



Design proposals for two decentralised waste management units in Pune, India

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ABSTRACT

The population growth and urbanisation in low-income countries bring issues of poor living standards and miserable sanitation conditions onto the agenda. If well-functioning waste management systems were developed, this could master some of the problems. The already existing local informal waste handling system that is common in many low-income countries, needs to be developed with proper sorting and composting solutions to decrease the environmental burden and improve the overall situation in the dense cities.

This master's thesis project is performed with the intention of developing functional decentralised waste management units in the city of Pune, India. The project called Garbage to Gardens is initiated by the Indian organisation Centre for Environment Education in collaboration with SWaCH waste-picker cooperative and the Pune Municipal Corporation. The initiative intends to decrease the environmental degradation

caused by unrecycled waste, enhance the life quality of the ragpickers and give the concerned areas heightened aesthetical, educational and recreational values. To achieve this, the units are to be incorporated with garden space. A good architectural design is essential to gain approval from the residents of the concerned areas, and also to persuade possible private property owners to deed their land for the units.

The proposed ideas are derived from the objectives, in order to produce a final design product that will serve its purpose. The objectives are based on gathered information and observations regarding the city, the current waste management system, the stakeholders, the project organisation and the potential obstacles.

The overall work method used in the project is called Logical Framework Approach. It is an objective-oriented project plan-

ning tool based on structured thinking and logical analyses, where we function as consultant designers with an intermediary role. In this case the LFA contains an array of submethods such as literature study, observations, study visits, site analyses, photography, sketching, 3D-modelling and more.

The outcome of the process is two design proposals for Anand Park and Kothrud districts in Pune. The areas have both similar and dissimilar attributes, thus needing site specific solutions. The main objectives are the same; aiming at a clean and beautified neighbourhood, business opportunity and income generation for the ragpickers, reduced environmental pollution and decreased waste disposal. Both the proposals contain sorting, storage and composting facilities, while the recreational aspect is more predominant in Anand Park and the educational in Kothrud.

SAMMANDRAG

Befolkningsökningen och urbaniseringen i utvecklingsländer för i många fall med sig låg levnadsstandard och svåra sanitära förhållanden för invånarna. Ett välfungerande sophanteringsystem kunde vara en lösning på en del av problemen. I låginkomstländer är det vanligt med ett lokalt informellt sopsystem, där soporna tas omhand utan myndigheters inblandning. Detta befintliga system fungerar, men behöver utvecklas med fungerande sorterings- och komposteringslösningar för att nå en minskad miljöpåverkan och skapa tilltalande städer.

Målet i detta examensarbete är att utveckla funktionsenliga decentraliserade sophanteringsanläggningar i staden Pune i Indien. Projektet vid namn Garbage to Gardens är initierat av den indiska organisationen Centre for Enviroment Education i samarbete med skräpplockarkooperativet SWaCH och den kommunala myndigheten Pune Municipal Corporation. Initiativet strävar till att minska på miljöförstöringen genom att

återvinna mer, höja livskvaliten för skräpplockarna och ge de berörda områdena högre estetiska, pedagogiska och rekreativa värden. För att uppnå detta ska anläggningarna integreras med parkmark. Goda arkitektoniska lösningar är nödvändiga för att invånarna i de berörda områdena skall ge sitt samtycke, och för att övertyga eventuella privata landägare om att upplåta sin mark för anläggningarna.

Idéförslagen som vi presenterar är baserade på bestämda mål för projektet, detta för att skapa en slutprodukt som tjänar sitt syfte. Målen är i sin tur baserade på information och observationer rörande staden, det nuvarande sophanteringssystemet, intressenterna, projektorganisationen och potentiella hinder.

I projektet används Logical Framework Approach som övergripande metod. Den är ett målstyrt projektplaneringsverktyg baserat på strukturerat tänkande och logiska analyser, där vår

roll är att vara medlande designkonsulter. I detta fall innefattar FLA:n diverse undermetoder så som litteraturstudie, observationer, studiebesök, platsanalyser, fotografi, skisser, 3D-model- lering med flera.

Resultatet av processen är två designförslag för stadsdelarna Anand Park och Kothrud i Pune. Områdena har både liknande egenskaper och stora olikheter, och behöver därför platsspecifika lösningar. De huvudsakliga målen är dock desamma; strävan mot ett rent och förskönat grannskap, ökade jobb- och inkomstmöjligheter för skräpplockarna samt minskad miljöförstöring och mindre behov av sopdeponering. Gemensamt för de båda förslagen är att de innehåller sorterings-, förvarings- samt komposteringsfaciliteter, medan den rekreativa aspekten är mer framträdande i Anand Park och den pedagogiska i Kothrud.

ABBREVIATIONS AND TERMS

autorickshaw = three-wheeled motor vehicle used like taxis. Drivers often self-employed.

BNCA = Maharshi Karve Stree Shikshan Samstha's Dr. Bhanuben Nanavati College of Architecture for women, affiliated to University of Pune, India

bungalow = single family house

CEE = Centre for Environment Education

crore = 10 000 000 (ten million)

dry waste = the non-organic fraction of the waste

DSI = deputy sanitary inspector

Eawag/Sandec = Department of Water and Sanitation in Developing Countries at the Swiss Federal Institute of Aquatic Science and Technology

electoral ward = administrative zone within a ward. Pune consists of 244.

GOPP = goal-oriented project planning

GNP = gross national product

HDPE plastic = high density polyethylene plastic

household = domestic unit consisting of an average of 4,5 people

informal sector = economic activity that is not taxed or monitored by a government, neither included in the country's GNP.

Inora = Institute for Organic Agriculture, Pune

KKPKP = Kagad Kach Patra Kashtakari Panchayat, trade union for wastepickers and scrap collectors

lakh = 100 000 (hundred thousand)

LFA = Logical Framework Approach

MFS = Minor Field Study

MSWM = municipal solid waste management

NGO = non-governmental organisation

Oikos = independent company in Pune specialised in ecology issues in the planning process

PMC = Pune Municipal Corporation

PMPML = Pune Mahanagar Parivahan Mahamandal Limited

ragpicker = waste collector within the informal sector

SIDA = Swedish International Development Cooperation Agency

SLU = Swedish University of Agricultural Sciences

SWaCH = Solid Waste Collection and Handling, cooperation of 1630 ragpickers

two-wheeler = motorbike or scooter

ward = administrative zone. Pune city consists of 14.

SWM = solid waste management

UN = United Nations

UNDP = United Nations Development Programme

UN-HABITAT = United Nations Human Settlements Programme

wet waste = the organic fraction of the waste

3D = three-dimensional

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INTRODUCTION

Preface

Question at issue

Aim

Limitation

Preface

This report is a master's thesis project at the Department of Urban and Rural Development at the Swedish University of Agricultural Sciences. Our wish from the start was to carry out a thesis project that has to do with globally important development issues. During the spring and summer of 2009, we were in contact with several authorities and architect offices while searching for a collaboration opportunity. Through Ramböll Natura we came in contact with the Indian organization CEE, Centre for Environmental Education, for whom Ramböll Natura was carrying out a project in the autumn of 2009. Architect Tomas Andersson at Ramböll Natura functioned as a link between CEE and us. Sanskriti Menon, his contact person in Pune, India, had a project proposal for us. She suggested we participate in a project on local waste management, an important development issue.

With this project in mind we applied for a Minor Field Study scholarship from the Swedish International Development Cooperation Agency (SIDA). In October 2009 we were awarded the scholarship, and our thesis is therefore simultaneously a Minor Field Study.

The project was carried out during the spring semester of 2010, during which two months were spent in Pune, India.

We would like to thank all the staff at CEE for hosting us at the office, and all the time and effort they gave to make our work smooth despite their busy work schedule. We would also like to thank all the engaged stakeholders that provided input and feedback to the project, particularly the SWaCH office staff and Mr Pravin Bhagwat of Anand Park. We are grateful to SIDA for giving us the MFS scholarship, and to the MFS administrator Monica Halling at SLU for assisting us with proper advice and a positive attitude. Thank you also to our supervisors Katri Lisitzin (SLU) and Sanskriti Menon (CEE). Last but not least, we want to thank all the friendly people we met in India for sharing information that was useful and interesting for both our project and to us personally.

Aim

The aim is to develop two well-functioning decentralised waste management units with aesthetical, educational and recreational values.

Question at issue

How can you design a decentralised waste management unit that is environmentally friendly and improves the life quality of the ragpickers and residents of the allocated neighbourhoods in Pune, India?

To be able to answer this question we have formed the following sub-questions:

- What are the problem issues in the concerned neighbourhoods?
- What needs are to be met for improved quality of life?
- How can decentralisation contribute to an environmentally sustainable waste management?
- How are the ragpickers and residents integrated into this process?
- How can the design process be managed successfully?
- What will the physical outcome of the project be?

Limitation

To be able to design a waste management unit that meets the purpose of enhancing both the environment and the quality of life we need to have a broad understanding of many things. This includes the society and culture, the physical circumstances in the areas, local participation in urban upgrading, the financial incentives of waste management projects and the composting techniques, among others. However, although we will refer to these issues in this report, our main focus is the physical design of the waste management units.

The Minor Field Study scholarship dictated that the field study was to last 8 weeks. Our work therefore consisted of 3 weeks of preparation in Sweden, 8 weeks of field study work in India, and 7 more weeks spent on compilation of the project in Sweden.

The report has been created in close collaboration between the two authors Manda Karlsson and Annie Söder. All study visits, meetings, design work and written parts have been worked on together, therefore this report can be considered as a joint project.



METHODOLOGY

Logical Framework Approach
Work plan

Logical Framework Approach

The foundation for our project method is the Logical Framework Approach method - the LFA. There are large amounts of information available on the LFA-method. For the purpose of this project we decided to focus on the summary developed by Sida in the report *“The Logical Framework Approach, A summary of the theory behind the LFA method”* (Örtengren, 2004). One reason for using the Sida methodology is that our project is financed by Sida through our Minor Field Study scholarship.

In the different stages of the LFA we use an array of sub-methods suitable for each step. In this way we hope to achieve a metatriangulation effect, where the combination of different methods can enforce a thorough examination of a complex situation. The submethods used are literature research, field study (containing observations, photography, non-structured interviews, study visits and city analyses), site analyses, and prolific design work (including brainstorming, sketching, 3D-modelling and different presentation methods).

We find it important to clarify that our part in the project is in the early stage of the process, as consultant designers. Therefore we will pass the follow-up stages in the method procedure onto other parties.

The Logical Framework Approach is developed as an instrument for objective-oriented planning as well as analysis, assessment, follow-up and evaluation of projects. The LFA system was developed in the 1970's and is today a standard method within the international development cooperation in the entire EU. This method is also used frequently by municipalities, private companies and organisations. The Swedish development agency Sida collaborates with around 30 countries where LFA is a key tool frequently implemented to accomplish improved quality, relevance, feasibility and sustainability in projects.

LFA is an objective-oriented project planning tool, meaning that listing the objectives and working towards them is the aim. Structured thinking and logical analysis are used as the basis. The method also strives to maximise the dialogue between different stakeholders in a structured way, where a sequence of questions form a framework. A key phrase within the LFA is common sense, which is said to be a phrase widely recognised but seldom practiced.

The LFA procedure

The LFA method includes a number of steps to reach the desired result. These steps can vary depending on the user. The nine steps of Sida's LFA method process are as follows:

- 1: Analysis of the project's context**
- 2: Stakeholder analysis**
- 3: Problem analysis/situation analysis**
- 4: Objectives analysis**
- 5: Plan of activities**
- 6: Resource planning**
- 7: Indicators/measurements of objectives**
- 8: Risk analysis and risk management**
- 9: Analysis of the assumptions**

The steps are not necessarily gone through in consecutive order, as the process benefits from revising earlier steps when new data has been collected in a later stage.

The points in each step of the process that we have focused on in the Garbage to Gardens project are as follows:

1: Analysis of the project's context

The first step is important to gain an understanding of the projects context. It may include the establishment of what kind of environment the project will be implemented in, and what external factors are important to fulfill the objectives of the project. A SWOT (strength, weaknesses, opportunities, threat) analysis is often carried out at this stage.

2: Stakeholder analysis

In step two a list is made of the stakeholders that may be influenced by or may influence the project. The stakeholders are divided into four main groups. These are beneficiaries/target group, implementers, decision-makers and financiers. All the stakeholders should get an opportunity to contribute with information and opinions along the process.

3: Problem analysis/situation analysis

In step three, the problem to be solved is analysed, as well as the reasons behind it. Causes and effects of the problem have to be distinguished to establish the necessary activities. A clear picture of the problem needs to be made to create an accurate activity plan.

By forming a relationship between causes and effects, you minimise the risk of focusing on only one solution to the problem. Some problems also have to be broken down into smaller pieces that can be solved separately in order to solve the overall problem.

Key questions are:

What is the main problem that needs to be solved? What causes this problem? What are the effects? Who is affected?

The problem analysis has to be made by the stakeholders, not the consultants.

4: Objectives analysis

The objective analysis is a mirror image of step three. Now you focus on the positive outcome instead of the things that need to change. The objectives can be divided into three categories: overall objectives, project purpose and results. The overall objectives are the hardest to manage and may not show results for many years, even though both the results and project purpose objectives have been fulfilled.

Key questions are:

What are the achievements of the project in the long run? Why is the project important? What does the project owner see as the most beneficial outcome of the project? Which sub-goals have to be achieved before reaching fulfillment?

5: Plan of activities

The activities in this step have to be established with a direct association to the project objectives. If you manage to plan activities that will eliminate the causes of the problem you are on the right track to obtaining the overall objectives. The activities may be seminars, construction etc.

6-9: Resource planning, Indicators/measurements of objectives, Risk analysis and risk management, Analysis of the assumptions

Our role does not justify involvement after the fifth step. However, these steps are crucial for a project to become sustainable and of high quality.

It is preferable to involve the most relevant stakeholders in a workshop. By doing this, everyone can be part of the decision-making and come to an agreement on the focus of the project. These kinds of workshops are called goal oriented project planning workshops. The first step of a GOPP is always to clarify why a change is needed and agree on what is to be done. When these first questions are solved the workshop continues with the different steps of the LFA method.

Important concerns to keep in mind

Quoted from Sida's LFA summary (Örtengren, 2004)

"The LFA method must be used with flexibility and with a great sense of what is required in each situation."

"It is important to let the problem and the desired achievement lead the way of the project instead of initiating activities blind sighted."

"Often several activities are needed in order to eliminate one problem."

"How the LFA method works depends very much on its users. LFA is no better and no worse than its users."

Work plan

To integrate all the steps we followed this chronological work plan. Prior to the project start we did extensive studies of composting methods to gain the necessary knowledge. Through research we came to the conclusion that there are no corresponding decentralised projects in Sweden that would be interesting, therefore we are not undertaking any field trip other than to a centralised composting unit in Gävle.

Research and preparation

- Literature studies
- Study of the technique of waste management and compost units
- Study of other community-based projects in developing countries
- Gather information from CEE on needs and wishes of stakeholders

Cultural orientation

- Get settled in the environment
- Learn about the city and its inhabitants
- Assess cultural clashes that might occur

Site analysis

- Gain an understanding of the concerned neighbourhoods and their surroundings
- Analyse the strengths, weaknesses, opportunities and threats on site
- Spatial analysis
- Study the functionality of other public spaces in the areas e.g. parks, communities and other
- Learn about the vegetation in Pune
- Study the local materials used in the outdoor environment

Drafts and ideas

- Compare to other relevant projects
- Develop general ideas relevant to the application sites
- Incorporate requirements from stakeholders
- Use a 3D model as a design tool

Design proposal

- Compose drafts into functioning proposal
- Evaluation by stakeholders
- Specify how/if the module can be implemented in other countries

Report writing

- Gather the lessons learned from literature, documentation, analysis, proposal and evaluation into a report

Final layout and presentation

- Finish the report



LITERATURE STUDY

Development and population growth
The impacts of urbanisation
Life quality vs environmental concerns
Waste management practices
Informal is normal
Decentralised systems
Community-based waste handling
Development cooperation
Waste sorting
Composting

The aim of the literature study was to collect and gain all the necessary knowledge to be able to successfully perform our part as design consultants in the Garbage to Gardens project. Our desire was to examine the following questions:
What are the underlying phenomena that cause the garbage crisis in the developing world?
Why is sanitation a problematic issue?
What are the characteristics of successful waste management?
How does a well-functioning waste management unit work?
In this chapter we will present the findings of the study.

Development and population growth

Developing countries are usually described as low- and middle income countries where the standard of living is low. However, there is no single internationally recognised definition of a developing or developed country. Usually the International Monetary Fund list in the annual Economic Outlook Report is regarded as the operative definition of the development status of the countries in the world. India has a gross national income per capita that according to IMF places the country among the developing nations, although the gaps between different income groups are enormous. Economy as the only criteria for development is a debatable subject because income gaps are not recognised, nor other sorts of development such as social development. Many instances have stopped using the vocabulary altogether, as it is impossible to make a clear distinction between developing and developed countries. Attempts have been made to elaborate other classifications. On the Human Development Index scale that apart from GNP also takes life expectancy and education levels into account, India classifies as a medium human development country (UNDP, 2009, p.145).

Regardless of the problems with development definitions, statistics show that the so called developing countries have a faster rate of population growth than high-income countries. The growth rate in low-income countries in 2008 according to UN facts was 2,1% annually, 1,1% in middle income countries and 0,7% in high-income countries (UN Data, 2010).

The reasons for the uneven population growth phenomenon are many. Among others the fear of babies dying is larger when health conditions are poor, as well as the reliance on children

to work on the family farm or business and take care of the parents in their old age. When women lack basic education - which is often the case in low-income countries - they tend to produce bigger families and less healthy children. If women have opportunities to work outside the home they usually start their families later and have fewer children. The access to modern contraceptives for family planning also make a huge difference. (Soubotina, 2004, p.18)

This naturally awakens questions of how and if the development is going to be equal in any manner when the population of poor regions expands too rapidly for the available resources. In India, with its population of 1,14 billion and annual growth rate of 1,46% (UN Data, 2010), this is an especially accurate and burning issue.

The impacts of urbanisation

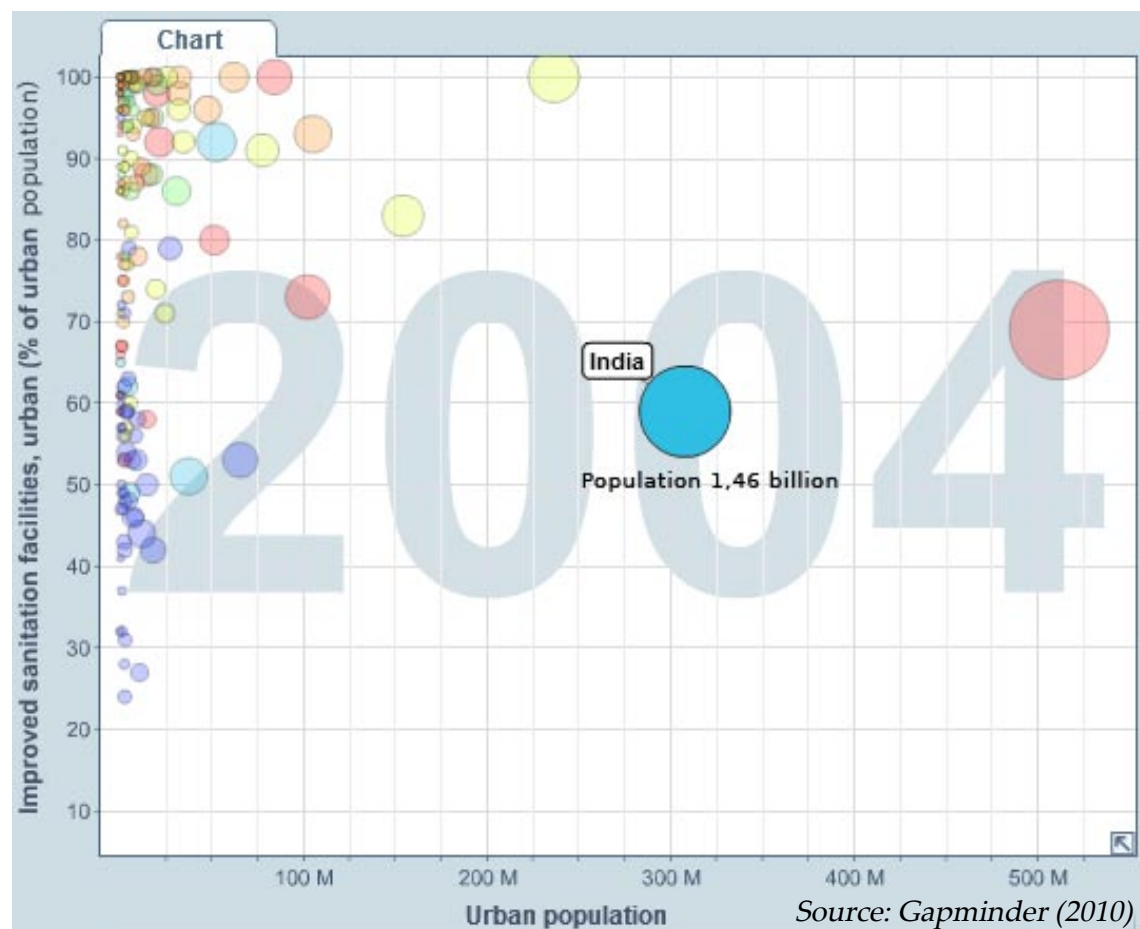
The urban population is growing faster than the rural population. In 2008, for the first time in world history, more than 50% of the world population lived in cities. Zurbrugg (2002, p.2) shows that the ratio of the total urban population that resides

in low-income countries will grow from 37% in 1995 to 45% in 2015 according to forecasts. 60% of urban population growth in developing countries is natural growth caused by reproduction, around 30% the net effect of rural-urban migration and 10% explained by changed boundaries of cities (Tannerfelt & Ljung, 2006, p.27).

The urbanisation is often referred to as a negative evolution, but if managed right it may also lead to positive outcomes. Among others the World Bank Infrastructure Group of Urban Development recognises that “the urban transition offers significant opportunities for countries to improve the quality of life for all their citizens” (2000, p.1), as it is easier to affect a population that is spatially concentrated. Up to two-thirds of the GDP of most countries is generated by one-third of the population in major urban centres, that therefore promote economic development if efficiently run, according to the authors of “More urban less poor - an introduction to urban development and management” (Tannerfelt & Ljung, 2006, p.13). Tannerfelt and Ljung say that it is not the urbanisation as such that cause degradation of the environment. They rather blame the economic development, but “obviously, this is still an urban issue, and it is in the urban areas where many and perhaps the



The urban population of low-income countries is growing faster than their wealthier counterparts.



*Chart over improved sanitation for the urban population.
In India just over half of the urban population has access to improved sanitation facilities.*

most serious environmental challenges have to be met” (p.62), this also because of the concentration of people. However, city dwellers use fewer resources and produce fewer wastes than non-city dwellers because of greater intensity of settlement (Gilbert et al, 1996, p.15). UN-HABITAT also emphasises the advantages of living in cities, saying: “Most cities are vibrant and dynamic places, each with their own unique character. If not to crippled by the urban externalities of congestion, pollution and crime, they have interesting streetscapes, work spaces and residential spaces in which the majority are able to make an acceptable income and obtain an education, if they wish, while enjoying a better standard of living at a considerably lower risk of death and starvation than their rural counterparts” (2003a, p.23).

On the other hand, there are noticeable problems in the more and more dense cities. Common examples are pollution, shortage of natural resources, social instability, lack of infrastructure and poverty. Solid waste management is a key question for both environmental sustainability and a high quality of life for the urbanising population, as it involves all

the mentioned issues. As UN-HABITAT puts it, “for many observers the condition of solid waste disposal is the first impression of an unacceptable living condition” (2003b, p.17). It is the most visible and striking aspect that indicates an inability to sustain a functioning city.

Life quality versus environmental concerns

The concepts of high quality of life and environmentally friendly lifestyle are hard to define. Is fulfilling basic needs enough to obtain a high quality of life? If not, what level of negative impact on the environment should be accepted in order to obtain one’s desired life standard? There are no clear answers, but an ongoing discussion about whether a high life standard can ever be environmentally friendly, and if global equality can be reached.

In the 1990 Human Development Report from the UN, human development was defined as “a process of enlarging people’s



Burning of waste is a customary practice in many parts of the world.

“current consumption cannot continue to be financed with economic debt that future generations must repay” Mahbub ul Haq

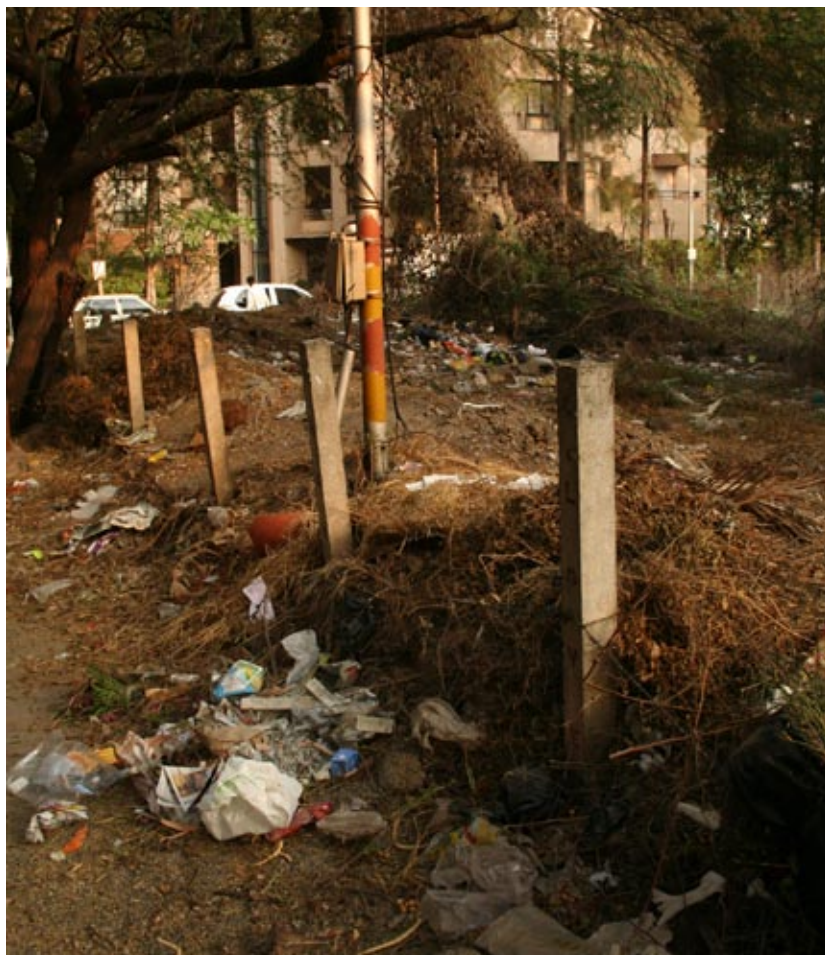
choices”. This definition has been used in the UN work ever since. But emphasising the human factor brings out the question about what happens when the choice is to consume more, while today’s consumption of natural resources already exceeds the supplies? In the UN report The Human Face of the Urban Environment Mahbub ul Haq means that “current consumption cannot continue to be financed with economic debt that future generations must repay. Sufficient investment must be made in the education and health of today’s population so as not to create a social debt for these future generations. Natural resources must be used judiciously so as not to impose ecological liability on those who come after us” (1995, p.22). Thus, he sees a risk in securing our own well-being on the expense of the well-being of the environment, as natural resources might run out or be damaged. However, he continues by saying that it is natural to live in a changing world, as

nature is not invariant. Environmental sustainability does not equal an environment where nothing is allowed to change, but if the changes are too drastic humankind might not adjust fast enough. So ul Haq agrees with the UN saying that it is rather the human choices that should be put in focus: “What we must preserve for future generations are development opportunities and human choices, and not each and every form of natural capital, or every ecological resource, or every species” (p.22).

The opinion of ul Haq seems to be predominant today. Not many claim that nature has a value of its own, and should therefore be protected on the same terms as humanity. Even WWF says that they want “people and nature to thrive together”(WWF, d.u.a), that the main reason why they try to save nature and wildlife is explicitly because “the diversity of life on Earth is not simply something to marvel over – it’s also vital for our own health and livelihoods”(WWF, d.u.b).

The conclusion that may be drawn is that our interconnectedness with the environment we live in makes it impossible to ensure a high quality of life without concern for nature. The impacts of disrespecting the environment might not be seen

Vacant lot transformed into microdump.



here and now, but another parts of the world or following generations might be hit hard. Striving towards an equal society, everybody should have the same chances to choose their lifestyle, but without jeopardising other people’s or future generations’ chances to live in an environment where it is possible to have an equally high quality of life. To succeed in this effort in today’s world with large income gaps, the rich may have to limit their consumption rather than restricting the poor from consuming. It is not an impossible equation to take initiatives that combine poverty reduction and solutions to environmental challenges. Some argue that countries like India that have not been truly industrialised, can take the step directly from being a developing country to a modern environmentally friendly state, as the techniques and knowledge now exist. In *The State of the World* report from 2009, the authors point out that reducing poverty is still a key question to meet environmental challenges, because having a solid economic base and access to food, water, health care and education makes households and communities cope better with shocks and stresses that new environmental conditions brings (Dodman, Ayers & Huq, 2009, p.154). In *The Human Face of the Environment* McGranahan explains that wealth and the consequential high quality of life often lead to an improvement of the environmental conditions, as “a wealthy urban lifestyle creates more waste, but the wealthy choose to devote part of their wealth to avoiding exposure to unhealthful or unpleasant pollutants” (1995, p.180).

Waste management practices

The establishment of functioning waste management is today a major challenge especially in the metro cities of Asia and Africa (Davis, 2006, p.139). Most urban local bodies in developing countries have economic constraints and are therefore unable to provide satisfactory waste management services (Rothenberger et al, 2006, p.5). The municipal approach, according to Rothenberger at Eawag/Sandec, is usually an “end of the pipe” solution, which means collection-transportation-crude dumping of waste. The recycling is often limited, and depending fully on the informal sector. A predominant majority of the waste could be reused either through recycling or composting, provided that the will, the finances, the knowledge and the equipment are at hand. Also, in developing countries the disposal sites are often improper or insufficient (Munasinghe, 1995, p.80).

The consequential sanitary problems of poor waste practices affect all citizens: streets are inaccessible due to piles of garbage, streams are blocked with junk, the air gets filled with odours and the ground water gets polluted. The lack of waste management constitutes a health hazard as it leads to higher incidence of endemic diseases and epidemics (Munasinghe, 1995, p.80). As an example, in 1994 there was an eruption of plague in the slums of Pune, which was aggravated by the poor waste practices (Dao, Yerino & Davenport, 2009, p.3). In order to master the problem with growing garbage piles and the associated diseases, residents or employed street sweepers often handle the problem by setting fire to the piles on a daily basis. This waste management custom generates new problems as natural resources are wasted and air pollutants from burning toxic materials are released into the atmosphere.

Informal is normal

In developing countries the informal sector typically represents 50-70 per cent of total employment (Tannerfelt & Ljung, 2006, p.130). There is a common misconception that poor people are unemployed and homeless. In reality, poor people do have some kind of livelihood, everybody lives somewhere and no one survives without water, as Tannerfelt and Ljung point out (2006, p.130). They continue by saying that “employment is expected to mean a fixed job with a safe salary; housing is supposed to mean dwellings with pre-set standards and solid building materials; water should come through the pipe, and flush toilets should be connected to a water-borne sewerage system”. All of these are desirable, but often the local authorities do not recognise the means that the poor households have developed to survive, and repress their efforts instead of supporting them, or provide solutions that are not working. A first step would be to recognise that the informal is normal, and that cities rely on the informal economy.

“There is a common misconception that poor people are unemployed and homeless” Göran Tannerfelt and Per Ljung

Ragpickers that deal with the waste outside the municipal SWM chain are typical representatives of such an underestimated informal workforce. Mohan Munasinghe says: “The



The majority of the urban population of low-income countries work within the informal economy.

livelihood of waste scavengers must be accounted for. In cases involving a decision to close, relocate, or centralize dump sites, the social and economic effects on waste pickers who make a living of the waste must be considered. Solution is to provide them a more promising livelihood is by employing them to separate waste at the source, at a transfer point, or in small recycling industries” (Munasinghe, 1995, p.82). This is an example of a pro-poor policy combatting the urban poverty, instead of working against the major group of urban poor.

Decentralised systems

A solution to the waste challenge is to develop programs of decentralised waste management, where the garbage is taken care of locally in or close to the residential areas. In Pune, the Pune Municipal Corporation is paying subsidies to organisations that can reduce the amount of waste that otherwise has to

be put in landfills by developing decentralised garbage collection sites (Dao, Yerino & Davenport, 2009, p.14). The recyclable waste and compost can also be sold to create revenue.

Decentralisation as a process, politically as well as logistically, has recently been recognised as better solution than centralisation. Tannerfelt and Ljung express it as follows: “Urban development is, by definition, local. National policies and resource allocation are extremely important, but without action at the local level, cities will not develop and the conditions for the urban poor will not improve” (2006, p.153).

Imparato and Ruster (2003, p.271) talk about three opportunities with decentralisation. The first is responsibility. If there is clarity in roles at the various levels, decentralisation attributes more administrative, technical and implementation functions – and responsibilities - to those who are the closest to the problem. Next there is bureaucratic simplification, meaning that the

administrations are closer to the people. Decentralisation does not mean that central actors have to be eliminated, but rather that the number of bureaucratic layers increases to put the power closer to the people. The third opportunity is the local knowledge that can be an advantage in decentralised endeavours.

However, it has to be kept in mind that decentralisation is still an ambiguous issue. Imparato and Ruster (2003, p.273) say that it is without doubt a positive process, but if certain conditions are not met it can backfire badly, or at the very least become a futile waste of energy. Lack of any of the following factors can knock back the efforts: authenticity of the process, adequate financing, availability of motivated and qualified personnel in sufficient numbers, clarity in the distribution of responsibility to the different levels etc (Imparato & Ruster, 2003, p.273).

Why is central collection not a good option? A typical feature of a developing country is a shortage of machines and skilled labour to manufacture modern goods and services, and a lack of municipal savings to finance investment without foreign input (Ministry of Foreign Affairs of Finland, 2009). This goes for India, where manpower and entrepreneurship are overflowing resources unlike technical equipment and economic capital. Thus, simple techniques are the most profitable, and they are usually best suited for small-scale facilities.

There are also environmental benefits with a decentralised system. Transports are avoided, which is significant especially considering the weight of wet organic waste, and thus more waste is likely to be recycled.










Community-based waste handling

A decentralised waste management system is usually community-based as it is not directly municipally or nationally governed. In many cases like in the Garbage to Gardens project the owners will be a ragpicker cooperative that is a large but overlooked community group. Sheela Patel comments that poor people previously have been completely left out of all decision-making in India’s cities (1995, p.93). She says “So when we speak of community participation and the ability to make informed choices - all these are words that we are struggling to give meaning to in all the survival strategies to which poor people are clinging”. In decentralised community-based

initiatives the ragpickers can be the ones running the units that are open for the rest of the community to use and enjoy, which at best can give them a new dignity and authority.

However, the different community groups may have different opinions, as no community is homogenous in interest, values, motivations or culture (Imparato & Ruster, 2003, p.22). In the World Bank report *The Human Face of the Urban Environment* Mohan Munasinghe writes that a socio-religious taboo exists about handling waste in many developing countries (1995, p.84). He continues: “This is particularly the case in the Indian subcontinent, where waste was traditionally handled by the ‘Untouchables’. This practice continues, although many have converted to Christianity or Islam. This attitude toward waste disposal degrades the value of the service provided by such people, and creates an unwillingness to clean up areas on a community basis”. But even if not everybody is enthusiastic or even interested, a community-based project has bigger chances to succeed as the authority for decision-making in on the community level.

Table. Levels of participation

Level of participation	Community role	Outsider role
NONE	-	
INDIRECT	 Bystander	<  Surrogate
CONSULT	 Interest group	<  Advocate
SHARED CONTROL	 Stakeholder	=  Stakeholder
FULL CONTROL	 Principal	>  Resource

Source: Adapted from Goethert (1998)

There are different models of how the community participation is to be implemented. Imparato and Ruster say that true participation “is a process in which men and women engage their will, their sense of responsibility, their abilities, their dignity” (2003, p.ix). UNDP on the other hand puts it like this: “People may, in some cases, have a high degree of control over the project. In other cases, control may be partial or indirect. The important thing is that people have a constant access to decision-making and power” (as cited in Imparato and Ruster, 2003, p.4). It is not a question of democracy or dictatorship; participation take different shapes and figure on a scale from nothing to complete community involvement. In the case of waste management, it is important that the citizens know their responsibilities, the daily routines, the standard procedures and the locational factors to ensure a high level of commitment (Onibokun, 1999, p.240).

“True participation is a process in which men and women engage their will, their sense of responsibility, their abilities, their dignity” Ivo Imparato and Jeff Ruster

Even if the community involvement is intense, and the role of outside consultants is minimal, it is important to have someone who acts as an intermediary between the different parties. Without a neutral project management, the interaction might be slow and inefficient, or even aggressive. “Appropriate intermediaries between project promoters and beneficiaries are one of the critical components for the success of a project involving community participation. From an operational point of view, the key factors that influence the effectiveness of the intermediaries are:

- the existence of organisations qualified and willing to act as intermediaries
- the allocation of sufficient resources to cover the cost of such intermediation” (Imparato & Ruster, 2003, p.98).

There is no clear end of a community-based project. As long as the community keeps evolving, so does the project. But “a program or project is sustainable when it generates a permanent improvement in the quality of life of the people involved” (Imparato & Ruster, 2003, p.42). The same authors also point out that apart from conserving the benefits of the project, the development process has to be continued after the project for it to be sustainable (p.43).

Development cooperation

Do developing countries need aid from foreign consults? The majority of development experts seem to reply with a yes, at least in the short term. Tannerfelt and Ljung say that the increased productivity of the urban economy will cover the costs of urban infrastructure and services in the long term (2006, p.139). In the short term on the other hand, the task is difficult due to human, institutional and financial constraints during a period of rapid change that we are experiencing right now.

It seems like the paradigms within development cooperation are changing: “while donors increasingly ‘interfere’ at policy level they also emphasise national ownership - developing countries ‘own their development’” (Tannerfelt & Ljung, 2006, p.144). The realisation that development must build on domestic resources has emerged during the last decades. Since ten years back there are the *Millennium Development Goals* and the *Millennium Declaration* from the UN for foreign co-operators to follow. They provide a policy framework usable not to make the mistakes that have been made through history in this field.





Wastepicker collecting segregated wet and dry waste from households.

Negative effects of development cooperation that are frequently brought up are aid dependency and the lack of national knowledge build-up. In India there is already a serious problem in the so called brain-drain effect, that brings highly educated people out of India where there are opportunities to earn more than on the domestic market. On the other hand, development cooperation can be positive if it offers an outside view, if the foreigners can see further than locals concerning local issues. Tannerfelt and Ljung say: "The solutions have to be 'home-grown' and the resources mobilised locally, but catalytic interventions by donors could be effective especially with regard to the poor" (2006, p.162) The goal for external assistants should always be to enhance the capability of the local government and professionals.

Imparato and Ruster say (2003, p.224) that the role of the foreign consult is not always easy. "The level of skills required for

this kind of work is actually higher than that normally required by conventional situations in the formal city, which is compounded by the fact that a basic understanding of informal sector social dynamics is also required". Therefore it is important to select the most suitable employees for development cooperation work.

Waste sorting

The concept of waste is highly relative. Waste does not become waste until someone has discarded it. Something that is waste to one person may be a useable product for someone else. In India most products are normally reused several times before they are ultimately considered waste, because of the many poor that do not have the choice of a wear and tear lifestyle. However, even when a product is broken or worn to the maximum, most of it can be considered a resource because of the recycling potential. "Waste, if just dumped on a landfill site, is a misplaced resource causing further environmental problems" (Rothenberger et al 2006, p.7). In spite of the definition of waste as something that the generator does not want, Laxmi Narayan says that many middle-class Indians still view waste pickers as thieves, because it becomes a valuable commodity when separated (2010). However, the legal system in India states that the ragpicker owns the waste as soon as she gets it from the client.

There are two main fractions of household waste: wet and dry. The wet waste is the organic biodegradable garbage, such as kitchen waste and garden waste that constitute around 75% of the total waste in developing countries like India, as opposed to 30-50% in Sweden (Inter-Info Nils Holmberg AB, 1992). The bio-degradable portion can be the raw-material for composting, which means obtaining a high quality nutritious manure. In some countries bio-gas is extracted from the organic waste instead, by inducing an anaerobic process in enclosed facilities. Landspreading of the organic material without treatment is sometimes performed, with risks of releasing too much or not enough nutrients to the fields. It can also cause harm to plants and people with contaminants and endemic diseases.

The dry waste is the non-organic portion, which can be divided into several fractions for recycling purposes. The most common ones are paper, glass, tin cans and cardboard. In Pune, India, the common number of fractions is 12-14, including several different sorts of paper, plastic and cardboard. According to

Laxmi Naryan it needs to be separated to this degree to be sold (2010). The non-recyclable fraction is called the discards, and is usually disposed of in landfills. Examples of non-recyclables are products made of a mix of different materials such as light bulbs and diapers, and different sorts of plastic and glass products like polystyrene and pyrex.

The waste separation can take place in different stages of the process. In many western countries source separation is performed, because it ensures uncontaminated waste fractions. However, it requires focused and on-going communication campaigns, so that the waste generating citizens know exactly how they should sort and handle the materials. Segregation into wet and dry fractions at source, and further sorting after collection is another model. It works well when the collectors and separators are the same, and have the right to sell the materials for their own benefit. Complete post-collection sorting at separation points is a third labour-intensive model, unfortunately inefficient because of contamination of especially the organic material. Some hazardous materials can easily spoil the whole batch of compost, for example toxic liquids, heavy metals or glass fragments. Compost made from garbage segregated from mixed waste after collection tend to have 4-10 times higher concentrations of toxic contaminants than compost made from source segregated organic waste. The last model that should be avoided for the same reason is having no separation at all, until possible retrieving from the landfill site. The recycling ratio is then very low compared to the other models. (Dulac, 2001, p.16)

"Waste, if just dumped on a landfill site, is a misplaced resource causing further environmental problems" Silke Rothenberger et al

Composting

Composting is the purposeful bio-degradation of organic matter. The process is caused by the metabolism of organic material by microorganisms, mainly bacteria but also fungi. Since composting is an aerobic process, the microorganisms that require oxygen are predominant. Degradation naturally happens everywhere in nature without human interference, but the aim for composting is to recapture the nutrients from the waste. The result is a humus-rich nutritious soil end product



Household garbage can be composted directly in flower pots.

that is useful for cultivation. During the process the volume of the material is reduced by approximately 40%, and hygienic and odour linked problems disappear. The process of composting is dependent on parameters such as the microorganisms, the temperature, the pH, the C/N quote in the raw material, the air supply and the water contents. (Persson, 1996)

The active composting phase lasts about 3-5 weeks in India, depending on the daily waste volume put together. The decomposed waste is to remain in the heaps, boxes or windrows for 4-6 weeks to allow maturing of the compost (Zurbrügg et al, 2004, p.657)

“Degradation naturally happens everywhere in nature without human interference” Karin Persson

There is a users’ manual called *Decentralised Composting for Cities of Low- and Middle Income Countries* (2006) from Eawag/Sandec (The Department of Water and Sanitation in Developing Countries at the Swiss Federal Institute of Aquatic Science and Technology) and an NGO in Bangladesh called Waste Concern (Rothenberger et al, 2006). They can be considered among the most experienced in the field of community-based composting schemes. Financed by the Netherlands

Agency for International Cooperation there was also an Urban Waste Expertise Programme between 1995-2001 that put together their experience in a report called *The Organic Waste Flow in Integrated Sustainable Waste Management, Tools for Decision-makers* (Dulac, 2001). The following important steps for setting up a decentralised composting facility can be deduced from the two users’ manuals:

Decision one: domestic, institutional, industrial or commercial waste?

Apart from the household waste, the origins of organic material can be eg. agriculture, horticulture, livestock, slaughterhouses, food processing, forestry, breweries and the oil industry. It is also possible to add faecal material, latrine and wastewater treatment plant sludges to the compost. Inclusion of these materials bring some more complexities to the composting compared to pure domestic waste, but if strict control is implemented a compost with very high nutrient levels can be obtained.

Decision two: what raw material is accepted?

The carbon/nitrogen ratio needs to be between 25 and 30 for optimal degradation to take place. Kitchen waste normally has a ratio of 15-25 while leaves have 50 and bark 100. Therefore it is important to achieve a good balance of different kinds of garbage. The size of the pieces in the compost also matter, especially for the oxygen supply to the microbes. Air will naturally flow through the pile because the air that is heated up by the microbe activity rises up, and new fresh air blows in to the bottom part of the pile. The condition is that the material is porous enough, which is achieved with structure-giving material such as twigs and leaves. However, large trunks and branches may need to be shredded. If the porosity is good, even and unchanging the compost does not even require turning for aeration.

Decision three: open or enclosed composting?

There are two fundamental types of composting techniques: open composting in heaps or windrows, and enclosed systems in buildings, tanks, boxes, containers or vessels. The open composting is done outdoors with simple equipment and is therefore cheaper and uses less energy, but it requires more space and time. There might be a problem if an uneven precipitation disturbs the moisture contents of the compost. Enclosed

systems are used where there is a need for visual impact mitigation and better control of nuisances and health impacts in the surroundings.

Decision four: design considerations

Before composting begins, some basic decisions have to be made. These include finding a suitable site, configuring it for the purpose, and designing the process based on the maximum volume that the site can handle. A good site is a piece of land that is nearly flat or 2-4% grade, with a good distance from ground or surface water. Additional advantages can be obtained if the areas are close to where the waste is generated, close to the compost users (the market) and easily accessible with vehicles. The composting site is to have three main areas: active composting, maturation and storage. Configuration and size depends on the quantity of materials to be processed.

Community composting in Pune.



“The local conditions strongly influence how the composting facility should work and look like” Silke Rothenberger et al

Decision five: operation and maintenance

Monitoring and troubleshooting are necessary activities, apart from the actual labour placing, turning and removing the compost. It is important to have the necessary equipment such as thermometers and scales, but even more important to have the necessary knowledge or information sources available. Operational safety and health protection should be the priority concern. It is important to have a clear system of responsibility for the different steps in the composting process and maintenance of the facility.

Decision five: use of mature compost

A marketing strategy is preferably established in advance, when the needs of the users can influence the type and quality of the compost product. The aim should be that all compost manure is sold or given away, and none disposed of as waste. Possible clients can be municipal agencies, nurseries, agricultural markets, landscaping companies, housing communities and private persons. It is important to keep in mind that the demand cycles may vary with the seasons, and adequate storage has to be arranged.

Other decisions

Apart from these decisions, there needs to be an accurate economic planning for the composting scheme. The financial plan will make it easier to find support and appear credible. Opportunities and threats should be determined prior to the launching. Stakeholder interest should be mapped out, as well as data collection of the waste generation.

Last but not least, according to the two users' manuals, local experience is always to be followed. The local conditions strongly influence how the composting facility should work and look like. The usage of materials should always be adapted to the local context, without jeopardising the function of each component.



FIELD STUDY

The city of Pune

The waste management system

Garbage to Gardens project organisation

Stakeholder views

Input from other sources

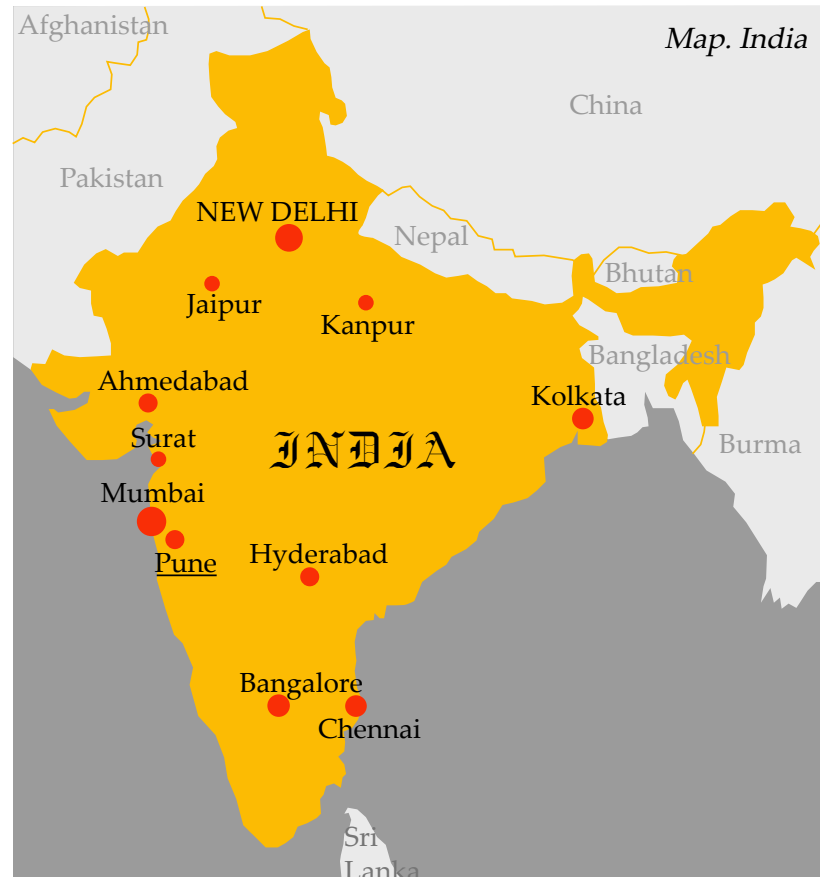
Own observations

Common project objectives

Obstacles and assumptions

THE CITY OF PUNE

In the field study chapter we present the features of the city of Pune, the waste management situation and the reality related to the project Garbage to Gardens. By gathering information and analysing the context we hope to build a foundation that will make the project well adapted to the prevailing situation.



Location and demographics

The city of Pune is located in the mid-west of India, about 160 km inland from Mumbai. It is the eight largest city of India, and the second largest in the state of Maharashtra, after Mumbai. It is the administrative capital of Pune district, and known for its educational facilities. It has nine universities and over 500 other colleges, institutes and schools (PMC, 2008a). It is often referred to as "the Oxford of the east".

The city is growing at a fast rate. In the last 50 years Pune has grown with a decennial rate of 25-65%, from having 600 000 inhabitants in the urban areas in 1961 to 4 200 837 in the most

recent ongoing census (Government of India, 2010-2011). In 2007 the annual growth rate was calculated to 5% according to the Ministry of Home Affairs (PMC, 2007, p.1~4).

The urban agglomeration has grown so fast due to the immigration of labour, especially for the thriving software and automobile sectors. For example, the IT sector grew from about Rs.250 crores to over Rs.6500 crores from 1999 to 2007 (PMC, 2007, p.1~43). Real estate prices have soared and the Pune Municipal Corporation has had many challenges to keep the municipal infrastructure up to date. Pune is said to have the highest per capita income in India, but still around 40% of the population live in slums (PMC 2008b).

Infrastructure

The main infrastructural problems due to population growth are related to public transport, a sufficient and organised road network, water and sewage supply, drainage for the monsoon season and waste management.

Pune has 1000 buses operating 282 routes run by the PMPML (Pune Mahanagar Parivahan Mahamandal Limited) the Indian public transportation company (PMPML, 2008). This is by far less than required, says Baba Shinde, Regional Transport Authority member. Further on he states: "According to [...] statistics, there should be at least 50 buses for a population of one lakh. But in Pune, we have only 1,250 buses in place of the required 2,000 buses" (Gurjar, 2009).

Because of the insufficient public transportation the numbers of two-wheelers are increasing on the roads of Pune, causing a problematic situation in the already polluted city. Jugal Rathi, president of PMP Pravasi Sangh, says: "It is not that people are going for two-wheelers by choice. Actually, they don't have any other option as the frequency of Pune Mahanagar Parivahan Mahamandal Ltd (PMPML) buses is low" (Gurjar, 2009). According to the Regional Transport Office, Pune has no less than around 1,4 million registered two-wheelers (RTO as cited in Kulkarni, 2010). Sujit Patwardhan from Parisar, a civil society organisation working on lobbying and advocacy for

sustainable development in Pune, has a different opinion (2010). He considers humans "slaves of comfort", generally choosing personal comfort before environmental friendliness. In the discussion about developing the road system to manage more traffic he declares: "Trying to solve traffic problems by building more roads is like putting out a fire with gasoline" (Patwardhan, 2010). Actually one cannot claim that he is wrong, as studies made in other parts of the world prove that expanded road systems generate new traffic instead of solving the current situation.

Another issue related to infrastructural difficulties is the unreliable electricity supply. In most of India the electricity grid cannot meet the needs for electricity in the expanding cities. Due to the overload, there are glitches in the electricity supply and the power often remains off for relatively long periods of time. In Pune many public areas like restaurants and malls rely on generators during power cuts, while residential areas may have to wait.

It is not only the electricity grid that is underdeveloped. The same problem goes for the storm water drainage system. Pune has severe floodings all over town during heavy rainfall, due to a drainage system that is dimensioned for a much smaller city with less paved areas and more green space where rain naturally may infiltrate.

The traffic situation in Pune.



Landscape and climate

Pune lies on the leeward side of the mountain ranges known as the Sahyadri Ranges and the Western Ghats. Beneath the mountains is the Deccan plateau. Pune city is situated in the transition zone, which gives it a great diversity of habitats in a small area. The city is founded at the confluence of the Mula and Mutha rivers which are tributaries of the Bhima river.

Pune experiences a tropical wet and dry monsoon climate. Winter months are November-February when the temperature during daytime stays around 22°C but can drop to 5°C at night. March-May are summer months with temperatures up to 40°C. June-October are monsoon months with heavy rainfalls and an average temperature of around 26°C. 87% of the precipitation falls during the monsoon months (NIC District-Pune, 2008).

The vegetation of Pune region belongs to the tropical deciduous zone. This kind of vegetation grows in areas with distinct dry and rainy seasons. Typical for the trees in this zone is the shredding of their leaves during the dry season March to May (NIC District-Pune, 2008). The vegetation in Pune is very substantial and contributes to the pleasant atmosphere both seen from the physical and psychological point of view. A great asset for the city is also the green slopes of Sahyadri mountain ranges, framing the city.

The Sahyadri mountains 30 km southwest of Pune during the dry summer season.

The dry condition during March to May makes the otherwise spectacular green, hilly landscape around Pune go arid and the exuberant greenery turns lifeless and unnoticeable. In the city where a large percentage of the vegetation is planted by man evergreen species are more frequently occurring. Especially the evergreen Banyan tree growing all over Pune is a remarkable specimen which makes the city embedded in greenery and helps neutralise the effect of the dominating traffic.

PMC recognises that the importance of public gardens is growing with urbanisation (PMC, 2007, p.6~1). According to PMC itself they are working extensively on their slogan of 'Green City' (2007, p.6~1) and the urban area of Pune is told to be among the greenest in the country (2007, p.2~1). However, the last years there has been an extensive elimination of greenery because of intense construction due to population growth.

City character

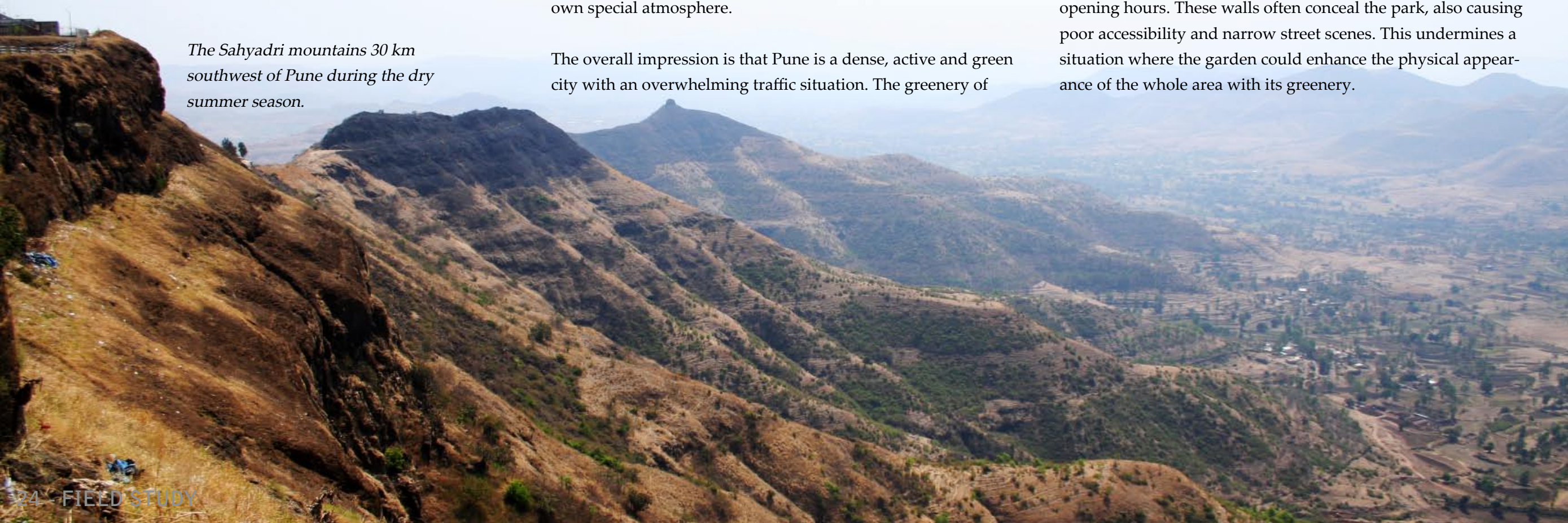
Equally important to the physical qualities of the city is the perceived character and mental impact on the inhabitants. Many features are added together in order to receive the overall impression of a city. In addition to that, a city may have an overall character while separate districts within the city may have their own special atmosphere.

The overall impression is that Pune is a dense, active and green city with an overwhelming traffic situation. The greenery of



The Banyan trees lining the street.

Pune consists mainly of large trees lining the roads. Other than roadside plantations, Pune has numerous gardens, both small local and large public ones. What should be pointed out is the fact that although there is quite a lot of garden space available there are no true natural green spaces preserved within the city. The term garden in Pune almost exclusively refers to ornamental gardens where structure and tidiness are key features. The existing gardens are almost always surrounded by high walls that prevent the public from entering except during the opening hours. These walls often conceal the park, also causing poor accessibility and narrow street scenes. This undermines a situation where the garden could enhance the physical appearance of the whole area with its greenery.



New broad roads burst their way through Pune leaving bare un-humane street scenes behind, where the vehicle is in focus. To many of the citizens of Pune this is an outrage, as Pune has gone from being a city where you reached any place by bike to a city where driving a bicycle often means putting your life at stake. Sujit Patwardhan from Parisar says that “traffic is like a dangling sword” (2010). This statement is, especially in Pune, a reality that has to be dealt with. Sujit Patwardhan is aware of the difficulties with cities depending on an infrastructure where motor vehicles are in focus. Reducing the capacity of the streets on behalf of the pedestrian and bicycle riders is not an option. Instead, research and planning are undertaken by Parisar to enhance and develop new pedestrian lanes and cycle paths in the city. There is also a discussion of increasing the speed control to help reducing the fatal accidents related to traffic. The roads in Pune are in a good shape, and even smaller streets in the outskirts of Pune are paved. The pedestrian lanes on the other hand are in quite a terrible condition. One has to look where to put ones feet to avoid walking into something or stumble. In many cases a sidewalk is not even present.

The extreme traffic is one of the factors that make Pune seem very active to a newcomer’s eye. Another element is the human activity that projects itself in all public spaces. The informal sector is a well-represented group in Pune, visible as hawkers, vendors and waste collectors on the sidewalks. Many small scale businesses share the verge of the streets as their market space. This leads to a very prominent street life, that forms one of the most visible characteristics of Pune.

The high density of people in central Pune puts the environment under high pressure. The short-term threats are the ones noticeable on an everyday basis like for example the air and

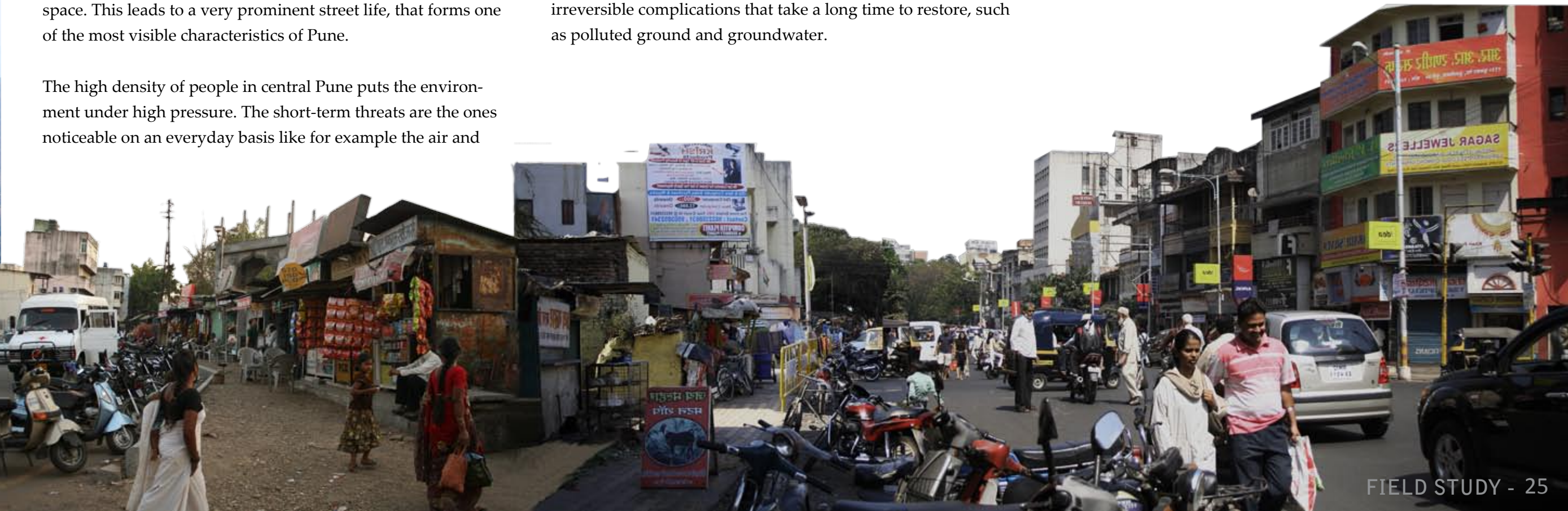


Decorations for festivity in Aundh Gaon, Pune



Vegetable market in Kothrud, Pune.

noise pollution and the continuous removal of vegetation to make space for new constructions. The long-term problems are consequences caused by the immediate effects. These are often irreversible complications that take a long time to restore, such as polluted ground and groundwater.



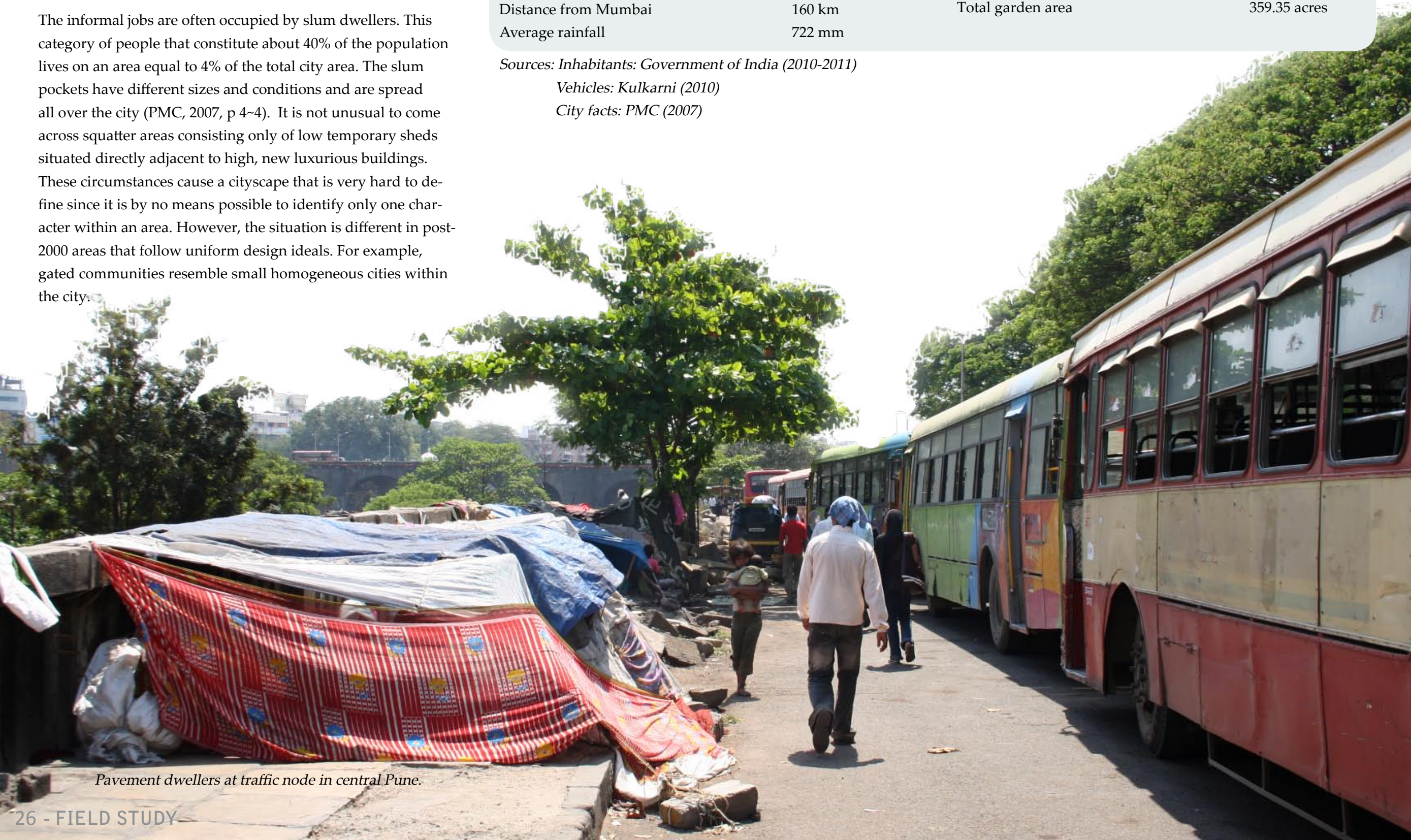
At first sight the city has a very clean appearance despite the abundant amounts of waste generated. While taking a closer look it is evident that there is a lot of informal work going on outside the range of the eye, work that plays an important role for the experienced tidiness. The ragpickers pick up the pieces of waste where the municipal corporation fails to keep up a satisfactory service. Though, the discards that are never collected have a tendency to agglomerate, confirming the expression “waste generates waste”. Abandoned and/or forgotten pieces of land often become local dumping sites and overfull, unattended containers often stand in piles of garbage.

The informal jobs are often occupied by slum dwellers. This category of people that constitute about 40% of the population lives on an area equal to 4% of the total city area. The slum pockets have different sizes and conditions and are spread all over the city (PMC, 2007, p 4~4). It is not unusual to come across squatter areas consisting only of low temporary sheds situated directly adjacent to high, new luxurious buildings. These circumstances cause a cityscape that is very hard to define since it is by no means possible to identify only one character within an area. However, the situation is different in post-2000 areas that follow uniform design ideals. For example, gated communities resemble small homogeneous cities within the city.

City profile of Pune

Total area	243.84 sq km	Number of administrative wards	14
Inhabitants	Approx. 4,2 million	Number of vehicles	1 891 929
Population density (2001)	10 412 / sq km	Number of two wheelers	1 410 821
Number of slum pockets	503	Number of cars and jeeps	280 371
Percentage of people living in slums (2001)	Approx. 40 %	Number of autorickshaws and others	200 737
Adult literacy rate	77%	Generated daily solid waste	Approx. 1000 ton
Infant mortality rate	57 per 1000 infants	Per capita daily waste generation	450g
		Treated waste water	78%
Altitude above sea level	559 m		
Distance from Mumbai	160 km	Total garden area	359.35 acres
Average rainfall	722 mm		

Sources: *Inhabitants: Government of India (2010-2011)*
Vehicles: Kulkarni (2010)
City facts: PMC (2007)

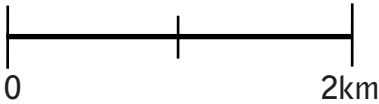


Pavement dwellers at traffic node in central Pune.



THE WARDS OF PUNE

- 1 Aundh
- 2 Karve Road
- 3 Ghole Road
- 4 Warje Karve Nagar
- 5 Tilak Road
- 6 Dhankwadi
- 7 Bibwewadi
- 8 Sahakar Nagar
- 9 Kasba VishramBagWada
- 10 Wada peth
- 11 BS Dhole Patil Road
- 12 Hadapsar
- 13 Yerwada
- 14 Sangamwadi



THE WASTE MANAGEMENT SYSTEM

Administrative structures

The State Law of India states in the *Municipal Solid Waste Management and Handling Rules 2000* that the municipalities are obliged to take care of the municipal waste (Ministry of Environments and Forests, 2000). These rules regulate how the waste collection, transport and disposal are to be conducted in a sanitary and safe way. Unfortunately the available resources are scarce, and very few measures have been taken to follow these rules.

At Pune Municipal Corporation there is a work structure for handling the SWM logistics. The city of Pune is divided into five zones, with a total of 14 wards. The wards consist of different numbers of electoral wards, in total 244. Among other officers, each ward has a medical officer who is in charge of several DSI:s (deputy sanitary inspectors). The DSI:s are controlling the waste management in two electoral wards each. These municipal officers are to make sure that the garbage is handled in the way that the state laws prescribe, and coordinate the waste management workforce.

Garbage container in Koregaon Park, Pune.



According to the mentioned law from the year 2000, all post-2000 residential constructions in Pune are obliged to have composting pits in the house compounds. Unfortunately many of the planned composting pits today remain unused and forgotten. Today around 7 tons of organic waste is composted by PMC, while several times more remains uncomposted. In the Environment Status report (PMC, 2007, p.12~6) it can be read that according to the law, all the citizens are directed to segregate the garbage at its source as the 1st of July 2005 was the last date of accepting non-segregated waste from the residents for collection. However, source segregation is still an exception rather than the common way. The law proposes education as a necessary means to enable composting and segregation. PMC has some educational outreach programs, but the largest educational effect is achieved by NGO:s trying to change the mindset of the Puneites with creative campaigns.

The municipal solid waste collection and treatment

A large city like Pune naturally generates great amounts of waste. Currently the municipality takes care of about 900-1000 tons of waste daily with a force of 2800 employees. The garbage is collected from yellow containers with the help of about 250 vehicles. The containers with unsorted material reach one of the seven transfer stations where the garbage awaits further transport to the landfill area Uruli Devachi 20 km outside of Pune. Uruli Devachi is not a true landfill by the definition of the word, but a dump. The nearby village of Uruli Devachi has recently had severe problems with pollution caused by leak water and complications related to long lasting fire outbreaks at the dump. In addition to the most critical issues, the citizens struggle daily with odours from the dump and heavy traffic passing through the village. Because of the many complaints from the people together with the undeniable fact that the



Transit station in Kothrud

dump soon is going to be unable to accommodate more waste, PMC has decided to take action. The municipality wants to decrease the amount of waste going to Uruli Devachi through waste segregation and composting. The recyclables extracted in the process could then be sold further in scrap shops without ever reaching the dump. The segregation and composting of the wet waste would make a huge difference in the proportion of waste going to the landfill area since the wet waste accounts for 78 % of the waste generated in Pune. To be able to go through with these changes, the municipality needs help from resources outside the municipal sector.

The informal sector

In some places the municipality does not take care of the waste despite the law, and wastepickers step in to collect the waste. Since the municipality still is the authority responsible for the garbage management, there is an agreement between the informal sector ragpickers and the PMC that implies that PMC will provide them with equipment and facilities as stated in the *Municipal Solid Waste Management and Handling Rules 2000*. In this way the informal work is integrated in the municipal scheme to fulfill the law without municipal involvement.

The waste collectors belong to the informal sector and constitute almost 1% of the population. The ragpickers are mostly refugee women that have had to leave their home regions because of droughts, floods or other natural hazards. The ragpickers almost always belong to the dalits which is the caste formerly referred to as “the untouchables”. These people are the poorest of the poor. This is a category of people that never

have had the opportunity to find a formal occupation, forced to do the jobs rejected by others. The ragpickers often live in the outskirts of slums or in separate slums close to their work range.

In Pune in 1993 the trade union KKPKP (Kagad Kach Patra Kashtakari Panchayat) was formed, consisting of ragpickers. They assembled to start a fight for improved social recognition in the society. SWaCH (Solid Waste Collection and Handling, a ragpicker cooperative) first came into existence in 2007 as a result of a pilot project launched by the KKPKP focusing on the ragpickers becoming service providers. Laxmi Narayan who is one of the founders of SWaCH says that turning the informal work force into an organised cooperative with more security and recognition will help the ragpickers become part of the society (2010). She points out that “ragpickers benefit all, but are recognised by no one” which also is a fact that this initiative strives to change.

The pilot project aimed to bridge the gap between the households and the municipal collection service. The ragpickers offered the residents door to door collection of the waste for a reasonable price. The initiative has led to a cooperative that today has as much as approximately 1630 employees (around one third of the ragpickers in Pune) that together serve 230000 households in Pune. (Narayan, 2010)

Today the ragpickers collect the waste either from the doorstep of the households or receive it from containers in the vicinity. They then separate the recyclables from the non-recyclables. The aim is that the waste collected by the waste collectors never will have to enter the municipal solid waste chain. The



Scrap shops outside Uruli Devachi.

ragpickers, almost exclusively women, work in pairs of two where each pair serves about 500 households a day. For each household the collection fee is 10 rupees/month or 5 rupees/month for slum dwellers. This gives the ragpickers a monthly salary of around 2500 rupees. The salary excludes the income from the separated and sold dry recyclables that the ragpickers also gain. The recyclables are separated into 12-14 types of dry waste. This sorted waste is then sold to retailers at scrap shops that pass them forward to stockists and wholesalers before they reach recycling facilities that are often located in the larger cities like Mumbai and Delhi. The prices for these recyclables are very low, which makes longer transports non-viable.

“ragpickers benefit all, but are recognised by no one” Laxmi Narayan

The landfill of Uruli Devachi.



The head office of SWaCH has a staff of seven people and is situated in Kothrud. In addition, they have ward coordinators in each of the 14 wards, and supervisors that coordinate the work in 1-2 electoral wards. The ideal number of ragpickers to be working in every ward is 20-25. These people can collect garbage from about 4000 households. Although SWaCH has personnel in all the wards of Pune they do not cover all areas. The cooperative is non-governmental but accesses municipal funding. PMC finances the salaries of the office staff and the equipment for the ragpickers. The equipment should according to the law constitute of pushcarts, clothes, protective gloves and masks. The reality among the SWaCH ragpickers is that they have got some pushcarts, although many also carry the waste on their heads. The other equipment is lacking in most cases.

SWaCH strives towards improving the work conditions for the ragpickers in terms of health and safety. They aim at providing the collectors with new, hygienic facilities throughout Pune where they can perform their work undisturbed and without a risk of having their separated recyclables stolen. They also wish for the workers to have proper equipment and work gear to avoid unnecessary injuries and health risks.

SWaCH ragpicker doing her daily work.



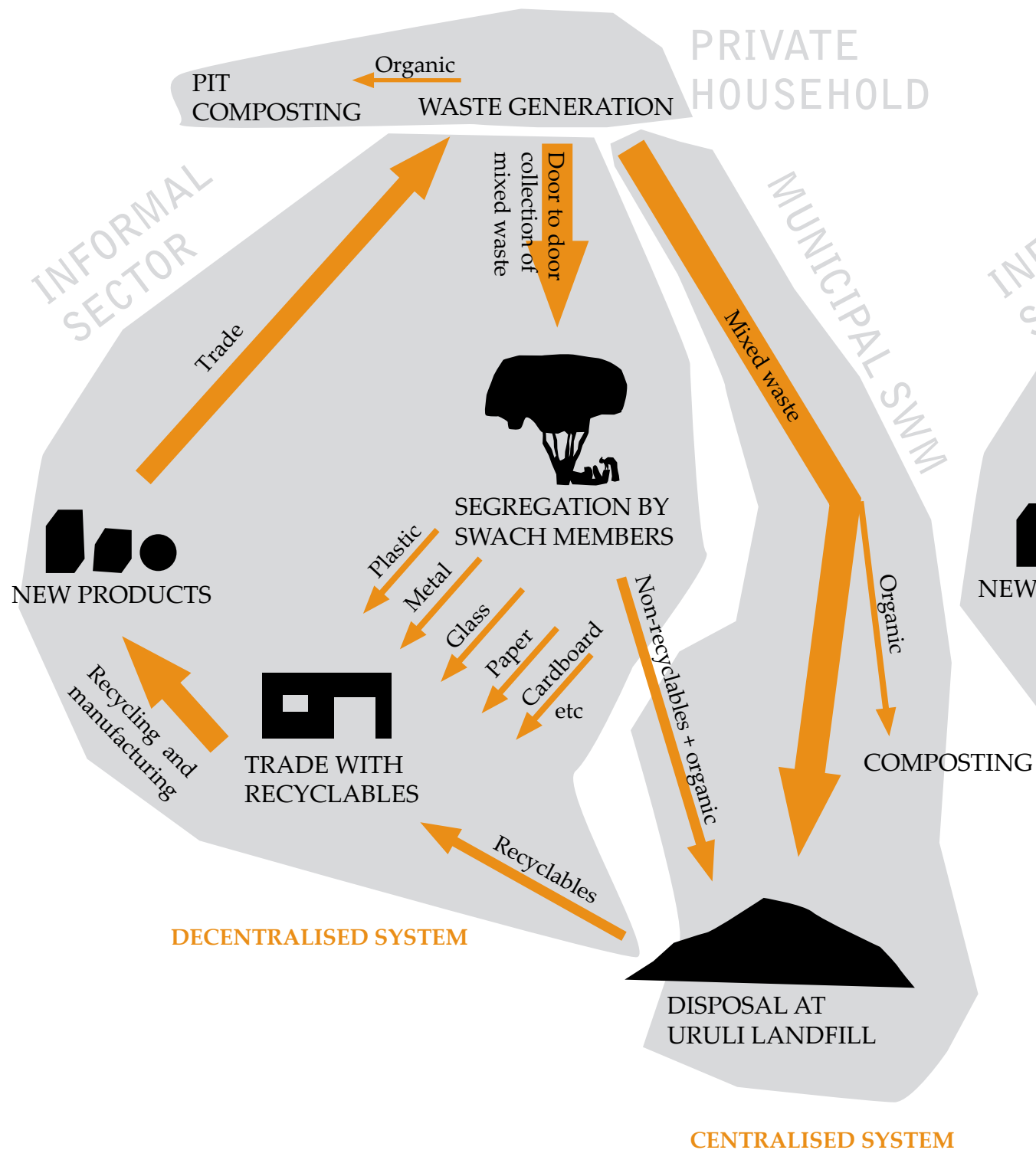
The advantages with a system like this are many. The decentralisation makes it profitable (no transport costs) and environmentally sound. It is a low cost solution; it is energy efficient and labour friendly. On the same time, it leads to high resource recovery and is economically sustainable. Although the system is working, it has improvement potential. Hard working staff within the cooperative struggle daily for achieving better work conditions and more recognition for employed ragpickers. This is done through exhibitions, demonstrations and information folders. Minimising container segregation is an important aim. If households would perform their own segregation of the waste, the risks of injuries related to container segregation could be reduced dramatically.

Although a lot of things still need to be improved the main objectives of the ragpicker initiative is partly fulfilled. This is the aim to award the collectors with social recognition, access to credit; access to educational scholarships for their children; medical and life insurance; increased bargaining power; recognition in the communities and an opportunity to upgrade their livelihoods. Through SWaCH the ragpickers have a steady income and the opportunity to secure the future of their children.

Contrasts in life standard visible in sorting areas.



THE CURRENT SOLID WASTE CYCLE



THE DESIRED SOLID WASTE CYCLE

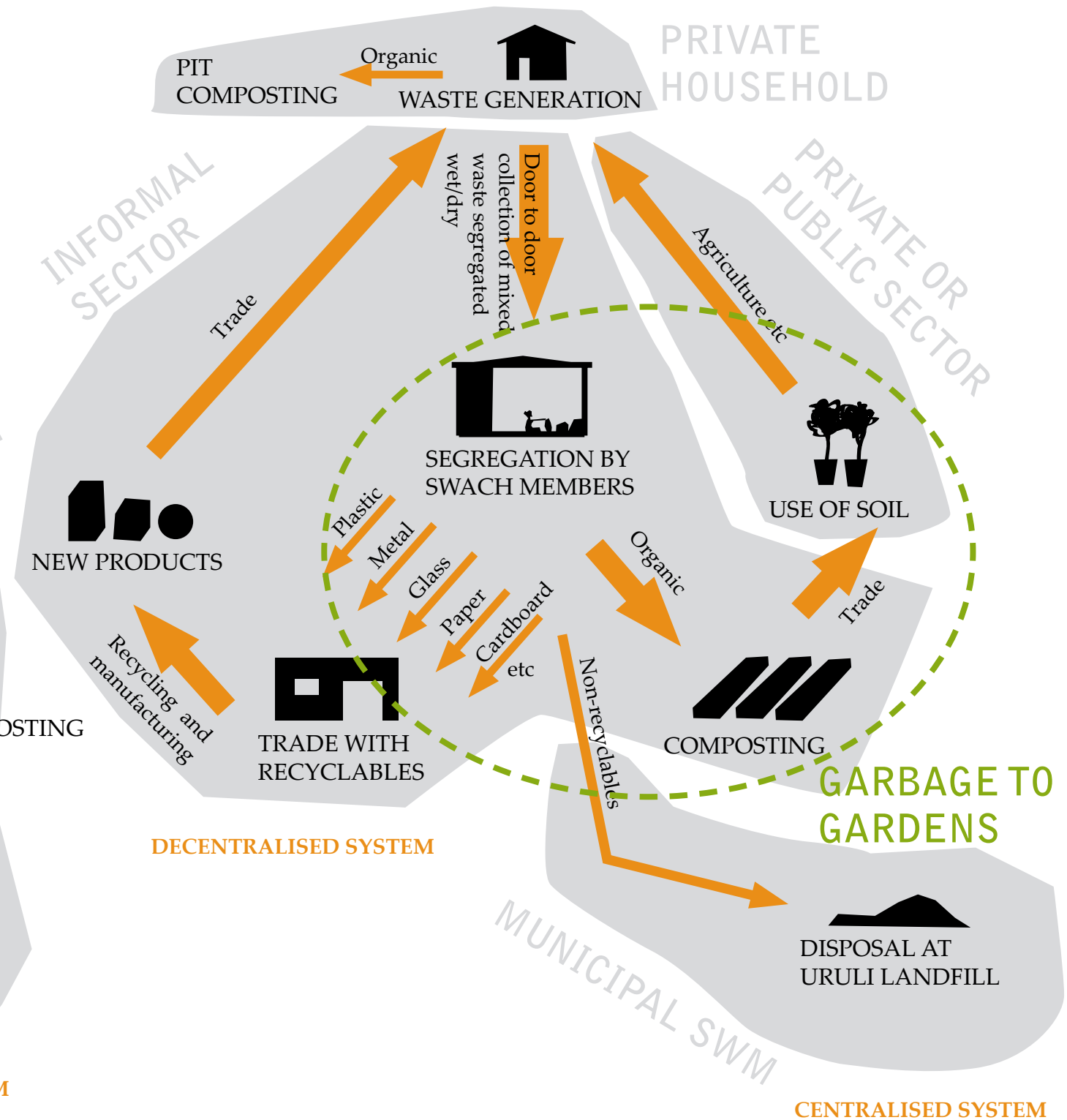


Figure.

These “before and after” scenarios show the core changes that the project Garbage to Gardens aims at in the areas concerned. The ragpickers will have better work conditions, and more waste will be recycled. The ragpickers will conduct composting to complement the household schemes and the little that is currently done within the municipal SMW. The end result is that

the rate of recycling is augmented significantly and the amount of waste disposed at Uruli Devachi landfill is restrained to only the non-recyclables. The economic profits concern the ragpickers that can separate garbage more efficiently and gain from the composting, but also the PMC that avoids transports and disposal costs. The environment gains from a more

complete recycling chain that reduces the need of manufacture of new products, as well as less pollution in connection to disposal. If this model was followed all over Pune, PMC would also avoid protests and credence problems as the residents close to Uruli Devachi would not have to witness further large scale environmental degradation.

GARBAGE TO GARDENS PROJECT ORGANISATION

Project initiative

The Garbage to Gardens project started off in 2009. There was a collaboration between students from the “Global Social Entrepreneurship” course at Yale School of Management and Centre for Environment Education in Pune. CEE was familiar with the work and needs of the SWaCH cooperative, and therefore challenged the Yale team to evaluate the feasibility of decentralised composting in Pune. Of particular importance was how to engage the residents to be more involved and informed in neighbourhood composting programs that incorporated garden space - thus the project name Garbage to Gardens.

The Yale students produced a report about the financial and administrative aspects of a composting project. In dialogue with SWaCH it was later noted that compost facilities are well suited to be placed near the existing sorting points, as the composting is to be performed by the same workers. It was recognised that the sorting points also needed improved facilities. Thus, the Garbage to Gardens project grew to incorporate both the sorting of the waste and the composting.

When we contacted CEE, they saw us as a good opportunity to go forward with the project, more specifically designing the physical outcome. SWaCH and CEE decided on two areas in Pune where a scheme like this was needed, and where the prerequisites seemed to be the right ones for it to work. These areas are called Anand Park and Kothrud Waste Depot, and will be presented in the proposal chapter.

Decision-makers

It is of utter importance for the project success that the units meet the needs of the ragpickers. Therefore, SWaCH has been our main source of feedback regarding the design aspects.

The PMC decides on land use and building permits, enforcing the legislative rules. Since it is also one of the financiers, PMC has the authority of the main decision-maker of the project.

Target group

The direct target group affected by the project is the SWaCH ragpickers. They can expect better facilities, which leads to better opportunities to stay healthy and obtain a higher income. In meetings about the project, the workers are usually represented by the administrative staff employed at the SWaCH head office.

Indirectly the residents of the areas concerned are also beneficiaries. Their environment will get less polluted and more beautiful, and their recreational opportunities will increase leading to better health.

Financers

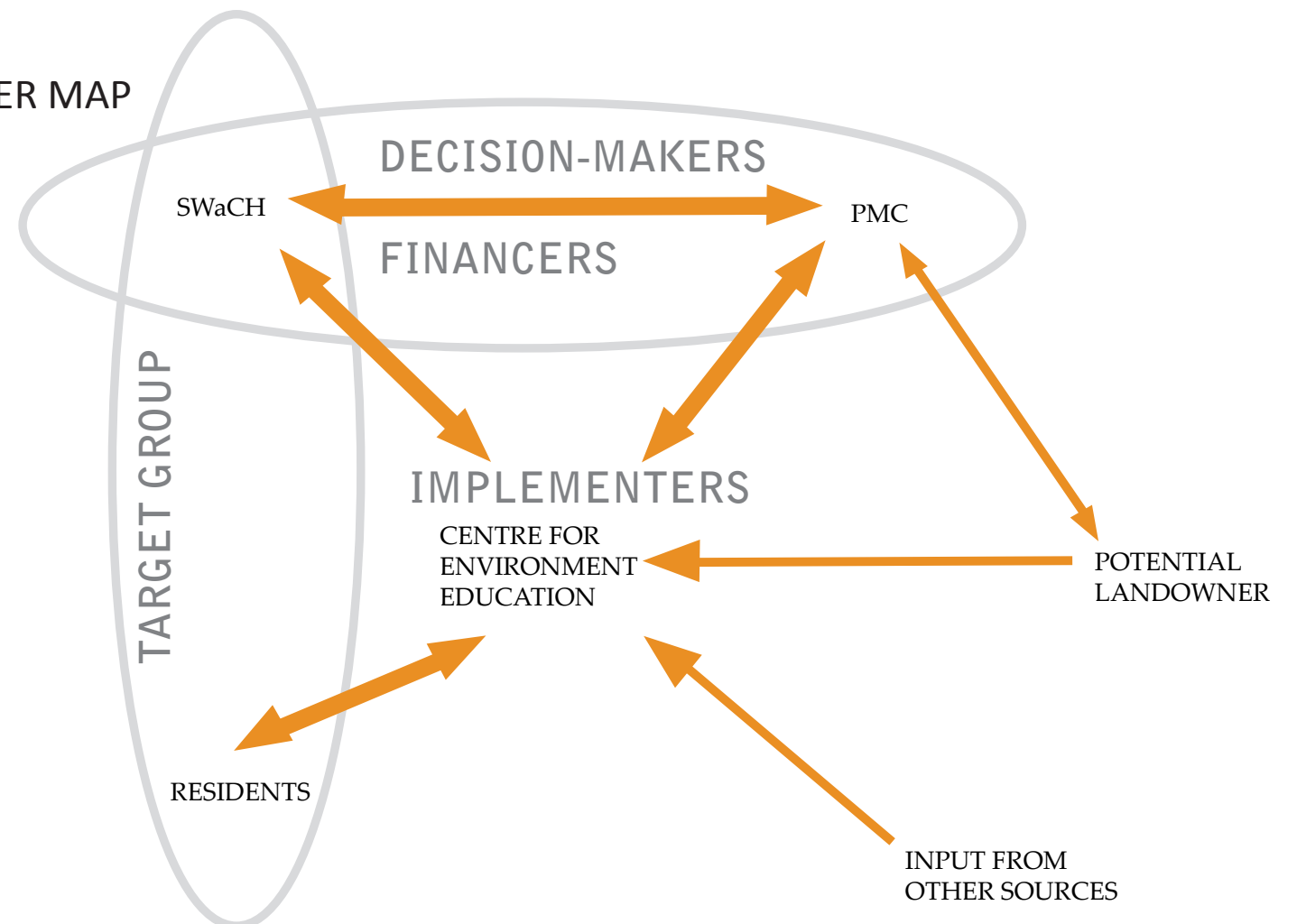
PMC will partly finance the construction of the waste management units. The remaining needed funds will be raised by SWaCH.

Implementers

Centre for Environment Education, CEE, is a national institution engaged in developing programmes and material to increase awareness about the environment and sustainable development. The organisation is spread over most of India, with 40 offices and 380 employees. It was founded in 1984 as the result of a unique partnership between the government and a non-governmental institution. It can be described as an NGO supported by the Ministry of Environment and Forests, Government of India.

CEE has the expertise in management of projects such as Garbage to Gardens. Their role in the project is not a stakeholder expecting own gain, but rather an intermediary hired to pull the strings. Formally we were interns at CEE during our stay in India, which made us consultant intermediaries.

STAKEHOLDER MAP



STAKEHOLDER VIEWS

SWaCH ragpickers

The SWaCH ragpickers are eager to have better facilities that suit their work. They are in regular contact with the administrative staff that represents them at project meetings. The ragpickers also attend some meetings themselves, for example to discuss the physical design of the work space.

Pune Municipal Corporation

The principal aim for PMC ward offices is to follow the legislation, in the economically most profitable way. PMC favours decentralised waste management solutions because of the cost reduction and smaller discards it leads to. In Anand Park Deputy Sanitary Inspector Dr Joshi has a great environmental awareness and puts effort in pursuing clean healthy neighbourhoods where the residents thrive.

Landowner

In Kothrud the PMC has donated part of the former landfill to SWaCH for the purpose of a waste management unit. Thus, there is consent from the landowner.

In Anand Park there is no free land owned by PMC, which means that private land needs to be used. Currently, it is still unclear who legally owns the lot proposed. If the Anand Park Residential Association manages to claim the ownership through the on-going court case, they will give their consent to the project. If the court favours Mr Sangwi who also claims to own the plot, the outcome might be different. He recognises the high land value and might want to construct buildings on the lot. He might also support the Garbage to Gardens project as it beautifies the area making the land more valuable without his economic input.

Residents

Residents generally do not recognise the problem issue of waste at all. Waste is often regarded as something filthy that is discarded from the household and should preferably be transferred out of sight as fast as possible. Often good waste management is requested, but on someone else's premises.

Though, some of the people we got to know has a totally different attitude. In Anand Park some residents have household composts on their own balconies. Mr and Mrs Bhagwat are examples of these driving spirits, who have also initiated community composting schemes. They are engaged in recycling projects, and are known as "the compost family" within their housing society. The Bhagwat family is actively trying to enlighten people of the issues of recycling and composting, and told us a lot about the resistance towards waste amongst people. Their view is that this resistance is often caused by misunderstandings and incorrect interpretations of waste issues.

Another key person in this project that we had the pleasure to meet is Mr Paranjape, the president of the Anand Park Residential Association. Mr Paranjape is also supportive of the idea of constructing decentralised composting units in the community although he is not very familiar with the topic. Having Mr Paranjape's consent is important, especially as he might impact other residents with his support of the project.

Centre for Environment Education

The main focus of CEE is to raise the environmental awareness among people, and support an environmentally sustainable society. As the intermediary consult it is naturally also important to succeed in the project to improve their reputation further.

*The result of household
composting in Pune.
Flowers planted in compost soil*



INPUT FROM OTHER SOURCES

Resource persons and offices

Inora

Inora is an institute established in 1992. The main activities within the institute are research, development and promotion of organic farm management, composting, treatment and recycling. Inora provides training programs and customised solutions for composting units within Pune. Currently there are over 40 communities that use the Inora vermicomposting method on their grounds.

We visited the Inora office and obtained information on composting solutions for different levels. They showed us a presentation with different examples. They also took us to some successful community-scale composting facilities in Kothrud. We were given guidelines for our plans: technical as well as architectural.

Oikos

Oikos is an independent practice specialised in ecology issues in the planning process. Their key concern is conservation, which they work with through undertaking various assignments related to eco-management, wildlife habitat restoration and eco-tourism development. The company is run by two diploma graduates in 'Sustainable Development of Natural Resources & Conservation'. Oikos works in close collaboration with landscape architects and field experts in plants, birds and insects.

Oikos has developed a digital library of the native plants of Maharashtra. This cd was an irreplaceable help in our endeavour to choose ecologically friendly plants for the units.

Sourabh Phadke

Sourabh Phadke is an architect from Pune specialised in eco-friendly constructions. This often means constructions with recycled materials such as discarded plastic bottles and paving components. Mr Phadke has launched numerous innovative construction projects around Pune. An example is the Aman Setu school that was built partly using earthbagging technique and a junk shed built from old worn out tires and plastic bottles. One of his greatest achievements is the development of a sanitation system where toilets made from bricks help village residents to reuse the sewage waste for agricultural purposes. Mr Phadke is also involved in other activities like teaching school children and village people eco-friendly infrastructure. In an article in Indian Express Phadke says that "the whole idea is to change ideologies. We have a natural tendency to complicate things" (Kulkarni, 2009).

Mr Phadke has helped us through repeated mail contact giving us tips of construction materials that can be used and guidelines for construction techniques. This has been of much help since we are new on the subject.

Students of landscape architecture

BNCA, Bhanuben Nanavati College of Architecture is an affiliation of the University of Pune, only for women. We were fortunate to get the chance of attending a one week architecture workshop during our stay in Pune. At the institute we also got to meet the landscape architects from the fourth grade and see their ongoing assignments.

One of the teachers also put us in contact with landscape architecture student called Rashmi Sonawane who is conducting a project remarkably similar to Garbage to Gardens as her master's thesis project. Mrs Sonawane was a much appreciated source of information during the whole process in India. It was priceless to exchange thoughts and ideas with someone within our own profession who knows our procedure as well as the local circumstances.

"The whole idea is to change ideologies. We have a natural tendency to complicate things" Sourabh Phadke

OWN OBSERVATIONS



Hanging gardens, Mumbai.



Shanivar Wada, Pune.



Private garden, Pune.

Indian park design ideals

Design ideals vary among people as well as among nations. As we are educated in landscape architecture in Sweden, we have a specific sense of what is considered more or less attractive based on the Swedish ideals. The result is designs where we combine these learned design ideals with our own personal taste and the needs of the client.

To establish what features represent beauty in the Indian context and what kind of functions can successfully be provided in the parks, we used a strategy based on own observations, internet research and dialogue.

Based on these efforts we established a few key characteristics of Indian gardens:

- Strict lines – pathways of stone paving and/or bare soil, trimmed bushes and hedges
- Open lawns – preferably green grass that you can sit on
- Monocultures – large areas with only one species of flowering annuals, bushes, grass or perennials
- Shading – large trees that provide places to sit away from the sun
- Ornaments – statues and fountains made from stone, temples, trimmed bushes
- Exotic plants – rich with flowers and aroma

There have been elaborate gardens in India for thousands of years. The Hindu gardens often contained baths, lotus-covered pools, flowerbeds and sacred trees. However, many western influences reached India through the centuries, among others through the invasion of Alexander the Great and later the Mughals who introduced the Islamic gardens. And perhaps most importantly, the British colonisation of India in the mid-19th century brought a whole set of new garden design ideals. We believe that although the observed characteristics contain traces of precedent ideals, most of them are clearly remnants of India's colonial past.

We visited public parks and gardens as well as private gardens. In Pune we saw the Empress Gardens, Agakhan Palace, Shanivar Wada, Rotary Club park in Koreagon Park, and private gardens. In Mumbai we visited Hanging Gardens (Pherozechah Metha Gardens) and Kamala Nehru Park among other public places.

Our conclusions

We recognise every country's different style as a beautiful indicator of human and ecological diversity. However, we will try to present alternative solutions to some of the popular elements of the Indian garden in the cases where they stand for a non-humane or unecological approach.

Also, we believe that functions often attract more people than the beauty itself. Our desire is to create varied design proposals with a multifunctional aspect to them, sprung from our opposition towards gardens and parks that focus on the beauty aspects but lack basic functions.

Ecology is another aspect that we regard as important in our design work. Monocultures are frequently used for vast parts of the gardens in India, although they undermine the biological diversity and may lead to the extinction of certain species that naturally inhabit the area. Especially large, low cut lawns pronounce a threat because they never allow other species to invade. Furthermore they require brute amounts of water. Unfortunately these kinds of lawns are very popular and hence frequently used in both public and private gardens. However, there is an alternative to these lawns: an ecological lawn consisting of two perennials that require less water and maintenance than the traditional grass lawn. The appearance and use of these alternative green spaces is similar to the lawn but the ecological and economical features are widely improved.

Our wish is to create interesting places with the tools of vegetation and other landscape elements. It is therefore important to use a variety of plants with beautiful flowers and foliage. Although, we have decided to use as few exotic plants and trees as possible because of their negative impact on the ecol-

ogy. Many of the exotic plants do not have their natural habitat in Pune and therefore pose a threat against the native plants. The exotics often outgrow the native ones and suffocate them with their strong vitality, weakening the biodiversity.

Social spaces

We experienced that there is a difference in Pune between places that are designed specifically for social gatherings and spontaneous public spaces within the city.

The intentionally designed parks and gardens are often open a few hours in the morning and afternoon, and closed during daytime. This controlled manner leads to a habit of more planned garden visits and less short spontaneous stops. Whole families often make trips to these parks especially in weekends to have picnics and socialise. People are often seen sitting on open lawns talking or practising sports. The parks are sometimes also used for outdoor studying. There are usually regulations on what kind of people may enter the parks. We suspect that parks and gardens are often designed for and used by the wealthier part of the society, while the poor population is kept outside. Apart from parks or green areas, there are very few planned and assigned public spaces in Pune. Squares used only for social purposes without markets and vending activities are

rarely seen. However, there is naturally a social aspect connected also to trade, as markets offer a place for meeting old acquaintances or establishing new contacts.

In our perception all open spaces within the city can be seen more or less as spontaneous public social space because of the never-ending activity caused by the population density. There are very few open spaces that are free from people and activity. The main public space is the street and the free side space in connection to it. The activities that are seen here are mainly related to business activities of different kinds, but social gatherings among friends also take place. For many of the poor, we think that the limit between public and private space is somewhat blurred. Street hawkers reside on sidewalks, roundabouts or any other available space. Mentally this makes the public areas turn private, although everyone is aware that the areas have a public nature. In higher income-groups people seem to take pride in owning own private space, hence the own home is seen as the main place for socialising among middle and high class Puneites.

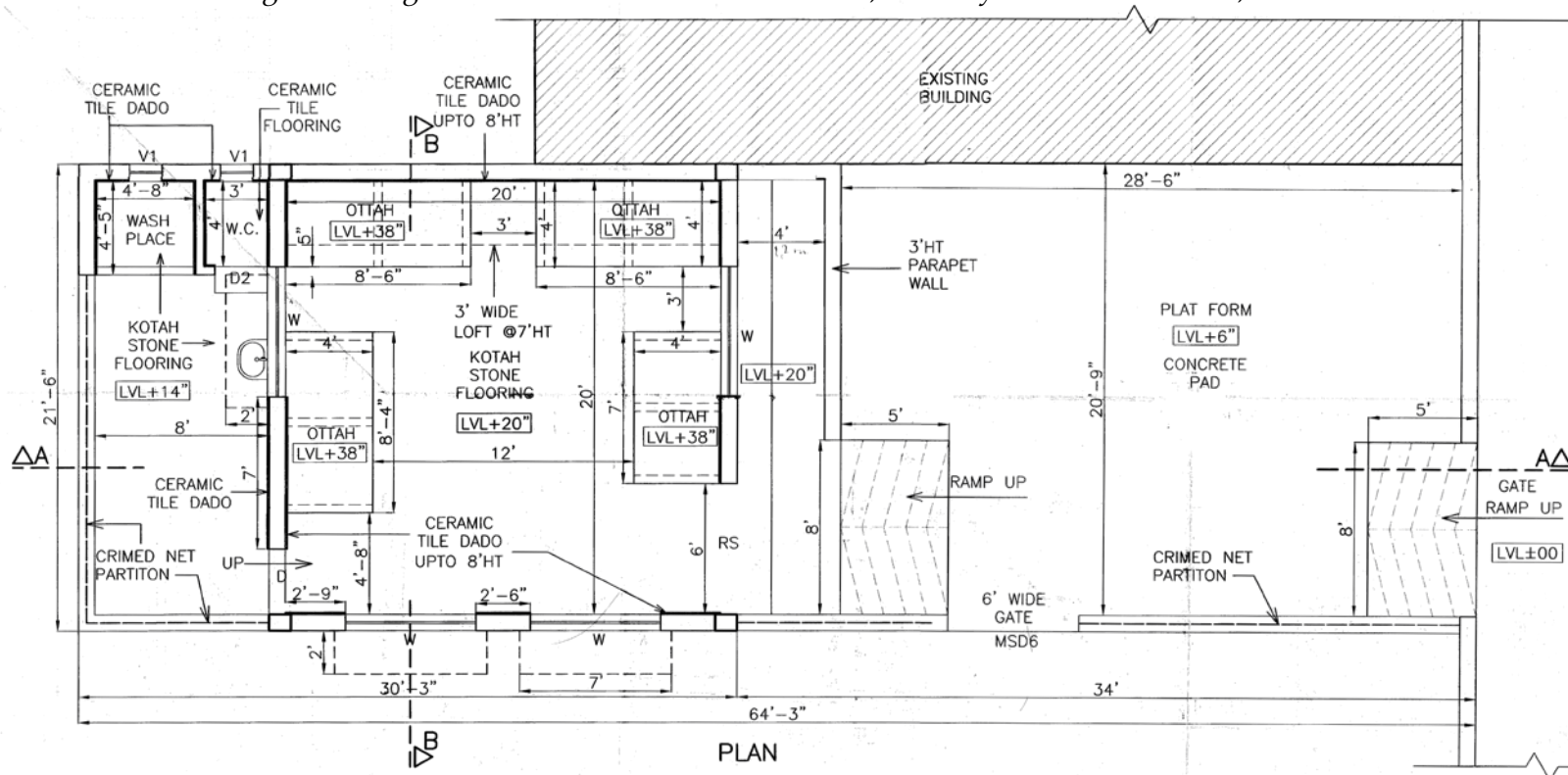
Sorting facility examples in Pune

We had the chance to visit a facility with a sorting shed for SWaCH wastepickers in the Aundh district, at the National

Chemical Laboratory (NCL). The sorting shed has a concrete platform covered by a roof and is surrounded by a low concrete wall. The shed is situated behind the walls of the NCL complex, thus no additional lockable storage spaces are provided. The separated waste is placed on the platform together with the unsorted waste. The sorting facility is combined with a composting shed where composting of the biodegradable waste takes place in small boxes on a shelf system. The material is first processed in a shredder and then put in the boxes that ensure a steady air and water supply.

We also got acquainted with the proposed plans for a new sorting shed in Pune that has been designed by Tata Motors LTD in collaboration with ragpickers from SWaCH. The location for the proposed sorting shed is Swachha Sanstha near PMC Ward Office in Aundh. The facility is going to contain a platform for dumping the waste, as well as a roofed building for sorting. Since the wastepickers oppose to having ordinary tables as they are used to sort the waste directly on the ground, the tables in the plan are only 46 cm high. There are also sanitary facilities such as a toilet and a wash place. The whole facility will be enclosed by a concrete wall with a fence on top, altogether a total height of 2,1 meter. The total area of the sorting shed is 130 sq m. We predict the facility to be solid and spacious.

Technical drawing for sorting shed at Swachha Sanstha in Aundh, made by TATA Motors LTD, Pune



NCL sorting shed in Aundh, Pune



Community composting sites in Pune

To gain an understanding of how community composting facilities can look like and function in the local context of Pune, we visited two communities in Kothrud that Inora has provided with technical composting solutions and designs. We also saw two communities in Pashan that the Aundh Ward Office has supported.

At all the sites they have used concrete compost tanks because they secure an efficient use of space as well as a fast composting. The amounts of waste from whole communities make it ineffective to use pots or smaller containers. All tanks are around 1 m wide, to ensure a good air supply to the microbes as well as an ergonomic work position for the compost workers. Some of the tanks are lowered into the ground and some placed on the ground. All facilities except Gajanan Housing Society have plastic roofs for protection.

At Gajanan Housing Society the compost tanks run along a wall. They melt in with the surroundings very well, providing an aesthetical framing to the garden of the society. In Silver Spring Society the composting tanks are also treated like a garden element, placed visibly on the common grounds. At Woodland Harmony Avenue the composting tanks are placed aside, in a part that appears to have been an unused spot before. The intention is to surround the tanks with greenery. At Anusha Residency the approach towards the compost is different, as it is dug down beside the car parking and therefore almost invisible.

At all sites the communities have employed devoted people that are responsible for the compost work. They collect the organic waste, put it in the tanks that in all cases follow a week system with one tank for each day, remove the mature manure, and maintain the good condition of the facilities.

Gajanan Housing Society B complex, Kothrud



Woodland Harmony Avenue, Kothrud



Silver Spring Society Panchavti, Pashan, Aundh



Anusha Residency, Pashan, Aundh



COMMON PROJECT OBJECTIVES

Based on all the information in this chapter, we have formulated project objectives that are common for both of the sites where we are conducting the project:

The project aim is to **MINIMISE THE DISCARDS** of waste that go to the landfill in Pune. The aim is also to increase the awareness among residents on the importance of limiting the use of natural recourses and raise the **KNOWLEDGE** level on recycling and waste management. Emphasis is also directed on improving the **WORK CONDITIONS** for the ragpickers with functional and robust **FACILITIES**.

- MINIMISE THE DISCARDS** - the project is to
- minimise the amount of waste that goes to Uruli Devachi landfill
 - create possibilities to separate and temporarily dispose 14 types of recyclables

- KNOWLEDGE** - the project is to
- raise the awareness on waste management
 - point out the potential use of recycled material in constructions
 - show the importance of the use of native plants

- WORK CONDITIONS** - the project is to
- improve the functional, ergonomic and hygienic conditions
 - enhance the security by providing an opportunity to lock away separated recyclables during night time
 - provide facilities suitable to be operated by SWaCH members

- FACILITIES** - the project is to
- welcome visionary and cost effective proposals
 - suggest environmentally friendly construction materials
 - propose roofs to protect both sorting and compost areas from heavy rains and sunshine



PMC transit station, Kothrud.

OBSTACLES AND ASSUMPTIONS

Regardless of preparations, one will always encounter obstacles while carrying out a project. The main obstacle is often lack of information in all kinds of situations. To overcome the information gap it is sometimes necessary to make assumptions to be able to continue the project.

We have identified the main obstacles for our project and listed the cases of necessary assumptions. By doing so, we are trying to counteract the impacts they could have if not recognised. Although, some of the assumptions may be sources of error, especially communication flaws and gaps in information.

Table. Identified obstacles and concluded assumptions under which we presume that the project can be carried out

CULTURAL OBSTACLE	ASSUMPTION
Cultural gaps and differences, especially noticeable in work related situations	
Difficulties associated with us being foreigners in an unfamiliar country	
Language gaps, information getting lost in translation	
KNOWLEDGE GAP OBSTACLE	ASSUMPTION
Climate and vegetation, whole new assortment	
Lack of knowledge of the Indian design ideals and how these can be incorporated in our design	Examples seen throughout our stay in India are accurate
We have never seen a full scale decentralised compost- and sorting unit this size in real life	Size and proportions similar to the ones of the technical drawing for Swachha Sanstha and literature examples will work
Second person information	Our contact persons provides us with the correct and sufficient information
No previous experience of constructions with garbage	
PROJECT RELATED OBSTACLE	ASSUMPTION
Uncoordinated information from stakeholders	Own judgement of the most likely is accurate
Lack of precise maps of our work areas	Self produced inventory maps accurate enough
Lack of information on the exact amounts of waste in the selected wards, also lack of percentage of wet and dry waste and examples the present fractions	Amounts based on approximate numbers still operable
Different priorities for different stakeholders within the project	
The work is carried out on behalf of an organisation, leading to constrictions, specific focus, time limits and so on	
Unexpected changes in the time schedule, postponed meetings etc	
Little awareness among the stakeholders of our focus, thesis guidelines and restrictions	
Difficulties to get information, material and feedback after our return to Sweden	



PROPOSALS

Anand Park

Kothrud Waste Depot

Vegetation suggestions

Materials and techniques

Technical details

ANAND PARK



THE ANAND PARK CASE

Background

The concerned communities are situated in Aundh, northwest Pune. Close by there is a village called Aundh Gaon that was incorporated in the PMC in 1995. Since then Aundh has been the target of heavy development. Currently it is one of the fastest growing areas of Pune. Aundh ward has around 153000 people on 41 sq km, a density of 38 people/hectare. There is only around 10 acres of public gardens in the area, none of it close to Anand Park.

The area is made up by apartment blocks and big bungalows. The three communities that are involved in the project are Anand Park, Chintamani Nagar and Sylvan Heights. They are different to the corporative societies that are common elsewhere in Pune, by having private owners of each block. There are residential associations whose mission is to look over the common land.

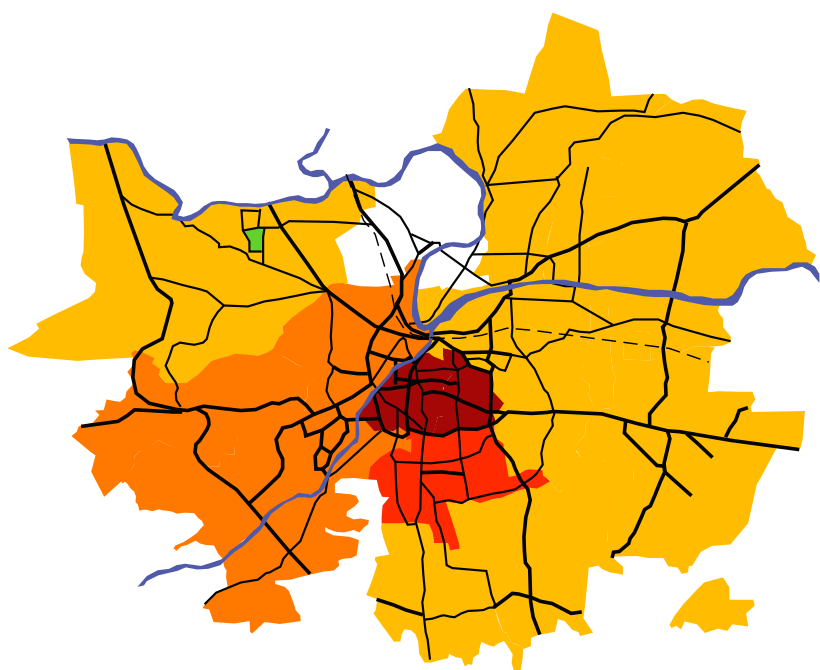
The exploitation pressure has led to high land prices in recent years. The SWaCH rag pickers that are working in the area have met problems with space for the separation of the waste, because of the lack of municipally owned properties. Around 7 years ago they were turned away from where they used to sort the waste, and moved to the corner of a vacant lot. There is a large tree that provides shading. This has been working well until recently, when the man who claims to be the owner of the lot got some complaints and also realised the high value of the property. Now he is not particularly happy to have any waste management constructions on the site, but keen on beautifying the area to avoid complaints.

The municipality on the other hand is supportive of the idea of local waste management in the area. The reason is the lack of household segregation of the waste. A large proportion of the houses is built after the year 2000 - and should therefore do composting on a household level - but very few even segregate the wet and dry waste. If the waste management system is not improved, SWaCH takes care of the recyclables but PMC transports all other waste to the landfill. It is unprofitable as the wet

waste it is heavy and expensive to transport. There is also garden waste such as branches and leaves that the PMC currently carry off, but would prefer to avoid transporting. If the organic waste was not anymore dumped at Uruli Devachi landfill, an option would be to bring it to an existing waste management unit in the south of Aundh managed by SWaCH. The problem is that the quality of the garden waste is not good enough for this facility. They have a pulveriser, but a shredder would also be needed. Another option is to leave the garden waste around or drop it in the river, which is a system often practiced but illegal and therefore not a real alternative. The best option therefore seems to be the construction of a new unit that responds to the specific needs of the Anand Park area.

Some of the residents are environmentally aware and have launched a community initiative to promote community level composting. Mr Pravin Bhagwat and mrs Aparna Bhagwat are in the frontline of the initiative. They have identified suitable lots in connection to the communities. Sorting the dry waste is not part of their focus, but CEE recognices that the sorting and the composting are well suited to take place on the same site. Partly because this ensures an efficient use of the precious land, but mostly because the SWaCH ragpickers are to serve as staff at both units.

In the following analyses we will present the inventory of the five allocated areas and a brief analysis to decide which place we recommend as the most well-suited for the purpose.



Map. Location of Anand Park area in Pune (green). Darker colour of ward implies greater density.

The amount of waste

750 households

400-500 g mixed kitchen waste/household/day

1 container of garden waste/week

10-12 ragpickers working at a time at the moment

SPECIFIC OBJECTIVES

In Anand Park the task is to **TAKE CARE OF THE COMMUNITY WASTE** in a way that awakens **POSITIVE FEELINGS** among passer-bys and residents. The unit will benefit from being a partly enclosed, protected area that moreover contributes to its surroundings as **A GARDEN** space with lots of greenery.

TAKE CARE OF THE COMMUNITY WASTE - the unit is to

- manage a total separation of wet/dry waste from the three communities
- decrease the cost that the community households spend today on carrying off the waste
- be proposed at the most well-suited location
- function as a combination of a sorting shed and a compost facility
- have the capacity to handle the waste from 750 households: 500 g kitchen waste/household/day and garden waste from 1/3 of the lots (2/3 is built)

POSITIVE FEELINGS- the unit is to

- attract interest and goodwill among the residents through the design and beautiful vegetation
- use recycled material in the constructions, but even more importantly blend in with the surroundings and have the prerequisites to stay visually pleasing even without intense maintenance work

A GARDEN - the unit is to

- enhance the environmental awareness among the residents through inviting people to the garden/waste unit where they can learn about the process
- be aesthetically pleasing to beautify the neighbourhood



Map. The locations of the allocated options for the waste management unit

LOCATION ANALYSIS

1. Current sorting space

This space is situated a bit aside the three involved communities. It has been used for sorting of the dry waste for several years, without the consent of the land owner but also without complaints until recently. It is easily accessible, but does not contain many specific aesthetic values, if the built structures are not touched up. It is very open in most directions, which undermines the feeling of good spatial enclosure.

Table. Analysis

	Poor	Good	Excellent
Sufficient space			
Accessibility			
Central location			
Existing aesthetical values			
trees			
ground vegetation			
other values			
Construction feasibility			
ground condition			
physical obstacles			
Spatial enclosure			



Map. The location of the Current sorting space



2. Corner lot

The lot on the corner of Anand Park Main Lane and the intersecting lane already has the appearance and characteristics of a small public space. The position could be used to draw attention to a waste management unit. Though, the space is extremely limited and the ground conditions do not easily allow for construction. The conclusion is that this space could successfully be used together with space no 3.

Table. Analysis

	Poor	Good	Excellent
Sufficient space			
Accessibility			
Central location			
Existing aesthetical values			
trees			
ground vegetation			
other values			
Construction feasibility			
ground condition			
physical obstacles			
Spatial enclosure			



Map. The location of the Corner lot

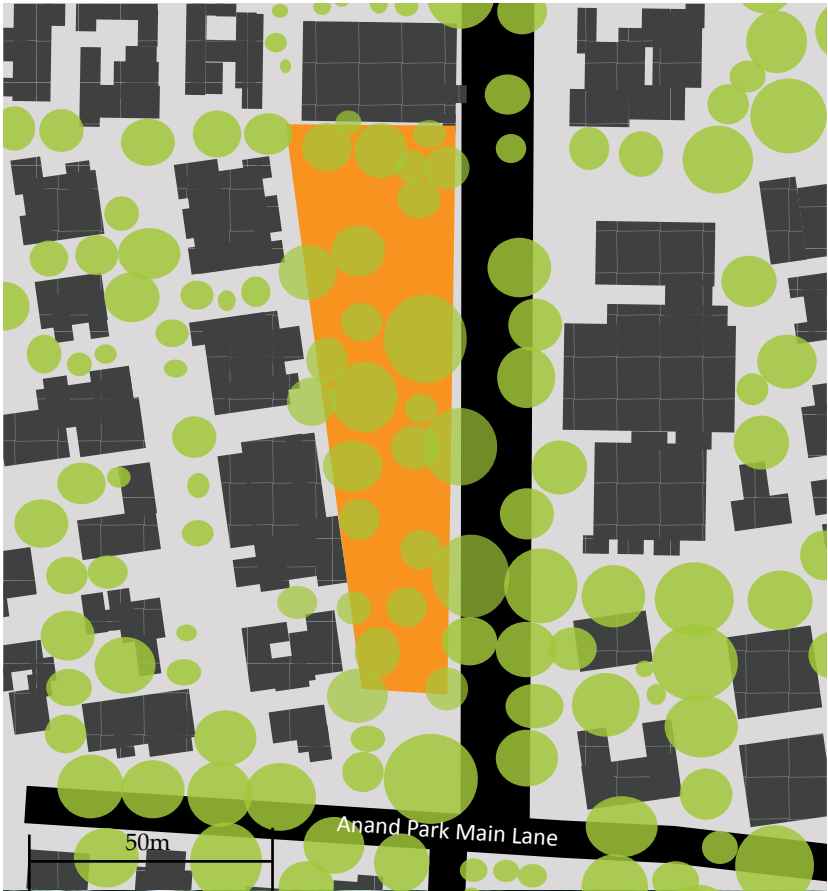


3. Large triangular lot

The favourable characteristics of this lot are several. The space is large enough and a manageable shape. Some of the trees, bushes and ground covering plants provide an aesthetic value together with the wall that nicely encloses the space in the north part. The lot is easily accessible with a wide street that could provide safe parking for visitors. It is centrally located with short distances to all three involved communities.

Table. Analysis

	Poor	Good	Excellent
Sufficient space			
Accessibility			
Central location			
Existing aesthetical values			
trees			
ground vegetation			
other values			
Construction feasibility			
ground condition			
physical obstacles			
Spatial enclosure			



Map. The location of the Large triangular lot



4. Chintamani and Swojas lot

The Chintamani lot favours from being an elongated area with varied values. The space gains even more value with a possible connection to Swojas lot. Though, the position within the enclosed Chintamani community decreases the accessibility. There is an existing concrete construction that may function as the floor of a sorting shed. Recently planted trees and bushes together with a small shed are pleasant elements within the area. The three-dimensional space is limited due to electricity cables.

Table. Analysis

	Poor	Good	Excellent
Sufficient space			
Accessibility			
Central location			
Existing aesthetical values			
trees			
ground vegetation			
other values			
Construction feasibility			
ground condition			
physical obstacles			
Spatial enclosure			



Map. The location of the Chintamani and Swojas lot



5. Sylvan Heights lot

The space located in the Sylvan Heights community is a narrow yard situated between two buildings. The high buildings together with large surrounding trees make the lot shaded and enclosed. Cables cross the area a few meters up in the air. The accessibility is rather low, hence the site can only be reached from within Sylvan Heights. The area is currently being used mainly as a parking lot for two-wheelers.

Table. Analysis

	Poor	Good	Excellent
Sufficient space			
Accessibility			
Central location			
Existing aesthetical values			
trees			
ground vegetation			
other values			
Construction feasibility			
ground condition			
physical obstacles			
Spatial enclosure			



Map. The location of the Sylvan Heights lot



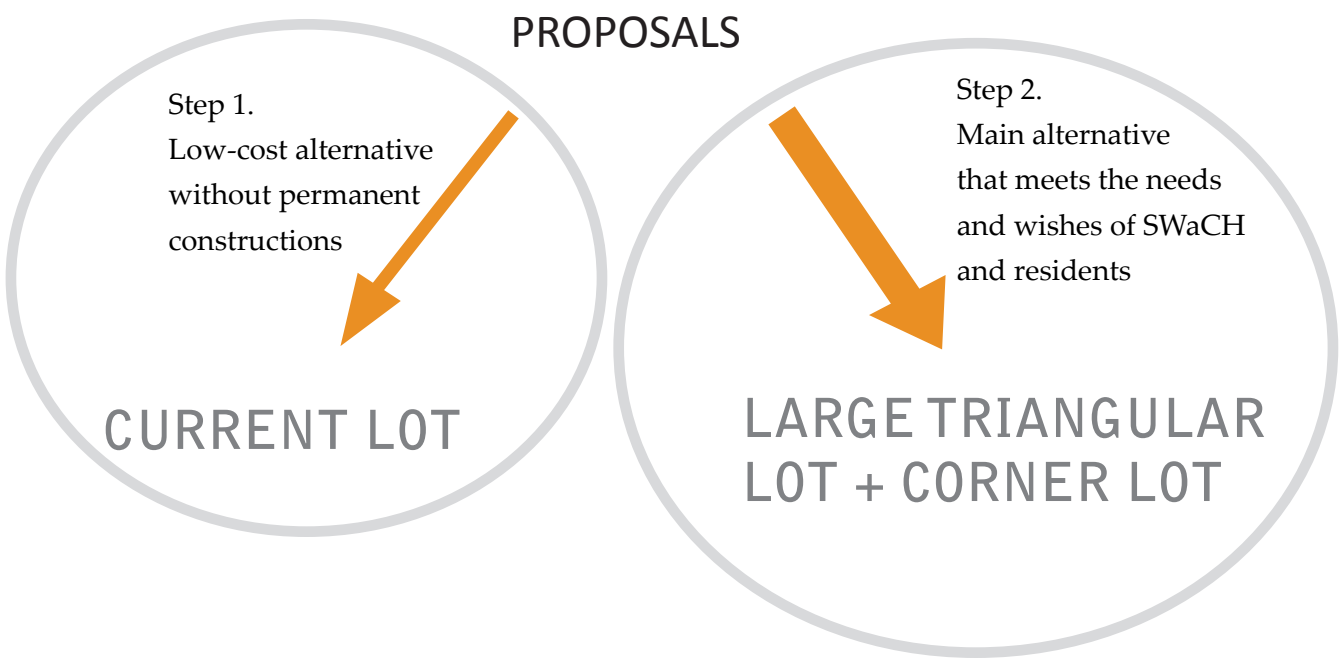
Conclusion on location

The previous analyses were made to establish which lot is best suited for a sorting and composting unit with an interconnected garden. The chosen categories of the analysis are crucial factors for the feasibility of the unit construction, concluded upon in relation to the objectives. The categories are: *Sufficient space and location* which are factors that affect the community waste handling efficiency; *Existing values*, that underpin the area in the process of becoming a garden that causes goodwill and positive feelings among the residents; *Construction feasibility* that helps to ease the process both economically and time wise; and *Spatial enclosure* that contributes to a better work atmosphere for the ragpickers. We graded these aspects of each lot on a poor-good-excellent scale, and through this evaluation we could conclude on the best suited location.

The analysis of the sites made it clear that the lot that best matches the criteria is the well-positioned large triangular lot. There *sufficient space*, *existing aesthetical values* and *spatial enclosure* all reached the highest grades. Together with the small corner lot it has good opportunities to work impeccably as a waste management unit. We therefore concluded that these two lots together enable an elaborated proposal.

Since quite a lot of capital and human resources will be necessary to make this unit come into being and as the poor financial reality is a fact, we also decided to make a low cost proposal with only temporary constructions for the current sorting space.

In the following chapter we will present the analysis and low-cost proposal for the current lot first, and then continue with the main analysis and proposal at the triangular and small corner lots.



CURRENT SORTING LOT

SWOT



Strengths

- Currently used as waste sorting place
- The accessibility, easy to reach from all directions
- Few households nearby, low risk of complaints about odours and vermin caused by the compost unit

Weaknesses

- Inadequate space, not enough room for both sorting and compost unit
- Non-central location

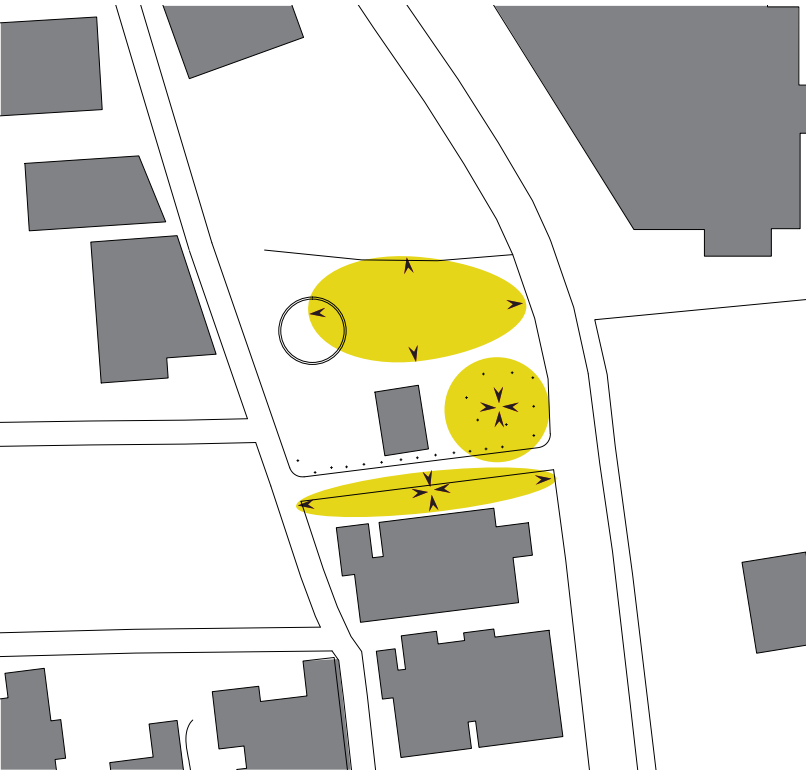
Opportunities

- Many passer-bys whose attention may be caught with interesting designs and appropriate information on site
- The circle of trees creates excellent shade and spatial enclosure to a certain extent
- The concrete fundament located within the lot can be used as storage space

Threats

- The absence of spatial enclosure and proper shelter
- Many passer-bys may pose a threat to the workers on site if negative-minded

SPATIAL STRUCTURE



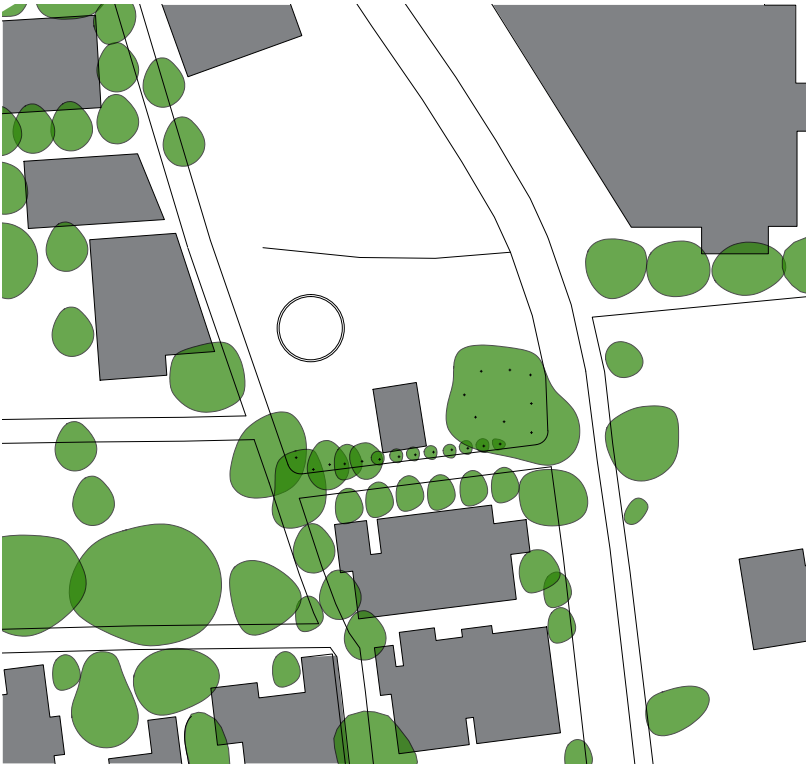
The spatial structure is rather weak at the site. The trees growing in a circle create a nice room that today is occupied by waste sorting ragpickers. The feeling of spatiality is more of a mental enclosure than a physical one and does not offer much protection to the workers on site. The large open room is only lined by a low fence and roads, which makes it a very undefined space. The most well defined room in the area is located outside the lot between a line of trees and a high building south of the lot, forming a very high and narrow room.

POTENTIAL DEVELOPMENT



The rather small site may be developed into a more aesthetic and ergonomic sorting facility than the existing one. Focus will be on light/temporary constructions and safety for the workers on site. The concrete circle has a potential as storage space for recyclables.

GREENERY



The amount of trees and bushes is small at the site except for the circle of trees in the southeast corner. The area would gain a lot of value through clearer spatial enclosure accomplished by trees. The lack of greenery makes the place exposed to sunlight and glances.

MOVEMENT



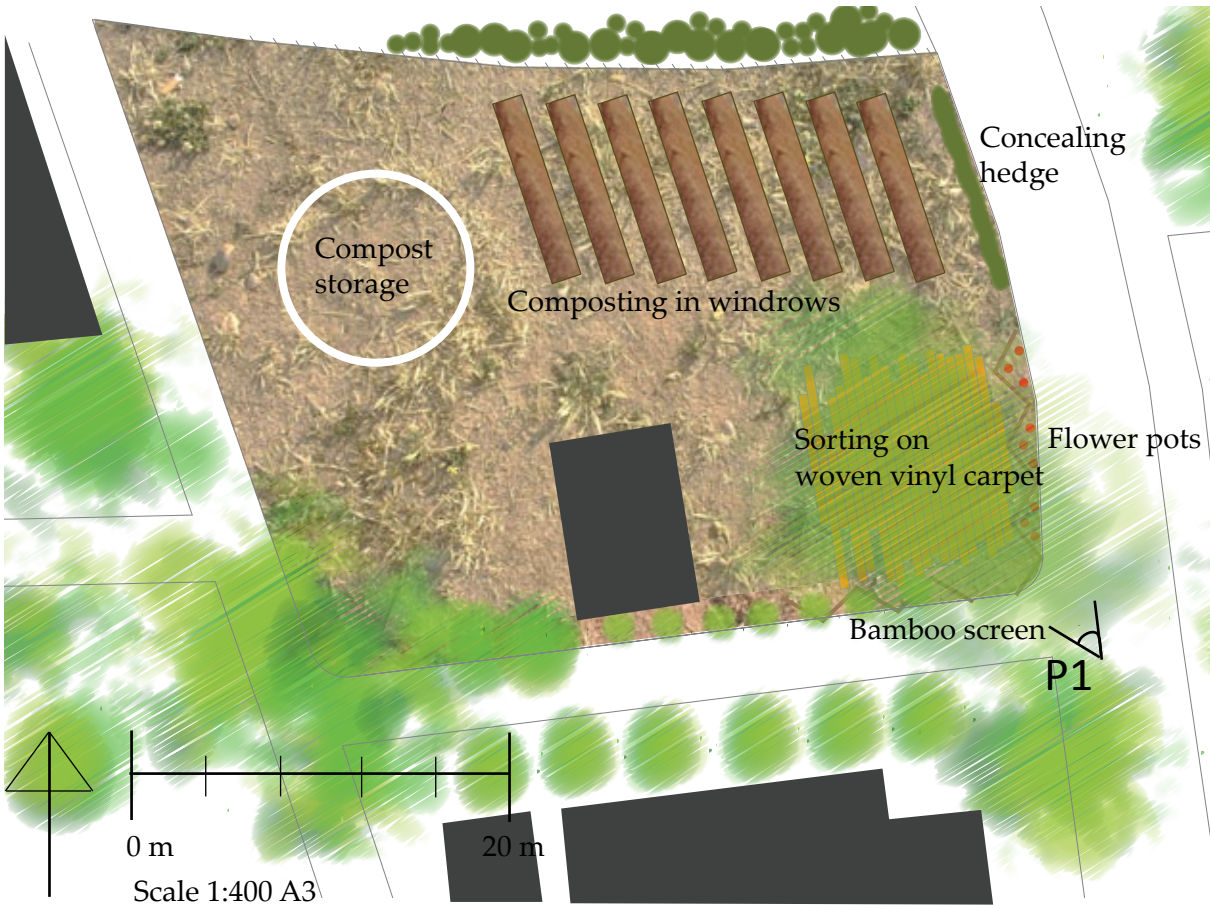
The area is surrounded by roads on every side, except for in the north where a bus depot is located. The roads together with a small supermarket generate a steady flow of traffic. The pedestrian movement is also frequent at the site, not least due to the ragpickers that carry garbage in large bags to and from the lot on their heads and on pushcarts.

Design proposal

This proposal is a low-cost alternative to the main proposal at the large triangular lot. The solutions here are therefore simple, temporary and cheap to construct. If this lot is to be continuously used for sorting solid household waste, the main approach is to improve the work conditions of the ragpickers and give the area a tidy appearance.

We have tried to make a proposal that can provide the ragpickers with substantial shade from the sun and protection from rainfall. By facilitating keeping the area clean and orderly the health hazards will be minimised. This will be obtained with vinyl carpets woven from recycled plastic bags constituting the floor of the sorting place. They are easy to sweep free from lingering garbage and wash clean with water. The treetops are enough to keep the sorting place shaded by summer time but during the monsoon plastic sheets can be tied up between the tree trunks as a shelter from massive precipitation. The sorting space is surrounded by bamboo screens that visually shield the workers from the streets. The screens will make the workers feel protected while the sorting will be hidden to avoid provocation.

The wet household waste that is segregated at the unit is taken care of in an open windrow composting system. The dimensions of the windrows are 1.6 m x 10 m. Inside the windrows there are bamboo aerators; a simple and non-permanent construction. The mature compost can be stored in the concrete circle before it is sold further. Manure can also be used in decorative flowerpots placed all over the area for beautification.



Plan. Current sorting lot



P1. Perspective: Sorting area
- shielding bamboo screens
- woven vinyl carpet
- beautifying compost pots

LARGE TRIANGULAR AND SMALL CORNER LOTS

SWOT



Strengths

- Large sufficient space
- Good accessibility, reachable both by car and foot
- Located centrally in the waste catchment area
- Enclosed protected area with a well-defined spatial structure
- Good passage and parking opportunities for large transport vehicles

Opportunities

- Large trees of high value
- The thriving crooked tree at the intersection at the corner lot
- Brick wall in good shape surrounding the northwest corner of the triangular lot
- Potential to become a nice garden because of the pleasantly enclosed space

Threats

- Many households nearby, risk of complaints about odours and vermin caused by the compost unit
- Large area, what happens with the rest of the lot if only a part is designed?
- Many trees in the area that may be protected and require special permission to be felled

Weaknesses

- An extensive removal work necessary (of old, dead trees and garbage)
- Existing shed/household located on the lot

POTENTIAL DEVELOPMENT



The site can be divided into several areas with different focus on development. The wide street can be used as an entrance area for vehicles while the corner lot may function as an introduction site. The lot itself can be divided into two parts that can potentially be used for garden versus composting and sorting purposes. Developing the southern part of the lot will raise the issue of how to deal with the residential shed now situated there.

MOVEMENT



The frequency of movement in the area is quite low due to few commercial and public places. The lot is lengthwise connected to a wide road where the traffic flow is minimal. The street is used by autorickshaw drivers that pause within the tranquil area. The intersection where there is more traffic is also made use of by rickshaw drivers awaiting customers.

SPATIAL STRUCTURE



The triangular lot can be divided into three rooms with their own distinct spatial features. All the rooms are very introvert except for the spacious and calm street space that continues in north-south direction. The northern part of the lot is mainly shaded and enclosed while the southern part is open with a meadow-like appearance. The whole triangular lot together with the street constitutes a large vacant lot that can be seen as a room itself. The small corner lot has a very distinct character and a snugly atmosphere.

GREENERY



The triangular lot together with its surroundings compose a very green area. There are many large trees mixed with recently planted trees along the road. In the broadest place of the lot the trees together create a roof of leaves.

Situation today



DESIGN PROPOSAL

Overall approach

A combined recreational garden and garbage unit situated in the heart of Anand Park.

Aesthetics

- only public green space in the entire area and remarkable with its greenery
- a variety of flowering and sweet-smelling native plants, both trees, bushes, shrubs, herbs, ground-covers and climbers
- a well-constructed, architecturally appealing and hygienic waste sorting and composting facility

Multifunctionality

- freedom to stroll on the path, have picnic on the environmentally friendly lawn, study native plants or see children's play
- capacity to cater for the waste management needs of the three communities Anand Park, Chintamani and Sylvan Heights
- enhancement of the environmental awareness and acting as a model for other communities

Features

- open to public during daytime
- enclosed by a low wall
- parking for vehicles outside



Bird's view perspective. Anand Garden

Anand Garden

Description

This proposal recreates the lot as Anand Garden (anand meaning joy or pleasure in Marathi), a combined garbage station and recreational garden lying in the heart of Anand Park. The garden is open daytime for the SWaCH cooperative employees as well as residents of the area and visitors. Anand Garden is the only public green space in the entire area and outstanding with its greenery. The garden is not just beautiful features; it also serves a good purpose in terms of waste management. The waste management unit has capacity to cater for the needs of the three communities Anand Park, Chintamani and Sylvan Heights with increment potential. The outreach of information to people helps to enhance the environmental awareness in the area.

The multifunction and proper use of the area is crucial due to the high land prices and the lack of free public space. In Anand Garden you can have picnic on the environmentally friendly lawn, study native plants, send your children to play, follow the solid wet waste from biodegradables to compost soil or just go for a stroll on the pathway that runs through the park.

To keep the area safe from intrusion during the closed hours, the area is surrounded by a wall made out of *urbancrete* with fencing on top. The urbancrete wall low so that you may enjoy the greenery even from the outside. On the wide street there is sufficient space to park vehicles, even school buses if student groups would wish to make a field trip to study the waste flow.

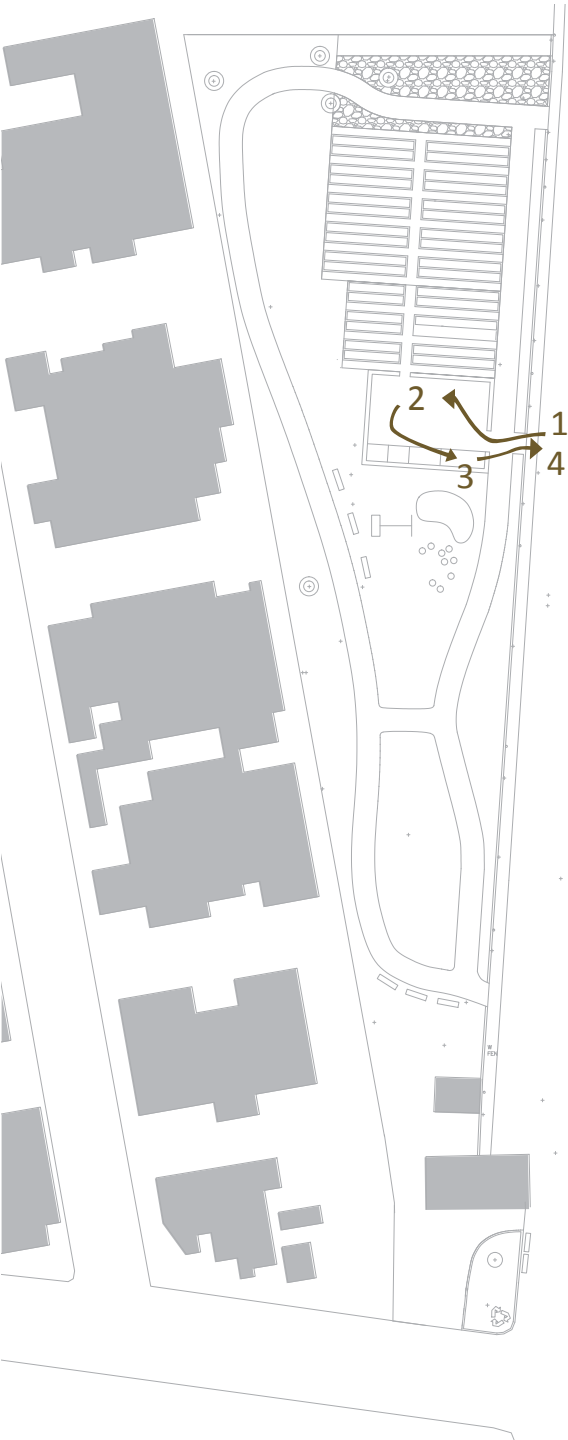
Design approach

The length of the area induced us to propose a path around the unit, as we also wanted to encourage recreation and exercise among the residents. The wavy shapes pose an alternative to the colonial ideal of strict lines. The shapes also create interesting rooms with different character and function for different needs. The lawns, flowerbeds and framing vegetation are however appreciated common elements in Indian gardens that we wanted to preserve, but also elaborate further using only sustainable garden elements and native plants . The placement of the sorting and composting facility is chosen with respect to accessibility, existing trees, surrounding households and the prevailing wind direction.



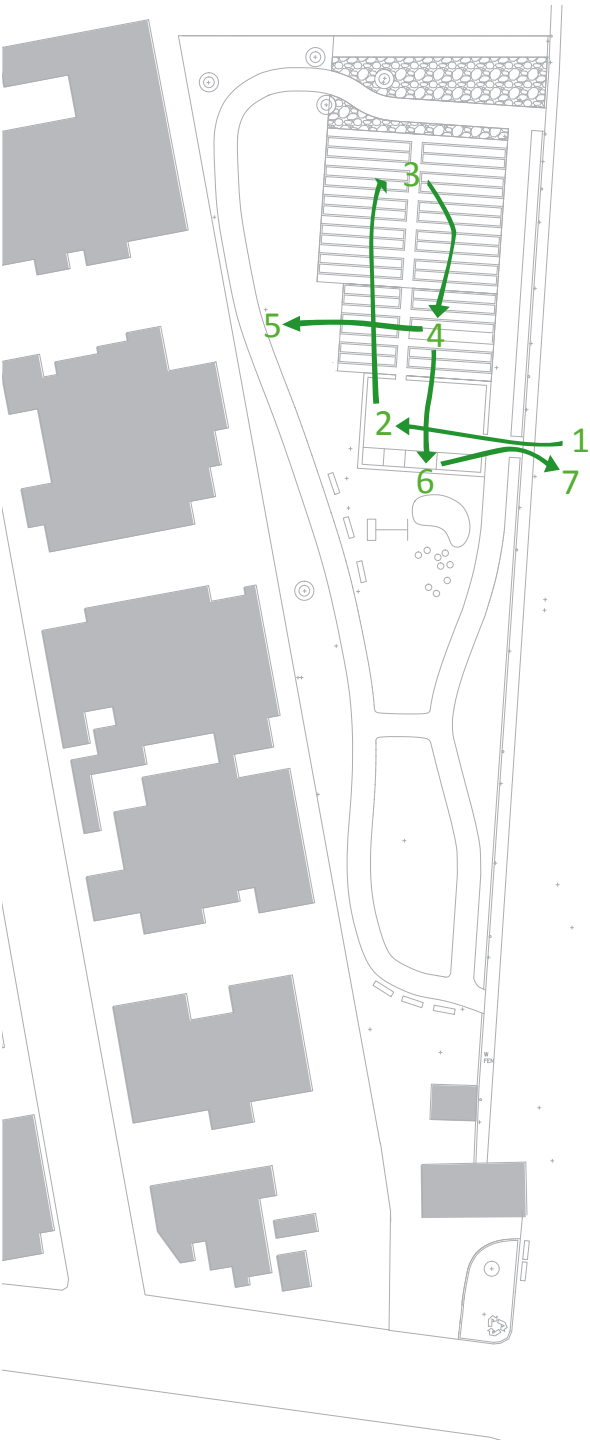
Proposed functions

DRY WASTE FLOW



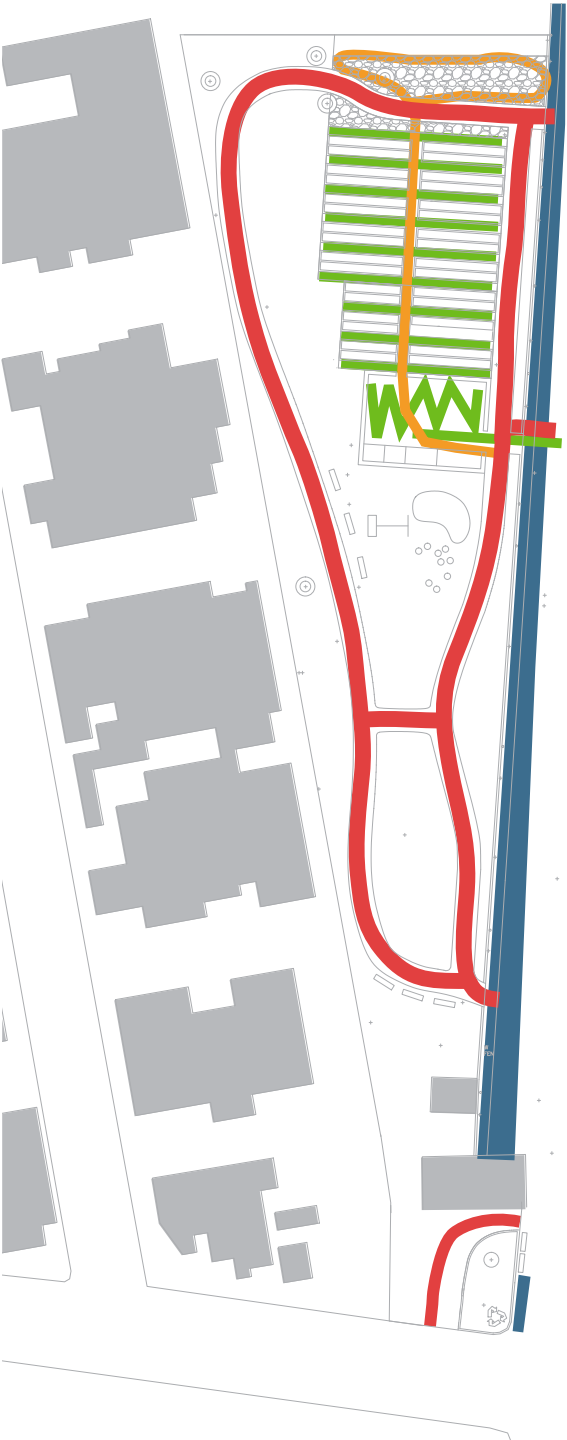
- 1. Arrival
- 2. Dumping and sorting
- 3. Storage
- 4. Further trading

WET WASTE FLOW



- 1. Arrival
- 2. Dumping and sorting
- 3. Composting
- 4. Maturation
- 5. Garden
- 6. Storage
- 7. Further trading



HUMAN MOVEMENT



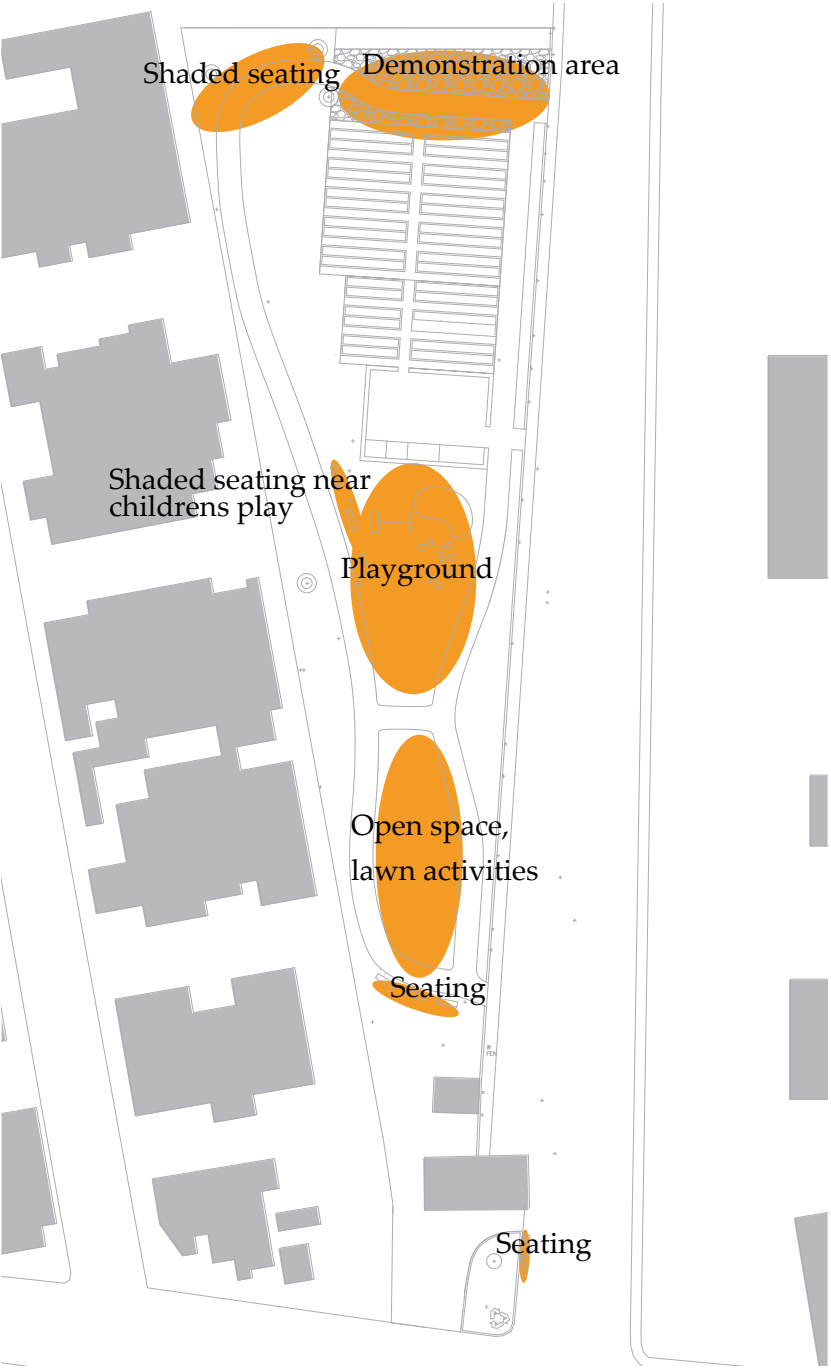
- Recreational visitors
- Field trip and information
- SWaCH workers
- Parking and rickshaws

VEGETATION



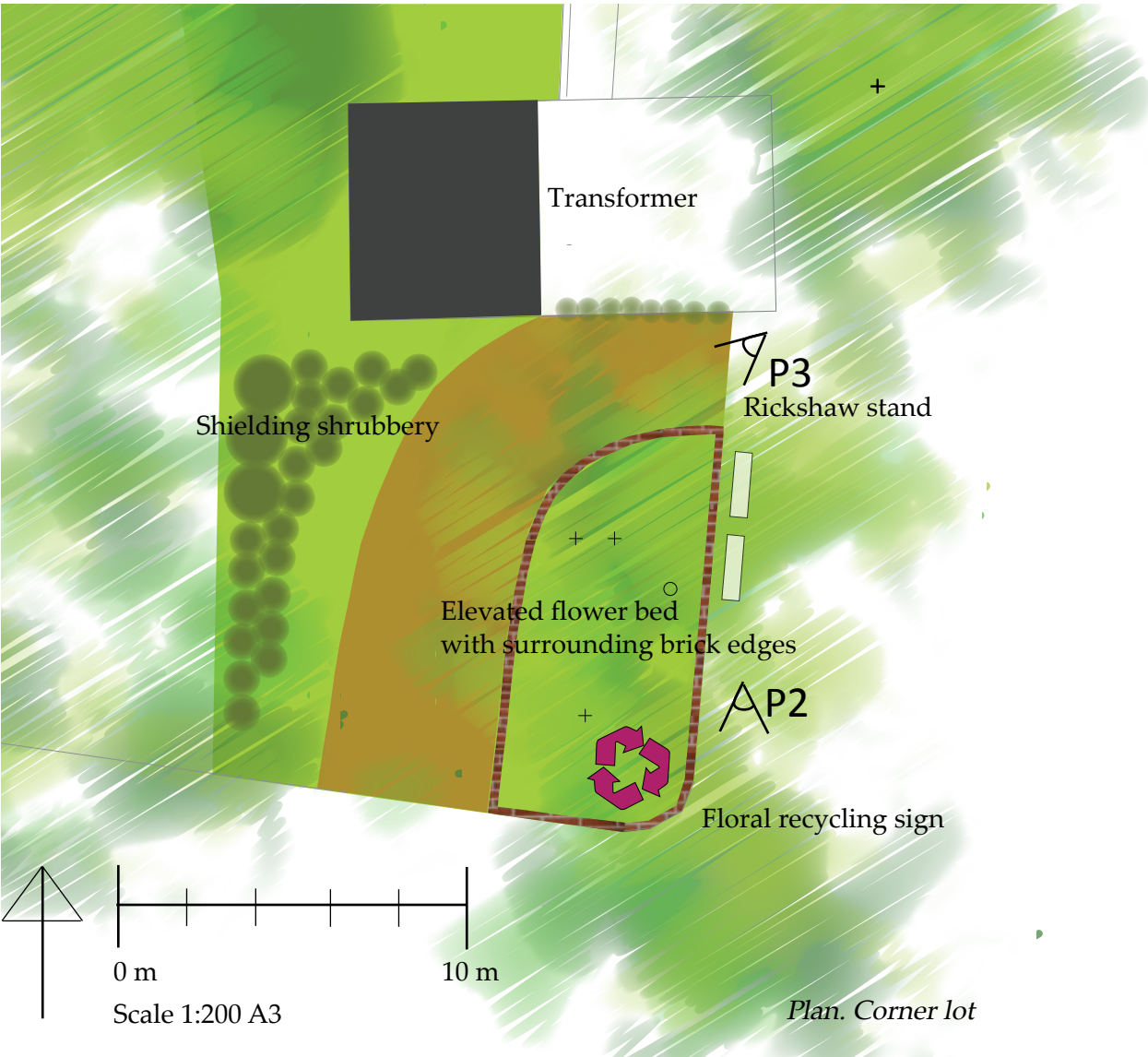
-  Framing vegetation
-  Flowering plants

TIME SPENDING



CLOSE-UP: CORNER LOT

Design proposal



The proposed design will make the corner lot both intriguing and aesthetically appealing. The construction is simple and straight forward. The most important features that are wished to be obtained through the design are tidiness, beauty, ability to awaken curiosity and transmit information. The corner lot will be a visual and functional treasure for residents in the surrounding communities as well as people passing by.

The corner lot will transform from an unused, forgotten space to a nice plantation with a message. The levelled part of the lot surrounding a large mango tree will be elevated further and framed by a low brick wall. Following the ground shape the wall is around 30 cm high on the garden side and only 10 cm on the street side. Inside the elevated area there will be ground covering herbs and perennials.

- P2. Perspective: Corner lot**
- elevated flower bed
 - floral recycling sign
 - climbing scrap animals
 - welcoming sign



On the corner there will be a sign in the shape of a recycling symbol, designed with plants of contrasting leaf colours. The contrasting plants may be separated by thin metal scrap pieces to keep the sign intact even when the plants grow.

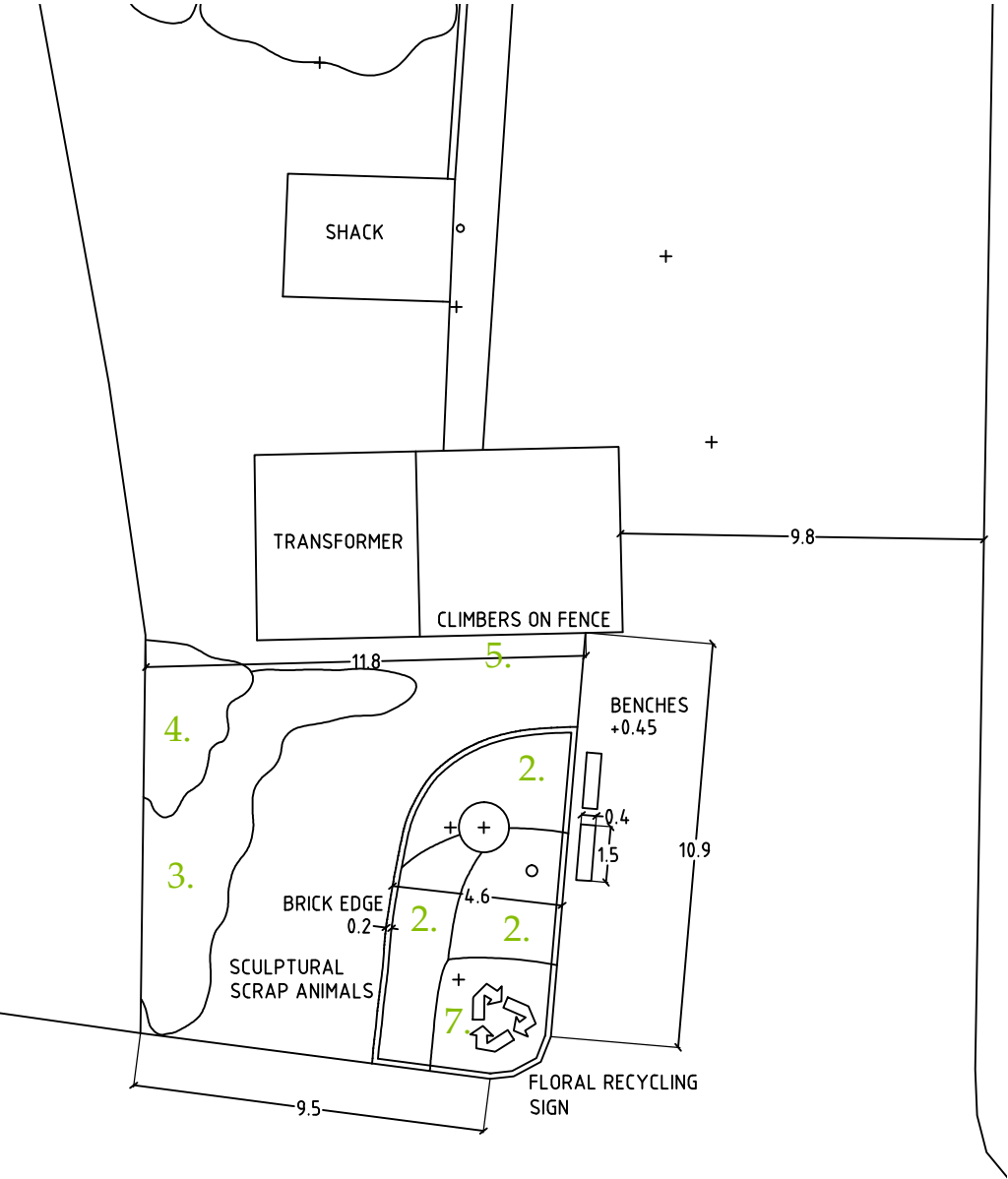
The lot can be entered behind the elevated part on a path that leads alongside the brick wall that also can be used for sitting

on. The path will be shielded from the neighbour household with high flowering bushes. Along the path there are also flowering climbers on the transformer fence. The dead fallen tree will be removed and instead the focus will be on the crooked tree that creates a roof of leaves above the intersection. Sculptural garbage animals may also embellish the area by climbing on the tree trunk.

P3. *Perspective: Corner lot at transformer*
- elevated flower bed
- seating: benches and edge wall
- protected path
- flowering framing bushes



Construction and vegetation



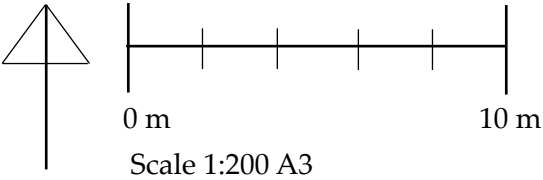
Technical drawing. Corner lot

MATERIALS

- Path: existing stone dust
- Wall edge around elevated plantation: bricks
- Benches: painted metal
- Sculptural scrap animals: scrap of choice (see p.94)

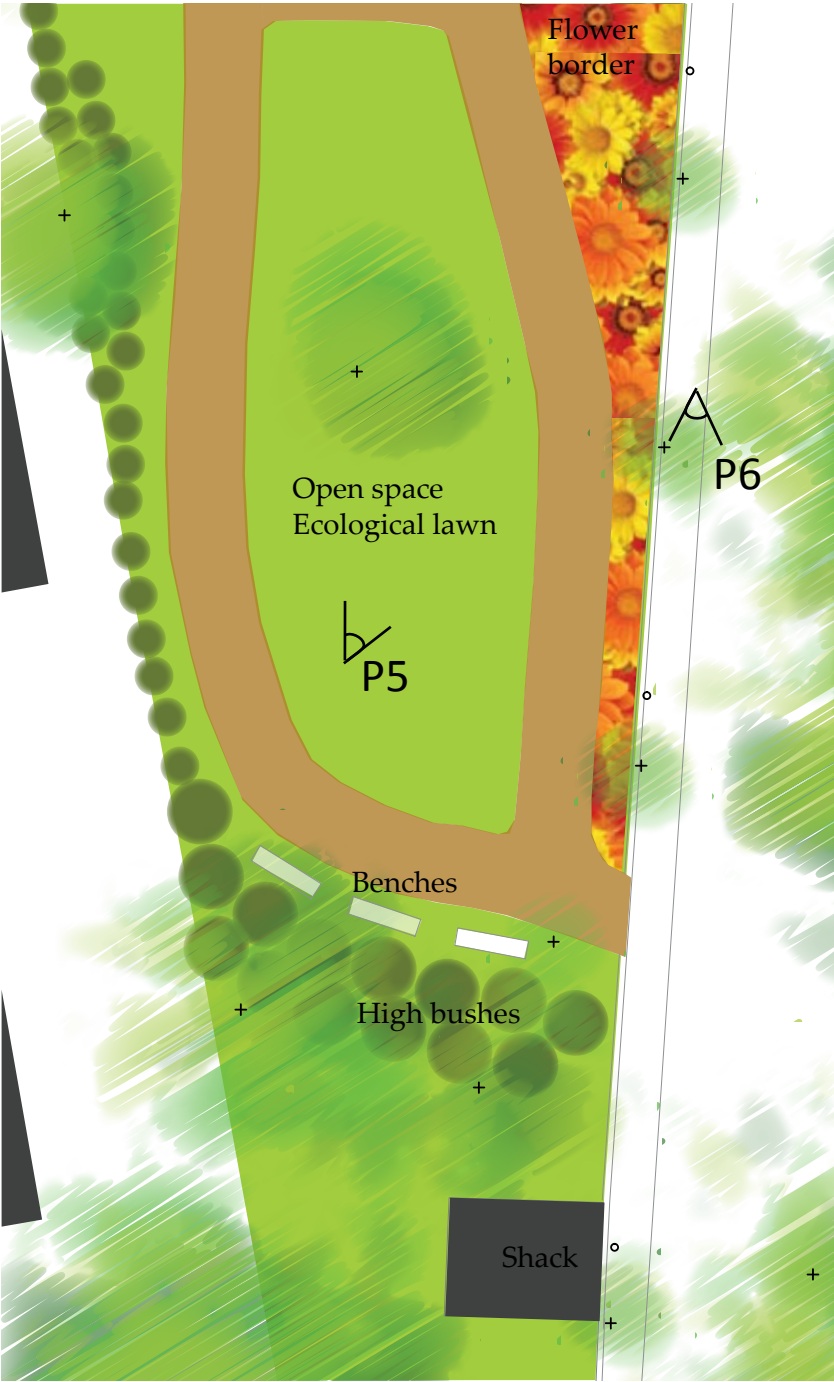
VEGETATION

Plant list on p.92

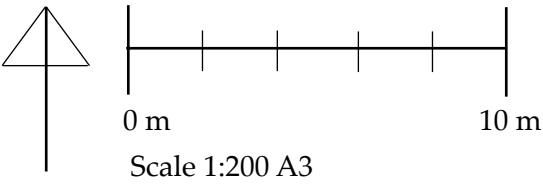


CLOSE-UP: SOUTH PART

Design proposal



Plan. South part



The open space in the south consists of an ecologically friendly lawn that has a high resemblance to ordinary grass. The area is open for a variety of activities. It is both functional and aesthetically appealing with a long flower border running alongside its eastern part. On the west side there are also bushes and plants along the wall creating an open space surrounded by greenery.

The shack residence in the south part of the garden is shielded off with high bushes.



Bird's view perspective. South part

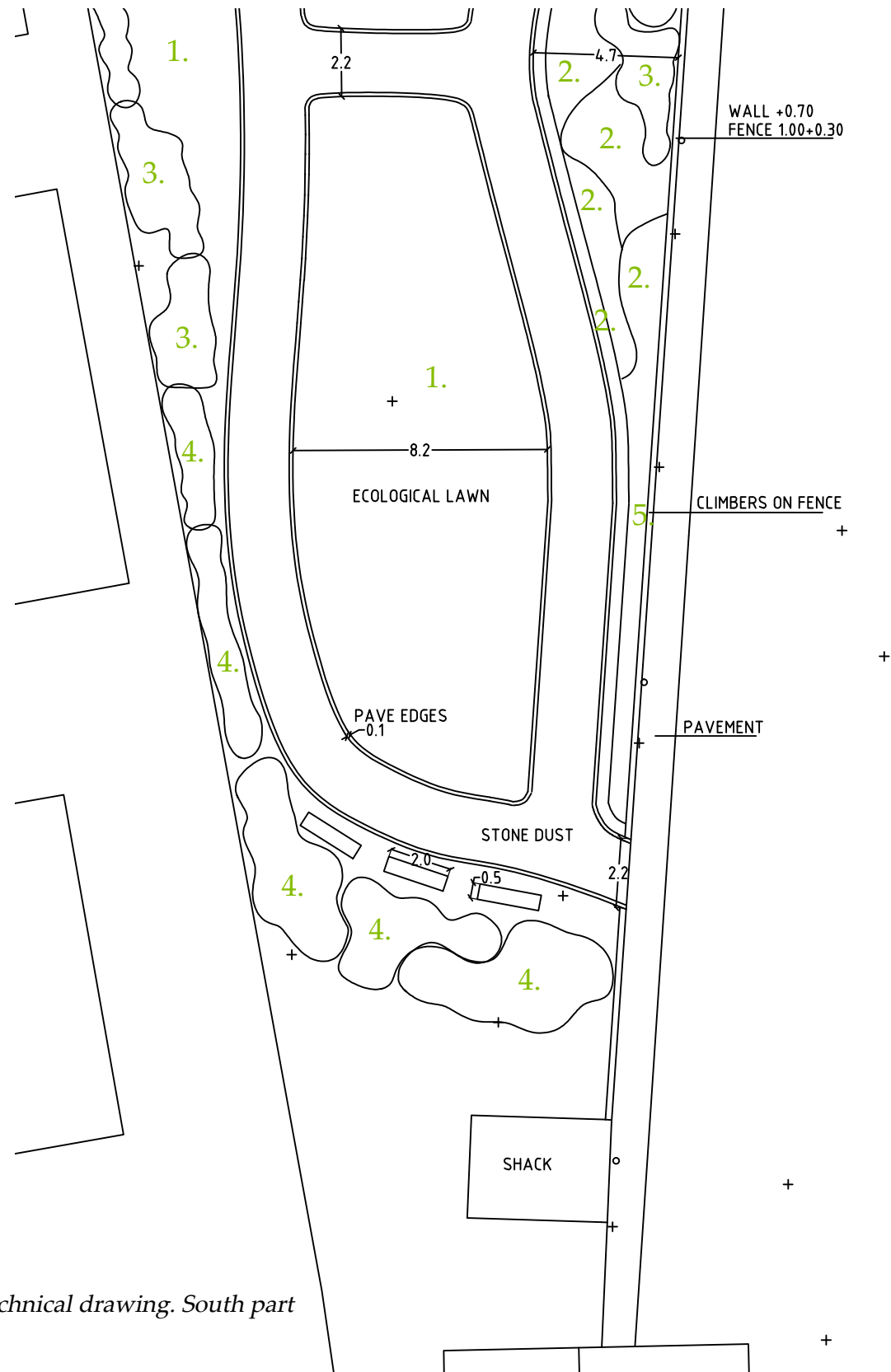
P5. *Perspective: Southern open area*
 - ecological lawn for optional activities
 - flowering plants along urbancrete wall
 - path for walking



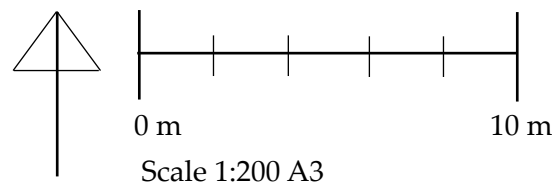
P6. *Perspective: Street outside the garden*
 - large parking space
 . urbancrete wall with see-through fencing



Construction and vegetation



Technical drawing. South part



MATERIALS

Path: stone dust

Path and plantation edges: stone

Benches: painted metal

Wall: urbancrete (see p.94)

VEGETATION

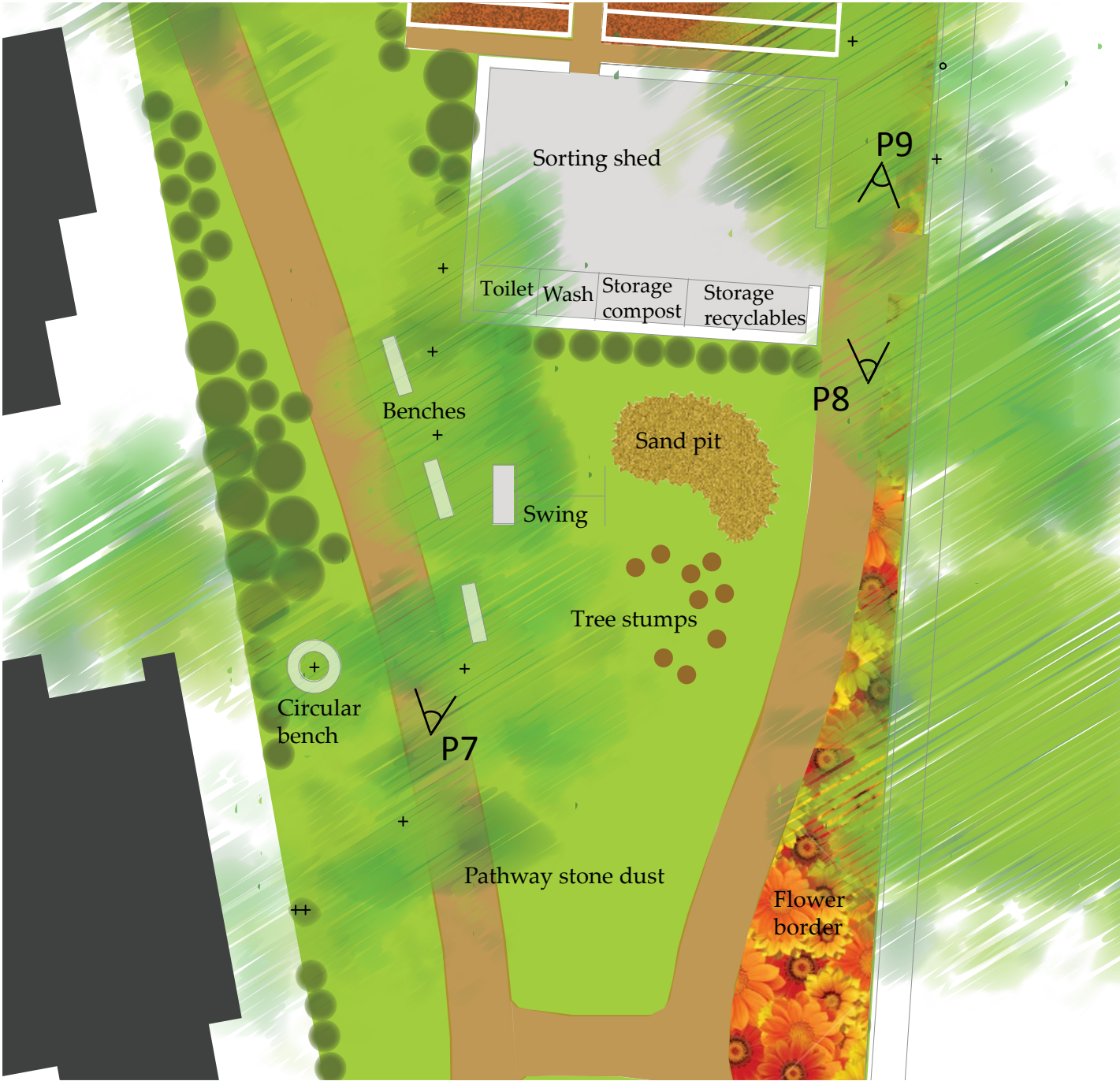
Plant list on p.92

CLOSE-UP: CENTRAL PART

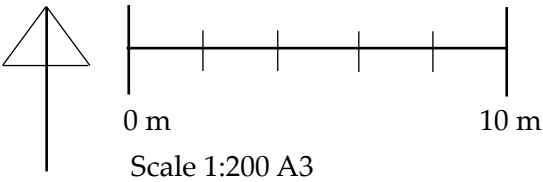
Design proposal

In the centre of the garden we propose a sorting and storage shed for the dry recyclables. The sorting facility is a small building constructed of left-over bags filled with non-degradable waste and earth, covered by a concrete plastering. The plastic roof protects the workers from rainfall and sunlight. The earthbag walls are low enough to ensure a clear view of the sorting activity from outside, but high enough to make the workers feel comfortable. Along the south long side of the shed there is a row of rooms. These are sanitary facilities and storage spaces for the different packed recyclables waiting to be traded further. All rooms can be locked to keep the recyclables and mature compost soil safe. The dumping and sorting area in the shed is 74 sq m which is enough to separate the waste from approximately 1000 households. The space is sufficient for a shredder and a desk for administration and payments regarding trading of compost. The toilet and wash space are 2x1,6 sq m each, storage for compost 3x1,6 sq m and recyclables 4,2x1,6 sq m. During the night the pushcarts can be locked to the fence outside the garden.

On the southern side of the shed there is a playground where children may play while their parents can rest in the shade of the trees. Some of the playing equipment is built from trees that have to be felled to make room for the shed. Examples are stumps to sit on and trunks to climb around on. There is also a sand pit where children can build sand castles, as well as a swing.



Plan. Central part





Bird's view perspective. Central part



P7. *Perspective: central west part*
- path alongside the children's playground
- benches in the shade
- bushes around the sorting shed



P8. *Perspective: central east part facing north*
 - path outside the sorting and composting facility
 - sweet-smelling flowers in plantations and pergolas
 - urbancrete wall with lockable gate
 - entrance to sorting shed



P9. *Perspective: central east part facing south*
 - entrance to sorting shed and storage space
 - sorting shed with earthbag and bamboo walls

Construction and vegetation



Technical drawing. Central part

MATERIALS

Path: stone dust

Path and plantation edges: stone

Benches: painted metal

Circular tree bench : concrete

Playground: sand pit, painted metal swings, tree stumps

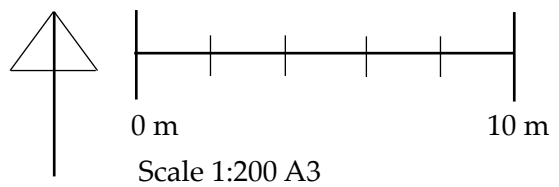
Wall: urbancrete (see p.94)

Sorting shed: earthbag walls (see p.94), HDPE plastic roof (see p.94)

Inner wall in shed: bamboo (see p.93)

VEGETATION

Plant list on p.92

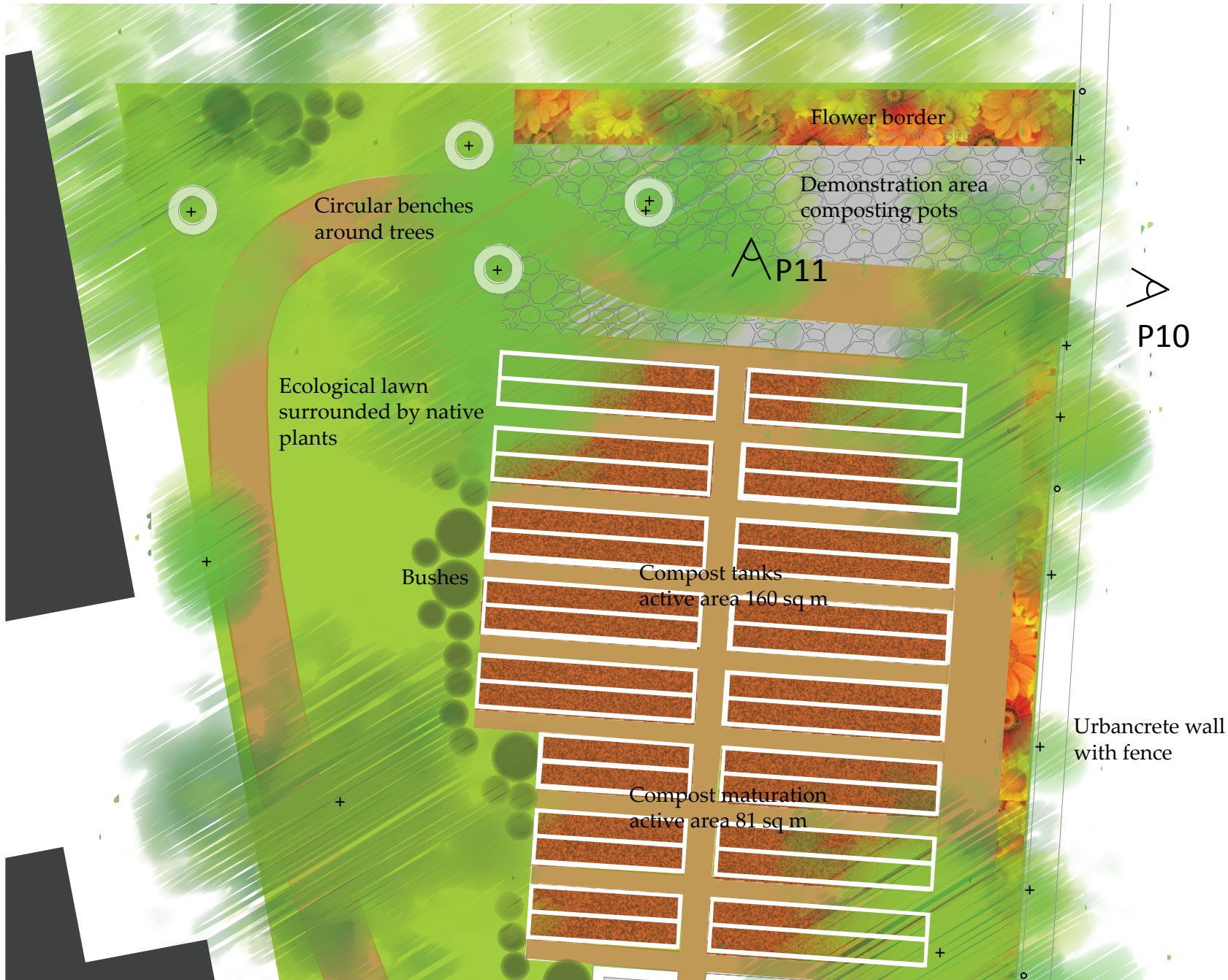


CLOSE-UP: NORTH PART

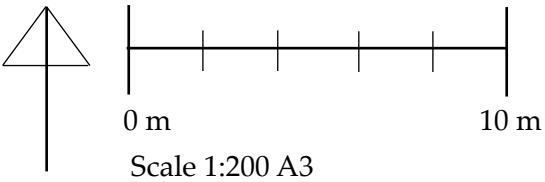
Design proposal

The northern part of the lot is the broadest and also the most shaded part of the proposal area. In the proposal the entrance leads the visitor straight to the demonstration area where information signs teach about the waste flow of both wet biodegradable waste and dry recyclable waste. Various composting methods at small scale are demonstrated to encourage citizens to start composting at household level. Composting pots filled with plants together with flowerpots embellish the area and create a welcoming atmosphere. Circular benches around trees are placed in the shadow for people who just want to come into the green recreational garden to have a rest.

The compost facility is constructed out of bricks and concrete with a plastic roof to protect the compost from excessive evaporation during summer and rainfall in the monsoon season. The active area of 160 sq m is enough to manage wet solid waste and garden waste from about 1000 households. After the first phase of composting the compost is moved to mature in the maturation area. This area requires only 81 sq m because of the shrinkage that takes place in the biodegradable process. The compost soil is to be used in the garden or sold to residents.



Plan. North part





Bird's view perspective. North part

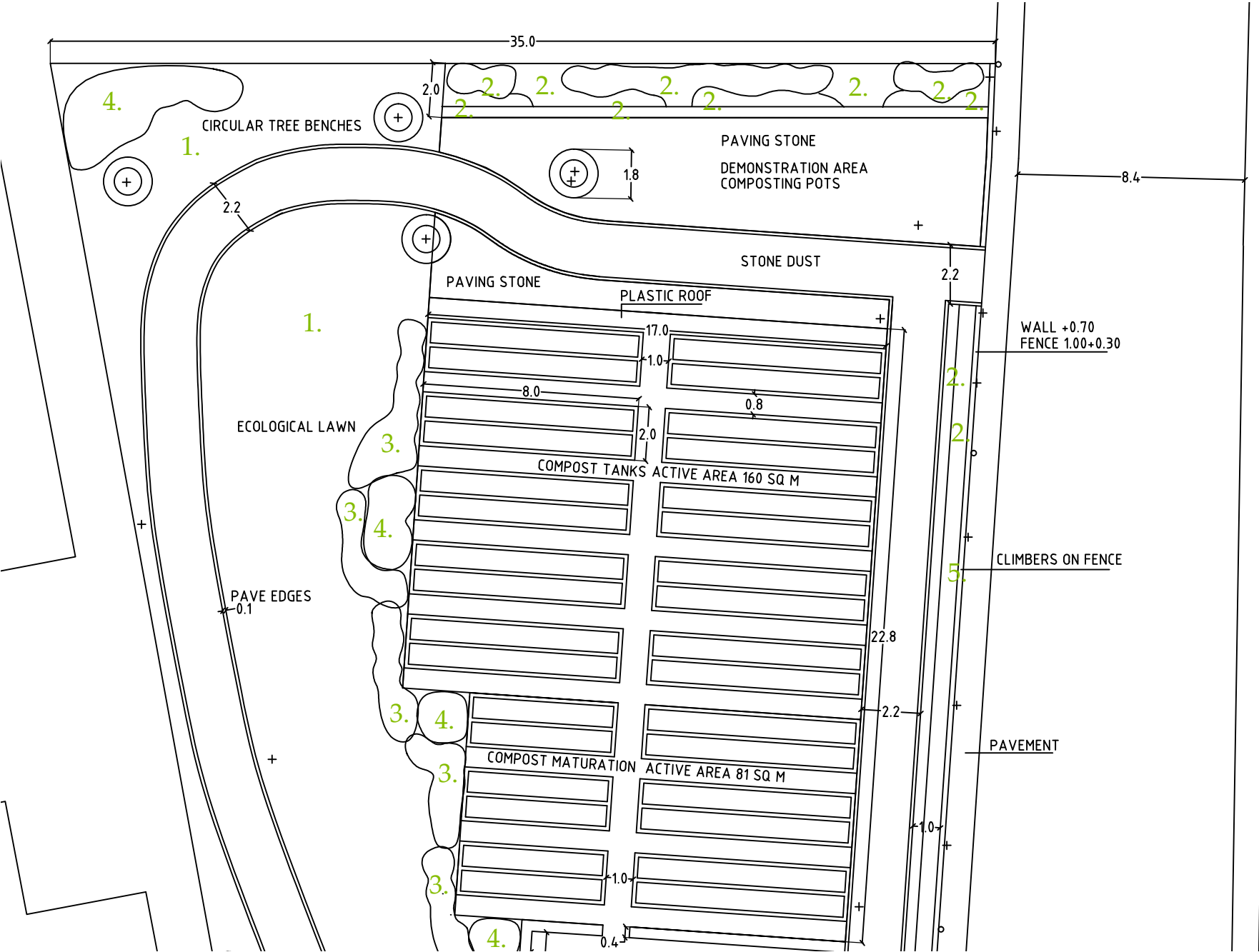
P10. *Perspective: north gate from street*
 - paved demonstration area for small-scale composting
 - urbancrete wall see-through fence
 - lockable gate



P11. *Perspective: compost facility seen from the demonstration area*
 - concrete composting tanks
 - roof of recycled plastic
 - decorative composting pots



Construction and vegetation

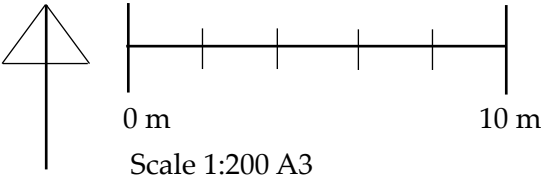


MATERIALS

- Path: stone dust
- Path and plantation edges: stone
- Compost facility: brick bottom, concrete tanks (see p.96), HDPE plastic roof (see p.94), metal poles, stone dust paths
- Demonstration platform and path: stone paving, Daily
- Dump pots (see p.93), ordinary pots
- Benches: painted metal
- Circular tree bench : concrete
- Wall: urbancrete (see p.94)

VEGETATION

Plant list on p.92



KOTHRUD WASTE DEPOT



THE KOTHRUD WASTE DEPOT CASE

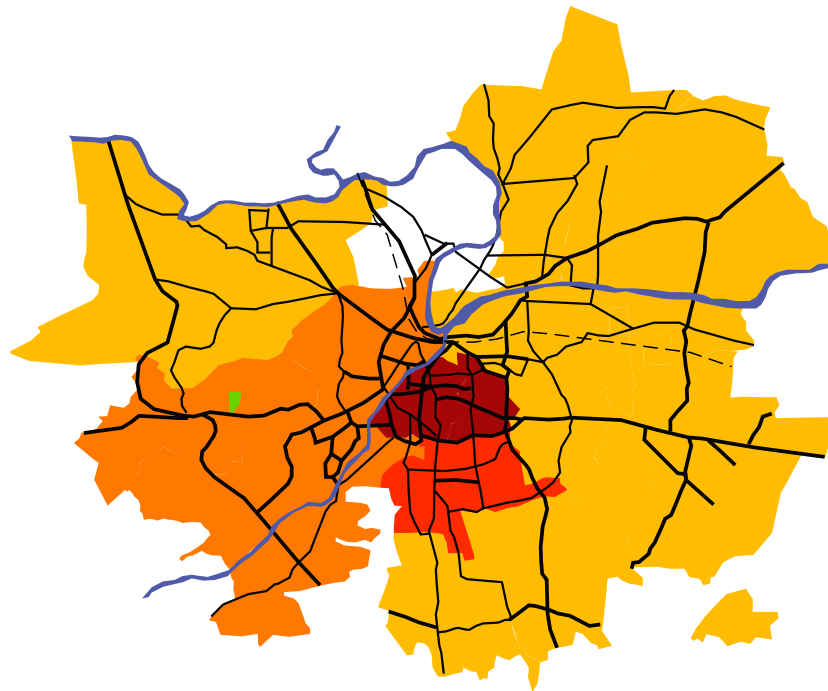
Background

The Kothrud area lies in Karve Rd ward in the southwest of Pune. The ward area is 16,3 sq km with a population of 147000. The density is 90 persons/ha, which makes Karve Rd ward one of the denser wards in Pune. It is also the ward that grows the second fastest. There are only around 15 ha of garden area in Karve Rd ward, none of it close to the waste depot where the project is to be carried out.

The space for the waste management unit is situated on a former landfill for solid waste in the north part of Kothrud, close to the large Paud Rd. The site itself is therefore not densely populated. The landfill has been out of use for about four years and the generated waste from Pune is instead being dumped at Uruli Devachi outside of the city. A part of the land at the former Waste Depot in Kothrud is still being used for waste management purposes in the shape of a transit station. The transit station is one out of 7 stations in Pune and receives numerous containers of garbage daily.

The SWaCH headoffice is also located within the area. The building is surrounded by rather steep slopes that are covered by the fast growing castor oil plant (erandi), a native plant with plenteous uses. The former Waste Depot area is covered by grass, bushes and small trees - all except a piece of land close to Paud road, where the transit station and the office building are located.

Pune Municipal Corporation who owns the plot has agreed to deed a piece of land around the office to SWaCH. The staff of the office wants to develop the area into an information centre open to the public. One of the informative aspects will be the constructed sorting and compost unit that will be able to manage all the dry waste and part of the wet waste generated in the ward and the office. In addition to the information aspect, the importance of open spaces where the staff may conduct experiments is crucial. The unit needs to be creative and innovative to trigger interest and attention among passer-bys. As much as possible shall be constructed out of recycled waste and the main focus is to communicate the importance of recycling and



*Map. Location of Kothrud in Pune (green).
Darker colour of ward implies greater density.*

show diverse methods that can be implemented on different scales, from household level to ward level. Another focus is to make the unit reflect the history of the site as a former landfill and make the design blend into the environment.

The amount of waste

Accurate numbers of generated waste in the Karve Rd ward are not available. The size of the facilities in Kothrud has therefore been based on space limitations, wishes from the SWaCH staff and approximate calculations. We tried to find out how much waste that reaches the transit station per day and the proportions of the 12-14 recycling material groups, but there has been no such monitoring. This information could be of interest if some of the waste is to be used in construction and for experimental purposes. No specific numbers were available at the time of our work, but there is currently a process going on that SWaCH may make use of during the construction period. For now the numbers of ragpickers that are going to work at the station are not available either.

SPECIFIC OBJECTIVES

At Kothrud Waste Depot SWaCH wants to create a new **SORTING- AND COMPOSTING** unit where part of the ward waste can be managed. The main purpose of the unit beside the function is to invite people and **CREATE CURIOSITY**, interest and respect for local waste management and the work of the ragpickers. The **DESIGN** should reach out with the message and the **KNOWLEDGE** to as many as possible.

- SORTING- AND COMPOSTING** - the unit is to
- be robust enough for prevailing weather conditions and intense usage
 - avoid crosscutting the road connecting to the transfer station

- CREATE CURIOSITY** - the unit is to
- catch attention
 - use recycled materials for all constructions possible, including creative art elements
 - have a clear, distinct and comprehensible theme, such as Waste Garden

- DESIGN** - the unit is to
- fit together with the SWaCH office building
 - have protection from dust blowing in through the windows
 - use recycled materials for all constructions possible, including creative art elements
 - include a placement of abandoned cars that are parked on the lot (auctioned out every 6 months)
 - add beauty to the area

- KNOWLEDGE** - the unit is to
- reflect the history, current use and surroundings
 - express an educational aspect, main target group classes of school children
 - use recycled materials for all constructions possible, including creative art elements
 - create connection between in- and outdoors eg. with an exhibition room with informative literature



Map. The location of the space within Kothrud Waste Depot area granted to the Garbage to Gardens project

SITE ANALYSIS

SWOT



Strengths

- The entrance platform
- High frequency of people passing by
- Several big empty spaces available
- Close to SWaCH head office
- Several trees of aesthetical and functional value
- Closeness to the memorial garden will generate a natural flow of people at the site

Weaknesses

- Poor lighting
- Heavy vehicles such as waste dump trucks
- Litter everywhere makes the place untidy
- Poorly maintained vegetation
- Area is hidden from the main road

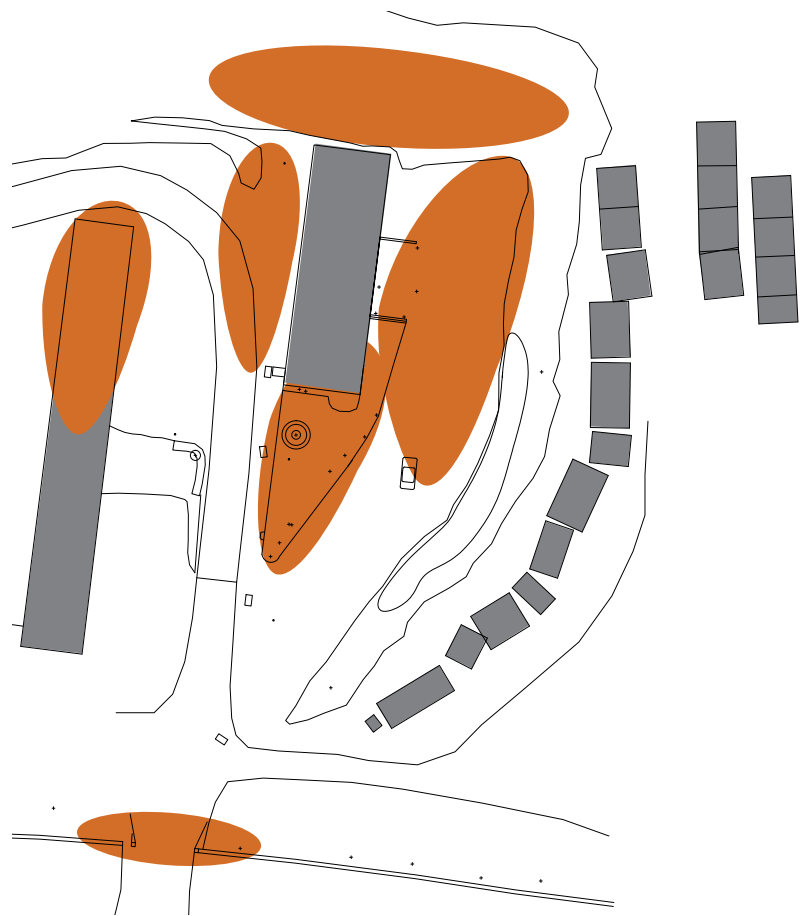
Opportunities

- Many possibilities at the site to awaken interest among people
- The large shed nearby
- The top floor of the building
- Slopes within the area result in fine run-off and nice views
- The historical aspect. The aesthetics could mirror the former use of the site as a landfill
- SWaCH office building, both interior and exterior

Threats

- The non-central location can result in few visitors
- The slope behind the house may cause complicated construction solutions
- Closeness to the transfer station causing generation of dust, odours etc.
- Old abandoned vehicles invading the lot, resulting in insufficient space
- Hard to maintain the aesthetics because of the steady inflow of new waste

Potential development



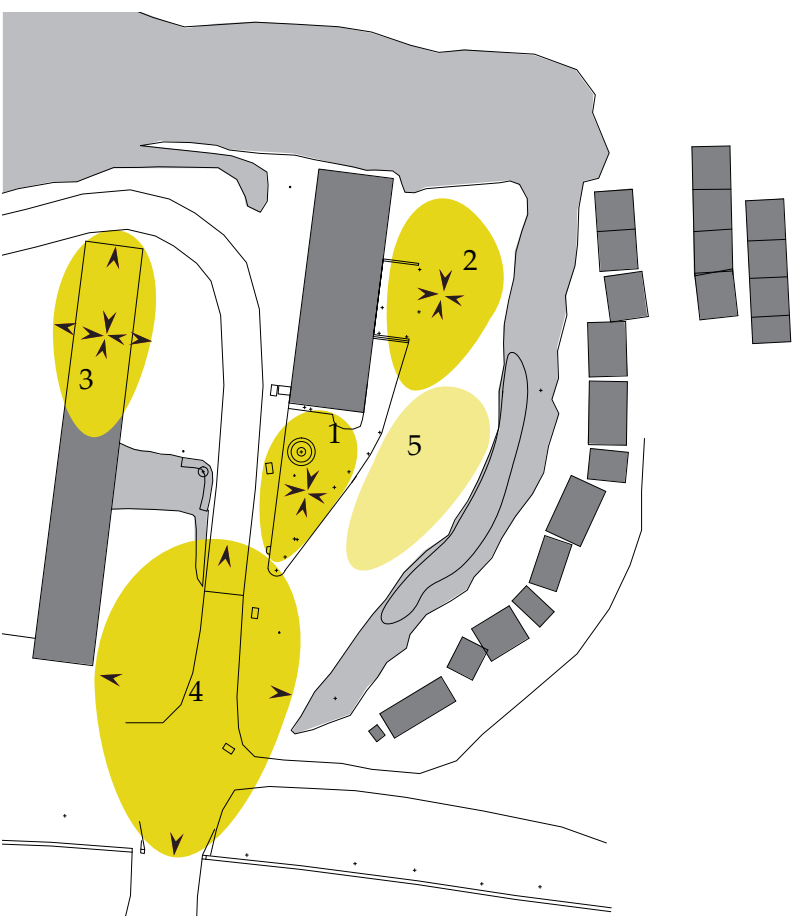
Within the area there are several spaces that can be seen as potential places for development. The different spaces may be used for specific functions; for example information, composting, sorting, interacting and attractions. The slope behind the building may be a great contribution of space if it is enhanced, for example by removing excess grass and shrubs. The vacant shed in the western side may be a good, temporary storing place.

Movement



Movement within the area is of a low frequency. Though, heavy waste dump trucks drive through the area daily. Wastepickers walk between the transit station and Paud road. Bikers are rare apart from those going to and from the SWaCH office. The main entrance is shared with the memorial tree garden and is hence used by several people each day.

Spatial structure



Spatial structure can be seen as a feeling of enclosure that a certain place with its surrounding generates.

- 1 Well defined, inviting, protected
- 2 Enclosed, spacious
- 3 Mentally enclosed, barrier-like
- 4 Spacious, open, flowing
- 5 Partly enclosed

Greenery



Greenery is welcoming the visitors into the area. Large trees growing near the office building contribute to a soothing environment where the tree crowns create a roof that offers shade from the sun. The slopes that surround the buildings are covered with small bushes and the characteristic castor oil plant (erandi) that is poisonous but usable.

Situation today



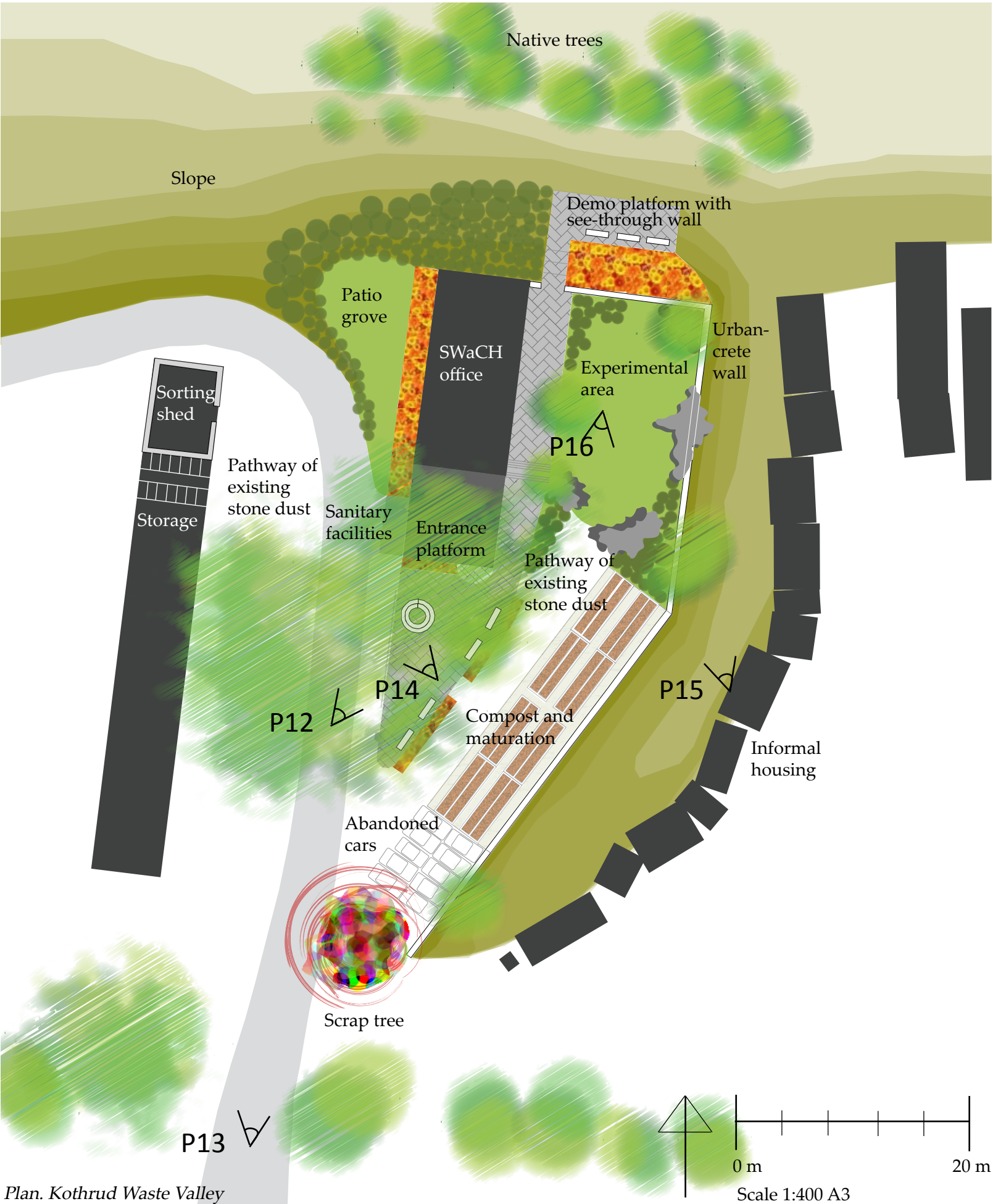
DESIGN PROPOSAL

Kothrud Waste Valley

Description

The area around the SWaCH office was formerly a dumpsite for the municipal waste. In this proposal this history intertwines with future, and turns the Garbage to Gardens concept outwards. The area will be recreated as Kothrud Waste Valley, where the educational aspect is evident. The area is beautified and made into an example of a functional waste management unit. There are spaces for interactive activities that highlight the waste management issues that Pune is facing, and promote solutions for different levels.

The Waste Valley can be used both for study visits by student groups and spontaneous visits by passer-bys or interested residents. The most important feature of the proposal is to catch the attention and attract interest in waste management among people. With its stimulating and beautiful environment, Kothrud Waste Valley will be a forum for seeing, discussing and inventing solutions to the waste problem. All constructions possible are made with recycled materials.



The ragpicker activity

The large shed west of the office building is partially turned into a sorting shed for the women that collect garbage in the area. In order to create a safe work environment the shed needs to be restored. To secure the stability of the shed, the columns that are in a very bad condition need to be replaced. The sorting area is 60 sq m where the waste from approximately 2500 households can be separated. When the ragpickers are done with the separation into 12-14 different types of waste, all the recyclables are packed and bagged, while discards are taken to the transit station just west of the shed. The recyclables are then stored in a lockable chicken wire compartment in connection to the sorting shed until traded further.

Each day around 400 kg of the organic waste (from around 250 households) that the rag pickers collect can be composted in the unit by SWaCH staff that is trained for the purpose. Ideally the composition is a mix of wet kitchen waste and shredded garden waste. Most of it goes to the composting tanks, which demonstrates an efficient community scale composting system. Some organic waste is also put in different kinds of pots and cairns, showing how household composting can be managed in an easy, clean and aesthetical way. The mature compost manure is then used in the garden, or bagged and stored with the recyclables until sold off. It is possible to organise regular shop hours when manure is sold to the public.

The waste path

When a visitor arrives to Waste Garden, the first thing he or she will notice is most likely the big tree made out of scrap, situated close to the gates. Hopefully he/she will get interested, and take the chance to follow the waste flow. The natural introduction site is on the platform right in front of the SWaCH office. On the front wall the flow is illustrated as a cartoon, also telling where on the site one can observe the different steps. If a school group is visiting, this is also where verbal introductions can be held with the students sitting on the benches under the trees.

From the platform one can continue to the sorting shed to see the segregation, packing and storing of the waste. As a comparison you can also walk a bit further to the transit station, to grasp what a difference it makes environmentally if nothing is recycled or composted.

A visit to the composting tanks will give knowledge of how the organic waste can be turned into a resource in only 3 weeks. We propose a system based on the days of the week, which can easily be applied to communities. The visitors will see a well-working odourless hygienic facility.

The path on the east side of the office is paved, and lined with composting pots suitable for households. The open lawn is an experiment space where SWaCH can develop new waste management ideas and techniques in collaboration with the public. The lawn is framed by landscaping elements: vegetation and cairns with composting holes. The slope is limited with an urbancrete wall along the area.

In the slope north of the lawn there is a demonstration space. Stairs lead up to a platform that has a wall against the slope made out of transparent acrylic or glass sheet. There you can see the underground with its traces from the area's past as a dumpsite. There are benches, and an opportunity to conduct scrap workshops where children can build things out of waste. The works of art can be taken home, or hanged in the scrap tree.

The roof terrace above the lower part of the office building can be reached by a ladder on the front side of the bathroom wall. From the terrace you get a nice overview of the waste valley. The terrace can be used as a meeting place for SWaCH members or just as an exciting viewpoint for visitors.

SWaCH administrative staff needs

On the west side of the office there is a proposed grove. The bushes provide wind shelter and dust barrier for the office windows, and create a natural harbour that can be used for meetings.

Vehicles

Two-wheelers and a number of four-wheelers can be parked along the entrance platform on the west side. The ragpickers can also lock their pushcarts to the stand during the night. The abandoned cars that are currently standing on the site are piled south of the composting facility in two layers. There they are easily accessible when they are to be auctioned out.

Overall approach

An interactive educational garden around the SWaCH head office.

Aesthetics

- a green space beautifying the area with landscaping elements such as high vegetation, open lawns, walls, cairns and pots
- a variety of flowering and sweet-smelling native plants: both trees, bushes, shrubs, herbs, ground-covers and climbers
- a well-constructed, hygienic waste sorting and composting facility to act as an example

Multifunctionality

- arranged study visits as well as spontaneous visits
- functional space for the SWaCH ragpickers to work
- capacity to cater for the waste management needs of 2500 households
- focus on environmental education within waste management
- act as a model on household, community and city level

Features

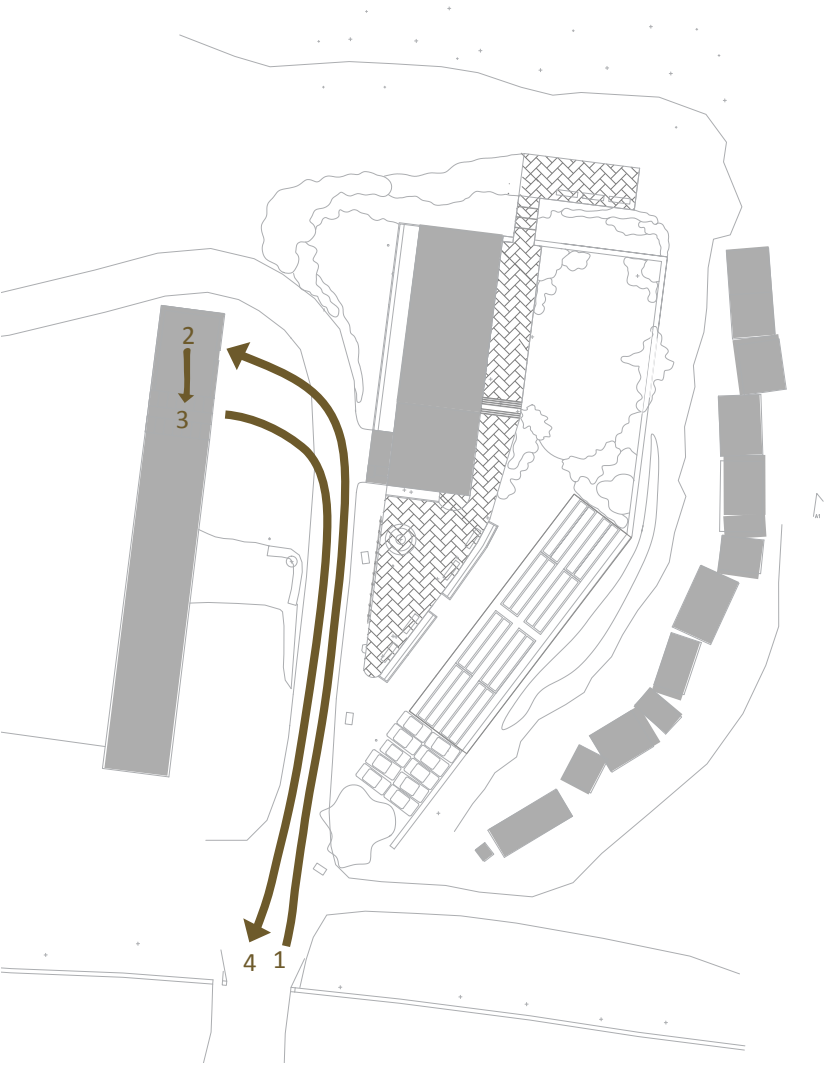
- open to public all day, although activities might take place at certain hours
- proximity to transit station and municipal tree memorial
- parking for vehicles arranged
- waste tree to interest people on the street and invite them into the waste valley

Design approach

The unit contains many gardening elements that are common in other Indian gardens with colonial influences. The use of recycled material in the constructions is the most significant divergence. Limited space, specific wishes by the SWaCH staff and large level differences are a few reasons as to why we have given Kothrud Waste Valley these specific solutions. There was a prominent wish to make the whole area tidy and clean, which we found made a naturalistic design more adapted to its surroundings inappropriate.

Proposed functions

DRY WASTE FLOW



- 1. Arrival
- 2. Dumping and sorting
- 3. Storage
- 4. Further trading

WET WASTE FLOW



- 1. Arrival
- 2. Dumping and sorting
- 3. Composting
- 4. Maturation
- 5. Garden
- 6. Storage
- 7. Further trading

HUMAN MOVEMENT



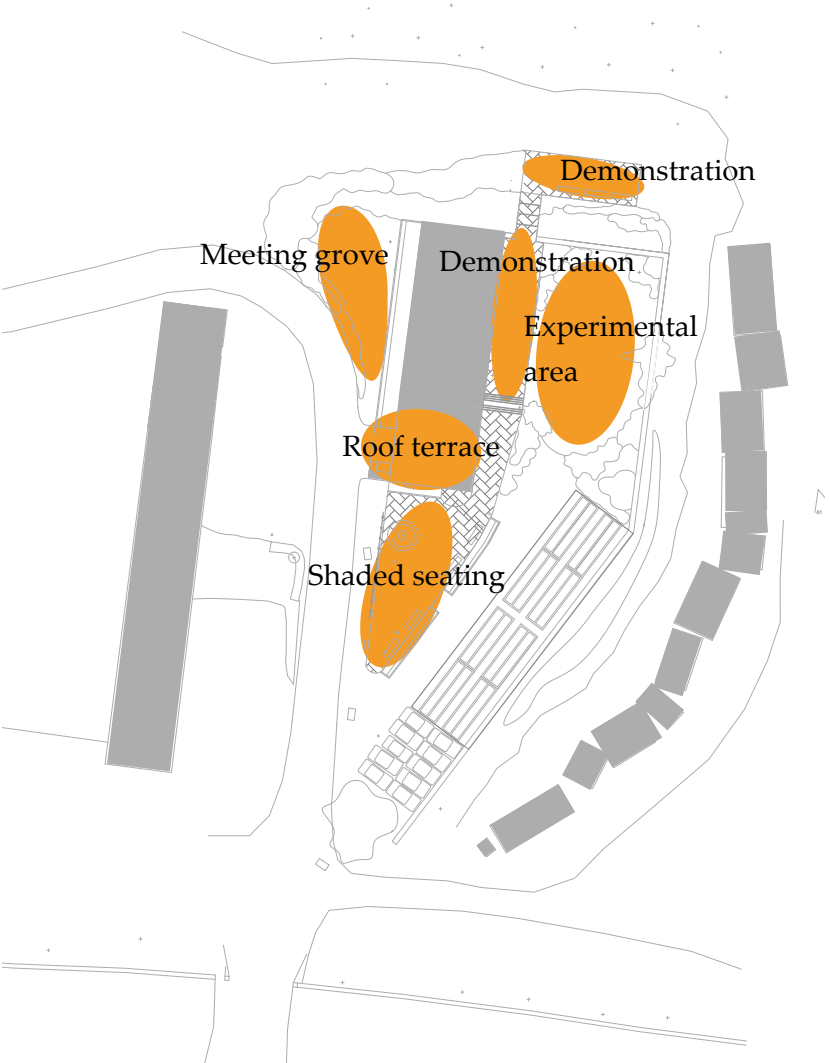
- Recreational visitors
- Field trip and information
- SWaCH workers
- Parking and rickshaws

VEGETATION



- Framing vegetation
- Flowering plants

TIME SPENDING



VISUALISATION



Bird's view perspective from north east.

P12. Perspective: platform area

- lush platform functioning as introduction site
- seating for groups listening to presentation or others
- waste cycle description on the SWaCH office front wall
- ladder leading to roof terrace
- bicycle parking that SWaCH pushcarts can be locked to during night-time
- grove to prevent dust in the building, and make grove for meetings



P13. *Perspective: view from Paud Rd*
 - startling scrap tree
 - road leading to platform, sorting shed and transit station further away on the area



P14. *Perspective: sorting shed*
 - sorting shed with low earthbag wall
 - lockable storage space of chicken wire
 - ladder leading to roof terrace
 - existing circular bench around tree



P15. *Perspective: interactive demonstration spaces east of office building seen from slope*

- ecological lawn for experiments and workshops
- cairns with holes for composting
- flowering framing vegetation
- pot composting demonstration on paved path along office wall
- platform in the slope with transparent wall cut into the slope to see the remains of former landfill
- compost tanks with roof or recycled plastic
- characterful native trees in the slope seen even from a distance



P16. *Perspective: demonstration space and compost seen from north*

- ecological lawn for experiments and workshops
- cairns and pots for compost demonstration
- flowering and sweet-smelling plants
- compost facility with curtains of recycled plastic bottles
- space for abandoned cars



CONSTRUCTION AND VEGETATION

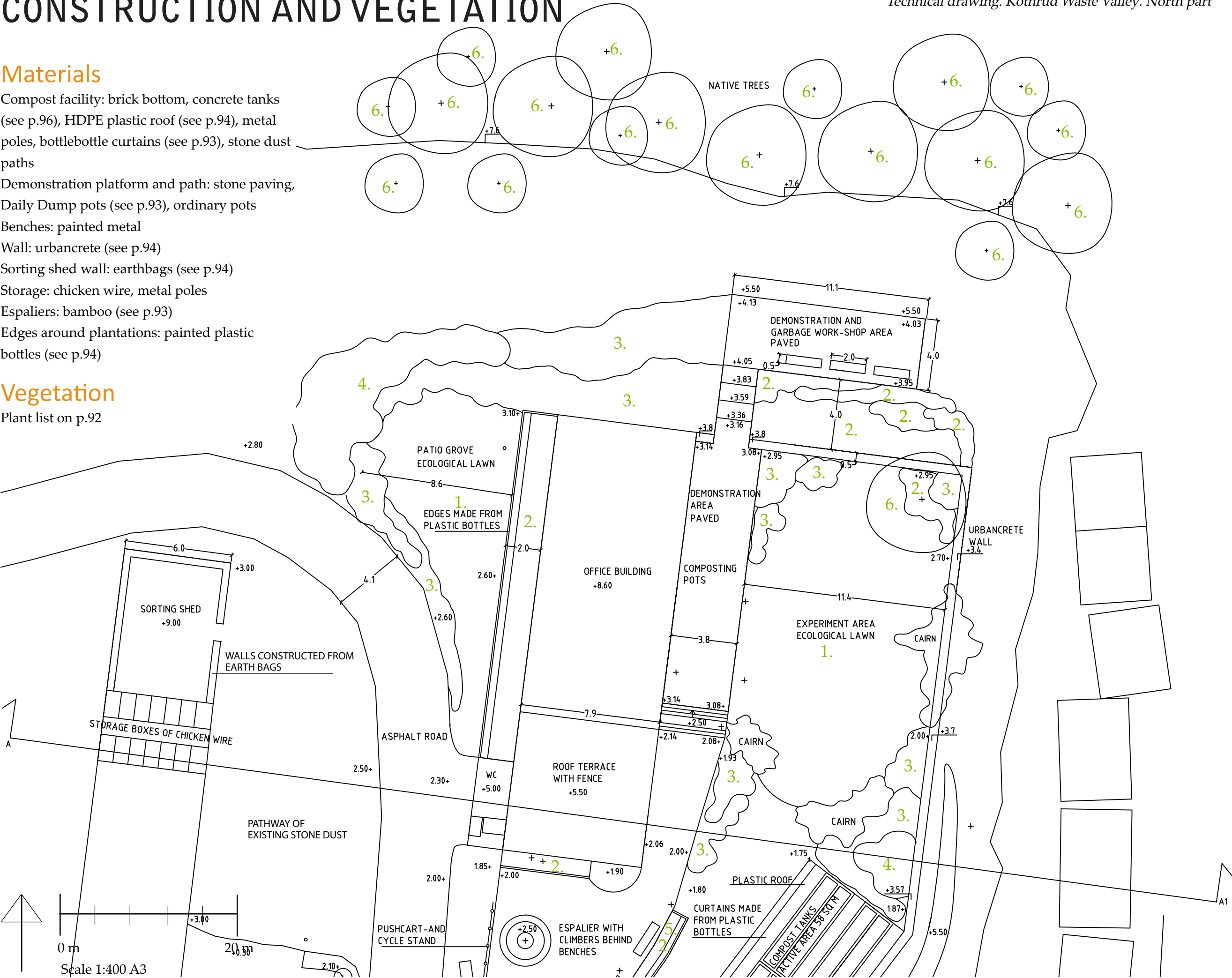
Technical drawing. Kothrud Waste Valley. North part

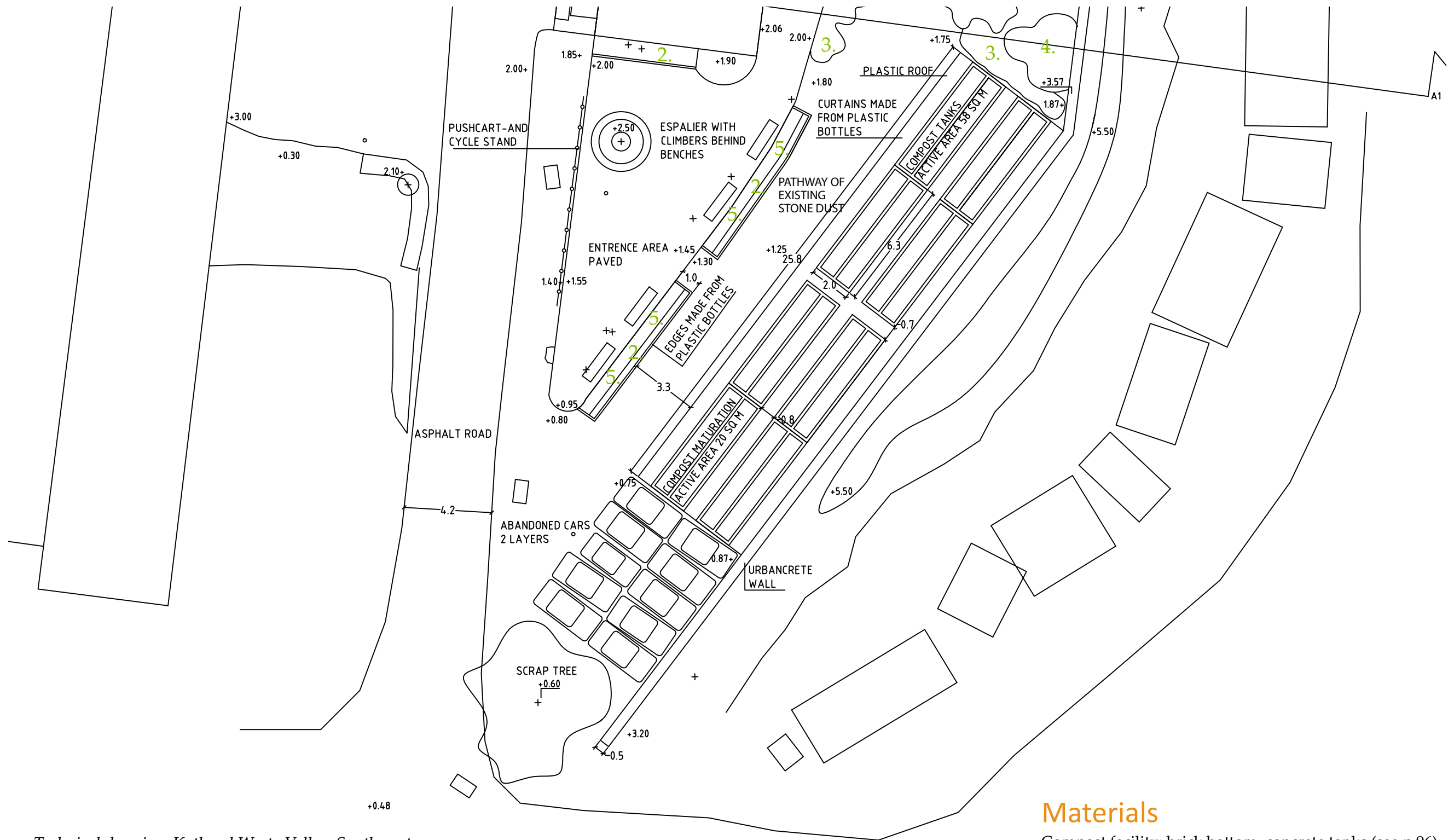
Materials

- Compost facility: brick bottom, concrete tanks (see p.96), HDPE plastic roof (see p.94), metal poles, bottlebottle curtains (see p.93), stone dust paths
- Demonstration platform and path: stone paving,
- Daily Dump pots (see p.93), ordinary pots
- Benches: painted metal
- Wall: urbancrete (see p.94)
- Sorting shed wall: earthbags (see p.94)
- Storage: chicken wire, metal poles
- Espaliers: bamboo (see p.93)
- Edges around plantations: painted plastic bottles (see p.94)

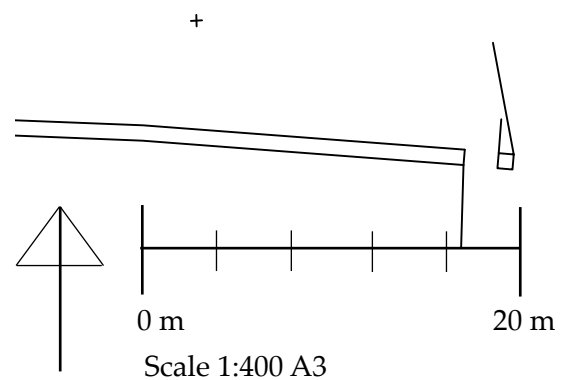
Vegetation

Plant list on p.92





Technical drawing. Kothrud Waste Valley. South part



Materials

Compost facility: brick bottom, concrete tanks (see p.96), HDPE plastic roof (see p.94), metal poles, bottlebottle curtains (see p.93), stone dust paths

Benches: painted metal

Wall: urbancrete (see p.94)

Esapliers: bamboo

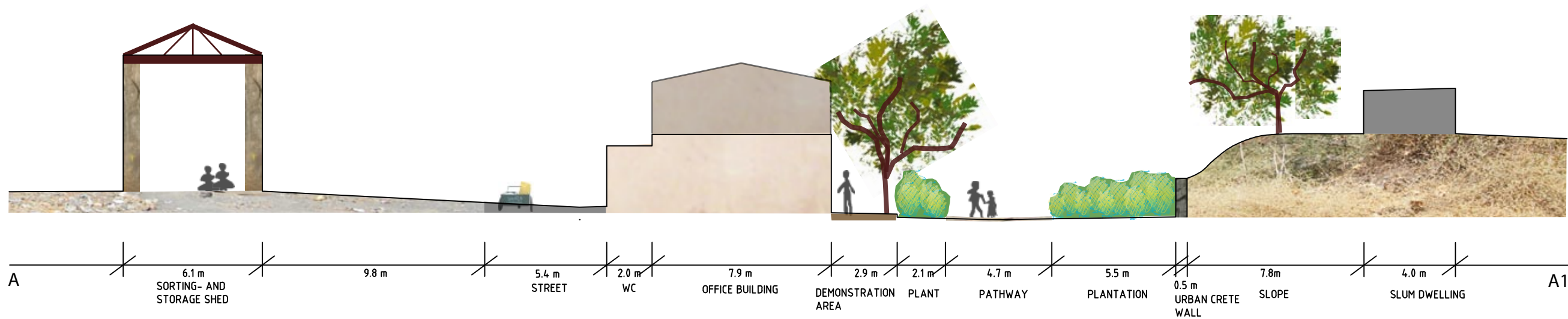
Edges around plantations: painted plastic bottles (see p.94)

Scrap tree: scrap of choice (see p.94)

Vegetation

Plant list on p.92

Section
A-A1



Section. Kothrud Waste Valley

VEGETATION SUGGESTIONS

This plant list is to be seen as a range of plants that work under the given circumstances, of which a few can be selected due to accessibility at the time of purchase. When several adjacent fields are marked with the same number, different combinations of plants can be used in the adjoining fields.

The vast majority are native plants and ecologically friendly since they can survive the local climate with a minimum of maintenance and water. Merely during the hottest months of the year the herbs and perennials need irrigation. Prior to plantation the ground should be covered with 10 cm of plant soil.

The plant suggestions are chosen among the native plants described on the *GROW NATIVES Information of 300 common and uncommon species of native plants* CD from Oikos (d.u.) and the online flora *Indiaplants.com* (Jagtap, d.u.).

1. Ecological lawn (always these two plants combined)

Centella asiatica	Mandukaparni
Cynadon dactylon	Harali

2. Perennials and herbs – Low vegetation

Plant distance: 30 cm center to center

Aloe vera	Korphad
Aptenia cordifolia ‘Rosea’	
Aster amellus	
Asystasia coromandalina ‘Alba’	
Bacopa monnieri	Neer Bragmi
Barleria prionotis	Kholeta
Celosia argentea	Kurdu
Celosia argentea plumosa var. New look	
Colebrookea oppositifolia	
Coleus blumei hybrids	
Cryptanthus bivittatus ‘Pink starlite’	
Eranthemum purpureum	Kodia Jambhala
Eranthemum roseum	Dashmul
Gazania rigens ‘Nanus’	Gazania
Hemigraphis colorata ‘Exotica’	
Hibiscus rosa sinensis ‘Rose flakes’	
Impatiens sp.	Terada
Mentha x piperita	
Ocimum sp.	Tulas
Pennisetum sp.	
Plectranthus barbantus	Mainmul
Pogostemon benghalensis	Pangali
Setcreasea purpurea/pallida	
Spermadictyon suaveolens	
Tamarix ericoides	Sherani
Tetrastigma vainianum	
Thespesia lampas	Ran Bhed
Trifolium dubium	
Tropaeolum major	

3. Mixed, medium high vegetation

Plant distance: 0,5-1 m center to center

Bauhinia tomentosa	PivalaKanchan
Carrisa congesta	Karwand
Clerodendrum inerme	Koynel
Crotalaria retusa	Dingala
Dichrostachys cinerea	Durangi
Justicia adhatoda	
Indigofera cassioides	Chimnati
Inoxa coccinea	Bakora
Maytenus senegalensis	Henkal
Plumbago zeylanica	Chitrak
Reinwardtia indica	Piwali abai
Vetiveria zizanoides	Wala
Woodfordia fruticosa	Dhayati

4. Framing, high vegetation

Plant distance: 1,5 m center to center

Bambusa arundinacea	Bamboo
Butea monosperma	Palas
Capparis divaricate	Pachunda
Dendrocalamus strictus	Bamboo
Gnidia glauca	Rametha
Murraya exotica/paniculata	Kunti
Murraya koenigii	Kadhipatta
Nyctanthes arbor –tristis	Parijatak
Vitex negundo	Nirgudi

5. Climbers

Argyreia nervosa	Samudra Ashok
Celastrus paniculatus	Malkanguni
Clematis triloba	Morvel
Cryptolepis buchani	Kawali
Diploclisia glaucescens	Watoli
Hiptage benghalensis	Madhavilata
Jasminum malabaricum	Kusar

6. Trees

Acacia nilotica	Babhul
Alangium salvifolium	Ankol
Artocarpus heterophyllus	Phanas
Azadirachta indica	Neem
Bauhinia purpurea	Rakta Kanchan
Cassia fistula	Bahava
Emblica officinalis	Awala
Ficus benghalensis	Wad
Ficus hispida	Kal Umbar
Ficus religiosa	Pimpal
Limonia acidissima	Kawath
Mangifera indica	Amba
Moringa oleifera	Shewaga
Santalum album	Chandan
Schleichera oleosa	Kusum
Tamarindus indica	Chinch
Terminalia bellirica	Beheda

7. Perennials for recycling sign

Plant distance: 20 cm center to center

Red leaves:	
Acalypha wilkesiana ‘Rosea’	Khajoti
Eranthemum purpureum	Kodia Jambhala
Hemigraphis colorata ‘Exotica’	
Herbstii acuminata	
Setcreasea purpurea/pallida	
Green leaves:	
Aptenia cordifolia ‘Rosea’	
Asystasia coromandalina ‘Alba’	
Mentha x piperita	
Tetrastigma vainianum	

MATERIALS AND TECHNIQUES

The aim is to use as little non-renewable natural resources as possible in the production of the materials used. Therefore we suggest the use of recyclables and residual masses as far as it is reasonable. In Anand Park the focal point is innovative beautification, which causes a choice of materials that do not look like waste even though they are recyclables. In Kothrud, however, the purpose is to educate about the possible uses of waste. There the suggested materials show their backgrounds as waste in a more obvious way, without looking unaesthetic.



BAMBOO WALLS

Bamboo canes joined together in dense screens. They can effectively be used for inner walls since degradation goes slow as long as the wall is not exposed to water.



BOTTLEBOTTLE CURTAINS

Curtains or screens made out of recycled plastic bottles.



DAILY DUMP POTS

House composter clay pot with lid or plant on top. Composting solution that bring together aesthetics, hygiene and convenience for anyone wanting to convert household waste to useful high-quality compost.



EARTHBAG BUILDING

Filling double earthbags with local, natural materials that are not decomposable, attractive to vermin or burnable. They are stacked in any shape desired and covered with plaster for protection, forming a wall or a building. Choose solid earthbags instead of flexible ones. For very stable constructions a mix of 10% cement, 10% water can be added to the filling material.



RECYCLED HDPE PLASTIC SHEETS

Recycled products of high density polyethylene plastic are melted down and made into corrugated plastic sheets. Suitable proportions of colored and transparent plastic can be used to create semi-opaque roofing for the compost facilities.



SCULPTURAL SCRAP ANIMALS

Any kind of scrap collected and formed into animal sculptures, for example a bengal tiger or monkey climbing in the tree.



PLASTIC BOTTLE EDGES

Recycled plastic bottles with the top part cut off. Painted, filled with sand and half dug into the ground placing them on a row after each other.



SCRAP TREE

Any kind of scrap built into a natural size tree. May have hanging scrap pieces with painted pictures of naturally occurring birds and their names.



URBANCRETE

Old concrete that has been torn out. Flatwork slabs such as sidewalks and driveways work best. It can be stacked like stone for walls etc.

TECHNICAL DETAILS

Space requirements

The basic fact we have used for the calculations is that the average household waste across economic classes in Pune consists of 22% dry and 78% wet waste, this according to SWaCH representative Laxmi Narayan (2010).

We have looked at three sources to size up how much space is required for the compost facility. According to the report “Decentralised composting of urban waste...” 150 sq m/ton of mixed waste/day is required (Zurbrügg et al, 2003, p.3). The Eawag/Sandec report suggests 510 sq m/3 tons mixed waste/day (Rothenberger et al 2006, p.85). The local Institute of Organic Agriculture Inora recommends 240 sq m/500 kg organic waste/day (Tadwalkar, 2010).

To be able to compare these recommended standards we needed to recalculate the figures to the same units. The calculations showed that 225 sq m (Zurbrügg), 255 sq m (Eawag/Sandec) and 480 sq m (Inora) is required/ton wet waste/day. We have decided to follow the recommendations from the Eawag/Sandec report because their report is substantial and credible and their recommendations are the in-between one of the three alternatives.

Site specific calculations

Since the following calculations are done through estimated numbers we have accounted for bigger areas than required to be sure that there will be sufficient space.

Anand Park: 400-500g kitchen waste + 600 g garden waste + 320 g dry waste / household / day
Wet waste from 1000 households/ day
Dry waste from 1000 households/ day
Facility may cater for a total of: ~1,5 ton waste/day

Kothrud: 400-500g kitchen waste + 600 g garden waste + 320 g dry waste / household / day
Wet waste from 2500 households/day, where waste from 300 households/day can be taken care of in the compost facility.
The remaining is to be discarded in the transit station nearby.
Dry waste from 2500 households/ day
Facility may cater for a total of: ~1,1 ton waste/day

Recommendations of sufficient area. Calculated for the amount of waste received at each location according to the Eawag/Sandec report (Rothenberger et al 2006, p.50).

	Anand Park	Kothrud
Sorting	20 sq m	60 sq m
Storage of rejects	15 sq m	15 sq m
Storage of recyclables	10 sq m	20 sq m
Composting	180 sq m	63 sq m
Maturation	75 sq m	26 sq m
Screening and bagging	18 sq m	18 sq m
Storage of compost	13 sq m	13 sq m
Office	10 sq m	(12 sq m)
Sanitary facility	10 sq m	10 sq m
Tool shed	8 sq m	8 sq m
Water supply point	4 sq m	4 sq m
Parking	20 sq m	30 sq m
Total	382 sq m	267 sq m

In our design proposals we have decided to adjust the recommended space requirements because of different factors.

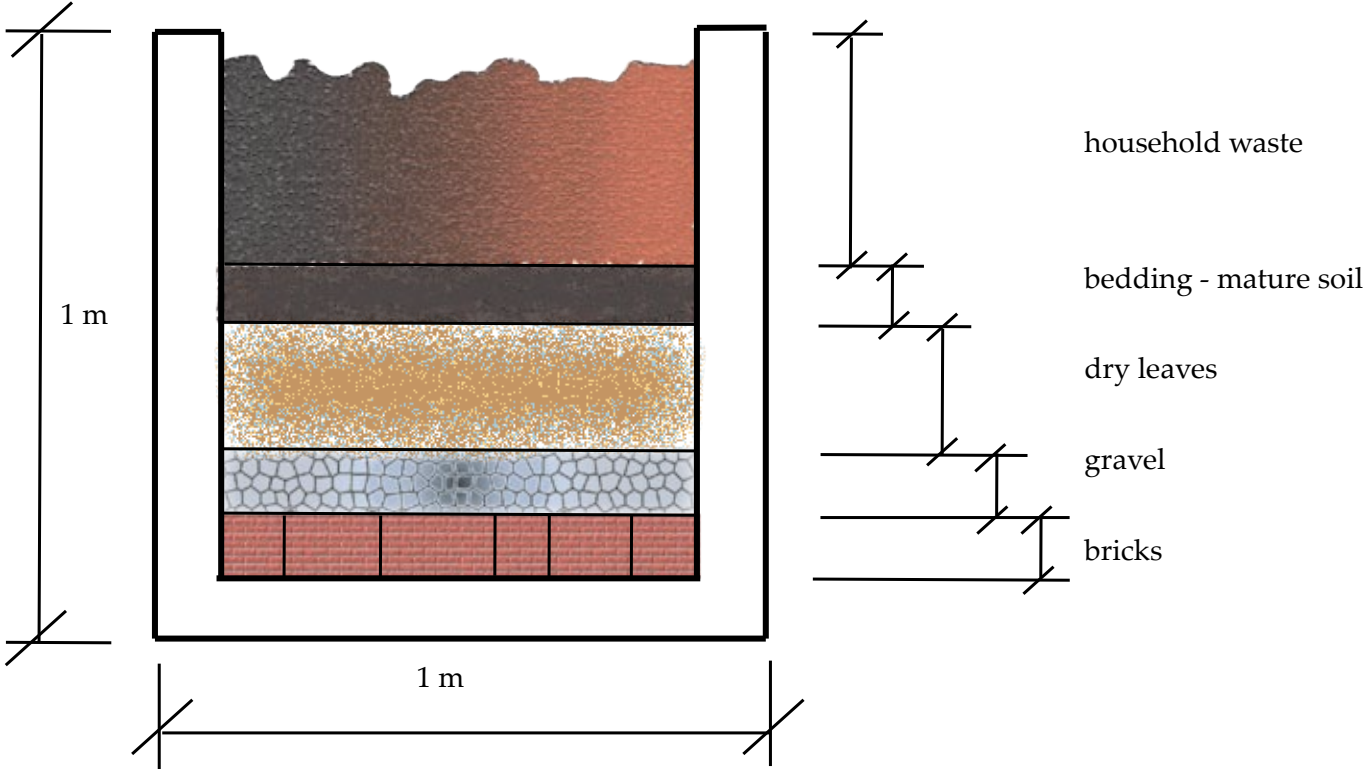
The sorting area in Anand Park is planned three times larger than suggested. Our justification for doing this is that space is not an issue, which means we might as well plan for an expanding unit where larger amount of waste may be taken care of later on. The sorting area also provides room for a small office space with a desk, chair and paper archiving possibilities. Potential sale of mature compost soil can also take place in the sorting shed.

In Anand Park the intake of dry waste cannot be higher in this phase because there are no possibilities to take care of wet waste from more than 1000 households due to space limitations. Trans-orting wet waste further to a transit station is not an option, since the main purpose of the unit is to reduce the transports. Since the wet and dry waste reach the facility un-segregated, the composting capacity is the limiting factor.

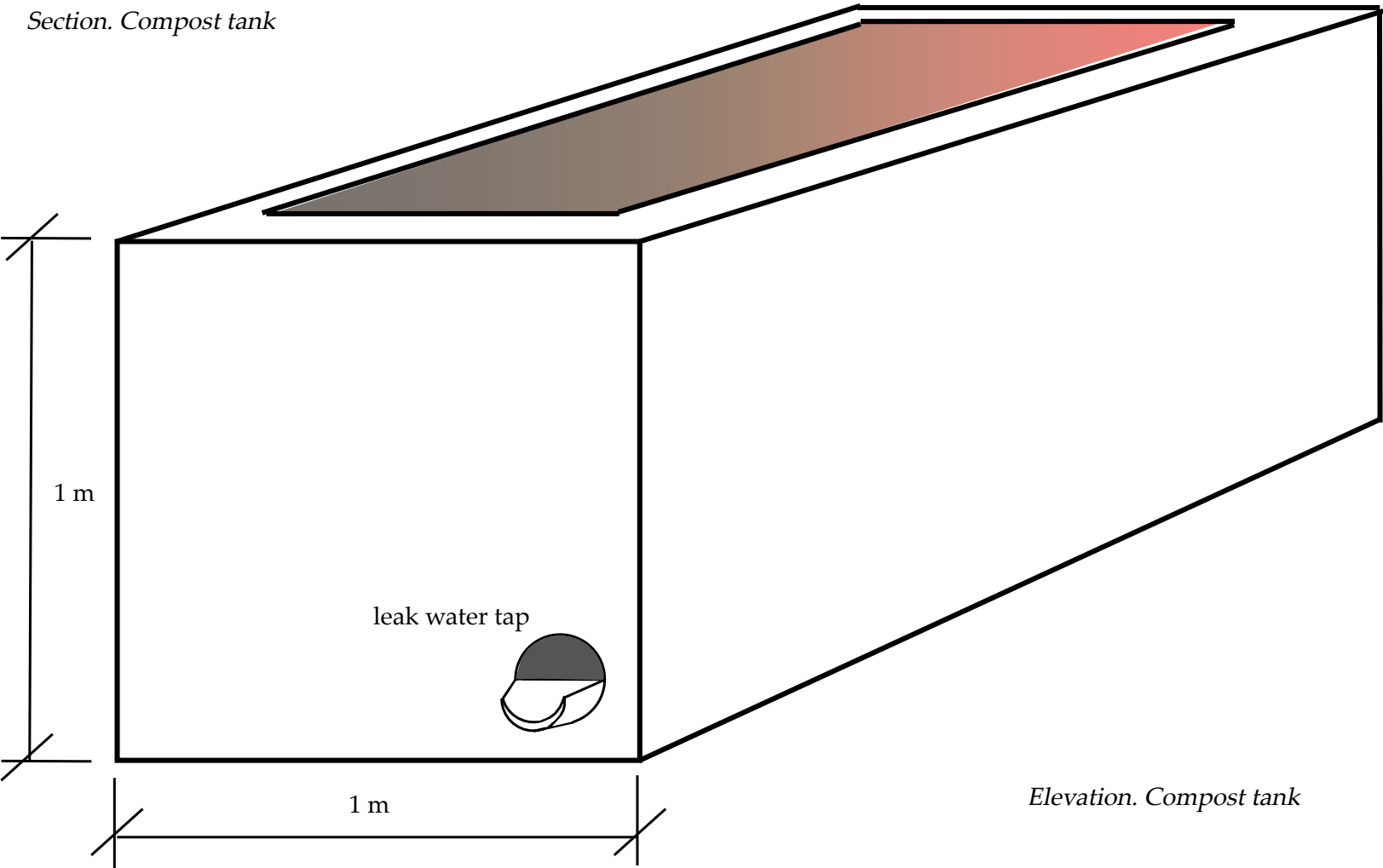
In Kothrud requests for open space from staff members at the SWaCH cooperative head office made us limit the area for compost and maturation. Hence wet waste from only 300 households can be handled at the site. Bigger amounts of dry waste can on the other hand be managed. In contrast to the Anand Park unit, the residual wet waste created through the segregating process may be dumped at the transit station close by if another solution is not developed. Letting the organic waste go to the landfill is clearly against the project objectives, but performing some composting is still a better option than doing no composting at all. We have not planned an office space nor a tool shed in Kothrud, because of the presence of the SWaCH office building that can provide these functions.

Proposed system

The proposed system has been developed with input from Inora on different composting systems that we got from mrs Tadvalkar (2010). The composting and maturation processes take place in concrete tanks with a depth and width of one meter. The length of the tanks may vary according to what suits the area best. The method used is vermicomposting, where worms and microbes transform the household waste into mature compost. The household waste is placed in specific compost tanks depending on the day of the week. Fresh household waste is thus added to each tank only once a week, giving the garbage time to decompose. If the compost gets exposed to extreme heat the tanks can be covered by wet cloth to keep the moisture inside the tanks and the excessive heat outside. Leak water from the compost trickles out through the tap in the lower part of the tank and can again be added to the top. The fresh water supply is situated in the most suitable location depending on free space and access at each site.



Section. Compost tank



Elevation. Compost tank



DISCUSSION

Our role in the project
Method evaluation
Project feasibility
Scandinavians in India
Predicted outcome versus reality
Lessons for our professional future
Concluding remarks

This chapter is an evaluation of the project Garbage to Gardens as well as of our contribution to it. We discuss what we have learned by working under unfamiliar circumstances in India, and how this can be used in our professional role as landscape architects.

Our role in the project

Why did we undertake this assignment?

We chose to apply for a Minor Field Study because we saw the opportunity to participate in a project we believed could make a difference to people in the long run. We wanted to enhance the quality of life for people and improve the environment over time. We also nurtured a hope for growing as human beings through the experience. Developing countries and the associated problems was something both of us wanted to gain more knowledge of. When we got the invitation from CEE to participate in the project Garbage to Gardens we saw a great opportunity to fulfil these wishes.

What do we want to achieve, and how?

Our main objective has been to contribute to a project that will result in an improvement of both the environmental and human quality. The end product has to be durable and long lasting in terms of function, aesthetics and construction. The only way to make these intents reality is through reaching out and receiving positive responses from stakeholders.

Once built, the facilities have to be functional and beautiful to attract both workers and visitors. If only one of the two conditions is fulfilled the project falls flat. A functional facility that is not used or maintained does not make a difference. But a non-functioning beautiful facility does not either have a positive impact, if the sole purpose is not visual pleasure. The best possible achievement would be a facility successful enough to inspire similar projects to be launched all over Pune, and further.

The advantage of being a landscape architect in a situation like this is that we are accustomed to understanding many professional groups, as well as to creating convincing images and plans for environments that suit different purposes. We have been trained to communicate with diverse categories of people, which also facilitates being good project coordinators that can push the project in the right direction. All along the process we have tried to keep in mind that we are landscape architects and that we need to let our work benefit from these specific skills.


It is easy to get lost in the world of engaging development concerns. One's wish to help may cause forgetting one's profession, and actually be of less use than one would have otherwise. Two architects Veikko Vasko and Hennu Kjisik, that have been working consistently in development projects during their career once said: "An architect has many faces - watch out or you might do many things that have nothing to do with architecture" (2008). Of course it is not always a bad thing to get involved, but we believe that the greatest impact will be made if we use our professional skills without too big distractions.

Have we reached our goal?

In the Garbage to Gardens project all the stakeholders - possibly apart from the landowner - are very eager and happy about the waste management units. We had a continuous dialogue with the SWaCH staff, representing the ragpickers during our design phase. They made an effort to listen to our ideas, and we incorporated their feedback in the proposal. We also had close contact with some real driving spirit residents from Anand Park, mr and mrs Bhagwat. All of this positive attitude made our work easier. We felt like our contribution was appreciated, which triggered us to do our best.

Just before leaving India, we presented our final proposal for Anand Park to SWaCH staff, Anand Park Residents Association chairman, Aundh Ward Deputy Sanitary Inspector from PMC and some staff from CEE. It was well received, and everybody said that our visualisation of the design convinced them that our solution was promising. They were eager to take our proposal further and construct it. Since one goal has been to





propose designs based on the wishes and needs of the stakeholders we saw their approval as an indicator of a successful work. Although we put the stakeholders in focus we feel that we have managed to stay designers and not forget our title as landscape architects throughout the process. We cannot predict the success of the built facility, though. We are staying in touch with the ones that are responsible for taking the project further, to do what we can to make sure the plans are not distorted along the way. Even if the units were to be constructed accurately according to our designs, we cannot get a verification of

a successful outcome before the units are constructed. There are questions of how the units will be received in the vicinities, if they will be managed in the right way to sustain their initial purpose and if the ragpickers will be able to adapt their routines to the new work conditions. We only hope that by listening closely to the involved parties and by combining all the wishes into a solution approved by them, this project will have a positive outcome.

There are crucial factors for the realisation of the project that we have no possibility to influence. The land ownership is one of them. In Kothrud it is not an issue since it is municipal land donated to SWaCH for the purpose, but in Anand Park the situation is more complex. After our departure we learned that the Resident Association has been fighting a legal battle for many years to claim ownership of open spaces in the area. Typically court cases in India run for tens of years. Most residents are of the view they cannot officially sponsor any construction activity until the court case is settled. However, a few weeks after our departure from India we got sent photos from the clearing of the triangular lot in Anand Park. Mr Bhagwat, SWaCH, CEE and DSI Dr Joshi have clearly decided that waiting is not a good option. They will start to clean up the space, and beautify it little by little. No one would resist that, and in the end if the court definitises that the ownership belongs to the Resident Association there will be no problem. If the court judges differently, the owner will hopefully think that the lot, with its new design will look better than before and give his consent.

In conclusion we have been lucky to collaborate with such dedicated and clever people. This close collaboration is a key factor that may lead to a successful project realisation.

Method evaluation

We chose to work with the Logical Framework Approach method because we realised in an early stage of the project that we as landscape architects naturally have a very similar work process. We are trained to approach projects from different angles and always include a broad range of aspects. It is the normal scenario to let the stakeholders of the project have a great influence, conducting to a better result. Like in the LFA method, we never have a predefined way from beginning to end to tackle a new assignment. Whenever we come across new data on the matter we may go back to rework and customise the task according to the new information, so that the final results are accurate and of a high quality.

Following the LFA method has been both an asset and a difficulty within our project. The positive aspect is that the LFA, if followed correctly, forms a firm foundation that dodges many errors and loopholes. All the actions within a project carried out with the Logical Framework Approach are directly connected to the objectives. Since the objectives are supposed to be developed in collaboration with the stakeholders the benefits of the project are ensured to be significant. The results of the project are easy to detect and evaluate by looking at the disappearance of the problem causes. The main obstacle for us working with the LFA has been that “the problem analysis has to be made by the relevant stakeholders, including the owners of the project, the people who know the situation, not by consultants of financing agencies” (Örtengren, 2004, p.11). Further one can read that “an initial (GOPP) goal oriented project-planning workshop is usually arranged for two to four days, depending



on the project and the needs. During the workshop the broad group of stakeholders normally go through the different steps in the LFA analysis” (Örtengren, 2004, p.21). Since we decided to be a part of the already on-going Garbage to Gardens project we had to adjust the method to our work process. We decided to form the project plan including the project analysis on our own, although we are the consultants in the project. No GOPP workshop was held. Our motivation for doing so is that we still obtained a vast amount of stakeholder input through the field study; input that we put much effort in including in the plan. While studying literature we also learned that participation can have different levels that may all be good in certain projects. In a waste management project it might not always serve the purpose to conduct residential meetings and workshops in the initial stage. Since garbage and waste issues are a delicate problem in India, the wealthier people have a tendency to ignore and reject them. In high-income neighbourhoods the residents often do not even want to see the garbage after they discard it. Since this is the state of mind, it is very hard to overcome the contempt toward having local sorting and composting units in the communities.

As already mentioned, by talking to involved environmentally engaged residents in Anand Park we learned that the best way to construct these facilities is to divide the process into different steps and implement one step at a time, hence gradually introduce the citizen to the new facility in their neighbourhood. This

“It is often easier to reject something in an early stage simply out of fear, than to adapt to something that is gradually constructed”

may be the only possible way of making a project like this reality. It is often easier for people to reject something in an early stage simply out of fear, than to adapt to something that is gradually constructed. By constructing one part at a time, you can first present the decorative garden parts of the design and create good-will among the citizens, and later proceed with the construction of the sorting and composting unit with support from the concerned communities. Information meetings with residents in the Anand Park area have also been arranged after our departure.

Other than that, the difficulties with our work method were mostly connected to communication glitches and participation issues. We tried to listen to the stakeholders’ needs but noticed that a lot of information was lost in translation. We also observed that we often have a different view than many of the stakeholders, especially concerning project objectives and design issues. Our way of dealing with this was to try extraordinarily hard to understand the reasons behind these opinions and then compromise on the solutions to please everyone. This resulted in an extensive design work where continuous feedback from the stakeholders was essential.

Project feasibility

Implementation

As we now leave our project it is on the verge of moving forward from the planning phase to the awaiting construction phase. With the proper work force the construction will not take long to complete. In Anand Park clearing of the lot is already in full progress. In Kothrud no changes are visible yet, but we feel confident that the desire to build the facility will make it happen.

Our main concern regarding the future of our project is the issue of management and attendance. If the proposed facilities are going to function and serve their purpose in the long run, someone needs to attend to them and make sure they are operated correctly. Educated staff, responsive members of communities, sufficient income and support from the municipality are conditions that must be fulfilled for this to be achieved. From this point onward we have only small possibilities to influence the outcome. We strongly hope and believe that the capable Puneites we have collaborated with will grab hold of the reins and govern this project to functionality.

Local solution or general global approach?

The waste management units we designed are very site-specific facilities, as all literature we have read indicates that this is necessary to make a project like this a success. If a facility is not adjusted to the local climate, social patterns, economic position and infrastructure it is not likely to fill its function.

However, we believe that the concept of decentralised waste solutions generally work well in developing countries throughout the world. As mentioned in the literature study results, experts say that decentralisation is the only policy that works in low-income countries with a growing population, availability of manpower being one of the reasons. Decentralisation of waste management is good for the employment rate of the society as it is labour-intensive, and profitable as it is cheap to run due to the simple technical solutions. Therefore we think that the basic design ideas, proportions and materials could be used in any developing country. However, we do not think that a similar waste management system would be economically profitable enough in an industrialised country, although a better environmental solution.

The spirit of mind at SWaCH is summarised in the three R's: "reduce, reuse, recycle". The world would gain if this attitude from developing countries was spread, instead of the throw-away mentality that is so predominant in the western world.

Future visions

In the short term, the Garbage to Gardens project strives towards well-functioning decentralised sorting and composting units where the local waste can be handled. The long term objective has a more complex nature. The wish is that the units will help in educating the citizens of Pune on garbage segregation and the importance of recycling, and encourage them to take the garbage sorting to the next level. The enlightened citizens would then get to the point where they start doing the separation at household level to minimise the discards as much as possible. The optimal scenario is that the recyclables are transported by the individuals themselves to a recycling centre where they are stashed for further trading, whereupon the non-recyclables are picked up by the municipality and dumped at landfills. If this vision becomes reality it would result in decreased demand of decentralised waste sorting sheds in their present-day form. They can then be developed into recycling centres, where the sorting and storage facilities instead become storage for the already segregated recyclables. The composting units may preferably still be in use together with the garden parts to continue to spread health and goodwill and produce nature friendly compost.

"welcome the situation and go with the flow"

For the vision to become reality, there are still huge obstacles in the shape of poverty and the need for employment for the current ragpickers and those whose life depend on the recycling industry. Currently, the employees of SWaCH are members of poor families that have had their lives destroyed by floods and other disasters. The aim with their employment as ragpickers of SWaCH is that they will gain a steady income, and get a chance to secure their children's future through education. This implies that the number of ragpickers will naturally decrease as their children acquire other professions. However, we suspect that there will always be a steady flow of people who for some reason end up on the bottom layer of society, and that these kind of work opportunities will always be needed unless the current situation in the world changes drastically.

Scandinavians in India

The culture and human relations

Travelling to another country is a thrilling and rewarding experience. Although exciting, it is not the easiest thing to be a newcomer in a foreign land. Everyone naturally has preconceived ideas that may not always correspond to reality. It is of uppermost importance that you face the new country with an open mind. Equally important is that you are welcomed and accepted by the country and its citizens, for you to feel contented. It is important to remember that it is natural to feel inconvenient and awkward at first. Instead of fearing the new, our motto was to welcome the situation and go with the flow.

One of the superior aspects about being abroad and having to face the cultural clashes is that you also learn a great deal about yourself. All the things that you take for granted because of learned behaviour and routines are questioned. When you repeatedly have to motivate your actions you get more aware of your own fundamental values. Another opportunity that is not to be forgotten is the possibility for us as visitors in a foreign country to contribute with new input and influence in a positive way. To be able to combine the teaching and learning

aspects one will have to be inviting, sharing and attentive. This takes effort and strength, whereas taking time to reflect over the situation from time to time is important.

One of the puzzles we experienced in India was the communication inequalities. The Indians speaking poor English was not the issue, quite the opposite. Although there is a class issue connected to it, most of the Indians we met spoke excellent English. But even though we understood what was said, we were not always sure that we understood the meaning because of our different backgrounds. An example of a misunderstanding is the information we got from Mrs Menon at CEE in an email prior to the trip saying that the target areas are “dense neighbourhoods” (2009). We immediately thought that we would work in slumlike areas, so we studied slum issues extensively before the departure. On site in Pune it became apparent that the areas were not slums at all, on the contrary neighbourhoods with well-off inhabitants. With dense neighbourhoods they just meant that there are very few vacant lots that could be used for waste management units.

We were soon to notice that Scandinavians are known in India to have a very polite nature and always wish to be pleasing. The Indians we got to know jokingly complained several times about our exaggerated desire to say “thank you” in all situations. The Indians that we met professionally were very straight forward in their language without sugar-coating much, which we appreciated. Though, we experienced that the Indians have a tendency to promise more than they can keep. It is not necessarily out of bad will, it is just customary to sound like you are going to help although you know that you do not have the possibility to. A few times we were disappointed when meetings were cancelled in the last minute and people did not answer emails.

Work habits and conditions

Working in a different environment requires flexibility. We were thrown into some unexpected situations during the trip, for example the first day when we were suddenly expected to

make an interview with the president of Anand Park Resident Association. It was good in the sense that it gave us a kick start, but at the time we would have wished for more introduction to the project.

Another work difference between Sweden and India is the amount of advance planning concerning meetings etcetera. In Sweden we are used to deciding on meetings weeks in advance, and the times do not usually change. In India we often had meetings on short notice. More than once we had people telling us to call them the same day as the meeting to decide on the details, like it was impossible to decide anything more than a day in advance.

During our stay in India we also learned about differences in presentation technique. Although we tried to adjust, we used a “typical Swedish layout” according to the Indians we met. This layout is very simple, clean and graphic. We appreciated



these comments, since one often gets blind to one's own way of doing things, stuck in routines. In our profession we think it is important to be very adaptable and create graphics that appeal to the client and not primarily to one's own taste. Though, sometimes compromises can be made so that one's own identity and idiom are not lost in the process.

The biggest difference from working at home was the issue of time. Simple things like transportation and coordination of meetings and field trips took us a disproportionately large amount of time. Unexpected changes of the stakeholders' objectives in Kothrud forced us to do some modifications that also led to having less time than expected. Although everything took us more time in India than it would have in Sweden we were fortunate to have the assistance of dedicated and skilled resource persons all along. Most likely this has compensated for some of the time loss.

"It is important to be prepared for being unprepared for the unpredicted"

Predicted outcome versus reality

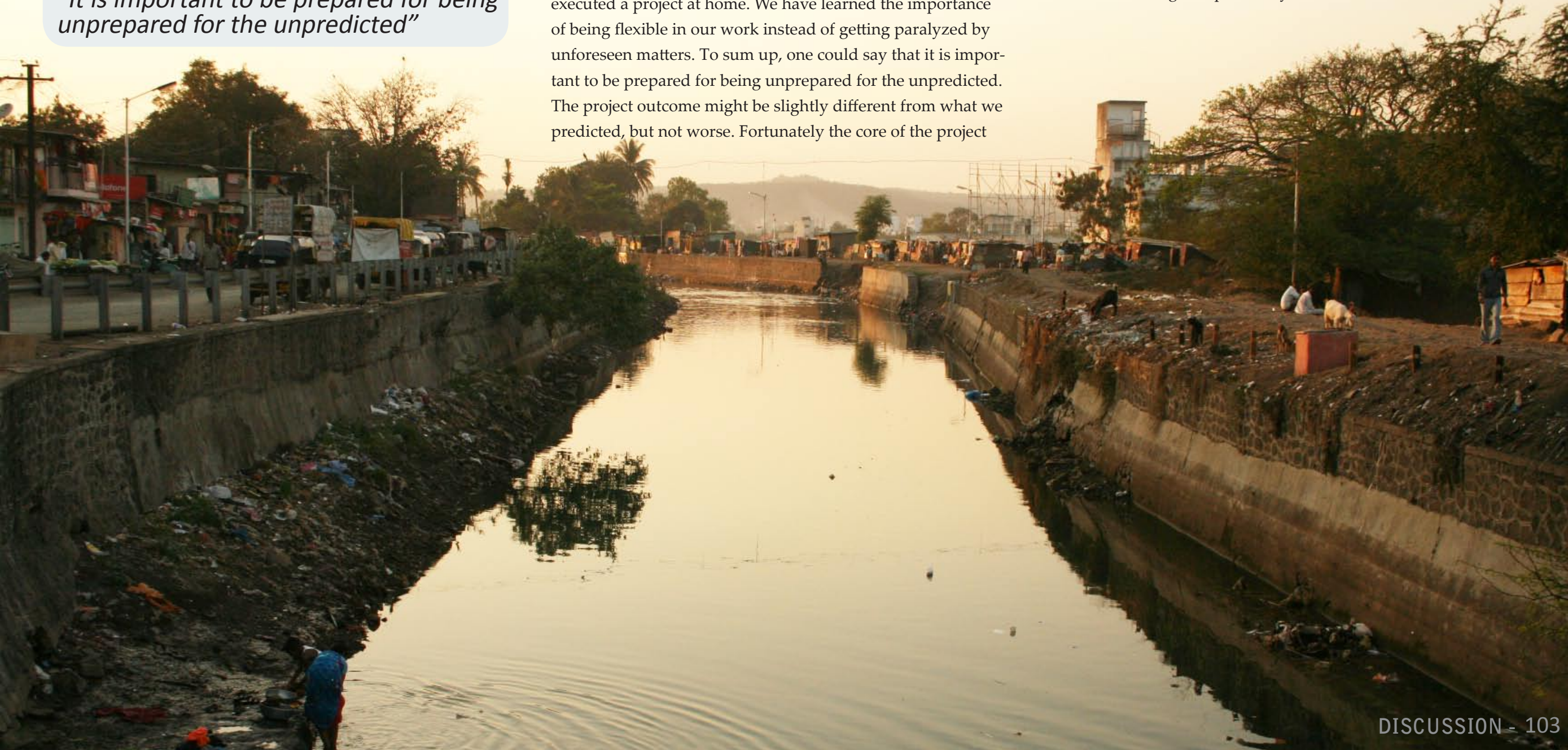
All along the process, we tried to keep in mind that "development projects might have to be developed during the process". But as long as one starts off with clear objectives, we think that changes will not be obstacles but rather chances for success. As we both are very keen on planning our work properly and having a clear structure, we tried from the beginning to organise and plan for the different stages in the process in order to reach the desired outcome. This plan incorporated a vision of our final product. Had this work been executed in Sweden the final product may perfectly well have been what we anticipated in the beginning. We have almost five years of experience in project work and have by now grasped the basics and learned our own working process and to calculate expected time consumption. But simultaneously with the change of country, we somewhat lost control of our project. We needed to adjust our time schedule a bit compared to what it would look like if we executed a project at home. We have learned the importance of being flexible in our work instead of getting paralyzed by unforeseen matters. To sum up, one could say that it is important to be prepared for being unprepared for the unpredicted. The project outcome might be slightly different from what we predicted, but not worse. Fortunately the core of the project

still remains the same which means that we had our opportunity to contribute to a project that will result in an improvement of both the environment situation and quality of life, where garbage will turn out to be garden.

Lessons for our professional future

Writing a master's thesis has taught us lessons that we will store in our mental database of experience. As the previous part of the discussion chapter implies, some of the lessons might only be useful for us if we continue working in India, and some generally in developing countries. However, we find most of the lessons eligible to be used in our professional role as landscape architects regardless of location.

As the title of the university course indicates, we have practised organising an independent degree project with all the ingredients. Working independently in a structured manner is



important in our field. We will often be part of large project groups with representatives from other professions, where we are expected to contribute with a part. Compared to engineers, architects or other likely group members, we find that landscape architects more often have an intermediary role, for example as a project leader. We think that the Garbage to Gardens project offered good practise exercising this role.

Collecting background information and making qualified analyses are common tasks for landscape architects. For us in Pune, this task had a higher difficulty level compared to doing the same in Sweden, because of the alien systems and perceptions. What we learned was the importance of asking many questions and not giving up digging for credible and relevant information. We did not always have the energy or opportunity to follow up all the input we got, but we believe being forward is a quality desirable also in Sweden.

In the design part, we think we got to practise developing practical solutions that all the stakeholders will accept. Projects where the human needs and wishes are given more importance than the architects own artistic ambition or desire to express herself is something that we strongly believe in. Also, we regard any design work as good practise because we get to refine our techniques, creative flow and computer skills each time.

Producing written material is common among the work assignments for landscape architects. In the future we might have to write different kinds of reports, proposal explanations, handling directions, environmental impact assessments and many other documents. Regardless of the language, we think one of the greatest benefits with writing this thesis is that we had an opportunity to develop our ability to express both concrete facts and abstractions and ideas verbally in text.

The several presentation occasions have given us more confidence in oral presentation. In some situations we did not have a long preparation time, and we naturally increased our effectiveness. This ability to be efficient under time pressure we believe is something landscape architects gain from, as well as an ability to speak in front of an audience. We are still far from experienced enough, but more so every time.

Concluding remarks

Waste management has truly been an significant issue in world history. Even when the early Christians had to make up a word for what we today know as hell, they thought of the landfill of Jerusalem called Gehenna and named hell after it. There poor people used to burn waste just like in so many places in India today. If poor waste management is so bad that Gehenna was used to describe an eternity away from all that is good and beautiful, we are certainly happy if we can take even a miniscule step on the way to solving this global problem.

In India we often felt like we were given a million paths to follow, like we were in the middle of something incomprehensible that we had to grasp and solve. But without us even noticing, our understanding of the local customs and problem issues grew. We learned to use our knowledge under these unfamiliar circumstances. We cannot claim that we have followed all the roads laid down before us, or that we would even be aware of all the information we have missed. But we think we have somehow managed to tackle what we thought was the biggest challenge with Garbage to Gardens: to compile all the knowledge, information and insinuations in a working format. Only after reaching that point, it was possible to think of solutions. We wholeheartedly wish that these solutions will make a difference in Pune.



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