



*Regional Development Plan Sargodha*  
*Solid Waste Management (SWM)*

**2022 – 2032**



**THE URBAN UNIT**  
Urban Sector Planning & Management Services Unit (Pvt.) Ltd.  
A Public Sector Company.



## **DISCLAIMER**

Urban Sector Planning and Management Sector Unit (Pvt.) Ltd. has prepared this report for Regional Solid Waste Management Plan in Sargodha Division. Maximum care and caution have been observed while developing this document.

No part of this document may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording or information storage and retrieval system, without the express permission, in writing, by competent authority.

The opinions expressed in the document are solely those of the authors and publishing them does not in any way constitute endorsement of the opinion by the Urban Unit.

### **TECHNICAL TEAM**

Mr. Abid Hussainy, General Manager (Environment and Social Safeguard), The Urban Unit

Mr. Hassan Ilyas, Program Manager-Environment, The Urban Unit

Mr. Muhammad Minhaj Sheikh, Program Officer-SWM, The Urban Unit

Mr. Haris Bin Khawar, Instructor Waste water, The Urban Unit

## Executive Summary

Waste production is eminent result of all human activities and it requires a handling system to save environmental and public health. In Punjab province an estimated 40,000 Ton of solid waste is generated each day which needs collection, transport and safe disposal. Along with efficient and safe waste collection and transport waste disposal must also be done in accordance with standards placed to protect nature and human health.

This plan which spans over a period of 10 years (2022 -2032) proposes the pathway towards increasing waste collection efficiency, its transport and much safer disposal as compared to the present situation covering all settlements within Sargodha Division. In First Phase of the project we will establish SWM plan for Sargodha city and after successful implementation in Sargodha city it will be expanded in other districts of Sargodha. Population of Sargodha City is expected to rise from 658,208 (2017 Census Report) to 876,496 by 2032 (Projected). Average amount of solid waste production is expected to increase from 294 Ton/day to 413 Ton/day in 2032. The plan also suggests increased waste collection efficiency and proposes Solid Waste Management Company in Sargodha for efficient SWM operations. It also suggests that green waste should be shredded using mobile shredder and then used as much within proximity of its source. This would decrease need for transport and disposal space in addition to provision of key nutrients back to soil. Rehabilitation of Existing dumpsite is also recommended to ensure efficient waste disposal and sustainable land use.

Currently municipal committee is being responsible for waste management within the municipalities. The system has thoroughly been assessed and it was found that in order to have a successful waste management system, Waste Management Company should be developed in Sargodha city. In first phase it will work in the jurisdiction of Sargodha city which may later expand its operations to remaining tehsils of Sargodha district in second phase after effectively performing in the city, whereas in the final phase it may expand its services to the whole Sargodha division. In addition to this, the plan also propose segregation, treatment and disposal facility in Sargodha which will help diverting solid waste to the disposal site. The Urban Unit team also proposes the concept of regional landfill sites in the division, whereas new sites have also been identified along with suitability analysis for the development of Landfill sites.

## CONTENTS

---

<b>Chapter 1. Introduction .....</b>	<b>10</b>
1.1 Background.....	10
1.2 Objectives.....	11
1.3 Methodology.....	11
<b>Chapter 2. Districts and The Current Situation of SWM .....</b>	<b>12</b>
2.1 Sargodha District .....	12
2.2 Population: .....	13
2.3 Waste Generation: .....	13
2.4 Khushab District .....	14
2.4.1 Description .....	14
2.4.2 Population:.....	14
2.4.3 Waste Generation:.....	15
2.5 Mianwali District .....	16
2.5.1 Description .....	16
2.5.2 Population:.....	16
2.5.3 Waste Generation:.....	17
2.6 Bhakkar District .....	18
2.6.1 Description .....	18
2.6.2 Population:.....	18
2.6.3 Waste Generation:.....	19
2.7 Current SWM Practices in Sargodha Division: .....	20
2.8 Current Disposal Practices in Sargodha Division:.....	24
<b>Chapter 3. Proposed SWM Plan For Sargodha Division .....</b>	<b>27</b>
3.1 Primary waste collection system: .....	28

3.2	Secondary waste collection system .....	29
3.3	Final disposal .....	29
3.4	Required resources .....	30
3.5	Zone Wise Division of Sargodha City.....	32
3.6	Financial Costing: .....	35
3.6.1	Capital Cost .....	36
3.6.2	Operational and Maintenance Cost.....	38
3.6.3	HR cost .....	39
3.7	Sargodha Waste Management Company Proposed.....	41
3.8	STD Facility Proposed .....	43
3.9	Components of STD.....	44
3.10	Benefits of the Facility.....	45
3.11	Environmental Benefits.....	45
3.11.1	Improvement in Groundwater Quality .....	45
3.11.2	Improvement in Air Quality .....	45
3.11.3	Improvement in Soil Quality .....	45
3.12	Details Of Activities Of Std Facility .....	45
3.13	Process Description Of Composting.....	47
3.14	Windrow Composting .....	47
3.15	Proposed Landfill Sites in Sargodha Division: .....	48
3.15.1	Sargodha-Khushab Landfill Site: .....	50
3.15.2	Bhakkar Landfill Site:.....	52
3.15.3	Mianwali Landfill Site .....	54
3.15.4	Comparison Matrix for Mianwali Landfill site Evaluation and ranking .....	58
<b>Chapter 4.</b>	<b>Recommendations &amp; Way Forward .....</b>	<b>59</b>

4.1	Recommendations .....	59
4.1.1	Street Sweeping and Drains Cleaning.....	59
4.1.2	Waste Collection System .....	59
4.1.3	Waste Transport System.....	60
4.1.4	Disposal System: .....	60
4.2	Way forward:.....	61

## List of Figures

FIGURE 1.1: SWM MODEL.....	11
FIGURE 2.1: SARGODHA DIVISION MAP .....	12
FIGURE 2.2: POPULATION VS WASTE GENERATION .....	14
FIGURE 2.3: POPULATION VS WASTE GENERATION KHUSHAB .....	16
FIGURE 2.4: POPULATION PROJECTION OF MIANWALI DISTRICT .....	17
FIGURE 2.5: POPULATION VS WASTE GENERATION MIANWALI .....	17
FIGURE 2.6: POPULATION VS WASTE GENERATION BHAKKAR.....	19
FIGURE 2.7: EXISTING SWM PRACTICES IN SARGODHA DIVISION .....	20
FIGURE 2.8: EXISTING SITUATION OF SWM IN SARGODHA .....	21
FIGURE 2.9: URBAN AND RURAL HIERARCHY .....	21
FIGURE 2.10: EXISTING DUMPSITE OF SARGODHA.....	24
FIGURE 2.11: SARGODHA TRANSFER STATION .....	24
FIGURE 2.12: SATELLITE IMAGERY OF EXISTING MIANWALI DUMPSITE .....	25
FIGURE 2.13: EXISTING LOCATION OF MIANWALI DUMPSITE.....	26
FIGURE 3.1: PROPOSED MODEL FOR SWM .....	28
FIGURE 3.2: PRIMARY COLLECTION EQUIPMENTS .....	28
FIGURE 3.3: SECONDARY CONTAINER LIFTING VEHICLES.....	29
FIGURE 3.4: OPERATIONAL MODEL FOR SWM .....	29
FIGURE 3.5: TERTIARY COLLECTION VEHICLES.....	30
FIGURE 3.6: ZONE WISE DIVISION OF SARGODHA.....	33
FIGURE 3.7: UNION COUNCILS IN SARGODHA.....	34
FIGURE 3.8: PROPOSED ORGANOGRAM FOR SWMC .....	42
FIGURE 3.9: WASTE MANAGEMENT HIERARCHY.....	43
FIGURE 3.10: COMPONENTS OF STD .....	44
FIGURE 3.11: PROCESSING AND RECOVERY ACTIVITIES AT STD .....	46
FIGURE 3.12: PROCESS FLOW DIAGRAM OF STD.....	46
FIGURE 3.13: WASTE TO COMPOST.....	47
FIGURE 3.14: WINDROW COMPOSTING.....	47
FIGURE 3.15: WINDROW TURNER .....	48
FIGURE 3.16: PROPOSED SARGODHA DIVISION LANDFILL AND TRANSFER STATIONS.....	49
FIGURE 3.17: MAP OF REGIONAL LANDFILLS SARGODHA .....	51
FIGURE 3.18: SATELLITE IMAGERY OF SARGODHA LANDFILL .....	51
FIGURE 3.19: MAP OF BHAKKAR REGIONAL LANDFILL .....	53
FIGURE 3.20: SATELLITE IMAGERY OF PROPOSED LANDFILL BHAKKAR .....	53
FIGURE 3.21: ON- SITE VIEW OF BHAKKAR LANDFILL.....	53
FIGURE 3.22: MIANWALI PROPOSED LANDFILL SITE AT MAHRANWALA .....	54

FIGURE 3.23: SATELLITE IMAGERY OF MAHRANWALA PROPOSED LANDFILL SITE.....	55
FIGURE 3.24: MIANWALI QADRABAD PROPOSED LANDFILL SITE BY MC OFFICIALS .....	56
FIGURE 3.25: MIANWALI QADRABAD PROPOSED LANDFILL SITE BY MC OFFICIALS .....	57
FIGURE 3.26: PROPOSED AND EXISTING DUMPSITES MAP OF MIANWALI .....	57

## List of Tables

TABLE 2:1: POPULATION VS WASTE GENERATION .....	13
TABLE 2:2: AREA WISE POPULATION OF KHUSHAB DISTRICT.....	15
TABLE 2:3: WASTE GENERATION OF KHUSHAB DISTRICT .....	15
TABLE 2:4 WASTE GENERATION OF MIANWALI DISTRICT .....	17
TABLE 2:5: POPULATION PROJECTION BHAKKAR DISTRICT .....	18
TABLE 2:6: WASTE GENERATION OF BHAKKAR DISTRICT .....	19
TABLE 2:7: EXISTING RESOURCES OF SWM IN MC SARGODHA.....	22
TABLE 2:8: EXISTING RESOURCES IN DISTRICT.....	23
TABLE 3:1: SARGODHA DUMPSITE AND TRANSFER STATIONS.....	30
TABLE 3:2: REQUIRED ADDITIONAL RESOURCES FOR EFFICIENT SWM IN SARGODHA CITY .....	30
TABLE 3:3: ADDITIONAL HR REQUIRED IN SARGODHA.....	31
TABLE 3:4: ADDITIONAL RESOURCES REQUIRED .....	32
TABLE 3:5: ADDITIONAL HR REQUIRED.....	32
TABLE 3:6: UNION COUNCIL WISE DIVISION OF EACH ZONE.....	33
TABLE 3:7: ZONE WISE DIVISION OF TOTAL RESOURCES IN SARGODHA.....	34
TABLE 3:8: CAPITAL COST FOR SWM IN SARGODHA CITY (2022-2032).....	36
TABLE 3:9: CAPITAL COST REQUIRED FOR REMAINING DISTRICT.....	37
TABLE 3:10: O&M COST FOR SWM IN SARGODHA CITY .....	38
TABLE 3:11: OPERATIONAL COST FOR REMAINING DISTRICTS.....	38
TABLE 3:12: HR COST FOR SWM IN SARGODHA CITY .....	39
TABLE 3:13: HR COST REQUIRED FOR DISTRICT.....	39
TABLE 3:14: COST SUMMARY OF REMAINING TEHSILS .....	40
TABLE 3:15: DETAILS OF SARGODHA-KHUSHAB REGIONAL LANDFILL .....	50
TABLE 3:16: BHAKKAR LANDFILL DETAILS.....	52
TABLE 3:17: DETAILS OF MIANWALI LANDFILL .....	54
TABLE 3:18: MIANWALI QADRADABD PROPOSED LANDFILL BY MC OFFICIALS .....	55
TABLE 3:19: LANDFILL EVALUATION MATRIX .....	58

## List of Acronyms

<b>SWMC</b>	Sargodha Waste Management Company
<b>CDG</b>	City District Government
<b>HR</b>	Human Resource
<b>LF</b>	Landfill
<b>MC</b>	Municipal Corporation
<b>MSW</b>	Municipal Solid Waste
<b>MS</b>	Mechanical Sweepers
<b>MD</b>	Mini dumpers
<b>SWM</b>	Solid Waste Management
<b>SW</b>	Solid waste
<b>TS</b>	Transfer Station
<b>TPD</b>	Ton per Day
<b>WMC</b>	Waste Management Company
<b>KPI</b>	Key Performance Indicators
<b>SPE</b>	Special Purpose Entity
<b>TOR</b>	Terms of Reference
<b>ITB</b>	Invitation to Bid
<b>RFP</b>	Request for Proposal
<b>EOI</b>	Expression of Interest

## CHAPTER 1. INTRODUCTION

---

### 1.1 BACKGROUND

Pakistan, being the fifth largest country in the world in terms of population<sup>1</sup>, is facing the problem of poor MSW management and problem is growing with every passing day. The situation is even more challenging due to rapid urbanization, overexploitation of non-renewable resources and increase in diversity of waste composition which is no longer mainly food waste rather includes growing amounts of plastic, paper, leather, rubber, textile, and glass etc.

The matter is of grave concern particularly in Punjab Province as it is the most progressive province in terms of population density, urbanization, industrialization, and economic growth. According to population census report 2017, Punjab is home to about 53% of whole population of the country and the number is increasing with growth rate of 2.13% annually<sup>2</sup>. Correspondingly, the waste generation has reached to a level where it is imperative to undertake substantial steps in solid waste management (SWM) management for an improved civic life in the province.

**Sargodha Division** is an administrative division of Punjab Province, Pakistan. Sargodha city is the capital of the division. Divisions are the third tier of government below the federal and provincial levels. In 2000, local government reforms abolished administrative divisions and raised the districts to become the new third tier of government. But in 2008, the division system was restored again.

According to 2017 census, Sargodha division had a population of 8,181,499, which includes 4,120,223 males and 4,046,036 females. Urban population of Sargodha Division was 2,028,631 which is expected to grow to 2,766,630 at an annual growth rate of 2.09%. Waste Generation from Urban Population of Sargodha Division in 2022 is estimated 1,800 tons per day and with the increasing population of the division and upgradation of the lifestyle of the people the waste generation is expected to rise in coming years. It is Estimated that the waste generation will reach to 2,500 tons/ day by 2032. There is a dire need to devise and implement an integrated SWM system that can manage waste collection, storage, its transportation, and safe disposal to avoid over exploitation of existing resources and to save environment. Keeping in view the rapidly increasing problem of poorly managed Municipal Solid Waste (MSW), The Urban unit has been given a task to devise a comprehensive SWM plan for Sargodha Division which covers every aspect of integrated SWM including generation, collection, storage, transportation and disposal.

---

<sup>1</sup> World Population Data Sheet 2017, Population Reference Bureau.

<sup>2</sup> Population Profile Punjab 2017, Population Welfare Department GoP.

## 1.2 OBJECTIVES

Following are the objectives of the plan:

- To analyse and document the gaps in existing SWM services in Sargodha Division in terms of institutional structure, human resource (HR), machinery and equipment, operational planning, and financing.
- To design an integrated Solid Waste Management (SWM) system for Sargodha Division, which is economically viable and sustainable in longer term.
- Procurement of New Resources
- Rehabilitation of dumping site and Regional Landfill
- To undertake basic field studies to address the gaps and to provide the future roadmap for efficient SWM in Sargodha.

## 1.3 METHODOLOGY

To achieve the above-mentioned objectives, following SWM model is proposed. In this proposed model, solid waste generated from settlements will be collected through Handcarts and Mini-Dumpers. It is then stored in containers having capacities of 0.8m<sup>3</sup> and 5m<sup>3</sup>. Solid waste will then be transferred into suitable vehicles (Arm rolls, Compactors, Tractor Trolleys and Dumpers) and transported to transfer station or controlled dumpsite/Landfill. The details of this model are discussed further in this report.

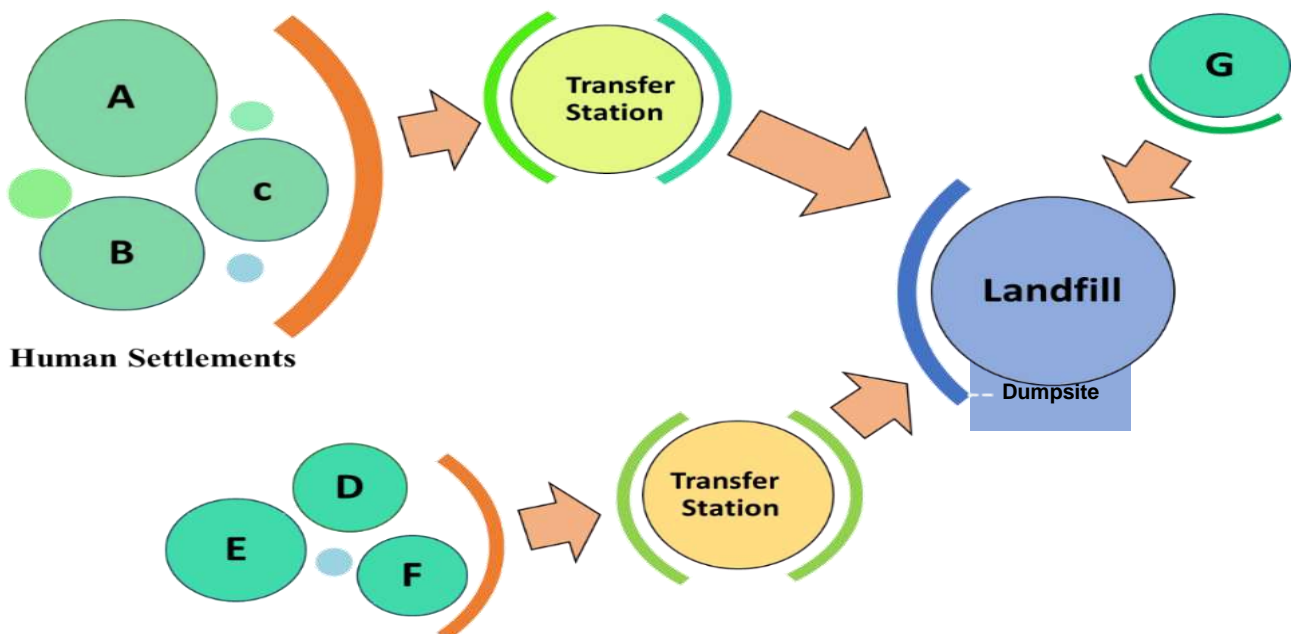


Figure 1.1: SWM Model

## CHAPTER 2. DISTRICTS AND THE CURRENT SITUATION OF SWM

### 2.1 SARGODHA DISTRICT

Sargodha is a capital of Sargodha Division, located in Punjab province, Pakistan. It is Pakistan's 12th largest city by population and one of the fastest-growing cities of the country. Sargodha is also known as the City of Eagles.

It is located 187 kilometres northwest of Lahore, in Sargodha District. It lies about 48 kilometres from the M-2 motorway, which connects Lahore and Islamabad. It is connected to the M-2 by several interchanges at different locations. Sargodha is roughly 91 km from Faisalabad, due southeast. Directly east connected by the M-2 motorway are Lahore and the route to Rawalpindi and Islamabad. Due east is the city of Jhang, toward the west are the city of Mianwali and the Chashma Barrage.

As of October 2012, the division system in Punjab Province has been restored and Sargodha became the divisional headquarters of districts Sargodha, Khushab, Mianwali and Bhakkar. Sargodha became the administrative capital of the Sargodha Division. The Municipal Committee of Sargodha city was upgraded into Municipal Corporation in 1981 when the population of city was increased over half a

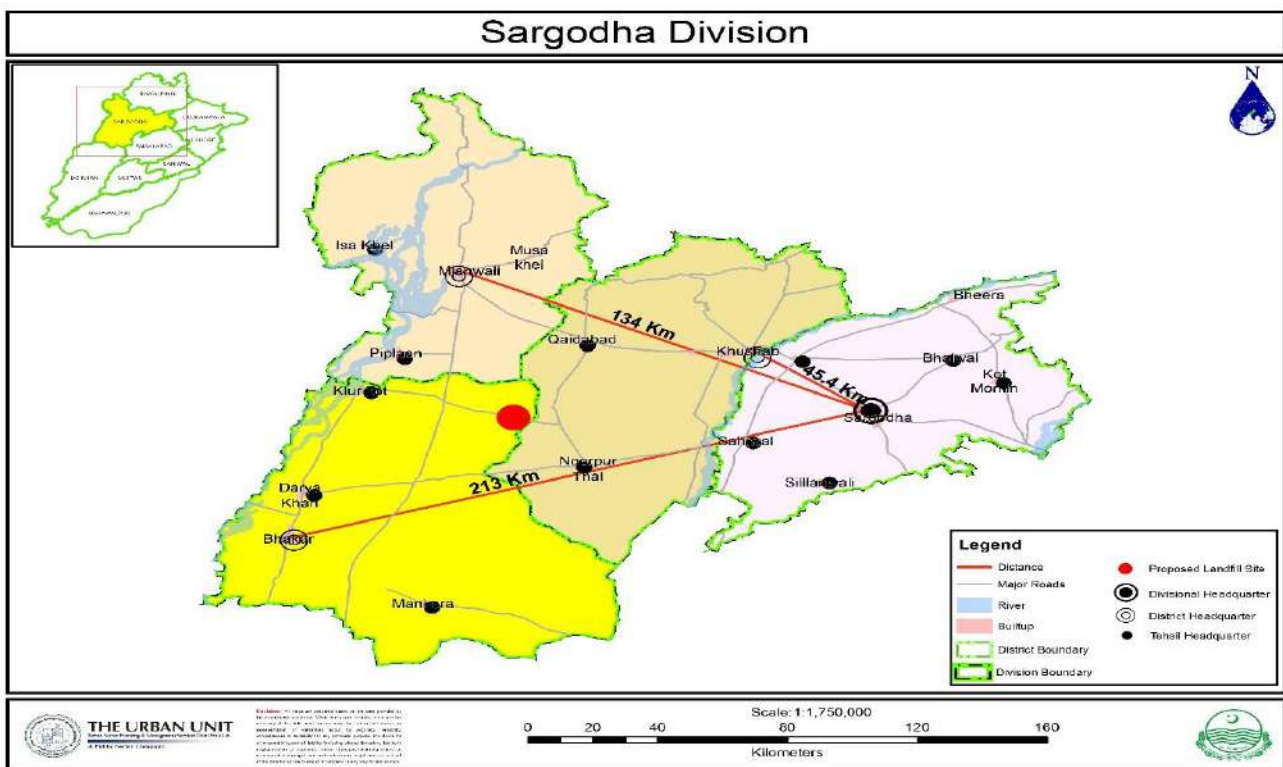


Figure 2.1: Sargodha Division Map

million. In December 2019, Sargodha Municipal Corporation was upgraded into Metropolitan Corporation under Punjab Local Government Act 2019.

## 2.2 POPULATION:

The population is one of the most important factors for determining the waste amount produced in a region. For the current study, population data has been taken from the population census of Pakistan, as it is a prime source of relevant information. The population census of 2017, which is the latest in the sources of the population censuses was used for the current analysis of the city's population. The current population data is projected till 2032 by taking a suitable growth rate. The following table summarizes the population of the Sargodha City.

## 2.3 WASTE GENERATION:

Waste generation of Sargodha has been calculated from the above-mentioned population. By conducting field visits and analyzing the quantity of waste generated on a real-time basis, the waste generation rate (WGR) of 0.4 kg/cap-day is taken for Sargodha City. By using these WGR, the total waste generation for the Sargodha City is projected till 2032 and is shown in the table below.

**Table 2:1: Population vs Waste generation**

<b>Year</b>	<b>Population Projected</b>	<b>Waste Generation (Tons/day)</b>
<b>2022</b>	723,869	294
<b>2023</b>	737,768	304
<b>2024</b>	751,933	315
<b>2025</b>	766,370	325
<b>2026</b>	781,084	337
<b>2027</b>	796,081	348
<b>2028</b>	811,366	360
<b>2029</b>	826,944	373
<b>2030</b>	842,821	385
<b>2031</b>	859,004	399
<b>2032</b>	875,496	413

Source: Pakistan Bureau of Statistics (PBS) Census Report 2017.

Considering the above table, MSW generation in the Sargodha city is calculated at around 294 tons per day which is approximately 107,310 tons per year and is expected to reach 150,745 tons per year by the end of 2032, taking maximum of 1.5% annual increase<sup>3</sup> in waste generation rate.

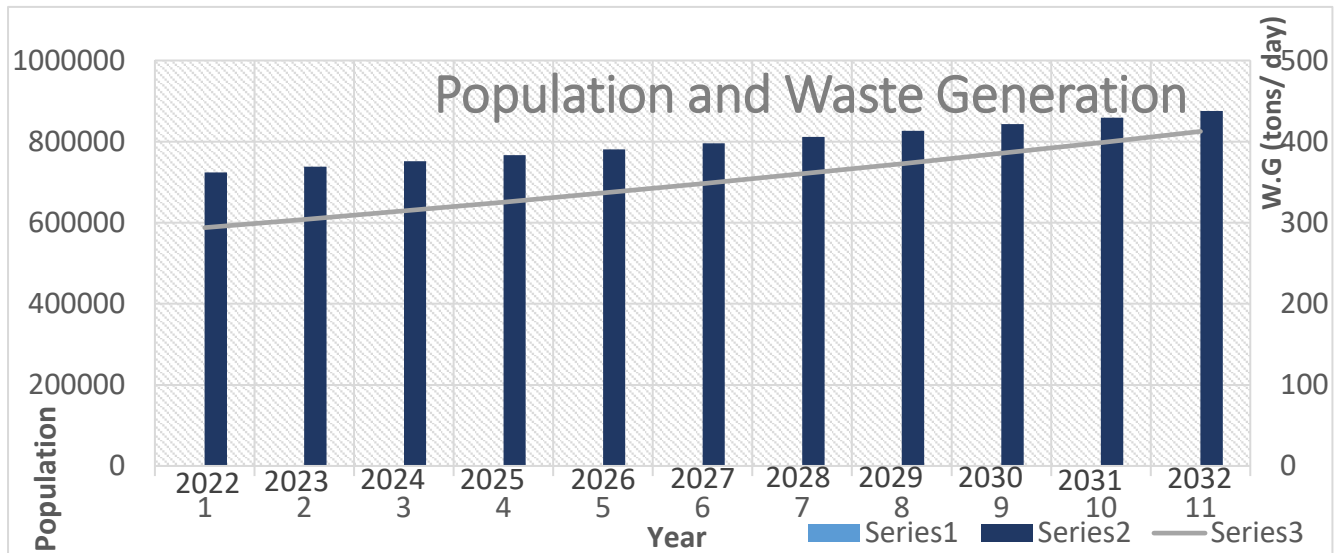


Figure 2.2: Population vs Waste Generation

## 2.4 KHUSHAB DISTRICT

### 2.4.1 Description

Khushab District is a district in the province of Punjab, Pakistan, with its administrative capital in Jauharabad. The district is named after the historical city of Khushab located within its boundaries. District Khushab is an agricultural district. The main crops are Sugarcane, Gram, Wheat and Rice. The headquarter of the district is based in Khushab. District Khushab has extreme hot and cold climate. Its land comprises mainly hills, plateaus, plains and deserts with river Jhelum flowing on its east. Some of the areas of tehsil Khushab are low lying and get flooded in rainy season.

### 2.4.2 Population:

According to the 1998 census, the population was 905,711 with 24.76% living in urban areas. The district consists of four tehsils: Khushab, Noorpur Thal, Quaidabad and Naushera. At the time of the 2017 census the district had a population of 1,280,372, of which 637,474 were males and 642,791

<sup>3</sup> What a Waste: A Global Review of Solid Waste Management, The World Bank report, March 2012.

females. Urban Population of Khushab City was 298,014 according to 2017 census which is expected to grow to 419,766 by 2032 at a growth rate of 2.31.

**Table 2:2: Area Wise population of Khushab District**

<b>Khushab District</b>			
<b>Tehsils</b>	<b>Pop 2017 (census)</b>	<b>Pop 2022 (projection)</b>	<b>Pop 2032 (projection)</b>
<b>Khushab</b>	298,014	334,062	419,766
<b>Noorpur</b>	19,780	21,235	24,475
<b>Newshehra</b>	13,753	15,393	19,286
<b>Quaidabad</b>	208,615	243,136	330,261

### 2.4.3 Waste Generation:

Waste generation from the population of Khushab is calculated and projected till 2032. A waste generation rate of 0.40 kg/cap-day is adopted for City while it is taken as 0.37 kg/cap-day for areas other than Khushab City<sup>4</sup>. Details of waste generation in the Khushab district are given in the table below: Considering the above table, the MSW generation of Khushab city is around 134 Tons per day which is approximately 48,771 Tons per year and is expected to reach 71,123 Ton per year (or 195 Tons per day) by the end of 2032. Considering the above table, the MSW generation of Khushab city is around 134 Tons per day which is approximately 48,771 Tons per year and is expected to reach 71,123 Ton per year (or 195 Tons per day) by the end of 2032.

**Table 2:3: Waste Generation of Khushab District**

<b>Khushab District</b>		
<b>Tehsils</b>	<b>Waste Generation 2022 (Tons/day)</b>	<b>Waste Generation 2032 (Tons/day)</b>
<b>Khushab</b>	134	195
<b>Noorpur</b>	8	11
<b>Newshehra</b>	6	8
<b>Quaidabad</b>	90	142

Considering the above table, the MSW generation of Khushab city is around 134 Tons per day which is approximately 48,771 Tons per year and is expected to reach 71,123 Ton per year (or 195 Tons per day) by the end of 2032.

<sup>4</sup> The values of waste generation rate is taken after carefully considering local conditions and after consulting relevant stakeholders of Khushab district

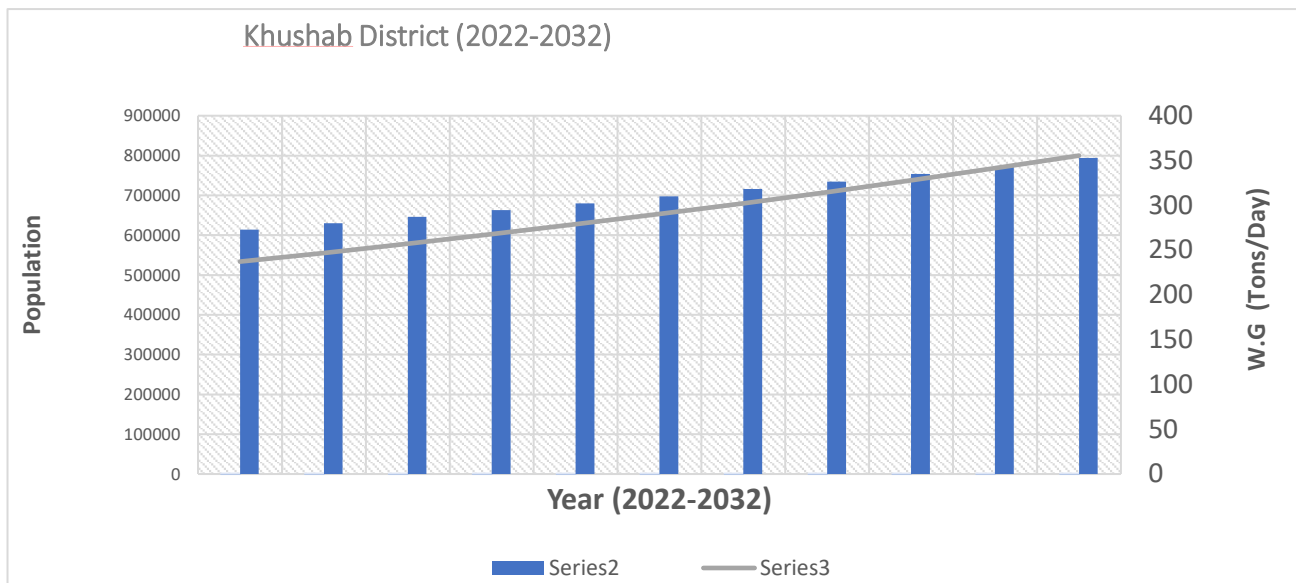


Figure 2.3: Population Vs Waste Generation Khushab

## 2.5 MIANWALI DISTRICT

### 2.5.1 Description

District Mianwali is the district of Punjab with an area of about 5,840 square kilometers. The main crops are Wheat, Sugarcane, Gram, Bajra and Cotton. The headquarter of the district is Mianwali city. District Mianwali bounded by district Attock on north-east, Chakwal and Khushab districts on east and Bhakkar on south and NWFP on its west and north-west. River Indus flows across the district from north to south. Three branches of the Thal Canal Emerging from Jinnah Barrage on river Indus near Kalabagh irrigate the vast areas. Another canal called Chashma Link Canal connects river Indus with river Jhelum through Chashma Barrage. The district has extreme hot and cold climate. The maximum temperature during the summer shoots up to 51°C while the minimum temperature recorded in winter is as low as 2°C. The average rainfall in the district is about 250 mm. District Mianwali mainly comprises hills, plateaus and plains. Mianwali district is administratively divided into three Tehsils. The name of tehsils is Mianwali, Isakhel and Piplan.

### 2.5.2 Population:

At the time of the 2017 census the district had a population of 1,542,601, of which 771,969 were males and 770,502 females. Rural population is 1,214,789 while the urban population is 327,812. Urban Population of Mianwali City was 147,411 according to 2017 census which is expected to grow to 196,074 by 2032 at a growth rate of 1.92.

At the time of the 2017 census, 76.05% of the population spoke Saraiki, 11.53% Pashto, 9.35% Punjabi and 2.76% Urdu as their first language.

### 2.5.3 Waste Generation:

Waste generation from the population of Mianwali is calculated and projected till 2032. A waste generation rate of 0.40 kg/cap-day is adopted for City while it is taken as 0.37 kg/cap-day for areas other than Mianwali City and waste generation rate is increase by 1.5% annually<sup>5</sup>. Details of waste generation in the Khushab district are given in the table below.

Figure 2.4: population projection of Mianwali District

Mianwali District			
Tehsils	Pop 2017 (census)	Pop 2022 (projection)	Pop 2032 (projection)
Mianwali	147,411	162,116	196,074
Isakhel	84,561	100,431	141,669
Piplan	95,840	102,840	118,413

Table 2:4 Waste Generation of Mianwali District

Mianwali District		
Tehsils	Waste Generation 2022 (Tons/Day)	Waste Generation 2032 (Tons/day)
Mianwali	65	91
Isakhel	37	61
Piplan	38	51

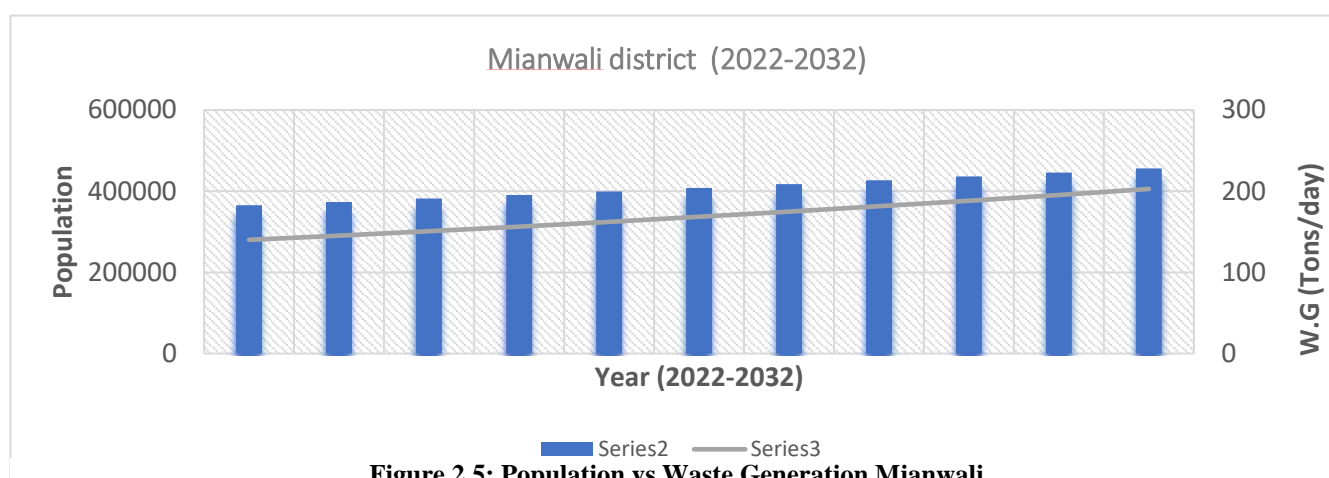


Figure 2.5: Population vs Waste Generation Mianwali

<sup>5</sup> The values of waste generation rate is taken after carefully considering local conditions and after consulting relevant stakeholders of Mianwali district

Considering the above table, the MSW generation of Mianwali city is around 65 Tons per day which is approximately 23,725 Tons per year and is expected to reach 33,215 Ton per year (or 91 Tons per day) by the end of 2032.

## 2.6 BHAKKAR DISTRICT

### 2.6.1 Description

Bhakkar is the principal city of Bhakkar District located in Punjab, Pakistan. It lies on the left bank of the Indus river. It is the 86th largest city in Pakistan. Bhakkar city is also the administrative centre of Bhakkar Tehsil one of the four tehsils of the district. Bhakkar Tehsil is subdivided into 17 union councils, three of which form the city of Bhakkar. District Bhakkar is the district of Punjab province with an area of about 8,153 square kilometers. The main crops are Sugarcane, Wheat, Gram, Cotton, Moong and Bajra. The headquarter of the district is Bhakkar city. On northern side of district Bhakkar lies the district Mianwali. The eastern and southern sides adjoin Khushab, Jhang and Layyah districts respectively. The river Indus flows on its western side across which lies district D.I.Khan. Bhakkar district is administratively divided into four Tehsils. The name of tehsils is Bhakkar, Kalor Kot, Mankera and Darya Khan.

### 2.6.2 Population:

At the time of the 2017 census the district had a population of 1,647,852, of which 843,056 were males and 804,669 females. Rural population is 1,388,198 while the urban population is 259,65. Bhakkar City. Urban Population of Bhakkar City was 112,807 according to 2017 census which is expected to grow to 166,270 by 2032 at a growth rate of 2.62.

**Table 2:5: Population Projection Bhakkar District**

<b>Bhakkar District</b>			
<b>Tehsils</b>	<b>Pop 2017 (census)</b>	<b>Pop 2022 (projection)</b>	<b>Pop 2032 (projection)</b>
<b>Bhakkar</b>	112,807	128,379	166,270
<b>Darya Khan</b>	80,421	89,009	109,034
<b>Kalur Kot</b>	52,281	57,694	70,259
<b>Mankera</b>	14,145	15,832	19,836

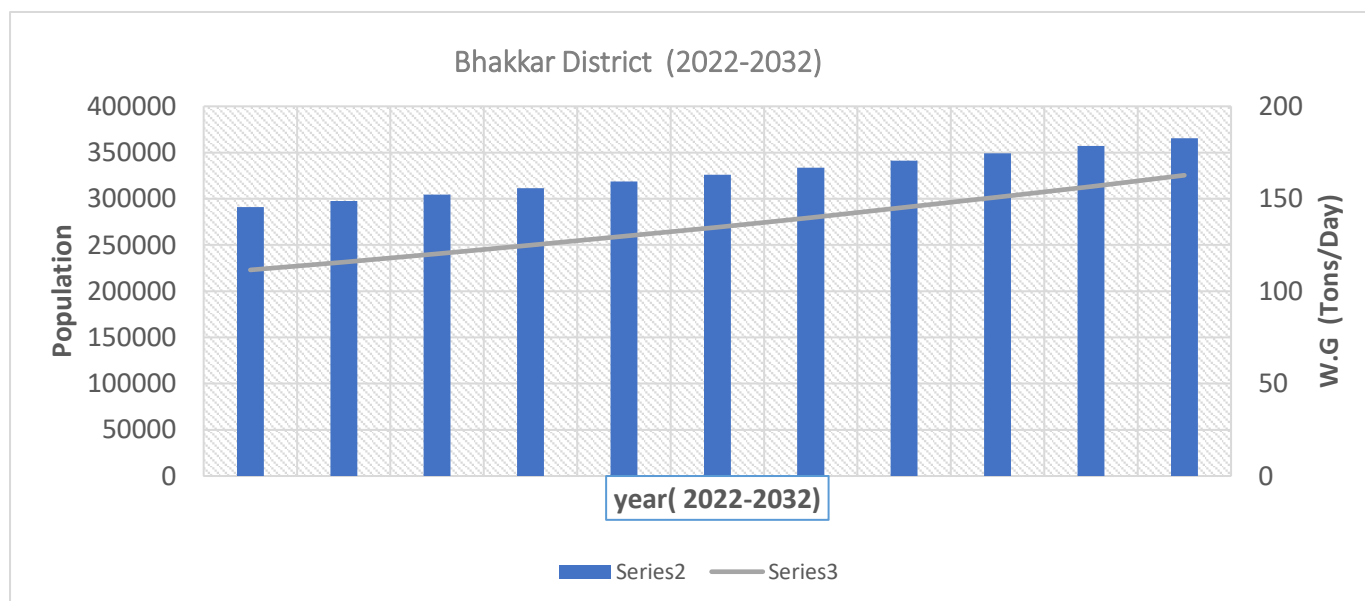
### 2.6.3 Waste Generation:

Waste generation from the population of Bhakkar is calculated and projected till 2032. A waste generation rate of 0.40 kg/cap-day is adopted for City while it is taken as 0.37 kg/cap-day for areas other than Bhakkar City and waste generation rate is increase by 1.5% annually<sup>6</sup>. Details of waste generation in the Khushab district are given in the table below,

**Table 2:6: Waste Generation of Bhakkar District**

Bhakkar District		
Tehsils	Waste Generation 2022 (Tons/day)	Waste Generation 2032 (Tons/day)
Bhakkar	51	77
Darya Khan	33	47
Kalur Kot	21	30
Mankera	6	9

Considering the above table, the MSW generation of Bhakkar city is around 51 Tons per day which is approximately 18,615 Tons per year and is expected to reach 28,105 Ton per year (77 Tons per day) by the end of 2032.



**Figure 2.6: Population Vs Waste Generation Bhakkar**

<sup>6</sup> The values of waste generation rate is taken after carefully considering local conditions and after consulting relevant stakeholders of Bhakkar district

## 2.7 CURRENT SWM PRACTICES IN SARGODHA DIVISION:

The services of SWM are currently managed by the Municipal corporation in each District. MCs of Districts are still using old methods of waste collection and transportation. There is no proper allocation of sanitary workers as the system is not established for SWM. The system currently has poor collection efficiency, as it consumes more time and more manpower to collect and transport the solid waste to dumpsites. This system deploys sanitary workers, Handcarts and mini dumpers to collect waste from households and sweep related waste. The waste is then stored in containers of different capacities. Transportation of waste is done through Arm-roll vehicles, dumpers, Tractor trolley and Compactors. As far as disposal is concerned, the waste is being dumped indiscriminately in open spaces and open plots of the city. However, there is a transfer station where waste is being dumped and transferred to dumpsite by loading it on dumpers and trolleys. No proper covering of vehicle is done while transporting waste from city/ transfer station to the dumpsite and littering is observed by the conveying vehicles on their way to the dumpsite.

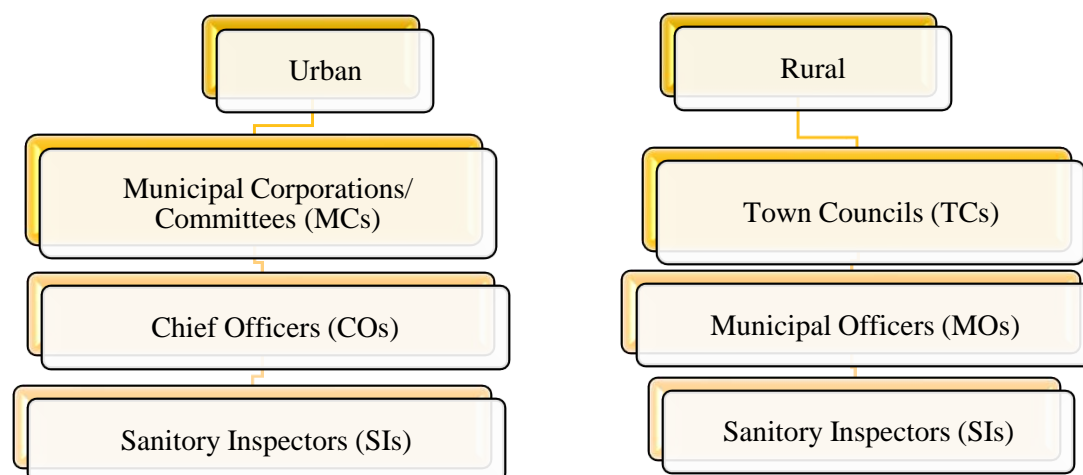


Figure 2.7: Existing SWM practices in Sargodha Division



**Figure 2.8: Existing Situation of SWM in Sargodha**

In the existing SWM system of Sargodha Division, Municipal Corporations (MCs) and Town/Tehsil Councils (TCs) are responsible to manage MSW in urban and rural areas respectively. Each MC is headed by Chief Officer (CO) and Town Council is headed by Municipal Officer (MO). The following chart shows the existing solid waste management structure followed in the Sargodha Division.



**Figure 2.9: Urban and Rural Hierarchy**

The details of existing equipment available in the Sargodha city are given in the table below.

**Table 2:7: Existing resources of SWM in MC Sargodha**

<b>Sr. No.</b>	<b>Resource</b>	<b>Total</b>	<b>Functional</b>	<b>Non-Functional</b>
1	Arm roll	03	03	0
2	Tractor trolleys	14	12	02
3	Loaders	07	06	01
4	Mechanical Sweeper	02	0	02
5	Tractor Front Blade	02	02	0
6	Mini Dumpers	06	06	0
7	Compactor	02	01	01
8	Dumper	13	09	04
9	Hand Carts	44	44	0
10	Containers 0.8m <sup>3</sup>	50	26	24
11	Containers 5m <sup>3</sup>	90	50	40
<b>Sr. No.</b>	<b>HR</b>	<b>Total</b>	<b>On duty</b>	<b>Vacant</b>
1	Sanitary Workers	885	519 (246 regular, 273 Daily Wages)	366
2	Drivers	3	3 (regular)	—

The table mentioned above shows that MC still have some resources but they are not enough to clear most of the waste from urban areas and uncollected waste is seen along the roadsides. There are a lot of Storage containers that are non-functional and some existing machinery is also is not operational which further decreases the operational capacity of SWM in Sargodha city. Sanitary workers and drivers are also not enough to manage city waste.

Existing resources from remaining districts were also collected and data is compiled in the form of table 5.1

**Table 2:8: Existing Resources in District**

<b>Existing Resources</b>	<b>Mianwali</b>	<b>Khushab</b>	<b>Bhakkar</b>
<b>Hand Carts</b>	0	10	0
<b>Containers (5 m<sup>3</sup>)</b>	0	0	13
<b>Containers (0.8 m<sup>3</sup>)</b>	4	0	0
<b>Mini dumper</b>	0	0	0
<b>Tractor Trolley</b>	6	5	6
<b>Arm Roll</b>	0	0	1
<b>Compactor</b>	2	0	0
<b>Mechanical Sweeper</b>	0	0	0
<b>Sanitary Workers</b>	84	52	78
<b>Drivers</b>	2	3	7

## 2.8 CURRENT DISPOSAL PRACTICES IN SARGODHA DIVISION:

Unfortunately, there is no proper sanitary landfill in whole Sargodha division. There is dire need of sanitary landfill for safe disposal of waste. This task has not been achieved mainly due to lack of finances and non-availability of appropriate land.

In **Sargodha District**, Municipal Corporation/Municipal Committees are providing services in terms of waste collection and disposal. In whole district, the collected waste is currently being disposed at “Chak 91-N” dump site without any soil cover. This site is in use for 20 years, but district is still deprived of a sanitary landfill. Disposed waste remain uncovered at this site and leachate (percolated contaminated water from solid waste) generated from this waste seeps through the soil and contaminates ground water.



Figure 2.10: Existing Dumpsite of Sargodha



Figure 2.11: Sargodha Transfer station

In **Khushab District**, the existing solid waste management system comes under the responsibility of its Municipal Committee. Collected waste is dumped along the sewerage drain, river bed and on the periphery of the city.

In **Bhakkar District**, the solid waste is collected and disposed by its Municipal Committee. The disposal of solid waste is also in the form of open dumping near Pul Sheikh Rao UC 1, Pulli Adil Utra UC 1, Pulli Lal Darvaish UC 3, Opposite Railway Station and Railway Crossing in the city. This open dumping is creating in-sanitary & unhygienic conditions, degrading the environment, emitting unbearable smells and providing breeding places for mosquitoes and flies.

Following is the summary of SWM system in Sargodha Division:

- In Sargodha, solid waste is being disposed-off directly.
- No treatment of waste is carried out except for informal recycling by scavengers.
- No system exists for separate disposal of hazardous waste.

- No measures are taken to negate adverse environmental effects caused by open dumping or throwing of waste into water bodies.

In **Mianwali District**, the existing solid waste management system is being managed by its Municipal Committee. The collected waste is being disposed-off in vacant plots, along river bed and on the periphery of the city.

The dumpsite of Mianwali is an open and uncontrolled dumpsite located in the center of the city adjacent to main graveyard and there is no distinguished boundary between the graveyard and the dumping site. Waste can be seen flying inside the graveyard when winds are blown and is a matter of concern for the authorities. Moreover, this site is being used for dumping of solid waste for quite a long time and there is not enough land left for future dumping practice as it is using the existing space of the graveyard. Due to the dumping of MSW within the city there is attraction of birds and flies which can cause health issues and disturb the flights at nearby air base which is located just 4 km from the existing dumping site.



**Figure 2.12: Satellite Imagery of Existing Mianwali Dumpsite**



**Figure 2.13: Existing Location of Mianwali dumpsite**

## CHAPTER 3. PROPOSED SWM PLAN FOR SARGODHA DIVISION

---

A comprehensive SWM System is required in the Sargodha to cater the existing problems to manage solid waste. The proposed SWM system in Sargodha Division will be a 10-year plan (2022 to 2032), which intends to uplift the existing practices and bring a more efficient and cost-effective waste management system to the district.

This system will provide a complete waste collection mechanism identifying resources that are needed to manage solid waste till 2032. Starting with waste collection from households, commercials, institutions, offices, and public places, and parks and transferring it into containers. The collected waste will then be transported in vehicles of suitable size and disposed of in a controlled dumpsite in an environmentally safe manner unlike the existing practice of wild dumping.

The proposed system of SWM will transform the functions and operations of existing SWM sectors and will be comprised of three (03) major components.

- Primary collection system
- Secondary collection system
- Final disposal

It may be noted that rural areas having a population of less than 10,000 persons are not included in this plan because of the following reasons.

1. Population in those areas is very scattered and sparsely distributed, hence a SWM system for these areas would not be economically viable.
2. Amount of waste generation is very low to have a separate collection and transportation system.
3. 70 to 80% of generated solid waste is organic in nature and is reused as fertilizer.

In this document we will give a detailed plan for implementation of first phase. Further plan will be devised after successful implementation of Phase-I.

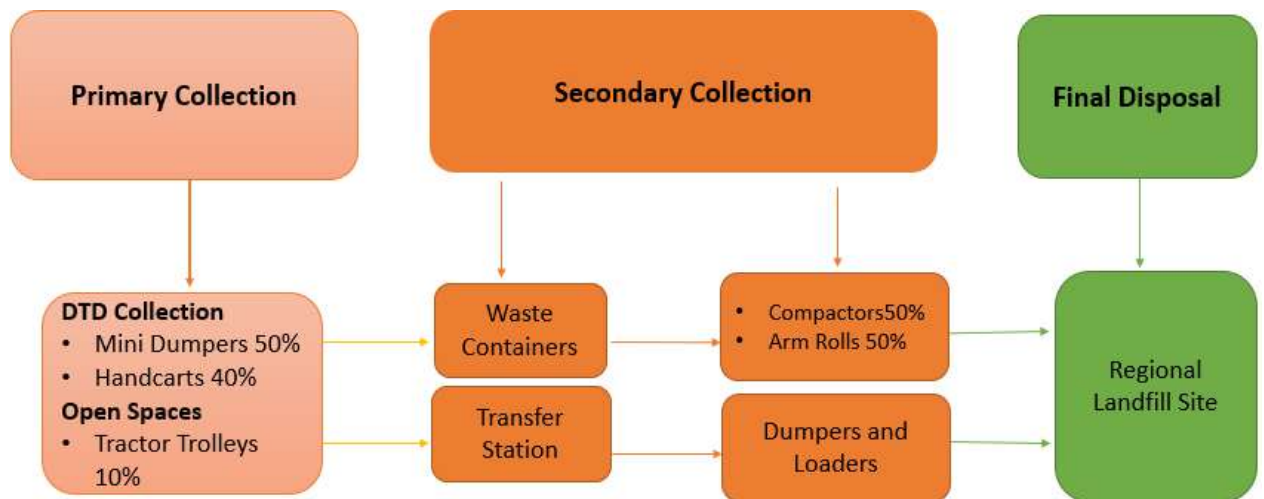


Figure 3.1: Proposed Model for SWM

### 3.1 PRIMARY WASTE COLLECTION SYSTEM:

Primary Collection is the collection of Solid Waste at the primary level i.e. consumer/generator level. In the proposed SWM plan, Primary collection will be done through handcarts (HC) and Mini dumpers (MD). In Sargodha, 50% of the generated waste will be collected by Mini-dumpers, 40% will be collected by handcarts and the remaining waste will come directly to containers/collection points. Workers for primary collection will collect the waste from households, markets, open vacant plots and bring it to the nearest collection points or community containers.

For remaining waste, trolleys and loader will be used to lift waste from open plots and collection points which will take the waste to the transfer station or landfill (if feasible). Sweeping of main road and inner streets will be improved by deploying sanitary workers.

The day-to-day duty of sanitary workers will include street sweeping, waste collection from households, de-silting, and scrapping works needed for streets and roads. In addition to a regular team of sanitary workers, there would be a special group of workers consisting of 10-15 sanitary workers, who will work in a team and clean public places like grounds, parks, and graveyards twice a week.



Figure 3.2: Primary Collection Equipments

### 3.2 SECONDARY WASTE COLLECTION SYSTEM

Secondary collection system is the collection of solid waste from the secondary level. In this type of collection system, the waste collected from the community would be taken to the designated Transfer Station (TS)/ temporary collection point or directly to the dumpsite (if feasible). Solid waste will be collected through compactors (having capacities of  $8\text{m}^3$ ) and arm roll vehicles, while remaining areas will be served through Arm roll vehicles and tractor-trolleys. Community Containers of  $5\text{m}^3$  capacity are proposed along major streets and places of littering/bulk generators/un-serviced areas. While containers of  $0.8\text{m}^3$  will serve secondary streets, roads, and localities. Mechanical Sweepers (MS) will be used to clean main roads while dumpers and excavators/loaders are proposed to clean plots and transport waste from TS.



Figure 3.3: Secondary Container lifting Vehicles

### 3.3 FINAL DISPOSAL

Final transport & disposal includes transportation of waste from locality/Transfer Station / temporary collection point to the controlled dumpsite. In Sargodha, the Dumpsite is situated within 11km periphery of any served area. In this way, POL costs will be lessened and effective utilization of machinery can be done in terms of trips.

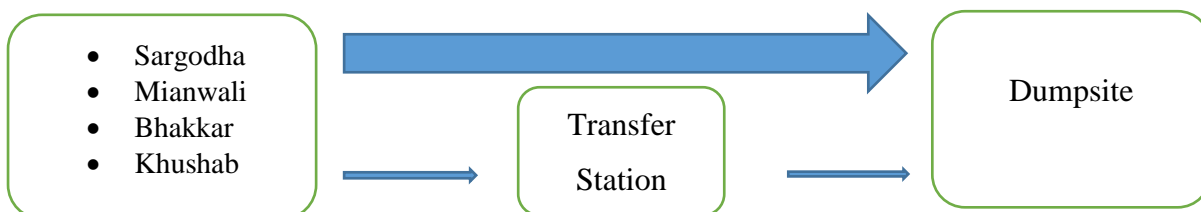


Figure 3.4: Operational model for SWM

The following combination of Transfer Stations and Dumping sites would cater to all the waste coming in a day from human settlements lying within the vicinity of the Dumpsite/Transfer Station. The Dumpsites in Sargodha City, transfer station and its coordinates are given below:



Figure 3.5: Tertiary Collection Vehicles

Table 3:1: Sargodha Dumpsite and transfer Stations

Sargodha Control Dumpsites (Proposed)					
Sr no	Area Served	Location of Dumping Site	Area (Acres)	Coordinates	Tonnage (tons/day)
1	Sargodha City	Chak 91-N	163	32.047, 72.728	294
2	Sargodha City	85 Wali Jahal		32.044, 72.623	

Proposed Landfill and Transfer station are Shown in fig 3.6 and 3.7:

### 3.4 REQUIRED RESOURCES

Based on waste load, and area requirements, the number of compactors, arm rolls, mini dumpers, dumpers, loaders, collection containers (having capacities of  $0.8\text{m}^3 / 5\text{m}^3$ ), mechanical sweeper, and required human resources are calculated for Sargodha City, Bhakkar, Khushab & Mianwali. The resources required are shown in the table below.

Table 3:2: Required additional Resources for Efficient SWM in Sargodha City

SR No.	Name	Resource Required
1	Handcarts	438
2	Mini dumper( $1\text{m}^3$ )	43
3	Containers ( $0.8\text{m}^3$ )	619

<b>4</b>	Containers (5m <sup>3</sup> )	53
<b>5</b>	Arm Rolls	14
<b>6</b>	Compactors (8 m <sup>3</sup> )	12
<b>7</b>	Dumper (8 ton)	4
<b>8</b>	Front End Loader	3
<b>9</b>	Mechanical Sweeper	2
<b>10</b>	Excavator 060	1
<b>11</b>	Monitoring Vehicles (Alto 660cc)	1

**Table 3:3: Additional HR required in Sargodha**

<b>Sr.No.</b>	<b>Name</b>	<b>HR Requirement</b>
<b>1</b>	Manager (operations+ HR/ admin+ Accounts/Finance+ MIS)	5
<b>2</b>	Assistant Managers (Ops)	3
<b>3</b>	AM (Admin+ HR+ Workshop+ Communications+ Accounts/ Finance+ MIS)	5
<b>4</b>	Sanitary Workers	356
<b>5</b>	Shift In charge/ workshop Incharge	2
<b>6</b>	Drivers	82
<b>7</b>	Guards	2
<b>8</b>	Tyreman	1
<b>9</b>	Painters	1
<b>10</b>	Supervisors	12

Table 3:4: Additional Resources Required

<b>Additional Resource Required</b>			
<b>Equipment</b>	<b>Mianwali</b>	<b>Khushab</b>	<b>Bhakkar</b>
Handcarts	82	168	65
Mini dumper (1 m <sup>3</sup> )	10	20	8
Containers (0.8 m <sup>3</sup> )	118	255	100
Containers (5 m <sup>3</sup> )	20	31	16
Arm Rolls	3	5	2
Compactors (8 m <sup>3</sup> )	2	3	1
Tractor Trolley (2 ton)	0	0	0
Front End Loader	0	0	0
Scraper (Blade)	1	1	1
Dumper (8 ton)	2	2	2
Front End Loader	1	1	1
Mechanical Sweeper	1	1	1
Water Bowser	1	1	1
Excavator 060	1	1	1
Monitoring Vehicles (Alto 660cc)	1	1	1

Table 3:5: Additional HR Required

<b>Additional HR Required</b>			
<b>HR</b>	<b>Mianwali</b>	<b>Khushab</b>	<b>Bhakkar</b>
Manager (ops+ HR/admin+ Account/ Fin+ MIS)	2	2	1
Assistant Managers (Ops)	1	2	1
Field officer	0	1	0
Sanitary Workers	79	283	51
Office boy	1	1	1
comp operators	1	1	1
POL In charge	1	1	1
Drivers	21	34	12
Guards	2	2	2
Tire men	1	1	1
Painters	1	1	1
Supervisors	1	5	1

### 3.5 ZONE WISE DIVISION OF SARGODHA CITY

Keeping in View the Existing Solid waste management system of Sargodha the city been divided into 4 zones to cater all waste generated and for best supervision and management. Zone 1 and zone 4 has 5 Union councils and zone 2 and zone 3 has 6 union councils each. Zonal and Union council division is shown in the fig 3.6 and 3.7 respectively.

Table 3:6: Union Council wise division of each zone

Union Council wise division of Zones	
Zone 1	UCs (1,2,3,4,5)
Zone 2	UCs (6,7,9,8,10,11)
Zone 3	UCs (12,13,14,15,16,17)
Zone 4	UCs (18,19,20,21,22)

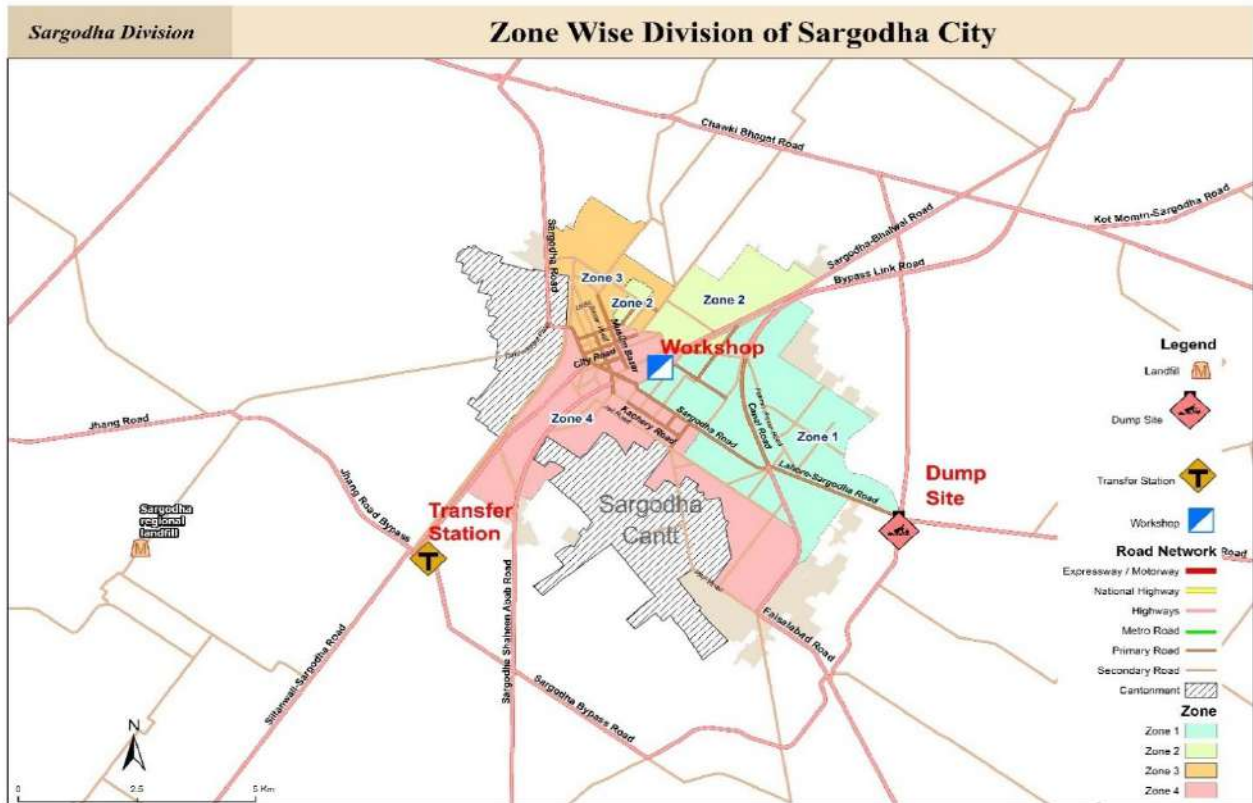


Figure 3.6: Zone wise division of Sargodha

## Sargodha City Landfill & Transfer Station

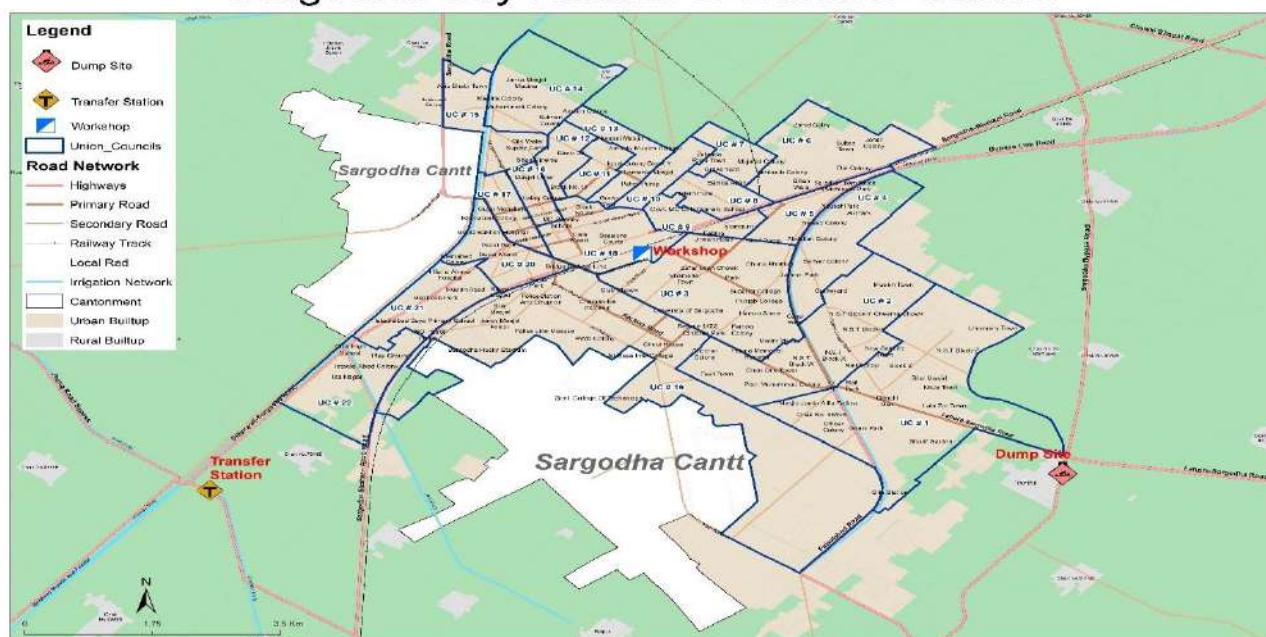


Figure 3.7: Union Councils in Sargodha

Distribution of Resources in Sargodha City is done equally in accordance with the number of Union Councils of each zone and separate resources are also allocated for Sargodha Cantonment.

Table 3.7: Zone wise Division of Total Resources in Sargodha

Resource	Total Resources	Cantonment Resources	Zone 1	Zone 2	Zone 3	Zone 4
Handcarts	482	111	85	101	101	84
Mini dumper(1m <sup>3</sup> )	49	10	9	10	11	9
Containers (0.8 m <sup>3</sup> )	645	124	118	142	142	119
Containers (5m <sup>3</sup> )	103	13	20	25	25	20
Arm Rolls	17	4	3	4	3	3
Compactors (8 m <sup>3</sup> )	13	3	2	3	3	2
Dumper (8 ton)	13	1	3	3	3	3
Front End Loader	47		11	12	13	11
Mechanical Sweeper	2	1	0	0	0	0
Excavator 060	1		0	0	0	0
Monitoring Vehicles (Alto 660cc)	1		0	0	0	0

Sanitary Workers	875	202	153	184	184	152
Drivers	85		19	23	23	20
Supervisors	12	3	3	2	2	2

### 3.6 FINANCIAL COSTING:

The total cost for Primary, Secondary, and Tertiary waste collection & transport for the whole district has been calculated using above mentioned resources. Taking the whole project life of 10 years, the following parameters were considered in costing

- Cost of handcarts, loader rickshaws, containers, compactors, arm roll vehicles, container carrier, Containers), Front End Loaders, and Monitoring vehicles.
- Capital and depreciation cost
- Operational and Maintenance Cost.
- Cost of HR for primary, Secondary, and Tertiary waste collection system (managers, sanitary workers, drivers, office staff and workshop staff)
- Office establishment and management costs including furniture, utilities, IT equipment, MIS systems and management staff etc.

The detail of each cost has been shown in tables below:

### 3.6.1 Capital Cost

Capital Cost for procurement of resources and purchasing of new machinery for Sargodha are as shown in table 3.8:

**Table 3:8: Capital Cost for SWM in Sargodha City (2022-2032)**

Name of area	Unit cost	Required Replacement during		Total (Million PKR)
		10 years		
Handcarts	50,000	3	150,000	65.6
Mini dumper (1 m <sup>3</sup> )	1,700,000	1	1,700,000	73.3
Containers (0.8 m <sup>3</sup> )	60,000	2	120,000	74.3
Containers (5m <sup>3</sup> )	550,000	2	1,100,000	58.4
Arm Rolls (ISUZU NTR)	7,700,000	1	7,700,000	109.1
Compactors (8m <sup>3</sup> )	9,000,000	1	9,000,000	103.6
Dumper (8 ton)	10,000,000	1	10,000,000	40
Front End Loader	3,200,000	1	3,200,000	9.6
Mechanical Sweeper (TRACTOR MOUNTED)	2,500,000	1	2,500,000	5.0
Excavator 120	30,000,000	1	30,000,000	30
Office Establishment				2.40
Monitoring Vehicles	1,800,000	1	1,800,000	1.8
Dep Cost				22.9
Capital Cost Total (Mil PKR)				<b>599.17</b>
Total Tonnage (10 Years) (Mil. Ton)				<b>1.41</b>
Cost per ton				<b>426</b>

*\*This cost includes depreciation cost as well.*

Operational and HR cost for the span of 10 years is attached at Table 3.8 & 3.9 respectively.

**Table 3:9: Capital Cost required for remaining District**

Resource	Unit cost (PKR)	Required Replacement during 10 years		Mianwali (Mil. PKR)	Khushab (Mil. PKR)	Bhakkar (Mil. PKR)
<b>Handcarts</b>	50,000	3	150,000	12.3	25.2	9.75
<b>Mini dumper (1 m<sup>3</sup>)</b>	1,700,000	1	1,700,000	17	34	13.6
<b>Containers (0.8 m<sup>3</sup>)</b>	60,000	2	120,000	14.16	30.6	12
<b>Containers (5 m<sup>3</sup>)</b>	550,000	2	1,100,000	22	34.1	17.6
<b>Arm Rolls (ISUZU NTR)</b>	7,700,000	1	7,700,000	23.1	38.5	15.4
<b>Compactors (8 m<sup>3</sup>)</b>	9,000,000	1	9,000,000	18	27	9
<b>Scraper (Blade)</b>	1,600,000	1	1,600,000	1.6	1.6	1.6
<b>Dumper (8 ton)</b>	10,000,000	1	10,000,000	20	20	20
<b>Front End Loader</b>	3,200,000	1	3,200,000	3.2	3.2	3.2
<b>Mechanical Sweeper (TRACTOR MOUNTED)</b>	2,500,000	1	2,500,000	2.5	2.5	2.5
<b>Water Bowser</b>	2,000,000	1	2,000,000	2	2	2
<b>Excavator 120</b>	30,000,000	1	30,000,000	30	30	30
<b>Office Establishment</b>				1.2	2.4	1.2
<b>Monitoring Vehicles</b>	1,800,000	1	1,800,000	1.8	1.8	1.8
<b>Dep Cost</b>				6.75	10.2	5.6
				175.62	263.1	145.23
<b>Total Tonnage (10 Years)</b>				310236	652498	254877
<b>Cost per ton</b>				<b>566.07</b>	<b>403.09</b>	<b>569.83</b>
<b>CAPEX (Million PKR)</b>				<b>175.61</b>	<b>263.02</b>	<b>145.24</b>

### 3.6.2 Operational and Maintenance Cost

Operational Cost for Sargodha is shown in table 3.9:

**Table 3:10: O&M cost for SWM in Sargodha city**

<b>Total Fuel Cost</b>	<b>189,156</b>
Month (Million PKR)	5.7
Yearly (Million PKR)	68.1
Maintenance (Million PKR)	10.2
Grand Total for 10 Years (Million PKR)	783.1
Total Tonnage (Million Ton)	1.41
Total Tonnage per year	140,602.36
POL (Mil)	68.10
Maintenance (Mil)	10.21
OPEX (Mil)	<b>78.31</b>
Cost per Ton	<b>557</b>

Operational Cost for Remaining Districts are shown in the table below:

**Table 3:11: Operational Cost for remaining districts**

	<b>Mianwali</b>	<b>Khushab</b>	<b>Bhakkar</b>
<b>Total Fuel Cost</b>	65,920	102,640	54,320
<b>Total Fuel Cost (Month) (Mil. PKR)</b>	1.98	3.1	1.63
<b>Total Fuel Cost (Year) (Mil. PKR)</b>	23.73	37	19.5
<b>Maintenance (Mil. PKR)</b>	3.55	5.5	2.93
<b>Grand Total for 10 Years (Mil. PKR)</b>	272.91	424.93	224.89
<b>Total Tonnage</b>	310,237	652,498	254,878
<b>Total Tonnage per year</b>	31,024	65250	25488
<b>POL (Mil)</b>	24	36.9504	20
<b>Maintenance (Mil PKR)</b>	4	5.54256	3.933
<b>OPEX (Mil PKR)</b>	<b>27</b>	<b>42.49</b>	<b>22.49</b>
<b>Cost per Ton</b>	<b>879.68</b>	<b>651</b>	<b>882</b>
<b>Controlled Dumpsite Cost per Ton</b>	<b>500</b>		

### 3.6.3 HR cost

HR Cost is for Sargodha Is Shown in Table 3.10:

**Table 3:12: HR cost for SWM in Sargodha City**

<b>HR</b>	<b>Salary/ Month</b>	<b>Total</b>
Sanitary Workers	30,000	10,680,000
Manager (operations+ HR/ Admin+ Account/ Finance + MIS)	150,000	750,000
Assistant Managers (Ops)	60,000	180,000
AM (Admin +HR + Workshop + Communication+ Account/ Finance+ MIS)	60,000	300,000
Shift In charge/ workshop In charge	35,000	70,000
Drivers	35,000	2,870,000
Guards	30,000	60,000
Tyreman	30,000	30,000
Painters	30,000	30,000
Supervisors	35,000	420,000
Total HR Cost/Month (Million PKR)		<b>15.39</b>
Total HR Cost/Year (Million PKR)		<b>184.68</b>
Tonnage/year		140,602
Cost per ton		1,313
HR Cost (Mil.)		<b>184.68</b>
Controlled Dumpsite Cost per Ton		<b>500</b>

HR Cost for the remaining Districts are shown in the table below:

**Table 3:13: HR cost Required for District**

<b>HR</b>	<b>Salary /Month</b>	<b>Mianwali</b>	<b>Khushab</b>	<b>Bhakkar</b>
<b>Sanitary Workers</b>	30,000	2,370,000	8,490,000	1,530,000
<b>Manager (ops +HR/ admin + Account/Fin +MIS)</b>	150,000	300,000	300,000	150,000
<b>Assistant Managers (Ops)</b>	60,000	60,000	120,000	60,000
<b>Field officer</b>	40,000	-	40,000	-
<b>POL In charge</b>	35,000	35,000	35,000	35,000
<b>Drivers</b>	35,000	735,000	1,190,000	420,000
<b>Office boy</b>	30,000	30,000	30,000	30,000

<b>Guards</b>	30,000	60,000	60,000	60,000
<b>Tire men</b>	30,000	30,000	30,000	30,000
<b>Painters</b>	30,000	30,000	30,000	30,000
<b>Computer Operator</b>	30,000	30,000	30,000	30,000
<b>Supervisors</b>	35,000	35,000	175,000	35,000
<b>Total HR Cost/Month (Mil. PKR)</b>		3.71	10.53	2.41
<b>Total HR Cost/Year (Mil. PKR)</b>		44.58	126.36	28.92
<b>Tonnage/year</b>		31024	65250	25488
<b>Cost per ton</b>		1,436.97	1,936.56	1,134.66
<b>HR Cost (PKR Mil.)</b>		<b>44.58</b>	<b>126.36</b>	<b>28.92</b>

Cost summary of tehsils in each Districts of Sargodha Division as given shown in the table below:

**Table 3:14: Cost Summary of remaining tehsils**

<b>Districts</b>	<b>Tehsils of Sargodha Division</b>	<b>Capital Cost (Millions PKR)</b>	<b>Operational Cost (Million PKR)</b>	<b>HR Cost (Million PKR)</b>
<b>Sargodha District</b>	Bhalwal	107.36	19.04	61.32
	Bhera	61.69	13.75	30.78
	Kot Momin	56.20	11.36	33.24
	Sahiwal	69.06	14.21	38.40
	Shahpur	55.11	11.36	33.96
	Sillanwali	42.42	11.79	22.02
<b>Mianwali District</b>	Isakhel	84.75	15.13	40.32
	Piplan	88.08	15.13	37.98
<b>Khushab District</b>	Noorpur	22.43	6.95	8.64
	Nowshehra	18.43	6.49	5.16
	Quaidabad	182.52	30.53	96.36
<b>Bhakkar District</b>	Darya Khan	84.82	16.65	41.88
	Kalur Kot	48.69	12.25	27.84
	Mankera	18.68	5.49	9.30

### 3.7 SARGODHA WASTE MANAGEMENT COMPANY PROPOSED

Moreover, in Sargodha City, for a better waste management system and governance, it is proposed to establish a Solid Waste Management Company in Sargodha. The company will provide SWM services within the jurisdiction of MC Sargodha. The company will be responsible for the collection, transportation, and safe disposal of waste generated on daily basis.

Currently municipal committee is being responsible for waste management within the municipalities. The system has thoroughly been assessed and it was found that in order to have a successful waste management system, Waste Management Company should be developed in Sargodha city. In first phase it will work in the jurisdiction of Sargodha city which may later expand its operations to remaining tehsils of Sargodha district in second phase after effectively performing in the city, whereas in the final phase it may expand its services to the whole Sargodha division.

Currently there is no proper allocation of sanitary workers and machinery for SWM operations as the current staff and machinery is being used by MC Sargodha for other departmental operations.

**Phase I:** Provide Integrated SWM service including collection, storage, transportation, and safe disposal of solid waste in the Sargodha City.

**Phase II:** After the successful provision of SWM services at MC/ city level of Sargodha, it is recommended that SWMC should extend their services of Integrated SWM (collection, storage, transportation, and safe disposal of SW) in remaining 06 Tehsils of Sargodha District.

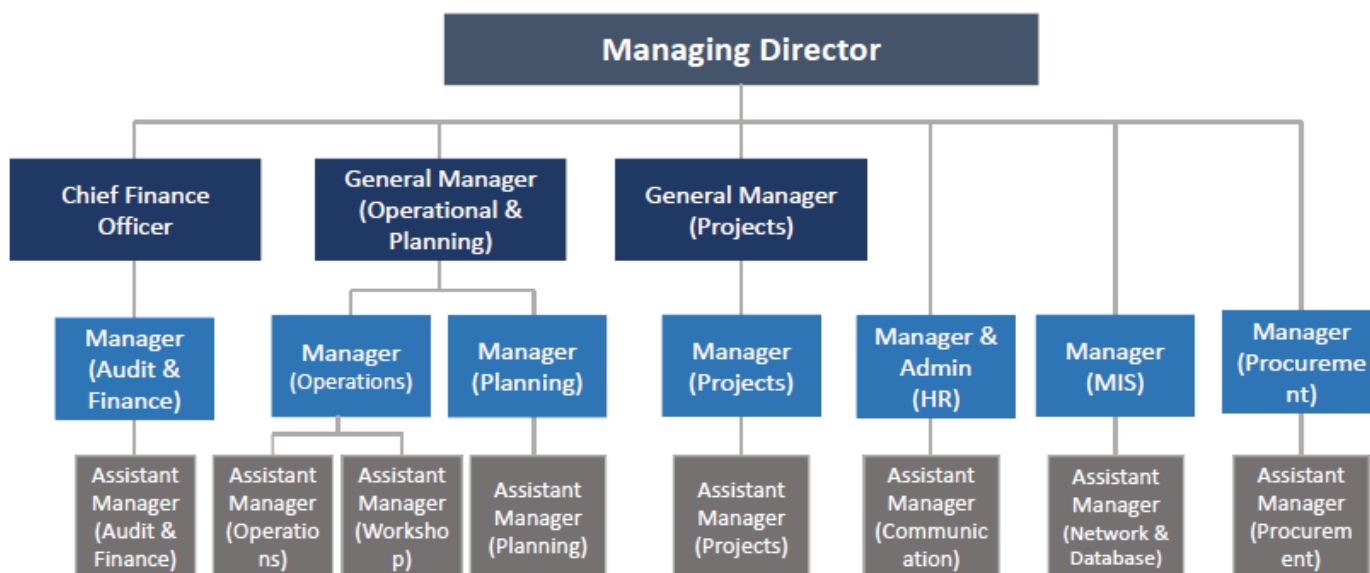
Phase	District	Areas
Phase-II	Sargodha	Bhalwal
		Bhera
		Kot Momin
		Sahiwal
		Shahpur
		Sillanwali

**Phase III:** In the third phase, it is recommended that SWMC should further extend its services in remaining districts and tehsils of Sargodha division with the areas where population is greater than 10,000 persons.

Phase	District	Area
Phase III	Mianwali	Mianwali
		Isakhel
		Piplan
	Khushab	Khushab
		Noorpur
		Nowshehra
		Quaidabad
	Bhakkar	Bhakkar
		Darya Khan
		Kalur Kot
		Mankera

Proposed Organogram of SWMC is given in the fig. 3.11:

**Figure 3.8: Proposed Organogram for SWMC**



### 3.8 STD FACILITY PROPOSED

In Developed world least preferred option for SWM is disposal of waste at dumping site or landfill to minimize its Harmful effects on the environment and sustainable use of land. So, we have proposed STD facility for Sargodha.

The term **STD** is coined by the Urban Unit, referred to **Segregation, Treatment & Disposal** of the Municipal Solid Waste.

#### Segregation

- Material Sorting Facility for recovering of the **Recyclables** (Plastic, Paper, Glass, ferrous Metals, Non-Ferrous Metals, Tetra Pack, cardboard etc.) and **combustibles** for production of Refused Derived Fuels (RDF)

#### Treatment

- Production of the compost from the **organic/ putrescible** waste.
- Production of RDF which can be used as fuel

#### Disposal

- Safe disposal of the residual **inert waste** on scientific basis

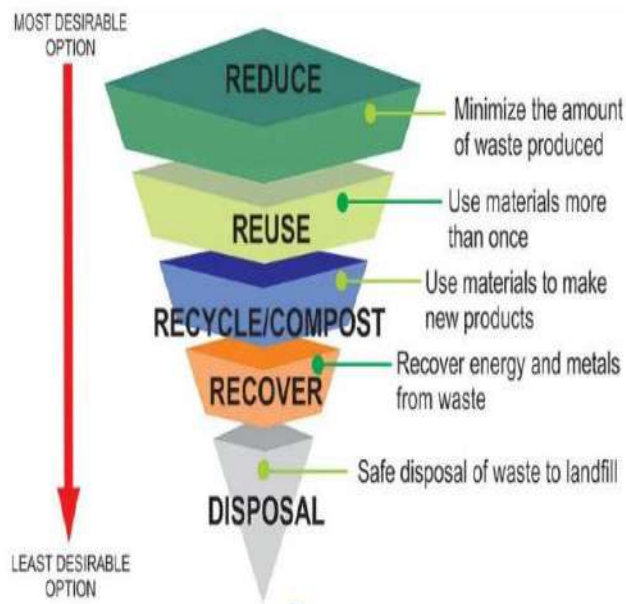
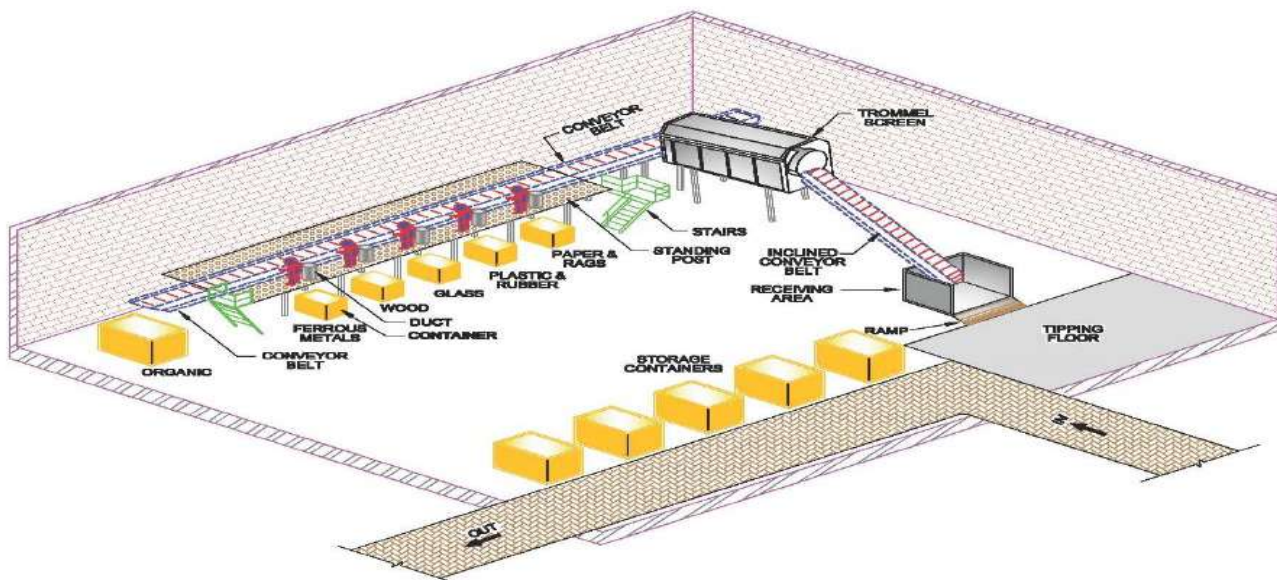


Figure 3.9: Waste Management Hierarchy



### 3.9 COMPONENTS OF STD

#### Site Layout 25 Acres

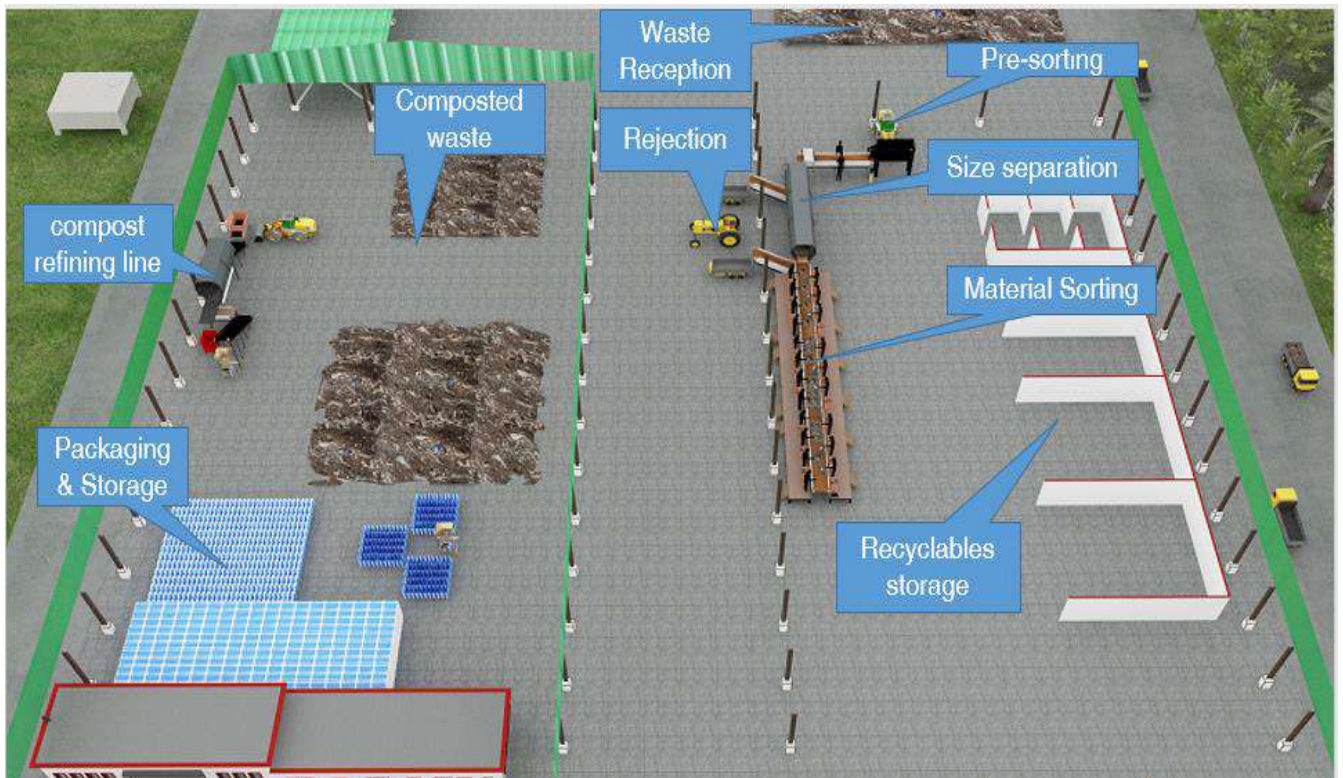


Figure 3.10: Components of STD

### 3.10 BENEFITS OF THE FACILITY

- Convert Organic Waste to Compost.
- Segregation of Recyclable Material
- Segregation for Refuse-Derived Fuel (RDF) Material.



### 3.11 ENVIRONMENTAL BENEFITS

#### 3.11.1 Improvement in Groundwater Quality

After sorting and treatment, organic material which cause leachate formation will be converted to Compost, thus preventing any further water pollution.

#### 3.11.2 Improvement in Air Quality

Burning of waste produce many toxic compounds which cause air pollution and endanger human health. After processing through this facility most of waste will be utilized and thus preventing the air pollution.

#### 3.11.3 Improvement in Soil Quality

Use of the compost in agriculture as a fertilizer will help soil to retain and absorb nutrients and water. Better water retention means less watering which ultimately help water conservation.

### 3.12 DETAILS OF ACTIVITIES OF STD FACILITY

The different activities performed in Segregation, Treatment and Disposal Facility (STD) Facility depend upon the functions of STD Facility i.e.

- a) The role that the STD Facility is to serve in the waste management system
- b) The types of material to be recovered
- c) The form in which the materials to be recovered will be delivered to the STD Facility
- d) The containerization and storage of processed materials for the buyer.

In view of the abovementioned functions, the following processing and recovery activities are being formulated for the STD Facility receiving mixed MSW of Sargodha City:

- Material Handling (transport and transfer of solid waste)
- Manual Sorting (recovery of recyclable materials from solid waste)
- Size Separation (separation of contraries and organics from the solid waste)
- Size Reduction (removal of bulky items)
- Densification (compaction of recovered materials)

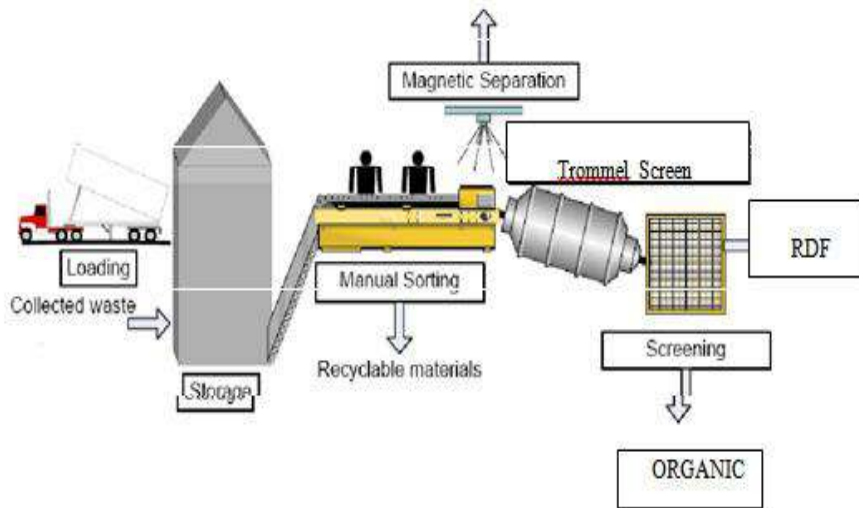


Figure 3.11: Processing and recovery activities at STD

Different operations to be carried out in STD Facility are best described with the help of following process flow diagram shown in fig 8.5.

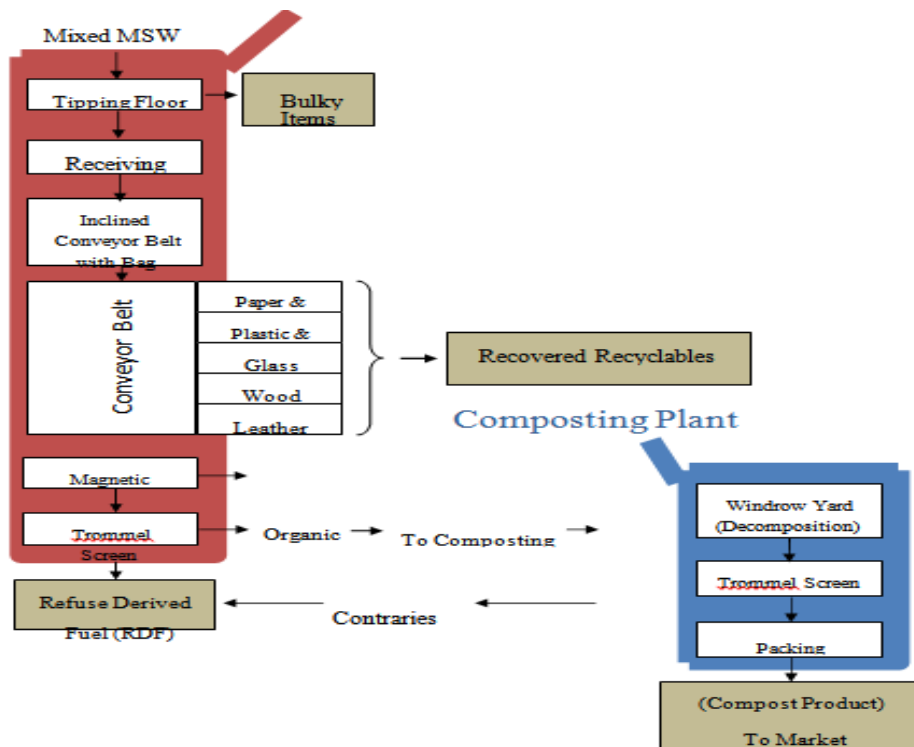


Figure 3.12: Process flow diagram of STD

### 3.13 PROCESS DESCRIPTION OF COMPOSTING

Composting is a biological process which utilizes microorganisms present in organic matter and soil naturally to decompose it into a stable organic material. The raw materials going into the compost are often referred to as “feedstock.” The end product, compost, is a dark brown, humus-like material which can be easily and safely handled, stored, and applied to land as a valuable soil conditioner as shown in figure 8.6.



Figure 3.13: Waste to compost

### 3.14 WINDROW COMPOSTING

When enough space is available, compost is formed into long, narrow conical piles as shown in figure 8.7. This method is used most often for on-farm composting. Width and height of windrows depends on the equipment used to turn and aerate the piles, and lengths are flexible increasing with the area availability. Windrows can be turned with a frontend loader or tractor. Specialized windrow turners that turn piles in place often require wider, lower piles ranging from 3 - 9 feet high and 9 - 20 feet wide.



Figure 3.14: Windrow composting

Once the degradation level is achieved, two or more windrows may then be combined to make room for new raw materials. Windrow composting activity spans over the whole year. In winter turning should be done during the days when temperature is relatively higher. In summers turning should be more frequent to avoid excessive leachate formation. Proper drainage for leachate collection and its disposal should be incorporated in the design for environment friendly activity.



**Figure 3.15: Windrow turner**

### **3.15 PROPOSED LANDFILL SITES IN SARGODHA DIVISION:**

A total number of 4 potential landfill sites have been identified in Sargodha Division named as

1. Sargodha landfill site
2. Bhakkar landfill site
3. Mianwali landfill site

All these sites have been identified according to site selection criteria given by EPA.<sup>7</sup> Following map shows locations of potential landfill sites and transfer stations planned for Sargodha Division

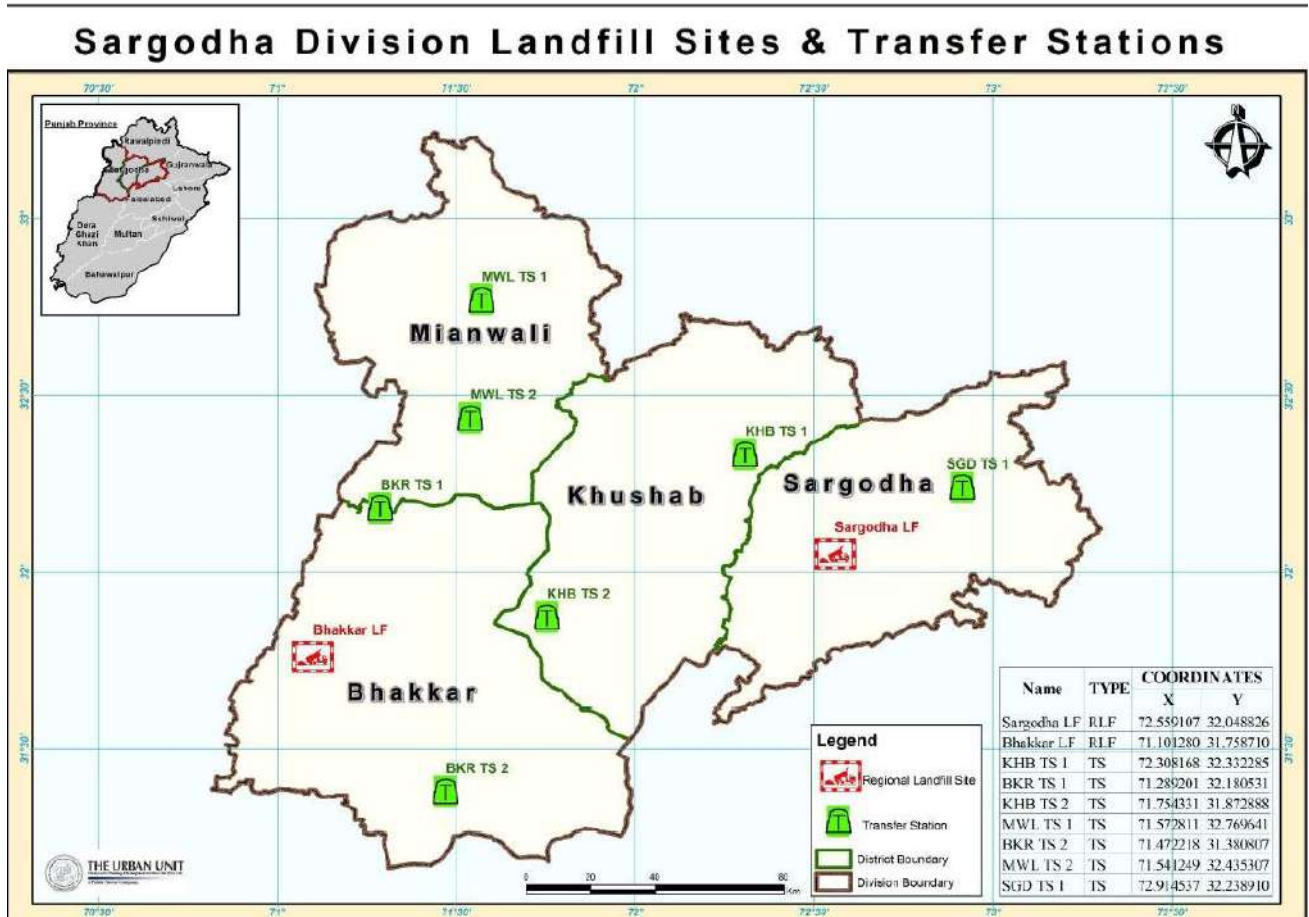
Regional Landfill project (RLFs) is proposed to establish regional landfill sites for safe disposal of solid waste at centralized locations. These landfill sites would serve their respective allocated regions for disposing their waste properly in future.

However, when regional landfill sites are established the hauling distances from the waste producing settlements to the sites increases. So, it would be uneconomical to transport all waste to distant landfill sites without introduction of waste transfer stations. Therefore, a combination of regional landfills and waste transfer stations is recommended in each division depending upon the optimum hauling distances.

---

<sup>7</sup> JICA Solid Waste Management Guidelines report for Pakistan, June 2005.

This combination of Transfer Stations and Landfill sites would cater all the waste coming from human settlements lying within the vicinity of Landfill/Transfer Station. For Sargodha Division, a total number of **seven transfer stations** along with **two landfill sites** have been proposed. These transfer stations would connect cities and villages all over the division with landfill sites. The figure showing proposed transfer stations and landfill sites in the Sargodha division is given below:



**Figure 3.16: Proposed Sargodha Division Landfill and Transfer Stations**

### 3.15.1 Sargodha-Khushab Landfill Site:

The Current population of Sargodha and Khushab District is 3.70 million and 1.28 million respectively and approximately 1820 Ton of MSW is generated by both district every day (using waste generation rate of 0.42 kg/capita/day for urban settlements and 0.3 kg/capita/day for rural ones)<sup>9</sup>. Depending upon the optimum hauling distances, one transfer station is being proposed for whole Sargodha District with one Sanitary Landfill Site located at 17 Km away from Sargodha district, at Chak Khonaan Road. The waste from this transfer station will be transferred to Sargodha landfill site. While in Khushab District, two transfer stations are being proposed however the waste from these will be transferred to both Sargodha and Bhakkar landfill sites.

**Table 3:15: Details of Sargodha-Khushab Regional landfill**

<b>Attributes</b>	<b>Description</b>
<b>Location</b>	The identified site is located at District Sargodha, almost 17 Km way from Sargodha city.
<b>Coordinates</b>	32.04883, 72.55911
<b>Status</b>	Acquired
<b>Area Available</b>	140 Acres
<b>Waste Load</b>	1,650 Ton/day
<b>Connectivity</b>	One-way single paved road is present
<b>Feasibility</b>	There is slum residential area in surrounding of site within the proximity of 50 feet. No water bodies nearby Land is barren
<b>Capacity</b>	The available land area is 140 acres, which will be enough to cater the waste of Sargodha District and two tehsils of Khushab District for next 10 years. It is further proposed that this site can be extended according to needs.

## Sargodha Regional Landfill Site & Transfer Stations

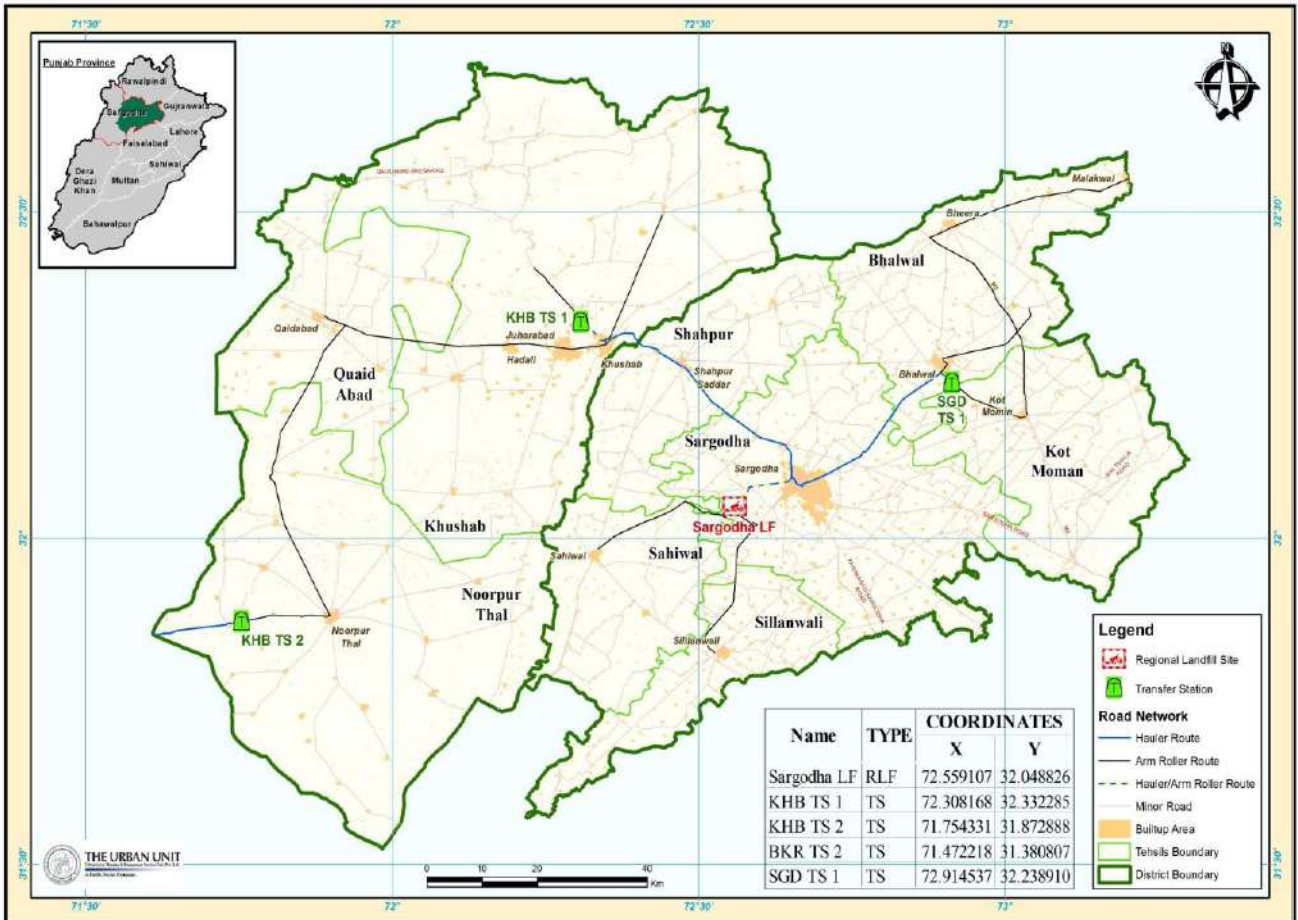


Figure 3.17: Map of Regional Landfills Sargodha

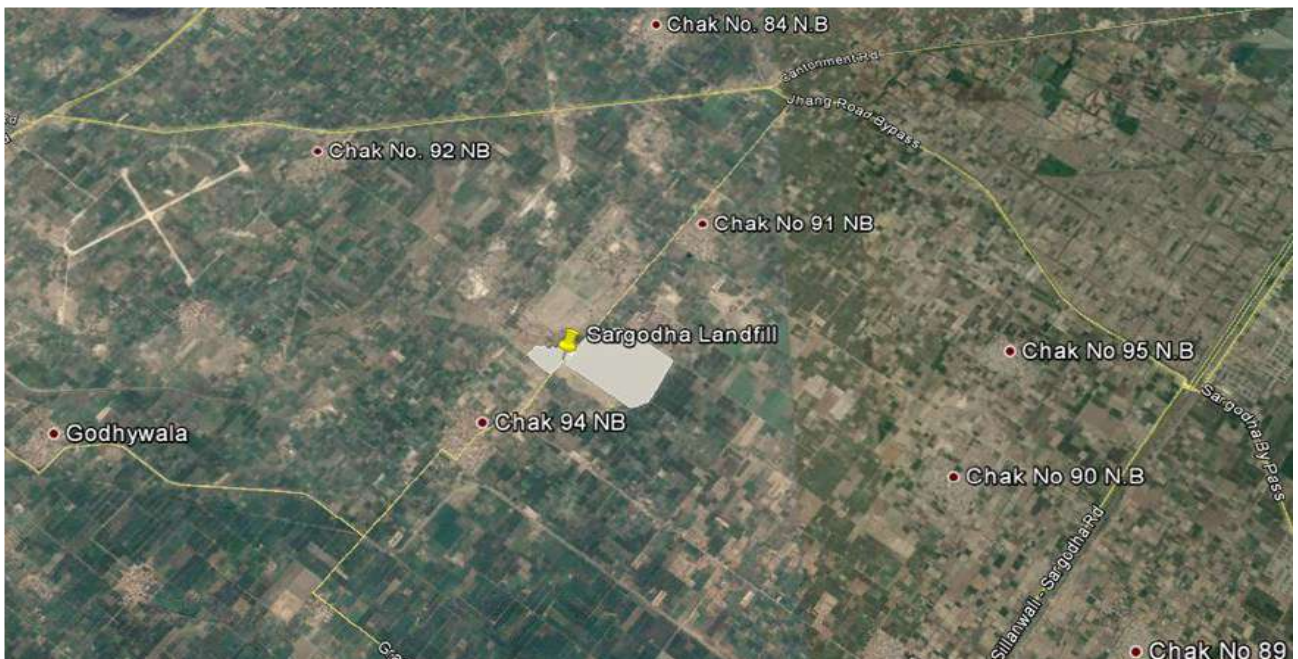


Figure 3.18: Satellite Imagery of Sargodha Landfill

### 3.15.2 Bhakkar Landfill Site:

According to 2017 census, the total population of Bhakkar & District is 1.65 million and it's estimated that everyday waste production is about 1080 Ton (using waste generation rate of 0.42 kg/(capita.day) for urban settlements and 0.3 kg/(capita.day) for rural one). Depending upon the optimum hauling distances, two transfer stations are being proposed for whole Bhakkar District with one Sanitary Landfill Site. The waste from these transfer stations will be transferred to Bhakkar landfill site.

**Table 3:16: Bhakkar landfill Details**

<b>Attributes</b>	<b>Description</b>
<b>Location</b>	The Bhakkar landfill site is located within the district Bhakkar, 19 km away from Bhakkar City centre on Darya Khan Bhakkar road.
<b>Coordinates</b>	31.74236, 71.10092
<b>Status</b>	Site identified and visited.
<b>Area Available</b>	80 Acres
<b>Waste Load</b>	1,250 Ton/day.
<b>Connectivity Roads</b>	One-way paved road is present
<b>Feasibility</b>	There is slum residential area in surrounding of site within the proximity of 500 meter. No water bodies nearby Land is barren
<b>Capacity</b>	The available land area is approx. 80 acres which will be enough to cater the waste of Bhakkar, and two tehsils of Khushab for next 10 years.

### Bhakkar Regional Landfill Site & Transfer Stations



Figure 3.19: Map of Bhakkar Regional Landfill

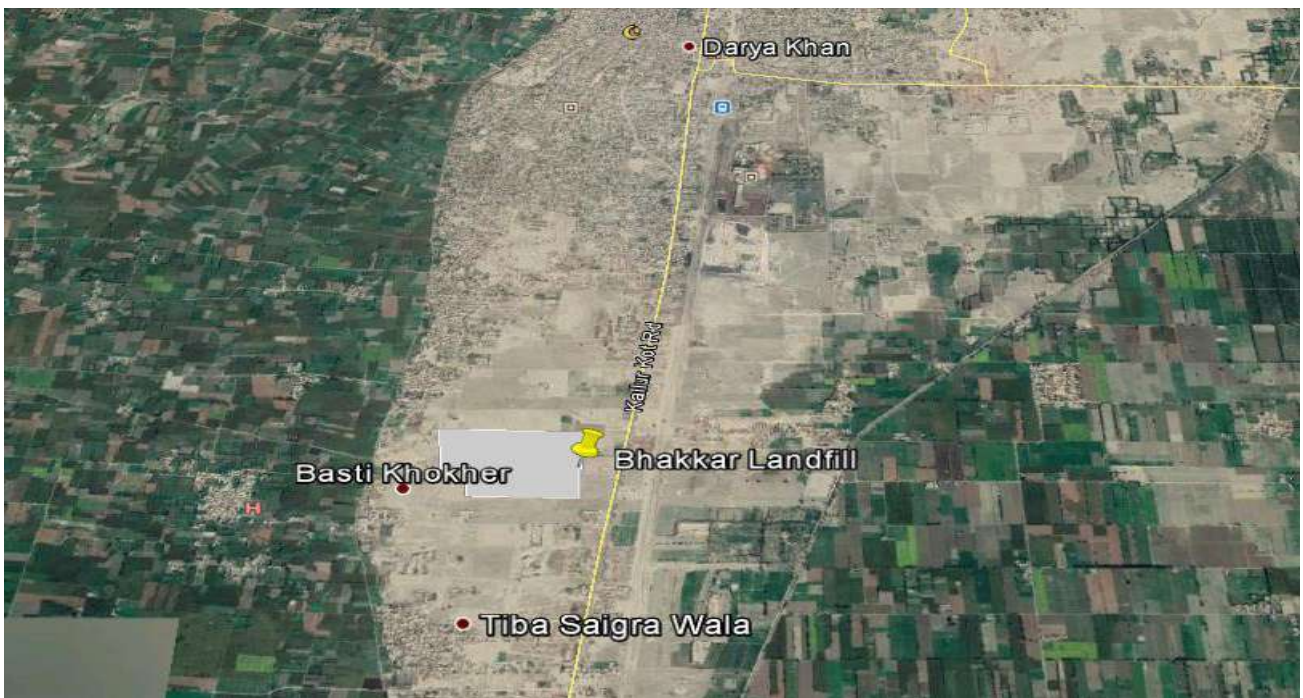


Figure 3.20: Satellite imagery of proposed landfill Bhhakkar

### 3.15.3 Mianwali Landfill Site

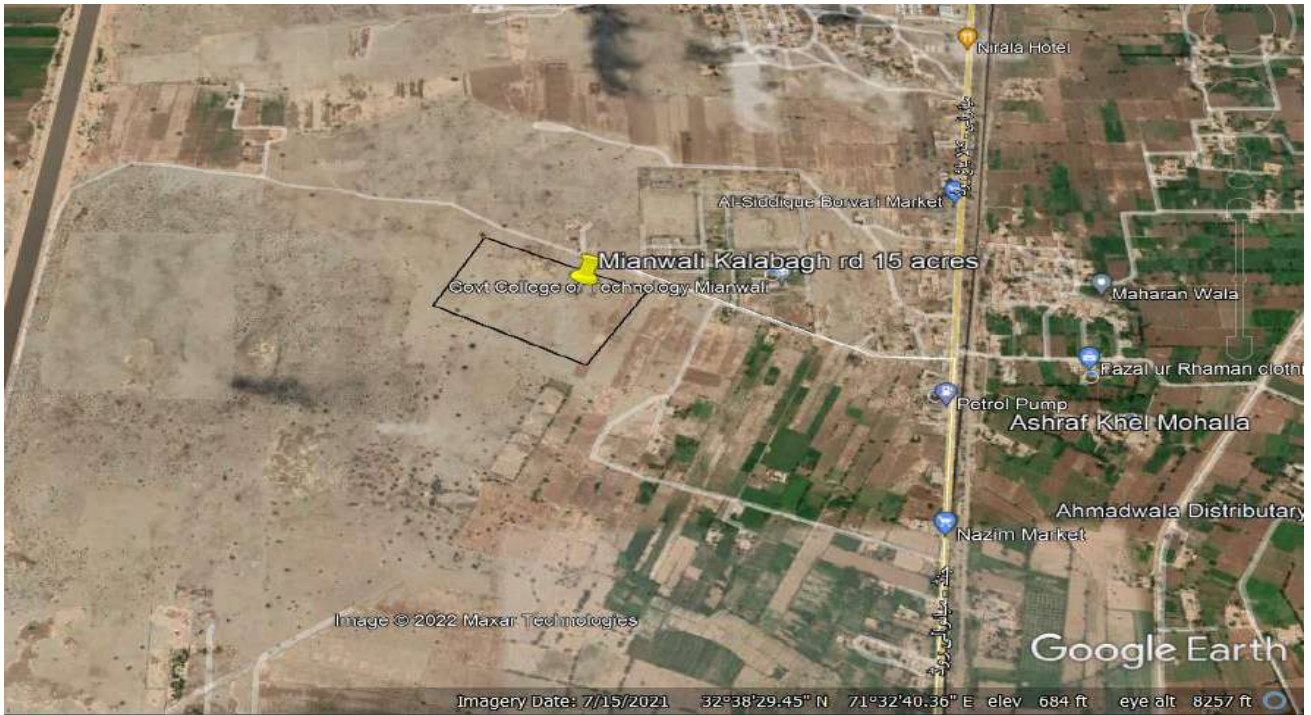
The Solid waste team from Urban Unit Visited Mianwali District for the Landfill site selection. Screening for the sites were done using GIS and Google maps. During the visit team had meetings with the Chief Officer, Sub Engineer and other MC Staff in which different options for landfill sites were discussed. After Consultations site visits were performed with the officials of MC Mianwali and two sites near Mianwali City are proposed out of which one can be acquired by MC Mianwali. The team suggested a controlled dumpsite or a landfill in the city to cater the waste generation for next 20 years.

**Table 3:17: Details of Mianwali landfill**

Attributes	Description
<b>Location</b>	The 1 <sup>st</sup> Landfill Site is located at Mahranwala near Mianwali-Kalabagh road approximately 8 kms from the Mianwali city.
<b>Coordinates</b>	32.64251944, 71.54625000
<b>Status</b>	Site identified and visited.
<b>Area Available</b>	20 Acres
<b>Waste Load</b>	100 Tons/day.
<b>Connectivity Roads</b>	one-way paved road is present
<b>Feasibility</b>	There is no residential area in surrounding of site within the proximity of 500 meter. No water bodies nearby Land is barren
<b>Capacity</b>	The available land area is approx. 15 acres which will be enough to cater the waste of Mianwali for next 20 years.



**Figure 3.22: Mianwali proposed landfill site at Mahranwala**



**Table 3:18: Mianwali Qadradabd proposed landfill by MC officials**

**Figure 3.23: Satellite imagery of Mahranwala proposed landfill site**

Attributes	Description
<b>Location</b>	The 2nd Landfill Site is located at Qadara Abad suggested by MC officials approximately 4 kms from the Mianwali city.
<b>Coordinates</b>	32.56522578, 71.52484914
<b>Status</b>	Site identified and visited.
<b>Area Available</b>	16 Acres
<b>Waste Load</b>	100 Tons/day.
<b>Connectivity Roads</b>	One-way paved road is present
<b>Feasibility</b>	There is residential area in surrounding of site within 300m water body is present approximately 1.3kms from site Land is Agricultural
<b>Capacity</b>	The available land area is approx. 16 acres which will be enough to cater the waste of Mianwali for next 20 years.



**Figure 3.24: Mianwali Qadrabad proposed Landfill site by MC officials**

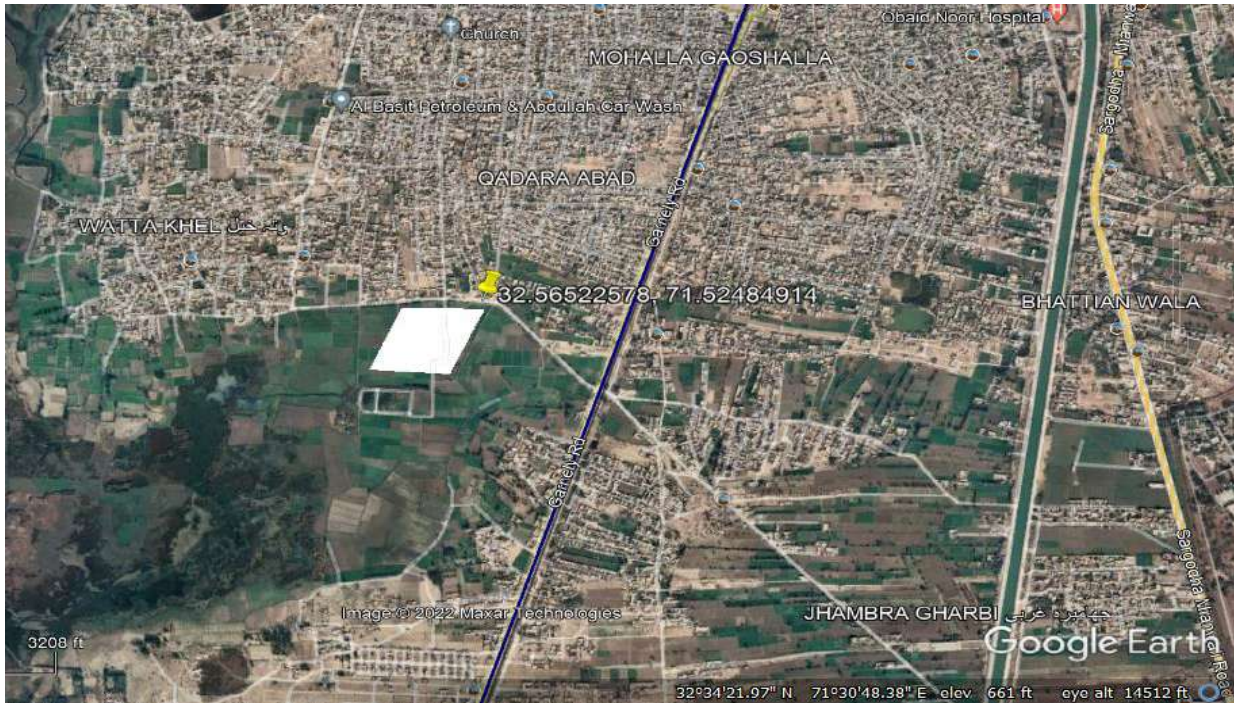


Figure 3.25: Mianwali Qadradab proposed landfill site by MC officials

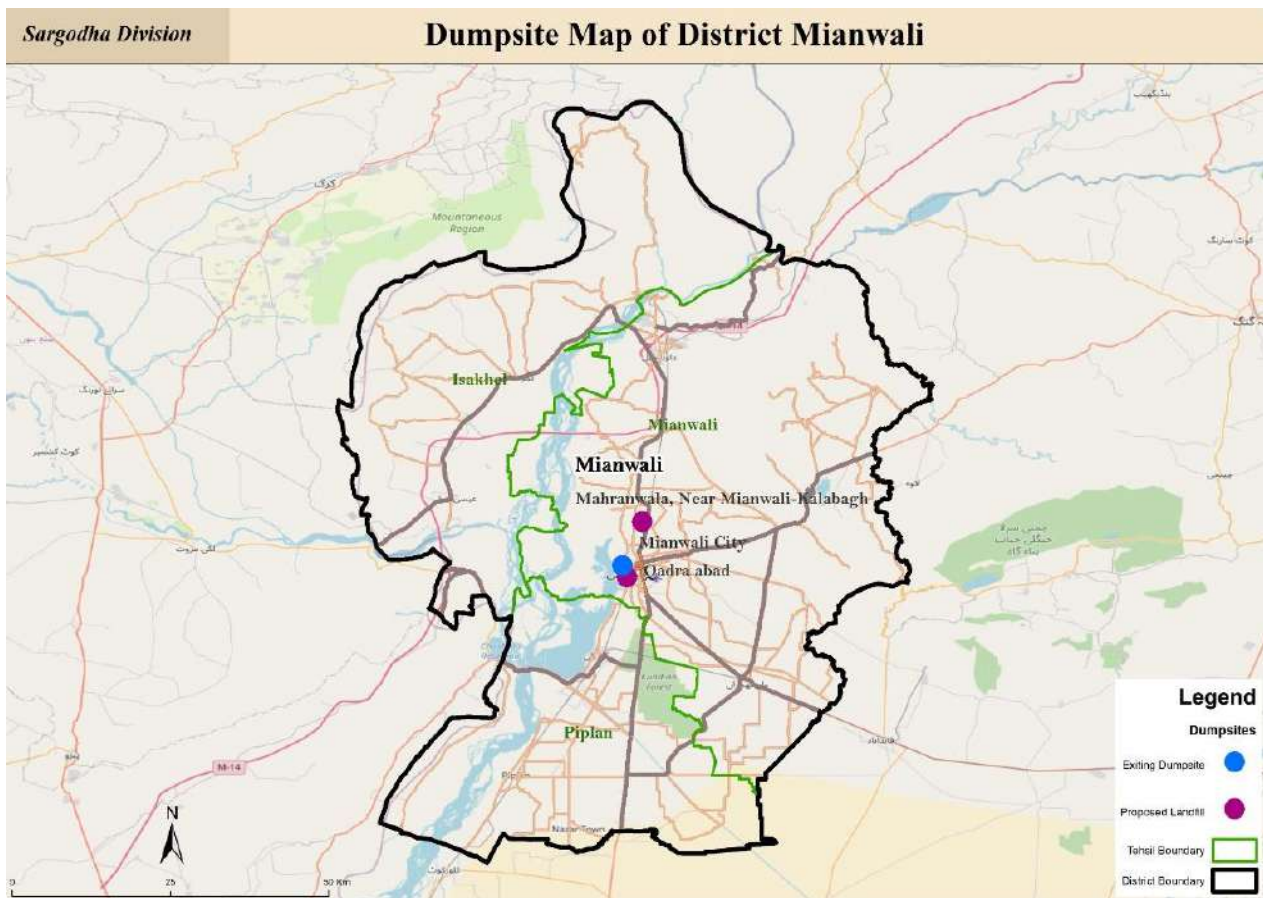


Figure 3.26: Proposed and existing Dumpsites map of Mianwali

### 3.15.4 Comparison Matrix for Mianwali Landfill site Evaluation and ranking

Multiple Sites for Mianwali landfill were identified using GIS and were evaluated considering various factors. Comparison Matrix of sites is shown in Table below:

**Table 3:19: Landfill Evaluation Matrix**

Potential landfill Sites/ Evaluation Criteria	Beruli LF-1	Mahranwala Mianwali-Kalabagh rd LF-2	Paka Kirar wala LF-4
<b>Economic Factors</b>			
Size and Capacity (Total Points :10)	8	8	9
Transfer Distance from the City (Total Points:5)	4	4	2
Road Accessibility (Total Points:5)	3	4	3
Availability of On-site Cover (Total Points:5)	3	4	4
Exposure/ Visibility of the Site (Total Points:5)	3	4	3
land Acquisition Cost (Total Points:10)	5	6	6
Quality of On-site soil (Total Points:5)	4	4	5
Secondary Infrastructure Cost (Total Points:10)	4	6	5
<b>Sub-Total (50)</b>	34	40	37
<b>Environment</b>			
Distance from the water body/drinking water sources/irrigation network (Total Points:10)	4	6	5
Nearby environmentally protected/ sensitive area/restricted area (5 Points)	4	4	3
Perennial stream within 300m (Points 5)	3	4	4
Impact to Eco System (Total Points:5)	4	4	4
Number of Trees at Site (Total Points:5)	4	5	7
<b>Subtotal (30)</b>	19	23	23
<b>Public Acceptance Criteria</b>			
Distance to the nearest residential area and related facilities (Total Points :5)	3	3	4
Historical, religious and cultural heritage sites within sites Proximity (Total Points :05)	4	3	3
Displacement of Local inhabitants (Total Points:10)	7	8	9
<b>Sub Total (20)</b>	14	14	16
	<b>67</b>	<b>77</b>	<b>76</b>

## **CHAPTER 4. RECOMMENDATIONS & WAY FORWARD**

---

### **4.1 RECOMMENDATIONS**

It is recommended that Citizens' Committees be formed in each community that monitors the waste management services. An app should be launched where these committees can upload daily issues to be dealt by the concerned authority/company. In addition to that, segregated collection of wet and dry waste should be ensured in a 3 years span and a pilot scale compost facility at SWMC existing dumpsite should be established.

Sector-wise recommendations for efficient SWM are given below

#### **4.1.1 Street Sweeping and Drains Cleaning**

Following recommendations are for noticeable improvements in services delivery for street sweeping and drain cleaning.

- Drain cleaning of lesser than 2ft. width and sweeping should be included in job descriptions of sanitary workers with a proper monitoring mechanism.
- All workers should be provided with necessary tools, and PPE's including gloves, face masks, and gumboot (for drain cleaner).
- If street sweeping is not possible during daytime in some areas due to congestion and traffic load, then the activity should be done in the nighttime.
- Zonal offices/MCs should be strengthened. The majority of activities related to SWM should be attempted to be solved at zonal offices/MCs.

#### **4.1.2 Waste Collection System**

Following recommendations are proposed for efficient waste collection system

- A model area in each of the district headquarters should be identified in which source segregation can be implemented immediately in par with international best practices.
- The focus should be on a 100% communal collection system with the immediate introduction of door-to-door collection in planned areas and posh societies of the Sargodha Division.
- Open collection points should be replaced by a covered bin of a suitable size.

- The door-to-door collection must be done using smaller vehicles, preferably MD's of 1m<sup>3</sup> capacity. It would be better if the proposed MD is equipped with compartments for biodegradable, non-biodegradable, and recyclable waste.
- In long term however, the waste producers must be sensitized to bring waste to communal container.
- It is recommended that green waste should be shredded with mobile shredder and used as a soil conditioner for parks and green belts.

### 4.1.3 Waste Transport System

The following recommendations are proposed for improvements in the transport system.

- A proper supervision mechanism should be in place, showing a number of containers cleared, the total quantity of fuel required vs total fuel used in a day, and detail about damaged containers and vehicles.
- Key Performance Indicators (KPIs) may be developed and monitoring teams be given targets of effective monitoring and reporting the non-compliance through the internet of things (IoT) based system for maintaining proper record of:
  1. Attendance of Field and Managerial staff,
  2. Operation and maintenance of existing vehicles,
  3. Procuring the additional vehicles required as per the specification and design duly approved by the relevant authorities,
  4. Lifting of the containers/bins/heaps as per the time communicated, and
  5. Preventive maintenance of the vehicles and containers.

### 4.1.4 Disposal System:

The following recommendations are for noticeable improvements in the disposal system.

- The construction of a separate landfill site in every city is not possible as it would involve huge investment and operational costs beyond our economic capability. Therefore, the inclusion of controlled dumpsites<sup>8</sup> must be done immediately into the current SWM system.

---

<sup>8</sup> Per ton cost for controlled dumping varies from Rs. 400 to Rs.700/ton depending upon the area

- Wild dumping should not be allowed in any case and controlled dumping as per technical guidelines to be practiced till the establishment of scientific Landfills (local or regional) into the system.

## **4.2 WAY FORWARD:**

The following steps are recommended as a way forward:

1. Approval of proposed model from the competent Forum and allocation of additional funds required for the implementation of the proposed model in Sargodha Division.
2. The regular staff salaries of MC/ TMA (who will later be transferred to SWMC after signing the SAAMA agreement) are not included in the given cost estimations. However, the budget for SWMC and MC / TMA staff salaries should be released/transferred separately to SWMC from Finance department, in lieu of PFC share/grant in aid/loan.
3. Nomination of Special Purpose Entity (SPE) for the signing of Agreement with defined TORs.
4. Development of execution Plan including the capacity development of MC for primary collection, procurement planning, action planning, and planning for the introduction of monitoring regimes.
5. Finalization of the detailed operational and financial plan for taking over SWM in Sargodha Division
6. Allocation of required funds on basis of the financial plan through special grant or allocation in ADP (Annual Development Plan).
7. Development of tender documents including ITBs, RFPs, EOI, and PQ documents.
8. Completion of the procurement process for integrated SWM system in Sargodha Division and award of contract.