SECTOR G

SOLID WASTE MANAGEMENT

VOLUME 3: SUPPORTING REPORT

SECTOR G: SOLID WASTE MANAGEMENT

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SECTOR G SOLID WASTE MANAGEMENT

1. LEGAL FRAMEWORK FOR SOLID WASTE MANAGEMENT

1.1 Legal Framework for the Entire Study Area

The study area is covered and governed by three authorities related to solid waste management (SWM): CDA (Capital Development Authority), TMA (Tehsil Municipal Authority) and RCB (Rawalpindi Cantonment Board).

In 1979 the compulsory solid waste functions of municipalities were given by "Punjab Local Government Act (LGO) 1979." as below;

(1) "Urban local council shall be responsible for the sanitation of its local area

(2) "Urban local council shall make adequate arrangements for the removal of refuse from public roads and streets, public latrines, drains and all the buildings and lands vested into local council and for the collection and proper disposal of such refuse. "

On 4 and 5 August 2000, the National Security Council (NSC)and the Federal Cabinet jointly approved "The Local Government Plan 2000", and the President of Pakistan announced "The Local Government Plan 2000 " on 14 August 2001.

Punjab Local Governments were installed at the level of the districts of the Province by 14 August 2001;"Provincial Local Government Acts of 2001" to formulate the basis for the Local Government System in 2001.

After that "The Punjab Local Government Act 2001"was promulgated by the Punjab Provincial Government, with the Act describing the roles of the province, the district (Zila) and sub-district (Tehsil) on execution of SWM, and Union on support for execution of SWM.

And the Act describes local government the responsibility for removal, collection and disposal of solid waste. The service of solid waste for Islamabad and Rawalpindi areas are described in "Local Government Acts 2001."

The following articles are related to solid waste management:

1.1.1 The Punjab Local Government Act 2001

This Act includes the articles related to removal, collection, disposal and reuse of solid wastes". These articles were designed to solve sanitation problem in cities against the background of rampant infectious waste and ensure a healthy living environment. The major contents of these articles are as summarized below:

(1) The concerned local government shall make adequate arrangements for the removal of refuse from all public roads and streets, public latrines, urinals, drains and all buildings

and land vested in local government for the collection and proper disposal of such refuse.

(2) The occupiers of all buildings and lands within the area of a local government shall also make adequate arrangements in this regard,

(3) The concerned local government shall cause public dustbins or other suitable receptacles to be provided, the concerned local government may, by public notice, require that all refuse accumulating in any premises or land shall be deposited by the owner or occupier of such premises or land in such dustbins or receptacles.

(4) All refuse removed and collected by staff of the local government or under their control and supervision and all refuse deposited in dustbins and other receptacles provided by local government shall be property of the local government.

(5) The concerned local government may, by notice, issue directions at which the manner in which and the conditions subject to which, any matter referred to in this paragraph may be carried out.

1.1.2 The Cantonment Act 1924

The Act is for the jurisdiction of Rawalpindi Cantonment Board (RCB) including an article of "Sanitation and Prevention and Treatment of Disease" in its Chapter X, which describes: "Every Board shall provide or appoint, in proper and convenient situations, public receptacles, depot or places for the temporary deposit or disposal of household rubbish, offensive matter, carcases of dead animals and sewage". The solid waste management in the jurisdiction area of RCB is judged to be rather good. However, the Cantonment Act 1924 does not fulfill all requirements for the optimum solid waste management. An important issue for the future management would be oriented to strengthening of recycles system for stolid waste.

1.2 Legal Capacity of Tehsil Municipal Administration (TMA)

A particular attention is given to the legal capacity of TMA, which takes the responsibilities for management of the largest volume of solid wastes in the Study Area. Head of the Tehsil is called "Tehsil Nazim". Tehsil Municipal Officer (T.M.O), under Tehsil Nazim, supervises four (4) Tehsil Officers, i.e. Tehsil Officer (T.O) of Planning, T.O. of Infrastructure and Service, T.O. of Municipal Regulations, and T.O. of Finance. "Sanitation and Solid Waste Management Sector" belongs to T.O. of Infrastructure and Service Division. And the four (4) T.O.s prepare the budget, personnel and projects proposal for the next fiscal year to Teshil Nazim for approval. Then the Tehsil Nazim presents the annual plan to the Tehsil Council. After the approval by the Council, the Tehsil Nazim can execute the relevant projects.

The relationship of the above-said entities is roughly shown in the figure below.

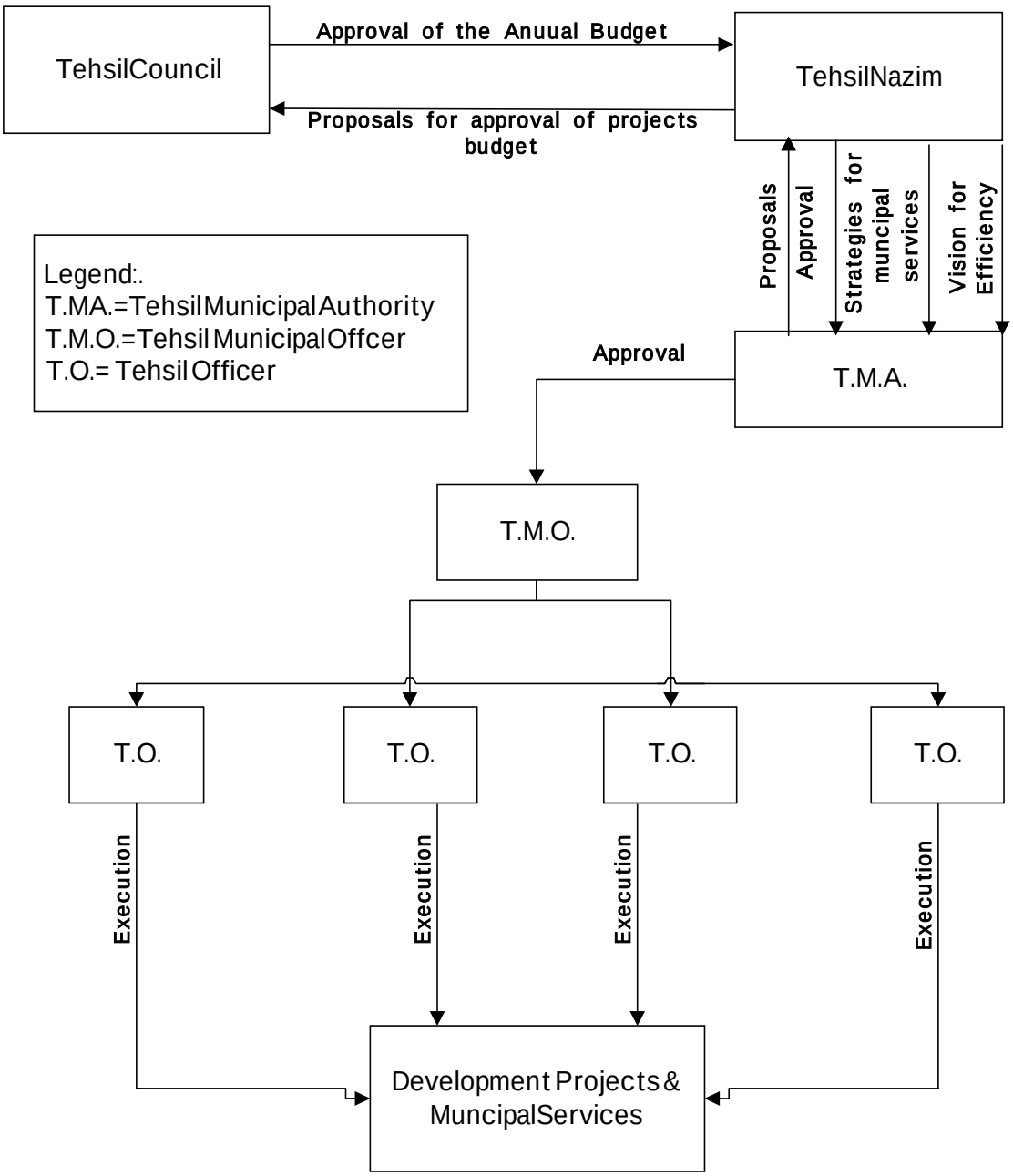


Fig. R G. 1 Relationship of the Tehsil Administration

2. SOLID WASTE COLLECTION RATIO AND SERVED POPULATION

Both CDA and TMA are conducting the collection service for only limited areas as shown in Fig. G.1. The collection ratio of the whole population in CDA is estimated at about 41% and that of TMA is also at about 66% (refer to Table R G.1). There are no collection services to the remote rural areas, including small administrative villages and encroachment communities like "Kachi Abadis". The people, who are residing in those communities, are conducting by themselves such inevitable service for their residential areas with limited resources. Hence the

service level from collection to final disposal is apparently inappropriate. As a result solid wastes are being dumped wherever the places are available such as small empty ones or rivers. Undesirable scenes are being observed anywhere in the urban areas with uncollected, scattered and unhealthy wastes. This kind of disorder is also caused by the activities of scavengers.

Beyond no involvement by the local government for solid wastes collection in the remote or encroacher areas, the local government has no capacity to supervise or guide the SWM in those areas. No data on the quantity and quality of the wastes are available in the local government. The "laissez-faire" attitude on SWM has been deteriorating the environment further, including the conditions of Lai Nullah and its tributaries. The dumped solid wastes are accumulated in the riverbeds, and the smooth flow is disturbed eventually. In case of a flood, the accumulated wastes will resist the smooth flow of the river and cause the overflow from the bank.

By hearing and interviewing the CDA, TMA and RCB officials, the information of three authorities is summarized in the table below for the total population of about 3 million. According to this table, the total generation amount of solid waste is estimated at 2,150 ton per day, of which 550 t/d, 700 t/d, and 900 t/d are generated in CDA, TMA and RCB, respectively. The collection amounts in CDA, TMA and RCB are estimated at 500 t/d, 600 t/d, and 700 t/d, respectively with the overall collection rate of about 83%.

Table R G. 1　Solid Waste Collection Ratio and Served Population

Authority	CDA	TMA	RCB	Total
Estimate solid waste generation (t/day)	550	700	900	2,150
Unit generation (kg/c/d)	0.92	0.47	1.00	0.72
Amount of collection (t/day)	500	600	700	1,800
Population (1,000)	600	1,500	900	3,000
Collection service area	E-7~9. F-5~11. G-5~11. H-, 8 & 9. I-8~11、Model village (Humak, Chak, Shahzad, Mangara Town, Rawal Town,)	Central areas of 46 union	Whole area	
Served population (1,000)	250	1,000	900	2,150
Collection ratio of population (%)	41	66	100	71

Source: JICA-Pak EPA "Domestic Solid Waste Management in Pakistan" April 2002 and JICA study 2003

3. FUNCTIONS OF SOLID WEST MANAGEMENT

"The Local Government Act 2001" describes the functions of SWM to local governments; CDA and TMA conduct SWM services as follows (refer to Article 73):

(1) Sweeping（street, road, park, public space）.

(2) Door to door collection of waste from residential and commercial areas.

(3) Transportation and disposal of solid waste.

(4) Removal of dead animals.

(5) Maintenance of public toilet.

(6) Maintenance of weekly bazaars.

In the line with the services, the Director of the Sanitation Section of CDA established "New Management Plan" for additional works beyond the regulated functions from year 2000, as follows:

Table R G. 2 New Management Plan of CDA

Weekday	Functions	Note
Monday	Sweeping of major/service road	Major roads in E-7~9. F-5~11. G-5~11. H-8-9.I-8~11 working in the morning (7a.m. to 9a.m.)
Tuesday	Cleansing of private sector	Private sector (G-6~10. I-10) working in the morning (7a.m. to 9a.m.)
Wednesday	Cleansing or inspecting private sectors	Inspection of G-6~10,I-10 by Assistant Director, Chief Sanitary Supretendent and Chief Sanitary Inspector
Thursday	Comprehensive cleansing program	To chose one sector and to clean up comprehensively.
Friday	Cleansing markets and public spaces	To clean up every market and Park (Jinnah Park, Daman-e-Koh View Point etc.)
Saturday	Cleansing streets and Weekly Bazaars	To clean up Itwar Bazaar, Mangal Bazaar and Jumma Bazaar

4. CATEGORIZATION OF SOLID WASTES

It is clear that the solid wastes contain a wide variety of wastes in reflecting the actual commodities used in usual life: from relatively safe one to highly dangerous one. Therefore it is a common practice to define the solid wastes according to their characteristics in many developing or developed countries. Infectious hospital waste and other hazardous wastes come from industrial and medical sectors. However CDA, TMA and RCB at present have no special classification of dangerous solid wastes such as hazardous waste, infectious hospital waste and industrial waste. They are just collecting and dumping these wastes together with other domestic wastes.

4.1 Importance of Solid Waste Component Data

The authorities concerned are not taking any effective measures to stop practice because of lack of awareness of numerical target of the collection ratio. As mentioned above, it is essential to understand what kinds of components are contained in the solid waste. It is quite easy to compare the differences among the cities, and to assess the historical trends as well as the future forecasting. However in Pakistan, as these kinds of data are not accumulated, it is difficult to formulate a plan and conduct effective collection, treatment and disposal in the SWM services. In Japan there is a large volume of the database concerning the matter.

The "Basic Design Study Report on Project for Improvement of Garbage Collection and Disposal in Rawalpindi City of Punjab Province in the Islamic Republic of Pakistan.

1995(JICA)" reported that the solid wastes are divided into the following ten (10) groups: paper, kitchen waste, plastics, textile, wood & glass, rubber & leather, metal, glass, stone & bone, soil & sand, others.

4.2 Hospital Infectious Waste

By interviewing some TMA officials, it was found out that infectious medical instruments (injection needles、operational instruments etc) are being recycled in this city area. And the TMA officials explained that they understand how dangerous the hazardous wastes being recycled are, and the related problems created by these recycling activities. However medical doctors and workers of small clinics and hospitals dispose the dangerous wastes in their daily works due to low awareness of infectious medical waste hazards.

"Hospital Waste Management Rules 2002 (draft)" have been prepared by Environmental Health Unit, Health Service Academy, and Ministry of Health. This is named as "Rules", but will not require the legal obligations from those who are working in the hospitals. Therefore this document shall be understood as "Guidelines." Basically the hospital itself is responsible for safe disposal of the infectious hospital waste in accordance with Hospital Waste Management Rules 2002.

Table R G. 3 Table of contents of Hospital Waste Management Rules 2002(draft)

Contents	Notes
Definition.	Hospital. Hospital waste, Infectious waste etc.
Responsibility for waste management	Every hospital shall be responsible for hospital waste.
Waste Management team	Duties and responsibilities of staff of hospital.
Waste Management plan	Waste management officer shall make the plan based on ISO14000
Segregation	To separate infectious waste, disposal medical waste (syringes, needles)、chemical waste (large quantities of pharmaceuticals) from non-risk wastes
Collection	To collect the wastes at least daily
Transportation	To use the transportation trolley only for the hospital waste transportation purpose
Storage	To store the wastes in the separate facility
Disposal	To treat the suitable, thermal, chemical incineration or other treatment methods based on the type of wastes
Accidents and spillage.	To implement the emergency procedures in case of accidents and spillages, mentioned in the Waste Management Plan
Waste minimization and reuse.	To avoid over-stocking, to make recycling program in the Waste Management Plan
Inspection	A health officer inspects every facilities and reports the contravention to the District Hospital Complaint Scrutiny Committee
Phased implementation	Federal Government may notify in the official Gazette.

Source:" Hospital Waste Management Rules 2002(draft)"

Table R G. 4 Solid Waste Component (TMA)

Component	House	Restaurant	Hotel	Shop	Market	Office	Road sweeping
Paper	5.3	2.6	19.5	16.8	7. 1	48.0	2.6
Kitchen waste	59.3	80.6	43.1	14.1	48.2	15.5	69.7
Plastics	5.2	0.9	6.7	20.0	3.9	3.9	3.5
Textile	3.0	0.0	4.6	4.0	16.2	3.9	4.4
Wood, grass	9.7	0.0	0.3	26.9	22.4	1.1	5.8
Rubber, leather	0.2	0.0	0.0	0.1	0.0	7.1	0.1
Metal	0.7	0.7	0.1	0.5	0.1	1.4	0.3
Glass, stone, bones	7.7	15.2	25.6	0.4	2.1	12.0	3.8
Earth & sand	8.2	0.0	0.0	17.2	0.0	7.1	9.8
Others	0.7	0.0	0.1	0.0	0.0	0.0	0.0
Combustible Waste (%)	83.4	84.1	74.3	81.9	97.8	79.5	86.1
Incombustible Waste (%)	16.6	15.9	25.7	18.1	2.2	20.5	13.9
Density (kg/l)	0.3 1	0.07	0.24	0.10	0.21	0.03	0.27

Source: Basic Design Study Report on Project for Improvement of Garbage Collection and Disposal in Rawalpindi City of Punjab Province in the Islamic Republic of Pakistan. 1995(JICA)"

5. COLLECTION, TRANSPORTATION AND DISPOSAL SYSTEM

5.1 SWM Organizations of CDA, TMA and RCB

Sub-directorate of Sanitation & Transport, one of sub directorates belonging to directorate of sanitation CDA, conducts solid waste management. The total number of the staff in Sub-directorate of Sanitation & Transport" is 1472, as shown in the table below. Khakrobe (Sweepers and collectors) are 1267 persons in total. 86% of all the staff and workers are sweepers and collectors in CDA. The SWM has a broad meaning of collection, transportation, disposal and the related technical/financial management.

The planning and civil engineers shall be recruited for an efficient management: 1) measurement of solid waste, 2) estimation of waste future generation, 3) facility and landfill planning, 4) landfill designing, and 5) design of other facilities (incineration, composting facility)

Table R G. 5 SWM Organization of CDA

Function	Contents	Number
Director	Directorate sanitation	1
Deputy Director		1
Assistant Director Sanitation & Transport	Whole management	1
Chief Sanitary Supretendent		1
Chief Sanitary Inspector	Zone (Zone1, Zone2)	2
Sanitary Inspector	Each sector	16
Sanitary Supervisor	Ever sub-sector	26
Mate	Every additional sector	56
Khakrobe (Sweepers and collectors)	Each site	1,267
Driver		60
Dumping Site	Operation	12
Work shop		30

In TMA there are a total of 1979 staff and workers in 2003, who are involved in the SWM activities. Assistant Director Sanitation has the overall responsibility for SWM in the area of TMA form collection to final disposal. The area is divided into four (4) sectors with each chief inspector. Each chief inspector is supported by sanitary inspector. The main works are being done by the sanitary workers (1753 in total) form collection, transportation and disposal. There are also 109 lorry loaders. One Korra Moharra is keeping record of vehicles at dumping site. The drivers are engaged in driving collection vehicles. The workshop is staffed with 35 workers who are engaged in repairing the vehicles. Besides the SWM, there are 286 workers for parks and gardens for maintenance activities.

Table R G. 6 SWM Organization of TMA

Function	Contents	Number
Sanitation Field		
Assistant director Sanitation	Whole Management	1
Chief Sanitary Inspector	4 sector	4
Sanitary Inspector	4 to 5 unions	16
Sanitary Supervisor	Each union	62
Korra Moharra	Record of vehicle at dumping site	1
Sanitary Worker	Collection &sweeping	1,753
Lorry Loader	Lifting garbage	109
Head Driver		1
Driver		32
Dumping Site Operator		6
Park & Gardens Operator		286
Work shop engineer and worker		35

Source: JICA Study 2003

The total number of the SWM organization in RCB is 1252 in 2003. There are nine (9) wards in the area with one sanitary inspector for each, to be supervised by one Chief Supervisor. He is to report daily activities related with SWM in the area to the Chief Sub-director. There is only one Chief Sub-director who holds overall responsibility of SWM in the area.

There are a total of 1160 sanitary workers for nine (9) wards, with about 129 workers each ward in average. The sanitary workers are engaged in collecting solid wastes from the generation points like households and institutions, and transporting and disposing them. Besides, the drivers (37 in number) are involved in driving collection vehicles.

Table R G. 7 SWM Organization of RCB

Function	Contents	Number
Chief sanitary sub director	Head of SWM	1
Chief sanitary inspector	Sub chief of SWM	1
Sanitary inspector	Each word	9
Sanitary supervisors	3-4 person per each word	44
Sanitary workers	Solid Waste Collector	1160
Drivers		37

Source: JICA Study 2003

According to the result of the Social Environment Survey, 70% of sweepers (sanitary workers) throw their collected solid waste into the rivers. TMA and CDA shall take proper measures to stop their dumping or educate them for right collection, transportation and disposal.

5.2 Financial Position of the SWM Entities

Three (3) SWM entities, namely CDA, TMA and RCB, are financially independent. Main financial resources of CDA and RCB come from the federal budget and users' charges or taxes. TMA is basically dependent upon the Tehsil budget and also colleting the users' charge.

The SWM budget consists of two kinds: recurrent budget and development one. The former covers the routine activities (personnel cost, minor repairs etc), while the latter covers major projects such as disposal site construction or vehicular purchase.

The following table summarizes the financial positions of the three (3) entities in 2000, based on the hearing survey of the staff. It is clear that CDA has only recurrent budget in comparison with the other entities. This means that there was no major project in CDA in 2000, or the development budget is given differently from the common budget.

Table R G. 8 SWM Budget and Personnel Cost

Item (2000)	CDA	TMA	RCB
Recurrent expenditure (Rs. Mil)	85.0	106.0	91.3
Development expenditure (Rs. Mil)	N.A	303.5	3.5
Total budget (Rs. Mil)	85.0	409.5	94.8
Number of staff and workers	1,473	2,306	1,215
Personnel cost (Rs.Mil)	70.7	110.0	58.3
Personnel Ratio vs Recurrent Exp. (%)	83.1%	103.0%	63.8%

Note: the average salaries of the staff and workers are assumed at Rs. 4000 per month.

The personnel cost of CDA against the recurrent expenditure amounts to 83.1%, which seems to be higher than usual, because only limited amount money would be available for the required expenditure like electricity, water or maintenance expenditures. In case of TMA, the personnel expenditure exceeded the recurrent expenditure by 3.0%, which seems to be obviously strange, because the recurrent expenditure shall cost all the cost required for the usual activities. In RCB the ration of the personnel cost to the recurrent expenditure is 63.8%, which seems to be realistic, because the excess part can cover the other items of expenditures.

5.3 Collection, Transportation and Disposal System

A sanitary worker collects bags of solid waste at door of the house (door to door collection system) and transports them to the primary collection place (such as containers or concrete bins). The collectors of CDA, TMA or RCB collect the solid wastes and transport them to the final disposal site and dispose of them.

Handcarts (with conveyance capacity of 20 to 25 kg) are used for the transportation from houses, while the owners are responsible for transportation from markets, factories and offices to the disposal site. On the other hand a handcart or a mechanical road sweeper is used for transportation from streets. A solid waste trolley (with conveyance capacity of 0.5 to 4t) and a truck with lifter are used for the transportation. In CDA skip lifters[1], compactors (with conveyance capacity of 1 to 5.5t), and tractor trolleys are used for the purpose.

After collection of the solid wastes, some of them are dumped to the final disposal site and the other may be thrown into the Lai Nullah River. "The Study for Social Environment –Lai Nullah Basin" reported that 85% of the waste is being thrown in Lai Nullah daily, to amount for more than 100t a day. No segregation of hazardous component from domestic waste is existent before sending to the dumping site, no treatment is given.

6. RECYCLING BY SCAVENGERS

The scavengers are called as the persons, who collect valuable materials in the solid waste and sell them to the buyers. The work itself is simple and anybody can scavenge, including children, secure a minimum level of income. Therefore the scavenging is a method with which unskilled people can live in urban areas. They are in a meaning contributing to the recycling and reuse of materials to result in reduction of the solid waste amount. On the other hand, during the scavengers collecting the solid waste, they are usually scattering the solid waste around the collection points.

By the interview with CDA and TMA staff, it was found out that within Islamabad there are about 200 scavengers in the city, while about 100 are active at the dumping site of H-12. In Rawalpindi some 900 to 1,000 people are scavenging in the city. The number of scavengers in the RCB area is not available to the JICA Study Team. It is assumed that this kind of survey to count the number of scavengers has never been conducted there.

In both Islamabad and Rawalpindi, Study Team hearings were conducted to the scavengers. According to the results they are collecting wastes of about 25 kg per day. Their income is estimated in the range of Rs 150 to 300 per day, which is a quite low to secure only minimum level of living in the urban area. On the other hand in terms of their contribution to the material recycling in Rawalpindi, the figure of 3 to 4% is estimated.[2]

[1] These skips are part of the mechanized waste collection system. Capacity of the skip varies from 2.5 cubic meters to 5.0cubic meter.

[2] The data from the report "Basic Design Study Report on Project for Improvement of Garbage Collection and Disposal in Rawalpindi City of Punjab Province in the Islamic Republic of Pakistan"

7. VEHICLES AND FACILITIES FOR COLLECTION OF SOLID WASTE

7.1 Vehicles for Collection of Solid Waste

Vehicles are usually used to collect solid wastes from generators. The existing vehicles for collection of SW for the Study Area (CDA, TMA and Cantonment) are listed below:

Table R G. 9 Vehicles for collection of Solid Waste

Authority/Board	Collection Vehicle	Number	Capacity	Model year
CDA (Capital Development Authority)	Refuse compactor	15	1 to 5.5t,	1988, 1992
	Skip lifter	5	0.5 to 4t,	1990
	Open dump truck	8	350kg,	1995
	Tractor trolley	8	4t,	1990,1992
TMA (Tehsil Municipal Authority)	Open dump truck	16	1.5t,	1989-1990
	Tractor	5		1985
	Container truck	30	2.5t,	1996
	Dump truck	4	4.5t,	1996
	Recovery vehicle	1		1996
	Front end loader	1		1996
RCB (Rawalpindi Cantonment Board)	Truck	23	1.5t,	1985-2002
	Tractor	7	--	
	Pickup truck	5	--	

Source: Domestic solid waste management in Pakistan.2002, JICA-PAK EPA

In CDA there are 15 refuse compactors with capacity of 1 to 5.5 t. Their ages are more than 10 years old. All five (5) skip lifters (model year 1990) have different capacities of 0.5 to 4 t. There are also eight (8) Bedford vehicles and eight (8) tractor trolleys. By interview of the staff, the compactors of CDA, which are ten or more years old, are becoming difficult to be maintained year by year.

In TMA there are as many as 30 container trucks with capacity of 2.5 t. Their model year is relatively new in 1996. For collection of solid wastes a total of 16 vehicles (Mazda T-3500) are in use for the designated area. There are five (5) tractors which are also used for collection. Besides, there are one (1) recovery vehicle and one (1) front end loader. The Japanese Government donated the collection vehicles and heavy equipment by Grant Aid Scheme in 1996.

In RCB there are 23 trucks for collection of solid wastes in the area. Their model years are largely different from 1985 to 2002. There are also some other vehicles for the SWM (tractor blades, road mechanical sweepers, pickup trucks and auto-loader trucks), but their model years are not available to JICA Study Team.

7.2 Solid Waste Management Facilities

The facilities required for an effective SWM are the workshop to maintain and repair the machines, parking site, and the dumping site to dispose of solid wastes. In a large service area the transfer station may be required to load solid wastes to larger vehicles by reloading solid

wastes in case it is proven to be more economical. Utilities like electricity and water are also important to operate and maintain these facilities.

In CDA electricity and water are available for the workshop and parking site（about 1.5ha） at G7/1. At present there is no designed damping site, but a site of about 1 km^2 in Sector H-12 is being used as the tentative damping area. For the future a site at Kuri is selected, which is located 22 km from Zero Point (about 25 min). The area is about 100 acres (40 ha).

In Rawalpindi the workshop（about 0.8ha） is located at Mukhsigah State with both electricity and water available. The parking site is located at the Community Center in Satellite Town. The present dumping site is located at Dhoke Gangal (25 Acre, or 10 ha), which is near to Air Force Airport, distanced by 5 to 8 km from the center of the City. Neither electricity nor water is available for the present site. This landfill site is covered with soil, because of location being near to the airport and fearing the bird's collision to airplanes.

TMA is planning to construct a new dumping site (85 Acres, or 34 ha), distanced by about 25 km for the TMA office. For the new site electricity is planned and water will be supplied from a well.

In Cantonment area the workshop and parking site are located at Gawal Mandi with electricity and water available. The present dumping site (23 acres, or 9 ha) is located along Mistral Road with distance of 10 km from the Cantonment Board Office. There is no plan to construct a new dumping site. By the interview with the RCB staff, remaining lifetime of dumping site is 5 to 7 years.

8. OTHER INFORMATION ON SOLID WASTE MANAGEMENT

Composting technology and incineration technology has not been introduced in the study area. It is known that used medical squirts; hypodermic needles, scalpels, and tweezers are sold in Bazaars of Rawalpindi.

Japanese Government donated collection vehicles to TMA by JICA Grant Aid in 1996. In 2001 two JOCVs[3] in the field of SWM were dispatched to TMA. In 2002, a JICA short-term expert of SWM was dispatched to EPA（Environmental Protection Agency）.

From 1996 to 2000, a community based SWM Improvement Project in Rawalpindi was carried out by a UNDP fund. This project was called as SWEEP (Solid Waste Management & Environment Enhancement Project). The purpose of the project was to train community leaders; the leaders enlighten the community members on SWM improvement in each district by discussion.

[3] Japan Overseas Cooperation Volunteer

9. RECOMMENDATIONS

It is common that most of the residents living close to Lai Nullah and its tributaries are apt to dump or dumping solid wastes into the river. The residents are taking an easy way to dump their solid wastes, instead of bringing them to the nearest containers. However, it should be understood that this kind of practice is deteriorating the rivers to a dirty and unhealthy place. When the residents are asked about their practice, they usually complain about lack of containers in their vicinity, or that the containers are always full of solid waste. What the residents want is simply to get rid of their solid wastes from their premises without considering any environmental impacts.

In order to relieve these unfavorable conditions, CDA, TMA and RCB shall take necessary actions to remove these habits, attitudes and kind of social customs. A realistic SWM policy shall be formulated and the following measures are proposed as urgent ones;

1) To Collect Accurate Solid Waste Data in a Scientific Way

The three (3) authorities are not aware of how much solid wastes are generated what kinds of components they are consisted of, how the characteristics are changing, etc. Due to lack of the collection capacity, they are just collecting some of the generated amounts and transporting them to dumping site. Obviously, that the remaining wastes are disposed of in empty lands or into rivers.

Presently the solid waste amount is estimated by visual judgment without weighing the actual weight. Because the visual judgment usually is not exact, it is certainly difficult to get accurate reliable data. The method is unreliable and shall be converted to a scientific one. The authority shall accumulate the basic data on the weights and components of the collected, disposed solid waste and generated solid waste. To formulate a scientific and efficient long-term plan of SWM, the measurement by the truck scale (measuring equipment for the truck weight) shall be conducted soon.

Moreover to formulate a future plan concerning the SWM, the data collection is essential to calculate the capacity and lifetime of the landfill site, or to estimate the required numbers of collection vehicles and so on.

2) To Legislate Act of SWM

Currently there are no separate rules for solid waste management in Pakistan. No treatment is given before sending to the landfill sites, landfills are poorly operated open dumping with leaving environmental pollution out of consideration. The strategic plan needs to be prepared comprising both long term strategy, vision of how municipal solid waste

management service in the city will be developed in the future, and action plan, how the city is going to get there.

Therefore to improve the situations related to solid wastes in Islamabad and Rawalpindi, "the Solid Waste Management Act" shall be legislated. "The Solid Waste Management Act" shall be designed to protect the living environment and promote public health. The residents (citizens), enterprises and the municipalities (government) play their respective rolls in promoting appropriate waste management.

The act shall clarify what kind of roles the residents (citizens), enterprises and the municipalities (government) are to play in the daily activities.

Important considerations for improving the SWM in the study area are summarized in the following Table R G 9.

Solid Waste Management Act (assumed name, hereafter referred to as "the Act") shall promote the creation of "source reduction of waste and recycling system".

People, enterprises and government shall cooperate together to reduce, reuse and recycling the waste. The Act shall provide their respective roles in promoting appropriate waste management.

Municipalities are responsible for management of domestic waste, such as garbage from households. Municipalities shall set solid waste management plan in respective administrative area. And the plan includes the following matters:

Estimate the volume of domestic waste to be generated and to be treated of fundamentals of proper domestic waste management and fundamentals relating to authorities carrying out such management. Matters pertaining to improvement of expansion of domestic waste treatment facilities and landfill site.

Enterprises are in charge of their own industrial waste such as construction waste, cinders, sludge and waste oil etc. generated from their own business activities. And each enterprise shall treat and dispose their waste by themselves consulting with the municipalities. Regardless of industrial waste, business must recycle waste produced from their activities and make effort for waste reduction.

The following measures relating to products and by-products are the way of source reduction of waste. 1) Measures for reducing waste by designing long-life products 2) Measure for reusing parts 3) Measures for manufacturers to recover and recycle end-of life products 4) Measures for reduction and recycling of by-products.

The owners of large office buildings and market directors may carry out the reduction of solid waste and recycling. First of all they shall set the reduction numerical target (goal) in

the offices or markets for solid. The volume of garbage may be measured or counted by numbers of bags baled in waste. And owners or the directors shall direct to reduce the garbage, which is generated by each tenant of the buildings or every small market owner in the market.

People should separate waste accordingly to their types. Moreover, in order to promote effective reduction, reuse and recycling waste. For example community residents gather and separate the garbage to dispose and resource to use from the waste and have the resources collected by recycling company.

Table R G. 10 Items to be Considered in the New SWM Act

Items to be considered	Explanation
To organize recycle system and to reduce the solid waste generation.	• To formulate source reduction, reuse, recycling, system. [4]
To define the solid waste	• To clarify the definition of domestic waste, hazardous wastes, infectious hospital waste and industrial wastes.
To clarify the duty and roll of central government, municipality, citizen and enterprise.	• Central Governments; To provide guidance and financial assistance from central government to municipalities • Municipalities; to collect, transport and dispose domestic waste. • Citizen and community; To separate and reduce their wastes To use as many recycled products. • Enterprise and factories; to be in charge of their own industrial wastes (such as construction waste, factory waste) i.e. each enterprise shall treat and dispose industrial waste by themselves consulting with municipalities. .
To make solid waste management planning	• To make solid waste management planning, consisting prediction of solid waste generation, future plan for landfill site and other solid waste treatment facilities.
To dispose hospital waste	• To collect, transport and dispose the infectious hospital waste by hospitals by themselves consulting with municipalities.

3) Reduction of Waste Generation by CBO or PEP

By the discussion and interview with TMA staff and CDA staff, after the SWEEP project had been completed, it was found that this kind of activity could not be sustained without large efforts required to maintain it. However JICA Study Team have come to a conclusion that this project would be useful to give substantial impacts, such as introducing the concept of Community-based Organization (CBO) or Private Enterprise Partnership to participate in solid waste management, to reduce the public cost and enlighten the importance of the social awareness.

Both the municipality and the citizen shall be responsible for solid waste management with the cooperation in order to effectively solve the solid waste management problem.

[4] Refer to" 8 RECOMMENDATIONS 2)To Legislate Ordinance of SWM"

At the garbage generation point, citizens (or community) can segregate and reduce the garbage. Community cooperation needs to be carried out the source reduction measures.

To formulate solid waste reduction programs, the municipality shall formulate a feasible strategy: 1) to promote the waste reduction program with community and enterprise participation, because of the high effectiveness of source reduction by the citizen, and 2) to introduce waste separation to make an easy waste recycling.

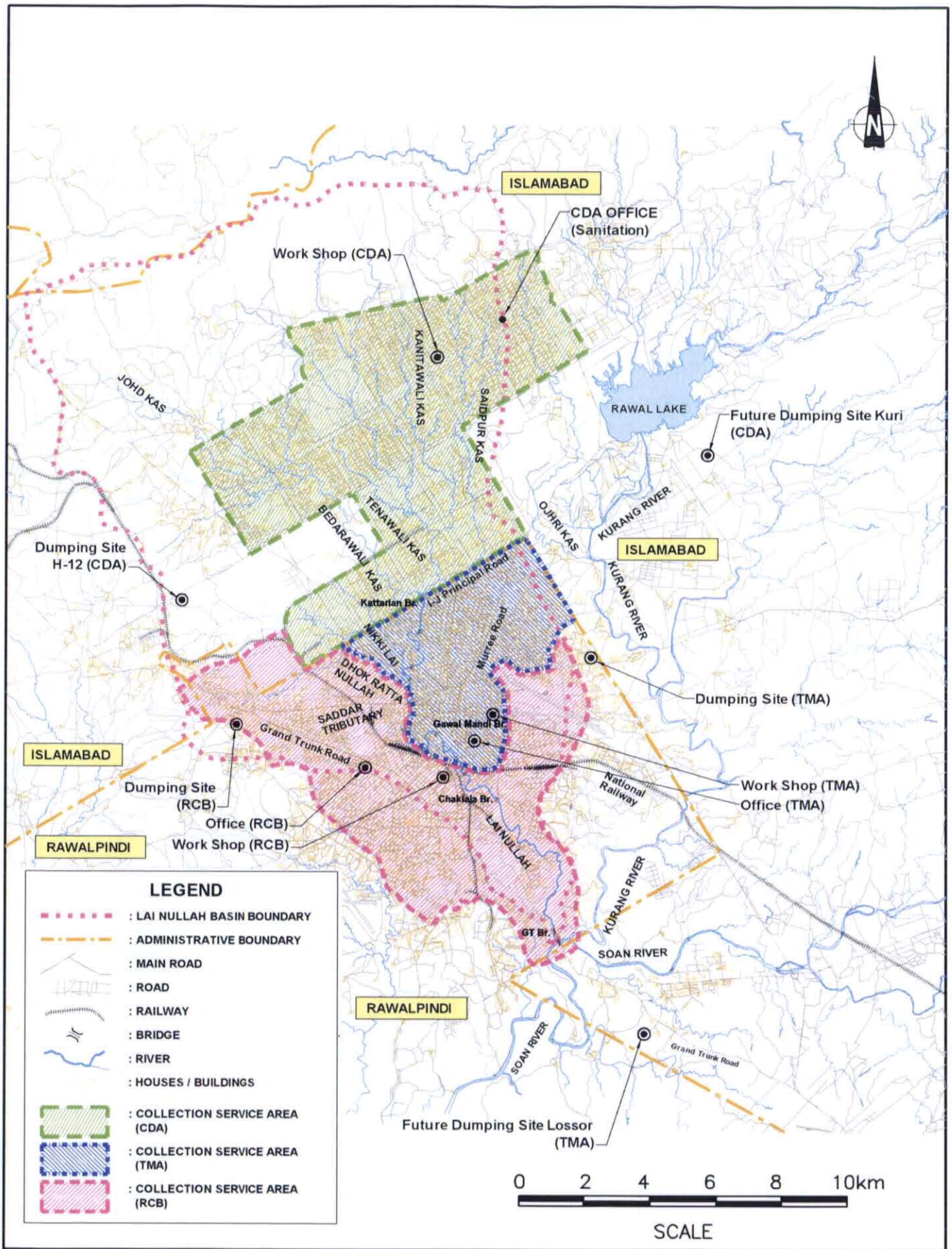
4) Gradual Prohibition of Scavenging Activity

The scavenging activity might contribute to the reduction and recycling of solid wastes to be collected to some degree. However negative impacts would not be negligible such as scattering the wastes or aesthetic disturbances. On the other hand there are a certain number of people, who are living on scavenging. A sudden prohibition would cause social problems related to the scavenging activity.

In light of avoiding sudden major change, JICA Study Team would propose to prohibit the scavenging gradually or only limited places. To this end a social survey will be required on the method and timing toward the prohibition of the scavenging activity.

SECTOR G

FIGURES



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. G.1

Location of Solid Waste Management Facilities

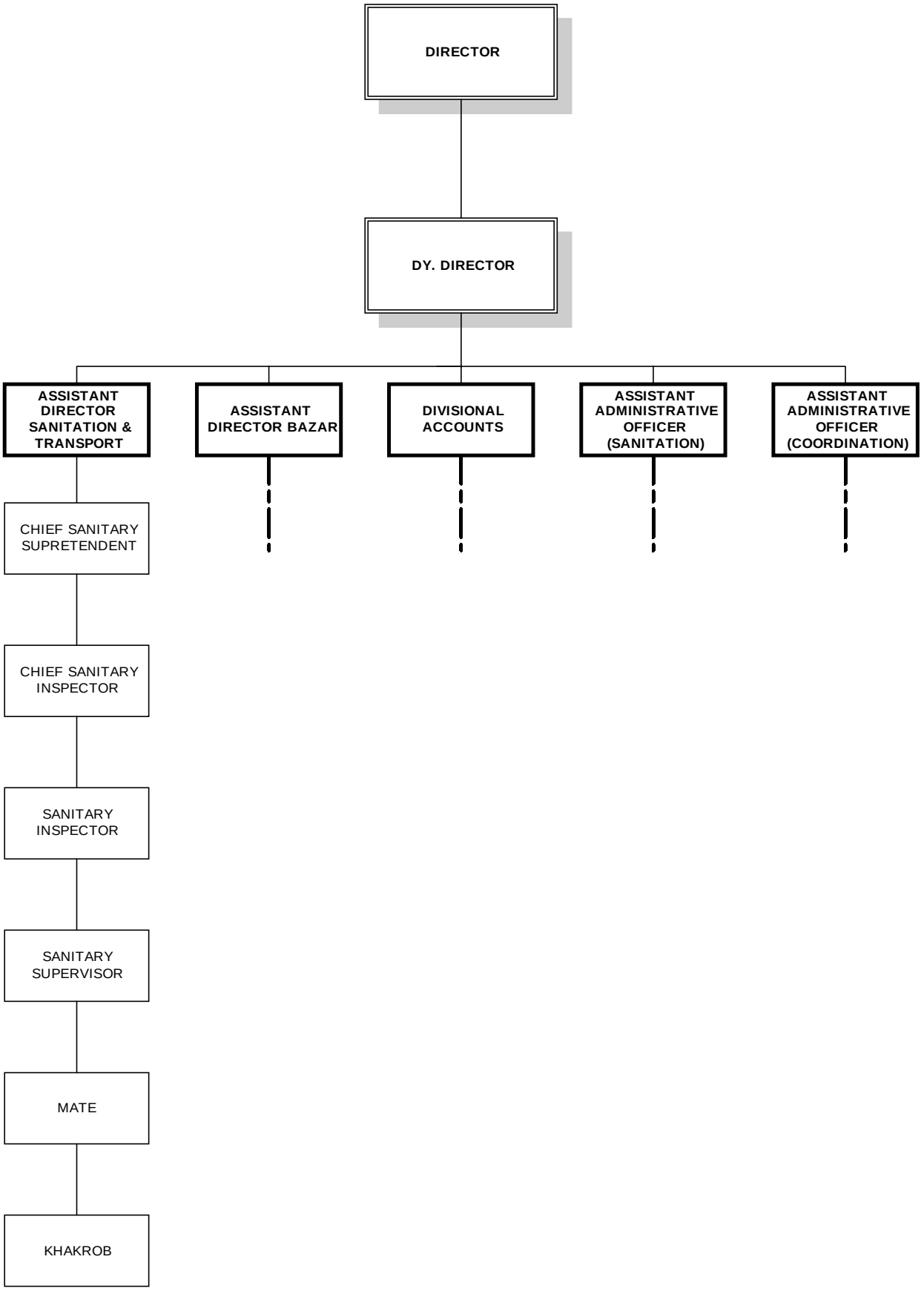


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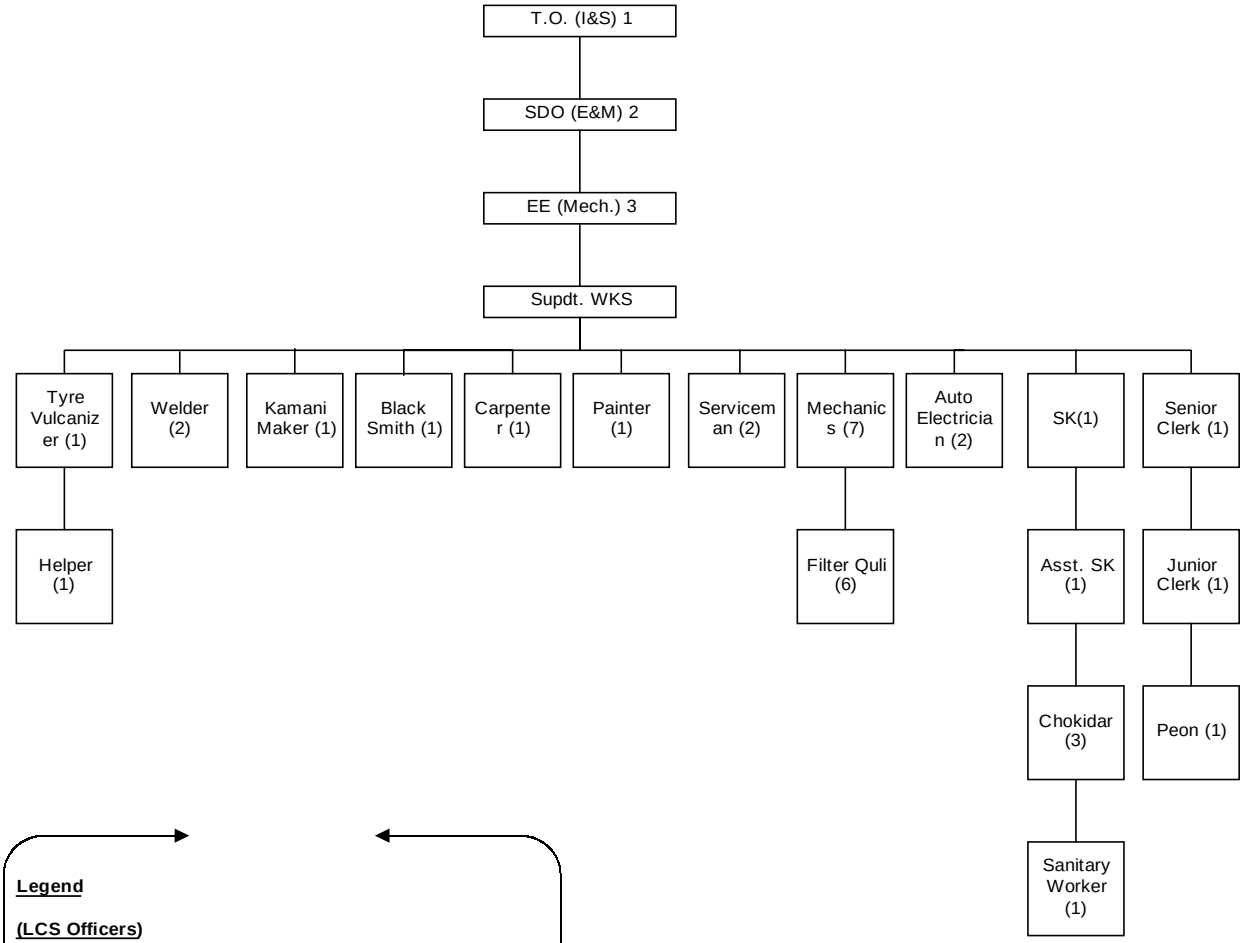
Fig. G.2

Organization of CDA Sanitation Section

ORGANIZATIONAL SETUP
MUNCIPAL AUTO WORKSHOP
TEHSIL MUNCIPAL ADMINISTRATION,
RAWALPINDI



Legend

(LCS Officers)

1. **Tehsil Officer (I&S) (TO)**
2. **Sub-Divisional Office (E&M) (SDO)**
3. **Sub-Engineer (Mech.) (EE)**

Non-LCS Officers/Officials	**No. of Posts**
1. Superintendent Workshop	1
2. Store Keeper Workshop (SK)	1
3. Senior Clerk	1
4. Mechanics	6
5. Auto Electrician	2
6. Junior Clerk	1
7. Assistant Store Keeper (Asst. SK)	1
8. Tyre Vulcanizer	1
9. Welder	2
10. Painter	1
11. Carpenter	1
12. Blacksmith	1

Legend

Non-LCS Officers/Officials	**No. of Posts**
13. Kamani Maker	1
14. Fitter Quli/Helper	7
15. Serviceman	2
16. Peon	1
17. Chokidar	3
18. Sanitary Worker	1
19. Mechanic Heavy Machinary	1
Total No. of Posts	**35**

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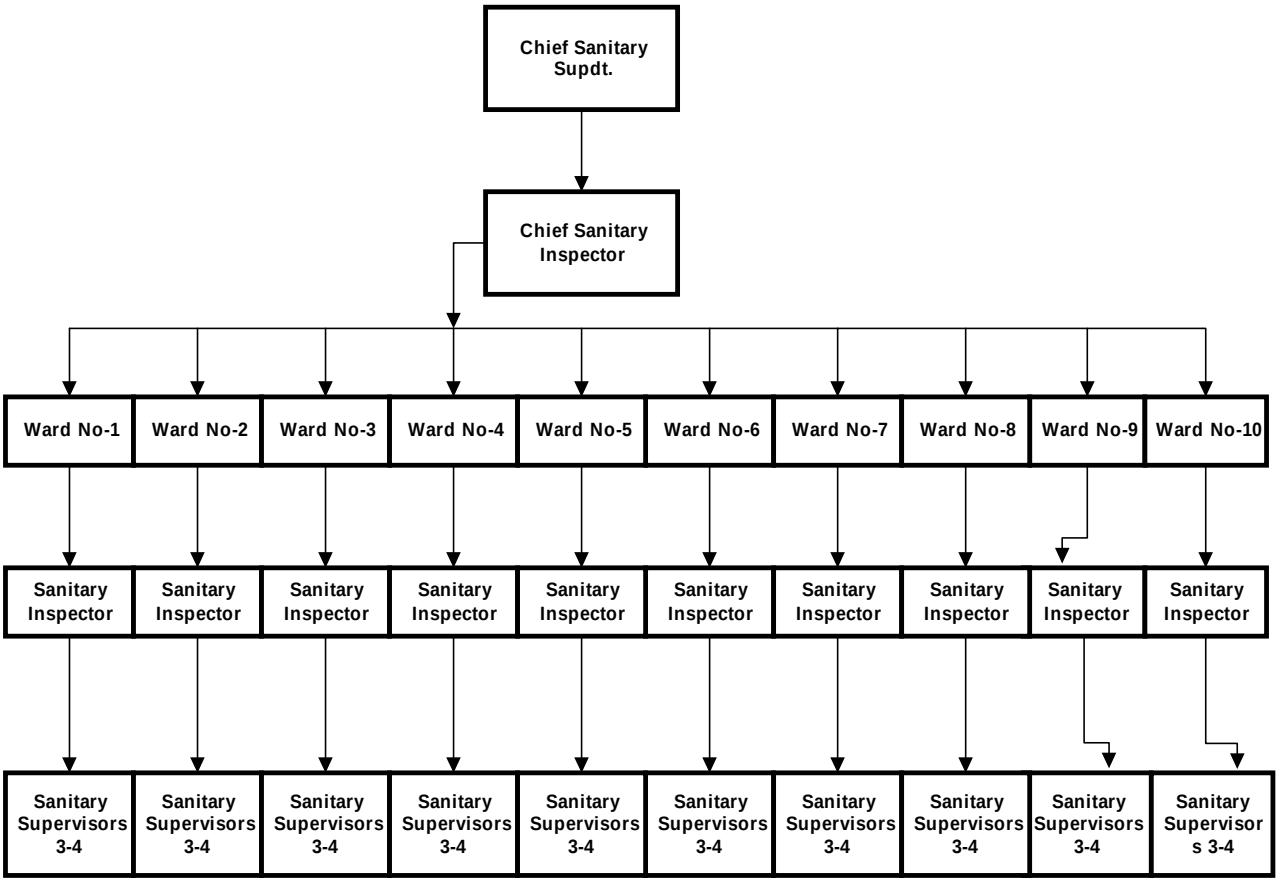
Fig. G.3

Organization of TMA Sanitation Workshop

SANITATION BRANCH



Present Population (2001)

Localities	Present Population
Ward No. 1	82,732
Ward No. 2	37,581
Ward No. 3	43,192
Ward No. 4	44,514
Ward No. 5	63,458
Ward No. 6	48,409
Ward No. 7	58,412
Ward No. 8	93,825
Ward No. 9	67,430
Ward No. 10	88,288
TOTAL	627,841

Sanitary Workers 1160

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Fig. G.4

Organization Chart of Sanitation Branch of RCB