



Chapter 1. Introduction

The growth rate of Tuguegarao City's population is increasing due to increase of number of commercial establishments and expansion of educational and other institutions which made waste generation and management part of the challenges to the city's local governance.

To address this pressing challenge, Tuguegarao City formulated and adopted the Updated Ten (10) - Year Ecological Solid Waste Management Plan in compliance to the provisions of Republic Act No.9003 otherwise known as Ecological Solid Waste Management Act of 2000. The plan promotes a system of optimum utilization of waste through the practices of re-using, reduction and recycling of waste. It promotes environmentally sound methods that encourages waste generators to utilize, conserve and recover valuable resources. It also prescribes appropriate procedure on handling and disposal of wastes to the facilities designed and intended for particular waste.

The plan shall set the guidelines and targets for solid waste avoidance and volume reduction through source reduction and minimization measures, composting, recycling and re-use before collection, treatment and disposal in appropriate and environmentally-sound solid waste management facilities.

City's Response

Tuguegarao City Government commits to implement the plans, strategies and actions to address the problem on waste management through the methods and measures pertaining to proper segregation, collection, storage, treatment and processing, using appropriate facilities and technologies.

Tuguegarao City is mindful of its primary responsibility to lead in the implementation and enforcement of the provisions of Republic Act No. 9003 within its political and demographic jurisdiction. It shall implement reuse, recycling, resource recovery, and composting methods in dealing with the municipal wastes. The city shall also retain its primary enforcement responsibility while establishing and maintaining its cooperative efforts with national, other local government units, non-governmental organizations and private sectors.



The City Government imposes as a condition for issuance and/or renewal of business permit or license for owners/operators/proprietors of commercial and industrial establishments the putting-up of appropriate labeled waste bins and impose the obligation of maintaining cleanliness within their immediate vicinity by placing the signage “**Tapat Ko, Linis Ko, Basura Ko-Pananagutan Ko.**”.

The City shall likewise intensify its law enforcement activities by apprehending, instituting appropriate actions and imposing corresponding fines and/or penalties against violators.

The TCENRO shall conduct continuous and massive IEC activities in different schools and barangays regarding the provisions of Republic Act No. 9003 on proper waste management.

Thus, the city formulated and updated its Ten (10) Year Ecological Solid Waste Management Plan (ESWMP) in compliance with the provisions of R.A. No. 9003 which specifically mandates all Local Government Units (LGUs) to have their respective 10 year Solid Waste Management Plan in accordance with the national framework and pursuant to the provisions of said Act. The plan will provide for strategies and activities which encourage the reduction and diversion of waste. The plan integrated the Barangay Solid Waste Management Plan of some barangays as part of city’s strategies in reduction, and collection of waste. The plan institutionalize public participation in the development and implementation of national and local integrated, comprehensive, and ecological waste management programs which will encourage cooperation and self-regulation among waste generators.

1.1 Purpose

The Plan shall ensure long term management of solid waste through the integration of various solid waste management plans and strategies of different barangays and stakeholders in its area of jurisdiction. The plan will create an integrated waste management with materials recovery facilities (MRF) strategically located at identified site or at the land field allocation of Tuguegarao City Government. The plan aims to explore all possibilities to create **Greater Green Tuguegarao City** with the use of environmentally compliant technologies.

The plan institutionalize the active participation of inhabitants of Tuguegarao City as responsible waste generators and wastes managers by imposing compliance to environmental laws, rules and regulations.



1.1.1 City's Vision Related to Solid Waste Management

Tuguegarao City envisions a livable city, litter-free, pollution-free, through the active participation of schools, barangays, religious groups and business sectors.

1.1.2 Key Issues Facing The Community

The fast-developing economy and rapid population growth have significantly increased solid waste generation which consequently became a major environment concern of the city. The problem is aggravated by the lack of apathy, value, discipline and cooperation of some unscrupulous individuals on proper waste management and disposal.

1.1.3 Goals of the Plan to Effectively Address the Major Concerns of the City.

The plan serves as the City's guide in implementing its solid waste management system consistent with the National Solid Waste Management Framework in compliance to mandate of R.A. No. 9003.

1.1.4 Intent of R.A No. 9003 and its Effect on Solid Waste Management

The law mandates a systematic, comprehensive and ecological solid waste management program which shall:

- (a) Ensure the protection of public health and environment;
- (b) Utilize environmentally-sound methods that maximize the utilization of valuable resources conservation and recovery;
- (c) Set guidelines and targets for solid waste avoidance and volume reduction through source reduction and waste minimization measures, including composing, recycling, re-use, recovery, green charcoal process and others, before collection, treatment and disposal in appropriate and environmentally-sound solid waste management facilities in accordance with ecologically sustainable development principles;
- (d) Ensure the proper segregation, collection, transport, storage, treatment and disposal of solid waste through the formulation and adoption of the best environmental practices in ecological waste management excluding incineration;



- (e) Promote national research and development programs for improved solid waste management and resource conservation techniques, more effective institutional arrangement and indigenous and improved methods of waste reduction, collection, separation and recovery;
- (f) Encourage greater private sector participation in solid waste management;
- (g) Retain primary enforcement and responsibility of solid waste management with local government units while establishing a cooperative effort among the national government, other local government units, non-government organizations and the private sector;
- (h) Encourage cooperation and self-regulation among waste generators through the application of market-based instruments;
- (i) Institutionalize public participation in the development and implementation of national and local integrated, comprehensive and ecological waste management programs; and
- (j) Strengthen the integration of ecological solid waste management and resource conservation and recovery topics into the academic curricula of formal and non-formal education in order to promote environmental awareness and action among the citizenry.

1.2 Approach

The Ten-Year ESWM Plan was formulated with the active participation, consultation and involvement of various stakeholders. Data are gathered from the different LGU departments, barangays, academe, transport groups, women's group, the business sector, non-government organizations (NGOs), national government agencies, religious sector and the grassroots level. These data are incorporated in the plan and considered during the identification of strategies to be implemented.

Waste Analysis and Characterization Study (WACS) was conducted using the "end-of-pipe" method and partial Typology. The WACS results are the basis in projecting waste generation in 10 years. It is also the basis in the preparation of engineering designs of facilities to be constructed and established in the disposal facility like the capacity of the Sanitary Land Fill cell, size of the leachate pond and dimensions of Materials Recovery Facilities (MRF). It is also used in determining the number of waste collection equipment, number of pick up points and collection frequency and routes.



Other significant data from the National solid Waste Management Commission (NSWMC), Department of Agriculture (DA), Department of Environment and Natural Resources (DENR), Environmental Management Bureau (EMB), Mines and Geosciences Bureau (MGB), National Statistics Office (NSO), PAGASA and other government offices are likewise utilized in the preparation of this plan.

These data and information consist of the quantity of solid wastes disposed and generated from various sources which were gathered through a 30-day Waste Analysis and Characterization Study (WACS) on “end-of-pipe” disposal conducted by the city government. A survey was conducted to determine the quantity of wastes diverted through composting, recycling and sale reusable materials to junkshops and itinerant junk buyers. The study shall determine the quantity of waste disposed and waste generated from various sources. The projected waste generation is the city’s basis in updating its Ten (10) Year Ecological Solid Management Plan.

1.3 Acknowledgement

Some provisions of the plan have been implemented. Nonetheless, the Updated Ten (10) Year Ecological Solid Waste Management Plan shall be implemented for calendar year 2016 to 2025.

Tuguegarao City Government through the Mayor Atty. Jefferson P. Soriano and City Vice-Mayor Hon. Bienvenido C. De Guzman II, sincerely acknowledges the active involvement and dedication of all those who contributed in the preparation and formulation of this Updated Ten (10) Year Ecological Solid Waste Management Plan. Through their active participation, expertise, support and consultations, the Plan is made effective and responsive to the challenges of the city.

Special thanks is equally extended to DENR-EMB R02, through Regional Director Engr. Cesar S. Siador Jr., for his invaluable kindness in allowing his staff in the Solid Waste Management Division to provide technical assistance in the enhancement, updating and review of the City’s 10-year solid waste management plan.

Finally, recognition is given to the personnel and staffs of TCENRO for their painstaking efforts and perseverance in collating appropriate data and in formulating the Ten Year Ecological Solid Waste Management Plan of Tuguegarao City.



Chapter 2. LGU Profile

2.1 Location

Tuguegarao City, the capital of the Province of Cagayan and the Regional Center of the Cagayan Valley is the oldest major trade, education and government center in northeast Luzon. Founded on May 9, 1604, Tuguegarao is the busiest center northeast of Metro Manila. It has all the facilities, amenities and attractions of a city with a laid back atmosphere and pace in its agricultural barangays, with a centrally-located Poblacion providing a bustling commercial and service center for the city and its environs.

It is a peninsula in the lower Cagayan River Basin, located immediately west of the Sierra Madre foothills. It is the only city of the Province of Cagayan and in approximately 483 kilometers north of Metro Manila, forty five (45) minutes by plane and ten (10) hours by land. It is bounded by Iguig Cagayan on the north, by Penablanca, Cagayan on the east, by the Province of Isabela on the south, and by the Cagayan River on the southwest and west. Across the river, the towns of Enrile and Solana are located to the southwest and west, respectively. The city's geographical coordinates are 121°43'46" longitude and 17°36'54" latitude.

The city is nestled in the verdant Cagayan Valley. It is protected by the Sierra Madre mountain range in the east, the Cordilleras in the West and by the far-off Caraballo Mountain in the south. It grew on the banks of the mighty Cagayan River and the swift Pinacanauan River. It has a total land area of 113.95 square kilometers and sub-divided into 49 barangays, twenty eight (28) of which are classified as urban barangay/s and twenty one (21) are classified as rural barangay/s.

More than half of the city consists of plains and almost one third (1/3) are hills found in its eastern boundaries. The City is free of any existing or probable fault line and is protected by the thickly forested ranges of the Sierra Madres from landslides. It has artesian aquifers at 12-90 meters that are recharged continuously. It is located in the typhoon belt of the Philippines and generally enjoys warm weather. It is noted for the hottest temperature ever recorded in the Philippines.

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Figure 1 below shows the location map of Tuguegarao City. See Annex C for bigger scale.

Figure 1. Location Map of Tuguegarao



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Land Area

Tuguegarao City has a total land area of 113.95 square kilometers.

2.2 History

Founded on May 09, 1604, the almost 4-century old center is the busiest socio-economic center in the northeast. It has all the facilities, amenities and attractions of a city with a laid-back atmosphere and pace, especially in its outlying barangays.

Functioning since May 24, 1839 as the capital of the Province of Cagayan that then included the entire Cagayan Valley Region and the seat of the Archdiocese of Tuguegarao on April 10, 1911, it was chosen the Regional Center of Cagayan Valley in 1975. By virtue of Republic Act 8755 that was ratified on December 18, 1999, Tuguegarao was converted into a component city of the Province of Cagayan.

2.3 Population

Tuguegarao City, the provincial capital and regional center, continues to dominate the provincial population with its 2.51% growth rate per annum. It has an estimated in-migration rate of 0.19% per annum. The city has 20,598 households with an average household size of 5.21 persons. It has a population density of 741 persons per km².

The four (4) largest barangays of Tuguegarao, in terms of population, are contiguous to each other and comprise the main residential area. These barangays, located just west of the Poblacion, are Ugac Norte, Ugac Sur, Cataggamman Nuevo and San Gabriel. They constitute 23.54% of the total population. The next big settlement cluster is found just north of the Poblacion and located near the big institutions, i.e. the big schools, the public market, the Tuguegarao Airport and the inter-provincial bus terminal. This cluster includes Tanza, Caritan Centro, Caggay, Atulayan Sur, Caritan Sur, Caritan Norte as well as Leonarda. The Centro barangays are all with modest population sizes because residences are limited to the top floors of the tall buildings or in between the buildings. The eastern barangays of the city are all with small population sizes because they comprise the main agricultural production area.

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Table 1 shows the current and projected population by barangay (both urban & rural) of Tuguegarao City for C.Y. 2015-2026.



2.4 Economic Profile /Land Use

As the seat of government in Region 02, Tuguegarao City's economy shifted to secondary and tertiary activities. The city attracted many establishments. The schools, institutions, banks, public markets and churches are a strong attraction factors.

Today, the versatile and expanding business sector in Tuguegarao include top-line products, specialized personal, utilities, recreational, institutional and business services, national and international couriers, electronic mail, telegraph, telefax, cell phones, banking, jet flights and internet services.

Tuguegarao City is known of being the "Pansit Capital" in Region 02 where more than two hundred panciterias are established and existing in the city. There are also restaurants, hotels, discos, videokes, movie houses, cafes, bars and other amenities found in Tuguegarao, offering a variety of entertainment, recreation and cuisine. Souvenir shops and native products are found in the two (2) public markets. Convenience stores, boutiques, grocery stores and the markets offer a variety of local and imported goods. Fresh fruits and vegetables are available every day. All these and more, lend a vibrant economic ambience in Tuguegarao City.

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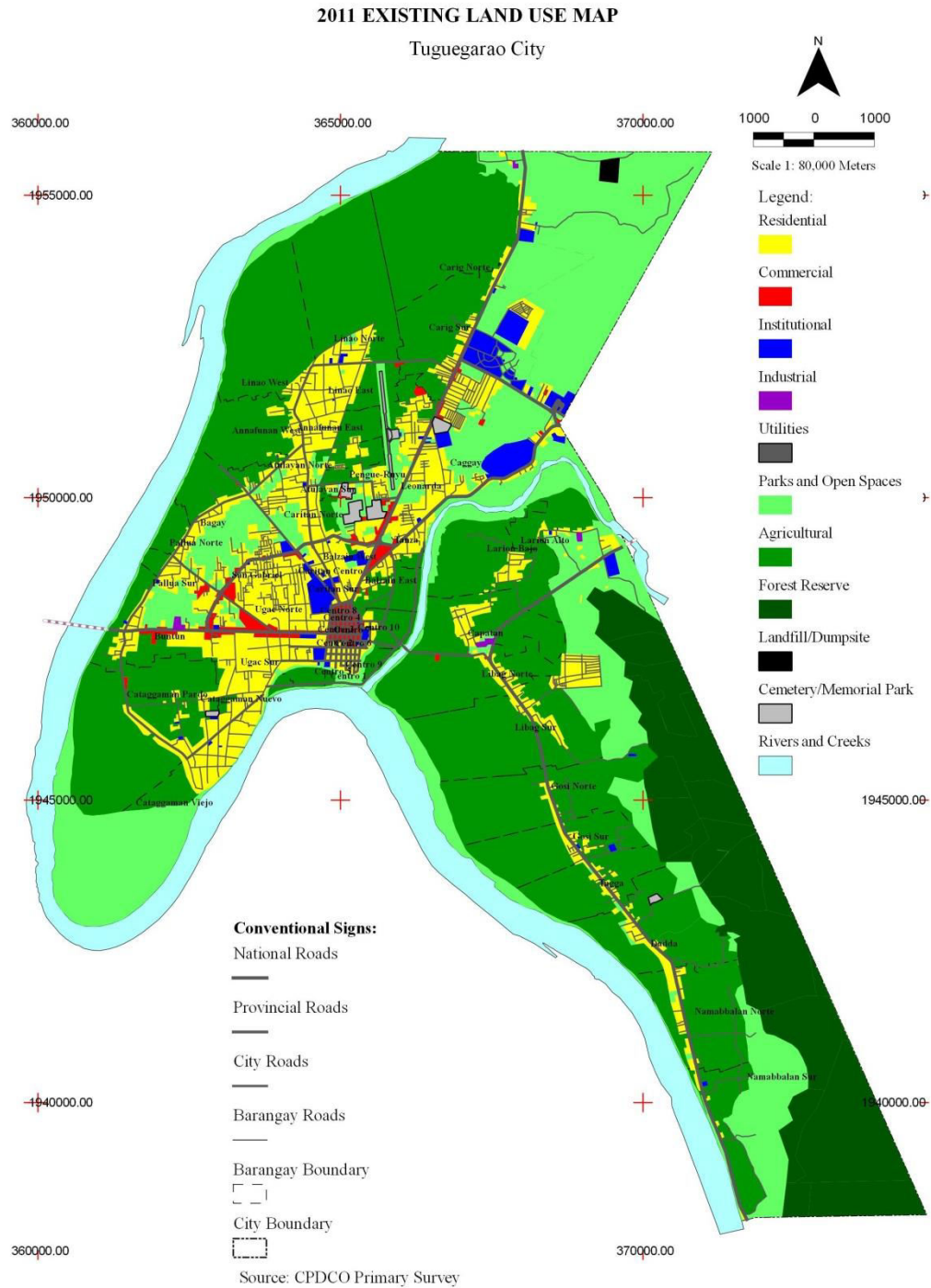
Table 2 below shows the existing land use as well as the approved land use plan of Tuguegarao City while Figure 2 and 3 is the Land Use Map and Transportation Route Map of the city, respectively. See Annex E and F for bigger scale.

Table 2. Land Use

2011 Existing Land Use			1993-2022 Approved Land Use Plan	
BUILT-UP	AREA	%	BUILT-UP	%
Residential	1,762.93	15.47%	Residential	21.54%
Commercial	168.90	1.48%	Commercial	2.20%
Institutional	187.73	1.65%	Institutional	1.67%
Industrial	18.45	0.16%	Industrial	0.72%
Utilities	181.24	1.59%	Utilities	2.43%
Sub-Total	2,319.25	20.44%	Sub-Total	28.55%
AGRICULTURAL	5,536.66	48.59%	AGRICULTURAL	51.65%
OPEN SPACES	2,440.77	21.29%	OPEN SPACES	1.85%
			FOREST	8.31%
CREEKS	1,098.32	9.64%	CREEKS	9.64%
Total Area	11,395	100.00%	Total Area	100.00%



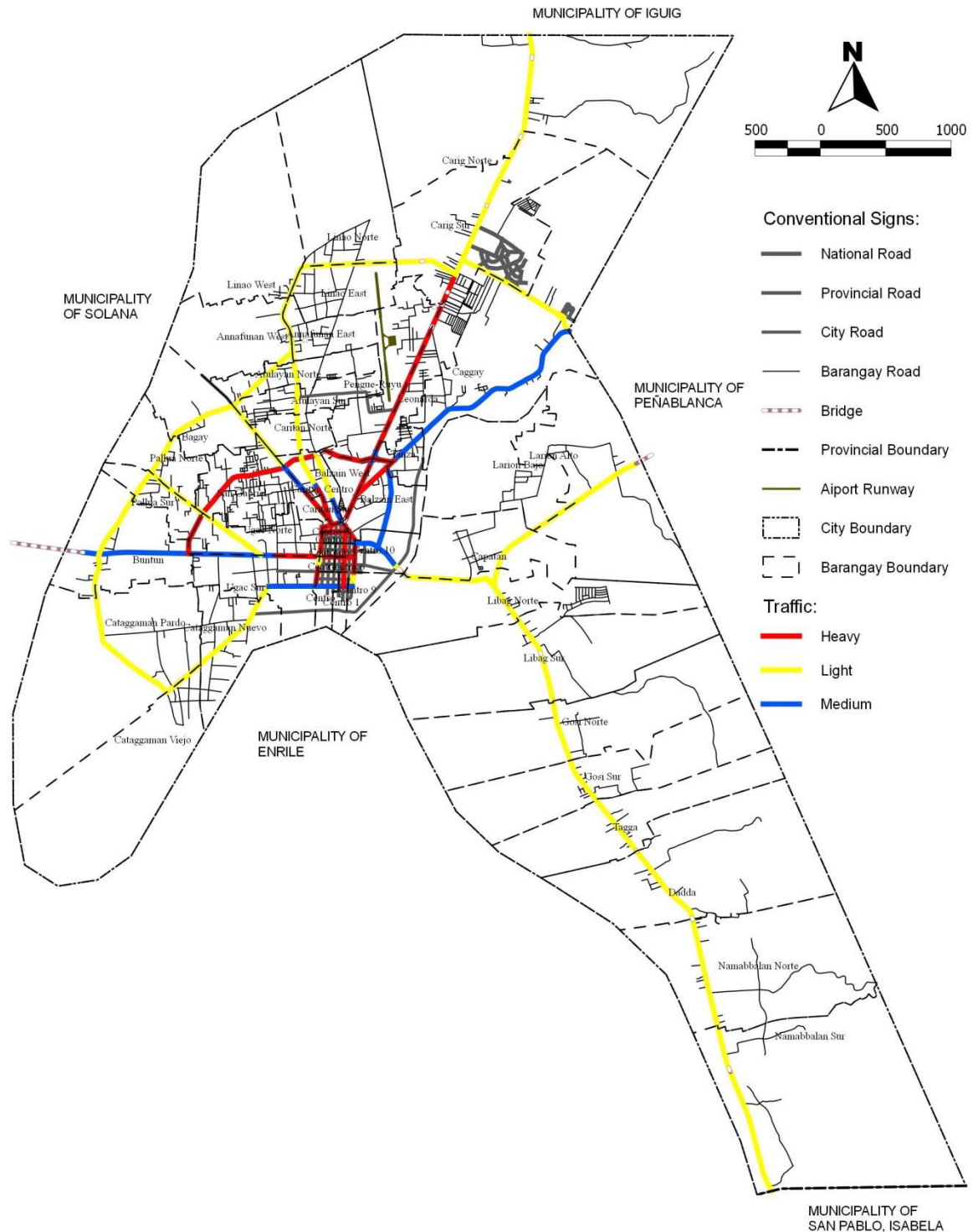
Figure 2. Land Use Map



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Figure 3. Transportation Route Map



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2.5 Physical Characteristics

Topography

More than half of Tuguegarao are plains, i.e. flat to nearly level land. These plains are about 65.5% of the city's total land area, majority of which are fertile alluvial plains being contiguous to the rivers. The lowest elevations range 10-16 meters above sea level and these are the flood plains of 0-1° slope all along the rivers. The Poblacion is located in the highest available elevation, 22-23 meters above sea level of flat land. The rest of the city is hills and hillocks, which line the eastern portion of the city, with elevations 40-146 meters above sea level.

The city is generally drained by the Cagayan River and by the Pinacanauan River, flowing from the Sierra Madre mountains in Peñablanca in the east, traverses the mid-eastern portion of the city, finally joining the Cagayan River at the mid-southern part of the city. Branching from the rivers are creeks which are usually dry during summer.

Table 3 shows the scope classification of soils within the territorial jurisdiction of Tuguegarao.

Table 3. Slope Classification

Description	Slope Range	Area in hectares	Percent
Flat, nearly level land	0-3°	7,752.00	68.03%
Gently sloping to undulating	3-8°	108.00	0.95%
Moderately sloping to rolling	8-18°	1,330.00	11.67%
Rolling to moderately steep	18-30°	1,362.00	11.95%
Steep	30-50°	843.00	7.40%
TOTAL		11,395.00	100%

Source: ALMED, Bureau of Soils & Water Management, DA



Climate

The city's latitude and topography influence its climate which is Type III characterized by no pronounced season, relatively wet from May to October, with maximum rain periods and dry seasons lasting from one to three months usually February to April. The northwest monsoon from East Asia brings dry and cool winds from November to January.

Due to the open northern coastline of the province, Tuguegarao experiences the full impact of the phenomenon, which could mean very cold mornings and evenings with average temperatures ranging from 16° to 23° Celsius. The trade winds from the Pacific are blocked by the Sierra Madre ranges. Being on the leeward, Tuguegarao has hot and dry climate in summer from February to May. From June to October, the southwest monsoon from the southern Hemisphere brings heavy rainfall as it blows over to the mountains. During this period, Tuguegarao registers its maximum monthly rainfall from 566 to 713 mm during typhoons. This heavy rainfall extends to the early part of November. The city is classified as a high typhoon and drought area.

Being protected in the east by the Sierra Madre mountain ranges and by the Cordilleras in the west, prevailing winds are north and northwest. When winds blow east or west, the city is on the leeward side, causing relatively dry weather and less cloudy skies than other locations. These clear skies result to warm days and cool nights. The Isohyetal Map of Northern Luzon reveals that Tuguegarao receives about 1,500 to 2,000 mm of rainfall a year.

Hydro-Geology

The bedrock formation of Tuguegarao is entirely of sedimentary form about 9,080 hectares, or 62.71% of the city's bedrock formation is recent alluvium of the quaternary-recent series(r), which was formed 0.01 to 2.5 million years ago. This is mostly found in the plains, which are contiguous to the rivers. The lower slopes in the eastern barangays of Tuguegarao have an older bedrock Foundation. This includes shale/sandstone/siltstone, Pliocene to Pleistocene late molasses' (n₃), formed some 2.5 to 7.0 million years ago, that consist of transgressive and thickly bedded marine clastics. The higher relief areas consist of shale/sandstone upper Miocene-pliocene sedimentary bedding (n₂), formed some 25.0 million years ago.

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Remnants of coral and other marine organisms are present in this bedding. The oldest sedimentary formation is very tiny portions of Middle-Upper Miocene formed 25 to 50 million years found in the highest elevations of Tuguegarao. The geologic classification of Tuguegarao City is shown in table 4 below.

Table 4. Geologic Classification

Classification	Area in Hectares	Percent
Sedimentary Form		
Quaternary Recent - Recent Alluvium	8,198.00	71.94%
Pliocene-Pleistocene - Shale/Sandstone/Siltstone	1,759.00	15.44%
Upper Miocene - Shale/Sandstone	1,438.00	12.62%
TOTAL	11,395.00	100%

Source: DENR - Mines & Geosciences Bureau

With respect to groundwater resources, the entire city has artesian aquifers at 12-90 meters, which are recharged continuously and the bedrock foundation is made of alluvium whose permeability is frequently high.

The distribution of earthquakes in the Philippines shows that Tuguegarao is free of any active fault, existing or probable. It is likewise located far from any zone of collision. It however lies in the Cagayan River basin liquefaction-prone area. Being at the valley floor and located near the foothills of the Sierra Madre ranges, it is susceptible to shallow land sliding in case of Intensity 7.5 earthquakes or when an intensity of at least RF VII is experienced in the area.

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Soil Characteristics

The soil types in the city are presented in table 5 below.

Table 5. Soil Types

Soil Type	Area in Hectares	Percent
Agustin Sandy Loam	496	4.35%
Bigaa Clay	450	3.95%
Carig Sandy Clay Loam	230	2.02%
Ilagan Sandy Clay Loam	2,870	25.19%
Quinga Clay Loam	1,249	10.96%
San Manuel Silt Loam	2,188	19.20%
Tagulod Clay Loam	3,014	26.45%
River Wash Sand	734	6.44%
Wet Spot	164	1.44%
TOTAL	11,395	100%

Source: DA/CIADP Detailed Soil Survey

Vegetative Cover

The city has its 74-hectare Tree Park in Namabbalan Sur and the 5-hectare Rogelio Baggayan Tree Park in Carig Sur as green belts. Several school-based youth organizations, barangays and Non-government Organizations (NGOs) regularly undertake tree planting activities city-wide. Households likewise plant trees in their home lots to help solve the flooding problem in the settlements.

MGB Findings on the Disposal Site

Results of the study indicate that the area met some of the major Site Selection Criteria of the Presidential Task Force on Waste Management for proper solid waste disposal site. Considering that the most critical factor in the evaluation of the site is the depth of the groundwater and the characteristics of underlying lithologies, a detailed study on the above-mentioned parameters was conducted and was established the

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suitability of the area for the Sanitary Landfill (SLF). However, it was recommended that there is a need to lay clay as liner at the base of the landfill to control the percolation of leachate towards the groundwater. See Annex G for details of MGB findings.

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**Table 1. Current and Projected Population by Barangay
(Urban & Rural)**

Barangay Urban	2015*	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Atulayan Sur	4,404	4,489	4,576	4,664	4,751	4,846	4,939	5,035	5,132	5,231	5,332	5,435
Balzain East	2,990	3,048	3,107	3,166	3,226	3,290	3,353	3,418	3,484	3,551	3,620	3,690
Balzain West	2,391	2,437	2,484	2,532	2,580	2,631	2,682	2,733	2,786	2,840	2,895	2,951
Buntun	4,373	4,457	4,543	4,631	4,718	4,812	4,904	4,999	5,096	5,194	5,294	5,396
Caggay	7,261	7,401	7,544	7,690	7,834	7,989	8,143	8,301	8,461	8,624	8,791	8,960
Carig Sur	4,536	4,624	4,713	4,804	4,894	4,991	5,087	5,185	5,286	5,388	5,492	5,598
Caritan Centro	4,872	4,966	5,062	5,160	5,256	5,361	5,464	5,570	5,677	5,787	5,898	6,012
Caritan Norte	3,093	3,153	3,214	3,276	3,337	3,403	3,469	3,536	3,604	3,674	3,745	3,817
Caritan Sur	1,833	1,868	1,904	1,941	1,978	2,017	2,056	2,095	2,136	2,177	2,219	2,262
Cataggaman Nuevo	8,161	8,318	8,479	8,643	8,805	8,980	9,153	9,329	9,510	9,693	9,880	10,071
Centro 01	1,158	1,180	1,203	1,226	1,249	1,274	1,299	1,324	1,349	1,375	1,402	1,429
Centro 02	553	564	575	586	597	608	620	632	644	657	669	682
Centro 03	339	346	352	359	366	373	380	388	395	403	410	418
Centro 04	566	577	588	599	611	623	635	647	660	672	685	698
Centro 05	1,126	1,148	1,170	1,192	1,215	1,239	1,263	1,287	1,312	1,337	1,363	1,390
Centro 06	195	199	203	207	210	215	219	223	227	232	236	241
Centro 07	262	267	272	277	283	288	294	300	305	311	317	323
Centro 08	125	127	130	132	135	138	140	143	146	148	151	154
Centro 09	969	988	1,007	1,026	1,045	1,066	1,087	1,108	1,129	1,151	1,173	1,196
Centro 10	2,282	2,326	2,371	2,417	2,462	2,511	2,559	2,609	2,659	2,710	2,763	2,816
Leonarda	2,503	2,551	2,601	2,651	2,700	2,754	2,807	2,861	2,917	2,973	3,030	3,089
Linao East	6,939	7,073	7,209	7,349	7,486	7,635	7,782	7,933	8,086	8,242	8,401	8,563
Pallua Sur	2,683	2,735	2,788	2,841	2,895	2,952	3,009	3,067	3,126	3,187	3,248	3,311
Pengue-Ruyu	5,629	5,738	5,848	5,961	6,073	6,194	6,313	6,435	6,559	6,686	6,815	6,946
San Gabriel	6,828	6,960	7,094	7,231	7,367	7,513	7,658	7,806	7,956	8,110	8,266	8,426

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Tanza	5,665	5,774	5,886	5,999	6,112	6,233	6,353	6,476	6,601	6,728	6,858	6,991
UgacNorte	9,615	9,801	9,990	10,182	10,373	10,579	10,784	10,992	11,204	11,420	11,640	11,865
Ugac Sur	10,858	11,068	11,281	11,499	11,714	11,947	12,178	12,413	12,652	12,896	13,145	13,399
Subtotal Urban	102,209	104,181	106,192	108,242	110,271	112,460	114,630	116,843	119,098	121,397	123,740	126,128
Barangay Rural	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Annafunan East	4,207	4,288	4,371	4,455	4,539	4,629	4,718	4,809	4,902	4,997	5,093	5,192
Annafunan West	3,310	3,374	3,439	3,505	3,571	3,642	3,712	3,784	3,857	3,931	4,007	4,085
AtulayanNorte	3,578	3,647	3,717	3,789	3,860	3,937	4,013	4,090	4,169	4,250	4,332	4,415
Bagay	3,638	3,708	3,780	3,853	3,925	4,003	4,080	4,159	4,239	4,321	4,404	4,489
Capatan	3,337	3,401	3,467	3,534	3,600	3,672	3,743	3,815	3,888	3,963	4,040	4,118
CarigNorte	2,267	2,311	2,355	2,401	2,446	2,494	2,543	2,592	2,642	2,693	2,745	2,798
Cataggamman Pardo	3,292	3,356	3,420	3,486	3,552	3,622	3,692	3,763	3,836	3,910	3,985	4,062
Cataggamman Viejo	4,246	4,328	4,411	4,497	4,581	4,672	4,762	4,854	4,948	5,043	5,140	5,240
Dadda	1,167	1,190	1,212	1,236	1,259	1,284	1,309	1,334	1,360	1,386	1,413	1,440
Gosi Norte	1,016	1,036	1,056	1,076	1,096	1,118	1,139	1,161	1,184	1,207	1,230	1,254
Gosi Sur	1,297	1,322	1,348	1,374	1,399	1,427	1,455	1,483	1,511	1,540	1,570	1,601
Larion Alto	1,856	1,892	1,928	1,966	2,002	2,042	2,082	2,122	2,163	2,204	2,247	2,290
Larion Bajo	2,345	2,390	2,436	2,483	2,530	2,580	2,630	2,681	2,732	2,785	2,839	2,894
Libag Norte	2,384	2,430	2,477	2,525	2,572	2,623	2,674	2,725	2,778	2,832	2,886	2,942
Libag Sur	2,708	2,760	2,814	2,868	2,922	2,980	3,037	3,096	3,155	3,216	3,278	3,342
Linao Norte	3,005	3,063	3,122	3,182	3,242	3,306	3,370	3,435	3,502	3,569	3,638	3,708
Linao West	1,665	1,697	1,730	1,763	1,796	1,832	1,867	1,903	1,940	1,978	2,016	2,055
NamabbalanNorte	1,433	1,461	1,489	1,518	1,546	1,577	1,607	1,638	1,670	1,702	1,735	1,768
Namabbalan Sur	746	760	775	790	805	821	837	853	869	886	903	921
Pallua Norte	2,450	2,497	2,545	2,595	2,643	2,696	2,748	2,801	2,855	2,910	2,966	3,023
Tagga	1,346	1,372	1,398	1,425	1,452	1,481	1,510	1,539	1,568	1,599	1,630	1,661
Subtotal Rural	51,293	52,283	53,292	54,320	55,339	56,438	57,527	58,637	59,769	60,922	62,098	63,297
GRAND TOTAL	153,502	156,464	159,484	162,562	165,610	168,898	172,157	175,480	178,867	182,319	185,838	189,425

* PSA 2015 Population Survey

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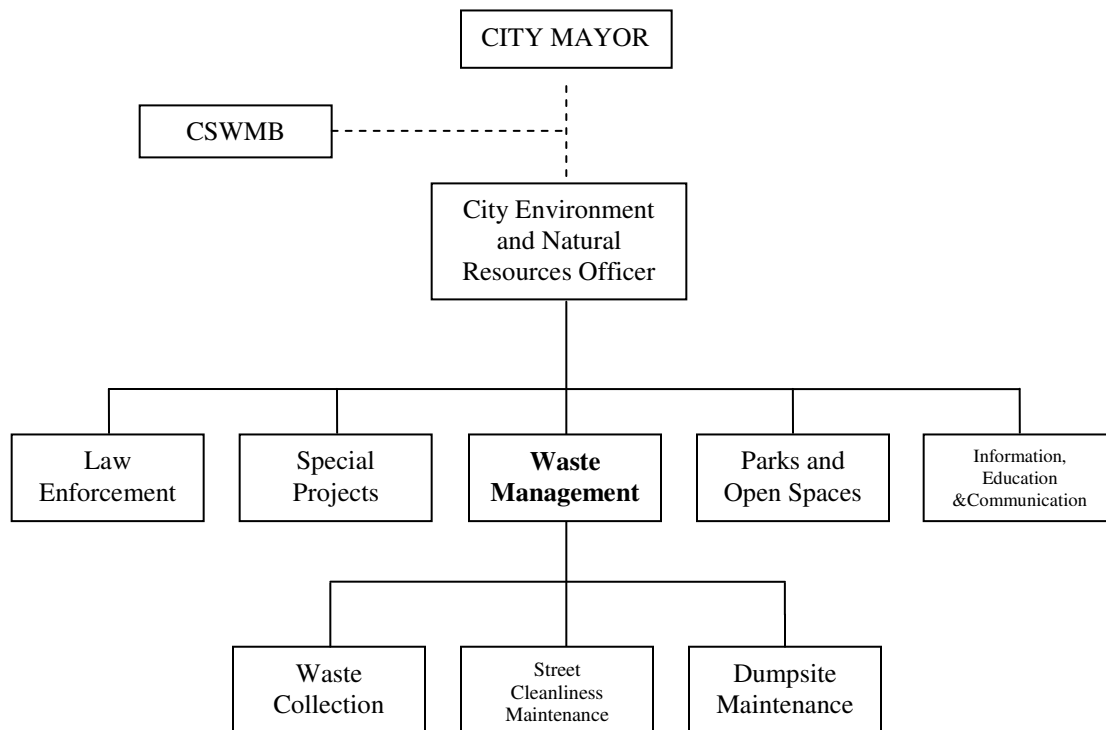
Chapter 3. Current Solid Waste Management Conditions

This Chapter presents an analysis on the solid waste management situation of Tuguegarao City in terms of (1) institutional arrangements; (2) current practices; (3) stages of solid waste management; (4) ESWM costs and revenues, and (5) key issues to be addressed.

3.1 Institutional Arrangements

Tuguegarao City Environment and Natural Resources Office (TCENRO) was created by virtue of City Ordinance No. 09-2015¹, wherein the office has five (5) component sections. Waste Management (SWM) Section is directly in charge in the implementation of Solid Waste Management Program of the city.

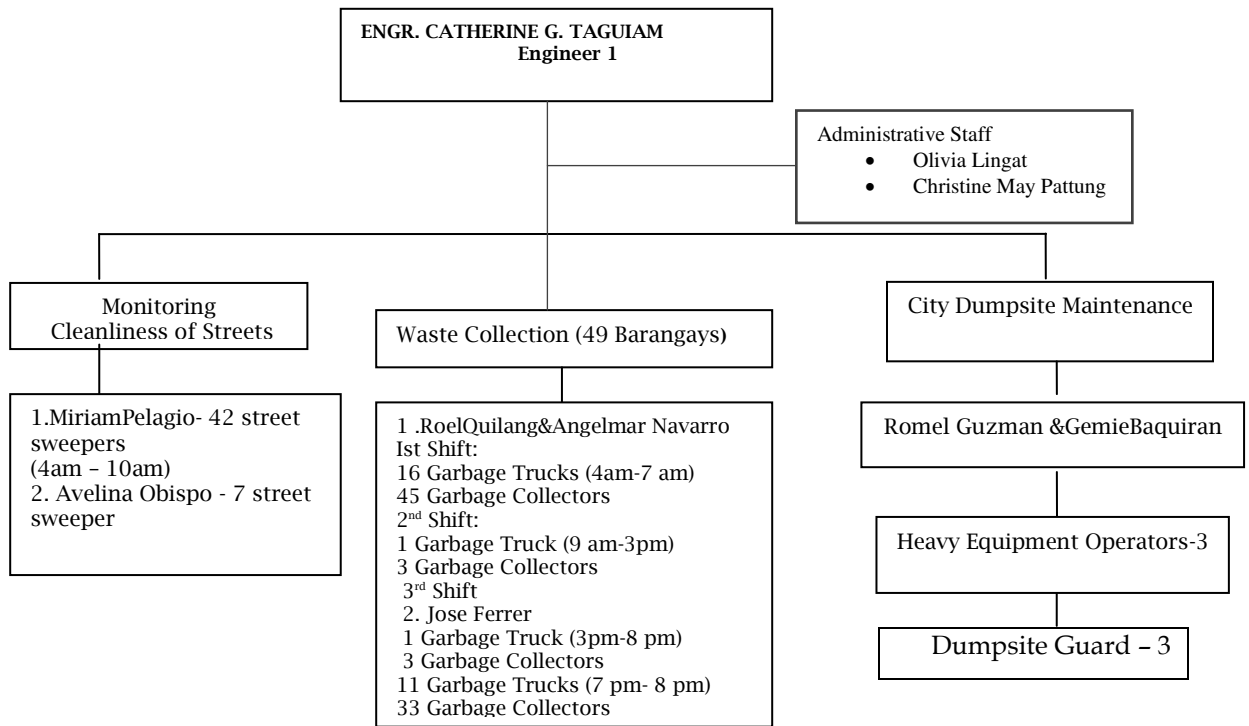
3.1.1 Organizational Framework



¹ Ordinance Creating the City Environment and Natural Resources Office



3.1.2 Organizational Chart of Solid Waste Management Section



3.1.3 List of Offices and their Responsibilities

Office	Role and Responsibility
City General Services Office	Provides logistics in the implementation of the ESWM programs and projects. Support and conduct the Bidding. Provides other support services
City Engineers Office	Preparation of plans and design of the Sanitary Landfill and other SWM facilities and utilities Deploys heavy equipment and other utility vehicles to facilitate the implementation of the ESWM plan.



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City Health Office	<p>Enforces sanitation rules and regulations pertaining to ESWM.</p> <p>Recommends measures and safeguards against pollution which is detrimental to one's health.</p> <p>Conducts regular check-up and provides medical services to personnel tasked in collecting waste.</p> <p>Assists the CENRO in the conduct of trainings and lectures on ill-effects of improper waste disposal to health and environment.</p>
City Budget Office	<p>Allocates funds for programs and projects intended for solid waste management</p>
City Treasurer's Office	<p>Facilitates the disbursement of necessary funds for the implementation of ESWM programs and projects.</p>
City Planning and Development Office	<p>Assists in the formulation of plans and programs on ESWM.</p> <p>Gathers data, convene and plan updates on ESWM activities and projects.</p>
City Agriculturist Office	<p>Conduct training on composting and organic farming.</p> <p>Assists in educating farmers on the ill-effect of burning agricultural waste.</p> <p>Monitors compliance of component barangays on RA 9003.</p>
City Social Welfare & Development Office	<p>Organizes scavengers and urban poor groups and recyclers.</p> <p>Monitors compliance of component Barangays on RA 9003.</p>
Sangguniang Panlungsod	<p>Enacts Ordinance/resolution for the approval of the Ecological Solid Waste Management Plan.</p> <p>Enacts necessary legislative measures to ensure successful implementation of ESWM programs.</p> <p>Institutionalize the organization of ESWM Board.</p>
DepEd/CHED	<p>Leads in the establishment of Ecology Learning Centers, Demo Center or Show Windows for ESWM Integrate ESWM in school Curriculum.</p> <p>Assists in advocacy on ESWM.</p>

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Department of Agriculture	Assists the City Agriculturist Office in implementing programs on composting and organic farming. Monitors the LGU's in the implementation of Agri-Programs and activities.
DENR, DOT, and PIA	Assists in the advocacy on waste reduction and segregation at source. Oversees and Monitors the implementation of ESWM plan.
DILG, DENR-EMB	Provide technical assistance in the formulation of the 10- Year ESWM Plan and its implementation.

3.2 Inventory of Equipment and Staff

3.2.1 Equipment

Table 6 shows the existing equipment of the city which may be used for purposes of solid waste management.

Table 6. Existing Equipment

Equipment	Capacity	Number of Units		
		Serviceable	Under Repair/Unserviceable	Total
Isuzu Dumptruck	12 m ³	2		2
Isuzu Dumptruck	10 m ³	4		4
Isuzu Dumptruck	6 m ³	5		5
Mini Dumptruck	3.55 m ³	2		2
Isuzu Forward	4.95 m ³	6		6
Total Garbage Truck		19		19
Bulldozer		2		2
Backhoe		1		1



Payloader		2		2
Push cart		49		49
Medical Waste Van		1		
TOTAL		74		74

3.2.2 Staff

Table 7 shows the list of personnel assigned to work in the promotion and implementation of the solid waste management programs and projects of the City.

Table 7. List of Personnel

Position	Status of Appointment			TOTAL
	Permanent	Casual	Job Order	
OIC-CENRO	1			1
Project Development Officer II	1			1
Engineer 1	1			1
Environment Management Specialist I	2			2
General Foreman	1			1
Foreman (Designate)		1		1
Area Managers	3			3
Garbage Truck Drivers	6	1	12	19
Garbage Collectors	4	27	37	68
Street Cleaner/Sweepers		8	41	49
Don Domingo Market Sweepers			4	4
Bulldozer Operator		1		1
Backhoe Operator			1	1
Pay loader Operator		1		1
Guards at SLF			3	3
TOTAL	19	39	98	156

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3.2.3 Staff Training

To ensure the efficient and effective delivery of services, members of the CSWMB and its Technical Working Group and employees are directly involved in ESWM trainings to enhance their knowledge, skills and abilities on ESWM.

Table 8 below shows the list of trainings on ESWM.

Table 8. List of Trainings on ESWM

Title Training	Date Attended	Venue
Integrated Post Management	2006	DA- Tuguegarao City
Training Workshop on Enhancing the performance of the Environmental Monitoring and Audit Role of Multi Partite Monitoring Team	2006	University Hotel, UP Diliman, Quezon City
Bio-Organic Fertilizer Trichogramma Utilization	2007	Iloilo City
Bio-Intensive Gardening	2007	DA-Tuguegarao City
Usage of Organic Fertilizer	2007	Agricultural Training Institute, Cabagan,Isabela
Vermi Composting	2008	ATI-Isabela
Farming System	2008	ATI-Isabela
Bio- Organic	2009	DA- Provincial Office
Bio-Composting	2009	DA-RFTC



Operationalization of Materials Recovery Facility (MRF) Cum Assessment of Ecological Solid Waste Management Implementation	2009	Villa Victoria Hotel, Pengue-Ruyu, Tuguegarao City, Cagayan
Recycling Demonstration	2009	SPU, Tuguegarao City
Bio composting through Villar Foundation	2015	Las Pinas, Metro Manila
Bio composting through Villar Foundation	2016	Las Pinas

The TCENRO and other concerned departments of Tuguegarao City Government visited other LGU's with similar programs for purposes of benchmarking.

Table 9 below shows the list of model LGUs visited.

Table 9. List of Model LGUs Visited

Location	Features/Insight Learned
Paranaque City	Solid Waste Management/Bio-composting
CVMLROS-Iguig Cagayan	Bio- Organic composting
ATI- Isabela	Vermi Composting
ATI- Echague, CYARRD	Bio-Organic Composting
Santiago City	Management of Slaughter house
Sanitary Landfill at Metro Clark, Capas, Tarlac and San Mateo Rizal	Operational Sanitary Landfill
San Jose Sico, Batangas City	Clay Lining Installation for SLF Cell
San Fernando, La Union	Best Practices on Solid Waste Management and Benchmarking on Charcoal Briquetting.

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3.3 Source Reduction

Source Reduction is a method of minimizing or eliminating the quantity, pollution load or toxicity of waste from the point of generation. One of the objectives of solid waste management is to encourage reduction of source of waste.

Current source reduction practices of the City are as follows:

- Reuse grocery bags or bring your own cloth bags/bayong to the store/markets
- Encouraging buying of shampoo, conditioner, coffee, creamer, etc in large containers rather than sachets
- Use of both sides of paper in offices
- Bringing of own utensils in schools and offices
- Minimize the use of sando bags in markets
- Re-purpose items in new and creative ways
- Buy durable items instead of disposables
- Eat whole foods not packaged
- Compost your kitchen scraps
- Try to repair before replacing
- Use cloth diapers for your baby
- Use rechargeable batteries
- Buy in bulk where possible
- Buy reusable water bottles
- Sell items you no longer needs
- Have printer ink refilled
- Buy products with minimal packaging



3.4 Collection

Tuguegarao City Government has implemented the “No Segregation, No Collection Policy”. All business establishments are required to be equipped with four (4) garbage bins with sizes commensurate to the volume of waste they generate daily. Transparent waste bags are placed in the garbage bins for safe and easy collection and loading of the segregated wastes to the garbage trucks by the waste collectors.

The City Government takes charge of collecting segregated wastes on a daily basis with two (2) to three (3) trips a day using the “collect and dump” method. Each truck is equipped with closed containers where biodegradable wastes are placed during the collection period. Waste collectors carry “banyeras” to transfer the content of drums/containers to the waiting garbage trucks. Waste collectors and sweepers with their carts and unload collect the segregated waste from the households, business establishments and pick up point and bring these wastes to the standby dump truck.

Big business establishments, private institutions and barangays that have their own garbage trucks which they exclusively use to dispose their wastes directly to the disposal site located at Barangay Carig.

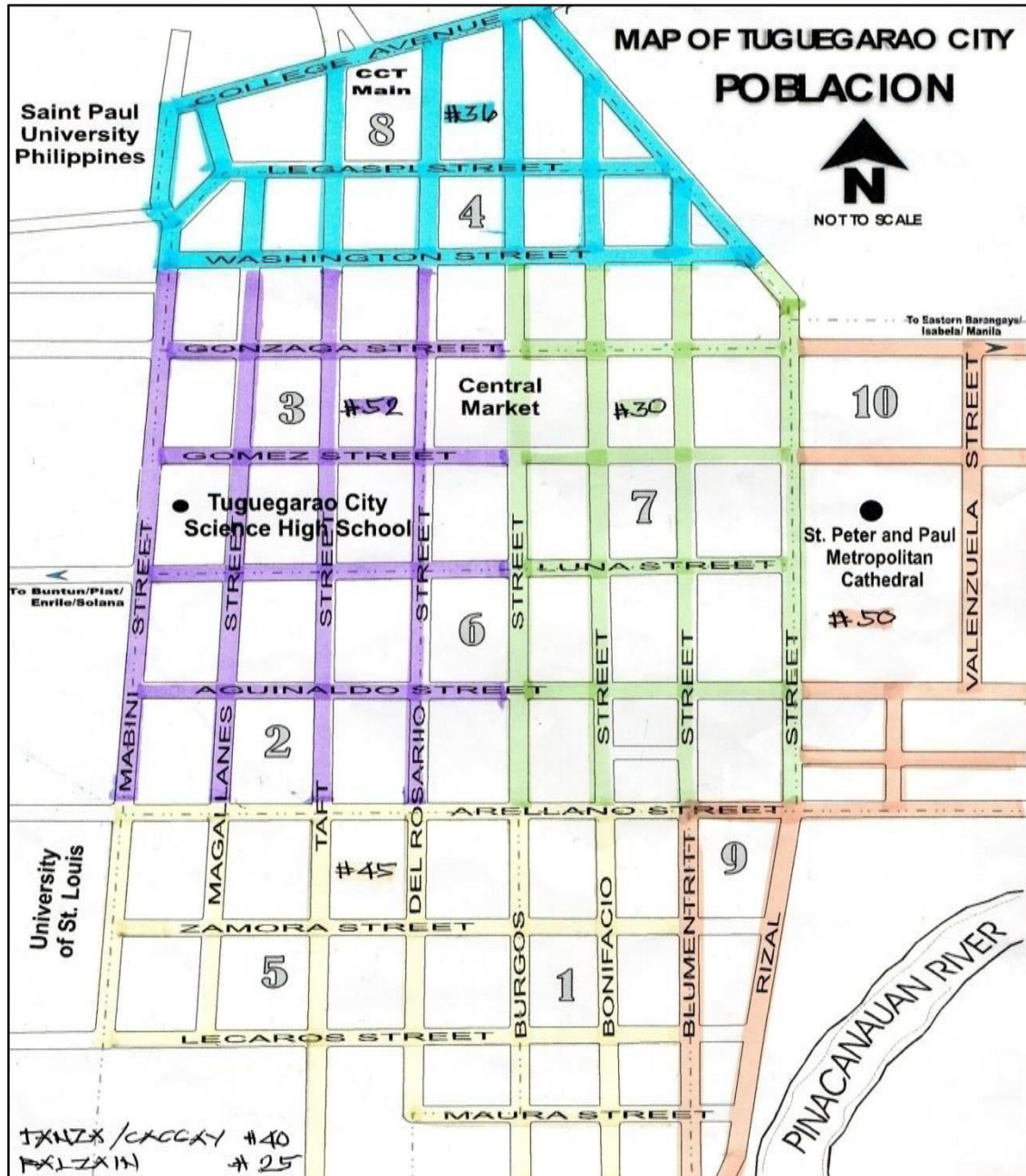
There are some areas in the urban barangays and in the eastern rural barangays of Namabbalan Sur/Norte, Tagga, Dadda, Gosi Sur/Norte and Libag Sur/Norte with interior roads not accessible by garbage trucks. The plan strategy, therefore, of the City Government to intensify waste collection in these areas will be as follows:

1. Door to door, house to house or establishment to establishment waste collection approach;
2. Collection shall be with the use of push carts or pedicab and wastes collection are brought to designated temporary pick-up points situated within the purok or at the nearest access road or main thoroughfares;
3. Garbage trucks load the wastes for disposal.



Figure 4 below shows the route of waste collection within Poblacion.

Figure 4. Route of Waste Collection within Poblacion



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Meanwhile, the table below presents the collection frequency and route of waste collection vehicles.

Table 10. Collection Frequency and Route

Frequency	Name of Barangay/ Office/ Subdivision	Remarks
Daily	Brgy 1-12, Brgy. Bagay Road, Brgy. Carig Norte, Carig Sur, Brgy Caritan Centro, Caritan Norte, Hi-way of Tanza, Main Road of Ugac Sur, Main Avenue of San Gabriel Village, Parking of lot of Jeeps at Buntun, Don Domingo Market, Slaughter House, Cagayan Valley Medical Center. Tanza and Caggay highway Cagayan State University	Barangays Market Jeepney Parking Area School
Weekly	San Gabriel, Tanza, Ugac Norte, Tanza. Annafunan East, Annafunan west, Atulayan, Capatan, Cataggaman Nuevo, Cataggman Pardo, Cataggaman Viejo, Gosi Norte, Gosi Sur, Larion Alto, Larion Bajo, Leonarda, Libag Norte, Libag Sur. Linao East, Linao Norte, Linao West, Namabbalan, San Gabriel, Tanza, Ugac Norte, Consuelo Heights, Teresita Blvd. Saint Stephen St., Uni-top.	Interior Roads Barangays



	<p>Namabbalan to Capatan, Diversion, Caritan Hi-way.</p> <p>Airport, Cruz Village, Macapagal Avenue, Panacal Village, RG Village, Saint Louis Village, San Jose Village, Sunshine Valley Homes Phase 1 & 2.</p> <p>DENR, Central Bank, DILG, NEDA, DSWDO</p>	<p>National Hi-ways</p> <p>Subdivisions/ Village</p> <p>Offices</p>
Others	<p>Bagay Road, City Homes, RECOM.</p> <p>Consuello Heights, Leonarda,</p>	<p>2 Times a Week</p> <p>3Times a Week</p>

Description of Areas not Currently Receiving Collection Services

As discussed earlier, there are still areas in the urban barangays and in the eastern barangays of Namabbalan Sur/Norte, Tagga, Dadda, Gosi Sur/Norte and Libag Sur/Norte whose interior roads are not accessible by garbage trucks and therefore not receiving collection services. The plan strategy, in such case, for the City Government to intensify waste collection in these areas will be as follows:

1. Door to door, house to house or establishment to establishment waste collection approach;
2. Collection shall be with the use of push carts or pedicab and such collection shall be placed at the designated temporary pick-up points situated within the purok or at the main thoroughfares.

Moreover, all the barangays are provided with copies of Executive Order No.19 series of 2016² issued by the City Mayor for their information and appropriate action.

² Executive Order Prescribing Guidelines and Enforcement Mechanisms in Solid Waste Management in the City



Collection Service by a Private Hauler

Tuguegarao City Government encourages the collection service to be undertaken by private hauler/s in order to augment the government's efforts of wastes collection.

3.5 Transfer

The City Government adopted the "collect and dump" method. However, transfer stations may be established should there be a considerable increase of volume of wastes.

As of now, the MRFs established in various clustered barangays including private and governmental institutions are utilized as transfer stations and pick-up points prior to final disposal.

3.6 Processing Facilities

Material Recovery Facilities (MRF) have been established at the Disposal Facility located at Barangay Carig Norte and at the City Demonstration Farm located at Barangay Gosi Norte which are equipped with rotary composting drums, handy shredder machines and weighing scale.

Figure 5 herein shows the established Material Recovery Facilities.

Figure 5. Material Recovery Facilities (MRF)

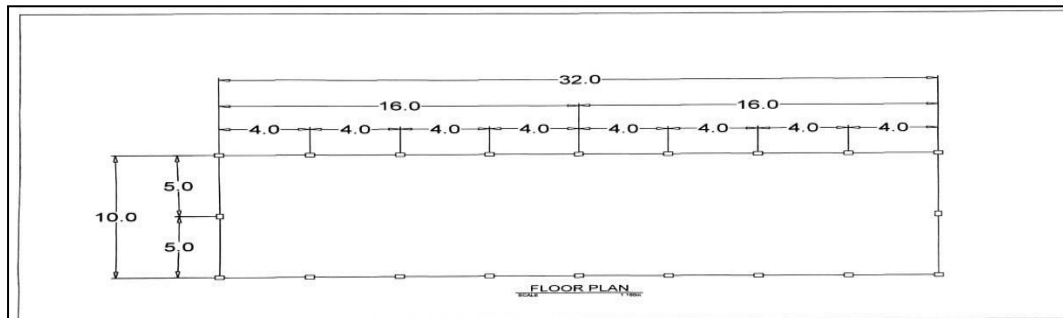


On left photo is the proposed floor design of Material Recovery Facility (MRF), while the right photo shows the existing structure of a Material Recovery Facility (MRF) at barangay Carig Norte, Tuguegarao City

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Meanwhile, the floor plan of Material Recovery Facilities at Carig Norte, Tuguegarao City is shown below.

Figure 6. Floor Plan of Material Recovery Facilities (MRF)



Vermin Composting Areas

There are nineteen (19) vermin composting areas established in various private lots of some barangays. The MRF and vermin composting facilities are established to process biodegradable wastes for composting, while other wastes are managed by the BESWMC for final segregation, reuse and recycling.

Figure 7 below shows the vermin composting areas in different barangays of the city.

Figure 7. Vermin Composting Areas in Different Barangays



Vermin composting of residence at barangay Libag Norte, Tuguegarao City

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On the left photo is a household vermin composting of residence at barangay Libag Norte, Tuguegarao City while the right photo is a vermin composting area established at Cagayan National High School.



On the left photo is a vermin composting area at Namabalan Elementary School while the right photo shows the household vermin composting of residence at barangay Namabalan, Tuguegarao City.

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Meanwhile, the vermin composting beds at the City Demonstration Farm is shown below.

Figure 8. Vermin Composting Beds at the City Demonstration Farm



The photo above is the composting beds established in the City Demonstration Farm at barangay Gosi Norte, Tuguegarao City.

3.7 Final Disposal

The existing disposal facility of Tuguegarao City Government has a total land area of 100,576 sq. meters located at the boundary of Tuguegarao City and the Municipality of Iguig which is accessible by concrete road 10.5 kilometers from the city proper.

With the advent of RA 9003, the traditional open dumpsite was converted into a controlled dumpsite. Subsequently, in compliance to the Closure Order of the DENR-EMB, Tuguegarao City Government implemented the Safe Closure and Rehabilitation Plan.

The components of the closure and rehabilitation plan consist of the following; (1) Site improvement. (2) Site grading and stabilization of critical slopes to facilitate drainage and prevent water impounding and promotes natural drainage. (3) Application and maintenance of soil cover to prevent water seepage into the waste pile prevent access of vectors including the proliferation of flies. The final topsoil cover 15 centimeter thick covers the 45 centimeter thick compacted soil. The top soil serves as

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protection layer for the compacted soil cover, as well as a support to plant growth or vegetation. (4) Peripheral canal and ditches constructed around the site divert runoff water and to prevent contact of waste pile with water in order to reduce leachate generation. Proper leachate management system and provision of gas vents at the closure site is established. (5) Perimeter fence and security personnel were provided to prevent unauthorized entry of waste pickers, children and illegal settlers and also entry of astray animals. (6) On the social aspect, the City Government conducted meetings and dialogues with waste pickers where some were employed as job orders for the maintenance and management of waste disposed while others were granted loan for livelihood projects.

The disposal facility is equipped with Material Recovery Facility and Residual Containment Area as shown below.

Figure 9. Disposal Facility



Disposal facility situated at barangay Carig Norte, Tuguegarao city



Meanwhile, figure 10 shows the Phase 1 and Phase 2 of the City's Disposal Facility.

**Figure 10. Safe Closure and the Rehabilitated Area
of Area 1 & 2 (On-going Activity)**



Phase 1



Phase 2

On the left photo is the rehabilitated area of the City's Disposal Facility while the right photo illustrates the current dumping area in the said disposal facility.

3.8 Special Waste

Special waste such as cell batteries, busted bulbs and others are collected by individual buyers/waste pickers and sell them to junkshops which in turn resell to the recovery centers for re-use. However, with the increasing collection of about 247 kilogram per day for special waste, a temporary storage area at the City Disposal Facility was constructed. (see chapter 4 under disposed waste)

The structure for the storage of intended assorted special waste is illustrated below.

Figure 11. Structure for the Storage of Assorted Special Waste



The photo above shows the established storage of assorted special waste at the City's Disposal Facility

On the other hand, table 11 below indicates the quantities of special waste disposed daily.

Table 11. Quantities of Special Waste Disposed

Items	Volume of Waste Disposed (kg./Day)
Assorted home appliances	26
Assorted home furniture and fixtures	29
Assorted Batteries	12
Assorted Cellphones	8
Paint/thinner containers	55
Rugs/worn out clothes	30
Spray canister	25
Assorted used Tires	76
Busted bulbs and ballasts	18
Other chemical containers	45
Total	324



The data in the table above indicates that the total volume of special waste disposed daily is 247 kilograms per day where 70 kilograms of assorted used tires is the highest.

3.8.1 Health Care Waste

Hospital waste management has been an issue for the past few years not only in our country but also in other countries. In response to this emerging concern, congress has enacted RA 6969 which provides for the safe, sanitary and efficient management of Toxic & Hazardous and Medical Wastes. The Department of Health has likewise established a mechanism to ensure that all hospitals and clinics comply with the requirements of RA 6969.

As mandated by the said law, toxic and hazardous wastes generated in hospitals and clinics shall be properly sorted, pre-treated by applying chemical disinfectants necessary to eliminate the emission of offensive odor, collected, transported and disposed at the decaying vault.

As reflected in table 12, health care wastes are composed of needles, sharps and other health care waste with a quantity of 87 kg./day and these are disposed in a septic vault at the City's disposal facility.

Table 12. Quantities of Health Care Wastes Disposed

Items	Volume of Waste Disposed (kg./Day)
Needles	2
Sharps	5
Gloves	20
Vials	15
Chemical containers	35
Others	10
Total	87



Moreover, the City Government encourages all existing health facilities to establish their respective septic vaults. As a matter of fact, Tuguegarao City Health Office and other public health facilities have already established their respective vaults.

Meanwhile, Tuguegarao City Peoples General hospital disposes its sharps and needles at the City Disposal Facility.

Figure 12 below presents the septic vault for medical wastes of public hospital in the city.

Figure 12. Septic Vault for Medical Wastes (Public Hospital)



The photo above shows the established septic vault for medical wastes of Cagayan Valley Medical Center.



Figure 13, on the other hand, shows the designed septic vault for sharps and needles at the City Disposal Facility.

Figure 13. Septic Vault for Sharps and Needles at the City Disposal Facility



Established septic vault for sharps and needles at the City Disposal Facility.

Meanwhile, the decaying vault of Cagayan Valley Medical Center is shown below.

Figure 14. Decaying Vault of Cagayan Valley Medical Center



The photo above is the established decaying vault of Cagayan Valley Medical Center.

Health waste management with the use of auto clave machines are illustrated below.

Figure 15. Management of Health Care Waste with the Use of Auto Clave



St. Paul Hospital's auto clave machines.

Moreover, the management of sharps/needles and placenta through composting at St. Paul Hospital is shown below.

Figure 16. Management of Sharps/Needles and Placenta through Composting at St. Paul Hospital



Management of sharps/needles and placenta through composting of St. Paul Hospital



3.8.2 City Government’s Strategy in Handling and Disposing of Household Hazardous Waste

The City shall seriously take into consideration the proper handling and disposition of household hazardous waste because the mismanagement of it will result to irreversible adverse affect on the environment and ultimately to human lives.

3.8.3 City Government’s Strategy in Handling and Disposing of Commercial and Industrial Hazardous Waste

The City shall likewise consider the proper handling and disposition of household hazardous waste because the mismanagement of it will result to irreversible adverse affect on the environment and ultimately to human lives.

3.9 Market for Recyclables

Recyclable materials are sold to various junkshops which are engaged in processing raw materials. Table 13 presents the accredited junkshop with existing Memorandum of Agreement with Tuguegarao City Government, to wit:

Table 13. List of Recyclable Materials

List of Junkshops in the City	Type of Waste Accepted	Quantity of Waste(in kg/Month) Others are in kg/day	Average Quantity of Waste in (kg/day)
Daniel Junkshop	Bakal	21,000	600
	Lata (Tin Can)	2,500	90
	Plastic	10,000	150



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	Yero	5,000	200
	Various Bottles (50,000 pcs-1 load)		3,300
	Carton		50
	Paper & Newspaper	250	20
Sedano Junkshop	Bakal	2500	3,000
	Lata (Tin Can)	3,000	100
	Plastic	2,000	100
	Yero	5,000	5,000
	Various Bottle (70,000 pcs - 1 load)	1 load	2,500
	Carton		50
Isabelita Junkshop	Bakal		180
	Lata (Tin Can)		20
	Plastic	120	20
	Yero	170	170
	Aluminum	60	60
	Bronze		65
	Cali		20
	Carton		25
	Stainless		20
	Various Bottles		20
	Paper		12

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Four A Brothers Junkshop	Bakal		850
	<i>Lata</i> (Tin Can)	340	340
	Plastic	500	500
	Yero	50	50
	Assorted Carton		
	Paper	590	590
	Various Bottles (6,000 pcs-1 load)	1 load	500
JT Fermin Junkshop	Bakal		700
	Plastic		100
	<i>Lata</i> (Tin Can)		150
	Yero		590
	Carton		25
	Paper		6
	Bakal		800
RPA Junkshop	Plastic	2,000	66
	Carton		20
	Assorted Bottles (6,000 pcs-1 load)	1 load	116
	<i>Lata</i> (Tin Can)		66
	Paper (Assorted)	400	3

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LJ Junkshop	Plastic	30	100
	Bakal		1,215
	Carton		12
	Assorted Bottles (1,500 pcs./daily) 875 Kg.	350	29
	<i>Lata</i> (Tin Can)	5	12
	Yero		115
	Bronze		58
DelaFuente Scrap Paper	Carton		50
	White Paper		10
	Assorted Paper	200	15
Total			22, 860 kg/day

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Table 14 below shows the list of industries in the City using recycled materials.

**Table 14. List of Industries in the City
Using Recycled Materials**

David Acido Food Products	Suka
RMD Trading	Lard
Nita’s Vinegar and Soy Sauce	Vinegar
Jay & Joy Vinegar & Soy Sauce Products	Vinegar and soy sauce
JCP Merchandise	Cooking Oil
Rivera’s Enterprise	Spring Oil
Benito Enterprise	Lard wholesale
R.S. Guzman Food Products	Vinegar/ Soy Sauce
R.O. PallayaBagoong Dealer	Bagoong
Agasim	Bagoong&Patis

3.10 Information, Education and Communication

Solid Waste Management Task Force was organized by the City Government to promote the objectives of RA 9003 and to enforce local ordinances dealing with littering and illegal disposal of waste. The task force spearheaded by the City Environment and Natural Resources Office (TCENRO) have strengthened its IEC activities through the orientation of barangay stakeholders on solid waste management and other environmental concerns.

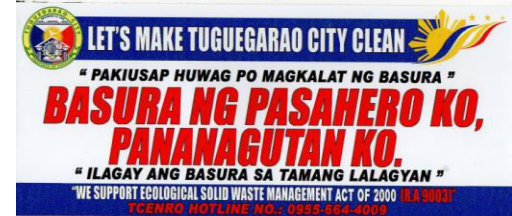
As part of its Solid Waste Management advocacy, Tuguegarao City Government distributed some movie/video clips to all barangays, schools and universities and shown on local tv channel. The ESWM advocacy was also made through print materials.



Figure 17. IEC Materials for City's Solid Waste Management Advocacy



Signages for business establishments



Sticker for tricycles



Signages installed along main thoroughfares

The following IEC activities are conducted, to wit:

1. The City Agriculture Office conducted training and seminars on vermin culture and propagation to farmers, women's club group, residents, RIC members, 4H Club Members and BAPC's;
2. Cagayan State University and the City Environment and Natural Resources Office launched the Pagguruffunan Community Based "Eco Savers Project in different barangays;
3. The Department of Science and Technology had a training and demonstration on composting with different barangay and stakeholders and members of the Water Quality Management Area Governing Board;
4. The City and the barangays put up composting area in the barangays and in the backyards of the residents;

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5. Secondary schools included in their curriculum waste reduction and minimization. Students are required to submit plastic containers to school every quarter of the year to be sold to junkshops. The proceeds are used for the improvement of the school;
6. The city launched in 2016 the Eco-Savers Program at the elementary level. Pupils are provided with passbook to list the quantity of recyclable materials in exchange for school materials like notebooks and pencil/ball pens as incentives;
7. Organization of YES "O" (Youth Environment in School Organization) in the different schools in the city.

Table 15 below shows the IEC activities being conducted by the City.

Table 15. IEC Activities

IEC Activities	Text Message	Target Audience	Effectiveness
1. Production of organic fertilizer.	Increase production more income.	Farmers	To scarce supply of organic fertilizers in markets and generates additional source of income.
2. Organic Farming	Extend lifespan and crops are more safer to eat.	Farmers	To protect and enhance food safety and to implement organic agriculture Act RA 10068.
3. Adopt a barangay	Change the value of discipline in the community.	Household residents	To ensure that specific information will reach the targeted sector that will do the desired behavior of waste segregation and management of waste.
4. Renewal of business permits	No to plastic	Business establishments	Reduction and minimization of plastic bags as packaging material.
5. Orientation of schools on Eco-Savers Program	To instill the value the of discipline and concern for the environment at a younger age.	Elementary and High School Level	Adopt a system of waste segregation scheme, to pave the way for the realization of waste diversion through re-use, reduce, recycle.



3.11 Costs and Revenues

Cost

Tuguegarao City Government allocates substantial funds intended for the ESWM program and activities in its approved annual budget.

A comparison of annual budget and actual expenses for 3 years is shown below.

Table 16. Comparison of Annual Budget and Actual Expenses for 3 Years

Year	Description	Annual Budget	Actual Expenses	(Over/Under)
2014	Provincial Gov't Financial Assistance	1,000,000.00	115,800.00	884,200.00
2015	Supplemental Budget	884,200.00	720,000.00	260,000.00
2016	Provincial Fund	260,000.00	260,000.00	
		<u>2,550,000.00</u>	<u>450,000.00</u>	<u>2,100,000.00</u>
	Supplemental Budget	2,810,000.00	710,000.00	2,100,000.00

The table above presents the corresponding budget which has been allocated for ESWM program implementation. Appropriations were allocated for the closure and rehabilitation of the open dump site, vertical structure and septic vault for special waste. The remaining budget on the year 2016 was utilized for the closure and rehabilitation of open dump site. For 2017, funds have been allocated for the closure and rehabilitation of the open dump site.



Meanwhile, Table 17 below shows the comparison on annual budget and actual expenses for 4 years.

Table 17. Comparison on Annual Budget and Actual Expenses for 3 Years (Maintenance and Services)

Year	Description	Annual Budget	Actual Expense	(Over/Under)
2016	Spare Parts/Repair & Maintenance Gasoline, Oil & Lubricant	7,348,089.00	6,258,484.40	1,374,012.86
		<u>6,500,000.00</u>	<u>6,215,591.74</u>	
		13,848,089.00	12,474,076.14	
2015	Spare Parts/Repair & Maintenance Gasoline, Oil & Lubricant	6,815,000.00	6,409,646.60	1,943,941.48
		<u>6,000,000.00</u>	<u>4,461,411.92</u>	
		12,815,000.00	10,871,058.52	
2014	Spare Parts/Repair & Maintenance Gasoline, Oil & Lubricant	6,500,000.00	5,934,219.90	1,268,480.10
		<u>5,468,000.00</u>	<u>4,765,300.00</u>	
		11,968,000.00	10,699,519.90	

The table above also presents the budget allocation for spare parts, gasoline, oil and lubricants consumption for garbage trucks utilized for garbage collection and service vehicles for implementation and for other purposes.

Revenues

Considering that solid waste management is a social service of the local government unit, the revenue derived therein is lower than the expenses incurred by Tuguegarao City. The table below shows the comparison between the Annual Expenses and Revenues on ESWM.



**Table 18. Comparison of Actual Expense
and the Revenues Collected (in Peso)**

Year	Actual Expenses	Revenues	(Over/Under)
2014	322,482.00 <u>12,474,076.14</u> 12,796,558.14	3,556,055.00	9,240,503.14
2015	720,000.00 <u>10,871,058.52</u> 11,591,058.52	3,508,750.20	8,082,308.32
2016	450,000.00 <u>10,699,519.90</u> 11,149,519.00	4,246,754.00	6,902,765.00

3.11 Key Issues for Solid Waste Management

Key issues encountered in the implementation of solid waste management program points to the following: (1) lack of information on proper waste management at source; (2) Inadequate number of waste collection trucks; (3) lack of cooperation and participation of the people.

Issues and problems relating to solid waste management redound to issues on the discipline of people, coordinative mechanisms between the barangays, the government and other stakeholders.

Such issues and problems on solid waste management shall include the following:

1. Few households properly segregate/recycle garbage especially in the urban barangays.
2. Ineffective/ unsystematic garbage collection.
3. Inadequate facilities/manpower.
4. Enforcement of ordinance, resolution, and regulation of solid waste management.
5. Residents setout garbage not on the specified time or schedule.
6. Absence of functional Materials Recovery Facility (MRF).
7. No budget allocation for ESWM Programs in the Barangay Level.
8. Unregulated waste disposal practices of transients and local tourists.
9. Non- existence of revenue generating measures on ESWM.



Chapter 4. Waste Characteristics

Data and information on the quantity of solid wastes disposed and generated from various sources was gathered through a 30-day Waste Analysis and Characterization Study (WACS) on “end-of-pipe” disposal conducted by the City Government. A survey was also conducted to determine the quantity of wastes diverted through composting, recycling and sale of factory returnable to junkshops and itinerant buyers. The results of the studies were used to determine the quantity of waste disposed and waste generated from various sources in the City. The projected waste generation was the City’s basis to update its ten (10) year Ecological Solid Management Plan.

4.1 Disposed Waste

Disposed waste is the total quantity of wastes collected and disposed at the existing disposal facility located at Carig Norte, Tuguegarao City. The table below shows the quantity of wastes disposed by various sectors in kilograms per day.

Table 19. Waste Disposed in Kilograms per Day

Major Waste Source	Biodegradable	Recyclable	Residual	Special Waste	Total Waste in Kilograms/day	% by Source
Residential	23,138	1,250	7,001	35	31,424	59.79
Food Establishment	11,500	250	466	94	12,310	23.88
Stores	150	65	300	20	535	1.01
Institutions	3,429	780	356	60	4,625	8.73
Industries	850	130	101	18	1,099	2.06
Public Markets	980	85	136	10	1,211	2.28
Recreational Centers	10	12	22	2	46	0.09
Slaughter House	200	4	14	3	221	0.42
Hospitals & Clinics (Special Waste Generators)	160	80	113	87	440	0.83
Service Centers	8	75	410	5	498	0.94
Grand Total	40,425	2,731	8,919	334	52,409	100

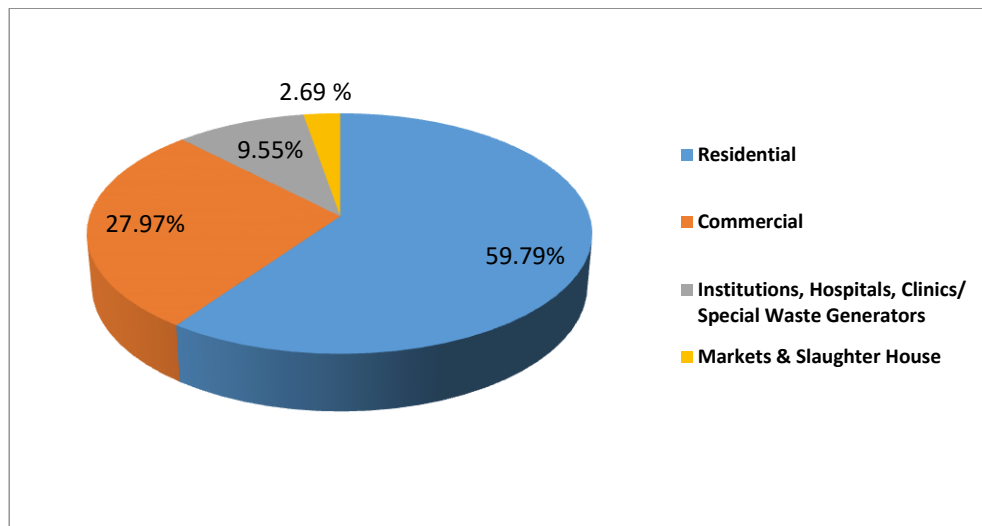
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Table 19 enumerates the quantity of wastes disposed from various waste sources in kilograms per day. It shows that out of the 52,409 kilograms of disposed waste per day, 41,246 kilograms/day or 77.48 % are biodegradable waste, while 8,919 kilograms/day or 16.75 % are residual waste, and 334 kilograms/day or .627 % constitutes special waste.

Meantime, the composition of waste disposed by source is presented in the pie-chart below.

Figure 18. Percentage Composition of Waste Disposed by Source



The illustration above indicates that 59.79 % of the quantity of wastes disposed comes from residential sources, while 27.97 % comes from commercial sources, 9.55 % comes from institutions and hospitals & clinics, and 2.69 % comes from the public market and slaughter house.

4.2 Diverted Waste

Some of the City's biodegradable waste are processed for animal feeding while recyclable materials are sold to accredited junkshops. Meantime, educational institutions are used to recycle plastic containers, straws, plastic bottles, etc. designed to create costumes during festivity. The table below shows the waste diversion in kilogram per day.



Table 20. Waste Diversion in Kilogram per Day

Major Waste Source	Waste Diversion in Kilograms		Total Waste Diversion in Kilograms per Day
	Recyclable	Compostable	
Residential	16,834	6,487	23,321
Food Establishment	1,600	4,591	6,191
Stores	153	300	453
Institutions	1,640	1,995	3,635
Industries	281	856	1,137
Public Markets	242	1,526	1,768
Recreational Centers	32	328	360
Slaughter House	15	184	199
Hospitals & Clinics (Special Waste Generators)	179	157	336
Service Centers	1,856	526	2,382
Grand Total	22,832	16,950	39,782

The data above implies that the highest diverted waste comes from the residential areas with 23,321 kilograms per day while the lowest waste diverted comes from special waste generators namely hospitals, clinics and the like.



4.3 Generated Waste

The daily waste generation at all source in the city is shown below.

Table 21. Waste Generation in Kilograms per day

Major Waste Source	Biodegradable	Recyclable	Residual	Special Waste	Total Waste in Kilograms/day
Residential	29,625	18,084	7,001	35	54,745
Food Establishment	16,091	1,850	466	94	18,501
Stores	450	218	300	20	988
Institutions	5,424	2,420	356	60	8,260
Industries	1,706	411	101	18	2,236
Public Markets	2,506	327	136	10	2,979
Recreational Centers	338	44	22	2	406
Slaughter House	384	19	14	3	420
Hospitals & Clinics Special Waste Generators	317	259	113	87	776
Service Centers	534	1,931	410	5	2,880
Grand Total	57,375	25,563	8,919	334	92,191

a) Biodegradable Wastes

Approximately 57.375 tons of wastes are generated per day where 62.23% is biodegradable materials* which is a vital input for entrepreneurial activities such as organic fertilizer production and marketing.

Biodegradable wastes compose of food/kitchen waste (fruit peelings, vegetable trims, soft shells, fish entrails, fowl innards, food leftovers), garden wastes (leaves, twigs, weed or uncultivated plants, flowers, fruits) and soiled toilet papers/wet papers or cartons.



b) Recyclable Wastes

Approximately 25.563 tons or 27.72 % of the total wastes generated per day are recyclable waste. This are derived from private establishment and public institutions in the city being the regional center of education, commerce and trade and the location of the Regional Government Center. Recyclable wastes compose of metals, tins, cans, bottles, glasses, hard/soft plastic containers, rubber, dry papers, boxes, cardboard, hard shells and other materials which can be re-used or recycled.

c) Residual Wastes

From the WACS result of the city, residual waste is approximately 8.919 tons per day. Residual wastes compose of disposal diapers, sanitary napkins, worn-out rugs, cartons for milk and juice containers, composite packaging(tetra packs), ceramics, candy wrappers/sachets, containers made from multiple layers of plastics/polyvinyl chloride (PVC) and other soiled materials that cannot be composted. The quantity of residual wastes generated has been reduced because some wastes categorized as residual like disposable glasses, rubber and others are being bought by junkshops.

d) Special Wastes

Approximately 334 kilograms per day or .362 % of the total waste generated are special wastes composed of Toxic and Hazardous Wastes (THWs) and Health Care wastes. THWs come in the form of dry cell batteries, lead-acid storage batteries, chemical containers, aerosol cans and related items, automotive rugs and discards, sharp materials and broken glasses/bottles, industrial or backyard production residue and sludge, and others. These wastes are disposed in a septic vault within the SLF compound. Some wastes toxic and hazardous waste are bought by junkshops who, in turn, sell them back to manufacturers for reuse.

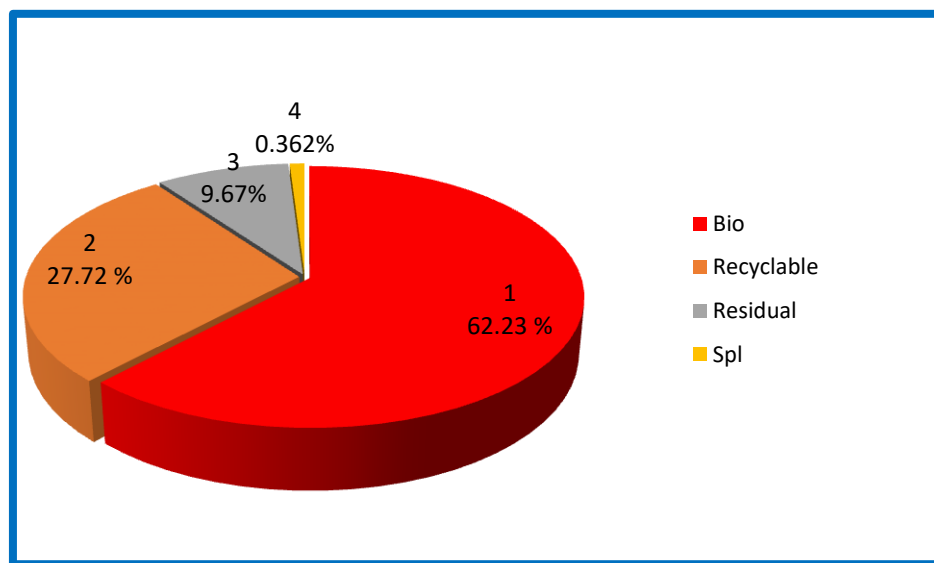
Health care wastes are generated by hospitals, clinics, funeral parlors and other health-related institutions in the form of bio-medical wastes from delivery rooms, operating rooms, emergency rooms, morgue, infectious urine and body fluids, sputum, organs and parts, expired medicine and other pharmaceutical products, used personal-hygiene and related products, contaminated linen, sheets, rugs, septic tank sludge



and related biomass. Generators of health-care wastes are mandated by RA 6969 to treat health care wastes and construct their own septic vault for the sanitary disposal of these wastes.

Figure 19 below indicates the percentage composition per classification of waste as to the waste generated/day gathered through survey and WACS result.

Figure 19. Percentage Composition per Classification



The per capita waste generation of Tuguegarao City is 0.60 kilograms per day which is higher than the national benchmark for cities which is 0.50 kilograms per day.

4.3 Projected Waste Generation

Projected waste generation is computed by multiplying the projected population of waste sources to the per capita waste generation (for households) and to the average waste generation (for commercial, institutions and other sources). Table 22 below presents the projected waste generation of waste sources in kilograms per day.



Table 22. Projected Waste Generation in Kilograms per Day

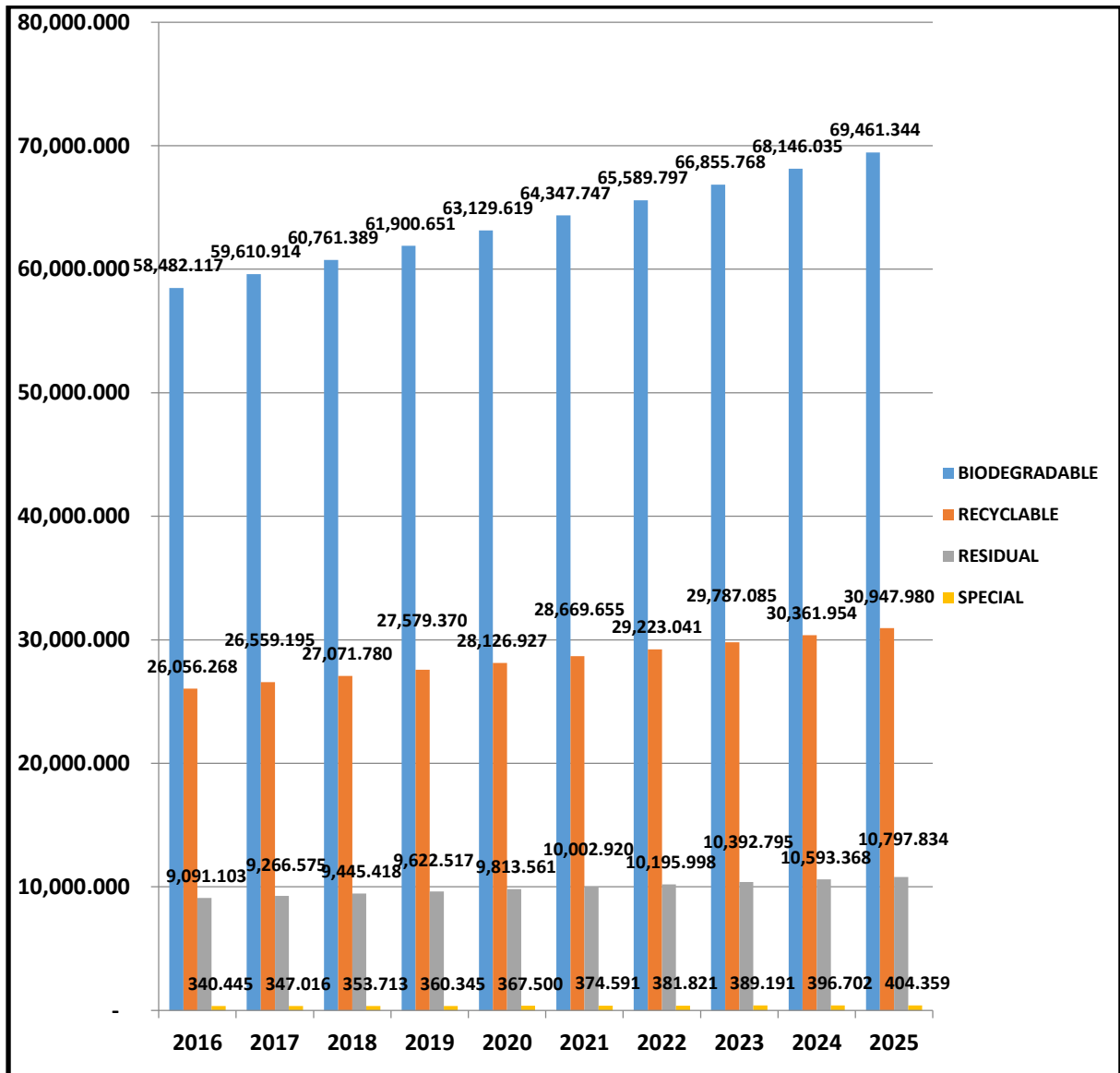
YEAR	BIODEGRADABLE	RECYCLABLE	RESIDUAL	SPECIAL	TOTAL
2016	58,482.117	26,056.268	9,091.103	340.445	93,969.933
2017	59,610.914	26,559.195	9,266.575	347.016	95,783.700
2018	60,761.389	27,071.780	9,445.418	353.713	97,632.300
2019	61,900.651	27,579.370	9,622.517	360.345	99,462.883
2020	63,129.619	28,126.927	9,813.561	367.500	101,437.607
2021	64,347.747	28,669.655	10,002.920	374.591	103,394.913
2022	65,589.797	29,223.041	10,195.998	381.821	105,390.657
2023	66,855.768	29,787.085	10,392.795	389.191	107,424.839
2024	68,146.035	30,361.954	10,593.368	396.702	109,498.058
2025	69,461.344	30,947.980	10,797.834	404.359	111,611.517
Cummulative Total	638,285	284,383	99,222	3,716	1,025,606
Average	63828.53815	28438.32541	9922.208832	371.5683092	102560.6407

The table above presents the projected waste generation by classification as basis in coming up with appropriate strategies to be implemented by the City Government in its Solid Waste Management Program. The data on residual waste for example, shall be the basis in coming up with the category and design of the Sanitary Landfill (SLF) to be established. It can also be the basis for decision makers on the Alternative Technology like palingogenesis, pyrolysis, black hole or other technologies like “Waste to Energy” that lead to Zero Waste Management.



Below is a chart comparison of projected waste generation per year (2016-2025).

Figure 20. Projected Waste Generation per Year (2016-2025)



The data in the above chart indicates that the projected waste generation increases every year for all types of waste. Biodegradable waste is still the highest contributor of waste generation while the least contributor is the special waste.

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Chapter 5. Legal and Institutional Framework

Republic Act No. 9003 otherwise, known as the Ecological Solid Waste Management Act of 2000 was enacted in response to the waste problem of the country. It mandates all public officials to implement the provisions of the law and to be conscious of the adverse effects of improper waste management and to address the problem.

Indeed, R.A 9003 provides the systematic procedure from generation to the disposal of waste. It likewise provides the standards for the generation, storage, collection, transport, segregation, and disposal of wastes. These standards are imposed to prevent health risks and hazards adverse to the environment and to the community.

5.1 Local Laws and Regulations

The City adheres to implement seriously the wisdom, intent and purpose of Republic Act 9003. With this, the City Government of Tuguegarao has enacted and implemented *City Ordinance No. 11-2000*³ with its salient features as follows:

**Table 23. Salient Features of City Ordinance No. 11-2000
vis-à-vis RA 9003**

Components of RA 9003	Major Components City Ordinance No. 11-2000	Requirements of the Law
Segregation into four(4) Classification: biodegradable, recyclable, residual and special	Segregation at source into two (2) classification: biodegradable and non- biodegradable.	Final segregation shall be undertaken prior to the disposal of wastes to effect waste into 4classifications
Segregated Collection	"No segregation, no collection" Policy	Segregated Collection
Processing and Recovery of Wastes	Waste recovery and processing at source	Processing and recovery of wastes

³ Solid Waste Management Ordinance of Tuguegarao City



No Burning Policy	Prohibition of open burning Incineration of hazardous wastes	No burning policy
No illegal dumping policy	Anti-littering	No illegal dumping policy
Fines and penalties for violations	Fines and Penalties for violations committed	Fines and penalties of violators
Collection of Fees for ESWM services provided by the LGU		Include in the amendment payment of Garbage Collection Fee and Tipping Fee (Disposal at the SLF)
ESWM Enforcers can be deputized	Deputation of Barangay officials, SK officials and barangay tanods as enforcers of the ordinance.	ESWM enforcers can be deputized

Aside from the said ordinance, there are also local executive issuances dealing with Solid Waste Management such as the following:

- 1) *Executive Order No. 09-2014* was issued “Establishing the Environment and Natural Resources Office of Tuguegarao City,” and
- 2) *Executive Order No. 20 Series of 2014* was issued “Creating an Interim Waste Management and Environmental Protection Office” to address the immediate needs of the City for solid waste management pending the passage of a city ordinance creating CENRO.

Meanwhile, the Sangguniang Panlungsod has enacted City Ordinance No. 09-2015 otherwise known as “An Ordinance Creating the Tuguegarao City Environment and Natural Resources Office and Appropriating Funds Thereof.” The TCENRO is composed of the following Sections, to wit:

- a. Environmental Protection and Law Enforcement Section
- b. Waste Management Section
- c. Parks and Tree Planting Area Maintenance Section
- d. IEC/ Special Projects Section

Tuguegarao City Environment and Natural Resources Office (TCENRO) of LGU-Tuguegarao City was created principally tasked to implement the provisions of Republic Act No. 9003 known as the Ecological Solid Waste Management of 2000, City Ordinance on Ecological Solid Waste Management and all laws, code or ordinances which may thereafter be passed or enacted pertaining to Ecological Solid Waste Management.



Moreover, the TCENRO implements the Ecological Solid Waste and environmental management programs and undertaking of the city.

5.2 Roles of City Solid Waste Management Board (CSWMB)

Republic Act No. 9003 mandates the organization of Solid Waste Management Board in every LGU. The Board is composed of different representatives from government and private sectors formulates policies, plans and programs for the management and disposal of city's solid wastes within their territories.

Tuguegarao City Mayor Atty. Jefferson P. Soriano recently issued Executive Order No. 66 series of 2017⁴ to reconstitute the Solid Waste Management Board of Tuguegarao City.

The City Solid Waste Management Board (see annex 4) performs major functions which include plan and policy formulation, program implementation and program monitoring and evaluation. It shall also provide technical assistance to the component barangays and perform the following:

- a) Develop the City Solid Waste Management Plan that shall ensure long- term management of solid waste, as well as integrate the various solid waste management plans and strategies of component barangays in its area of jurisdiction. In the development of the Solid Waste Management Plan, it shall conduct consultations with the various sectors of the community;
- b) Adopt measures to promote and ensure the viability and effective implementation of solid waste management programs in all its component barangays;
- c) Monitor the implementation of the City Solid Waste Management Plan through its various political subdivisions and in cooperation with the private sector and Non-government Organizations(NGO's);
- d) Adopt specific revenue - generating measures to promote the viability of its Solid Waste Management Plan;
- e) Convene regular meetings for purposes of planning and coordinating the implementation of the solid waste management plans of the respective component barangay;
- f) Oversee the implementation of the City Solid Waste Management Plan

⁴Executive Order Reconstituting the Solid Waste Management Board of Tuguegarao City



- g) Review every two (2) years or as the need arises, the City Solid Waste Management Plan for purposes of ensuring its sustainability, viability, effectiveness and relevance in relation to local and international developments in the field of solid waste management;
- h) Develop specific mechanism and guidelines for the implementation of the City Solid Waste Management Plan;
- i) Recommend necessary logistical and operational support to component barangays;
- j) Recommend measures and safeguards against pollution and the preservation of the natural ecosystem;
- k) Provide the necessary logistical and operational support to its component cities and municipalities in consonance with subsection (f) of section 17 of the Local Government Code; and
- l) Coordinate the efforts of component barangays in the implementation of the City Solid Waste Management Plan.

The CENRO acts as Secretariat in all its meetings and proceedings. It provides technical assistance and advisory to the Chairman and to the members on all matters pertaining to their functions. See Annex E for the composition of CSWM Board.

5.3 Barangay Solid Waste Management Committees (BSWMC)

The Barangay Solid Waste Management Committees (BSWMC) in all component barangays have been organized and reconstituted. They are required to formulate their Solid Waste and Environmental Management Plan (see Annex I).

Tuguegarao City Government through the TCENRO institutionalized the **Search for Cleanest and Greenest Barangays**, where all barangays are assessed and evaluated. Evaluation sheet is attached in Annex I.

CSWMB conduct participatory meetings with the Liga ng mga Barangay to align the solid waste management programs of the city and to monitor its Management (BESWM) Strategic Plan to insure that their plans are integrated, aligned and complimentary to the City Solid Waste Management Plan.



5.4 Stakeholders Participation

Tuguegarao City Government encourages participation of various stakeholders in the implementation of the city’s solid waste management, focused on waste reduction, segregation and waste recovery to ensure the sustainability of the city’s ESWM program.

Tuguegarao City Government through the TCENRO also launched the *Search for Eco-Friendly Schools in Tuguegarao City*. It is a search/contest for all the Elementary and High Schools in Tuguegarao City.

Listed below are the various stakeholders in the city and their roles.

Table 24. Current Activities of Stakeholders

Stakeholders	Current Activities	LGU Action for support
Tagga Group of Involved Stakeholders (TGIS)	Promotion of BESMAC Program in the Barangay	To conduct and sustain Search for Model Barangay on ESWM
Barangay Officials	Maintenance and declogging of drainage canals in the barangay Implement the Clean and Green Program Sustain the recycling program in the barangay IEC on proper waste segregation Implement Operation Linis and Tree Planting Activities of the City Government	Technical and financial support from the City Government To explore market for recycled products To sustain collection of non-biodegradable wastes in the barangay



Academe	<p>Conduct of IEC during students forums, assemblies and meetings</p> <p>Conduct research related to environment concerns</p> <p>Practice of 4 R's (reduce, re-use, recycling, and " respect")</p> <p>Rain water harvesting and adoption of conservation measures</p> <p>Required tricycles to provide receptacles inside their units</p> <p>Periodic environmental seminar for employees and students</p> <p>Conduct of IEC in adopted Barangays</p> <p>Periodic Tree Planting activities</p>	<p>Provide assistance for reproduction of IEC Materials and other training needs</p> <p>Strengthen and sustain partnership for environmental activities</p>
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National Government Agencies in the Regional Government Center	<p>Practice of waste reduction</p> <p>Segregation</p> <p>Tree Planting Activities</p>	Segregated Collection of Solid Waste
Barangay Base Rural Improvement Club (RIC)	<p>Recycling of wastes</p> <p>Participate in tree planting activities and clean up drives</p> <p>Conduct IEC</p>	Assists in the marketing the recycled products
TODA	<p>Provide waste receptacles in their tricycle units</p> <p>Maintain cleanliness in designated parking areas</p>	Provide IEC Materials on ESWM for every Tricycle Unit
BASURA RUN	<p>Cleaning of streets and collecting garbage along highway in cooperation with the PE students of Cagayan State University (CSU) and members of the Fun Run.</p>	Provide dump trucks to collect garbage they cleaned.
SIERRA MADRE OUTDOOR CLUB (SMOC)	Tree Planting	Provide IEC Materials



Chapter 6. Plan Strategy

6.1 Vision

Tuguegarao City adopts plan strategies to implement the provisions of the 10-year Ecological Solid Waste Management Plan. This chapter discusses goals and objectives of the city in addressing the problems of solid waste and in attainment of its vision and mission towards clean and green city of the north.

Tuguegarao City's Vision

"The Premier Ybanag City", a resilient and environmentally sustainable city with an empowered populace in collective action to uphold the principles of human dignity, equality and equity, actively working towards a diversified yet strong, vibrant and investment friendly economy; a richer cultural identity having the best peace and order situation in Northern Luzon; and taking pride of its action".

Tuguegarao City's Mission

Tuguegarao City Government is determined to provide its people a better perspective of governance: a local government one with its people in its desire for change and progress to improve lives through genuine service for the general welfare. It shall promote in the attainment of its vision "Environmental and Solid Waste Management and Mainstreaming of Disaster Risk Reduction and Management/Climate Change Adaptation".

In support of the plan strategy, it has to be emphasized that one of the **16-POINT AGENDA of Tuguegarao City Government** includes among others the "Efficient Implementation of Ecological, Environmental and Waste Management Plans and Programs". The City, therefore, adopted the following *Development Goals, Objectives and Strategies* as its road map to progress:

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Updated Ten Year Ecological Solid Waste Management Plan
CY 2016-2025



	Improved Quality of Life			People Empowerment		Good Governance
Constituency	Anti-Criminality focused on Crime Prevention 1 Anti-Criminality Plan	Traffic and Transport Management System 1 Transport Plan 1 Traffic Mgt Plan	Ecological Solid Waste Management Zero Waste Management Operational Sanitary Landfill	Youth Empowerment 3 Annual Searches for Ten Outstanding Youth Leaders	Women Empowerment Implementation of the Magna Carta of Women Implement GAD prog-rams, projects, and activities	Institutionalized Barangay People's Day Visit every barangay at least once a year
	Comprehensive Healthcare Program Reduced Infant Mortality Reduced Maternal Mortality Reduced Morbidity	Senior Citizens and Persons with Disabilities Development Expanded benefits to Senior Citizens and PWDs	Massive Tree Planting Pollution Control (Air, land, water, noise, etc.) Agro-forestry projects and management	Industrial and Commercial Development Establish 2 Micro Enterprises a year Support 6 existing Micro Industries/year Support City Pasalubong Centers	Globally Competitive Educational Environment Improved School Achievement Rate, Completion Rate, PRC Board Exams passing rate	Enhanced Business- and Client-Friendly Environment Business-Friendly City award 1 Permanent One-Stop-Shop for all services Simplified client service procedures
Infrastructure	Support to Farmers and Fisher Folk Update AFMA Plan Implement AFMA Plan	Enriched Ibanag Cultural Heritage 3 Annual Cultural Festivals Use Mother Tongue in Basic Education Create City Tourism Office	Strengthened CDRRM and CCA 100% delivery of basic services to all disaster victims Develop and maintain City Tree Park, Family Park, Hillside Flower Park	3 Pavvurulun Trade Fairs Livelihood projects	Assist multi-purpose cooperatives	Encourage people participation in programs and policy formulation
	Road construction and road widening	Integrated Flood and Water Management Plan	Strengthened DRRM and CCA 50% structural and non-structural measures implemented	Livelihood and Training Centers	Compliance with Accessibility Law	Establish 1 Command Center, 47 Barangay Action Centers Build 3 Welcome Arches

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Finance	Allocation and appropriation of funds for the implementation of all programs, projects and activities		Strengthened DRRM and CCA Disaster prevention and mitigation, preparedness, response, rehabilitation and recovery programs	Operational City website Create position for Webpage developer/administrator	Resource generation and modernization	Enhanced Fiscal Management 10% p.a. increase in Revenues Full implementation of the Public Financial Management Improvement Plan
Organization	Creation/ Organization of Local Bodies and Councils	Composite Response Team	Strengthened DRRM and CCA Trained BLGUs, schools, businesses, rescue teams and volunteers	Update Human Resource Development Plan 100% officials and employees skilled and knowledgeable	Increased NGO, CSO and PO participation in policy formulation and implementation	Full implementation of the Strategic Performance Measurement System Anti-Red Tape Act implementation

DRRM - Disaster Risk Reduction and Management CCA - Climate Change Adaptation

City's Solid Waste Management Goals and Objectives

Tuguegarao City Government's Solid Waste Management Goals and Objectives shall be as follows:

- To institutionalize waste reduction and segregation at source
- To implement an effective and efficient waste collection scheme
- To adopt a strategy that promotes re-use, recycling and composting
- To fully implement the safe closure and rehabilitation plan of the existing controlled disposal facility
- To establish an Eco Park with SLF facilities
- To adopt alternative technology for residual wastes
- To create employment and additional livelihood opportunities through the city's ESWM program;
- To instill discipline among its constituents thus transforming them to responsible waste managers; and
- To ensure the active involvement and participation of all stakeholders in the City's ESWM program

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6.2 Targets

6.2.1 Waste Diversion Targets

RA 9003 mandates a mandatory 25% waste diversion five (5) years after its implementation with significant increases thereafter. The volume of waste to be diverted is computed by multiplying the projected volume of waste by the desired rate. Percentage of waste diverted and disposed for 10-year period will be shown below in table 25.

Table 25. Percentage Diverted and Disposed

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
% Diverted	50	55	75	87	89	89	89	89	89	89
% Disposed	50	45	25	13	11	11	11	11	11	11

6.3 Strategies

Waste Reduction

Programs, projects and activities to reduce waste at source are the following:

- 1) Use of indigenous and biodegradable packaging materials;
- 2) Encourage consumers to purchase large volume or quantity of goods;
- 3) Promote re-use and recycling of materials;
- 4) Encourage backyard composting;
- 5) Minimize the use of plastic and other non-biodegradable materials;
- 6) Promote and adopt other environment-friendly practices;
- 7) Enactment of local ordinances for the reduction of waste; and
- 8) Implementation of programs that provide incentives on the use of indigenous materials.

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Segregation at Source

Both urban and rural barangays, wastes is segregated into Four categories: (1) biodegradable waste or "nabubulok"; and (2) recyclable waste (3) residual waste; both are non-biodegradable or "di-nabubulok" and (4) special waste.

Collection and Transport

- 1) In urban barangays, all types of wastes from the business establishments and residential houses is collected by the city government along with its "No Segregation, No Collection Policy" in all the areas of collection points. For rural barangays, only the "di-nabubulok" (residual and special wastes) is collected at designated pick-up points of the barangay.
- 2) "Door to door" collection for commercial and urban barangays is adopted and collection from Barangay Materials Recovery Facility (MRF) and pick points is done at rural barangays.
- 3) The city shall strictly impose the policy that waste will be set out only on the time and date of scheduled collection. Waste trucks will be equipped with public address system to alarm the persons concerned of the presence of the waste collectors and trucks for them to bring out their waste for collection.

Recovery and Processing

Recoverable wastes from urban barangays is managed at the Central MRF situated in the disposal site. The MRF is equipped with composting facility, an area for factory returnable materials and another area for temporary storage of toxic and hazardous waste (THWs) which are collected by factories and manufacturers for proper decontamination, treatment and disposal.

In rural barangays, household level waste generator is mandated to establish their respective compost pit for biodegradable wastes.

A purok or barangay MRF is strategically established to serve as pick-up points for recyclable wastes, THWs and residual wastes.



Final Disposal

Residual wastes are disposed in Sanitary Landfill for the proper handling, management and disposal of wastes. The SLF is equipped with facilities and amenities to ensure the health and sanitation of personnel that are involve in the operations and maintenance of the SLF such as wash area to ensure the cleanliness and decontamination of garbage collection trucks and other equipments

Sustainable greening of the buffer zone is undertaken to ensure odor control and non-proliferation of insects and rodents and such activity is shown under Figure 21.



Figure 21. Greening of Buffer Zones



Cleaning and planting activity undertaken by the City Government to the buffer zones of the City's Disposal Facility.

Other Strategies in the Implementation of the City's Solid Waste Management Program

The solid waste management programs of the City shall also be implemented with such other strategies as follows:

- 1) Encourage full support and participation of stakeholders;
- 2) Efficient, intensive and massive waste collection efforts;
- 3) Strengthen the partnership of the City Government and component barangays for collaboration;

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- 4) Massive information and education campaign to ensure involvement of all sectors;
- 5) Strict monitoring and evaluation on the implementation of the plan;
- 6) Strict implementation of environmental laws and ordinances;
- 7) Prosecution of violators and imposition of stiffer penalties;
- 8) Adoption and implementation of programs for incentives and awards to recognize best implementers on ESWM;
- 9) Encourage public-private sector partnership (PPP).
- 10) In anticipating the would-be established manufacturing companies in the city, it will be the policy of the City Government of Tuguegarao to require each manufacturing company to: 1) comply with the conduct of EICs, 2) submit their toxic release inventory, and 3) update the City government of their strategy in handling their final waste disposal.



Chapter 7. Solid Waste Management System

Using the Solid Waste Management Profile, other relevant data and the results of the Situational Analysis, the City through the City Solid Waste Management Board (CSWMB) adopts and implements Solid Waste Management System that aims to address the concerns on SWM from source generation until its final disposal. It adheres to the four (4) stages of solid waste management and compliance to existing environmental laws on pollution control, liquid waste and toxic and hazardous waste management.

7.1 Source Reduction

Source reduction is the primary goal of solid waste management following the hierarchy of reuse, reduce and recycle. These strategies decreases the volume of disposed waste quantities and pollution risk.

The City Environment and Natural Resources Office and BESWMC are tasked to facilitate the Information Education and Communication campaign on proper waste management. They will also be tasked to sustain public awareness particularly at the household level on waste segregation, backyard composting and recycling of materials. The IEC activities is channeled thru quad media such as radio and local cable television programs, distribution of flyers and posting of slogans and placards.

Adoption of a policy on the utilization of improvised bag out of paper as alternative to the use plastic bags in packing products or commodities. An ordinance shall be enacted regulating the use of plastics bags for packaging.

Schools and other educational institutions shall ensure that waste management shall be incorporated in their curriculum in the primary, secondary and college level.

Barangays, business establishments, NGO's and private organizations shall be given incentives as provided in Section 45 of RA 9003.

The City Government with the support of the BSWMC, will monitor the source reduction and segregation at source in households, business establishments, schools, hospitals and office. The City in coordination

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with the EMB, shall deputize enforcers from Punong Barangay, Purok Leaders, Barangay Tanods, SK, and Barangay Chairman on Environment Protection, stakeholders and other institutions.

Periodic survey or assessment will be conducted on households, business establishments and other waste generators on their compliance with the solid waste management practices.

Table 28 below presents the schedule of source reduction programs of the city.

Table 26. Schedule of Source Reduction Programs

Programs	Persons involved	Schedule of Implementation
1. Information dissemination campaign		
a. Waste segregation at source	Households per zones	2014 - 2026
b. Establishment of vermin composting and household compost pits.	Barangay officials, households, schools	2014-2026
c. Supply of labeled bins	Business establishments schools/universities offices	2014-2026
d. Establishment of functional MRF's	Barangay/s, schools/ Universities, malls	2014-2016
e. Trainings and technology demonstration on the production of organic fertilizer production	Farmers	2014-2015
f. School-based seminar on SWM and agriculture	Elementary (pupils and teachers)	2015-2022
g. Meetings and barangay assemblies	Barangay officials and the community	2014-2026
h. Organized Recycling group on charcoal briquetting and trainings and production of charcoal briquette takes place.	Tuguegaro Federation of Women's Club	2015



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2. Establishment of vermi bed at the demo farm and barangay/s	City Agriculture Office, 4 A's Club, household and barangay/s	2014-2026
3. Production of organic fertilizer.	City Agriculture Office, 4 A's Club, household and barangay/s	2014-2026
4. Organized recycling groups on the production of pillows, bags, slippers, apron etc.	Senior citizens, youth and RIC's, BNS and BHW's	2014-2026
5. Incentives and Awards Program		
a. Conduct Search for Cleanest and Greenest Barangay.		2014-2026
b. Conduct Search for Eco-Friendly Barangay.		2014-2026
6. Mandatory requirement on the construction of MRF's and composting facility at the household and barangay level.	Household/barangay officials	2014-2017
7. Start-up on the implementation of segregated collection	Households, barangays, business sectors and other schools	2016
8. Monitoring and Evaluation on the reduction of waste	City ENRO and City General Services Office	2015-2026



7.2 Collection

7.2.1 Overview

Waste collection services shall be the shared responsibility of the Barangays and the City. The collection scheme shall be systematic, hygienic and cost-efficient. The City shall intensify its collection efforts to ensure efficiency of waste collection and proper disposition in appropriate facilities designed and constructed for the purpose.

For rural barangays, management of biodegradable, compostable and recyclable will be the responsibility of the Barangays. The City Government, on the other hand, shall collect residual and special wastes from designated pick-up points in the barangays. An incentives program for barangays with functional MRFs shall be established to ensure the systematic management of biodegradable and recyclable waste in rural areas. The City will establish various redemption areas to buy back the waste.

For urban barangays, collection of segregated wastes shall be the responsibility of both the City and the barangays for those with space to put up MRF and composting areas. Pick-up points and schedule for storage and set-out shall be established to ensure the smooth and systematic collection of solid waste in urban areas. The City shall likewise establish various redemption areas to buy back the waste.

Only segregated waste shall be collected and shall only be on the date and time designated for collection. Unauthorized establishment of dumping areas shall be prohibited and considered as illegal to be dealt with in accordance with law.

7.2.2 Collection Equipment and Routes

The City has the following waste collection vehicles as shown below.

Figure 22. Collection Vehicle of the City Government



In the photos above are the waste collection vehicles of the City Government for purposes of implementing its Solid Waste Management Policies and Programs

For rural barangays, collection equipment such as mini dump trucks, pedicabs or pushcarts shall be used to transport waste from the households to the Barangay MRF. Financial and other types of assistance shall be provided to the barangays to ensure proper and sanitary collection of wastes.



The Tuguegarao City Government purchased one (1) unit of medical waste van for collection of hospital, toxic and hazardous wastes as shown in the pictures below.



Collection Frequency and Routes

Using the average waste generation per day of urban and rural barangays and the types of wastes being collected by the City as basis, the frequency of collection is as follows:

Table 27. Collection Frequency

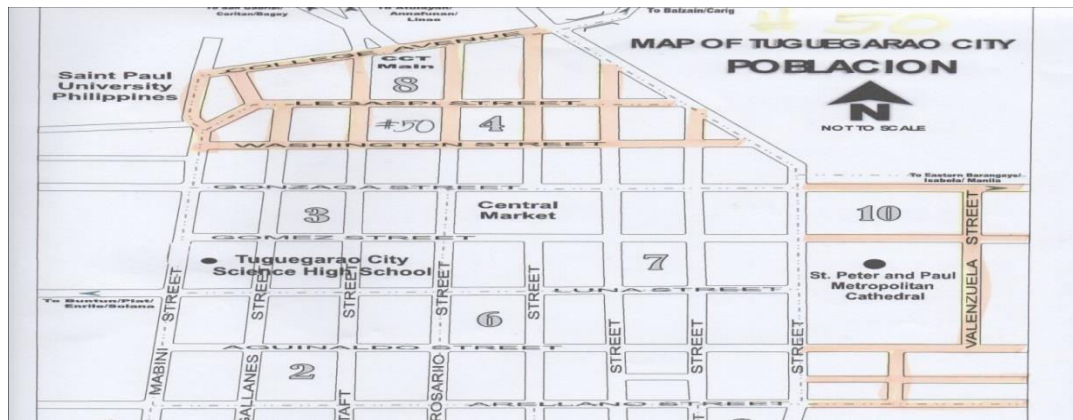
Brgy.	Collection Vehicle	Capacity (tons)	Frequency
Urban	2-Dumptruck	6	Daily
	1-Dumptruck	3	
	1-Dumptruck	3	
	1-Dumptruck	3	
	1-Dumptruck	3	
	1-Dumptruck	3	
	1-Dumptruck	6	
Rural	2-Dumptruck	6	2x a week
	1-Dumptruck	3	2x a week
	1-Dumptruck	3	2x a week
	1-Dumptruck	3	2x a week
	1-Dumptruck	6	2x a week
	1-Dumptruck	8	2x a week
	1-Dumptruck	3	Once a week
Rural	1-Dumptruck	3	2x a week Once a week
Rural	1-Dumptruck	3	2x a week Once a week
Rural	1-Dumptruck	3	2x a week Once a week

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Further, figure 23 below shows the route for waste collection within the Poblacion.

Figure 23. Route of Waste Collection within Poblacion



For urban barangays, the collection route shall be the pick-up or curb points of adjacent and nearby barangay. Each collection team shall be given specific pick-up points/barangays to cover with a back-up team to augment street sweepers and waste collectors.

Meanwhile, for rural barangays the transport of biodegradable and recyclable wastes from source to the Barangay MRF shall be the responsibility of the barangay while residual and special wastes shall be collected by the City Collection Team from pick-up points.

In alleys or streets not accessible by the collection vehicle, the residents shall be mandated to bring their special and residual wastes in designated pick-up points. A policy shall be enacted to ensure the systematic collection of wastes.

Waste collection vehicles will be equipped with public address system for efficient collection of waste (1) to prevent scavengers and astray animals from scattering the waste in the streets or unauthorized dumping areas and (2) to impose as policy the proper setting out of waste on given time and date.



Schools and other business establishment (waste generators) shall provide their own collection equipment to transport their own waste at the City disposal site. The collection equipment is designed to meet the requirement of the waste generator and service area with that of the frequency of collection and also the number of trips a certain truck collects waste.

Data on the quantity of wastes collected from the different barangays shall be recorded and monitored to serve as guide in designing and redesigning the collection frequency and route.

Table 28 below presents the list of additional vehicles and equipments from calendar year 2014 to 2017.

Table 28. List of Existing and to be Acquired Collection Vehicles and Equipments

VEHICLES/ EQUIPMENTS	No. of Units as of C.Y. 2016	No. of Units Acquired or to be Acquired for the Year								
		2017	2018	2019	2020	2021	2022	2023	2024	2025
Garbage Truck	19				2					2
Compactor			4							
Wheel type loader	3									
Crawler type bulldozer	2									
Wheel type backhoe	1									

The table above indicates that for the next nine (9) years, Tuguegarao City Government will be purchasing 4 additional garbage trucks while it will purchase in C.Y. 2018 four (4) units of garbage compactors to anticipate the waste collection.

7.2.3 Private Collection Service

The City Government may allow the entry and contracting of private haulers for the collection of waste to cope with the demands of waste collection particularly from commercial complex and subdivision houses. Private establishments and home owners associations may contract out the services of private haulers for the collection of their waste.

7.2.4 Storage and Set-out

The City Government requires the different sectors to provide their own labeled trash bins suitable for the quantity and type of materials to be disposed. The Barangay Officials shall inform residents how to handle solid waste for collection through policies and guidelines. In residential areas, plastic containers/drums are required for waste storage. Garbage bins should be placed in alleys or at curbsides designated as pick-up points. Accumulated waste at street sides are collected through push carts to be hauled to garbage trucks. Schools, malls and hospitals are required to provide their respective establishments the prescribed labeled trash bins.

Complex commercial establishments and malls are required to have their own material recovery facility for waste storage, segregation, sorting and collection points.

Figure 24. Trash Bins



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Compliance of business establishments and schools in providing properly labeled trash bin

7.2.5 Segregated Recyclables

Barangays are responsible in the management and collection of the recycled waste within their respective barangays. Each barangay or clustered barangays shall establish its own Materials Recovery Facility (MRF) as drop-off centers. Collectors of different barangays shall collect waste per zone from household through pushcart that shall be brought to the MRF. On a monthly basis, recovered wastes from the barangays shall be collected by an accredited junkshop monthly and the corresponding amount of such shall be given to the owner of the recyclable wastes or may donate it for whatever purpose it may serve.

An incentive and awards program shall be given to barangays with functional MRFs.

7.2.6 Segregated Compostables

The MRF shall accommodate the composting facility in rural barangays. Collection of biodegradable waste from household through pushcart is on a daily basis and shall be brought to Material Recovery Facility (MRF) or composting facility for processing. Two eco-aides and a resident of the barangay shall be assigned at the Material Recovery Facility to process and be responsible of the production of organic fertilizer. To be free from paying garbage collection fees, residents with an area for composting shall be encouraged to put up their backyard compost pits. The City started implementing segregated collection for

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compostable waste at the public market and presently garbage truck drivers deliver biodegradable waste at the Demo Farm to processed vermin cast.

Garbage trucks are used to transport the compostable waste to a composting facility from the public market; the frequency of collection shall be on a daily basis. Plastic containers are provided to each garbage truck to place leftover foods.

Barangays are tasked to collect compostable waste with the use of pushcarts and pedicabs to be brought to their composting facility.

The City Government provides assistance to the households which have areas for establishing vermin composts. The said assistance would be in the form of construction materials. The implementation of this undertaking forms part of the Bottoms-Up Budgeting scheme of the National Government through the Department of Agriculture.

7.2.7 Mixed Solid Waste/Residuals

The collection shall be done by the City Government on a daily basis at the city proper while the northern, western, and eastern barangays the frequency of collection shall be twice a week

Below is the table showing the types of collection vehicle, capacity & collection frequency for 5 years from 2017 - 2021.

Table 29. Types of Collection Vehicle, Capacity and Collection Frequency for 5 years from 2017 - 2021

Vehicle	Capacity (tons)	Collection Frequency	Period of implementation				
			2017	2018	2019	2020	2021
Garbage Truck	3	Daily	x	x	x	x	x
Garbage Truck	6	Daily	x	x	x	x	x
Garbage Truck	8	Daily	x	x	x	x	x
Garbage Compactor	10	Daily		x	x	x	x



Plans for Collecting Residuals

The City Government scheduled separate collection of residual waste from the urban barangays and rural barangays. Residual waste collected from the different barangays shall be placed and disposed in a landfill cell.

Plan to Increase Coverage of Collection Service

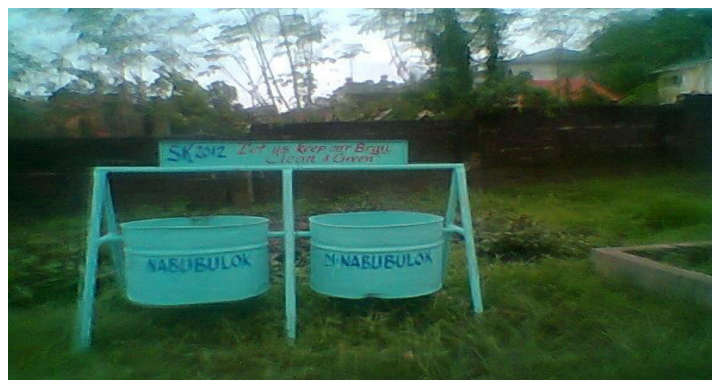
The Materials Recovery Facilities and designated pick-up points at the clustered barangays are collected by the City Government on a scheduled basis.

7.3 Segregation, Recycling and Composting

7.3.1 Segregation

In compliance to the City Ordinance No. 11-2000, there are specified fines and penalties for violators and all waste generators are mandated to segregate waste at source. Properly labeled and segregated receptacles shall also be situated in public places, institutions, business establishments and along roadsides to support the mandatory segregation of waste at source as discussed earlier.

Figure 25. Roadside Garbage Bins



Properly labeled garbage bins along roadsides



Strategy For Segregation

The following are the segregation strategies:

1. Financial and technical assistance for the establishment and construction of MRF and bio-composting facilities.
2. Establish linkages with the market outlets of recycled and recovered wastes.
3. If necessary, extend assistance in the massive and extensive collection of waste per purok.

Plan Implementation

1. Continuing implementation, monitoring and evaluation of existing PPAs.
2. Upgrade existing facilities
3. Provide collecting vehicles and facilities

7.3.2 Recycling

A recycling group shall be organized to manage and operationalize the recycling activities of the City in the Barangay and Central MRF. The primary goal of recycling is to recover materials of value and resell to buyback centers.

The secondary goal is to reduce the amount of residual waste to be disposed in order to lengthen the lifespan of the landfill site.

Schools/institutions shall integrate in their curriculum the recycling of waste which will be promoted in coordination with the Department of Trade and Industry in terms of marketing.

The City Government will provide technical trainings for the operation and management of MRF, records keeping and financial management of retrievals and recycling activities.

Facility for the clustered barangays shall be established to house the four (4) hammer mills and four (4) briquetters which were funded by the Department of Trade and Industry under the Bottom up Budgeting (BUB) program of the government. The beneficiaries were grouped into four clustered barangays responsible for the technology on the production and marketing of charcoal briquettes.

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Another facility was already established in the barangay for trained members of the RIC responsible in the technology on the production of basket, bags, rope, mats etc out of water lily.

Strategy For Recycling

The following are the recycling strategies:

1. Financial and technical assistance for the establishment and construction of MRF and bio-composting facilities.
2. Establish linkages with the market outlets of recycled and recovered wastes.
3. If necessary, extend assistance in the massive and extensive collection of waste per purok

Plan Implementation

1. Continuing implementation, monitoring and evaluation of existing PPAs.
2. Upgrade existing facilities
3. Provide collecting vehicles and facilities.

Figure 26. Recyclable Bags



Livelihood bags made out of recyclable materials

Figure 27. Sewing of Apron and Finished Product

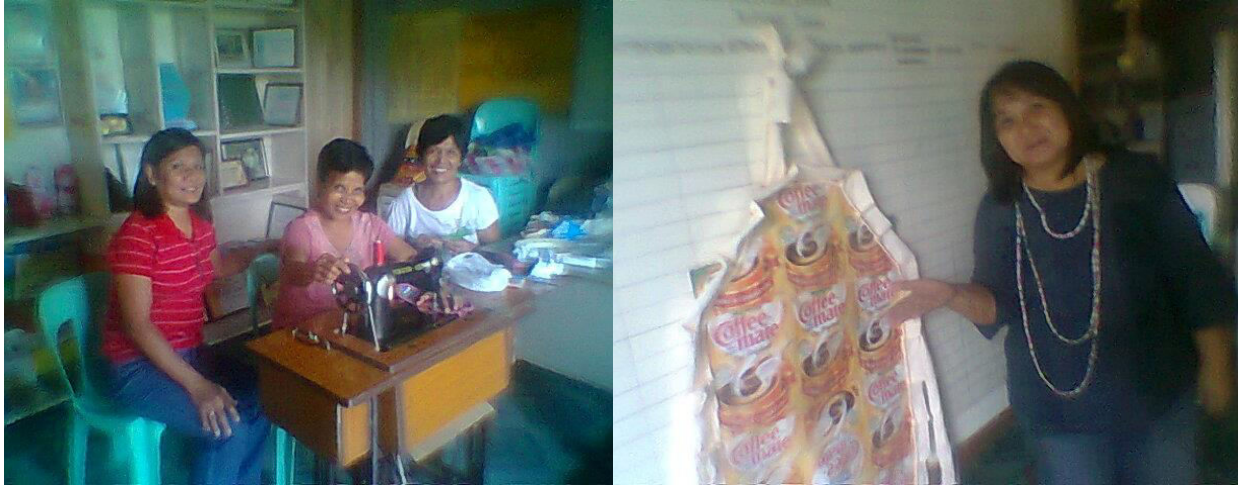


Figure 28. Production of Lei, Bags, Flowers and Slippers



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Livelihood products made out of recycling materials

7.3.3 Composting/Management of Biodegradable Waste

Composting facility with equipment shall be established in the MRF situated at the SLF site. The facility shall have three (3) stage components: (1) final sorting; (2) composting; and (3) recycling areas.

The City Government through the City Agriculture Office shall implement and disseminate information to encourage the barangays on backyard composting of biodegradable waste. Barangay health workers and other barangay-based institutions will support the various programs on waste diversion and conversion of biodegradable waste to fertilizer.

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Educational institutions shall be encouraged to sustain and intensify their composting and recycling activities through grant of incentives and awards by the City Government.

Figure 29 below shows the vermin composting of some residents in the City while figure 30 presents the other form of composting.

Figure 29. Vermin Composting



Household vermin composting

Figure 30. Other Forms of Composting



Meanwhile, the composting facility located at the demo farm consist of ten (10) units of culture beds with a dimension of 1.0m x 3.0m to cater biodegradable waste collected from the public market with an existing capacity of 3,000 kg. per day. (see annex G for quantities of compostable waste per barangay)

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The group of “Magsasaka Syentista” supports other farmers as a start-up for vermin composting by donating one (1) kilo of worm (night crawler) for the operational /establishment of composting areas. The City Government through the City ENRO and City Agriculture Office monitor and enforce the provisions on the establishment of culture beds or composting areas at the households and barangay levels.

Methods of determining categories of biodegradable waste for diversion

For recycling:

Waste diversion through recycling promotes economical recovery and re-use of waste materials. To encourage recyclers of waste materials, the following actions may be considered:

- Identification of prospective markets for recycled materials.
- Determination of income vis-à-vis the cost of production.
- Determination of business ownership or proprietorship.

- Drop-off-centers- shall reduce the transportation cost, barangays shall provide storage bins at regular points to prevent overflow of materials.
- Buy Back Centers- private buyback centers for marketable materials.

For Composting:

Waste diversion through composting of biodegradable waste will be undertaken with the following :

- Pilot Projects in different barangays.
- Testing of results on the nutrient contents of the products.
- Feasibility study on the economic and financial viability of the program.



7.3.4 Marketing and Market Development

Marketing of organic fertilizer or compost and other recycled products shall be undertaken with technical assistance from the Department of Trade and Industry (DTI). This shall be managed by the Rural Improvement Club (RIC) to be assisted by the City Agricultural Office and Technology and Livelihood Development Office. Organic fertilizer produced at the landfill site can also be used at the demo farm of the City Agricultural Office and can be given as assistance to farmers.

Recyclables from households are brought to barangay MRF or drop-off centers to be sold to junkshops. Other recyclables brought to sanitary landfill are stored in the City MRF and are sold to accredited junkshop. Below is a table showing the estimated price per kilogram of recovered materials.

Table 30. Estimated Price for Every Type of Recovered Materials

Type of Recovered Materials	Estimated Price per Kilogram
Bakal	Php10.00
Lata (Tin Can)	Php2.00
Plastic	Php6.00
Yero	Php4.00
Various Bottles	Php2.00
Carton	Php2.00
Paper & Newspaper	Php3.00

Evaluation of procurement preferences for compost and recycled materials shall be studied through research from Department of Trade and Industry and Department of Agriculture the evaluation of the feasibility of the procurement preferences for the purchased of compost products as to the grant of price, the farming community is still on the development of upgrading the test results of Nitrogen, Phosphorus and Potassium (NPK) content of the product before they can decide on the best price for compost.



7.4 Transfer

7.5 Alternative Technology for Residual Wastes

The City shall adopt alternative technologies that shall transform residual waste into economically viable uses.

7.6 Disposal

The city disposal site is located near the border of the Municipality of Iguig and it is about 1.4 kilometers from Maharlika Highway. The site could be accessed through a narrow varying 3-6 meter wide rugged road that leads towards the wide alluvial plain of the area. The estimated travel time from the main collection area could range from 20 to 30 minutes.

7.6.1 Solid Waste Disposal Capacity

The City Waste Disposal Facility has an area of 10.06 hectares, a portion of which was utilized as service roads for collection vehicles. A portion of the lot was allocated for the Administrative Building and City's Material Recovery Facility. To prolong the lifespan of the landfill cell, only residual wastes will be accepted in the landfill cell.

Below is a table that describes the projected volume of residual wastes for 10 - year period.

Table 31. Projected Volume of Residual Waste

Year	Volume of Residual Wastes (Kg/Day)
2016	9,091.103
2017	9,266.575
2018	9,445.418
2019	9,622.517



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2020	9,813.561
2021	10,002.920
2022	10,195.998
2023	10,392.795
2024	10,593.368
2025	10,797.834
Annual Average in 10 Years	9,922

Meanwhile, the city has to sustain the increase of waste diversion from source every year through recycling and composting programs. Waste segregation at source and segregated collection shall be strictly implemented in the City. Massive information dissemination shall be conducted to the different barangays. Setting up and establishment of composting areas and MRF/s, schools and other institutions shall be implemented to increase waste diversion. Second sorting shall be implemented at the disposal site.

The remaining area of the existing disposal capacity is approximately three (3) hectares so it can accommodate the waste more than ten (10) years, provided only residual waste shall be accepted and disposed in the landfill cell.

The overall plan of the City is to have second sorting of waste at the City Dumpsite. The type of waste to be disposed at the cell is the residual waste. Biodegradable waste shall be delivered to composting facility provided by the barangays or clustered barangays while recyclable materials shall be disposed through junkshops. For 2015, the City Government allocated a budget for the purchase of another lot for future expansion of the City disposal facility to accommodate residual waste.

The projected amount of disposal capacity needed to accommodate residual waste over 10-year period, the phase 2 landfill cell having a area of two (2) hectares will be constructed to accommodate the residual waste to be disposed. (see Chapter 6 table 25 for the discussion and illustration of waste disposal target.)

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7.6.2 Existing Facilities

The controlled dumpsite has an administrative building with a floor area of 84.50 square meters and it has a Material Recovery Facility with an area of 320 square meters equipped with 3 units shredder, 1 unit shiever and 2 units rotary composting drums. The facility also has an existing deep well, with a 70% completed perimeter fence and a sufficient supply of electricity.

The city was issued a permit by NTP to convert open dumpsite into a controlled dumpsite. The open dump mentioned is the same with that of the controlled dump applied for an Authority to Close issued by the EMB regional office. As specified in the conditions/guidelines of the NTP, a brief information of the closure plan was forwarded to the regional office for the conversion of the two (2) open dumping areas into a controlled dump site in the portions of the 10 hectare lot as mentioned in Chapter 3. Copy of SCRCP issued by EMB Region 02 is provided in Annex "K".



Figure 31. Administrative Building at the SLF Site



Established administrative building at the Sanitary Landfill

Meanwhile, the floor plan of a centralized Materials Recovery Facility at the SLF site with compartments for the storage of recyclable materials and vermi beds for compostable waste is typically shown below.

Figure 32. Floor Plan of MRF

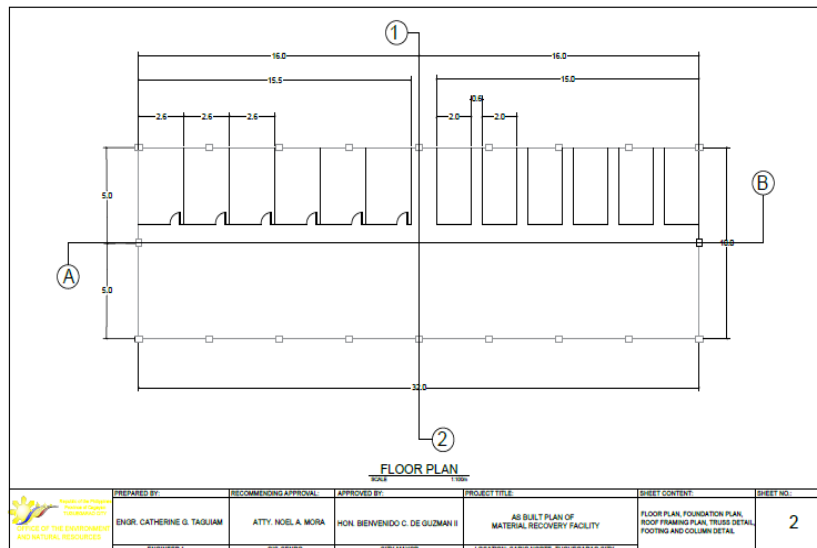


Figure 33. Materials Recovery Facility at the SLF Site



On left photo is the proposed floor design of Material Recovery Facility (MRF), while the right photo shows the existing structure of a Materials Recovery Facility (MRF) at barangay Carig Norte, Tuguegarao City

Figure 34. MRF Equipments



Rotating drums and bioreactor for City MRF



Figure 35. MRF Equipment for Acquisition



Plastic Shredder



Glass Pulverizer

Meanwhile, perimeter fence was constructed with 4 layered concrete hollow blocks and above the concrete blocks is provided with cyclone wire framed with G.I. pipes for every (three) 3 meters interval as illustrated below.

Figure 36. Perimeter Fence at the SLF Site





7.6.3 New Facilities

The construction of sanitary landfill facility as final waste disposal at Carig Norte, Tuguegarao City will meet the requirements of RA 9003. Below is the figure showing the Sanitary Landfill Location Map and the Site Development Plan.

Figure 37. Sanitary Landfill Location Map

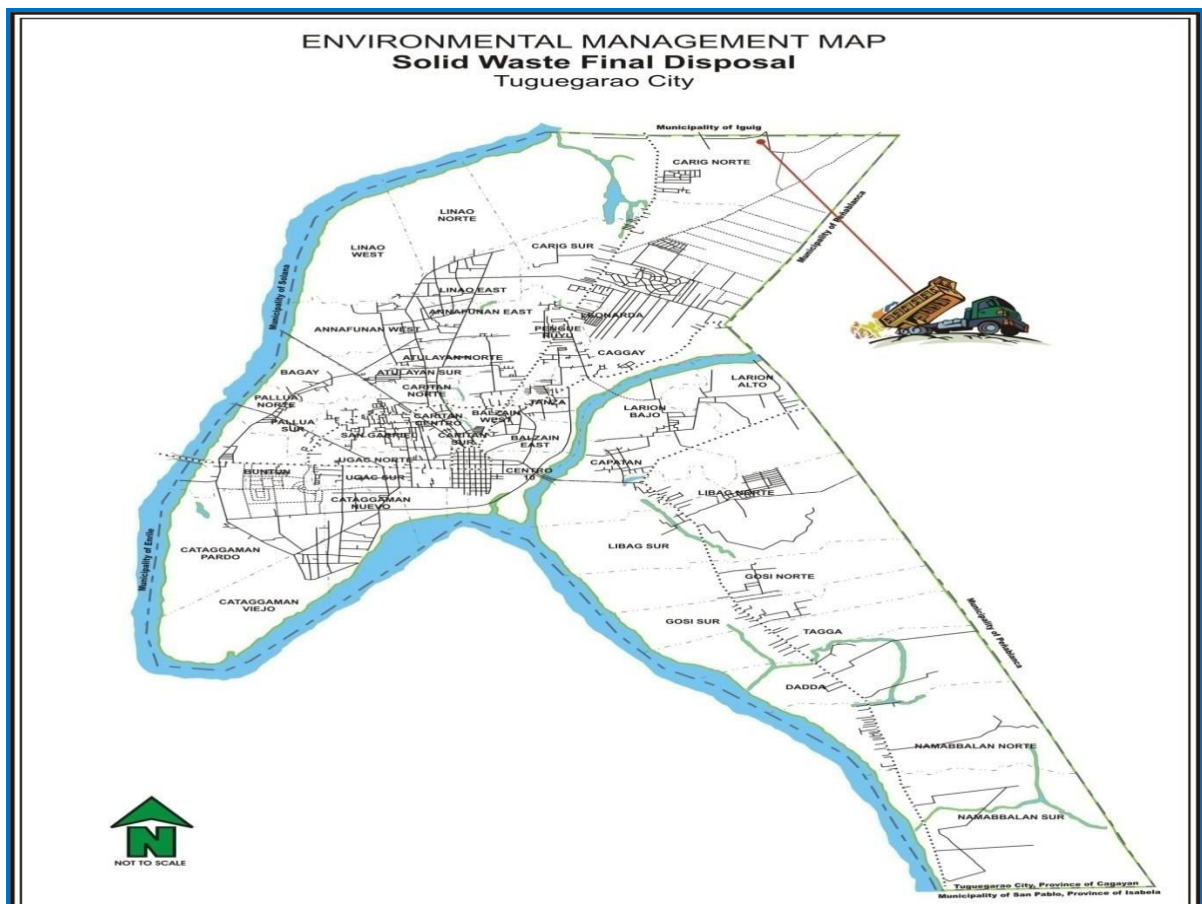
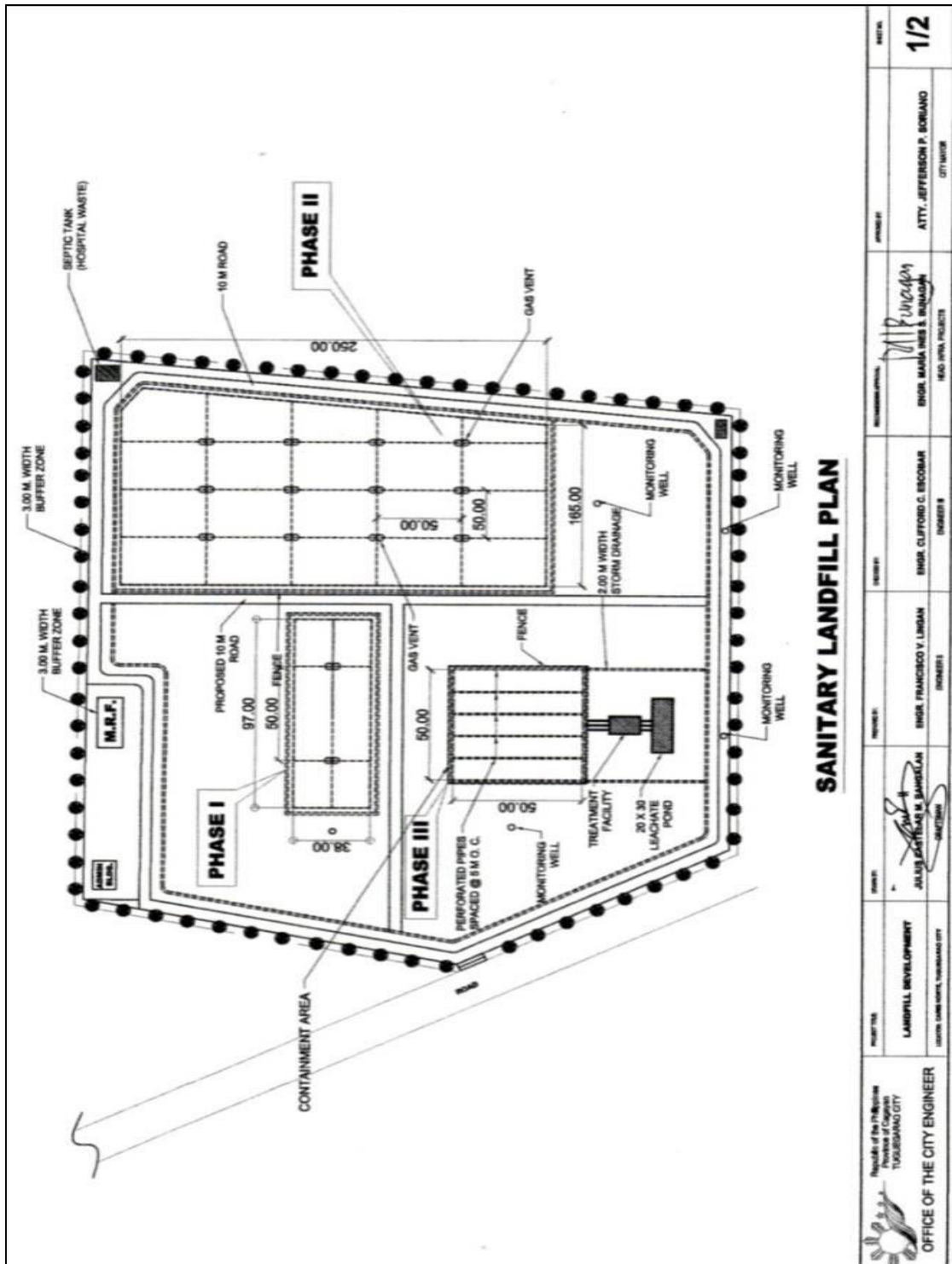




Figure 38. Site Development Plan



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7.6.4 Categorized Disposal Facilities at SLF

Design

The sanitary landfill is designed for residual wastes only. Table 32 below presents the volume of residual wastes (kg./day).

Table 32. Volume of Residual Wastes

Year	Volume of Residual Wastes (Kg./Day)
2016	9,091.103
2017	9,266.575
2018	9,445.418
2019	9,622.517
2020	9,813.561
2021	10,002.920
2022	10,195.998
2023	10,392.795
2024	10,593.368
2025	10,797.834
Average Annual Residual Waste for 10 Years	9,922.20

The average annual residual waste for ten (10) years is 9,922 kg/day. Using the empirical formula in converting kilograms to cubic meters, the corresponding value in cubic meters is 3506.28 cu.meter.



Meanwhile, the basic formula in computing the design of the landfill capacity is given below:

$$DLC = \{ADLV + CMV\} \times TLS$$

Where:

DLC = Design Landfill Capacity

ADLV = Annual designed landfill volume (in cubic meters)

CMV = Soil cover volume (in cubic meters)

TLS = Target Life Span

Applying the same formula, the target lifespan of the first cell is approximately eight (8) years. (Detailed computation is in the annex L)

SLF Cell

The Landfill Development plan includes the construction of SLF cell for phase 1 with an estimated area of one (1) hectare having a lifespan of 8 years and the other SLF cell for phase 2 shall be established with an area of 2 hectares having a lifespan of 14 years, provided only residual waste shall be disposed on the two (2) landfill cell.

Below is the typical SLF design.

Figure 39. Typical SLF Design Cross Section of Cell



SLF DESIGN CROSS SECTION OF CELL

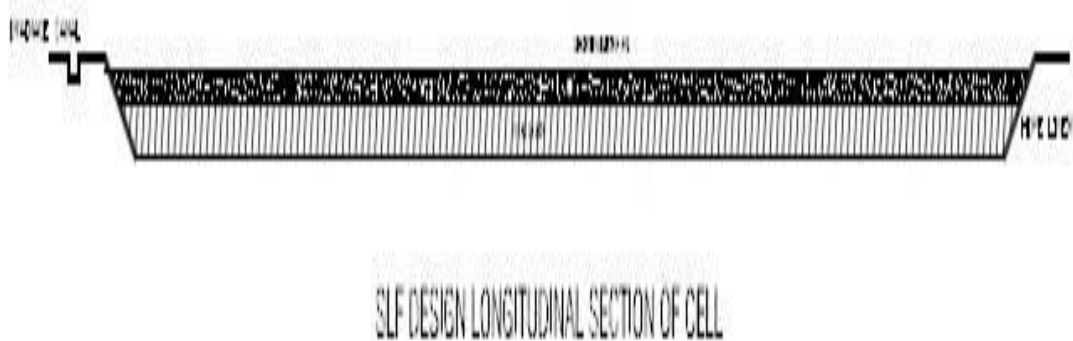


HDPE Liner

Supply and installation of HDPE liner is necessary to act as a barrier and to provide sealing by preventing the leachate from penetrating into the ground that will contaminate ground water.

Below would be the figure showing the SLF design longitudinal design section of cell.

Figure 40. Typical SLF Design Longitudinal Section of Cell



Leachate Collection System and Leachate Pond

Leachate is drained and collected to the leachate pond through the perforated pipe installed above the HDPE liner connected directly to the leachate pond.

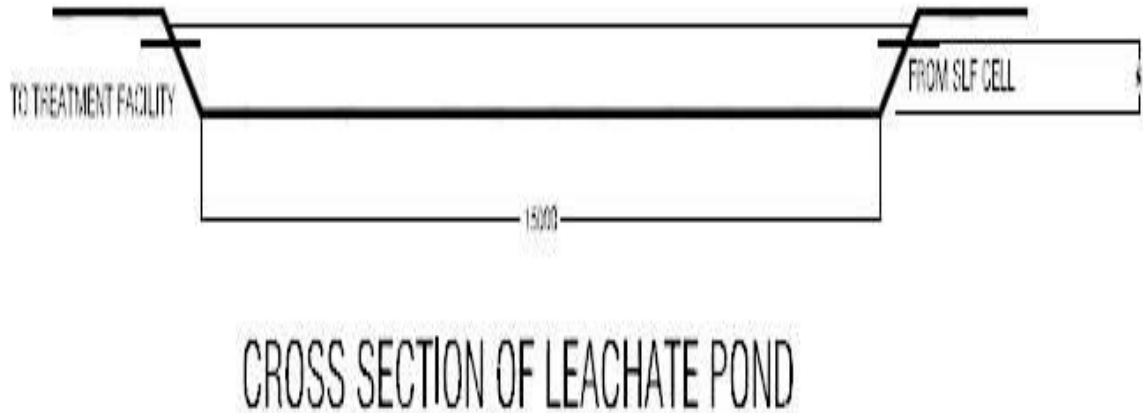
The leachate pond to be constructed has a dimension of 10m x 20m x 3m. The construction of leachate treatment facility (see Annexes on the design and detail) can also improve the quality of leachate and effluent quality to be discharged into river and creeks.

The moisture content of mixed waste ranges from 20% to 25 % as per study of students from College Chemical Engineering of the Cagayan State University.



Below is the typical cross section of leachate pond.

Figure 41. Typical Cross Section of Leachate Pond



Gas Vents

Gas vents shall be provided at the SLF cell because of various gases from the process of decomposition from disposed waste.

Drainage Canals

The Landfill site shall be provided with drainage system for intercepting run-off water from entering the landfill area. It may regulate discharge flow and trapping of settle able solids at the landfill site.

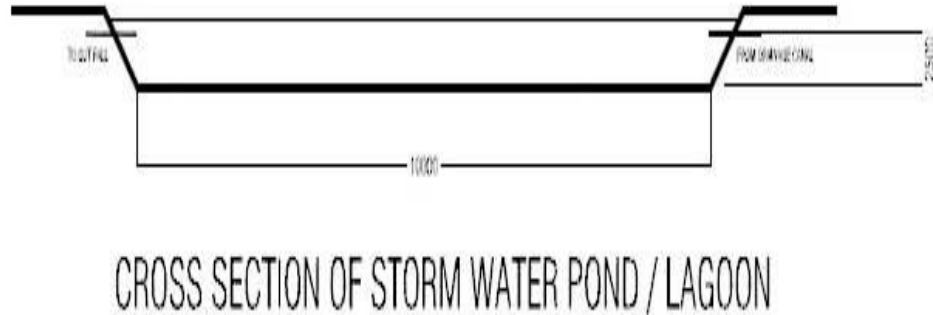
Storm Water Pond or Lagoon

A drainage canal shall be constructed at the landfill site to collect rainwater through gravity flow and shall drain into the storm water pond or lagoon.

Below is the figure showing the typical cross section of storm water pond or lagoon.



Figure 42. Typical Cross Section of Storm Water Pond/Lagoon



Access Road

To ensure a safe passage of collection vehicles and smooth traffic flow especially during rainy seasons, concreting of roads shall be implemented starting from Saint Claire Monastery to the Landfill Site. Some of the areas inside the landfill site shall be utilized as service roads to be concreted and other areas shall be covered with mixed gravel.

Monitoring Wells

Monitoring wells shall be constructed at the upstream and downstream of the landfill site in order to check the quality of groundwater to ensure that the liner system of the landfill site is functioning well without leakage. Secondly to detect any pollution so that remedial works can be carried out to prevent the extent of pollution on the groundwater surrounding the landfill site.



Weighbridge

Weighbridge is a basic requirement for landfill site to record the weight of incoming waste. It will be installed at the entrance of the landfill site. As a general guideline, a landfill receiving more than 50 tons a day of solid waste is required to have weighbridge installed.

7.7 Special Waste

Special waste like batteries, bulbs, canister and paint cans shall be tightly packed and sealed, stored in a vertical storage shed type building to be constructed at the sanitary landfill.

Table 33. Estimated Quantities of Special Waste to be Generated in the Future

Special Waste	Average Quantity (kg./day)
Assorted home appliances	28
Assorted home furniture and fixtures	32
Assorted batteries	14
Assorted cell phones	10
Assorted paint / thinner containers	60
Rugs/worn out clothes	36
Spray canister	30
Assorted used tires	80
Other chemical containers	47
Hospital waste	15
Busted Bulbs	20
Total	372 kg./day



In the table above, the average quantities of special waste to be generated in the future would be estimated to 372 kilograms per day.

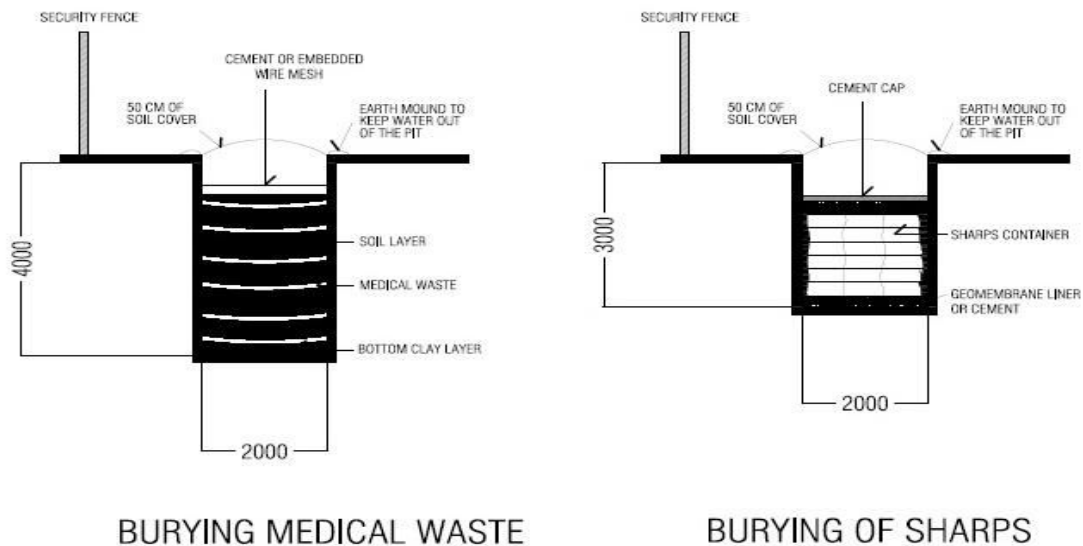
7.7.1 Health Care, Toxic and Hazardous Waste

Public and private hospitals, funeral parlors and other toxic waste generators are required to construct their own septic tanks and/or vaults for health care, toxic and hazardous waste. The City Government, in coordination with EMB, shall strictly monitor the compliance of these institutions to RA 6969 particularly on the proper handling and disposal of toxic and hazardous waste.

Bulky Non-Toxic Waste

After recovery, special wastes which are bulky but non-toxic nor hazardous shall be stored in the vertical structure located SLF site as shown in the figure below.

**Figure 43. Bulky Non-Toxic Waste
to be Disposed in SLF Cell**





7.8.1 Information, Education and Communication (IEC)

The TCENRO, with coordination of the different stakeholders, shall undertake the following IEC strategies in the implementation of this ESWM plan such as:

1. Conduct of continuous IEC to different barangays;
2. Posting of tarpaulins, billboards in the different strategic places of the different barangays;
3. Attending barangay assembly as resource speakers on proper waste management;
4. Law enforcement
5. Apprehend violators of R.A. 9003
6. Annual search for cleanest and greenest barangays
7. Annual search for eco-friendly schools
8. Requiring all business establishment and household to post the slogan "Tapat ko Linis Ko, Basura Ko Pananagutan Ko"
9. Requiring all tricycle units to post the sticker "Basura ng Pasahero Ko, Pananagutan Ko"
10. Print and broadcast media

The purpose of IEC activities is to strengthen the communities like household residents, barangay officials, religious leaders and business sectors on their participation in the implementation of RA 9003. The support of the stakeholders is very significant in attaining of the ESWM objectives. A specific information shall be disseminated in order to change every individuals behavior in the management of waste.

Target Audience for the IEC to be conducted shall be the following:

- LGU officials and Employees
- Barangay Officials
- Academe represented by School heads
- Household
- Market vendors and TODA
- CAFC's/Farmer



7.8.2 Core Messages

Target audience contributed their core messages during the IEC.

After the initial conduct of IEC, it was expected that reduction of waste on the total waste generation of the city shall take place.

Table 34. Core Messages

Target Audience	Core Messages	School/CAFC'S
LGU Official, Barangay Officials, Farmers	Tapat ko, Linis ko! Kung hindi tayo, sino? Ang mangunguna Sa pag-aayos ng basura. Increase production and income resulting to ecological and economical impact. Integrate organic farming in the production of crops resulting to climate change mitigation and adaptation.	
Academe	Young and old we are called stewards of the environment. What we do to nature, we do to ourselves. Now is the time to protect what is still in the environment.	Saint Louis University



7.8.3 Approach

The different sectoral approaches that will be used as part of the IEC will be the following:

1. For schools – there’s a need to integrate SWM in the curriculum and make ESWM as a way of life to the students.
2. For TODA – to require them to attend the orientation seminar for renewal of tricycle franchise and mayor’s permit.
3. Market Vendors – to require them to attend in their regular meeting on waste management.
4. Barangays – to conduct information dissemination during barangay people’s day and barangay assemblies relative to waste management.
5. CSOs and other sectors – to conduct information dissemination during their meetings.
6. Business Establishments – to conduct orientation on waste management.

Below is the table showing the planned IEC Activities.

Table 35. Planned IEC Activities

Purpose	Target Audience	Subject of message	Method	Responsible Person	Monitoring Plan
1.Segregation of waste at source	Household	Segregation at source	During barangay assemblies	City ENRO, DENR-EMB and other Stakeholders	Conduct monthly inspection of barangay officials on the compliance household per “purok” on the provisions RA 9003
a.Establishment of MRF b.Provisions of labelled garbage bins	Barangay officials				and every barangay should have to submit a monthly monitoring report to City ENRO for purposes of coming up with a
2. Percentage of waste diversion goals on composting and recycling.	Barangay Officials/Tanods	Waste diversion through composting and recycling			
3.Enforcing / penalizing of violators of City Ordinance 11-		Penalized violators			



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2000 on Anti-Littering Law					monitoring & assessment report of every barangays compliance.
4.Segregation of waste at source 5. Waste Reduction through minimization for the usage of plastic packaging materials.	Establishment	Segregation at source with supported IEC materials.	Interpersonal meetings, during renewal of mayor's permit	City ENRO, DENR-EMB and other Stakeholders	Conduct monthly monitoring on the compliance of what were discuss during meetings.
6.Segregation of waste at source 7.Waste recovery through "Eco-savers program"	Schools	Segregation at source	During meetings, symposiums	City ENRO, DENR-EMB and other Stakeholders	Conduct monthly monitoring on the compliance of what were discuss during meetings
8.Conduct of information, education campaign	TODA	Segregation and provisions of trash bins	During meetings	City ENRO	Conduct of meetings every Thursday prior to the release of Mayor's Permit

Implementation schedules on information activities are indicated in Chapter 12 table 48 under education component. Simultaneous to the construction of infrastructure will be the groundwork for the participatory side of the Solid Waste Management Programs.

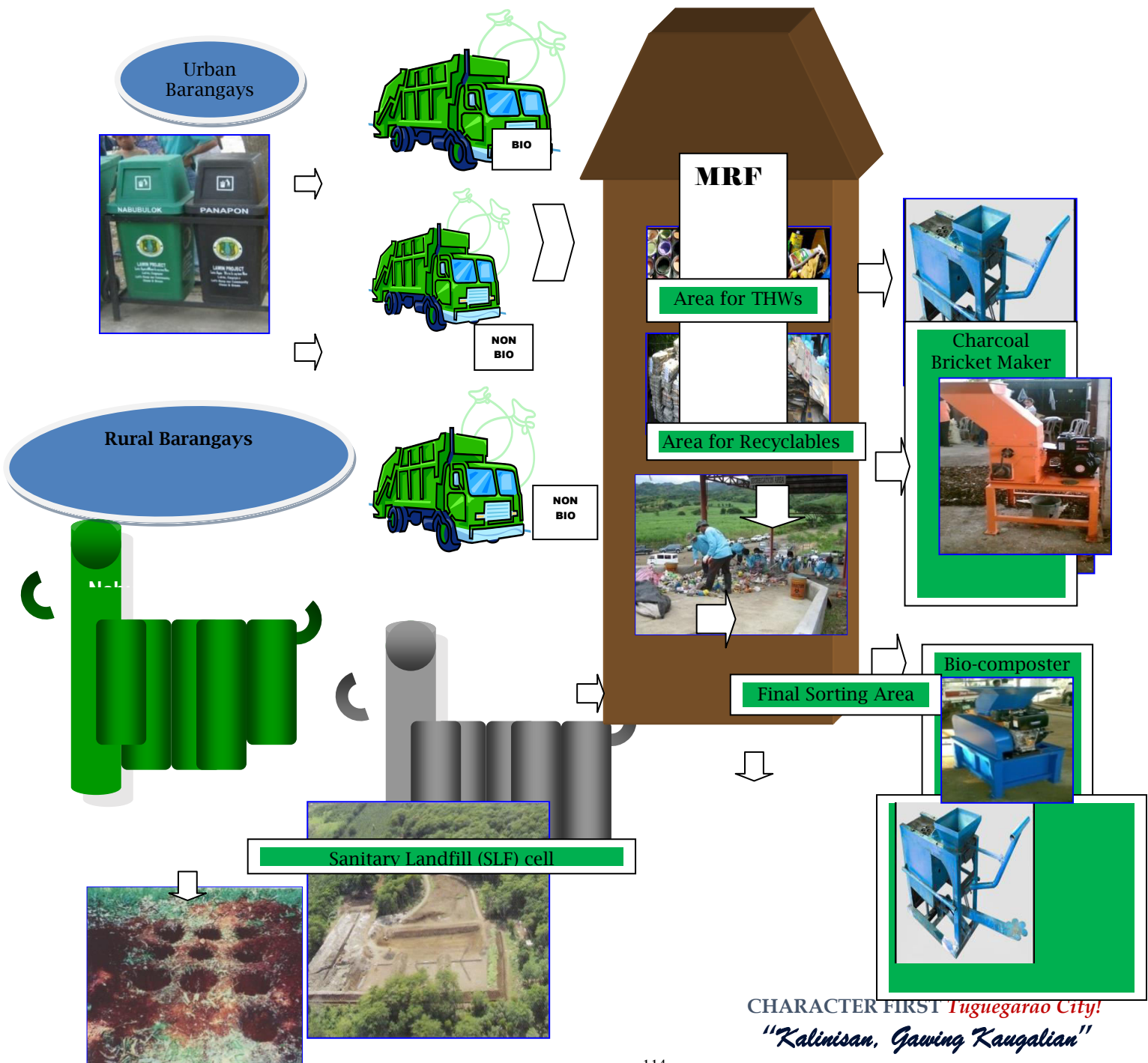
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Chapter 8. Implementation Strategy

8.1 Framework

The Solid Waste Management Program of the City shall operate in this general framework as shown in the figure below. Segregated waste at source shall be collected and transported to the Barangay/Central MRF for final sorting, recovery and processing. Then the remaining refuse shall be disposed in the SLF cell or septic vault.

Figure 44. General Framework of Tuguegarao City Solid Waste Management Program



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8.2 Diversion Projections

To meet the mandated diversion requirement, the table below presents data for types of waste materials diverted.

Table 36. Comparison of Waste Diversion Targets to the Quantity of Wastes to be Diverted

Year	Waste Generated/ Capita/ Day(kg)	Projected Population (1.93% growth rate)	Daily Waste Generated	% Diversion Target	Waste To be Diverted(kg)	% to be Disposed	Waste to be Disposed	% Biodegradable Waste to be Diverted (62.23%)	Biodegradable Waste (kg)	% Recyclable to be Diverted (27.72%)	Recyclable (kg)
2016	0.6	156,464	93,878.40	50	46,939.20	50	46,939.20	30	28,163.52	20	18,775.68
2017	0.6	159,484	95,690.40	55	52,629.72	45	43,060.68	35	33,491.64	20	19,138.08
2018	0.6	162,562	97,537.20	75	73,152.90	25	24,384.30	50	48,768.60	25	24,384.30
2019	0.6	165,610	99,366.00	87	86,448.42	13	12,917.58	60	59,619.60	27	26,828.82
2020	0.6	168,898	101,338.80	89	90,191.53	11	11,147.27	62	62,830.06	27	27,361.48
2021	0.6	172,157	103,294.20	89	91,931.84	11	11,362.36	62	64,042.40	27	27,889.43
2022	0.6	175,480	105,288.00	89	93,706.32	11	11,581.68	62	65,278.56	27	28,427.76
2023	0.6	178,867	107,320.20	89	95,514.98	11	11,805.22	62	66,538.52	27	28,976.45
2024	0.6	182,319	109,391.40	89	97,358.35	11	12,033.05	62	67,822.67	27	29,535.68
2025	0.6	185,838	111,502.80	89	99,237.49	11	12,265.31	62	69,131.74	27	30,105.76

8.3 Monitoring Program

To ensure smooth implementation of programs, projects and activities indicated in the plan, periodic assessment shall be conducted by the Board and its TWG. The Plan Implementation Schedule (see Chapter 12) shall be the basis in coming up with a monitoring device to assess the success of the program.

Important data like average volume of waste diverted and disposed shall be maintained by the City ENRO to monitor success in waste diversion and waste reduction strategies being implemented. Junkshop owners shall also be enjoined to keep track of the volume of recyclable wastes being bought and sold to supplement data of the City ENRO. For barangays, a monitoring tool similar to the Policy Audit and Compliance Tracking System (PACTS) utilized by the DILG, shall be device to monitor their compliance to the mandates of RA 9003. The compliance of barangays can be rewarded through an incentives and awards program for best implementers on ESWM.

Three years after the implementation of the City’s ESWM Program, monitoring and evaluation (M&E) to assess program impacts on various stakeholders shall be undertaken. Results of the M&E shall be the basis for policy formulation and program redesigning and innovation.



8.4 Incentive Programs

Tuguegarao City government will provide incentives to the different stakeholders mentioned in the lists below.

Incentives may come from projects, cash rewards or awards, financial assistance, tax holidays, exemption from paying garbage or tipping fees and other forms of incentives, grants or assistance.

Title of Program	Target Sector	Incentive/Awards
Best ESWM Implementer	Households	Plaque & Cash Award
	Barangays	Plaque & Financial Assistance for development projects
	Schools	Plaque and financial assistance for educational materials and study tours
	Hospitals and Clinics	Plaque and financial assistance for educational materials and study tours
	Funeral Parlors	Plaque and financial assistance for medical equipment and medicine
	Private Sector/NGO and other groups	Plaque and financial assistance or cash award
		Plaque and cash award
Observance of the “no plastic bag” policy	Business establishments	Plaque, cash award or tax incentive
Model Family on Waste Reduction Practices	Households	Plaque and cash prizes
Most Functional MRF	Barangays	Plaque and cash award



Chapter 9. Institutional Aspects

9.1 Roles

Every stakeholder has a task in the implementation of the various stages of the plan. The active involvement of all the stakeholders will contribute to the attainment of the objectives and targets of the 10-year Solid Waste Management Plan.

Below is a table showing the roles and functions of the different stakeholders.

Table 37. Roles and Functions of the Stakeholders

Stakeholders	Roles and Functions
City Solid Waste Management Board	<ul style="list-style-type: none"> • Monitor & oversee the implementation of the City Solid Waste Management Plan of the City • Policy formulation and provide technical assistance to component barangay. • Crafting of the 10-year City Solid waste Management Plan of the City
Barangay Solid Waste Management Committee	<ul style="list-style-type: none"> • Formulates policies and strategies on SWM at the Barangay level • Prepares action plan for monitoring system • Effectuate efficient system and effective solid waste management in the barangay level.
Barangay Officials	<ul style="list-style-type: none"> • Formulates Barangay ordinance for the implementation of solid waste management programs. • Deputized solid management enforcers • Penalized violators of the Law, ordinance, rules and regulations
Schools /Institutions	<ul style="list-style-type: none"> • Conduct Information education campaign for the proper practice of waste segregation at elementary, secondary and college levels.
Business Establishments	<ul style="list-style-type: none"> • Provide garbage bins for waste segregation and support ESWM Programs
Non-Government Organizations	<ul style="list-style-type: none"> • Create livelihood programs on recycling of waste to reduce waste disposed at the City dumpsite.



Households	<ul style="list-style-type: none"> • Practice waste segregation at source for p[roper collection and disposal. • Provide space for backyard composting for compostable waste.
Junkshop Organization	<ul style="list-style-type: none"> • Participate in the accreditation on the buying of recyclable waste at the Barangay level.

9.2 Legal

The plans of the City Government to update and implement the programs on solid waste management are based primarily on the wisdom and intent of the salient provisions of Republic Act 9003 as well as the enacted local ordinance of the city particularly City Ordinance 11-2000 otherwise known as the “Tuguegarao City Ordinance on Solid Waste Management”.

With the legal basis on hand, the TCENRO conducts extensive apprehension on violators of Republic Act 9003 and the aforementioned city ordinance.

Eventually, the TCENRO apprehended violators of illegal dumping and littering of waste in areas not designated as pick up points. The City Environment and Natural Resources Office conducted trainings for street sweepers, garbage truck drivers and waste garbage collectors as deputized environmental law enforcers and agents.

The City Environment and Natural Resources Office is one of the signatories in the Application Form for the renewal and/or registration of business establishment. A Compliance Certificate is issued to owners of business establishment after showing proof of compliance that such establishment is equipped with four (4) properly marked waste bins by the owner/operator/proprietor.

9.2.1 Recommended Changes to City Structure (TCENRO as Department)

Tuguegarao City Government through the passage of appropriate local legislation shall expand the City Environment and Natural Resources Office(TCENRO) to a Department which will be principally

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tasked in the sustainable implementation of the Solid Waste Management Programs (see Attached Structure). The expansion of the Office into a Department shall strengthen the effective mechanism in addressing the concerns in the implementation of all SWM programs of the City.

Comprehensive Environmental Management Code of Tuguegarao City

There is likewise a need for the passage of **Comprehensive Environmental Management Code of Tuguegarao City** which will embody the City's ideals, mission and vision in seriously undertaking its commitment to protect and enhance the environment and ecology.

9.2.2 Amendments of Zoning and Building Codes

The updating of the Comprehensive Land Use Plan and the corresponding City Zoning Ordinance shall be taken into serious consideration since the proposed SLF has to be programmed for such purpose. No permit of occupancy shall be issued by the City Government for buildings, subdivisions and condominiums unless there are provisions for the planting of trees and ornamental plants as part of the cleanliness to be implemented. Owners or administrators of old and abandoned buildings should maintain clean surroundings and free from informal dwellers. They should give support by beautifying the surroundings of the lot. Further, the issuance of a Development Permit for all kinds of subdivisions shall first secure and submit Environment Impact Assessment and Environment Compliance Certificate coming from the Department of Environment and Natural Resources which shall be posted at the barangay hall for strict monitoring of the implementation of the project. In the issuance of mayors permits an ordinance mandating the provisions of two (2) kinds of receptacle in the establishment.

9.2.3 Measures to Impose Penal Provisions

The City Ordinance on proper waste management and disposal of waste shall be amended and integrated in the Comprehensive Environment Code which shall provide the appropriate fees, charges, fines and penalties to be collected and imposed pursuant to the provisions of Republic Act 9003 and Republic Act No. 7160.

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The following national laws shall be used as basis in the enactment of City Ordinances to supplement the provisions of the City Ordinance on Ecological Solid Waste Management by the Sangguniang Panlungsod of Tuguegarao, to wit:

1. Republic Act No. 10068, an act providing for the development and promotion of organic agriculture in the Philippines and for other purposes,
2. the Sanitation Code,
3. Clean Air Act and
4. Climate Change Adaptation.

9.2.4 Other Legal Requirements

The City Mayor shall require at least one member of household especially the head of the family, applicants for marriage license, city scholars and applicants for business permits to attend trainings and seminars on Ecological Solid Waste Management.

As earlier stated, the City shall institutionalize the grant of award and incentive programs on Solid Waste Management to encourage citizen's participation and involvement. Environmental Trust Fund shall be allocated from the regular budget and those derived from the payment of fines, penalties and fees to be used exclusively for environmental management programs.

The City Solid Waste Management Board shall create a committee in-charge for the formulation of the criteria and guidelines for the awards and incentive programs.

The City Government in coordination with the DENR-EMB shall deputize enforcers and agents tasked to implement Solid Waste Management and other Environmental Laws, Ordinances, Rules and Regulations. The deputized law enforcement officers and agents shall have the authority to apprehend violators. Under RA No. 9003, barangays are principally tasked to implement the provisions of Ecological Solid Waste Management Act are considered persons in authority and shall have the power to enforce the law, institute appropriate actions and impose corresponding penalties.

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Chapter 10. Social and Environmental Aspects

10.1 Social Aspects

10.1.1 Significant Social Impacts from Community-Based SWM

Socio- Economic Benefits

The Solid Waste Management(SWM) program to be implemented shall meet the demand of the fast growing population, business establishments, institutions and other industries that flourish in the City. It shall also be an additional source of revenue for the City.

Health Benefits

Waste burning especially plastics and other heterogeneous wastes could result in the emission of toxic substances in the air. Hence, open burning is strictly prohibited at the City Sanitary Landfill. To avoid accidental fires, it is therefore recommended that gases generated from waste layers could be removed by using gas vents. Daily covering of solid waste and well compacted be implemented to control the presence of flies, rodents and minimizes odor.

Informal dwellers at the landfill site shall not be allowed. Illegal dumping shall be prohibited in roads and waterways to avoid clogging of drainage system. Leachate coming from waste can contaminate ground water, installation of lining is necessary to avoid penetration on ground water. Daily soil covering of waste shall be implemented at the SLF site to avoid breeding of vermin, flies and other potential carriers of communicable diseases.

To avoid all adverse impacts to public health and for environmental protection , the method of waste disposal in a Category 3 final disposal facility is widely recommended.

Employment Generation

The establishment of a sanitary landfill and a Materials Recovery Facility can create employment and livelihood opportunities for the marginalized sectors in the city.

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Out of school youth, women groups and other members of the society can be tapped as workers in the Material Recovery Facility (MRF) and Sanitary Land Fill (SLF) or as deputized enforcers of Solid Waste Management (SWM).

Revenue Generation

Payment of environment or users fee of P25.00 in a month on the equivalent of P300.00 per household yearly can generate additional revenues for the city.

10.1.2 Social Acceptability of Proposed Solid Waste System

The sensitivities of the community residents and the general public were the primary consideration in the site selection and design of the city's solid waste management system. Site assessment was undertaken by the DENR-MGB prior to the design of the categorized disposal facility and regular monitoring shall be undertaken to ensure that the SLF shall not pose any threat or danger to the health and sanitation of the residents.

To address issues and concerns on health, pollution and other dangers posed by the disposal facility, the design of the Sanitary Land Fill (SLF) shall be strictly based on the standards set by the law and other rules and regulations.

The safe distance of settlements from the Sanitary Landfill should be 200 meters away. This requirement shall also be the prime basis for project acceptability.

10.2 Environmental Aspects

Proper and effective mitigating measures shall be implemented at the disposal facility to avoid unpleasant odor from fresh rotten waste and odor produce from decomposition process.

The proposed site for the establishment of sanitary landfill is accessible to garbage trucks but far from residential areas. The topography of the landfill site is flat that will guarantee that the solution will flow directly to the leachate pond, then it shall be treated at the treatment facility.



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Buffer zones shall be provided along perimeter of the landfill site to minimize odor that comes from the dumping area.

Proper waste segregation and effective segregated collection shall be imposed to all Barangay/s and the "NO SEGREGATION NO COLLECTION POLICY" will be strictly implemented by the City in accordance to R.A 9003.

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Chapter 11. Financial Aspects

Tuguegarao City government shall allocate funds for the implementation of its Solid Waste Management Program as embodied in this chapter. The programs, projects and activities programmed herein shall ensure the attainment of the city’s goals and objectives to protect the environment and to respond to the health and sanitation needs and welfare of the community.

11.1 Investment Cost

Investment cost on the City’s Solid Waste Management Program to cover the four (4) stages below is indeed costly. The cost covers the landfill development, acquisition of collection equipment and vehicles, composting facilities and other infrastructure and physical development. (See Annexes M.1-M.4) on the detailed cost breakdown of stationary and rolling equipments.

Table 38. Total Investment Cost (in Thousand Pesos)

Cost Items	Cost Breakdown										
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Stage 1: Source Reduction & Segregation at Source	309		364		420		476		532		2,101
Stage 2: Collection & Transport	2,765	115	3,060	60	3,265	70	3,570	75	4,075	145	17,200
Stage 3: Recovery & Processing	2,530	505	2,765	490	5,105	1,705	520	520	535	565	15,240
Stage 4: Final Disposal	12,776	12,793	9,906	4,344	2,244	24,544	1,756	1,696	1,406	10,000	81,467
TOTAL	18,380	13,413	16,095	4,894	11,034	26,319	6,322	2,291	6,548	10,710	116,008

The above table indicates that the total investment cost for SWM amounts to PhP 116,008,000. Bulk of the funds shall be on the year 2016, 2017 and 2021 during the establishment of the SLF cells and its development.

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Investment costs to be incurred in the city’s SWM program can be financed through the 20% Development Fund or from revenues sourced out through grants and other financing schemes. To explore other sources of funding, the City government should strengthen its Project Management Team who shall take lead in the preparation of Project Proposal or Feasibility Studies to be submitted to local or foreign donors or financial institutions.

11.2 Annual Cost

Annual cost on SWM consists of maintenance and other operating expenses and costs incurred on program management like salaries and wages of personnel assigned in the management of landfill and MRF, supplies and materials in conduct of IEC and program monitoring and evaluation. The table below presents the detailed costs to be incurred per year:

Table 39. Annual Cost of SWM Program per Stage in Thousand Pesos

Cost Items	Cost Breakdown										
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total
Stage 1: Source Reduction & Segregation at Source	-	55	-	58	-	61	-	64	-	67	304
Stage 2: Collection & Transport	9,380	9,850	10,350	10,800	11,300	11,520	11,970	12,200	11,300	12,970	111,640
Stage 3: Recovery & Processing	345	270	335	260	270	270	280	280	290	310	2,910
Stage 4: Final Disposal	5,014	4,016	4,016	1,650	1,650	1,850	1,900	1,900	2,150	2,100	26,246
Program Management	3,516	3,571	3,476	3,581	3,486	3,641	3,546	3,551	3,601	3,606	32,059
TOTAL	18,255	17,562	18,177	16,349	16,706	17,342	17,696	17,995	15,193	16,955	176,675

The above table shows that bulk of the costs is on stage 2: collection and transport. This is due to the expenses incurred on gasoline and other expenses incurred by the collection equipment and vehicles of the city government. The least cost is on stage 1: segregation at source since costs to be incurred in this stage is only on the replacement or repair and maintenance of segregated waste bins. The materials needed shall be purchased by the city government for stage 2 the labor cost for the repair of vehicles and pushcarts is approximately 20% of the cost indicated per year including operating and maintenance cost including fuel,

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repair, spare parts etc. (see annex M.2 on Detailed Cost Items for stage 2 under Collection and Transport.)

Table 40. Administrative Cost including Insurances, Office Expenses (in thousand pesos)

Cost Items	Cost Breakdown										
	2016	2017	2018	2019	2020	20221	2022	2023	2024	20225	Total
Stage 1: Source Reduction & Segregation at Source	4,252.50	4,252.50	4,252.50	4,465.20	4,465.20	4,465.20	4,688.40	4,688.40	4,688.40	4,922.80	45,139.60
Stage 2:Collection & Transport	5,273.00	5,273.00	5,273.00	5,536.65	5,536.65	5,536.65	5,813.50	5,813.50	5,813.50	6,104.15	54,973.60
Stage 4: Final Disposal	588.40	588.40	588.40	617.80	617.80	617.80	648.70	648.70	648.70	681.10	6,245.60
Office Supplies Expenses	50	50	50	60	60	60	80	80	80	80	650.00
TOTAL	10,164.0	10,164	10,164	10,680	10,680	10,680	11,231	11,231	11,231	11,788	107,009

The table above is the administrative cost breakdown that includes insurances and office expenses. The annual cost for personnel expenses shall be derived from the monthly salary and wages of employees plus government share for GSIS and Pag-ibig Fund inclusive of personal deductions of SSS, Pag-ibig premiums and GSIS premiums and Philhealth of personnels.

On the administrative part, the bulk of cost was also on stage 2: collection and transport, personnel in-charge on the collection and transport of garbage.

11.3 Funding Options

Share from the City Revenue

The projected annual Internal Revenue Allotment (IRA) of the City indicated in the table below is a conservative estimate with an assumption of 5% increase every year.

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Table 41. Share of SWM Cost over Projected IRA

YEAR	Projected Revenue	Estimated Cost of SWM	Percent Share of SWM Cost to Projected Revenue
2016	372,594,459	46,801	0.013%
2017	391,224,182	36,334	0.009%
2018	410,785,391	44,196	0.011%
2019	431,324,661	30,205	0.007%
2020	452,890,894	44,942	0.010%
2021	475,535,439	53,647	0.011%
2022	499,312,211	37,266	0.007%
2023	524,277,821	29,563	0.006%
2024	550,491,712	37,463	0.007%
2025	578,016,298	39,480	0.007%
Total	4,686,452,767	399,895	0.009%
Average	468,645,277	39,990	0.009%

From the above table, we can deduce that allocating 1% of the Annual Revenue will ensure the smooth implementation of the City's ESWM program.

Local Revenues

The city shall explore additional sources of revenues to ensure the successful implementation of its 10-Year solid waste management program. Some strategies that can be adopted through legislative measures are as follows:

1.) Collection of Tipping Fees

On the development, operation and maintenance of the SLF, the city shall collect tipping fees from private entities or nearby local government units that do not have a disposal Facility depending on the volume of garbage disposed at the landfill site.



2). Collection of Garbage Fees

At present, the city collects garbage fees from business establishments. The city shall enact an ordinance for the mandatory payment of household garbage fees amounting to P120.00 per annum or P10.00 per month. The collection of garbage fees shall commence on the first year of implementation.

3). Fines and Penalties

Through the effective deployment and strict enforcement of deputized enforcers, the city can generate revenues from the collection of fines and penalties from violators by means of City Ordinance. This will include the non- payment of garbage fees, service fees and tipping fees of non- compliance to the requirement of the city ordinance.

Table 42. Other Source of Revenues to Ensure the Successful Implementation of the City’s 10-Year Solid Waste Management Program

Year	Garbage Fees from Households	Garbage Fees from Business Establishment	Tipping Fees	Fines & Penalties	Total
2016	2,010,240	4,699,357	60,000	60,000	6,829,597
2017	2,049,060	5,373,244	60,000	60,000	7,542,304
2018	2,088,600	6,143,767	60,000	60,000	8,352,367
2019	2,127,780	7,024,784	60,000	60,000	9,272,564
2020	2,170,020	8,032,138	60,000	60,000	10,322,158
2021	2,211,840	9,183,946	60,000	60,000	11,515,786
2022	2,254,560	10,500,924	60,000	60,000	12,875,484
2023	2,298,060	11,817,902	60,000	60,000	14,235,962
2024	2,342,400	12,125,126	60,000	60,000	14,587,526
2025	2,387,640	14,676,621	60,000	60,000	17,183,073
Total	21,940,200	89,576,621	600,000	600,000	112,176,821
Average	2,194,020	8,957,662	60,000	60,000	11,217,682

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External Source of Funds

Tuguegarao City Government may avail of loan grants from financial institutions to finance capital investment particularly on infrastructure development of the facilities. Some sources may include the following:

- 1.) National Government
- 2.) Private Entity (debt of loans, Build Operate Transfer (BOT) option & Joint venture
- 3.) Official Development Aid
- 4.) Other Sources (Provincial Development Fund, Senatorial/Congressional Development Fund,
- 5.) President's and Vice President's Social Fund and Local/foreign Grants and Donations

The City shall facilitate the project proposal on out sourcing of funds for project development. The City shall assign a unit task for the preparation of all funding requirements as to the standards set by any lending or donor company. This 2014 and 2015, the city was given a fund from the Department of Agriculture under the BUB project, trainings on the knowledge and skills of farmers for the production of organic fertilizer utilized for organic farming and materials for the construction of vermin beds.

Moreover, the City Government and the Department of Trade and Industry funded under the 2014 BUB Project includes Basic and Upgrading Skills Training on charcoal briquetting, Enterprise and Sustainable Solid Waste Management Training, benchmarking and on site visit of LGU with technology of charcoal briquetting and the purchase of equipment and raw materials to start the implementation.

11.4 Cost Evaluation and Comparison

11.4.1 Cost for Waste Management per Capita

An analysis on the per capita cost for SWM is necessary in determining the average cost incurred by the city government per person on the SWM services provided to its constituents. To compute for the per capita cost for SWM, the total cost per year is divided by the projected population.

The table below shows the detailed cost of SWM per capita for ten years:

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Table 43. Per Capita Cost on SWM per Year in Pesos

Year	Total Cost (in Pesos)	Population	Per Capita Cost on SWM (in Pesos)
2016	46,801	156,464	299.12
2017	36,334	159,484	227.82
2018	44,196	162,562	271.87
2019	30,205	165,610	182.39
2020	44,942	168,898	266.09
2021	53,647	172,157	311.62
2022	37,266	175,480	212.37
2023	29,563	178,867	165.28
2024	37,463	182,319	205.48
2025	39,480	185,838	212.01
Total	399,895	1,707,679	2,054.92
Average	39,990	170,767.90	205.49

The above table shows that SWM cost per capita is P193.28 or roughly P200.00 per annum. This implies that the city government has to collect PhP1,000.00 per year from every household to make its SWM services self-liquidating. Since the city shall only collect PhP120.00 per year per household, this means that the SWM services of the city shall be 88% subsidized by the city government. The city’s SWM services remain to be a social service.

11.4.2 Cost for Waste Management by Unit Weight for Each Type of Service

The table below shows the comparative cost for each type of service on SWM. The highest cost is on waste Collection and Transport amounting to Php 98.94 per person while the least cost to be incurred is on Recovery and Processing amounting to Php 4.64 per person.

The City Waste Collection Team shall implement the efficient and systematic collection scheme to maximize the use of equipments and facilities and to reduce cost of collection.



Table 44. Cost of SWM per Stage in Pesos

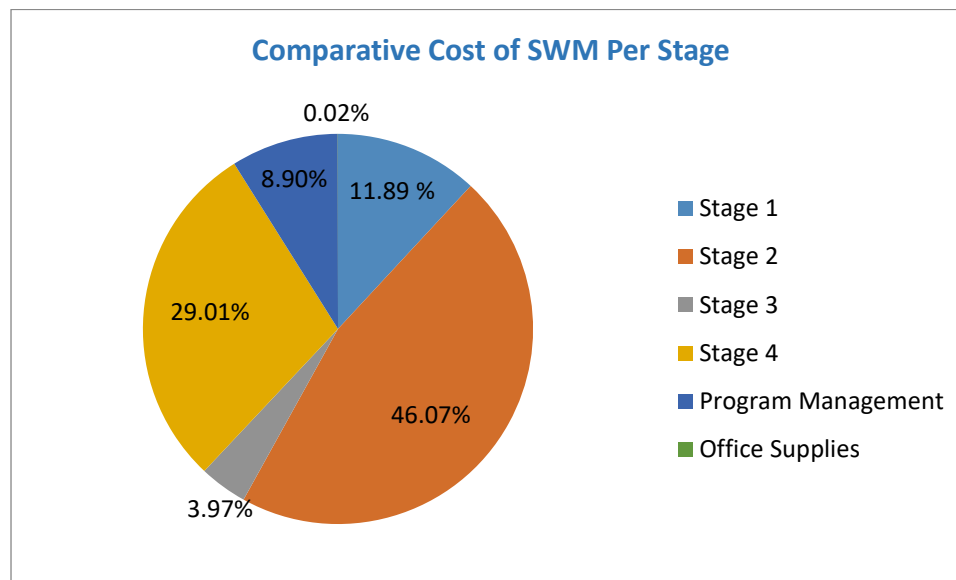
Stages of SWM	Average Cost	Average Population	Cost per Stage	%/stage
Stage 1	4,754,600.00	170,767.90	27.84	11.89
Stage 2	18,424,310	170,767.90	107.89	46.07
Stage 3	1,587,500	170,767.90	9.30	3.97
Stage 4	11,601,000	170,767.90	67.93	29.01
Program Management	3,557,500	170,767.90	20.83	8.90
Office Supplies	65,000	170,767.90	0.38	0.16
Total	39,989,910	170,767.90	206.33	100.00



11.4.3 Comparative Analysis of Cost of SWM per Stage

The figure below indicates that the percentage of stages based on the comparative cost, stage 2 has the highest which is 46.07% while the lowest is on office supplies with a value of .02%

Figure 45. Comparative Cost of SWM per Stage



11.4 Ways to Optimize Costs

Cost Recovery

Cost recovery is computed by dividing the total revenues by the total cost on SWM. It presents the amount or percentage that goes back to the coffers of the city government if local revenues are collected out of the SWM services being provided. The table below shows the cost recovery on the city's SWM Programs.



Table 45. Cost Recovery per Year in Percent

Year	Total Revenues From Local Sources	Total Cost on SWM	Cost Recovery in %
2016	6,829,597	46,801,000	14.59
2017	7,542,304	36,334,000	20.76
2018	8,352,367	44,196,000	18.90
2019	9,272,564	30,205,000	30.70
2020	10,322,158	44,942,000	22.97
2021	11,515,786	53,647,000	21.47
2022	12,875,484	37,266,000	34.55
2023	14,235,962	29,563,000	48.15
2024	14,587,526	37,463,000	38.94
2025	17,183,073	39,400,000	43.61
Total	112,716,821	399,817,000	28.19
Average	11,271,682	39,981,700	28.19

The table above shows that there was a cost recovery of 14.59 percent on the City's SWM programs in the year 2016 while there will be an increased of cost recovery of 48.15 percent by the year 2023.

11.5 Summary

11.5.1 Summary of Investment Cost, Annual Cost and Annual Revenues by Year

Below is a table showing the summary of investment cost, annual cost and annual revenues by year.

Table 46. Summary of Investment Cost, Annual Cost and Annual Revenues by Year

Year	Investment Cost	Annual Cost	Annual Revenues
2016	18,380	28,420.50	6,829,597
2017	13,413	22,921.00	7,542,304
2018	16,095	28,100.50	8,352,367
2019	4,894	25,310.60	9,272,564
2020	11,034	33,907.85	10,322,158
2021	26,319	27,328.49	11,515,786
2022	6,322	30,943.90	12,875,484
2023	2,291	27,271.57	14,235,962
2024	6,548	30,914.90	14,587,526
2025	10,710	28,769.80	17,183,073
Total	116,006	283,889.11	112,176,821
Average	11,601	28,388.91	11,217,682

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Chapter 12. Plan Implementation

12.1 Phases of Responsibilities

To ensure a successful implementation of ESWM programs of the City, targets for the programs, projects and activities (PPA) implementation with the proper delineation of responsibilities should be established. The table below presents the breakdown of the different PPA's to be implemented in the entire operation period, corresponding targets/timeframe and office, persons responsible in the implementation of the plan are specified.

Table 47. Lists of Activities, Projects, Programs and Responsible Persons

Phase	Projects/Programs/ Activities	Targets/ Time frame	Office/ Person Responsible
I. Pre-Implementation Phase	Re-organization of CSWMB/TWG and BSWMC	2016-2017	CLGOO/Punong Barangay
	Creation of CENRO office	2016	Sangguniang Panglunsod
	Establishment of barangay/s SWM Team	2016	CENRO, Barangays
	Enactment and enforcement of Legislative measures and other issuances supportive to the plan.	2016-2017	Sangguniang Panglunsod Barangay/s
	Conduct massive IEC in all sectors of the society.	2017-2026	CENRO, CSWMB/TWG
	Coordination with NGAs, NGOs, and other groups.	2017-2026	CENRO, CSWMB/TWG
II. Implementation Plan	Purchase of labelled trash bins with stand & garbage bags	2017,2019,202 1,2023 & 2025	CENRO, GSO
	Establishment/erection of signboards/billboards	2017,2019,202 1,2023 & 2025	CENRO, GSO

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	Construction of warehouse for recyclable materials at the Sanitary Landfill	2018	CEO, CENRO
	Lot purchase , purchase of composting equipments and construction of district MRF's	2017-2018	CEO, CENRO, GSO
	Operation of City MRF/Composting Facilities	2017-2026	CENRO
	Purchase of garbage truck	2014, 2016 & 2017	CENRO, GSO
III. Implementation Phase	Purchase of pushcart	2017-2026	GSO
	Establishment of Sanitary Landfill (Phase 1 & 2)	2017-2025	CENRO
	Implementation of the scheme programs for incentive and awards	Yearly 2017-2026	CENRO, CSWMB
IV. Post Implementation Phase	Conduct of Plan Monitoring and Evaluation Periodic Reporting Implementation of Incentives & Awards Program	2017-2026 Quarterly/ Annually	CSWMB/TWG
IV. Safe Closure and Rehabilitation Plan Implementation	Closure of two areas at the disposal facility	2016-2018 first quarter	CENRO

12.2 Milestone

12.2.1 Milestones in Implementation of Institutional/Legal Aspects of the Plan

Organization, orientation briefing and project tour of different sectoral committees like City and barangay speakers bureau, business sectors, Academe and among others will take place while capability building

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interventions will immediately be undertaken like technical trainings for barangays on composting, SLF and MRF managers and maintenance.

Creation and filling up of the position of CENRO officer and technical staff shall be pursued. Public hearing shall be conducted prior to the endorsement of the CSWMB to the City Mayor for endorsement to the Sangguniang Panglunsod for their appropriate action.

Favorable endorsement of the plan to the Sangguniang Panglunsod for final action pursuant to R.A. 9003 after which the same will be submitted to the NSWMC for final approval.

12.2.2 Milestones in Implementation of the Solid Waste Management System

Solid waste management system shall be effective through massive and intensive information education campaign to be undertaken to all the 49 barangays of Tuguegarao City. Waste segregation at source and the practice of backyard composting shall be enforced to households to attain reduction of waste. As part of the enforcement system incentive and award programs shall be implemented to encourage the people on their active participation. The establishment of barangay MRF/Eco-centers and City Eco-centers as sorting areas and functional of the City MRF at the Sanitary landfill site to prolong the lifespan of the landfill system.

ALTERNATIVE TECHNOLOGY: Waste to Energy -Waste Processing Plant (WPP)

A private corporation proposed to Tuguegarao City Government the installation, operation and maintenance of small, modular, renewable energy Municipal Solid Waste Processing Project. The company has been engaged in waste-to-Energy Technologies. The company is capable of processing 20 tons to 1,000 tons per day of MSW. The corporation adopts Waste-to-Energy Plasma Gasification Technology which Clean Tech, water free and incineration -free Waste to Energy Processing Plant.

This alternative technology will definitely address the issue on ecological solid waste management and eliminating the need for additional dumpsites/ landfills by introducing a pioneer technology that caters to recycling process, and transformation of waste to synthetic petroleum products, synthetic gas (syngas), and carbon neutral pellets through undergoing a high temperature Thermolysis (HTT) Gasification Process.

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The corporation will invest Waste Processing Plant (WPP) at no cost to the Local Government Unit of Tuguegarao City, under the terms and conditions as contained in the Memorandum of Agreement with a period of twenty five (25) years. The investment, operation and management of the WPP will be fully carried out by the company under the following terms.

- Tonnage available of the LGU is fifty (50) tons per day (minimum);
- The corporation will process 24/7 the delivered existing and/ or daily collected segregated MSW of the LGU without any requirement for tipping/ gate fees;
- LGU will deliver its existing and daily segregated MSW to the processing corporation only;
- LGU shall provide a site to house the WPP with a land area of five thousand (5,000) to ten thousand (10,000) square meters at no cost to corporation.

Benefits to the LGU

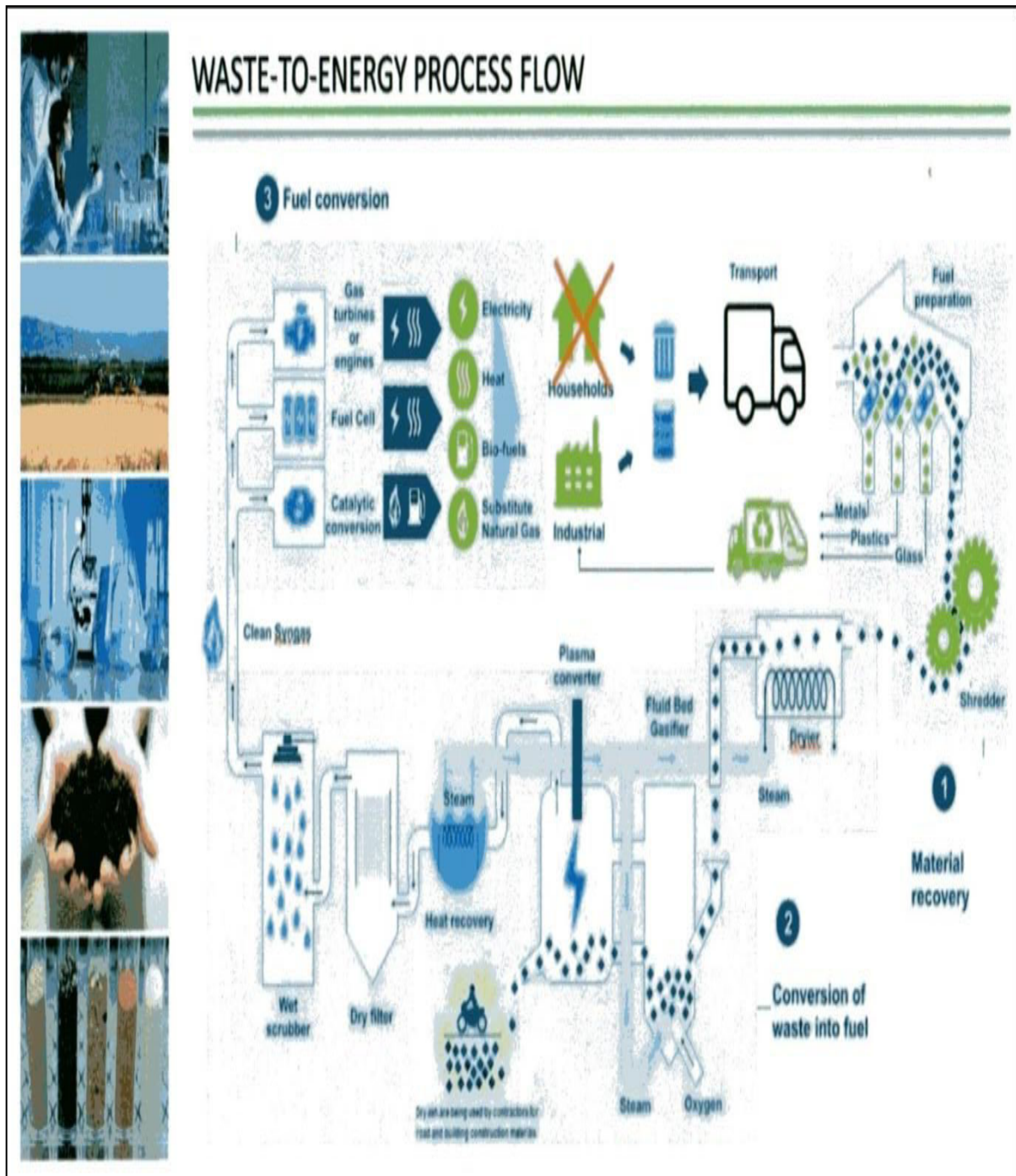
The benefit that the LGU may derive from a waste processing project will be as follows:

- NO WASTE ON SITE- 24/7 processing of segregated, existing, daily MSW;
- SIGNIFICANT SAVINGS- savings on cost/budget related to disposal processing, and management; eliminated cost on tipping/ gate fees; recovered value from rehabilitated land;
- ENVIRONMENTAL COMPLIANCE- addressed ecological issues on solid standards complaint (EU Directives 2030);
- EMPLOYMENT GENERATION- 60 to 80 job opportunities for local residents;
- REVENUE from the tipping/ gate fees collected from its nearby municipalities even the possibility of expanding clients and increasing daily collected waste due to the 24/7 processing and elimination of waste by the corporation;
- Annual Business Tax and the Real Property Tax to be paid by the corporation.

With the waste processing project, Tuguegarao City Government will reduce its budget for the operation and maintenance of its sanitary landfill and save the budget for the acquisition of additional land for the expansion of the sanitary landfill and establishment of material recovery facilities.

Below is an illustration showing the flow of a waste-to-energy process.

Figure 46. Waste-to-Energy Processing Service



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12.3 Schedule of Implementation

P/P/As	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
I. Environmental Organization/Institutional										
1.Organization of Sectoral Committees										
2.Appointment& designation of SLF staff										
3.Reactivation of junkshop owners										
4.Organized team in-charge in marketing recycled products										
5.Coordination with NGAs, DOST & DTI										
6.Strengthening of CSWMB and BSWMC										
7.Establishment of feedback mechanism										
8.Creation of CENRO office										
9. Formulation of MOA with interested parties to use SLF										
II.ENGINEERING COMPONENT										
1. Establishment of HH compost pit/ Backyard composting										
2. Establishment of Brgy. Vermin- composting										
3. Provisions of additional labeled garbage bins on public places										
4. Repair/Maintenance of barangay collection equipment										
5. Establishment of barangay dropped of centers, pick-ups points/ collection points										
6.Establishment/construction of district MRF's including survey work.										
7.Establishment/construction of storage area at SLF for sorting and to house recyclable materials										

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8.Purchase of district MRF' s composting equipment										
9.Safe Closure and Rehabilitation Plan										
10.Construction of phases of SLF										
III. EDUCATION COMPONENT										
1.Training of trainers for speaker bureau										
2.Conduct IEC in all barangay/sectors/institutions										
3.Integration of SWM programs as part of their curriculum										
4. Conduct of capability building for all SWM actors and stakeholders with livelihood establishment.										
IV. ENFORCEMENT COMPONENT										
1.Deputization of Enforcers										
2.Enactment of appropriate legislative measures										
3.Incentive and Awards program										
4.Implementation of "No Segregation, No Collection Policy"										
5. Assigning of barangay collectors with allowances										
V. Monitoring and Evaluation										
1.Conduct periodic assessment, monitoring and evaluation										
2. Plan evaluation and updating										

Table 48. List of SWM Programs, Projects and Activities in a 10-year Timeline



Table 49. Summary of Diversion Goals and Quantities

Year	Biodegradable Waste Kg./day	Recyclable Waste kg./day	Total	% Diversion Goals	Quantities of Waste Diversion
2016	58,482.117	26,056.27	84,538.39	50	42,269.19
2017	59,610.914	26,559.19	86,170.11	54	45,650.73
2018	60,761.389	27,071.78	87,833.17	58	50,943.24
2019	61,900.651	27,579.37	89,480.02	62	55,477.61
2020	63,129.619	28,126.93	91,256.55	66	60,229.32
2021	64,347.747	28,669.66	93,017.40	70	65,112.18
2022	65,589.797	29,223.04	94,812.84	74	70,161.50
2023	66,855.768	29,787.08	96,642.85	78	75,381.43
2024	68,146.035	30,361.95	98,507.99	82	80,776.55
2025	69,461.344	30,947.980	100,409.32	86	86,352.02
Average	63,828.54	31,099.85	92,266.86	68	62,741.46

The result of the summary for waste diversion goals shall be obtained from Table 22 Projected Waste Generation (kg./day), **quantities for the volume of biodegradable waste and recyclable waste per year in kg./day** targeted through percentage per year of waste diversion which starts from 2016 up to the tenth year to meet the mandate of waste diversion.



CONCLUSION

Tuguegarao City Government, with the active participation of all stakeholders, commits to undertake the approaches, methodologies and strategies adopted in the Updated Ten (10) -Year Ecological Solid Waste Management Plan. It will strictly implement the policies regarding re-use, reduction and recycle of wastes generated and impose the mandatory wastes segregation at source. It will pursue its direction towards "ZERO WASTES MANAGEMENT" by adopting appropriate technologies which convert wastes into energy and other economic uses.

In protecting human and living things, preserving our environment and enhancing our ecology, Tuguegarao City promotes the use of organic substances from biodegradable wastes and non-toxic raw materials.

The Updated Ten(10)-Year Ecological Solid Waste Management Plan provides the guidelines and sets the road map for the city's attainment of its vision and mission. The Plan is one of the vital documents and instruments in making Tuguegaraoone of the Green City of the country.

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