Technical Assistance Consultant's Report

Project Number: TA 8817
January 2017

Nepal: Far Western Region Urban Development Project (Volume 5)

Prepared by: Michael Green

London, United Kingdom

For: Ministry of Urban Development
Department of Urban Development and Building Construction

Asian Development Bank

Government of Nepal
Ministry of Urban Development

Second Integrated Urban Development Project

(IUDP2)

(PPTA 8817–NEP)

Draft Final Report

Discussion Note # 4

Municipal Urban Infrastructure – Part C : Dhangadhi

September 2015

Draft Final Report

Discussion Note #4 –

Municipal Urban Infrastructure – Part C : Dhangadhi

Contents

1 Water Supply

1.1 Principle Sources of Drinking Water

1. The project town is located on an alluvial plain crossed by numerous perennial water courses, but none of these surface water courses are used for household drinking water. However, they do ensure an adequate supply of groundwater for drinking and other purposes. The larger water supply schemes and a number of institutions (such as Kailali Multiple College, and Kailali Hospital) install tube-wells to extract water from deep aquifers (100m to 150m deep).

2. However, the majority of households, which are generally rural, rely on shallow tube wells, dug wells and springs. Most of the hand-pumps are installed by the householders themselves located within their premises with little or no hygienic protection is provided to the hand pumps. The shallow tube wells extract water from the top layer aquifer which is susceptible to contamination.

1.2 Current Water Supply Schemes

3. Currently, there are two major city water supply schemes in Dhangadhi Municipality; both of them serving the main urbanised areas (See **Figure 1-1**). Of a total 21,030 households, approximately 30% of the households within the municipal area have access to a piped water supply system. Of those, 4,300 households in the core city area of the town; (i.e. parts of ward 1, 2, 3, 4 and 5) are supplied with piped water by Nepal Water Supply Corporation (NWSC). A further 2,190 HHs (ward 8 and part of wards 1, 5 and 7) are served by the recently constructed Shivanagar water supply project[1].

1.2.1 NWSC drinking water supply system

4. NWSC supplies drinking water to 4,300 metered consumers and 16 non-metered public taps. The source of water for this system is groundwater drawn from a deep aquifer around 150m deep. There are two overhead tanks. One, a low head RCC overhead tank of 180m^3 capacity, serves primarily the market area. The second overhead tank is a modular steel structure built with Japanese assistance of 200m^3 capacity located at Hansapur.

5. NWSC supplies water for six hours a day (two hours each in the morning, mid-day and in the evening). The supply hours are generally considered inadequate by most households' daily water demand. Consequently, supply is supplemented by household shallow hand pumps. The production capacity is reported to be 3.24 million litres per day. Generally, public supply is about 2.97 million litres per day, distributed through 32km pipeline. Very minimum losses were reported in the NWSC system. The only water treatment is chlorination using batched bleaching powder.

1.2.2 Shivanagar Small Town Water Supply Project

6. The water supply system provides 2,190 metered consumers covering the whole of ward No.8 and parts of wards 1, 5 and 7 (see map in Annex 4C-A). The scheme has two deep production tube wells and one test boring tube well. Each has a 300mm or 200mm diameter borehole with depths of more than 100m. There is a 450m^3 overhead tank and a 300m^3 underground storage reservoir tank. The 3 tube-well submersible pumps discharge to the underground reservoir via an aerator and pressure filter. A further 3 pump sets lift

[1] ADB Second Small Town Water Supply and Sanitation Sector Project through MOUD, DWSS.

water from the ground reservoir to the overhead tank prior to distribution through 36km of pipelines.

1.3 Funding Water Supply Operations and Management

7. NWSC, an autonomous entity under Ministry of Urban Development, is not involved in design and construction of water supply projects but it manages and operates some of the city water supply system in the city core area. Other water supply project such as Shivanagar water supply project operation and maintenance is undertaken by a Water Supply Users Committee (WSUC). WSUC also provided a share of the construction cost along with central government and development partners.

1.4 Proposed Interventions

1.4.1 NWSC Scheme

8. Of the municipal households, 70% do not have access to a piped water supply. A water supply scheme in the north part of Municipality is presently being planned which covers mainly Jali Gaon, ward no. 6. In addition, NWSC has also planned to expand its distribution system within its current coverage area (see **Figure 1-1**). Although water supply is not seen by the municipality as a high priority (possibly because they are not directly involved with its provision) it is the highest priority demand from Dhangadhi households[2].

1.4.2 Option for IUDP2

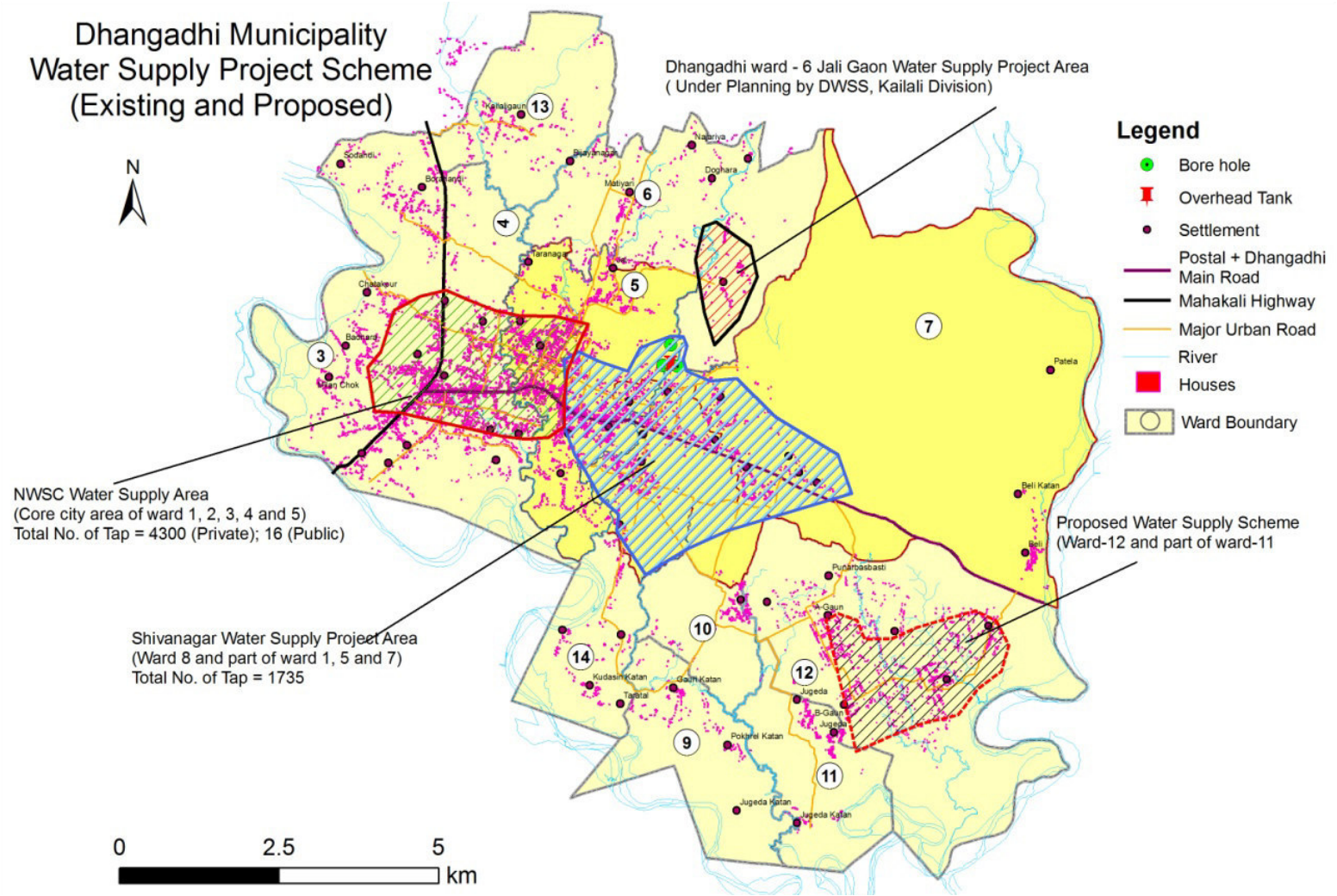
9. Based on the regional economic vision and conceptual urban plan, field assessment and consultation with municipal officials and other stakeholders, a water supply scheme is proposed to serve over 2,000 households of ward No.12 and part of ward No.11 (see **Figure 1-1**). For O&M on this new scheme a similar arrangement to the Shivanagar scheme with a WSUC could be used.

10. The scheme would be designed for base population of 10,000 (2,000 households) (year 2015) and a design population of 21,000 (3,350 households) by year 2030.

11. Based on the cost of the Shivanagar scheme, the total estimated cost including boring, pump house, pump sets, transformers, reservoirs/OHT, water treatment and distribution would be about NRs.420 million ($ 4.20 million).

[2] TA 8817-NEP socio-economic household survey, March 2015.

Figure 1-1: Water Supply Schemes in Dhangadhi – Status and Identified Needs



2 Sanitation and Wastewater

2.1 Toilet Facilities

2.1.1 Domestic Toilet Facilities

12. Existing sanitation facilities are generally quite basic in the rural areas of Dhangadhi Municipality. Although the municipality has imposed mandatory provision to construct toilets along with septic tank and soak pit in each house, some of the poorer households still only have simple pit latrines while 23% of households still do not have their own toilet facilities. Major reason for not having latrines is economic problem and lack of space. Many people do not know how to build latrine and a few have the habit of defecating in open spaces.

2.1.2 Public and Community Toilet Facilities

13. Dhangadhi Municipality has constructed 5 community toilet facilities are at different locations in the city area to try to reduce the need for open defecation, as listed in **Table 2-1**.

Table 2-1: Public Toilets

Location	Operated / Managed
District Administration Office	Private individual.
Dhangadhi Municipalty Office:	Private individual.
Bus Park	Bus park management Committee
Sangam Tole (ward no. 6)	Sangam Tole management committee
Chauraha (Near Nepal Police Boarding School)	local youth club

2.2 Current Wastewater Collection and Treatment

2.2.1 Municipal Sanitation Systems

14. At present there is no piped sewerage in the Municipality. The majority of premises in the denser areas of the municipality have septic tanks with soak pits. There is no municipal service offered for removing septage (septic sludge) from the septic tanks when they get full. Usually, households will contact a local contractor who will arrange to empty the tank manually. There is only one contractor in Dhangadhi who uses a sludge tanker to evacuate septic tanks.

15. Frequently, the septic tanks are not properly maintained or are under capacity resulting in the septage flowing over into the soak pit. In many cases the soak pit does not work, or not constructed, and the septic tank overflows into the surface water road drainage network resulting in a public health risk.

2.2.2 Wastewater Treatment and Disposal Options

16. A detail study is required to determine the appropriate solution to improve the poor wastewater management within the municipality, as follows:

a) Identify areas where wastewater disposal or septic tanks are problematic, i.e. where septic tanks are overflowing onto land or into surface water drainage: e.g. due to i) high water table; ii) impervious ground; iii) no space for soak-pit; iv) septic tank needs frequent desludging; v) no space for septic tank; vi) prolonged seasonal flooding.

b) Identify areas in relation to phased urban development appropriate for on-site and off-site sewage treatment and disposal including staged development options:

i.e. i) on-site septic tanks with soak-pit; ii) septic tanks with overflow to small bore sewerage; and iii) conventional sewerage.

17. A phased wastewater management plan should then be prepared in relation to proposed urban development plans by following the approach of using appropriate technology by utilizing and upgrading the existing system as described above, taking into consideration appropriate methods for faecal sludge management (FSM).

18. A study was undertaken in 2007[3] for the improvement of roads and drainage plus the development of a sewerage network and sewage treatment. The study proposed a number of branch sewers flowing into the main sewer feeding to the STP. However, the study did not mention whether property wastewater house connections were included, the sewer pipe diameters or the type of sewage treatment process proposed. A block site for the STP was indicated although its boundary was not defined.

2.2.3 STP Location Option

19. A number of natural drainage channels pass through the city, generally flowing from north to south. These discharge into the Mohana River which forms the western and southern boundary of the municipality which is later joined by the Khutiya River which forms the eastern municipal boundary. The ground elevation in the city centre is about 176m asl falling about 4m to 172m asl at the river immediately south. The municipal land to the south west falls a further 5m to 167m asl. North of the city centre the land rises slightly by about 8m to around 184m asl.

20. The best site for a STP to serve the present main urban area is located due south of the Tribeni Chok, near where two of the natural drainage channels flow into the Mohama River. An area of approximately 10Ha should be acquired as a priority.

21. Note: If sewerage is not initially installed in the city, the proposed area could be developed as an integrated waste treatment facility. This could include treatment of septage (septic tank sludge) and bio-degradable municipal solid waste for producing compost.

2.2.4 Preliminary Wastewater Improvement Cost

22. Until a comprehensive study is undertaken on wastewater management in the municipality it is only possible to provide indicative costs for comparison.

On-site wastewater improvements

23. The main investment cost is the provision of a septage treatment plant. An anaerobic digestion technology is suggested, which generates biogas as well as providing hygienic quality compost fertilizer. In case of septage sludge treatment, anaerobic digestion technology seems to be most socially and environmentally acceptable option than aerobic composting technology based on past experiences from the municipalities of Nepal. Even if biogas is not utilized fully, at least a quality compost product would be produced. This could be included as part of a bio-degradable component for solid waste management improvements.

24. Other costs would include the provision of sludge vacuum tankers, although these could be provided by the private sector, as is present practice, and the service paid for by

[3] Geoc Nepal Pvt. Ltd. Sept. 2007 for DUDBC Dhangadhi

the property owner. Operation of the septage treatment plant could be assisted by the sale of compost fertilizer and utilization of biogas.

Component Description		Cost Estimate (NRs. million)
Septage Treatment Plant (40 cu.m per day)		30
Equipment:- Three gulley bowzers (4,000 l)		25
	Total NRs.	55
	US $	0.55 million
Operations and Maintenance (Annual)		NRs.3 million

Small bore sewerage

25. In areas where the on-site soak pits do not function properly, small bore sewerage could be installed to prevent the septic tanks overflowing into the open drainage network. Only the settled wastewater which sometimes includes some light floating matter is discharged into the small bore sewer. Consequently, the sewer pipes can be laid at shallow gradients. However, some pumping might be necessary depending on the ground contours to lift the settled wastewater up to a simple treatment plant before discharge to the river. The following costs are dependent on the extent of the system.

Component Description		Cost Estimate (NRs. million)
Small bore sewerage		300
Septic tank effluent pumping station		30
Septic tank effluent treatment plant (lagoon / reed beds)		80
Other miscellaneous costs (land / buildings / power)		150
	Total NRs.	460
	US $	4.6 million
Operations and Maintenance (Annual)		NRs.15 million

26. In the main commercial high or density residential areas the most economical solution might be to install small bore sewerage to collect septic tank overflows connected to a small decentralized effluent treatment (DEWATS) plant.

27. With this option, on-site wastewater management improvements as described above would still be required since property septic tanks would still be utilized.

Conventional sewerage and sewage treatment

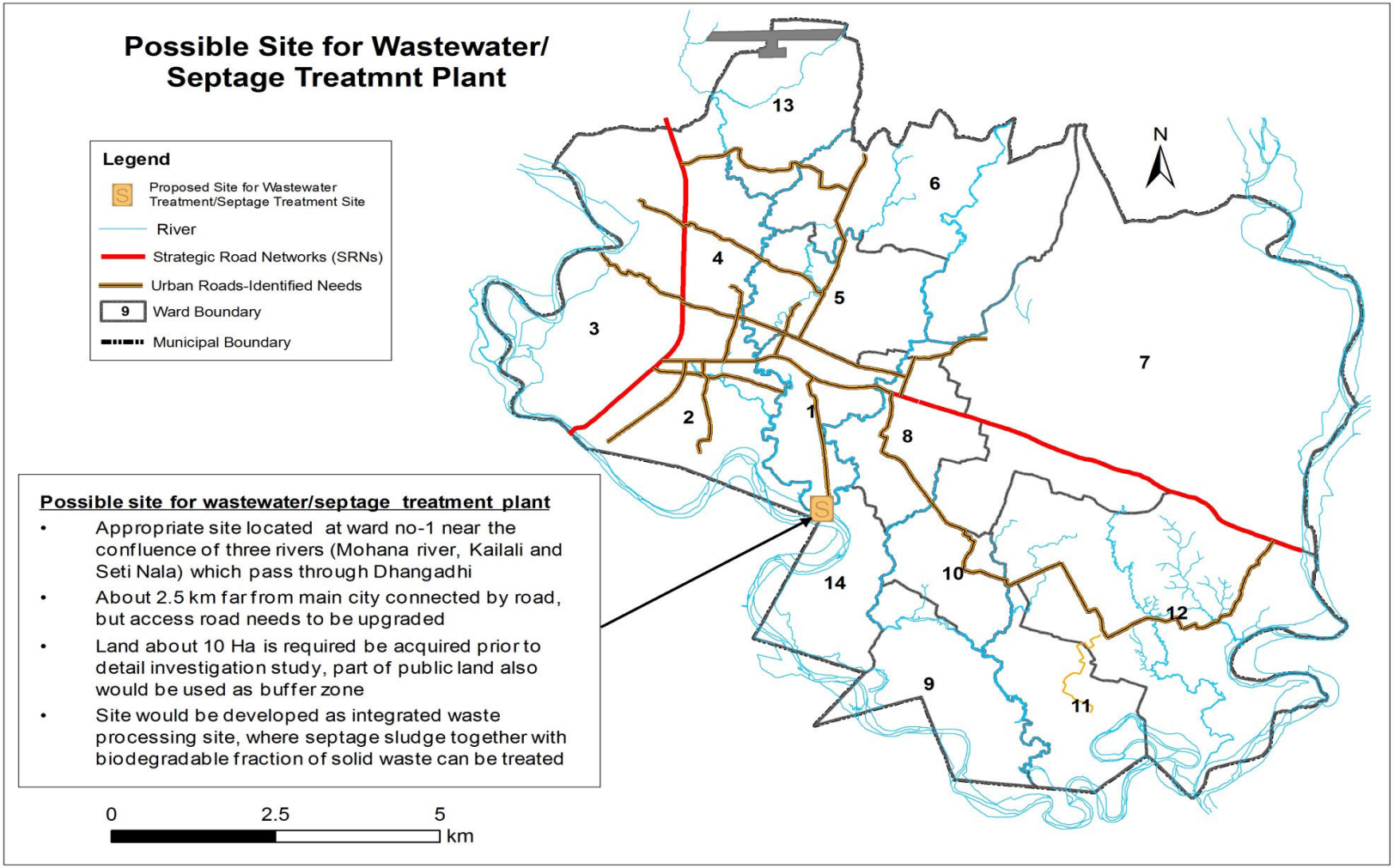
28. Conventional sewerage will only operate if there is a regular 24-hour water supply system that provides an excess of 100 lcpd (litres-per-head-per-day) plus a guaranteed power supply and skilled maintenance staff.

29. The sewers must be constructed with adequate gradient to maintain cleansing velocities in the sewerage system to prevent blockages. As a result, in flat terrain such as in Dhangadhi, sewers can easily exceed 4m deep and pumping stations will be required to lift the sewage up to the surface for treatment.

30. Costs based on construction of sewerage and sewage treatment plant for an Indian city with a present population of 90,000 increasing to 270,000 in 30 years. However, this option is NOT recommended for the present project.

Component Description		**Cost Estimate (NRs. million)**
Sewerage (trunk and collectors plus house connections)		820
Sewage pumping stations and rising mains		80
Sewage treatment plant (USAB + ASP)		230
Other miscellaneous costs (land / buildings / power)		270
	Total NRs.	1,400
	US $	14.0 million
Operations and Maintenance (Annual)		NRs. 60 million

Figure 2-1: Location of proposed wastewater treatment plant



3 Solid Waste Management

3.1 Existing Solid Waste Management Practices

3.1.1 Waste Type and Generation

31. In general, municipal waste covers the solid waste generated from households, commercial and institutional establishments. Medical and industrial wastes contain hazardous and infectious waste, which should be treated separately. According to a field survey undertaken in 2012[4], the average household and municipal solid waste (MSW) generation in Dhangadhi were reported to be 0.14 and 0.28 kg/capita/day. With these per-capita waste generation rates and projected population for the year 2015, the total MSW generation from Dhangadhi Municipality is estimated at 31 tons/day.

3.1.2 Solid Waste Composition

32. The waste obtained from the household, commercial and institutional waste is categorized into seven different types, as listed below.

Organic waste	Rubber and Leather
Plastics	Metals
Paper and paper products	Glass
Textile	Others (inert materials etc.)

33. In Dhangadhi the household waste composition consists of organic wastes (68%), paper (10%), plastic (13%), metal (1%), glass (3%), rubber and leather (2%) and other (3%). However, paper/ paper products are main fractions in institutional waste with 51% followed by plastic with 18% and organic waste with 16%. In commercial waste sources, plastic dominated the waste composition with 28%, followed by organic with 23%, glass with 15%, paper and paper products with 12% while others are less than 10%.

34. When all three major sources of wastes are combined, the average composition of MSW becomes as follows: organic waste 44%; plastics 19%, paper and paper products 16%; glass 7%; metals 3%; textiles 1%; rubber and leather 3%; and others 7%.

3.1.3 Street Cleaning and Primary Collection

35. The municipality has scheduled waste collection two times every day; i.e. early in the morning and in the afternoon in the main city street. The municipal workers sweep the streets every day only in the morning and the collected waste is handled by the municipal workers. All the waste is collected in municipality trucks which is finally dumped on the bank of nearby Kailali nala after collection; about 300m from the municipality office.

36. The current waste collection rate is about 42%; i.e. the municipality is able to collect about 12 tons of waste per day from estimated 31 tons of generated waste. The household waste, commercial waste is placed either in containers or on the roadside in front houses, which is then collected by the municipality. The municipality provides a roadside pick-up service. There is no door-to-door service.

[4] ADB, 2012; http://www.adb.org/publications/solid-waste-management-nepal-current-status-and-policy-recommendations

3.1.4 Waste Transportation

37. For the collection and transportation of solid waste different types of equipment / vehicles are used, which are listed in **Table 3-1**.

Table 3-1: Equipment used for the SWM

S.N.	Equipment	Number	Volume(cu m)
1	Tractor	1	4.5
2	Compactor	1	8
3	Cart	10	0.2
4	Rickshaws	10	0.5
5	Shawls	3	-
6	Broom	90 kg/month	-

38. There is no transfer station in Dhangadhi municipality. All waste collected by the municipal vehicles is directly taken to the disposal site. Recently, the municipality purchased land in ward No.2, about 2km south from main city centre for establishing a waste sorting / processing centre and transfer station.

3.1.5 Organic Waste Composting

39. In rural municipal areas, organic household wastes generated are feed to domestic animals (e.g. cow, pig, etc) or the decomposable waste is used for composting at domestic level. Few households in urban areas practice household composting. Some years ago the municipality provided some compost bins to the households with awareness training from SWMTSC. However, none of the community level composting bins are presently in operation. There is not any private composting plant and municipality has scheduled to construct and operate a small scale composting plant by mid of 2015 (2072).

3.1.6 Recycling

40. Waste segregation is not officially organized in the Municipality but recyclable wastes that can be sold to the waste pickers are stored separately. The scrap dealer collects reusable and recyclable fractions like paper and paper product, plastic, metals, glass bottles. In exchange they mainly give food items in exchange for the waste. The waste pickers sort the wastes which are then transported either to India or to Nepalgunj.

3.1.7 Treatment of Hazardous (Industrial / Clinical) Waste

41. The Municipality does not have any system for collecting and managing medical waste or any other type of special waste separately. There are 79 health institutes in the municipality including hospitals, clinics and pharmacists. Medical waste from these establishments is dumped along with regular municipal waste.

42. Hospital wastes (general waste + hazardous wastes) are mixed to MSW stream despite the government regulation, requiring every hospital to properly dispose of waste (The Solid Waste Management Act 2011, states: “the responsibility for processing and management of hazardous waste, medical waste, chemical waste…under the prescribed standards shall rest with the person or institution that has generated the solid waste”).

43. Seti zonal hospital has its own normal incinerator (not standard). Hazardous waste of the zonal hospital is managed by the hospital. Almost all health institutions, including

hospitals, do not have proper facilities to dispose of hospital waste that is hazardous which presents a risk to municipal waste workers, the general public health and the environment.

3.1.8 Final Disposal

44. The collected waste is disposed of in temporary open piles in open spaces and along riversides. The collected waste from the municipality is dumped in the steep depressed land of a river. This is environmentally bad practice of waste disposal. All the waste from the municipality including household, institutional, commercial, hospital, industrial, bulky waste, workshop waste, and farm waste are dumped together, some which might be hazardous.

3.2 SWM Institutions

3.2.1 Municipal Authorities

45. Environment and sanitation unit under the Social Development Section of Dhangadhi Municipality is responsible for the waste management of the municipality. The activities under the SWM includes street sweeping, waste collection and transportation to dumping site, mobilization and supervision of sanitation staffs, and maintenance of equipment.

46. The head of Environment and Sanitation unit is solely responsible for decision making in waste management and environmental improvement. Beside, the unit head, there are two supervisors, 2 drivers and 25 sweepers involved in SWM in Dhangadhi Municipality but none have had adequate training in waste management.

3.2.2 Private Enterprises

47. The private sector is not directly involved in SWM for the municipality. However, the municipality had contracted a private firm called VOC Nepal to manage solid waste but terminated the contract due to legal issues.

3.2.3 NGO and CBO Initiatives and Informal Sector

48. Due to the common perception that solid waste management is the sole responsibility of municipality, there has been little participation of people in waste management activities undertaken in the municipality, which eventually lead to failure of the SWM program.

49. Dhangadhi municipality (mainly Social Development Section) carries out public awareness and trainings on wastes segregation, household level composting on the regular basis. Sometimes the municipality involves the communities to clean up campaigns. Dhangadhi municipality has started to work with local communities, Tole Lane Organization (TLO) and NGOs in conducting awareness program on the waste management.

50. This awareness program is done to promote recycling, reuse, reduce and composting. The Municipality has organized awareness programs for households with the help of women health volunteers. The Municipality has also conducted sanitation education in different schools of Dhangadhi. Further, one of the Tole Lane Organization called Taranagar TLO is getting involved to manage community wastes at community level. The informal sector like cycle vendors (Scavenger) and few scrap shops are involved in collecting and selling reusable and recyclable fractions of MSW.

3.3 Future Waste Generation

51. From experience, it is noted that there is a relation between the unit waste generation (kg/capita/year) and socio-economic situation in an area. The gross domestic product

(GDP) is considered the most important indicator for the forecast of future waste generation. But, there is no established relationship between GDP and unit waste generation rate. Therefore, a constant unit waste generation rate in the planning period is considered. Using the projected population over period of 2011 -2041 and average per capita MSW generation (kg/capita/day) given in previous section (0.28 kg/capita/day), total daily waste generation in Dhangadhi Municipality has been projected. **Table 3-2** provides the projected total waste over the planning period (2012- 2041)

Table 3-2: Projected Daily Waste Generation in Dhangadhi over 2012-2041

Description	Planning Period						
	2012	2016	2021	2026	2031	2036	2041
Population	101970	117151	134592	158426	186481	224867	271154
MSW (ton/d)	29	33	38	44	52	63	76

52. Similarly, based on current average municipal waste composition data, projection of each component of municipal waste over given time frame has been carried out. The projected data of each fraction over planning period is given in **Table 3-3**.

Table 3-3: Projection of various MSW component over time frame (2012- 2041)

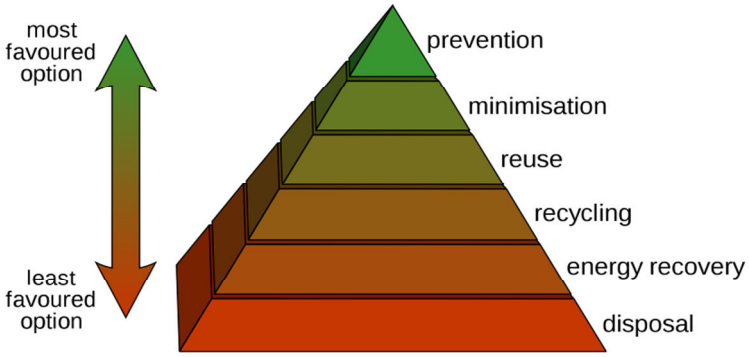
Waste type	**Planning Period**						
	2012	2016	2021	2026	2031	2036	2041
Total waste (ton/yr)	**10421**	**11973**	**13755**	**16191**	**19058**	**22981**	**27712**
Organic waste (ton/yr)	4563	5243	6023	7090	8345	10063	12134
Plastics (ton/yr)	1999	2297	2639	3106	3657	4409	5317
Papers (ton/yr)	1718	1974	2268	2670	3143	3789	4570
Glass (ton/yr)	726	834	959	1128	1328	1602	1931
Metals (ton/yr)	269	309	355	418	491	593	715
Textiles (ton/yr)	126	145	167	196	231	279	336
Rubber/Leather (ton/yr)	335	385	443	521	614	740	892
Others (ton/yr)	684	786	903	1062	1250	1508	1818
Reusable & recyclable fraction (ton/yr)	**5175**	**5945**	**6830**	**8040**	**9464**	**11412**	**13761**

3.4 Proposed SWM Improvement and Costs

3.4.1 SWM Development Strategy

53. The guiding principles of SWM strategy of Dhangadhi Municipality is in line with SWM act 2011, Local-self Government Act, 1999 and other relevant environmental related acts. The following guiding principles for SWM strategy and approach will be considered. The strategy ensures that the focus is on waste prevention (preventing the generation and minimizing the waste that is being generated) as a first priority. If the first option is neither insufficient nor practical or technically or sociologically feasible, then other solutions have to be considered. The strategic approach applied for the development of strategy is based on the internationally recognized waste hierarchy which includes as shown in **Figure 3-1**.

Figure 3-1: Waste Hierarchical Structure



54. The following are the guiding principles:

- Zero waste target: This shall be the ultimate target to be achieved through practicing the concept of reduce, reuse and recycle and extended producers' liability in a concerted manner. Not more than 25% of waste shall be landfilled by 2030.
- Provisions of Solid Waste Management Act 2011 (2068), which has fundamentally incorporated the basic principles mentioned above.
- Ensuring People Participation – Municipality alone cannot meet the challenge of keeping the city clean. To change peoples' attitude on solid waste and to minimize the waste produced including plastic waste and facilitate sustainable waste management peoples' participation must be ensured. To change their attitude and behaviour on solid waste, information, education and communication (IEC) programs throughout the municipality will be needed.
- Participation of communities, TLOs, private sector enterprises and other stakeholders. - One of the best model for waste management in Dhangadhi could be involvement of private sectors and TLOs, where one of the private organization had been already involved on SWM in contract basis and a few TLOs are working for SWM in their locality independently.
- SWM services to be made self-sustaining. - service shall be made self sustaining within a period of 5 years by resource recovery and cost recovery approach such as levy of user fee charges and revenue from reusable and recyclable products.
- Maintaining strong communication and dissemination of information

55. In addition to MSW processing, septage (septic tank sludge) could also be treated and included in the composting stream. Thus, Integrated Waste Processing Sites (IWPS) could be developed. These do not necessarily have to be in one location. Small IWPS could be scattered around the municipality depending of waste sources plus environmental and social acceptability. In case of septage sludge treatment, an anaerobic digestion technology would be socially and environmentally acceptable option which generates biogas as well as producing quality hygienic compost fertilizer. Only the by-products (reject waste) would be transferred to the final disposal site.

56. It is expected that the fully functional requirements for integrated solid waste management (ISWM) system may be difficult to implement in the project municipalities during the first phase of the project. Gradual improvement in waste management with

associated public awareness and education is suggested for the planned transformation from open dumps to sanitary landfills.

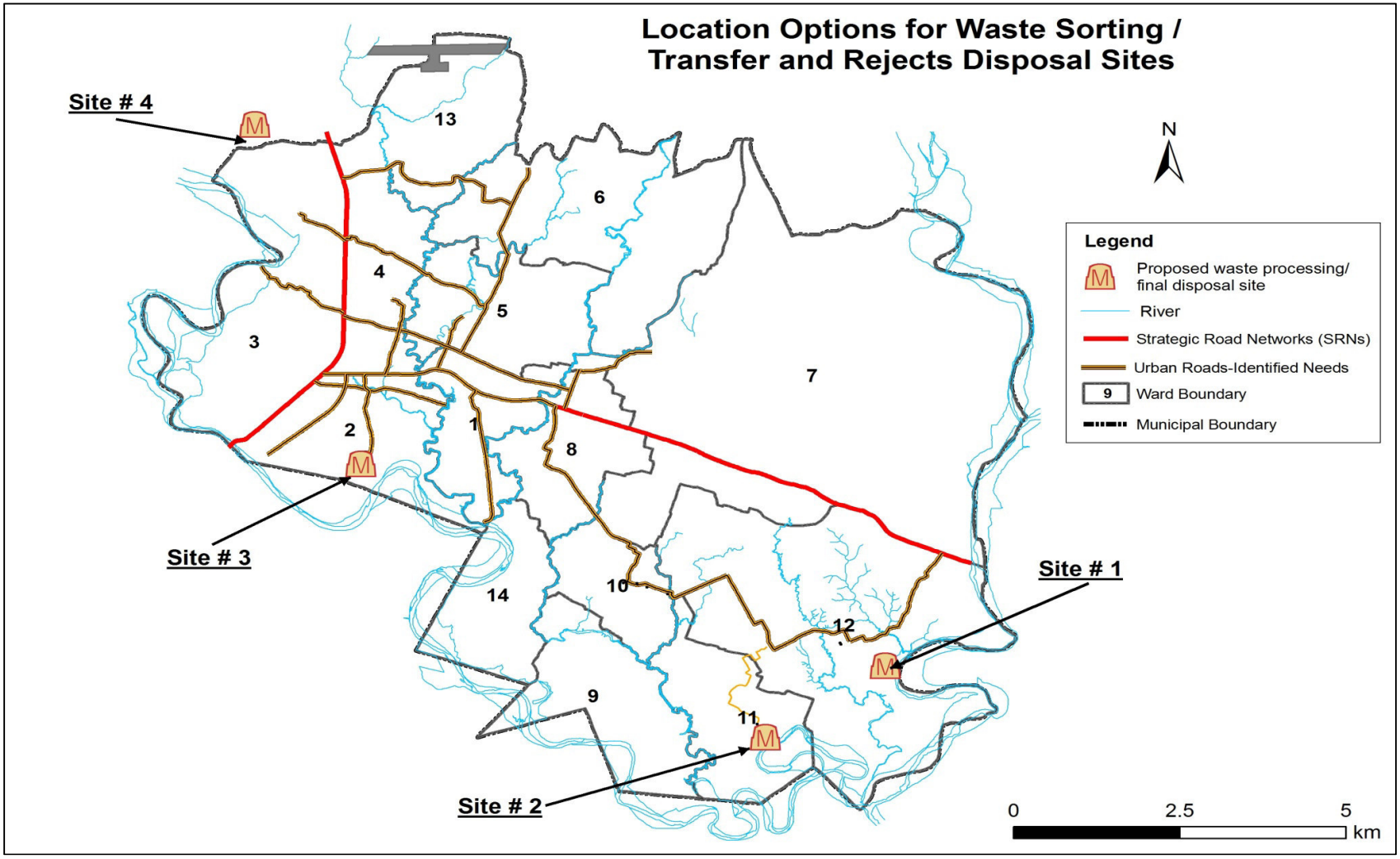
57. The final disposal site (engineered landfill site/sanitary landfill site) as required will only accept rejects from the compost plant and residue from recycling plant / facilities and other unwanted wastes.

58. Based on regional economic development vision and conceptual urban development plan, preliminary field visit and stakeholder's consultation meetings, there is also the opportunity for a sub-regional shared landfill site to be developed by both Dhangadhi and Attariya municipalities. The brief description of possible a sub-regional shared landfill site is given in DN#4 Part A of this Draft Final Report. However, the technical and financial viability for shared landfill site for two or more regional municipalities as well as institutional / financial mechanism for operational arrangement have to be carefully examined during detail design. A number of alternative sites for waste sorting/transfer station and final disposal have been identified in Dhangadhi Municipality. **Table 3-4** provides a brief description of each site, which are indicated in **Figure 3-2**.

Table 3-4: Alternative Sites for waste processing and final disposal

Site No.	Description
Site # 1	• Located at ward no. 12 of Dhangadhi, about 12km south-west from city center • A few km new road needs to be developed to access the site • River training and flood protection would be required as site is located near Khutiya River • No nearby human settlement, but far from city area which may increase transportation cost • As private land, it would need to be acquired prior detail investigation
Site # 2	• Located at ward no. 11 of Dhangadhi, about 10km south-west from city center • A few km new road needs to be developed to access site • The public land would be used for developing site but surrounding private land also needs to be acquired prior detail investigation • River training and flood protection should be required as site is located near the confluence of Mohana and Khutiya River • No nearby human settlement, but far from city area which may increase transportation cost
Site # 3	• Private land purchased by Municipality • Located at ward no- 2 of municipality which is about 2km far from city center • A little infrastructures has already been developed • As located at low land, pounding during monsoon is common, needs to be developed appropriate drainage
Site # 4	• Located at ward no. 11 of Attariya near the border of Dhangadhi Municipality • The site is about 1.5 km from Mahakali Highway and connected by road, but access road needs to be upgraded • As abandoned old brick factory area and far from any human settlement, the site seems to be socially and environmentally accepted, • Used only for reject materials (not allowed bio-degradable waste) as site is located nearby airport (less than 4km far from airport).

Figure 3-2: Location Options for Waste Sorting / Transfer and Rejects Disposal Sites



3.4.2 Indicative SWM Component Packages and Cost

59. Costs based on construction of Integrated SWM system for Nepalgunj (IUDP-1) with a similar geographical condition and waste generation pattern.

Component Description		Cost Estimate (NRs. million)
Sanitary Landfill Site development		150
Other development works (internal service road, weighbridge, power supply, water supply, administrative building etc)		40
Compost Plant for bio-degradable fraction (5 ton/day windrow composting plant) with digested component of septage treatment plant		20
Equipments/Vehicles/Tools		50
Recycling facilities		3
Community development program/3R promotion activities		10
Miscellaneous costs including land, access road etc.		50
	Total NRs.	323
	US $	US$ 3.23 million
Annual operation cost (first year cost)		NRs. 15 million

4 Urban Roads and Surface Water Drainage

4.1 Municipal Roads

4.1.1 Current Status of Municipal Road

60. There are 561km of roads (black topped, gravel road and earthen surface/track) including Mahakali Highway and Postal Road in Dhangadhi Municipality. Beside 13km of main highway, about 20% (113km) municipal roads are reported as blacktopped. All the remaining roads are either gravel or earthen surfaced. The total length and status of road is given in **Table 4-1** and shown **Figure 4-1**.

Table 4-1: Length and status of roads in Dhangadhi Municipality

Road Type	Total Length (km)	Blacktop (km)	Gravel (km)	Earthen (km)
Strategic Road Networks (SRNs)	13	13	0	0
Municipal Road (MR) including earthen track and trails	548	113	233	202
Total	**561**	**126**	**233**	**202**

4.1.2 Road Network Responsibility

61. Strategic road networks (SRNs) such as highways and feeder roads are maintained/ upgraded by Department of Roads (DoR). In Dhangadhi Municipality, Mahakali Highway and Postal road are maintained by DoR.

62. The District Development Committee (DDC) maintains all the local rural roads while the municipality is a responsible for the maintenance of all the urban roads. However, as per new DTMP guidelines, DDC will be mainly responsible to plan, upgrade and construct District Road Core Networks (DRCNs)[5]. **Annex 4C-B** provides a list of the major urban roads including SRN within municipality.

4.1.3 Problems and Issues

63. The section of Mahakali Highway (India border to Attariya border) passes along the western edge of the municipality in a north-south direction. As part of regional development, this should be upgraded into a 4 lane highway with service roads and proper drainage with facilities for travellers.

64. Although about 360km of blacktop and gravel roads has been reported in the municipality, large parts of municipality are not still accessible throughout the year. Further, due to lack of proper drainage and regular maintenance, most of the roads/lanes in the municipality are in a poor state and need to be improved or upgraded. To provide access to all settlements within the municipal boundary, new road construction and/or upgrading existing earthen track is essential. This should be part of future urban development planning and investment based on the regional economic and urban development vision.

65. Another important road (Dhangadhi Main Road) runs perpendicular to Mahakali Highway passes through the main commercial area of the municipality. The road needs to be improved with necessary footpath and drainage providing a presentable urban road. In addition, the open storm water drains are often full of garbage in many places.

[5] DTMP Guidelines 2012, http://rtiswap.gov.np/dtmp_guideline.php

66. The other important city road parallel to Dhangadhi Main Road also passes from north part of core city area and connects with Mahakali Highway. Though the road has blacktopped surface, it is in a very poor state with extensive pot-holes in many places. The existing ROW is also not as per urban road standards and few bridges also need to be constructed in this road.

67. The postal road that runs parallel to the East-West Highway is being upgraded/ improved by DoR (with assistance from Indian Government) eastwards from the municipality. However, the alignment is yet to be agreed to the west of Dhangadhi. Many other major urban roads, both in north-south or east-west corridors have not been constructed as per minimum urban road standard. Many of them require to be upgraded.

4.2 Drainage Adequacy and Key Issues

4.2.1 Municipal Surface water drainage

68. It is reported that many places of Dhangadhi including main road area (i.e. city center) gets flooded due to heavy rainfall during the monsoon.

69. There is very little effective surface water drainage in the municipality besides a small number of natural water courses and along the main road market area. Dhangadhi Municipality reportedly has a total of 14.5km storm water drains. The road side drains have generally been built without any proper design or gradient and do not function effectively. The capacity of existing drains is generally not adequate and many open drains are filled with garbage, silt and often inoperational due to lack of maintenance. However, a few hundred meters of storm water drain is being constructed by DUDBC.

70. Dhangadhi Municipality has two major rivers at its borders; Khutiya Nadi in the east and Mohana river in the west. In addition, there are many other streams (natural water courses) such as Kailali Nala, Seti Nala etc. flowing north-south and ultimately meet the Mohana river in the south. These watercourses drain surface run-off collected from major parts of the city. So, the presences of these water courses give a substantial advantage to the city in developing storm water drainage system. However, the size of these watercourses has been reduced significantly in many places due to encroachments reducing their capacity especially during the monsoon.

4.2.2 Fluvial (river) Flooding

71. During stakeholder's consultation meetings, it was reported that flooding from the Mohana and Khutiya Rivers and other rivulets is very common during the monsoon each year. Floodwaters have occasionally waterlogged many settlements of the municipality including the core city and its adjoining areas, while lack of a proper drainage and sewage system has exacerbated the situation causing serious health concerns. The rainfall and resulting floods in monsoon of 2013 was the worst in 30 years[6]. Beside flooding, the erosion of river bank especially in Khutiya and Mohana rivers is an equally problematic issue in Dhangadhi. Many hectors of land is washed way every year during monsoon. However, the Adarsha Community Users Group of Ward No. 3 implemented the bio-embankment scheme using bamboos and sand against the flood water protecting river bank from erosion under the Western Terai Landscape Conservation Project (WTLCP)[7].

[6] http://reliefweb.int/report/nepal/act-alliance-alert-floods-south-western-nepal
[7] http://www.spotlightnepal.com/News/Article/MOHANA-RIVER-Bio-Embankment-Works-

4.2.3 Sustainable Drainage Systems

72. Surface water drainage systems (SuDS) objectives are to minimize the impacts from development on the quantity and quality of the runoff, and maximize amenity and biodiversity opportunities. Their characteristics include natural features such as ponds, wetlands and shallow ditches called swales. Hard engineered elements are often used in high density, commercial and industrial developments. These include permeable paving, canals, treatment channels, attenuation storage and soakaways.

73. SuDS should be developed under the project in-line with the ideals of sustainable development. The system should be designed to both manage the environmental risks resulting from urban runoff and to contribute wherever possible to environmental enhancement[8].

74. The primary purpose of SuDS is to mimic the natural drainage of the area prior to development. This is achieved by capturing rainfall, allowing as much as possible to evaporate or soak into the ground close to where it fell, and then conveying the remainder to the nearest watercourse. Along the way any pollutants, such as metals and hydrocarbons from roads and car parks, are reduced. Water entering a local watercourse is therefore cleaner. If the water is kept on the surface as much as possible the SuDS can provide valuable amenity asset for local residents and create new habitats for wildlife.

75. SuDS will become increasingly important to control surface water as rainfall increases because of climate change. It can also provide other benefits in developments such as passive cooling, which will again help mitigate any increase in temperatures due to climate change.

4.3 Proposed Roads and Drainage Improvements

4.3.1 Ongoing and Planned Road Development

76. Four new bridges are either being constructed or planned by DoR on municipal roads in Dhangadhi. A bridge over Mohana river is under construction which connects Dhangadhi Municipality with villages of another district (Kanchanpur) and an additional three bridges are going to be started within this fiscal year. A bridge at Campus-Chatakpur Gate road near Rastra bank, and a bridge are proposed for the Dhangadhi ring road near Kailali multiple campus plus a bridge at Gulma-Church road near Santoshi tole are planned by DoR.

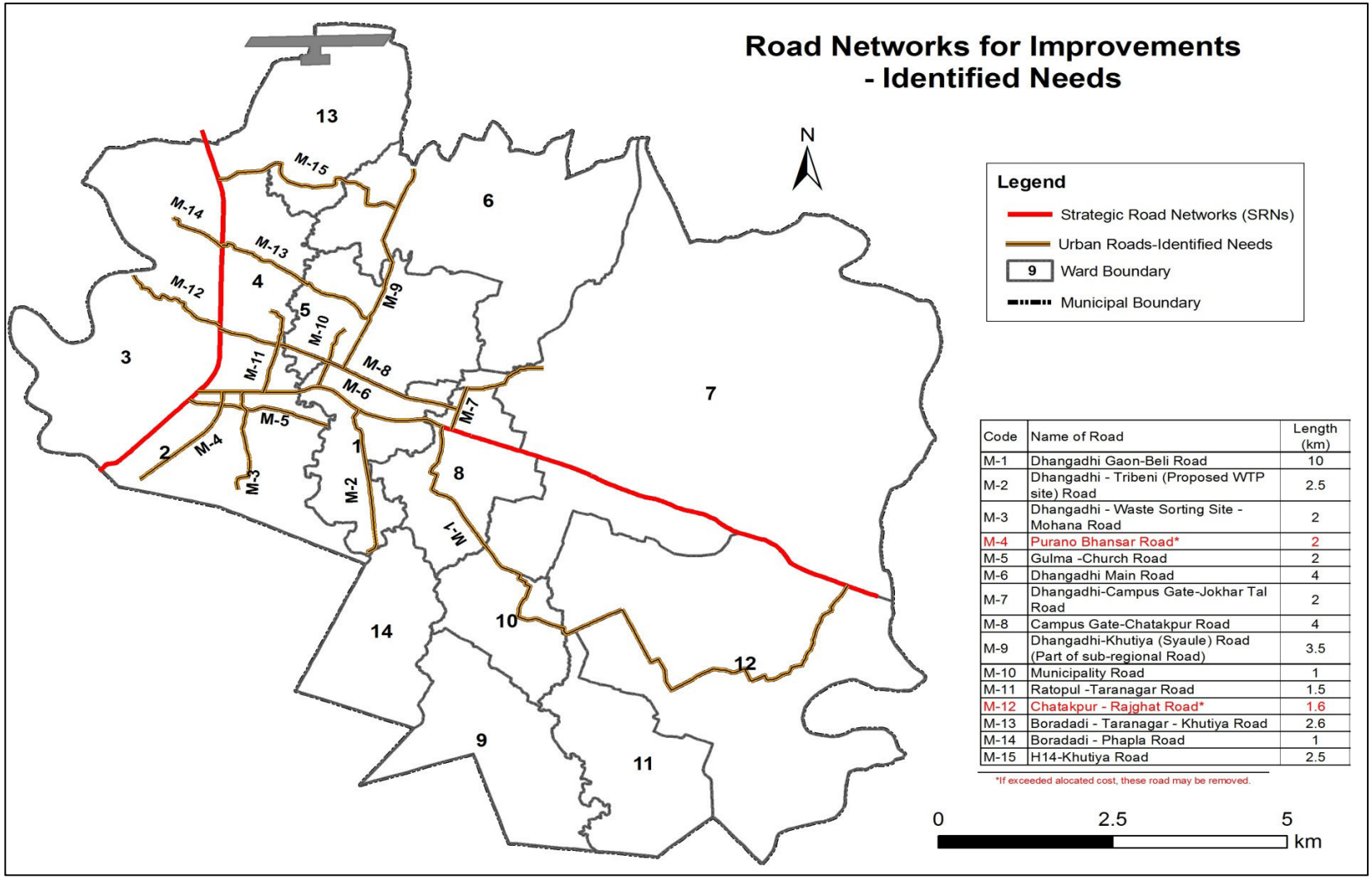
4.3.2 Components and Benefits

77. Other than the main highways, only 113km roads are blacktopped. None have been constructed to required urban road standards (two lane road 7.5m to 10m pavement width) with storm water drainage and footpaths on each side of road. Thus, almost all municipal roads within Dhangadhi need to be improved and upgraded. Through stakeholder's consultation a total of nearly 70km of urban roads were considered as high importance urban networks in the municipality.

78. Based on the regional economic development vision and conceptual urban development plan and field assessment with municipal officers, 42km of high important roads have been prioritized for possible inclusion in the project. The SRN and major urban road network improvements of Dhangadhi Municipality are shown in **Figure 4-1**. The names of road identified for possible intervention within the project are listed in **Table 4-1**.

[8] For detail information on visit http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

Figure 4-1: Main Roads and Drainage Improvements



Code	Name of Road	Length (km)
M-1	Dhangadhi Gaon-Beli Road	10
M-2	Dhangadhi - Tribeni (Proposed WTP site) Road	2.5
M-3	Dhangadhi - Waste Sorting Site - Mohana Road	2
M-4	Purano Bhansar Road*	2
M-5	Gulma -Church Road	2
M-6	Dhangadhi Main Road	4
M-7	Dhangadhi-Campus Gate-Jokhar Tal Road	2
M-8	Campus Gate-Chatakpur Road	4
M-9	Dhangadhi-Khutiya (Syaule) Road (Part of sub-regional Road)	3.5
M-10	Municipality Road	1
M-11	Ratopul -Taranagar Road	1.5
M-12	Chatakpur - Rajghat Road*	1.6
M-13	Boradadi - Taranagar - Khutiya Road	2.6
M-14	Boradadi - Phapla Road	1
M-15	H14-Khutiya Road	2.5

*If exceeded alocated cost, these road may be removed.

79. The Hasanpur-Syaule Road is strategically important to both Attariya and Dhangadhi Municipalities, has been identified as sub-regional project to be included in IUDP2. The road starts near Dhangadhi municipal offices and joins the East-West Highway at Syaule Bazar in Attariya, close to the proposed new Attariya municipal offices. Of a total 11km total length of this linkage, 7.5 km lies in Attariya Municipality, while 3.5km is in Dhangadhi Municipality. The detail description along with GIS map of this sub-regional road is given in respective section of DN#4 Part A of this Draft Final Report.

Table 4-2: Roads Identified for Possible Intervention

Code	Name of Road	Length (km)	Proposed Width (m)	Unit cost (NRs./km, million)
M-1	Dhangadhi Gaon-Beli Road	10	16	34
M-2	Dhangadhi - Tribeni (Proposed WTP site) Road	2.5	16	30
M-3	Dhangadhi - Waste Sorting Site - Mohana Road	2	15	30
M-4	Purano Bhansar Road*	2	15	30
M-5	Gulma -Church Road	2	16	40
M-6	Dhangadhi Main Road	4	30	40
M-7	Dhangadhi-Campus Gate-Jokhar Tal Road	2	20	30
M-8	Campus Gate-Chatakpur Road	4	20	40
M-9	Dhangadhi-Khutiya (Syaule) Road (Part of sub-regional Road)	3.5	30	40
M-10	Municipality Road	1	15	40
M-11	Ratopul -Taranagar Road	1.5	15	40
M-12	Chatakpur - Rajghat Road*	1.6	16	30
M-13	Boradadi - Taranagar - Khutiya Road	2.6	16	30
M-14	Boradadi - Phapla Road	1	16	30
M-15	H14-Khutiya Road	2.5	15	30
	Total Length (Approx.)	42km		

4.3.3 Roads and Drainage Improvement Cost Summary

80. For the estimation of roads and drainage improvement cost, the unit rate was adopted from Department of Road. The recent cost for improvement/upgrading of urban road with varying width under Kathmandu Valley road improvement/extension program is about NRs.9 million to NRs.38 million with an average NR.23.5 million per lane per km. The average cost for just widening, upgrading and providing drainage and minimum footpath is around NRs.40 million/ km.

81. Based on this reference rate, the estimated cost for the improvement of about 42km road in Dhangadhi Municipality would be almost NRs.1360 million (US$ 13.60 million).

5 Urban Development Facilities

5.1 Vehicle / Bus Park

82. The existing Bus Park is located in the heart of city and creates severe traffic congestion in main city road. Illegal parking of vehicles including trucks has further exacerbated the traffic problem. The development of new Bus Park has therefore become essential. Alternative locations have been identified for a new Bus Park (See **Figure 5-1**), where the municipality has already taken initiative to acquire land. Cost based on Bus Park facility with similar requirements at Bheemdatt Municipality (to be constructed soon), the estimated cost for proposed Bus Park would be NRs.150 million.

5.2 Cricket / Sports Arena

83. Youth are attracted towards cricket in entire Far Western Region. A few national level games have been already been successfully played in Dhangadhi despite poor infrastructure facilities. This shows Dhangadhi has great potential to be established as Sports Arena.

84. Initiations have been taken at a private level and land at Phapla, Dhangadhi has been identified for the development of a Cricket Stadium (See **Figure 5-1**). The access road up to project site will be upgraded/improved within this IUDP2 project, however the development of such a centre should be developed by the Cricket Association Nepal under Ministry of Youth and Sports.

5.3 Municipal Building

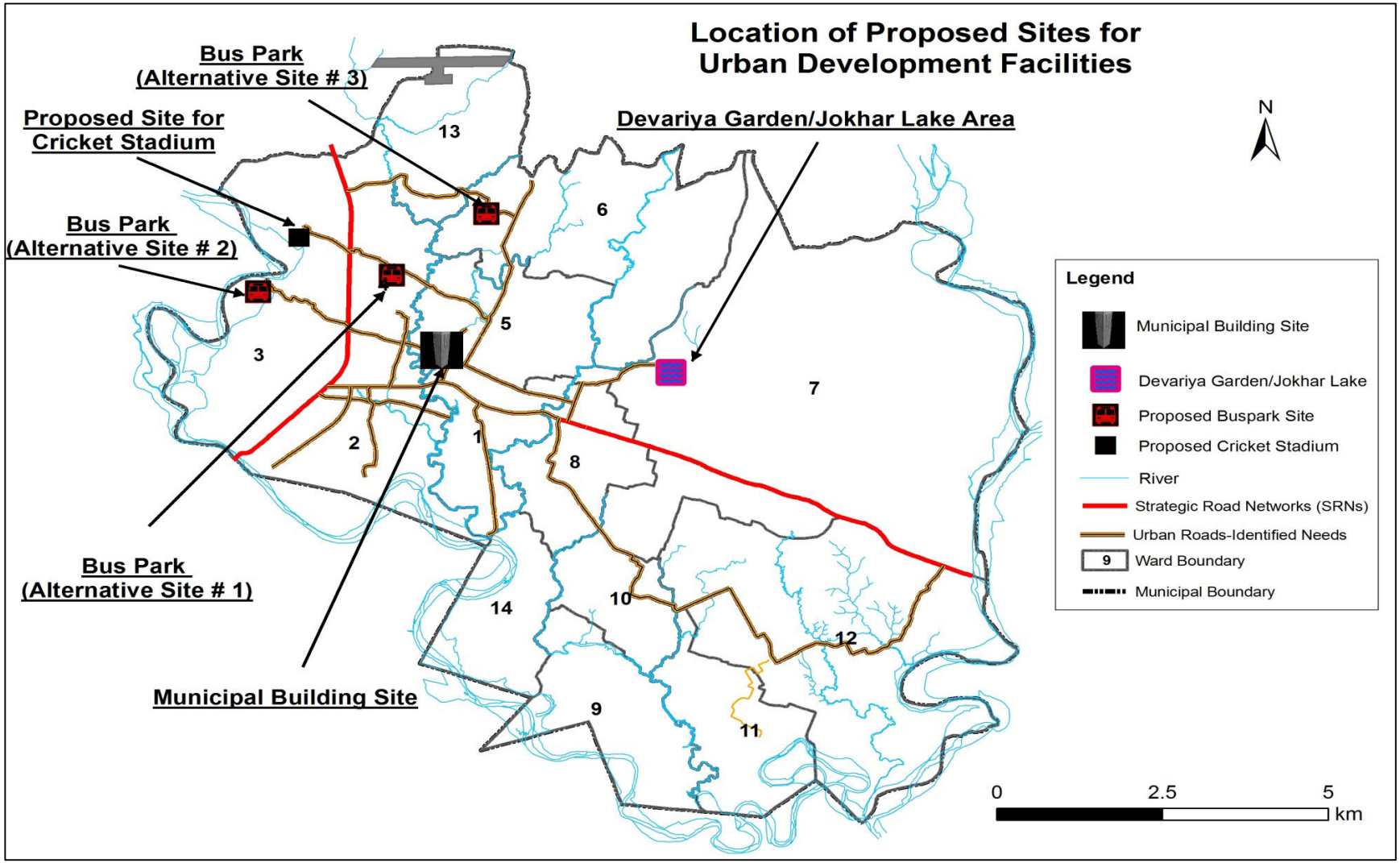
85. As one of the oldest municipalities in Nepal, the municipality does not have adequate building facilities to provide day to day services to its citizens. One of the existing old buildings needs to be demolished and a new building constructed with modern facilities to provide quality modern municipal services. Municipal funds can be shared either in the form of grant from central government (MoFALD) or loan to upgrade/retrofit the municipal building facilities. NRs. 10 million has been allocated for this purpose subject to detail design.

5.4 Development of Jakhor Lake Area

86. Despite the potentiality to attract many tourists with destinations like the Jhakhor lake, the region has remained out of sight of visitors. There is also a Botanical Garden adjoining the lake and few basic infrastructures for tourism activities have already been initiated by municipality, District Plant Resource Office etc., this area would be developed as multi-purposes tourist destination.

87. The Plant Resources Office, tourism board, TDS should develop this area. Municipal funds would be shared. The estimated contribution cost is NRs. 7 million.

Figure 5-1: Municipal Buildings and Facilities



6 Prioritization of Identified Components and Indicative Costs

88. Although five urban infrastructure components have been identified in Dhangadhi Municipality, all the components will not be equally important for immediate investment. Through stakeholder consultation, site visits and professional judgment, the infrastructure components identified are ranked in the following order as shown in **Table 6-1**.

Table 6-1: Prioritization of the Infrastructure Components Identified

Priority	Component
1st	Municipal Roads & Drainage
2nd	Solid Waste Management
3rd	Water Supply
4th	Municipal Facilities/Infrastructures
5th	Wastewater Management & Treatment

89. The indicative cost estimates for Dhangadhi Municipality based on the infrastructure components identified through extensive stakeholder consultation and site visits are summarized in **Table 6-2**.

Table 6-2: Dhangadhi Municipality Identified Needs and Indicative Cost Estimates

Sector	**Proposed Intervention**				**Indicative Cost**		
	Description	Proposed Wards	Additional Household	Popn. %	NRs. million	$ million	%
Water Supply	Deep tube wells and distribution	11 & 12	2,000	10%	420	4.20	15%
Wastewater Management	Small bore sewerage in centre	1, 2, 3, 4 & 5	2,500	12%	505	5.05	18%
Solid Waste Management	Integrated waste management system with landfill site	1, 2, 3, 4, 5 & 8	9,000	44%	323	3.23	12%
Municipal Roads and Drainage	Seal and develop municipal roads		42		1,360	13.60	49%
Municipal Facilities	1. Vehicle / Bus Park				150	1.50	5%
	2. Improvements to municipal building				10	0.10	0.4%
	3. Development of Jakhor Lake Area				7	0.07	0.3%
Community Infrastructure	To be indentified during design				25	0.25	1%
Dhangadhi Total					**2,800**	28.00	100%

90. The estimated cost of the identified investments for Dhangadhi is NRs.2,800 million. However, this is only an indicative cost of the identified priority investments. The final scope of work and actual investments might change slightly following site investigations and further analysis during detail design.

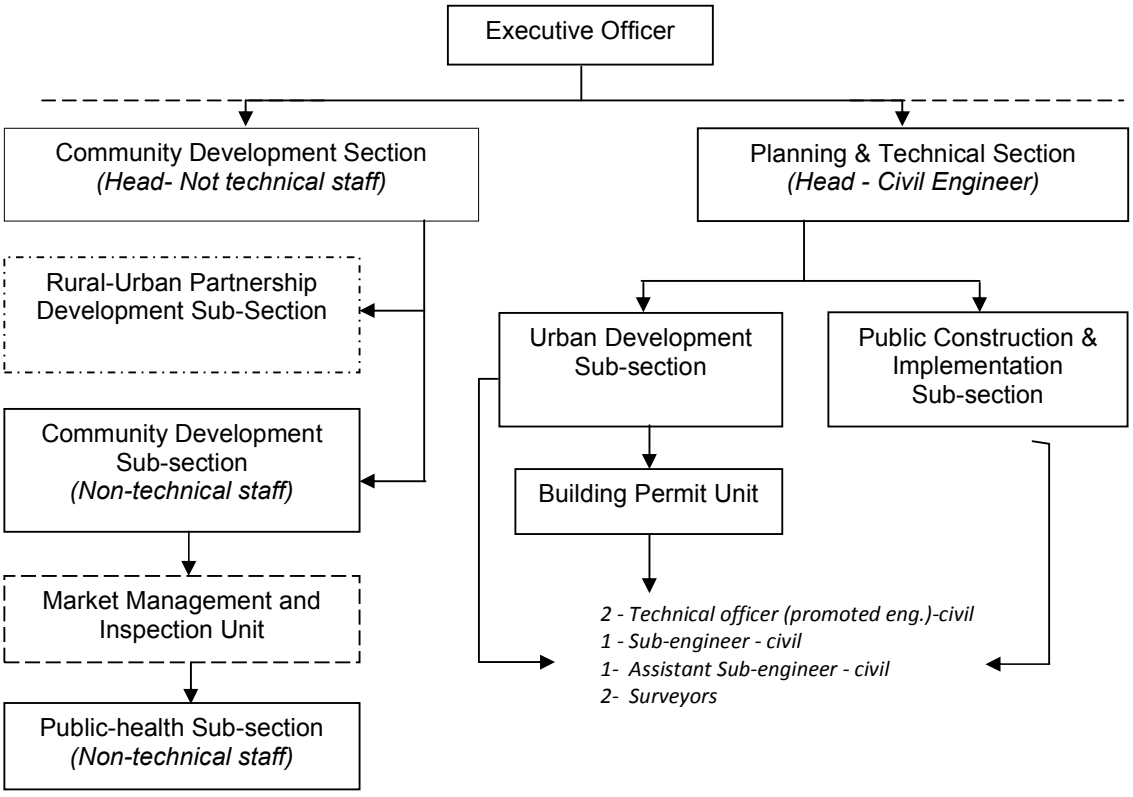
7 Institutional Capacity for Municipal Infrastructure

7.1 Existing Institutional Arrangements for Municipal Infrastructure

91. Though Dhangadhi is a well established municipality, it does not have the necessary divisions/ sections and required adequately trained technical staff for fully providing basic municipal infrastructure services. The existing municipal organization structure includes a planning and technical section with a section head (senior civil engineer). Under this section, there are two separate sub-sections; urban development and program sub-section and public construction and implementation sub-section. In addition to the section head there are two technical officers (promoted engineer-civil), 1 sub-engineer (Civil), 2 assistant sub-engineers (civil), and two surveyors responsible for urban infrastructure activities.

92. The SWM and sanitation component is handled by the community and development sub-section without any technical or trained staff. The overall organization structure of Dhangadhi Municipality is provided in Discussion Note # 6. The institutional arrangements and staff responsible just for municipal infrastructure are given in **Figure 7-1**.

Figure 7-1: Existing Institutional Arrangements for Municipal Infrastructure



93. Although water supply is one of the basic urban infrastructures to be provided by a municipality, Dhangadhi municipality is not directly involved in the delivery of this urban service. Piped water in Dhangadhi is provided in the main city area by NWSC. Unfortunately, NWSC branch office lacks sufficient trained and competent technical staff.

94. In addition to NWSC, there is a piped water supply scheme managed and operated by a water supply users committee (WSUC). Institutionally, this is headed by a chairperson

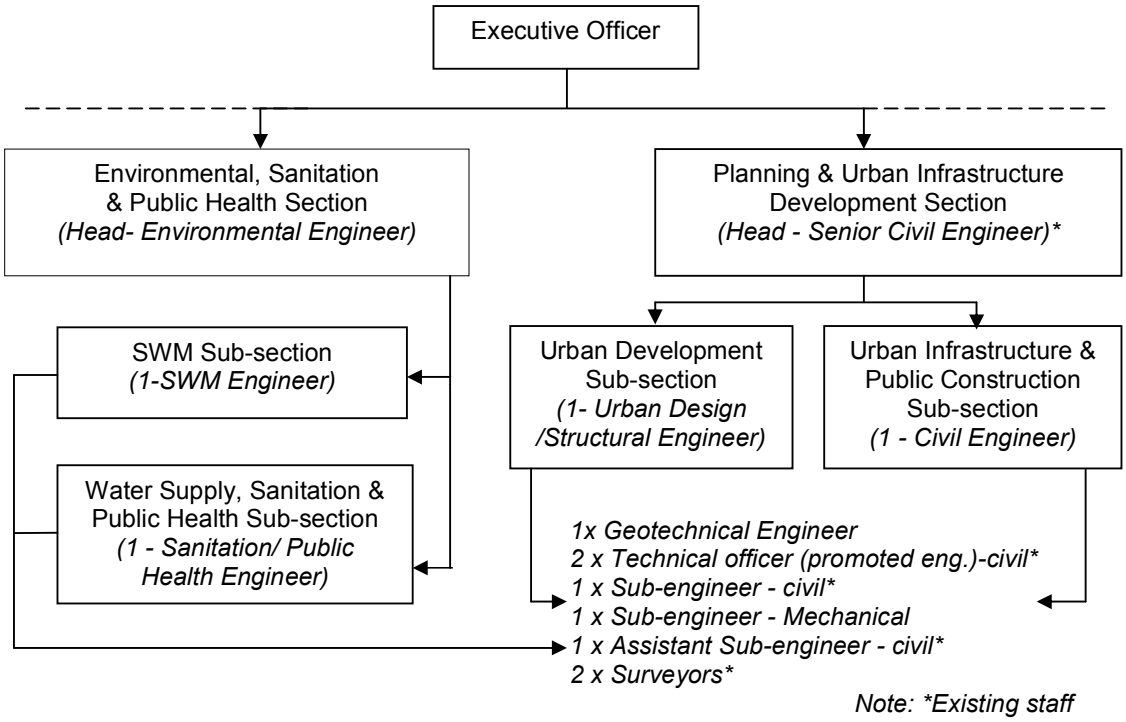
elected by the water users. The WSUC has a few staff that uses a basic management information and computerized billing system. Although the WSUC receives technical assistance from the Kailali water supply and sanitation division office (WSSDO), there is no in-house trained technical staff available to operate and maintain the water supply infrastructure regularly on a day-to-day basis.

7.2 Recommended Institutional Arrangements for Municipal Infrastructure

95. The municipality should have, in the medium to long term, in-house capability to independently develop, operate and maintain their infrastructure. The municipality should have planned asset management programs with the necessary resources and capacity to operate and maintain the municipal services provided.

96. Due to the nature of urban infrastructure services to be provided by the municipality, different divisions/ sections/ units should be established to operation and maintain the smooth delivery of each municipal infrastructure service. Competent technical staff in each division/ section must be recruited with clear job descriptions. The recommended institutional arrangement for Dhangadhi municipality is given in **Figure 7-2**.

Figure 7-2: Recommended Institutional Arrangements for Municipal Infrastructure



97. For the proposed expansion of the city water supply, DSC should evaluate different operational and management modalities and make recommendations. Currently, WSUC is one of the better models for water supply operation and management in many towns, including Dhangadhi. However, the existing institutional arrangement should be strengthened with recruitment of competent technical staff to ensure sustainable operation and maintenance.

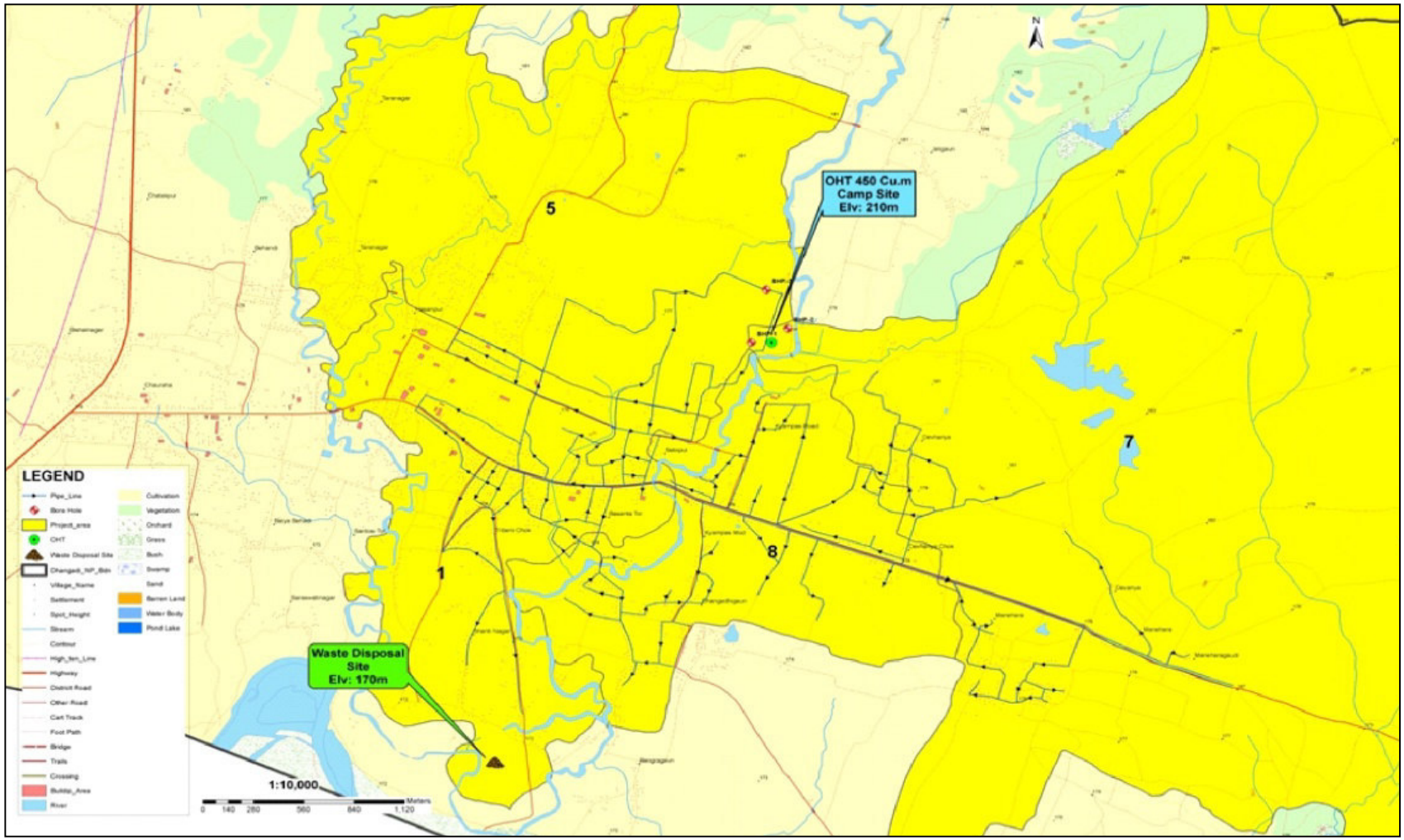
98. The Institutional Development Consultant (IDC) to be engaged through the Project (see Discussion Note #7) will provide further analysis of municipal infrastructure management requirements and provide or arrange training as appropriate.

ANNEX 4C-A

Shivanagar Water Supply Project

Coverage and Distribution Lines

Annex 4C-A: Shivanagar Water Supply Project - Coverage and Distribution Lines



ANNEX 4C-B

Dhangadhi Municipality Major Urban Roads and SRNs

Annex 4C-B: Dhangadhi Municipality Major Urban Roads and SRNs[9]

S.N.	Name	Passing Ward	Length (km)	Exist ROW (m)		Proposed ROW (m)
				Min	Max	
1	Mahakali Highway	2, 3, 4 & 13	5.5	50	50	Highway Standard
2	Bishanagar-Chatakpur-Boradandi Road	3	2.2	5.5	17	10
3	Old Bhansar Road	2	2	10	11	10
4	Bhaibehadi- Posatal Road	2	0.9	6	15	10
5	Sarswatinagar-Chandannath Mil	2	0.8	8	9	10
6	Pipalchautari-Sarswatinagar-SSP Office South gate Road	2	0.4	6	-	6
7	Kabisthan-Krishna Mandir Road	2	0.8	-	-	9
8	Tribeni chowk- Krishna Mandir Road	1	1.1	-	-	9
9	Pashupati Mnadir-Tribeni Chowk Shantinagar Road	1	2	7.5	13.5	10
10	Adalat-Dhangadhi Gaon-Bangarakatan	1	3.5	6.5	12	12
11	Postal Road-Dhangadhi Gaon-Juda Phulnaiya Road	1, 8 & 14	8	9.5	-	12
12	Postal Road-Manehara-Ghuiyaghat West Road	7 & 10	2	9	10	10
13	Postal Road-Manehara-Ghuiyaghat East Road	7 & 10	2	10	10	12
14	Beli- C Gaon-B Gaon-A Gaon -Ghuiyaghat Road	7, 10 & 12	6.5	-	-	12
15	Postal Road-Punarbas Manehahra-D Gaon-C Gaon - Jugeda Road	7, 11 & 12	5	-	-	12
16	Postal Road-Beli -Patela Road	7	3	-	-	10
17	Postal Road-Sadbhawana Marga-Jali- Bijuliya Road	8 & 6	4	10	-	12
18	Postal Road-Campus Gate Road	1	0.75	21	-	21
19	Postal Road-Plywood Factory Road	1	0.4	8	-	9
20	Postal Road-Nainadevi Road	1	0.5	6.5	-	9
21	Hospital - TCN Road	5	0.4	7.25	-	9
22	DDC-Auditorium Road	5	0.45	-	-	16
23	Laxmi Narayan Temple-Rastra Bank Road	5	0.4	12.5	15	16
24	Postal Road-Waster Supply Office- Behadi Road	4	0.7	4	9	9
25	Rato Pul-Behadi Road	4	1.2	7	14	12
26	A Gaon-D Gaon-C Gaon- Dada Gaon-Postal Road (Beli) Road	10 & 12	3.5	-		12
27	Behadi-Taranagar Road	4 & 5	2	-		12
28	Behadi-Campus Road-Shantipur-Army Camp South Gate (Mahakali Highway) Road	4	1.4	-		12
29	Behadi-Kailali Nala West-Newbasti-Taranagar	5	0.9	5.5		9

[9] Dhangadhi Municipality Office, 2015

S.N.	Name	Passing Ward	Length (km)	Exist ROW (m)		Proposed ROW (m)
				Min	Max	
30	Rastra Bank-Panchodaya School Road	5	0.5	4	13.5	9
31	Lonely Plantet School (Hasanpur)-Matiyari Beladevipur Road	5, 6 & 13	5	8.5	-	16
32	Hasanpur Gaon-Jai Tallo Matoyari-Beladevipur Road	5	6	10	-	16
33	Nainadevi-TDC planning chowk-Hasanpur East-Jai Road	5	1.2	8.5	12	12
34	Campus Chatakpur Road-Sivanagar-Jai Road	1 & 5	2	4	-	10
35	Mahakali Highway (NP tax office)-School-Kailali Gaon-Pallo Matiyari Road	5 & 13	3.5	7.5	-	9
36	Mahakali Highway-Kailali Gaon-Airport Road	13	2	8	-	9
37	Mahakali Highway-Amy Hospital North-Taranagar Hasanpur Road	4, 5 & 13	2	6.5	-	12
38	Chatakpur-Campus Road	1, 4, 5 & 8	3.6	11.5	-	16
39	Panchodaya School South-East Hasanpur Road	5	0.75	11.5	-	12
40	Jai-Jali Road	5 & 6	1.2	-	16	12
41	Jai-Khet-Jali Road	5	1.1	-	12.5	12
42	Irrigation Office- Aishrwaya School Road	5	0.16	-	-	12
43	Postal Road	1, 2, 4, 5, 7 & 8	9.5	15	-	30
44	Police Gulma SSP Office- Kailali Nala Road	1	2	7	-	12
45	Kabisthan-Tribei Mod-Dhangadhi Gaon Road-Adalat South Dhangadhi Gaon Road	1, 7 & 8	0.65	7.5	27	12
46	Milanchowk-Kalika Tole-Baiyabehadi - Sarswatinagar Road	2	1.5	7	9	9
47	Postal Road-Devariya Garden-Jakhor Lake Road	7	1.5	9	-	9
48	Bhansar-Brick Factory Road	3	0.8	5.5	-	9
49	Police Gulma-Pragatinagar Road	3	1.2	5.5	-	10
50	National Tele- Jyotinagar Road	3	1.2	9	-	10
51	Mahakali Highway-Sawmil-Bishalnagar Road	3	1.2	7	-	9
52	Mahakali Highway-Chatakpur Road	3	1	7	10.5	9
53	Mahakali Highway-Boradandi- Dillasainik Mandir Road	3	2.5	8	11	10
54	Mahakali Highway-Boradandi School-Chakpur Road	3	0.8	7	9	12
55	Mahakali Highway-NP boundary-Rajpur Road	3	1	-	-	12
56	Boradadi Gaon-Rajpur Road	3	0.7	-	-	9
57	Gulma North-Bishalnagar Road	3	0.3	-	-	12
58	Gurudhwar-Bishalnagar Road	3	1	5	-	9
59	Milanchowk-Brick Factory Road	3	1.1	9	11	12

Government of Nepal
Ministry of Urban Development

Second Integrated Urban Development Project

(IUDP2)

(PPTA 8817–NEP)

Draft Final Report

Discussion Note # 4

Municipal Urban Infrastructure – Part D : Jhalari Pipaladi

September 2015

Draft Final Report

Discussion Note #4 –

Municipal Urban Infrastructure – Part D : Jhalari Pipaladi

Contents

1 Water Supply

1.1 Principle Sources of Drinking Water

1. The source of water for drinking and other purposes in Jhalari Pipaladi is groundwater either from shallow or deep aquifers. No surface drinking water schemes exist in the municipality. Most individual households rely on shallow wells and hand pumps all of which can easily be susceptible to contamination.

1.2 Current Water Supply Schemes

1.2.1 Scheme Coverage

2. There is a small scale water supply system in Jhalari Pipaladi managed by a Water Supply User Committees (WSUC). Only 2% of the present municipal population has access to the piped water supply system in this newly created municipality (CBS, 2011). The existing small water supply scheme covers only ward no-10, an area mainly along main E-W highway. However, another water supply scheme is under construction by DWSS which will supply drinking water to Kaluwapur, mainly in Jhalari Pipaladi Ward No.11.

1.2.2 Funding Water Supply Operations and Management

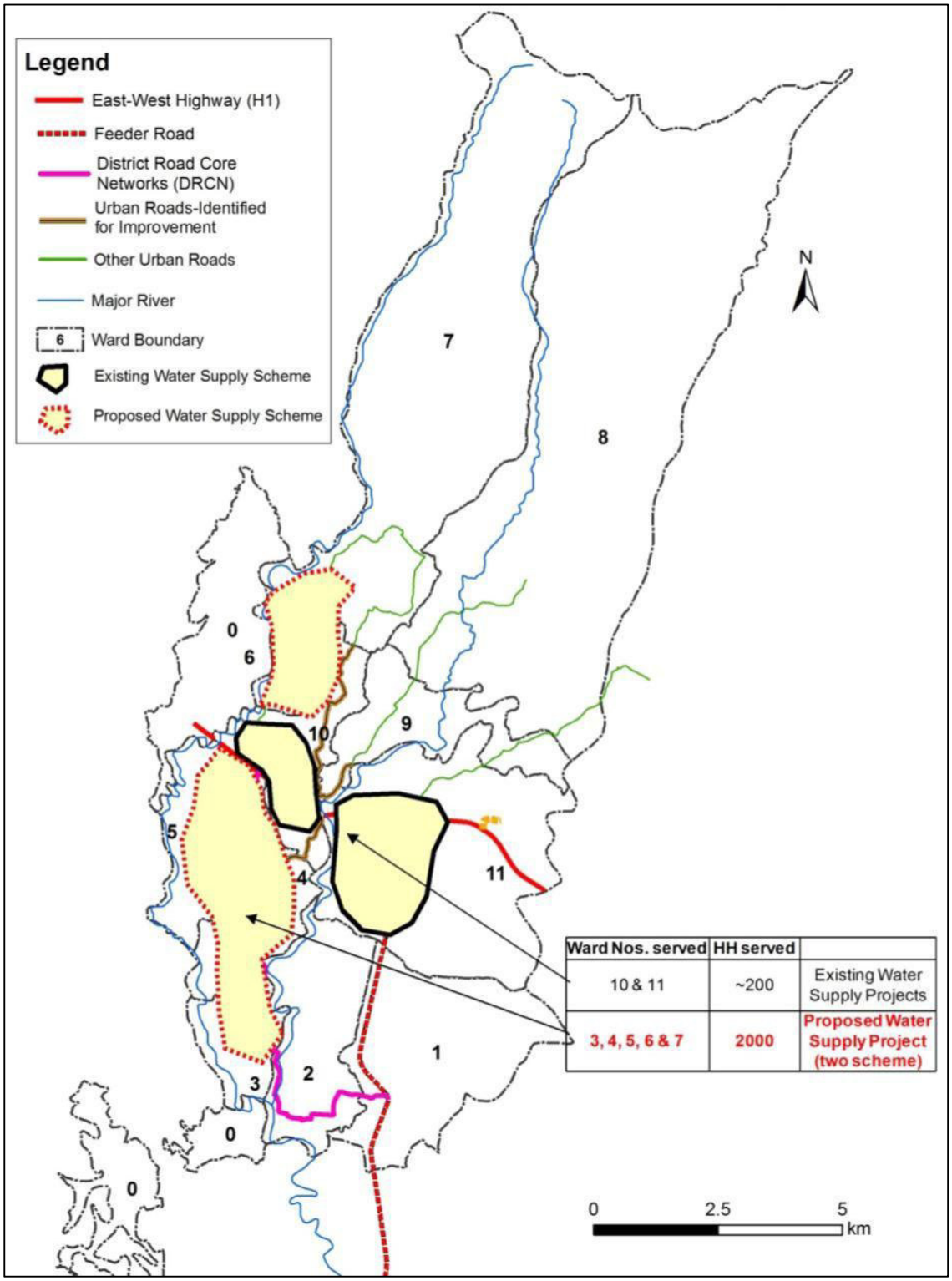
3. The existing piped water system is managed and operated by a WSUC.

1.3 Proposed Interventions

4. In addition to upgrading/ extension of existing water supply schemes in ward Nos.10 and 11, based on the regional economic vision and conceptual urban plan, field assessment and consultation with municipal officials and other stakeholders, two water supply scheme is proposed; one to serve areas of Wards 3, 4 and 5 and another to serve areas of Wards 6 and 7. This proposal has been approved by stakeholder's consultation and municipal authority. The indicative coverage area and beneficiaries of existing and identified water supply scheme are shown in **Figure 1-1**.

5. Based on a design population of 20,000 and similar schemes, the cost would be about NRs.400 million ($4.00 million) and include deep well boring, pump house, pump sets, transformers, reservoirs/OHT, water treatment and distribution. O&M arrangements for this new scheme would be similar to the present schemes with a WSUC.

Figure 1-1: Municipal Water Supply Scheme- Status and Identified Needs



2 Sanitation and Wastewater

2.1 Toilet Facilities

2.1.1 Domestic Toilet Facilities

6. The sanitation situation in Jhalari Pipaladi is very poor. Many houses constructed along the East-West Highway have private toilets but the majority of people i.e. 57% households still have no toilet facilities, especially in the rural areas (CBS, 2011).

2.1.2 Public and Community Toilet Facilities

7. Although there are two public toilets in Jhalari Pipaladi Municipality, open defecation in open spaces is still common. One of the public toilets is located at Jhalari Bazar of ward No.10, while another is in Kaluwapur Bazar of ward No.11. Construction costs of both toilets were shared by the DDC, VDC and Bazar Management Committee. Operation and maintenance of the toilets is arranged by the Bazar Management Committee.

2.2 Current Wastewater Collection and Treatment

2.2.1 Municipal Sanitation Systems

8. There is no sewerage system in Jhalari Pipaladi Municipality. The majority of premises in the urban areas of the municipality have septic tanks with soak pits. There is no municipal service offered for removing septage (septic sludge) from the septic tanks when they get full. Usually, households will contact a local contractor who will arrange to empty the tank manually. The collected septage is usually sold to farmers untreated as fertilizer.

9. Frequently, the septic tanks are not properly maintained or are under capacity resulting in the septage flowing over into the soak pit. In many cases the soak pit does not work, or not constructed, and the septic tank overflows into the surface water road drainage or into vacant plots or fields, resulting in a public health risk.

2.2.2 Wastewater Treatment and Disposal Options

10. A detail study is required to determine the appropriate solution to improve the poor wastewater management within the municipality, as follows:

a) Identify areas where wastewater disposal or septic tanks are problematic, i.e. where septic tanks are overflowing onto land or into surface water drainage: e.g. due to i) high water table; ii) impervious ground; iii) no space for soak-pit; iv) septic tank needs frequent desludging; v) no space for septic tank; vi) prolonged seasonal flooding.

b) Identify areas in relation to phased urban development appropriate for on-site and off-site sewage treatment and disposal including staged development options: i.e. i) on-site septic tanks with soak-pit; ii) septic tanks with overflow to small bore sewerage; and iii) conventional sewerage.

11. A phased wastewater management plan should then be prepared in relation to proposed urban development plans by following the approach of using appropriate technology by utilizing and upgrading the existing system as described above, taking into consideration appropriate methods for faecal sludge management (FSM).

2.2.3 Preliminary Wastewater Improvement Cost

12. Until a comprehensive study is undertaken on wastewater management in the municipality it is only possible to provide indicative costs for comparison.

On-site wastewater improvements

13. The main investment cost is the provision of a septage treatment plant. An anaerobic digestion technology is suggested, which generates biogas as well as produces hygienic quality compost fertilizer. For septage sludge treatment, anaerobic digestion technology also seems to be better socially and environmentally acceptable option than aerobic composting technology based on past experiences from the municipalities of Nepal. Even if biogas is not utilized fully, at least a safe quality compost product would be produced. This could be included as part of a bio-degradable component for solid waste management improvements.

14. Other costs would include the provision of sludge vacuum tankers, although these could be provided by the private sector, as is present practice, and the service paid for by the property owner. Operation of the septage treatment plant could be assisted by the sale of compost fertilizer and utilization of biogas.

Component Description		**Cost Estimate (NRs. million)**
Septage Treatment Plant (20 cu.m per day)		15
Equipment:- One gulley bowzers (4,000 l)		8
	Total NRs.	23
	US $	0.23 million
Operations and Maintenance (Annual)		NRs.1 million

Small bore sewerage

15. The main population is concentrated along the main E-W highway, but the majority (~70%) is scattered over the remaining rural area. The following costs therefore only refers to the more urban character areas.

16. In areas where the on-site soak pits do not function properly, small bore sewerage could be installed to prevent the septic tanks overflowing into the open drainage network or into vacant plots. Only the settled wastewater which sometimes includes some light floating matter is discharged into the small bore sewer. Consequently, the sewer pipes can be laid at shallow gradients. However, some pumping might be necessary depending on the ground contours to lift the settled wastewater up to a simple treatment plant before discharge to the river. The following costs are dependant of the extent of the system.

Component Description		**Cost Estimate (NRs. million)**
Small bore sewerage		30
Septic tank effluent pumping station		10
Septic tank effluent treatment plant (lagoon / reed beds)		20
Other miscellaneous costs (land / buildings / power)		60
	Total NRs.	120
	US $	1.20 million
Operations and Maintenance (Annual)		NRs.3 million

17. In the main commercial high or density residential areas the most economical solution might be to install small bore sewerage to collect septic tank overflows connected to a small decentralized effluent treatment (DEWATS) plant.

18. With this option, on-site wastewater management improvements as described above would also still be required since property septic tanks would still be utilized.

Conventional sewerage and sewage treatment

19. Conventional sewerage will only operate if there is a regular 24-hour water supply system that provides an excess of 100 lcpd (litres-per-person-per-day) plus a guaranteed power supply and skilled maintenance staff. In addition, as a guide, a population density greater than 100 persons/hectare is required for the system to be economical. As a newly created municipality, presently with low population densities and no capacity to operate such a type of sewerage and sewage treatment system this option is not considered further.

3 Solid Waste Management

3.1 Existing Solid Waste Management Practices

3.1.1 Waste Type and Generation

20. Households, commercial establishments, institutions, industries, health institutions, are all waste generators in the municipality. In general, municipal waste covers the waste generated from households, commercial and institutional establishments. Medical and industrial wastes containing hazardous and infectious wastes, should be treated separately.

21. As this is a newly created municipality, there has been no previous study on solid waste generation and composition. For preliminary planning purposes, the waste generation from other towns located in a similar geographical, socioeconomic and demographic condition can be adopted.

22. The average municipal solid waste (MSW) generation for Jhalari Pipaladi has been considered as 0.20, which is less than average national MSW generation rate (0.32 kg/capita/day) but comparable to other towns of Nepal with population less than 50,000. With this per-capita waste generation rates and projected population for the year 2015, the total MSW generation from Jhalari Pipaladi Municipality is estimated to be 9 tons/day.

3.1.2 Solid Waste Composition

23. The waste obtained from the household, commercial and institutional waste is categorized into seven different types, as listed below.

Organic waste	Rubber and Leather
Plastics	Metals
Paper and paper products	Glass
Textile	Others (inert materials etc.)

24. The characteristics of MSW collected from any area depends on various factors such as consumer patterns, food habits, cultural traditions, lifestyles, economic status of inhabitants and climate. The composition of MSW is changing with increasing use of packaging materials and plastics. Based on average composition of similar towns and average national composition pattern, bio-degradable component is expected to be dominant in this municipality. However, in the urban areas with more commercial activities, use of plastics has increased which was observed during field visits.

3.1.3 Street Cleaning and Primary Collection

25. No municipal household or commercial waste collection system exists in the municipality. However, waste is collected in the commercial areas along the main highway arranged by a Bazar Management Committee, which also collects waste from houses in the core area by charging a solid waste collection fee.

3.1.4 Waste Transportation

26. The collected waste mainly from market area along highway is transported in tractor-trailer and dumped in open spaces, forest land or on the river bank.

3.1.5 Organic Waste Composting

27. There is no municipal level organic composting in Municipality. However in rural areas, organic wastes generated from HH are fed to domestic animals such as cow, pig, etc or the decomposable waste is used for composting at domestic level. But such practices are not done in the urban area where the majority of compostable waste comes to the street for final disposal.

3.1.6 Recycling

28. There is not any formal recycling practice in the Municipality which has not initiated or promoted a recycling program.

3.1.7 Treatment of Hazardous (Industrial / Clinical) Waste

29. The Municipality does not have any separate system for collecting and managing medical waste or any other type of special waste separately. As a newly created municipality, it has only a health post and a few medical shops/clinics. All wastes, whether household, medical waste, industrial waste, construction and demolition waste are mixed and discarded together.

3.1.8 Final Disposal

30. Jhalari Pipaladi Municipality does not have any SWM system and so any waste collected by Bazar Management Committee is disposed of in open spaces and on the sides of rivers.

3.2 SWM Institutions

3.2.1 Municipal Authorities

31. No municipal SWM system is in place as it is newly created municipality.

3.2.2 Private Enterprises

32. A committee formed by business people in the core area is involved in waste collection in the municipality. However, no other private enterprises are involved in waste treatment and resource recovery activities.

3.2.3 NGO and CBO Initiatives and Informal Sector

33. No NGO, CBO and Informal Sector are involved in managing MSW.

3.3 Future Waste Generation

34. From experience, it is noted that there is a relation between the unit waste generation (kg/capita/year) and socio-economic situation in an area. The gross domestic product (GDP) is considered the most important indicator for the forecast of future waste generation. Because there is no empirical relationship between GDP and the waste generation rate, a constant unit waste generation rate over the planning period is considered. Using the projected population over the period of 2011 to 2041 and the average per capita MSW generation (kg/capita/day) given in an earlier section, total daily waste generation in Jhalari Pipaladi Municipality has been projected as shown as **Table 3-1**.

Table 3-1: Projected daily MSW generation in Attariya Municipality over 2012-2041

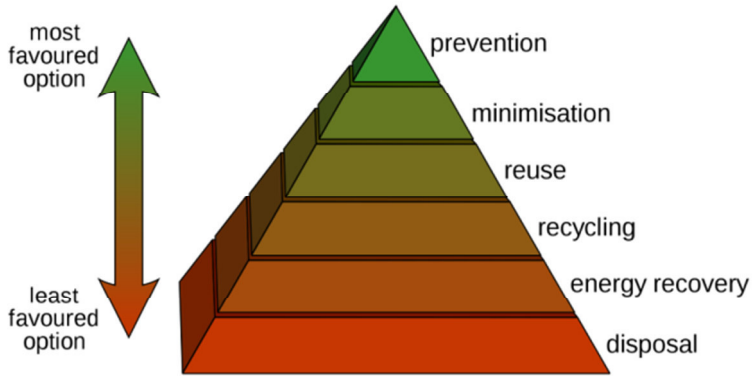
Description	Planning Period						
	2012	2016	2021	2026	2031	2036	2041
Population	42026	48283	55472	65296	76859	92680	111758
MSW (ton/d)	8	10	11	13	15	19	22

3.4 Proposed SWM Improvement and Costs

3.4.1 SWM Development Strategy

35. As a newly created municipality, the focus is on waste prevention (preventing the generation and minimizing the waste that is being generated) is the first priority. If the first option is neither sufficient nor practical or technically or sociologically feasible, then other solutions have to be considered. The strategic approach applied for the development of strategy is based on the internationally recognized waste hierarchy which is shown in **Figure 3-1**. The sophisticated waste collection and transportation system and large scale advanced treatment for solid waste would not be appropriate for such a new and small municipality.

Figure 3-1: Waste Hierarchical Structure



36. The following are the guiding principles:

- Zero waste target: This shall be the ultimate target to be achieved through practicing the concept of reduce, reuse and recycle and extended producers' liability in a concerted manner. All the existing open dump sites should be closed immediately and not more than 25% of waste shall be landfilled by 2030.
- Provisions of Solid Waste Management Act 2011 (2068), which has fundamentally incorporated the basic principles above.

- Ensuring People Participation – Municipality alone cannot meet the challenge of keeping the city clean. People participation shall be ensured to change their attitude and behaviour on solid waste through information, education and communication (IEC) programs throughout the municipality to change peoples' attitude on solid waste and to minimize the waste produced including plastic waste and facilitate sustainable waste management.
- Participation of communities, TLOs[1], private sector enterprises and other stakeholders would be an effective modality for SWM in a new municipality.
- SWM services to be made self-sustaining. - service shall be made self sustaining within a period of 5 years by resource recovery and cost recovery approach such as levy of user fee charges and revenue from reusable and recyclable products.
- Maintaining strong communications and dissemination of information

37. In addition to MSW processing, septage (septic tank sludge) could also be treated and included in the composting stream. Thus, Integrated Waste Processing Sites (IWPS) could be developed. These do not necessarily have to be in one location. Small IWPS could be scattered around the municipality depending of waste sources and environmental and social acceptability. In case of septage sludge treatment, an anaerobic digestion technology would be socially and environmentally acceptable option which generates biogas as well as producing quality hygienic compost fertilizer.

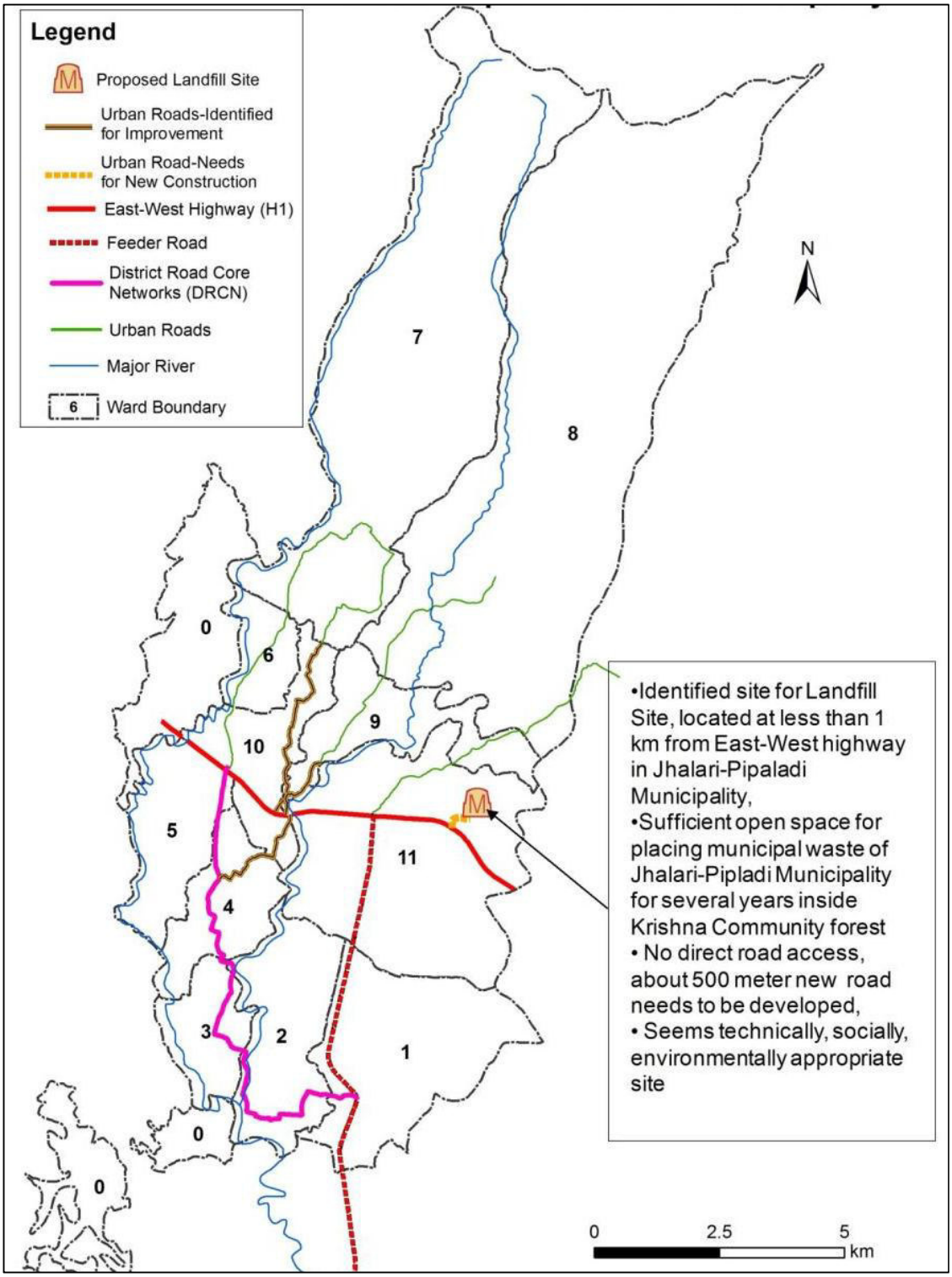
38. It is expected that the fully functional requirements for integrated solid waste management (ISWM) system may be difficult to implement during the first phase of the project. Gradual improvement in waste management with associated public awareness, education and enforcement of law is suggested for the planned transformation from open dumps to sanitary landfills.

39. Based on field visits, there is no opportunity for a sub-regional shared landfill site with other project municipalities as this municipality is isolated by reserve and other big forest areas. Further, it becomes uneconomic to transport a small amount of waste over a longer distance as Jhalari Pipaladi does not generate significant amount of waste since its area is mostly rural. Thus and final disposal site needs to be developed within the municipality.

40. One site for MSW disposal has been identified within municipal boundary which is less than 1km far from East-West Highway. Although the site is located within Krishna Community Forest Area, the location is open space without any trees. The identified site seems to be technically, socially and environmentally acceptable if legal issues are resolved. A further, series of consultation meetings with community people are required. The site can be developed for several years but a few hundred meters new road will need to be developed. The identified site for waste processing and engineered landfill site is shown in **Figure 3-2**.

[1] TLO Abbreviation for Tole Lane/Development Organizations. Usually between 30 to 60 households are represented in one group organization. They are mostly involved in drinking water, health, environment and sanitation issues of their community.

Figure 3-2: Location of Proposed Waste Processing and Engineer Landfill Site



3.4.2 Indicative SWM Component Packages and Cost

41. Cost is estimated based on Integrated SWM system for existing projects in other towns of Nepal with a similar geographical condition and waste generation pattern is shown in **Table 3-2**. As a newly created municipality, focus should be on promoting 3Rs activities including small scale community based waste treatment plants rather than large landfill site.

Table 3-2: SWM Indicative Components and Cost

Component Description	Cost Estimate (NRs. million)
Engineered Landfill Site development	50
Other development works (internal service road, weighbridge, power supply, water supply, administrative building etc)	15
Small scale Municipal Compost Plant for bio-degradable fraction (3 to 5 ton/day windrow composting plant) with digested components of septage treatment plant	20
Equipments/Vehicles/Tools	20
Recycling facilities	2
Community level small scale projects/3Rs promotion activities including household composting and small community based compost plants	30
Miscellaneous costs including land, access road etc.	65
Total NRs.	202
US $	2.02 million
Annual operation cost (first year cost)	NRs. 5 million

4 Urban Roads and Surface Water Drainage

4.1 Municipal Roads

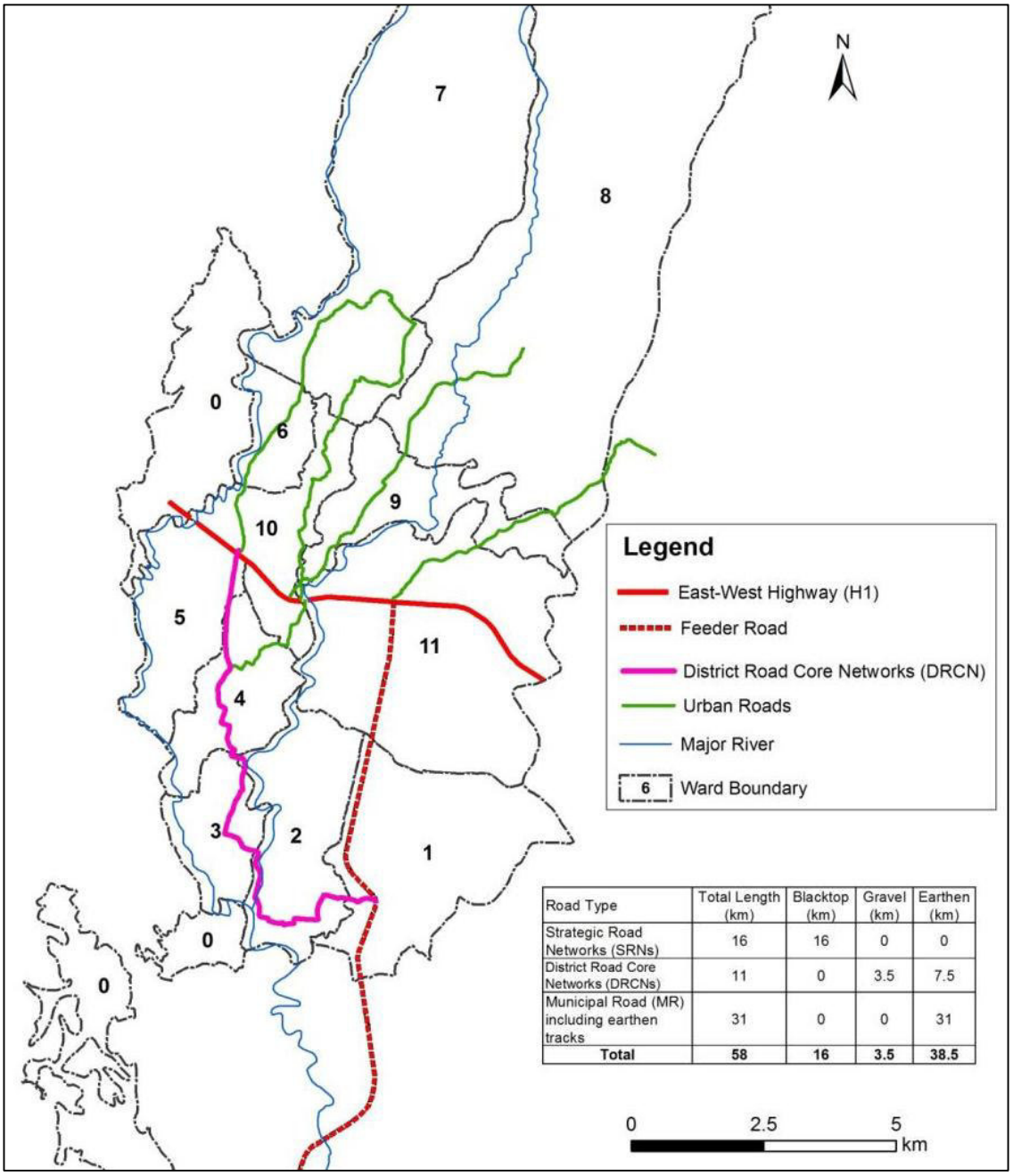
4.1.1 Current Status of Municipal Road

42. There is a 58km network of roads (mostly earthen track with partly gravel road) excluding SRN in Jhalari Pipaladi Municipality. Beside the section of SRNs, no municipal roads are of blacktopped status. All the remaining urban roads are either gravel or earthen surface type. **Table 4-1** shows the total road networks including municipal road and their surface type and indicated in **Figure 4-1**.

Table 4-1: Length and status of roads in Jhalari-Pipaladi Municipality

Road Type	Total Length (km)	Blacktop (km)	Gravel (km)	Earthen (km)
Strategic Road Networks (SRNs)	16	16	0	0
District Road Core Networks (DRCNs)	11	0	3.5	7.5
Municipal Road (MR) including earthen tracks	31	0	0	31
Total	**58**	**16**	**3.5**	**38.5**

Figure 4-1: Status of Road Networks in Jhalari-Pipaladi Municipality



Road Type	Total Length (km)	Blacktop (km)	Gravel (km)	Earthen (km)
Strategic Road Networks (SRNs)	16	16	0	0
District Road Core Networks (DRCNs)	11	0	3.5	7.5
Municipal Road (MR) including earthen tracks	31	0	0	31
Total	**58**	**16**	**3.5**	**38.5**

4.1.2 Road Network Responsibility

43. Strategic road networks (SRNs) such as highways and feeder roads are maintained by the Department of Roads (DoR). The District Development Committee (DDC) maintains all the local rural roads. However, as per new DTMP guidelines, DDC will be mainly responsible to plan, upgrade and construct District Road Core Networks (DRCNs)[2]. The municipality is a responsible for the maintenance of all other urban municipal roads.

[2] DTMP Guidelines 2012, http://rtiswap.gov.np/dtmp_guideline.php

4.1.3 Problems and Issues

44. A section of the East-West Highway bisects the municipality. As part of regional development, this should be upgraded into a 4-lane highway with service roads and proper drainage and facilities for travellers.

45. As a newly created municipality, road access is a major problem. Although more than 58km of roads has been reported in the municipality, most of the municipal roads are not accessible throughout the year in large parts of the municipality. Further, due to lack of proper drainage, drainage crossing structures and regular maintenance, most of the sections of the road network are in a poor state and need to be improved or upgraded.

46. To provide access to all settlements within the municipal boundary, construction of several new roads and/or upgrading existing earthen tracks is essential. This should be part of future urban development planning and investment based on the regional economic and urban development vision.

4.2 Drainage Adequacy and Key Issues

4.2.1 Municipal Surface Water Drainage

47. There is no proper surface water drainage in the municipality except along the E-W highway. The sizes of the existing drains, which lack regular maintenance, are not adequate.

4.2.2 Fluvial (river) Flooding

48. There are two main natural river channels passing north to south through the municipality. During stakeholder consultation meetings, river flooding was reported to be common during the monsoon. River bank erosion is also problematic in Jhalari Pipaladi.

4.2.3 Sustainable Drainage Systems

49. Surface water drainage systems (SuDS) objectives should be used in the project to minimize the impacts from development on the quantity and quality of the runoff, and maximize amenity and biodiversity opportunities. Their characteristics include natural features such as ponds, wetlands and shallow ditches called swales. Hard engineered elements are often used in high density, commercial and industrial developments. These include permeable paving, canals, treatment channels, attenuation storage and soakaways.

50. SuDS should be developed in-line with the ideals of sustainable development. The system should be designed to both manage the environmental risks resulting from urban runoff and to contribute wherever possible to environmental enhancement[3]. The primary purpose of SuDS is to mimic the natural drainage of the area prior to development. This is achieved by capturing rainfall, allowing as much as possible to evaporate or soak into the ground close to where it fell, and then conveying the remainder to the nearest watercourse. Along the way any pollutants, such as metals and hydrocarbons from roads and car parks, are reduced. Water entering a local watercourse is therefore cleaner. If the water is kept on the surface as much as possible the SuDS can provide valuable amenity asset for local residents and create new habitats for wildlife.

51. SuDS will become increasingly important to control surface water as rainfall increases because of climate change. It can also provide other benefits in developments

[3] For detail information on visit http://www.ciria.org/Resources/Free_publications/the_suds_manual.aspx

such as passive cooling, which will again help mitigate any increase in temperatures due to climate change.

4.3 Proposed Roads and Drainage Improvements

4.3.1 Components and Benefits

52. Other than the main E-W highway, none of the urban roads are blacktopped. However, the 11km long Bansamitee-Pipaladi-Jonapuri Road is one of the major roads within municipal boundary which is being presently upgraded by DTO/DDC.

53. All the municipal roads are earthen surfaced. Thus, almost all municipal roads within Jhalari-Pipaladi need to be improved and upgraded as per urban road standards (two lane road 7.5m to 10m pavement width) with storm water drainage and footpaths on each side of road). Through stakeholder's consultation a total of nearly 31km of urban roads were identifies as important urban networks in the municipality.

54. Based on the regional economic development vision and conceptual urban development plan and field assessment with municipal officers, 8km of high important roads have been prioritized for possible inclusion in the project. The names of road identified for possible intervention within the project are listed in **Table 4-2**. The SRN and major urban road network improvements of Jhalari-Pipaladi Municipality are shown in **Figure 4-2**.

Table 4-2: Roads Identified for Possible Intervention

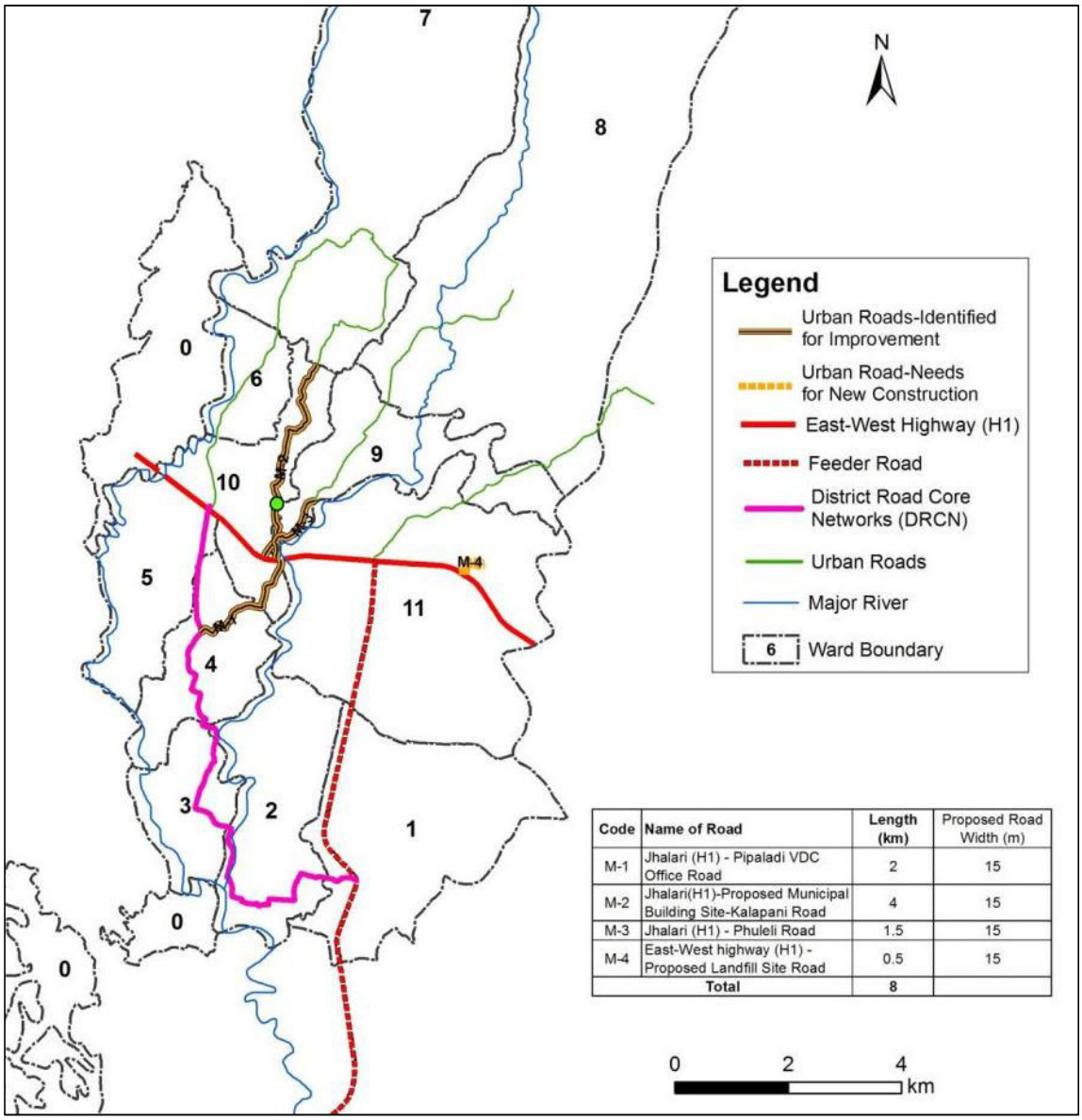
Code	Name of Road	Length (km)	Proposed Road ROW (m)
M-1	Jhalari (H1) - Pipaladi VDC Office Road	2	15
M-2	Jhalari(H1)-Proposed Municipal Building Site-Kalapani Road	4	15
M-3	Jhalari (H1) - Phuleli Road	1.5	15
M-4	East-West highway (H1) - Proposed Landfill Site Road	0.5	15
	Total	**8**	

4.3.2 Roads and Drainage Improvement Cost Summary

55. For the estimation of roads and drainage improvement cost, the unit rate was adopted from Department of Road. The recent cost for improvement/upgrading of urban road with varying width under Kathmandu Valley road improvement/extension program is about NRs.9 million to NRs.38 million with an average NR.23.5 million/lane/km. The cost for just widening, upgrading and providing drainage and minimum footpath is around NRs.40 million/km.

56. Based on this reference rate, the estimated cost for the improvement of 8km road in Jhalari Pipaladi Municipality would be almost NRs.320 million ($3.20 million).

Figure 4-2: Jhalari Pipaladi Proposed Road and Drainage Improvements



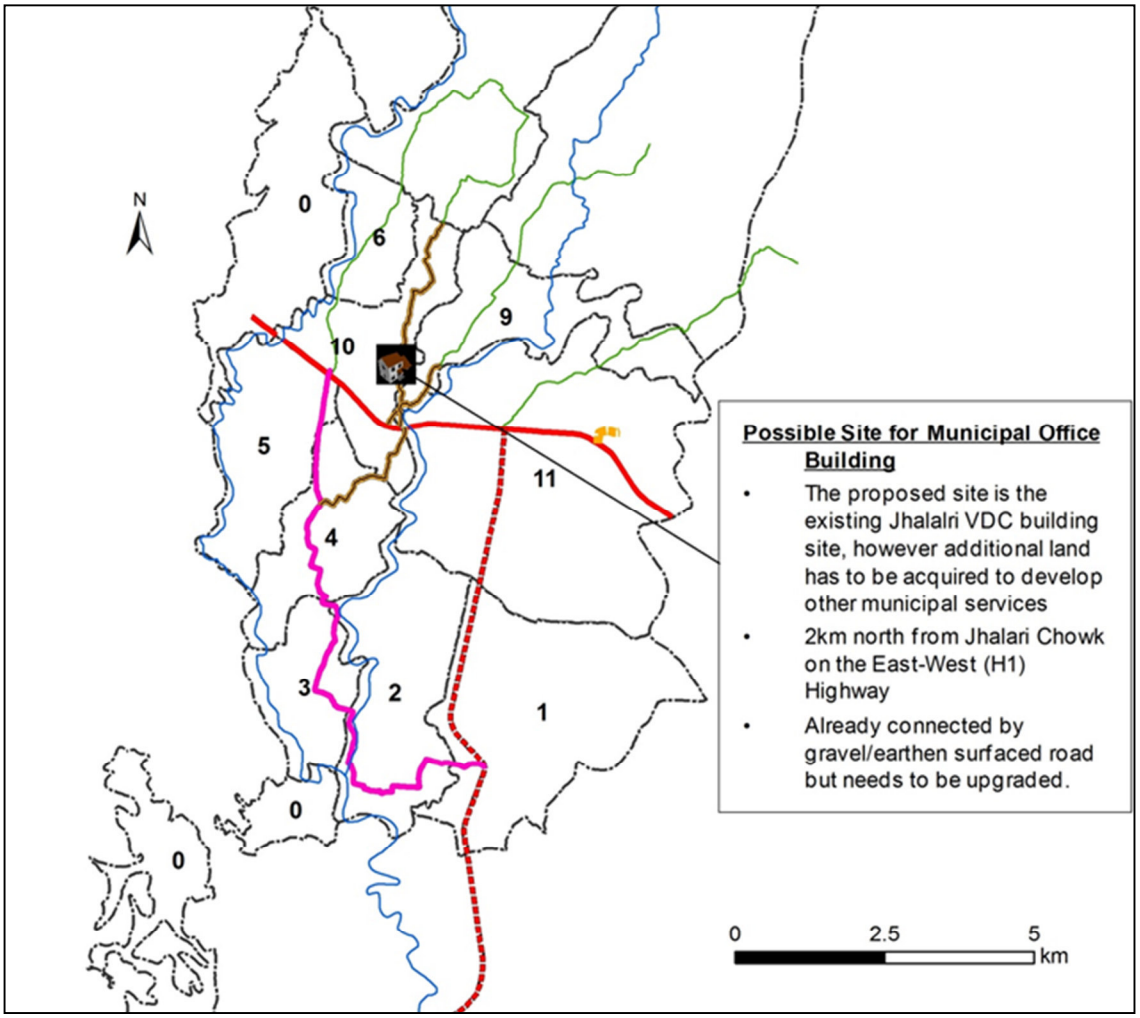
Code	Name of Road	Length (km)	Proposed Road Width (m)
M-1	Jhalari (H1) - Pipaladi VDC Office Road	2	15
M-2	Jhalari(H1)-Proposed Municipal Building Site-Kalapani Road	4	15
M-3	Jhalari (H1) - Phuleli Road	1.5	15
M-4	East-West highway (H1) - Proposed Landfill Site Road	0.5	15
Total		8	

5 Urban Development Facilities

5.1 Municipal Building

57. As a newly created municipality, it does not have its own municipal building. The existing Jhalari VDC building site has been proposed for new municipal building; however additional land has to be acquired to develop other municipal services. The municipal office building site is shown in **Figure 5-1**. The existing site is about 2km north from Jhalari Chowk on the East-West (H1) Highway has been already connected by gravel/earthen surfaced road but it needs to be upgraded. The cost of building should be shared with the municipal fund (grant from MoFALD). The estimated contributing cost for the new municipal building is estimated as Rs.70 million ($0.7 million).

Figure 5-1: Location for Municipal Office Building



6 Prioritization of Identified Components and Indicative Costs

58. Although five urban infrastructure components have been identified in Jhalari-Pipaladi Municipality, all the components will not be equally important for immediate investment. Through stakeholder consultation, site visits and professional judgment, the infrastructure components identified are ranked in the following order as shown in **Table 6-1**.

Table 6-1: Prioritization of the Infrastructure Components Identified

Priority	Component
1st	Municipal Roads & Drainage
2nd	Water Supply
3rd	Solid Waste Management
4th	Municipal Building
5th	Wastewater Management & Treatment

59. The indicative cost estimates for Jhalari-Pipaladi Municipality based on the infrastructure components identified through extensive stakeholder consultation and site visits are summarized in **Table 6-2**.

Table 6-2: Jhalari-Pipaladi Municipality Identified Needs and Indicative Cost

Sector	Proposed Intervention				Indicative Cost		
	Description	Proposed Wards	Additional Popn	Popn. %	NRs. million	$ million	%
Water Supply	Deep tube wells and distribution	3, 4, 5, 6, & 7	2,000	10%	400	4.00	35%
Wastewater Management	Small bore sewerage in centre	10 & 11	400	14%	143	1.43	12%
Solid Waste Management	Integrated waste management system with landfill site	3, 4, 5, 6, 7, 10 & 11	3,190	31%	202	2.02	18%
Municipal Roads and Drainage	Seal and develop municipal roads		8km		320	3.20	28%
Municipal Facilities	1. Municipal Building				70	0.70	6%
Community Infrastructure	To be indentified during design				15	0.15	1%
Jhalari Pipaladi Total					**1,150**	11.50	100%

7 Institutional Capacity for Municipal Infrastructure

7.1 Existing Institutional Arrangements for Municipal Infrastructure

60. As a recently created municipality, Jhalari-Pipaladi has not established any section for providing and maintaining basic municipal infrastructure services. Except for two assistant sub-engineer transferred from the original VDCs it has no trained technical staff. The overall organization structure of Jhalari-Pipaladi Municipality is provided in Discussion Note #6.

61. Although water supply is one of the basic urban infrastructure to be provided by a municipality, Jhalari Pipaladi municipality is not directly involved for the delivery of this urban service. The existing small water supply scheme is managed and operated by a WSUC. Institutionally, it is headed by a chairperson elected by the water users. The WSUC receives

technical assistance to some extent from water supply and sanitation division office (WSSDO). However, WSUC has no any in-house competent technical staffs to operate and maintain their water supply infrastructures regularly on a day-to-day basis.

7.2 Recommended Institutional Arrangements for Municipal Infrastructure

62. The municipality should have, in the medium to long term, in-house capability to independently develop, operate and maintain their infrastructure. The municipality should have planned asset management programs with the necessary resources and capacity to operate and maintain the municipal services provided.

63. Due to the nature of urban infrastructure services to be provided by the municipality, different divisions/ sections/ units should be established to operation and maintain the smooth delivery of each municipal infrastructure service. Competent technical staff in each division/ section must be recruited with clear job descriptions. The recommended institutional arrangement for Jhalari Pipaldai municipality is given in **Figure 7-1**.

64. For the proposed expansion of the municipality water supply, DSC should evaluate different operational and management modalities and make recommendations. Currently, WSUC is one of the better models for water supply operation and management in many towns in Nepal. However, the existing institutional arrangement should be strengthened with recruitment of competent technical staff to ensure sustainable operation and maintenance.

65. The Institutional Development Consultant (IDC) to be engaged through the Project (see Discussion Note #7) will provide further analysis of municipal infrastructure management requirements and provide or arrange training as appropriate.

Figure 7-1: Recommended Institutional Arrangements for Municipal Infrastructure