

# Application for Plastic Pavillion Student Award 2023

**Title:**

Clean-Up Freetown

**Project description/ summary:**

Clean-Up Freetown is a strategic design concept to empower local citizens to clean their city, while preserving valuable resources and safeguarding nature and water supplies. Focusing on the innovative use of plastic materials by recycling plastic waste in the slums of Sierra Leone, the project encourages locals to actively collect, sort, and recycle plastic, transforming it into new products. This includes educational posters, inspirational products, and architectural drawings of recycling workshops. Taking a holistic approach, the project thoroughly investigates the underlying needs, struggles, and incentives of the target group to develop a comprehensive solution for cleaning nearby lakes and oceans of plastic waste. This positively impacts the local community and the surrounding natural environments. Facilities are thoughtfully designed with disassembly in mind, and a strategic plan for implementation is in place to ensure successful integration into the city's infrastructure.

**Context:**

The project was designed by Emilie Victoria Ferraro Steuch, Kehong Song, and Nicholas Davine, who are students enrolled in the joint master's programme of Strategic Design and Entrepreneurship at Copenhagen Business School and the Royal Danish Academy for Architecture, Design, and Conservation. The development of this project was prompted by a request from the Danish NGO Engineers Without Borders, which sought solutions for plastic collection, sorting, transportation, and recycling. The challenge specifically focused on the slums of Freetown, located in Sierra Leone, West Africa.

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# Plastic Workshop

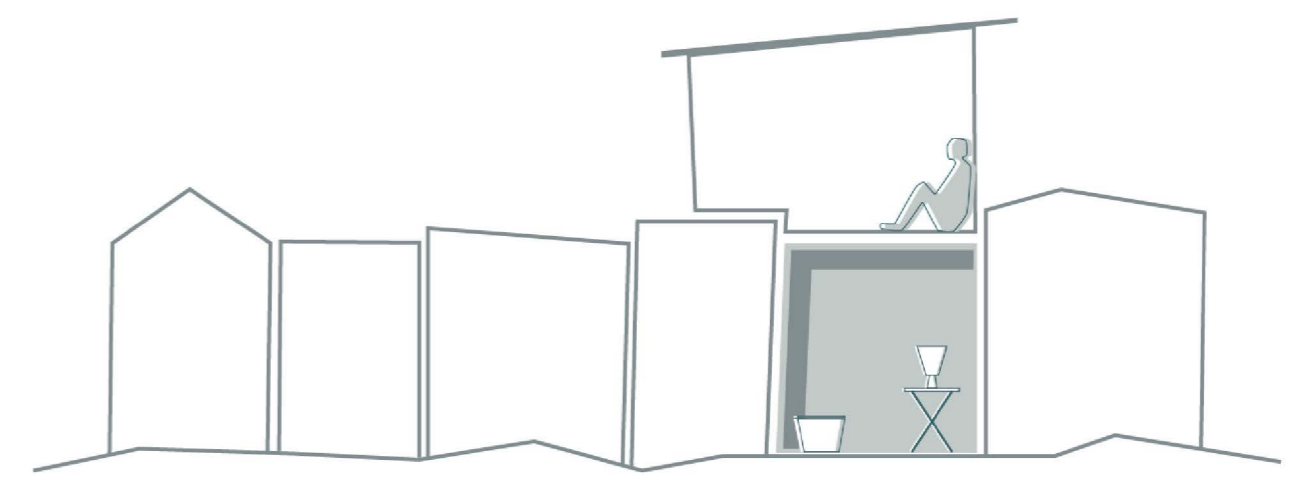
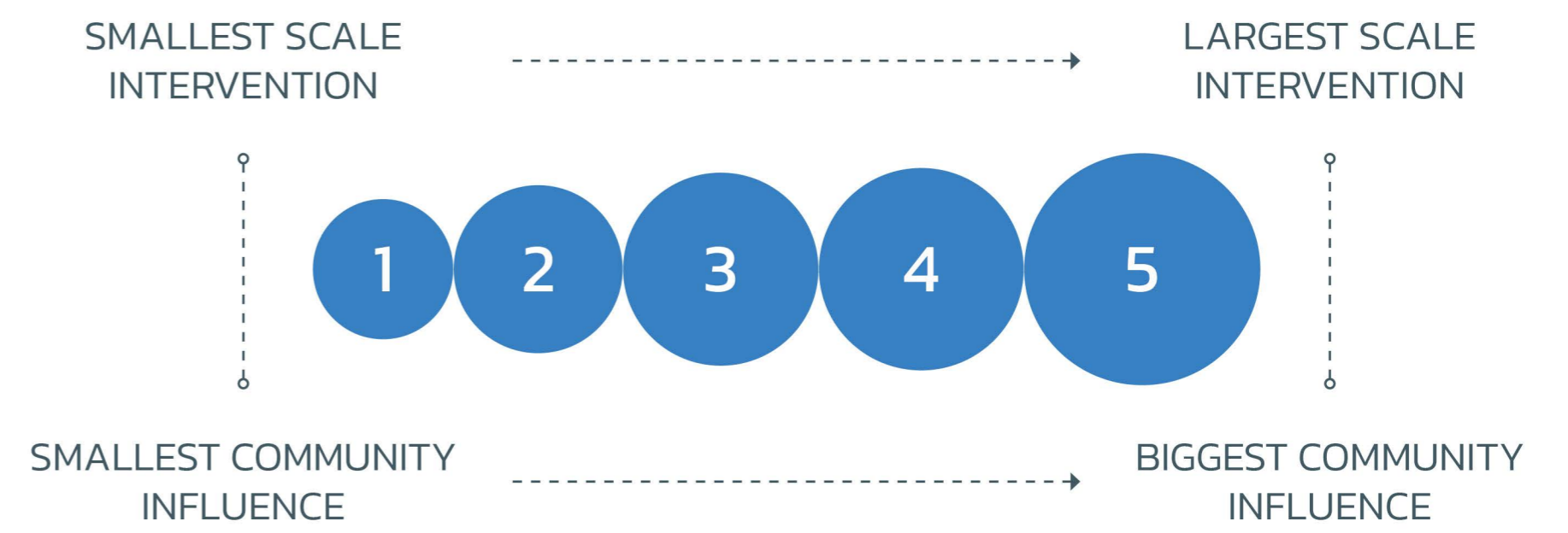
Through our research and collaboration with Danish NGO Engineers Without Borders, we are proposing an innovative organizational strategy to the communities in Freetown that will create a circular flow of events leading to the removal of plastic waste.

The strategic proposal will provide local jobs, education, and markets, through the creation of recycled plastic products. This open-source project enables and empowers locals with grassroots change, to incentivise plastic waste as we know it today.

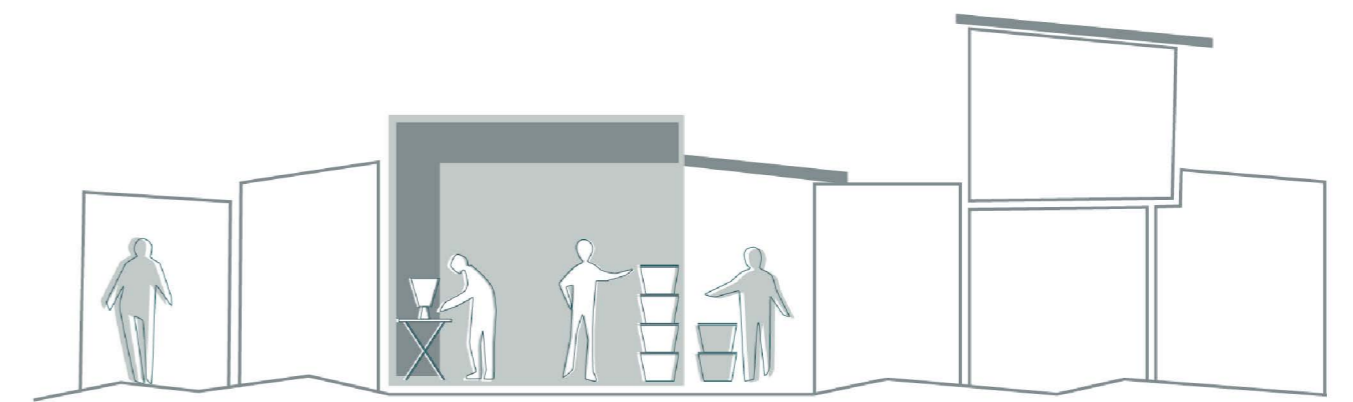


To ensure the infrastructure and educational needs of the community are met – we propose a facility for these activities to take place. As a result of collaboration with Engineers Without Borders, we best evaluate to offer varying scales of interventions to the local communities of Freetown.

Scales of intervention are based on research feasibility studies including: cost, construction, engagement, education, and overall mission.



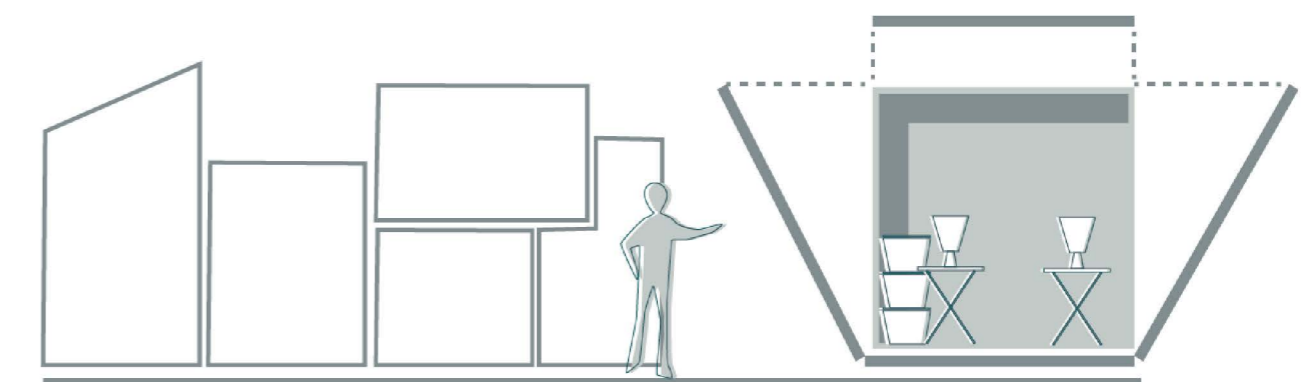
**1** SMALL SCALE – implementing small machinery or educational space into an available existing structure.



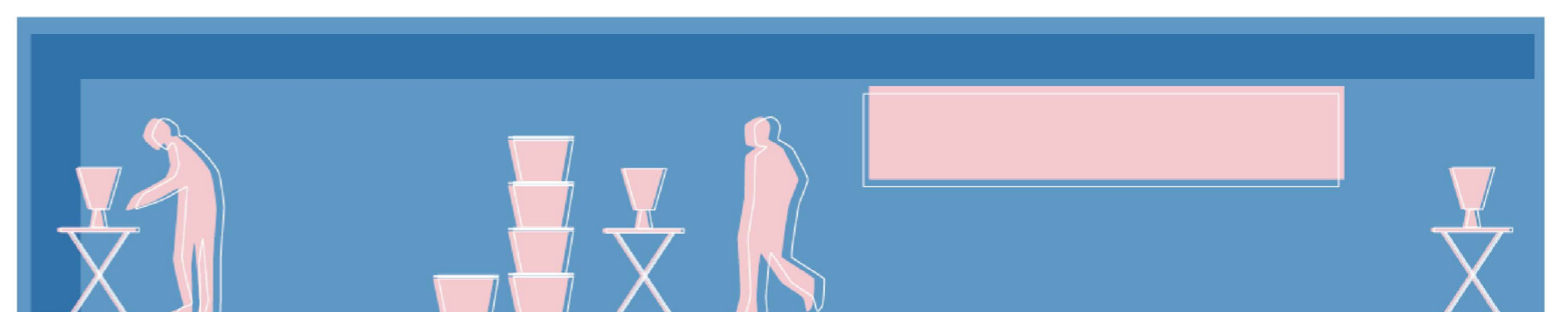
**2** SMALL SCALE – implementing a small temporary building made of locally available material.



**3** MEDIUM SCALE – Implementing recycling facilities and educational spaces into an available existing large structure (such as a school building or church).



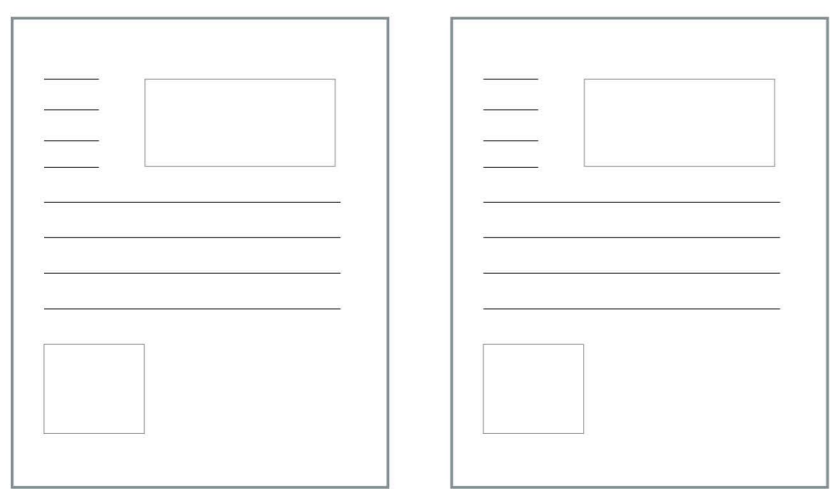
**4** LARGE SCALE – implementing a complete temporary facility (designed for disassembly) into an available site.



**5** LARGE SCALE – implementing a complete permanent facility – designed with local knowledge and skills as well as most appropriate materials and solutions – to house the entire plastic workshop strategy and provide educational classes.

## Learning The Tools

The core objectives of this pilot project are education and empowerment. We propose conducting collaborative workshops in the communities, including themes: plastic waste; the possibilities of recycled plastics; and, safety and instructions for the machinery.

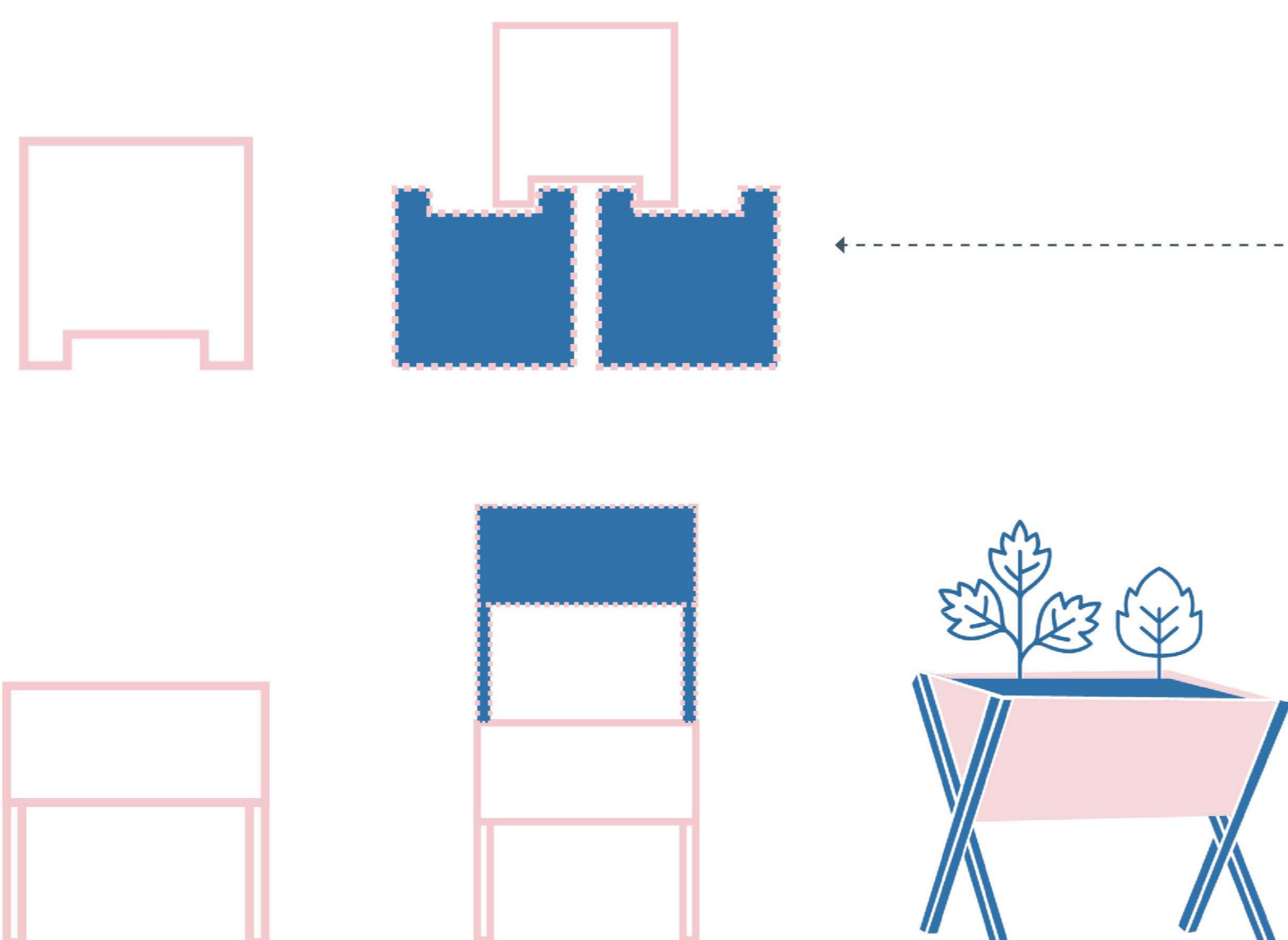


## Re-valuing Plastic

The concept engages primarily with the opportunity for locals to reconnect with traditional agricultural principles using an innovative approach. Following localized collection of plastic waste, we have prototyped one possibility of recycled plastic.

The design is a small-scale vertical garden – that can be disassembled and transported indoor and outdoor as a response to safety and theft.

This proposal is only one of the unlimited possibilities of recycled plastic. End products of the users in Freetown will be entirely open-source and designed and constructed as per their needs and desires.





# CLEAN-UP FREETOWN

The plastic waste crisis is having profound impacts globally – most devastatingly on developing and impoverished countries where infrastructure and knowledge is not readily available.

In accordance with United Nations Sustainable Development Goal 14 – Life Below Water – plastic in our oceans is increasingly impacting all biological diversity on Earth – requiring systemic transformation to minimize the risks of the planetary boundaries we are influencing.

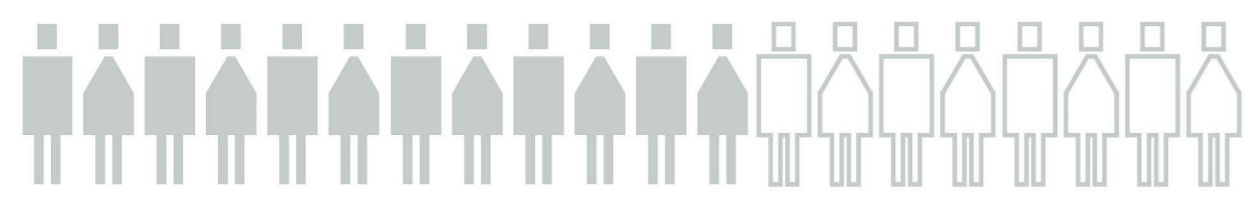
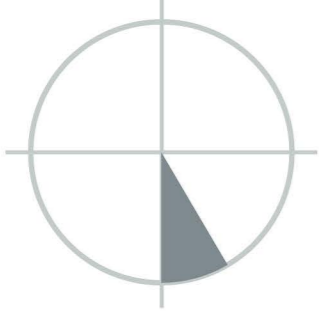
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ranking in Human Development Index



7.95 %

arable land



3/5 of people are engaged in agriculture



Parsley Onion Spinach Cabbage Sweet potato Rice



Population per house

8.8



flooding from the seasonal rains  
July - September



Literacy rate

48.1 %



Life expectancy

55



**ENGINEERS  
WITHOUT BORDERS  
DENMARK**

## The Linear Problem



## A Circular Strategy



Land and ocean plastic waste in Sierra Leone's capital Freetown is severely impacting local fisheries and industries – a main resource in ensuring daily food supply and local jobs can continue.

By utilising our resources to assist with communities living in severe poverty, it is our moral and ethical responsibility to collaborate with them to provide the infrastructure and education necessary.



## Freetown, Sierra Leone



# CLEAN-UP: FREETOWN

Strategic Design Concept & Proposal

Nicholas Davine

Kehong Song

Emilie VF Steuch



# Design Challenge



Plastic



Engineers Without Borders

*The Freetown Plastic Clean-up Project:  
How can Engineers Without Borders support local collection, transport,  
sorting and storage of plastic waste?*



Sierra Leone



Royal Danish Academy/ CBS



Sustainable Development Goal 14



182 / 189



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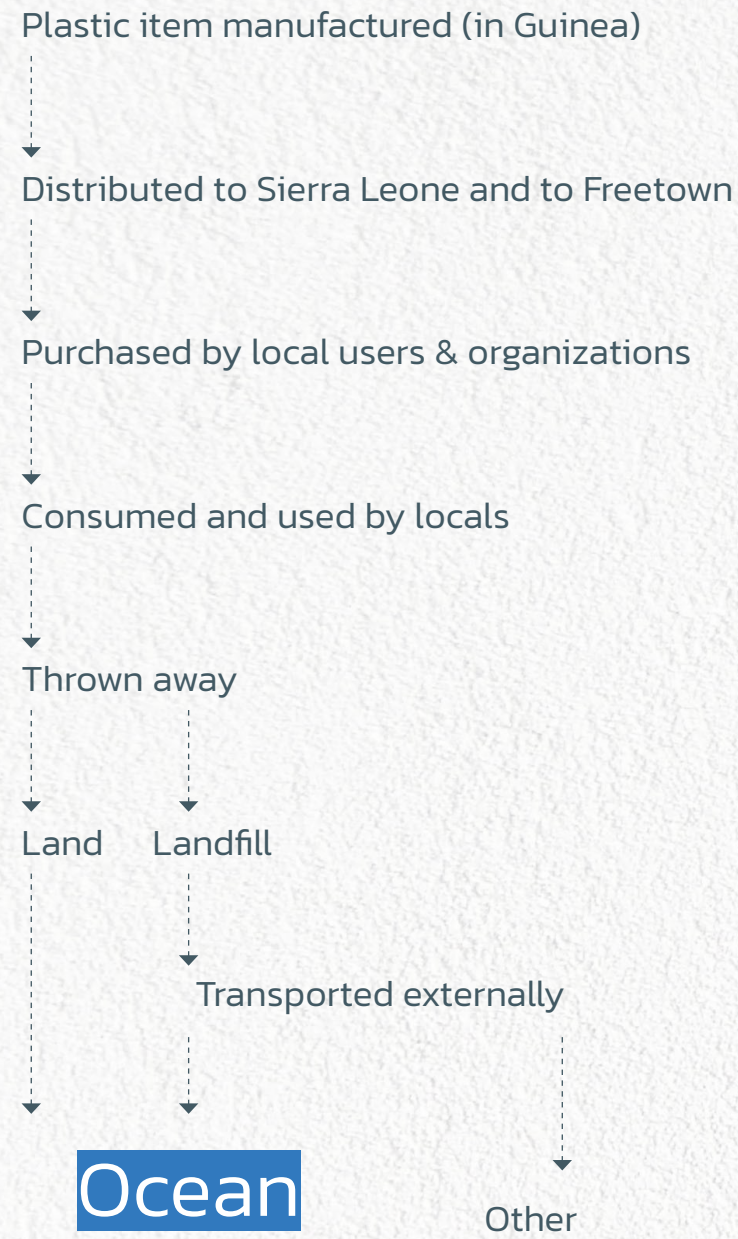


Life expectancy

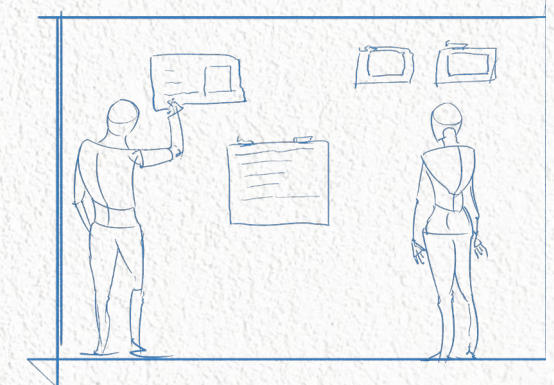
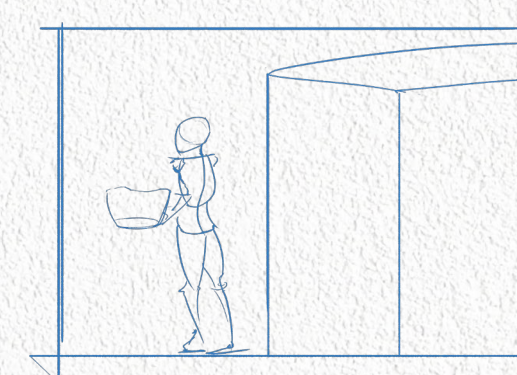
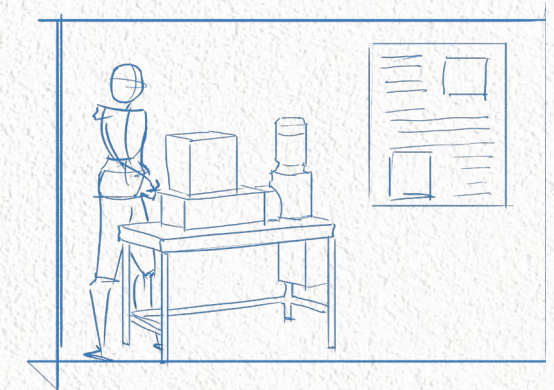
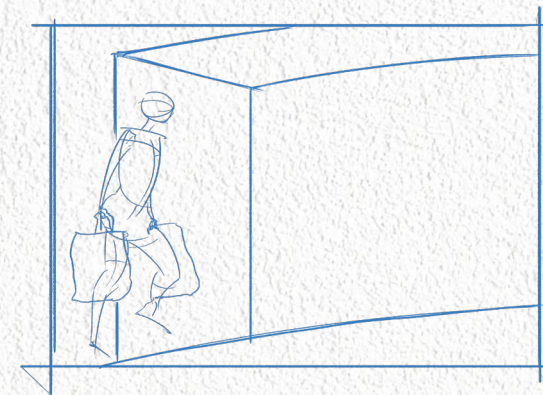
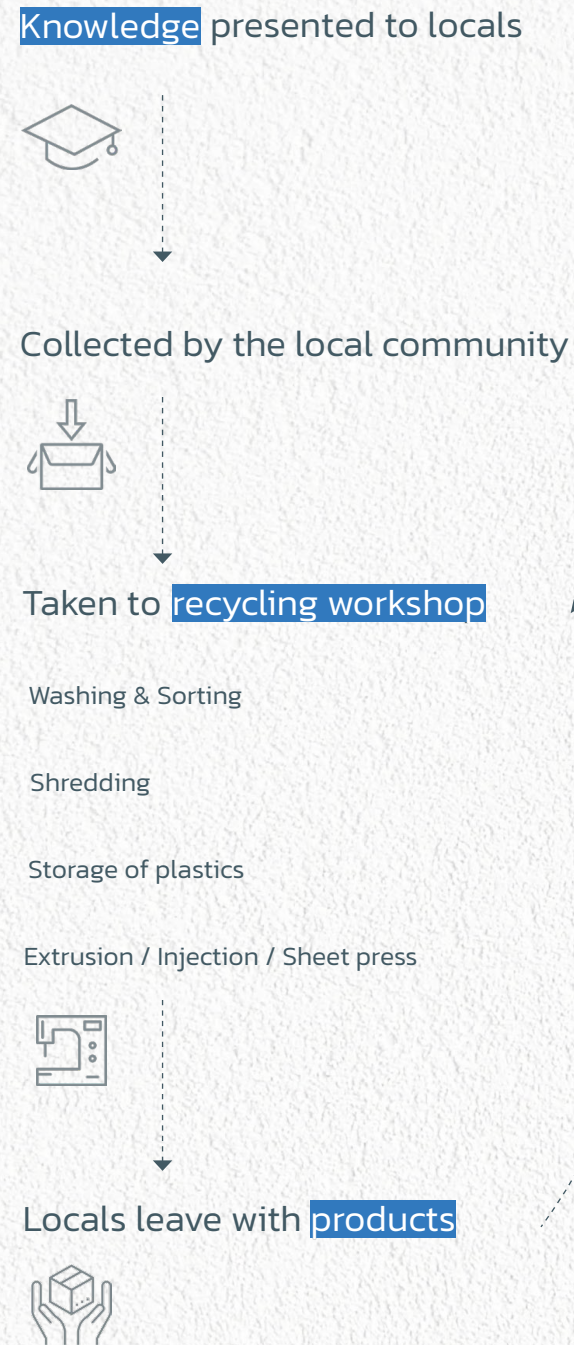
55



## The Linear Problem



## A Circular Strategy







## Shredder

Type	Double shaft
Cost	17,000 kr + Motor
Weight	340 kg
Dims	1205 x 550 x 1512 mm
Blade	6mm width
Elec	380v / 16amp / 3kw

## Extruder

Type	Single screw
Cost	15,000 kr
Weight	110 kg
Dims	1500 x 600 x 1550 mm
Elec	400v / 16amp / 5kw

## Injection

Type	Hand powered
Cost	2000 kr
Weight	30 kg
Dims	830 x 1000 x 1830 mm
Elec	230v / 3.5amp / 800w

## Compression

Type	Car jack
Cost	1,450 kr
Weight	40 kg
Dims	600 x 400 x 1600 mm
Elec	230v / 12amp / 2.8kw



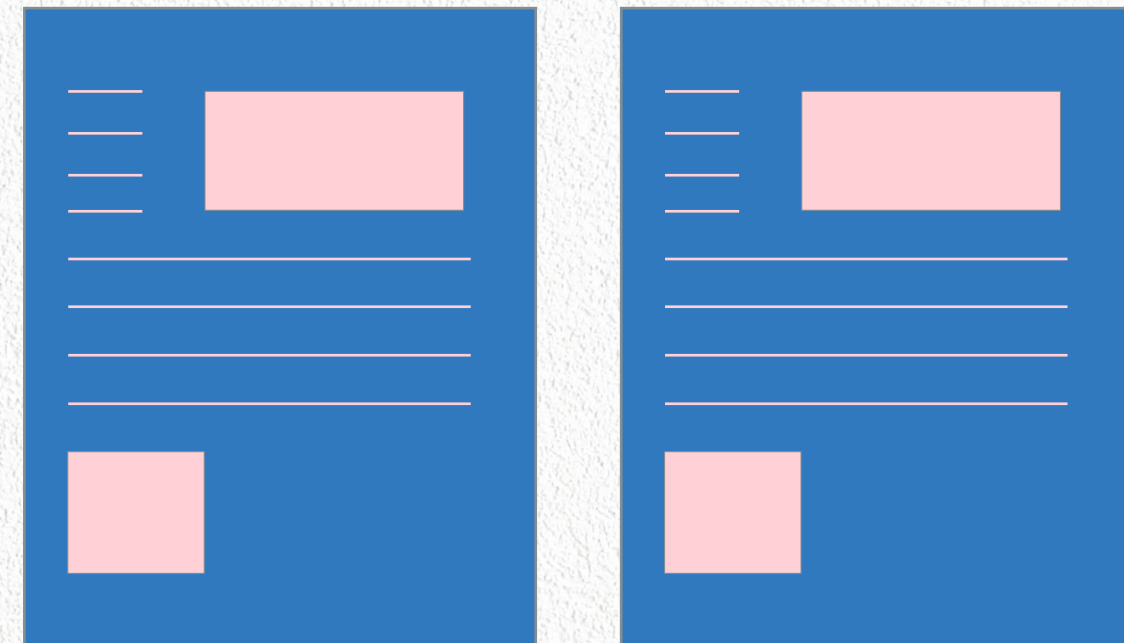


# Learning the tools








## Collaborative workshops:

- Plastic waste
- The possibilities of recycled plastics
- Safety and instructions for the machinery
- Illiterate friendly

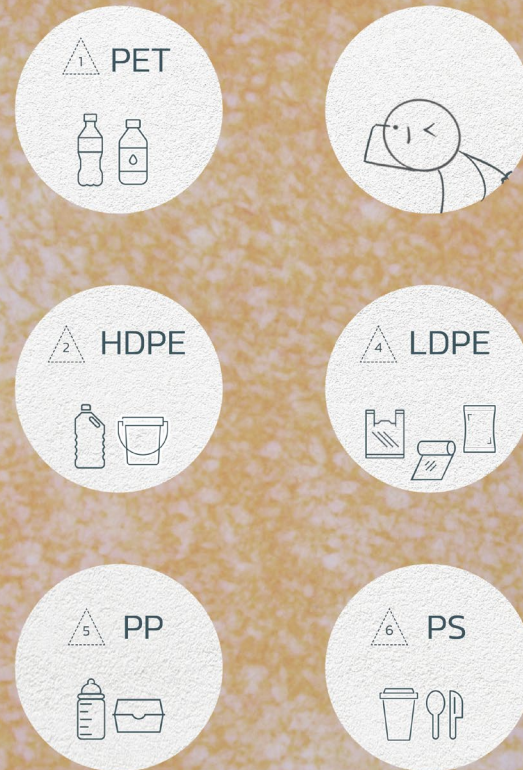




## SORT WITH ME

- 1 Find the code 
- 2 If you can't  
Match the pictures   
Ask our staff 
- 3 Put them in the buckets  
  


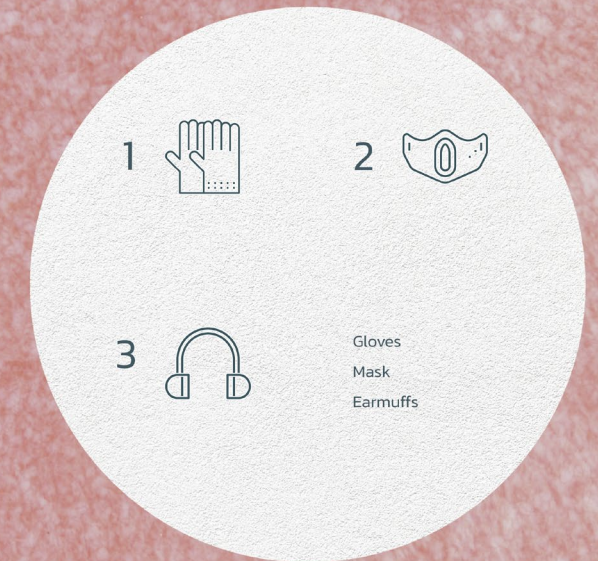
## WHAT WE NEED



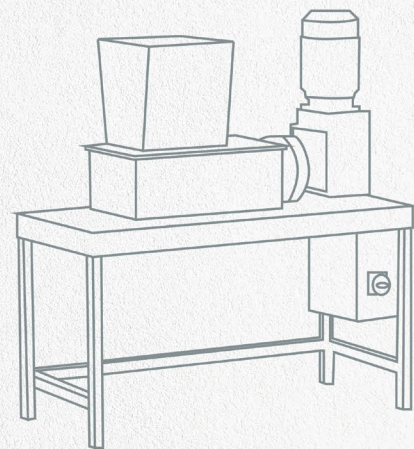
## WHAT WE DON'T NEED



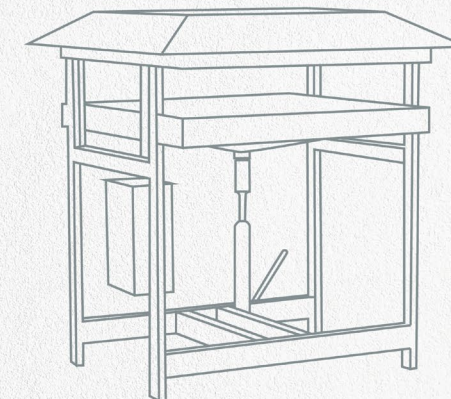
## SAFETY RULES



## SHREDDER



## SHEET PRESS







### SORT WITH ME

- 1 Find the code
- 2 If you can't
- 3 Put them in the buckets

### WHAT WE NEED


### WHAT WE DON'T

PET

HDP

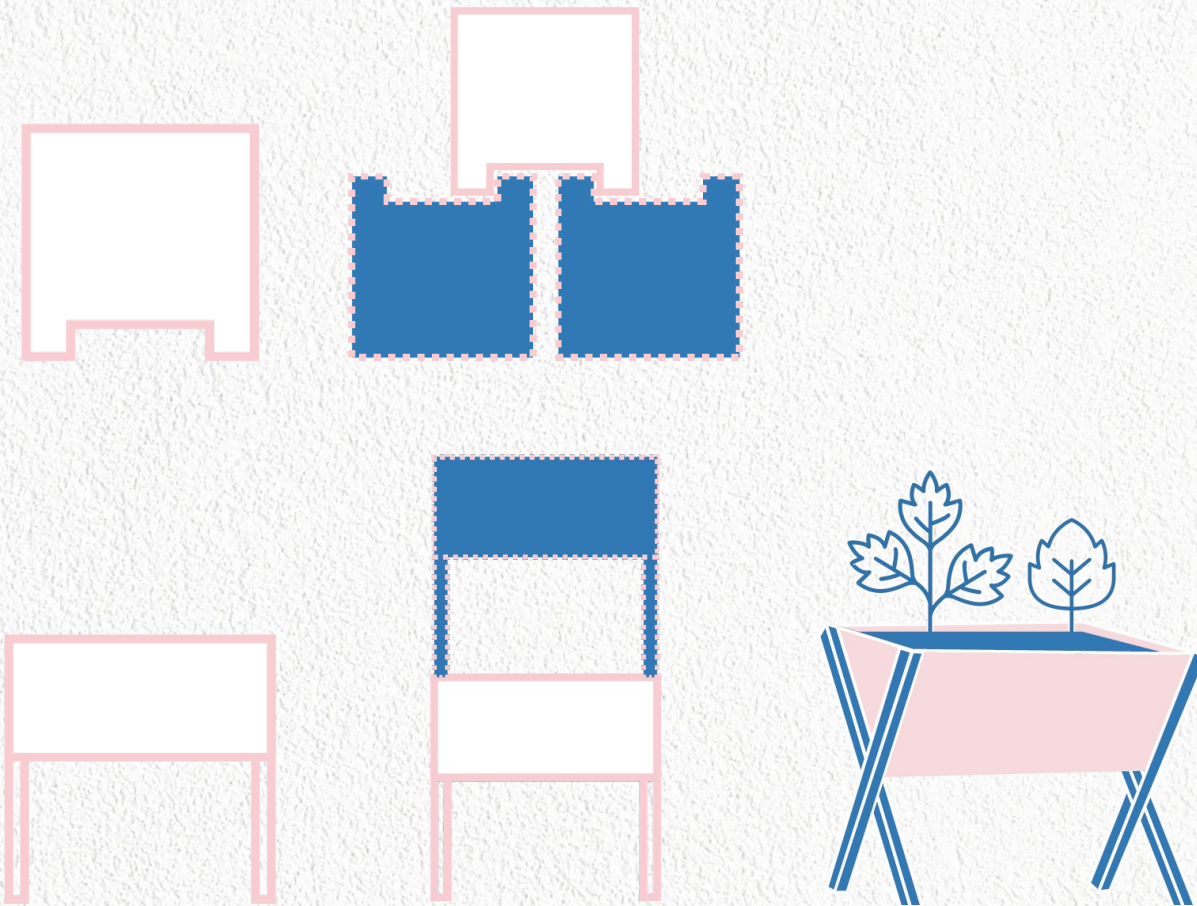


# Re-valuing Plastic

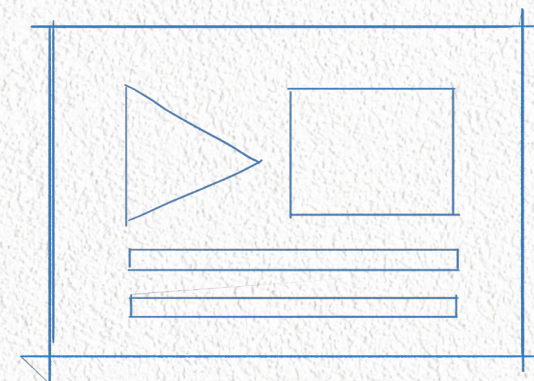


## Small-scale vertical garden

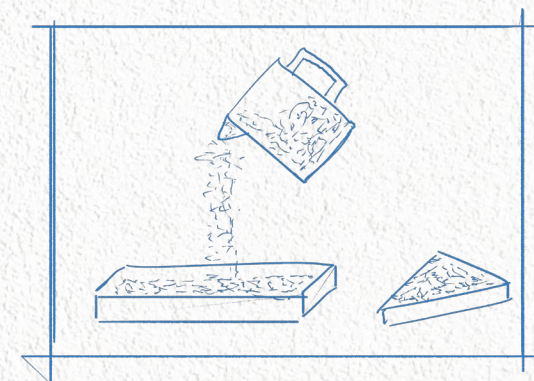
- Transportable → avoiding theft
- Designed for disassembly
- Recyclable
- Small and vertical → ideal for small space living`



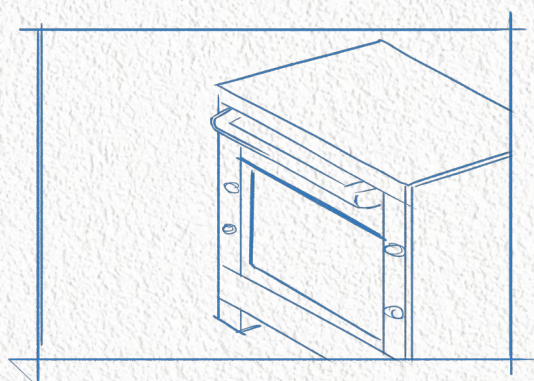




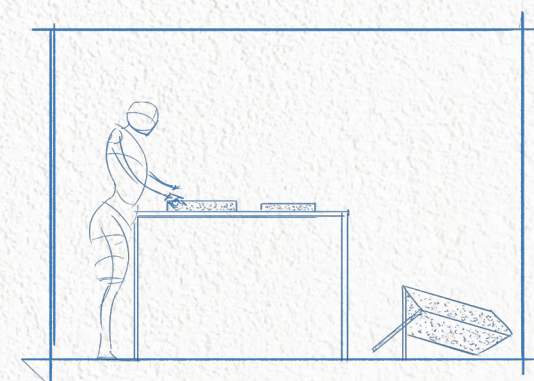
Provide the moulds



Fill up the mould with plastic grains



Heat up - cool down

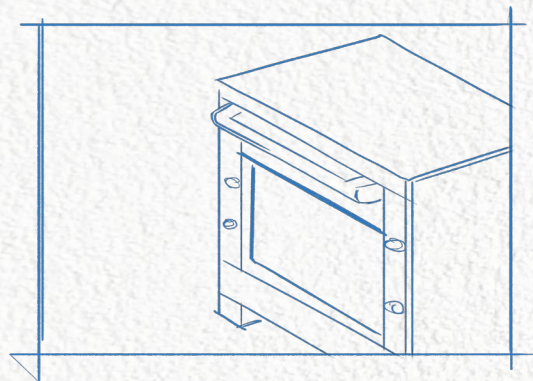


Assemble

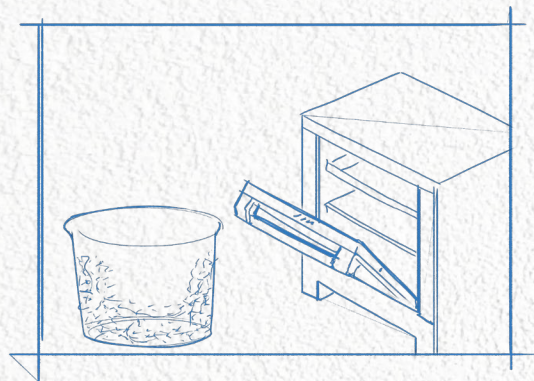




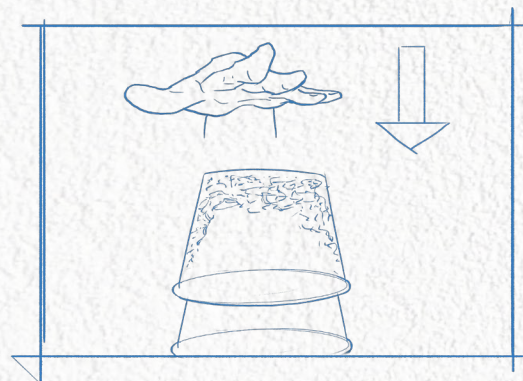




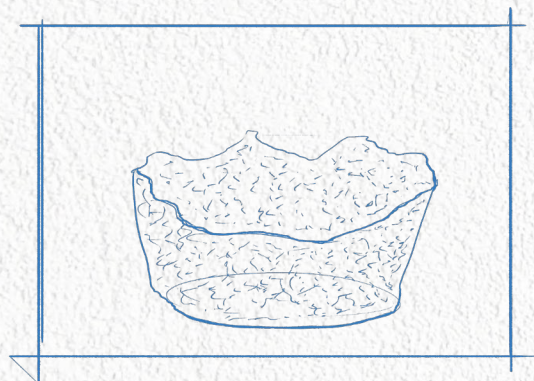
Heat up in bowl A



Cool down



Invert bowl A on bowl B and press



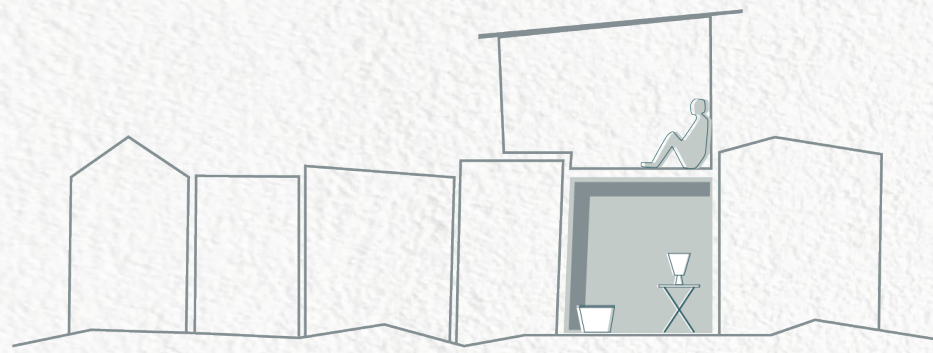




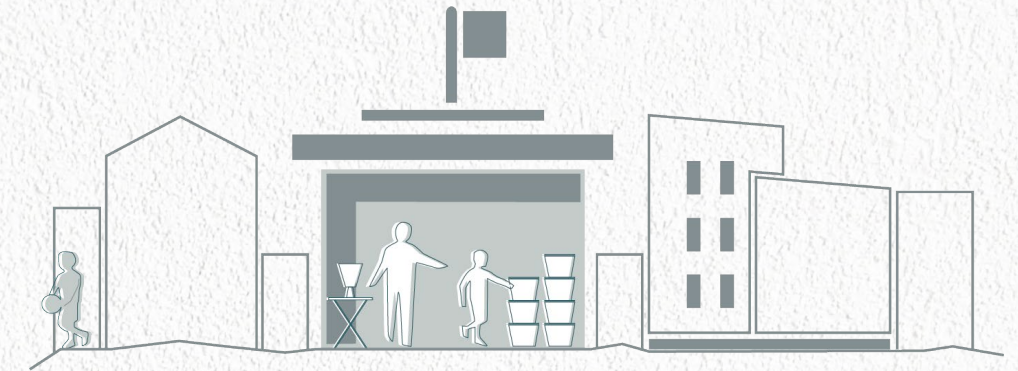


# Plastic Workshop

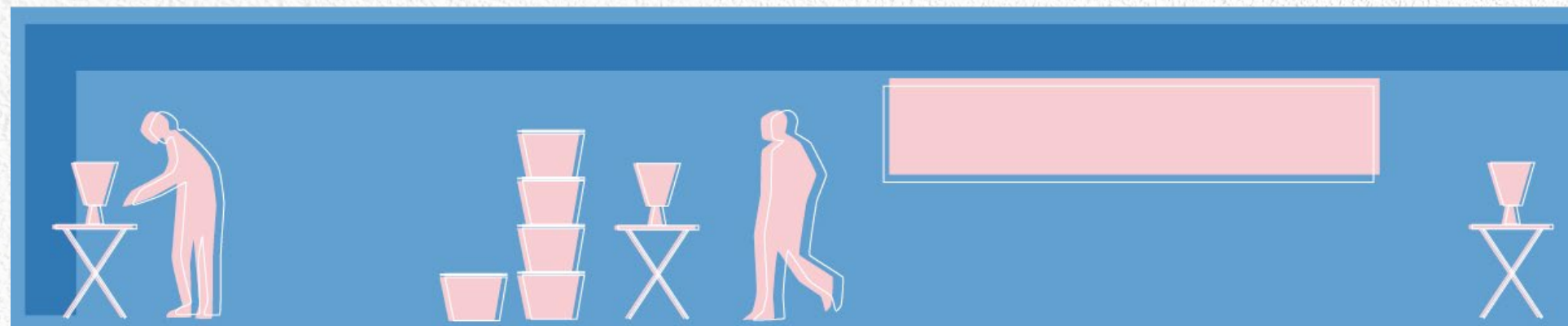




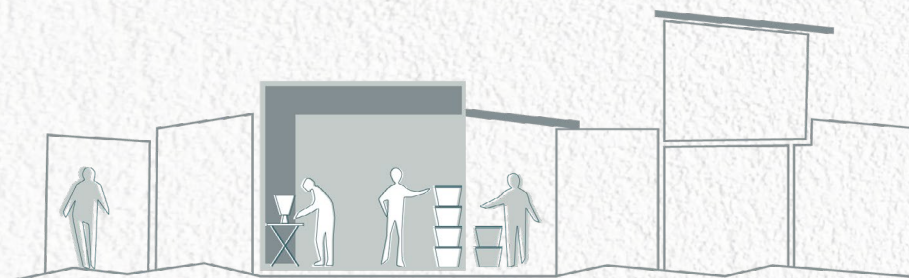
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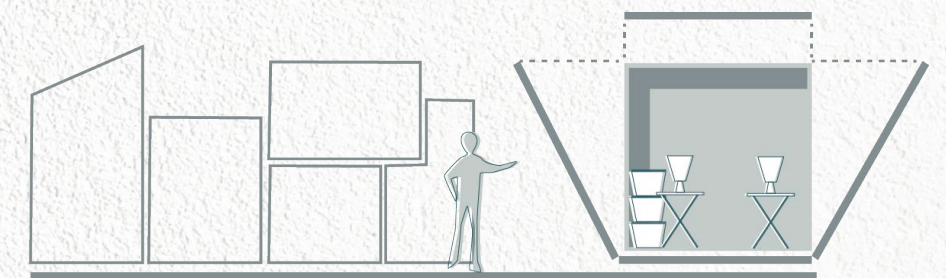
3



**5** LARGE SCALE – implementing a complete permanent facility – designed with local knowledge and skills as well as most appropriate materials and solutions – to house the entire plastic workshop strategy and host educational workshops and communal spaces, connecting communities and increasing social ties to a bigger agenda.



2



4



Option 01 – Low impact

Option 02 – Low impact

Option 03 – High risk

Option 04 – Medium impact

Option 05 – High impact

**OPTION 01 – SMALL SCALE**

**ADVANTAGES**

COST EFFECTIVE  
FLEXIBLE INTERVENTION LOCATIONS  
IMPLEMENT STRAIGHT AWAY  
START THE EDUCATIONAL PROCESS  
MULTIPLE COMMUNITIES AT ONCE

**CHALLENGES**

MACHINE SAFETY AND SECURITY  
DELEGATING RESPONSIBILITY  
NOT THE COMPLETE RECYCLING PROCESS  
MAINTENANCE  
CAN'T ACHIEVE STRATEGIC GOAL

**OPTION 02 – SMALL SCALE**

COST EFFECTIVE  
FLEXIBLE INTERVENTION LOCATIONS  
IMPLEMENT STRAIGHT AWAY  
START THE EDUCATIONAL PROCESS  
MULTIPLE COMMUNITIES AT ONCE

NOT THE COMPLETE RECYCLING PROCESS  
WHO HAS THE RESPONSIBILITY?  
UNLIKELY TO ACHIEVE STRATEGIC GOAL

**OPTION 03 – MEDIUM SCALE**

COMPLETE RECYCLING FACILITY  
UTILISING AVAILABLE STRUCTURES  
MULTIPLE COMMUNITY ENGAGEMENT  
SAVE ON BUILDING MATERIALS  
MAY ACHIEVE STRATEGIC GOAL

QUALITY OF THE EXISTING STRUCTURE  
ASSIGNING RESPONSIBILITY  
POSSIBILITY OF NO AVAILABLE LOCATION  
LOCATION MIGHT NOT BE APPROPRIATE

**OPTION 04 – LARGE SCALE**

COMPLETE RECYCLING FACILITY  
UTILISING AVAILABLE STRUCTURES  
MULTIPLE COMMUNITIES COLLABORATING  
SAVE ON BUILDING MATERIALS  
TRANSPORTABLE & RELOCATABLE  
CAN ACHIEVE STRATEGIC GOAL

EXPENSIVE TO IMPLEMENT  
NOT SITE CONTEXTUAL  
BUILDING COMMUNITY TRUST  
ONLY AVAILABLE A SHORT TIME

**OPTION 05 – LARGE SCALE**

LONG TERM COMMUNITY ENGAGEMENT  
UTILISING LOCAL MATERIALS AND SKILLS  
COMMUNITY EMPOWERMENT  
PROVIDING LOCAL JOBS & INCOME  
COMPLETE RECYCLING FACILITY  
LARGE SCALE COLLABORATIVE EFFORT  
MANY VALUABLE STAKEHOLDERS  
ENGAGING WITH EDUCATION  
A GLOBAL PILOT PROJECT

EXPENSIVE TO IMPLEMENT  
LONG DESIGN PROCESS  
SELECTING APPROPRIATE LOCATION  
BUILDING COMMUNITY TRUST  
ENSURING COMMUNITY ENGAGEMENT



OCEAN PLASTIC + -



- + LANDFILL

**+ schools**

Opportunity to communicate the education with nearby schools. Commencing the community engagement.

**+ landfill**

A key source of the problem where the plastic waste is located. Road access to the chosen site.

**+ our site**

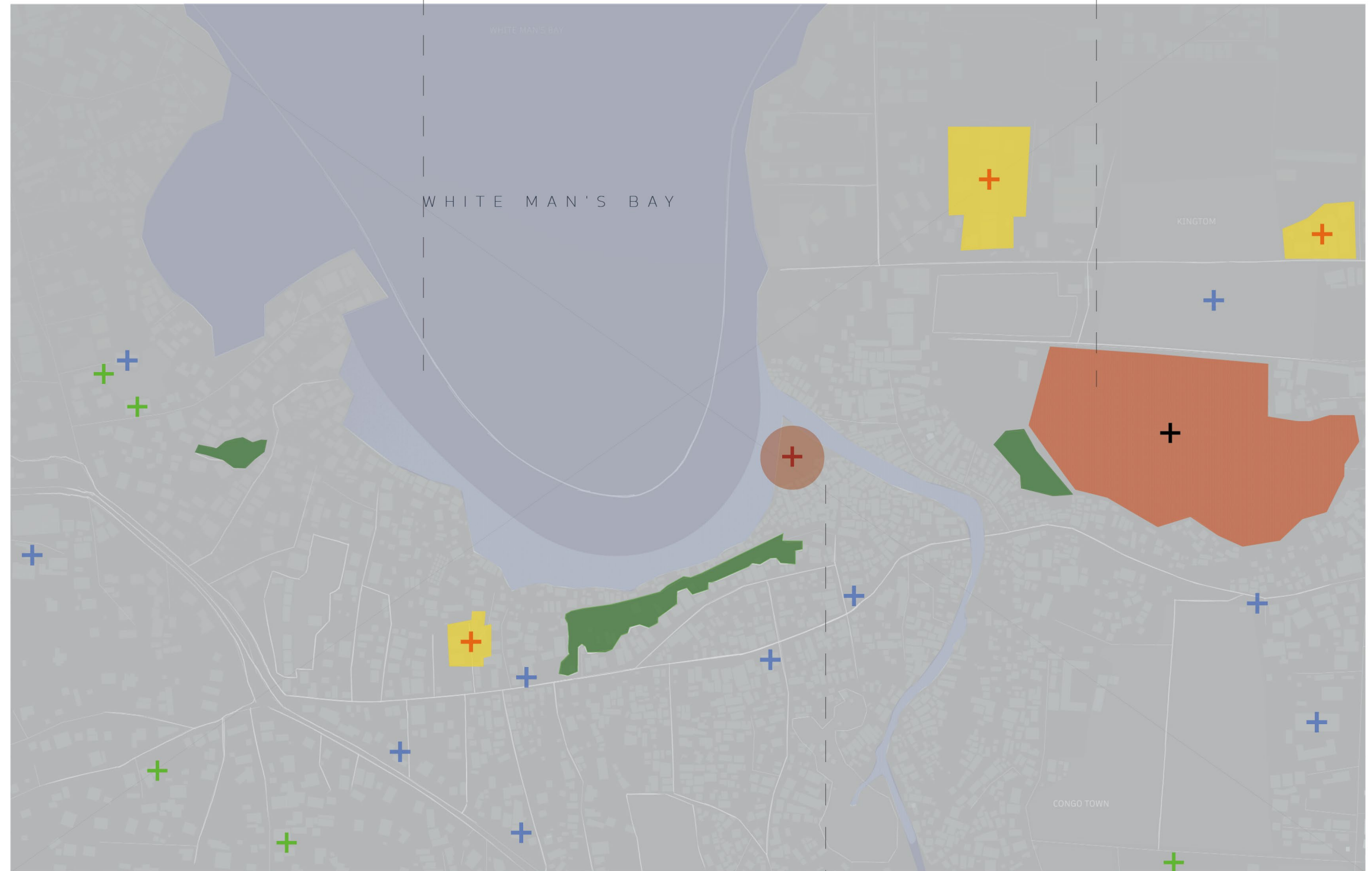
A junction of connectivity amongst other key locations around this northern bay of Freetown, Sierra Leone.

**+ hotels**

The opportunity to create a visual impact and attract tourism both nationally and internationally.

**+ religious buildings**

A representation of public and communal places of gathering. Potential opportunities to expand on these community aspects.



INFORMAL SETTLEMENTS

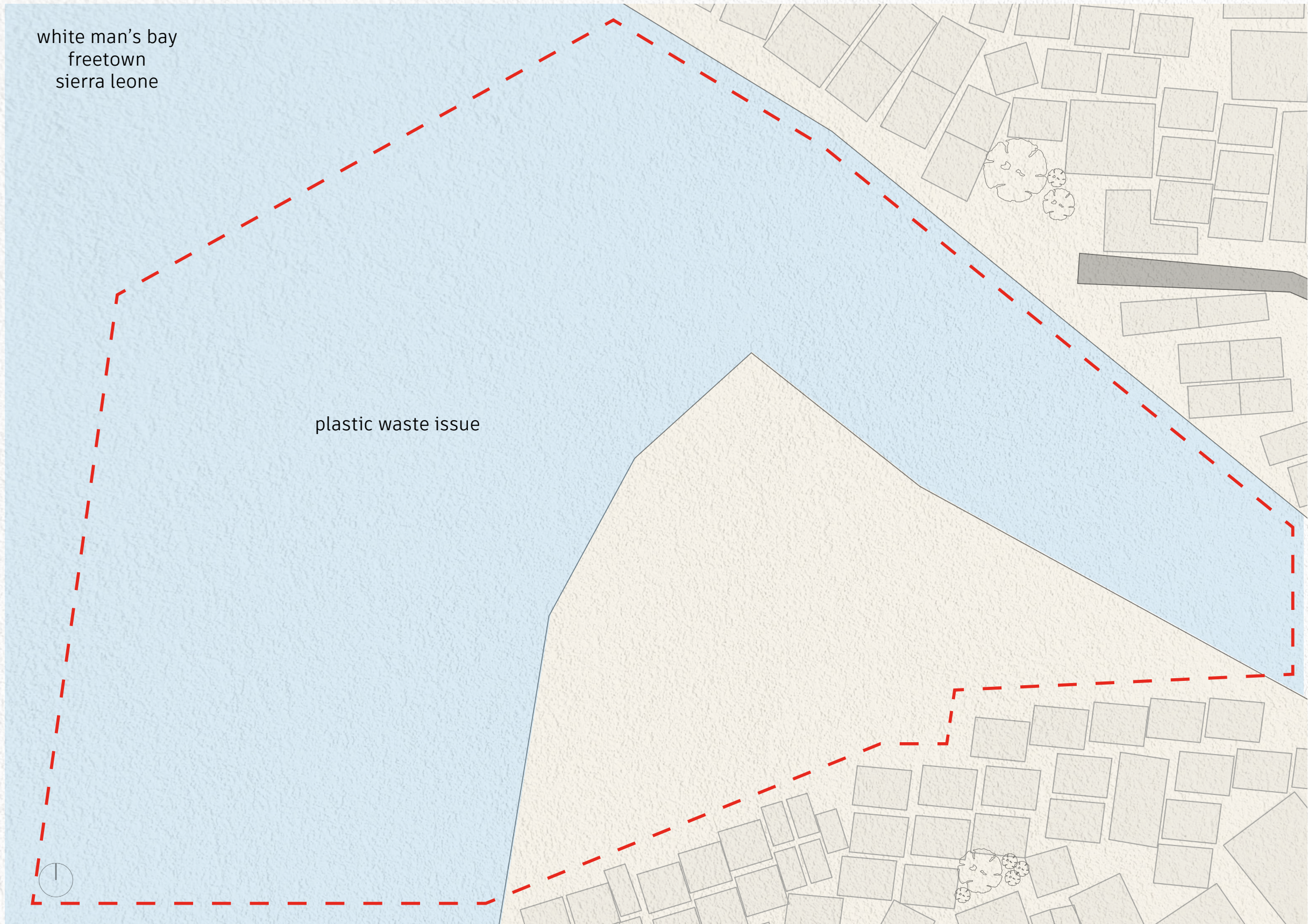


SITE MAPPING



white man's bay  
freetown  
sierra leone

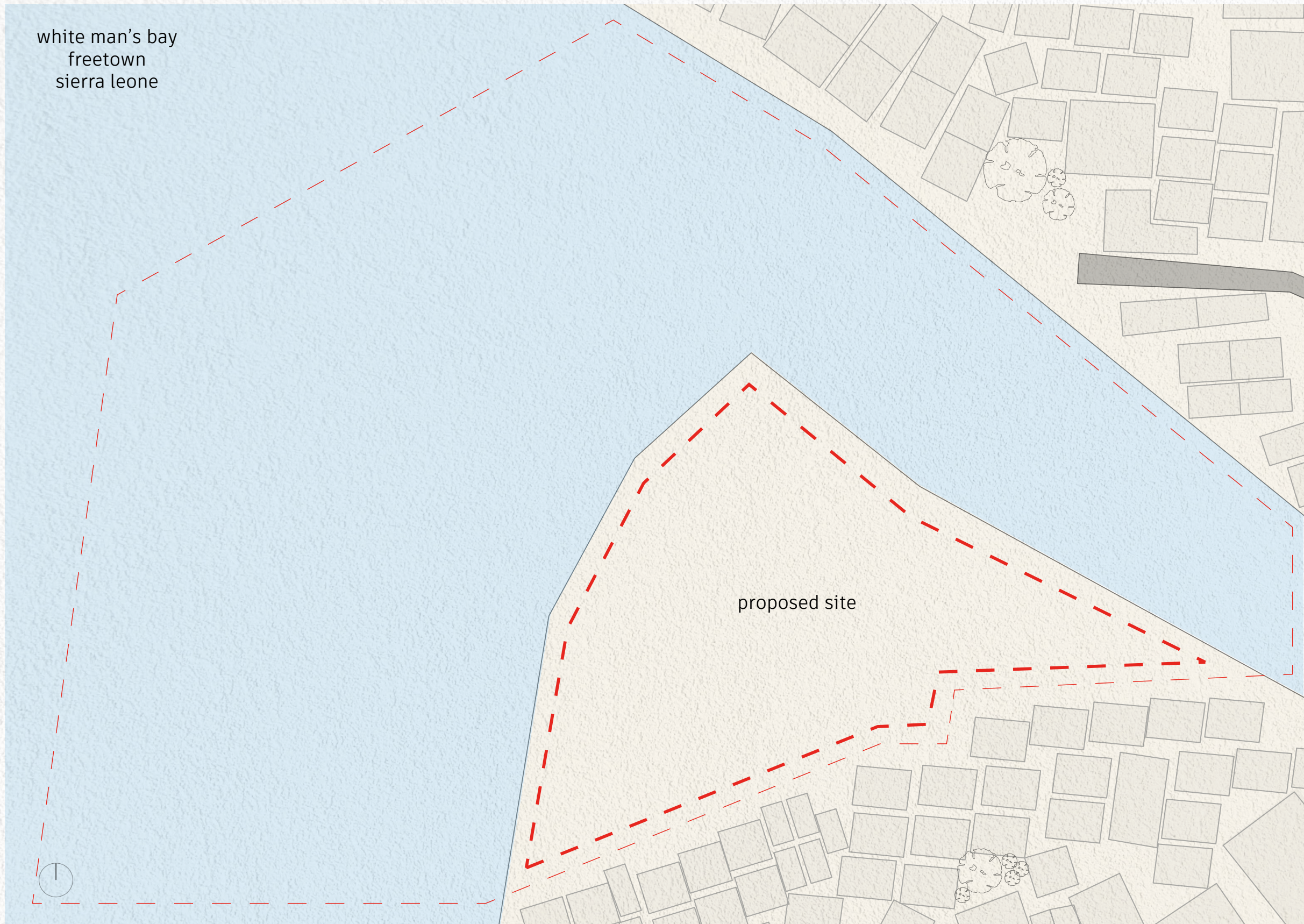
plastic waste issue





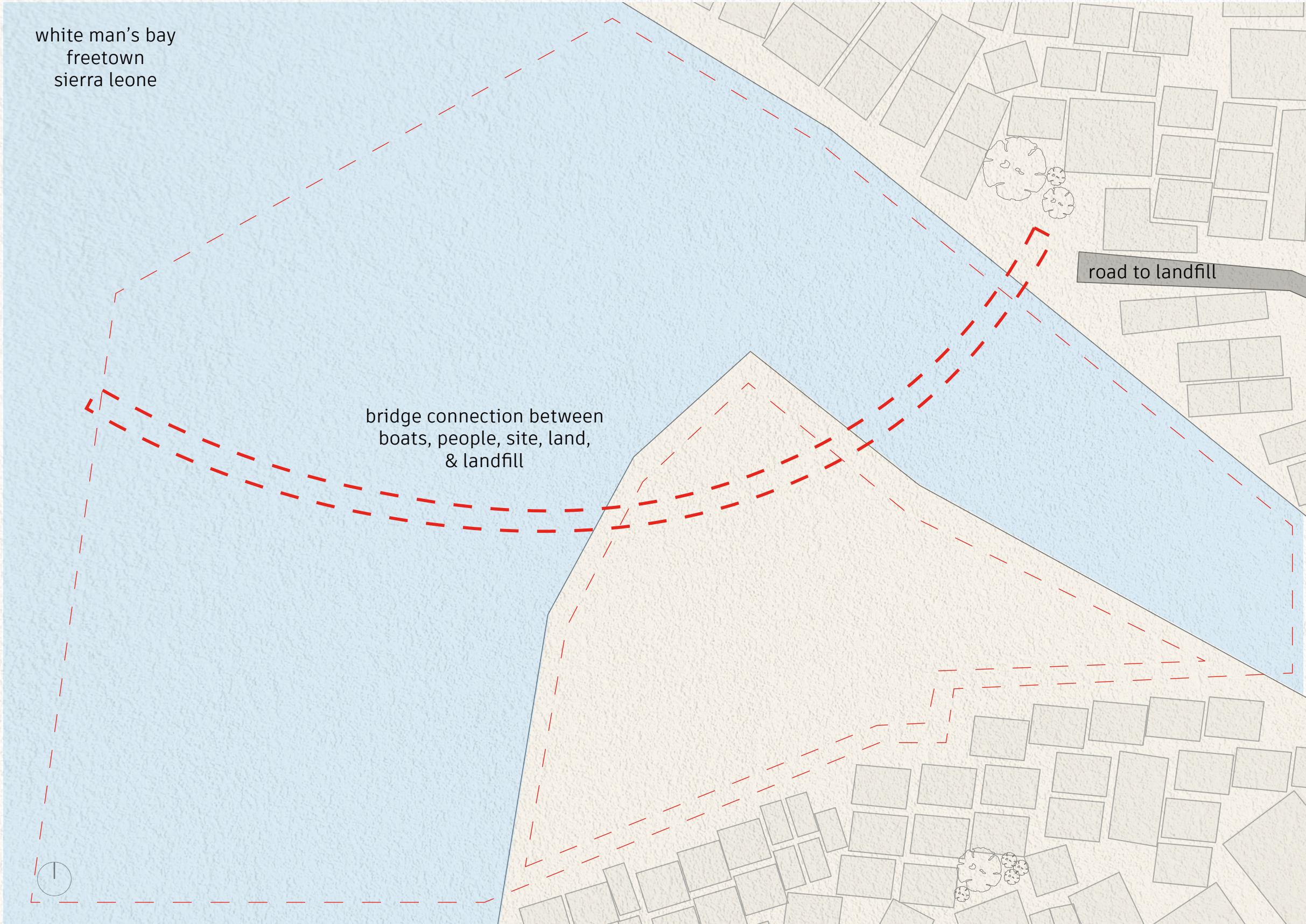
white man's bay  
freetown  
sierra leone

proposed site





white man's bay  
freetown  
sierra leone



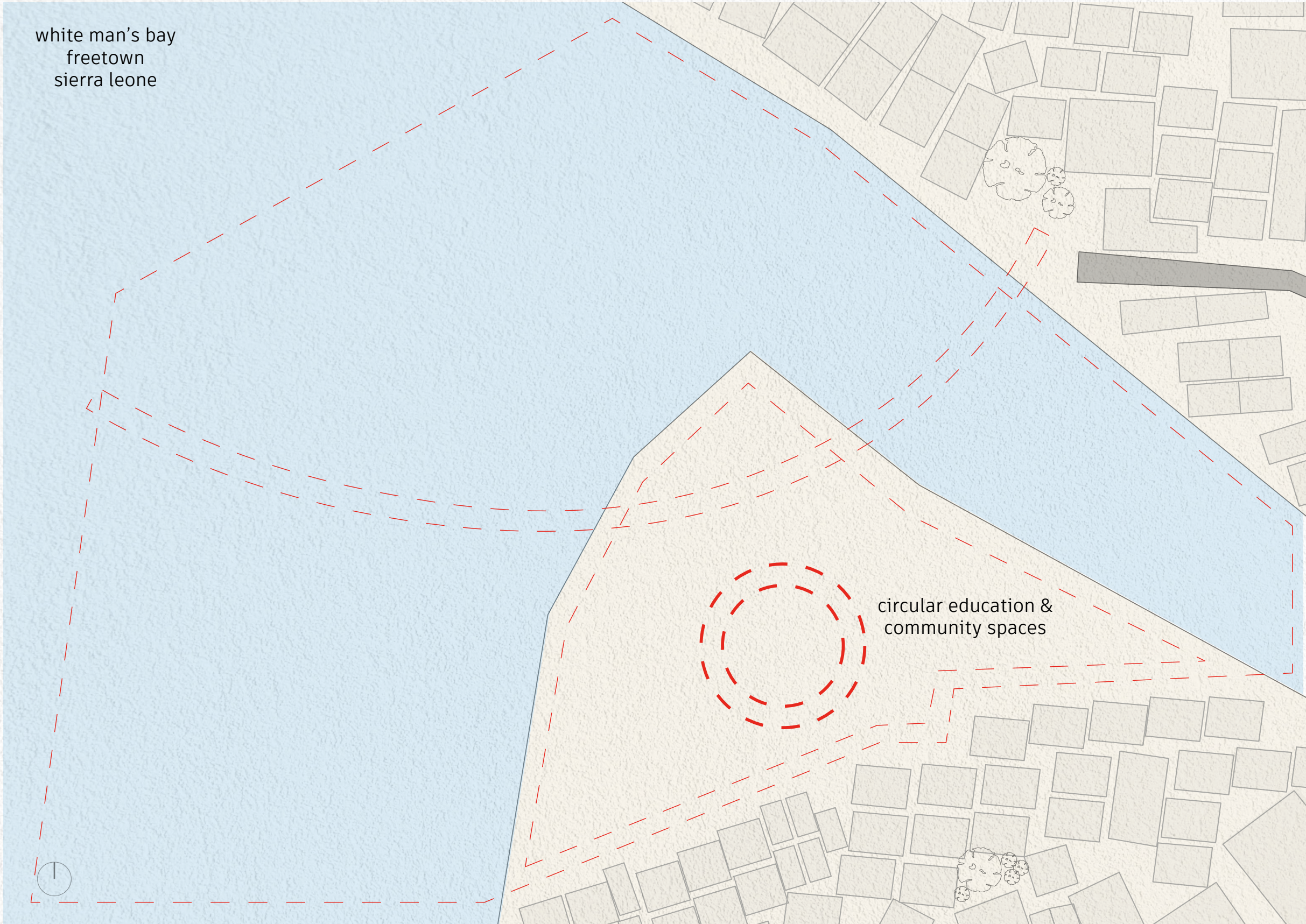
bridge connection between  
boats, people, site,  
& landfill

road to landfill





white man's bay  
freetown  
sierra leone



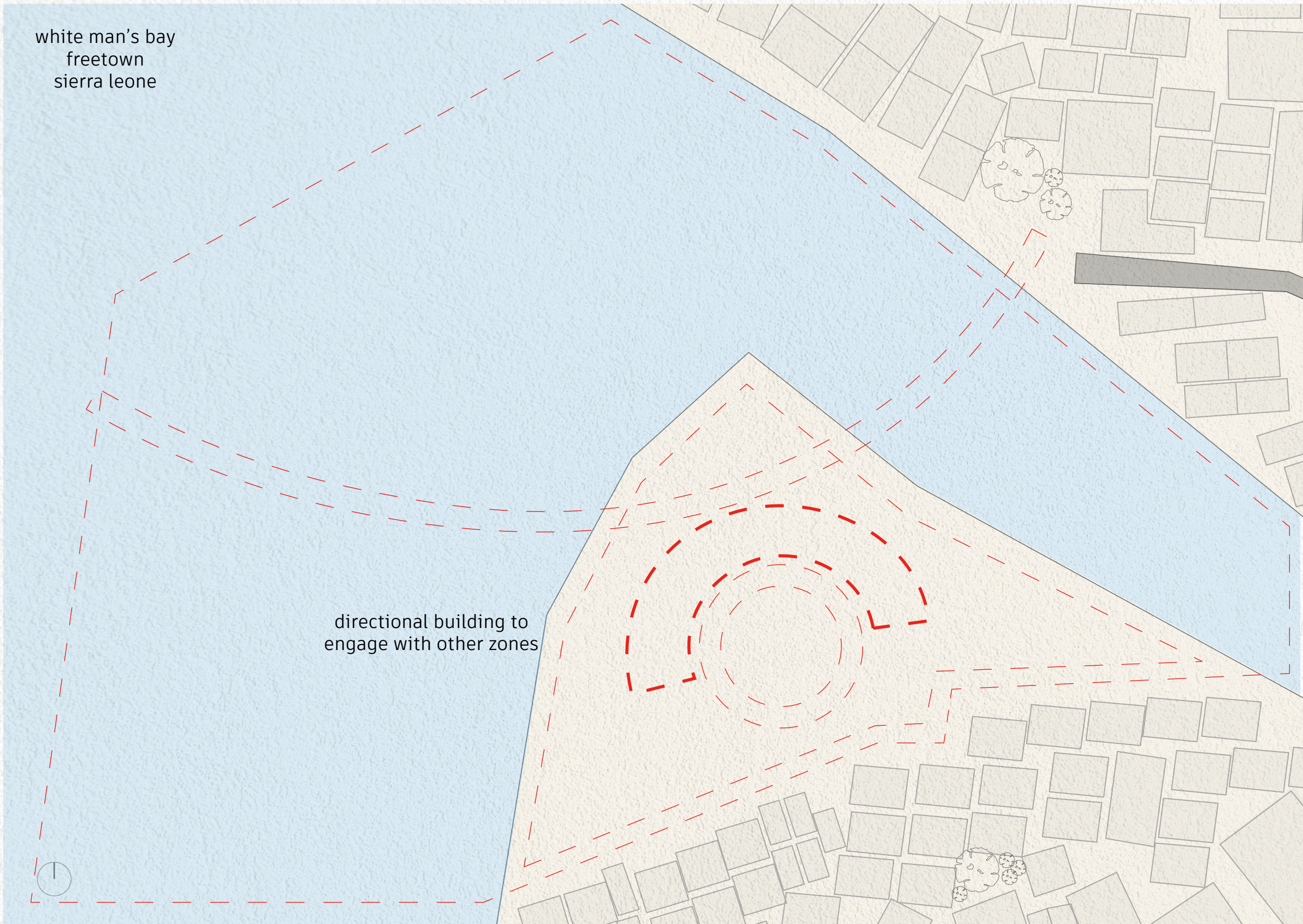
circular education &  
community spaces





white man's bay  
freetown  
sierra leone

directional building to  
engage with other zones







INFORMAL SETTLEMENTS

EXISTING TREES

OPEN SPACE

CONNECTING BRIDGE

SANDY OCEAN BANK

EXISTING ROAD ACCESS TO LANDFILL

RIVER

INFORMAL SETTLEMENTS

SANDY OCEAN BANK

CONNECTING PATHWAY FOR FISHERMAN

MACHINERY ZONE

ROOF OUTLINE

SORTING & STORAGE ZONE

EDUCATION WORKSHOPS MARKETS

INFORMAL SETTLEMENTS

PATHWAY TO RESIDENTIAL

WASHING ZONE

SANDY OCEAN BANK

RECYCLED PLASTIC FURNITURE

SITE PLAN  
SCALE 1:250



