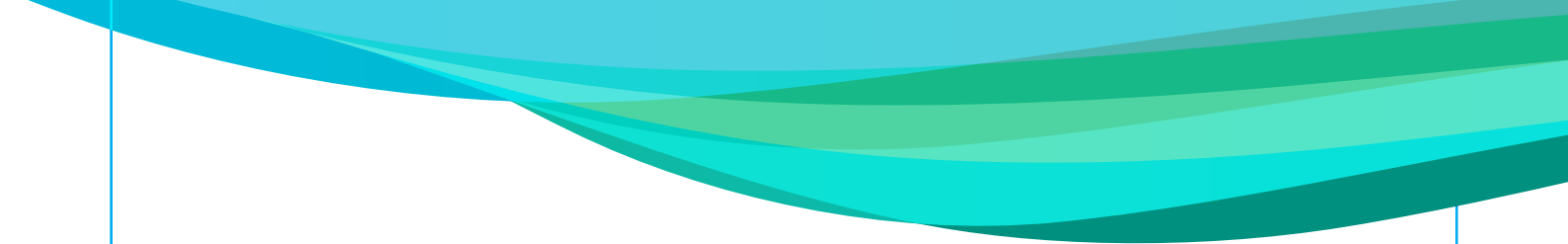


case study
MALAYSIA

Waste Segregation at Source
Solving Plastic Pollution in Penang



The SEA circular project – Reducing marine litter by addressing the management of the plastic value chain in Southeast Asia is implemented by the United Nations Environment Programme (UNEP) Regional Office for Asia and the Pacific and the Coordinating Body on the Seas of East Asia (COBSEA), with funding support from the Government of Sweden. SEA circular aims to reduce and prevent plastic pollution and its impact by working with governments, businesses, civil society, academia, and international partners. The initiative promotes market-based solutions and enabling policies to transform plastic value-chain management, strengthens the science base for informed decision making, creates outreach and awareness. The project leverages COBSEA’s regional mechanism to tackle the transboundary challenge of marine litter in a harmonized manner.

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Disclaimer

The opinions expressed in this publication are those of the authors and contributors and do not necessarily represent the views of the United Nations or any of its affiliated organizations. The boundaries and names shown and the designations used in maps do not imply official endorsement or acceptance by the United Nations.

Acknowledgment

This case study was developed as part of the **SEA circular project - 'Reducing marine litter by addressing the management of the plastic value chain in Southeast Asia'** implemented by [United Nations Environment Programme \(UNEP\)](#) and [Coordinating Body on the Seas of East Asia \(COBSEA\)](#) with funding support from the Government of Sweden.

This case study on Waste Segregation at Source: Solving Plastic Pollution aims to reduce the usage of single-use plastic, promote waste segregation at source, increase the recovery of plastic, and encourage circular economy concept.

The project was coordinated by the Malaysian Ministry of Environment and Water (national focal point) and Malaysian Green Technology & Climate Change Centre (implementing body), under the guidance of Dr. K. Nagulendran and his team - Jamalulail Abu Bakar, Eddy Mazuaansyah Mohd Ali Murad, Therese Tiu Kok Moi, Muhammad Ammar bin Mohd Ghause, Malisa Mat Noor and Ts. Roslina Muhammad.

Supervision and coordination for development of the case study was done by Ms Jacqueline Chang, National Consultant.

The case study was implemented and conducted by a team from Penang Green Council – Josephine Tan, Siti Najihah Binti Che Saad and Tan Thung. The study was supported by Seberang Perai City Council officer, Chew Eng Seng and members of the Environment Resource Centre, which were led by Lim Chee Keong, Annas Bin Mohd Kassim, and Abdul Rahman Bin Saat.

Special appreciation to The Right Honourable Mr Chow Kon Yeow, The Chief Minister of Penang, Honourable Mr Phee Boon Poh, Penang State Environment and Welfare Committee Chairman, and Dato' Sr Hj Rozali bin Hj Mohamud, Mayor of Seberang Perai City Council (MBSP) for the continuous support and assistance.

We are very grateful for the contributions, inputs and detailed insights provided by the below government departments, private sector organisations, and other stakeholders during the course of this case study:

Government Departments (in alphabetical order)	Private Sector Organisations and Other Stakeholders (in alphabetical order)
<ul style="list-style-type: none"> • Penang Economic Planning Unit 	<ul style="list-style-type: none"> • Buddhist Tzu Chi Merits Society Malaysia
<ul style="list-style-type: none"> • Penang Island City Council (MBPP) 	<ul style="list-style-type: none"> • Circular Economy Club, Malaysia & Penang chapters
<ul style="list-style-type: none"> • Solid Waste Management Unit, Local Government Division 	<ul style="list-style-type: none"> • Community at Taman Bagan Lalang and Kampung Permatang Nibong • Environment Resource Centre of Kampung Permatang Nibong & Taman Bagan Lalang • Impact Revolution Enterprise (Impaclution) • Malaysian Plastics Manufacturers Association (MPMA) • Malaysian Plastics Recyclers Association (MPRA) • Olive Tree Hotel Penang

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Foreword

Marine litter is a serious issue faced everywhere and it is transboundary in nature. At the national and subnational levels, its presence and impacts to the environment and people are more visible and direct. Marine litter is caused by a number of reasons and one of them is leakage of debris to the ocean and this includes plastic litter. Apart from unpleasant sight, a more concerning issue with regard to plastic is when microplastics, the very fine particles of plastic chemical substances enter the marine food chain. While research is still steep on its impact to human, as seafood consumers, humans need to be mindful of the potential harmful effects of micro-plastic in the food chain.

The good news is, we can proactively reduce the impact on marine environment. With the support from the United Nations Environment Programme (UNEP), Coordinating Body on the Seas of East Asia (COBSEA) and the financial assistance from the Swedish Government, the Ministry of Environment and Water, Malaysia has implemented a project called "**Reducing Marine Litter by Addressing the Management of the Plastic Value Chain in Southeast Asia**". I would like to take this opportunity to express our sincere appreciation to these agencies and our local

implementing partners that have supported us in this very important endeavour. We have produced several important outputs under this project, and I hope these will assist us in charting our way forward in managing the marine litter issue.

One of the components under this study is to conduct a pilot project to reduce land-based plastic leakages. In this regard, I wish to appreciate the active involvement of Penang Green Council and Seberang Perai City Council (MBSP) in carrying out this pilot project. The project has looked into the very fundamental issue of waste management which supports the larger goal of reducing single-use plastic, promote waste segregation at source, increase recovery of plastic, and encourage circular economy pathways.

I hope the findings, good practices and lessons learnt from this project has benefitted Penang in supporting the state's sustainable waste management, specifically in addressing plastic waste. Through this publication, this experience can be shared with wider stakeholders.

Thank you.

Dato' Sri Ir. Dr. Zaini Bin Ujang
Ministry of Environment and Water, Malaysia

Foreword

The generation of household wastes, as well as the rise of a new sort of plastic pollution issue, have become major environmental and safety concerns in Penang especially during the Covid-19 pandemic. The only way is to address the management of plastic value chain by adopting a re-thinking process.

SEA circular project has given us the opportunity to rethink and redesign the future of plastic. The concept of circular economy has been the core element in this project, and should serve as the way forward for Penang's sustainable development.

The Right Honourable

Mr. Chow Kon Yeow

The Chief Minister of Penang, Penang State Government

To realise the Penang 2030 vision of a Family-Focused, Green and Smart State that Inspires the Nation, Penang Green Agenda recommends the Waste Industry Policy to push for upstream waste reduction and downstream waste management for different types of waste including plastics. Transitioning to circular economy allows long term resilience, generates economic opportunities and also provides environmental and societal benefits.

"SEA circular project has provided fantastic opportunities to create and open up to new perspectives instead of remaining trapped in the frustrations of the present. With creativity and innovation, we really can redesign our future."

Kampung Permatang Nibong and Taman Bagan Lalang are the two locations in Seberang Perai that were successfully selected to implement this SEA circular pilot project. This project aids the planning in reducing the adverse effects of marine pollution caused by plastic entering the sea. I hope these two locations can be a role model to other communities in reducing the overall plastic and waste disposal.

Seberang Perai City Council (MBSP) has launched the Seberang Perai Circular Economy Roadmap in an effort to reduce usage of single-use plastic by using an

evidence-based and holistic approach involving all key stakeholders. The circular economy practices ensure long-term sustainability and reduce waste sent to the landfill. By adopting Smart Partnership 7P's - People, Public, Private, Philanthropy, Philosopher, Planet, Partnership, I believe we can achieve Low Carbon City by 2022.

"Seberang Perai Aspiring City of Tomorrow"

Dato' Sr Hj Rozali Bin Hj Mohamad

Mayor of Seberang Perai City Council (MBSP)

Table of Contents

Acknowledgment

Foreword

1.	Executive Summary	8
2.	Introduction	10
3.	New Approaches for Solving Plastic Pollution at Source	11
	3.1 <i>Current Baseline Scenario at Pilot Sites</i>	11
	3.2 <i>Integrated Solid Waste Management (ISWM) with 4Rs</i>	12
	3.3 <i>Circular Economy Models and Community Solutions</i>	14
	3.4 <i>Cross-sectoral Cooperation: Source-to-Sea Approach</i>	15
	3.5 <i>Investment Pathways</i>	15
4.	Intervention	16
	4.1 <i>Specific Solutions Identified and Applied</i>	16
	4.1.1 <i>Community Engagement</i>	16
	4.1.2 <i>4Rs Practices and Education</i>	17
	4.1.3 <i>Regulation and Law Enforcement</i>	17
5.	Initial Results and Early Observations	18
	5.1 <i>Immediate Observations after the Intervention</i>	18
	5.2 <i>Changes Observed against the Baseline Scenario</i>	19
6.	Improvements	21
	6.1 <i>Gaps and Needs</i>	21
	6.2 <i>Solutions</i>	22
7.	Way Forward: Sustainability and Upscaling	23
	7.1 <i>Action Plan on Long Term Behaviour Shifts</i>	23
	7.2 <i>Replicability/Transferability of the PGC Model & SNDP</i>	25
	7.3 <i>Sustainability Plans for SNDP Programme</i>	25
8	List of Abbreviations	26

Table of Figures

Figure 1:	Penang's Green Initiatives towards Waste Management	8
Figure 2:	Geographical Location of Penang, Malaysia	10
Figure 3:	Planting Green Community (PGC) Model	10
Figure 4:	Weight and Revenue of Recyclable Waste	11
Figure 5:	Primary Data - Waste Generation per Household at TBL in October 2020	11
Figure 6:	Primary Data - Waste Generation per Household at KPN in October 2020	11
Figure 7:	The Integrated Solid Waste Management Model at Pilot Project Locations	12
Figure 8:	DPSIR Framework prior to Implementing Penang Pilot Project	12
Figure 9:	Strategies for Elimination of Single-use Plastics and Hard-to-Recycle Plastic Packaging	13
Figure 10:	Circular Economy Model and Instruments at Pilot Project Locations	14
Figure 11:	Depiction of the 2-dimensional Source-to-Sea Management	15
Figure 12:	Six Methodologies Applied to Solving Plastic Pollution at Source	16
Figure 13:	Interview Session with Community on Site	16
Figure 14:	Discussion on the Issue Raised during SNDP Workshop on Site	16
Figure 15:	Problem Solving Methodology Adopted under SNDP Framework	16
Figure 16:	Circular Plastic Kiosk Training to the Committee Members of ERC by USM	17
Figure 17:	Recycled and Repurposed Finished Products from the Circular Plastic Kiosks	17
Figure 18:	Hierarchy of Plastic Circularity Solutions for PGC Pilot Projects Phase 2	18
Figure 19:	Plastic Waste Pathway at Pilot Project Locations	19
Figure 20:	Total Weight of Plastic and Waste Pathway in TBL by 2030	20
Figure 21:	Total Weight of Plastic and Waste Pathway in KPN by 2030	20
Figure 22:	Gaps and Solution Identified at Pilot Project Locations with Stakeholders	21
Figure 23:	Seberang Perai Circular Economy Roadmap	23
Figure 24:	Seberang Perai Circular Economy Roadmap - Single-use Plastic	23
Figure 25:	Seberang Perai Circular Economy Roadmap - Recycling and Upcycling Industry	24
Figure 26:	Potential Locations to Replicate the PGC Model	25

Executive Summary

Penang is stepping up its efforts for sustainable development through various initiatives for the past 12 years. The Penang State Government is currently working on a **No Single-Use Plastic by-law** to help curb single-use plastics and to support “**Malaysia’s Roadmap towards Zero Single-Use Plastics 2018-2030**” released by the former Ministry of Energy, Science, Technology, Environment & Climate Change (MESTECC) and succeeded by Ministry of Environment & Water (KASA).

To achieve the objectives of the SEA circular project, the pilot projects on “Waste Segregation at Source: Solving Plastic Pollution in Penang” was implemented to close the existing gaps between the key national stakeholders, to

contribute to the state's targets above, to report progress updates to KASA and assist in contributing towards **KASA’s Environmental Sustainability in Malaysia Roadmap 2020-2030 targets** under the Strategic Collaboration Pillar. The **Planting Green Community (PGC) Model** is part of initiative to improve circular economy practices in the communities of Taman¹ Bagan Lalang and Kampung² Permatang Nibong. The empowerment of local community leaders in the **Sustainable Neighbourhood Development Programme (SNDP)** is a key for the long-term community behavioural changes and the value-add of environmental initiatives throughout the introduction of a circular plastic kiosk are core components in this project.

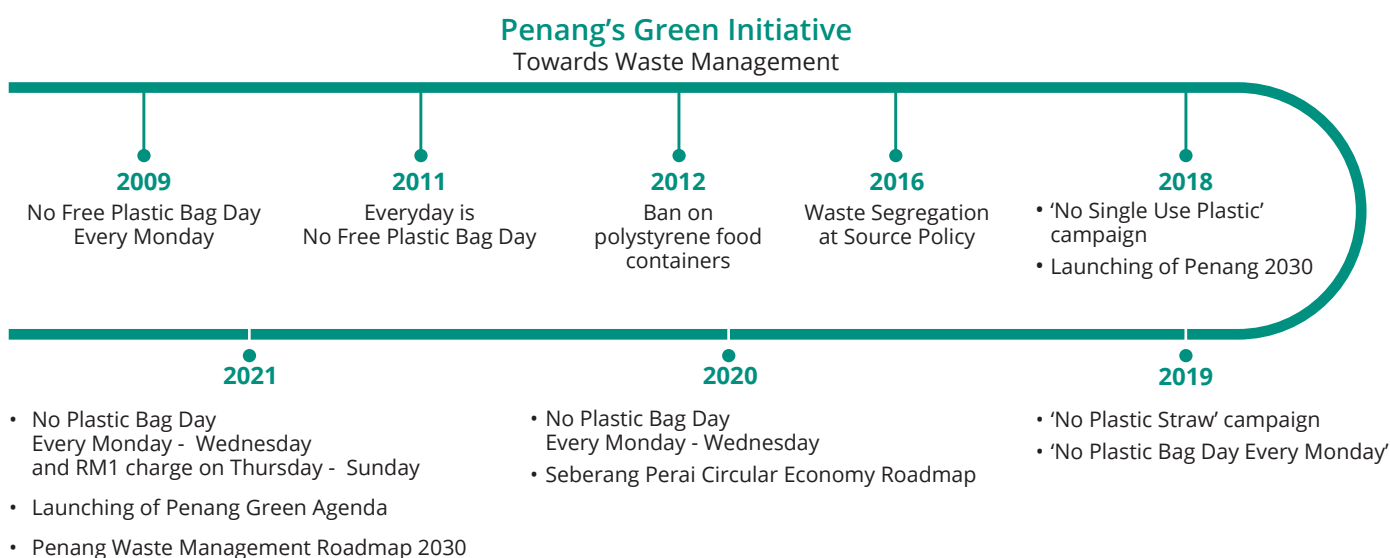


Figure 1 : Penang’s Green Initiatives towards Waste Management

Source : Penang Green Council, 2021

¹ The word ‘Taman’ is the Bahasa Malaysia word for residential area

² The word ‘Kampung’ is the Bahasa Malaysia word for village or rural area

Key Findings

- Although local communities possess general knowledge in 4Rs, this must be transformed into action via the PGC model to activate this social norm and promote community behavioural changes (shifting from a take-make-use-waste culture and practicing a 4R lifestyle).
- SNDP enables adaptive decision making as it provides a space for local communities to raise their concerns surrounding environmental, economic and social issues.
- The shift to waste segregation behaviour within local communities is slow but gradual. Therefore, the range of plastic waste collected by the recycling centre will be rolled out by phases.
- New skills imparted from training not only generated income to support the community's ongoing environmental initiatives, but also promoted self-sufficiency within the vulnerable groups.
- Contributing towards the implementation of the upcoming Malaysia's National Marine Litter Policy and Action Plan 2021-2030.

Lessons Learned

- The 'carrot and stick' approach by the state government is necessary to change consumption behaviour.
- Market enablers for recycled plastics must be established in order to encourage recycled plastic products.
- Effective strategies can only be built when the gap between state, market (i.e. private sectors) and civil society is bridged.
- Development of a waste database is critical for monitoring performances and assessing efficacy of current and future projects.
- The ownership and commitment from the local communities are crucial in developing and sustaining the project.

Introduction

Penang, the second smallest Malaysia state located in northwest Malaysia, comprises of mainland Seberang Perai and Penang Island. Known as the “Pearl of the Orient”, Penang is an urbanised state with a population of 1.98 million and a total area of 1049 km².

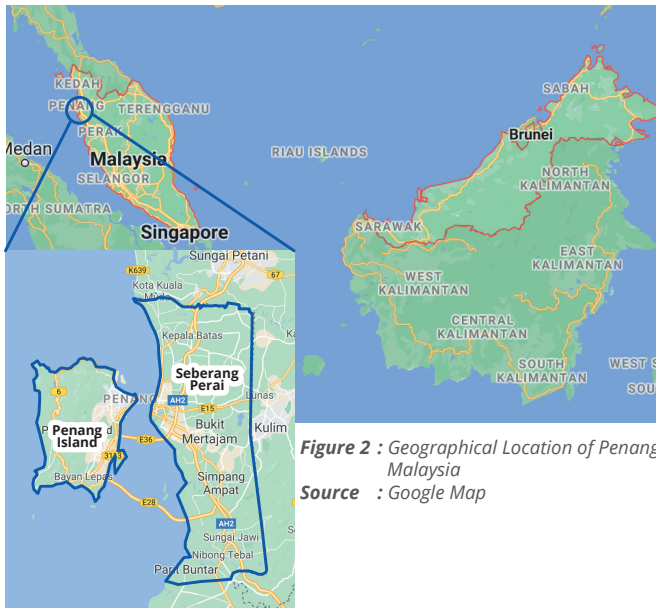


Figure 2 : Geographical Location of Penang, Malaysia
Source : Google Map

Penang faces challenges in solid waste management due to limited land availability. In 2019, approximately **2,220 metric tons of waste per day is sent to the landfill (2.3kg generated per person per day)³**. Solid wastes are collected by the local councils and transported to respective transfer stations in Batu Maung and Ampang Jajar. These transfer stations are transit points for waste and reduce the number of trips to the landfill and emissions from transportation.

In September 2020, the Seberang Perai City Council or Majlis Bandaraya Seberang Perai (**MBSP**) launched the **Seberang Perai Circular Economy Roadmap**, the **first Circular Economy Roadmap at state level in Malaysia**. The said Roadmap emphasises the use of the Circular Economy model to reduce waste sent to the landfill, consists of eight components: reducing landfill reliance, **recycling and upcycling, single-use plastics**, food waste, construction & demolition waste, electronics and hazardous waste, renewable energy, and water and wastewater.

In 2021, the Penang State Government has planned for a multi-dimensional roadmap to revolutionise waste management in Penang - **Penang Waste Management Roadmap 2030**. This roadmap will serve as a framework for the State to focus on waste prevention targets and to create a waste industry policy to energise job creation and economic growth.

This **SEA circular project** case study focuses on two locations: Taman Bagan Lalang (TBL) and Kampung Permatang Nibong (KPN) by introducing the **Planting Green Community (PGC) Model** and **Sustainable Neighbourhood Development Programme (SNDP)**. The results and lessons learned from this **community model pilot project** will assist MBSP to scale implementation and action plans on the **4Rs concept - Reduce, Recover, Recycle and Repurpose** in the Circular Economy Roadmap. The data collected and the successful implementation of the **PGC model** plays a pivotal role in contributing to the Circular Economy Roadmap, Penang Waste Management Roadmap and to be replicated in other communities across the state.

Planting Green Community Model

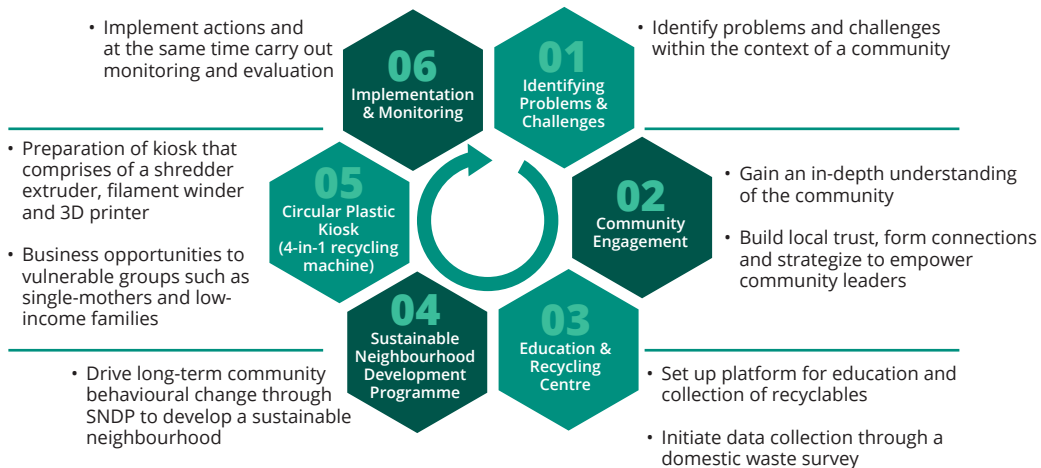


Figure 3 : Planting Green Community (PGC) Model
Source : Penang Green Council, 2020

³ Penang Monthly, Nov 2020, Environment in Number 10

New Approaches for Solving Plastic Pollution at Source

3.1 Current Baseline Scenario at Pilot Sites

Penang State adopts the [Local Government Act 1976](#) (state's local councils to manage its waste independently) and implemented the [Waste Segregation at Source \(WSAS\) Policy in 2016](#) where residents are required to **segregate their waste into two streams - recyclables and general waste** before collection by the local authorities. Residents are also **encouraged to reduce** their waste by practicing **reuse** or composting. **Figure 4** shows the **weight and revenue of recyclable materials** collected by MBSP since the implementation of WSAS.

Year	Seberang Perai City Council (MBSP)	
	Weight (kg)	Revenue (RM)
2016	60,138.90	14,034.23
2017	137,790.00	30,009.04
2018	81,944.00	16,920.93
2019	107,786.00	21,497.20
2020	7,585.98 <i>(Covid-19, SOPs)</i>	8,874.00 <i>(Covid-19, SOPs)</i>
Total	395,244.88	91,335.40

Figure 4 : Weight and Revenue of Recyclable Waste
Source : Primary data collected by MBSP on recycling data on annual basis 2021

To develop the baseline data on solid waste generation in both pilot locations, a domestic waste survey was conducted with the cooperation of local residents to segregate their wet and dry waste into different bags. A total of **390 out of 499 households (78%) participated** in the survey in October 2020. The survey results disclosed that plastic waste ranks **third at TBL** and **fourth at KPN** in the **household waste category**.⁴

On average, TBL and KPN generate **122.07kg** and **79.39kg of waste per day**, respectively, with **0.53kg (TBL)** and **0.50kg (KPN) of waste per household**. The percentages of plastic waste per household prior to the commencement of the pilot project were **10% at TBL** and **7% at KPN in October 2020**. In order to reach the 80% recycling rate by 2030 for the whole of Seberang Perai area⁵, MBSP has set **10% waste reduction annually** for pilot projects, which includes plastic waste.

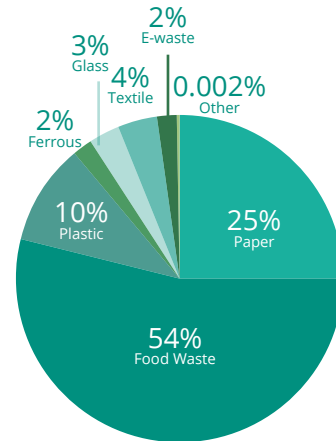


Figure 5 : Primary Data - Waste Generation per Household at TBL in October 2020
Source : Primary Data collected by MBSP and Penang Green Council from 11 -25 October 2020

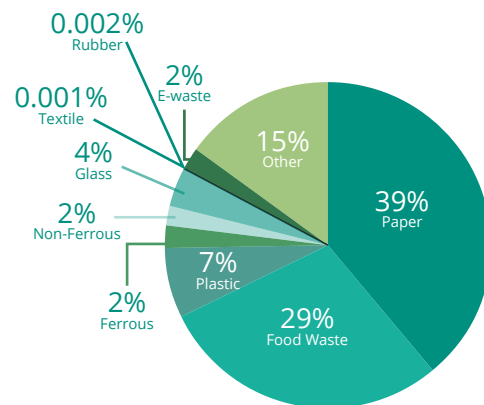


Figure 6 : Primary Data - Waste Generation per Household at KPN in October 2020
Source : Primary Data collected by MBSP and Penang Green Council from 11 -25 October 2020

⁴ Primary data collected by MBSP and Penang Green Council during domestic waste survey from 11 – 25 October 2020

⁵ Seberang Perai Circular Economy Roadmap (2020), available at <https://www.mbsp.gov.my/docmajlis/bandar-rendah-karbon/cer.pdf>

3.2 Integrated Solid Waste Management (ISWM) with 4Rs

The current WSAS will be upgraded by applying the **integrated solid waste management (ISWM) system (Figure 7)**⁶ including the application of 4Rs strategies supported by different stakeholders on the ground in the waste management.

There were several approaches to inculcate long-term community behavioural change at pilot project sites and support new policy instruments in solving plastic pollution issues in Penang. The **Driver-Pressure-State-Impact-Response (DPSIR) framework** was applied to provide a detailed storyline about the current plastic crisis to the communities, thereby aiding stakeholders in identifying key issues and problems and determining measures to be taken.

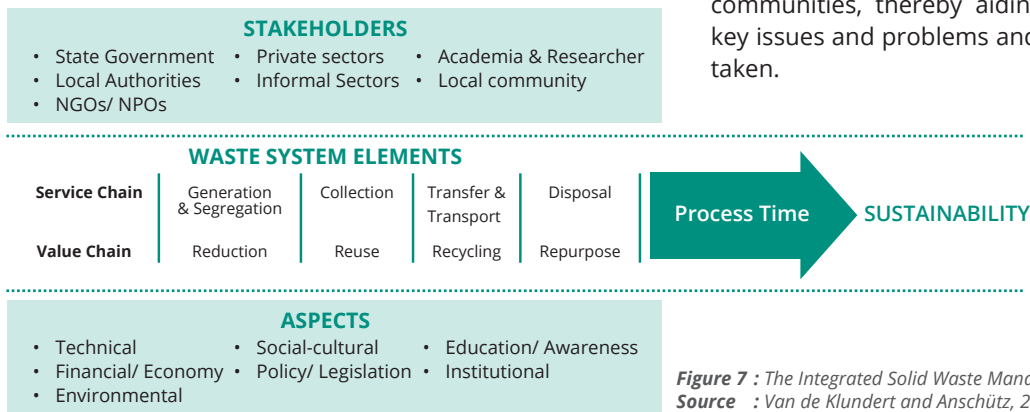


Figure 7 : The Integrated Solid Waste Management Model at Pilot Project Locations
Source : Van de Klundert and Anschutz, 2001 and Penang Green Council, 2020

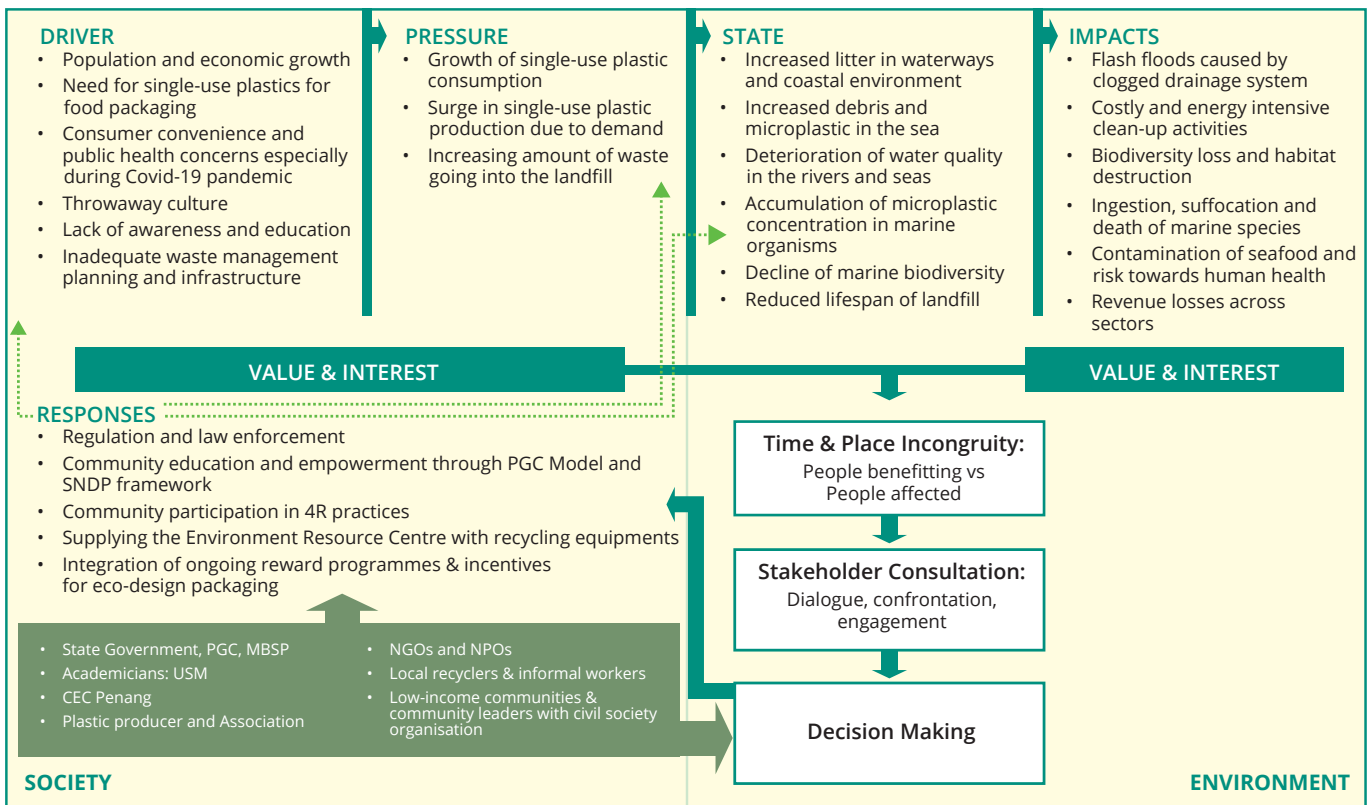


Figure 8 : DPSIR Framework prior to Implementing Penang Pilot Project
Source : MBSP and Penang Green Council, 2020

⁶ Van de Klundert, A., Anschutz, J., & Scheinberg, A. (2001). *Integrated sustainable waste management-the concept. Tools for decision-makers. Experiences from the urban waste expertise programme (1995-2001).*

The community engagements (feedback/ inputs via surveys) held at the pilot locations were submitted to MBSP to assist the compilation of primary data of various locations. This assisted MBSP to identify how to strengthen the current waste management collection for both urban & rural locations and embed circular economy solutions to improve Penang State Government's Waste Management Roadmap 2030.

Based on the current scenario, the **strategies for elimination of single-use plastics and hard-to-recycle plastic packaging** in pilot locations are tabulated in **Figure 9** below:








PLASTIC TYPE	POLYMER	COMMON USES	RECYCLABLE	OPTION TO REDUCE/ ELIMINATE
 PETE	PET (Polyethylene Terephthalate)	Water and beverage bottles, dispensing containers for cleaning fluid, biscuit trays	<ul style="list-style-type: none"> Recycle 	<ul style="list-style-type: none"> Waste minimisation education Reuse Upcycling e.g. (stationary case, flower pots, home decor) Recycle using shredder machine or plastic kiosk and convert to new products Policy enforcement - MBSP target to eliminate single-use plastic by 2030
 HDPE	HDPE (High-Density Polyethylene)	Milk containers, cleaning agents, shampoo bottles, ice-cream containers	<ul style="list-style-type: none"> Recycle 	<ul style="list-style-type: none"> Waste minimisation education Reuse Upcycling e.g. (stationary case, flower pots, home decor) Recycle using shredder machine or plastic kiosk and convert to new products
 PVC	PVC (Polyvinyl Chloride)	Plastic piping, roof sheeting, cabling insulations	<ul style="list-style-type: none"> Often used for industrial purposes Often not recycled due to chemical properties Depends on recycler 	<ul style="list-style-type: none"> Recycle Upcycling e.g. (stationary case, flower pots, home decor)
 LDPE	LDPE (Low-Density Polyethylene)	Plastic bags, food wrapping, trays	<ul style="list-style-type: none"> Hard to recycle 	<ul style="list-style-type: none"> Waste minimisation education Reuse Policy enforcement - MBSP target to eliminate single-use plastic by 2030
 PP	PP (Polypropylene)	Bottle caps, microwave dishes, houseware, medical, automobile parts	<ul style="list-style-type: none"> Recycle 	<ul style="list-style-type: none"> Waste minimisation education Upcycling e.g. (stationary case, flower pots, home decor) Recycle
 PS	PS (Polystyrene)	Food takeaway containers, plastic cutlery, egg tray	<ul style="list-style-type: none"> Elimination of single-use plastics Rarely recycled Depends on recycler 	<ul style="list-style-type: none"> Waste minimisation education Penang has banned the use of polystyrene containers since December 2012 Packaging of electrical products (polystyrene foam) will be recycled and sold back to recyclers/ electronics shops Policy enforcement - MBSP target to eliminate single-use plastic by 2030
 OTHER	Other	Water cooler bottles, baby cups	<ul style="list-style-type: none"> Hard to recycle Risks of contamination of recycling Depends on recycler 	<ul style="list-style-type: none"> Waste minimisation education Upcycling e.g. (stationary case, flower pots, home decor)

Figure 9 : Strategies for Elimination of Single-use Plastics and Hard-to-Recycle Plastic Packaging
Source : MBSP and Penang Green Council, 2020

3.3 Circular Economy Models and Community Solutions

Figure 10 shows solutions towards reduction of plastic leakage. The end-of-life of plastics can be recycled through community-based projects and looped back into the economy with various identified market-based instruments.

The pilot project holds potential for replication in reducing land-based marine litter leakages by adopting the proposed circular economy model when replicating the PGC model.

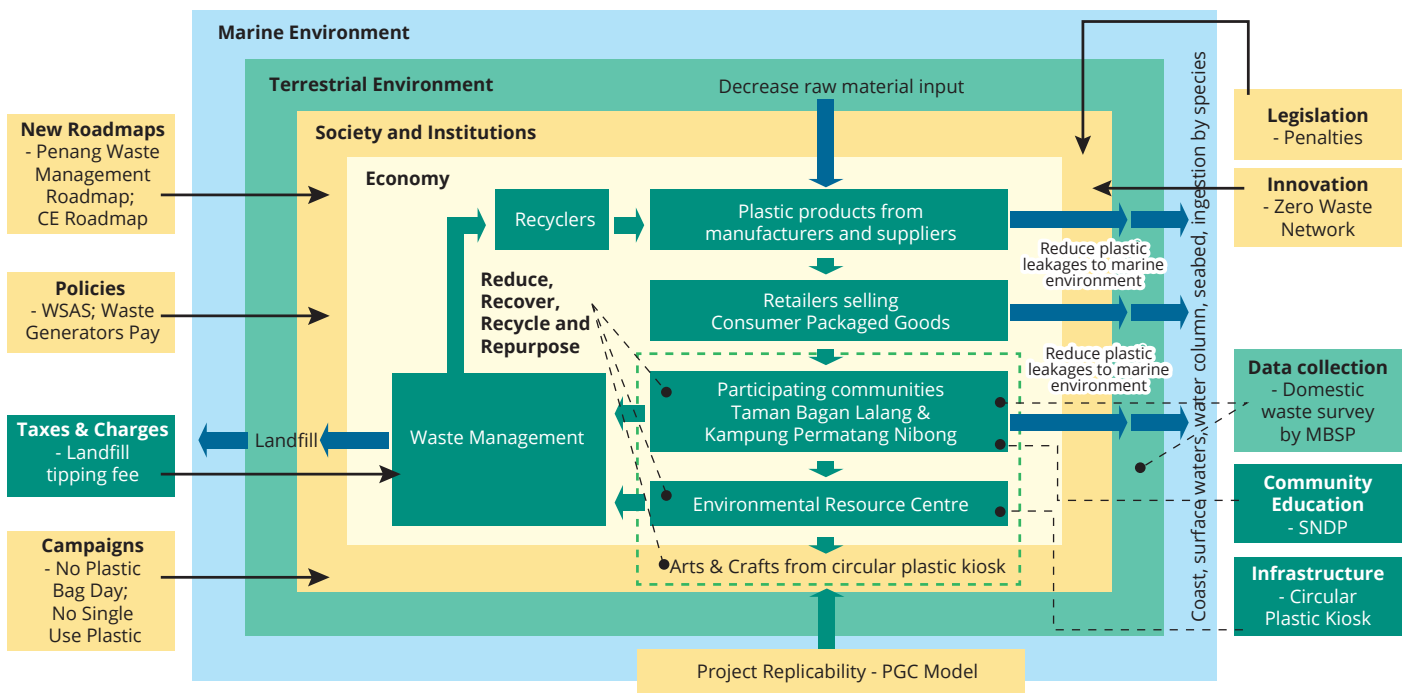


Figure 10: Circular Economy Model and Instruments at Pilot Project Locations
 Source : MBSP and Penang Green Council, 2020

3.4 Cross-sectoral Cooperation: Source-to-Sea Approach

A holistic approach is key to effectively address the plastic leakage issue. The Source-to-Sea approach breaks existing barriers apart to better understand land-sea interactions, and the importance of **cross-sectoral cooperation** which are closely interlinked. Coordination across these sectors promotes informed decision-making on land, water, marine, solid waste and wastewater management⁷. Figure 11 shows the **2-dimensional approach** applied in the **PGC model** for both pilot project sites:

- **State:** Penang State Government is responsible for creating people-centric policies that ensure a balance is achieved between protecting the environment, and strengthening the state’s economy.
- **Market:** Besides enabling opportunities for the people to increase 4R practices, the private sector should create job opportunities to encourage adoption of the circular economy approach in their business models.
- **Civil society:** Influencers, NGOs via awareness action-oriented campaigns can mobilise citizens in adopting 4Rs best practices (sustainability lifestyle), change mindsets and inculcate behavioural change.

3.5 Investment Pathways

Apart from receipt of international funds (SEA circular project), the PGC model can be sustained and replicated state wide with continued **support of government grants, green tax exemptions for private sector players, Corporate Social Responsibility (CSR) projects and via Public-Private-Partnerships (PPPs) modalities**. In addition, continuous learning opportunities (e.g. upcycle plastic packaging workshop and plastic kiosks training) provided by various stakeholders could help **generate additional income (i.e., promote self-sufficiency) for vulnerable groups such as single-mothers and low-income families**.

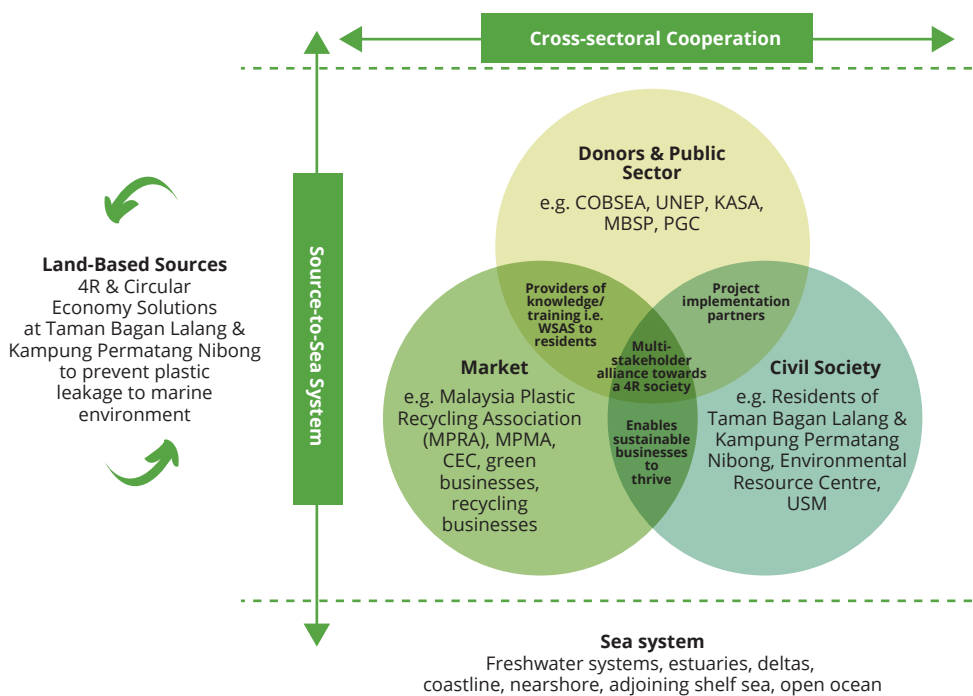


Figure 11: Depiction of the 2-dimensional Source-to Sea Management
Source : MBSP and Penang Green Council, 2020

⁷ Mathews, R.E. & Stretz, J. (2019). Source-to-Sea Framework for Marine Litter Prevention: Preventing Plastic Leakage in River Basins. Stockholm: SIWI.

Intervention

4.1 Specific Solutions Identified and Applied

Referring to the PGC model in Figure 3 above, **six methods in Figure 12** below have been applied to collect the data and input from the community and other related stakeholders.



Figure 12: Six Methodologies Applied to Solving Plastic Pollution at Source
Source : MBSP and Penang Green Council, 2020

4.1.1 Community Engagement

Based on the observation from **house to house visits and interviews**, the communities at pilot project sites have been practicing WSAS but proactivity varies between households. Although many individuals are familiar with the principle of reducing waste, it takes more than just public campaigns to break the throwaway culture.

The SNDP is a programme that **aims to design a conceptual framework for implementing long-term behavioural changes** that focuses on **'bottom up' action, driven by a group of communities in partnership with 'top down' resourcing, facilitation and coordination by**

local government. A survey on awareness levels and behavioural habits of residents was conducted to gather information and also assisted the Penang government in identifying the elements needed to create a successful sustainable neighbourhood framework. The creation of sustainable neighbourhoods together with local community will not only build their capacity to develop their own sustainable neighbourhood planning, but also empower them to take up ownership to improve their living environment. The mechanism adopted under the SNDP framework for better community planning has been tabulated in **Figure 15**.

Problem Solving Methodology Adopted Under SNDP Framework

01

Identify The Problem

Diagnosing the problem - the context, background and symptoms of the problems.

02

Determine The Root Cause(s) of The Problem

Explore on the causes of the problem.

03

Develop Alternative Solutions

Identify as many potential solutions to the problem as possible.

04

Select A Solution

Evaluate all solutions suggested and narrow to most feasible and voted by all the community members.

05

Implement The Solution

Draft out an initial project planning timeline and action plan to execute the selected solution.

06

Evaluate The Outcome

Monitor and collect data to ensure the outcome is attained

Figure 15: Problem Solving Methodology Adopted under SNDP Framework
Source : Penang Green Council, 2020



Figure 13: Interview Session with Community on Site
Source : Penang Pilot Project, Penang Green Council, 2020



Figure 14: Discussion on the Issues Raised during SNDP Workshop on Site
Source : SNDP, Penang Pilot Project, Penang Green Council, 2021

4.1.2 4Rs Practices and Education

To further enhance and add value to the communities' ongoing environmental commitments, the Environment Resource Centre (ERC) has been upgraded with a circular plastic kiosk that applies the **4Rs concept**. The ERC is a catalyst working with the informal waste sector and embeds community volunteerism in driving inclusive community participation. The concept was inspired by **Precious Plastics**. For this pilot project, Universiti Sains Malaysia (USM) recommended a **4-in-1 recycling machine** which comprises a **shredder, extruder, filament winder, and 3D printer**. Post-consumer used plastic such as **polyethylene terephthalate (PET) and high-density polyethylene (HDPE)** can be shredded and printed into new products (alphabet blocks, keychain, screw) via this kiosk which can be sold to generate income by the identified vulnerable groups⁸. This **downstream-responsive strategy** embeds circular economy approaches to reduce land-based plastic leakage.

The local recyclers engaged in this pilot project play a vital role in providing collection services for recycling activities at the ERC. In addition to the plastic kiosks, the ERC at KPN also has a **plastic shredder machine used to shred all types of plastic waste**. The local recyclers would purchase the shredded plastics from the ERC.



Figure 16: Circular Plastic Kiosk Training to the Committee Members of ERC by USM

Source : Penang Pilot Project, Penang Green Council, 2020

To enhance the 4R education and public awareness efforts, **family-based education programmes** such as **No Single-Use Plastic (NSUP) Game**⁹, **Plastic-licious**, and **Snap & Win** were introduced to encourage the local community to practice segregation of plastic waste and increase recycling rates. In return, the participating residents for Plastic-licious and Snap & Win will receive **eco-friendly products such as rice straw, collapsible cups, bamboo toothbrush, and tote bag from Penang Green Council** as a reward. In order to encourage behavioural shift, the incentivising approach (carrot) should be opted, rather than imposing penalties (stick).

4.1.3 Regulation and Law Enforcement

To continue the success of **"Penang No Free Plastic Bag"** and **"NSUP"** campaign, and to align with **"Malaysia's Roadmap towards Zero Single-Use Plastics 2018-2030"**, and the upcoming **"Malaysia's Circular Economy Roadmap for Plastics"** and **"Malaysia's National Marine Litter Policy and Action Plan 2021-2030"**, Penang State Government is planning to implement a **"No Single-use Plastic" by-law** in year 2021 after applying the six methods in Figure 12 above. This by-law is supported by the 2018 public survey (**76% of respondents supported to ban the use of single-use plastic items at hotels, restaurants, cafe, and food outlets in Penang**)¹⁰ conducted by Penang Green Council to understand the **public's perception on the implementation of the "NSUP Campaign"** in Penang.



Figure 17: Recycled and Repurposed Finished Products from the Circular Plastic Kiosks

Source : Penang Pilot Project, Penang Green Council, 2020

⁸ Vulnerable group - Single mother and low-income families

⁹ Game developed by Universiti Pendidikan Sultan Idris (2020), <https://www.youtube.com/watch?v=ddp1PIIPoM&feature=youtu.be>

¹⁰ No Single-Use Plastic Items at Food Eateries in Penang (2018), available at http://www.pgc.com.my/2020/wp-content/uploads/2020/11/BI_NSUP_Customer.pdf

Initial Results and Early Observations

5.1 Immediate Observations after the Intervention

The ERC committee in collaboration with MBSP has organised the **Environmental and Entrepreneurship Workshop**, where cleaned post-consumer **plastic packaging and 3-in-1 plastic sachets were crafted into carrier bags, baskets and purses**. Approximately **40 women, mostly single mothers and housewives, have been taught this new skill**. This free skills training provided by MBSP helped the women groups and B40 groups¹¹ enhance their skills to generate/supplement income for their families.

To increase recycling efforts & improve habits in advancing recycling activities, the plastic kiosks are instrumental in promoting recycling awareness within communities, and ERC leaders are empowered to provide dedicated support to close the gaps and minimise challenges where the capacity of formal recycling is lacking in certain community segments. The plastic kiosks also helped the community members learn new skills and generate passive incomes

for various parties such as single mothers and B40 community members. **Ten members of ERC from each pilot project location are now well trained** in the categories of plastics, equipment operations and the know-how on maintaining the machine and its parts. Due to current Covid-19 SOPs safety measures, the two types of identified valuable plastic that can be currently diverted from ending up at landfills/leaking to the environment and can be recycled by the kiosk are clean high-value **PET and HDPE** to safeguard community members involved in the collection and handling process. **The MBSP and ERC will focus on plastic bottles** due to its higher resale value compared to other types of plastic in Phase 1 of the pilot project. All other types of plastic not mentioned in this case study will also be included post-MCO 3.0 restrictions via a hierarchy of proposed solutions in Phase 2 of the PGC model (Figure 18). Here, communities will be equipped with knowledge and life skills on how to better close the plastic loops effectively by keeping plastic circularity above ground as long as possible i.e. scaling activities from upcycling to focusing on share, maintain/prolong, redistribute¹² as per Covid-19 SOP measures.

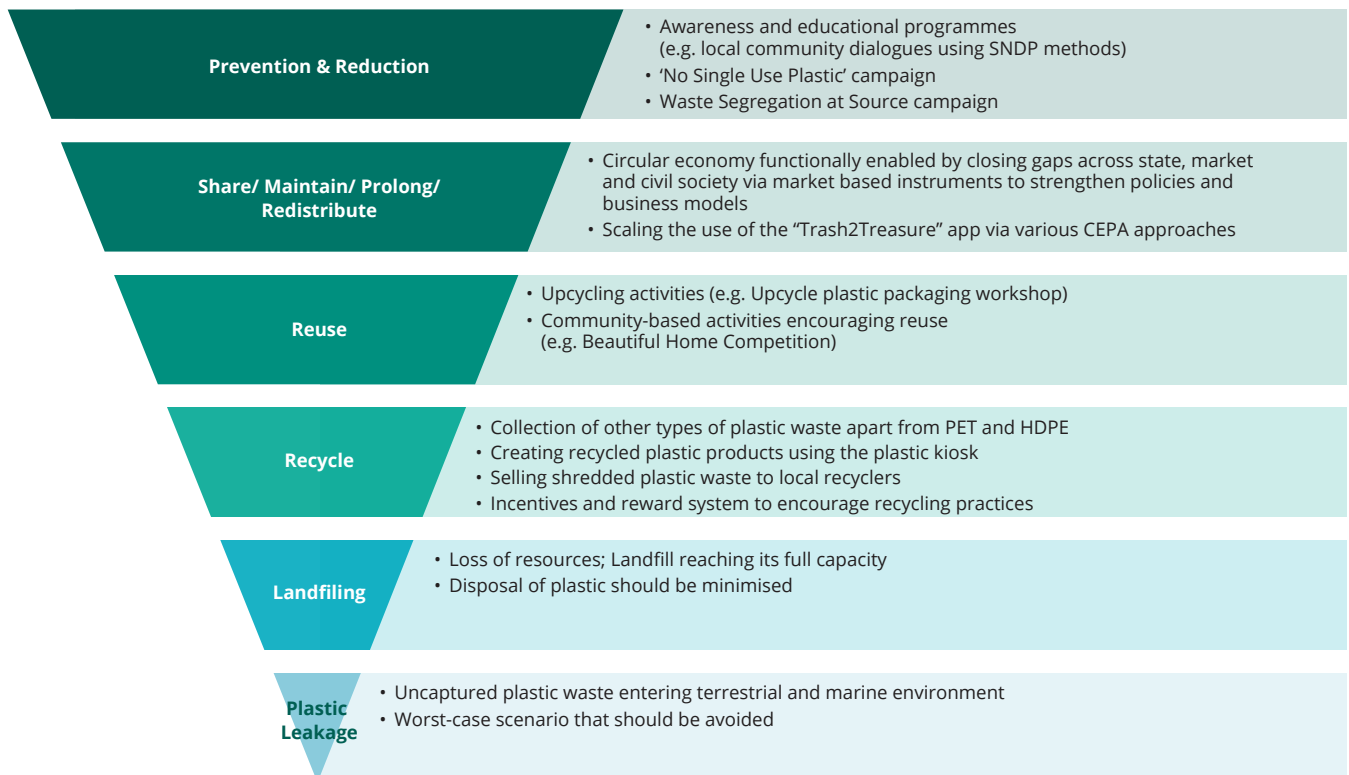


Figure 18: Hierarchy of Plastic Circularity Solutions for PGC Pilot Projects Phase 2
Source : Penang Green Council, 2021

¹¹ Malaysians are categorized into three income groups: the top 20% (T20), the middle 40% (M40), and the bottom 40% (B40) (B40) based on the Department of Statistics' (DOSM) Household Income and Basic Amenities (HIS/BA) survey of 2019, (*Household Income & Basic Amenities Survey Report 2019: Malaysia*)

¹² These are the smaller key tech loops of the butterfly diagram to be activated prior to reaching the last tech loop on recycling to increase plastic circularity above ground and to prevent leakage below ground. See <https://www.ellenmacarthurfoundation.org/circular-economy/concept/infographic>

The plastic waste (**plastic mineral bottles, plastic shampoo and body bath bottles, and plastic cutleries**) collected by the community will be converted to new goods such as flower pots, keychains, and pre-school toys (alphabet and number blocks). This initiative obtained the buy-in from stakeholders and residents. Though technical training is required, its action-oriented approach made it easier for residents to adopt the 4Rs as part of the pilot project's proposed circular economy model for managing plastic waste.

As recycling was challenging during Coronavirus disease 2019 (COVID-19), education on reduce and reuse was increased through the **Snap & Win, Plastic-licious, SNDP Workshop, and NSUP Game**. The NSUP game developed by **Universiti Pendidikan Sultan Idris (UPSI)** helps educate children identify single-use plastic and understand its impacts towards the environment. The game has been shared among the community at pilot project locations and **approximately 234 primary and secondary schools in the Seberang Perai area**.

To develop strong local leadership, **10 members of each ERC are required to lead the PGC model** with the support from related stakeholders. These people are chosen based on their proactiveness, supportive spirit and committed behaviour since the commencement of the pilot projects. During the SNDP workshop, with the guidance from Penang Green Council, the community leaders have shown their interest and passion in contributing ideas and potential solutions to tackle the issues raised by their fellow villagers. The three main issues highlighted during the workshop are **river pollution, waste segregation, and community participation**. After completion of the pilot projects, Penang Green Council will continue to work hand in hand with both communities to develop a sustainable neighbourhood framework that is replicable to other communities in Penang.

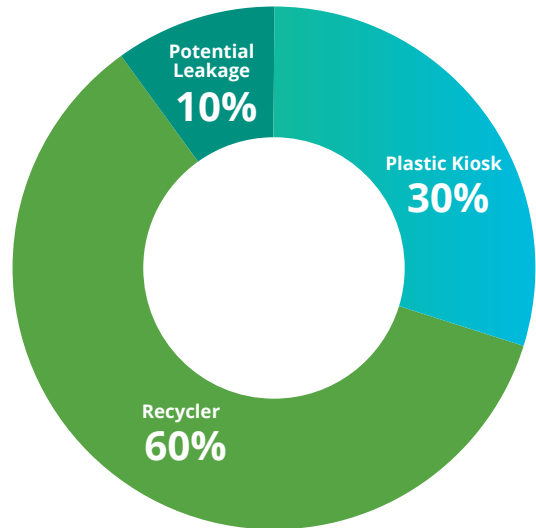


Figure 19 : Plastic Waste Pathways at Pilot Project Locations
Source : MBSP and Penang Green Council, 2020

5.2 Changes Observed against the Baseline Scenario

A future scenario for year 2030 has been developed under the assumption that both communities, having successfully adopted the PGC model, set targets to **reduce plastic waste by 10% annually and divert 90% of plastic waste** away from the landfill. The scenario also assumes a waste pathway in which 30% of plastic wastes are recycled by the kiosk and 60% are sold to the recyclers, while the remaining 10% represents potential leakage into the environment.

Utilizing survey data collected on sites in 2020, the community of TBL and KPN (Figure 20 and 21) are expected to generate 1553kg and 707kg of the plastic waste in 2030, respectively. Both communities will experience of **65.13% decrease of plastic waste from 2020 to 2030**. This scenario will help and support **MBSP's goal of becoming a zero-waste city by 2030**, with 80% recycling rate and the elimination of single-use plastic.

Plastic Waste at Taman Bagan Lalang

Year	Total weight of plastic / year (kg)	Waste Pathways		
		To kiosk/ year (kg)	To recyclers/ year (kg)	To landfill/ year (kg)
2020	4455.56	1336.67	2673.33	445.56
2021	4010.00	1203.00	2406.00	401.00
2022	3609.00	1082.70	2165.40	360.90
2023	3248.10	974.43	1948.86	324.81
2024	2923.29	876.99	1753.97	292.33
2025	2630.96	789.29	1578.58	263.10
2026	2367.86	710.36	1420.72	236.79
2027	2131.08	639.32	1278.65	213.11
2028	1917.97	575.39	1150.78	191.80
2029	1726.17	517.85	1035.70	172.62
2030	1553.56	466.07	932.13	155.36

Figure 20 : Total Weight of Plastic and Waste Pathway in TBL by 2030

Source : MBSP and Penang Green Council, 2021

Plastic Waste at Kampung Permatang Nibong

Year	Total weight of plastic / year (kg)	Waste Pathways		
		To kiosk/ year (kg)	To recyclers/ year (kg)	To landfill/ year (kg)
2020	2028.41	608.52	1217.05	202.84
2021	1825.57	547.67	1095.34	182.56
2022	1643.02	492.90	985.81	164.30
2023	1478.71	443.61	887.23	147.87
2024	1330.84	399.25	798.51	133.08
2025	1197.76	359.33	718.66	119.78
2026	1077.98	323.39	646.79	107.80
2027	970.18	291.06	582.11	97.02
2028	873.17	261.95	523.90	87.32
2029	785.85	235.75	471.51	78.58
2030	707.26	212.18	424.36	70.73

Figure 21 : Total Weight of Plastic and Waste Pathway in KPN by 2030

Source : MBSP and Penang Green Council, 2021

Improvements

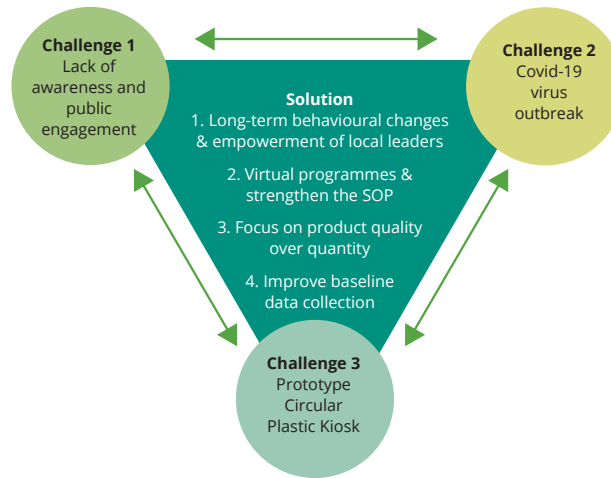


Figure 22 : Gaps and Solutions Identified at Pilot Project Locations with Stakeholders
Source : MBSP and Penang Green Council, 2020

6.1 Gaps and Needs

Since the implementation of the WSAS policy and NSUP Campaign in 2016 and 2019 respectively, Penang Green Council has started various campaigns to educate and engage the local community such as the House-to-House educational programmes, roadshows, dialogues series, and educational talks.

Although many awareness and education programmes have been conducted, the concept of **'Take-Make-Dispose'** and **'someone will clean it up'** mind-sets are still entrenched in communities not covered by the pilot project locations. According to a public survey of No Single-Use Plastic Items at Food Eateries in Penang (Customer), **48.8% of the respondents indicated that they dispose single-use plastic items into rubbish bins after use instead of recycling it.**¹³ In Penang, single-use plastics are being consumed at an alarming rate. The emergence of COVID-19 has specially reinforced this social behaviour due to concerns of public health. In consequence, this has contributed to large amount of single-use plastic waste being sent to the landfill and increasing littering issue.

Due to COVID-19 outbreak, Malaysia's Movement Control Order (MCO) and Conditional Movement Control Order (CMCO) from March 2020 to March 2021 created various challenges for the pilot projects. Other envisaged programmes such as SNDP workshop and recycling programme that involved community participation were postponed to minimise the COVID-19 virus outbreak. Whilst the pandemic has inevitably driven the use of single-use plastic, the pilot project had continued its focus on **segregation of waste at households** and instilling the

4Rs best practices where possible. According to Penang Green Council's 2020 survey, **The Impacts of MCO towards Waste Generation in Penang Island, the use of single use plastics have increased as consumers shifted towards online shopping and food delivery services during the pandemic**¹⁴. Moving forward, the PGC model and SNDP programmes have to be customised to capture the increase of plastic packaging waste from these unforeseen circumstances when the pilot project started in August 2019.

During the pilot testing phase of the circular plastic kiosk, some challenges were recorded such as maintenance of machinery on a monthly basis, scaling of production rates, and limited plastics accepted for shredding (i.e. only 2 types). For plastics to be effectively recycled, the local community needs to work on ensuring that **all plastic waste must be cleaned and dried as part of the segregation process and have labels removed from their plastic packaging** as well. The sorting of plastics by categories (Type 1 to Type 7) is still challenging for certain people and continuous education is compulsory.

After completing the Plastic Disclosure Project (PDP) training and a few consultations with the local council (March until September 2020), we have identified that **data availability** on plastic waste is still lacking. The training helped to **facilitate the strengthening of the data collection methodology** though MBSP and Penang Green Council believe there is still room for improvement. However, during the COVID-19 outbreak, limitations on time and manpower have hindered the collection of detailed information of all plastic waste as fully exemplified in the PDP.

¹³ No Single-Use Plastic Items at Food Eateries in Penang (2018), available at http://www.pgc.com.my/2020/wp-content/uploads/2020/11/BI_NSUP_Customer.pdf

¹⁴ The Impacts of Movement Control Order (MCO) Towards Waste Generation in Penang Island (2020), available at

<https://www.pgc.com.my/2020/wp-content/uploads/2020/10/The-Impacts-of-Movement-Control-MCO-Towards-Waste-Generation-in-Penang-Island.pdf>

6.2 Solutions

To ensure continuity of waste segregation at households and to encourage the 4Rs lifestyle, **education through S NDP** can increase the engagement of communities to create a **sense of ownership towards their environment**. The **six methodologies in Figure 12 above** will need to be tweaked and strengthened during the COVID-19 outbreak, to include more support and manpower from the local government and related stakeholders to carry out implementation and action-oriented activities.

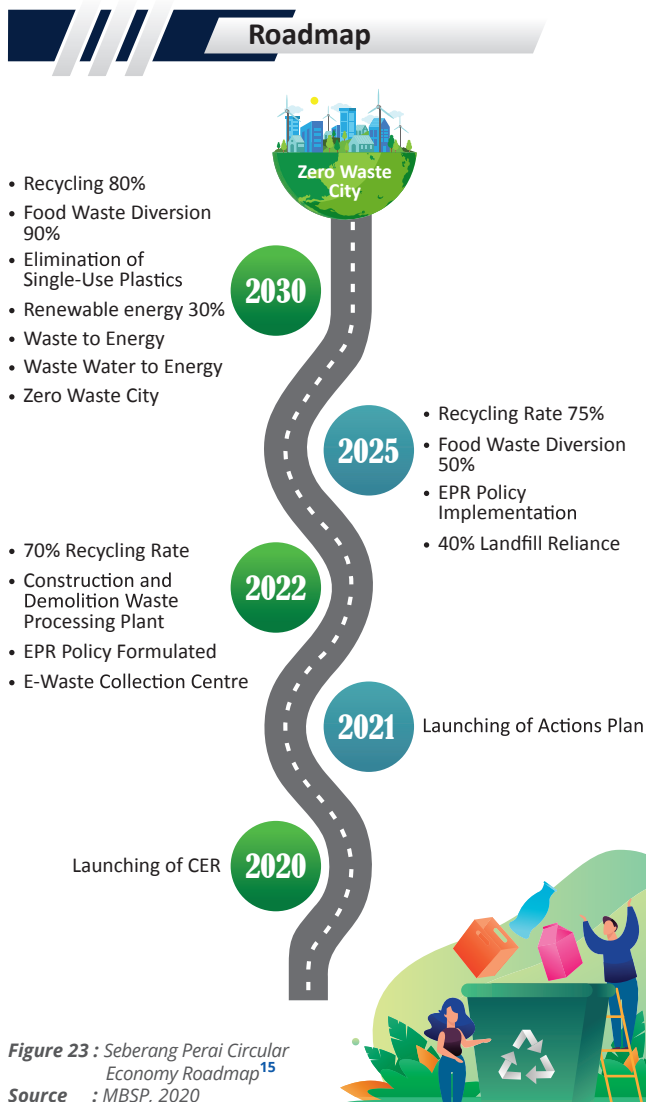
Penang Green Council and MBSP have taken an initiative to **better integrate & streamline ongoing initiatives and reward programmes** following the COVID-19 Standard Operating Procedures (SOP). For example, all face-to-face workshops have been **replaced with online workshops** while on the ground engagement and evaluation have been replaced with **incentivising the committee members** to provide data, pictures, and videos of activity done by the local communities via online submissions.

Penang Green Council and MBSP have worked closely with USM to ensure the machine can be run smoothly. Continuous education and training on the proper way to dispose of plastic waste and operation of plastic kiosks is required. To tackle the other categories of plastic, and increase collection for recycling, efforts to scale will need to be implemented via a **Public-Private Partnership modality**. Plans to do so will commence in 2022 with pilot projects incorporating the Extended Producer Responsibility element.

There is a need to review and improve baseline data collection. Apart from collecting household waste composition (i.e. general weight of plastic), it is important to also obtain the breakdown of plastic weight by categories, and also identify the top ten items generated in households with its respective weights. Data should also be gathered in the long-term so that changes in trends can be observed.

Way Forward: Sustainability and Upscaling

7.1 Action Plan on Long Term Behaviour Shifts



In order to achieve a **75% recycling rate by 2025** and **elimination of single-use plastics by 2030**, MBSP is committed to educate the community in their jurisdiction and is confident that there will be a shift towards pro-environmental behaviour.

a) NSUP Campaign and Educational Awareness

To encourage long-term behavioural changes, starting January 2021, Penang state government has announced the **No Plastic Bag Day Every Monday - Wednesday Campaign and RM1.00 will be charged per plastic bag from Thursday - Sunday** to accelerate the shift from dependency on single-use plastic bags to the adoption of reusable bags on regular basis. Although COVID-19 outbreak has fuelled the use of single-use plastics, the **"No Plastic Straw" campaign** will be continued and it has become **compulsory for all food and beverage premises to be registered with the local authority**. These **premises will no longer place plastic straws in the corner/counter** that can be obtained directly by consumers and will only be **provided upon request**.

Environmental education should begin in early childhood and be used to gradually change public perception and behaviour. **All schools in Seberang Perai will be encouraged to become recycling and education centres**, which will help students learn about recycling and green practices in an indirect manner. In 2021, MBSP together with Fraser & Neave Holdings Bhd (F&NHB) created a **short video clip about 5Rs (Rethink, Refuse, Reduce, Reuse, Recycle) philosophy** and this will be shared to all schools to educate students and their teachers.

Single-Use Plastics

- FORMULATE EXTENDED PRODUCER RESPONSIBILITY (EPR) POLICY BY 2022
- IMPLEMENT EPR POLICY BY 2025
- SINGLE-USE PLASTICS ELIMINATION BY 2030



Figure 24 : Seberang Perai Circular Economy Roadmap - Single-use Plastic
Source : MBSP, 2020

¹⁵ Seberang Perai Circular Economy Roadmap (2020), available at <https://www.mbsp.gov.my/docmajlis/bandar-rendah-karbon/cer.pdf>

Recycling and Upcycling Industry

- ACHIEVE 75% RECYCLING RATE BY 2025
- FURTHER IMPROVE RECYCLING RATE AT 80% BY 2030



Figure 25 : Seberang Perai Circular Economy Roadmap - Recycling and Upcycling Industry
Source : MBSP, 2020

b) Reward and Incentives

Incentives from government and businesses could help encourage the public to practice 4Rs. Penang State Government through Penang Green Council has provided incentive schemes and environmental awards such as [Penang Green Office](#), [Penang Green School Award](#), [Penang Green Kindy Incentive](#), and [Penang Green Event Incentive](#) to green crusaders and eco-conscious partners. By adopting waste segregation and proper waste management in offices, schools/ kindergartens and events, incentives or rewards will be granted to recognise their efforts in developing the state of Penang as a sustainable and green state by 2030.

c) Engagement with Relevant Stakeholders

To support the Malaysia's Roadmap towards Zero Single-Use Plastic 2018 - 2030 and to increase national recycling rate, Penang Green Council intends to **collaborate with food delivery services to encourage hawkers in Penang to replace plastic food containers with other alternatives** (recycled paper containers, plant-based containers). As a kick-start, the hawkers will be given alternative food containers in collaboration with other stakeholders. **The Deposit Return Scheme is a concept that will eventually be promoted to eateries.** In addition to the ongoing education and also to **promote Communication, Education, and Public Awareness (CEPA)** among the community, MBSP plans to meet the factories that manages domestic plastic waste in their jurisdiction, partner with the local community leaders to better mobilise the collection of single-use plastic waste and offer a better price to collectors.

It is imperative for the state government to legalise the **informal waste sector** in Penang. Formalisation with legitimate documentation could be made attractive by introducing **incentives** and providing support in **business registration and licensing**. Benefits of formalisation include improved operational and employment conditions, promoting inclusiveness, practicing a human rights-based approach, addressing the rights and needs of the informal waste sector and increase social acceptance amongst communities in Penang.

7.2 Replicability/ Transferability of the PGC Model & SNDP

The compilation of programmes under PGC model would form a comprehensive guide in aiding the start-up of community-based waste management **across the nation** and can be replicated to **several potential areas (Figure 26)** by following the steps in Figure 3. The model can also be **modified depending on the location, size of community, and local government initiatives and commitment.**

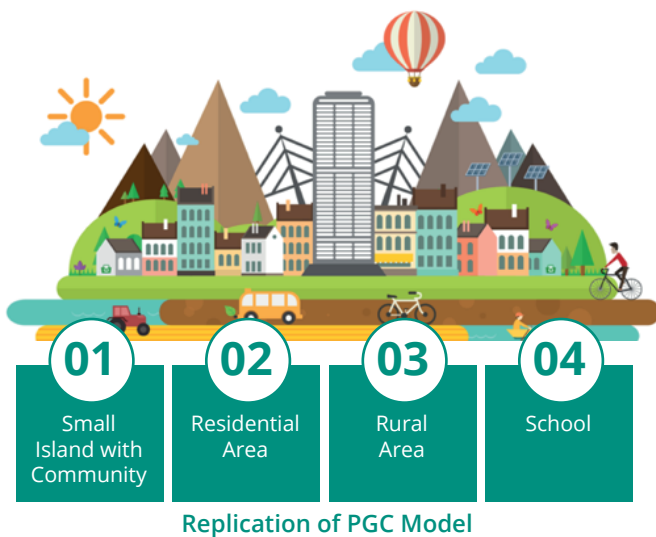


Figure 26 : Potential Locations to Replicate the PGC Model
Source : Penang Green Council, 2021

7.3 Sustainability Plans for SNDP Programme

Developing a sustainable neighbourhood is important because these communities are where people live, play, and meet daily. It becomes a place that forms people's identity and fosters neighbourhood relationships that cultivate a happier and healthier culture.

During the workshops, the local communities were given the opportunity to take part in discussing and brainstorming ideas to enhance the sustainability practices within their community. This process helps to increase their **sense of ownership** where they are more proactive in addressing the problems faced in the community. The example of community proactiveness is shown by seeing people picking up trash, educating and motivating other communities, and organising their own environmental programmes.

After identifying the problem and solutions, it is important to engage the relevant stakeholders to address the specific issues highlighted in each community. This will also provide anticipated opportunities to further enhance the sustainability practices in the community. Following up, the suggested plans by Penang Green Council team to sustain this programme are as follows:

- Act as an **advisor to guide the community leaders** in organising environmental education programmes to create awareness on the selected problem for the local community.
- **Share the relevant educational materials and ideas** that would increase local community participation in the environmental events organised by the community leaders.
- **Connect the relevant stakeholders** in terms of providing technical assistance, guidance and advice to execute and enhance the solutions.
- **Design a sustainable neighbourhood framework** as a reference point for other community leaders in Penang to establish their own sustainable neighbourhood.

List of Abbreviations

Abbreviation	Detailed description and/or explanation
4R	Reduce, Recover, Recycle and Repurpose
CMCO	Conditional Movement Control Order
COBSEA	Coordinating Body on the Seas of East Asia
COVID-19	Coronavirus Disease 2019
CSR	Corporate Social Responsibility
DPSIR	Driver-Pressure-State-Impact-Response
ERC	Environment Resource Centre
F&NHB	Fraser & Neave Holdings Bhd
HDPE	High-density Polyethylene
ISWM	Integrated Solid Waste Management
KASA	Kementerian Alam Sekitar dan Air (Ministry of Environment & Water)
KPN	Kampung Permatang Nibong
MBSP	Majlis Bandaraya Seberang Perai (Seberang Perai City Council)
MCO	Movement Control Order
MESTECC	Ministry of Energy, Science, Technology, Environment & Climate Change
MGTC	Malaysian Green Technology & Climate Change Centre
NGOs	Non Governmental Organisations
NSC	National Steering Committee
NSUP	No Single-Use Plastic
PDP	Plastic Disclosure Project
PET	Polyethylene Terephthalate
PGC	Planting Green Community
PMU	Project Management Unit
PPPs	Public-Private-Partnerships
SEA	South East Asia
SNDP	Sustainable Neighbourhood Development Programme
SOP	Standard Operating Procedures
TBL	Taman Bagan Lalang
UNEP	United Nations Environment Programme
UPSI	Universiti Pendidikan Sultan Idris
USM	Universiti Sains Malaysia
WSAS	Waste Segregation at Source