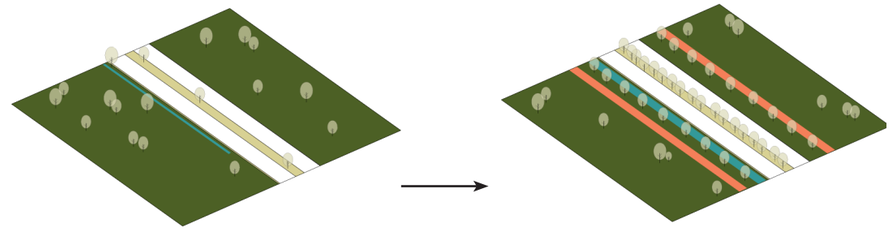
Residential area where there is no provision for cycle track. The proposal is to make the area more pedestrian friendly

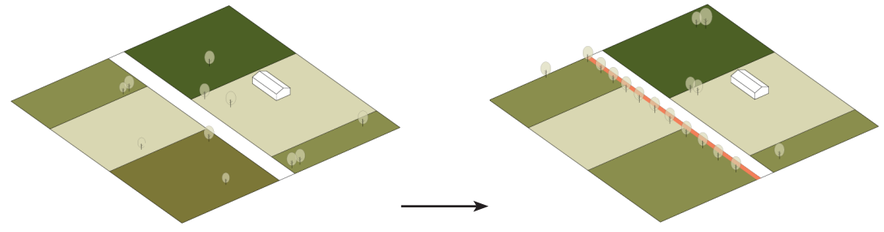
Source: https://www.google.co.uk/maps/@52.0146399,4.3756382,14z

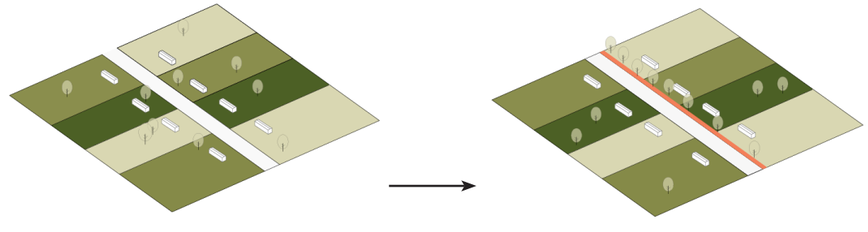
EXISTING

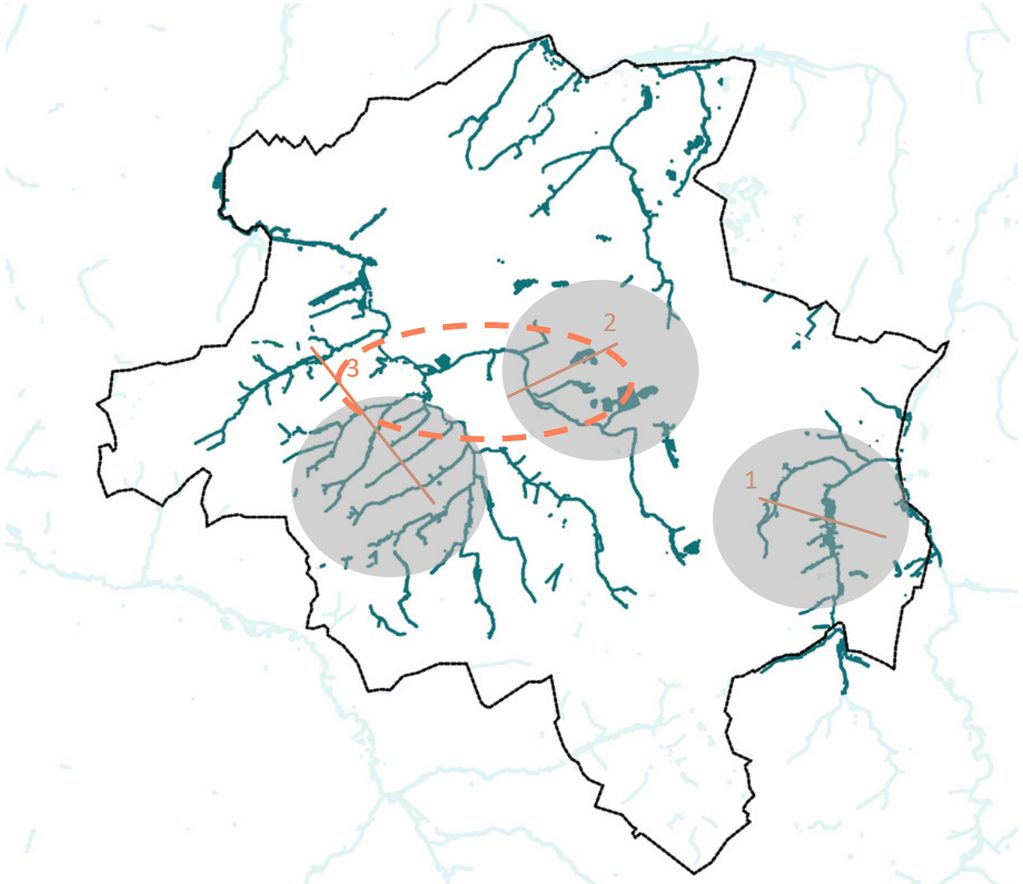
PROPOSAL







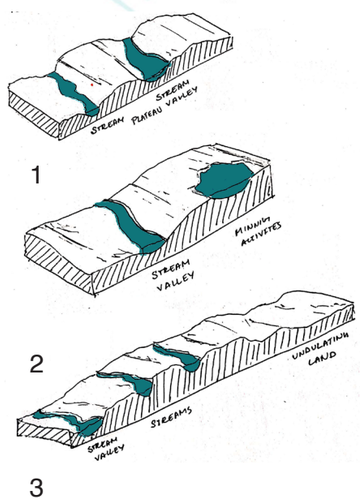


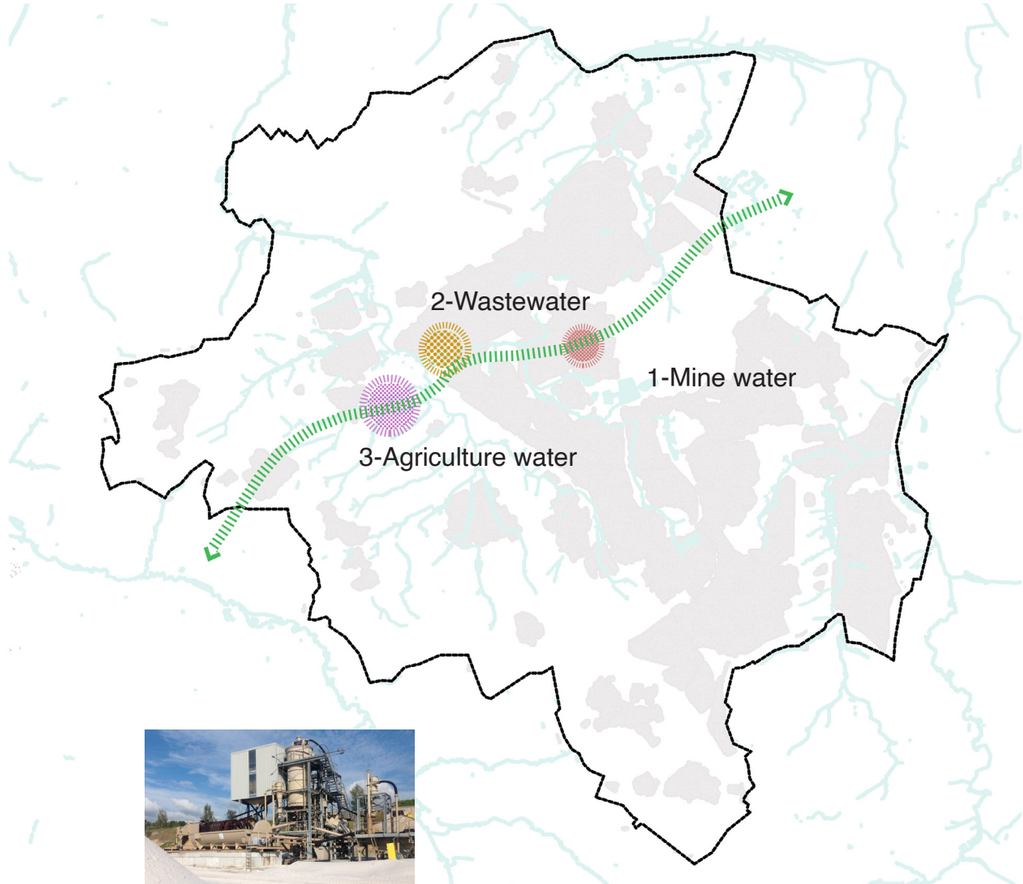


Water catchment area

Based on the water catchment areas and the topography of the region , it can distinguished mainly into 3 main characteristics with different features.

Firstly the stream cutting through the valley surrounded by plateau where dwellings have developed. Towards the agriculture fields the brooks have undulating terrain.





1-Mine water


2-Wastewater


3-Agriculture water

Site location

Three different water issues area lie in the same one of the networks which be detailed into different multifunctional strategies which could complement each other.

Based on swarm planning theory the sustainable interventions can be done in local scale and then pattern can emerge connecting all the interventions.

Reviving the degraded

Design proposal

5.2 Meso scale - network

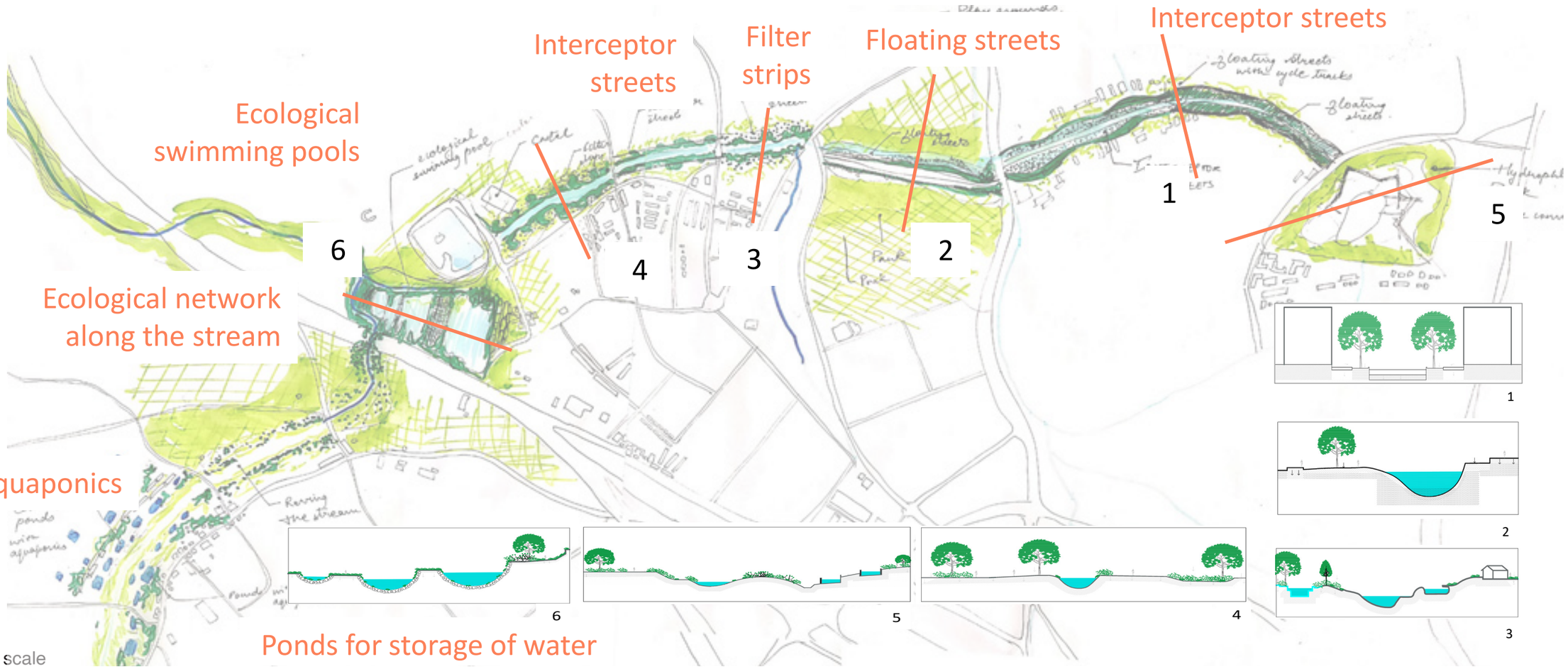
The main challenge is fragmentation of the areas because of the unproductive aes that remained after the mining actives.

In the urban areas during heavy storms there are chances of flooding because there are no water catchment areas.

Source: https://www.google.co.uk/maps/@52.0146399,4.3756382,14z

Reviving the degraded

Design proposal

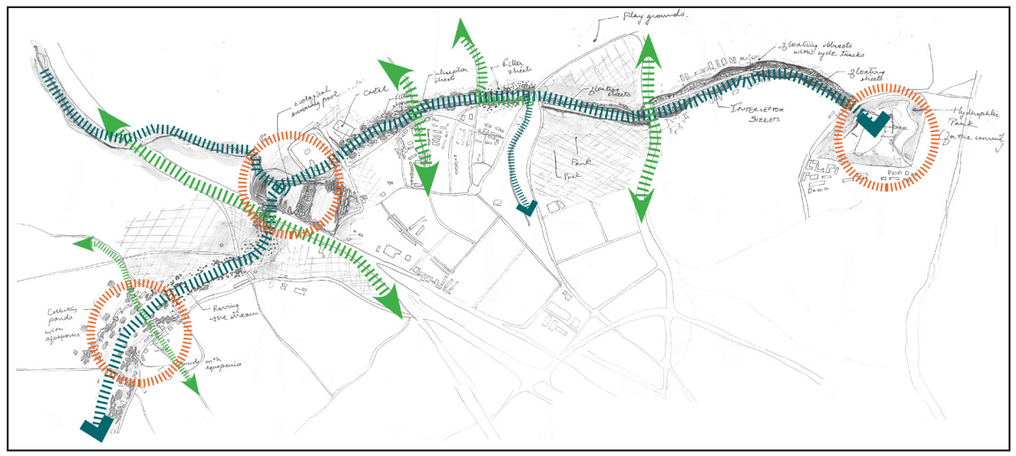


Meso scale

The three site locations which has different water issues could be connected through blue and green structure.

The blue green structure overlaps with the infrastructure network where the cycle routes could be enhanced and it can be connected to the leisure cycling route around the Parkstad passing through main historical areas and squares. This would add to recreational value.

This also reorganizes the un-planned spaces and integrates with the blue-green structure.



Reviving the degraded

Design proposal

Network system- unplanned areas

In the meso scale the design task is to create a network system as a landscape structure to reorganize the fragmented region. This also act multi beneficial. The network system connects the spatial structure of the fragmented region. Mainly through cycle routes with ecological network and blue structure.

Based on the new water system the network can be re organized in the entire area. The fragmented urban space and unplanned areas will be integrated. The landscape will be stitched into the urban structure.

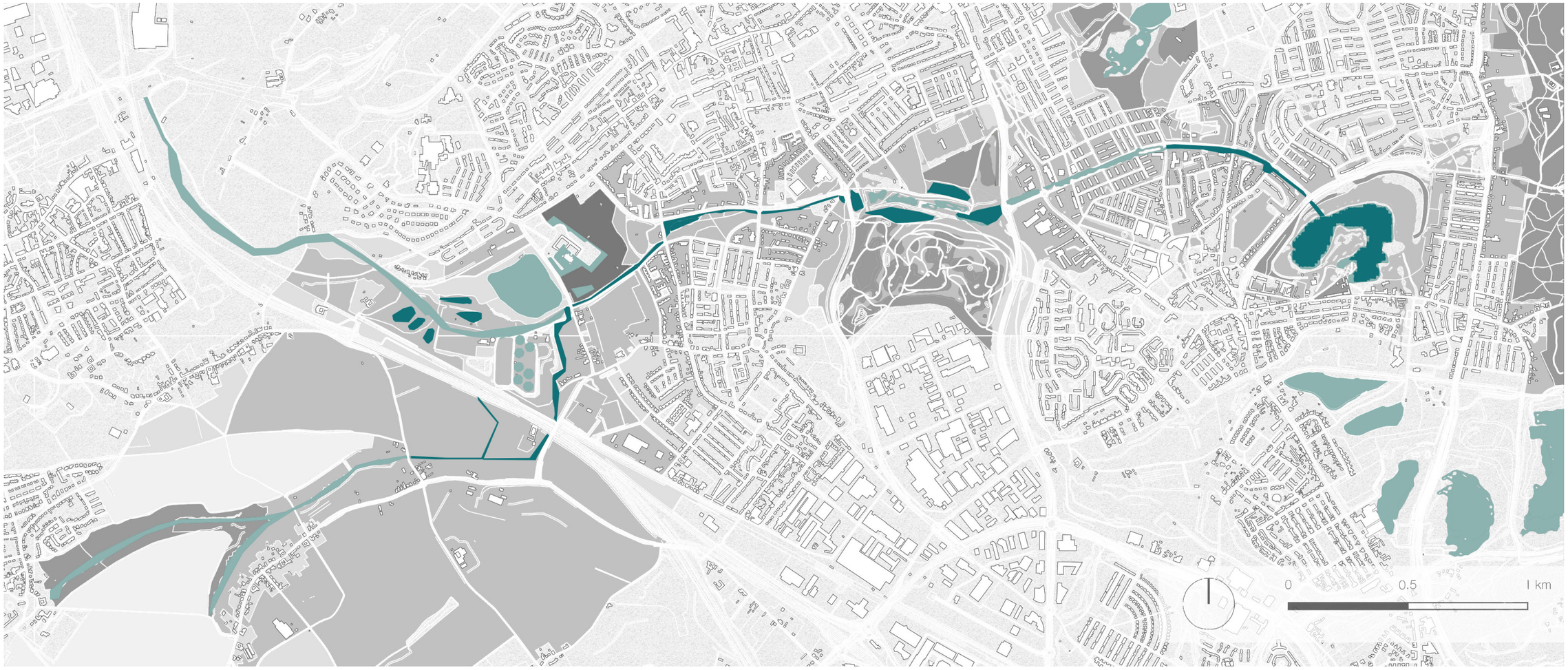
To build the new structure firstly the water has to be purified. Then based on the topography the unplanned spaces can be integrated to the existing structure. Water will be a strong element link the fragmented parcels.

The last step in this scale of design to introduce different themes and programs for the unplanned spaces . Where water is the key for each site. Based on site specific challenges and characteristics each site has its owns identity.

The multi-functional programs enables activities, making spaces for people to improve the social activities and integrated to urban activities. So that public spaces can acts main nodes, serving as a kind of landmark for navigation through the region.

Reviving the degraded

Design proposal



New water system

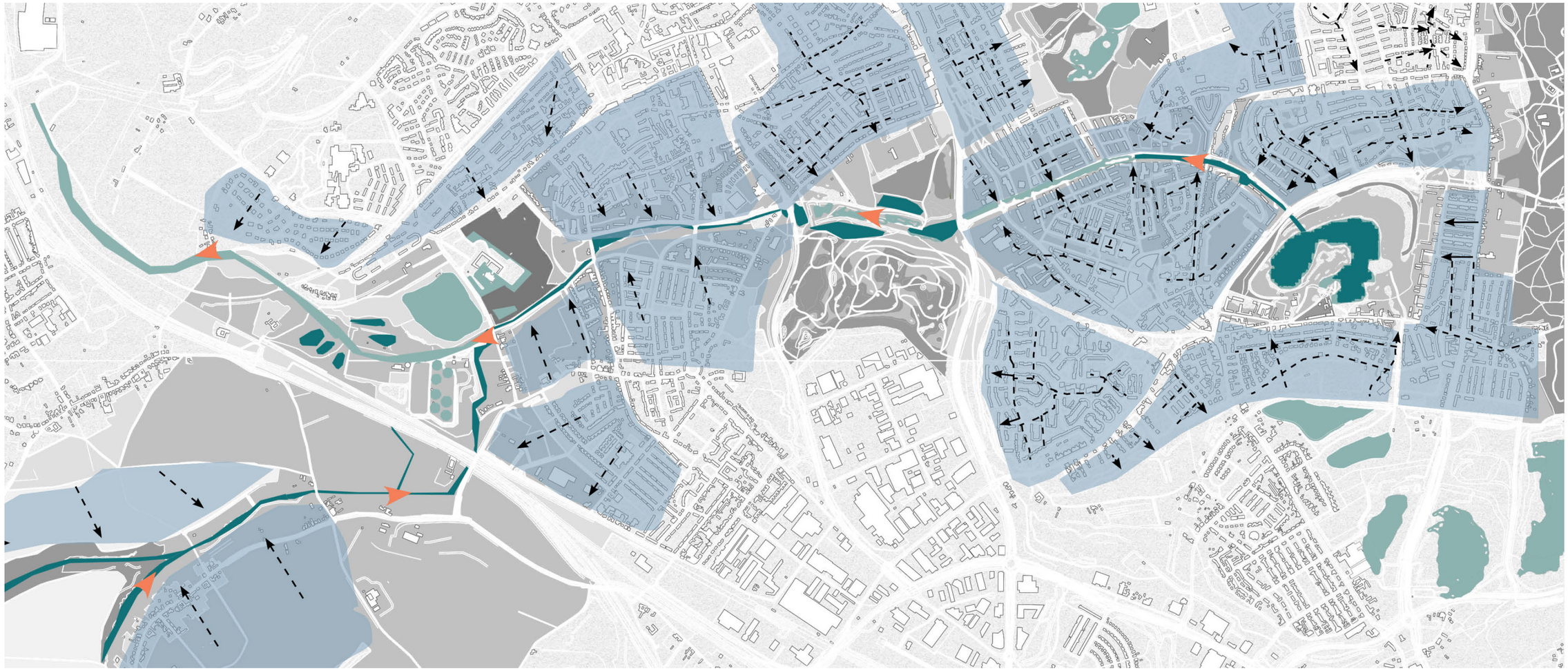
Currently the water structure is polluted and disconnected in few areas due to urbanization and low maintenance. This has affected the soil in turn affecting the ecology of the area.

Water acts as important ecological corridor has many habitats can nurture and develop along the edges as well.

Connecting the water structure would enhance the network and would create backbone for the development of the region. Based on the topography missing linkages can be connected.

Reviving the degraded

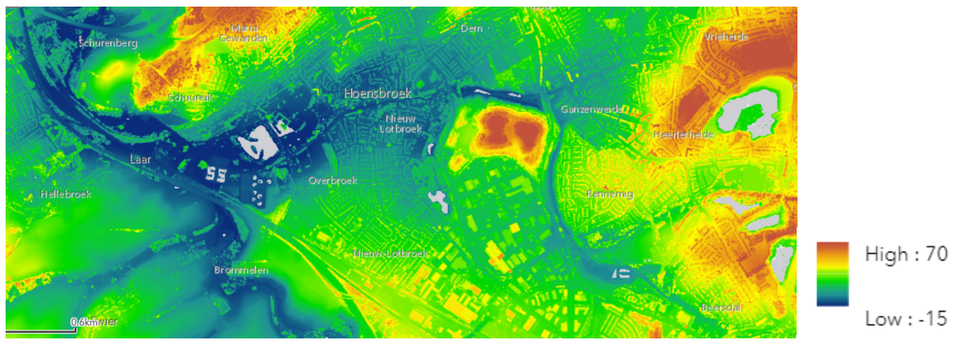
Design proposal



Storm water management

By creating the new water system that connect the existing water bodies the water can be managed in a efficient way.

The unplanned areas connected to water system and they act as spaces that adapt to change incase of extreme situations.



Elevation
Source: https://www.ahn.nl/ahn-viewer

New waterbody

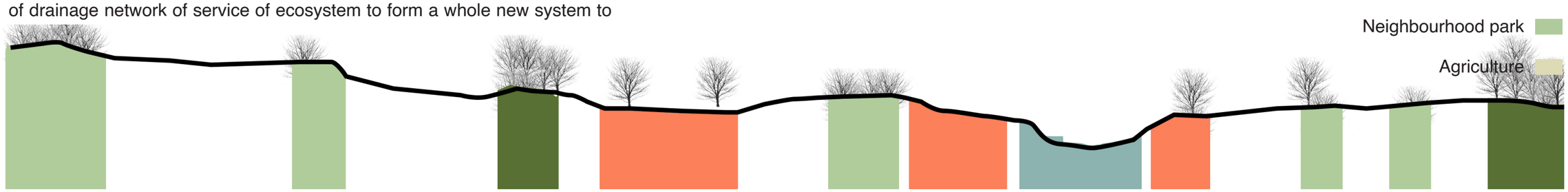
Existing

Reviving the degraded

Design proposal

Green structure- hierarchy of green spaces

The design of green space can integrated with other functions as well with complement and work together to develop a whole new system. Interaction of drainage network of service of ecosystem to form a whole new system to



Section depicting the hierarchy of green spaces

Reviving the degraded

Design proposal

Understanding the planned and the unplanned spaces

The actors of the region are residential, visitors from the near by areas and professional from offices and industries which are few The planned areas are mainly residential in the region.

Reviving the degraded

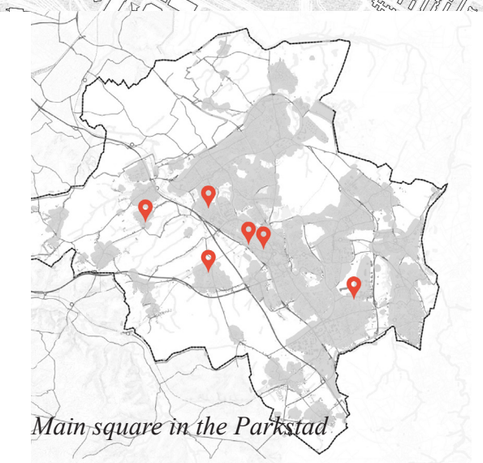
Design proposal

Bicycle routes

Main Bicycle routes
recreational routes

Cycle routes plays a important role in connecting the heritages sites and squares of the region. This will result in healthier living and easier accessibility.

Leisure lane along the parkstad



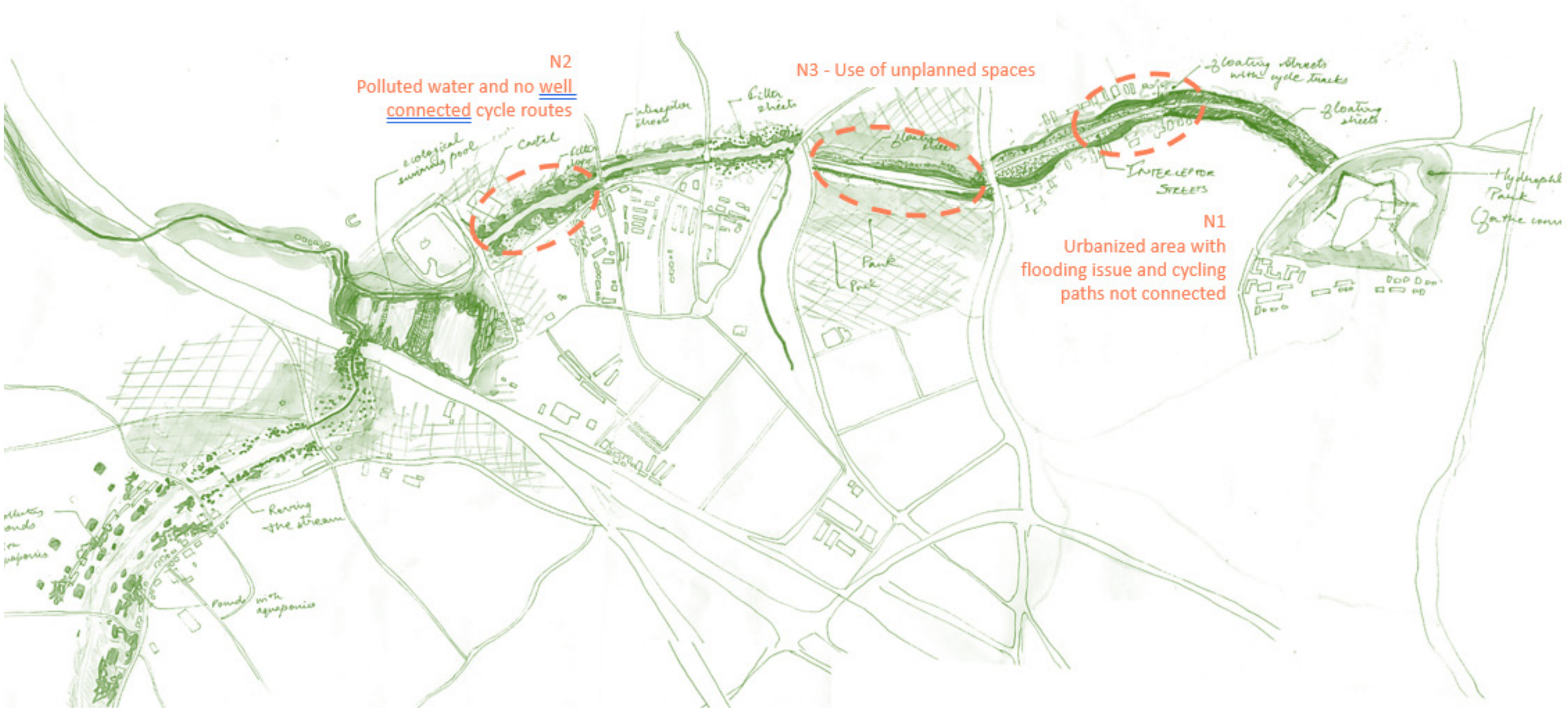
Main square in the Parkstad

Heerlen has:

Ca. 600 hectare public greenspace
Ca. 89.500 inhabitants

The aim in the Netherlands is 75 m^2 of public greenspace per household
Heerlen has 148 m^2

In contrast 46,4% of private gardens is a stone desert

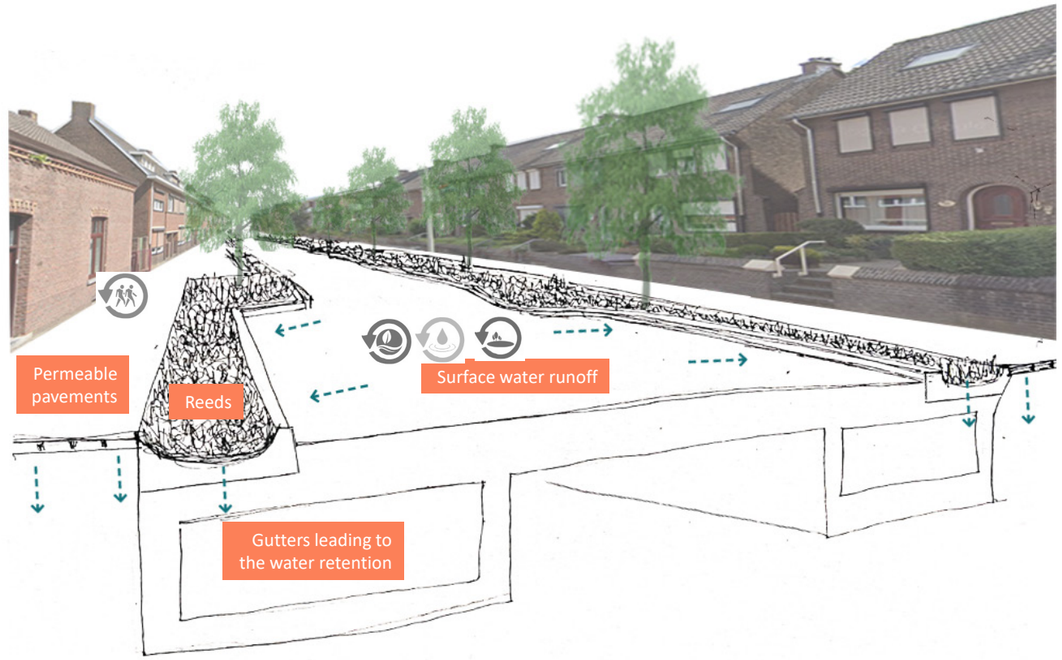

N2
Polluted water and no well connected cycle routes
N3 - Use of unplanned spaces
N1
Urbanized area with flooding issue and cycling paths not connected
ecological swimming pool
Canal
Irrigation streets
Filter streets
Floating streets
Floating streets with cycle tracks
Interceptor Streets
Park
Park
Hydrophil Park
Reviving the stream
Pounds with aquaponics

Challenges in the network

Flooding in urban areas: Due to urbanization, rainy season experiences flooding on the roads whereas summer season has issues with water scarcity.

Polluted water mainly because of the run offs from the streets which contains oils and greases.

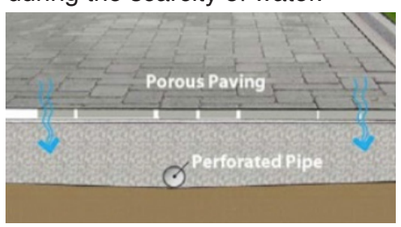
Cycling tracks not connected because the main roads are mainly concerned. Due this there cycling route is not convenient.



Source: https://www.google.co.uk/maps/@52.0146399,4.3756382,14z

Interceptor streets

Small scale retrofit in public streets to collect rainfall and prevent flooding during heavy storms.
The reeds collect water and absorbing the nutrients. Then the water is collected in the gutters which can be reused by the inhabitants during the scarcity of water.



Porous paved area to absorb water , so that ground water restores sand let the trees grow well.

Filter strips

To clean the water from using duck weeds. This lets the ecology also to strive.

The growth of duck weeds is maintained by the ropes so that they do not cover the entire canal. The ropes could also be used to harvest the duck weed which can be used for the production of bio-mass.

The duck weed absorbs the waste nutrients in the water and this purifies the water.

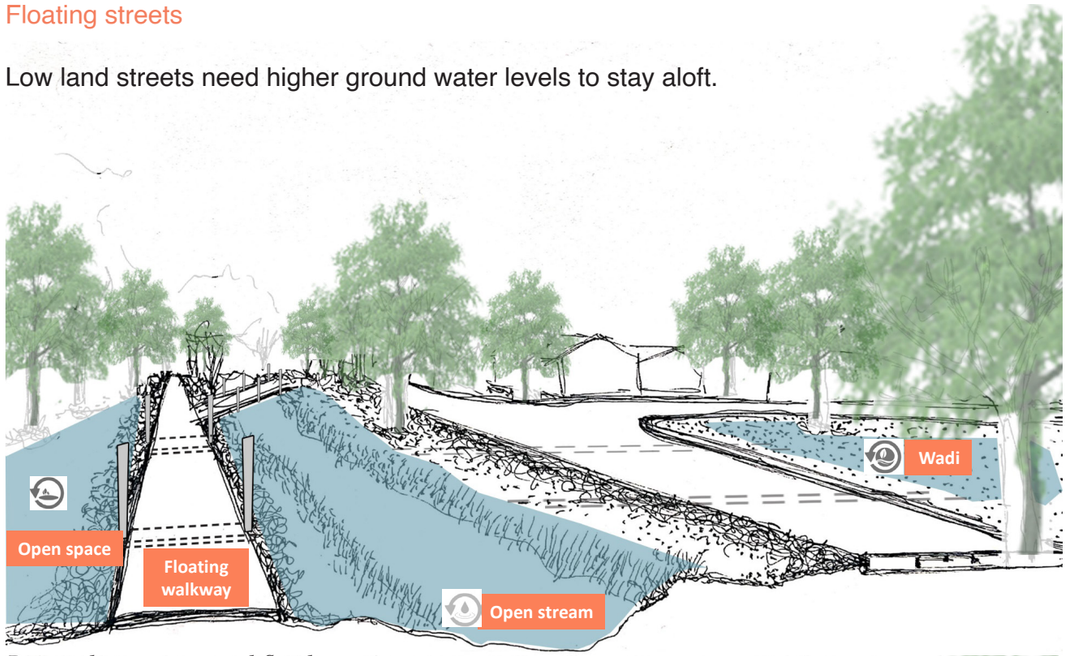
Low lands need waterways and improved ground water management in order to maintain soil stability.

River stone is used on canal edge to add the character of the region.

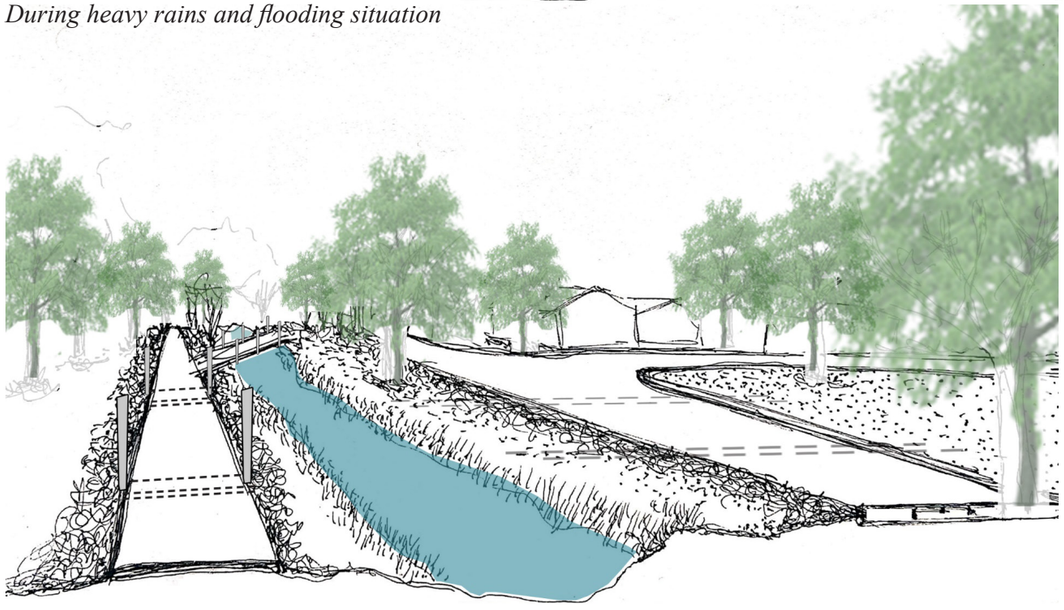
Street trees to absorb the nutrients in the soil and also help in restoring ground water.

Floating streets

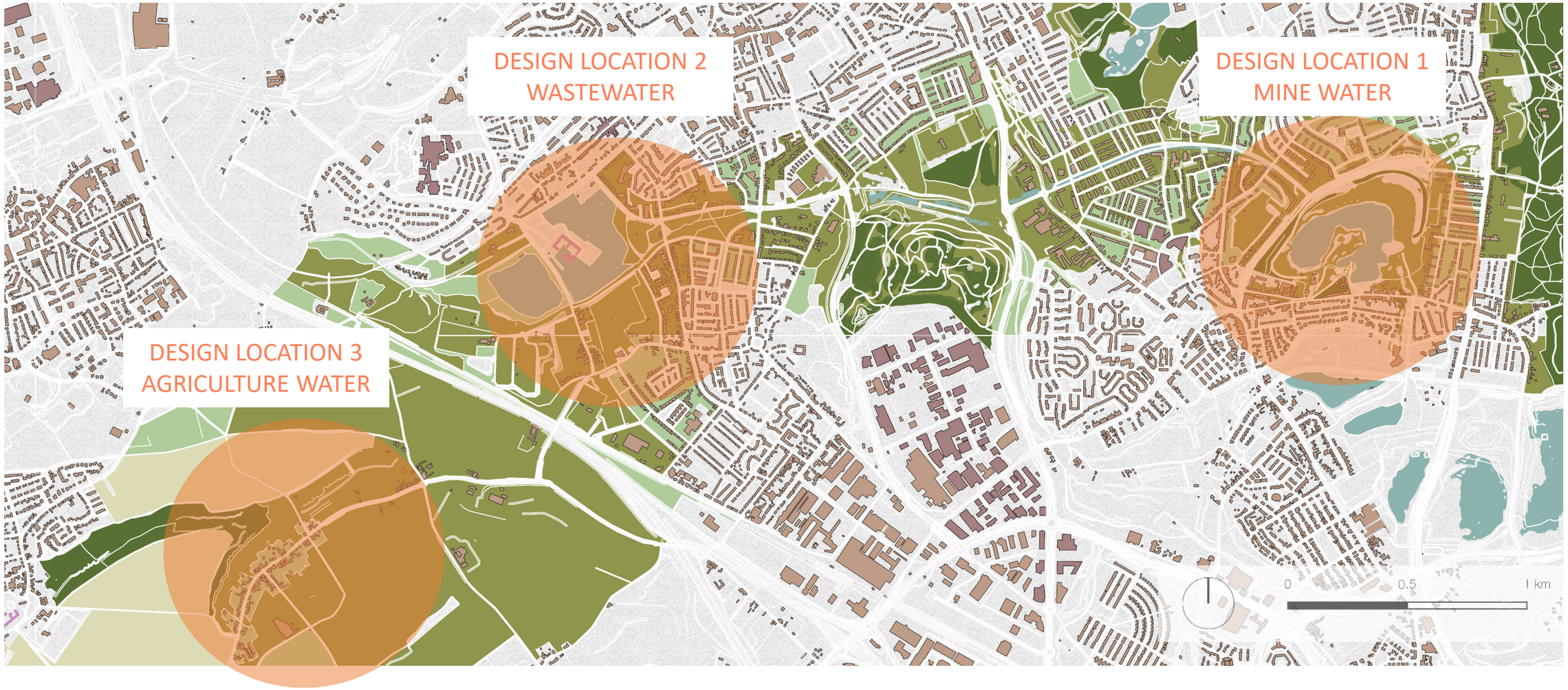
Low land streets need higher ground water levels to stay aloft.



During heavy rains and flooding situation



During summer the streams the dry up letting the green patched to form.



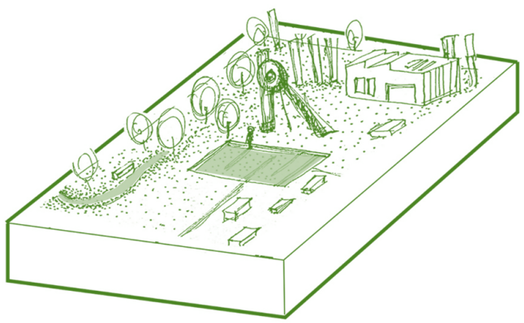
Site locations

Three sites with different water issues have designed and elaborated.

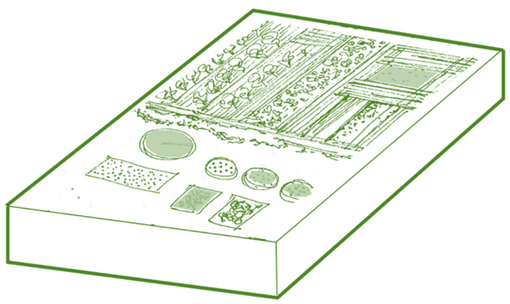
5.3 Design site location 1- Mine water

Few years back this was an active mining site . Current there are sand mining activities going on , which has degraded the area.

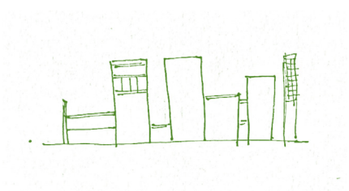
MANY NEIGHBOURHOODS AROUND, NEXT TO FOREST AREA, INDUSTRIAL WASTE, HIGH LAND, HIGHLY CONTOURED, ABANDONED LAND



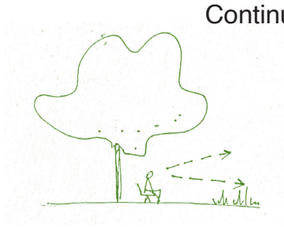
Protect industrial heritage



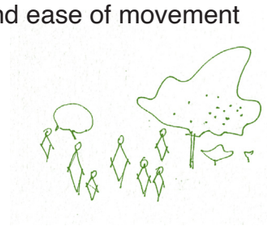
Continuity and ease of movement



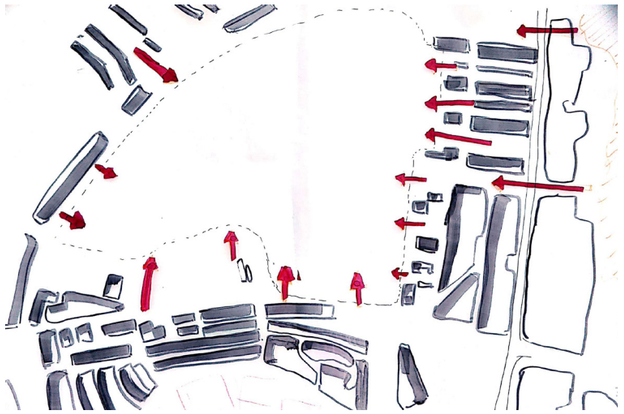
Industrial heritage



Park facilities

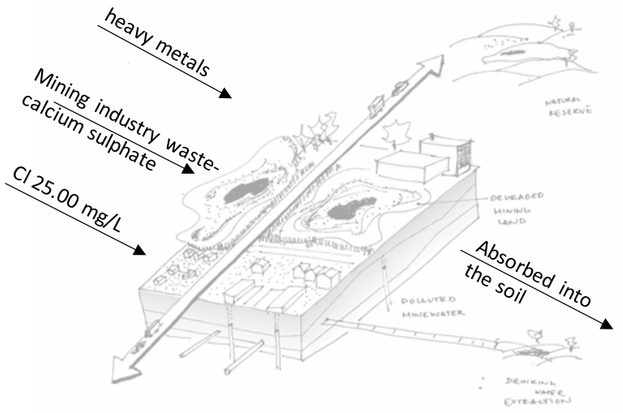


Community gathering



Disconnected neighbourhood

The residents have fenced for privacya nd safety as open spaces have no activity. It abandoned and degraded because of which the residents diconnect from their area. This creates patches of neeighbourhood which aare fragmented.

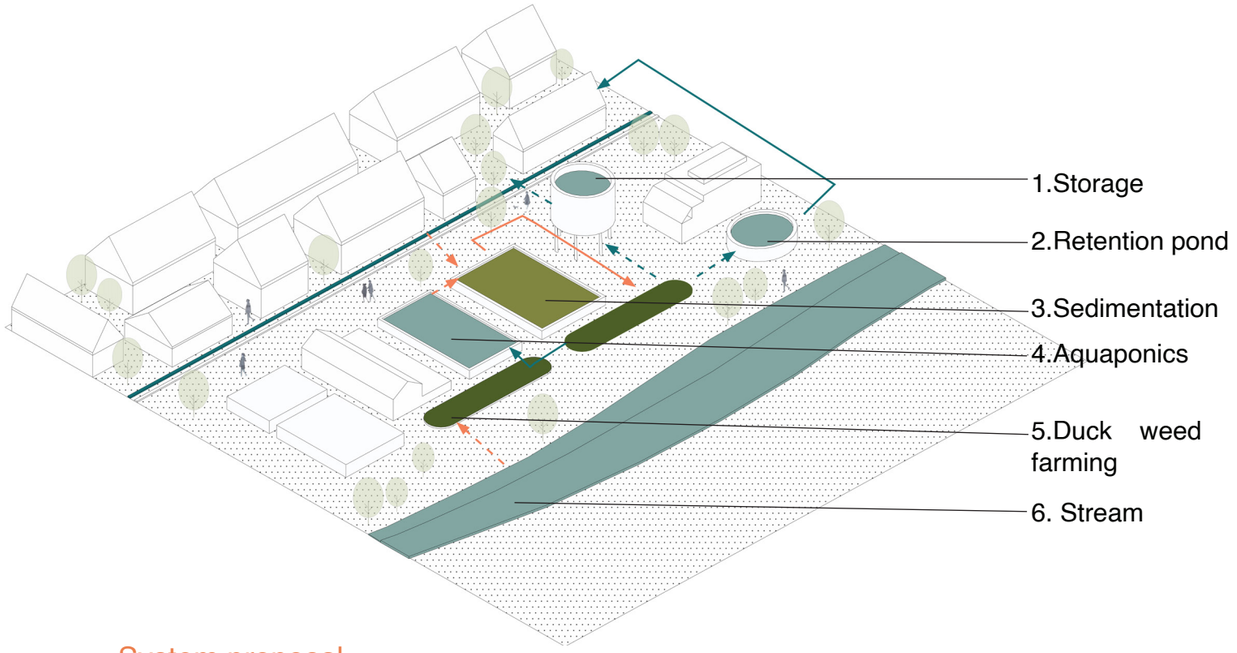


Water pollution

Mine water generally contains heavy metals or additives used in the mining industry. Rising mine water can lead to an increase in groundwater level in the overburden. Due to this groundwater is at risk.

Ecologically degraded

-mining activities results with loss of vegetation
-disconnected with ecological area
-pollution

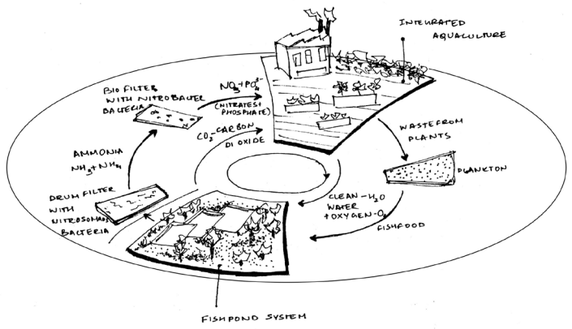


System proposal

For the community-gathering space, having walking trails for the inhabitants. Also improving the accessibilty to the site.

Water purification system to removing the contaminants from water. This will improve the quality of the space.
This finally lets the ecology to develop and revive the area.

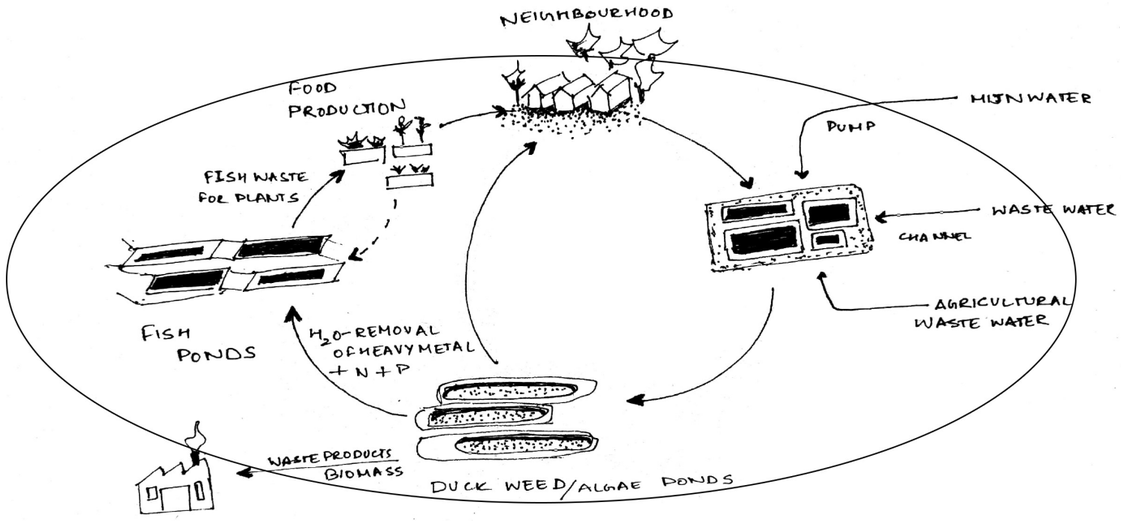
Thus making it a Hydrophilic park .



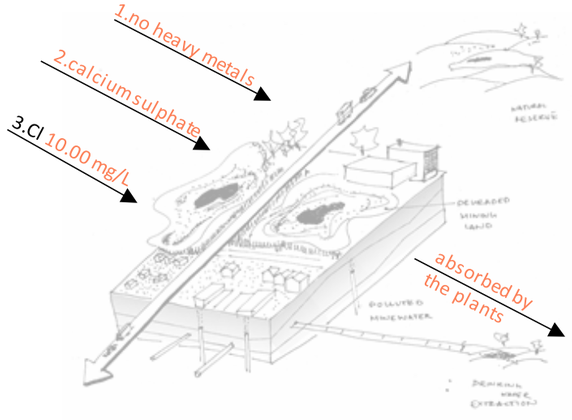
Flow of nutrients in the aquaponics system

WATER STORAGE

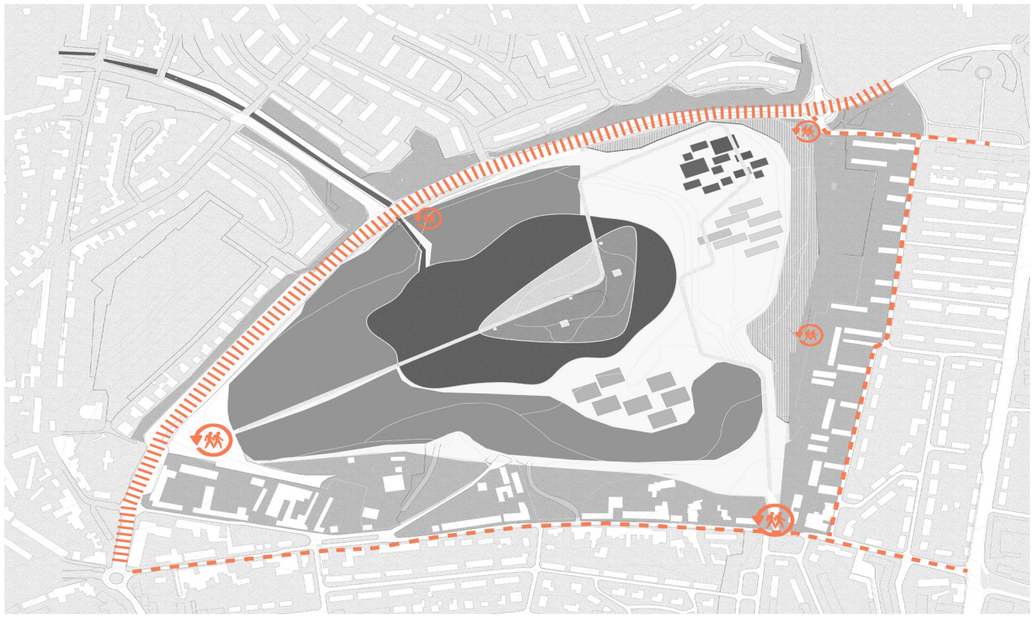
SEDIMENTATION POND — DUCKWEED/ALGAE TREATMENT — AQUAPONICS



Closed cycle of water and understanding the flow of nutrients



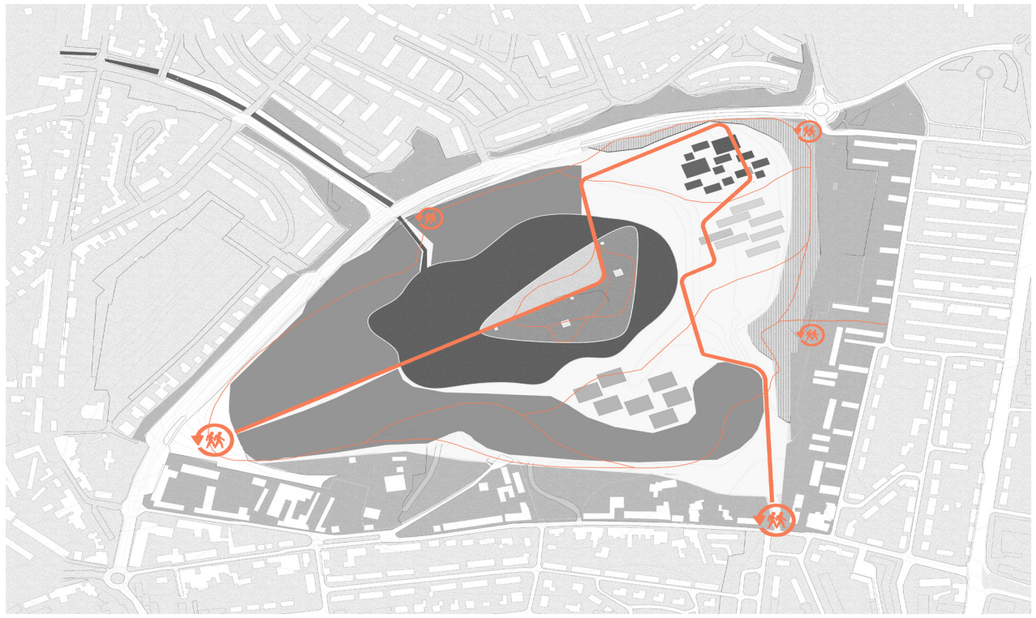
The purification of water biologically takes place in stages. The system of pond are used to filter it. Firstly the large particles and heavy metals are separated from the process called sedimentation. Then the water is sent to the duck weed ponds. Here the most the contaminants are removed from the water. Finally the purified water is used in the aquaponic system or else used by the inhabitants for irrigation.



Accessibility

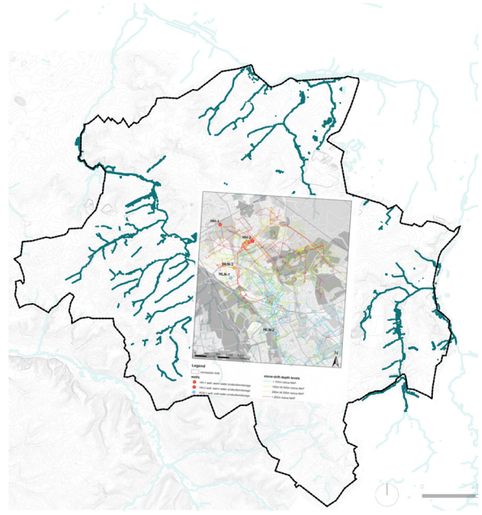
Pathways for different users such as cyclists , dog walking trails , walking strolls , running trails of different aged groups. Walking through the natural water treatment processes.

Source: https://www.google.co.uk/maps/@52.0146399,4.3756382,14z

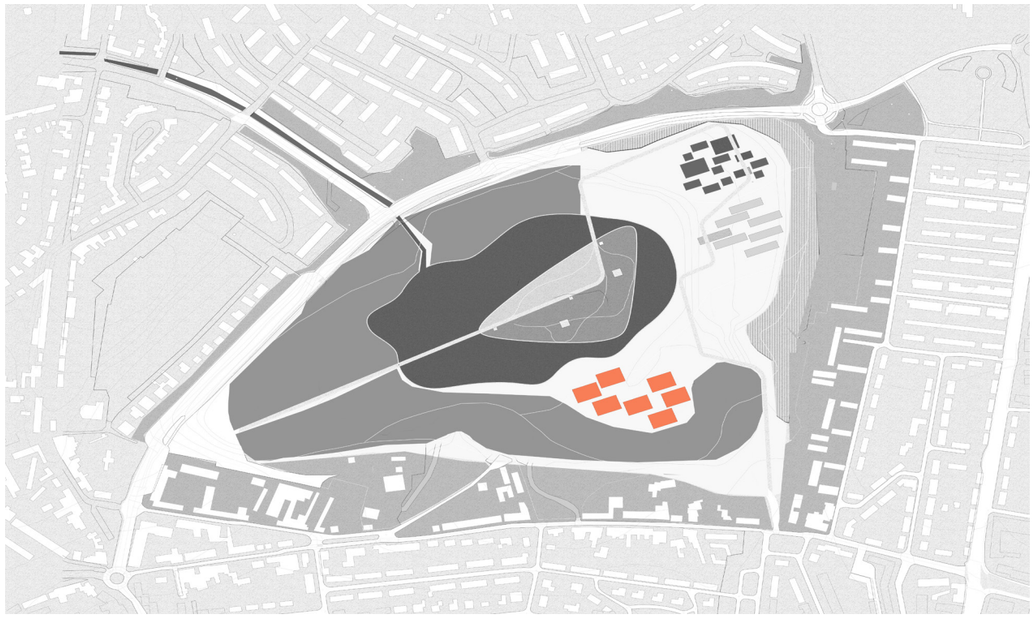


Routing

Based on the shafts location underground the routin is designed along the water treatment process and the route is highlighted with local stone and corten steel where it is required.



shafts location in the area



Water purification

Sedimentation ponds are the lowest point so that the water and other impurities can settle.
Reeds absorbs few contaminates and then purifies the water for some extent.

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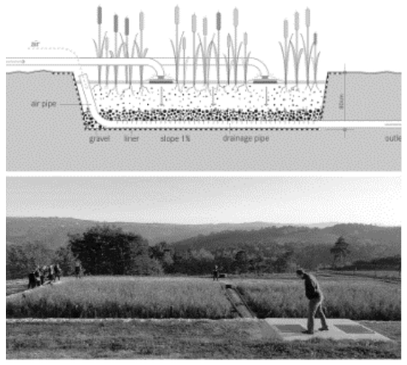
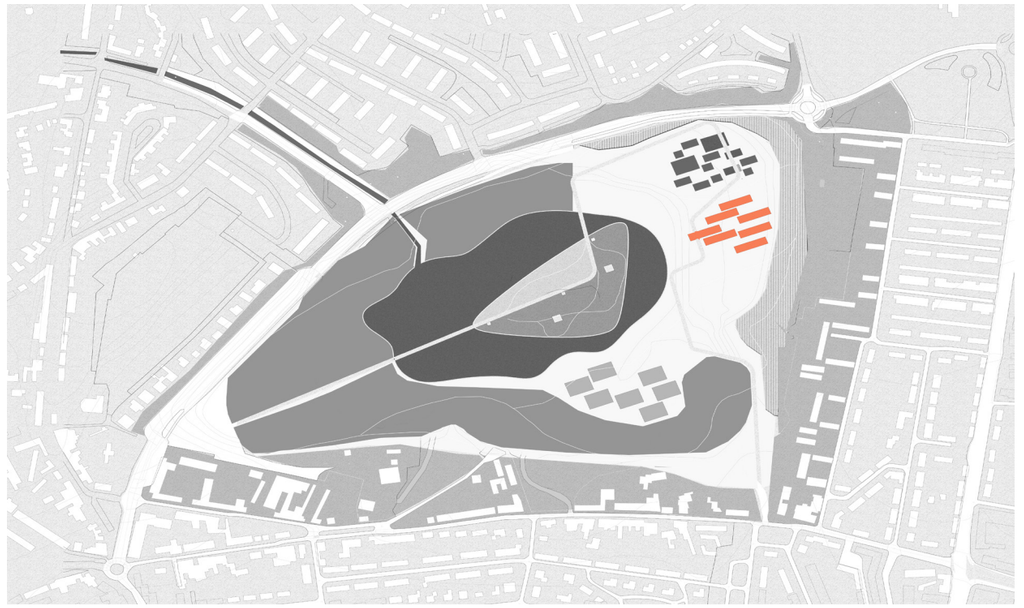


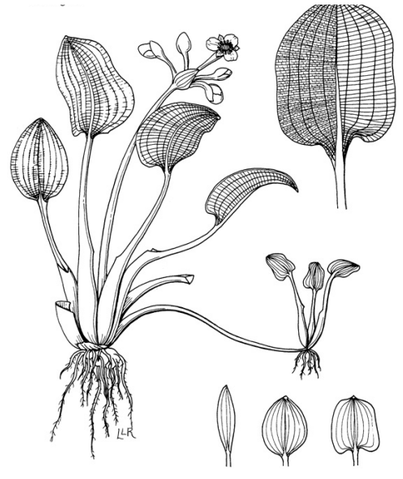
Source: https://www.google.co.uk/maps/@52.0146399,4.3756382,14z

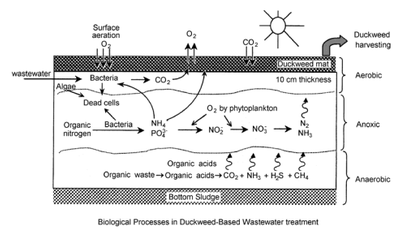
WATER STORAGE

SEDIMENTATION POND — DUCKWEED/ALGAE TREATMENT — AQUAPONICS

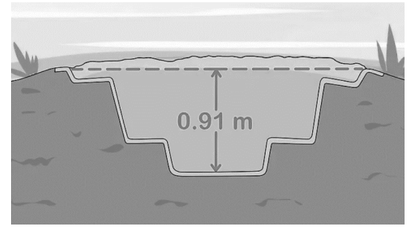


Duck weed farming absorbs most of the nutrients from water. This helps the duck weed to grow and multiply. The duck weed can then be harvested and used for the production of biomass.



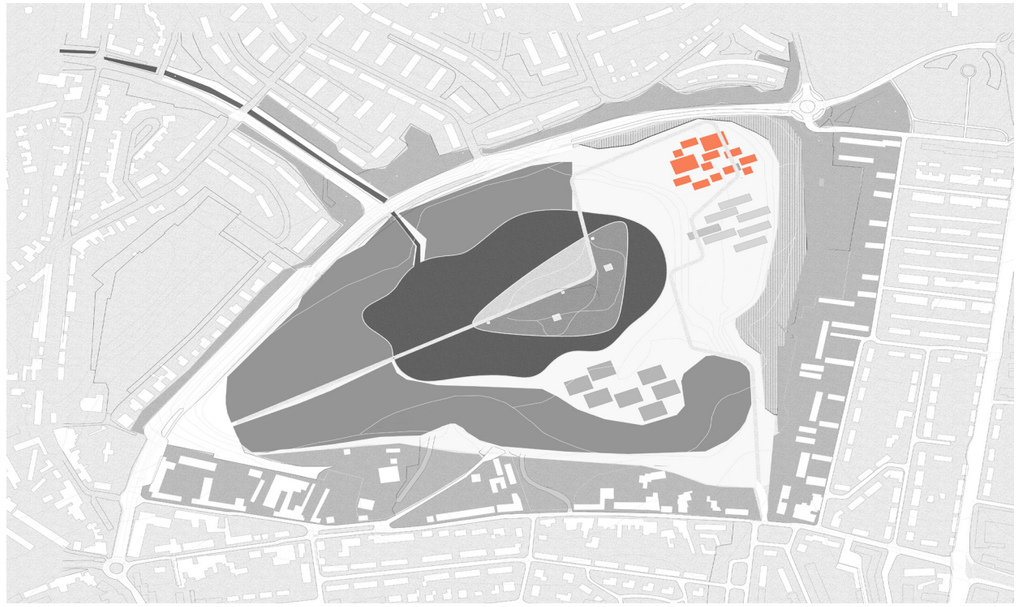


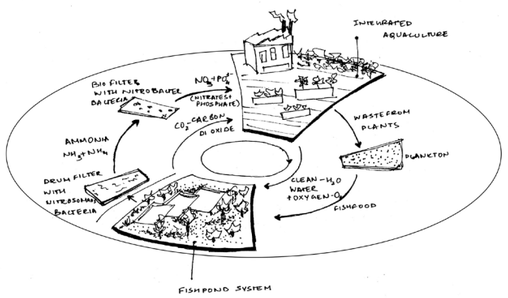
Biological Processes in Duckweed-Based Wastewater treatment



WATER STORAGE

SEDIMENTATION POND — DUCKWEED/ALGAE TREATMENT — AQUAPONICS





Flow of nutrients in the aquaponics system

Aquaponics system

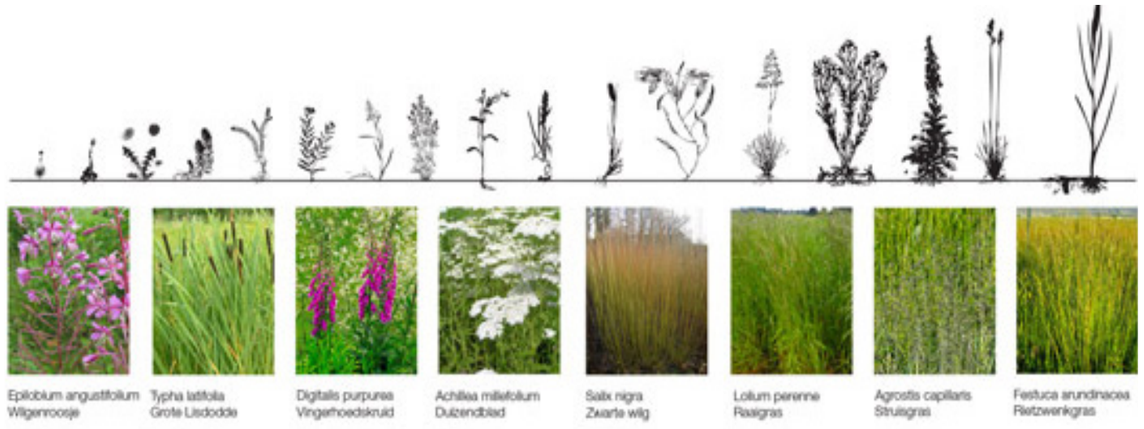
System where fish breeds and also vegetable plants grow. The waste from the fish is used as nutrients from the plants.

If the pond system receives around tho - three thousand per capita for 21 days.
This can produce around 12 tons fish/ha/year which is about 1800 euros/ha
(Gijzen and Ikramullah, 1999).

WATER STORAGE

SEDIMENTATION POND — DUCKWEED/ALGAE TREATMENT — AQUAPONICS

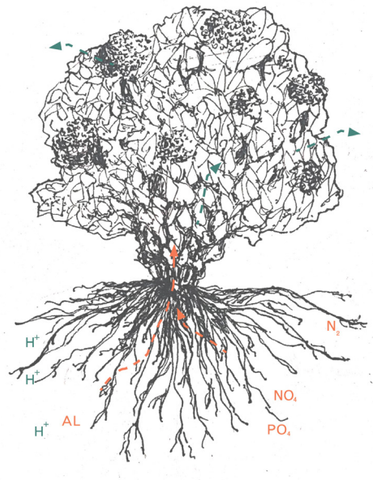
Ecological connections



Planting details which absorb nutrients from the soil
Source: https://deceuvel.nl/en/about/sustainable-technology/

Reeds absorbs cadium, sulphates and phosphates and releases ions and hydrogen which makes the nutrient and improves the degraded soil.

The increased vegetation filter pollutants and shades the water allowing it to carry more oxygen. Increased vegetation captures more carbon and healthy ecosystem services.



Hydrangeas are flowering plants which is mainly used as ornamental. They are responsible for drawing Aluminium out of the soil.

Various plants can capture the nutrients from the soil to purify it. It also benefits their growth.

Salix alba purifies the soil and by absorbing the nutrients from the soil. It is usually water tolerant tree, its grows in wet soil.

Pine tree

Biodiversity

1. Water pools s habitat for amphibians .
2.Pollinating insects
3.Treetops and mining equipments for birds of prey
4.Hidding places for birds and small mammals
5.Predators preventing plaques

Site location 1- site plan

Time process

The design is executed in mainly 3 phases . During initial first few years, the main goal is to purify the water and to remove toxic impurities.

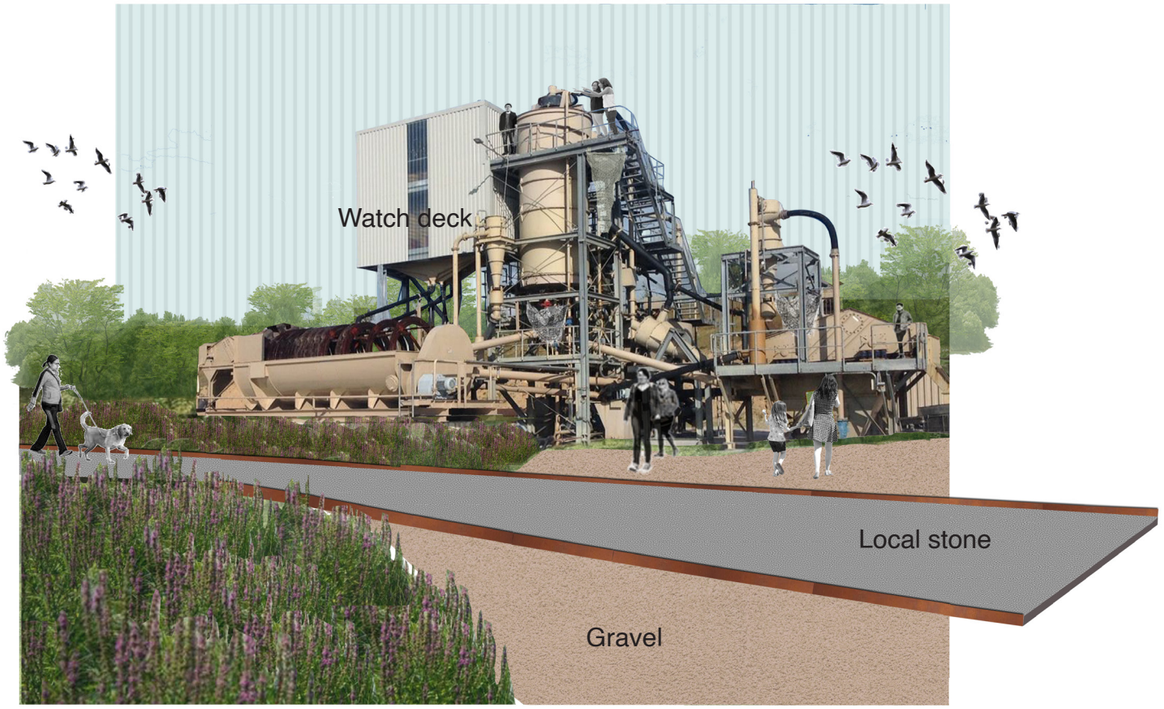
Second phase is concentrated on ecology. The natural process develops and eco habitats flourish.

Third phase is converting the landscape into production to generate economy. This can initiated by the inhabitants to generate revenue for the area.

1-3 years

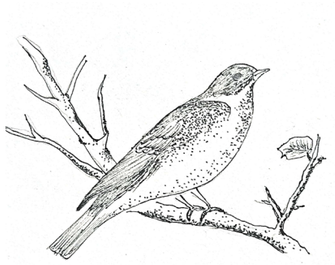
3-6 vears

7-10 years



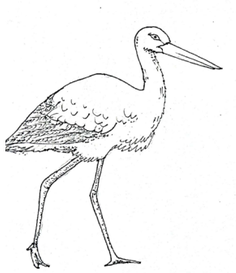
Mining equipment - acts as viewing decks overlooking the water treatments and the plaza. This aslo creates a landmark and directs the people inside the hydrophilic park.
The few years the mining equipment acts as eco habitat for especially for birds especially Northern Hover, Winter stork, collared sand martin. Hidding places for birds and mammals.

Currently many birds have threat of habitat loss due to various resons that is mining activities, urbanization and so on.



Collared sand martin

Northern Hover



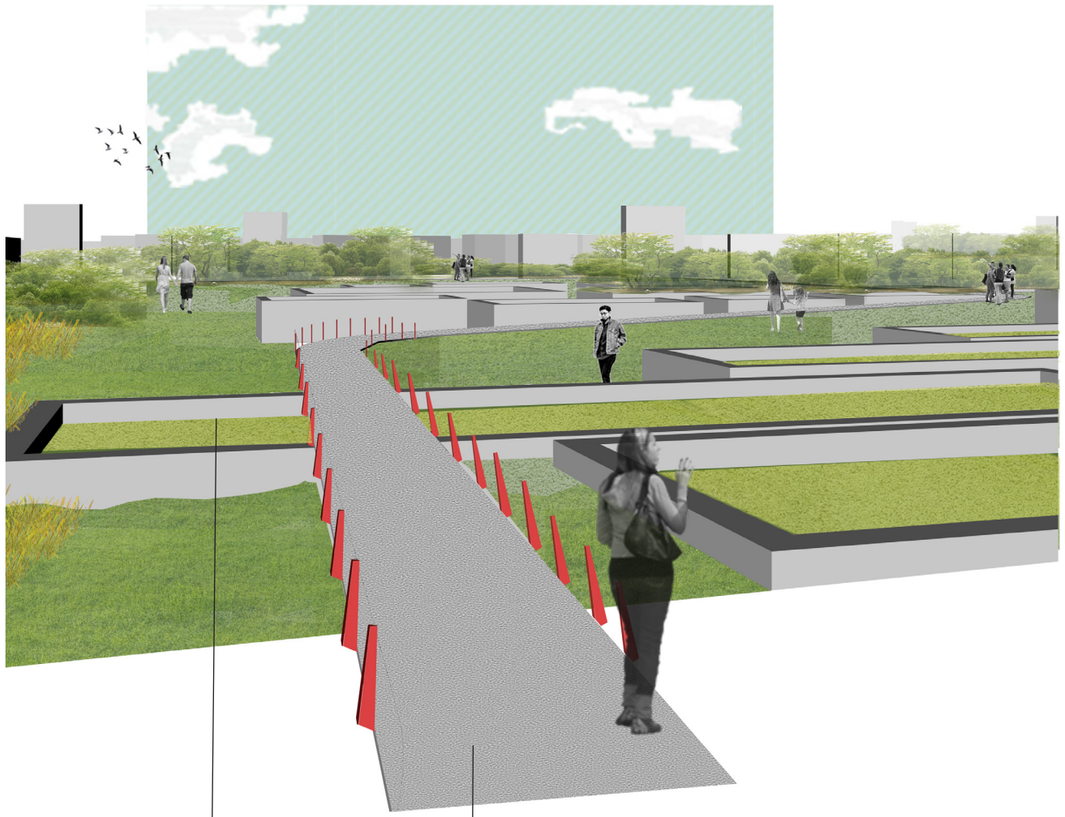
Winter stork

Overlooking the sedimentation ponds

Sedimentation ponds in the lowest part of the site

Key plan

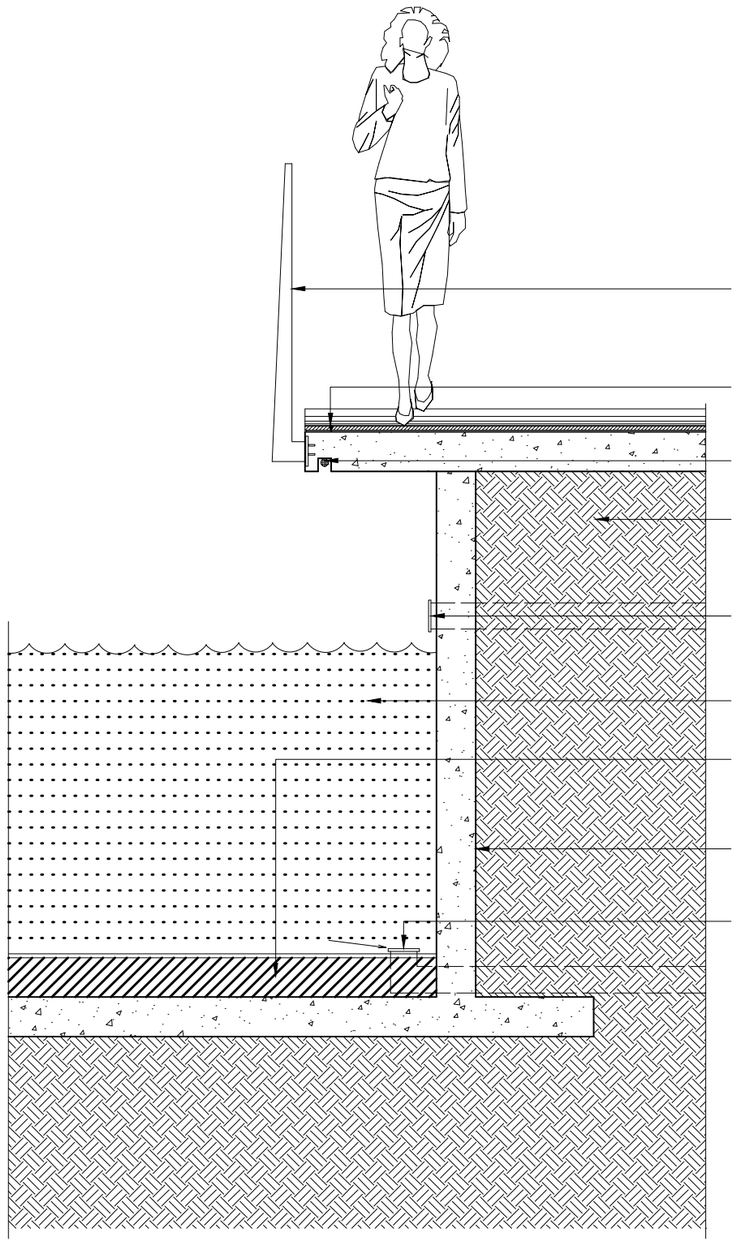
Trail through the duck week ponds



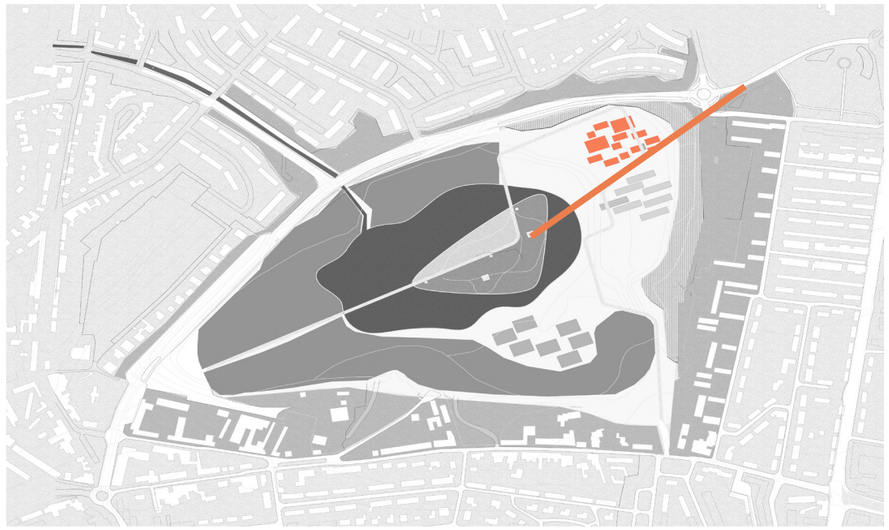
Duck weed ponds of exposed concrete of varying water depth.

Local stone used for main pathway with corten steel railing for safety

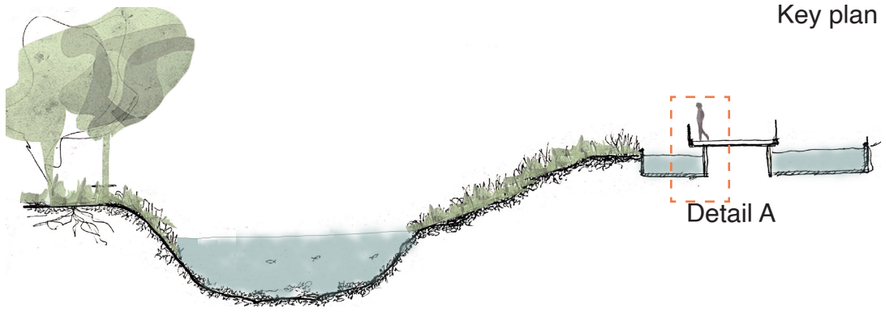
Key plan



Detail A of the path



Key plan



Section through biological treatment and the ecological island

Keeping the contaminated soil on-site and capping it with clean topsoil prevented its further preventing it's spread into the surrounding soils and water bodies. Thus making it safe.

Corten steel

Exposed concrete

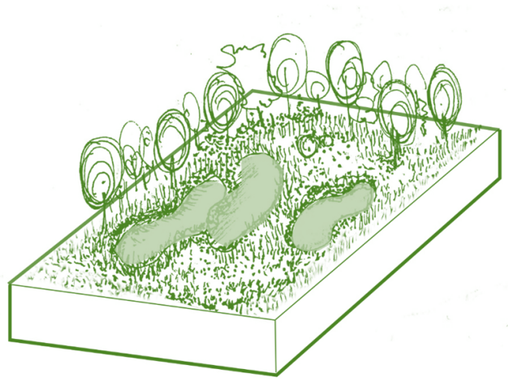
Local stone
-mergel lime stone

Salix alba
Poular
Ash
alus
Hawthorn hedges
Craetgus monogyna

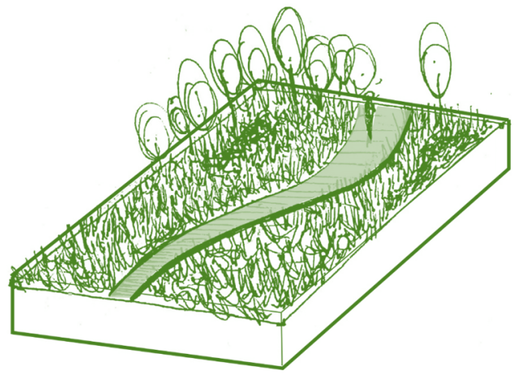
5.4 Design site location 2- Waste water

This is tourist site with a famous castle
So this site is mainly designed for the visitors. There is waste water treatment facility which produces water. Ecological swimming pools could be designed to provide more facilities to the visitors.

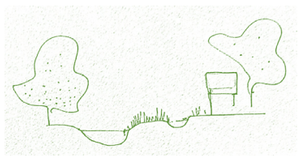
Low land, water catchement area, castles next to the site, connected to main infrastructure.



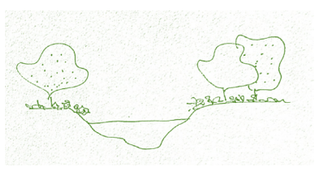
Design for adaptability and reusing



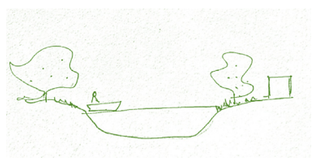
Create spaces for people



Reuse of water



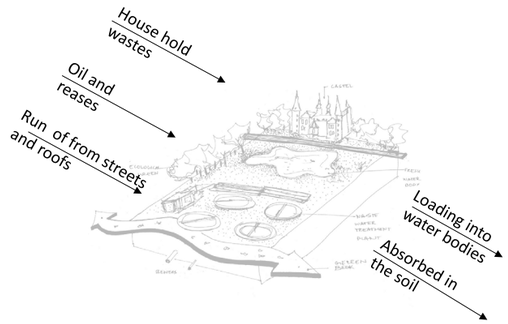
Ecological edges



Recreational activities

Unplanned areas

Most of the areas around the site is unplanned because it is around the water treatment facility.



Waste nutrients and chemical water plant.

The treated waste water has high concentration of K, P. Mainly includes bacteria, viruses and protozoa, oils and greases which are runoff from streets, parking lots and roofs.

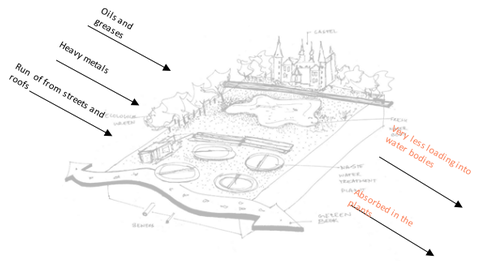
Source: https://www.google.co.uk/maps/@52.0146399,4.3756382,14z

Low ecology

Ecology is not develop because of the treatment facility. The stream is next to it is polluted or else dry. This does not let ecology to thrive.

Tourist attraction

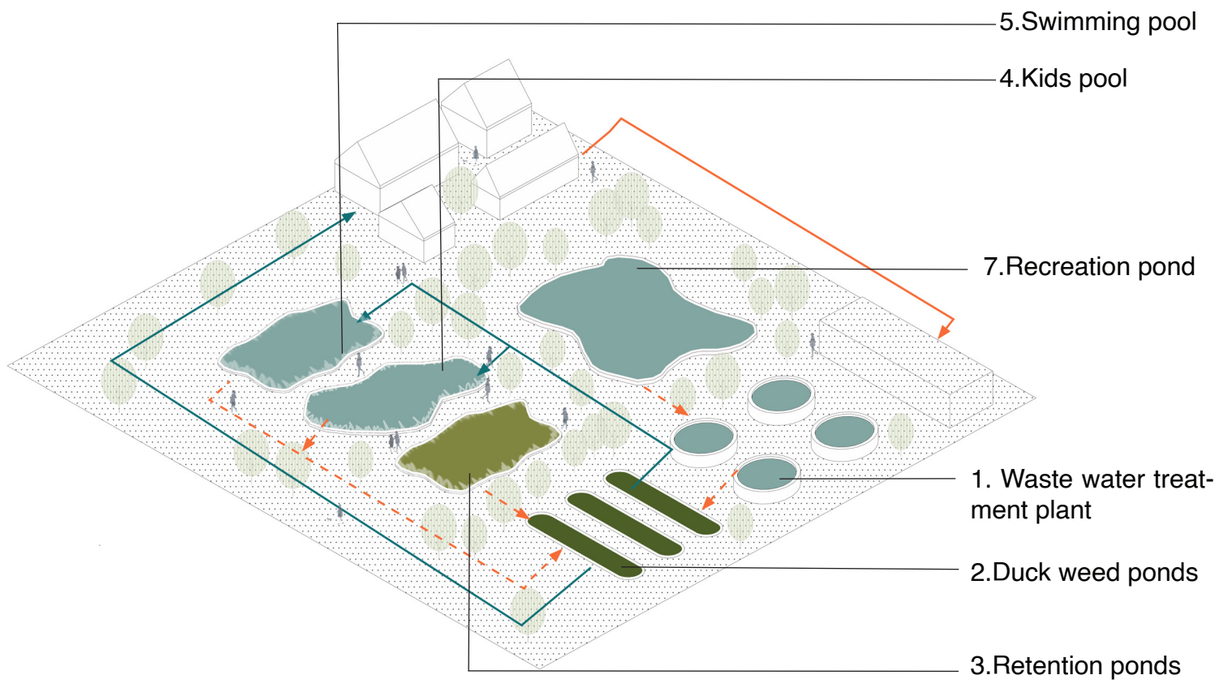
The castle attracts a lot of crowd especially during holidays. It is one of the oldest. By providing more activities and facilities around the area , revenue can be generated.



Production of clean water

The waster water treatment facility receives water from most of the houses around the area. The toxins are removed and the water flows into the stream. There is potential to store the water and use it in different ways.

Ecological swimming pool- Boekenberg park, Antwerp
Source: https://www.antwerpen.be/



System Proposal

For the visitors- ecological swimming pool.
Water purification through natural systems and duck weed farming.

Zoning of the site

1.Wastewater treatment plant which purifies the water from the the main impurities.

2.Duck weed ponds to improve to the level of swimming standards.

3.Retention ponds to collect water during rainy season and for the development of ecological habitat.

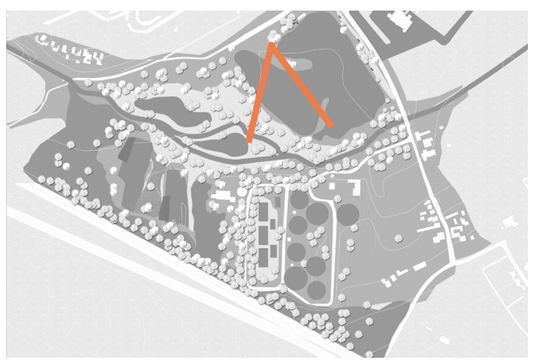
4.Reeds on the edges of the kids pool of depth 1.5 m to purify the water.

5.Lap pool. the water recirculated to the duck weed ponds for purification.

Site plan of ecological swimming pool

Informal routes for visitors

Recreational pond habitat for small mammals and birds in front of the castle



Key plan

Wetland to purify water and retain it.

Reeds to purify water

Key plan

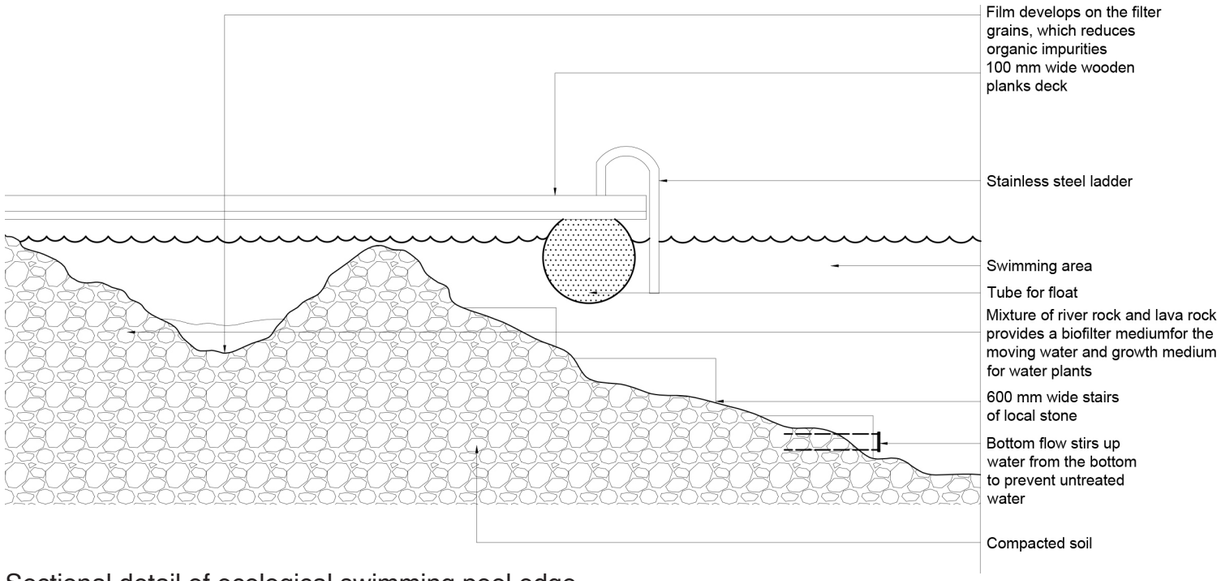
View overlooking the pool

Swimming pool with ecological edge

Reeds to purify water and to circulate it

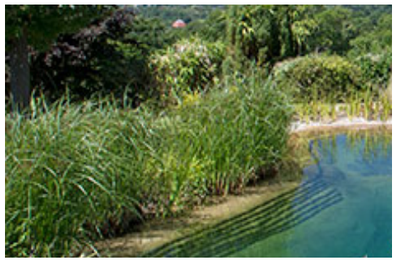
Wooden deck along the pool

Key plan

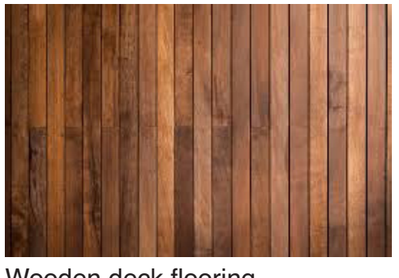


Sectional detail of ecological swimming pool edge

River stone on the edges



Reeds to purify water



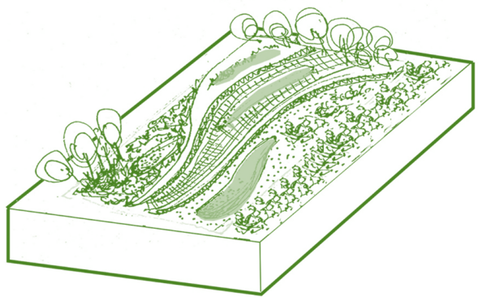
Wooden deck flooring

Fine gravel for pathways

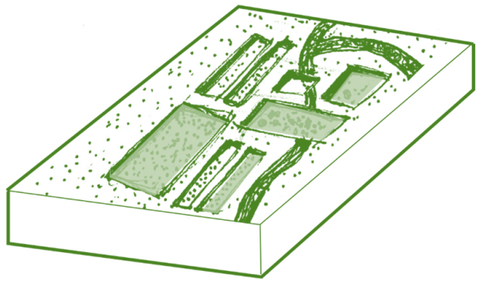
Source: https://www.google.co.uk/maps/@52.0146399,4.3756382,14z

5.5 Design site location 3- Agriculture water

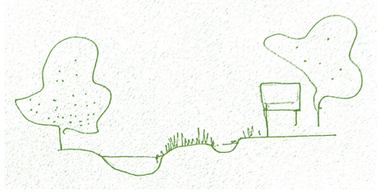
Located along the brook . This area currently unproductive area were sometimes cattle food is grown.



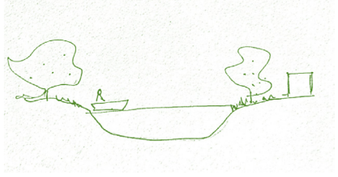
Design for resilient landscape



Multifunctionality and diversify



Reuse of water



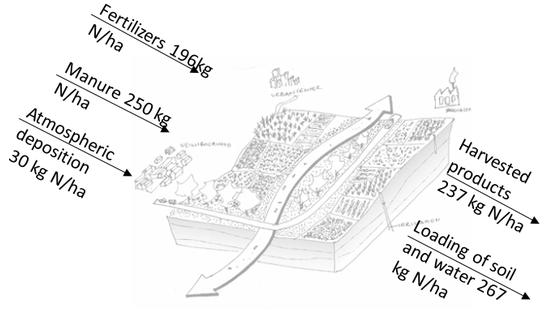
Rereational activities

Gathering area

Challenges

Stream drying out

Due to various activities affect the regions the groundwater table. Especially during the summer most of the brooks are dry for couple of months.

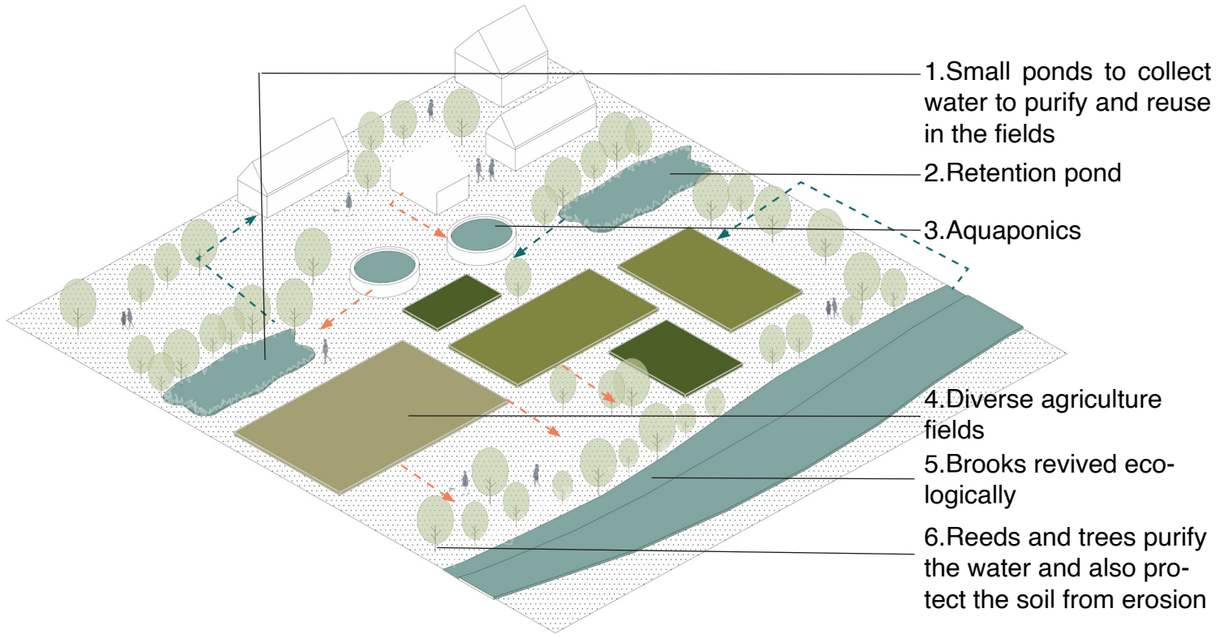


Waste nutrients

Due to fertilizers and pesticides. NHy and NOx are atmospheric depositions, Cd, N and P are present in inorganic fertilizers, and animal manure contains Cu, Zn, N and P.

Low productivity

The mass production plants with usage of fertilizers and pesticides.

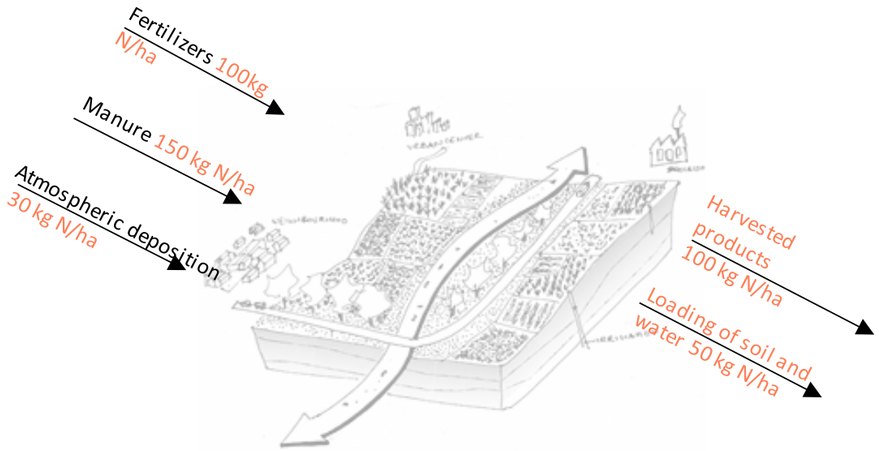


System proposal

For production for locals- sustainable farming creating operational landscape.

Waste nutrients can be absorbed by the diverse crops planted in rotation to improve the quality of soil and also absorbing waste nutrients.

Along the brooks there is proposed Natura 2000



Reuse nutrients in water

Diverse agriculture

The fields of varying sizes for varieties of crops to increase the yield and profit from the local.

Graften
to reduce erosion

Ecological edge
along the stream

Diverse farming
and native plants

Wetlands to
purify water

Forest patch to
absorb nutrients

Ponds to retain
water in the fields

Site plan of productive landscape

Graften- typical landscape feature of this region

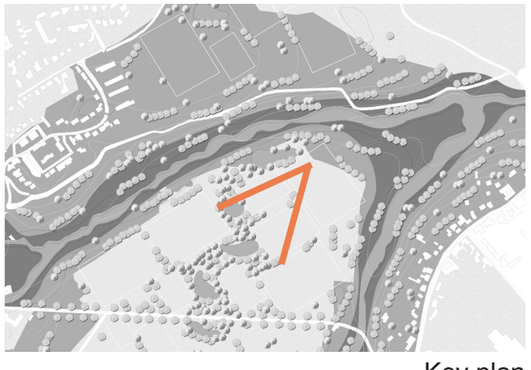
https://www.google.co.uk/maps/@52.0146399,4.3756382,14z

Orchard- typical feature of this region

View of diverse agriculture farming
Companion of planting integrating the native trees with agriculture. integrating it with the people and also character of the area.

Orchards to prevent soil erosion and diverse plantation

Gathering area for locals



Key plan

Reviving the degraded
Design proposal

Land of maurits mine

Source: https://www.demijnen.nl/collectie/foto/terrein-op-de-staatsmijn-maurits-12/all/?keys=&tid=&index=13&page=170&over=1

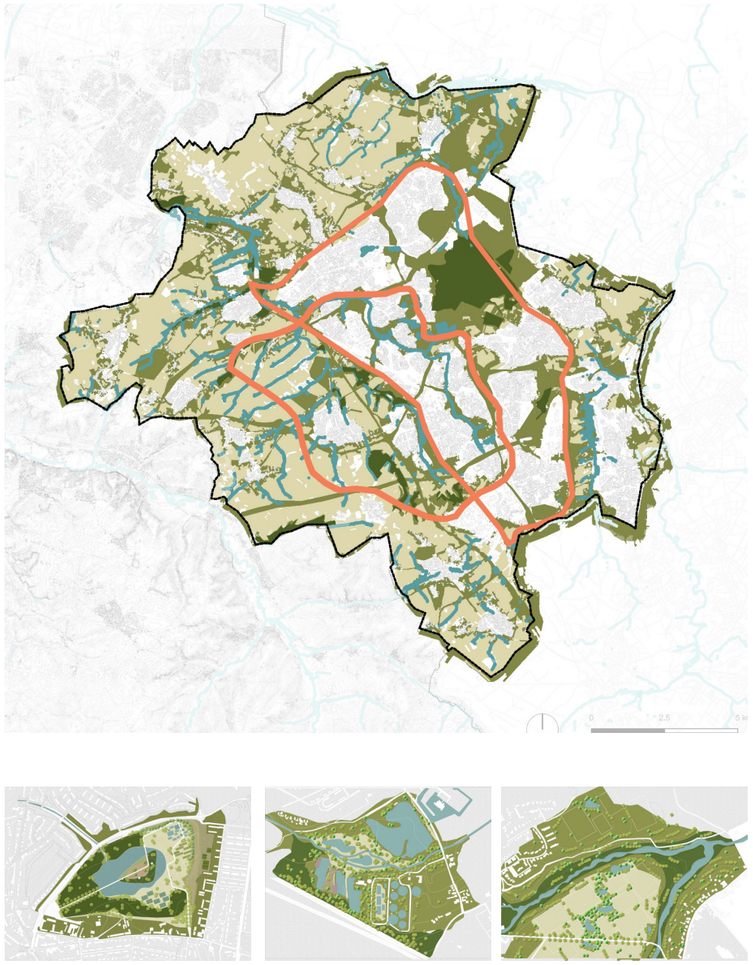
06

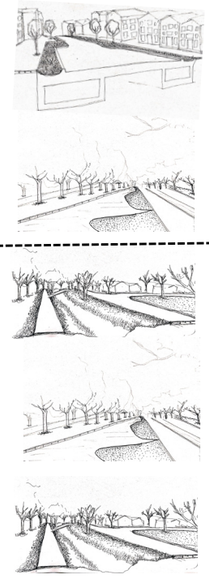
CONCLUSION

What are **circular design strategies** and spatial framework in the **degraded** and **fragmented** landscape to reduce water (mine, agriculture, wastewater) pollution in Parkstad?

Eco device

Swarm planning theory





Operational landscape

Blue green network system

Socio-ecological balance

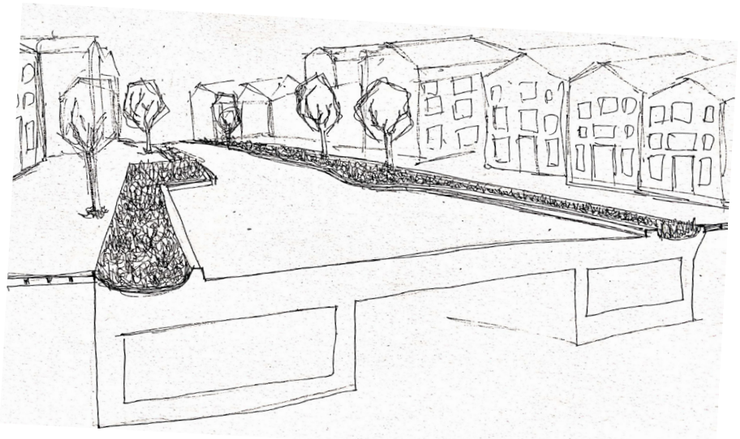
Concluding by answering my question, based on the framework of eco device and swamp planning theory, this led to my master plan and three smaller interventions. And these small interventions are connected by this network system to create an operational landscape, which is blue or green network system to have an ecological social ecological balance.

Reviving the degraded

Conclusion

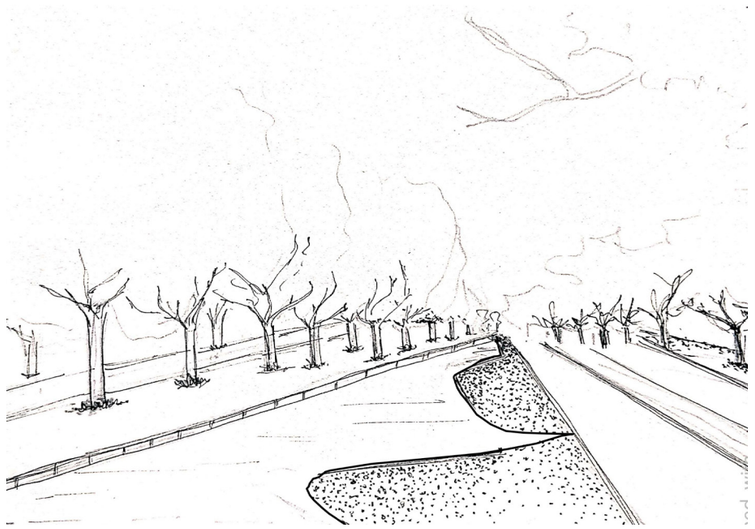
“Street is river of life”

-William(urban gorillas)



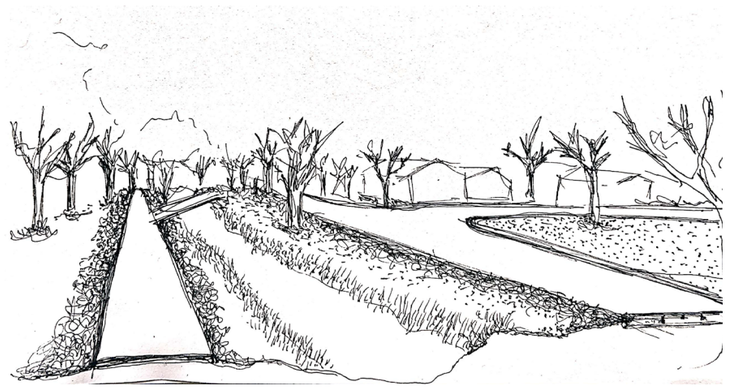
INTERCEPTOR STREETS

(reusing)



FILTER STRIPS

(purification)



FLOATING STREETS

(storing)

these smaller interventions connected to these network topologies that is treat as a river of life. So basically intercept as treats for reusing the water filter strips for the purification of water on the floating streets for storing. And, also these design principles can be used in similar locations. Basically unplanned areas can create multifunctional spaces in urban and landscape fabric to cater sudden change and make the region more adaptive to create green and blue structure, creating a network system, which acts as the development of the region to make it more resilient.

Mine water

Disconnected to the neighborhood

Mine Water pollution

Ecologically degraded

Hydrophilic park

Wastewater

Unplanned areas

Low ecology value

Waste Water treatment

Ecological pool

Agricultural water

Stream drying

Waste nutrients

Low productivity

Diverse agriculture

The smaller interventions has differrent challenges which site specific but are mine water, wastewater and agricultural water. The mine water is converted into hydrophilic park where the wastewater is converted and which led to an ecological pool. And, agricultural water is commercial and agriculture area is more towards production.

Locations with similar conditions

Unplanned spaces can create multifunctional spaces in urban and landscape fabric to cater sudden change and make the region adaptive

A network created by blue & green structures acts as a development strategies in these regions hence making it resilient.

Landscape as a operative tool can be used to create resilient region.

This graduation project focuses mainly on creating an operational, productive landscape, to make Parkstad more resilient, adaptable by reusing the waste nutrients to create operational landscapes, resulting in purification of water and improving the spatial quality of the area. This strengthens identity and enhances the experience to the locals of the region.

The resources are limited, as they are often misused, polluted, or eroded (Unhabitat,2018). The use of resources needs to be done responsibly and sustainably which still is not true in the developing and growing world, which is resulting in degradation of the environment. To make the people aware on the growing waste all over the world that several human activities have depleted many of the natural resources due to the ever-growing demand and consumer market.

Vacant, abandoned, or polluted lands are vital to be revived has it as a negative impact on the locals of the region. For this purpose, the existing region needs to improve their living and overall health by following more sustainable growth models (Bishop,2017), “by improving the physical and social environments of cities” (Benton ,2013) (p. 431).

The issues of waste nutrients are important, has it deals with challenges of current societies. Challenges of the environment usually are pollution, unproductive soils, consumed. These areas have disconnected with the landscape, resulting fragmentation of the region.

This also leads to Societal challenges due to the low economy, the spaces are abandoned or underused. This has visual impact and these are perceived as unsafe areas that negatively affect the locals resulting in a shrinking population. Urban and landscape fabric acts as a system together that can develop the ability to respond to changing environmental conditions for resilience.

Within the region, the existing unplanned spaces become the backbone in designing the infrastructure. This leads to flexible and adaptive systems to adapt to the changes in the developing world by taking into account the principles obtained from swarm planning and eco device. The neighbourhood level design elaborates micro-scale design interventions to integrate neighbourhood with ecological functions therefore progressively establishing renewed relationships. Thus, a multiscale approach helped in designing better and efficient operational landscapes.

6.2 Reflection

I have always been interested in working on projects that have been degraded or exploited because of human activities example post mining sites, dumpfields and so on. India, the country I am from is a developing nation where the resources have been exploited rapidly in recent decades and due to this pollution levels and ecology is not considered.

The degrading landscape is one of the main issues that are of alarming concerns has the climate is also changing. It is not only to improve it ecologically, but further to integrate it into urban fabric and benefit the inhabitants.

Parkstad, post-industrial site was suitable for this research. Currently the economy and population are shrinking. The region needs a new metabolic system that can emerge improving the quality of life and making region adaptive and resilient.

After weeks of desk analysis and mapping I understood the background of the region, but I couldn't relate to the spatial structure. So, the field trip helped me a lot to formulate my research objective. When I was present in Parkstad there was disconnect between spaces. The whole region was not integrated. Has I was cycling around to explore the heritage sites, few were not easily accessible.

During the field trip, the main focus was on the spatial quality of different areas, to understand the scale and intensity of impact on the people of the region due to degraded areas.

Choosing the methodology helped in structuring the project and having a strong base setup for the project. The research was mainly based on literature study to understand challenges and opportunities of the degraded land, in order to make it resilient and adaptive. The theories interconnect to analyse the waste nutrient flows and helps towards creating a resilient and adaptable region through design.

The analysis stage has been done mostly by research in which the design is framing the constraint. On the contrary, while designing research sets the boundaries or shapes the project. Hence both play an important role during the process of developing a project on producing food, water for generating economy and reusing and reducing waste.

I faced a couple of challenges through the process. Firstly integrating different systems such as duck farming, aquaponics system. I detailing and given more importance to technical aspects, not considering the spatial quality. Then when I worked through different scales and help from my mentors. I

realized that blue - green is the main structure and spatial quality plays an important role to connect with neighbourhood and the unplanned spaces. So the spatial structure shaped the project and integrate various functions.

Working through the scales is a bit challenging as well as I had to go back forth to develop the design. In this project the main focus is water , so at a regional scale water system was overlapping the terrain. I characterized the region into three main catchment areas. the which I then developed it in detail smaller scales. The blue structure develops space and creates spatial atmosphere in certain areas. These interventions in different scales cohere with each other.

Parkstad region was large and there were time constraints to analyze, research, propose and detail. Time also needs to consider while designing and landscape is not static and always growth and this dynamic process will continue.

So, for my proposed a new network system that could be integrated into the urban and the landscape fabric. It strengthens the characteristics of the region and also the landscape qualities. To achieve this I had to understand in detail the terrain, the water management, existing abandoned land, unplanned and green areas. Reorganizing the unplanned spaces with the existing water system developed into a new blue-green network structure. So the open spaces that are mainly the unplanned spaces reconnect and have multifunction.

The sustainable way to develop the region, I focused on reusing the waste nutrients from the water and soil. Further purifying it as well having a multi-function to the areas. This resulted in reviving the degraded and reconnecting the fragmented patches.

The project also relooks at how the duckweed farming and fish ponds (aquaponics system) can spatially be connected to the neighborhood to generate economy and also revive the area. The proposed design strategy not only revives the area and improves the quality of the region environmentally. Moreover, the design with use of local materials and native plants could be easily adapted in the region by using landscape features and the existing characteristics.

Limitation of the project. Firstly, the details regarding the quality of water and exact quantities of the nutrients was difficult to analyse. I wanted to detail study of the site for pictures and better study but due to the lock down of corona virus I was not able to visit but managed and completed the project. I found it a bit hard to follow digital mentoring because discussion face to face would more helpful especially during the design stage. But after a few sessions online with mentors I was able to manage and got adjusted to it.

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