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Final Report

Consultancy Services

For

Environmental Impact Assessment (EIA) of Post-disaster Debris Collection, Disposal and Management Sites

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EXECUTIVE SUMMARY

The EA report is organized in seven chapters. Chapter I covers the proposal background, its objectives, Statuary legal requirements of the Government of Nepal and Multilateral Funding Agencies with highlights on the EA study methodology and limitations. Chapter II includes the purpose and scope of the program activities, location and accessibility, area covered by the program sites, layout plan for the program and potential post disaster debris holding capacity of the program area. Chapter III highlights the policy and legislative framework of the Government of Nepal in matters related to handling of the post disaster debris in conjunction with the environmental and social safeguard issues highlighting the key policy and legal provisions related with the post disaster debris management. Chapter IV includes the descriptions of the existing baseline environmental conditions covering, physical, biological, and socio-economic and cultural environmental aspects. Chapter V evaluates the different available alternatives for the post disaster debris management from environmental and social safeguard perspective. Chapter VI identifies the program site specific environmental and social issues and predicts the significance of the identified impacts. This chapter also proposes cost effective and pragmatic mitigation prescriptions for each of the identified impacts following the mitigation principles of avoid, minimize and compensation. Chapter VII is the Environmental Management Plan for the post disaster debris management in the program sites to ensure the environmental integrity and sustainability of the program sites and surrounding areas.

The Program sites for post disaster debris management locate within the heavily populated urban area of Kathmandu Valley in the Municipalities of Kathmandu and Lalitpur. The proposed sites do not involve resettlement and rehabilitation issues, nor it attracts issues related to degradation or damage to natural habitats. The sites are connected with motorable access from multiple points. Though the proposed site area occupy large space, all the space within the sites could not be utilized for debris management because of topographic and infrastructural characteristics of the sites. Accordingly the debris holding capacity of the sites is greatly compromised. The site capacity will further reduce if debris segregation for resource recovery is opted.

The key adverse environmental and social impacts of the debris management in the proposed sites are summarized as under:

- Air pollution
- Water Pollution
- Noise Pollution
- Obstruction to transport infrastructure facilities
- Damage and obstruction to storm water drainage, sewer lines, water supply and electrical and Telecommunication lines
- Community Health and Safety
- Occupational Health and Safety

Issue based Mitigation measures have been prescribed for the avoidance and minimization of pollution streams and damage and obstruction to transport and other infrastructures and safety measures for the protection of community health and safety and occupational health and safety.

To ensure that the proposed mitigation measures are implemented and monitored and the environmental and social integrity of the proposed sites and its surroundings are safeguarded, an Environmental Management Plan is formulated. It proposes structure for the environmental management plan administration involving all the stakeholders of the post disaster debris management assigning specific roles and responsibilities in the post disaster debris management cycle. The environmental planning includes guiding principles and flexible Issue Based Management Plans and Site Based Management Plans to accommodate the unforeseen impacts for adaptive management in the management cycle. Plans for site supervision, monitoring/auditing of key indicator parameters (internal, external and third party), record keeping and reporting are a part of the environmental Management Plan. Grievance Redress Mechanism is inbuilt with the plan so as to address the issues of the communities in time, avoid conflict, and unhindered implementation of activities.

ABBREVIATION

ADB:	Asian Development Bank
BOD:	Biological Oxygen Demand
CA:	Conservation Area
CBO:	Community Based Organizations
CCCM:	Camp Coordination and Camp Management
CITES:	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNDRC:	Central Natural Disaster Relief Committee
CNG:	Compressed Natural Gas
DANA:	Damage Assessment and Need Assessment
DoHM:	Department of Hydrology and Meteorology
DRM:	Disaster Risk Management
DRR:	Disaster Risk Reduction
EA:	Environmental assessment
EIA:	Environment Impact Assessment
EMP:	Environmental Management Plan
EMS:	Environmental Management System
EOC:	Emergency Operation Center
EPA:	Environment Protection Act
EPR:	Environment Protection Regulation
EU:	Environmental Unit
GIS:	Geographic Information System
GON:	Government of Nepal
GPS:	Global Positioning System
GRC:	Grievance Redress Committee
HFA:	Hyogo Framework of Action
HR:	Hunting Reserves
HSU:	Hertridge Smoke Unit
IEE:	Initial Environmental Examination
IMPs:	Issue Based Management Plans
IOM:	International Organization for Migration
IUCN:	International Union for Conservation of Nature
KUKL:	Kathmandu Upatyaka Khanepani Limited
LPG:	Liquefied Petroleum Gas
MADRM:	Municipal Authority for Disaster Risk Management
masl:	Meter above sea level
MDRMU:	Municipal Disaster Reduction Unit
MoHA:	Ministry of Home Affairs
MOPE:	Ministry of Population and Environment
MOSTE:	Ministry of Science, Technology and Environment
MSWM:	Municipal Solid Waste Management
NARC:	Nepal Agricultural Research Council
NCDRM:	National Commission for Disaster Risk Management
NDWQS:	National Drinking Water Quality Standard
NGO:	Non Governmental Organization
NP:	National Parks
NTU:	Nephelometric Turbidity Units
OSHA:	Occupational Safety and Health Administration
PCR:	Physical Cultural Resources
PDDM:	Post Disaster Debris Management
PDDMC:	Post Disaster Debris Management Contractors
PDDMO:	Post Disaster Debris Management Office

PM:	Particulate Matter
SAR:	Search and Rescue
SMPs:	Site Based Management Plans
ToR:	Term of Reference
TSP:	Total Suspended Particulate
UNOCHA:	United Nation Office for the Coordination of Humanitarian Affairs
VDC:	Village Development Committee
WHO:	World Health Organization
WR:	Wildlife Reserve

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CHAPTER 1: INTRODUCTION

1.1 Background

Nepal lies in an active seismic zone due to its geo-tectonic setting over the leading edge of the Indian plate sub ducting underneath the Eurasian plate. The collision of Indian plate with the Eurasian plate formed the gigantic Himalayas. The process of mountain building is still continuing with a mean uplift rate of 1 mm per annum and is expressed as occasional seismic events associated with micro to mega earthquakes.

Kathmandu, located in the central part of Nepal, because of its geological characteristics comprising of a thick sequence of quaternary deposits accumulated over the hard rock formations dissected by faults and other tectonic lineaments, is comparatively more vulnerable to earthquake risks than the other similar geographical regions of Nepal. More than seven earthquakes causing high damage to life and property were recorded from Kathmandu since 1255 AD[1]. The 1934 Nepal Bihar earthquake of magnitude 8.4 caused serious damages to 60% of the buildings in the Kathmandu Valley and killed about 4,300 people[2]. Currently the Kathmandu valley has undergone an exponential growth in population with over 2.52 million residential people. The estimated built structures in the Kathmandu valley is around 0.3 million housing more than 0.6 million households[3]. Considering the substandard buildings comprising the major share of the built structures in the Kathmandu valley, occurrence of an estimated 9 Richter scale earthquake, is potential to cause 40,000 dead, 100,000 to 200,000 injured, 60% of buildings destroyed, and 600,000 to 900,000 homeless[4].

An overview of the historic earthquakes, their periodicity and over 80 years of no mega earthquake in the valley make the valley more inevitable for major earthquake. In the event of such mega earthquake, priority management issues relates to disaster waste as it threats the environmental health and safety vis a vis cause impediment to post-disaster rescue operations. Disaster waste results from the collapse of buildings, damage to infrastructures (Roads, Electrical transmission lines, Water supply systems, Sewerage systems, Tele-communication systems), land degradations etc. Managing disaster waste is critical as it is mixed waste and difficult to separate. Furthermore, disaster wastes are likely to be contaminated with toxic or hazardous constituents leading to environmental degradation and health problems.

In view of these potential environmental and health problems of disaster wastes generated from the earthquake, on the leadership of Ministry of Home Affairs (MoHA), the International Organization for Migration (IOM) as co-lead of the camp coordination and camp management (CCCM) cluster, undertook a study to identify open spaces within Kathmandu for the propose of post earthquake disaster waste management as a part of pre-disaster management strategy/preparedness.

Under this study, a total of 83 open spaces were identified and published in the Government of Nepal Gazette detailing the locations. Out of the 83 identified locations, 9 open spaces were then proposed for Environment Impact Assessment (EIA) study on the first phase as pre-disaster preparedness strategy.

[1] *www.nset.org.np/nset/php/**earthquake_history**.php*

[2] Nippon Koei Co., Ltd, and Oyo Corporation, 2002. The Study on Earthquake Disaster Mitigation in the Kathmandu Valley, Kingdom of Nepal, Final Report, JICA/ MHA/HMG, March 2002.

[3] CBS, 2012. National Population and Housing Census (National Report). Government of Nepal, National Planning Commission, CBS, Kathmandu Nepal, November, 2012.

[4] IOM/USAID/Ministry of Home Affairs, 2013. Kathmandu Valley Open space. DRAFT RELEASE V.1 15-05-13

1.2 Objective of the Study

The overall objective of the pre-disaster Debris Collection and Disposal Environmental Impact Assessment (EIA) is:

(i) to determine the environmental baseline condition of site(s) and their corresponding region (micro and macro location) for debris removal and disposal;
(ii) assess the likely impact of disposal, removal and recycling of materials;
(iii) determine the ways for environmentally friendly site management and careful handling of construction waste and reuse plan of debris and harnessing economic aspect of it;
(iv) identify and estimate cost related mitigation measures and monitoring activities;
(v) consult the public and main stakeholders in relation with the project benefits and the related environmental and social issues; and
(vi) Determine potential volumes of debris per area, the hazards and potential areas of disposal difficulties.

The specific objective of the EIA study is to ensure sustainable development taking into account the environmental and social safeguard measures in compliance with the national environmental policies and legislative frameworks vis a vis international best practice policies and guidelines (World Bank/ADB environmental and social safeguard policies including guidelines on hazardous and toxic materials; UNOCHA disaster waste management guidelines etc.)

1.3 Statuary Requirements

1.3.1 National Context

Statutory legal requirement for the development activities including the Disaster Debris Management in Nepal is the Environment Protection Act (EPA) 1997. The EPA mandates requirement of IEE/EIA studies for all the activities as stipulated in the Environment Protection Regulation (EPR) 1997. Schedule 1 and 2 of the EPR has screened programs/development works from environmental considerations and has listed programs/development works requiring IEE (Schedule 1) and EIA (Schedule 2) level studies.

The guiding environmental screening criteria for IEE/EIA requirement for waste management including filling of land with waste, transfer station with resource recovery, and waste segregation and recycling is based on the volume of waste handled, area occupied by waste handling facilities, and the hazardous nature of the waste. As per EPR Schedule 2.H all the sites proposed for disaster debris management are required to go through the EIA study and approval in compliance with the procedures of the EPR as these sites either exceed the threshold of volume of waste handling (refer Schedule 2.H.2.(a))[5], or the area occupied (refer Schedule 2.H.2.(b) and (c))[6] or the hazardous nature of the waste (refer Schedule 2.H.3)[7].
The programs screened as requiring EIA studies by the EPR has to comply with the disclosure provision thrice during the EA process, once at the beginning of EA process through 15 days public notification in

[5] (a) Filling of land with more than One Thousand tons of waste per year (*all the proposed sites exceed this capacity of the waste handling*).

[6] (b) Activities relating to transfer stations and resource recovery areas spread over upto Three hectares (*Ringroad Maharajgunj Chabahil, Lagankhel Ringroad (Satdobato – Ekantakuna), Ringroad Gwarko Satdobato, Ringroad Balkumari Gwarko sites exceed more than 3 ha of area)*
(c) Selecting, picking, disposing, and recycling waste through chemical, mechanical or biological techniques in an area upto Two hectors.*(Bagmati Corridor 5, Ringroad Maharajgunj Chabahil, Lagankhel Ringroad (Satdobato – Ekantakuna), Ringroad Gwarko Satdobato, Ringroad Balkumari Gwarko sites exceed more than 2 ha of land area)*

[7] Following construction activities relating to hazardous waste of the following nature in any scale: (a) Construction of waste plant; (b) Construction of waste recovery plant; (c) Constructing of a site for filling accumulating or burying waste, (d) Construction of a site to store the waste; and (e) Construction of a waste treatment facility.(*All the sites may receive some kinds of hazardous waste and may have storage facility dedicated to such wastes*)

the National Newspaper to prepare Scoping and ToR documents and second after preparation of draft EA document at the local level (Public Hearing) and third through 30 days public notification with copies of the EAs at local and central levels. The first two disclosures is the responsibility of the developer while the third is conducted officially by the Ministry of Science, Technology and Environment (MOSTE). Review and approval process by the MOSTE is required twice, first of the Scoping Document and ToR of the proposed EIA study and second of the detailed EIA document. The detailed EIA document normally comprises the Program description, Legislative framework attracting implementation, the Program Development Area Environmental/Social Baseline (physical, biological, socio-economic and cultural), Program Alternatives, Program Impacts, Mitigation Measures to address the impacts, and Environmental Management Plan.

Given the scope of the works stipulated in the ToR for this study, compliance to the official EPR provision is not required. However, from the technical consideration this EA document covers the documentation requirements of the EIA as per EPR including informal stakeholder consultation as a part of disclosure.

1.3.2 International Policies and Guidelines

The bilateral and multilateral funding agencies including World Bank, Asian Development Bank etc, require application of environmental and social safeguard policies for the post disaster debris management. The safeguards are designed to ensure evaluation of environmental and social issues in decision making, reduce and manage the risks associated with the post disaster debris management, and provide a mechanism for consultation and disclosure of information. The likely attracted World Bank's safeguards policies by the disaster debris management and their objectives are listed below (Table 1.1).

Table 1.1: World Bank Environmental and Social Safeguards and Their Policy Objectives

OP/BP	Safeguard	Policy Objective
4.01	Environmental Assessment	Help ensure the environmental and social soundness and sustainability of investment projects; Support integration of environmental and social aspects of projects in the decision-making process
4.04	Natural Habitats	Promote environmentally sustainable development by supporting the protection, conservation, maintenance, and rehabilitation of natural habitats and their functions
4.11	Physical Cultural Resources (PCR)	Assist in preserving PCR and in avoiding their destruction or damage. PCR includes resources of archeological, paleontological, historical, architectural, religious (including graveyards and burial sites), aesthetic, or other cultural significance
4.12	Involuntary Resettlement	Avoid or minimize involuntary resettlement and, where this is not feasible, assist displaced persons in improving or at least restoring their livelihoods and standards of living in real terms relative to pre-displacement levels or to levels prevailing prior to the beginning of project implementation, whichever is higher
4.20	Indigenous Peoples	Design and implement projects in a way that fosters full respect for indigenous peoples' dignity, human rights, and cultural uniqueness and so that they (1) receive culturally compatible social and economic benefits, and (2) do not suffer adverse effects during the development process
4.36	Forests	Realize the potential of forests to reduce poverty in a sustainable manner, integrate forests effectively into sustainable economic development, and protect the vital local and global environmental services and values of forests

The environmental assessment guided by the OP/BP 4.01 consists of 6 basic elements apart from conditionality of loan agreement: i) Screening, ii) Environmental assessment (EA) documentation requirements, iii) Public consultation, iv) Disclosure, v) Review and approval of EA documentation, vi) Arrangements for supervision, monitoring, and reporting. The environmental screening process categories the programs/activities as category A, B, or C depending on the perceived risks from higher to lower order. The category A programs require Detailed Environmental Impact Assessment (EIA), at least two consultation, disclosure of the EA report to WB group and in country including program development area and affected people, review and approval of the document, and arrangements for supervision,

monitoring and reporting. The category B programs require Environmental Management Plan (EMP), at least one consultation, discloser to in country including program development area and affected people, review and approval of the document, and arrangements for supervision, monitoring and reporting. The category C programs do not require any of the above.

Considering the physical, biological, and social baseline of the sites proposed for Disaster Debris Management, the program attracts only OP/OB 4.01 of the World Bank Policy. Further screening of the program reveals it to be a Category B Program and does not essentially require detailed Environmental Impact Assessment. This EA document complies with the policy provisions of the World Bank and could be subjected to the review and approval process.

1.4 Study Methodology

In view of the program's nature and information requirements for EIA baseline, Impact Prediction and mitigation measures design and Environmental Management Plan; the study methodologies are broadly classed into three distinct divisions: i) Environmental Baseline, ii)Impact Prediction and Mitigation, and iii) Environmental Management Plan.

1.4.1 Methodology for Environmental Baseline

This includes, in the first phase, desk level literature review of the program and related documents from IOM and other relevant entities, even including consultation with IOM staff including staff directly responsible for this program to understand the program and its objectives. In the follow up stage, literature review of similar type of studies at the international level was undertaken. In addition, the post disaster management approaches followed in different countries and literatures associated were also reviewed. The case studies which shows challenges in managing disaster debris such as issues associated with managing large volumes of waste, ensuring ability of property owners to return to an area and assist with cleanup, separating hazardous and non hazardous waste and management were also reviewed. Likewise, the policy and legal framework of the government of Nepal related to the proposed program and associated activities were also reviewed in order to comply with the policy, legal framework while preparing the EIA document. Available information (published and unpublished) on the environmental, social and cultural aspects of the proposed program sites were also collected from various sources to figure out the data gaps to be covered during the field surveys.

Based on the understanding of the program objective, the likely program activities and the required policy and legal framework governing the program activities, a set of checklists were prepared for baseline environmental data collection. In addition, the key local stakeholders were identified and a plan is designed for stakeholder consultation at the local level. The objective of the plan was to provide program information at the local level and solicit their inputs in the program activities to address the environmental and social safeguard issues raised during the consultation. The field survey teams then were trained on the baseline data collection using the checklists at each of the identified sites and organizing consultation at the local level using, Rapid Rural Appraisal, Focus Group Discussions, and Interviewing tools with key informants.

In the second phase, field surveys were conducted at each of the program sites using the checklists to register the existing environmental and social baseline within the areas covered by the sites. These checklists covered information on the Physical, Biological, Socio-economic and Cultural environments. All of the information collected at the desk level and field level investigations are presented in Chapter 3 and 4.

The physical environmental aspects covered: i) land use, ii) topography and morphology, iii) geology and soil, iv) drainage and hydrology, v) climate, vi) land erosion and instability, viii) pollution aspects (air, water, land and noise) etc. Samples of soil, and water were collected from the sites for laboratory analysis, while noise level at each of the program site is monitored. Air quality is derived from the

secondary literature to characterize the pollution status of the program area. 1:25000 topographic maps of Survey Department, Goggle Image and GIS techniques were extensively used to characterize the local and regional land use, land erosion and land instability and drainage characteristics, while information on geology, climate and hydrology is derived from the secondary literatures in addition to the local observations.

The biological environmental aspects covered the nature of the floral and faunal habitats of the program sites. 1:25000 topographic maps of Survey Department, Goggle Image and GIS techniques were extensively used to characterize the habitat conditions. In addition, the flora and fauna of the program sites were recorded for each of the sites. The standing trees of the sites were enumerated as per species along with records of diameter at breast height, and height etc.

The socio-economic environment covered the information on the land ownership, number of owners, current use the land by the owners, community use of the land, community infrastructures (water supply, electrical lines, telecommunication lines, storm water and sewerage drainage systems, other built structures etc) etc. within the program covered area. Photographic records for each of the sites were taken to provide a general impression of the area. Likewise all the infrastructures within the program sites were photographed and recorded. Outside the program area, information on the settlements, service facilities (schools, healthcare facilities), community health and hygiene, livelihood means of the nearby communities etc were recorded.

In conjunction with the environmental baseline survey, stakeholder consultations were carried out as planed during the desk level study. The records of the stakeholder consultation are presented in Annex 1, along with their concerns and input. A total of 87 persons were consulted in various PRA, Focus group, and interview session. The concerns and input of the stakeholders registered during the consultation have been given special consideration while designing the mitigation prescriptions (Chapter 6) and in the Environmental Management Plan (Chapter 7).

1.4.2 Methodology for Impact Prediction and Mitigation

Program impacts are the outcome of the interaction of the program activities with the baseline environmental conditions of the program area and its surroundings. The program activities during the commissioning and decommissioning were analyzed based on the extent, duration, and magnitude of the activities in relation to program sites and its surroundings environmental resources and their reversible and irreversible implications using a range of prediction tools which includes cause and effect analysis, GIS tools, simple statistical analysis, prediction models, and stakeholders concerns etc. Apart from the above, impacts of the past programs elsewhere, personnel experience of the professionals in similar geographical locations and similar socio-economic environment have also been used extensively for the impact prediction.

All the identified impacts then were analyzed for mitigation options using principles of avoidance, minimization, and compensation including the inputs from the stakeholders. The measures identified as avoidance options were subsequently included in the program design. Those impacts which could not be avoided by modification of the program or its activities a range of options were identified for implementation which includes both minimization and compensation measures. The selection of the mitigation measures is based on their effectiveness to remediate the potential impacts, their cost effectiveness, and effectiveness in other programs of similar nature, etc.

1.4.3 Methodology for Environmental Management Plan

The environment Management Plan is a live document and is a reference guideline for all the parties involved in the environmental management of the program. Apart from financial and logistic support, it requires a robust institutional mechanism backed by the inputs of knowledgeable staffs to undertake, supervise, monitor and audit the program activities at each step of program commissioning and

decommissioning with needed readjustment and corrective measures if so required. Thus institutional mechanism and the knowledge of the staffs that are likely to be involved in the environmental management are crucial for the success of the EMP. An analysis of the existing intuitional framework, and the capacity and strength of the staffs within the existing institutions is made to fill in the gap and required support from outside in the pre-disaster and post disaster periods.

1.5 Study Limitations

The stakeholder consultation during the study could only cover stakeholders living close to program sites. Efforts made to involve district and central level stakeholders for consultation were not productive as only few showed interest on the program activities.

CHAPTER 2: THE PROPOSED PROGRAM

2.1 Purpose and Scope of the Program

The purpose of this program is to provide facilities for effective and efficient management of earthquake disaster-generated debris within the municipal boundaries of the Kathmandu and Lalitpur, in the valley of Kathmandu Nepal. Ideally, disaster debris management in permanent debris management sites is beneficial from economic as well environmental perspective. The proposed program sites locate within the dense settlement areas of Kathmandu and Lalitpur Municipalities and could not be used for final disaster debris management. Unavailability of open space of adequate size within the municipal boundaries leads for the identification of these temporary sites. Because of their locations and potential diverse uses of the sites the identified sites could be operated for a limited duration (6 to 18 months) in the post disaster period. The purpose of these sites is to facilitate immediate rescue and reconstruction operation with an objective to protect the overall natural and socio-economic environment and safeguard the health and hygiene of the earthquake affected communities. With the completion of the rescue operations, these sites will be re-instated and rehabilitated to pre-program conditions.

The 9 program sites are applicable to all debris operations following an earthquake disaster, and to all types of disaster-generated debris, including vegetative debris, construction and demolition debris, and household debris. The designated program sites apart from accumulation of the earthquake debris will implement appropriate measures, where feasible and practical, to recycle and/or reuse disaster-generated debris of all types.

2.2 Program Site Location

Nine program sites are located inside the Kathmandu valley within the municipal boundaries of Kathmandu, and Lalitpur. Name and the location of these sites are presented in ***Table 2.1***. ***Figure 2.1*** present the location of the sites in the Kathmandu valley, while ***Figure 2.2 to 2.10*** presents the Google images of the sites to depict the overview of the sites in the given urban setting.

Table 2.1: The Program sites for Disaster Debris Management

SN	Name of the Program Sites	Municipality	Site Characteristics
1	Bagmati Corridor 4	Kathmandu, Ward 12	River Bank of Bagmati
2	Bagmati Corridor 5	Kathmandu, Ward 11	River Bank of Bagmati
3	Bagmati Corridor 6	Kathmandu, Ward 34	River Bank of Bagmati
4	Ringroad Maharajgunj- Chabahil	Kathmandu, Ward 4, 7 & 3	Ring Road
5	Shankha Park	Kathmandu, Ward 4	Public Park
6	Oxygenation Park	Lalitpur, ward 4	Abandoned Sewage Treatment Area
7	Ringroad Balkumari- Gwarko	Lalitpur, ward 7, 8 &9	Ring Road
8	Ringroad Gwarko -Satdobato	Lalitpur, ward 17 & 15	Ring Road
9	Ringroad Satdobato -Ekantakuna	Lalitpur, Ward 13, 14 and 15	Ring Road

The Bagmati corridor sites 4, 5 and 6 including the Shankha Park in the Kathmadu Municipality and Oxygenation Park site in the Lalitpur Municpality do not show major built structures within the sites except in the Oxygenation Park. The Ringroad sites both of Kathmandu and Lalitpur Municpality on the other hand are largely occupied by the road, electrical and communication lie infrastructures with about 16 to 20m wide green belt on either side of the road. All of the sites are located in the public land (Government land) and does not attract costly resettlement and rehabilitation issues.

Figure 2.1: Location Map of Program Sites

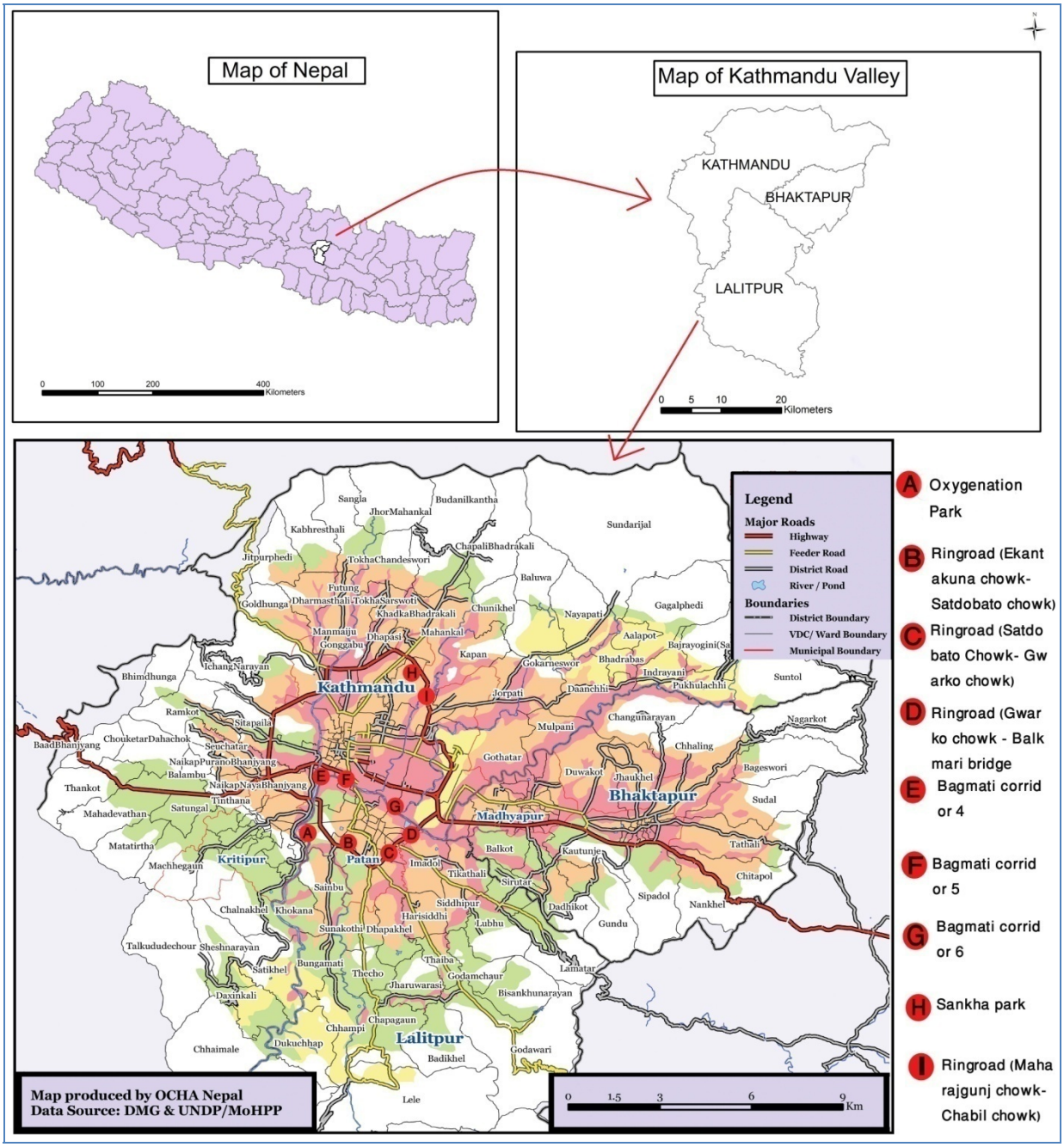


Figure 2.2: Google Image Bagmati Corridor – 4

Figure 2.3: Google Image Bagmati Corridor – 5

Figure 2.4: Google Image Bagmati Corridor – 6

Figure 2.5: Google Image Ringroad Maharajgunj -Chabahil

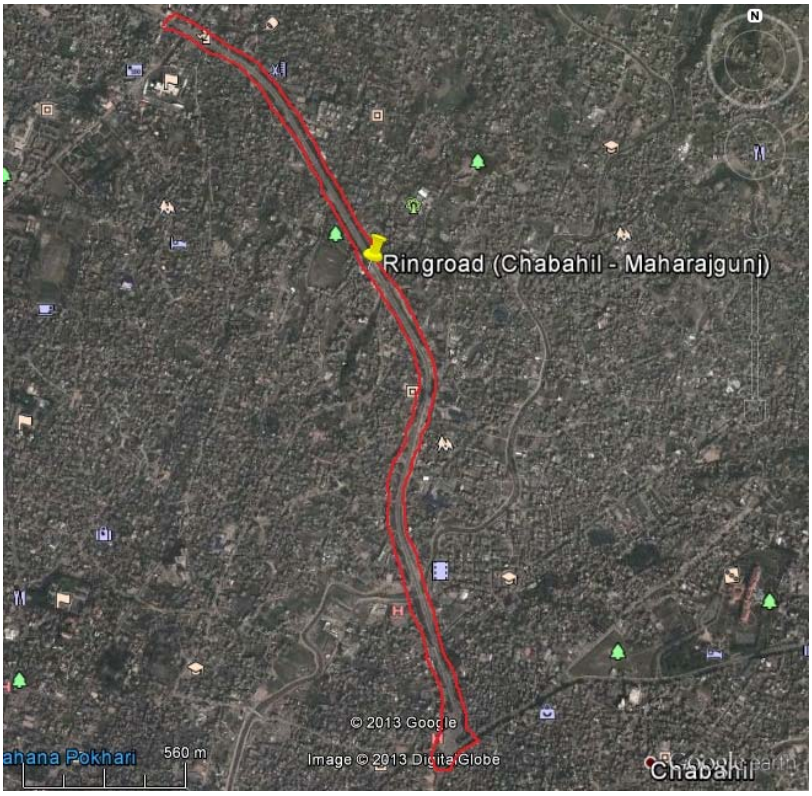


Figure 2.6: Google Image Shankha Park

Figure 2.7: Google Image Oxygenation Park

Figure 2.8: Google Image Ringroad- Balkumari -Gwarko

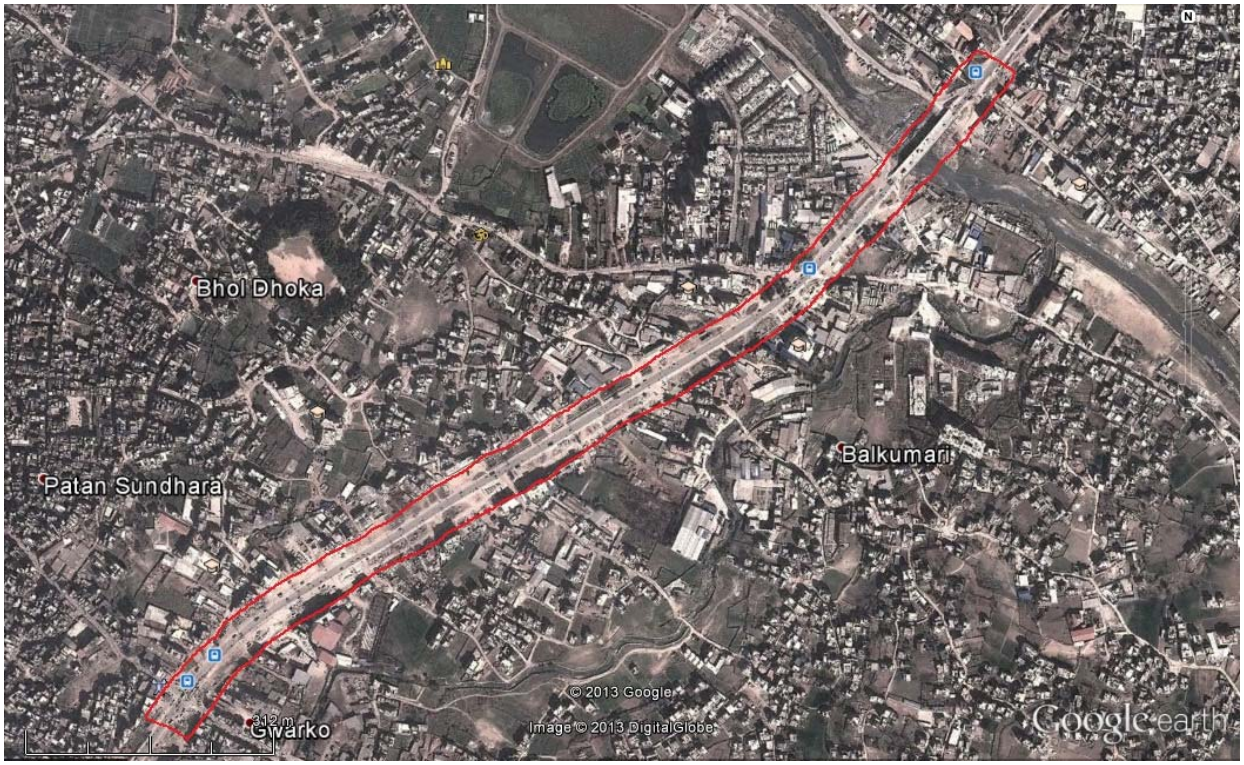


Figure 2.9: Google Image Ringroad- Gwarko- Satdobato

Figure 2.10: Google Image Ringroad- Satdobato -Ekantakuna

2.3 Site Accessibility

All of the proposed program sites have one or multiple motorable access to the sites. The width of the motorable access and easiness to traffic movement into the site however varies from site to site. Table 2.2 present the site access conditions.

Table 2.2: Access conditions of the Program Sites

S.N	Program Site Name	Number of Access to the site	Motorable lane of access road	Remarks
1	Bagmati Corridor 4	2 from north	One	Passes from dense settlement to enter the site
2	Bagmati Corridor 5	3 from north and one from south	3 one lane, 2 two lane	4 of the access roads pass through the dense settlement to enter the site
3	Bagmati Corridor 6	4 from eastern side and one from western side	2 one lane , 3 two lane	3 of the access roads pass through dense settlement to enter the site
4	Ringroad Maharajgunj Chabahil	13 from the northern side and 17 from the southern side. Apart from it is accessed from the two end of the Ring Road	Out of 13 entries from north 7 are two lane, two are four lane and the rest one lane roads. Out of 17 entries from the south, 8 are two lane, one 4 lane, rest one lane roads. The two ends of the ring road are 4 lane road	The entry from the north and south passes through the dense settlement to enter the site
5	Shankha Park	2	Ring road entry is 4 lane road, while the other entry from south is 2 lane road.	
6	Oxygenation Park	3	1 two lane 2 one lane	One entry pass through dense settlement to enter the site

S.N	Program Site Name	Number of Access to the site	Motorable lane of access road	Remarks
7	Ringroad Balkumari Gwarko	*9 from western side , 7 from eastern side, Apart from these, it is accessed from the two end of the Ring Road	Out of 9 western side entry, 5 two lane rest one lane; Out of 7 eastern side entry 3 two lane rest one lane. The two ends of the ring road are 4 lane road	7 western entry roads pass through dense settlement to enter the site, while all the eastern access pass through dense settlement to enter the site
8	Ringroad Gwarko Satdobato	*7 from eastern side , 6 from western side Apart from these, it is accessed from the two end of the Ring Road	Out of 7 eastern side entries 3 are 2 lane rest one lane. Out of 6 western side entries only one is 2 lane rest one lane roads. The two ends of the ring road are 4 lane road	All of the eastern and western access roads pass through the dense settlements to enter the site
9	Ringroad Satdobato Ekantakuna	*10 entry from the northern side, 14 entry from southern side. Apart from these, it is accessed from the two end of the Ring Road	Out of 10 entries from north, 3 are two lane rest one lane roads. Out of 14 entries from south 5 are two lane rest one lane roads. The two ends of the ring road are 4 lane road	All the northern and southern access roads pass through the dense settlement to enter the site

Note: * These sites overlap in area with each other, and the access roads entering the site may be double counted.

2.4 Area coverage of Program Sites

The Kathmandu Valley Open Space Report (2013) has specified the land area coverage for each of the proposed programs sites**.** But the report is silent with regard to actual occupancy of the program sites for the operational activities of the disaster debris management. The site visits during EA assessment works reveals that all the area demarcated within sites could not be practically used for debris management. The Ringroad sites (Ringroad Maharajgunj Chabahil, Ringroad Balkumari Gwarko, Ringroad Gwarko Satdobato, and Ringroad Satdobato Ekantakuna) include the main central road section as well as the side roads built at the edge of the green buffer zone on either side of the Ringroad. Since Ringroad is the traffic lifeline of Kathmandu, it needs to be reinstated and maintained as a priority activity after the earthquake. As per the guiding principles of post disaster activity first and foremost rescue activity initiates with the reinstatement of the important road corridors, transmission and telecommunication lines to facilitate effective and efficient rescue operation mobilization vis a vis to address the environmental and socio-economic damage caused by the earthquake including evacuation of dead and injured from their homestead. Likewise, in some of the sites (such as Oxygenation Park and Shankha Park) there are already some built structures within the allocated area, which may have to be protected for later rehabilitation/reinstatement works.

In consideration of the above realities, all the specified areas of the Kathmandu Valley Open Space Report (2013) could not be effectively utilized for the disaster debris management in the post disaster period. However, parts of the area could be used avoiding space occupied by the key infrastructures (such as roads, electrical and communication lines, drainage, sewerage and water supply lines etc.). Based on the field evaluation of the sites (topographic conditions for debris deposition and recycling activities and to maintain efficient traffic mobility etc.) land area which could be effectively used for disaster debris management for each of the program sites is estimated in ***Table 2.3.***

Table 2.3: Land Area that could be Effectively Used for Disaster Debris Management

S.N	Program Sites	Total Area (ha) as per open Space report	Effective Area (ha) for use based on site evaluation	Remarks
1	Bagmati Corridor 4	1.59	1	The Bagmati and Bishnumati Bank requires some cut off distance to avoid bank landslip, and discharge of debris to the river. Likewise temples, drainage and roads will have to avoided.
2	Bagmati Corridor 5	2.7	2.1	The Bagmati Bank requires some cut off distance to avoid bank landslip, and discharge of debris to the river. Likewise roads and the drainage and sewage lines will have to avoided
3	Bagmati Corridor 6	0.63	0.3	The Bagmati Bank requires some cut off distance to avoid bank landslip, and discharge of debris to the river. Likewise roads and the drainage and sewage lines will have to avoided
4	Ring road Maharajgunj Chabahil	17.4	6	Main road, side roads, entry to side access roads, drainage and electrical and telecommunication lines need to be avoided. Only space available is the green belt on either side. Further the topography (fill up section and cut sections between Shanka park to Dumbarahi, Dhumbarai to suke Dhara, Dhobi Khola to Chabahil chouk) does not permit safe placement of debris.
5	Shankha Park	1.75	1.3	Memorial Pillar need to be avoided
6	Oxygenation Park	35.94	27.94	Solar panel and other office areas on the western side of the park has to be avoided.
7	Ringroad Balkumari Gwarko	7.82	3	Main road, side roads, entry to side access roads, drainage and electrical and telecommunication lines need to be avoided. Only space available is the green belt on either side. Further the topography (fill up section between Manohara bridge to Gwarko on the western side) limits safe placement of debris.
8	Ringroad Gwarko Satdobato	7.11	3.3	Main road, side roads, entry to side access roads, drainage and electrical and telecommunication lines need to be avoided. Only space available is the green belt on either side
9	Ringroad Satdobato Ekantakuna	11.71	5	Main road, side roads, entry to side access roads, drainage and electrical and telecommunication lines need to be avoided. Only space available is the green belt on either side. Further the topography (cut section near Ekantakuna) limits safe placement of debris.

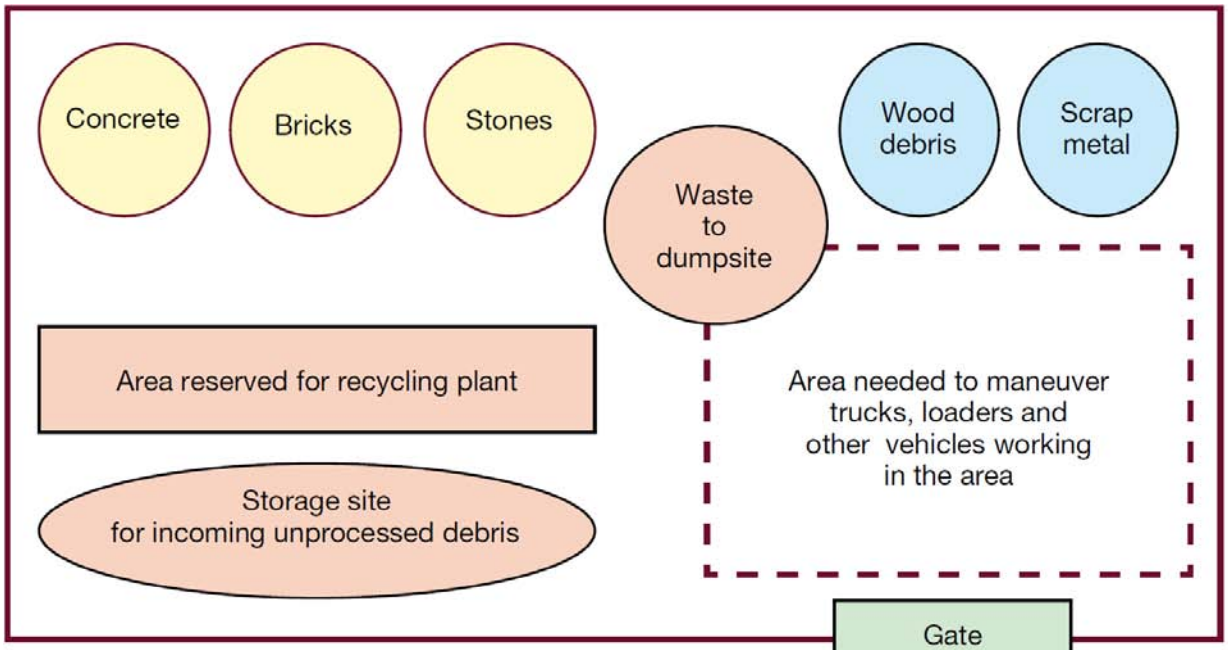
The Ringroad sites have been planned for road expansion from four to 8 lane corridor. The first phase of expansion from Kalanki Chowk to Koteshwor Chowk covering the program sites Ringroad Satdobato Ekantakuna section, Ringroad Gwarko -Satdobato section and Ringroad Balkumari - Gwarko section has already started and will be completed within next 3 years. In the second phase remaining part of the Ringroad from Koteshwor Chowk to Kalanki Chowk will be expanded within 7 years from now. Even after the expansion of the road these sites could be used temporarily such that on one half of the road occupied area (four lanes) is used for disaster debris management while the other half is operated for regular traffic. In this scenario, due to availability of table flat land on the road surface effective utilization area will increase by about 30% than the existing scenario.

2.5 Disaster Debris Handling Plan for the Program Sites

The Kathmandu Valley Open Space Report (2013) is silent on how the disaster debris will be handled in the program area. A typical temporary disaster debris management site comprises areas for: unloading and storing hauled debris, a mobile or stationary processing plant and storage for recycled material and

waste to be transferred to permanent sites including storage area to accommodate hazardous waste if required. A generalized suggested layout plan of the temporary sites is depicted in ***Figure 2.11***.

Figure 2.11: Typical Layout Plan for the Temporary Sites



Source: Disaster Waste Management Guideline, UNEP/OCHA Environment Unit, 2013.

Given the shape and size of the program sites, it will be difficult to plan typical layout for disaster debris handling in the proposed site. The program sites of linear shape with small land area (Bagmati Corridor 4, Bagmati Corridor 5, and Bagmati Corridor 6) will not be feasible for recycling operation with large and medium sized machinery. Recycling operation in these sites will have to be managed through the limited use of small machinery dominated mostly by hand picking. The Ringroad sites, extending linearly for over a kilometer to 3 kilometers with a number of road entry points from either side of the road is a challenge for the waste management. As these sites locates by the side of the roads, use of machinery for segregation of reusable and recyclable material is possible in the off traffic hours in addition to the hand picking of reusable and recyclable materials. The Sankha Park site due to shape and topography of the land despite being small effective use of medium sized machinery for recycling is possible. The Oxygenation Park site is the most suitable area for large scale operation of the recycling equipments and the layout plan of the site could be adjusted to the typical disaster debris management site as depicted in ***Figure 2.11***. As detailed layout planning is out of scope of this EA assessment in the proposed program sites, it is recommended to carry out such planning before hand as preparedness strategy by the concerned agency keeping in view of the issues discussed above.

2.6 Potential Debris Volume Capacity of the Program Sites

The debris volume capacity of the sites depends on a number of factors such as:

- Topography of the program sites (sites with relatively steep slopes have lower capacity compared to the flat ground)
- The shape of the sites (Square or Oval sites have higher capacity than the linear sites of equal area with limited widths)
- Scale of recycling operation using machine, or handpicking (sites with machinery have lower capacity than the sites using hand picking
- Safety of the adjoining infrastructures or community habitation (Some areas will have to be left as set off distance to avoid risks of accidents and obstruction)

Keeping in view of the above factors, the debris volume capacity of the identified sites is estimated in three different scenarios in ***Table 2.4***.

Table 2.4: Volume Capacity of the Program Sites

S.N	Program Sites	Effective Area (ha) for use based on site evaluation	Placement of Debris only/no recycling operation (m^3)	With limited recycling hand picking and small machinery (m^3)	With full scale recycling using large machinery(m^3)
1	Bagmati Corridor 4	1	30000	21000	16500
2	Bagmati Corridor 5	2.1	63000	44100	34650
3	Bagmati Corridor 6	0.3	9000	6300	4950
4	Ring road Maharajgunj Chabahil	6	180000	126000	99000
5	Shankha Park	1.3	65000	45500	35750
6	Oxygenation Park	27.94	1676400	1173480	922020
7	Ringroad Balkumari Gwarko	3	90000	63000	49500
8	Ringroad Gwarko Satdobato	3.3	99000	69300	54450
9	Ringroad Satdobato Ekantakuna	5	150000	105000	82500
Total		49.94	2362400	1653680	1299320

CHAPTER 3: POLICY AND LEGISLATIVE FRAMEWORK

Though promulgation of legal framework (Natural Calamity (Relief) Act. 2039 B.S. (1982)) for disaster risk management in Nepal dates back to 1982, specific policies for disaster risk management and integration of disaster risk management in the cross-sectoral policies and legislation have remained weak till date. The National Strategy for Disaster Risk Management (2009) based on the spirits and aspirations of the government and people of Nepal as embodied in the 10th Five-year Development Plan (2002-2007) and also the Interim National Development Plan (2008-2010 and 2010 - 2013), provides strategic direction to develop and implement realistic policies, plans and programmes suitable to the needs and requirements of the country by integrating a range of cross-sectoral institutions in the public and private domains of the Government of Nepal.

Despite weak linkages of the pre and post disaster risk management in the cross-sectoral policies, legislations, guidelines, standards etc of the Government of Nepal, the existing cross-sectoral polices and legislative frameworks have some provisions which attracts the issues of disaster risk reductions in relation to environmental and social safeguard. The following sections present an overview of the attracted policies, legislations, guidelines, standards, etc.

3.1 Policies

Following are the key policy instruments of the Government of Nepal attracted by the project in the process of disaster reduction and disaster debris management.

- Three Years Interim Plan 2007 (2064 BS)
- National Strategy for Disaster Risk Management, 2009
- National Action Plan on Disaster Management in Nepal, 1996
- Local Infrastructure Development Policy, (2061BS)
- Solid Waste Management National Policy, 1996 (2053 BS)
- Water Supply and Sanitation National Policy, 2060 (2004 BS)
- Shelter Policy, 1996
- Land Use Policy, 2012 (2069BS)
- Forest Policy 2000 (2056 BS)
- Nepal Biodiversity Strategy 2002 (2059 BS)
- National Water Strategy 2002 (2059 BS) and Nepal Water Plan 2005 (2062 BS)
- Nepal Environmental Policy and Action Plan, 1993 (2050 B.S)
- National Conservation Strategy, Nepal, 1988 (2045 B.S)

Key policy instruments of the government of Nepal relevant to the disaster risk reduction are summarized in the ***Table 3.1***.

Table 3.1: Key Policy Instruments of GON Related to the Project

S.N	Name of Policy	Attracted Policy instruments
1	Three Years Interim Plan 2007 (2064 BS); Three Years Interim Plan 2010 (2067 BS)	Chapter 26 of 2007 and Chapter 6.3 of 2010 plan recognizes the importance of disaster risk reduction and mitigation, emphasizes the need to introduce changes into the prevailing national policies for the required shift of focus from disaster response to prevention, mitigation and preparedness, identifies challenges such as the need to foster coordination among the institutions, and seeks to promote better understanding of hazards and the related disaster risks. The Plan recognizes existing lacunae such as the lack of institutional capacities at various levels, and emphasizes the need for systematic hazard/vulnerability mapping, enhancing public awareness and capacities for disaster risk assessment and building code implementation, and the need to establish proper institutional mechanism at the highest level for establishing a comprehensive DRM system.

S.N	Name of Policy	Attracted Policy instruments
2	National Strategy for Disaster Risk Management, 2009	It is based on the principles of: i) Human Rights and Protection, ii) Gender and Social Inclusion, iii) Decentralization and Local Self-governance and iv) Staff Safety and Security and is guided by cluster approach and Hyogo Framework of Action 2005-2015 (HFA). The priority actions designed are broadly categorized into cross-sectoral and Sectoral strategies. The cross-sectoral strategy includes the following Priority Actions: Priority Action 1: Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation; Priority Action 2: Identify, assess and monitor disaster risks and enhance early warning; Priority Action 3: Better Knowledge Management for Building a culture of Safety; Priority Action 4: Reducing Risks in Key Sectors and Establishment of Mechanisms for DRR; and Priority Action 5: Enhance Preparedness for Effective Response Each of these priority actions are integrated to the following sector planning for disaster risk reduction: ▪ Agriculture and Food Security Sector; ▪ Health and Nutrition Sector; ▪ Education Sector; ▪ Shelter, Infrastructural and Physical Planning Sector; ▪ Livelihood Protection Sector; ▪ Water and Sanitation Sector; ▪ Information Communication, Coordination & Logistics sector; and ▪ Search and Rescue (SAR) and Damage Assessment and Need Assessment (DANA) Sector
3	National Action Plan on Disaster Management in Nepal, 1996	This is the first disaster Management plan that has been prepared concentrating basically on preparedness, response, mitigation, rehabilitation and reconstruction. The plan is broadly divided into four sections: i) Disaster preparedness; ii) Disaster Response; iii) Reconstruction and Rehabilitation Action and iv) Disaster Mitigation with specific set of actions to be under taken by the government of Nepal**.**
4	Local Infrastructure Development Policy, 2061	Under the local infrastructure development policy, disaster preparedness is one of the key area of awareness development by the district development committees, Village development Committees and the Municipalities.
5	Solid Waste Management National Policy, 2053 (1996)	The policy does not envisage the disaster debris as a source of solid waste, however, the objectives of the policy is to minimize environmental pollution, use waste as resource, increase public awareness on the waste management issue, and involve local bodies and private parties on waste management.
6	Water Supply and Sanitation National Policy, 2060 (2004 BS)	The policy recognizes that all people have a right to access to basic water supply and sanitation services.
7	National Shelter Policy 1996	To address the issue of disaster risk management the policy has the objective to: i) support improving of the standard of existing houses and the growth of the residential houses by adopting the positive steps in significant aspects like: land and infrastructure, services, building materials and technology; and ii) reduce the environmental impacts induced by the cause of settlements, to improve the basic health services and to adopt the techniques of reducing the impacts of disasters in the shelters
8	Land Use Policy 2012 (2069 BS)	As a preventive measure to the disaster risk reduction, the land use policy has an objective to regulate settlement and urbanization in areas that are less hazardous from the natural disaster perspective. Further it emphasize on the provision of open space in the urban area land use planning.
9	Forest Sector Policy 2000 (2056 BS)	Though the policy does not specifically address disaster, one of the long term objective of the forest sector policy is to protect land from degradation by soil erosion, floods, landslides, desertification, and other ecological disturbances as a preventive measure to disaster risk reduction
10	Nepal Biodiversity Strategy 2002 (2059 BS)	Chapter 5, emphasize on the biodiversity conservation through land use planning approach to protect and manage biodiversity on a sustainable,

S.N	Name of Policy	Attracted Policy instruments
		long-term basis.
11	National Water Strategy 2002 (2059 BS) and Nepal Water Plan 2005	Strategic output 1 of the strategy recognize the water induced disaster as one of the key issues and design activities for disaster preparedness, apart from prior identification of disaster prone areas and actions to mitigate the related disaster. Output 2 of the strategy and Part D Section 6 of the Nepal Water Plan encompass actions that relates to environmental assessment of the water related development projects though wider public participations to ensure protection of communities and resources related to disaster.
12	Nepal Environmental Policy and Action Plan, 1993	The five policy principles a) to manage efficiently and sustainably natural and physical resources; b) to balance development efforts and environmental conservation for sustainable fulfillment of the basic needs of the people; c) to safeguard natural heritage; d) to mitigate the adverse environmental impacts of the development projects and human actions; and e) to integrate environment and development through appropriate institutions , adequate legislation and economic incentives , and sufficient public resources, guide the development activities including the disaster management in Nepal.
13	National Conservation Strategy, Nepal, 1988	The policy principles a) to ensure the sustainable use of Nepal's land and renewable resources; b) to preserve the biological diversity of Nepal in order to maintain and improve the variety and quality of crops and livestock and to maintain the variety of wild species both plant and animal; and c) to maintain the essential ecological and life-support systems such as soil regeneration, nutrient recycling and the protection and cleansing of water and air, guide the national conservation strategy including disaster management in Nepal.

These sectoral and cross-sectoral policies announced by the government of Nepal in various periods are the key policy instruments to mainstream the environmental and social safeguard dimensions in the disaster preparedness and implementation of plans and actions in the post –disaster periods.

3.2 Legislative Framework

Following are the key sectoral and cross-sectoral Acts, Rules and Regulations to be complied while preparing the disaster preparedness plans and its implementation in the post-disaster periods.

- Interim Constitution of Nepal 2007 (2064 BS)
- Environment Protection Act 1997 (2053 BS),
- Environment Protection Rule 1997 (2054 BS) as amended
- Natural Calamity (Relief) Act. 1982 (2039 BS)
- Solid Waste Management Act, 2011
- The Building Act, 1998 (2055 BS), the Building Regulation 2009
- Construction Business Act, 2055 (1999) and Construction Business Rules, 2056 (2000)
- Nepal Water Supply Corporation Act, 2046 (1989),
- Soil and Watershed Conservation Act 1982 (2039 BS)
- Forest Act 1993 (2049 BS)
- Forest Rules 1995 (2051 BS)
- National Parks and Wildlife Conservation Act 1973 (2029 BS)
- Wildlife Reserve Rules 1977 (2034 BS)
- Water Resources Act 1992 (2049 BS)
- Water Resources Regulations 1993 (2050 BS)
- Land Acquisition Act 1977 (2034 BS)
- Ancient Monument Protection Act 1956 (2013 BS)
- Local Self Governance Act 19989 (2055 BS)
- Local Self Governance Rules 1999 (2056 BS)
- Labor Act 1991 (2048 BS)
- Aquatic Animal Protection Act 1961 (2017 BS)

Table 3.2 highlights the important provisions of relevant Act, Rules, and Regulations

Table 3.2: Important Acts, Rules, and Regulation Provisions related to the Project

S.N	Acts, Rules, and Regulation	Related Provisions
1	Interim Constitution of Nepal 2007 (2064 BS)	Article 16 (1) human rights related to environment and health; Article 27 related to right to information,; Article 35 (5) related to priority to the prevention of adverse impacts in the environment from physical development activities, protection of the environment and special safeguard of the rare wildlife, protection and sustainable use flora/ fauna and biological diversity; Section 13, Part 3 related to equal treatment of citizens and provisions by law for the protection, empowerment or advancement of women, Dalits, indigenous people (Adivasi/ Janajati); Article 19 related to Rights to Property, compensation to acquired property; and Article 33, related to socio-economic security to the economically and socially backward classes including the landless, bonded labours, tillers and Harawa/Charawa; Article 22, (1-5) related to rights of children; are the key provisions of the interim constitutions which requires compliance.
2	Environment Protection Act 1997 (2053 BS),	The important provisions related to environmental protection compliance are as listed: Article 3 mandates IEE/EIA study for development projects; Article 4 prohibits implementation of projects without approval; Article 5, and 6 describes the approval procedures; Article 7 prohibits emission of pollutants beyond the prescribed standards; Article 9 and 10 stipulates provisions for the protection of natural heritage and Environmental Protection Area; Article 17 stipulates compensation provisions arising from the discharge of waste and pollution; Article 18 has provision of punishment for actions against the Act and rules, guidelines and standards formulated under the Act; Article 19 stipulates the rights to appeal to the concerned Appellate court against the decision of concerned authority.
3	Environment Protection Rule 1997 (2054 BS) as amended	The key provisions related to environmental protection compliance are as listed : Rule 3 stipulates environmental screening criteria for undertaking IEE/EIA study**;** Rule 4, 5 and 6 stipulates procedures for determining scope for IEE/EIA including public notification and approval of IEE/EIA scope of works; Rule 7, and 10 stipulates provisions for conducting IEE/EIA assessment including public notification and public hearing for IEE/EIA works and requirement of recommendation letters from the project development VDCs/Municipalities; Rule 11 stipulates approval procedures including disclosure of IEE/EIA report; Rule 12 mandates developer to comply with the approved IEE/EIA provisions to avoid, mitigate, and monitoring of the impacts, Rule 13 stipulates the responsibility of the concerned body to monitor the project implementation; Rule 14 stipulates the responsibility of the Ministry to conduct Environmental examination of the project after 2 years of construction completion; Rule 15, 16, 17, 18, 19 and 20 stipulates provisions to prohibition and control of pollution; Rule 26, 27, 28, 29, 30, 31, 32 and 33 stipulates procedures and provisions for the conservation of Natural Heritage and Environmental Conservation Zones; Rule 45. 46 and 47 stipulates procedures and provisions for compensation to the affected.
4	Natural Calamity (Relief) Act. 2039 B.S. (1982)	This Act has been made to make arrangement for the operation of relief work and the maintenance of people's convenience with a view to protect the life and property of the people. Section 3 of the Act has empowered government to declare any area as Disaster affected or likely to be affected by publishing a notification in the Nepal Gazette. Similarly, Section 4 of the Act, empowers government to give orders or to undertake the following works in the disaster area. ▪ To close down, as required, the governmental or nongovernmental offices, educational institutions and other institutions in disaster area; ▪ To prohibit the activities in disaster area which may cause adverse effect on relief work; ▪ To depute the employees of governmental or nongovernmental offices or of institutions; ▪ To evacuate or cause to be evacuate the people from disaster are to the

S.N	Acts, Rules, and Regulation	Related Provisions
		areas of safety; ▪ To requisition the movable and immovable property of any individual or institutions on temporary bases for a prescribed period, if such property is required to be used for the purpose of relief work; ▪ To evacuate or cause to be evacuated the goods and commodities from disaster ▪ Area to the areas of safety; ▪ To make use of the means and resources of the government; ▪ To requisition and make use of the means of transportation owned by nongovernmental offices, association and individuals of the concerned district for some fixed period time; ▪ To requisition the food grains, clothes, medicine, construction material and other items belonging to nongovernmental offices, institutions and individuals of the concerned district and distribute it to the victims of natural calamity; ▪ To try to save the real-estates, factories, temples and shrines and religious places and other significant objects and places from destruction; ▪ To constitute aid groups and send them to disaster areas; ▪ To take other necessary security measures for the safeguard of the life and property of the common people, to do other activities as prescribed by government Under Section 5 of the Act, Central Natural Disaster Relief Committee (CNDRC) has been constituted under the chairmanship of the Home Minister in order to formulate and implement the policies and programs relating to the natural disaster relief work and to undertake other necessary measures related thereof. Section 5.4 the working procedures of the CNDRC may be fixed by the CNDRC itself. Section 6 of the Act defines the functions and duties of the CNDRC. Section 7 of the Act empowers the government for the constitution of other Natural Disaster Relief Committees, at regional, district and local levels. Section 7a, Section 9 and Section a of the Act defines the functions and duties of the Regional, district and local Committees respectively.
5	The Building Act, 2055 (1998), the Building Regulation (2009) and National Building Codes	The act is promulgated to make necessary provisions for the Regulation of building construction works in order to protect building against earthquake, fire and other natural calamities. Section 3 of the Act empowers government to constitute Building construction Management upgrading (consolidation) committee. The section 4 of the Act empowers the committee for the followings. ▪ To regulate building construction works in order to minimize the possible loss to buildings from earthquake, fire and other natural calamities. ▪ To formulate a building code in order to regulate building ▪ construction works and submit it to the Government of Nepal for approval, ▪ To inquire into whether approval of designs has been made in consonance with the standards set forth in the building code,8 ▪ To make recommendation to the Nepal Quality Assurance Council to determine the quality of native or foreign materials related with building construction, Section 10 of the act mandates construction of the buildings as per the Building codes. Section 11 of the Act requires prior approval of the building design for construction within the municipal area. Section 12 prohibits municipal authority to approve designs contrary to the building codes. Section 13 empowers municipal authority to supervise buildings and verify construction as per the approved design and code and take action if not complied as per section 14 of the Act. Building Regulation 2009 stipulates the procedures of the Act implementation including provisions for building code.
6	Solid Waste Management Act 2011	The Act is promulgated to to make arrangement for the systematic and effective management of solid waste by minimizing the solid waste at source, re-using, processing or disposing of the solid waste, and to maintain the clean and healthy environment by minimizing the adverse effects of the solid waste in the public health and environment.

S.N	Acts, Rules, and Regulation	Related Provisions
		Section 3 of the Act makes local bodies (VDCs/Municipalities) responsible for the waste management. Section 10 requires reduction, reuse, and recycling of wastes wherever feasible. Section 11 and 12 of the Act stipulates site selection for transfer station and final disposal management as responsibility of local bodies while taking care of environmental and social safeguard issues of the sites. Section 13 of the Act empowers local bodies to license private parties for the waste management. Likewise Section 20, 21 and 21 entrust local bodies to supervise, monitor and prepare environmental and social safeguard plans for the solid waste management activities. Section 23 of the Act has the provision of formation of Solid Waste Management Council to streamline the policies and other waste management provisions pursuant to the Act. Likewise Section 26 of the Act has an provision of establishment of Solid Waste Management Technical Support Center shall be established to provide technical support to the Local Bodies for solid waste management and to carry out research and study on the subject related therewith.
7	Construction Business Act, 2055 (1999) and Construction Business Rules, 2056 (2000)	The Act has the objective to make necessary provisions on the operation of construction business by promoting and developing construction entrepreneurs so as to maintain required quality standards of public construction works. Section 3 of the Act prohibits public construction works without having obtained the license. Section 13 of the Act empowers government to constitute a Construction Business Development Council to prepare necessary policies and give direction to the concerned bodies in order to carry out the construction business in a consolidated and systematic manner including preparation of norms required to maintain quality standards of public construction works. Construction Business Rules, 2056 (2000) stipulates the procedures of the Act provisions.
8	Nepal Water Supply Corporation Act, 2046 (1989),	The Act objective is to establish a Nepal Water Supply Corporation and operate it so as to maintain the health and convenience of the general public make proper arrangements to make available pure drinking water on a regular basis and the system of sewerages in various areas of the country.
9	Soil and Watershed Conservation Act 1982 (2039 BS)	The Act objective is to the control natural disasters such as floods, landslides, and soil erosion to ensure the convenience and maintain the economic interests of the public. Section 3 of the Act empowers the Government to declare any area of Nepal as a protected watershed area. Section 10 of the Act empowers the Watershed Conservation Officer to prohibit any actions within the protected watershed areas.
10	Forest Act 1993 (2049 BS)	Article 17 stipulate provision of lease and permit from the government to establish right on the facilities on the national forest; Article 18 prohibits transfer of facility or any other rights on the national forest to the others; Article 22 establish government rights on the forest product of the national forest; Article 25 empower government to handover the national Forest as Community forest to develop, conserve, use and manage the Forest and sell and distribute the Forest Products independently by fixing their prices according to Work Plan; Article 31 empowers government of Nepal to grant any part of the National Forest in the form of Leasehold Forest for the forest conservation purpose; Article 49 prohibits any actions causing harm to the forest other than specified in the Act and Rules under the Act; Article 67 stipulates land rights of the government on the Community Forest, Leasehold Forest and Religious Forest; Article 68 empowers Government to give assent to use any part of the Government Managed Forest, Community Forest, Lease hold Forest or Religious Forest for the implementation of national priority plan/project if there is no alternative for the plan/project implementation.
11	Forest Rules 1995 (2051 BS)	Rule 7 prohibit forest cutting without obtaining license; Rule 8 stipulates the procedures of licensing for forest products; Rule 65 make the national priority project developer using national forest area responsible for the compensation of the loss or harm to any local individual or community due to the project and also make the developer responsible to meet the entire expenses required for the cutting, making in to pieces and transporting the Forest Products in a Forest Area to be used.

S.N	Acts, Rules, and Regulation	Related Provisions
12	National Parks and Wildlife Conservation Act 1973 (2029 BS)	Article 5, stipulates provisions of restriction on damage to forest product and to block, divert any river or stream flowing through national park or reserve, or any other source of water, or use any harmful or explosive materials without obtaining a written permission; Article 9 lists the protected wildlife prohibited for hunting; Article 13 prohibits collection of samples from National parks and Reserves without obtaining license
13	Wildlife Reserve Rules 1977 (2034 BS)	Rule 4 stipulates provision of entry pass to enter into the Parks or Reserve, Rule 6 stipulates restricted activities within the Parks and Reserves, Rule 11 stipulates prior approval for any research activities or study within the parks or reserves.
14	Water Resources Act 1992 (2049 BS)	Article 3 stipulates the water resource right to the Government; Article 4 prohibits use of water resources without obtaining license except the specified uses under the Act; Article 7 establish the priority order on the utilization of water resource; Article 8 stipulates procedure for water resource licensing; Article 16 empowers government to utilize the water resources and acquisition of others land and property for the development of water resource as stipulated in the Act; Article 18 stipulates the right of the government to fix the quality standards of water; Article 19 prohibits pollution of water resource above prescribed pollution tolerance limits; Article 20 stipulates not to cause harm and adverse effect on environment while developing the water resource project;
15	Water Resources Regulations 1993 (2050 BS)	Rule 12 to 21 stipulates the provision and procedures of licensing for the water resource utilization; Rule 32 to 35 stipulates provisions, procedures and responsibilities for the acquisition of land and property for the development of water resources;
16	Land Acquisition Act 1977 (2034 BS)	Article 3 stipulates power to the government to acquire any land anywhere for public purpose subject to compensation under this Act; Rule 4 empower government to acquire land upon request by institutions subject to the payment of compensation and all other expenses under this Act; Rule 5, 6, 7 and 8 stipulates provisions and procedures for initiating initial land acquisition process and estimating compensation rates; Rule 9 and 8 stipulates procedures and provisions for notification to land acquisition; Rule 11 stipulates provision of right to file complain by the affected on the public notice with regard to the land right; Rule 13, 14, 15 stipulates procedures and provisions of Compensation fixation; Rule 16 and 17 stipulates criteria for compensation fixation; Rule 19 stipulates discloser of the compensation entitlement through public notification; Rule 25 stipulates provision of Complain against the compensation rates to the Ministry of Home affairs. The decision of the Ministry of Home affairs on the complain is final
17	Ancient Monument Protection Act 1956 (2013 BS)	Section 2 defines the ancient monuments; Section 3, and 17 empowers government to declare any place or area as monument site/area; Section 13 restricts transfer, transaction, export or collection of ancient monument and archaeological object or curio without prior approval of the government;
18	Local Self Governance Act 1999 (2055 BS)	Section 28 and 96 relating to functions, duties, and power of the VDCs/Municipalities on forest, sanitation and environment, soil erosion and river control, Physical development, Section 33 and 101 related to judicial power on compensation for damage crops, labor wages etc; Section 47 and 115 relating to co-ordination with the governmental and non-governmental institutions; Section 55 relating to natural resource utilization tax; section 70 and 165 relating to punishment against the act provisions.
19	Local Self Governance Rules 1999 (2056 BS)	Rule 49 relating to approval of construction works; Rule 68 and 138 relating to approval and clearance of the project; Rule 69 and 139 relating to supervision and monitoring of the project; Rule 149 relating to application for permission.
20	Labor Act 1991 (2048 BS)	Section 3 relating to classification of the posts; section 4 relating to appointment letter; Section 5 prohibition on child labor and restriction on minor and women; Section 10 on job security; section 12 related to retrenchment and re-employment, section 16, 17, 18 and 19 relating to working hours; section 20, 21, 22, 23, 25 and 26 related to remuneration; section 27 to 36 relating to occupational health and safety; section 37 to 44 relating to welfare arrangements; section 46 related to special arrangement is the construction

S.N	Acts, Rules, and Regulation	Related Provisions
		sites; Section 50 to 60 related to conduct and penalties; section 72 to 82 related to settlements of labor disputes.
21	Aquatic Animal Protection Act 1961 (2017 BS)	Section 5 (5B) relating to the provisions of fish ladder and fish hatchery while constructing water diversion structures and prior permission from the government)

The existing legislative frameworks which regulate the government environmental and social safeguard policies pre-dates many of the policy announcements. Timely updates of the legislative frameworks are rare and are one of the bottlenecks to internalize the announced policies during program preparation and implementation. Water Resource Act and Regulation, Forest Act and Regulation, Land Acquisition Act, Aquatic Animal Protection Act etc pre-date the recent policies on environment and social safeguards. As a result there are number of gaps in the legislative frameworks which contradict the announced policies of the government of Nepal. Apart from the above, the bilateral and multilateral funding agency guidelines related to environmental and social safeguard are not adequately addressed by the existing legislations. Of the attracted legislative framework the Land Acquisition Act has many shortcomings to ensure the resettlement and rehabilitation of the affected parties. The Act provisions are not adequate enough to address the rights of the affected parties as stipulated in the social safeguards of the multilateral and bilateral funding agencies.

3.3 Guidelines, Manuals, and Standards

Following sectoral and cross- sectoral guidelines, manual and standards of the government of Nepal will have to be complied in the preparation of the environmental reports including study procedures, impact identification and prediction, design of the mitigation prescriptions and formulating monitoring protocols and compliance standards during project construction and operation.

- National EIA Guidelines 1993 (2049 BS)
- Guidelines on Land Use of Forest Area for other Purposes (Ban Chhetrako Jagga Anya Prayojanko Lagi Upalabdha Garaune Karyabidhi, 2063 BS) 2006.
- Forest Produces Collection, Sale and Distribution Guidelines 2000 (2057 BS)
- EIA Guidelines for Forestry Sector, 1995 (2051 BS);
- (2063 BS)
- EIA Guidelines for Water Resource Sector 1994 (2050 BS)
- Nepal Vehicle Mass Emission Standard, 2056
- Nepal Vehicle Mass Emission Standard, 2056)(For Gas Operated Vehicles)
- Generic Standard Part I: Tolerance Limits for Industrial Effluents to be ddischarged into Inland Surface Waters, 2058
- Nepal Ambient Air Quality Standards 2060
- Vehicle Emission Standards, 2057 for in use Vehicles
- Drinking Water Quality Standards 2063

A brief highlight of the sectoral coss-sectoral guidelines, manuals and standards is presented in ***Table 3.3*** below:

Table 3.3: Highlights of the Sectoral and Cross –sectoral Guidelines, Manuals and Standards

S.N	Guidelines, Manuals and Standards	Related Matters
1	National EIA Guidelines 1993 (2049 BS)	A generic EIA guidelines related to procedures for EIA Scoping, and TOR preparation, baseline environmental studies, information disclosure, public consultation, prediction and evaluation of impacts, mitigation prescriptions, monitoring and EIA report preparation
2	Guidelines on Land Use of Forest Area for other	The guideline addresses the conditions to make forest land avail to the development project and required compensatory measures for the loss of forest

S.N	Guidelines, Manuals and Standards	Related Matters
	Purposes (Ban Chhetrako Jagga Anya PrayojankoLagi Upalabdha Garaune Karyabidhi, 2063 BS) 2006.	land use and forest products.
3	Forest Produces Collection, Sale and Distribution Guidelines 2000 (2057 BS)	The guidelines specifies various procedure and formats for getting approval for vegetation clearance, delineation of lands for vegetation clearance, evaluation of wood volume etc.
4	EIA Guidelines for Forestry Sector, 1995 (2051 BS)	The guideline specifies the EIA procedures to be followed while undertaking environmental studies that involve forest areas.
5	EIA Guidelines for Water Resource Sector 1994 (2050 BS)	The guideline sets procedures for a) identification of positive and negative impacts of water resource projects over both short-term and long-term period on natural and human environments. b) development of mitigation management and monitoring plan, and c) public hearing and interaction with affected group, NGOs, donors and the relevant government agencies.
6	Nepal Vehicle Mass Emission Standard, 2056	Compliance to Type I to Type V tests for the vehicles fuelled with gasoline and diesel while importing vehicles for the project
7	Nepal Vehicle Mass Emission Standard, 2056)(For Gas Operated Vehicles)	Compliance to Type I to Type V tests for the vehicles fuelled with LPG and unleaded gasoline while importing vehicles for the project
8	Generic Standard Part I: Tolerance Limits for Industrial Effluents to be ddischarged into Inland Surface Waters, 2058	Tolerance limits of the effluent discharged into inland surface waters
9	Nepal Ambient Air Quality Standards 2060	Limits of the ambient air quality parameters around the construction sites
10	Vehicle Emission Standards, 2057 for in use Vehicles	Tolerance limits for the project vehicular emissions
11	Drinking Water Quality Standards 2063	Quality of the drinking water supply in the project camps and construction sites

Most of the sectoral and cross-sectoral guidelines/manuals leaving aside a few of the forestry sector guideline are generic and related with the process and procedures for mainstreaming the environmental studies during project preparation phase. Specific guidelines on addressing the specific impacts on physical, biological and socio-economic and cultural resources and their monitoring protocol are lacking. Similarly the environmental standards so far promulgated are generic and do not cover project specific concerns.

3.4 International Convention and Treaties

The international convention and treaties applicable to the project are:

- Convention on Biological Diversity, 1992 (2049 BS)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973 (2029 BS)
- Convention (No.169) Concerning Indigenous and Tribal Peoples in Independent Countries 1989 (2046 BS)
- United Nations Framework Convention on Climate Change 1992 (2047 BS)

The key provisions of the international convention and treaties related to the project are briefly highlighted in ***Table 3.4***.

Table 3.4: Key Provisions of the International Convention and Treaties

S.N	International Conventions and Treaties	Related Provisions
1	Convention on Biological Diversity, 1992 (2049 BS)	Article 14 of the Convention to introduce appropriate procedures requiring project EIA
2	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973 (2029 BS)	Article II of the convention classifies species as Appendix I, II, and III species which are subjected to regulation in order not to endanger their survival.
3	Convention (No.169) Concerning Indigenous and Tribal Peoples in Independent Countries 1989 (2046 BS)	The Article 7 relating to the right of the indigenous and tribal people to decide their own priorities for the process of development. Article 12, 13, 14 and 15 relating to the safeguards of rights of the indigenous people in the land and natural resources in territories traditionally occupied by them. Article 16 relating to participation in the decision making process and resettlement process with full compensation of the resulting loss or injury).
4	United Nations Framework Convention on Climate Change 1992 (2047 BS)	Article 4 (f) related to impact assessment to avoid or mitigate or adapt to climate change;

CHAPTER 4: BASELINE ENVIRONMENT

The natural and social baseline of the Program Sites discussed in this chapter represents the existing conditions with projection of likely future trends in without Program scenario. The projected impacts due to the Program commissioning and decommissioning in the post disaster periods have used the existing baseline conditions on natural and social environments as the benchmark.

The environmental baseline for the program sites discussed in this chapter is based on the compilation of primary on site surveys on physical, biological and social resources including information derived from the published and unpublished literatures, and maps. The natural and social environment baseline is broadly discussed in three broad headings viz. Physical Environment, Biological Environment, and Socio-economic and Cultural Environment as required by the EPR' '97/GoN. The discussion on the environmental baseline, wherever feasible is made on two broad headings viz. local ((indirect impact area covering the outskirts of the program sites extending up to 500 m from the program boundary sites) and the direct impact area (covering Program Occupied area).

Annex 4.1 presents the site specific baseline environments as depicted during the field survey.

4.1 Physical Environment

The physical environmental baseline covers the physical aspects of the identified program sites including the physiography/geomorphology, geology and soil, meteorology and hydrology, land use and watershed conditions, erosion and landslides, air, water, noise quality etc.

4.1.1 Topography and Physiography/Geomorphology

On the regional physiographic perspective the program sites locates in the Midland Physiographic Zone (Hagen 1969)[1] in the valley of Kathmandu in central Nepal. The Kathmandu valley exhibit a lacustine depositional landforms modified by the actions of the river systems that drains the valley due south through the gorge of Dakshinkali to the south. The central part of the valley floor, where the program sites are located, has a flat rolling landscape varying in elevation from 1275 to 1345 m from the mean sea level. The topographic elevations of the different program sites are presented in Table 4.1. Along with the slope directions and nature of the slope.

Table 4.1: Topographic Elevations and Slopes of the Program Sites

SN	Program Sites	Topographic elevation from - to (masl)	General slope and directions	Remarks
1	Bagmati Corridor 4	1285 -1288	>5, due south	Depositional surface flat, The slope near the River bank is about 40 degree due to steep cutting by Bagmati river
2	Bagmati Corridor 5	1285 - 1290	>5, due south	Depositional surface flat The slope near the River bank is about 40 degree due to steep cutting by Bagmati river
3	Bagmati Corridor 6	1290 - 1293	>5 , due SE	Depositional surface flat The slope near the River bank is about 40 degree due to steep cutting by Bagmati river
4	Ringroad Maharajgunj Chabahil	1310 - 1341	>5 sloping direction vary in different sections	Large part of the depositional surface are flat, but due to cut and fill nature of the road, immediate slope in the cut and fill area is >30 degree
5	Shankha Park	1342 - 1344	>5 , due SE	Depositional surface flat
6	Oxygenation Park	1280 - 1288	>5 , due W and S	Depositional surface flat,

[1] Hagen, T. 1969. Report on the geological survey of Nepal. Vol. I (preliminary reconnaissance).Denkschr, Schweiz. Naturf. Gesellsch., Bd. 86, H. 1. Zürich, 1969

SN	Program Sites	Topographic elevation from - to (masl)	General slope and directions	Remarks
				compartmentalized to 3 large depressions bordered on all sides by elevated embankments of about 2.5 m height
7	Ringroad Balkumari Gwarko	1297 - 1306	>5 sloping direction vary in different	Large part of the depositional surface are flat, but due to fill nature of the road, immediate slope in the fill area is >10 degree
8	Ringroad Gwarko Satdobato	1306 - 1337	>5 sloping direction vary in different	Large part of the depositional surface are flat, but due to fill nature of the road, immediate slope in the fill area is >10 degree
9	Ringroad Satdobato Ekantakuna	1308 - 1337	>5 sloping direction vary in different	Large part of the depositional surface are flat, but due to cut and fill nature of the road, immediate slope in the cut slope is >30 degree

Note: Spot elevation derived from Google Image 2013, others based on field Survey 2013.

4.1.2 Geology and Soil

On the regional geological setting the program sites locates in the Lesser Himalayan Zone. The program sites lie on the Kathmandu Klippe comprising of crystalline rocks overlain uncomfortably by the sedimentary and meta-sedimentary sequences. In the Kathmandu Valley including the Program site areas, the hard rock geology is concealed beneath the thick lacustrine and fluvio-lacustrine deposits comprising of alternating sequence of sand, silt and lacustrine clay deposits.

The soils developed over the lacustrine deposits are the depositional soil modified by the recent human activities. The laboratory soil analysis of the different program sites are presented in ***Annex 4.2,*** while the ***Table 4.2*** highlights the key soil textural characteristics and NARC ratings.

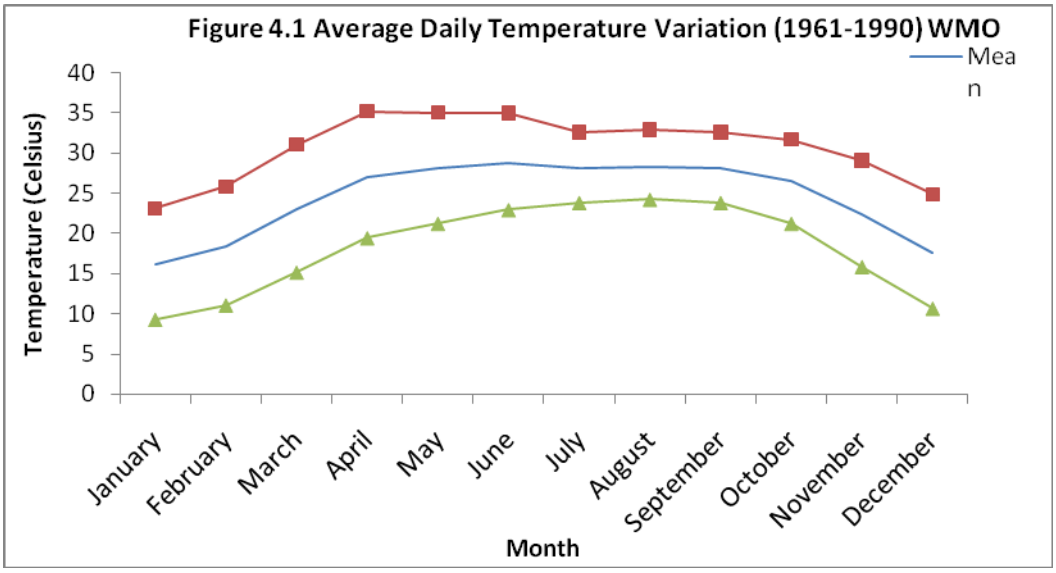
Table 4.2: Soil Textural Characteristics of the Program Sites

SN	Program Sites	Soil Texture	NARC Rating Nitrogen	NARC Rating Organic Matter
1	Bagmati Corridor 4	Loam	High	High
2	Bagmati Corridor 5	Silty Loam	High	Medium
3	Bagmati Corridor 6	Sandy Loam	Medium	Low
4	Ringroad Maharajgunj Chabahil	Sandy Loam	High to Low	Medium to Low
5	Shankha Park	Sandy Loam	Medium	Low
6	Oxygenation Park	Loam	Medium	Low
7	Ring road Balkumari Gwarko	Sandy Loam	Medium	Medium
8	Ringroad Gwarko Satdobato	Sandy Loam	Medium	Medium
9	Ringroad Satdobato Ekantakuna	Loam	Medium	Low

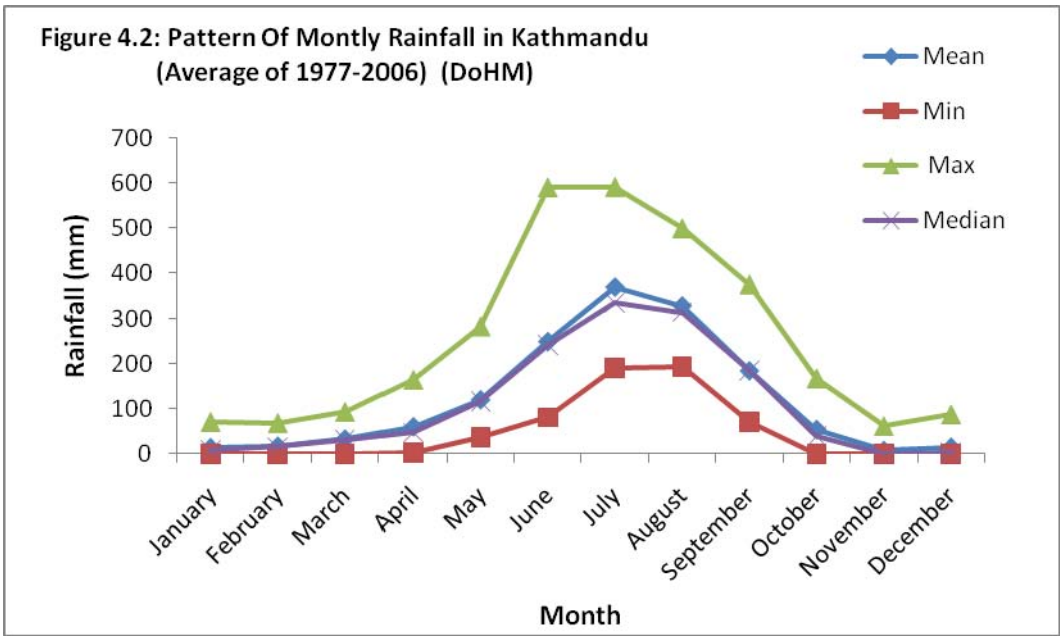
Source: Field Survey 2013

4.1.3 Meteorology and Hydrology

Under Köppen's climate classification, parts of the valley with lower elevations experience mild humid subtropical climate, while parts of the valley with higher elevations experience subtropical highland climate. In general the in the Kathmandu valley the mean summer temperature varies from 23–26 °C with extreme maximum temperature shoring up to 36°C while the mean winter temperature varies from 10 to 15 °C with extreme minimum of - 2°C. Figure 4.1 presents the temperature variation in different months in terms of maximum, mean and minimum.



Rainfall is mostly monsoon-based (about 80% of the total concentrated during the monsoon months of June to September). The valley center receives the least rainfall while the valley periphery has higher annual rainfall. The annual rainfall varies between 1400 mm to 2900 mm depending upon the strength of monsoon in the different years. Average rainfall distribution month wise is presented in ***Figure 4.2***.



Kathmandu valley has a typical centripetal drainage system. All the drainage lines originating on the surrounding mountain rim flow towards the valley center and then the main drainage Bagmati drains the valley due south through the gorge of Chobhar and Dachinkali to the south across the southern mountains. River hydrology of the valley is influenced by the monsoon season and is at its peak during the Month of August and minimum in the month of March.

Though site specific records of meteorological data for the program sites are not available, their locations in relation to the available recording station reveals a similar meteorological conditions. The program sites Bagmati Corridor 4,5 and 6 lie adjacent to the principle drainage Bagmati have a risk of flood and river side cutting, whereas the sites Ring road Balkumari Gwarko and Ringroad Maharajgunj Chabahil extend across Manohara river and Dhobi Khola river also has risks of floods and river cutting in the sections crossing these rivers.

4.1.4 Land Use

The Kathmandu valley is going through a phase of land use change due to rapidly expanding urban area at the valley center. The drastic land use change is noted within the municipal boundaries. Bhagabat Rimal 2001[2] has worked out the land use change in the Kathmandu metropolitan including Lalitpur. The Table 4.3 represents the land use patterns in 1976, 1989, 2001 and 2009 respectively.

Table 4.3: Land Use at Kathmandu Metropolitan between 1976 to 2009

Land use type	1976 MSS	1989 TM	2001 ETM+	2009 ETM+
Urban/ Builtup	11.0	23.1	41.0	51.5
Open Area/Nonuse	15.3	3.9	1.0	0.3
Water Body	1.0	0.7	0.7	0.4
Cultivated land	62.3	61.0	45.7	40.8
Natural Vegetation	10.4	11.3	11.6	7.0

Land use statistics in percentage, 1976-2009.

Over the period the urban/built up area in the city increased from 11.0 in 1976 to 51.5 % in 2009 where the open area decreased 15.3% to 0.3% and natural vegetation lands from 10.4% to 7 % in the same periods. Urban/built up area expanded in the expense of agriculture, open area and forest lands use in different periods. Figure show water area is constant than other character in 1989- 2001 but it more than 50% decreased from 1976 to 2009 explaining encroachment of the riverine flood plain areas.

In terms of land use, the Program sites, locates in the open spaces within the urban built up areas. Table 4.4 presents the specific land use of the program sites.

Table 4.4: Program Sites Land Use

SN	Program Sites	Specific Land Use	Remarks
1	Bagmati Corridor 4	Flood Plain /Water body	Abandoned flood plain. Due to down cutting by the Bagmati River, the flood plain is now elevated about 3 to 5 m from the river bed and remain dry except exceptional floods
2	Bagmati Corridor 5	Flood Plain /Water body	Abandoned flood plain. Due to down cutting by the Bagmati River, the flood plain is now elevated about 3 to 5 m from the river bed and remain dry except exceptional floods
3	Bagmati Corridor 6	Flood Plain /Water body	Abandoned flood plain. Due to down cutting by the Bagmati River, the flood plain is now elevated about 3 to 5 m from the river bed and remain dry except exceptional floods
4	Ringroad Maharajgunj Chabahil	Open land/ Green belt of the Ring Road	The land area is allocated for the road infrastructure
5	Shankha Park	Open land/ Recreation Park	
6	Oxygenation Park	Open land	The land area is allocated for the infrastructure Sewage Treatment Plant
7	Ringroad Balkumari Gwarko	Open land/ Green belt of the Ring Road	The land area is allocated for the infrastructure
8	Ringroad Gwarko Satdobato	Open land/ Green belt of the Ring Road	The land area is allocated for the road infrastructure
9	Ringroad Satdobato Ekantakuna	Open land/ Green belt of the Ring Road	The land area is allocated for the road infrastructure

Source: Field Survey 2013

[2] Bhagaba Rimal, 2001. Land Use Change Analysis of Kathmandu Metropolitan, Using Remote Sensing and GIS. *www.gisdevelopment.net › Geospatial Application Papers*

4.1.5 Land Stability and Erosion

As discussed in section 4.1.1 above the program site land units are flat and gently sloping. The riverine area sites such as Bagmati Corridor, 4, 5 and 6, the land units edge facing the river side, however, show abrupt break in the slope of over 30 degree. The river bank cuttings in the monsoon are pushing these slopes backwards progressively and are the sites of small scale land failures. Likewise, the Ring road sites, particularly the fill sites show slope breaks of over 30 degrees, slope length, however, vary from section to section. These sites are also at risk of failure, surface and rill erosion during the monsoon season. Table 4.5 presents the length of slope break sections with risk of land failure and erosion in the proposed program sites.

Table 4.5: Program Sites with Risks of Land Failure and Erosion

SN	Program Sites	Length of Slope Break (m)	Slope Length (Average m)	Remarks
1	Bagmati Corridor 4	300	10	Slope height is about 2.5 to 3 m
2	Bagmati Corridor 5	270	10	Slope height 2 to 2.5 m
3	Bagmati Corridor 6	150	11	Slope height 2.5 to 3 m
4	Ringroad Maharajgunj Chabahil	1195	15	Slope height vary from 2.5 to 7 m
5	Shankha Park	-	-	
6	Oxygenation Park	-	-	
7	Ringroad Balkumari Gwarko	160	10	Slope height about 2 m
8	Ringroad Gwarko Satdobato	-	-	
9	Ringroad Satdobato Ekantakuna	300	8	Slope height about 2.5 m

Source: Field Survey 2013

4.1.6 Water Quality

Water samples of the nearby dug well from the program sites were taken wherever such dug wells existing inside or close to the site. Results of water quality analysis of the dug wells are presented in ***Annex 4.3***. ***Table 4.6*** highlights the water quality characterizes of the observed sites

Table 4.6: Water Quality of the Dug Wells inside or Close to the Program Sites

SN	Program Sites	Location	Remarks
1	Bagmati Corridor 4	Inside	Turbidity, ammonia, iron, manganese and E. coli exceeds NDWQS, Nepal
2	Bagmati Corridor 5	Inside and outside	Turbidity, ammonia, iron, manganese and E. coli exceeds NDWQS, Nepal, Outside sample is devoid of E. coli
3	Bagmati Corridor 6	Inside	Turbidity, ammonia, iron, manganese and E. coli count exceeds NDWQS, Nepal
4	Ringroad Maharajgunj Chabahil	Inside	In one sample turbidity, iron and E. coli exceeds NDWQS, Nepal while the other is within the NDWQS, Nepal
5	Shankha Park	Inside	Turbidity and iron exceeds NDWQS, Nepal
6	Oxygenation Park	Inside	Turbidity, ammonia, iron and manganese exceeds NDWQS, Nepal
7	Ringroad Balkumari Gwarko	Outside	Turbidity, iron, manganese and E. coli exceeds NDWQS, Nepal
8	Ringroad Gwarko Satdobato	Outside	Turbidity, ammonia, iron, manganese and E. coli exceeds NDWQS, Nepal
9	Ringroad Satdobato Ekantakuna	Inside	Turbidity, ammonia, iron, manganese and E. coli exceeds NDWQS, Nepal

Source: Field Survey 2013

Most of the well water do not meet the National Drinking Water Quality Standards of Nepal and are unfit for consumption without prior treatment. The pollution of the well water is related to the poor sanitation conditions and haphazard discharge of solid as well sanitary sewage on the open areas.

In addition, recent documented results of the Bagmati River water quality were also reviewed. The results are presented in ***Annex 4.4***. The surface runoff drained from the program sites ultimately joins the Bagmati River at various locations. River Bagmati is highly polluted. Dissolved oxygen level is less than 4 mg/lt. In the central part of the urban area, the dissolved oxygen level is near zero while the levels of Biological oxygen Demand (BOD) vary from 30 to 80 mg/lt and likewise the Chemical Oxygen Demand (COD) vary from 50 to 150 mg/lt. The pollution of the Bagmati River mainly resulted from the direct discharge of untreated sewers.

4.1.7 Ambient Air Quality

There are no documented records of ambient air quality for the proposed program sites. However, the ambient air quality status of the program sites could be inferred from the available records in the Kathmandu valley. Kathmandu valley ambient monitoring results are available for the six different sites namely Thamel, Putali Sadak, Patan Hospital, Kirtipur, Machhegaon and Bhaktapur. The Thamel site represents the typical urban residential area, while Putali Sadak, and Patan represent the heavy traffic corridors within the urban center. Kirtipur and Bhaktapur represent urban peripheral sites and the Macchegaon site is the Kathmandu valley background site. The results of the ambient air quality monitoring are presented in ***Annex 4.5***.

Table 4.7 presents the likely air quality situations in the proposed program sites based on the locational correlation of the sites with the monitored sites of the Kathmandu valley.

Table 4.7: Likely Ambient Air Quality Status of the Proposed Program Sites.

SN	Program Sites	Correlation with the Monitored sites	Remarks on air quality Status
1	Bagmati Corridor 4	Thamel (urban residential)	Average 24-hour concentration is 177µg/m^3 that is higher than National Ambient Air Quality Standard and WHO standard
2	Bagmati Corridor 5	Thamel (urban residential)	Average 24-hour concentration is 177µg/m^3 that is higher than National Ambient Air Quality Standard and WHO standard
3	Bagmati Corridor 6	Thamel (urban residential)	Average 24-hour concentration is 177µg/m^3 that is higher than National Ambient Air Quality Standard and WHO standard
4	Ringroad Maharajgunj Chabahil	Putali Sadak – High traffic corridor	Average daily emission is excessively high (i.e. 485 µg/m^3) which is four times higher than the National Ambient Air Quality Standard and twenty times the WHO standard. Similarly, for June-July month, average PM10 ambient concentration is 125µg/m^3 which is a higher value to National Ambient Air Quality Standard and WHO Standards
5	Shankha Park	Thamel (urban residential)	Average 24-hour concentration is 177µg/m^3 that is higher than National Ambient Air Quality Standard and WHO standard
6	Oxygenation Park	Bhaktapur	Average PM10 ambient concentration is below National Ambient Air Quality Standard
7	Ringroad Balkumari Gwarko	Putali Sadak – High traffic corridor	Average daily emission is excessively high (i.e. 485 µg/m^3) which is four times higher than the National Ambient Air Quality Standard and twenty times the WHO standard. Similarly, for June-July month, average PM10 ambient concentration is 125µg/m^3 which is a higher value to National Ambient Air Quality Standard and WHO Standards
8	Ringroad Gwarko Satdobato	Putali Sadak – High	Average daily emission is excessively high (i.e. 485

SN	Program Sites	Correlation with the Monitored sites	Remarks on air quality Status
		traffic corridor	µg/m^3) which is four times higher than the National Ambient Air Quality Standard and twenty times the WHO standard. Similarly, for June-July month, average PM10 ambient concentration is 125µg/m^3 which is a higher value to National Ambient Air Quality Standard and WHO Standards
9	Ringroad Satdobato Ekantakuna	Putali Sadak – High traffic corridor	Average daily emission is excessively high (i.e. 485 µg/m^3) which is four times higher than the National Ambient Air Quality Standard and twenty times the WHO standard. Similarly, for June-July month, average PM10 ambient concentration is 125µg/m^3 which is a higher value to National Ambient Air Quality Standard and WHO Standards

The spread of the daily and monthly air quality monitoring data for the suspended particulates show high degree of variation. The monsoon months show lower values compared to the dry season.

4.1.8 Noise Levels

The proposed program sites were monitored for noise level in the day time zone to get a picture of the noise levels at the boundary lines of the proposed sites. ***Table 4.8*** presents the results of spike monitoring at the day time zone for the proposed program sites.

Table 4.8: Noise Level at the Proposed Program Sites

SN	Program Sites	Minimum (dBA)	Maximum (dBA)	Leq (dBA)	Noise source
1	Bagmati Corridor 4	43	65	45	Major noise contributing sources are Conversation among people sound of occasional motor bike
2	Bagmati Corridor 5	44	66	55	Major noise contributing sources are Conversation among people sound of occasional motor bike
3	Bagmati Corridor 6	44	70	59	Significant sound of aircraft people's conversation occasional motor bike
4	Ringroad Maharajgunj Chabahil	56 to 54	89 to 75	66 to 73	Major noise sources noticed during monitoring were Vehicles especially power horn of large truck and buses.
5	Shankha Park	55	89	73	Major noise sources from vehicular movement especially power horns of heavy truck and bus.
6	Oxygenation Park	46	61	52	Major noise sources noticed during monitoring were background noise from Construction Company (Adarsha Nirman Company). occasional approach of bikes
7	Ringroad Balkumari Gwarko	63	78	69	Major noise sources noticed during monitoring were Vehicles especially power horn of large truck and buses

SN	Program Sites	Minimum (dBA)	Maximum (dBA)	Leq (dBA)	Noise source
8	Ringroad Gwarko Satdobato	55	83	69	Major noise sources noticed during monitoring were Vehicles especially power horn of large truck and buses.
9	Ringroad Satdobato Ekantakuna	57	72	63	Major noise sources noticed during monitoring were Vehicles especially power horn of large truck and buses

Source: Field Survey 2013

The road side areas show high level of environmental noise almost comparable to industrial and commercial areas (leq 70 dBA) while the noise levels of the Bagmati corridor sites and oxygenation Park are well within the residential zones (leq 55 dBa)[3].

4.2 Biological Environment

The biological environmental baseline focuses on the ecological status and the floral and faunal habitats in the proposed program sites with special attention on the flora and fauna of conservation significance.

4.2.1 Ecological Sensitivity

The proposed program sites lie outside the officially declared conservation sites such as National Parks (NP), Wildlife Reserve (WR), Hunting Reserves (HR), Conservation Area (CA) etc. Further these sites are not the sites of local ecological significance in terms of flora and fauna conservation. From the ecological perspective the program sites could be defined as the sites of highly modified nature and has no value of natural ecology.

4.2.2 Floral Communities

The program sites, particularly, the Ring road sites and the Park site (Shankha Park), show the presence of planted trees. The lists of trees recorded in the program sites are presented in Table 4.9.

Table 4.9: List of Trees recorded in the Program sites

S.N	Local Name	Common Name	Scientific Name
1	Pipal	Peepal Tree	*Ficus religiosa*
2	Bar	Banyan tree	*Ficus benghalensis*
3	Masala	Lemon scented eucalyptus	*Eucalyptus citriodora*
4	Rubber plant	Rubber plant	*Ficus elastica*
5	Kaiyo phool	-	*Delonix regia*
6	Shirish	The blue mimosa	*Jacaranda mimosifolia*
7	Uttish	Nepal black ceder	*Alnus nepalensis*
8	Lahare peepal	-	*Populus deltoides*
9	Bans	Feathery bamboo	*Bambusa vulgare*
10	Dhupi	-	*Cryptomeria japonica*
11	Salla	Chir pine	*Pinus roxburghii*
12	Khari	European neettle wood	*Celtis australis*
13	Bhogate	Melon fruit	*Citrus maxima*
14	Rudraksha	Utrasum bead tree	*Elaeocarpus sphaericus*
15	Aaru	Peach	*Prunus persica*

Source: Field Survey 2013.

The Program sites are not the sites of natural vegetation communities except for a few herbs and shrub species. ***Table 4.10*** lists the species wise number of trees within the proposed sites.

[3] IFC 2007. Environmental Health and Safety Guidelines

Table 4.10: Numbers of Trees in the Program Sites

SN	Program Sites	Local Name of Tree Species and number	Remarks
1	Bagmati Corridor 4	Peepal Tree -5 Bar Tree – 1 Masala Tree - 1	GPS Location and Photographs of trees are given in Annex 4.1, Bagmati Corridor 4
2	Bagmati Corridor 5	-	-
3	Bagmati Corridor 6	-	-
4	Ringroad Maharajgunj Chabahil	Rubber plant – 2 Kaiyo tree – 467 Shirish tree -116 Uttish – 8 Peepal tree – 10 Lahare peepal tree -10 Bar tree -1	Photographs of trees are given in Annex 4.1, Ringroad Maharajgunj Chabahil
5	Shankha Park	Rubber plant -2 Kaiyo tree -3 Shirish tree -2 Peepal tree -6 Lahare peepal tree -70 Dhuppi tree -79 Rudraksha -1 Salla -1 Unknown -15	Photographs of trees are given in Annex 4.1, Shankha Park
6	Oxygenation Park	Kaiyo tree -4 Bhogate tree -1 Khari – 1 Dhupi tree -4	Photographs of trees are given in Annex 4.1, Oxygenation Park
7	Ringroad Balkumari Gwarko	Rubber plant – 2 Kaiyo tree – 13 Shirish tree -3 Peepal tree – 3 Lahare peepal tree -11 Dhupi tree -1	Photographs of trees are given in Annex 4.1, Ringroad Balkumari Gwarko
8	Ringroad Gwarko Satdobato	Rubber plant – 4 Kaiyo tree – 30 Shirish tree -17 Aru - 1 Peepal tree – 6 Lahare peepal tree -27 Dhupi tree -20 Salla tree – 3 Bar tree - 1	Photographs of trees are given in Annex 4.1, Ringroad Gwarko Satdobato
9	Ringroad Satdobato Ekantakuna	Bamboo clump - 1 Kaiyo tree - 36 Shiris tree -363 Khari tree - 1 Peepal tree -8 Lahare Peepal tree – 6 Dhuppi tree – 9 Salla tree – 10 Masala tree – 1 Bar tree - 2	

Source: Field Survey 2013

4.2.3 Flora of Conservation Significance

None of the recorded trees are listed in the conservation significance lists of the Government of Nepal, IUCN red list and in the CITES Appendices. The recorded trees such as Peepal and Bar trees have a religious significance in Nepal.

4.2.4 Faunal Communities

The proposed program sites are not the natural habitats for the faunal species. Common house rates are the occasionally reported mammal species while some snakes and frogs are reported in the monsoon months. Among avian species, such as crow, sparrow, pigeon, doves etc commonly found in the urban areas of Kathmandu are found in the program sites. The trees of the ring road sites occasionally show nest of these birds.

4.2.5 Fauna of Conservation Significance

None of the recorded faunas are listed in the conservation significance lists of the Government of Nepal, IUCN red list and in the CITES Appendices.

4.3 Socio-economic and Cultural Environments

The socio-economic and cultural environment baseline for the proposed program sites focuses on the demographic features of the Kathmandu valley in general and of the Municipalities in particular highlighting the numbers of housing structures and their nature. With this general background, the baseline will deal with the socio-economic and cultural features of the proposed program sites.

4.3.1 Demographic Features of Kathmandu Valley and the Municipalities

Kathmandu valley is comprised of three district administrative areas, namely Kathmandu, Lalitpur and Bhaktapur. ***Table 4.11*** presents the general demographic characteristics of the Kathmandu Valley.

Table 4.11: Demographic Characteristics of the Kathmandu Valley

S.N	Particulars	District			Total
		Kathmandu	Lalitpur	Bhaktapur	
1	Total Population	1744240	468132	304651	2517023
2	Male	913001	238082	154884	1305967
3	Female	831239	230050	149767	1211056
4	Sex Ratio (M/ F)	109.8	103.5	103.4	107.837
5	Total House Hold	469145	114443	68636	652224
6	Average Household Size	3.72	4.09	4.44	4.082
7	Area in sq. km	395	385	119	899
8	Population Density(person/sq. km)	4416	1216	2560	2800

Source: National Population and Housing Census 2011[4]

Total population of the valley is 2517023. The larger share of population resides in the Kathmandu district followed by Lalitpur and Bhaktapur. Average household size for the valley is 4.082 with least family size in Kathmandu district followed by Lalitpur and Bhaktapur. Average population density in the valley is 2800/km^2 whereas the average population density for the country is 1381/km^2. Population density in the Kathmandu district is around 4416/km^2 followed by Bhaktapur and Lalitpur.

Kathmandu valley comprises of 5 municipalities and 114 village Development Committees. The population concentration is highest in the municipalities compared to the village Development committees. Nearly 57% of the Kathmandu valley population reside in the five municipalities and the population density in the municipalities added together is 14703/km^2 with highest in the Kathmandu metropolitan city (19726/km^2) followed by Lalitpur (14574/km^2), Bhaktapur (12461/km^2), Thimi (7474/km^2), and Kirtipur (4444/km^2). Outside the municipal areas in the village development committees the average population density is 1360/km^2, which is lower than the national average (***Table 4.12***).

[4] CBS, 2012, National Population and Housing Census 2011.

Table 4.12: Demographic characteristics of Municipalities and VDCs of Kathmandu Valley

S. N	Particulars	Kathmandu district			Lalitpur district		Bhaktapur district		
		Kathmandu Metropolitan	Kirtipur Municipality	VDCs (57)	Lalitpur Sub Metropolitan	VDCs (41)	Bhaktapur Municipality	Madhyapur Thimi Municipality	VDCs (16)
1	Total Population	975453	65602	703185	220802	247330	81748	83036	139867
2	Male	511841	36476	364684	113781	124301	41081	42723	71080
3	Female	463612	29126	338501	107021	123029	40667	40313	68787
4	Sex Ratio (M/ F)	110.4	125.2	107.7	106.3	101.0	101.0	106.0	103.3
5	Total House Hold	254292	19441	195412	54581	59862	17639	20302	30695
6	Average Household Size	3.84	3.37	3.60	4.05	4.13	4.63	4.09	4.56
7	Area in sq. km	49.45	14.76	330.79	15.15	369.85	6.56	11.11	101.33
8	Population Density(person/sq. km)	19726.0	4444.6	2125.8	14574.4	668.7	12461.6	7474.0	1380.3

Source: National Population and Housing Census 2011[5]

[5] CBS, 2012, National Population and Housing Census 2011.

4.3.2 Housing Infrastructures Kathmandu Valley and the Municipalities

Table 4.13 presents the number of housing infrastructures by types of foundations in the Kathmandu valley, while Table ***4.14*** depicts the wall types of the housing structures.

Table 4.13: Housing Infrastructures by types of Foundation – Kathmandu Valley

S.N	Foundation type	District			Total	Percentage
		Lalitpur	Bhaktapur	Kathmandu		
1	Mud bonded bricks/stone	36858	28269	80811	145938	23.82
2	Cement bonded bricks/ stone	34151	17894	165677	217722	35.54
3	RCC with pillar	33934	20868	174916	229718	37.50
4	Wooden pillar	562	290	2522	3374	0.55
5	Other	275	273	1243	1791	0.29
6	Not stated	2725	963	10375	14063	2.30
	Total	**108505**	**68557**	**435544**	**612606**	**100.00**

Source: National Population and Housing Census 2011

Table 4.14: Housing Infrastructures by Types of Wall – Kathmandu Valley

S.N	Type of outer wall	District			Total	Percentage
		Lalitpur	Bhaktapur	Kathmandu		
1	Mud bonded bricks/ stone	32342	26044	65556	123942	20.20
2	Cement bonded bricks/ stone	71117	39677	350265	461059	75.14
3	Wood / Planks	585	283	2447	3315	0.54
4	Bamboo	606	436	3558	4600	0.75
5	Unbaked	751	775	1982	3508	0.57
6	Others	298	345	1161	1804	0.29
7	Not Stated	3806	997	10575	15378	2.51
	Total	**109505**	**68557**	**435544**	**613606**	**100.00**

Source: National Population and Housing Census 2011

Nearly 60% of the housing infrastructures are poorly founded in the Kathmandu valley. Even the housing structures with relatively better foundation, resistant to earthquake are questionable. Likewise conclusion could be drawn for the outer wall resistant to earthquake. It is to note that highest numbers of structures are in the Kathmandu district followed by Lalitpur and Bhaktapur.

The database on the concentration of building structures for the municipalities of the Kathmandu valley are not available for comparison in relation to VDCs, however it is assumed that more than 60% of the structures are confined within the municipal areas with higher ratio of structures in Kathmandu metropolitan city compared to other municipalities.

4.3.3 Land Ownership of the Program Sites

All of the program sites are the public land but with ownership with different institutions of the government of Nepal. The land occupation for disaster debris management in the post earthquake disaster, thus does not involve economic or physical displacement of people from their land and

property. In other words, the land occupation will not require prior resettlement and rehabilitation planning. ***Table 4.15*** depicts the ownership of the program sites by different institutions of the GON and the current usage of the area by the local communities.

Table 4.15: Land Ownership of the Program Sites

SN	Program Sites	Public Land Ownership	Current use
1	Bagmati Corridor 4	Kathmandu Municipality	Playground by local community, construction material storage, and cremation activities
2	Bagmati Corridor 5	Kathmandu Municipality	Playground and dumping of solid waste and storage of construction material by the local communities
3	Bagmati Corridor 6	Kathmandu Municipality	Storage of construction material and recreational area such as sunbathing by the locals
4	Ringroad Maharajgunj Chabahil	Department of Roads	Green belt, parking and storage of construction material
5	Shankha Park	Kathmandu Municipality	Recreational park for the local people. A small area at the northern corner of the site is used by KUKL for water boring plant
6	Oxygenation Park	Kathmandu Upatyaka Khanepani Limited	Open land is used as playground by the local community. North central part of the site is used for the offices and storage of construction materials by Kathmandu Upatyaka Khanepani Limited (KUKL). The south western area is used by the Chinese Ring Road Expansion Contractors. Western part of the site is used for solar panel installation by KUKL.
7	Ringroad Balkumari Gwarko	Department of Roads	Green belt, parking and storage of construction materials
8	Ringroad Gwarko Satdobato	Department of Roads	Green belt, parking and storage of construction materials
9	Ringroad Satdobato Ekantakuna	Department of Roads	Green belt, parking and storage of construction materials

Source: Field Survey 2013

4.3.4 Nearest Settlement and Communities

The program sites locate in the hub of the urban settlements of Kathmandu and Lalitpur Municipality. ***Table 4.16*** presents the nearest settlements, distance from the nearest buildings, and the characteristics of communities residing in the nearby areas.

Table 4.16: Program Site's Nearest Settlement and Communities

SN	Program Sites	Distance from Nearest settlement	Name of the Nearest Settlements	Community Characteristics
1	Bagmati Corridor 4	Adjacently north of the site	Sabal Bahal and Teku Dovan	Settlement is mostly dominated by ethnic groups of Newars, Tamangs and Dalits.
2	Bagmati Corridor 5	Adjacently north of the site	Gusin Ghat (Sukumbasi Basti) and Tripureshowr	Mixed ethnic groups, majority are Dalit with few numbers of Tamang, Chettri, and Bahun
3	Bagmati Corridor 6	Adjacently	Sankhamul	Mixed ethnic group dominated by

SN	Program Sites	Distance from Nearest settlement	Name of the Nearest Settlements	Community Characteristics
		northwest of the site		Brahmins, Gurungs and Newars including Dalits and Chhetris
4	Ringroad Maharajgunj Chabahil	Adjacently on either side of Ring road	Narayan Gopal Chowk, Dhumbarahi, Suke Dhara , Chabahil	Mixed ethnic group dominated by Brahmins and Newars including Dalits and Chhetris
5	Shankha Park	30 meters	Chandol in west and east, Narayangopal chowk in north and Dhumbarahi in South	Mixed ethnic group dominated by Brahmins and Newars including Dalits and Chhetris
6	Oxygenation Park	200 houses at the border line of the site	Aafal Tole and Basnet Gau on the North West, Pattipa Chowk in East, Bagdore in South East, Singoti Gau in north	mixed ethnicity including: Brahmin, Newar, Dalit and Chhetr
7	Ringroad Balkumari Gwarko	Adjacently on either side of Ring road	Gwarko, Balkumari	Mixed ethnic group dominated by Brahmins and Newars including Dalits and Chhetris
8	Ringroad Gwarko Satdobato	Adjacently on either side of Ring road	Satdobato, Gwarko	Mixed ethnic group dominated by Brahmins and Newars including Dalits and Chhetris
9	Ringroad Satdobato Ekantakuna	Adjacently on either side of Ring road	Ekantakuna, Kusunti, Mahalaxmisthan, Chapagaun dobato, Satdobato	area is dominated by Brahmin, Gurung, Newar and Chhetri

Source: Field Survey 2013

The Bagmati corridor sites, Oxygenation Park and Shankha Park locate in residential areas, whereas the Ring Road sites have a mix of residential and commercial utility. The communities living adjacent to the Bagamati corridor site 4 and 5 are represented by poor communities depending mostly on wage labor, while that of Bagmati Corridor 6, Shankha Park, and Oxygenation Park are Middle class communities based on service and jobs. The Ringroad sites are dominated by rich and middle class communities relying on jobs/services and commerce.

4.3.5 Built Infrastructures

Within the proposed program sites there are few built infrastructures which serve to the communities located close to the sites. ***Table 4.17*** presents the status of built infrastructures (house, Bus stops, electrical poles, wells, sewer/storm drains etc. in the program sites.

Table 4.17: Built Infrastructures in the Program Sites

SN	Program Sites	Electric lines	Storm water drains and drainage	Water supply pipes through the sites	Wells, tube wells & tap	Other Structures	Religious structures
1	Bagmati Corridor 4	4 electric and Telephone poles, one high voltage transmission pole	One underground sewer drainage and one storm water drainage crossing the site.	-	3 wells and 1 hand pump	one public toilet	4 cremation areas;, 3 small temples (Shiva Mandir, Ganesh Mandir and Bishnu Mandir)
2	Bagmati Corridor 5	-	4 storm water drainage and about 5 sewerage drainage pipes passing across	-	-	-	-
3	Bagmati Corridor 6	4 electric poles	one underground sewer drainage	=	-	-	-
4	Ringroad Maharajgunj Chabahil	124 electric poles	Storm water drain on either side of ring road at most of the sections. In addition there are underground sewer lines in some sections, numbers not known	The drinking water pipes are laid underground along the both side of the road. Numbers not known	Two tap and one spring water source	18 building structures, 6 Bus stands, and 1 bridge	2 temples
5	Shankha Park	-	a toilet and underground the sewage drainage	-	-	3 permanent structures, 3 picnic stalls, , 2 ponds and 1 water boring plant	1 temple
6	Oxygenation Park	22 electric poles	One surface storm water/ sewer drainage	-	-	12 built structures	-
7	Ringroad Balkumari Gwarko	55 electric poles	open channel all along the road on either side of ring-road and underground crossing at few locations	Drinking water pipes are laid underground on either side of the road, numbers not known	-	4 bus stands and 1 bridge	-
8	Ringroad Gwarko Satdobato	49 electric poles	Surface storm water drainage on both side of the road and underground sewerage	Drinking water pipes are laid underground on either side of the	one public tap	4 bus stands, 1 water tank and 1 bridge	3 temples

SN	Program Sites	Electric lines	Storm water drains and drainage	Water supply pipes through the sites	Wells, tube wells & tap	Other Structures	Religious structures
			drainage along the road	road, numbers not known			
9	Ringroad Satdobato Ekantakuna	95 electric poles	Surface storm water drainage on either side of the road; underground sewerage drainage is also built but length and numbers not known	Drinking water pipes are laid underground on either side of the road, numbers not known	one well	Four bas stands	1 Temple

Source: Field Survey 2013

Note Photographs and GPS locations of the infrastructures for all sites is presented in Annex 4.1

4.3.6 Nearest Educational and Health Institutions

A number of educational and health institutions are located close to the program sites. ***Table 4.18*** present the lists of the health and educational institutions and their distance from the sites.

Table 4.18: Nearest Educational and Health Institutions

SN	Program Sites	Educational Institution	Distance from site (m)	Health Institution	Distance from site (m)
1	Bagmati Corridor 4	• Mahendra Sarasawati School • Saraswati Niketan School	• 200m • 1000	• Teku Hospital	• 1600
2	Bagmati Corridor 5	• Vishwa Niketan Higher Secondary School	• Adjacently to the site	• Teku eye hospital • Teku Saruwa Rog Hospital	• 200 • 500
3	Bagmati Corridor 6	• Awareness International Academy • Neric Academy	• 150 • 200	-	
4	Ringroad Maharajgunj Chabahil	• Norvic Institute of Nursing Education • Kathmandu Valley High School • Kantipur English High School • Prolific Higher Secondary School • Brooklyn International College • New Millennium College • Pushpalal Memorial College	• 300 • 40 • 120 • 150 • 110 • 120 • 200	• Family Health Care and Research Centre • Dhanawantari Aayurvedic Hospital • Anamol Hospital and Research Centre • Om Hospital and Research Centre • Medicare National Hospital and Research Centre • Helping Hand Hospital	• 70 • 80 • 50 • 50 • 70 • 50
5	Shankha Park	• Kantipur English School	• 200	• Dhanawantari Aayurvedic Hospital	• 200
6	Oxygenation Park	• Panchakanya Kumari School • Modern Indian School	• 200 • 100	• Astamatrika Hospital Pvt. Ltd	• 500
7	Ringroad Balkumari Gwarko	• Prabhat Higher Secondary School • Bal Deeksha Sadan Higher Secondary School • Quest College • Kathmandu University School of Management • Hindu Vidya Peeth	• 130 • 250 • 200 • 450	• Kist Medical College Teaching Hospital	• 450

SN	Program Sites	Educational Institution	Distance from site (m)	Health Institution	Distance from site (m)
		• Kathford International College • School of Engineering • Milestone International College	• 300 • 70 • 70 • 90		
8	Ringroad Gwarko Satdobato	• Mahendra Adarsha Vidyashram • The Rising School • Kathmandu College of Management • Prabhat Higher Secondary School	• 100 • 50 • 110 • 100	• Baidya and Banskota (B & B) Hospital	• 250
9	Ringroad Satdobato Ekantakuna	• Mahendra Bhrikuti Secondary School • Anisha Tibetan school • Mahima Montessori Kinderland • Machapuchchhre International School • Delight Secondary School • Kathmandu Institute of Theology • Angels Heart School • Einstein Academy • Araniko Secondary School • Asian College • Mahendra Adarsha Vidyashram	• 100 • 100 • 300 • 100 • 50 • 50 • 70 • 20 • 60 • 105 • 100	• Tibetan Camp Hospital • Talchikhel Medicine Pharma • Laligurans Hospital	• 50 • 50 • 15

Source: Field Survey 2013

4.3.7 Archeological and Cultural Significance

The proposed program sites are not the sites of archeological significance. Some of the sites, however, comprises of structures which have a cultural significance to the local communities. ***Table 4.17***, last column, presents the structures of local cultural significance in the program sites. Bagmati corridor 4 is also a site for cremation of dead bodies by some sect of the Newar communities. The temples in other site have a local cultural value only.

4.3.8 Future Plans on the Program Sites

Of the 9 proposed program sites, seven of the sites (Bagmati Corridor sites 4, 5 and 6 and 4 Ringroad sites) have been planned for the road expansion through the sites. Road expansion activity is already initiated in the Ringroad – Satdobato – Ekantakuna site and is expected to continue in the Ringroad - Gwarko –Satdobato and Ringroad - Balkumari – Gwarko site from 2014. The Ringroad - Maharajgunj – Chabahil site is planned for expansion within 2020. All of these sites will be occupied by the road infrastructure once the expansion is completed.

In the Bagmati Corridor 4 and 5 road construction along the northern edge of the site has already initiated by the Kathmandu Municipality. A similar plan is also proposed for the Bagmati Corridor 6. With the expansion of the site nearly 7 m width of the proposed site will be utilized by the road infrastructure.

Nearly 8 ha of the Oxygenation Park area is already occupied by Solar Panel installation and Camps for the Ringroad construction contractor. Further occupation of the land on this site is not envisaged, whereas the Shankha Park site is already developed as a public recreation site.

CHAPTER 5: ALTERNATIVE ANALYSIS

The proposed program sites have been evaluated based on various plausible alternatives including no program site alternative. This section briefly discusses the various alternatives considered for the evaluation of the program sites from environmental and social safeguard perspectives.

5.1 No Program Site Alternative

Kathmandu Valley is at high risk of a major earthquake. A major earthquake [9 on the Richter scale] will have disastrous consequences for Kathmandu residents. Open Space report (2013) projects 40,000 dead, between 100,000 - 200,000 injured, 60% of buildings destroyed, and between 600,000 - 900,000 left homeless in the event of a major earthquake.

In such an event, the first and foremost post disaster requirement is to remove the disaster debris from the place of origin to the nearest possible distance so as to facilitate rescue operations and initiate rehabilitation and reconstruction at the earliest to safeguard the earthquake stricken communities. Apart from this one of the key objectives of such post disaster debris management is to maximize the economic resources from the reusable and recyclable debris material to minimize the costs of rehabilitation and reconstruction vis a vis provisioning of job opportunities to the affected communities near to their dwellings.

The program sites are proposed for the management of the post disaster debris in the event of a major earthquake. The sites have been identified as a part of pre-disaster preparedness to mobilize the rescue and reconstruction operation at the earliest to minimize the hardship of the communities affected by the earthquake disaster. It is therefore no program site for the post disaster debris management means magnification of misery and suffering of the communities in the event of earthquake. For this reason no Program site Alternative is rejected in favor of the Program Sites for disaster debris management.

5.2 Alternatives to Program Site Locations

A total of 83 open spaces have been identified in the Kathmandu Valley, under the overall leadership of Ministry of Home Affairs (MoHA) the International Organization for Migration (IOM) as co-lead of the Camp Coordination and Camp Management (CCCM) cluster, to be used for humanitarian purposes in the event an earthquake. Of the total 83 open space sites, 9 sites have been identified as priority sites for post disaster debris management. These open spaces sites were published in the Government of Nepal Gazette detailing the location and rules set forth around the application of the open space program in the April of 2013.

Within the Kathmandu and Lalitpur Sub Metropolitan there is a general lack of open spaces. As explained in section 4.1.4, Table 4.3, the available open space in these municipalities has declined from nearly 15% by area to 0.3% in between 1976 to 2009. As post disaster debris management requires relatively large land areas close to the densely populated areas to minimize the travel distance to gain lead time for effective rescue and reconstruction operations with limited resources, available sites have to be screened from area perspective as well as natural and social safeguard perspectives keeping in view the nearest possible location. The proposed program sites have been selected from these considerations from among the 83 sites for post disaster debris management. Given the available open space sites, the selected 9 sites have comparatively larger area and comparatively low natural and social risks.

5.3 Permanent verses Temporary Site Alternatives

From the management perspective, placement of the post disaster debris in the permanent sites is the best option. However, such an alternative option needs assessment of the sites, if such sites are available within 15 to 20 km from the disaster sites. In the case of Kathmandu Valley, permanent sites

within 15 to 20 km from the urban centers are not available. Existing landfill site for the Solid Waste management for the Kathmandu valley locates nearly 40 km from the Kathmandu urban center. Even this site has been nearing its capacity of land filling. As of date Kathmandu Solid Waste Management is looking for a permanent site and is finding difficulty in locating the sites within existing 40 km distance from the valley urban center.

Considering the above constraints, planning for transporting post disaster debris to permanent sites for land filling at this stage of pre-disaster preparedness is a difficult proposition. It is therefore, the proposed sites have been selected as temporary sites for use from 6 to 18 months of post disaster. The advantage of these temporary sites is segregation of reusable and recyclable materials near the consumption areas. The disadvantage, however, is re-transportation of the unusable debris from the temporary sites to the permanent sites and rehabilitation of the temporary sites to pre-program conditions. Given the current state of affairs, the sites though being less suitable compared to the permanent sites have been selected as the best option.

5.4 Public Land versus Private Land Alternative

The selected sites are the Public lands owned and managed by the various government institutions. The selection of the open space for debris management or for other humanitarian needs have given preferences to public lands than to the private lands. The basic objective was to minimize the social safeguard issues such as compensation, resettlement and rehabilitation by avoiding the private land and property in the selection of the open space.

5.5 Reuse, Recycling of Post Disaster Debris versus Final Disposal without Segregation of Reusable and Recyclable

Post disaster debris comprises a number of reusable and recyclable materials. Disposal of the debris without segregation of the reusable and recyclable material is a resource loss. It is therefore the proposed post disaster debris management has given priority for the segregation of the reusable and recyclable materials from the disaster debris in the proposed program sites. The objective is to minimize the costs of reconstruction through the maximum use of the reusable and recyclable materials of the disaster debris vis a vis provisioning of the employment opportunities to the poor communities by involving them in the debris segregation activities.

CHAPTER 6: ENVIRONMENTAL IMPACTS AND MITIGATION

6.1 Impact Identification

In conjunction with the baseline environmental information as described briefly in Chapter IV and elaborated in Annex 4.1, and the potential activities of the debris management operations at the program sites, the environmental impacts were identified using interactive matrix. The identified impacts were then evaluated for without mitigation scenario based on the criteria set by the National Environmental Impact Assessment Guideline gazette of the Government of Nepal in 1993. The factors considered for the impact prediction are; i) direct or indirect nature of the impact, ii) extent or areal coverage of the impact, iii) duration of the impact or the period of time the impacting activity, and iv) the magnitude of the impact considering the severity of the impacts based on judgment value assigned by the team of experts rather than the numerical value. The impact significance is then evaluated taking into consideration the characteristics of the impacts as reversible and irreversible and ease of mitigation in case reversible impacts.

The ***Table 6.1*** below presents the identified environmental impacts for each of the program sites in an interactive matrix signifying the envisaged adverse impacts as low, medium, and high. All of the envisaged impacts are short term impacts occurring within a time frame of 6 to 18 months. The magnitudes of the activities in the program sites are considered to be moderate to high during the debris placement and segregation till the site rehabilitation works. All of the impacts are evaluated to be of reversible nature and the program sites could be rehabilitated to pre-debris management conditions. Care, however, should be focused on the segregation, housekeeping and final disposal management of the hazardous wastes associated with the earthquake debris.

As the ring road debris management sites locate along the primary traffic flow area and connected with a number of external and internal traffic corridors of the valley, debris placement in these sites without consideration of these realities is expected to exert high adverse impacts on the access through obstruction to both vehicular and human traffic.

The Bagmati Corridor sites located by the river banks due to topographic breaks are potential to bank failure due to overloading of the debris material. The envisaged risks are highly adverse and have potential to block and divert the river if proper cares are not taken. Air and noise pollution is likely to be high in all the sites during the debris management period because of the nature of loading, unloading and breaking activities of the debris material. As the surrounding water quality of the recipient rivers is already polluted, the impact on the water quality is less likely to be significant, but care are warranted in the management of hazardous wastes which has potential of polluting the groundwater of the adjoining areas.

Community Health and safety is an issue of concern in most of the program sites because of their location in the middle of the urban dwellings. Further unregulated entry of local communities in search of reusable goods and recyclable materials in the debris management sites increases the risk of exposures to air, noise and other hazardous pollutants. Apart from this accidental risks during loading, unloading and segregation activities of the debris material. Those communities living close to the sites are also exposed to high level of fugitive emissions as well as high noise levels.

Obstruction of storm water drainage, sewer lines or blocking of water supply pipes are the other issues of concern to local community hygiene and health. The problems related to storm water drains and sewer lines will magnify manifold in the event of rains. As Kathmandu experiences high rainfall in the monsoon periods, these issues need specific consideration while managing the debris in the proposed sites. The occupational health and safety is the other issue of concern related to the workforce engaged in the debris management activities including segregation works. The Bagmati Corridor 4 site has a special religious significance for a sect of Newar community. The dead bodies are cremated in these sites and should be given due attention.

Table 6.1: Environmental Impacts of Post Disaster Debris Management in the Program Sites

DEBRIS MANAGEMENT ACTIVITIES	Land Clearance									Debris Placement									Debris Sorting for Reusable and Recycling Materials									Transfer of Segregated Debris to Permanent Sites									Program Sites Rehabilitation/ Restoration								
PROGRAM SITES	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
ENVIRONMENTAL IMPACTS																																												
Physical Environment																																												
Topography/ morphology	N	N	N	N	N	N	N	N	N	M-	M-	M-	M-	M-	M-	M-	M-	M-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	+	+	+	+	+	+	+	+	+
Geology/Soil	N	N	N	N	N	N	N	N	N	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	N	N	N	N	N	N	N	N	N	+	+	+	+	+	+	+	+	+
Hydrology/ Surface runoff	N	N	N	N	N	N	N	N	N	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	L-	L-	L-	L-	L-	L-	L-	L-	L-	+	+	+	+	+	+	+	+	+
Land use Change	N	N	N	N	N	N	N	N	N	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	+	+	+	+	+	+	+	+	+
Erosion/ land instability	N	N	N	N	N	N	N	N	N	H-	H-	H-	M-	L-	L-	L-	L-	M-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	+	+	+	+	+	+	+	+	+
Water Quality	N	N	N	N	N	N	N	N	N	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	+	+	+	+	+	+	+	+	+
Air Quality	N	N	N	N	N	N	N	N	N	H-	H-	H-	M-	M-	H-	M-	M-	M-	H-	H-	H-	M-	M-	H-	M-	M-	M-	H-	H-	H-	M-	M-	H-	M-	M-	M-	+	+	+	+	+	+	+	+	+
Noise Level	N	N	N	N	N	N	N	N	N	H-	H-	H-	M-	M-	H-	M-	M-	M-	H-	H-	H-	M-	M-	H-	M-	M-	M-	H-	H-	H-	M-	M-	H-	M-	M-	M-	+	+	+	+	+	+	+	+	+
Biological Environment																																												
Ecological Degradation	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	L-	+	+	+	+	+	+	+	+	+
Loss of vegetation/Trees	L-	L-	L-	M-	M-	L-	M-	M-	M-	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	+	+	+	+	+	+	+	+	+
Loss of plants of conservation significance	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Loss of wildlife habitat	L-	L-	L-	M-	M-	L-	M-	M-	M-	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	+	+	+	+	+	+	+	+	+
Loss of habitats - fauna of conservation significance	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Socio-economic and Cultural Environment																																												
Resettlement and Rehabilitation of affected communities	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Obstruction to Community Access/traffic	N	N	N	N	N	N	N	N	N	L-	L-	L-	H-	L-	L-	H-	H-	H-	L-	L-	L-	H-	L-	L-	H-	H-	H-	L-	L-	L-	H-	L-	L-	H-	H-	H-	+	+	+	+	+	+	+	+	+
Obstruction to storm waster drainage	N	N	N	N	N	N	N	N	N	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	+	+	+	+	+	+	+	+	+
Obstruction to Sewer lines	N	N	N	N	N	N	N	N	N	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	+	+	+	+	+	+	+	+	+
Obstruction to Water supply lines and dug well	N	N	N	N	N	N	N	N	N	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	+	+	+	+	+	+	+	+	+
Affect to Electrical Lines/ Telecommunication	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	+	+	+	+	+	+	+	+	+
Community Health and Safety	N	N	N	N	N	N	N	N	N	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	L-	L-	L-	L-	L-	L-	L-	L-	L-
Occupational Health and Safety	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	L-	L-	L-	L-	L-	L-	L-	L-	L-
Affect to the nearby Educational and Health Institutions	L-	L-	L-	L-	L-	L-	L-	L-	L-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	M-	L-	L-	L-	L-	L-	L-	L-	L-	L-
Affect to Archeological Sites	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Affect to the Religious and Cultural sites	H-	N	N	L-	L-	N	N	L-	L-	H-	N	N	L-	L-	N	N	L-	L-	H-	N	N	L-	L-	N	N	L-	L-	H-	N	N	L-	L-	N	N	L-	L-	+	+	+	+	+	+	+	+	+
Employment Opportunities	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Resource Recovery																			+	+	+	+	+	+	+	+	+																			

Note:

Program Sites: 1 = Bagmati Corridor 4; 2 = Bagmati Corridor 5; 3= Bagmati Corridor 6; 4 = Ringroad Maharajgunj Chabahil; 5 = Shankha Park; 6 = Oxygenation Park; 7 = Ringroad Balkumari Gwarko; 8 = Ringroad Gwarko Satdobato; 9 = Ringroad Satdobato Ekantakuna

Impacts: - = Adverse impact; and + = Positive impact

***Impact Significance*:** L = Low impact, M = Moderate Impact, H = High Impact, and N = No Impact

6.2 Mitigation Measures

Table 6.1 above provides a synoptic evaluation of the potential adverse impacts of the debris management in the proposed program sites. This section deals with the cost effective and pragmatic measures to avoid, minimize or compensate the envisaged impacts of the post disaster debris management in the program sites. Mitigation measures for each of the identified impacts are described separately in the section below with reference to the program site applicable.

6.2.1 Physical Environment

6.2.1.1 Topography/Morphology

The topography and morphology of the program sites will change considerably due to deposition of the disaster debris. All the program sites will see such changes in topography and morphology of the sites till the completion of the rehabilitation works. The envisaged change is unavoidable and will remain as residual impact till the completion of rehabilitation of the program sites. To minimize the impact of such change following minimization measures will be implemented.

- Deposition of the debris waste shall not exceed more than 3 m for sites 1,2,3,4,7,8, and 9. For sites 5 and 6 the deposition height will be limited to 5 and 6 m respectively.
- All the sites will be rehabilitated to pre-program conditions topographically and morphologically.

6.2.1.2 Geology/Soil

The disaster debris management is not expected to change the overall geological characteristics of the program site grounds. The upper soil layers, however, will be compacted by the load of the debris and movement of machinery. Depending upon the disaster debris chemical constituents, particularly, organic wastes (household solid waste), hazardous wastes (chemical solvents, lubricants, paints, pesticides, batteries, etc) stored at the damaged houses and institutions will contaminate the soil degrading its characteristics. To minimize the impact of debris management on the soil of program sites following measures will be implemented.

- As far as possible segregate and separate the solid waste and hazardous household wastes at the disaster site and transport them separately to the program sites and store these materials in a separate compartment of the site in containers or over the geo-textile liner to contain the leakage to the soil
- Arrange a separate final disposal of the organic and hazardous waste in accordance with the best practice disposal mechanism for the organic and hazardous waste
- Loosen the compacted soil of the program sites to pre-program conditions at the end of the site rehabilitation

6.2.1.3 Hydrology/Surface Runoff

The deposition of the disaster debris on the program sites will bring changes in the surface hydrology due to barrier effect particularly during the monsoon season. The existing water ways/drainages will be modified. The barrier created by the debris across the waterways may even form water pools in front of the debris. Such surface runoff in the monsoon over the debris has possibility of erosion of the debris material and even leakage of the chemical contaminants to the surrounding areas or the recipient water body. To avoid and minimize the impacts following measures will be implemented.

- The natural waterways passing across the program sites will not be used for debris management. A cut off distance of about 2 m will be maintained along the water ways while placing the debris to avoid blockage of the natural water ways
- The compartments used for the storage of the organic and hazardous waste will be covered by thick plastic sheets to avoid contamination of the rain runoff water with the hazardous chemicals

- The formation of water pools in front of the debris management site will be avoided by provisioning suitable channel to conduit the water to the natural water ways.

6.2.1.4 Land Use Change

The change in land use temporarily during the disaster debris management activity is unavoidable. To avoid permanent land use change following measures will be implemented.

- All the unusable and unrecyclable debris material will be transferred to a permanent landfill site, while reusable and recyclable materials will be segregated and sold to the local vendors and needy communities. The inert materials will be utilized as the sub-base material for the earthen roads or filling the depression area.
- The site will be rehabilitated to land use similar to the pre-debris management conditions.

6.2.1.5 Erosion/Land Instability

Erosion and land instability during disaster debris management relates to the load of the debris material, height of the deposited debris material and surface runoff during rainy days. Land instability due to load of the deposited debris is expected at site 1, 2, and 3 (Bagmati Corridor site). The slope break towards the river side is potential for such land failure, if the site is loaded by debris up to the slope break. Failure on the deposited debris is expected if the height of the debris exceeds more than 3 m in the site 1, 2, 3, 4, 7, 8, and 9 provided the outward slopes of the debris exceed 30 degree. Similarly erosion of the deposited debris is expected from the outward sloping surface in the high rain periods. To minimize the impacts of erosion and land instability following measures will be implemented.

- A 3 m cut off distance will be maintained from the edge of the slope break for the deposition of the debris material in site 1, 2, and 3 to avoid ground failure along the edge of the slope break towards Bagmati River
- The height of the debris deposition will be maintained to less than 3 m for sites 1, 2, 3, 4, 7, 8, and 9.
- The outward slope of the deposited debris will be maintained to about 30 degree
- The Ring road sites (4, 7, 8, and 9) will avoid debris deposition in fill and cut areas exceeding slopes around 30 degree and slope length more than 3 m to avoid erosion and failure risk of the deposited debris.

6.2.1.6 Water Quality

The earthquake debris are generally dominated by inorganic inert materials (concrete, bricks, foundations, asphalt, wallboard, glass, rebar, carpets, plastics etc see ***Box 1***) and are

Box 1

- Household items,
- Vehicles,
- Personal possessions,
- Damaged or destroyed buildings, including bricks, broken concrete, reinforcing iron, wood, roofing, electrical wiring and piping,
- Materials from damage to roads, railways and other infrastructure,
- Materials collected in irrigation canals, water ponds,
- Hazardous materials, and,
- Sand, gravel and wood and other vegetative matter related to earthquake disaster

Less likely to produce organic and heavy metal pollutants. But these wastes could be mixed with other organic and hazardous wastes (food, green waste, unused and left over containers of pesticides, solvents, oil, grease, mobiles, paints , asbestos etc.). These wastes have potential of contaminating the land and the surface runoff water passing through the debris material.

The water quality issue from the debris management sites thus relates to contaminated surface runoff from the sites in the event of rainfall and percolation of the contaminated waters of the sites into the groundwater.

The receiving water bodies (Bagmati, Dhobi Khola, Manohara Khola and Tukucha etc) of the Program sites are already heavily polluted by organic wastes and the discharge of the surface runoff from the management sites is not likely to seriously affect the water quality of the receiving water bodies. The groundwater, however, might be impacted due to leaching of the contaminated waters from the debris management sites.

To avoid and minimize the impact of water quality degradation following measures will be implemented.

- Regular municipal solid waste will not be brought to the proposed debris deposition site for management.
- The hospital or health care waste will not be brought to the proposed debris deposition sites
- As far as possible, the organic wastes and hazardous waste will be segregated at the disaster sites and treated separately for the management in the regular landfill site of the Kathmandu valley.
- On site segregation efforts will be made at the debris management sites soon after the off loading of the mixed earthquake debris on the proposed debris management sites
- The segregated organic and hazardous waste will be stored separately in a bonded area with precaution against leakage, runoff contamination as explained in Box 2.
- The collected organic and hazardous waste will be regularly transferred to the municipal landfill for final disposal.
- Formation of water pools inside and outside of the proposed debris management site will not be allowed.

Box 2

- Area should be covered with two layers of plastic sheeting, tarps, or a concrete pad.
- Fence off the area.
- If possible, surround fenced off area with absorbent booms (to absorb any potential leaks) or sandbags (to prevent spills from seeping into the ground).
- Use wooden pallets to raise collection bins off the ground and ascertain potential leaks.
- Provide adequate space for walking/carrying items between pallets.
- Segregate containerized gases, liquids, or solids by material type (e.g. corrosive wastes, reactive wastes). Place each material type in a separate bin or barrel, and label the bin or barrel appropriately.
- Cover collection bins or barrels with plastic liners/lids or cover the entire hazardous waste collection site with a tent to prevent water collecting in bins.
- Cylinders containing compressed gas should be placed upright and be secured.
- Provide sufficient fire extinguishers for the site in case fire breaks out. Four fire

6.2.1.7 Air Quality

Loading, unloading, breaking and segregation of the debris material is likely to generate high level of fugitive emissions, apart from the combustion emissions from the vehicles, equipments and machinery. The program sites ambient air is are already charged with high level of suspended particulate matter. Generation of fugitive emission (suspended particulate matter) will occur throughout the debris management period till the site restoration. Nearly 90% of the suspended particulate matter will be of size above PM_{10} and is expected to settle within few hundred meters from the place of origin. About 10% of the generated particulate matter will be of size less than PM_{10} and is expected to remain in the atmosphere for a longer period. The areas adjoining the debris deposition sites, thus, will have a higher level of particulate emissions with implication on the surrounding air quality and general community and

occupation health of the people. The communities living far off from the sites, however, will have minimal effect due to settling of the larger faction within few hundred meters from the site.

To minimize the impact of such fugitive emissions following measures will be implemented.

- Light water sprinkling of the debris deposition sites, and high segregation activity areas at regular intervals
- Fencing of the debris management sites with corrugated sheet /plastic sheets to a height of 2.5 m to contain surface dispersion of the dusts out of the debris management sites.

6.2.1.8 Noise Level

The vehicular movements, loading and unloading of debris materials, breaking/crushing of debris manually or by machines as a part of segregation for reusable and recyclable material will generate noises. Expected noise levels at the proposed site will vary from 70 to 90 dBA and the average Leq noise level might be around 70 – 75 dBA. The day time Leq noise level in the proposed sites is envisaged to accentuate by about 10 to 20 dBA. This change in noise level in the proposed sites will affect the communities living close to the sites (up to 150 m far from the site boundary).

To minimize the affect of noise level change following measures will be implemented.

- Fencing of the debris management sites with corrugated sheet /plastic sheets to a height of 2.5 m to create a noise barrier and minimize the affect of noise to the communities
- Plan areas for debris deposition and segregation within the sites far from the critical sensitive recipients (schools, hospitals etc, dense residential sites)
- Restrict loading, unloading and segregation of debris only in the day time zone (i.e. 6 hours to 20 hours)

6.2.2 Biological Environment

6.2.2.1 Ecological Degradation

The proposed sites are not the natural ecological sites and represent highly ecologically modified areas within the urban environmental setting. The dusts, noise, and deposition of the disaster debris will further degrade the ecological conditions of the sites. The ecological degradation of the proposed sites is unavoidable; however, control measures on water, air, and noise pollution as proposed above in ***section 6.1.1.6, 6.1.1.7 and 6.1.1.8*** will minimize the ecological degradation to the extent possible in such sites.

6.2.2.2 Loss of Vegetation/Trees

The expected loss of trees species from the sites are presented in ***Chapter 4, Table 4.10***. This is an unavoidable loss, however to minimize the loss of trees from the proposed sites following measures will be implemented.

- Prepare a layout plan for each site as depicted in Chapter 2, Figure 2.11 allocating areas for debris deposition, segregation, vehicle maneuver and storage of segregated wastes
- Identify trees and tag trees for felling requirement to give space for debris management
- The trees at the outer boundary edge and disturbing the management will be avoided from felling

6.2.2.3 Loss of Faunal Habitats

The proposed sites are not the natural habitats of terrestrial fauna. However, a few of the avian species adjusted with the urban environment (noise and pollution) do have nests in the trees. The felling of the trees will impact these avian species. Since these species are highly resilient species, the loss of the trees with nest is not considered to have a serious implication in their habitats. Further these species are not the species of conservation significance. The loss will be residual impact of the program activities.

6.2.3 Socio-economic and Cultural Environment

6.2.3.1 Obstruction to Community Access/Traffic

The Ringroad sites (Site 4, 7, 8, 9) of nearly 50 m width including the central road, green belts and the inner roads is proposed for debris management. Since Ring road is the traffic life line of Kathmandu, closer of the Ringroad for debris waste management is inconceivable. Further the Ringroad is crossed by a number of motorable access roads (refer ***Chapter 2, Table 2.2 and Figure 2.5, 2.8, 2.9 and 2.10***). These access roads are the main entry and exit points from the Ringroad (the main vehicular traffic corridor of Kathmandu) to the communities living inside and outside of the Ringroad. Deposition of debris in these sites with no consideration of these motorable access points will not only obstruct the traffic into the Ringroad but will also have serious implication in the people's mobility and access to their properties, residence and work place. To avoid these impacts following measures will be implemented.

- The Ringroad central road section shall not be used for debris management and will be opened at all times for the vehicular traffic
- Only sections of the Green belt shall be used for disaster debris management
- Intersections of the entry motorable access will be avoided for debris management. A set off distance of about 3 m from the intersection's outer boundary line will be maintained at all times to allow free movement of vehicular ad human traffic.
- The inner side roads (motorable/non-motorable) at the outer periphery of the Ring Road green belt will be avoided for debris management. A set off distance of 3.5 m will be maintained at all time from the center line of the inner road to allow free and safe movement of vehicular and human traffic.
- For the sites (Site 1, 2, and 3), a set of distance of 3.5 meter will be left on the inner side of the sites (opposite river bank side) to allow free and safe movement of vehicular and human traffic.

6.2.3.2 Obstruction to storm water drainage

The proposed sites for disaster debris management sites have a number of storm water drainage lines across or adjacently parallel to the site. ***Chapter 4, Table 4.17*** lists the numbers of such storm water drainages in the different program sites. ***Annex 4.1*** presents the GPS locations and photographic records of such storm water drainages. Unmindful deposition of the debris and their segregation has potential of obstruction of these storm water drainages with serious implication on the public health through formation of chess pools and preparing grounds for the breeding of the pest vectors of different diseases. To avoid such unhygienic and poor sanitary situation following measures will be implemented.

- A set off distance of 3 m shall be maintained from the boundary line of open storm water drainages for the deposition of the disaster debris.
- Accidental fall of debris material in the open storm water drainage will be cleared regularly to allow free flow of water from the drainage system
- Underground crossing sections of the storm water drainage will be avoided for thick debris deposition

6.2.3.3 Obstruction to Sewer lines

The proposed sites for disaster debris management sites have a number of sewer lines across or adjacently parallel to the site. ***Chapter 4, Table 4.17*** lists the numbers of such sewer lines in the different program sites. ***Annex 4.1*** presents the GPS locations and photographic records of such sewer lines. Unmindful deposition of the debris and their segregation has potential of obstruction of these sewer lines with serious implication on the public health through formation of chess pools and preparing grounds for the breeding of the pest vectors of different diseases. To avoid such unhygienic and poor sanitary situation following measures will be implemented.

- A set off distance of 3 m shall be maintained from the boundary line of open sewer lines for the deposition of the disaster debris.
- Accidental fall of debris material in the open sewer line will be cleared regularly to allow free flow of sewage

- An investigation of the underground sewer lines will be made to understand the layouts of such lines within the site boundary
- Underground sections of the sewer will be avoided for thick debris deposition

6.2.3.4 Damage to Water supply lines and dug well

The proposed sites for disaster debris management sites have a number of water supply lines across or adjacently parallel to the site. ***Chapter 4, Table 4.17*** indicates presence of underground water supply lines in the different program sites. Apart from this there are few tap stands, dug wells, and water springs in some of the sites under use by the communities. The GPS location and photographic records of the dug well, tap stands, and water springs are presented in Annex 4.1 for the different sites. Since establishment of water supply is the first priority in the post disaster period to provide relief to people sufferings, special attention on this is a priority action item of the relief team. Unmindful deposition of thick mass of debris has potential of damage to the water supply lines with serious implication on water availability situation and on the public health. To avoid such damage to the water supply lines following measures will be implemented.

- An investigation of the underground water supply lines and their depth from the surface will be made to understand the layouts of such lines within the site boundary
- Thick deposition of the debris material above such lines will be avoided as far as possible
- Set of distance for the tap stands, dug well and the water springs shall be maintained at all time to provide access to the local communities for local water resources.

6.2.3.5 Affect to Electrical Lines/Telecommunication

The proposed sites for disaster debris management have a number of electrical and telecommunication poles within the sites. ***Chapter 4, Table 4.17*** lists the numbers of such poles in the different program sites. ***Annex 4.1*** presents the GPS locations and photographic records of electrical and telecommunication poles. The GPS location and photographic records of the electrical and telecommunication poles are presented in ***Annex 4.1*** for the different sites. Since establishment of electrical and communication system is the first priority in the post disaster period to provide relief to people sufferings, special attention on this regard is priority action item of the pre-disaster preparedness team. To provide space for the debris management in the proposed sites without interfering with the electrical and communication systems of the area in the post disaster period following will be implemented in the pre-disaster preparedness period.

- All the electrical and telecommunication poles located within the proposed sites are relocated at the boundary lines of the proposed site so as to keep the place open for disaster debris management.

6.2.3.6 Community Health and Safety

The proposed program sites are the sites of disaster debris management and involve heavy vehicular traffic movements loaded with the diverse kinds of debris materials. Further within the sites the debris materials will be segregated using diverse kinds of equipments and machinery. The loading, unloading operations including breaking and crushing of the debris materials generates fugitive dusts and high level of noises. Presence of potentially hazardous materials also poses the risk of contamination of the dust, water sources and land within and around the program sites. Obstruction or damage to storm water drainage systems, sewers, water supply pipes passing across or adjacent to the program sites is the other concern related to public utility services. All of the above are the issues related to the health and safety risks to the communities living close to the sites. To safeguard the nearby communities from the health and safety risks of the program site operations following measures will be implemented.

- Fence the program areas to restrict trespassing of the program sites by the local communities
- Implement fugitive dusts control measures
- Implement noise control measures

- Implement measures to avoid obstruction or damage to the storm water drainage systems, sewer lines, and water supply lines in and around the program sites
- Avoid formation of chess pools of water in and around the program sites
- Instruct the drivers involved in the debris transportation to restrict speed and other traffic safety measures at all time of operation
- Conduct awareness program to the local communities on issues of community health and safety related to the program operations including trespassing of the program sites, playing and toiling around the program sites, unauthorized use of the debris materials etc.

6.2.3.7 Occupational Health and Safety

Occupational health risks to the workers and operators involved in the waste management and segregation operation in the program sites relates to direct contact with waste comprising angular and sharp edge debris of diverse kinds including hazardous wastes such as asbestos, pesticides, oils and solvents, exposures to high noise and dust levels, working close with the heavy equipments, electrical appliances etc. This is one of the key concerns related to health and safety of the occupational workers and need proper attention. To avoid and minimize the impacts on occupational health and safety following measures will be implemented.

- Workers and operators of the program sites will be provided trainings on the potential occupational health and safety risks working within the program area prior to engaging the workers.
- The workers will be provided with Personnel Protective Equipments (such as helmets, shoes, gloves, eye glass, air masks, ear muffs, etc) as to the requirement of the work of the occupational workers.
- Special training will be provided to the workers dealing with the debris breaking, handling, and segregating the materials using equipments and electrical appliances for the safe use of the equipments, and the personnel protective equipments
- The danger sings shall be placed in areas involving risks of contamination and electrical or other high degree hazards. Such areas will be cordoned off for the entry to the unauthorized workers.
- Use of protective equipments by all the workers at all time of the work will be strictly monitored. The workers neglecting the use of protective equipment will not be allowed with the program sites.

6.2.3.8 Affect to the nearby Educational and Health Institutions

All of the proposed program sites have some educational or health institutions close to them (refer ***Chapter 4, Table 4.18***). Particularly dust and noise generated from the program sites will be nuisance to these institutions. To minimize the impacts following measures will be implemented.

- Implement measures to minimize the dusts
- Implement measures to minimize the nose level
- Layout planning of the loading/unloading and segregation areas with high dust and noise away from the institutions
- Advise the educational and health institutions to close the windows and doors facing towards the program sites

6.2.3.9 Affect to the Religious and Cultural sites

Chapter 4, Table 4.17 lists the religious and cultural sites within the different program areas. The GPS location and the photographic records of these sites are presented in ***Annex 4.1.*** These sites have a spiritual and sentimental attachment with the local communities of the area. Even if these sites are damaged by the earthquake disaster, will remain as the sites of people's feelings and spiritual attachment. To minimize the impact related to these sites following measures will be implemented.

- The cremation sites and temple sites will not be used for debris deposition.
- A set of distance will be maintained to these sites with a passage for the communities to offer their prayers and cremation of bodies as required.

- These sites will be restored in parallel with the debris management operations

6.2.3.10 Employment Opportunities

One of the major issues with the disaster hit communities, particularly the poor and destitute, is the loss of work opportunities. The proposed program site activities provide job opportunities to such peoples in the site clearance of program sites, debris loading unloading operations, debris segregation, and site restoration. To further enhance this positive issue, the program site operators will implement the followings.

- Establish a policy to employ the poor and destitute people of the adjoining areas to restore livelihood of these people in the post disaster period
- Enforce this policy on all the activities of the program sites by incorporating the provision on the contract document of private contractor or the public office
- Regularly monitor the provision implementation by the involved partners

6.2.3.11 Resource Recovery

Earthquake Disaster wastes also presents opportunities. It contains valuable material such as concrete, steel, and timber as well as other valuables. This value can be realized as either a source of income or as a reconstruction material, and reduce burdens on natural resources that might otherwise be harvested for reconstruction.

The proposed segregation of the disaster debris provide opportunity to recover these materials for better use which otherwise will be wasted. The debris collection and segregation works, however, may face legal challenges due to ownership and access issue.

The debris even after the disaster has some value and is the property of the owner. The owners may want to retain ownership of the debris because of its value. Debris management authorities should ensure that debris items with value remain accessible to the owner. The owner should be compensated at fair market value for the items which are taken and used for another purpose (e.g., bricks from damaged buildings which could be used for road sub-surface). It is therefore, this issue of ownership and compensation needs to be planned out in advance of debris removal. Disaster survivors needs to be consulted prior to debris removal and should come to an agreement on how to compensate the value of debris material.

Even after the disaster, it is not acceptable to enter private property and remove items without permission of owner. For post disaster debris management, debris collection from the disaster area needs intrusion onto private property, including the removal and disposal of personal possessions. The disaster debris management authorities need prior consultation with the disaster survivors to avoid legal conflict and establish procedures for debris clearance including handling of valuables and personal possession which may have sentimental value.

CHAPTER 7: ENVIRONMENTAL MANAGEMENT PLAN

7.1 Background

This Environmental Management Plan (EMP) has been prepared for the Post Disaster Debris Management Program Sites to set out environmental management requirements and to develop procedures to ensure that all mitigation measures and monitoring requirements specified in this Environmental Assessment (EA) study report will be carried out in subsequent stages of Post Disaster Debris Management (PDDM). This plan covers structures of the Environment Unit (EU) of the Post Disaster Debris Management Office (PDDMO) and main roles and responsibilities of the parties involved in all phases of PDDM.

This EMP is based on the review of experiences of previously operated PDDM of similar nature elsewhere and findings of the EA study in conjunction with Government of Nepal Act, Regulations and Guidelines relevant to the PDDM.

7.2 Objectives of the EMP

The basic objectives of the EMP are to:

- Formulate PDDM activities in particular the implementation of EMP;
- Formulate a monitoring program for baseline, impact and compliance monitoring; and
- Formulate an environmental auditing program to be implemented after PDDM operations

7.3 Statutory Requirements

7.3.1 Environmental Legislation

The Environmental Protection Act and Environmental Protection Rules is the main umbrella Act and Rules in Nepal, which covers environmental aspects related to PDDM. The MoSTE is the lead agency, which administers the environmental matters emphasizing on environmental conservation and management through internalizing environmental assessment, pollution control and prevention, conservation of natural heritage sites, compensation for environmental damages etc. However, there are several other policies, guidelines, acts and rules which relate to PDDM and should comply with the provisions by the involved parties during the period. The relevant Government of Nepal legislation and government policies and guidelines affecting and applicable to the PDDM are listed below:

- Interim Constitution of Nepal 2007 (2064 BS)
- Environment Protection Act 1997 (2053 BS),
- Environment Protection Rule 1997 (2054 BS) as amended
- Natural Calamity (Relief) Act. 1982 (2039 BS)
- Solid Waste Management Act 2011
- Nepal Water Supply Corporation Act, 2046 (1989),
- Water Resources Act 1992 (2049 BS)
- Water Resources Regulations 1993 (2050 BS)
- Ancient Monument Protection Act 1956 (2013 BS)
- Local Self Governance Act 19989 (2055 BS)
- Local Self Governance Rules 1999 (2056 BS)
- Labor Act 1991 (2048 BS)
- Aquatic Animal Protection Act 1961 (2017 BS)

7.3.2 Environmental Standards

There are very few environmental standards endorsed by MoSTE and other GoN line agencies. Except for vehicular emissions standards and tolerance limits for inland effluent discharge, most of the

environmental pollution standards, are in the formulation process. Considering the above situation following environmental standards are proposed for PDDM. These environmental standards shall be treated as other acts and regulations until GoN enforces standards in the specified sector for the project environmental compliance propose.

Table 7.1: Standards for Effluents Discharged into Inland Waters from the PDDM Sites

SN	Parameters	Tolerance Limits
1.	Total Suspended solids, mg/L, Max	30-200
2.	Particle size of total suspended particles	Shall pass 850-micron Sieve.
3.	pH	5.5 to 9.0
4.	Temperature	Shall not exceed 40 degree C in any section of the stream within 15 meters down-stream from the effluent outlet
5.	Biochemical oxygen demand (BOD) for 5 days at 20 degree C, mg/L, Max	30-100
6.	Oils and grease, mg/L, Max	10
7.	Phenolic compounds, mg/L, Max	1
8.	Cynides (as CN), mg/L, Max	0.2
9.	Sulphides (as S), mg/L, Max	2
10.	Radioactive materials:	
11.	a. Alpha emitters, c/ml, Max	7 OCT
12.	b. Beta emitters, c/ml, Max	8 OCT
13.	Insecticides	Absent
14.	Total residual chlorine, mg/L	1
15.	Fluorides (as F), mg/L, Max	2
16.	Arsenic (as As), mg/L, Max	0.2
17.	Cadmium (as, Cd), mg/L, Max	2
18.	Hexavalent chromium (as Cr), mg/L, Max	0.1
19.	Copper (as Cu), mg/L, Max	3
20.	Lead (as Pb), mg/L, Max	0.1
21.	Mercury (as Hg), mg/L, Max	.01
22.	Nickel (as Ni), mg/L, Max	3
23.	Selenium (as Se), mg/L, Max	0.05
24.	Zinc (as Zn), mg/L, Max	5
25.	Ammonical nitrogen, mg/L, Max	50
26.	Chemical Oxygen Demand, mg/L, Max	250
27.	Silver, mg/L, Max	0.1

Source: Standards adopted from MOSTE

Table 7.2: Drinking Water Quality Standards for PDDM Sites

SN	Parameters	Desirable Limits	Maximum Tolerable Limit
1.	Colour, Hazen units, Max	10	15
2.	Odour	Unobjectionable	
3.	Taste	Agreeable	
4.	Turbidity, NTU, Max	5	10
5.	Total Dissolved Solids, mg/l , Max	500	1500
6.	pH value	6.5 – 8.5	May be relaxed up to 5.5 on the lower and up to 9 on higher side.
7.	Total Hardness (as $CaCO_3$) mg/l, Max	250	
8.	Calcium (as Ca), mg/l, Max	75	
9.	Magnesium (as Mg), mg/l, Max	30	
10.	Copper (as Cu), mg/l, Max	1	may be extended upto 1.5
11.	Iron (as Fe), mg/l, Max	0.3	
12.	Manganese (as Mn), mg/l, Max	0.1	may be extended upto 0.5
13.	Chlorides (as Cl), mg/l, Max	250	
14.	Sulphate, (as SO_4), mg/l, Max	150[2]	

[1] Value for turbidity is 5 in FAR(for mineral water), PFA, BS, WHO

SN	Parameters	Desirable Limits	Maximum Tolerable Limit
15.	Nitrate (as NO_3), mg/l, Max	45	No relaxation
16.	Fluoride (as F), mg/l, Max	1.5	
17.	Phenolic compounds, (as C_6H_5OH), mg/l, Max	0.001	May be relaxed upto 0.002
18.	Mercury (as Hg), mg/l, Max	0.001	No relaxation
19.	Cadmium (as Cd), mg/l, Max	0.01	No relaxation
20.	Selenium (as Se), mg/l, Max	0.01	No relaxation
21.	Lead (as Pb), mg/l, Max	0.01	No relaxation
22.	Arsenic (as As), mg/l, Max	0.05	No relaxation
23.	Cyanide (as CN), mg/l, Max	0.05	No relaxation
24.	Chromium (as Cr^{6+}), mg/l, Max	0.05	No relaxation
25.	Residual free Chlorine, (as Cl), mg/l, Min	0.2	
26.	Ammonia, mg/l, Max	1.5	
27.	Aluminium, mg/l, max	0.2	
28.	Boron mg/l, max	0.3	
29.	Nickel, mg/l, max	0.02	
30.	Hydrogen sulphide, mg/l, max	0.1	
31.	Zinc, mg/l, max	3	

Source: Standards adopted from Department of Water Supply & Sewerage

Table 7.3: Ambient Air Quality Standards in the adjoining Areas of PDDM sites

Parameters	Units	Averaging Time	Concentration in Ambiant Air, maximum
TSP (Total Suspended Particulates)	$\mu g/m^3$	Annual	-
		24-hours*	230
PM_{10}	$\mu g/m^3$	Annual	-
		24-hours*	120
Sulphur Dioxide	$\mu g/m^3$	Annual	50
		24-hours**	70
Nitrogen Dioxide	$\mu g/m^3$	Annual	40
		24-hours**	80
Carbon Monoxide	$\mu g/m^3$	8 hours**	10,000
		15 minute	100,000
Lead	$\mu g/m^3$	Annual	0.5
		24-hours	-
Benzene	$\mu g/m^3$	Annual	20****
		24-hours	-

Source: National Ambient Air Quality Standards adopted from MoSTE

**Note: 24 hourly values shall be met 95% of the time in a year. 18 days per calendar year the standard may be exceeded but not on two consecutive days.*

***Note: 24 hourly standards for NO_2 and SO_2 and 8 hours standard for CO are not to be controlled before MOPE has recommended appropriate test methodologies. This will be done before 2005.*

*****Note: To be re-evaluated by 2005.*

Table 7.4: Emissions Standards for PDDM 'in-use' Vehicles

Fuel	Wheelers Type	Manufacturing Date	Emissions
Petrol	Four-Wheelers	Up to 1980	• 4.5% CO • 1,000 ppm HC*
	Four-Wheelers	After 1981	• 3.0% CO • 1,000 ppm HC*
	Three-Wheelers	Up to 1991	• 4.5% CO • 7,800 ppm HC*
	Three-Wheelers	After 1991	• 3.0% Co • 7,800 ppm HC*

[2] Value for Sulphate BS:200, FAR(for mineral water) and PFA:250

Fuel	Wheelers Type	Manufacturing Date	Emissions
	Two-Wheelers		• 4.5% CO • 7,800 ppm HC*
Diesel	-	Up to 1994	• 75 HSU
		After 1994	• 65 HSU
LPG/CNG	All categories		• 3.0% CO* • 1,000 ppm HC*

Source Nepal Gazette, BS 2054-9-8, Ministry of Works and Transport

** Nepal Gazette, BS 2057-7-7, Ministry of Population and Environment*

CO – carbon monoxide; HC – Hydrocarbon; HSU – Hertridge Smoke Unit

Table 7.5: Proposed Noise Exposure Limits for the Work Environment PDDM Sites

(Adopted from Occupational Safety and Health Administration (OSHA).

SN	Noise Exposure (dBA)	Permissible exposure (Hours and Minutes)
1.	85	16 hrs.
2.	87	12 hrs. –18 min.
3.	90	8 hrs.
4.	93	5 hrs – 18 min.
5.	96	3 hrs.-30 min.
6.	99	2 hrs. – 18 min.
7.	102	1 hr. – 30 min.
8.	105	1 hr.
9.	108	40 min.
10.	111	26 min.
11.	114	17 min.
12.	115	15 min.
13.	118	10 min.
14.	121	6.6 min.
15.	124	4 min.
16.	127	3 min.
17.	130	1 min.

Source: Marsh, 1991.

Table 7.6: Proposed Average Equivalent Sound Levels Recommended to Protect the Public Health and Welfare of the Surrounding areas of PDDM Sites

S.N.	Land Use	Measure	To Protect Against Activity Interference and Hearing Loss Effects (dBA)
1.	Residential including farm residences	Leq (24)	55
2.	Commercial	Leq (24)	70
3.	Hospitals	Leq (24)	55
4.	Industrial	Leq (24)	70
5.	Educational	Leq (24)	55
6.	Recreational Areas	Leq (24)	70
7.	Farmland and general unpopulated land	Leq (24)	70

Source: U.S, Environmental Protection Agency, 1974

Note: Leq (24) = Equivalent Sound Level in decibels for 24 hours.

7.3.3 Environmental Permits and Approvals

Permits and Approvals relevant to the PDDM sites are presented in ***Table 7.7*** below.

Table 7.7: Permits and Approvals Required

Issues	Authority	Approval and permits
Environmental Impact Assessment Reports and Environmental Management Plans	Ministry of Environment, science and Technology	Approval
Site Occupation for PDDM	Department of Roads /Kathmandu and Lalitpur municipality - For site 4, 7, 8, and 9 Kathmandu Municipality – Sites 1, 2, 3, 4 and 5 Kathmandu Upatyaka Kanepani Limited (KUKL) – Site 6	Approval and Permit
Tree clearing and Government owned land	Department of Roads; KUKL , Kathmandu and Lalitpur Municipality and District Forest office Kathmandu and Lalitpur	Approval and permits
Restoration of cultural and religious sites	Kathmandu and Lalitpur Municipalities and Department of Archaeology	Approval
Relocation or restoration of infrastructures	Electric and Telecommunication Poles – Nepal Electricity Authority and Nepal Telecommunication Storm water drains , Sewers and Water supply lines – Department of Water supply and Sewerage and KUKL	Approval

7.4 Project Environmental Management Framework

7.4.1 Project Environmental Management Plan Structure and Stakeholders Responsibility

The PDDM Environmental Management Framework is prepared to shows linkages with different parties to be involved directly or indirectly during the different phases of PDDM operation in compliance with the existing Act and Rules.

Overall PDDM environmental management is the responsibility of PDDMO. Key stakeholders including PDDMO, to be involved for project environmental management in the hierarchy order are:

- National Commission for Disaster Risk Management (NCDRM)
- National Authority for Disaster Risk Management (NADRM)
- Municipal Authority for Disaster Risk Management (MADRM)
- Post Disaster Debris Management Office (PDDMO)
- Post Disaster Debris Management Contractors (PDDMC)
- Non Government Organizations (NGOs), Community Based Organizations (CBOs), Media etc.

Since heads of the different Ministries, administrative heads of the Ministries (Secretaries), and heads of security institutions (Military and Police) are members of the NCDRM are envisaged to provide their inputs to NCDRM for PDDM issues and are not listed separately as key stakeholders. Likewise, all the departmental heads of the technical line institutions of the GON are the members of the NADRM they are also not listed as separate stakeholders.

Considering the capacity and strength of the institutions involved in the disaster risk management at the central and local levels, outsourcing of the competent consultants/individuals in the PDDMO is envisaged, particularly for the management of Environmental Unit (EU) under PDDMO. The limited human resource available in the Municipal Environmental Unit and Municipal Solid Waste Management Section could not be effectively utilized for PDDM as they will also have to perform the regular daily works related to MSWM. Besides, the available human resource is not well versed with the environmental management of the post disaster debris.

Currently, the municipalities are carrying the MWSM by themselves in the Kathmandu valley. In the event of disaster, the resources available with MSWM sections will not be sufficient to effectively manage the post disaster debris. It is therefore PDDMO need to hire contractors for PDDM.

The main roles and responsibilities of different stakeholders in the various phases of PDDM preparedness, implementation and restoration are briefly presented below:

7.4.1.1 National Commission for Disaster Risk Management (NCDRM)

- Endorse/Approve policies and plans on PDDM
- Arrange/oversee provision of government funds for PDDM, preparedness, and response
- Arrange oversee provisions of funds and technical assistance for PDDM from bi-lateral, sub-regional, regional and international cooperation

7.4.1.2 National Authority for Disaster Risk Management (NADRM)

- Forward policies and plans on PDDM for endorsement from NCDRM
- Review of PDDM preparedness Plan and Environmental Management Plan prepared by the Local levels DRM institutions
- Facilitate, guide and monitor preparedness for PDDM at National, District and Local Levels
- Assist establishment and operation of Emergency Operation Center (EOC) at Local levels with needed financial, equipment and logistic supports to carryout PDDM in the event of the disaster
- Review and approve guidelines, standards for PDDM, SOPs, training curricula for pre and post PDDM prepared by Local DRM institutions
- Maintain close coordination and communication with other govt. agencies, UN agencies, donors and other stakeholders for PDDM funding and technical assistance to the Local DRM institutions
- Regularly supervise and monitor the Pre- and Post DDM activities of local level DRM institutions

7.4.1.3 Municipal Authority for Disaster Risk Management (DADRM)

- Review PDDM preparedness and implementation plan prepared by PDDMO in coordination with the Municipal DRM Unit, Municipal Environmental Unit and MSWM Section and get approval from the concerned authorities
- Review guidelines and standards for PDDM for local level prepared by PDDMO and get approval from concerned authorities
- Assist PDDMO in the establishment and operation of Emergency Operation Centers (EOC) equipped with required equipments, logistics for PDDM
- Undertake prior Approval and Permits of the PDDM sites
- Establish a PDDMO with members from Municipal Disaster Reduction Unit (MDRMU) and Municipal Solid Waste Management Unit (MSWMU)
- Secure required funding and personnel for PDDMO

7.4.1.4 Post Disaster Debris Management Office (PDDMO)/Environmental Unit (EU)

- Formulate PDDM preparedness and implementation plan with layouts on each program sites and get approval from the concerned authorities
- Prepare guidelines and standards for PDDM for local level and get approval from concerned authorities
- Conduct education, training and public awareness programs on PDDM preparedness and management
- Undertake prior precautionary measures to keep the open space identified and approved by the concerned authority free of obstruction for PDDM
- Appoint PDDMC for the PDDM on different Program sites and provide needed training on the environmental issues of PDDM
- Ensure the provisions of EMP are adequately incorporated in the contract document of the PDDMC
- Establish a Environmental Unit (EU) and designate the following responsibility to the EU

    - Provide environmental trainings to the concerned staffs of PDDMO, PDDMC on their roles and responsibilities for effective environmental management in the PDDM cycle
    - Assess the post-disaster debris situation and determine:

a) Types of debris involved, e.g., household items, vehicles, personal possessions, bricks, broken concrete, reinforcing iron, wood, roofing, electrical wiring and piping, vegetative matter, other types of waste.
b) Presence of hazardous materials, by type.
c) Quantities (volumes) of different types of materials by area

- Determine whether debris processing will take place at the site of collection or will debris be transported to program sites for processing
- Determine whether processing will be done through labor intensive, machine intensive or a combination of methods
- Determine levels of compensation to be paid for debris processed on the program sites and how this compensation will be paid.
- Determine Program sites for the transportation of debris material from the disaster area and give orders to the PDDMC to initiate management operations at the program sites
- Update Issue Based Management Plans (IMPs) regularly in the PDDM cycle
- Review the Site Based Management Plans (SMPs) prepared by PDDMC and give approval for implementation
- Undertake required supervision and monitoring as per the EMP including legal compliance requirements of the PDDM operations of the contractor on daily, weekly and monthly basis as required
- Provide corrective actions on the non-compliance issues to the contractors with date for compliance
- Keep records of supervision and monitoring
- Prepare bi-monthly monitoring reports for review

7.4.1.5 Post Disaster Debris Management Contractors (PDDMC)

- Formulate SMPs incorporating the requirements of IMPs and get approval from PDDMO/EC
- Providing environmental training to all staff and sub-contractors, to ensure personnel have a clear understanding of environmental requirements relevant to their scope of work and can meet their environmental responsibilities;
- Surveying and pegging of the allocated Program site/s
- Executing PDDM activities in accordance with the measures set out in this EMP and any additional measures required to meet PDDMP approval and permit conditions and other statutory requirements
- Regularly maintaining environmental protection measures on the Program site/s;
- Participating in and assisting with EU site inspections and audits, and following EU's directions to ensure that all works are conducted to specified standards;
- Environmental monitoring, recording and reporting as specified in the EMP
- Implementing corrective actions as directed by the EU, PDDMO, DADRM, NADRM and any other government agency with legislative responsibilities; and,
- Maintaining an environmental management system (EMS) in full compliance with the International Organization of Standardization standard 14001 (ISO 14001).

7.4.1.6 Non Government Organizations (NGOs), Community Based Organizations (CBOs), Media etc

The role of national and local NGOs and media in the preparedness and post disaster period for the PDDM is crucial. They can act as bridging medium between the local communities and the PDDMO. Community's role for the smooth PDDM implementation is very important. Active community participation in all the phases of PDDM is fundamental for the effective environmental management. The interaction and feedback of the local communities in the EA process has provided feedback for the preparation of this EMP framework. Further interactions with the local communities to involve them in the strengthening of the EMP as the PDDM progresses will be of added value. It is therefore consultation will continue

throughout the PDDM operation periods to solicit the concerns of communities. The EU in coordination with the national and local NGOs, CBOs and Media will arrange the venue and timings to meet regularly with the community forum and update the EMP as required addressing the concerns of the local communities.

7.5 Environmental Planning

To guide and control the site environmental integrity, environmental management plans are designed in three levels as under:

1. Environmental Management Plan (EMP) – incorporates the overarching guiding principles, measures and procedures guiding the project environmental management
2. Issue based Management Plans (IMP) – incorporates measures and procedures within the overarching guiding principles for the management of specific environmental issues
3. Site based Management Plans (SMP) – incorporates site specific management measures within the framework of IMP and EMP

7.5.1 Environmental Management Plan (EMP)

The EMP has an overall objective to maintain highest degree of environmental and social performance during PDDM cycle and will be guided by the following principles and procedures.

- Fulfill all environmental and social conditions associated with PDDM EA approvals;
- Develop, promote, and foster a shared sense of responsibility for environmental and social performance of the PDDM;
- Promote environmental awareness and understanding among employees and contractors through training, define stakeholders roles and responsibilities towards environmental and social management and linking project performance to overall environmental performance;
- Encourage an understanding of social and cultural sensitivities of local communities and the importance of minimizing PDDM impacts on local lifestyles and culture;
- Establish best practice environmental management standards and guidelines to control if not possible minimize, and mitigate potential environmental harm for each PDDM activity undertaken
- Promote improved environmental and social performance through the effective use of management systems
- Monitor environmental and social performance throughout the PDDM and implement an adaptive management approach for continuous improvement;
- To ensure that grievances from affected communities and stakeholders are responded to and managed appropriately,
- Work with local communities to ensure that they benefit as a result of PDDM; and
- Regularly disseminate PDDM related information, continue consultations with stakeholders, and involve them throughout all phases of the PDDM;

This EMP provides a single-source, overarching environmental framework for all implementing parties, government agencies and stakeholders.

7.5.2 Issue Based Management Plans (IMPs)

Issue Management Plans (IMPs) are the supporting plans to overall EMP. The IMPs includes required mitigation measures for each of the issues in Chapter VI of this EA report, which includes:

- Topography/Morphology
- Geology/Soil
- Hydrology/Surface Runoff
- Land Use Change
- Erosion/Land Instability

- Water Quality
- Air Quality
- Noise Level
- Ecological Degradation
- Loss of Vegetation/Trees
- Loss of Faunal Habitats
- Obstruction to Community Access/Traffic
- Obstruction to storm water drainage
- Obstruction to Sewer lines
- Damage to Water supply lines and dug well
- Affect to Electrical Lines/Telecommunication
- Community Health and Safety
- Occupational Health and Safety
- Affect to the nearby Educational and Health Institutions
- Affect to the Religious and Cultural sites
- Employment Opportunities
- Resource Recovery

Table 7.8 presents the IMP in matrix format including the envisaged impacts, required mitigation action, individual or agency responsible, national standards and guidelines, timing of actions, responsible authority, and tentative financial requirements. The IMPs will be updated by the PDDMO/EU from time to time, in response to government requirements or to clarify management responsibilities, planning, permits and approvals, mitigation measures, and monitoring and reporting procedures. These IMPs will provide the reference to PDDMC for the preparation of Site Management Plans (SMPs).

7.5.3 Site Management Plans (SMPs)

In compliance with the principles and measures stipulated in this EMP and IMPs PDDMC will prepare SMPs for each program sites. Each SMPs shall contain a layout map(s) of the program sites and provide the descriptions with indication on maps on the followings:

- Debris unloading, segregation, storage, marketing and site restoration activities and associated works that will occur over the PDDM cycle;
- Environmental features that have the potential to be impacted by above activities; and,
- The environmental mitigation measures that will be implemented over the duration of PDDM cycle and illustrate these on a plan(s);

Depending on the program sites, environmental issues therein, and the activities to be undertaken, the level of details in the SMPs will vary from site to site. The SMPs will normally include the following sub-components.

- Traffic Management Plan
- Erosion and Sediment Control Plan;
- Air, Water and Noise Pollution Control Plan
- Storm Water Drainage, Sewer, and Water Supply Management Plan
- Community Health and Safety Management Plan
- Occupational Health and Safety Management Plan
- Site Rehabilitation/Restoration Plan

The SMPs may be revised as the PDDM works progress to include the unforeseen measures. Each SMPs shall contain a Pre-Commencement Checklist that will be completed by the PDDMC and reviewed by the PDDMO/EC prior to the start of activities being permitted to commence on that site. Each SMPs shall be submitted to the PDDMO/EC at least two days prior to the proposed commencement of site activities. The PDDMC must obtain a formal Notice to Proceed for each site from the PDDMO/EC before

commencement of operations. Each SMPs will also contain a Record of Mitigation Measures, summarizing the measures contained in the plan that shall be used as a checklist.

7.6 Site Supervision, Environmental Monitoring and Auditing, Record Keeping and Reporting

7.6.1 Site Supervision

The PDDMO/EC will conduct regular site supervision of all the PDDM sites on daily basis and observe and report the activities of the PDDMC particularly relating to environmental compliance.

If any activities are not being undertaken in accordance with the contract and EMP conditions, the PDDMC shall be instructed by the PDDMO/EC through a note on the site specifying corrective measures and through formal letter the next day to rectify the situation.. The PDDMO/EC shall undertake a follow-up inspection to ensure that it has been rectified individually or jointly with PDDMC.

7.6.2 Environmental Monitoring and Auditing

Front line internal monitoring of its operations is the responsibility of the PDDMC. It will record all of its activities including application of mitigation activities as specified in the IMPs and SMPs.

Apart from this, PDDMO/EC will conduct regular ***external environmental monitoring*** during PDDM cycle to provide baseline data, confirm project compliance and to detect any adverse impacts/non-compliances. The focus of this routine external environmental monitoring by PDDMO/EC will be to ensure strict compliance with management plan provisions during PDDM cycle and to minimize the direct and indirect PDDM environmental impacts including unforeseen impacts. ***Table 7.8*** summarizes the monitoring measures.

Table 7.8: Environmental Monitoring Indicators

Feature / Issue	Methods and Scope	Parameter	Location	Front line Responsibility	Time /Frequency
Prior PDDM Phase (Baseline monitoring)					
Air Quality	Air quality monitoring by air quality samplers	TSP and PM 10	One site for each Program site, The monitoring site will be located at least 50m away from the program site boundary	EC	once
Noise Level	Noise level meters	dBA	One site for each Program site, The monitoring site will be located at least 50m away from the program site boundary	EC	Once
Water Quality	Water sampling and testing of Dug wells	Parameters specified in Table 7.1	Of the Dug well monitored in EA study but located outside the Program sites	EC	Once
PDDM Operation Phase (Impact and Compliance Monitoring)					
Air Quality	Air quality monitoring by air quality samplers	TSP and PM 10	At the sites monitored for baseline	EC	Once a month
Noise Level	Noise level meters	dBA	At the sites monitored for baseline	EC	Once a month
Water Quality	Water sampling and testing of main receiving waters	Parameters specified in Table 7.1	At the sites monitored for baseline	EC	One a month

Feature / Issue	Methods and Scope	Parameter	Location	Front line Responsibility	Time /Frequency
	Water Supply at Program site workers	Parameters as specified in Table 7.2	Camp water for drinking	PDDMC	Twice a month
Approved EA/EMP	Visual site observation and consultation with communities	IMPs/SMPs	All program sites	EC	Daily

In addition to the above an ***independent third party monitoring/Auditing*** of PDDM operations will be formally undertaken by appointed monitoring expert from the DADRM once in six months.

7.6.3 Record Keeping

The PDDMC shall keep records of all the activities and works undertaken in the PDDM cycle, which besides others shall include:

- All necessary permits and approvals;
- Updated IMPs
- Approved SMPs
- Updated SMPs
- Lists of monthly employment records
- Proof of environmental and safety training;
- Monthly records of sickness, injuries and accidents
- A daily record of mitigation measure implementation;
- All environmental monitoring results;
- Record of all maintenance of environmental controls;
- All written instructions for corrective actions
- Records of follow up inspection for corrective actions
- All correspondence on environmental management matters, including any complaints received.

All records shall be kept at site premises and maintained in a legible state for the full period of PDDM Cycle for each site. Environmental records will be made available to, PDDMO/EC, DADRM, and the third party monitoring expert upon request. PDDMO/EC will also maintain the records of supervision and monitoring/auditing undertaken and the instructions for corrective actions to PDDMC. In addition it will maintain the records of comments on suggestion from the stakeholders on the monthly environmental monitoring reports.

7.6.4 Reporting

The PDDMC will prepare a work completion and environmental monitoring report once every 15 days to the PDDMO/EC. PDDMO/EC shall prepare an environmental monitoring report every month which will be circulated to the respective stakeholders for review and comments for needed corrective actions if so required. Likewise the reports of third party monitoring/Auditing will be circulated soon after the receipt of the report by PDDMO/EC to the stakeholders. Upon receipt of the comments and suggestions from the stakeholders, PDDMO/EC will take essential actions for the environmental improvements by passing the corrective actions to the contractors and conducting follow up inspections during regular supervision and monitoring works.

7.7 Complain Handling and Grievance Redress

Complain handling during the PDDM cycle will be through EC Chief of the PDDMO. The EC office will maintain separate "*Complaints Register*", recording all complaints received from individuals or groups, either written or verbal. Each record shall detail:

- The name of the complainant
- The time and date the complaint was received;
- An explanation of the specific complaint;
- The signature of the complainant;

- The signature of the employee who recorded the complaint;

If the complaints are minor, efforts will be made by EC chief to resolve the issue by providing information or the actions within its jurisdiction. If the complains are major and could not be resolved, the unresolved complains will be passed to Grievance Redress Committee every week by EC. The GRC will be headed by PDDMO manager and shall consist of members of the concerned Municipality, affected persons, NGOs and local area CBO and EU Chief. The GRC will meet every week (if grievances are brought to the Committee), determine the merit of each grievance, and resolve grievances within 15 days of receiving the complaint. The affected person can present his or her concerns/issues to the GRC. The GRC will suggest corrective measures and assign clear responsibilities for implementing its decision in a timely manner as decided. The EC will be responsible for processing and placing all papers before the GRC, recording decisions, issuing minutes of the meetings, and taking follow-up action to ensure that formal orders are issued and decisions are carried out.

If each of the above measures fails, the affected person can seek legal redress of the grievance in the appropriate courts, which is the formal legal court system.

7.8 EMP Costs

The EMP cost is broken down into three categories as under:

1. Environmental Management Cost
2. Environmental Mitigation Costs
3. Environmental Monitoring/Auditing Costs

7.8.1 Environmental Management Consultant Cost

This cost includes the costs of hiring consultants for the specific management, supervision and auditing of environmental issues of PDDM in the program sites. This cost shall be included in the PDDM management costs.

7.8.2 Environmental Mitigation Costs

The specific items requiring cost for mitigation measures are presented in ***Annex 7.1***. As all the mitigation measures will be implemented by the PDDMC, these costs shall be included in the PDDMC's BOQ .

7.8.3 Environmental Monitoring Cost

The proposed PDDM operation in the program sites is envisaged to lasts for about 18 months. Accordingly the environmental monitoring costs particularly for the equipment based measurements and analysis is presented for this period of operation as per the plan presented in ***section 7.6.2*** and ***Table 7.8*** as under.

Table 7.9: Environmental Monitoring Auditing Costs

S.N	Particulars	Nos of Tests	Unit Rate (NRs)	Total cost (NRs)
A	Baseline			
1	Air quality monitoring	9	25000	225000
2	Noise	9	12000	108000
4	Water quality	9	5500	49500
B	Impact			
1	Air quality monitoring	162	25000	4050000
2	Noise	162	12000	1944000
4	Water Quality	162	5500	891000
5	Drinking water camps	324	2500	810000
			Total	***8077500***

Annex 1.1: Public Consultation for IOM Post-Debris Management Project

A. Site Name: Ring road (Narayangopal Chowk – Chabahil Chowk)

Date: 23/12/2013

Location: Across the site area

Approached Questions:

According to the home ministry of Government of Nepal and IOM 40% constructed buildings in Kathmandu Valley are in risk of destruction in case of high scale earthquake. In such a situation of chaos and disaster the emergency plan is to collect the post disaster debris and temporarily store and manage in these sites. The post disaster debris will be managed and disposed in timely manner and an emergency situation will be tackled. If you have any comment, feedback or suggestions then we are here to collect it.

Comments Received:

1) Initiative taken by the government is wise and brilliant we are here to support it;
2) Positive response from the public; and
3) Few worried about daily life activity of people living in the nearby area due to obstruction in road and risk of communicable diseases.

- All together 12 individuals responded to our queries. Since the site covers the large area views of people are collected at different location across the site.

List of Respondent

S.N	Name	Address
1	Yadav Pokharel	Sukedhara
2	Hari Khadka	Maharajgunj
3	Salendra b. Bohara	Ring road
4	Deepak khadka	Ring road
5	Radhika Khanka	Bansbari
6	Sabita Giri	Dhumbarahi
7	Purshotam Dangol	Sankha park
8	Prajwol Aryal	Sukedhara
9	Rishab humagain	Sukedhara
10	Nagarik Bazaar	Chappal Karakhana
11	Saroj Pokherel	SUkedhara
12	Rishi Regmi	Sukedhara

B. Site Name: Sankha Park:

Date: 23/12/2013

Location: Dhumbarahi

Approached Questions:

According to the home ministry of Government of Nepal and IOM 40% constructed buildings in Kathmandu Valley are in risk of destruction in case of high scale earthquake. In such a situation of chaos and disaster the emergency plan is to collect the post disaster debris and temporarily store and manage in these sites. The post disaster debris will be managed and disposed in timely manner and an emergency situation will be tackled. If you have any comment, feedback or suggestions then we are here to collect it.

Comments Received:

1) This is one recognizable open space in the valley and is under the municipality thus it is good decision to manage the city's dwellers and post disaster debris in case of unpredictable natural disaster; and
2) This is a positive step and everyone should help each other in such a situation of emergency and to use such an open space is a good decision taken by the authorities and planners.

- All together 11 individuals responded to our queries. The list of Respondents are given below:

List of Respondent

S.N	Name	Address
1	Krishna Basnet	Sukedhara
2	Krishna Bahadur shahi	Bhaktapur
3	Post bhd Shrestha	Sukedhara
4	Shanti Shrestha	Sukedhara
5	Gita Shah	Sukedhara
6	Gopal Dhakal	Chabahil
7	Ashwin Aryal	Chabahil
8	Hikmat Thapa	Chabil
9	Rupa Ojha	Kapan
10	Sabina KC	Chabil
11	Prem Kumari Panta	Naxal

C. Site Name: Satdobato – Gwarko:

Date: 24/12/2013

Location: Across the site area

Approached Questions:

According to the home ministry of Government of Nepal and IOM 40% constructed buildings in Kathmandu Valley are in risk of destruction in case of high scale earthquake. In such a situation of chaos and disaster the emergency plan is to collect the post disaster debris and temporarily store and manage in these sites. The post disaster debris will be managed and disposed in timely manner and an emergency situation will be tackled. If you have any comment, feedback or suggestions then we are here to collect it.

Comments Received:

1) Most of the participants responded positively; and
2) Few stated that, there are more open spaces within the premises of National Agriculture Research Centre (NARC) and in nearby areas, it will not be aesthetic to store post disaster debris in the road as it will give bad message to visitors and road users. It will also create a situation of chaos in the street and as the road is expanding this should have been planned in other more potential areas. It is not easy to reuse debris as there will be no rapid construction compared to the rate of destruction, although it can be managed it will take more than a year and thus road is not a good option for post disaster debris management.

- All together 13 individuals responded to our queries.

List of Respondent

S.N	Name	Address
1	Subash Pandey	Satdobato
2	Chandra Dangol	Satdobato
3	Rup lal Singh	Satdobato
4	Amarjyoti Kauro	Satdobato
5	Bacchu tam Dahal	Satdobato
6	Rajendra Shrestha	Satdobato
7	Shri raj Dhungana	Satdobato
8	Sarun Dahal	Gwarko
9	Mahesh Shrestha	Dhapakhel
10	Nani maya Shrestha	Dhapakhel
11	Radhe shyam Shrestha	Dhapakhel
12	Bhawana Shrestha	Dhapakhel
13	Sumindra Malla	Imadol

D. Site Name: Gwarko – Balkumari:

Date: 24/12/2013

Location: Across the site area

Approached Questions:

According to the home ministry of Government of Nepal and IOM 40% constructed buildings in Kathmandu Valley are in risk of destruction in case of high scale earthquake. In such a situation of chaos and disaster the emergency plan is to collect the post disaster debris and temporarily store and manage in these sites. The post disaster debris will be managed and disposed in timely manner and an emergency situation will be tackled. If you have any comment, feedback or suggestions then we are here to collect it.

Comments Received:

1) All of the participants responded positively; and
2) Out of all the participants, one participant clearly outlined the potential of river banks for post disaster debris management. According to this participant, there is large space in the bank of *Gwarko Khola* (river). This river was around 70 feet wide before two and half decades and now is merely 30 feet wide thus there is huge space left in the bank. Compared to road this can be a better alternative but road will act as an emergency place to rescue affected people and to store the post disaster debris and later transfer to potential open spaces. All in all this is a positive step taken by the authorities.

- All together 10 individuals responded to our queries.

List of Respondent

S.N	Name	Address
1	Bhagiratna Bajracharya	Pinche
2	Hira kaji Maharjan	Gwarko
3	BIjaya Pujaroi	Teta
4	Nasi Maharjan	
5	Dinesh Kulu	Naradevi
6	Chandra Kaji Maharjan	Gwarko
7	Ram bhd Maharjan	Siddhipur
8	Man bhd Lama	Gwarko
9	Surya man Shrestha	Bhaktapur
10	Keshav Niraula	Gwarko

E. Site Name: Bagmati corridor 4:

Date: 26/12/2013

Location: Teku Dovan

Approached Questions:

According to the home ministry of Government of Nepal and IOM 40% constructed buildings in Kathmandu Valley are in risk of destruction in case of high scale earthquake. In such a situation of chaos and disaster the emergency plan is to collect the post disaster debris and temporarily store and manage in these sites. The post disaster debris will be managed and disposed in timely manner and an emergency situation will be tackled. If you have any comment, feedback or suggestions then we are here to collect it.

Comments Received:

1) It is the good effort for proper management of post debris.
2) Since there are many religious temples at the western part of the site, it would be impossible to use for the debris management. Moreover it is also the place for cremation of dead bodies (Ghat), so most of the part at western part cannot be used for rubbish management.
3) The plan of constructing road along the Bagmati River will also covers a large area for road development, so the site is unfit for debris management.

- All together 9 individuals responded to our queries.

List of Respondent

S.N	Name	Address
1	Sabita Pariyar	Sabal Bahal
2	Uddhav Pariyar	Sabal Bahal
3	Uttar Rokha	Sabal Bahal
4	Dhurba Maharjan (Chairperson – Tole Sudhar Samiti)	Sabal bahal
5	Mohan Shrestha	Sabal bahal
6	Deepak Shrestha	Teku
7	Suman Rai	
8	Uttam Maharjan	Teku
9	Shankar Maharjan	Sabal bahal

F. Site Name: Ring road (Ekantakuna - Satdobato):

Date: 26/12/2013

Location: Across the site

Approached Questions:

According to the home ministry of Government of Nepal and IOM 40% constructed buildings in Kathmandu Valley are in risk of destruction in case of high scale earthquake. In such a situation of chaos and disaster the emergency plan is to collect the post disaster debris and temporarily store and manage in these sites. The post disaster debris will be managed and disposed in timely manner and an emergency situation will be tackled. If you have any comment, feedback or suggestions then we are here to collect it.

Comments Received:

1) The future planning program for post disaster waste management is welcoming, but the site should be selected in such place where there is enough open space for efficient management of debris.
2) Since the ring road extension work is on progress, there wouldn't be enough space left for the debris management.

- All together 9 individuals responded to our queries.

List of Respondent

S.N	Name	Address
1	Nabin Raj bhandari	Nakhu
2	Basudev Acharya	Nakhu
3	Shree raj Dhungana	Satdobato
4	Dev lal Subedi	Mahalaxmithan
5	Yadav Chaudhari	Mahalaxmithan
6	Krishna Khadka	Satdobato
7	Rajendra Shrestha	Satdobato
8	Prem lal Maharjan	Satdobato
9	Keshav man Joshi	Satdobato

G. Site Name: Bagmati corridor 5:

Date: 26/12/2013

Location: Gusin ghat, Tripureshowr

Approached Questions:

According to the home ministry of Government of Nepal and IOM 40% constructed buildings in Kathmandu Valley are in risk of destruction in case of high scale earthquake. In such a situation of chaos and disaster the emergency plan is to collect the post disaster debris and temporarily store and manage in these sites. The post disaster debris will be managed and disposed in timely manner

and an emergency situation will be tackled. If you have any comment, feedback or suggestions then we are here to collect it.

Comments Received:

1) This is a positive step and everyone should help each other in such a situation of emergency and to use such an open space is a good decision taken by the authorities and planners.
2) Since there is very small area for the debris management it seems challenging.
3) There are many underground and surface sewer pipes in the site, so effective plan should be made without interrupting the existing sewer system.

- All together 10 individuals responded to our queries.

List of Respondent

S.N	Name	Address
1	Shyam Chaulagai	Tripureshowr
2	Sharoj Paudel	Chitwan
3	Santosh Chettri	Tripureshowr
4	Khagendra Kunwar	Nepalgunj
5	Sanjay Chaudhari	Tripureshowr
6	Lal Bhd Sadhumagar	Tripureshowr
7	Jau sing Thakuri	Tripureshowr
8	Nabin Rai	Tripureshowr
9	Surya bhd Bi ka	Gusinghat
10	Binod shahi	Gusinghat

H. Site Name: Oxygenation Park:

Date: 26/12/2013

Location: Dhobighat

Approached Questions:

According to the home ministry of Government of Nepal and IOM 40% constructed buildings in Kathmandu Valley are in risk of destruction in case of high scale earthquake. In such a situation of chaos and disaster the emergency plan is to collect the post disaster debris and temporarily store and manage in these sites. The post disaster debris will be managed and disposed in timely manner and an emergency situation will be tackled. If you have any comment, feedback or suggestions then we are here to collect it.

Comments Received:

1) As the site belongs to Kathmandu Upatyeka Khanepani Limited (KUKL), Authorization from KUKL should be taken.
2) Most of the participants were positive as the site covers a large area and it has an open space.
3) Even though the site is ideal for debris management, the access roads are narrow which may be a problem during emergency situation so effective plan should be made for the debris management.

- All together 6 individuals responded to our queries.

List of Respondent

S.N	Name	Address
1	Madhav khatri (KUKL office)	Dhobighat
2	Shyam lal Shrestha	Dhobighat
3	Santosh Neupane	Basnet gaun
4	Prem Basnet	Basnet gaun
5	Suman Alemagar	Pattipa chowk
6	John Tamang (Adarsha Nirman Company)	Dhobighat

I. Site Name: Bagmati Corridor 6:

Date: 26/12/2013

Location: Shankhamul

Approached Questions:

According to the home ministry of Government of Nepal and IOM 40% constructed buildings in Kathmandu Valley are in risk of destruction in case of high scale earthquake. In such a situation of chaos and disaster the emergency plan is to collect the post disaster debris and temporarily store and manage in these sites. The post disaster debris will be managed and disposed in timely manner and an emergency situation will be tackled. If you have any comment, feedback or suggestions then we are here to collect it.

Comments Received:

1) Positive response from the public.
2) But some finds it challenging to manage the huge debris within such small area.
3) Since the site lies in the existing service road, few worried about daily life activity of people living in the nearby area due to obstruction in road and risk of communicable diseases.

- All together 7 individuals responded to our queries.

List of Respondent

S.N	Name	Address
1	Ishowr Acharya	Baneshowr
2	Bir Bhd Rana Magar	Shankamul
3	Man bhd Shrestha	Shankamul
4	Chandra Maharjan	Gwarko
5	Raghu Chaudhari	Shankamul
6	Naresh Paudel	Gwarko
7	Bhuwan pandey	Balkumari

List of all Respondent Contacted

S.N	Name	Address
1	Nagarik Bazaar	Chappal Karakhana
2	Hari Khadka	Maharajgunj
3	Salendra b. Bohara	Ring road
4	Deepak khadka	Ring road
5	Radhika Khanka	Bansbari
6	Sabita Giri	Dhumbarahi
7	Purshotam Dangol	Sankha park
8	Prajwol Aryal	Sukedhara
9	Rishab humagain	Sukedhara
10	Yadav Pokharel	Sukedhara
11	Saroj Pokherel	SUkedhara
12	Rishi Regmi	Sukedhara
13	Krishna Basnet	Sukedhara
14	Krishna Bahadur shahi	Bhaktapur
15	Post bhd Shrestha	Sukedhara
16	Shanti Shrestha	Sukedhara
17	Gita Shah	Sukedhara
18	Gopal Dhakal	Chabahil
19	Ashwin Aryal	Chabahil
20	Hikmat Thapa	Chabil
21	Rupa Ojha	Kapan
22	Sabina KC	Chabil
23	Prem Kumari Panta	Naxal

S.N	Name	Address
24	Subash Pandey	Satdobato
25	Chandra Dangol	Satdobato
26	Rup lal Singh	Satdobato
27	Amarjyoti Kauro	Satdobato
28	Bacchu tam Dahal	Satdobato
29	Rajendra Shrestha	Satdobato
30	Shri raj Dhungana	Satdobato
31	Sarun Dahal	Gwarko
32	Mahesh Shrestha	Dhapakhel
33	Nani maya Shrestha	Dhapakhel
34	Radhe shyam Shrestha	Dhapakhel
35	Bhawana Shrestha	Dhapakhel
36	Sumindra Malla	Imadol
37	Bhagiratna Bajracharya	Pinche
38	Hira kaji Maharjan	Gwarko
39	BIjaya Pujaroi	Teta
40	Nasi Maharjan	
41	Dinesh Kulu	Naradevi
42	Chandra Kaji Maharjan	Gwarko
43	Ram bhd Maharjan	Siddhipur
44	Man bhd Lama	Gwarko
45	Surya man Shrestha	Bhaktapur
46	Keshav Niraula	Gwarko
47	Sabita Pariyar	Sabal Bahal
48	Uddhav Pariyar	Sabal Bahal
49	Uttar Rokha	Sabal Bahal
50	Dhurba Maharjan (Chairperson – Tole Sudhar samiti)	Sabal bahal
51	Mohan Shrestha	Sabal bahal
52	Deepak Shrestha	Teku
53	Suman Rai	
54	Uttam Maharjan	Teku
55	Shankar Maharjan	Sabal bahal
56	Nabin Raj bhandari	Nakhu
57	Basudev Acharya	Nakhu
58	Shree raj Dhungana	Satdobato
59	Dev lal Subedi	Mahalaxmithan
60	Yadav Chaudhari	Mahalaxmithan
61	Krishna Khadka	Satdobato
62	Rajendra Shrestha	Satdobato
63	Prem lal Maharjan	Satdobato
64	Keshav man Joshi	Satdobato
65	Shyam Chaulagai	Tripureshowr
66	Sharoj Paudel	Chitwan
67	Santosh Chettri	Tripureshowr
68	Khagendra Kunwar	Nepalgunj
69	Sanjay Chaudhari	Tripureshowr
70	Lal Bhd Sadhumagar	Tripureshowr
71	Jau sing Thakuri	Tripureshowr
72	Nabin Rai	Tripureshowr
73	Surya bhd Bi ka	Gusinghat
74	Binod shahi	Gusinghat
75	Madhav khatri (KUKL office)	Dhobighat
76	Shyam lal Shrestha	Dhobighat
77	Santosh Neupane	Basnet gaun
78	Prem Basnet	Basnet gaun
79	Suman Alemagar	Pattipa chowk
80	John Tamang (Adarsha Nirman Company)	Dhobighat
81	Ishowr Acharya	Baneshowr

S.N	Name	Address
82	Bir Bhd Rana Magar	Shankamul
83	Man bhd Shrestha	Shankamul
84	Chandra Maharjan	Gwarko
85	Raghu Chaudhari	Shankamul
86	Naresh Paudel	Gwarko
87	Bhuwan pandey	Balkumari

ANNEX 4.1: SITE SPECIFIC BASELINE ENVIRONMENTS

Bagmati Corridor 4

Site location:

The site lies in the Kathmandu Metropolitan City (KMC) ward no. 12 of Kathmandu District (Figure 1, 2 and 3). It lies to the northeast of Bishnumati –Bagmati Confluence along the right bank of Bagmati River. It represents the elevated river flood plain of Bagmati River. It is an open land with settlements and religious shrines (temple and cremation sites) delimiting its northern boundary. Bagmati River delimits its boundary to the south, while Bishnumati River forms its western boundary. The eastern boundary is marked by the Teku – Kalopul Motarable Bridge. An earthen road extends from the eastern corner to the western corner of the site along its northern edge. This road is connected to Tripureshwor – Teku Main Road about 400 meters north of the site. Teku – Kalopul bridge across Bagmati River also connects the site to Jhamshikel Area. The GPS coordinate of the eastern border of the site is N 27˚ 41' 34.9'' & E 85˚ 18' 15.1'' and the western border is N 27˚ 41' 31.6'' & E 85˚ 18' 7.4''.

Figure 1: Google Image of the Site

Figure 2: Site Location

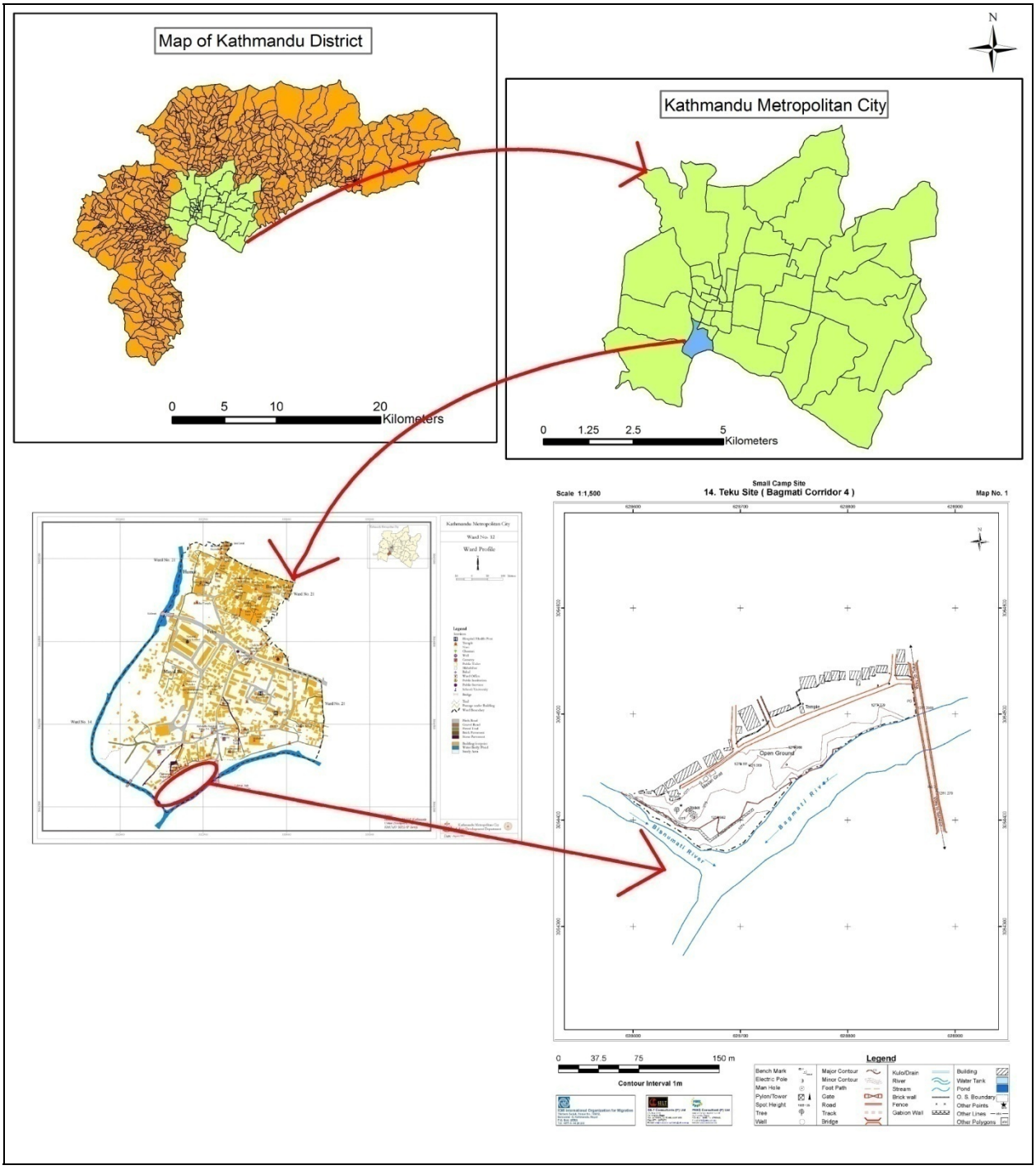
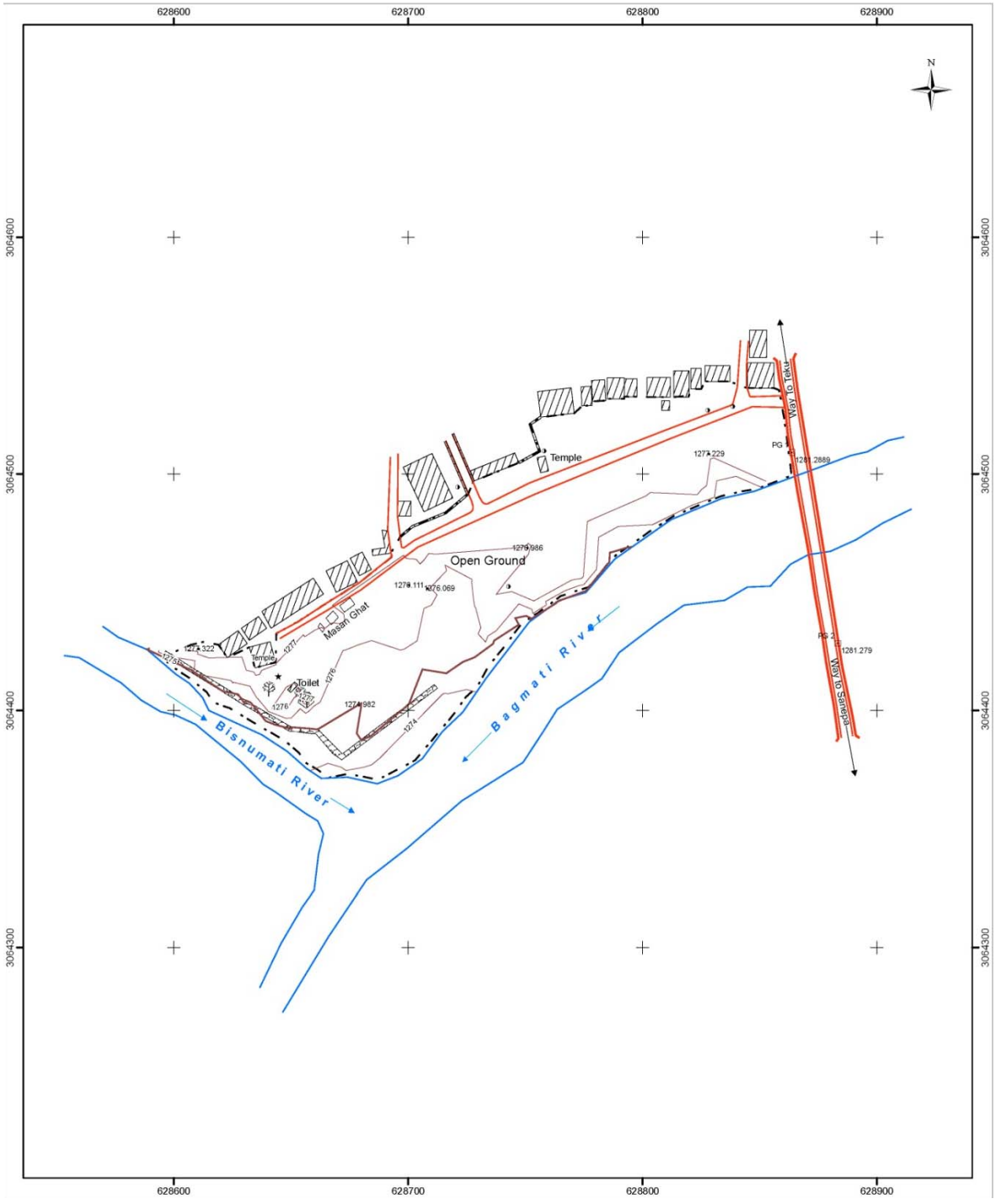


Figure 3: Site Layout



The GPS coordinate of photography point and the general view from this point on different direction is presented in figures below.

1. **GPS coordinate of photography point (Eastern border of the site)**
   27˚41’ 34.9’’ N 85 ˚18’ 15.1’’ E Altitude: 1287 m

Figure 4. Facing North

Figure 5. Facing East

Figure 6. Facing West

Figure 7. Facing South

2. **GPS coordinate of Photography Point (Western border of the site)**
   27˚41’ 31.6’’ N 85 ˚18’ 7.4’’ E Altitude: 1287 m

Figure 8. Facing East

Figure 9. Facing South

Figure 10. Facing west

Figure 11. Facing north

- **Infrastructure:**
  - Nearest settlement: Settlement lies adjoining to northern border of the site. Settlement is well managed with concrete blocks and buildings. There are about 60 multi storey houses attached to the site. Name of the settlement area is *Sabal Bahal* and *Teku Dovan*.
  - Electric lines: There are 4 electric and Telephone poles inside the boundary of the site along the northern edge of the site and one high voltage transmission line pass across north south section of the. The GPS location of individual pole is given below:

1. Pole no 1: 27˚41’ 35.5’’ N 85˚ 18’ 14.7’’ E
2. Pole no 2: 27˚ 41’ 35.3’’ N 85 ˚18’ 13.9’’ E
3. Pole no 3: 27˚41’ 35.0’’ N 85˚ 18’ 13.1’’ E
4. Pole no 4: 27˚41’ 33.2’’ N 85˚ 18’ 11.1’’ E
5. High voltage transmission line: 27˚41’ 34.5’’ N 85˚ 18’ 35.4’’ E

Photographs of Individual pole

<table>
<tr><td> 
Figure 1. Pole no 1 and 2</td><td> 
Figure 2. Pole no 3</td></tr>
<tr><td>GPS coordinate of the photography location
27˚41’ 35.5’’ 85˚ 18’ 14.7’’ E
Direction: Facing west</td><td>GPS coordinate of the photography location
27˚ 41’ 34.8’’ N 85 ˚18’ 12.7’’ E
Direction: Facing North</td></tr>
<tr><td> 
Figure 3. Pole no 4</td><td> 
Figure 4. Transmission line passing across the site</td></tr>
<tr><td>GPS coordinate of the photography location
27˚41’ 33.5’’ 85˚ 18’ 10.4’’ E
Direction: Facing south</td><td>GPS coordinate of the photography location
27˚41’ 34.5’’ N 85˚ 18’ 35.4’’ E
Direction: Facing south</td></tr>
</table>

- Storm water drains and drainage: Natural drainage recipient is Bagmati River and Bishnumati River on the south and west. There is one underground sewer drainage and one storm water drainage crossing the site. The GPS coordinate of the drainage locations is given below:

- Underground sewer drainage:

1. Inlet (from Panchanagari marg): 27˚41’ 34.9 ’’ N 85˚ 18’ 13.3’’ E
2. Outlet: 27˚41’ 33.9’’ N 85˚ 18’ 13.4’’ E

- Surface storm water drainage:

1. Inlet: 27˚41’ 33.1 ’’ N 85˚ 18’ 9.6’’ E
2. Outlet: 27˚41’ 32.5’’ N 85˚ 18’ 9.7’’ E

Photographs of Drainage

<table>
<tr><td> 
Figure 5. Underground sewerage line from Panchanari marg</td><td> 
Figure 6. Underground Sewerage drain outlet</td></tr>
<tr><td>GPS coordinate of the photography location
27˚41’ 34.9 ’’ N 85˚ 18’ 13.3’’ E
Direction: Facing south</td><td>GPS coordinate of the photography location
27˚41’ 33.9’’ N 85˚ 18’ 13.4’’ E
Direction: Facing south</td></tr>
<tr><td> 
Figure 7. Storm water drain inlet</td><td> 
Figure 8. Storm water drain outlet</td></tr>
<tr><td>GPS coordinate of the
27˚41’ 33.1 ’’ N 85˚ 18’ 9.6’’ E
Direction: Facing north</td><td>GPS coordinate of the photography location
27˚41’ 32.5’’ N 85˚ 18’ 9.7’’ E
Direction: Facing south</td></tr>
</table>

- Water supply pipes through the sites: No
- Wells, tube wells: There are 3 wells and 1 hand pump inside the site boundary. These wells and hand pumps are not currently in use
- The GPS location of the wells and hand pump is as below:
  1. Well no. 1: 27˚41’ 35.0’’ N 85˚ 18’ 12.1’’ E
  2. Well no. 2: 27˚41’ 34.9’’ N 85˚ 18’ 11.9’’ E
  3. Well no. 3: 27˚41’ 32.8’’ N 85˚ 18’ 9.0’’ E
  4. Hand pump: 27˚41’ 31.8’’ N 85˚ 18’ 7.5’’ E

Photographs of Well and Hand pump

Figure 20. well no 1 and 2

GPS coordinate of the photography location:
27˚41’ 35’’ N 85˚ 18’ 12.1’’ E
Direction: Facing west

Figure 21. Well no 3

GPS coordinate of the Photography location:
27˚41’ 32.8’’ N 85˚ 18’ 9.0’’ E
Direction: Facing south

Figure 9. Hand pump

GPS coordinate of the photography location:
27˚41’ 31.8’’ N 85˚ 18’ 7.5’’ E
Direction: Facing south

- Other purpose of the site: Site land is used as playground by local community, construction material storage, and cremation activities.
- Educational facilities: The nearest school is Mahendra Sarasawati School at 2 minutes walking distance .i.e. approximately 200 meters towards north of the site; and Saraswati Niketan School at 10 minutes walking distance .i.e. approximately 1 kilometers towards north of the site.
- Health facilities: Nearby hospital of the site is Teku Hospital which is approximately 1.6 kilometers from the site towards east.
- Cremation area: There are about 4 cremation areas inside the site boundary among which 3 are in use and 1 is not. The GPS location of the individual cremation area is given below:
    1. Cremation area no 1: 27˚41’ 34.6’’ N 85˚ 18’ 11.8’’ E
    2. Cremation area no 2: 27˚41’ 33.4’’ N 85˚ 18’ 9.4’’ E
    3. Cremation area no 3: 27˚41’ 32.6’’ N 85˚ 18’ 8.2’’ E
    4. Cremation area no 4: 27˚41’ 32.5’’ N 85˚ 18’ 8.1’’ E

Photographs of Cremation area

Figure 10. Unused Cremation area no 1

GPS coordinate of the photography location:
27˚41’ 34.6’’ N 85˚ 18’ 11.8’’ E
Direction: Facing north

Figure 11. Cremation area no 2

GPS coordinate of the Photography location:
27˚41’ 33.4’’ N 85˚ 18’ 9.4’’ E
Direction: Facing south

Figure 12. Cremation area no 3 and 4

GPS coordinate of the photography location:
27˚41’ 32.6’’ N 85˚ 18’ 8.2’’ E
Direction: Facing east

- Temple: There are 3 small temples within the site boundary namely Shiva Mandir, Ganesh Mandir and Bishnu Mandir. The GPS coordinate of the individual temple is given below:
  1. Temple no.1 (Shiva mandir): 27˚41’ 35.4’’ N 85˚ 18’ 13.5’’ E
  2. Temple no.2 (Ganesh mandir): 27˚41’ 35.1’’ N 85˚ 18’ 11.8’’ E
  3. Temple no.3 (Bishnu mandir): 27˚41’ 33.2’’ N 85˚ 18’ 9.2’’ E

Photographs of Temple

Figure 13. Temple no 1 (Shiva Mandir)

GPS coordinate of the photography location:
27˚41’ 35.4’’ N 85˚ 18’ 13.5’’ E
Direction: Facing east

Figure 14. Temple no 2 (Ganesh mandir)

GPS coordinate of the Photography location:
27˚41’ 35.1’’ N 85˚ 18’ 11.8’’ E
Direction: Facing west

Figure 15. Temple no 3 (Bishnu mandir)

GPS coordinate of the Photography location:
27˚41’ 33.2’’ N 85˚ 18’ 9.2’’ E
Direction: Facing south

- Toilet: There is one public toilet within the boundary of the site. The GPS coordinate of the toilet is 27˚41’ 31.7’’ N & 85˚ 18’ 7.7’’ E . Photograph of the toilet is presented below.

Figure 16. Public toilet

GPS coordinate of the photography location:
27˚41’ 31.7’’ N 85˚ 18’ 7.7’’ E
Direction: Facing west

- **Biological features:**
  - Though the site is a natural riverine area is highly modified by discharge of solid and liquied wastes and do not show presence of natural flora and fauna.
  - There are 7 planted trees inside the boundary of the site. Among them 1 is Masala tree, 1 is barand other 5 are peepal trees. The details of the trees are given below (Table 1):

Table 1. Details of trees

S.N	Tree species (Local Name)	Dbh (cm)	Height (m)	GPS cordinate	
1	Peepal Tree (a)	24	5	27˚41' 31.5'' N	85˚ 18' 8.1'' E
2	Peepal Tree (b)	36	7	27˚41' 31.5'' N	85˚ 18' 8.1'' E
3	Peepal Tree (c)	45	8	27˚41' 31.5'' N	85˚ 18' 8.1'' E
4	Peepal Tree (d)	60	9	27˚41' 31.5'' N	85˚ 18' 8.1'' E
5	Peepal Tree (e)	65	11	27˚41' 31.6'' N	85˚ 18' 7.4'' E
6	Bar Tree	21	6	27˚41' 31.9'' N	85˚ 18' 8.9'' E
7	Masala Tree	27	7	27˚41' 31.8'' N	85˚ 18' 8.8'' E

Field Survey, 2013 December

Photographs of Trees

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Figure 30. Pipal tree (e)</td><td>Figure 31 Bar tree</td></tr>
<tr><td>GPS coordinate photography:
27˚41’ 31.6’’ N 85˚ 18’ 7.4’’ E
Direction: facing south</td><td>GPS coordinate Photography:
27˚41’ 31.9’’ N 85˚ 18’ 8.9’’ E
Direction: facing south</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Figure 17. Masala tree</td><td>Figure 18. Pipal trees(a, b, c, d)</td></tr>
<tr><td>GPS coordinate Photography:
27˚41’ 31.8’’ N 85˚ 18’ 8.8’’ E
Direction: facing south</td><td>GPS coordinate Photography:
27˚41’ 30.5’’ N 85˚ 18’ 7.1’’ E
Direction: facing south</td></tr>
</table>

- **Social features:**
  - Site land ownership: the site is owned by Kathmandu Municipality, government of Nepal.
  - Nearby settlement: Sabal Bahal and Teku Dovan

People living close to the site are mainly engaged in labor and as an employee in various private organizations. The settlement is mostly dominated by ethnic groups of Newars, Tamangs and Dalits and most inhabitants are Followers of Hinduism and Buddhism.

- **Perception of the Community**
  - After the decision has been made community is forced to agree due to its ethic thus consultation with community should have been done before selecting this site for debris management.
  - In case of national emergency due to natural disaster, the community’s debris management should be given priority than other area’s debris management.

- **Will it hamper community’s accessibility in site, if the site is fenced?**

Site is attached and accessible by community from the northern border and fencing the site will obstruct community’s access to road, wells, temples which lie within the selected site. Community use the same road to access the main road thus fencing the border of site will hamper community’s daily life. Instead, if a gap is maintained in northern border while fencing then the daily life will not be obstructed instead usage of common area will be hampered.

The proposed site has been planned by the Department of Roads to use for construction of Bagmati Corridor road. According to community, the road will be operating in 2.5 years from now.

- **Noise Levels**

Major noise source: Since the site is far from noise producing sources like road and industrial area, no significant sound pressure level was measured. Major noise contributing sources noted during monitoring are Conversation among people (Human voice pitch), sound of occasional motor bike & cycle, shouting of small kids playing nearby.

General weather condition: During monitoring period the general weather cold and mild sunny.

Monitoring Day/ Date/time: Wednesday, 11/12/2013, 2:00 pm

Monitored by: Prasan Karmacharya

GPS location of Monitored site: 27˚41'32.16 '' N 85˚ 18' 07.70'' E

Figure 19. Noise monitoring

Sound Pressure Level:

The sound pressure level of the site has been presented in **Table no. 2**. The maximum sound pressure level within the site premises was 65 dB(A) and minimum sound pressure level was 43 dB(A). The equivalent sound pressure level was 55 dB(A).

Table 2. Sound Pressure Level, Within the Site Premises {dB(A)}

Noise Descriptors	Sound Pressure Level
Minimum	43
Maximum	65
Leq	55

Field Survey, 2013 December

Management Issues

- **Religious Activities** – The site is a religious hot spots of the Newar community. It is used for cremation of dead bodies and related religious activities. Use of the site for rubble management is likely to affect the ongoing religious activities.
- **Access to the site** – To assess the site from the Main Road, it need use of the narrow roads passing through relatively dense settlements. Two way traffic on these roads is difficult, further, the probability of damage to these roads is likely in the event of earthquake.
- **Size of the site** – Tentative usable area of the site is around 10000 m^2, which is a small area for effective management of earthquake rubbles and segregation of usable.
- **Drainage and sewers** - The general layout of the area is east west and the general drainage (natural) is north south. Deposition of rubbles is likely to obstruct the existing natural drainage. In addition the site is already crossed by one natural drainage and 1 underground sewer drainages.

Obstruction of these drainages is likely to impact the overall sanitary conditions of the Sabal Bahal and Teku Dovan

- **Noise pollution** – Traffic movements and segregation activities is likely to enhance the noise level of the site surroundings impacting the adjoining communities of Sabal Bahal and Teku Dovan.
- **Air pollution** – Traffic movements and segregation activities is likely to generate high fugitive dust emissions in surrounding areas with implication on the health of the adjoining communities of the Sabal Bahal and Teku Dovan.
- **Bagmati River** - The spill or casting of the rubble materials on the Bagmati River is likely to impact the existing river channel, obstruction of the river flow and river channel shifting towards south affecting the opposite bank.
- **Obstruction to mobility and access** – Fencing of the site is expected to impair the mobility of the Sabal Bahal and Teku Dovan communities and access to their houses from the existing earthen road.
- **Community health and safety** – The site lies adjacent to the community dwelling. Apart from noise pollution, air pollution, degradation of overall sanitation, the adjoining communities are likely to be exposed the accidental risks such as traffic, loading/unloading operations, segregation operations etc.
- **Occupational health and safety** – Exposure to high noise, dusts, and working with rubbles while segregation are some of the issues related to occupational health and safety.
- **Future Development** – A Plan for Bagmati Corridor road is on the air according to local people on this bank of the river. If this plan is to be implemented, then the proposed site will have only limited area. In such a case, the area becomes too small for effective utilization for rubble management even for a short period.

Bagmati Corridor 5

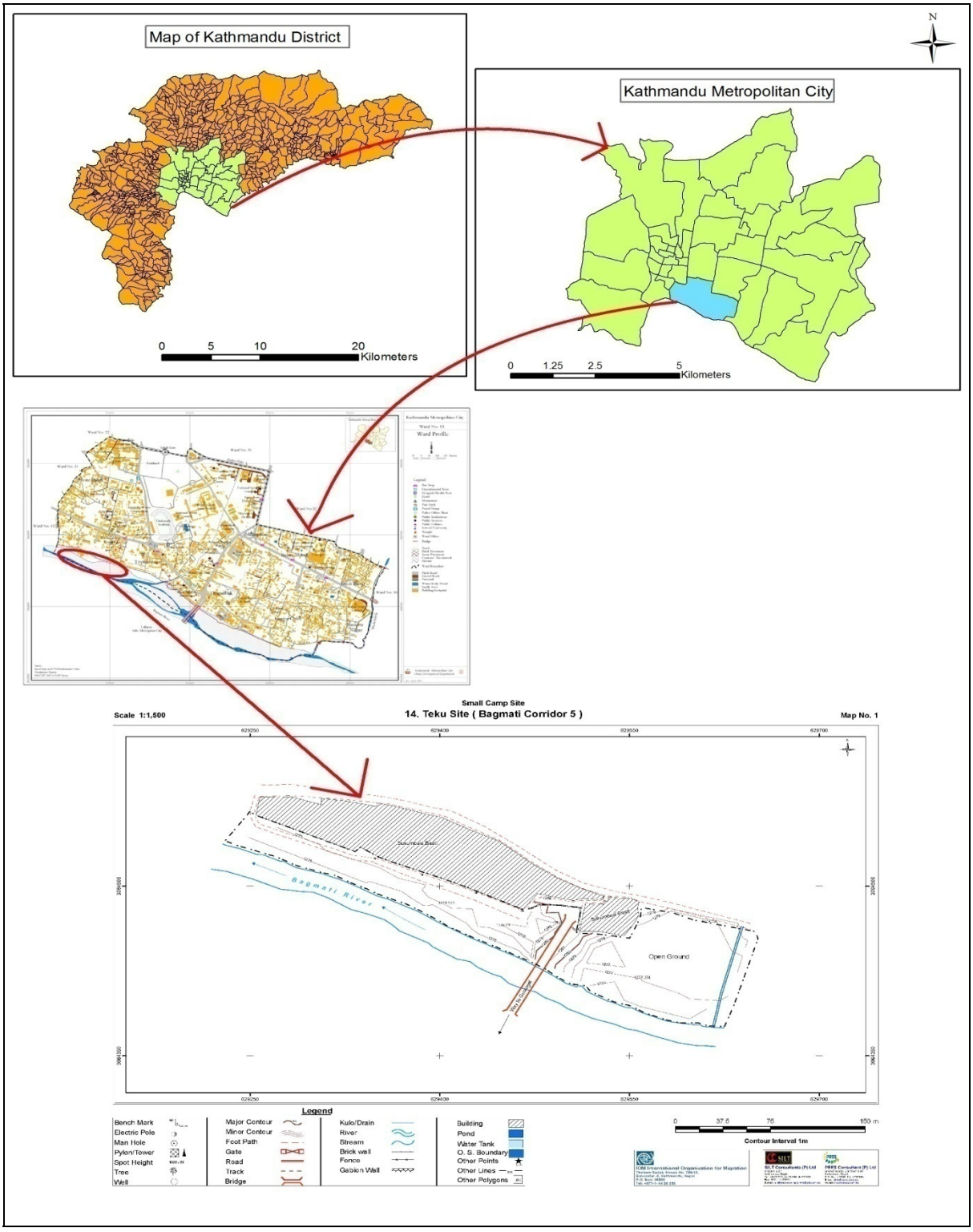
Site location:

The site lies in the Kathmandu Metropolitan City (KMC) ward no. 11 (Figure 1 and 2). The GPS coordinate of the eastern corner of the site is N 27 ˚ 41' 32'' & E 85 ˚ 18' 43'' and the western corner is N 27 ˚ 41' 36'' & E 85 ˚ 18' 29''. It lies on the right bank of Bagmati River about 530m west of Thapathali bridge leading to Kupondole, Lalitpur. River Bagmati delimits the south boundary while Sukumbasi Basti demarcates its northern boundary. To the east and west it is bordered by open land. The site extends east to west for a length of 420m. The eastern 100m length of the site is widest with a width of about 85m, the rest length of the site vary in width between 35m to 18m including an earthen motorable road of about 5m width along the northern border with Sukumbasi Basti. An under construction motorable bridge on Bagmati River pass across the site about 137m west of the site eastern boundary.

Figure 1: Google Image of the Site Location

At present the site is assessed from the western and eastern corners from the existing narrow road (12ft) which is connected with the Tripureshowor – Teku road. With the development of under Construction Bridge, the site could be assessed from the fairly wide (26ft wide) Bagmati corridor road of Lalitpur. The GPS coordinate and the general view of the site from different direction is shown in the figure below (Figure 1, 2, 3, 4, 5, 6, 7, and 8).

Figure 2: Location map of the site



1. **GPS coordinate (Eastern border of the site)**

   27˚ 41'30.4'' N 85 ˚18' 42.9'' E Altitude: 1278 m

Figure 3. Facing North

Figure 4. Facing West

Figure 5. Facing South

Figure 6. Facing East

2. **GPS coordinate (Western border of the site)**

   27˚ 41’36.9’’ N 85 ˚18’ 29.7’’ E Altitude: 1278 m

Figure 7. Facing East

Figure 8. Facing West

Figure 9. Facing South

Figure 10. Facing north

Infrastructure:

- Nearest settlement: There is no settlement inside the project site boundary. Tripureshor is the nearest settlement from the site, beside there is huge settlement of squatters (Sukumbasi Basti) named Gusin Ghat adjoining to the project site at the northern border.
- Electric lines: No
- Storm water drains and drainage: There are about 4 storm water drainage and about 5 sewerage drainage pipes passing across the proposed site. The GPS coordinate of the drainages are given below:

- **Storm water drainage:**

1. Drainage no. 1 (Surface)
   Inlet: 27˚41' 32.95'' N 85˚ 18' 43.59'' E (Figure 10)
   Outlet: 27˚ 41'30.4'' N 85 ˚18' 42.9'' E (Figure 11)
2. Drainage no. 2 (Surface)
   Inlet: 27˚41' 32.06'' N 85˚ 18' 39.23'' E (Figure 12)
   Outlet: 27˚41' 32.06'' N 85˚ 18' 39.23'' E (Figure 13)
3. Drainage no. 3 (Underground)
   Inlet: 27˚41' 34.7'' N 85˚ 18' 34.5'' E (Figure 18)
   Outlet: 27˚41' 34.1'' N 85˚ 18' 34.1'' E (Figure 19)
4. Drainage no. 4 (Surface)
   Inlet: 27˚41' 36.9'' N 85˚ 18' 29.7'' E (Figure 20)
   Outlet: 27˚41' 35.7'' N 85˚ 18' 29.31'' E (Figure 21)

- **Sewer drainage:**

1. Drainage no. 1 (underground)
   Inlet: 27˚41' 32.95'' N 85˚ 18' 43.59'' E (Figure 10)

Outlet: 27˚ 41’30.4’’ N 85 ˚18’ 42.9’’ E (Figure 11)

2. Drainage no. 2 (Surface)
   Inlet: 27˚41’ 32.06’’ N 85˚ 18’ 39.23’’ E (Figure 12)
   Outlet: 27˚41’ 32.06’’ N 85˚ 18’ 39.23’’ E (Figure 13
3. Drain no. 3 (Underground)
   Inlet: 27˚41’ 34.5’’ N 85˚ 18’ 35.4’’ E (Figure 14)
   Outlet: 27˚41’ 34.2’’ N 85˚ 18’ 35.4’’ E (Figure 15)
4. Drain no. 4 (underground)
   Inlet: 27˚41’ 36’’ N 85˚ 18’ 30.6’’ E (Figure 16)
   Outlet: 27˚41’ 34.2’’ N 85˚ 18’ 35.4’’ E (Figure 17)
5. Drain no. 5 (Underground)
   Inlet: 27˚41’ 34.7’’ N 85˚ 18’ 34.5’’ E (Figure 18)
   Outlet: 27˚41’ 34.1’’ N 85˚ 18’ 34.1’’ E (Figure 19)

Photographs of Drainage and Storm water drain

Figure 11. Inlet of Surface Storm water drainage no. 1 and underground sewer no. 1

GPS coordinate:
27˚41’ 32.95’’ N 85˚ 18’ 43.59’’ E
Direction: Facing south

Figure 12. Outlet of Surface Storm water drainage no. 1 and underground sewer no. 1

GPS coordinate:
27˚ 41’30.4’’ N 85 ˚18’ 42.9’’ E
Direction: Facing south

Figure 13. Inlet of Surface Storm water drainage no. 2 and sewer no. 2

GPS coordinate:
27˚41’ 32.06’’ N 85˚ 18’ 39.23’’ E
Direction: Facing south

Figure 1. Outlet of Surface Storm water drainage no. 2 and sewer no. 2

GPS coordinate:
27˚41’ 32.06’’ N 85˚ 18’ 39.23’’ E
Direction: Facing south

<table>
<tr>
<td> 

Figure 2. Inlet of underground sewer no. 3</td>
<td> 
Figure 3. Outlet of incomplete underground sewer no. 3</td>
</tr>
<tr>
<td>GPS coordinate:
27˚41’ 34.5’’ N 85˚ 18’ 35.4’’ E
Direction: Facing south</td>
<td>GPS coordinate:
27˚41’ 34.2’’ N 85˚ 18’ 35.4’’ E
Direction: Facing south</td>
</tr>
<tr>
<td> 
Figure 4. Underground Sewerage drain no. 4</td>
<td> 
Figure 5. Sewerage drain outlet no. 4</td>
</tr>
<tr>
<td>GPS coordinate:
27˚41’ 36’’ N 85˚ 18’ 30.6’’ E
Direction: Facing north</td>
<td>GPS coordinate:
27˚41’ 34.2’’ N 85˚ 18’ 35.4’’ E
Direction: Facing south</td>
</tr>
<tr>
<td> 
Figure 6. Inlet of Underground sewerage no. 5 and storm water drain no. 3</td>
<td> 
Figure 7. Outlet of Underground sewerage no. 5 and storm water drain no. 3</td>
</tr>
<tr>
<td>GPS coordinate:
27˚41’ 34.7’’ N 85˚ 18’ 34.5’’ E
Direction: Facing south</td>
<td>GPS coordinate:
27˚41’ 34.1’’ N 85˚ 18’ 34.1’’ E
Direction: Facing south</td>
</tr>
</table>

	
Figure 8. Inlet of Storm water drain no. 4	**Figure 9. Outlet of Storm water drain no. 4**
GPS coordinate: 27˚41’ 36.9’’ N 85˚ 18’ 29.7’’ E Location: Direction: Facing south	GPS coordinate: 27˚41’ 35.7’’ N 85˚ 18’ 29.31’’ E Direction: Facing south

- Water supply pipes through the sites: No
- Wells, tube wells: There is no well or tube well inside the site boundary. But there are around 10 wells in the Sukumbasi basti which lies near the northern border of the site. The nearest well from the border of the site is about 2 meter. The GPS coordinate of the nearest well is given below:

Photographs of Well:

	
Figure 10. Well at the border of the site	**Figure 11. Well at the Sukumbasi basti near site**
GPS coordinate: 27˚41' 35.8'' N 85˚ 18' 31.2'' E Direction: facing west	GPS coordinate: 27˚41' 35.1'' N 85˚ 18' 36.8'' E Direction: facing north

- Other purpose of the site: The site is used as playground and dumping of solid waste by the local people. Beside construction material are stored on the project site. According to locals the site is also planned for the construction of road along the right bank of Bagmati River.
- Educational facilities: The nearest school is Vishwa Niketan Higher Secondary School which lies adjoining to the northern boundary of the project site.
- Health facilities: The nearest hospital is Teku eye hospital which is around 200 meters far and other is Teku Saruwa Rog Hospital which is about 500 meters from the project site.

- **Biological features:** Since the project site encroached by settlements is not a natural habitat of wildlife. The project site is devoid of standing trees. Some Cynodon species can be seen as the dominant herb species around the project site.

- **Social features:**
  - Site land Kathmandu Municipality, : Government of Nepal.
  - Nearby settlement: Gusin ghat (Sukumbasi Basti) and Tripureshowr:

Sukumbasi Basti:

The Sukumbasi Basti currently known as Gusin Ghat was settled in 2052 B.S. There are around 360 HHs in the community. This community is composed of mix group of ethnicity. Majority of the community is dalit and others are Tamang, Chettri, and Bahun. Most of them follow Hinduism followed Christian and Buddism. There are around 15 wells in the community. Since the water quality is not good the water is only used for washing purpose. They depend upon other source like tanker for drinking purpose. For the cooking purpose most of the people use LPG followed by fuel wood and kerosene. Almost all HHs are facilitated with electricity as lighting energy. Toilet is build by most of the Houses. Majority of the people are engaged in labor work and small shops for their livelihood.

- Security situation: Since the southern part of the site is Bagmati River it is not approachable from this side. But to the north the site is open to Sukumbasi Basti.
- The fencing of the site including the earthen road is likely to obstruct the local communities to access their properties.

- **Noise Levels**

Major noise source: Since the site is far from noise producing sources like road and industrial area, no significant sound pressure level was measured. Major noise contributing sources noted during

monitoring are Conversation among people (Human voice pitch), sound of occasional motor bike, vehicle & cycle, shouting of small kids playing nearby.

General weather condition: During monitoring period the general weather was cold and mild sunny.

Monitoring Day/ Date/time: Wednesday, 11/12/2013, 2:00 pm

Monitored by: Prasan Karmacharya

GPS location of Monitored site: 27˚41' 35.4'' N 85˚ 18' 32.8'' E

Sound Pressure Level:

The sound pressure level of the site has been presented in **Table no. 1**. The maximum sound pressure level within the site premises was 66 dB(A) and minimum sound pressure level was 44 dB(A). The equivalent sound pressure level was 55 dB(A).

Table 1. Sound Pressure Level, Within the Site Premises {dB(A)}

Noise Descriptors	Sound Pressure Level
Minimum	44
Maximum	66
Leq	55

Field Survey, 2013 December

- **Site Management Issues**
  - **Access to the site** – To assess the site from the Main Road, it need use of the narrow roads passing through relatively dense settlements. Two way traffic on these roads is difficult, further, the probability of damage to these roads is likely in the event of earthquake.
  - **Size of the site** – Tentative usable area of the site is around 13000 m^2, which is a small area for effective management of earthquake rubbles and segregation of usable.
  - **Drainage and sewers** - The general layout of the area is east west and the general drainage (natural) is north south. Deposition of rubbles is likely to obstruct the existing natural drainage. In addition the site is already crossed by four natural drainage and 4 sewer drainages which are open drainage. Obstruction of these drainages is likely to impact the overall sanitary conditions of the Sukumbasi Basti.
  - **Noise pollution** – Traffic movements and segregation activities is likely to enhance the noise level of the site surroundings impacting the adjoining school education and the communities of Sukumbasi Basti.
  - **Air pollution** – Traffic movements and segregation activities is likely to generate high fugitive dust emissions in surrounding areas with implication on the health of the adjoining school children and the communities of the Sukumbasi Basti.
  - **Bagmati River** - The spill or casting of the rubble materials on the Bagmati River is likely to impact the existing river channel, obstruction of the river flow and river channel shifting towards south affecting the opposite bank.
  - **Obstruction to mobility and access** – Fencing of the site is expected to impair the mobility of the Sukhumbasi Basti communities and access to their houses from the existing earthen road.
  - **Community health and safety** – The site lies adjacent to the community dwelling. Apart from noise pollution, air pollution, degradation of overall sanitation, the adjoining communities are likely to be exposed the accidental risks such as traffic, loading/unloading operations, segregation operations etc.
  - **Occupational health and safety** – Exposure to high noise, dusts, and working with rubbles while segregation are some of the issues related to occupational health and safety.
  - **Future Development** – A Plan for Bagmati Corridor road is on the air according to local people on this bank of the river. If this plan is to be implemented, then the proposed site will have only limited area on the eastern 100 m length of the river (ca. 8000m^2). In such a case, the area becomes too small for effective utilization for rubble management even for a short period.

Bagmati Corridor 6

Site location:

The site lies in the Kathmandu Metropolitan City (KMC) ward no. 34 of Kathmandu District (Figure 1 & 2). It lies at the confluence point of the Bagmati River and Manohara River. The site is open land which symbolizes natural flood plain of River Bagmati. The southern region of the site is the Bagmati River and there is a dense settlement in the northern region. The Eastern border is demarked by old iron bridge. The site is easily accessible as it lies in the Bagmati Corridor road. The site is about 450 meter far from the road connecting Sankhamul and Baneshwor. It is connected through 16 feet road from the main road (Sankhamul to Baneshwor) to the site. Beside that the site is also accessible from the Shantinagar gate of Baneshor to the site (approximately 1.5 km) along Bagmati corridor road which is about 26 feet wide.

The GPS coordinate of the eastern border of the site is N 27 ˚ 40’ 45.8’’ & E 85 ˚ 20’ 05.2’’ and the western corner is N 27 ˚ 40’ 43.6’’ & E 85 ˚ 20’ 00.8’’.

Figure 1. Google Image of site

Figure 2. Site location

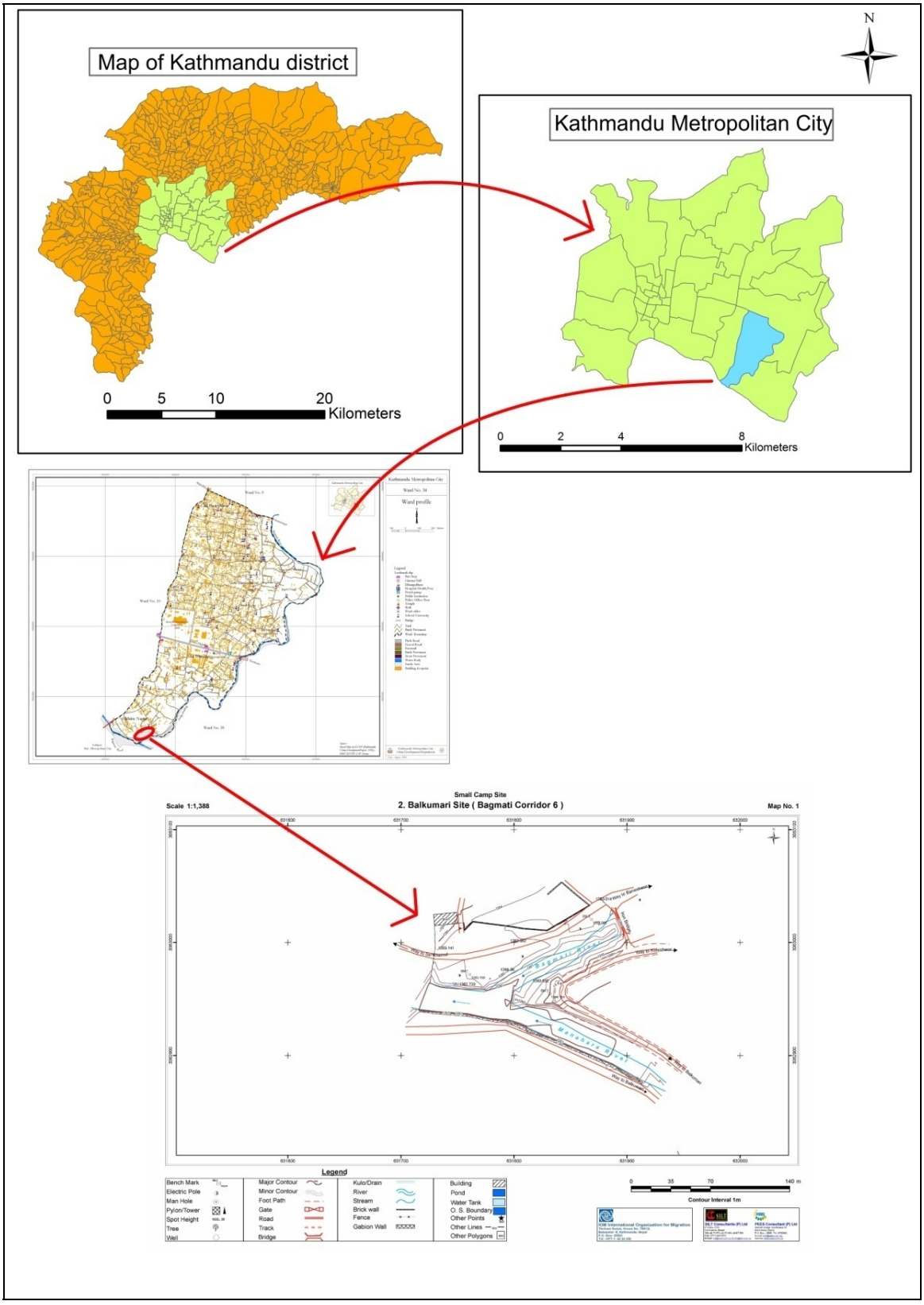
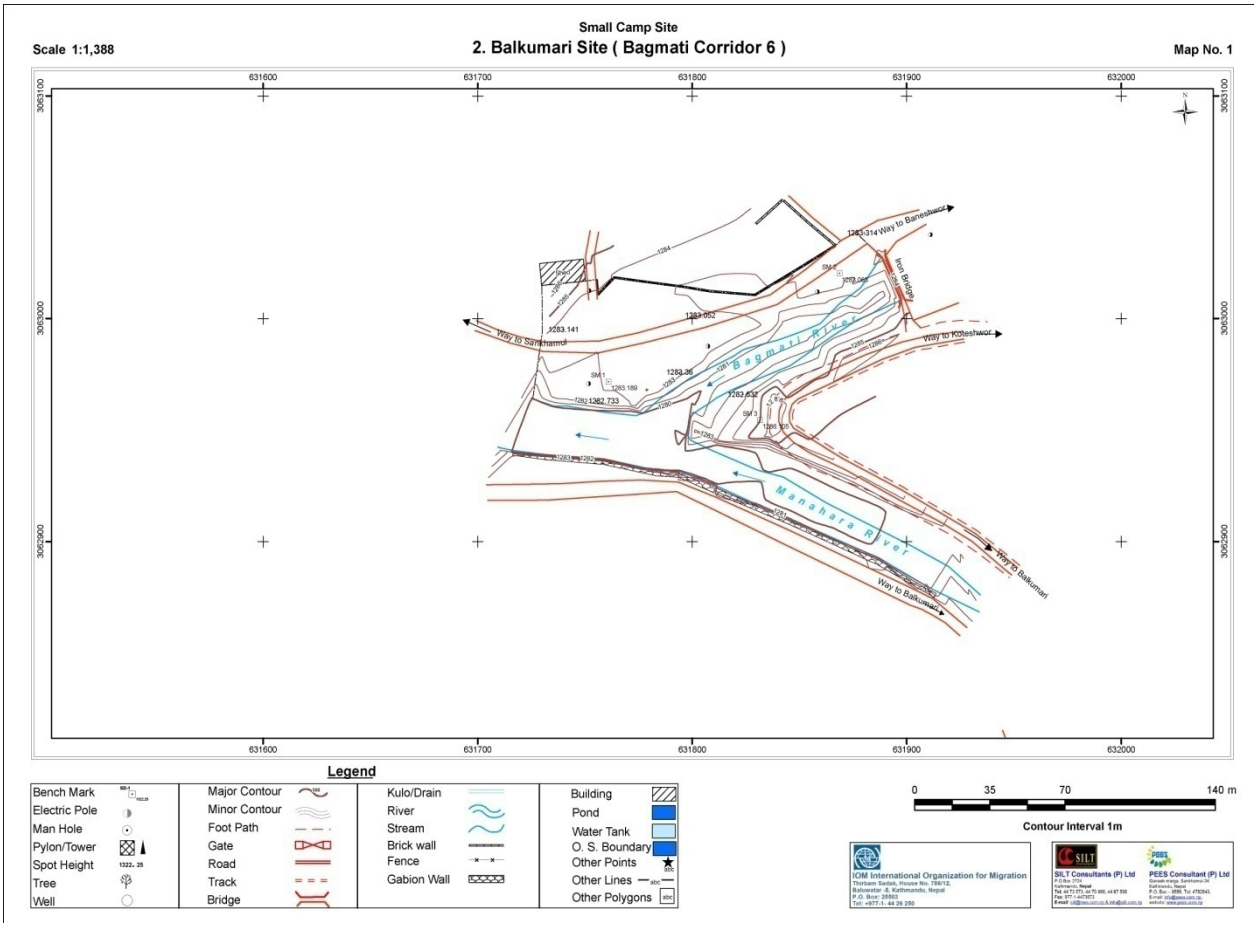


Figure 3. Site layout



The GPS coordinate and the general view of the site from different direction is shown in the figure below (Figure 4, 5, 6, 7, 8, 9, 10 &11).

1. **GPS coordinate (Eastern border of the site – near iron bridge)**

   27˚ 40’ 45.8’’ N 85˚20’ 05.2’’ E Altitude: 1293 m

Figure 4. Facing South

Figure 5. Facing East

Figure 6. Facing North

Figure 7. Facing West

2. **GPS coordinate (Western border of the site)**

27˚ 40’43.6’’ N 85 ˚20’ 00.8’’ E Altitude: 1290 m

Figure 8. Facing East

Figure 9. Facing North

Figure 10. Facing West

Figure 11. Facing South

Infrastructure:

- Nearest settlement: Nearest settlement area in the site is known as Sankhamul with 15 households attached to the border of site where approximately 300 people reside. A ten storey apartment is also under construction close to the site.

  One building is attached to the northern border of site and set back distance of other nearest buildings to the site is about 10 meters in northern border of the site whereas Bagmati River flows from the southern border of the site.

- Electric lines: There are about 4 electric poles inside the boundary of the site. The GPS location and the photographs of individual pole is given below:

Photographs of Individual pole

<table>
<tr><td> 
Figure 12. Electric pole no. 1</td><td> 
Figure 12. Electric pole no. 2</td></tr>
<tr><td>GPS coordinate:
27˚40’ 45.2’’ N 85˚ 20’ 04.1’’ E
Direction: Facing West</td><td>GPS coordinate:
27˚40’ 44.3’’ N 85˚ 20’ 02.0’’ E
Direction: Facing East</td></tr>
<tr><td> 
Figure 13. Electric poles no. 3</td><td> 
Figure 14. Electric pole no. 4</td></tr>
<tr><td>GPS coordinate:
27˚40’ 43.9’’ N 85˚ 20’ 00.3’’ E
Direction: Facing West</td><td>GPS coordinate:
27˚40’ 45.3’’ N 85˚ 20’ 0.1’’ E
Direction: Facing North</td></tr>
</table>

- Storm water drains and drainage: There is no storm water drainage. But there is one underground sewer drainage inside the project site boundary. The GPS coordinate of the drainages are given below:

Photographs of Drainage

Figure 15. Inlet of underground sewer

GPS coordinate:
27˚40’ 44.9’’ N 85˚ 20’ 0.1’’ E
Direction: Facing North

Figure 16. Outlet of underground sewer

GPS coordinate:
27˚ 40’43.6’’ N 85 ˚19’ 59.8’’ E
Direction: Facing south

- Recipient natural drainage and distance from the site: Natural recipient of the natural drainage is Bagmati River in the southern border of the site.
- Water supply pipes through the sites: No
- Wells, tube wells: No:
- Other purpose of the site: Storage of construction material and recreational area such as sunbathing by the locals. Beside that people use to extract sand from the river and deposit in the site area.

Figure 17. Workers extracting sand form River

GPS coordinate:
27˚40’ 43.6’’ N 85˚ 20’ 0.8’’ E
Direction: Facing East

Figure 18. Sand deposited in the bank of River

GPS coordinate:
27˚40’ 43.6’’ N 85˚ 20’ 0.8’’ E
Direction: Facing East

- Educational facilities: The nearest school is Awareness International Academy which is about 150 meters north from the site and Neric Academy which is about 200 meters north from the site.
- Health facilities: There are no any health facilities around the site.

- **Biological features:** Since the project lies along the Bagmati corridor which is highly encroached by settlement not a single tree exists in the project site. The site is small natural flood plain where discarded wastes are dumped. And moreover the site is also used for the storage of sand extracted from river, so there is no sign of any natural flora and fauna.
- **Social features:**

➢ Site land ownership: the site is owned by Kathmandu Municipality, government of Nepal.
➢ Occupational status of communities living close to the site: People living in nearby areas are involved in private small scaled businesses such as grocery shop in nearby areas, vehicle workshop and governmental organizations for job.

➢ Ethnic and Religious Background of the Communities close to the site: Except the traditional settlement in core areas of the Kathmandu Valley, most areas are multi-cultural and diverse with communities from various parts of the country. Thus there is presence of mixed ethnic group dominated by Brahmins, Gurungs and Newars including Dalits and Chhetris. Most people in this area follow Hinduism and Buddhism.
➢ Perception of the Communities on the proposed plan: Community people are not against the plan of post disaster debris management in the proposed site and are in favor of supporting such initiative.
➢ Approach of site by communities from all side for security concern: The site lies within the road and is easily accessible to community from all possible direction.
➢ Fencing of the site: Attached settlements use the site as connecting road to Sankhamul, Koteshwore, Baneshwore and Balkumari thus fencing of the site will disturb the daily life activities of the community.

- **Noise Levels**

Major noise source: Even though the site is far from noise producing sources like road and industrial area, significant sound pressure level was recorded. As the site lies about 1.5 km far from airport boundary, significant sound level of aircraft during its take off was record. Other noise contributing sources noted during monitoring were Conversation among people (Human voice pitch), sound of occasional motor bike, vehicle & cycle, Construction activities.
General weather condition: During monitoring period the general weather was warm and mild sunny.
Monitoring Day/ Date/time: Thrusday, 12/12/2013, 2:30 pm
Monitored by: Prasan Karmacharya
GPS location of Monitored site: 27˚40' 44.64 '' N 85˚ 20'01.89 '' E
Sound Pressure Level:
The sound pressure level of the site has been presented in **Table no. 1**. The maximum sound pressure level within the site premises was 70 dB(A) and minimum sound pressure level was 44 dB(A). The equivalent sound pressure level was 59 dB(A). The sound produced by the aircraft was recorded to be the maximum sound pressure level.

Table 1. Sound Pressure Level, Within the Site Premises {dB(A)}

Noise Descriptors	Sound Pressure Level
Minimum	44
Maximum	70
Leq	59

Field Survey, 2013 December

Management Issues

➢ **Access to the site** – Since the road connecting the site from the main road is very narrow and densely populated; it is difficult to access the site easily. Moreover, the probability of damage to these roads is likely in the event of earthquake.
Size of the site – Tentative usable area of the site is around 6000 m^2, which is a small area for effective management of earthquake rubbles and segregation of usable.

- **Drainage and sewers** – The general layout of the area is east west and the general drainage (natural) is north south. There is one underground sewer drainage where as the storm water from the settlement to the north runs through ground surface to the natural recipient River Bagmati to the south. Obstruction to the storm water flow may impact the sanitary conditions of the settlement nearby.
- **Noise pollution** – Traffic movements and segregation activities is likely to enhance the noise level of the site surroundings impacting the adjoining communities of Sankhamul.
- **Air pollution** – Traffic movements and segregation activities is likely to generate high fugitive dust emissions in surrounding areas with implication on the health of the adjoining communities of the Sankhamul.
- **Bagmati River** – The spill or casting of the rubble materials on the Bagmati River is likely to impact the existing river channel, obstruction of the river flow and river channel shifting towards south affecting the opposite bank.
- **Community health and safety** – The site lies adjacent to the community dwelling. Apart from noise pollution, air pollution, degradation of overall sanitation, the adjoining communities are likely to be exposed the accidental risks such as traffic, loading/unloading operations, segregation operations etc.
- **Occupational health and safety** – Exposure to high noise, dusts, and working with rubbles while segregation are some of the issues related to occupational health and safety.
- **Future Development -** If the plan of widening Bagmati corridor road is to be implemented, then the proposed site will have only limited area. In such a case, the area becomes too small for effective utilization for rubble management even for a short period.

Chabil site, Ringroad (Maharajgunj – Chabil)

Site location:

The site lies in the Kathmandu - Metropolitan City (KMC) ward no 4, 7 & 3 of Kathmandu District**.** The site is located at the northern side of KMC which is the core point of business and economic activities. The site roughly extends from north to south, the green belt of the ring road segment from Maharajgunj chowk to Chabil chowk which is about 3000 m long and has an average width of 18 m. Storm water drainage runs for most of the road length with underground cross-drainage structures to divert flows towards south at frequent intervals. Electrical/telecommunication poles are located on either side of the Ring Road near storm water drainage. Nearly 60% of the open space (green belt) stretch is planted with different types of trees, while about 40% of the space is open used for car parking and storage of construction materials. Average width of the green belt on either side of Ring Road (including internal side road) is about 18 m. The GPS coordinate of the Northern border of the site is 27 ˚44' 25.1'' N & 85˚ 20' 11.5'' E and the Southern border is 27 ˚43' 00.78'' N & 85 ˚ 20' 47.7'' E . The site lies from 20 meter north from Narayan Gopal Chowk to 20 meter south of Chabahil Chowk in both sides of the ring road, thus is easily accessible.

Figure 1. Site location Google image

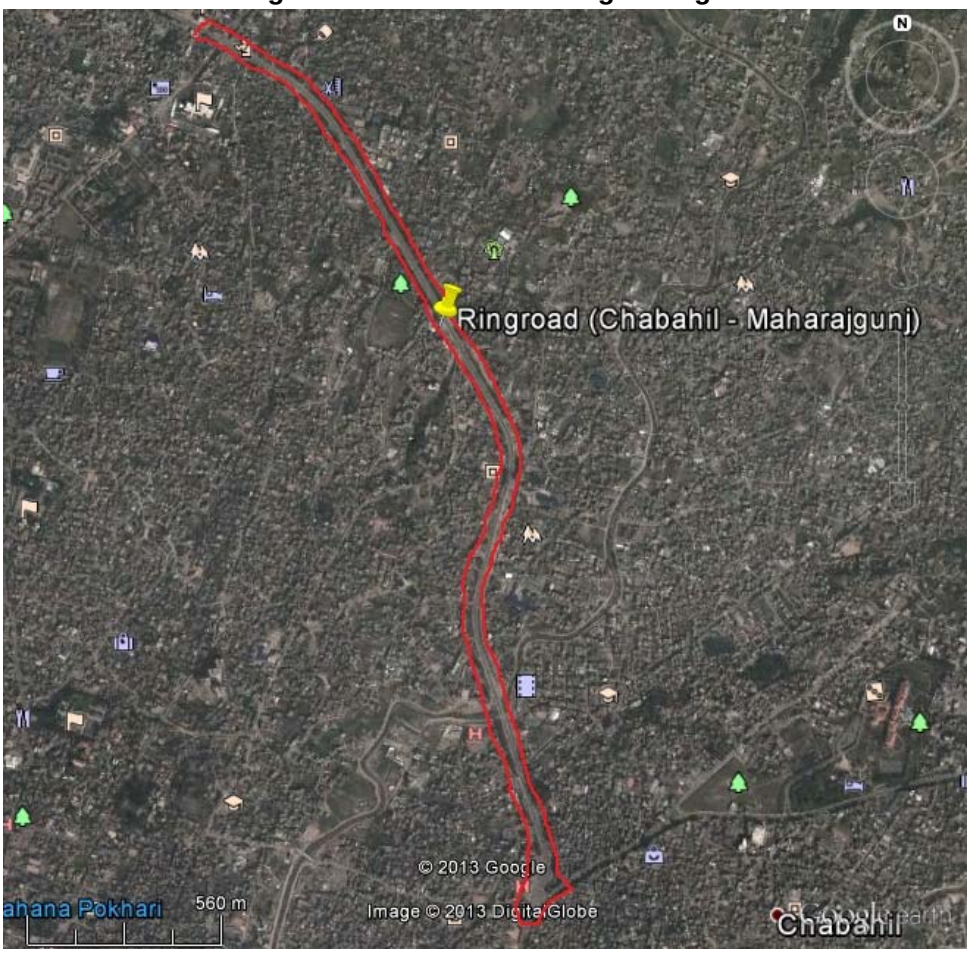
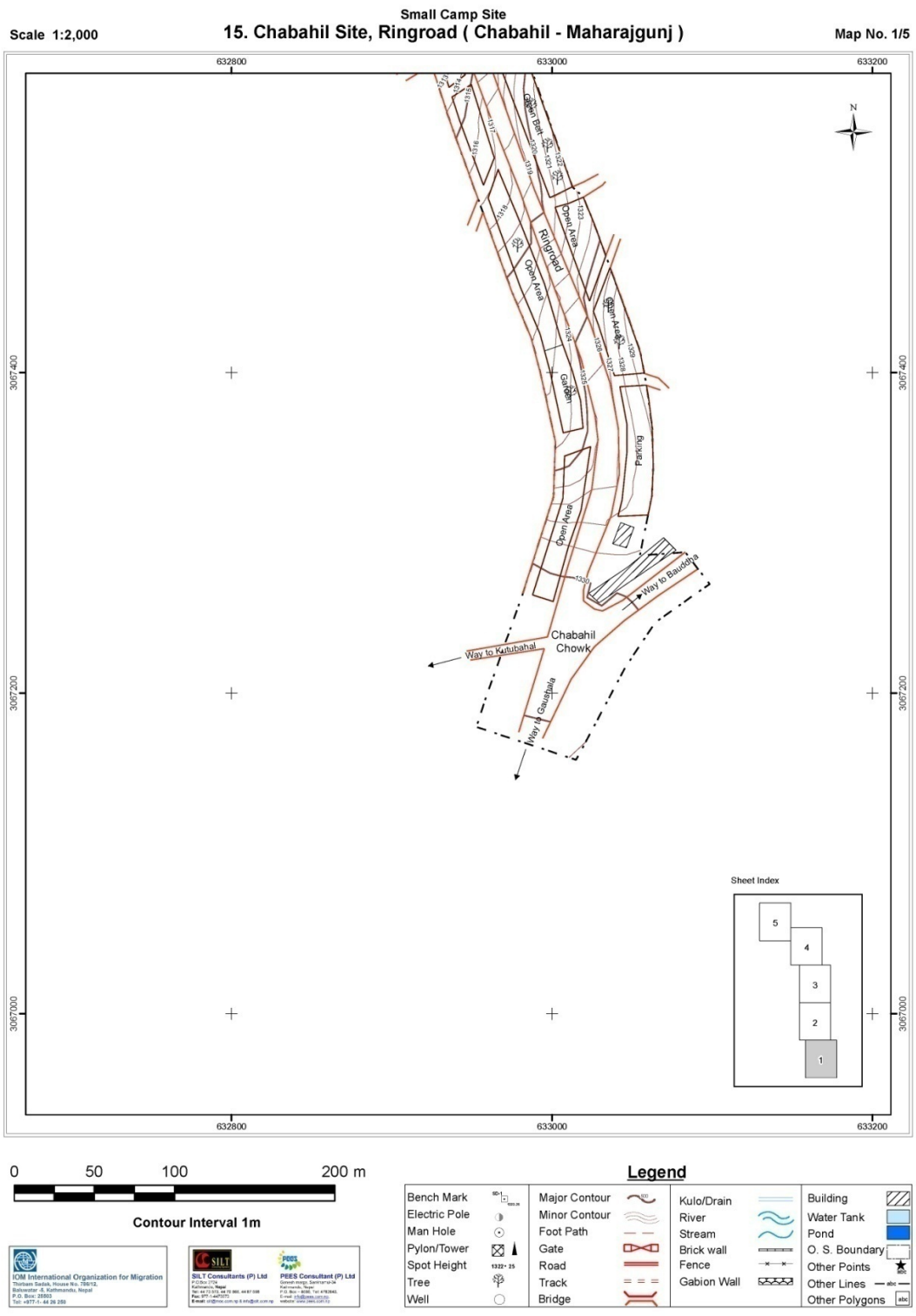
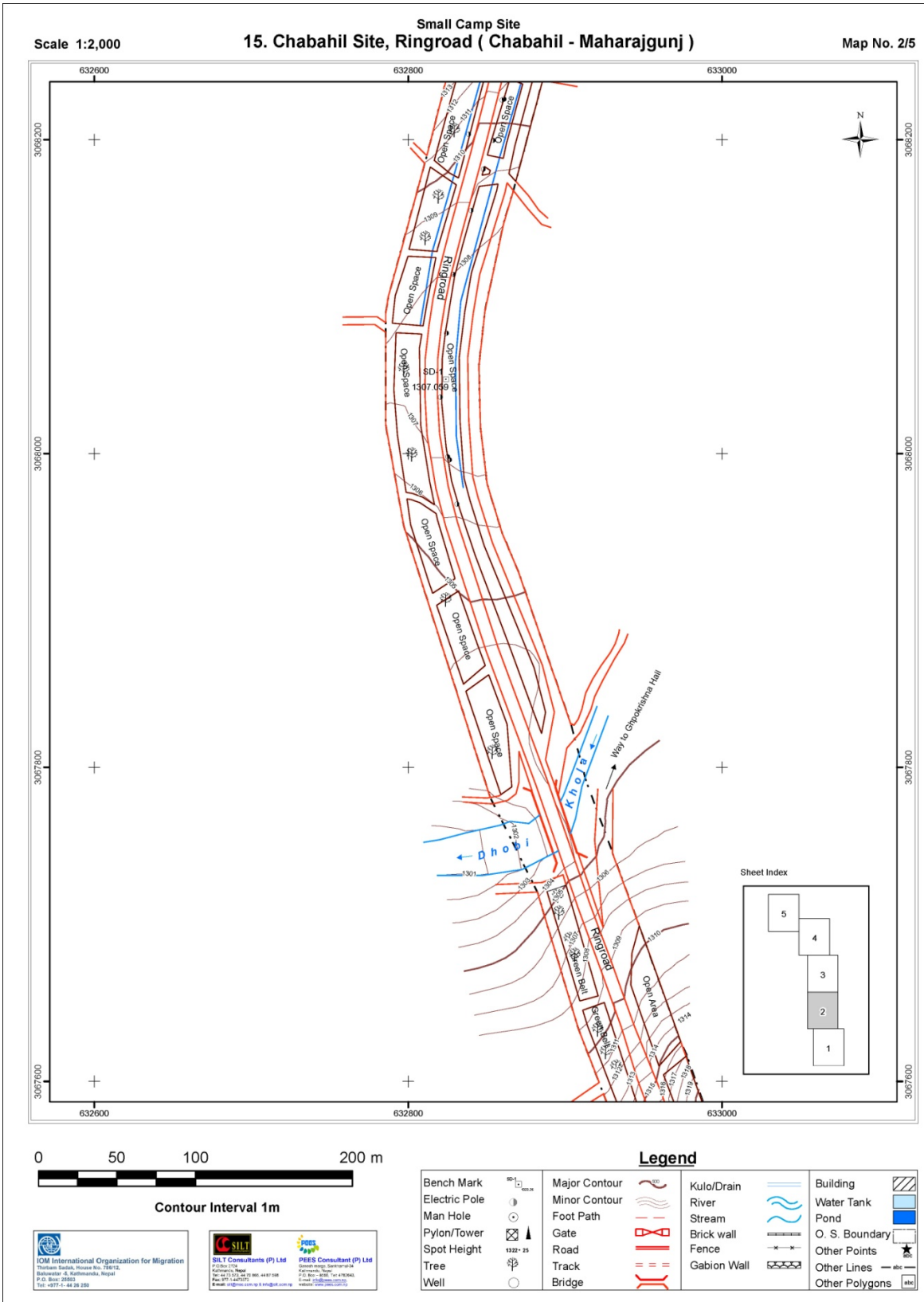


Figure 2. Site location



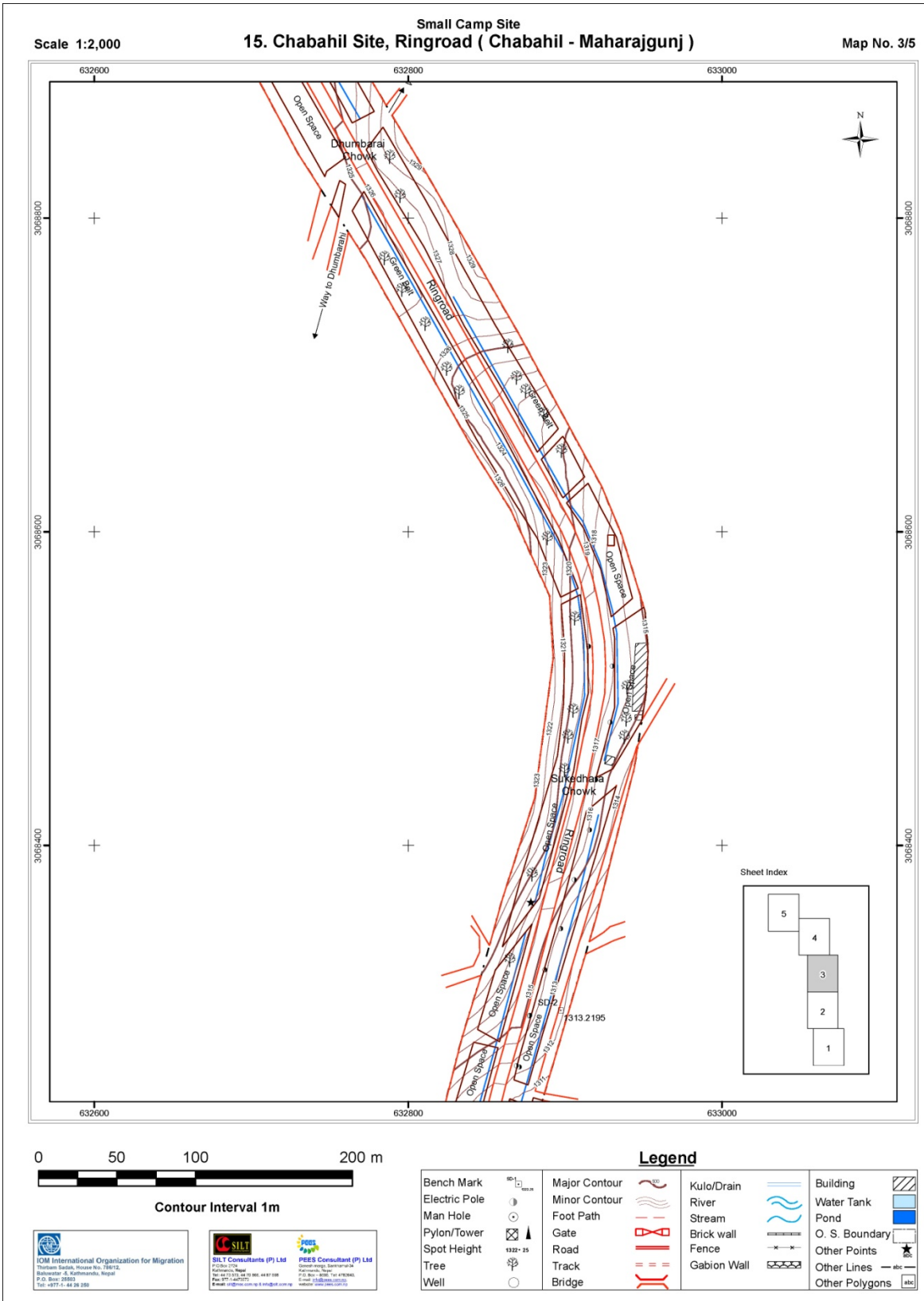
(1)

Figure 3. Site location



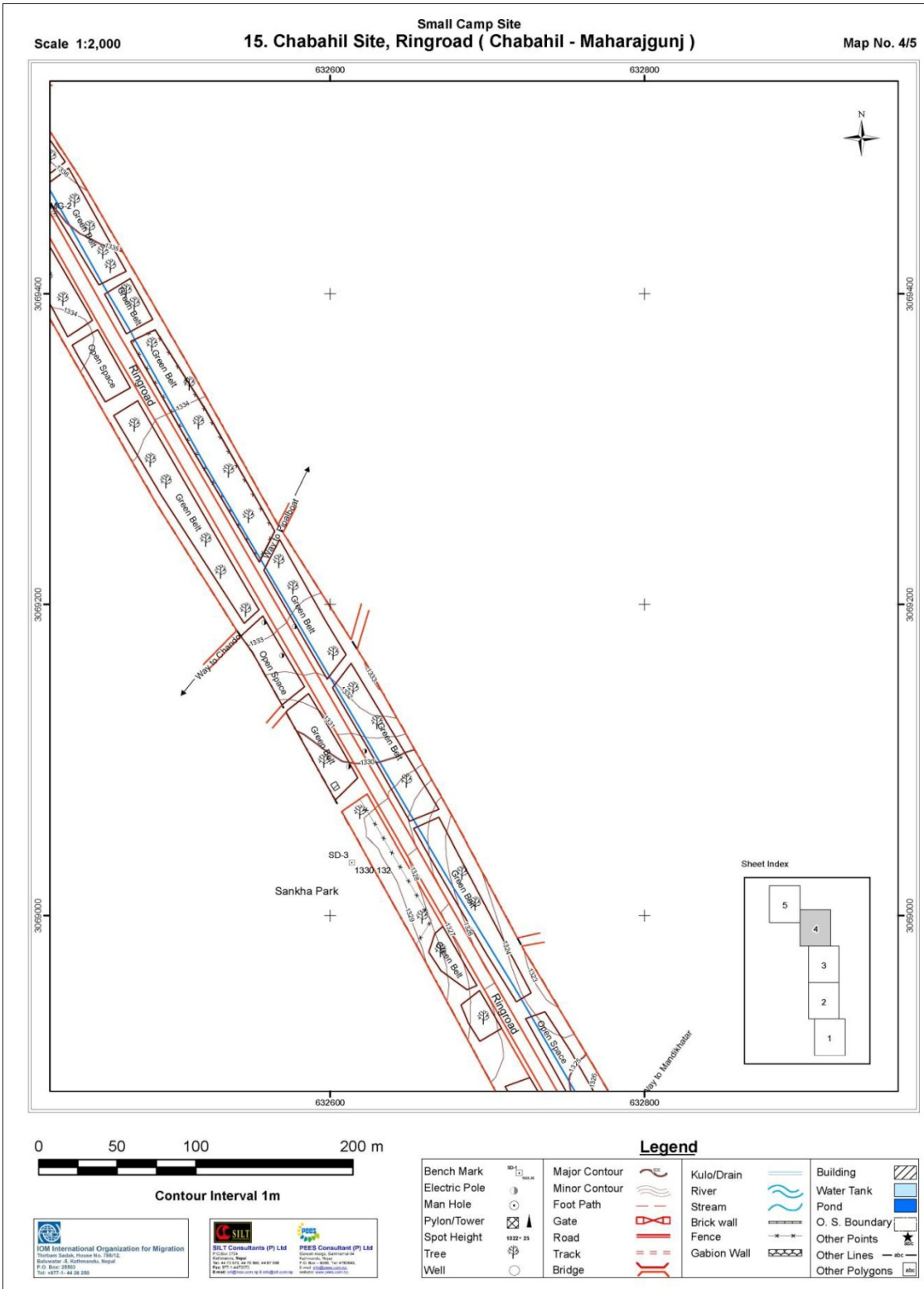
(2)

Figure 4. Site location



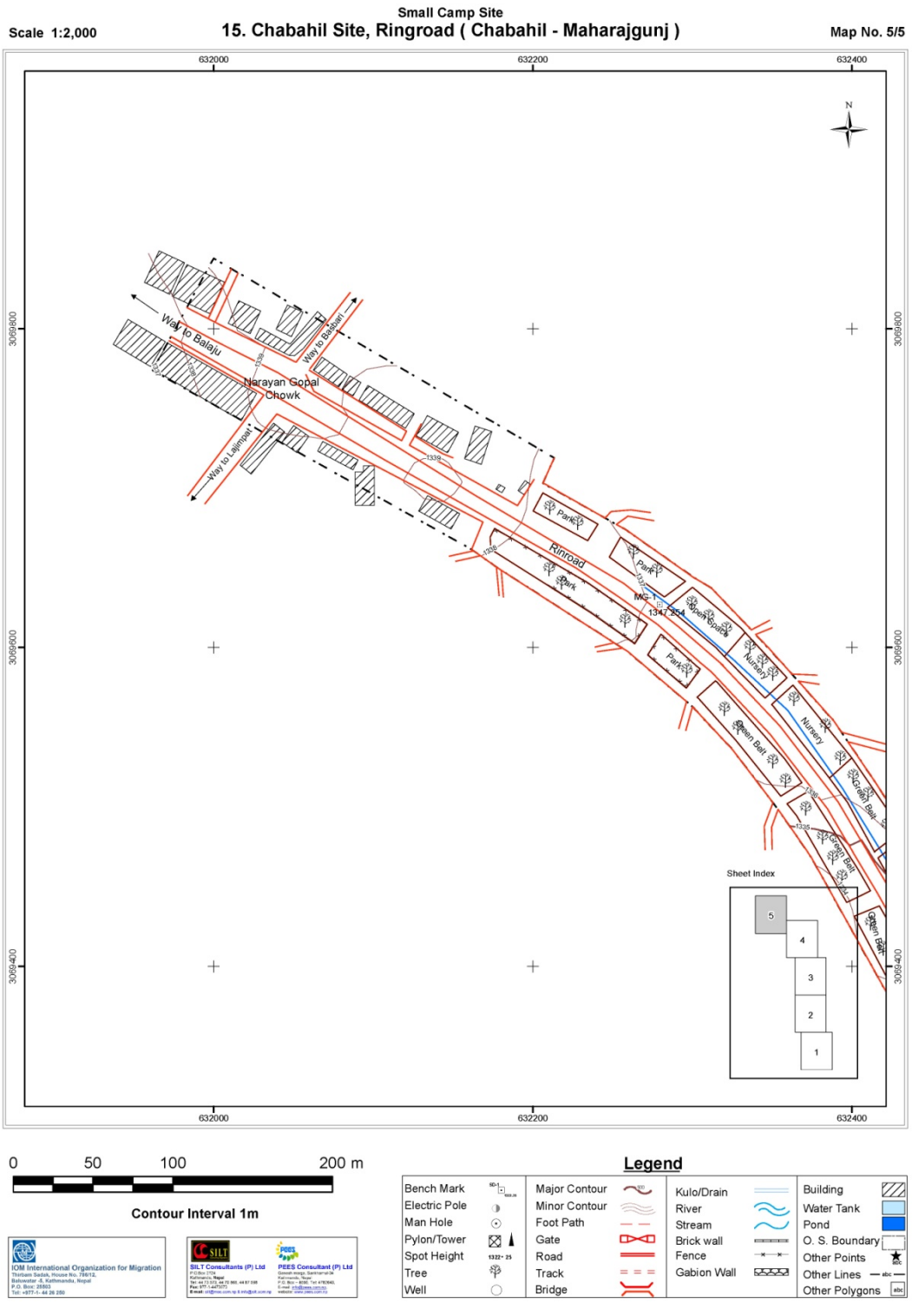
(3)

Figure 5. Site location



(4)

Figure 6. Site Location (5)



The GPS coordinate and the general view of the site from different direction is shown in the figure below:

1. **GPS coordinate (Northern border of the site – Near Narayangopal chowk, Maharajgunj)**

27˚ 44’ 25.1’’ N 85 ˚20’ 11.5’’ E Altitude: 1355 m

Figure 7. Facing north

Figure 8. Facing East

Figure 9. Facing South

Figure 10. Facing West

2. GPS coordinate (at the midpoint of the site)

27˚ 43’ 51.6’’ N 85 ˚20’ 41.7’’ E Altitude: 1338 m

Figure 11. Facing South

Figure 12. Facing East

Figure 13. Facing North

Figure 14. Facing West

Infrastructure:

- Electric lines: There are about 124 electric poles inside the boundary of the site. The GPS location and the photographs of individual pole is given below:

Photographs of Individual pole

Figure 15. Electric pole no. 1

GPS coordinate:
27˚44’25.25 ’’ N 85˚ 20’ 11.8’’ E

Figure 16. Electric pole no. 2

GPS coordinate:
27˚44’24.7 ’’ N 85˚ 20’ 12.9’’ E

Direction: Facing North	Direction: Facing East
 **Figure 17. Electric poles no. 3**	 **Figure 18. Electric pole no. 4**
GPS coordinate: 27˚44’ 24.1’’ N 85˚ 20’14.1 ’’ E Direction: Facing east	GPS coordinate: 27˚44’ 23.7’’ N 85˚ 20’14.9 ’’ E Direction: Facing East
 **Figure 19. Electric pole no. 5 &6**	 **Figure 20. Electric pole no. 7**
GPS coordinate: 27˚44’23.04 ’’ N 85˚ 20’ 16.16’’ E Direction: Facing east	GPS coordinate: 27˚44’ 22.4’’ N 85˚ 20’ 17.35’’ E Direction: Facing east
 **Figure 21. Electric pole no. 8**	 **Figure 22. Electric pole no. 9**
GPS coordinate: 27˚44’ 21.7’’ N 85˚ 20’18.7 ’’ E Direction: Facing east	GPS coordinate: 27˚44’ 20.84’’ N 85˚ 20’ 20.14’’ E Direction: Facing east

Figure 23. Electric pole no. 10

GPS coordinate:
27˚44’19.9 ’’ N 85˚ 20’21.7 ’’ E
Direction: Facing North

Figure 24. Electric pole no. 11

GPS coordinate:
27˚44’ 19.2’’ N 85˚ 20’22.8 ’’ E
Direction: Facing East

Figure 25. Electric pole no. 12

GPS coordinate:
27˚44’18.5 ’’ N 85˚ 20’ 23.5’’ E
Direction: Facing North

Figure 26. Electric pole no. 13

GPS coordinate:
27˚44’17.8 ’’ N 85˚ 20’ 24.2’’ E
Direction: Facing East

Figure 27. Electric pole no. 14

GPS coordinate:
27˚44’ 16.9’’ N 85˚ 20’ 25.3’’ E
Direction: Facing North

Figure 28. Electric pole no. 15

GPS coordinate:
27˚44’ 16.63’’ N 85˚ 20’25.5 ’’ E
Direction: Facing East

<table>
<tr><td> 
Figure 29. Electric pole no. 16</td><td> 
Figure 30. Electric pole no. 17</td></tr>
<tr><td>GPS coordinate:
27˚44’15.2 ’’ N 85˚ 20’26.5 ’’ E
Direction: Facing East</td><td>GPS coordinate:
27˚44’13.8 ’’ N 85˚ 20’27.2 ’’ E
Direction: Facing East</td></tr>
<tr><td> 
Figure 31. Electric pole no. 18</td><td> 
Figure 32. Electric pole no. 19</td></tr>
<tr><td>GPS coordinate:
27˚44’ 11.5’’ N 85˚ 20’29.2 ’’ E
Direction: Facing East</td><td>GPS coordinate:
27˚44’09.77 ’’ N 85˚ 20’30.01 ’’ E
Direction: Facing East</td></tr>
<tr><td> 
Figure 33. Electric pole no. 20</td><td> 
Figure 34. Electric pole no. 21</td></tr>
<tr><td>GPS coordinate:
27˚44’08.57 ’’ N 85˚ 20’30.8 ’’ E
Direction: Facing East</td><td>GPS coordinate:
27˚44’ 07.4’’ N 85˚ 20’31.9 ’’ E
Direction: Facing East</td></tr>
</table>

Figure 35. Electric pole no. 22

GPS coordinate:
27˚44’05.56 ’’ N 85˚ 20’ 32.73’’ E
Direction: Facing East

Figure 36. Electric pole no. 23

GPS coordinate:
27˚44’04.47 ’’ N 85˚ 20’ 33.43’’ E
Direction: Facing East

Figure 37. Electric pole no. 24

GPS coordinate:
27˚44’00.88 ’’ N 85˚ 20’ 35.66’’ E
Direction: Facing East

Figure 38. Electric pole no. 25

GPS coordinate:
27˚43’ 59.01’’ N 85˚ 20’ 37.2’’ E
Direction: Facing North

Figure 39. Electric poles no. 26 & 27

GPS coordinate:
27˚43’ 54.23’’ N 85˚ 20’ 40.24’’ E
Direction: Facing North

Figure 40. Electric pole no. 28

GPS coordinate:
27˚43’52.55 ’’ N 85˚ 20’41.19 ’’ E
Direction: Facing North

Figure 41. Electric pole no. 29

GPS coordinate:
27˚43’ 43.9’’ N 85˚ 20’45.8 ’’ E
Direction: Facing South

Figure 42. Electric pole no. 30

GPS coordinate:
27˚43’ 42.3’’ N 85˚ 20’ 45.5’’ E
Direction: Facing South

Figure 43. Electric pole no. 31

GPS coordinate:
27˚43’41.04 ’’ N 85˚ 20’ 45.1’’ E
Direction: Facing South

Figure 44. Electric pole no. 32

GPS coordinate:
27˚43’40.23 ’’ N 85˚ 20’ 44.83’’ E
Direction: Facing South

Figure 45. Electric pole no. 33

GPS coordinate:
27˚43’39.18 ’’ N 85˚ 20’44.46 ’’ E
Direction: Facing South

Figure 46. Electric pole no. 34

GPS coordinate:
27˚43’ 38.4’’ N 85˚ 20’ 44.2’’ E
Direction: Facing South

Figure 47. Electric pole no. 35

GPS coordinate:
27˚43’ 37.34’’ N 85˚ 20’ 43.84’’ E
Direction: Facing South

Figure 48. Electric pole no. 36

GPS coordinate:
27˚43’36.32 ’’ N 85˚ 20’43.50 ’’ E
Direction: Facing South

Figure 49. Electric pole no. 37

GPS coordinate:
27˚43’ 35.27’’ N 85˚ 20’43.21 ’’ E
Direction: Facing South

Figure 50. Electric pole no. 38

GPS coordinate:
27˚43’ 34.26’’ N 85˚ 20’42.9 ’’ E
Direction: Facing South

Figure 51. Electric pole no. 39

GPS coordinate:
27˚43’33.7 ’’ N 85˚ 20’42.6 ’’ E
Direction: Facing South

Figure 52. Electric pole no. 40

GPS coordinate:
27˚43’32.7 ’’ N 85˚ 20’ 42.4’’ E
Direction: Facing South

Figure 53. Electric pole no. 41

GPS coordinate:
27˚43’30.6 ’’ N 85˚ 20’ 41.7’’ E
Direction: Facing South

Figure 54. Electric pole no. 42 & 43

GPS coordinate:
27˚43’ 29.01’’ N 85˚ 20’ 41.6’’ E
Direction: Facing South

Figure 55. Electric pole no. 44

GPS coordinate:
27˚43’ 28.1’’ N 85˚ 20’41.5 ’’ E
Direction: Facing South

Figure 56. Electric pole no. 45

GPS coordinate:
27˚43’ 26.8’’ N 85˚ 20’ 41.6’’ E
Direction: Facing South

Figure 57. Electric pole no. 46

GPS coordinate:
27˚43’ 25.3’’ N 85˚ 20’42.05 ’’ E
Direction: Facing South

Figure 58. Electric pole no. 47

GPS coordinate:
27˚43’ 26.8’’ N 85˚ 20’ 41.5’’ E
Direction: Facing South

Figure 59. Electric pole no. 48

GPS coordinate:
27˚43’25.9 ’’ N 85˚ 20’41.8 ’’ E
Direction: Facing South

Figure 60. Electric pole no. 49

GPS coordinate:
27˚43’ 24.4’’ N 85˚ 20’42.5 ’’ E
Direction: Facing South

Figure 61. Electric pole no. 50

GPS coordinate:
27˚43’25.8 ’’ N 85˚ 20’41.9 ’’ E
Direction: Facing South

Figure 62. Electric pole no. 51 & 52

GPS coordinate:
27˚43’22.1 ’’ N 85˚ 20’ 43.4’’ E
Direction: Facing South

Figure 63. Electric pole no. 53, 54, 55, 56

GPS coordinate:
27˚43’ 19.2’’ N 85˚ 20’ 44.4’’ E
Direction: Facing South

Figure 64. Electric pole no. 57 & 58

GPS coordinate:
27˚43’17.2 ’’ N 85˚ 20’ 45.06’’ E
Direction: Facing South

Figure 65. Electric pole no. 59

GPS coordinate:
27˚43’16.46 ’’ N 85˚ 20’45.52 ’’ E
Direction: Facing South

Figure 66. Electric pole no. 60

GPS coordinate:
27˚43’15.4 ’’ N 85˚ 20’ 45.8’’ E
Direction: Facing South

Figure 67. Electric pole no. 61, 62 & 63

GPS coordinate:
27˚43’ 14.2’’ N 85˚ 20’ 46.1’’ E
Direction: Facing South

Figure 68. Electric pole no. 64

GPS coordinate:
27˚43’13.7 ’’ N 85˚ 20’ 46.3’’ E
Direction: Facing South

Figure 69. Electric pole no. 65

GPS coordinate:
27˚43’12.4 ’’ N 85˚ 20’46.7 ’’ E
Direction: Facing South

Figure 70. Electric pole no. 66

GPS coordinate:
27˚43’ 11.5’’ N 85˚ 20’ 47.1’’ E
Direction: Facing South

Figure 71. Electric pole no. 67

GPS coordinate:
27˚43’10.6 ’’ N 85˚ 20’47.7 ’’ E
Direction: Facing South

Figure 72. Electric pole no. 68

GPS coordinate:
27˚43’09.09 ’’ N 85˚ 20’ 48.01’’ E
Direction: Facing South

Figure 73. Electric pole no. 69

GPS coordinate:
27˚43’07.08 ’’ N 85˚ 20’48.9 ’’ E
Direction: Facing South

Figure 74. Electric pole no. 70

GPS coordinate:
27˚43’ 05.46’’ N 85˚ 20’49.6 ’’ E
Direction: Facing South

Figure 75. Electric pole no. 71

GPS coordinate:
27˚43’04.44 ’’ N 85˚ 20’ 49.5’’ E
Direction: Facing South

Figure 76. Electric pole no. 72

GPS coordinate:
27˚43’ 03.39’’ N 85˚ 20’ 48.9’’ E
Direction: Facing South

<table>
<tr>
<td> 
Figure 77. Electric pole no. 73</td>
<td> 
Figure 78. Electric pole no. 74 & 75</td>
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<tr>
<td>GPS coordinate:
27˚43’01.3 ’’ N 85˚ 20’ 48.09’’ E
Direction: Facing South</td>
<td>GPS coordinate:
27˚43’ 08.94’’ N 85˚ 20’ 47.26’’ E
Direction: Facing North</td>
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<tr>
<td> 
Figure 79. Electric pole no. 76</td>
<td> 
Figure 80. Electric pole no. 77</td>
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<tr>
<td>GPS coordinate:
27˚43’10.5 ’’ N 85˚ 20’46.7 ’’ E
Direction: Facing North</td>
<td>GPS coordinate:
27˚43’ 12.2’’ N 85˚ 20’ 46.2’’ E
Direction: Facing North</td>
</tr>
<tr>
<td> 
Figure 81. Electric pole no. 78 & 79</td>
<td> 
Figure 82. Electric pole no. 80</td>
</tr>
<tr>
<td>GPS coordinate:
27˚43’13.5 ’’ N 85˚ 20’45.7 ’’ E
Direction: Facing North</td>
<td>GPS coordinate:
27˚43’14.4 ’’ N 85˚ 20’45.3 ’’ E
Direction: Facing North</td>
</tr>
</table>

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<tr><td> 
Figure 83. Electric poles no. 81</td><td> 
Figure 84. Electric pole no. 82</td></tr>
<tr><td>GPS coordinate:
27˚43’16.1 ’’ N 85˚ 20’ 44.7’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚43’ 20.01’’ N 85˚ 20’43.3 ’’ E
Direction: Facing North</td></tr>
<tr><td> 
Figure 85. Electric pole no. 83</td><td> 
Figure 86. Electric pole no. 84</td></tr>
<tr><td>GPS coordinate:
27˚43’21.6 ’’ N 85˚ 20’ 42.8’’ E
Direction: Facing North</td><td>GPS Coordinate:
27˚43’ 23.1’’ N 85˚ 20’ 42.2’’ E
Direction: Facing North</td></tr>
<tr><td> 
Figure 87. Electric pole no. 85</td><td> 
Figure 88. Electric pole no. 86</td></tr>
<tr><td>GPS Coordinate:
27˚43’ 24.6’’ N 85˚ 20’ 41.5’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚43’ 26.38’’ N 85˚ 20’ 41.08’’ E
Direction: Facing north</td></tr>
</table>

Figure 89. Electric pole no. 87

GPS coordinate:
27˚43’ 27.88’’ N 85˚ 20’ 40.95’’ E
Direction: Facing North

Figure 90. Electric pole no. 88

GPS coordinate:
27˚43’ 29.4’’ N 85˚ 20’40.9 ’’ E
Direction: Facing north

Figure 91. Electric pole no. 89

GPS coordinate:
27˚43’ 30.6’’ N 85˚ 20’41.21 ’’ E
Direction: Facing North

Figure 92. Electric pole no. 90

GPS coordinate:
27˚43’ 32.08’’ N 85˚ 20’41.6 ’’ E
Direction: Facing North

Figure 93. Electric pole no. 91

GPS coordinate:
27˚43’33.5 ’’ N 85˚ 20’41.9 ’’ E
Direction: Facing North

Figure 94. Electric pole no. 92

GPS coordinate:
27˚43’ 35.04’’ N 85˚ 20’ 42.5’’ E
Direction: Facing North

Figure 95. Electric pole no. 93

GPS coordinate:
27˚43’36.5 ’’ N 85˚ 20’42.9 ’’ E
Direction: Facing North

Figure 96. Electric pole no. 94

GPS coordinate:
27˚43’37.8 ’’ N 85˚ 20’43.4 ’’ E
Direction: Facing North

Figure 97. Electric pole no. 95

GPS coordinate:
27˚43’ 40.04’’ N 85˚ 20’43.9 ’’ E
Direction: Facing North

Figure 98. Electric pole no. 96

GPS coordinate:
27˚43’40.7 ’’ N 85˚ 20’44.2 ’’ E
Direction: Facing north

Figure 99. Electric pole no. 97

GPS coordinate:
27˚43’42.2 ’’ N 85˚ 20’44.7 ’’ E
Direction: Facing North

Figure 100. Electric pole no. 98

GPS coordinate:
27˚43’ 43.01’’ N 85˚ 20’ 44.8’’ E
Direction: Facing North

Figure 101. Electric pole no. 99

GPS coordinate:
27˚43’43.9 ’’ N 85˚ 20’44.9 ’’ E
Direction: Facing North

Figure 102. Electric pole no. 100

GPS coordinate:
27˚43’44.86 ’’ N 85˚ 20’ 44.8’’ E
Direction: Facing North

Figure 103. Electric pole no. 101

GPS coordinate:
27˚43’45.8 ’’ N 85˚ 20’ 44.3’’ E
Direction: Facing North

Figure 104. Electric pole no. 102

GPS coordinate:
27˚43’46.7 ’’ N 85˚ 20’ 43.8’’ E
Direction: Facing North

Figure 105. Electric pole no. 103

GPS coordinate:
27˚43’48.1 ’’ N 85˚ 20’ 42.8’’ E
Direction: Facing West

Figure 106. Electric pole no. 104

GPS coordinate:
27˚43’ 49.9’’ N 85˚ 20’42.1 ’’ E
Direction: Facing West

Figure 107. Electric pole no. 105

GPS coordinate:
27˚43’ 51.1’’ N 85˚ 20’41.1 ’’ E
Direction: Facing West

Figure 108. Electric pole no. 106

GPS coordinate:
27˚43’51.8 ’’ N 85˚ 20’40.5 ’’ E
Direction: Facing West

Figure 109. Electric pole no. 107

GPS coordinate:
27˚43’52.4 ’’ N 85˚ 20’ 40.2’’ E
Direction: Facing West

Figure 110. Electric pole no. 108

GPS coordinate:
27˚43’54.1 ’’ N 85˚ 20’39.1 ’’ E
Direction: Facing West

Figure 111. Electric pole no. 109

GPS coordinate:
27˚43’ 55.4’’ N 85˚ 20’ 38.3’’ E
Direction: Facing North

Figure 112. Electric pole no. 110

GPS coordinate:
27˚43’ 57.8’’ N 85˚ 20’ 36.8’’ E
Direction: Facing West

Figure 113. Electric pole no. 111

GPS coordinate:
27˚43’58.6 ’’ N 85˚ 20’36.5 ’’ E
Direction: Facing North

Figure 114. Electric pole no. 112

GPS coordinate:
27˚43’ 59.94’’ N 85˚ 20’ 35.5’’ E
Direction: Facing North

Figure 115. Electric pole no. 113

GPS coordinate:
27˚44’01.3 ’’ N 85˚ 20’34.6 ’’ E
Direction: Facing North

Figure 116. Electric pole no. 114

GPS coordinate:
27˚44’ 02.8’’ N 85˚ 20’33.7 ’’ E
Direction: Facing North

Figure 117. Electric pole no. 115

GPS coordinate:
27˚44’ 03.9’’ N 85˚ 20’33.01 ’’ E
Direction: Facing North

Figure 118. Electric pole no. 116

GPS coordinate:
27˚44’05.1’’ N 85˚ 20’ 32.2’’ E
Direction: Facing North

Figure 119. Electric pole no. 117

GPS coordinate:
27˚44’ 06.5’’ N 85˚ 20’31.8 ’’ E
Direction: Facing North

Figure 120. Electric pole no. 118

GPS coordinate:
27˚44’15.4 ’’ N 85˚ 20’ 25.9’’ E
Direction: Facing North

Figure 121. Electric pole no. 119

GPS coordinate:
27˚44’21.05 ’’ N 85˚ 20’ 18.5’’ E
Direction: Facing West

Figure 122. Electric pole no. 120

GPS coordinate:
27˚44’21.6 ’’ N 85˚ 20’ 17.05’’ E
Direction: Facing West

Figure 123. Electric pole no. 121

GPS coordinate:
27˚44’ 22.38’’ N 85˚ 20’ 15.7’’ E
Direction: Facing West

Figure 124. Electric pole no. 122

GPS coordinate:
27˚44’ 23.1’’ N 85˚ 20’ 14.1’’ E
Direction: Facing West

 **Figure 125. Electric pole no. 123**	 **Figure 126. Electric pole no. 124**
GPS coordinate: 27˚44'23.3 '' N 85˚ 20' 13.6'' E Direction: Facing West	GPS coordinate: 27˚44' 23.9'' N 85˚ 20'12.7 '' E Direction: Facing West

- Storm water drains and drainage: The site lies along the Ring road corridor from the Narayangopal chowk- maharajgunj to Chabil chowk. Storm water drain is managed through an open channel in the eastern border of the rind-road (From Narayangopal Chowk to Om Hospital and Research Centre in the left hand side of the ring road) and through an underground pipeline in crossing of the ring road leading towards sub-ways. While in right hand side of the road from Narayan Gopal Chowk to Om Hospital and Research Centre the storm water is managed through underground sewerage pipe. Storm water drain mainly flows from north to south, as ring road is in north to south in this place, due to elevation in northern part of the site and is finally disposed in natural stream nearby Om Hospital and Research Centre leading towards Bagmati River. From Chabahil Chowk the storm water is mixed with sewerage and is disposed in the natural stream flowing nearby Om Hospital and Research Centre through underground piping which has no effect in the selected post debris management site.
  The photographs and GPS coordinate of the drainage is given below:

Photographs of the drainage:

 **Figure 127. Surface storm water drain**	 **Figure 128. Surface storm water drain along road**
GPS coordinate: 27˚43' 51.1'' N 85˚ 20' 41.5'' E Direction: Facing East	GPS coordinate: 27˚44' 06.5'' N 85˚ 20'31.8 '' E Direction: Facing South

- Water supply pipes through the sites: The drinking water pipes are laid underground along the both side of the road.

- Wells, tube wells and tap: There are two tap inside the boundary of the site. Beside that there is one spring water source. The GPS location and the photograph is given below:

Figure 129. Spring water source

GPS coordinate:
27˚43’ 51.6 ’’ N 85˚ 20’ 41.7’’ E
Direction: Facing East

Figure 130. Tap no. 1

GPS coordinate:
27˚43’ 08.1 ’’ N 85˚ 20’ 48.5’’ E
Direction: Facing East

Figure 131. Tap no. 2

GPS coordinate:
27˚43’ 38.9 ’’ N 85˚ 20’ 44.7’’ E
Direction: Facing west

- Structures: There are 18 building structures inside the site. Since the site is along the ring road there are 6 Bus stands, 1 bridge and 2 temples. The photographs and GPS coordinates of bus stands and temple are given below:

Photographs of Structure:

<table>
<tr><td> 
</td><td>  </td></tr>
<tr><td>Figure 132. Building no. 1</td><td>Figure 133. Building no. 2</td></tr>
<tr><td>GPS coordinate:
27˚44’ 25.4 ’’ N 85˚ 20’11.6 ’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚44’ 25.1’’ N 85˚ 20’ 12.7’’ E
Direction: Facing North</td></tr>
<tr><td> 
</td><td>  </td></tr>
<tr><td>Figure 134. Building no. 3</td><td>Figure 135. Building no. 4</td></tr>
<tr><td>GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Figure 136. Building no. 5</td><td>Figure 137. Building no. 6 & 7</td></tr>
<tr><td>GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North</td></tr>
</table>

Figure 138. Building no. 8

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North

Figure 139. Building no. 9

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North

Figure 140. Building no. 10

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North

Figure 141. Building no. 11

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North

Figure 142. Building no. 12 & 13

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North

Figure 143. Building no. 14

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North

Figure 144. Building no. 15

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North

Figure 145. Building no. 16, 17 & 18

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing North

Figure 146. Bus stand no. 1

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing South

Figure 147. Bus stand no. 2

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing West

Figure 148. Bus stand no. 3

GPS coordinate:
27˚44’ ’’ N 85˚ 20’ ’’ E
Direction: Facing west

Figure 149. Temporary vegetable and fruit stalls

GPS coordinate:
27˚43’ 43.9 ’’ N 85˚ 20’ 45.8’’ E
Direction: Facing East

Figure 150. Plant nursery

GPS coordinate:
27˚43’ 42.2 ’’ N 85˚ 20’ 45.3’’ E
Direction: Facing East

Figure 151. Traffic police post

GPS coordinate:
27˚43’ 41.5’’ N 85˚ 20’45.3 ’’ E
Direction: Facing East

Figure 152. Bus stand no. 4

GPS coordinate:
27˚43’ 39.2 ’’ N 85˚ 20’ ’’ E
Direction: Facing west

Figure 153. Bus stand no. 5

GPS coordinate:
27˚43’ 20.4 ’’ N 85˚ 20’43.9 ’’ E
Direction: Facing South

Figure 154. Bridge

GPS coordinate:
27˚43’ 19.7 ’’ N 85˚ 20’43.7 ’’ E
Direction: Facing South

Figure 155. Kumari mandir

GPS coordinate:
27˚44’ 02.8 ’’ N 85˚ 20’ 34.1’’ E
Direction: Facing west

	
Figure 156. Temple	**Figure 157. Bus stand no. 6**
GPS coordinate: 27˚43’ 15.1’’ N 85˚ 20’ 45.2’’ E Direction: Facing west	GPS coordinate: 27˚43’ 18.1 ’’ N 85˚ 20’44.01 ’’ E Direction: Facing North

- Other purpose of the site: Green belt, parking and storage of construction material.

- Educational facilities:

  Since the site covers the large area along the ring road there are many educational facilities near the site. The details of the educational facilities are given below:

1. 300 metres North East from Narayangopal Chowk: Norvic Institute of Nursing Education;
2. 40 metres East from coordinate 27°44’16.83” N 85°20’24.93” E: Kathmandu Valley High School;
3. 120 metres North West from Sankha Park: Kantipur English High School;
4. 150 metres South West from Dhumbarahi Chowk: Prolific Higher Secondary School;
5. 110 metres South from Sukedhara Chowk: Brooklyn International College;
6. 120 metre South East from Sukedhara Chowk: New Millennium College; and
7. 200 metres North West from Chabahil Chowk: Pushpalal Memorial College.

- Health facilities: The details of nearest hospital along the site are given below:

1. 70 metres East from Dhumbarahi Chowk: Family Health Care and Research Centre;
2. 80 metres East North from Dhumbarahi Chowk: Dhanawantari Aayurvedic Hospital;
3. 50 metres West from Dhumbarahi Chowk: Anamol Hospital and Research Centre;
4. 50 metres West from Gopi Krishna Chowk: Om Hospital and Research Centre;
5. 70 metres South West from Chabahil Chowk: Medicare National Hospital and Research Centre; and
6. 50 metres West from Chabahil Chowk: Helping Hand Hospital.

- **Biological features:** The project site lies along the green belt constructed during the ring road construction. There are about 641 trees inside the site boundary. The details of the trees are given below:

Table 1. Details of trees

S.N	Tree species (Local Name)	No of trees
1	Rubber plant	2
2	Kaiyo tree	467
3	Shirish tree	116
4	Uttish	8
5	Peepal tree	10
6	Lahare peepal tree	37
7	Bar tree	1
	Total	**641**

Photographs of Trees

	
Figure 158. Group of Shirish trees	**Figure 159. Group of trees**
GPS coordinate: 27˚44' 17.3'' N 85˚ 20' 24.7'' E Direction: facing East	GPS coordinate: 27˚43' 49.06'' N 85˚ 20' 42.5'' E Direction: facing West

	
Figure 160. Group of Kaiyo tree	**Figure 161. Group of Trees**
GPS coordinate: 27˚44' 20.6'' N 85˚ 19' 20.9'' E Direction: facing East	GPS coordinate: 27˚44'18.5 '' N 85˚ 20' 23.5'' E Direction: facing north

- **Social features:**
  - Site land ownership: Department of Roads, Government owned land
  - Occupational status of communities living close to the site: Both parts of the ring road is used for business purposes and many people living in those areas have established some kind of business and service providing organization close to the site.
  - Ethnic and Religious Background of the Communities close to the site: Settlement in ring road area is diverse and mainly people from other parts of the country have migrated to these places. Thus due to this diversity, there is presence of mixed ethnic group dominated by Brahmins and Newars including Dalits and Chhetris. Most people in this area follow Hinduism and Buddhism with small number of people following Christianity.
  - Perception of the Communities on the proposed plan: Community people are not against the plan of debris management in the proposed site.

- Nearby settlement: There are many settlements along the road. The site lies from 20 meter north from Narayan Gopal Chowk to 20 meter south of Chabahil Chowk in both sides of the ring road, thus is easily accessible.

  <u>Nearest Settlement area:</u>

- 700 meters South East from Narayangopal Chowk is known as Narayan Gopal Chowk;
- 900 meters South from the end of Narayan Gopal Chowk (refer to first bullet point) is known as Dhumbarahi;
- 500 meters South from end of Dhumbarahi (refer to second bullet point) is known as Gwarko; and
- Remaining 900 meters from the end of Gwarko (refer to third bullet point) is known as Chabahil.

Set back distance from the nearest building to the site is about 5 meters in both side of the site .i.e. eastern and western border of the site.

- Approach of site by communities from all side for security concern: The site lies in both side of ring road thus it is easily accessible to community from all possible direction.

- Fencing of the site: Attached settlements use the site as connecting road to ring-road thus fencing of the site will disturb the daily life activities of the community.

- **Noise Levels**

Major noise source: As the site lies along the busiest road of the valley (from Narayangopal chowk to Chabil chowk), significant sound pressure level was recorded. Major noise sources noticed during monitoring were Vehicles especially power horn of large truck and buses. Other sources noted during monitoring were Conversation among people (Human voice pitch), Construction activities.

General weather condition: During monitoring period the general weather was warm and mild sunny.

Monitoring Day/ Date: Thursday, 12/12/2013

Monitored by: Prasan Karmacharya

Sound Pressure Level:

Since the site along the ring road covers a large area (about 3 km), the noise level was monitored at 3 different places, namely

S.N	Site Location	GPS location	Monitored time
1	Near Narayangopal chowk	27˚44'19.17 '' N 85˚ 20' 21.8 '' E	12: 30 pm
2	Near Sankha park	27˚44'01.72 '' N 85˚ 20' 34.24'' E	1:15 pm
3	Near Chabil chowk	27˚43' 09.06'' N 85˚ 20' 47.1'' E	2:15 pm

The sound pressure level at different site has been presented in **Table no. 2**. The maximum sound pressure level among different site was found 89 dB(A) at Sankha park and minimum sound pressure level was found 54 dB(A) at Narayan gopal chowk. The equivalent sound pressure level at different place namely Narayangopal chowk, Sankha park and Chabil chowk was 68 dB(A), 73 dB(A) and 66 dB(A) respectively. The sound produced by power horn of heavy truck and bus was recorded as maximum sound pressure level.

Table 2. Sound Pressure Level, at different Site {dB(A)}

Noise Descriptors	Sound Pressure Level		
	Near Narayan gopal chowk	Near Sankha park	Near Chabil chowk
Minimum	54	55	56
Maximum	75	89	79
Leq	68	73	66

Field Survey, 2013 December

Management Issues

- ***Site Location*** – Located at the middle of the heavily populated area adjacent to the traffic life line
- **Available *area*** – The area is too small for the management of the earthquake rubble. Further, the width of the area is too small even to deposit the rubble in desired quantities. Maximum deposition height could not exceed 2.5 m for the safety of the rig road traffic.

- ***Traffic* obstruction** – There are about 19 motor able entry points in the proposed stretch (9 from southern side and 10 from northern side). Continuous filling of the site with rubbles from east to west on either side of Rig Road will obstruct the inflowing traffic into the Ring Road. Leaving space to allow traffic into Ring Road will further reduce the available size for rubble management.
- **Obstruction *to access the property*** – The internal side roads and foot trails are the key assess routes to the built residential and commercial property located at the northern and southern perimeter of the proposed site. Using the entire available area for rubble management will obstruct the access to property. Leaving safety space for access will further reduce the size of the available area for rubble management.
- **Obstruction *to surface storm water drainage*** – The surface storm water drainage on either side of the Ring Road is the primary drainage outlet for the settlements located at the perimeter of the site. Filling of the purposed site will obstruct the existing natural as well as manmade surface drainage network. In the event of rainfall water logging is expected in the settlement areas degrading the sanitation conditions. Further spill and side casting of the rubble in the existing storm water drainage of the Ring Road is likely to obstruct the existing drainage will implication on the road surface of the Ring Road. Maintaining a safety distance to avoid the above consequences will further reduce the available area for rubble management.
- **Damage *to water supply pipe network***: All of the water supply pipes are underground. Exact locations of the pipeline network are not available. Local people maintain that the water supply pipes are buried on the proposed site. Loading of the site by rubble is likely to damage the pipes and the water supply to the community. Further any breakage of the pipe in a water supply system with intermittent supply operation is likely to contaminate the supply water with implication on the community health.
- **Damage to Electrical and Telecommunication Lines** – About 124 electrical and telecommunication poles exist on either side of the Rig Road. Most of these poles locate by the side of the storm drainage, but a few locates in the middle of the green belt. These infrastructures will have to be relocated.
- **Temple relocation** – two temple is located within the proposed site, which may require relocation
- **Building relocation** – There are about 18 buildings located inside the site boundary which may require relocation or that area may be avoided.
- **Noise pollution** – Traffic movements and segregation activities is likely to enhance the noise level of the site surroundings impacting the adjoining school education and the communities.
- **Air pollution** – Traffic movements and segregation activities is likely to generate high fugitive dust emissions in surrounding areas with implication on the health of the adjoining school children and the communities.
- **Community health and safety** – The site lies at the heart of the community dwelling. Apart from noise pollution, air pollution, degradation of overall sanitation, the adjoining communities are likely to be exposed to the accidental risks such as traffic, loading/unloading operations, segregation operations etc.
- **Occupational health and safety** – Exposure to high noise, dusts, and working with rubbles while segregation are some of the issues related to occupational health and safety.
- **Future Development** – A road expansion program is going on in this area. The plan proposes to expand the road width for 8 lane road. In this case all the available area (the green belt) will be utilized for the road expansion leaving no space for rubble management.

Lagankhel Ringroad (Satdobato – Ekantakuna)

Site location:

The site is the green belt developed on either side of the Ring Road from Ekatakuna to Satdobato in the Lalitpur Sub - Metropolitan City (LSMC) ward no 13, 14 and 15 of Lalitpur District **(Figure 1, 2, 3 and 4).** It is located at the center of the urban hub. Roughly extending from east to west, the green belt on northern and southern flank of the Ring Road is approximately 2000 m long and has an average width of 18m. About 10m wide Ring Road on the center of the green belt is flanked on either side by about 2 m wide storm water drainage which runs for most of the road length with underground cross-drainage structures to divert flows towards south at frequent intervals (200 to 500 m). At the outer edge of the storm water drainage electrical/telecommunication poles are located on either side of the Ring Road. Nearly 60% of the open space (green belt) stretch is planted with different types of trees, while about 40% of the space is open used for car parking and storage of construction materials. Average width of the green belt on either side of Ring Road (including internal side road) is about 18m. Approximately 3.5m wide internal side road on the outer edge of the green belts is developed in the eastern 1000m section, while in the of the western section about 2m wide foot trails forms the outer edge of the green belts.

The size of the area including ring road and internal side road is about 11.71 ha. Excluding Ring Road, storm water drainage, safe distance to electrical poles, and the internal side road and foot path is about 5 ha. This means the area available is two linear belts approximately 2000 m long with an average width of 12.5 m.

Figure 1: Site Location Google Image

Figure 2: Site Location (1)

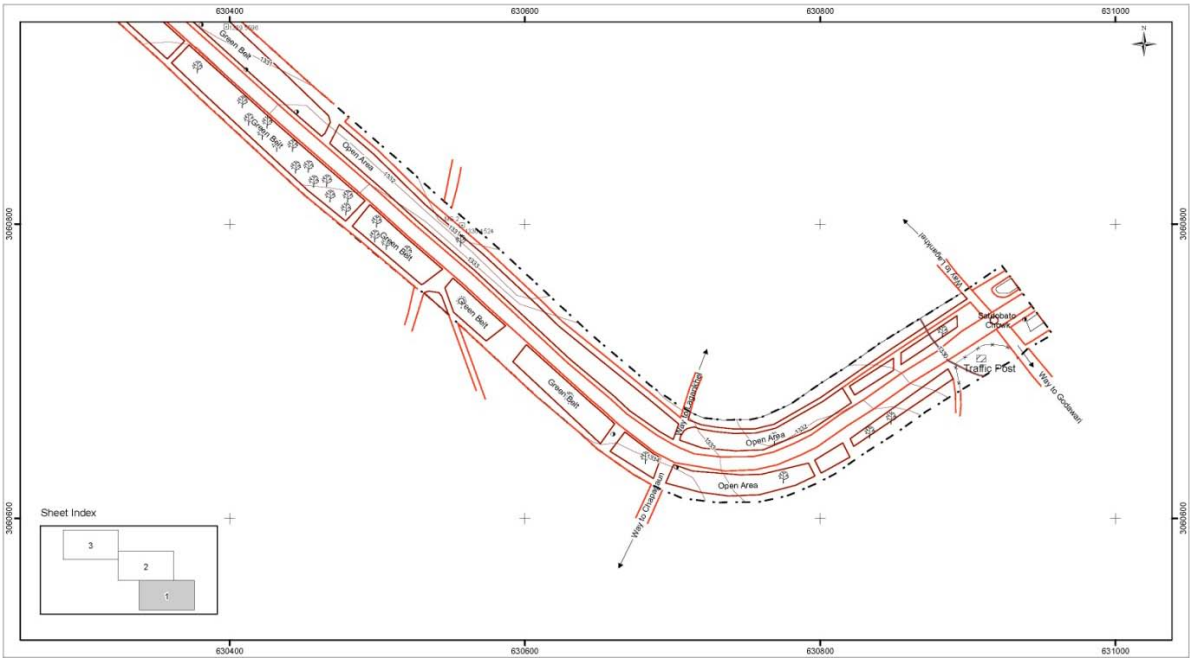


Figure 3: Site Location (2)

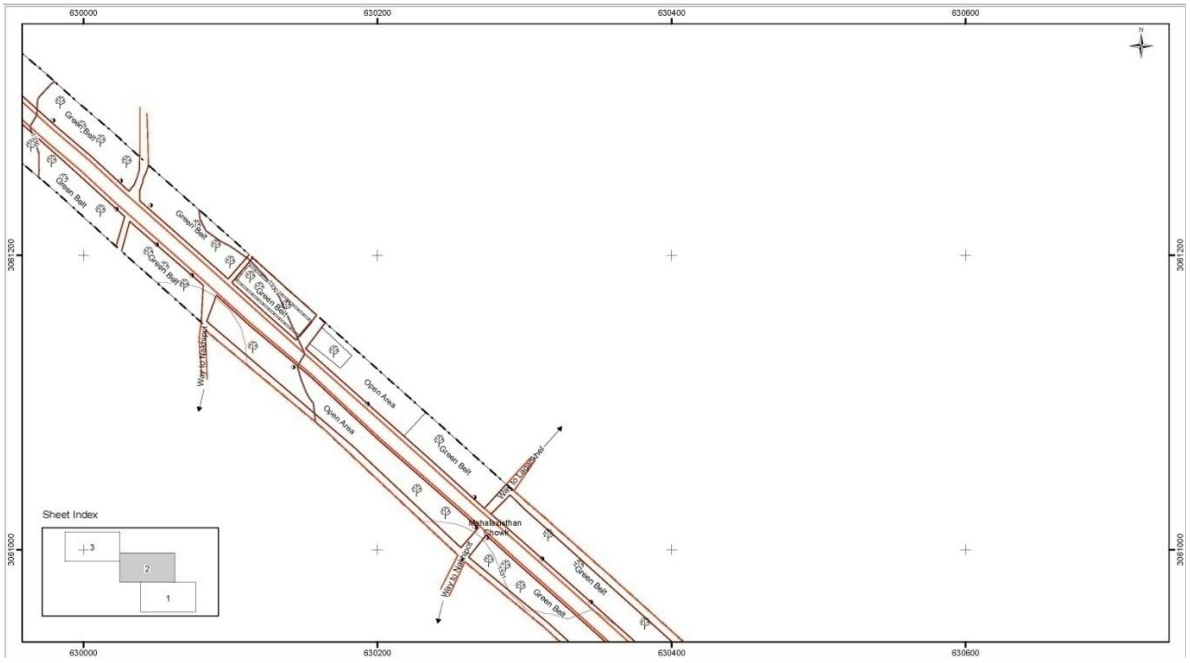
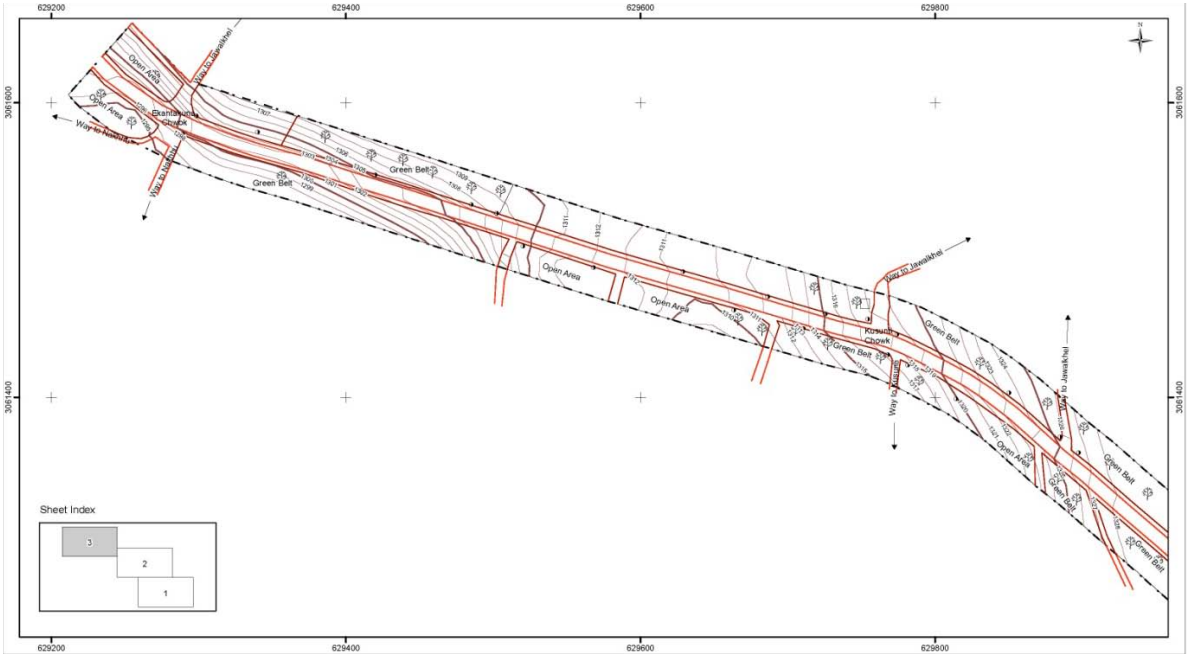


Figure 4: Site Location (3)



The GPS coordinate and the general view of the site from different direction is shown in the figure below:

1. **GPS coordinate (Western border of the site – Near petrol pump at Ekantakuna chowk)**
   27˚ 40’ 2.4’’ N 85 ˚18’ 29.2’’ E Altitude: 1316 m

Figure 5. Facing East

Figure 6. Facing South

Figure 7. Facing West

Figure 8. Facing North

2. **GPS coordinate (at the northern side of ring road near Office of Transport Management at Ekantakuna, Lalitpur)**

27˚ 39’ 58.3’’ N 85 ˚18’ 39.0’’ E Altitude: 1317 m

Figure 9. Facing West

Figure 10. Facing North

Figure 11. Facing East

Figure 12. Facing South

3. GPS coordinate (At the Northern border of site – at Chapagaon chowk)

27˚ 39’ 29.3’’ N 85 ˚19’ 21.5’’ E Altitude: 1341 m

Figure 13. Facing South

Figure 1. Facing East

Figure 15. Facing North

Figure 16. Facing West

4. **GPS coordinate (At the Eastern border of site – at Satdobato chowk)**

27˚ 39’ 31.9’’ N 85 ˚19’ 28.3’’ E Altitude: 1340 m

Figure 17. Facing East

Figure 18. Facing South

Figure 19. Facing West

Figure 20. Facing North

5. **GPS coordinate (At the Southern border of site – at Dhasikhel chowk)**

27˚ 39’ 45.9’’ N 85 ˚18’ 59.5’’ E Altitude: 1340 m

Figure 21. Facing West

Figure 22. Facing North

Figure 23. Facing East

Figure 2. Facing South

Accessibility: Since the site lies along the ring road, the site is easily accessible from east and west from the Rig Road. At this stretch apart from Ring Road the sites could be approached from 14 points from the southern side and 8 points from the northern side. Most of the entry roads to this stretch from north and south are narrow roads for passage of two way traffic.

Infrastructure:

- Electric lines: There are about 95 electric poles inside the boundary of the site. Most of these poles are o the outer edge of the storm drainage on either side of Ring Road. The GPS location and the photographs of individual pole is given below:

Figure 25. Electric pole no. 1

GPS coordinate:
27˚40’ 2.3’’ N 85˚ 18’ 28.5’’ E

Figure 3. Electric pole no. 2 & 3

GPS coordinate:
27˚40’ 1.1’’ N 85˚ 17’ 29.64’’ E

Direction: Facing South	Direction: Facing East
 **Figure 4. Electric poles no. 4**	 **Figure 5. Electric pole no. 5**
GPS coordinate: 27˚40’ 0.6’’ N 85˚ 18’ 30.1’’ E Direction: Facing east	GPS coordinate: 27˚40’ 0.2’’ N 85˚ 18’ 30.5’’ E Direction: Facing South
 **Figure 6. Electric pole no. 6**	 **Figure 30. Electric pole no. 7**
GPS coordinate: 27˚39’ 59.7’’ N 85˚ 18’ 32.0’’ E Direction: Facing east	GPS coordinate: 27˚39’ 59.1’’ N 85˚ 18’ 33.1’’ E Direction: Facing east
 **Figure 31. Electric pole no. 8**	 **Figure 32. Electric pole no. 9**
GPS coordinate: 27˚39’ 58.9’’ N 85˚ 18’ 34.6’’ E Direction: Facing east	GPS coordinate: 27˚39’ 57.5’’ N 85˚ 18’ 39.03’’ E Direction: Facing east

Figure 33. Electric pole no. 10

GPS coordinate:
27˚39’ 56.8’’ N 85˚ 18’ 41.5’’ E
Direction: Facing East

Figure 7. Electric pole no. 11

GPS coordinate:
27˚39’ 56.5’’ N 85˚ 18’ 42.5’’ E
Direction: Facing East

Figure 8. Crossing over of transmission line

GPS coordinate:
27˚39’ 55.6’’ N 85˚ 18’ 44.7’’ E
Direction: Facing West

Figure 9. Electric pole no. 12

GPS coordinate:
27˚39’ 56.1’’ N 85˚ 18’ 44.1’’ E
Direction: Facing East

Figure 10. Electric pole no. 13

GPS coordinate:
27˚39’ 58.48’’ N 85˚ 18’ 46.1’’ E
Direction: Facing North

Figure 11. Electric pole no. 14

GPS coordinate:
27˚39’ 54.9’’ N 85˚ 18’47.6 ’’ E
Direction: Facing East

Figure 12. Electric pole no. 15

GPS coordinate:
27˚39’ 54.2’’ N 85˚ 18’ 49.1’’ E
Direction: Facing East

Figure 40. Electric pole no. 16

GPS coordinate:
27˚39’ 53.4 ’’ N 85˚ 18’ 50.6 ’’ E
Direction: Facing East

Figure 41. Electric pole no. 17

GPS coordinate:
27˚39’ 52.4’’ N 85˚ 18’ 52.1’’ E
Direction: Facing East

Figure 42. Electric pole no. 18

GPS coordinate:
27˚39’51.2 ’’ N 85˚ 18’53.3 ’’ E
Direction: Facing East

Figure 43. Electric pole no. 19

GPS coordinate:
27˚39’50.26 ’’ N 85˚ 18’54.5 ’’ E
Direction: Facing East

Figure 44. Electric pole no. 20

GPS coordinate:
27˚39’ 48.2’’ N 85˚ 18’ 57.2 ’’ E
Direction: Facing East

Figure 13. Electric pole no. 21

GPS coordinate:
27˚39’ 48.04 ’’ N 85˚18’ 57.3 ’’ E
Direction: Facing East

Figure 14. Electric pole no. 22

GPS coordinate:
27˚39’ 46.4 ’’ N 85˚ 18’ 59.2’’ E
Direction: Facing East

Figure 15. Electric pole no. 23

GPS coordinate:
27˚39’ 46.4 ’’ N 85˚ 18’ 59.2’’ E
Direction: Facing North

Figure 16. Electric pole no. 24

GPS coordinate:
27˚39’ 46.1 ’’ N 85˚ 18’ 59.9’’ E
Direction: Facing East

Figure 17. Electric poles no. 25

GPS coordinate:
27˚39’ 50.2 ’’ N 85˚ 18’ 54.59 ’’ E
Direction: Facing east

Figure 50. Electric pole no. 26

GPS coordinate:
27˚39’ 49.2’’ N 85˚ 18’ 55.9’’ E
Direction: Facing West

Figure 51. Electric pole no. 27

GPS coordinate:
27˚39’ 47.9 ’’ N 85˚ 18’ 57.5’’ E
Direction: Facing east

Figure 52. Electric pole no. 28

GPS coordinate:
27˚39’ 47.04’’ N 85˚ 18’ 58.6 ’’ E
Direction: Facing east

Figure 53. Electric pole no. 29

GPS coordinate:
27˚39’ 41.8’’ N 85˚ 19’ 05.2 ’’ E
Direction: Facing east

Figure 54. Electric pole no. 30

GPS coordinate:
27˚39’ 40.2’’ N 85˚ 19’ 07.07 ’’ E
Direction: Facing east

Figure 55. Electric pole no. 31

GPS coordinate:
27˚39’ 39.3 ’’ N 85˚ 19’ 08.3’’ E
Direction: Facing East

Figure 56. Electric pole no. 32

GPS coordinate:
27˚39’ 39.2’’ N 85˚ 19’08.3 ’’ E
Direction: Facing East

Figure 57. Electric pole no. 33 & 34

GPS coordinate:
27˚39’ 38.2’’ N 85˚ 19’ 9.5’’ E
Direction: Facing East

Figure 58. Electric pole no. 35

GPS coordinate:
27˚39’37.2 ’’ N 85˚ 19’ 10.68’’ E
Direction: Facing East

Figure 59. Electric pole no. 36

GPS coordinate:
27˚39’ 35.4’’ N 85˚ 19’ 13.1 ’’ E
Direction: Facing East

Figure 60. Electric pole no. 37

GPS coordinate:
27˚39’ 34.3’’ N 85˚ 19’ 14.2’’ E
Direction: Facing East

Figure 61. Electric pole no. 38

GPS coordinate:
27˚39’ 33.3’’ N 85˚ 19’ 15.6’’ E
Direction: Facing East

Figure 62. Electric pole no. 39

GPS coordinate:
27˚39’ 32.2’’ N 85˚ 19’ 16.8’’ E
Direction: Facing East

	
Figure 63. Electric pole no. 40 & 41	**Figure 18. Electric pole no. 42 & 43**
GPS coordinate: 27˚39’ 31.8’’ N 85˚ 19’ 17.7’’ E Direction: Facing East	GPS coordinate: 27˚39’ 31.3’’ N 85˚ 19’ 18.01 ’’ E Direction: Facing East
	
Figure 19. Electric pole no. 44	**Figure 20. Electric pole no. 45**
GPS coordinate: 27˚39’ 30.39’’ N 85˚ 19’19.21 ’’ E Direction: Facing East	GPS coordinate: 27˚39’ 29.3 ’’ N 85˚ 19’ 21.5’’ E Direction: Facing East
	
Figure 21. Electric pole no. 46	**Figure 22. Electric pole no. 47**
GPS coordinate: 27˚39’ 28.9 ’’ N 85˚ 19’ 21.6 ’’ E Direction: Facing south	GPS coordinate: 27˚39’ 28.7’’ N 85˚ 19’ 23.1’’ E Direction: Facing south

Figure 23. Electric pole no. 48

GPS coordinate:
27˚39’ 30.3’’ N 85˚ 19’ 26.1’’ E
Direction: Facing East

Figure 70. Electric pole no. 49 & 50

GPS coordinate:
27˚39’ 31.05’’ N 85˚ 19’27.4 ’’ E
Direction: Facing East

Figure 71. Electric poles no. 51

GPS coordinate:
27˚39’ 31.43 ’’ N 85˚ 19’ 27.9’’ E
Direction: Facing South

Figure 72. Electric pole no. 52

GPS coordinate:
27˚39’ 31.95 ’’ N 85˚ 19’29.1 ’’ E
Direction: Facing South

Figure 73. Electric pole no. 53

GPS coordinate:
27˚39’ 31.4 ’’ N 85˚ 19’ 29.8’’ E
Direction: Facing North

Figure 24. Electric pole no. 54

GPS coordinate:
27˚39’ 30.8 ’’ N 85˚ 19’ 28.7’’ E
Direction: Facing west

Figure 25. Electric pole no. 55

GPS coordinate:
27˚39’ 30.6 ’’ N 85˚ 19’ 28.16 ’’ E
Direction: Facing east

Figure 26. Electric pole no. 56

GPS coordinate:
27˚39’ 30.4’’ N 85˚ 19’ 27.6’’ E
Direction: Facing north

Figure 27. Electric pole no. 57

GPS coordinate:
27˚39’ 29.8 ’’ N 85˚ 19’26.6 ’’ E
Direction: Facing North

Figure 28. Electric pole no. 58

GPS coordinate:
27˚39’ 29.1’’ N 85˚ 19’ 25.4’’ E
Direction: Facing north

Figure 29. Electric pole no. 59

GPS coordinate:
27˚39’ 29.3’’ N 85˚ 19’ 26.01’’ E
Direction: Facing North

Figure 80. Electric pole no. 60

GPS coordinate:
27˚39’ 28.16 ’’ N 85˚ 19’ 22.3’’ E
Direction: Facing East

Figure 81. Electric pole no. 61

GPS coordinate:
27˚39’ 27.9’’ N 85˚ 19’22.5 ’’ E
Direction: Facing West

Figure 82. Electric pole no. 62

GPS coordinate:
27˚39’ 28.6’’ N 85˚ 19’ 20.18’’ E
Direction: Facing West

Figure 83. Electric pole no. 63

GPS coordinate:
27˚39’ 30.37’’ N 85˚ 19’18.17 ’’ E
Direction: Facing West

Figure 30. Electric pole no. 64

GPS coordinate:
27˚39’ 32.7 ’’ N 85˚ 19’ 15.16’’ E
Direction: Facing West

Figure 31. Electric pole no. 65

GPS coordinate:
27˚39’ 35.3 ’’ N 85˚ 19’ 12.33’’ E
Direction: Facing East

Figure 32. Electric pole no. 66

GPS coordinate:
27˚39’ 37.7 ’’ N 85˚ 19’ 9.22’’ E
Direction: Facing West

Figure 33. Electric pole no. 67

GPS coordinate:

27 °39’ 40.5 ’’ N 85 ° 19’ 5.54’’ E

Direction: Facing West

Figure 34. Electric pole no. 68

GPS coordinate:

27 °39’ 41.1 ’’ N 85 ° 19’4.84 ’’ E

Direction: Facing West

Figure 35. Electric pole no. 69

GPS coordinate:

27 °39’ 42.4 ’’ N 85 ° 19’ 3.38’’ E

Direction: Facing West

Figure 90. Electric pole no. 70

GPS coordinate:

27 °39’ 44.3’’ N 85 ° 19’ 00.99’’ E

Direction: Facing West

Figure 91. Electric pole no. 71 & 72

GPS coordinate:

Figure 92. Electric pole no. 73

GPS coordinate:

27 °39’ 45.1’’ N 85 ° 18’ 59.8’’ E Direction: Facing West	27 °39’ 45.5’’ N 85 ° 18’ 59.1’’ E Direction: Facing west
 **Figure 93. Electric poles no. 74**	 **Figure 36. Electric pole no. 75**
GPS coordinate: 27 °39’ 47.6’’ N 85 ° 18’ 56.7 ’’ E Direction: Facing West	GPS coordinate: 27 °39’ 49.6 ’’ N 85 ° 18’ 54.6’’ E Direction: Facing West
 **Figure 37. Electric pole no. 76**	 **Figure 38. Electric pole no. 77**
GPS coordinate: 27 °39’ 50.84’’ N 85 ° 18’ 52.97’’ E Direction: Facing West	GPS coordinate: 27 °39’ 52.21’’ N 85 ° 18’ 51.02 ’’ E Direction: Facing West

Figure 97. Electric pole no. 78

GPS coordinate:

27 °39’ 52.7’’ N 85 ° 18’ 50.7 ’’ E

Direction: Facing east

Figure 39. Electric pole no. 79

GPS coordinate:

27 °39’ 53.0’’ N 85 ° 18’50.5 ’’ E

Direction: Facing east

Figure 99. Electric pole no. 80

GPS coordinate:

27 °39’ 53.9 ’’ N 85 ° 18’ 48.9’’ E

Direction: Facing East

Figure 100. Electric pole no. 81 , 82 & 83

GPS coordinate:

27 °39’ 54.3 ’’ N 85 ° 18’ 47.9’’ E

Direction: Facing West

Figure 101. Electric pole no. 84

GPS coordinate:

Figure 102. Electric pole no. 85

GPS coordinate:

27 °39’ 54.6’’ N 85 ° 18’ 47.1’’ E Direction: Facing West	27 °39’ 55.1’’ N 85 ° 18’45.4 ’’ E Direction: Facing West
 **Figure 40. Electric pole no. 86**	 **Figure 41. Electric pole no. 87**
GPS coordinate: 27 °39’ 55.6’’ N 85 ° 18’43.7 ’’ E Direction: Facing East	GPS coordinate: 27 °39’ 56.06’’ N 85 ° 18’ 41.97’’ E Direction: Facing East
 **Figure 42. Electric pole no. 88**	 **Figure 43. Electric pole no. 89**
GPS coordinate: 27 °39’ 56.63’’ N 85 ° 18’ 40.26’’ E Direction: Facing West	GPS coordinate: 27 °39’ 57.1’’ N 85 ° 18’ 38.4’’ E Direction: Facing West

Figure 44. Electric pole no. 90

GPS coordinate:

27 °39’ 57.9’’ N 85 ° 18’ 36.9’’ E

Direction: Facing West

Figure 45. Electric pole no. 91

GPS coordinate:

27 °39’ 58.03’’ N 85 ° 18’ 35.07’’ E

Direction: Facing East

Figure 46. Electric pole no. 92

GPS coordinate:

27 °39’ 59.08’’ N 85 ° 18’31.96 ’’ E

Direction: Facing West

Figure 47. Electric pole no. 93

GPS coordinate:

27 °39’ 59.7 ’’ N 85 ° 18’ 30.7’’ E

Direction: Facing West

Figure 48. Electric pole no. 94

GPS coordinate:

Figure 49. Electric pole no. 95

GPS coordinate:

27 °39’ 59.51 ’’ N 85 ° 18’ 30.17’’ E Direction: Facing West	27 °39’ 59.88 ’’ N 85 ° 18’ 28.72’’ E Direction: Facing North

- Storm water drains and drainage: The site lies along the Ring road corridor from the Ekantakuna Chowk to Satdobato Chowk. There is the surface storm water drainage on both side of the road and the sewerage drainage is built underground along the road (not seen from the surface). The photographs and GPS coordinate of the drainage is given below:

Photographs of the drainage:

 **Figure 50. Underground sewerage and storm water drain**	 **Figure 51. Surface storm water drain along road**
GPS coordinate: 27 °40’ 0.17’’ N 85 ° 18’ 30.57’’ E Direction: Facing North	GPS coordinate: 27 °39’ 59.56’’ N 85 ° 18’32.47 ’’ E Direction: Facing East
 **Figure 52. Surface storm water drain**	 **Figure 53. Surface storm water drain**
GPS coordinate: 27 °39’ 29.01’’ N 85 ° 19’ 25.5’’ E Direction: Facing west	GPS coordinate: 27 °39’52.2 ’’ N 85 ° 18’ 51.43’’ E Direction: Facing West

- Water supply pipes through the sites: The drinking water pipes are laid underground along the both side of the road.
- Wells, tube wells: There is one well inside the boundary of the site. The GPS location and the photographs of the well is given below:

Figure 54. Well

GPS coordinate:

27 °39’ 57.4 ’’ N 85 ° 18’ 39.89’’ E

Direction: Facing west

- Structures: There are no permanent residential building structures inside the site except for four bas stands and a temple. The photographs and GPS coordinates of bus stands and temple are given below:

Photographs of Structure:

Figure 55. Temporary Bus stand

GPS coordinate:

27 °39’ 46.2 ’’ N 85 ° 18’ 59.39’’ E

Direction: Facing north

Figure 56. permanent bus stand

GPS coordinate:

27 °39’ 32.2’’ N 85 ° 19’ 15.8’’ E

Direction: Facing South

Figure 57. Ganesh Mandir

GPS coordinate:

27 °39’ 38.6’’ N 85 ° 19’08.3’’ E

Direction: Facing South

Figure 58. Temporary bus stand

GPS coordinate:

27 °39’ 54.2’’ N 85 ° 18’ 46.8’’ E

Direction: Facing West

Figure 59. Temporary bus stand

GPS coordinate:

27 °40’ 00.54’’ N 85 ° 18’ 28.27’’ E

Direction: Facing west

- Other purpose of the site: Nearly 60% of the green belt is planted with trees. Remaining 40% open areas of the belt is used for storage of building materials, equipments and parking of vehicles. Small temporary shops have been established in some parts of green belt.

- Educational facilities:

  Since the site covers the large area along the ring road there are many educational facilities near the site. The details of the educational facilities are given below:

  - 100 metres north from Ekantakuna Chowk: Mahendra bhrikuti secondary school and opposite to it: Anisha Tibetan school in western side of Ekantakuna road;
  - 300 metres north from Kusunti Chowk: Mahima Montessori Kinderland and Training Centre in eastern side of Damodar Magra;
  - 100 metres south from Kusunti Chowk: Machapuchchhre International School in western side of Damodar Marga;
  - 50 metres north from Mahalaxmi Bustop: Delight Secondary School;

- 50 metres north from Mahalaxmisthan Chowk: Kathmandu Institute of Theology;
- 70 metres north from Mahalaxmisthan Chowk: Angels Heart School;
- 20 metres south from Mahalaxmisthan Chowk: Einstein Academy;
- 60 metres north east from Talchikhel chowk: Araniko Secondary School;
- 105 metres north west of Satdobato Chowk: Asian College;
- 100 metres south from Satdobato Chowk: Mahendra Adarsha Vidyashram

➢ Health facilities: The details of nearest hospital along the site are given below:

- 50 metres north from Ekantakuna Chowk : Tibetan Camp Hospital;
- 50 metres south from Talchikhel Chowk: Talchikhel Medicine Pharma;
- 15 metres south from Talchikhel Chowk: Laligurans Hospital;

- **Biological features:** The proposed site is a modified man made plantation area and is not an natural habitat of the flora and fauna. There are about 437 trees inside the site boundary. The details of the trees are given below:

S.N	Tree species (Local Name)	No of trees
1	Bamboo clump	1
2	Kaiyo tree	36
3	Shirish tree	363
4	Khari tree	1
5	Peepal tree	8
6	Lahare peepal tree	6
7	Dhuppi tree	9
8	Salla tree	10
9	Masala tree	1
10	Bar tree	2
	Total	**437**

Photographs of Trees

Figure 60. Bamboo clump

GPS coordinate:

27 ˚40’ 01.2’’ N 85 ˚ 18’ 30.1’’ E

Direction: facing North

Figure 61. Group of Shirish trees

GPS coordinate:

27 ˚39’ 59.2’’ N 85 ˚ 18’ 34.5’’ E

Direction: facing east

	
Figure 62. Group of Kaiyo tree	**Figure 63. Group of Dhupi, kaiyo and Shirish**
GPS coordinate: 27 ˚39’ 38.6’’ N 85 ˚ 19’ 08.3’’ E Direction: facing West	GPS coordinate: 27 ˚39’ 54.0’’ N 85 ˚ 18’ 45.6’’ E Direction: facing West

- **Social features:**
  - Site land ownership: Department of Roads, Government owned land
  - Nearby settlement: There are many settlements along the road. The details of the settlement are given below:

Settlements:

- 500 metres east from eastern border of site is: Ekantakuna;
- 400 metres east from end of ekantakuna is Kusunti;
- 550 metres east from end of ekantakuna is Mahalaxmisthan;
- 400 metres east from end of Mahalaxmisthan is Chapagaun dobato; and
- 400 metres east from end of Chapagaun dobato is Satdobato.

Settlement Pattern:

- Northern as well as southern perimeter of the site is heavily populated;
- Most of the built structures on the perimeter are residential and commercial structures;
- Average structure story is 3.5 (approximately 10 meter high)
- The The area is dominated by Brahmin, Gurung, Newar and Chhetri;
- Majority follow Hinduism and Buddhism in this area.

Security situation: Since the site lies along the busiest road of the valley, the site is easily accessible from all the side and not secure.

Noise Levels

Major noise source: As the site lies along the busiest road of the valley (from Ekantakuna chowk to Satdobato chowk), significant sound pressure level was recorded. Major noise sources noticed during monitoring were Vehicles especially power horn of large truck and buses. Other sources noted during monitoring were Conversation among people (Human voice pitch), Construction activities.

General weather condition: During monitoring period the general weather was warm and mild sunny.

Monitoring Day/ Date/time: Wednesday, 11/12/2013, 1:15 pm

Monitored by: Prasan Karmacharya

GPS location of Monitored site: 27 ˚39’ 57.47 ’’ N 85 ˚ 18’ 39.8’’ E

Sound Pressure Level:

The sound pressure level of the site has been presented in **Table no. 1**. The maximum sound pressure level within the site premises was 72 dB(A) and minimum sound pressure level was 57 dB(A). The equivalent sound pressure level was 63 dB(A). The sound produced by vehicular movement and power horn is the major contributing to maximum sound pressure level.

Table 1. Sound Pressure Level, Within the Site Premises {dB(A)}

Noise Descriptors	Sound Pressure Level
Minimum	57
Maximum	72
Leq	63

Field Survey, 2013 December

Management Issues

- ***Site Location*** – Located at the middle of the heavily populated area adjacent to the traffic life line
- **Available *area*** – The area is too small for the management of the earthquake rubble. Further, the width of the area is too small even to deposit the rubble in desired quantities. Maximum deposition height could not exceed 2.5 m for the safety of the rig road traffic.
- ***Traffic* obstruction** – There are about 24 motor able entry points in the proposed stretch (14 from southern side and 8 from northern side). Continuous filling of the site with rubbles from east to west on either side of Rig Road will obstruct the inflowing traffic into the Ring Road. Leaving space to allow traffic into Ring Road will further reduce the available size for rubble management.
- **Obstruction *to access the property*** – The internal side roads and foot trails are the key assess routes to the built residential and commercial property located at the northern and southern perimeter of the proposed site. Using the entire available area for rubble management will obstruct the access to property. Leaving safety space for access will further reduce the size of the available area for rubble management.
- **Obstruction *to surface storm water drainage*** – The surface storm water drainage on either side of the Ring Road is the primary drainage outlet for the settlements located at the perimeter of the site. Filling of the purposed site will obstruct the existing natural as well as manmade surface drainage network. In the event of rainfall water logging is expected in the settlement areas degrading the sanitation conditions. Further spill and side casting of the rubble in the existing storm water drainage of the Ring Road is likely to obstruct the existing drainage will implication on the road surface of the Ring Road. Maintaining a safety distance to avoid the above consequences will further reduce the available area for rubble management.
- **Damage *to water supply pipe network***: All of the water supply pipes are underground. Exact locations of the pipeline network are not available. Local people maintain that the water supply pipes are buried on the proposed site. Loading of the site by rubble is likely to damage the pipes and the water supply to the community. Further any breakage of the pipe in a water supply system with intermittent supply operation is likely to contaminate the supply water with implication on the community health.
- **Damage to Electrical and Telecommunication Lines** – About 95 electrical and telecommunication poles exist on either side of the Rig Road. Most of these poles locate by the side of the storm drainage, but a few locates in the middle of the green belt. These infrastructures will have to be relocated.
- **Temple relocation** – one temple is located within the proposed site, which may require relocation
- **Noise pollution** – Traffic movements and segregation activities is likely to enhance the noise level of the site surroundings impacting the adjoining school education and the communities.
- **Air pollution** – Traffic movements and segregation activities is likely to generate high fugitive dust emissions in surrounding areas with implication on the health of the adjoining school children and the communities.
- **Community health and safety** – The site lies at the heart of the community dwelling. Apart from noise pollution, air pollution, degradation of overall sanitation, the adjoining communities are likely

to be exposed to the accidental risks such as traffic, loading/unloading operations, segregation operations etc.

- **Occupational health and safety** – Exposure to high noise, dusts, and working with rubbles while segregation are some of the issues related to occupational health and safety.
- **Future Development** – A road expansion program is going on in this area. The plan proposes to expand the road width for 8 lane road. In this case all the available area (the green belt) will be utilized for the road expansion leaving no space for rubble management.

Oxygenation Park

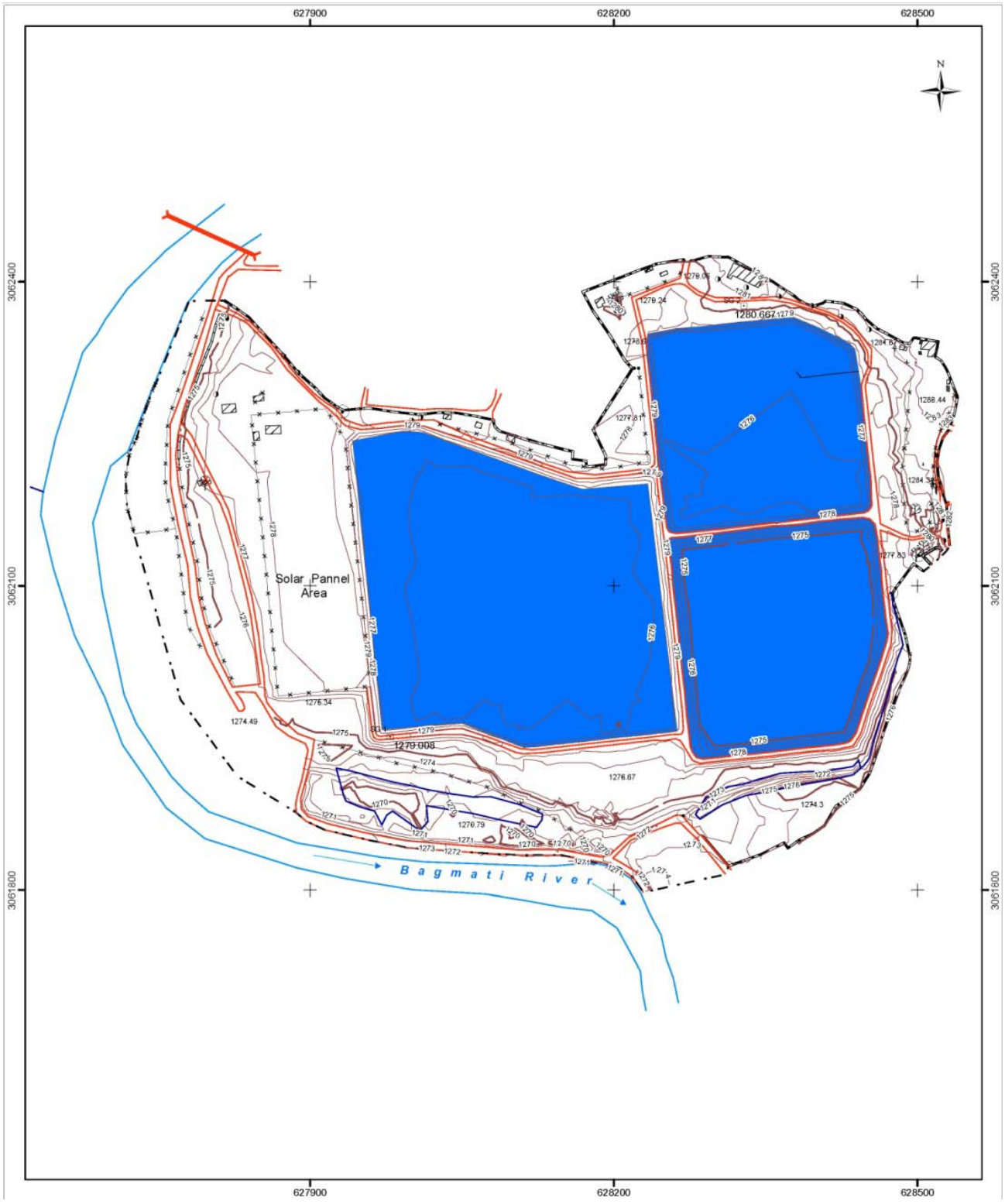
Site location:

The site lies in the Lalitpur Sub - Metropolitan City (LSMC) ward no. 4 of Lalitpur District (Figure 1 and 2) on the left bank of Bagmati River opposite Tribhuvan Univerity campus. Available area as per the proposal is 35.94 ha.

The site, “Oxygenation Park” is at a distance of about 450 meters south from Bagdole chowk, ring road. The proposed site is bordered on the north and east by relatively sparse settlements, while River Bagmati limits the site boundary on the west and south. The site could be accessed from east, north, and south. The access roads from the eastern side are narrow one lane corridor. From the north, the site could be accessed from three points, two from the mid central part and the third from the northwestern corner. The entry points of mid central part are narrow one lane corridors connecting to a east west road linking to Ring Road in the east and Bagmati Road corridor in the west. The Bagmati Corridor road enters the project site from the northwestern corner and passes along the Bagmati river all along the western and southern side of the proposed site. The same Bagmati corridor is the southern entry point to the site. The linking roads to the Rig Road from the southern entry point, however, are narrow and mostly one lane corridor. The proposed site is an abandoned oxygenation pond for the sewage treatment of the Kathmandu and Lalitpur Municipality and has established road network along the bunds of the oxygenation ponds.

Figure 1: Site Location Google Image

Figure 2: Site Location Map



The GPS coordinate and the general view of the site from different direction is shown in the figures below (Figure):

1. **GPS coordinate (North eastern border of the site – Near KUKL office building)**

27˚ 40’26.1’’ N 85 ˚17’ 54.7’’ E Altitude: 1291 m

Figure 3. Facing North

Figure 4. Facing East

Figure 5. Facing South

Figure 6. Facing West

2. **GPS coordinate (Eastern border of the site – near last pole)**

27˚ 40’ 24.2’’ N 85 ˚17’ 59.6’’ E Altitude: 1288 m

Figure 7. Facing West

Figure 8. Facing East

Figure 9. Facing South

Figure 10. Facing north

3. **GPS coordinate (South west corner of the site – near Solar panel site)**

27˚ 40’ 12.7’’ N 85 ˚17’ 41.6’’ E Altitude: 1284 m

Figure 11. Facing West

Figure 12. Facing North

Figure 13. Facing East

Figure 14. Facing South

4. GPS coordinate (South east corner of the site)

27˚ 40’ 11.7’’ N 85 ˚17’ 58.5’’ E Altitude: 1284 m

Figure 15. Facing North

Figure 16. Facing East

Figure 17. Facing South

Figure 18. Facing West

Infrastructure:

- Electric lines: There are 22 electric poles inside the boundary of the site. The GPS location and the photographs of individual pole is given below: Most of these electrical poles lies along the boundary line of the site .

Photographs of Individual pole

Figure 19. Electric pole no. 1

GPS coordinate:
27˚40’ 27.3’’ N 85˚ 17’ 52.9’’ E
Direction: Facing North

Figure 20. Electric pole no. 2

GPS coordinate:
27˚40’ 27.2’’ N 85˚ 17’ 54.2’’ E
Direction: Facing west

Figure 21. Electric poles no. 3

GPS coordinate:
27˚40’ 26.9’’ N 85˚ 17’ 55.1’’ E
Direction: Facing east

Figure 1. Electric pole no. 4

GPS coordinate:
27˚40’ 26.5’’ N 85˚ 17’ 56.2’’ E
Direction: Facing east

Figure 2. Electric pole no. 5

GPS coordinate:
27˚40’ 26.2’’ N 85˚ 17’ 57.3’’ E
Direction: Facing east

Figure 3. Electric pole no. 6

GPS coordinate:
27˚40’ 25.7’’ N 85˚ 17’ 58.4’’ E
Direction: Facing east

Figure 4. Electric pole no. 7

GPS coordinate:
27˚40’ 25.2’’ N 85˚ 17’ 59.4’’ E
Direction: Facing east

Figure 5. Electric pole no. 8

GPS coordinate:
27˚40’ 22.5’’ N 85˚ 17’ 38.3’’ E
Direction: Facing east

Figure 6. Electric pole no. 9

GPS coordinate:
27˚40’ 22.1’’ N 85˚ 17’ 42.1’’ E
Direction: Facing North

Figure 7. Electric pole no. 10

GPS coordinate:
27˚40’ 22.1’’ N 85˚ 17’ 37.0’’ E
Direction: Facing south

Figure 8. Electric pole no. 11

GPS coordinate:
27˚40’ 22.96’’ N 85˚ 17’ 36.05’’ E
Direction: Facing North

Figure 30. Electric pole no. 12

GPS coordinate:
27˚40’ 24.47’’ N 85˚ 17’ 36.10’’ E
Direction: Facing North

Figure 31. Electric pole no. 13

GPS coordinate:
27˚40’ 25.3’’ N 85˚ 17’ 36.0’’ E
Direction: Facing North

Figure 9. Electric pole no. 14

GPS coordinate:
27˚40’ 24.5’’ N 85˚ 17’ 35.7’’ E
Direction: Facing south

Figure 10. Electric pole no. 15

GPS coordinate:
27˚40’ 23.5’’ N 85˚ 17’ 35.3’’ E
Direction: Facing south

Figure 11. Electric pole no. 16

GPS coordinate:
27˚40’ 22.8’’ N 85˚ 17’ 35.0’’ E
Direction: Facing south

Figure 12. Electric pole no. 17

GPS coordinate:
27˚40’ 21.8’’ N 85˚ 17’ 34.8’’ E
Direction: Facing south

Figure 13. Electric pole no. 18

GPS coordinate:
27˚40’ 20.9’’ N 85˚ 17’ 34.7’’ E
Direction: Facing south

	
Figure 14. Electric pole no. 19	**Figure 15. Electric pole no. 20**
GPS coordinate: 27˚40’ 20.0’’ N 85˚ 17’ 34.9’’ E Direction: Facing south	GPS coordinate: 27˚40’ 18.7’’ N 85˚ 17’ 35.2’’ E Direction: Facing south
	
Figure 16. Electric pole no. 21	**Figure 40. Electric pole no. 22**
GPS coordinate: 27˚40’ 17.7’’ N 85˚ 17’ 35.4’’ E Direction: Facing south	GPS coordinate: 27˚40’ 16.6’’ N 85˚ 17’ 35.6’’ E Direction: Facing south

- Storm water drains and drainage: One surface storm water drainage and sewer drainage locates inside the boundary of the proposed site. The photographs and GPS coordinate of the drainage and sewer is given below:

Photographs of the drainage:

	
Figure 41. Surface sewer and storm water drain inlet	**Figure 17. Surface sewer and storm water drain mid point**
GPS coordinate: 27˚40’ 15.1’’ N 85˚ 18’ 0.4’’ E Direction: Facing south	GPS coordinate: 27˚40’ 11.0’’ N 85˚ 17’ 59.1’’ E Direction: Facing west

	
Figure 18. Surface sewer and storm water drain mid point	**Figure 19. Surface sewer and storm water drain Outlet**
GPS coordinate: 27˚40’ 9.7’’ N 85˚ 17’ 52.7’’ E Direction: Facing west	GPS coordinate: 27˚40’ 8.0’’ N 85˚ 17’ 49.9’’ E Direction: Facing south

- Water supply pipes through the sites: No
- Wells, tube wells: No.
- Structures: There are about 10 to 12 built structures inside the boundary of the site. The KUKL, the ower of the land property has 3 built structures. Solar Energy has 4 built property including the solar panel. The Chinese Ring Road expansion contractor has 2 built structures for its office and labor force. A small portion of private land at southern border owned by Prabhu finance company is leased to Adasha Nirman Company and has few blocks of built structures within the leased land.. The photographs and GPS coordinate is given below:

Photographs of Structure:

	
Figure 20. KUKL office building (no .1)	**Figure 21. KUKL Building (no. 2)**
GPS coordinate: 27˚40’ 26.7’’ N 85˚ 17’ 52.4’’ E Direction: Facing north	GPS coordinate: 27˚40’ 27’’ N 85˚ 17’ 54.8’’ E Direction: Facing north

Figure 22. KUKL office building (no .3)

GPS coordinate:
27˚40’ 44.3’’ N 85˚ 18’ 25.7’’ E
Direction: Facing west

Figure 23. Office Building of solar Energy (no. 4)

GPS coordinate:
27˚40’ 22.8’’ N 85˚ 17’ 37.4’’ E
Direction: Facing East

Figure 24. Office Building of solar Energy (no. 5)

GPS coordinate:
27˚40’ 22.9’’ N 85˚ 17’ 37.0’’ E
Direction: Facing west

Figure 50. Building of solar Energy (no. 6)

GPS coordinate:
27˚40’ 22.1’’ N 85˚ 17’ 37.0’’ E
Direction: Facing south

Figure 51. Office Building of Chinese ring road expansion team (no. 7)

GPS coordinate:
27˚40’ 17.1’’ N 85˚ 17’ 35.9’’ E
Direction: Facing west

Figure 52. Office Building of Chinese ring road expansion team (no. 8)

GPS coordinate:
27˚40’ 18.7’’ N 85˚ 17’ 35.2’’ E
Direction: Facing north

Figure 53. Solar panel installation area

GPS coordinate:
27˚40' 17.1'' N 85˚ 17' 35.9'' E
Direction: Facing east

Figure 54. Nepal Adarsha Nirman company

GPS coordinate:
27˚40' 8.4'' N 85˚ 17' 50.8'' E
Direction: Facing East

Other purpose of the site: At present the open areas outside the built property boundaries are used as playground by the local community. North central part of the site is used for the offices and storage of construction materials by Kathmandu Upatyaka Khanepani Limited (KUKL). The south western area is used by the Chinese Ring Road Expansion Contractors. Western part of the site is used for solar panel installation by KUKL. The Solar panels were established under the technical and financial support of the government of Japan on 11th January 2013. Installation capacity of the solar panel is 680.4 KW and generates 2.296 MWh of energy per day.

- Educational facilities: The details of the nearest educational facilities are given below:
  - Panchakanya Kumari School which is 500 metres west from the north central entrance gate of the site; and
  - Modern Indian School lies across the Bagmati River on the southern side at a distance of about 100 meter from the site boudry.
- Health facilities: The nearest hospital is Astamatrika Hospital Pvt. Ltd, which is about 500m north from the north central entrance gate of the site.

- **Biological features:** Since the project site was used as waste water treatment plant in the past is highly modified from ecological perspective. It is not a natural ecological site for the flora and fauna. Some floral species like cydnodern, titepati, banmara, lantana camera etc are the commonly growing herb and shrub. Ten planted trees locate inside the boundary of the site. The details of trees are presented in Table 1 below.

Table 1: Tree characteristics and location in the proposed site

S.N	Tree species (Local Name)	Dbh (cm)	Height (m)	GPS coordinate	
1	Kaiyo tree	30	7	27˚40' 43.7'' N	85˚ 18' 24.7'' E
2	Kaiyo tree	25	7	27˚40' 43.7'' N	85˚ 18' 24.7'' E
3	Kaiyo tree	30	6	27˚40' 43.7'' N	85˚ 18' 24.7'' E
4	Kaiyo tree	45	7.5	27˚40' 43.7'' N	85˚ 18' 24.7'' E
5	Bhogate tree	20	4	27˚40' 43.7'' N	85˚ 18' 25.6'' E
6	Khari	60	8	27˚40' 43.7'' N	85˚ 18' 25.6'' E
7	Dhupi tree	20	5	27˚40' 44.0'' N	85˚ 18' 25.6'' E
8	Dhupi tree	25	5	27˚40' 44.0'' N	85˚ 18' 25.6'' E
9	Dhupi tree	20	5	27˚40' 44.0'' N	85˚ 18' 25.6'' E
10	Dhupi tree	25	5	27˚40' 44.0'' N	85˚ 18' 25.6'' E

Photographs of Trees

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>Figure 56. Kayio tree</td><td>Figure 57. Khari tree</td></tr>
<tr><td>GPS coordinate:
27˚40’ 43.7’’ N 85˚ 18’ 24.7’’ E
Direction: facing West</td><td>GPS coordinate:
27˚40’ 43.7’’ N 85˚ 18’ 25.6’’ E
Direction: facing east</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Figure 58. Bhogate tree</td><td>Figure 59. Dhupi tree</td></tr>
<tr><td>GPS coordinate:
27˚40’ 43.7’’ N 85˚ 18’ 25.6’’ E
Direction: facing east</td><td>GPS coordinate:
27˚40’ 44.0’’ N 85˚ 18’ 25.6’’ E
Direction: facing south</td></tr>
</table>

- **Social features:**
  - ➢ Site land ownership: Land owned by KUKL
  - ➢ Nearby settlement: The details of the nearest settlements are given below:
    - Aafal Tole and Basnet Gau on the North Western border of site;
    - Pattipa Chowk in Eastern border of site;
    - Bagdore in South Eastern border of site;
    - Singoti Gau in northern border of site;
    - Distinctive feature of site: Sunrise Tower on the North Eastern side of site about 200m in ward number 3 of Lalitpur sub-metropolitan city.

There are about 200 households at the border line of the site. People living in nearby area are of mixed ethnicity including: Brahmin, Newar, Dalit and Chhetri. Majority of population living in this area follow Hinduism and Buddhism.

- ➢ Security situation: Since the border of the site is fenced by brick walls except some place in southern border, the site safe from the accessibility perspective.

- **Noise Levels**

Major noise source: As the site lies far from busy road and industrial area, no significant sound pressure level was recorded. Major noise sources noticed during monitoring were background noise from

Construction Company (Adarsha Nirman Company). Other sources noted during monitoring were Conversation among people (Human voice pitch), occasional approach of bikes.

General weather condition: During monitoring period the general weather was cold and mild sunny.

Monitoring Day/ Date/time: Wednesday, 11/12/2013, 2:00 pm

Monitored by: Prasan Karmacharya

GPS location of Monitored site: 27˚40' 12.34'' N 85˚ 17' 53.69'' E

Sound Pressure Level:

The sound pressure level of the site has been presented in **Table no. 1**. The maximum sound pressure level within the site premises was 61 dB(A) and minimum sound pressure level was 46 dB(A). The equivalent sound pressure level was 52 dB(A).

Table 1. Sound Pressure Level, Within the Site Premises {dB(A)}

Noise Descriptors	Sound Pressure Level
Minimum	46
Maximum	61
Leq	52

Field Survey, 2013 December

- **Site Management Issues**
  - **Site Access –** Though there are multiple entry to the site, only northwestern corner entry is better, however, is constrained by earthen nature of the road corridor in the event of earthquake.
  - **Site Area –** By size the area is suitable for earthquake rubble management. Due to placement of solar panel for electricity generation, nearly 8 ha of the western side is likely to be unusable for rubble management.
  - **Drainage –** Natural drainage of the area is east to west. Deposition of rubble is likely to create natural drainage obstruction in the eastern side.
  - **Noise pollution** – Traffic movements and segregation activities is likely to enhance the noise level of the site surroundings impacting the adjoining communities particularly of the northern and eastern boundary areas.
  - **Air pollution** – Traffic movements and segregation activities is likely to generate high fugitive dust emissions in surrounding areas with implication on the health of the adjoining communities on the north and eastern boundary areas
  - **Bagmati River** - The spill or casting of the rubble materials on the Bagmati River is likely to impact the existing river channel, obstruction of the river flow and river channel shifting towards south and west affecting the opposite bank.
  - **Occupational health and safety** – Exposure to high noise, dusts, and working with rubbles while segregation are some of the issues related to occupational health and safety.

Chabil site (Sankha Park)

Site location:

The site lies in Chandol of the Kathmandu Metropolitan City (KMC) ward no 4 of Kathmandu District **(Figure 1, 2 & 3).** It lies at the northern side of the KMC near Narayangopal chowk. The site is located inside the Sankha Park which was constructed for recreational activities of the people. The north and east side of the park adjoins the Ring road section from Maharjgunj chowk to Chabil chowk. The western region is marked by dense settlement and southern region adjoins the open land which is used as playground by local people. The park area is somewhat flat land with massive number of trees planted for greenery of the park environment. Since the site lies adjacent to ring road it is easily accessible.

The GPS coordinate at the central part of the site is N 27˚ 44' 01.13'' & E 85˚ 20' 33.08''.

Figure 1. Google Image of the Site

Figure 2. Site location of the site

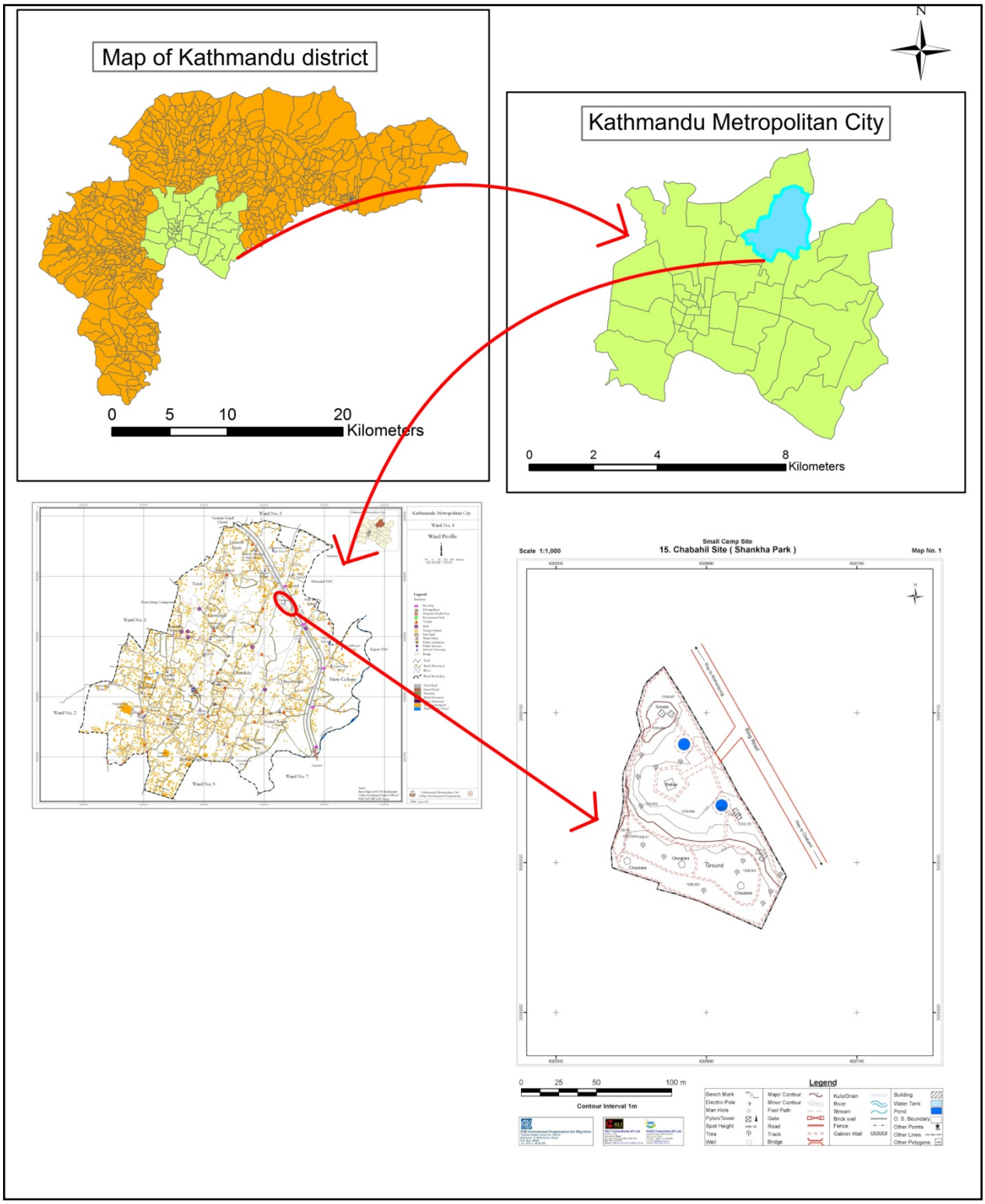


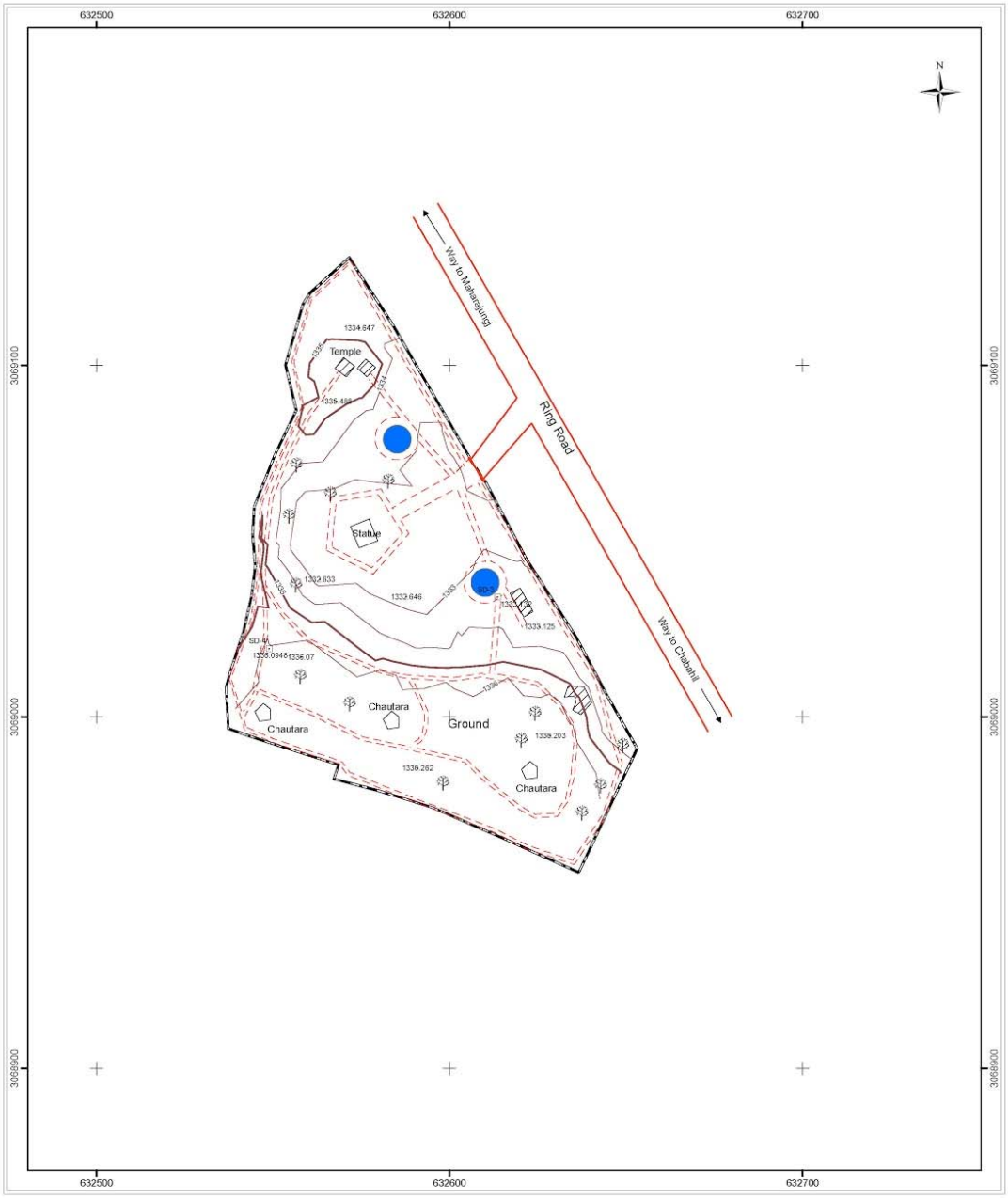
Figure 3. Site layout

Small Camp Site

Scale 1:1,000

15. Chabahil Site (Shankha Park)

Map No. 1



0 25 50 100 m

Contour Interval 1m

IOM International Organization for Migration

SILT Consultants (P) Ltd

PEES Consultant (P) Ltd

Legend

Bench Mark	Major Contour	Kulo/Drain	Building
Electric Pole	Minor Contour	River	Water Tank
Man Hole	Foot Path	Stream	Pond
Pylon/Tower	Gate	Brick wall	O. S. Boundary
Spot Height	Road	Fence	Other Points
Tree	Track	Gabion Wall	Other Lines
Well	Bridge		Other Polygons

The GPS coordinate and the general view of the site from different direction is shown in the figure below:

1. **GPS coordinate (Midpoint of the site)**

   27˚ 44’ 01.1’’ N 85 ˚20’ ’33.08’ E Altitude: 1343 m

Figure 4. Facing West

Figure 5. Facing North

Figure 6. Facing East

Figure 7. Facing South

Infrastructure:

- Electric lines: No
- Storm water drains and drainage: There are no specific channels for storm water drainage because more than 90% land area of the site is covered by soil and plants thus absorbing all the storm water into the ground. Presence of such area will help in groundwater recharging of the area. There are few buildings and one consists of a toilet, the sewage drainage from that toilet is managed through underground piping in the site and mixed in the main sewerage pipeline of the area in eastern side of the site.
- Recipient natural drainage and distance from the site: Nearest natural recipient of the natural drainage is a natural stream leading towards Bagmati River which is 600 meters east from the eastern border of site.
- Water supply pipes through the sites: No
- Wells, tube wells & tap: No
- Structures: There are no any residential building structures inside the site but since the site lies inside the park area, there are 3 permanent structures used by park management committee, 3 picnic stalls, 1 temple, 2 ponds and 1 water boring plant. The photographs and GPS coordinates of different structures are given below:

Photographs of Structure:

<table>
<tr><td> 
Figure 8. Park information desk</td><td> 
Figure 9. Public toilet</td></tr>
<tr><td>GPS coordinate:
27˚44’ 00.22’’ N 85˚ 20’ 34.38 ’’ E
Direction: Facing East</td><td>GPS coordinate:
27˚43’ 59.3’’ N 85˚ 20’ 34.8’’ E
Direction: Facing East</td></tr>
<tr><td> 
Figure 10. Park stall no. 1</td><td> 
Figure 11. Park stall no. 2</td></tr>
<tr><td>GPS coordinate:
27˚43’ 58.6 ’’ N 85˚ 20’ 34.35 ’’ E
Direction: Facing South</td><td>GPS coordinate:
27˚43’ 59.23’’ N 85˚ 20’33.09 ’’ E
Direction: Facing West</td></tr>
<tr><td> 
Figure 12. Park stall no. 3</td><td> 
Figure 13. Temporary Bus stand</td></tr>
<tr><td>GPS coordinate:
27˚43’ 59.95 ’’ N 85˚ 20’ 32.01’’ E
Direction: Facing West</td><td>GPS coordinate:
27˚43’59.1 ’’ N 85˚ 20’ 31.4 ’’ E
Direction: Facing South</td></tr>
</table>

<table>
<tr><td> 
Figure 14. Shiva mandir</td><td> 
Figure 15. Pond no 1</td></tr>
<tr><td>GPS coordinate:
27˚44’ 02.8’’ N 85˚ 20’ 32.2 ’’ E
Direction: Facing West</td><td>GPS coordinate:
27˚44’ 00.48’’ N 85˚ 20’ 33.9 ’’ E
Direction: Facing West</td></tr>
<tr><td> 
Figure 16. Pond no. 2</td><td> 
Figure 17. KUKL Water boring plant</td></tr>
<tr><td>GPS coordinate:
27˚44’01.8 ’’ N 85˚ 20’ 33.05’’ E
Direction: Facing West</td><td>GPS coordinate:
27˚44’03.4 ’’ N 85˚ 20’ 32.8 ’’ E
Direction: Facing North</td></tr>
</table>

- Other purpose of the site: Since the project site lies inside the park area, the area is developed as the recreational park for the local people. Beside that small area at the northern corner of the site is used by KUKL for water boring plant.

- Educational facilities: There is Kantipur English School which is about 200 meter North West from the site.

- Health facilities: The nearest hospital is Dhanawantari Aayurvedic Hospital which is about 200 meter east from the site.

- **Biological features:** The project site lies inside the park area which is developed as the recreational park for the local people. Different species of plant are being planted to maintain the greenery of the park periphery. The details of the trees are given below:

S.N	Tree species (Local Name)	No of trees
1	Rubber plant	2
2	Kaiyo tree	3
3	Shirish tree	2
4	Peepal tree	6
5	Lahare peepal tree	70
6	Dhuppi tree	79

S.N	Tree species (Local Name)	No of trees
7	Rudraksha	1
8	Salla	1
9	Unknown	15
	Total	**179**

Photographs of Trees

Figure 18. Group of Lahare Peepal tree

GPS coordinate:
27˚43' 59.04 '' N 85˚ 20'32.88 '' E
Direction: facing North

Figure 19. Group of dhupi Tree

GPS coordinate:
27˚44' 01.82'' N 85˚ 20' 33.24 '' E
Direction: facing West

- **Social features:**
  - Occupational status of communities living close to the site: People living in nearby areas are involved in private small scaled businesses such as grocery shop in nearby areas and private as well as governmental organizations for job.
  - Ethnic and Religious Background of the Communities close to the site: Except the traditional settlement in core areas of the Kathmandu Valley, most areas are multi-cultural and diverse with communities from various parts of the country. Thus there is presence of mixed ethnic group dominated by Brahmins, Gurungs and Newars including Dalits and Chhetris. Most people in this area follow Hinduism and Buddhism.
  - Perception of the Communities on the proposed plan: Community people are not against the plan of post disaster debris management in the proposed site and are in favor of supporting such initiative.
  - Site land ownership: Kathmandu Municipality , Government owned land
  - Nearby settlement: Nearest settlement area in the site is known as Chandol in west and east, Narayangopal chowk in north and Dhumbarahi in South. However nearby areas are also known as Sankha Park due to the presence of this open green landmark space in Kathmandu city. There are about 100 households attached to the border of the site, except eastern border which is ring road, along with one newly constructed apartment based building in south western corner of the site where only few apartments are used till now for residence. Approximately there are 500 people residing in the buildings attached to border of the site. Set back distance of nearest buildings to the site is about 30 meters in all direction except eastern border of the site.
  - Security situation:
    - Approach of site by communities from all side for security concern: The site is attached to the ring road and is fenced by 8 feet high brick wall thus the site can only be accessed from the main gate of the park which is in the eastern part of the site.
    - Fencing of the site: The site has been protected by fencing and is of no use to the community except recreational purposes such as picnic, morning / evening walks and sunbathing thus it

will cause no harm to the community's life, in case of disaster management, living nearby the site due to fencing of the site.

- **Noise Levels**

Major noise source: As the site lies near the busy road (Ring road), significant sound pressure level was recorded. Major noise sources noticed during monitoring were noise from vehicular movement especially power horns of heavy truck and bus. Other sources noted during monitoring were Conversation among people (Human voice pitch), construction activities.

General weather condition: During monitoring period the general weather was cold and mild sunny.

Monitoring Day/ Date/time: Thursday, 12/12/2013, 1:15 pm

Monitored by: Prasan Karmacharya

GPS location of Monitored site: 27˚44'01.84 '' N 85˚ 20'34.24 '' E

Sound Pressure Level:

The sound pressure level of the site has been presented in **Table no. 1**. The maximum sound pressure level within the site premises was 89 dB(A) and minimum sound pressure level was 55 dB(A). The equivalent sound pressure level was 73 dB(A). The sound produced by power horn of trucks and buses are the major source for high sound pressure level.

Table 1. Sound Pressure Level, Within the Site Premises {dB(A)}

Noise Descriptors	Sound Pressure Level
Minimum	55
Maximum	89
Leq	73

Field Survey, 2013 December

Management Issues

- **Access to the site** – Since the site lies adjacent to Ring road, accessibility will not be a significant issues for the earthquake debris materials.
- **Size of the site** – Even though the site covers around 11000 m^2, Tentative usable area of the site is around 7000 m^2, which is very small area for the effective management of the debris. There are many infrastructures like picnic stalls, toilet, park information desk, temples, water boring plant, water pond which covers a significant area inside the park premises and they may need relocation for the effective management of the debris. More over there are around 180 trees planted inside the park periphery which will certainly hinder the debris management activity.
- **Noise pollution** – Traffic movements and segregation activities is likely to enhance the noise level of the site.
- **Air pollution** – Traffic movements and segregation activities is likely to generate high fugitive dust emissions in surrounding areas with implication on the health of the adjoining communities.
- **Obstruction to mobility and access** – Since the site is Public Park, fencing of the site is not expected to impair the mobility of the local people, but they will be unable to enjoy the recreational activities inside the park premises.
- **Occupational health and safety** – Exposure to high noise, dusts, and working with rubbles while segregation are some of the issues related to occupational health and safety.

Satdobato site, ringroad (Gwarko –Balkumari)

Site location:

The site lies in the Lalitpur Sub - Metropolitan City (KMC) ward no 7, 8 & 9 of Lalitpur District**.** It lies in the ring road section from Gwarko chowk to Balkumari chowk roughly extending from east to west. The green belt on northern and southern flank of the Ring Road is approximately 1200 m long and has an average width of 18 m. Storm water drainage can be seen in the most of the road length with underground cross- drainage structures at frequent intervals. At the outer edge of the storm water drainage electrical/telecommunication poles are located on either side of the Ring Road. Most of the open space is used for car parking and storage of construction materials. Average width of the green belt on either side of Ring Road (including internal side road) is about 18 m.

The GPS coordinate of the eastern border of the site is 27 ˚ 40’ 24.9’’ N & 85 ˚20’ 32.4’’ E and the western border is 27 ˚ 40’ 02.6’’ N & 85 ˚19’ 57.8’’ E. The site lies from 15 meter west from Gwarko chowk till the end of Manahara Bridge in both sides of the ring road, thus is easily accessible.

Figure 1. Site location google image

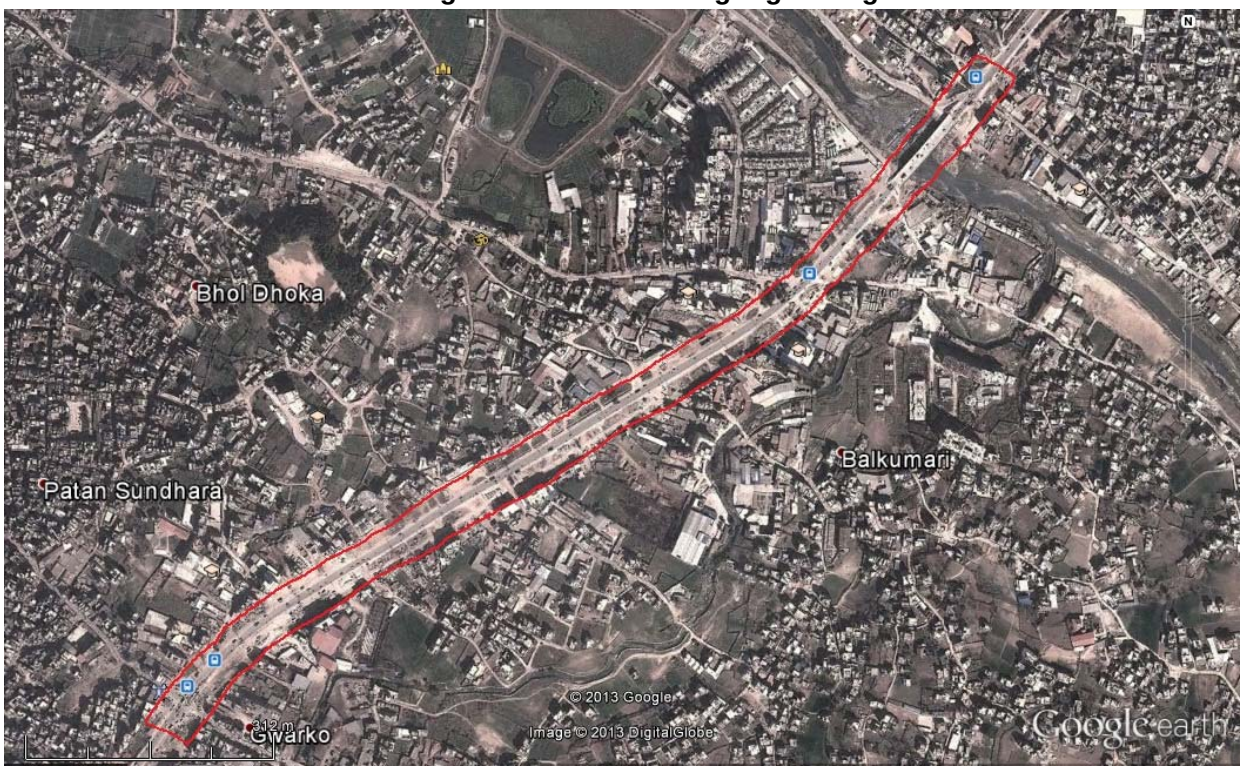


Figure 2. Site location (1)

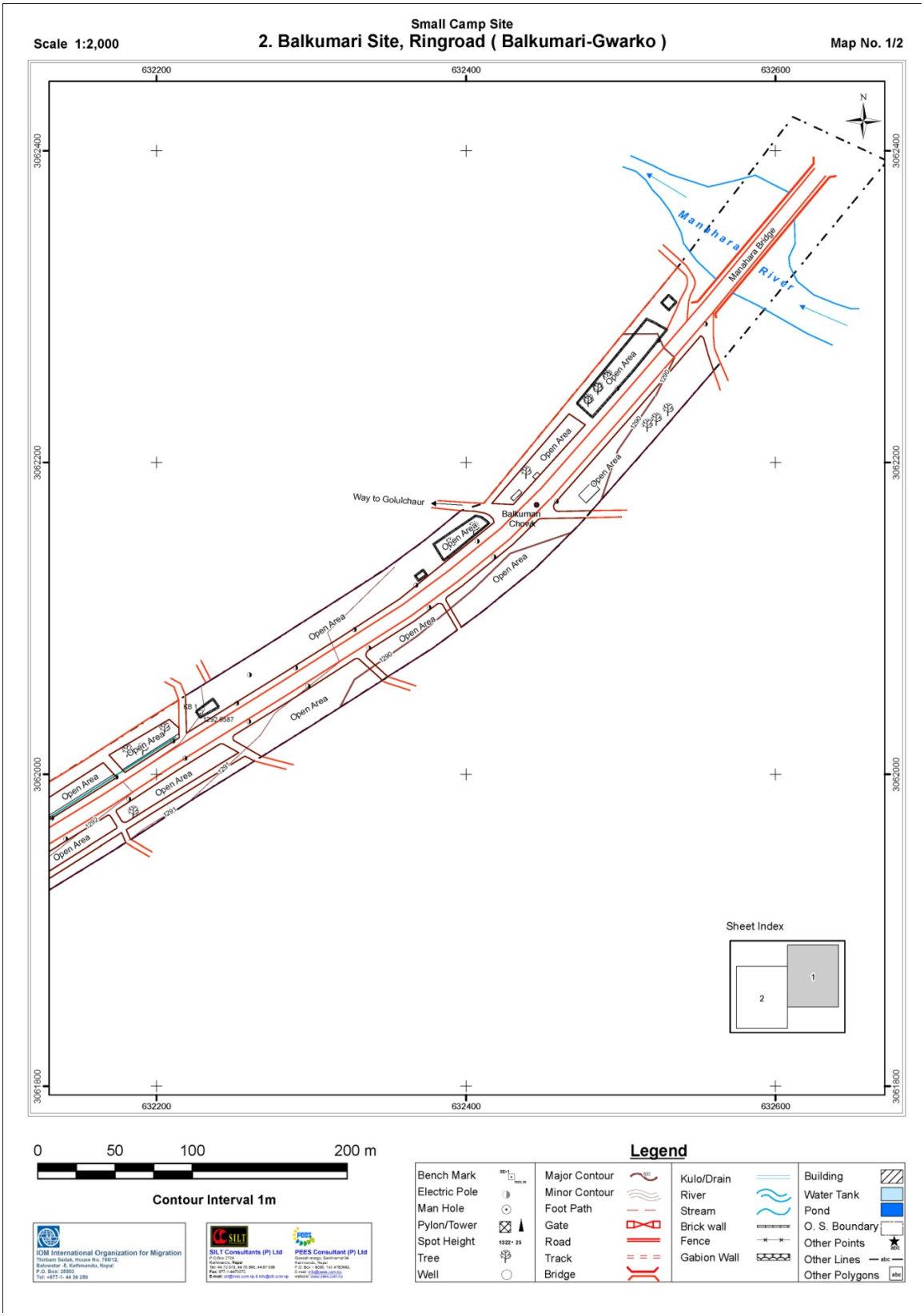
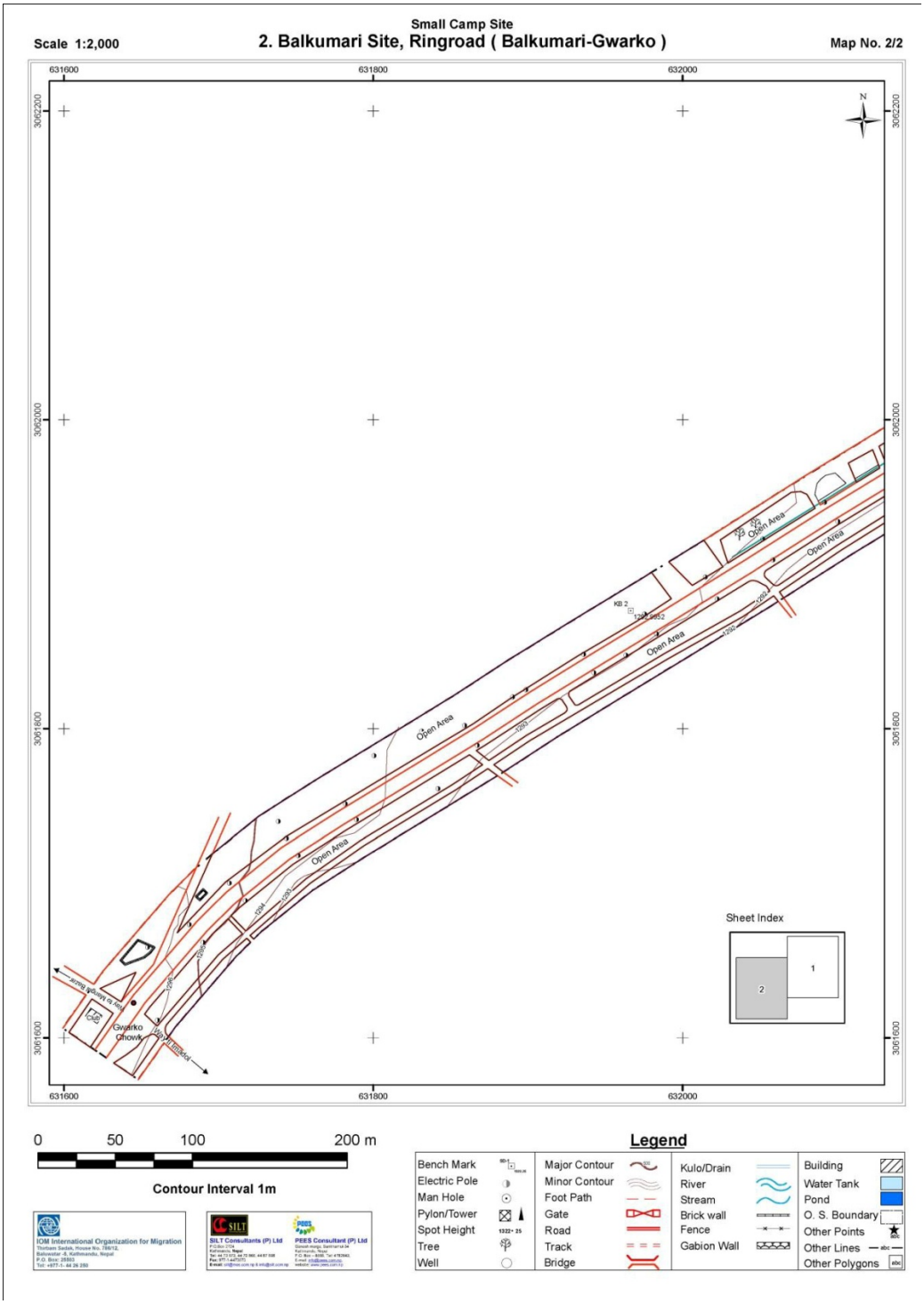


Figure 3. Site location (2)



The GPS coordinate and the general view of the site from different direction is shown in the figure below:

1. **GPS coordinate (Northern border of the site- Balkumari chowk)**

   27˚ 40’ 17.5’’ N 85 ˚20’ 24.2’’ E Altitude: 1301 m

Figure 4. Facing East

Figure 5. Facing North

Figure 6. Facing West

Figure 7. Facing South

2. GPS coordinate (at the Western border of the site – Gwarko chowk)

27˚ 40’ 02.6’’ N 85 ˚19’ 57.8’’ E Altitude: 1305 m

Figure 8. Facing North

Figure 9. Facing East

Figure 10. Facing South

Figure 11. Facing West

3. **GPS coordinate (At the Eastern border of site – at Balkumari bridge)**

27 ˚ 40’ 24.9’’ N 85 ˚20’ 32.4’’ E Altitude: 1296 m

Figure 12. Facing West

Figure 13. Facing North

Figure 14. Facing East

Figure 15. Facing South

Infrastructure:

- Electric lines: There are about 55 electric poles inside the boundary of the site. The GPS location and the photographs of individual pole is given below:

Photographs of Individual pole

Figure 16. Electric pole no. 1

Figure 17. Electric pole no. 2

GPS coordinate: 27 ˚40’ 2.7’’ N 85 ˚ 19’ 58.2’’ E Direction: Facing East	GPS coordinate: 27 ˚40’03.8 ’’ N 85 ˚ 19’ 59.4’’ E Direction: Facing East

<table>
<tr><td> 
Figure 18. Electric poles no. 3</td><td> 
Figure 19. Electric pole no. 4</td></tr>
<tr><td>GPS coordinate:
27˚40’ 4.4’’ N 85˚ 20’ 0.07’’ E
Direction: Facing East</td><td>GPS coordinate:
27˚40’05.19 ’’ N 85˚ 20’ 02.41’’ E
Direction: Facing East</td></tr>
<tr><td> 
Figure 20. Electric pole no. 5</td><td> 
Figure 21. Electric pole no. 6</td></tr>
<tr><td>GPS coordinate:
27˚40’ 5.96’’ N 85˚ 20’ 03.81 ’’ E
Direction: Facing east</td><td>GPS coordinate:
27˚40’06.8 ’’ N 85˚ 20’ 05.1 ’’ E
Direction: Facing east</td></tr>
<tr><td> 
Figure 22. Electric pole no. 7</td><td> 
Figure 23. Electric pole no. 8</td></tr>
<tr><td>GPS coordinate:
27˚40’07.39 ’’ N 85˚ 20’ 06.64 ’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚40’ 8.19’’ N 85˚ 20’ 8.11 ’’ E
Direction: Facing East</td></tr>
</table>

Figure 24. Electric pole no. 9

GPS coordinate:
27˚40’ 8.94’’ N 85˚ 20’ 9.53 ’’ E
Direction: Facing East

Figure 25. Electric pole no. 10

GPS coordinate:
27˚40’09.1 ’’ N 85˚ 20’ 09.4 ’’ E
Direction: Facing East

Figure 26. Electric pole no. 11

GPS coordinate:
27˚40’ 10.4’’ N 85˚ 20’12.36 ’’ E
Direction: Facing East

Figure 27. Electric pole no. 12

GPS coordinate:
27˚40’ 11.2’’ N 85˚ 20’ 13.8’’ E
Direction: Facing East

Figure 28. Electric pole no. 13

GPS coordinate:
27˚40’12.01 ’’ N 85˚ 20’ 15.3 ’’ E
Direction: Facing East

Figure 29. Electric pole no. 14

GPS coordinate:
27˚40’ 12.5’’ N 85˚ 20’ 16.1 ’’ E
Direction: Facing East

Figure 30. Electric pole no. 15

GPS coordinate:
27˚40’ 12.9’’ N 85˚ 20’ 16.7’’ E
Direction: Facing East

Figure 31. Electric pole no. 16

GPS coordinate:
27˚40’ 13.5’’ N 85˚ 20’18.2 ’’ E
Direction: Facing East

Figure 32. Electric pole no. 17

GPS coordinate:
27˚40’ 14.25’’ N 85˚ 20’19.64 ’’ E
Direction: Facing East

Figure 33. Electric pole no. 18

GPS coordinate:
27˚40’ 15.01’’ N 85˚ 20’ 21.03’’ E
Direction: Facing East

Figure 34. Electric pole no. 19

GPS coordinate:
27˚40’15.79 ’’ N 85˚ 20’ 22.44’’ E
Direction: Facing East

Figure 35. Electric pole no. 20

GPS coordinate:
27˚40’ 16.51’’ N 85˚ 20’ 23.3’’ E
Direction: Facing East

Figure 36. Electric pole no. 21

GPS coordinate:
27˚40’16.72 ’’ N 85˚ 20’ 23.7 ’’ E
Direction: Facing East

Figure 37. Electric pole no. 22

GPS coordinate:
27˚40’17.5 ’’ N 85˚ 20’ 24.2 ’’ E
Direction: Facing East

Figure 38. Electric pole no. 23

GPS coordinate:
27˚40’18.01 ’’ N 85˚ 20’ 25.3 ’’ E
Direction: Facing East

Figure 39. Electric pole no. 24

GPS coordinate:
27˚40’18.88 ’’ N 85˚ 20’ 26.26 ’’ E
Direction: Facing East

Figure 40. Electric poles no. 25

GPS coordinate:
27˚40’19.87 ’’ N 85˚ 20’ 27.1 ’’ E
Direction: Facing East

Figure 41. Electric pole no. 26

GPS coordinate:
27˚40’ 20.82’’ N 85˚ 20’ 28.1’’ E
Direction: Facing East

Figure 42. Electric pole no. 27

GPS coordinate:
27˚40’20.5 ’’ N 85˚ 20’ 28.6 ’’ E
Direction: Facing West

Figure 43. Electric pole no. 28

GPS coordinate:
27˚40’19.54 ’’ N 85˚ 20’ 37.79’’ E
Direction: Facing West

Figure 44. Electric pole no. 29

GPS coordinate:
27˚40’18.8 ’’ N 85˚ 20’ 26.8’’ E
Direction: Facing West

Figure 45. Electric pole no. 30

GPS coordinate:
27˚40’17.65 ’’ N 85˚ 20’ 25.7 ’’ E
Direction: Facing West

Figure 46. Electric pole no. 31

GPS coordinate:
27˚40’16.94 ’’ N 85˚ 20’ 25.06’’ E
Direction: Facing West

Figure 47. Electric pole no. 32

GPS coordinate:
27˚40’ 16.5’’ N 85˚ 20’ 24.24 ’’ E
Direction: Facing West

Figure 48. Electric pole no. 33

GPS coordinate:
27˚40’15.49 ’’ N 85˚ 20’ 22.7’’ E
Direction: Facing West

Figure 49. Electric pole no. 34

GPS coordinate:
27˚40’14.9 ’’ N 85˚ 20’ 15.6 ’’ E
Direction: Facing West

Figure 50. Electric pole no. 35

GPS coordinate:
27˚40’ 13.9’’ N 85˚ 20’ 19.8 ’’ E
Direction: Facing West

Figure 51. Electric pole no. 36

GPS coordinate:
27˚40’13.22 ’’ N 85˚ 20’ 18.5’’ E
Direction: Facing West

Figure 52. Electric pole no. 37

GPS coordinate:
27˚40’ 12.31’’ N 85˚ 20’ 17.09’’ E
Direction: Facing West

Figure 53. Electric pole no. 38

GPS coordinate:
27˚40’11.9 ’’ N 85˚ 20’ 15.6 ’’ E
Direction: Facing West

Figure 54. Electric pole no. 39

GPS coordinate:
27˚40’10.78 ’’ N 85˚ 20’ 14.15 ’’ E
Direction: Facing West

Figure 55. Electric pole no. 40

GPS coordinate:
27˚40’ 10.11’’ N 85˚ 20’ 12.69 ’’ E
Direction: Facing West

Figure 56. Electric pole no. 41 & 42

GPS coordinate:
27˚40’ 09.28’’ N 85˚ 20’ 11.31 ’’ E
Direction: Facing West

Figure 57. Electric pole no. 43

GPS coordinate:
27˚40’08.54 ’’ N 85˚ 20’ 09.84 ’’ E
Direction: Facing West

Figure 58. Electric pole no. 44

GPS coordinate:
27˚40’07.83 ’’ N 85˚ 20’ 08.37 ’’ E
Direction: Facing West

Figure 59. Electric pole no. 45

GPS coordinate:
27˚40’ 06.99’’ N 85˚ 20’ 06.88’’ E
Direction: Facing West

Figure 60. Electric pole no. 46

GPS coordinate:
27˚40’ 06.27’’ N 85˚ 20’ 05.50’’ E
Direction: Facing West

Figure 61. Electric pole no. 47

GPS coordinate:
27˚40’ 05.6’’ N 85˚ 20’ 04.2 ’’ E
Direction: Facing West

Figure 62. Electric pole no. 48

GPS coordinate:
27˚40’ 04.79’’ N 85˚ 20’ 02.70’’ E
Direction: Facing West

Figure 63. Electric pole no. 49

GPS coordinate:
27˚40’03.98 ’’ N 85˚ 20’ 01.28 ’’ E
Direction: Facing West

Figure 64. Electric pole no. 50

GPS coordinate:
27˚40’03.17 ’’ N 85˚ 19’ 59.93 ’’ E
Direction: Facing West

Figure 65. Electric pole no. 51

GPS coordinate:
27˚40’ 02.25’’ N 85˚ 19’ 58.66’’ E
Direction: Facing West

Figure 66. Electric pole no. 52

GPS coordinate:
27˚40’01.51 ’’ N 85˚ 19’ 57.56’’ E
Direction: Facing West

Figure 67. Electric pole no. 53

GPS coordinate:
27˚40’ 00.53’’ N 85˚ 19’ 56.63 ’’ E
Direction: Facing West

Figure 68. Electric pole no. 54 & 55

GPS coordinate:
27˚39’ 59.97’’ N 85˚ 19’ 56.31 ’’ E
Direction: Facing West

- Storm water drains and drainage: The site lies along the Ring road corridor from the Gwarko chowk to the Balkumari Bridge. Storm water drain is managed through an open channel in the northern border of the rind-road and through an underground pipeline in crossing of the ring road leading towards sub-way in north direction. Storm water drain mainly flows from west to east due to elevation in western part of the site. But due to ring road expansion activities the drainage in most of the place are destroyed.

The photographs and GPS coordinate of the drainage and construction activities are given below:

Photographs of the drainage and construction Activities:

<table>
<tr><td> 
Figure 69. Surface storm water drain along road</td><td> 
Figure 70. Construction activities along the road</td></tr>
<tr><td>GPS coordinate:
27˚40’ 10.14’’ N 85˚ 20’ 11.68’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚40’ 14.41’’ N 85˚ 20’ 19.71’’ E
Direction: Facing East</td></tr>
<tr><td> 
Figure 71. Construction activities along the road in the Balkumari Bridge</td><td> 
Figure 72. Construction activities in front of Gopi Krishna Hall</td></tr>
<tr><td>GPS coordinate:
27˚40’21.91 ’’ N 85˚ 20’ 29.17 ’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚40’ 03.83’’ N 85˚ 20’ 01.71 ’’ E
Direction: Facing South</td></tr>
</table>

- Water supply pipes through the sites: The drinking water pipes are laid underground along the both side of the road.
- Wells, tube wells & tap: No
- Structures: There are no any residential building structures inside the site but since the site is along the ring road there are 4 bus stands and 1 bridge. The photographs and GPS coordinates of different structures are given below:

Photographs of Structure:

Figure 73. Bus stand no. 1

GPS coordinate:
27˚40'01.82'' N 85˚ 19'43.3 '' E
Direction: Facing north

Figure 74. Bus stand no. 2

GPS coordinate:
27˚40' 18.02 '' N 85˚ 20'25.08 '' E
Direction: Facing North

Figure 75. Balkumari Bridge

GPS coordinate:
27˚40' 25.03 '' N 85˚ 20' 32.25 '' E
Direction: Facing West

Figure 76. Bus stand no. 3

GPS coordinate:
27˚40' '' N 85˚20' '' E
Direction: Facing West

Figure 77. Bus stand no. 4

GPS coordinate:
27˚39' 51.68 '' N 85˚ 19' 48.5'' E
Direction: Facing West

- Other purpose of the site: Green belt, parking and storage of construction materials.
- Educational facilities:

Since the site covers the large area along the ring road there are many educational facilities near the site. The details of the educational facilities are given below:

1. 130 metres North from Gwarko Chowk: Prabhat Higher Secondary School;
2. 250 metres North East from Gwarko Chowk: Bal Deeksha Sadan Higher Secondary School;
3. 200 metres North East from Gwarko Chowk: Quest College;
4. 450 metres North East from Gwarko Chowk: Kathmandu University School of Management;
5. 300 metre North West from Balkumari Chowk: Hindu Vidya Peeth;
6. 70 metres West South from Balkumari Chowk: Kathford International College: School of Engineering; and
7. 90 metres West North from Balkumari Chowk: Milestone International College.

➢Health facilities: The details of nearest hospital along the site are given below:

1. 450 meters South from Gwarko Chowk: Kist Medical College Teaching Hospital.

- **Biological features:** The project site lies along the green belt constructed during the ring road construction. There are about 34 trees inside the site boundary. The details of the trees are given below:

S.N	Tree species (Local Name)	No of trees
1	Rubber plant	2
2	Kaiyo tree	13
3	Shirish tree	3
4	Peepal tree	3
5	Lahare peepal tree	11
6	Dhuppi tree	1
7	Bar tree	1
	Total	**34**

Photographs of Trees

Figure 78. Lahare peepal tree

GPS coordinate:
27˚40’ 19.82 ’’ N 85˚ 20’26.7 ’’ E
Direction: facing North

Figure 79. Peepal Tree

GPS coordinate:
27˚40’ 09.13’’ N 85˚ 20’ 11.20 ’’ E
Direction: facing West

	
Figure 80. Group of Kaiyo tree	**Figure 81. Rubber plant and Kaiyo tree**
GPS coordinate: 27˚40’ 10.14’’ N 85˚ 20’ 11.68’’ E Direction: facing North	GPS coordinate: 27˚40’ 16.81’’ N 85˚ 20’ 23.48’’ E Direction: facing North

- **Social features:**
  - Site land ownership: Department of Roads, Government owned land
  - Occupational status of communities living close to the site: Both parts of the ring road is used for business purposes and many people living in those areas have established some kind of business and service providing organization close to the site. Besides that working age group (25 years and above) are involved in private and governmental organizations for job.
  - Ethnic and Religious Background of the Communities close to the site: Settlement in ring road area is diverse and mainly people from other parts of the country have migrated to these places. Thus due to this diversity, there is presence of mixed ethnic group dominated by Brahmins and Newars including Dalits and Chhetris. Most people in this area follow Hinduism and Buddhism with small number of people following Christianity.
  - Perception of the Communities on the proposed plan: Community people are not against the plan of debris management in the proposed site but demand there must not be any disturbance in their daily life activities and accessibility to basic necessities such as: drinking water, electricity, sewage management and road usage.
  - Nearby settlement: There are many settlements along the road. Gwarko is the main settlement near the western border of the site and Balkumari is the nearest settlement in the eastern border of the site. Set back distance from the nearest building to the site is about 5 meters in both side of the site .i.e. northern and southern border of the site.
- Approach of site by communities from all side for security concern: The site lies in both side of ring road thus it is easily accessible to community from all possible direction.
- Fencing of the site: Attached settlements use the site as connecting road to ring-road thus fencing of the site will disturb the daily life activities of the community.

- **Noise Levels**

Major noise source: As the site lies along the busiest road of the valley (from Gwarko chowk to Balkumari chowk), significant sound pressure level was recorded. Major noise sources noticed during monitoring were Vehicles especially power horn of large truck and buses. Other sources noted during monitoring were Conversation among people (Human voice pitch), Construction activities.

General weather condition: During monitoring period the general weather was warm and mild sunny.

Monitoring Day/ Date/time: Friday, 13/12/2013, 12:00 pm

Monitored by: Prasan Karmacharya

GPS location of Monitored site: 27˚40' 16.2'' N 85˚ 20' 23.4 '' E

Sound Pressure Level:

The sound pressure level of the site has been presented in **Table no. 1**. The maximum sound pressure level within the site premises was 78 dB(A) and minimum sound pressure level was 63 dB(A). The equivalent sound pressure level was 69 dB(A). Vehicular movement and power horn are the major source of high sound level pressure.

Table 1. Sound Pressure Level, Within the Site Premises {dB(A)}

Noise Descriptors	Sound Pressure Level
Minimum	63
Maximum	78
Leq	69

Field Survey, 2013 December

Management Issues

- ***Site Location*** – Located at the middle of the heavily populated area adjacent to the traffic life line
- **Available *area*** – The available area is only limited to the green belt on the either side of ring road which is very small area for the management of the earthquake rubble. Further, the road expansion activities along the ring road had made the site inappropriate area for rubble management.
- ***Traffic* obstruction** – There are about 15 motor able entry points in the proposed stretch (7 from southern side and 8 from northern side). Continuous filling of the site with rubbles from east to west on either side of Rig Road will obstruct the inflowing traffic into the Ring Road. Leaving space to allow traffic into Ring Road will further reduce the available size for rubble management.
- **Obstruction *to access the property*** – The internal side roads and foot trails are the key assess routes to the built residential and commercial property located at the northern and southern perimeter of the proposed site. Using the entire available area for rubble management will obstruct the access to property. Leaving safety space for access will further reduce the size of the available area for rubble management.
- **Obstruction *to surface storm water drainage*** – The surface storm water drainage on either side of the Ring Road is the primary drainage outlet for the settlements located at the perimeter of the site. Filling of the purposed site will obstruct the existing natural as well as manmade surface drainage network. In the event of rainfall water logging is expected in the settlement areas degrading the sanitation conditions. Further spill and side casting of the rubble in the existing storm water drainage of the Ring Road is likely to obstruct the existing drainage will implication on the road surface of the Ring Road. Maintaining a safety distance to avoid the above consequences will further reduce the available area for rubble management.
- **Damage *to water supply pipe network***: All of the water supply pipes are underground. Exact locations of the pipeline network are not available. Local people maintain that the water supply pipes are buried on the proposed site. Loading of the site by rubble is likely to damage the pipes and the water supply to the community. Further any breakage of the pipe in a water supply system with intermittent supply operation is likely to contaminate the supply water with implication on the community health.
- **Damage to Electrical and Telecommunication Lines** – About 55 electrical and telecommunication poles exist on either side of the Rig Road. Most of these poles locate by the side of the storm drainage, but a few locates in the middle of the green belt. These infrastructures will have to be relocated.
- **Noise pollution** – Traffic movements and segregation activities is likely to enhance the noise level of the site surroundings impacting the adjoining school education and the communities.
- **Air pollution** – Traffic movements and segregation activities is likely to generate high fugitive dust emissions in surrounding areas with implication on the health of the adjoining school children and the communities.
- **Community health and safety** – The site lies at the heart of the community dwelling. Apart from noise pollution, air pollution, degradation of overall sanitation, the adjoining communities are likely

to be exposed to the accidental risks such as traffic, loading/unloading operations, segregation operations etc.

- **Occupational health and safety** – Exposure to high noise, dusts, and working with rubbles while segregation are some of the issues related to occupational health and safety.
- **Future Development** – A road expansion program is going on in this area. The plan proposes to expand the road width for 8 lane road. In this case all the available area (the green belt) will be utilized for the road expansion leaving no space for rubble management.

Satdobato site, ringroad (Satdobato – Gwarko)

Site location:

The site lies in the Lalitpur Sub - Metropolitan City (LSMC) ward no 15 & 17 of Lalitpur District**.** The site is the green belt developed on either side of the Ring Road from Satdobato to gwarko which is among the busiest segment of the ring road. The site roughly extends from north to south which is about 1200 m long and has an average width of 18 m. Ring Road which is about 10 m wide lies on the center of the green belt is flanked on either side by about 2 m wide storm water drainage which runs for most of the road length with underground cross-drainage structures to divert flows towards south at frequent intervals (200 to 500 m). Most of the electric poles are located along the either side of the ring road. Most part of the site is green belt where different species of plant like Shirish, Kaiyo, lahare peepal etc are been planted. Even though the site area is about 71000 m^2 the usable land area is two linear belts approximately 1200 m long with an average width of 12.5 m (i.e. about 30000 m^2).

The GPS coordinate of the eastern border of the site is 27 ˚ 40’ 01.03’’ N & 85 ˚19’ 55.6’’ E and the western border is 27 ˚40’ 02.4’’ N & 85 ˚ 18’ 29.01’’ E. The site lies from 40 meter west from Satdobato chowk to 20 meter east from Gwarko chowk attached to both sides of the ring road, thus is easily accessible.

Figure 1. Site location Google image

Figure 2. Site location (1)

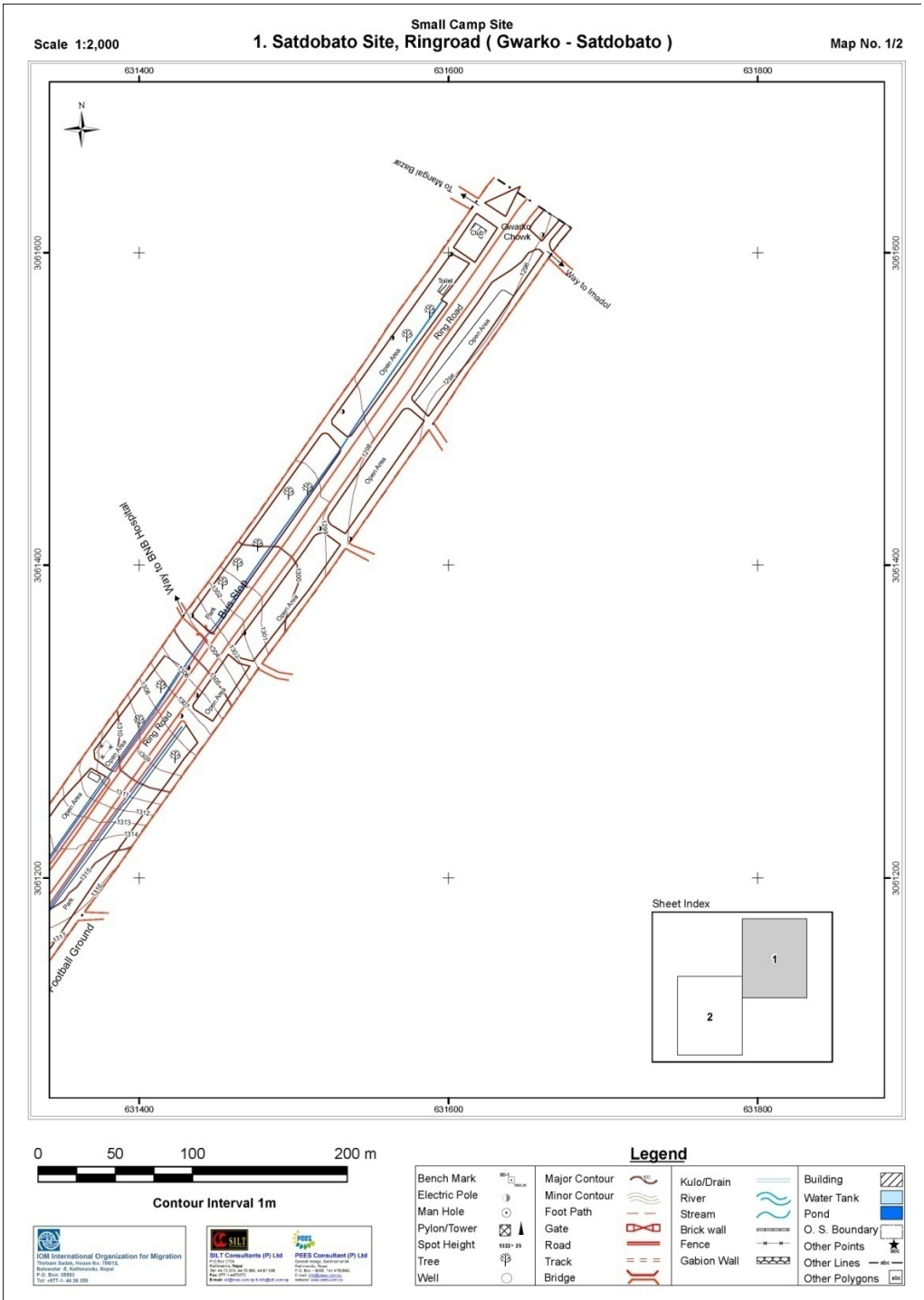
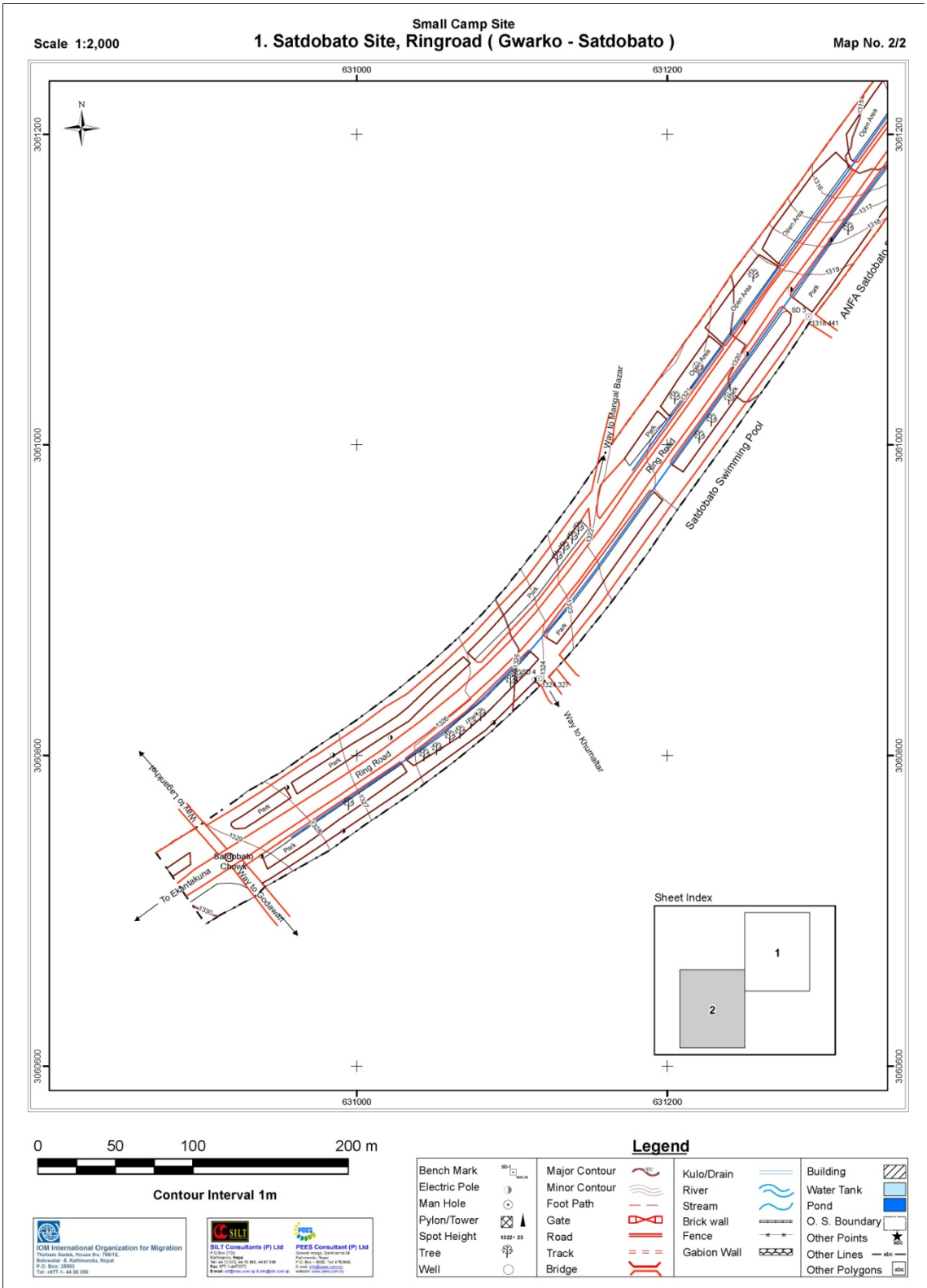


Figure 3. Site location (2)



The GPS coordinate and the general view of the site from different direction is shown in the figure below:

1. **GPS coordinate (Northern border of the site)**

27˚ 39’ 48.4’’ N 85 ˚19’ 46.1’’ E Altitude: 1322 m

Figure 4. Facing East

Figure 5. Facing South

Figure 6. Facing West

Figure 7. Facing North

2. GPS coordinate (at the Eastern border of the site)

27 ˚ 40’ 02.6’’ N 85 ˚19’ 57.8’’ E Altitude: 1305 m

Figure 8. Facing North

Figure 9. Facing East

Figure 10. Facing South

Figure 11. Facing West

3. **GPS coordinate (At the Western border of site – at Satdobato chowk)**

27 ˚ 39’ 31.9’’ N 85 ˚19’ 28.3’’ E Altitude: 1340 m

Figure 12. Facing East

Figure 13. Facing South

Figure 14. Facing West

Figure 15. Facing North

Infrastructure:

- Electric lines: There are about 49 electric poles inside the boundary of the site. The GPS location and the photographs of individual pole is given below:

Photographs of Individual pole

Figure 16. Electric pole no. 1 & 2

GPS coordinate:
27 ˚39’ 33.9’’ N 85 ˚ 19’ 30’’ E
Direction: Facing South

Figure 17. Electric pole no. 3

GPS coordinate:
27 ˚39’ 33.51’’ N 85 ˚ 19’31.87 ’’ E
Direction: Facing East

Figure 18. Electric poles no. 4

GPS coordinate:
27˚39’ 33.9’’ N 85˚ 19’ 32.8’’ E
Direction: Facing North

Figure 19. Electric pole no. 5

GPS coordinate:
27˚39’ 34.5’’ N 85˚ 19’ 33.56 ’’ E
Direction: Facing East

Figure 20. Electric pole no. 6

GPS coordinate:
27˚39’ 35.5’’ N 85˚ 19’ 34.7’’ E
Direction: Facing east

Figure 21. Electric pole no. 7

GPS coordinate:
27˚39’ 36.9’’ N 85˚ 19’ 36.27’’ E
Direction: Facing east

Figure 22. Electric pole no. 8

GPS coordinate:
27˚39’ 38.2 ’’ N 85˚ 19’ 37.5’’ E
Direction: Facing North

Figure 23. Electric pole no. 9

GPS coordinate:
27˚39’ 38.5’’ N 85˚ 19’ 37.8’’ E
Direction: Facing North

Figure 24. Electric pole no. 10

GPS coordinate:
27˚39’ 40.25’’ N 85˚ 19’ 39.1’’ E
Direction: Facing North

Figure 25. Electric pole no. 11 & 12

GPS coordinate:
27˚39’ 40.8’’ N 85˚ 19’ 39.7’’ E
Direction: Facing North

Figure 26. Electric pole no. 13, 14, 15 & 16

GPS coordinate:
27˚39’ 42.1’’ N 85˚ 19’ 40.7’’ E
Direction: Facing North

Figure 27. Electric pole no. 17

GPS coordinate:
27˚39’43.7 ’’ N 85˚ 19’ 42.05’’ E
Direction: Facing North

Figure 28. Electric pole no. 18

GPS coordinate:
27˚39’ 44.8’’ N 85˚ 19’ 43.0’’ E
Direction: Facing North

Figure 29. Electric pole no. 19

GPS coordinate:
27˚39’ 46.1’’ N 85˚ 19’43.9 ’’ E
Direction: Facing East

<table>
<tr><td> 
Figure 30. Electric pole no. 20</td><td> 
Figure 31. Electric pole no. 21</td></tr>
<tr><td>GPS coordinate:
27˚39’47.2 ’’ N 85˚ 19’44.9 ’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚39’ 48.4 ’’ N 85˚ 19’ 46.1’’ E
Direction: Facing North</td></tr>
<tr><td> 
Figure 32. Electric pole no. 22</td><td> 
Figure 33. Electric pole no. 23</td></tr>
<tr><td>GPS coordinate:
27˚39’ 49.7’’ N 85˚ 19’ 46.9’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚39’ 50.9 ’’ N 85˚ 19’ 48.05’’ E
Direction: Facing North</td></tr>
<tr><td> 
Figure 34. Electric pole no. 24</td><td> 
Figure 35. Electric pole no. 25</td></tr>
<tr><td>GPS coordinate:
27˚39’ 52.24’’ N 85˚ 19’ 49.1’’ E
Direction: Facing East</td><td>GPS coordinate:
27˚39’ 53.3’’ N 85˚ 19’ 50.07 ’’ E
Direction: Facing East</td></tr>
</table>

Figure 36. Electric pole no. 26

GPS coordinate:
27˚39’ 54.5 ’’ N 85˚19’ 50.8’’ E
Direction: Facing East

Figure 37. Electric pole no. 27

GPS coordinate:
27˚39’ 55.76’’ N 85˚ 19’52.04 ’’ E
Direction: Facing North

Figure 38. Electric pole no. 28

GPS coordinate:
27˚39’ 56.9’’ N 85˚ 19’ 53.07’’ E
Direction: Facing East

Figure 39. Electric pole no. 29

GPS coordinate:
27˚39’ 58.02 ’’ N 85˚ 19’ 54.02’’ E
Direction: Facing East

Figure 40. Electric poles no. 30

GPS coordinate:
27˚39’ 59.6’’ N 85˚ 19’ 55.2’’ E
Direction: Facing North

Figure 41. Electric pole no. 31, 32, 33 & 34

GPS coordinate:
27˚40’ 00.3’’ N 85˚ 19’ 55.8’’ E
Direction: Facing North

Figure 42. Electric pole no. 35

GPS coordinate:
27˚40’ 01.2 ’’ N 85˚ 19’ 56.44 ’’ E
Direction: Facing North

Figure 43. Electric pole no. 36

GPS coordinate:
27˚40’ 1.79 ’’ N 85˚ 19’ 57.2 ’’ E
Direction: Facing West

Figure 44. Electric pole no. 37

GPS coordinate:
27˚39’ 51.6’’ N 85˚ 19’ 49.3 ’’ E
Direction: Facing West

Figure 45. Electric pole no. 38

GPS coordinate:
27˚39’ 49.8’’ N 85˚ 19’ 47.8’’ E
Direction: Facing West

Figure 46. Electric pole no. 39

GPS coordinate:
27˚39’ 42.9 ’’ N 85˚ 19’ 42.6 ’’ E
Direction: Facing North

Figure 47. Electric pole no. 40

GPS coordinate:
27˚39’ 41.8’’ N 85˚ 19’ 41.56 ’’ E
Direction: Facing North

Figure 48. Electric pole no. 41

GPS coordinate:
27˚39’ 40.6’’ N 85˚ 19’ 40.45 ’’ E
Direction: Facing North

Figure 49. Electric pole no. 42

GPS coordinate:
27˚39’ 39.6 ’’ N 85˚ 19’39.6 ’’ E
Direction: Facing North

Figure 50. Electric pole no. 43

GPS coordinate:
27˚39’ 34.49’’ N 85˚ 19’ 34.71’’ E
Direction: Facing North

Figure 51. Electric pole no. 44

GPS coordinate:
27˚39’ 34.06’’ N 85˚ 19’34.16 ’’ E
Direction: Facing North

Figure 52. Electric pole no. 45

GPS coordinate:
27˚39’ 33.52’’ N 85˚ 19’ 33.30’’ E
Direction: Facing North

Figure 53. Electric pole no. 46

GPS coordinate:
27˚39’32.79 ’’ N 85˚ 19’ 32.24’’ E
Direction: Facing West

Figure 54. Electric pole no. 47

GPS coordinate:
27˚39’ 32.81 ’’ N 85˚ 19’ 32.21’’ E
Direction: Facing West

Figure 55. Electric pole no. 48

GPS coordinate:
27˚39’ 32.05’’ N 85˚ 19’ 30.87’’ E
Direction: Facing West

Figure 56. Electric pole no. 49

GPS coordinate:
27˚39’ 31.47’’ N 85˚ 19’ 29.9’’ E
Direction: Facing West

- Storm water drains and drainage: The site lies along the Ring road corridor from the Satdobato chowk to Gwarko chowk. There is the surface storm water drainage to the both side of the road and the sewerage drainage is built underground along the road.
- Open channel drain in northern part of the ring road flowing from west to east which is eventually directed in Manohara River in leading towards eastern part of the site.
- Natural recipient of the natural drainage is Manohara River which is 1.5 Kilometers east from the eastern border of site.

The photographs and GPS coordinate of the drainage is given below:

Photographs of the drainage:

Figure 57. Surface storm water drain along road

GPS coordinate:
27˚39’ 40.06’’ N 85˚ 19’ 38.91’’ E
Direction: Facing North

Figure 58. Underground sewer drain mixed to the surface water drain

GPS coordinate:
27˚39’ 42.1’’ N 85˚ 19’ 40.7’’ E
Direction: Facing North

Figure 59. Underground sewer destroyed during road construction

GPS coordinate:
27˚39’ 56.8’’ N 85˚ 19’ 53.8 ’’ E
Direction: Facing South

Figure 60. Underground sewer destroyed during road construction

GPS coordinate:
27˚39’ 51.4 ’’ N 85˚ 19’ 49.4 ’’ E
Direction: Facing West

- Water supply pipes through the sites: The drinking water pipes are laid underground along the both side of the road.
- Wells, tube wells & tap: There is one public tap inside the boundary of the site. The GPS location and the photographs of the well is given below:

Figure 61. Public tap

GPS coordinate:

27˚39’ 47.27 ’’ N 85˚ 19’ 44.38’’ E Direction: Facing North

- Structures: There are no any residential building structures inside the site but since the site is along the ring road there are 4 bus stands, 3 temples, 1 water tank and 1 bridge. The photographs and GPS coordinates of different structures are given below:

Photographs of Structure:

<table>
<tr><td> 
Figure 62. Shiva Mandir</td><td> 
Figure 63. Ganesh Mandir</td></tr>
<tr><td>GPS coordinate:
27˚39’45.1 ’’ N 85˚ 19’43.3 ’’ E
Direction: Facing north</td><td>GPS coordinate:
27˚39’ 47.2 ’’ N 85˚ 19’ 44.39’’ E
Direction: Facing North</td></tr>
<tr><td> 
Figure 64. Buddha mandir</td><td> 
Figure 65. Water tank</td></tr>
<tr><td>GPS coordinate:
27˚39’ 55.5 ’’ N 85˚ 19’ 51.3 ’’ E
Direction: Facing North</td><td>GPS coordinate:
27˚39’46.75 ’’ N 85˚ 18’ 44.01’’ E
Direction: Facing North</td></tr>
<tr><td> 
Figure 66. Bridge</td><td> 
Figure 67. Bus stand no.1</td></tr>
<tr><td>GPS coordinate:
27˚39’ 51.68 ’’ N 85˚ 19’ 48.5’’ E</td><td>GPS coordinate:
27˚39’58.4 ’’ N 85˚ 19’ 54.01 ’’ E</td></tr>
</table>

Direction: Facing North	Direction: Facing North
 **Figure 68. Bus stand (destructed) no. 2**	 **Figure 69. Bus stand no. 3**
GPS coordinate: 27˚39’ 59.93’’ N 85˚ 19’ 55.04’’ E Direction: Facing North	GPS coordinate: 27˚39’52.13 ’’ N 85˚ 19’ 48.9’’ E Direction: Facing North
 **Figure 70. Bus stand no.4**	
GPS coordinate: 27˚39’42.9 ’’ N 85˚ 19’42.1 ’’ E Direction: Facing North	

- Other purpose of the site: Most of the site is used for storage of building materials and equipments. The site is also used for parking of vehicles and small temporary shops have been established along the road. Most of the area is developed as green belt which was planted during the construction of the ring road.

- Educational facilities:

  Since the site covers the large area along the ring road there are many educational facilities near the site. The details of the educational facilities are given below:

- 100 metres South from satdobato chowk: Mahendra Adarsha Vidyashram;
- 50 metres North from Bodhigram Bus stop: The Rising School;
- 110 metres South East from Bodhigram Bus stop: Kathmandu College of Management; and
- 100 metres North West from Gwarko Chowk: Prabhat Higher Secondary School.

- Health facilities: The details of nearest hospital along the site are given below:
  - 250 metres West from Gwarko Chowk: Baidya and Banskota (B & B) Hospital.

- **Biological features:** The project site lies along the green belt constructed during the ring road construction. There are about 109 trees inside the site boundary. The details of the trees are given below:

S.N	Tree species (Local Name)	No of trees
1	Rubber plant	4
2	Kaiyo tree	30
3	Shirish tree	17
4	Aaru	1
5	Peepal tree	6
6	Lahare peepal tree	27
7	Dhuppi tree	20
8	Salla tree	3
9	Bar tree	1
	Total	**109**

Photographs of Trees

Figure 71. Group of Kaiyo tree

GPS coordinate:
27˚39' 38.2 '' N 85˚ 19' 37.5'' E
Direction: facing North

Figure 72. Group of Shirish trees

GPS coordinate:
27˚39' 52.24'' N 85˚ 19' 49.1'' E
Direction: facing West

Figure 73. Group of Lahare peepal tree

GPS coordinate:
27˚39' 40.6'' N 85˚ 19' 40.45 '' E
Direction: facing North

Figure 74. Rubber plant

GPS coordinate:
27˚39'45.1 '' N 85˚ 19'43.3 '' E
Direction: facing North

- **Social features:**
  - Site land ownership: Department of Roads, Government owned land
  - Occupational status of communities living close to the site: Both parts of the ring road is used for business purposes and many people living in those area have established some kind of business and service providing organization close to the site. Besides that working age group (25 years and above) are involved in private and governmental organizations for job.
  - Ethnic and Religious Background of the Communities close to the site: Settlement in ring road area is diverse and mainly people from other parts of the country have migrated to these places. Thus due to this diversity, there is presence of mixed ethnic group dominated by Brahmins and Newars including Dalits and Chhetris. Most people in this area follow Hinduism and Buddhism with small number of people following Christianity.
  - Perception of the Communities on the proposed plan: Community people are not against the plan of debris management in the proposed site but demand there must not be any disturbance in their daily life activities and accessibility to basic necessities such as: drinking water, electricity, sewage management and road usage.

  - Nearby settlement: There are many settlements along the road. The details of the settlement are given below:
    - 750 meters from eastern corner of the site is Satdobato and remaining 800 meters towards is east is Gwarko.
    - Set back distance from the nearest building to the site is about 5 meters in both side of the road or site .i.e. northern and southern border of the site.

  - Security situation: Since the site lies along the busiest road of the valley, the site is easily accessible from all the side.
    - Approach of site by communities from all side for security concern: The site lies in both side of ring road thus it is easily accessible to community from all possible direction.

    - Fencing of the site: Attached settlements use the site as connecting road to ring-road thus fencing of the site will disturb the daily life activities of the community.

    - The fencing of the site is likely to affect the daily activities of the local people and the transportation status of the site.

- **Noise Levels**

Major noise source: As the site lies along the busiest road of the valley (from Gwarko chowk to Satdobato chowk), significant sound pressure level was recorded. Major noise sources noticed during monitoring were Vehicles especially power horn of large truck and buses. Other sources noted during monitoring were Conversation among people (Human voice pitch), Construction activities.

General weather condition: During monitoring period the general weather was warm and mild sunny.

Monitoring Day/ Date/time: Friday, 13/12/2013, 1:00 pm

Monitored by: Prasan Karmacharya

GPS location of Monitored site: 27˚39' 33.55'' N 85˚ 19' 33.05 '' E

Sound Pressure Level:

The sound pressure level of the site has been presented in **Table no. 1**. The maximum sound pressure level within the site premises was 83 dB(A) and minimum sound pressure level was 55 dB(A). The equivalent sound pressure level was 69 dB(A). The sound of vehicular movement of power horn was the main source of high sound pressure level.

Table 1. Sound Pressure Level, Within the Site Premises {dB(A)}

Noise Descriptors	Sound Pressure Level
Minimum	55
Maximum	83
Leq	69

Field Survey, 2013 December

Management Issues

- ***Site Location*** – Located at the middle of the heavily populated area adjacent to the traffic life line
- **Available *area*** – The available area is only limited to the green belt on the either side of ring road which is very small area for the management of the earthquake rubble. Further, the road expansion activities along the ring road had made the site inappropriate area for rubble management.
- ***Traffic* obstruction** – There are about 14 motor able entry points in the proposed stretch (7 from southern side and 7 from northern side). Continuous filling of the site with rubbles from east to west on either side of Ring Road will obstruct the inflowing traffic into the Ring Road. Leaving space to allow traffic into Ring Road will further reduce the available size for rubble management.
- **Obstruction *to access the property*** – The internal side roads and foot trails are the key assess routes to the built residential and commercial property located at the northern and southern perimeter of the proposed site. Using the entire available area for rubble management will obstruct the access to property. Leaving safety space for access will further reduce the size of the available area for rubble management.
- **Obstruction *to surface storm water drainage*** – The surface storm water drainage on either side of the Ring Road is the primary drainage outlet for the settlements located at the perimeter of the site. Filling of the purposed site will obstruct the existing natural as well as manmade surface drainage network. In the event of rainfall water logging is expected in the settlement areas degrading the sanitation conditions. Further spill and side casting of the rubble in the existing storm water drainage of the Ring Road is likely to obstruct the existing drainage will implication on the road surface of the Ring Road. Maintaining a safety distance to avoid the above consequences will further reduce the available area for rubble management.
- **Damage *to water supply pipe network***: All of the water supply pipes are underground. Exact locations of the pipeline network are not available. Local people maintain that the water supply pipes are buried on the proposed site. Loading of the site by rubble is likely to damage the pipes and the water supply to the community. Further any breakage of the pipe in a water supply system with intermittent supply operation is likely to contaminate the supply water with implication on the community health.
- **Damage to Electrical and Telecommunication Lines** – About 49 electrical and telecommunication poles exist on either side of the Rig Road. Most of these poles locate by the side of the storm drainage, but a few locates in the middle of the green belt. These infrastructures will have to be relocated.
- **Noise pollution** – Traffic movements and segregation activities is likely to enhance the noise level of the site surroundings impacting the adjoining school education and the communities.
- **Air pollution** – Traffic movements and segregation activities is likely to generate high fugitive dust emissions in surrounding areas with implication on the health of the adjoining school children and the communities.
- **Community health and safety** – The site lies at the heart of the community dwelling. Apart from noise pollution, air pollution, degradation of overall sanitation, the adjoining communities are likely to be exposed to the accidental risks such as traffic, loading/unloading operations, segregation operations etc.
- **Occupational health and safety** – Exposure to high noise, dusts, and working with rubbles while segregation are some of the issues related to occupational health and safety.

- **Future Development** – A road expansion program is going on in this area. The plan proposes to expand the road width for 8 lane road. In this case all the available area (the green belt) will be utilized for the road expansion leaving no space for rubble management.

ANNEX 4.2: SOIL ANALYSIS REPORT

Entry No. : NCL – 178 (S) (4) - 12 - 2013 Date Received : 11 - 12 - 2013

Sample : Soil (Ringroad Ekantakuna Satdobato, R1) Date Completed : 23 - 12 - 2013

Client : IOM Sampling Date : 11 – 12 – 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 39′ 57.46″ N and 85° 18′ 39.94″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:1)	pH Meter, USDA Agricultural Handbook 60	8
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.11
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	20.36
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	88.4
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	2.2
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	7.95
b)	Sand, (%)		51.7
c)	Silt, (%)		40.4
d)	Soil Type		L

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

L: Loam; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Remarks: As per NARC classification, the observed values for nitrogen (>0.1%) and organic matter (>2%) were medium and low ranking respectively.

Entry No. : NCL – 178 (S) (4) - 12 - 2013 Date Received : 11 - 12 - 2013

Sample : Soil (Oxygenation Park) Date Completed : 23 - 12 - 2013

Client : IOM Sampling Date : 11 – 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 40′ 11.58″ N and 85° 17′ 54.56″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:1)	pH Meter, USDA Agricultural Handbook 60	6.8
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.11
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	20.36
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	46.34
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	2.3
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	23.6
b)	Sand, (%)		28.4
c)	Silt, (%)		48.0
d)	Soil Type		L

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

L: Loam; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Remarks: As per NARC classification, the observed values for nitrogen (>0.1%) and organic matter (>2%) were medium and low ranking respectively.

Entry No. : NCL – 178 (S) (4) - 12 - 2013 Date Received : 11 - 12 - 2013

Sample : Soil (Bagmati Corridor, B5) Date Completed : 23 - 12 - 2013

Client : IOM Sampling Date : 11 – 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 41′ 35.29″ N and 85° 18′ 31.53″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:1)	pH Meter, USDA Agricultural Handbook 60	7.4
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.21
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	53.5
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	226.73
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	4.8
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	9.6
b)	Sand, (%)		37.4
c)	Silt, (%)		52.0
d)	Soil Type		SL

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

SL: Silty Loam; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Remarks: As per NARC classification, the observed values for nitrogen (>0.2%) and organic matter (<5%) were high and medium ranking respectively.

Entry No. : NCL – 178 (S) (4) - 12 - 2013 Date Received : 11 - 12 - 2013

Sample : Soil (Bagmati Corridor, B4) Date Completed : 23 - 12 - 2013

Client : IOM Sampling Date : 11 – 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 41′ 31.67″ N and 85° 18′ 07.97″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:2)	pH Meter, USDA Agricultural Handbook 60	7.2
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.25
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	64.7
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	225
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	5.8
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	15.6
b)	Sand, (%)		42.4
c)	Silt, (%)		42
d)	Soil Type		L

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

L: Loam; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Entry No. : NCL – 181 (S) (5) - 12 - 2013 Date Received : 12 - 12 - 2013

Sample : Soil (Chabahil, C1) Date Completed : 27 - 12 - 2013

Client : IOM Sampling Date : 12 – 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 44′ 19.05″ N and 85° 20′ 21.55″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:1)	pH Meter, USDA Agricultural Handbook 60	7.1
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.21
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	53.87
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	151.23
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	4.8
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	7.9
b)	Sand, (%)		67.7
c)	Silt, (%)		24.4
d)	Soil Type		SL

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

SL: Sandy Loam; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Remarks: As per NARC classification, the observed values for nitrogen (>0.2%) and organic matter (>2.5%) were high and medium ranking respectively.

Entry No. : NCL – 181 (S) (5) - 12 - 2013 Date Received : 12 - 12 - 2013

Sample : Soil (Chabahil, C2) Date Completed : 27 - 12 - 2013

Client : IOM Sampling Date : 12 – 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 44′ 01.29″ N and 85° 20′ 34.7″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:1)	pH Meter, USDA Agricultural Handbook 60	6.9
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.13
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	27.07
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	78.9
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	2.7
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	6.9
b)	Sand, (%)		71.7
c)	Silt, (%)		21.4
d)	Soil Type		SL

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

SL: Sandy Loam; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Remarks: As per NARC classification, the observed values for nitrogen (>0.1%) and organic matter (>2.5%) both were of medium ranking.

Entry No. : NCL – 181 (S) (5) - 12 - 2013 Date Received : 12 - 12 - 2013

Sample : Soil (Chabahil, C3) Date Completed : 27 - 12 - 2013

Client : IOM Sampling Date : 12 – 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 43′ 12.35″ N and 85° 20′ 45.90″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:1)	pH Meter, USDA Agricultural Handbook 60	7.4
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.09
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	15.9
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	151.96
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	1.9
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	4.9
b)	Sand, (%)		79.7
c)	Silt, (%)		15.4
d)	Soil Type		LS

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

LS: Loamy Sand; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Remarks: As per NARC classification, the observed values for nitrogen (<0.1%) and organic matter (>2%) both were of low ranking.

Entry No. : NCL – 181 (S) (5) - 12 - 2013 Date Received : 12 - 12 - 2013

Sample : Soil (Shankha Park) Date Completed : 27 - 12 - 2013

Client : IOM Sampling Date : 12 – 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 43′ 59.32″ N and 85° 20′ 32.99″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:1)	pH Meter, USDA Agricultural Handbook 60	6.9
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.11
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	20.36
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	50.6
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	2.3
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	5.9
b)	Sand, (%)		69.7
c)	Silt, (%)		24.4
d)	Soil Type		SL

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

SL: Sandy Loam; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Remarks: As per NARC classification, the observed values for nitrogen (>0.1%) and organic matter (<2.5%) both were of medium ranking.

Entry No. : NCL – 181 (S) (5) - 12 - 2013 Date Received : 12 - 12 - 2013

Sample : Soil (Bagmati Coridor, B6) Date Completed : 27 - 12 - 2013

Client : IOM Sampling Date : 12 – 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 40′ 43.50″ N and 85° 20′ 01.16″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:1)	pH Meter, USDA Agricultural Handbook 60	6.5
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.15
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	33.67
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	46.17
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	2.2
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	4.9
b)	Sand, (%)		65.7
c)	Silt, (%)		29.4
d)	Soil Type		SL

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

SL: Sandy Loam; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Remarks: As per NARC classification, the observed values for nitrogen (>0.1%) and organic matter (<2.5%) both were of medium ranking.

Entry No. : NCL – 184 (S) (2) - 12 - 2013 Date Received : 13 - 12 - 2013

Sample : Soil (Ring Road-Balkumari-Gwarko, BG1) Date Completed : 27 - 12 - 2013

Client : IOM Sampling Date : 13 – 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 40′ 15.84″ N and 85° 20′ 23.97″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:1)	pH Meter, USDA Agricultural Handbook 60	7.4
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.19
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	44.93
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	215
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	4.1
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	4.9
b)	Sand, (%)		68.7
c)	Silt, (%)		26.4
d)	Soil Type		SL

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

SL: Sandy Loam; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Remarks: As per NARC classification, the observed values for nitrogen (<0.2%) and organic matter (<5%) were high and medium ranking respectively.

Entry No. : NCL – 184 (S) (2) - 12 - 2013 Date Received : 13 - 12 - 2013

Sample : Soil (Ring Road-Satdobato - Gwarko, SG1) Date Completed : 27 - 12 - 2013

Client : IOM Sampling Date : 13 – 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 39′ 53.45″ N and 85° 19′ 51.47″ E

S. N.	Parameters	Test Methods	Observed Values
1.	pH at 14°C (1:1)	pH Meter, USDA Agricultural Handbook 60	7.8
2.	Total Nitrogen, (%)	Kjeldahl Digestion, FAO Fertilizer & Plant Nutrition Bulletin No. 19	0.15
3.	Available Phosphorus, (µg/g)	Olsen, ASA Monograph Number 9. FAO Fertilizer & Plant Nutrition Bulletin No. 19	33.77
4.	Available Potassium, (µg/g)	Kjeldahl Digestion, Soil Analysis, Jackson M. L. Bremner, J. M. and C. S. Mulvaney	136.5
5.	Organic Matter, (%)	Modified Walkley & Black, USDA Agricultural Handbook 60	3.3
6.	Texture		
a)	Clay, (%)	Hydrometer, Tropical Soil Biology and Fertility; Anderson J.M. & Ingram, J.S.I. Gee, G. W. and J. W. Bauder	4.9
b)	Sand, (%)		67.7
c)	Silt, (%)		27.4
d)	Soil Type		SL

Note: The determination was carried out in air dried (Depth: 0 ~ 10cm) soil sample.

NARC Rating	N, %	OM, %
High (H)	>0.2	>5
Medium (M)	0.11 ~ 0.2	2.5 ~ 5
Low (L)	≤ 0.1	≤ 2

Note: The analysis was carried out in air dried samples.

SL: Sandy Loam; AAS – Atomic Absorption Spectrophotometer; USDA: United State Department of Agriculture; FAO: Food and Agriculture Organization.

Remarks: As per NARC classification, the observed values for nitrogen (>0.1 %) and organic matter (>2.5%) both were of medium ranking.

ANNEX 4.3: WATER QUALITY ANALYSIS REPORT

Entry No. : NCL – 177(W) (5) - 12- 2013 Date Received : 11- 12- 2013

Sample : Water (Ringroad, Ekantakuna – Satdobato, R1) Date Completed : 20 -12– 2013

Client : NESS (IOM) Sampling Date : 11 – 12- 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 39′ 57.52″ N and 85° 18′ 39.61″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 15^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.5	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	493	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**40**	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	286	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	295	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	63	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	**5.3**	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	3.9	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.02	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	79.4	200
11.	Magnesium, (mg/l)		21.4	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	**2.55**	0.3
13.	Manganese, (mg/l)		**1.51**	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**9**	Nil

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except turbidity, ammonia, iron, manganese and E. coli, all observed values lie within the prescribed NDWQS for drinking water. The water was very hard in nature.

Entry No. : NCL – 177(W) (5) - 12- 2013 Date Received : 11- 12- 2013

Sample : Water (Oxygenation Park) Date Completed : 20 -12– 2013

Client : NESS (IOM) Sampling Date : 11 – 12- 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 40′ 06.44″ N and 85° 17′ 53.52″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 15^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.8	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	296	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**21**	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	184	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	171	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	9.3	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	**12**	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	2.8	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.03	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	52.5	200
11.	Magnesium, (mg/l)		12.9	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	**1.67**	0.3
13.	Manganese, (mg/l)		**1.43**	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	Nil	Nil

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except turbidity, ammonia, iron and manganese, all observed values lie within the prescribed NDWQS for drinking water. The water was very hard in nature.

Entry No. : NCL – 177(W) (5) - 12- 2013 Date Received : 11- 12- 2013

Sample : Water (Bagmati Coridor, B4) Date Completed : 20 -12– 2013

Client : NESS (IOM) Sampling Date : 11 – 12- 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 41′ 31.52″ N and 85° 18′ 07.45″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 15^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.6	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	777	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**19**	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	414	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	507	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	118	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	**7.7**	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	41.3	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.13	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	119.8	200
11.	Magnesium, (mg/l)		28	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	**1.48**	0.3
13.	Manganese, (mg/l)		**0.72**	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**48**	Nil

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except turbidity, ammonia, iron, manganese and E. coli count, all observed values lie within the prescribed NDWQS for drinking water. The water was very hard in nature.

Entry No. : NCL – 177(W) (5) - 12- 2013 Date Received : 11- 12- 2013

Sample : Water (Bagmati Corridor B5a) Date Completed : 20 -12– 2013

Client : NESS (IOM) Sampling Date : 11 – 12- 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 41′ 35.56″ N and 85° 18′ 31.54″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 15^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.6	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	1188	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**310**	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	802	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	641	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	150	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	**25.1**	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	27.3	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.28	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	221	200
11.	Magnesium, (mg/l)		61	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	**134.6**	0.3
13.	Manganese, (mg/l)		**6.43**	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	Nil	Nil

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except, all observed values lie within the prescribed NDWQS for drinking water. The water was very hard in nature.

Entry No. : NCL – 177(W) (5) - 12- 2013 Date Received : 11- 12- 2013

Sample : Water (Bagmati Corridor B5b) Date Completed : 20 -12– 2013

Client : NESS (IOM) Sampling Date : 11 – 12- 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 41′ 35.1″ N and 85° 18′ 36.8″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 15^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.8	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	408	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	4	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	196	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	134	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	68.5	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	**1.7**	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	41.3	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.13	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	51.3	200
11.	Magnesium, (mg/l)		16.5	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.29	0.3
13.	Manganese, (mg/l)		0.08	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**7**	Nil

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except ammonia and E. coli count, all observed values lie within the prescribed NDWQS for drinking water. The water was hard in nature.

Entry No. : NCL – 182(W) (4) - 12- 2013 Date Received : 12- 12- 2013

Sample : Water (Chabahil C1) Date Completed : 20 -12– 2013

Client : NESS (IOM) Sampling Date : 12– 12- 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 44′ 20.24″ N and 85° 20′ 19.21″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 14^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.8	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	574	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**12**	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	351	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	307	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	56.3	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.45	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	15.5	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.05	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	102.6	200
11.	Magnesium, (mg/l)		23.1	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	**0.45**	0.3
13.	Manganese, (mg/l)		N. D. (<0.02)	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**9**	Nil

N. D.: Not Detected

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except turbidity, iron and E. coli, all observed values lie within the prescribed NDWQS for drinking water. The water was very hard in nature.

Entry No. : NCL – 182(W) (4) - 12- 2013 Date Received : 12- 12- 2013

Sample : Water (Chabahil C2) Date Completed : 20 -12– 2013

Client : NESS (IOM) Sampling Date : 12– 12- 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 43′ 51.6″ N and 85° 20′ 41.7″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 14^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.5	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	291	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	N. D. (<1)	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	130	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	64.4	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	42.6	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.06	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	32.8	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.01	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	32.1	200
11.	Magnesium, (mg/l)		12.2	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	0.17	0.3
13.	Manganese, (mg/l)		N. D. (<0.02)	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	Nil	Nil

N. D.: Not Detected

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: All observed values lie within the prescribed NDWQS for drinking water. The water was moderately hard in nature.

Entry No. : NCL – 182(W) (4) - 12- 2013 Date Received : 12- 12- 2013

Sample : Water (Sankhapark, SP1) Date Completed : 20 -12– 2013

Client : NESS (IOM) Sampling Date : 12– 12- 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 43′ 59.54″ N and 85° 20′ 35.20″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 14^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.5	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	277	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**39**	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	106	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	94	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	41	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.18	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	3.8	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	<0.01	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	29.7	200
11.	Magnesium, (mg/l)		7.8	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	**1.09**	0.3
13.	Manganese, (mg/l)		0.04	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	Nil	Nil

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except turbidity and iron, all observed values lie within the prescribed NDWQS for drinking water. The water was moderately hard in nature.

Entry No. : NCL – 182(W) (4) - 12- 2013 Date Received : 12- 12- 2013

Sample : Water (Bagmati Corridor, B6) Date Completed : 20 -12– 2013

Client : NESS (IOM) Sampling Date : 12– 12- 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 40′ 45.16″ N and 85° 20′ 78.45″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 14^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.8	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	587	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**29**	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	216	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	337	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	36	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	**27.9**	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	25.1	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.12	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	58.5	200
11.	Magnesium, (mg/l)		17	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	**2.16**	0.3
13.	Manganese, (mg/l)		**0.49**	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**23**	Nil

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except turbidity, ammonia, iron, manganese and E. coli count, all observed values lie within the prescribed NDWQS for drinking water. The water was veryhard in nature.

Entry No. : NCL – 183(W) (2) - 12- 2013 Date Received : 13 – 12 - 2013

Sample : Water (Ring Road, Satdobato Gwarko) Date Completed : 24 - 12– 2013

Client : NESS (IOM) Sampling Date : 13 - 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 39′ 53.45″ N and 85° 19′ 51.47″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 12^{o}C	Electromeric, 4500 - H^+ B,: APHA	6.6	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	585	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**120**	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	210	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	339	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	37	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	**48.5**	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	5.2	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.10	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	58.5	200
11.	Magnesium, (mg/l)		15.6	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	**6.77**	0.3
13.	Manganese, (mg/l)		**1.33**	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**11**	Nil

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except turbidity, ammonia, iron, manganese and E. coli, all observed values lie within the prescribed NDWQS for drinking water. The water was very hard in nature.

Entry No. : NCL – 183(W) (2) - 12- 2013 Date Received : 13 – 12 - 2013

Sample : Water (Ring Road, Balkumari Gwarko) Date Completed : 24 - 12– 2013

Client : NESS (IOM) Sampling Date : 13 - 12 - 2013

Sampled By : NESS

GPS Location of Sampling site: 27° 40′ 15.61″ N and 85° 20′ 25.30″ E

S. N.	Parameters	Test Methods	Observed Values	NDWQS, Nepal
1.	pH at 12°C	Electromeric, 4500 - H^+ B,: APHA	6.6	6.5 - 8.5
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	713	1500
3.	Turbidity, (NTU)	Nephelometric, 2130 B, APHA	**17**	5
4.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	370	500
5.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	300	-
6.	Chloride, (mg/l)	Argentometric Titration, 4500 - Cl^- B, APHA	87	250
7.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	0.16	1.5
8.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	5.9	50
9.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.08	-
10.	Calcium, (mg/l)	EDTA Titrimetric, 3500 - Ca B & 3500 - Mg B APHA	88.2	200
11.	Magnesium, (mg/l)		36.5	-
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	**0.94**	0.3
13.	Manganese, (mg/l)		**0.29**	0.2
14.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**460**	Nil

Note:

NDWQS: National Drinking Water Quality Standard - 2063; AAS: Atomic Absorption Spectrophotometer; UV: Ultraviolet; EDTA: Ethyelenediaminetetraacetic acid; NTU: Nephelometric turbidity unit; MPN: Most Probable Number; NEDA: N-1-Naphthyleethylenediamine dihydrochloride; APHA: American Public Health Association.

Remarks: Except turbidity, iron, manganese and E. coli, all observed values lie within the prescribed NDWQS for drinking water. The water was very hard in nature.

ANNEX 4.4: BAGMATI RIVER WATER QUALITY REPORT

Entry No. : NCL – 113 (W) (6) - 09 - 2013 Date Received : 26 - 09 - 2013

Sample : Bagmati River Water (4, Bhameshwor) Date Completed : 04 - 09 - 2013

Client : ICIMOD Sampling Date : 25 - 08 - 2013

Sampled By : NESS Location : Pashupatinath

Geographical Coordinates : $27^{o}44'21.7''N; 85^{o}23'17.5''E$

S. N.	Parameters	Test Methods	Observed Values
1.	pH @ $25^{o}C$	Electromeric, 4500 - H^{+} B,: APHA	6.6
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	108
3.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	30
4.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	40
5.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 – 1989	33.5
6.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	50
7.	Dissolved Oxygen, (mg/l)	Winkler Azide Modification, 4500 - O C, APHA	3.9
8.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	1.7
9.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	2.9
10.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.22
11.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**4600**
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	1.8
13.	Manganese, (mg/l)		0.07
14.	Lead, (mg/l)		N. D. (<0.01)
15.	Copper, (mg/l)		N. D. (<0.01)
16.	Zinc, (mg/l)		0.02

N. D. Not Detected.

Remarks: The observed dissolved oxygen was lesser than 5mg/l and the water was contaminated with E. coli.

Entry No. : NCL – 113 (W) (6) - 09 - 2013 Date Received : 26 - 09 - 2013

Sample : Bagmati River Water (5, Thapathali) Date Completed : 04 - 09 - 2013

Client : ICIMOD Sampling Date : 25 - 08 – 2013

Geographical Coordinates : $27^{o}41'21.1''N; 85^{o}18'57.7''E$

Sampled By : NESS Location : Kopundole

S. N.	Parameters	Test Methods	Observed Values
1.	pH @ $25^{o}C$	Electromeric, 4500 - H^{+} B,: APHA	7
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	316
3.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	84
4.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	114
5.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 – 1989	65
6.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	88
7.	Dissolved Oxygen, (mg/l)	Winkler Azide Modification, 4500 - O C, APHA	0.5
8.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	7.3
9.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	2.1
10.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.01
11.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**11000**
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	1.82
13.	Manganese, (mg/l)		0.20
14.	Lead, (mg/l)		N. D. (<0.01)
15.	Copper, (mg/l)		0.02
16.	Zinc, (mg/l)		0.04

N. D. Not Detected.

Remarks: The observed dissolved oxygen was lesser than 5mg/l and the water was contaminated with E. coli.

Entry No. : NCL – 113 (W) (6) - 09 - 2013 Date Received : 26 - 09 - 2013

Sample : Bagmati River Water (6, Ganeshsthan) Date Completed : 04 - 09 - 2013

Client : ICIMOD Sampling Date : 25 - 08 - 2013

Sampled By : NESS Location : Chovar

Geographical Coordinates : $27^{o}39'28.7''N; 85^{o}17'36.4''E$

S. N.	Parameters	Test Methods	Observed Values
1.	pH @ $25^{o}C$	Electromeric, 4500 - H^{+} B,: APHA	6.9
2.	Electrical Conductivity, (µmhos/cm)	Conductivity Meter, 2510 B, APHA	442
3.	Total Hardness as $CaCO_3$, (mg/l)	EDTA Titrimetric, 2340 C, APHA	103
4.	Total Alkalinity as $CaCO_3$, (mg/l)	Titrimetric, 2320 B, APHA	158
5.	Biological Oxygen Demand, (mg/l)	Winkler Azide Modification (Dilution & Seeding), 5210 B, APHA, ISO 5815 – 1989	79
6.	Chemical Oxygen Demand, (mg/l)	Potassium Dichromate Reflux, 5220 B, APHA	150
7.	Dissolved Oxygen, (mg/l)	Winkler Azide Modification, 4500 - O C, APHA	3.2
8.	Ammonia, (mg/l)	Direct Nesslerization, 4500 - NH_3 C APHA	8.9
9.	Nitrate, (mg/l)	UV Spectrophotometric Screening, 4500 - NO_3^- B, APHA	5.2
10.	Nitrite, (mg/l)	NEDA, Colorimetric, 4500 - NO_2^- B, APHA	0.01
11.	E. Coli Count, (MPN Index/100 ml)	Multiple Tube Fermentation, 9221 E, APHA	**11000**
12.	Iron, (mg/l)	Direct Air - Acetylene AAS, 3111 B, APHA	3.3
13.	Manganese, (mg/l)		0.28
14.	Lead, (mg/l)		N. D. (<0.01)
15.	Copper, (mg/l)		0.02
16.	Zinc, (mg/l)		0.05

N. D. Not Detected.

Remarks: The observed dissolved oxygen was lesser than 5mg/l and the water was contaminated with E. coli.

ANNEX 4.5: AMBIENT AIR QUALITY MONITORING REPORT

Annex 4.5: The ambient air quality monitoring data of Kathmandu valley

On October 2002 with the support of DANIDA government and former Ministry of Environment and Population (HMG/MOPE), six air pollution monitoring stations were installed in different locations of the Kathmandu valley as shown in Figure 1.

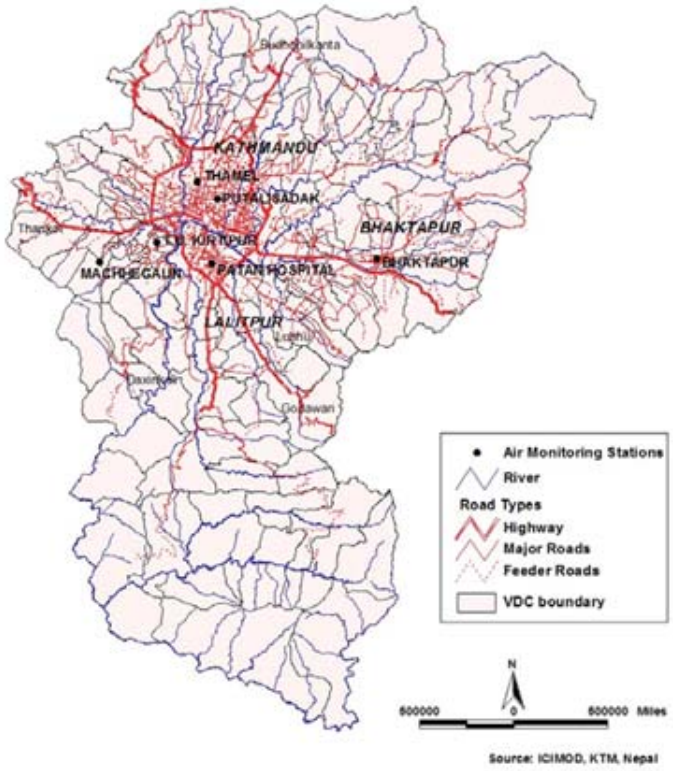


Figure 1. Map of the Kathmandu Valley (With Air Monitoring Stations)

The instruments are capable of measuring the ambient particulate matter of aerodynamic diameter 10 µm (PM10). After the installation, Government of Nepal especially ministry of environment is actively involved in publishing the data of PM10. Till today, Ministry of science, technology and environment (MoEST) has updated the 24 hours data of ambient PM10 concentration. Out of six stations, four of them are functional to collect the air pollution data for the valley that are as follows:

1. Putalisadak
2. Thamel
3. Bhaktapur
4. Machhegaun

1. Putalisadak

Putalisadak is one of the lively centers of Kathmandu valley where traffic flow and people movement are relatively higher. It is a core area of the valley where MoEST have installed the air pollution monitoring equipment to measure daily PM10 ambient concentration. In the recent publication, MoEST has updated the data of four months (i.e. February, March, June and July). With the generated data from the station, following figures are plotted (Figure2 and Figure 3).

From the Figure 2, it is clear that average daily emission is excessively high (i.e. 485 µg/m^3) which is four times higher than the National Ambient Air Quality Standard and twenty times the WHO standard. Similarly, for June-July month, average PM10 ambient concentration is 125µg/m^3 which is a higher value to National Ambient Air Quality Standard and WHO Standards. Maximum pollution level was observed to be 910µg/m^3 on 21st February 2013. Whereas, during monsoon time (June-July 2013) pollution level had dropped substantially and maximum limit detected is 287µg/m^3 on 1 July 2013 (as shown in Figure 3).

Figure2. PM10 level of Putalisadak February-March 2013

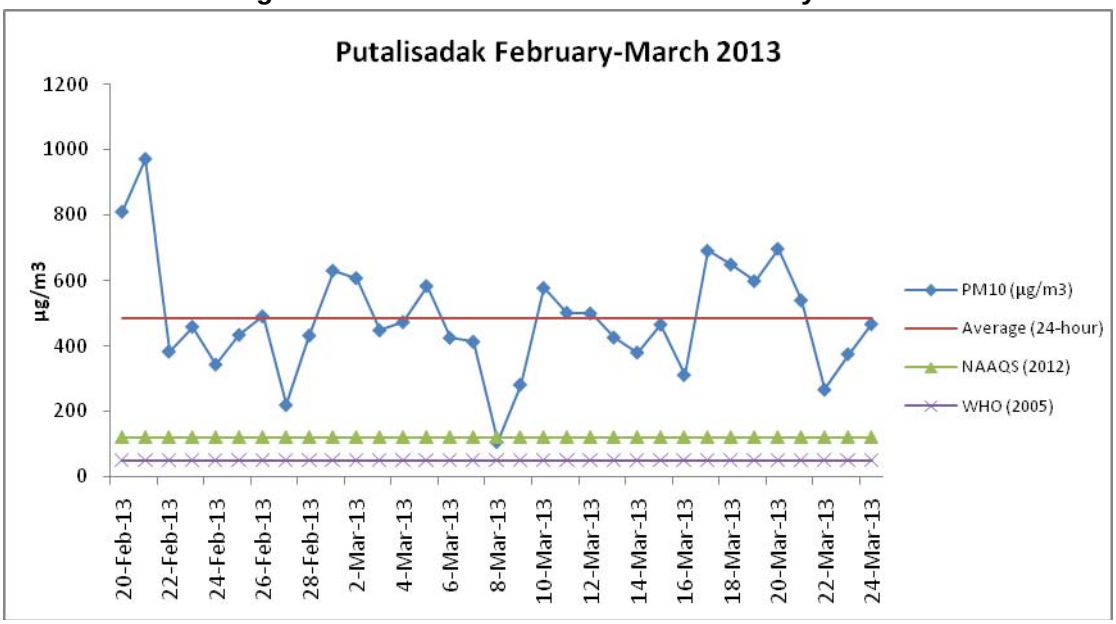
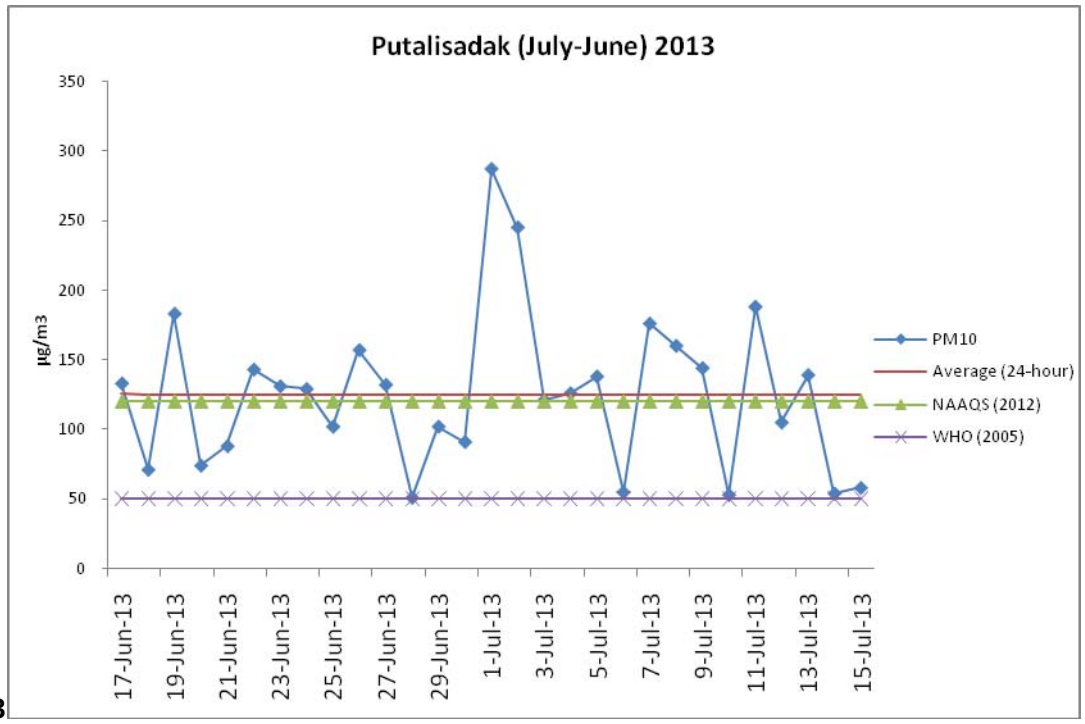


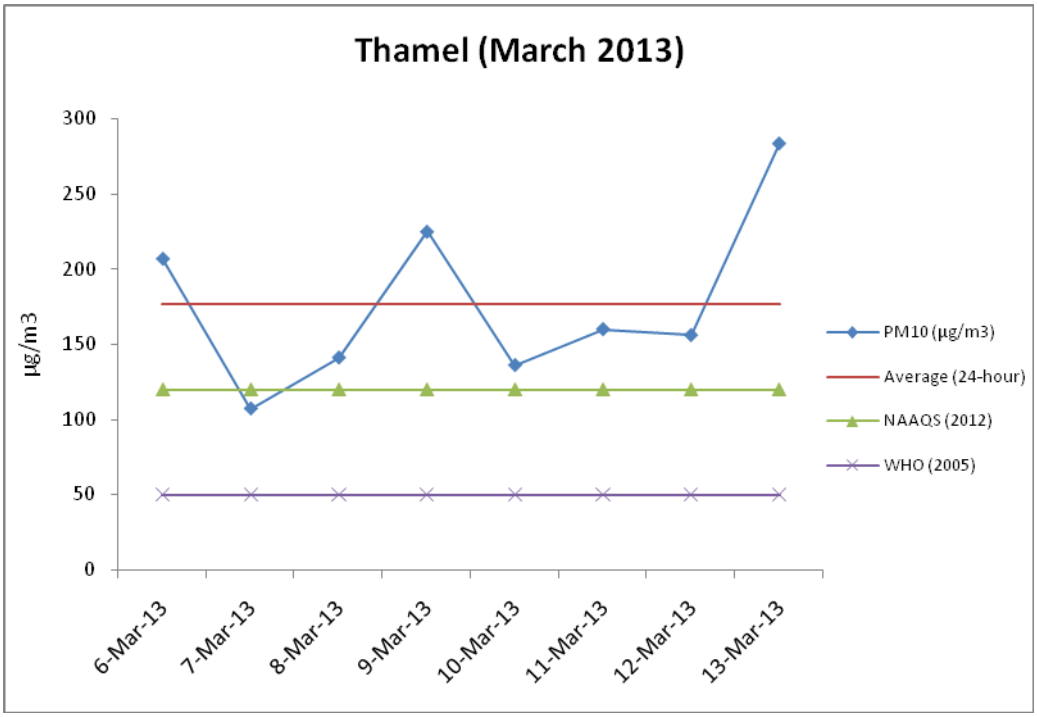
Figure3. PM10 level of Putalisadak June-July 2013



2. Thamel

Thamel lies in between residential and urban center that is situated in core area of the valley. It is a major tourist center with high public activities. It is another air pollution monitoring point for MoEST. In the recent Publication of MoEST, weekly air pollution data from 6th March to 13th March 2013 is updated. As we can see in Figure 4, average 24-hour concentration is 177µg/m^3 that is higher than National Ambient Air Quality Standard and WHO standard. Maximum PM10 level is 284µg/m^3 recorded on 13th March 2013. This shows that pollution level is higher and need to be improved.

Figure 4. PM10 level of Thamel March 2013



3. Bhaktapur

Bhaktapur city is an urban area of Kathmandu valley, adjacent to the Araniko highway. Bhaktapur area has significant number of brick Kiln Industries which contributes about 11% of total emission in the valley (Gautam, 2006)[1]. In the recent publication of MoEST, four month (February, March, June and July) data of PM10 ambient concentration of Bhaktapur are updated. With the data, following graphs (Figure 5 and Figure 6) are plotted to see the pattern of pollution level of each month. Average PM10 concentration for the month of February and March 2013 is 316µg/m^3. With comparison to National Ambient Air Quality Standard 2012, average PM10 level is higher where as in the monsoon season (June-July) average PM10 level has dropped to 41µg/m^3. Similarly, PM10 level on Feb-march 2013 has exceeded the WHO standard and in June- July PM level is below the standards.

[1] Action Plan for Air Quality Management in Kathmandu Valley, Gautam, C (2006), *Ministry of Environment, Science and Technology*, Government of Nepal.

Figure 5. PM10 level of Bhaktapur February-March 2013

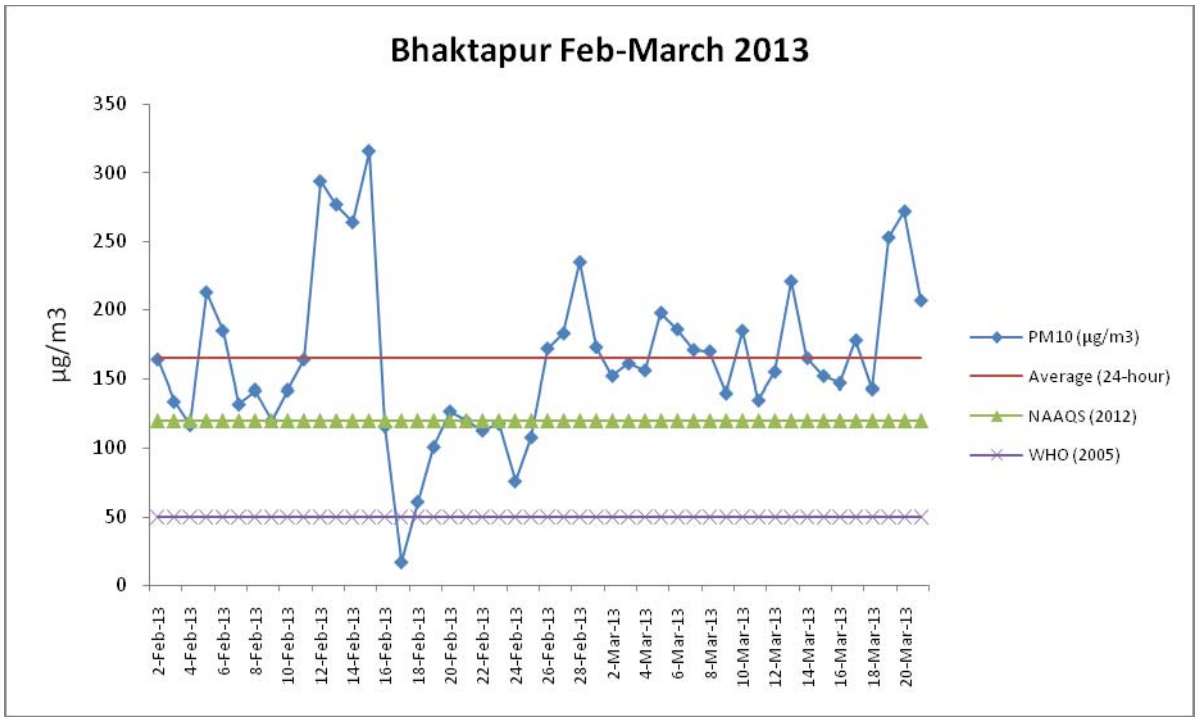
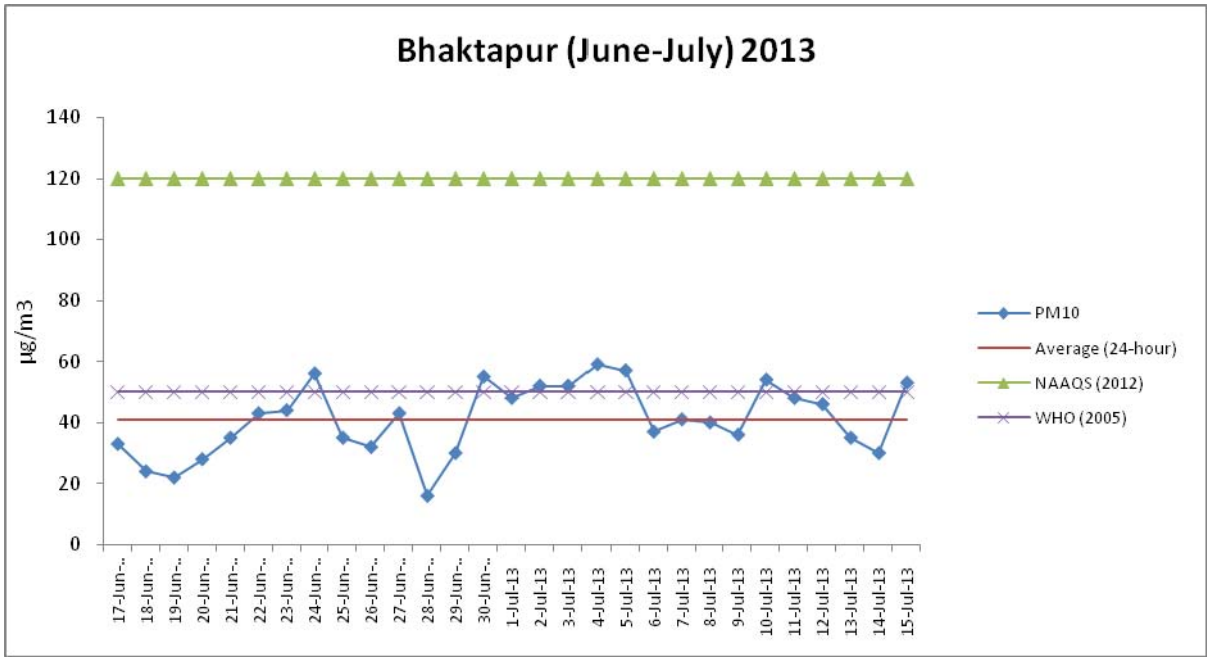


Figure 6. PM10 level of Bhaktapur June-July 2013



4. Machhegaun

Machheagaun is a rural area, situated at south west part of the Kathmandu valley. It is rural area where MoEST have installed one of its instruments for regular monitoring of PM10 ambient concentration. From the data collected from MoEST, following daily variation of PM10 concentration of Machhegaun is plotted as depicted in Figure 7 and 8 which is comparatively low to urban and resident area of the valley. It clearly says that average PM10 ambient concentration is below National Ambient Air Quality Standard. Whereas on contradictory to it, Ambient PM10 level for

February-March month had exceeded the WHO standards. Similarly, June-July month shows lower pollution level that is below the WHO standards. The highest PM10 ambient air concentration detected in Machhegaun station is 130µg/m^3 on 26th February 2013 (Figure 7). This shows that pollution level is significantly low to cause any health effect in this part of the valley.

Figure 7. PM10 level of Macchegaon February- March 2013

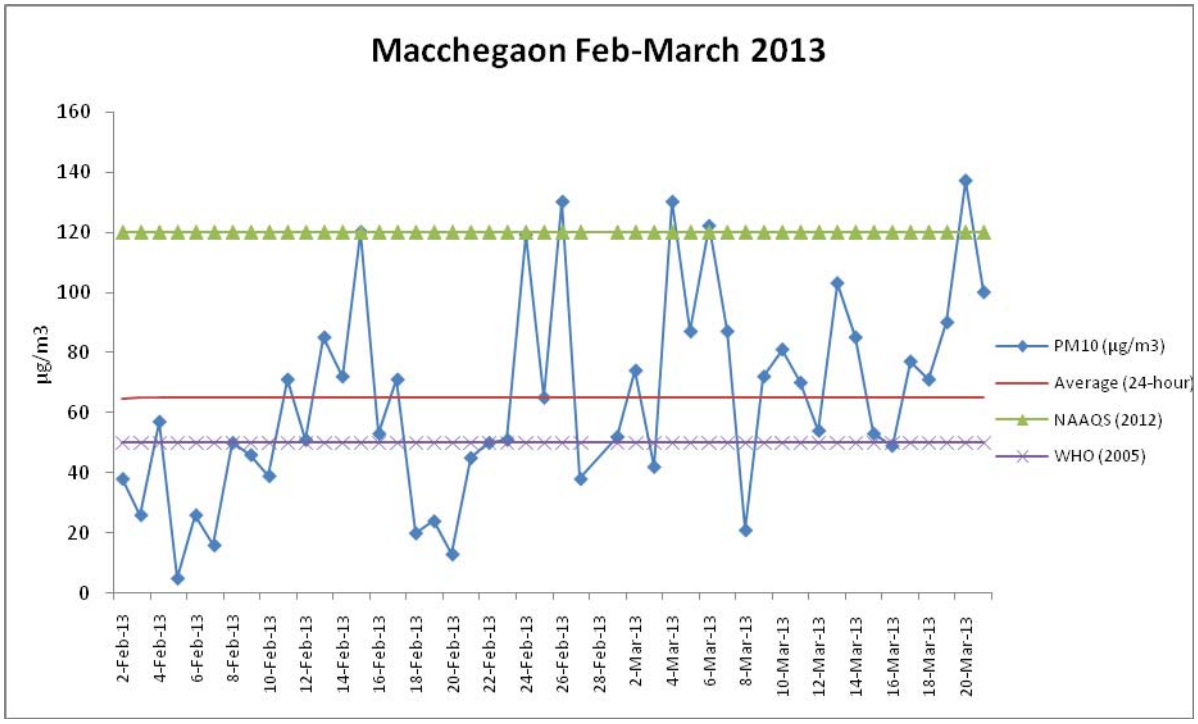
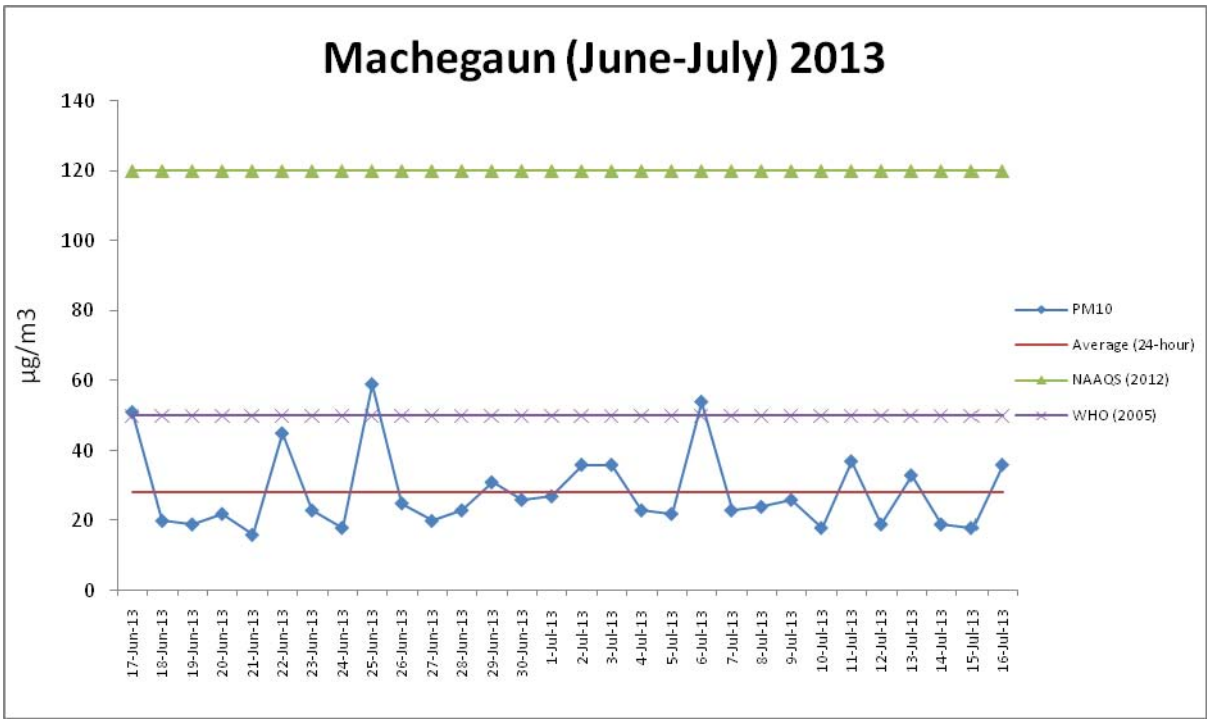


Figure 8. PM10 level of Macchegaon June-July 2013



ANNEX 7.1: ISSUE BASED MANAGEMENT PLANS (IMPs) MATRIX

Annex 7.1: Issue Based Management Plans (IMPs) Matrix

Environmental Issues	Mitigation Measures	Individuals /Agency responsible	National Standards or Guidelines/ Approved Documents	Timing of Actions	Competent Authority/agency	Mitigation Costs (NPR)	Remarks
Physical Environment							
Topography/Morphology	Deposition of the debris waste shall not exceed more than 3 m for sites 1,2,3,4,7,8, and 9. For sites 5 and 6 the deposition height will be limited to 5 and 6 m respectively	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
	All the sites will be rehabilitated to pre-program conditions topographically and morphologically	PDDMC	EA/EMP	Post Operation	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
Geology/Soil	As far as possible segregate and separate the solid waste and hazardous household wastes at the disaster site and transport them separately to the program sites and store these materials in a separate compartment of the site in containers or over the geo-textile liner to contain the leakage to the soil	PDDMC	EA/EMP	Post Operation	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Arrange a separate final disposal of the organic and hazardous waste in accordance with the best practice disposal mechanism for the organic and hazardous waste	PDDMC	EA/EMP	Post Operation	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Loosen the compacted soil of the program sites to pre-program conditions at the end of the site rehabilitation	PDDMC	EA/EMP	Post Operation	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
Hydrology/Surface Runoff	The natural waterways passing across the program sites will not be used for debris management. A cut off distance of about 2m will be maintained along the water ways while placing the debris to avoid blockage of the natural water ways	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility

Environmental Issues	Mitigation Measures	Individuals /Agency responsible	National Standards or Guidelines/ Approved Documents	Timing of Actions	Competent Authority/agency	Mitigation Costs (NPR)	Remarks
	The compartments used for the storage of the organic and hazardous waste will be covered by thick plastic sheets to avoid contamination of the rain runoff water with the hazardous chemicals	PDDMC	EA/EMP	Operation Period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	The formation of water pools in front of the debris management site will be avoided by provisioning suitable channel to conduit the water to the natural water ways	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
Land Use Change	All the unusable and unrecyclable debris material will be transferred to a permanent landfill site, while reusable and recyclable materials will be segregated and sold to the local vendors and needy communities. The inert materials will be utilized as the sub-base material for the earthen roads or filling the depression area	PDDMC	EA/EMP	Post Operation	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	The site will be rehabilitated to land use similar to the pre-debris management conditions	PDDMC	EA/EMP	Post Operation	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
Erosion/Land Instability	A 3 m set off distance will be maintained from the edge of the slope break for the deposition of the debris material in site 1, 2, and 3 to avoid ground failure along the edge of the slope break towards Bagmati River	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
	The height of the debris deposition will be maintained to less than 3 m for sites 1, 2, 3, 4, 7, 8, and 9	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
	The outward slope of the deposited debris will be maintained to about 30 degree	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility

Environmental Issues	Mitigation Measures	Individuals /Agency responsible	National Standards or Guidelines/ Approved Documents	Timing of Actions	Competent Authority/agency	Mitigation Costs (NPR)	Remarks
	The Ring road sites (4, 7, 8, and 9) will avoid debris deposition in fill and cut areas exceeding slopes around 30 degree and slope length more than 3m to avoid erosion and failure risk of the deposited debris	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
Water Quality	Regular municipal solid waste will not be brought to the proposed debris deposition site for management	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
	The hospital or health care waste will not be brought to the proposed debris deposition sites	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
	As far as possible, the organic wastes and hazardous waste will be segregated at the disaster sites and treated separately for the management in the regular landfill site of the Kathmandu valley	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
	On site segregation efforts will be made at the debris management sites soon after the off loading of the mixed earthquake debris on the proposed debris management sites	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
	The segregated organic and hazardous waste will be stored separately in a bonded area with precaution against leakage, runoff contamination	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
	The collected organic and hazardous waste will be regularly transferred to the municipal landfill for final disposal	PDDMC	EA/EMP	Operation Period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Formation of water pools inside and outside of the proposed debris management site will not be allowed	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
Air Quality	Light water sprinkling of the debris deposition sites, and high segregation activity areas at regular intervals	PDDMC	EA/EMP	Operation Period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ

Environmental Issues	Mitigation Measures	Individuals /Agency responsible	National Standards or Guidelines/ Approved Documents	Timing of Actions	Competent Authority/agency	Mitigation Costs (NPR)	Remarks
	Fencing of the debris management sites with corrugated sheet /plastic sheets to a height of 2.5 m to contain surface dispersion of the dusts out of the debris management sites	PDDMC	EA/EMP	pre -operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
Noise Level	Fencing of the debris management sites with corrugated sheet /plastic sheets to a height of 2.5 m to create a noise barrier and minimize the affect of noise to the communities	PDDMC	EA/EMP	pre -operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Plan areas for debris deposition and segregation within the sites far from the critical sensitive recipients (schools, hospitals etc, dense residential sites)	PDDMC	EA/EMP	pre -operation period	PDDMO/EC		Include in civil contract as responsibility
	Restrict loading, unloading and segregation of debris only in the day time zone (i.e. 6 hours to 20 hours)	PDDMC	EA/EMP	Operation Period	PDDMO/EC		Include in civil contract as responsibility
Biological Environment							
Ecological Degradation	Water Quality control measures	PDDMC	EA/EMP	Operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Air Quality Control Measures	PDDMC	EA/EMP	Operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Noise Quality control Measures	PDDMC	EA/EMP	Operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
Loss of Vegetation/Trees	Prepare a layout plan for each site as depicted in Chapter 2, Figure 2.11 allocating areas for debris deposition, segregation, vehicle maneuver and storage of segregated wastes	PDDMC	EA/EMP	pre -operation period	PDDMO/EC		Include in civil contract as responsibility
	Identify trees and tag trees for felling requirement to give space for debris management	PDDMC	EA/EMP	pre -operation period	PDDMO/EC		Include in civil contract as responsibility

Environmental Issues	Mitigation Measures	Individuals /Agency responsible	National Standards or Guidelines/ Approved Documents	Timing of Actions	Competent Authority/agency	Mitigation Costs (NPR)	Remarks
	The trees at the outer boundary edge and disturbing the management will be avoided from felling	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
Socio-economic and Cultural Environment							
Obstruction to Community Access/Traffic	The Ringroad central road section shall not be used for debris management and will be opened at all times for the vehicular traffic	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	sections of the Green belt shall be used for disaster debris management	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	Intersections of the entry motorable access will be avoided for debris management. A set off distance of about 3m from the intersection's outer boundary line will be maintained at all times to allow free movement of vehicular ad human traffic	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	The inner side roads (motorable/non-motorable) at the outer periphery of the Ring Road green belt will be avoided for debris management. A set off distance of 3.5 m will be maintained at all time from the center line of the inner road to allow free and safe movement of vehicular and human traffic	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	For the sites (Site 1, 2, and 3), a set of distance of 3.5 meter will be left on the inner side of the sites (opposite river bank side) to allow free and safe movement of vehicular and human traffic	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
Obstruction to storm water drainage	A set off distance of 3 m shall be maintained from the boundary line of open storm water drainages for the deposition	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility

Environmental Issues	Mitigation Measures	Individuals /Agency responsible	National Standards or Guidelines/ Approved Documents	Timing of Actions	Competent Authority/agency	Mitigation Costs (NPR)	Remarks
	of the disaster debris						
	Accidental fall of debris material in the open storm water drainage will be cleared regularly to allow free flow of water from the drainage system	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	Underground crossing sections of the storm water drainage will be avoided for thick debris deposition	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
Obstruction to Sewer lines	A set off distance of 3 m shall be maintained from the boundary line of open sewer lines for the deposition of the disaster debris	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	Accidental fall of debris material in the open sewer line will be cleared regularly to allow free flow of sewage	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	An investigation of the underground sewer lines will be made to understand the layouts of such lines within the site boundary	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	Underground sections of the sewer will be avoided for thick debris deposition	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
Damage to Water supply lines and dug well	An investigation of the underground water supply lines and their depth from the surface will be made to understand the layouts of such lines within the site boundary	PDDMC	EA/EMP	Pre-operation period	PDDMO/EC		Include in civil contract as responsibility
	Thick deposition of the debris material above such lines will be avoided as far as possible	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	Set of distance for the tap stands, dug well and the water springs shall be maintained at all time to provide access to the local communities for local water	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility

Environmental Issues	Mitigation Measures	Individuals /Agency responsible	National Standards or Guidelines/ Approved Documents	Timing of Actions	Competent Authority/agency	Mitigation Costs (NPR)	Remarks
	resources						
Affect to Electrical Lines/Telecommunication	All the electrical and telecommunication poles located within the proposed sites are relocated at the boundary lines of the proposed site so as to keep the place open for disaster debris management	MADRM	EA/EMP	Pre-operation period	NADRM		
Community Health and Safety	Fence the program areas to restrict trespassing of the program sites by the local communities	PDDMC	EA/EMP	pre -operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Implement fugitive dusts control measures	PDDMC	EA/EMP	Operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Implement noise control measures	PDDMC	EA/EMP	Operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Implement measures to avoid obstruction or damage to the storm water drainage systems, sewer lines, and water supply lines in and around the program sites	PDDMC	EA/EMP	Operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Avoid formation of chess pools of water in and around the program sites	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	Instruct the drivers involved in the debris transportation to restrict speed and other traffic safety measures at all time of operation	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	Conduct awareness program to the local communities on issues of community health and safety related to the program operations including trespassing of the program sites, playing and toiling around the program sites, unauthorized use of the debris materials etc	PDDMO/EC	EA/EMP	pre -operation period /Operation Period	MADRM		

Environmental Issues	Mitigation Measures	Individuals /Agency responsible	National Standards or Guidelines/ Approved Documents	Timing of Actions	Competent Authority/agency	Mitigation Costs (NPR)	Remarks
Occupational Health and Safety	Workers and operators of the program sites will be provided trainings on the potential occupational health and safety risks working within the program area prior to engaging the workers	PDDMC	EA/EMP	Pre- operation and operation period	PDDMO/EC		Include in civil contract as responsibility
	The workers will be provided with Personnel Protective Equipments (such as helmets, shoes, gloves, eye glass, air masks, ear muffs, etc) as to the requirement of the work of the occupational workers	PDDMC	EA/EMP	operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Special training will be provided to the workers dealing with the debris breaking, handling, and segregating the materials using equipments and electrical appliances for the safe use of the equipments, and the personnel protective equipments	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	The danger sings shall be placed in areas involving risks of contamination and electrical or other high degree hazards. Such areas will be cordoned off for the entry to the unauthorized workers	PDDMC	EA/EMP	operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Use of protective equipments by all the workers at all time of the work will be strictly monitored. The workers neglecting the use of protective equipment will not be allowed with the program sites	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
Affect to the nearby Educational and Health Institutions	Implement measures to minimize the dusts	PDDMC	EA/EMP	Operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Implement measures to minimize the noise levels	PDDMC	EA/EMP	Operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
	Layout planning of the loading/unloading and segregation areas with high dust and noise away from the institution	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility

Environmental Issues	Mitigation Measures	Individuals /Agency responsible	National Standards or Guidelines/ Approved Documents	Timing of Actions	Competent Authority/agency	Mitigation Costs (NPR)	Remarks
	Advise the educational and health institutions to close the windows and doors facing towards the program sites	PDDMO/EC	EA/EMP	operation period	MADRM		
Affect to the Religious and Cultural sites	The cremation sites and temple sites will not be used for debris deposition	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	A set of distance will be maintained to these sites with a passage for the communities to offer their prayers and cremation of bodies as required	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
	These sites will be restored in parallel with the debris management operations	PDDMC	EA/EMP	operation period	PDDMO/EC	Required	Include the costs in PDDMC's BOQ
Employment Opportunities	Establish a policy to employ the poor and destitute people of the adjoining areas to restore livelihood of these people in the post disaster period	PDDMO/EC	EA/EMP	operation period	MADRM		
	Enforce this policy on all the activities of the program sites by incorporating the provision on the contract document of private contractor or the public office	PDDMC	EA/EMP	operation period	PDDMO/EC		Include in civil contract as responsibility
Resource Recovery	Consultation with the disaster survivors prior to debris removal to come to an agreement on how to compensate the value of debris material	MADRM	EA/EMP	Pre-operation period	NADRM		
	Consultation with the disaster survivors to avoid legal conflict and establish procedures for debris clearance including handling of valuables and personal possession which may have sentimental value.	MADRM	EA/EMP	Pre-operation period	NADRM		