

Five Year Integrated Pollution Emission Management Plan of Mandaue

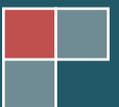




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1. INTRODUCTION

The Pollution Emission Management is a Core Roadmap under Environmental Sustainability of the Mandaue City local government unit through the MCENRO. It is one of the strategic programs of the department and the city to help build a resilient community, develop a resilient economy and promote a sustainable environment. With an objective to “*Engage and empower communities to foster environmental sustainability and resilience*”, this strategy shifts from centralized pollution monitoring led by the department to an integrated and participatory monitoring action through cooperation with local stakeholders especially the barangays.

The Pollution Emission Management under the Environment Management Roadmap supports the Mandaue’s vision to become a resilient city driven by manufacturing-based, retail and services, MSMEs by creating a sustainable and balanced environment while advancing the economic growth of the city and promoting a liveable society through responsive governance and multi-sectoral involvement.

The Pollution Emission Management roadmap was developed to advance and address pollution emission problems brought by urbanization and the improved economy. This integrated five-year pollution emission management plan will be used as the blueprint for the city’s pollution management.

The Plan provides strategies and mechanisms to engage businesses and environmental agencies in strict and voluntary self-regulation, to promote their compliance with environmental standards as well as mobilize public participation and transparency in wetland conservation and protection, involving affected communities and stakeholders at various stages of project developments to ensure safe, smart, and sustainable development.

Stakeholders will develop accountability, stewardship and unity in managing these resources as the plan will be proposed to be adapted and implemented in the different plans and programs of Mandaue City. MCENRO will also ensure that programs and activities in PEM are anchored on this plan at the community level at the least together with the potential partners mentioned in this plan.

Overall, this Plan will contribute to improved water quality of the major river environments, water bodies and other natural resources in the city. Restoring its overall health and condition would ultimately benefit Mandauehanons as it would also restore the ecological benefits and gifts of nature from its restored biodiversity and river ecological balance.

2. BACKGROUND

Mandaue is one of the three highly urbanized cities in the island of Cebu. Rapid urbanization and development of the city leads to negative impact to health and environment. Increased socio-economic and transport activities results to a cascading negative effects in terms



increased emission and waste water discharges thereby affecting important river and coastal ecosystems.

Moreover, a research conducted by UP Cebu indicated that the rapid development of Mandaue City has resulted into higher local temperatures as vegetation and natural landscapes are changed into buildings and structures. The research findings report that transport and industrial emission, compounded by heavily build-up areas, contributes to developing hot zones in areas that correspond to the city's industrial development (GuHeat, 2019). Likewise, the GuHeat research findings also relay that cooler zones are noticeable near waterways, mangroves and vegetation, which seems to be reducing over the years.

The Comprehensive Land-Use Plan (CLUP), Mandaue Climate Change Adaptation Framework (CCAF) and Local Climate Change Action Plan (LCCAP) provides importance in the protection of natural resources of the city and to its vulnerable sectors dependent to it. It also highlights some important adaptive capacity as well as mitigation strategies to address impacts of environmental destruction and climate change. Vulnerable ecosystems identified in these documents are the focused areas of management of this Pollution Emission Management Plan. Hence integrated management of river, coastal and other wetland areas as well as the atmosphere is important in the implementation of adaptation and mitigation strategies.

This management plan will address the need to have a strategy and approach that mitigate the impacts of pollution emission within the local context of Mandaue City ensuring that economic development does not compromise environmental sustainability, ecological balance and human well-being of Mandahuehanons.

This Plan is expected to improve water quality of the major river environments if not bringing back its original health condition and stop further degradation. With the overall health and condition restored, natural river biota on land, and is also expected to thrive. In the long run, these effects will cascade to benefiting local people as the river will be free of contaminants that pose hazard to human health as well.

3. POLLUTION EMISSION MANAGEMENT PLAN

This 5-Year PEMP is designed and will be strategically implemented throughout the Mandaue City. Stakeholder engagement and empowerment especially local and business communities will be among the key players in attaining environmental sustainability, community resilience and economic resilience of Mandaue.

To achieve the key targets for the identified focused areas, a phased implementation approach will be used. **Profiling and mapping and baseline sampling** will be implemented for baseline purpose and suited for short-term goal as part of **Phase 1**. On the other hand, on Phase 2 programs for medium to long-term goal based on baseline information generated during Phase 1 will be implemented. Depending on the success of implementation and scenario, Phase 2 may increase in coverage and exposure over time. Areas for implementation under Phase 2 will be **ambient air quality monitoring, water quality monitoring, monitoring and enforcement, and information and education**.

An assessment and review of outputs under Phase 1 will be conducted in coordination with other department units before the implementation of Phase 2, to improve and/or modify the execution of this Plan.

The PEMP implementation structure is presented in **Figure 1** while the description of the individual programs and other information is presented in succeeding section.

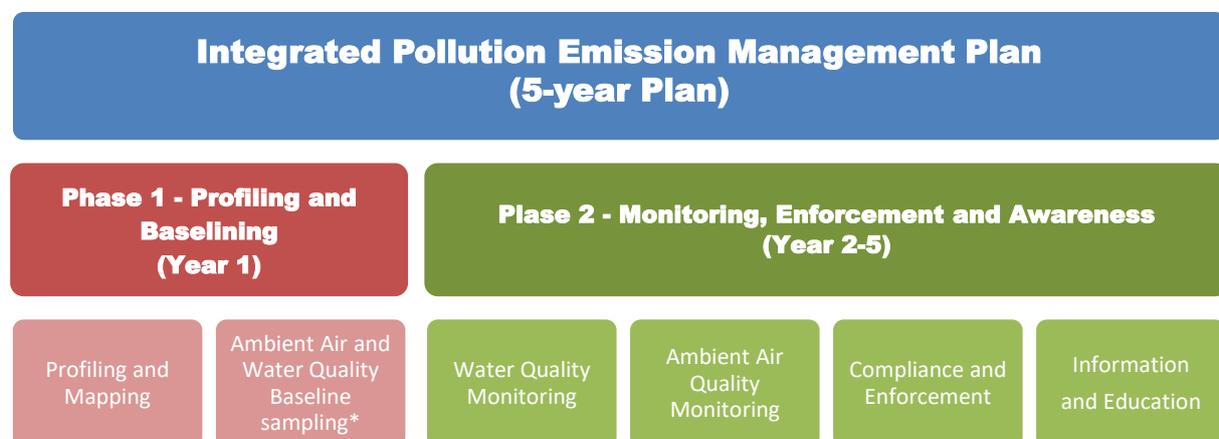


Figure 1. Pollution Emission Management Plan (PEMP) implementation structure



A. FOCUS AREA 1: PROFILING and MAPPING

a) Objectives

- To conduct inventory and identification of business establishments and industries that has potential to pollute the environment (e.g. wastewater discharge and emission to the atmosphere);
- To conduct spatial distribution mapping of establishments/industries operating within Mandaue and;
- To identify potential environmental champion and partners for the rehabilitation and protection of the environment of Mandaue, as well as laggards of environmental compliance.

b) Description

Profiling and mapping will involve recording and/or documentation of establishment and its nature of business including operation, products and compliance with respect to environmental management. The profiling and mapping activities will cover commercial and industrial activities excluding residential areas therein. Specifically, it will focus on business and industries expected to release wastewater to drainage and river systems and emit air pollution to the atmosphere.

The profiling of business establishment operating within the city of Mandaue covers those businesses registered and operating from 2019 to 2021 and with permits/licenses from DENR EMB and BPLO of Mandaue. Based on data provided by the Business Processing and Licensing Office (BPLO) for 2019 to 2021, **Table 1** shows the number of registered business commercial establishment of Mandaue subject for profiling which existed before the Covid-19 pandemic and temporary closed during the pandemic are being identified and considered in the inventory.

Table 1. Inventory of Registered Business Establishment by BPLO Mandaue

Year	No. of Registered Business	Estimated establishment with waste water discharge and/or smoke emission
2019	13,561 ^a	325
2020	15,168 ^a	242
2021	11,452 ^{a,b}	201 ^b

^aincludes delivery permit holders, ^bJan-Nov 2021 only

Moreover, parallel to the profiling is mapping and geo-tagging of registered establishments with wastewater discharge and air pollution potential. Industries that emit pollutants to the environment and those proximate to river systems (i.e. Butuanon River, Mahiga River), coastal areas and other important ecosystems of Mandaue are considered priority.

Outcomes of the profiling and mapping will be used for monitoring and other interventions of the department and/or City Government.



c) Tasks

The plan of action that the PCM unit, the department and other interested parties will apply for this plan includes the following:

- Conduct data gathering from registry of BPLO, DENR-EMB 7 and MCENRO;
- Profiling/documentation of identified establishments/industries with waste water discharge and air emission potential and;
- Geo-tagging of establishments/industries with waste water discharge and air emission potential in coordination with other LGU department (i.e. CPDO, OSM).

B. FOCUS AREA 2: BASELINE SAMPLING (Ambient Air Quality and Water Quality)

a) Objectives

- To establish baseline presence and condition of contaminants in the target areas;
- To determine the ambient air and water quality parameters during a pre-program period for the purpose of determining the range of variation of the system and establishing reference points against which changes can be measured and;
- To determine initial proactive mitigation intervention of human health and environment of Mandaue.

b) Description

Pursuant to Republic Act 8749 (Philippine Clean Air Act of 1999) and Republic Act No. 9275 (Philippine Clean Water Act of 2004), which provide for the abatement and control of pollution to our atmosphere and water bodies, the concerned agencies and partners are mandated and tasked to implement individual role for the prevention or mitigation of any forms of air and water pollution to our environment.

For the baseline sampling of ambient air quality and water, strategic sampling sites will be identified and sampled during dry and wet season to determine site condition. Target areas for ambient air quality baseline sampling will be industrial zones, high commercial and transport activity adjacent to residential areas. Ambient air sampling will be supported by noise sampling to determine levels of sound emission in these areas. But other areas of concern will be considered depending on the situation and as the need arise. For water quality, baseline sampling will be limited to river systems such as Butuanon and Mahiga River, coastal areas and other wetland areas of Mandaue.

Sampling devices used for this baseline information are as follows:

- Environmental Beta Attenuation Mass Monitor (E-BAM)
- Eureka Water Probe Manta+30
- Noise Meter/Sound Level Alert SL 130)

An estimated maximum of 10 sites for ambient air quality and 20 sites for water quality sampling will be considered and subject for assessment. This is based on pre-identified and recommended sites identified by the office and other stakeholders and is subject for monitoring.



Information generated from baseline sampling will be used in ambient air and water quality monitoring of Mandaue, in addition to existing monitoring conducted by DENR-EMB 7 as the lead agency mandated to implement R.A. 8749 and R.A. 9275.

c) Tasks

The plan of action that the PCM unit, the department and other interested parties will apply for this plan includes the following:

- Identification of industrial zone and areas with high commercial and transport activities (ambient air quality sampling) and areas along river systems and coastal areas (water quality sampling);
- Site reconnaissance and validation assessment;
- Profiling and mapping of identified sites;
- Sampling, data collation and analysis and;
- Report preparation and submission.

C. FOCUS AREA 3: AMBIENT AIR QUALITY MONITORING

a) Objectives

- To establish and assess the level of pollution in relation to the ambient air quality standards (including noise standard) and;
- To establish robust and sound information as basis for planning and air quality management and mitigation of Mandaue.
- To forge linkages and partnership with other stakeholder and other interested parties for water monitoring and conservation programs.

b) Description

The applicable requirements for ambient air quality prescribed in the RA 8749 or Philippines Clean Air Act (CAA) and its implementing rules and regulations (DAO 2000-81) will be the basis for monitoring using the PM₁₀, PM_{2.5} and Total suspended particles as the parameters to be measured. The results will of the monitoring will be compared against the National Ambient Air Quality Standards for Source Specific Air Pollutant (NAAQSSAP), National Ambient Air Quality Guideline Values (NAAQGV), and the National Emission Standards for Source Specific Air Pollutants (NESSAP), as shown in **Table 2**.

Table 2. National Emission Standards for Source Specific Air Pollutants (NESSAP)

Pollutant	NAAQGV 1	NESSAP 2	NAAQSAP 3
PM ₁₀	150 µg/Ncm	-	200 µg/Ncm
PM _{2.5}	75 µg/Ncm	-	-
Total suspended particulates (TSP)	230 µg/Ncm	150 µg/Ncm	300 µg/Ncm

Note: (1) Table 1 of DAO 2000-81; (2) Table 2 of DAO 2000-81; (3) Table 3 of DAO 2000-81

For Mandaue, ambient air quality monitoring will be implemented on Year 2 under Phase 2 through monitoring of the identified and selected sites using Environmental Beta

Attenuation Mass Monitor or E-BAM (**Figure 2**). It is a portable and battery device that provides real-time beta gauge comparable to U.S. EPA methods for PM10 particulate measurements. Other parameters for monitoring are dust particulates and temperature.



Figure 2. E-BAM instrument

Ambient air quality in a particular area may be influenced by several factors, which may have direct or indirect relationships with the parameters measured. Site conditions and emission sources during the time of monitoring will be identified and noted to provide an assessment of the dispersion dynamics in the immediate area. Figure 3 presents the proposed air quality monitoring locations. A total of 10 stations placed in different areas of concern will be monitored throughout the implementation period of this plan.

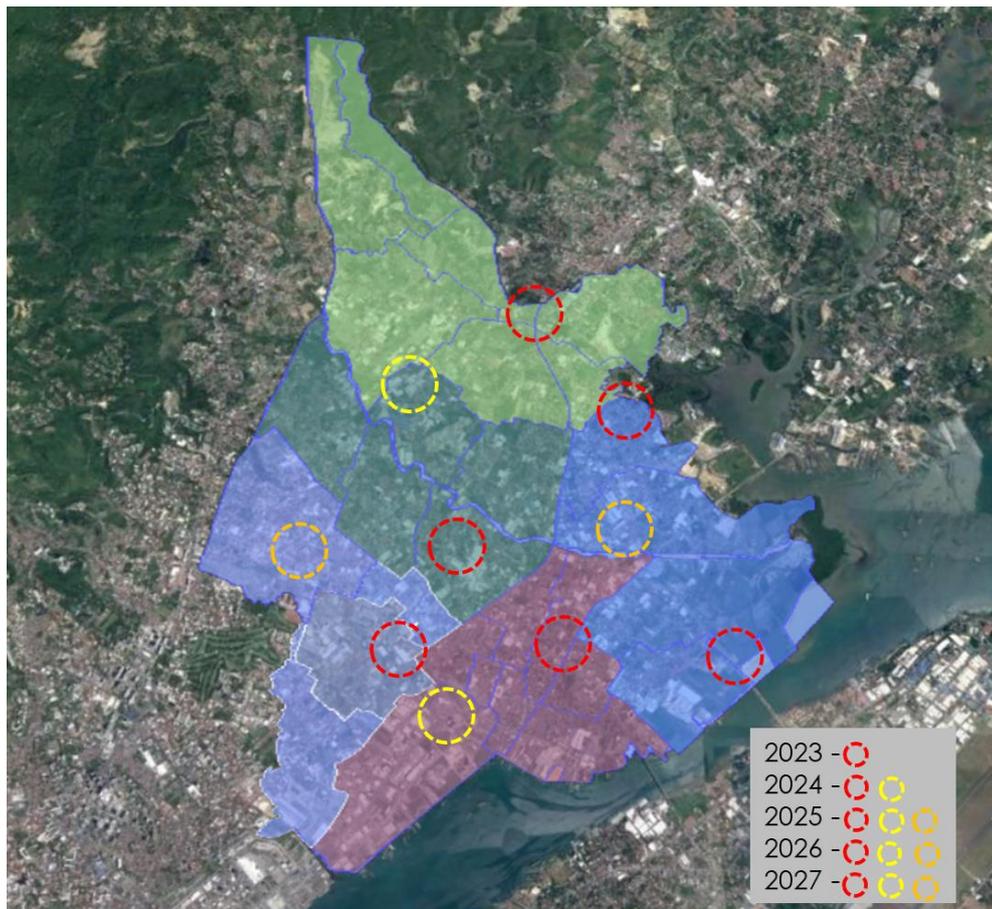


Figure 3. Proposed Air Quality Monitoring Stations for Sampling

In support to ambient air quality monitoring, parallel noise sampling will also be conducted in the areas. The regulation of noise pollution as presented in Section 78 of PD 984 (National Pollution Control Decree of 1976), as amended by NPCC MC No. 1980-002 will be used as the criteria for the noise levels recorded. The Environmental Quality Standards for Noise, monitoring time brackets and receptor categories promulgated in the circular are presented in **Table 3**.

Table 3. NPCC noise standards in dBA

Category	Daytime (9am-6pm)	Morning/ Evening (5am-9am) / (6pm-10pm)	Nighttime (10pm-5am)	Category Description
AA	50	45	40	100-m from schools, nurseries, hospitals
A	60	50	45	Residential area
B	65	60	55	Commercial area
C	70	65	60	Light industrial area
D	75	70	60	Heavy industrial area



c) Tasks

The plan of action that the PCM unit, the department and other interested parties will apply for this plan includes the following:

- Site reconnaissance and assessment;
- Profiling and mapping of identified sites;
- Sampling, data collation and analysis;
- Report preparation and submission and;
- IEC campaign and feedbacking.

D. FOCUS AREA 4: WATER QUALITY MONITORING

a) Objectives

- To determine the water quality and assess the level of pollution do water bodies in Mandaue City in relation to the water quality standards through regular monitoring;
- To gather information on the biophysico-chemical properties of water bodies as basis for sound planning and management of water quality in river systems, coastal areas and other wetland areas of Mandaue;
- To facilitate linkage-building through research studies and other adaptation and mitigation actions for the conservation of river systems, coastal areas and other wetland areas of Mandaue

b) Description

Water quality results will be compared against the DENR Administrative Order 2016–08, Water Quality Guidelines (WQG) and General Effluent Standards (GES) of 2016. The DAO 2016-08 was issued to provide guidelines for the classification of all water bodies (i.e., freshwaters, marine waters, and groundwater) in the country. These guidelines include determination of time and trends and the evaluation of stages of deterioration/enhancement of water quality; evaluation of the need for taking actions in preventing, controlling, or abating water pollution; and designation of water quality management areas.

Water bodies and its quality, according to their intended beneficial usage, were classified according to the following as presented in **Table 4**.

Table 4. Water body classification and usage of freshwater

Classification	Intended beneficial use
Class AA	Public Water Supply Class I – Intended primarily for waters having watersheds, which are uninhabited and/or otherwise declared as protected areas, and which require only approved disinfection to meet the latest Philippine National Standards for Drinking Water (PNSDW).
Class A	Public Water Supply Class II – Intended sources of water supply requiring conventional treatment (coagulation, sedimentation, filtration, and disinfection) to meet the latest PNSDW.
Class B	Recreational Water Class I – Intended for primary contact

Classification	Intended beneficial use
	recreation (e.g., bathing, swimming, etc.)
Class C	<ol style="list-style-type: none"> 1. Fishery Water for the propagation and growth of fish and other aquatic resources. 2. Recreational Water Class II – for boating, fishing, or similar activities 3. For agriculture, irrigation, and livestock watering
Class D	Navigable waters

For the target monitoring locations, except for Mahiga River, Butuanon and Cansaga Bay are identified by DENR-EMB 7 as class D and class SC respectively (**Table 5**).

Table 5. Water resources profile of Butuanon and Cansaga Bay, DENR EMB-7 (2019)

Name of waterbodies	Location	Classification	
Butuanon River	Mandaue City	D	Freshwater
Cansaga Bay	Consolacion and Mandaue	SC	Marine

The water quality monitoring will be implemented through monitoring of selected sites using Eureka water probe Manta+30, a multi-parameter sondes for monitoring water quality in fresh, brackish and marine waters (**Figure 4**). All sondes may be used for discrete sampling, profiling, as self-powered loggers, or connected to telemetry stations for continuous real-time monitoring, with water quality data accessible via cloud-based software.

Manta+30 model comes standard with wipered turbidity, temperature, pH, conductivity, dissolved oxygen, and optional ORP and depth sensors.



Figure 4. Eureka water probe Manta+30

Water quality monitoring may be influenced by several factors such as presence of rain, flash floods in upland areas of the river systems and other man-made activities, all of which may direct or indirectly affect the parameters measured. The conditions and discharges of sources during the time of monitoring will identified and noted. **Figure 5** and **Table 6** presents the proposed water quality monitoring locations for Year 2 under Phase 2 program of this plan.

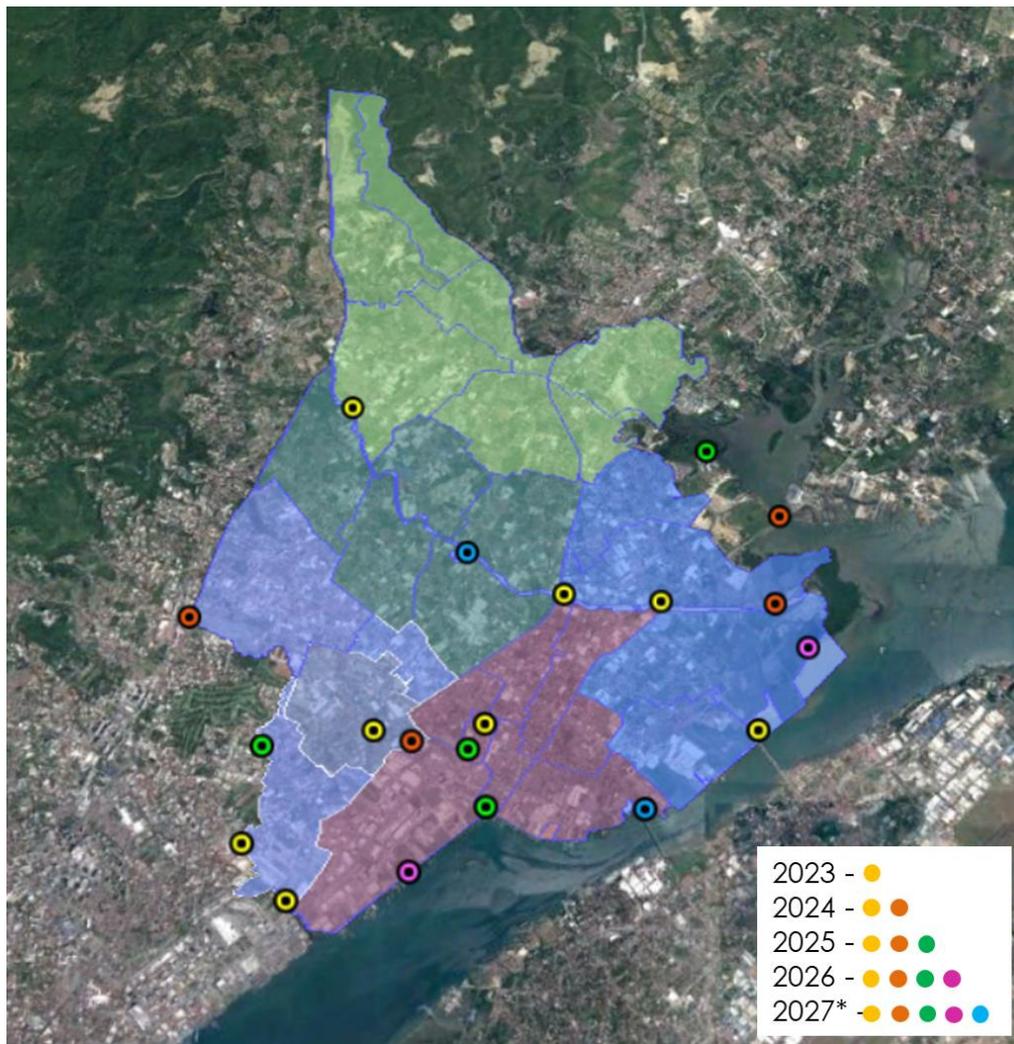


Figure 5. Proposed Water Quality Monitoring Stations for Sampling

Information from the results of the water quality monitoring and other interventions will direct river rehabilitation intervention and programs particularly Butuanon River which in the long run is geared towards the change the classification of the water body of Butuanon River.

c) Tasks

The plan of action that the PCM unit, the department and other interested parties will apply for this plan includes the following:

- Site reconnaissance and assessment;
- Profiling and mapping of identified sites;
- Water quality sampling and data collation and analysis;
- Report preparation and submission and;
- IEC campaign and feedbacking.



Table 6. Water Quality Monitoring sampling target (proposed locations)

Wetland Area	2023 (8 sites)	2024 (12 sites)	2025 (16 sites)	2026 (18 sites)	2027 (20 sites)
Butuanon River	<ul style="list-style-type: none"> Cambogaong Bridge, Paknaan Pilit Bridge, Cabancalan BR Viewing Deck, Ibabao-Estancia 	<ul style="list-style-type: none"> Cambogaong Bridge, Paknaan Pilit Bridge, Cabancalan BR Viewing Deck, Ibabao-Estancia Near Umapad Day Care ctr/Old Dumpsite 	<ul style="list-style-type: none"> Cambogaong Bridge, Paknaan Pilit Bridge, Cabancalan BR Viewing Deck, Ibabao-Estancia Near Umapad Day Care ctr/Old Dumpsite 	<ul style="list-style-type: none"> Cambogaong Bridge, Paknaan Pilit Bridge, Cabancalan BR Viewing Deck, Ibabao-Estancia Near Umapad Day Care ctr/Old Dumpsite 	<ul style="list-style-type: none"> Cambogaong Bridge, Paknaan Pilit Bridge, Cabancalan BR Viewing Deck, Ibabao-Estancia Near Umapad Day Care ctr/Old Dumpsite Maguikay area of Butuanon River
Mahiga River	<ul style="list-style-type: none"> Linear Park Segment B, Subangdaku Innodata, Subangdaku 	<ul style="list-style-type: none"> Linear Park Segment B, Subangdaku Innodata, Subangdaku Near UC Banilad Bridge 	<ul style="list-style-type: none"> Linear Park Segment B, Subangdaku Innodata, Subangdaku Near UC Banilad Bridge Near Pagnadait, Banilad 	<ul style="list-style-type: none"> Linear Park Segment B, Subangdaku Innodata, Subangdaku Near UC Banilad Bridge Near Pagnadait, Banilad 	<ul style="list-style-type: none"> Linear Park Segment B, Subangdaku Innodata, Subangdaku Near UC Banilad Bridge Near Pagnadait, Banilad
Tipolo Creek	<ul style="list-style-type: none"> Tipolo Bridge, Tipolo 	<ul style="list-style-type: none"> Tipolo Bridge, Tipolo Beside ICC/Hall of Justice, Tipolo/CSSEAZ 	<ul style="list-style-type: none"> Tipolo Bridge, Tipolo Beside ICC/Hall of Justice, Tipolo/CSSEAZ 	<ul style="list-style-type: none"> Tipolo Bridge, Tipolo Beside ICC/Hall of Justice, Tipolo/CSSEAZ 	<ul style="list-style-type: none"> Tipolo Bridge, Tipolo Beside ICC/Hall of Justice, Tipolo/CSSEAZ
Mantuyong Creek	<ul style="list-style-type: none"> Near CBS Bank (old Mantuyong Brgy Hall), Mantuyong 	<ul style="list-style-type: none"> Near CBS Bank (old Mantuyong Brgy Hall), Mantuyong 	<ul style="list-style-type: none"> Near CBS Bank (old Mantuyong Brgy Hall), Mantuyong Before Tipolo-Mantuyong creek convergence zone, Mantuyong 	<ul style="list-style-type: none"> Near CBS Bank (old Mantuyong Brgy Hall), Mantuyong Before Tipolo-Mantuyong creek convergence zone, Mantuyong 	<ul style="list-style-type: none"> Near CBS Bank (old Mantuyong Brgy Hall), Mantuyong Before Tipolo-Mantuyong creek convergence zone, Mantuyong



Wetland Area	2023 (8 sites)	2024 (12 sites)	2025 (16 sites)	2026 (18 sites)	2027 (20 sites)
Coastal Areas	<ul style="list-style-type: none"> Pajara Park area, Umapad 	<ul style="list-style-type: none"> Pajara Park area, Umapad Cansaga Bridge area, Paknaan 	<ul style="list-style-type: none"> Pajara Park area, Umapad Cansaga Bridge area, Paknaan Near Slaughterhouse/DGS, Labogon Near old Public Market, Centro 	<ul style="list-style-type: none"> Pajara Park area, Umapad Cansaga Bridge area, Paknaan Near Slaughterhouse/DGS, Labogon Near old Public Market, Centro Near Ridge Port, CSSEAZ Umapad coastal area 	<ul style="list-style-type: none"> Pajara Park area, Umapad Cansaga Bridge area, Paknaan Near Slaughterhouse/DGS, Labogon Near old Public Market, Centro Near Ridge Port, CSSEAZ Near Bridge 1, Looc Umapad coastal area



E. FOCUS AREA 5: MONITORING and ENFORCEMENT

a) Objective

- To ensure that essential standards, restrictions, condition and other factors in the business establishments' operation are observed in accordance with the legal environmental framework and permits/clearances issued by different authorities;
- To conduct regular monitoring and enforcement within the jurisdiction of Mandaue in coordination with other stakeholders to implement environmental laws, policies and other local legislations and;
- To protect the state of natural resources of the city specifically the river systems, coastal areas and other wetland areas free from destructive activities.

b) Description

The compliance of commercial, industrial and other business entity operating within Mandaue to environmental laws, policies and regulations means there is acceptance of, and action in accordance with the rules and regulations of the City. In the absence of stakeholder compliance, enforcement and monitoring is required. Compliance and enforcement involve the application of a broad range of approaches, using both incentives and disincentives. These approaches change over time and can consist of "soft" preventive measures, such as education, warning, and community service/action or "hard" sanctions, such as penalty imposition and revocation of permits/clearances related to their operation.

In coordination with other concerned stakeholders such as the BLGUs, LGU offices/departments, national government agency/ies and/or academe and non-government organizations, compliance and enforcement is a continuing program of this plan for long-term targets.

c) Tasks

The plan of action that the PCM unit, the department and other interested parties will apply for this plan includes the following:

- Identification and profiling of establishment and barangays with environmental problems;
- Mapping of identified sites and identification of local partners for monitoring and enforcement;
- Conduct monitoring along river systems, coastal areas or wetlands in coordination with other units, local stakeholders and interested parties and;
- Community engagement and IEC campaign.

F. FOCUS AREA 6: INFORMATION AND EDUCATION

a) Objectives

- To disseminate information relevant to local environmental conditions and problems of the communities;



- To develop information materials need for the education and awareness program of PEM Plan and;
- To increase knowledge and awareness of local communities and solicit community participation.

b) Description

Information and education program is an essential outreach strategy in building voluntary and strict compliance. Educational programs help stakeholders understand the importance of cooperation and participation for the attainment of the goals of PEM plan, recognize the consequences of negative behaviour or actions, and programs. It can also ensure that stakeholders are aware of the legal and judicial sanctions that could result from violation of the policies and regulations.

IEC is a public messaging approach that is aimed at changing or reinforcing environment-related behaviours and practices of a target audience concerning a specific problem. This includes promotion of materials, knowledge sharing and dissemination. The information dissemination through a communication plan will be implemented in multi-approaches and mode such as use of multi-media platform, web-based application, community engagement which include talks, seminars and orientations, with the use of visual aid in local and English translations.

Purok-based information dissemination will be implemented, especially in areas with environmental problem, in a calibrated and targeted audience. Coordination with local and national groups or parties will be explored and implemented, if necessary and available.

c) Tasks

The plan of action that the PCM unit, the department and other interested parties will apply for this plan includes the following:

- Identification of environmental issues for information and education material development;
- Identify and harness existing and potential mode of information dissemination;
- Conduct community education and information drive and;
- Promote partnership and linkage-building for environmental advocacy among local communities especially to vulnerable groups (women, children and youth).



4. TIMELINE, BUDGET REQUIREMENT AND COLLABORATING PARTNERS

The details of the timeline of implementation and other requirements of this Integrated Pollution Emission Management Plan are presented in **Table 7**. The PCM unit of MCENRO will lead in the implementation of all areas identified in this plan in collaboration with other department units, LGU departments/offices and interested partners such as but not limited to national government agency/ies (NGAs), academic institutions, private sectors, youth and women organizations, non-government and people's organization (NGO/PO).

The proposed frequency of monitoring and sites identified in the Ambient Air Quality and Water Quality Monitoring programs is subject to changes depending on the situation – availability of personnel, sampling equipment, and favourable site condition (i.e. weather condition, peace and order security, health issues). Similarly, the proposed budget allocation is subject to change depending on availability of funds and/or allocation prioritization of the department and city.

Outcomes of the sampling, monitoring and enforcement and IEC will be used in achieving a liveable Green and Smart City of Mandaue.



Table 7. Pollution Emission Management Plan

AREA /Programs/ [1]	Performance Indicators [2]	Timeline/Performance Targets [3]					Frequency of Sampling [4]	Performance Monitoring Tool Used and Data Collection Method [5]	Data Sources [6]	Budgetary requirements (estimates) [7]	Collaborating Partners [8]
		2022	2023	2024	2025	2026					
Profiling and Mapping	no. of commercial establishments registered and operating in the City of Mandaue	X	-	-	-	-	NA	Desktop study and field validation	BPLO, MCENRO, DENR-EMB, CPDO, MIPAC	20,000.00	BLGUs, CPDO
Baseline Sampling: Ambient Air Quality and Water Quality	No. of sites identified and sampled	x	-	-	-	-	NA	Desktop study and field validation	MCENRO, CPDO, DENR-EMB, MIPAC	650,000.00	BLGUs, CPDO, Academe, private institutions/ individuals
Water Quality Monitoring	- no. of water quality monitoring stations - parameters monitored: pH, ORP, conductivity, turbidity	-	X	X	X	X	monthly	<i>ex-situ</i> sampling through water quality device (Eureka)	DENR EMB, BLGUs, CPDO	1,400,000.00	BLGUs, CPDO, Academe, private institutions/ individuals
Air Quality Monitoring	- no. of air quality stations monitored - no. parameters monitored	-	X	X	X	X	monthly	<i>in-situ</i> sampling through EBAM and Noise Meter	DENR EMB, BLGUs, CPDO	1,200,000.00	BLGUs, CPDO, Academe, private institutions/ individuals
Monitoring and Enforcement	- no. of regular coordination meeting of PCOs of different industries/commercial establishments - no. of coordination	-	X	X	X	X	monthly	Community engagement, FGD, KII	MCENRO, OSM, DENR-EMB, CPDO, HUDO, BPLO, MIPAC, BLGUs, City Agri	100,000.00	BLGUs, PNP, City Agri, HUDO, OSM, BPLO



AREA /Programs/ [1]	Performance Indicators [2]	Timeline/Performance Targets [3]					Frequency of Sampling [4]	Performance Monitoring Tool Used and Data Collection Method [5]	Data Sources [6]	Budgetary requirements (estimates) [7]	Collaborating Partners [8]
		2022	2023	2024	2025	2026					
	meeting with BLGUs for monitoring and enforcement - no. of monitoring and enforcement conducted										
Information, education and communication (IEC)	- no. of IEC materials developed - no. of awareness raising and education campaign conducted - no. of target audience reached through different mode of dissemination	-	X	X	X	X	monthly	Community engagement, seminars, orientations, talks, and through use of online platforms, etc.	MCENRO, OSM, PIO, HUDO, BLGUs, Academe, CSOs/NGOs, NGAs	100,000.00	BLGUs, OSM, HUDO, City Agri, PIO, Academe, CSOs/NGOs, NGAs
										3,470,000.00	