資料 5 ソフトコンポーネント計画書

ソフトコンポーネント計画（案）

１．ソフトコンポーネントを計画する背景

ネパール国「ポカラ上水道改善計画」は、ポカラ市及び周辺 1 村において浄水施設の新設、配水池の新設、導・送・配水管の整備、各戸メータの調達等を実施することにより、給水水質・給水頻度等の水道サービスの改善及びネパール水道公社（Nepal Water Supply Cooperation、以下 NWSC）ポカラ支所の経営改善を図り、もってポカラ市住民の生活環境の改善に寄与するものである。

1)現状

ポカラ市の水道は、NWSC ポカラ支所がその水道事業を担うが、現在以下のような技術的課題を抱えている。

① 給水水質の問題 : 浄水施設がないため雨季の給水濁度は高く、安全な給水水質を確保できていない。

② 不均一な給水頻度 : 水源水量の不足、既設管路の能力不足、不十分な配水操作のため、不均一な給水状況となっている。

③ 給水能力不足 : 現在の需要量は給水人口 304,900 人、1 日平均使用水量を 130L/人/日、漏水率 36%とした場合、約 62,000m^3/日であるが、実際の給水量は 54,120m^3/日程度であり、給水能力が不足している。

④ 高い漏水率 : 現在の漏水率は約 36%と推計され、導水量の半分以上が無収水となっている。

⑤ 水道施設の対症療法的な運転維持管理 : NWSC ポカラ支所では水道施設の運転維持管理は、マニュアル/作業手順書 (SOP: Standard Operating Procedure) がないままで行われている。職員への指導・指示は、口頭のみで対処的に行われており、体系的なトレーニングも実施されてない。また、定期的な施設点検やその記録がなされていない。

また、このような技術的課題を改善することにより経営状況の改善も期待できる。特に、適切な配水技術不足や高い漏水率が収入不足の主たる原因となっていることから、これら原因を改善することにより、経営状況の改善が期待でき、NWSC ポカラ支所はより良好な経営が可能となる。

2)ソフトコンポーネントの必要性

本プロジェクトにより水道施設（沈砂・沈殿池の新設、浄水場の新設、配水池の新設、導送配水管及び配水管網の更新等）が全面的に整備される。本プロジェクトの概要を以下に示す。

表-1 プロジェクトの概要

	項　　目	事業内容
施設建設	導水管	φ800mm、延長 1.2km（敷設替え）
	沈砂・沈殿池	42,000m^3/日
	浄水場	緩速ろ過池 41,000m^3/日
	送水管	φ 300-500mm, 管延長 7.9km
	配水池・高架水槽	配水池 2 池、高架水槽 1 池
	配水本管	φ 150-500mm, 延長 49.8km

	項　　目	事業内容
	配水支管	φ50-150mm, 延長 52.9km
	給水管	φ13mm, 7,300 カ所
施設改良	既設配水池 2 箇所	配水池改良、塩素消毒設備 流量計 φ200-400mm
	既設高架水槽	流量計 φ200mm、φ400mm
	既設井戸(3 箇所)	流量計
資機材調達	給水メータ	9,000 個
	水質分析機器	一式
	小型掘削機	2 台
	管探知機	2 台
	バルブ探知機	2 台
ソフトコンポーネント(S/C)		- 浄水場　運転･維持管理 - 配水システム　運転･維持管理 - 給水管敷設　施工管理技術 - 水質測定･管理
実施設計･施工監理		一式

NWSC ポカラ支所は現在、このうち沈砂・沈殿池、浄水場（緩速ろ過池）を有しておらず、運転・維持管理の知識・技術がなく、技術習得が必要となる。合わせて、浄水場、配水池、給水栓の水質管理のために導入される水質分析機器を用いた水質測定・管理の手法についてもその技術の習得も必要である。また、プロジェクト完了後には配水頻度を市内で均一化するために、より効率的な配水コントロールが求められる。さらに、高い漏水率の原因である不適当な給水管の敷設を適切な敷設に改善することが必要である。そこで、NWSC の水道施設運転・維持管理能力を向上・強化するため、ソフトコンポーネントにてこれらの技術支援を行う必要がある。

２．ソフトコンポーネントの目標

本ソフトコンポーネントは、本プロジェクトで整備される設備・機器が建設、試運転、引き渡しの後、運転維持管理に関する技術指導、給水施設の維持管理に関する技術指導、水質管理手法に関する技術指導を行うことにより、本事業の目標である、給水水質の改善、給水頻度の改善、漏水量の低減、及び NWSC ポカラ支所の経営改善を支援するものである。

３．ソフトコンポーネントの成果

ソフトコンポーネントでは、「浄水場 運転・維持管理」、「配水システム 運転・維持管理」、「給水管敷設 施工管理理技術」及び「水質測定・管理」の 4 つを対象として、下記の成果を期待する。

『NWSC ポカラ支所技術職員が、新たに建設する浄水施設の運転・維持管理、適切な配水システムの運転・維持管理、適切な給水管敷設、及び定期的な給水水質測定・水質管理に必要な知識・技術を習得することにより、主な事業目標である給水水質の改善、給水頻度の改善、漏水量の低減、及び NWSC ポカラ支所の経営改善が達成できるようになる。』

４．評価達成度の確認方法

成果と評価達成度の確認方法を**表-2** に示す。技術研修指導者は、成果チェックリストを用い、確認し、研修生の知識と技術の理解度を評価する。

表-2　ソフトコンポーネントの成果とその確認方法

成果	達成度の確認方法
成果 1 浄水施設を適切に運転・維持管理し、良質な水を継続的に生産することができる。	・講義内容に対する試験及び質問への回答で理解度を確認する ・浄水施設の運転・維持管理の状況及び報告書作成状況を評価し、達成度を確認する (いずれも、成果達成度確認用チェックリストにより判定)
成果 2 配水システムを適切に運転・維持管理し、水道水を効率的に給水できる。	・講義内容に対する試験及び質問への回答で理解度を確認する ・配水施設の運転・維持管理の状況及び報告書作成状況を評価し、達成度を確認する (いずれも、成果達成度確認用チェックリストにより判定)
成果 3 適切な給水管の敷設技術を習得することにより、給水管からの漏水を削減する。	・給水管敷設の実技により達成度を確認する (成果達成度確認用チェックリストにより判定)
成果 4 浄水プロセス、配水ネットワークでの定期的な水質測定により、継続的に配水、給水水質を管理する。	・講義内容に対する試験及び質問への回答で理解度を確認する ・水質分析機材による水質の測定及び報告書作成状況を評価し、達成度を確認する (いずれも、成果達成度確認用チェックリストにより判定)

５．ソフトコンポーネントの活動（投入計画）

ソフトコンポーネントは、上水道コンサルタント技術者(本邦コンサルタント：浄水プロセス、配水システム、給水管、水質) 4 名による直接支援型とし、その期間は国内作業も含めて 12.0 か月とし、本邦コンサルタントの現地作業支援のため、現地コンサルタントと通訳・翻訳者を各 10.5 か月雇用する。その活動計画を**表−3** に示す。

表-3　ソフトコンポーネントの概要

成果	必要とされる技術・業種	現況の技術レベルと必要とされる技術レベル/施設・資材	活動内容及び研修項目	活動方法	必要な投入量	成果品
成果１ 浄水施設を適切に運転・維持管理し、良質な水を継続的に生産することができる。	技術： - 浄水処理、水質、運転、維持管理 業種： - 浄水プロセス	・NWSC ポカラ支所は沈砂池・沈殿池、浄水場を運転した経験が全くない。 ・乾季・雨季の Mardi 川水質に対応し、沈砂・沈殿池、浄水場（緩速ろ過池）を適切に運転・維持管理し、継続的に、良質な水を生産するための知識、経験の習得が必要である。 [施設・資材]浄水場・水質分析機器	◇沈砂・沈殿池、浄水場の機能の理解 ◇原水水質と浄水プロセスの関係の理解 ◇沈砂・沈殿池、浄水場の運転方法 ◇沈砂・沈殿池、浄水場の維持管理 [研修項目] 沈砂池・沈殿池、浄水場の機能と運転・維持管理方法、高濁度時の対応 [対象] Manager/Operator 他計 15 名	- クラスルーム研修 - 沈砂池・沈殿池、浄水場での OJT	- 浄水プロセス技術者(日本人コンサルタント) 企画/準備/報告書/実施： 浄水プロセス：1 名 x 4.5 ヶ月 - 現地コンサルタント技術者：1 名 x 4.0 ヶ月 - -現地通訳・翻訳者：1 名 x 4.0 ヶ月	・沈砂/沈殿池、浄水場運転マニュアル ・沈砂/沈殿池、浄水場維持管理マニュアル 報告書様式
成果２ 配水システムを適切に運転・維持管理し、水道水を効率的に給水できる。	技術： - 配水管理、水質、運転、維持管理 業種： - 配水管理	・既存のネットワークにおいてバルブ操作を行い配水調整しているが、配水が均等でなく、地域によって給水頻度に偏りが生じている。 ・配水システムの構造・機能を理解し、公平かつ効率的な配水方法を習得する。 [施設・資材]配水池・ネットワーク	◇配水システムの機能の理解 ◇既存配水システムの問題点の理解 ◇配水システムの運転方法 ◇配水システムの維持管理 [研修項目] 配水システムの機能と運転・維持管理方法 [対象] Manager/Operator 他計 15 名	- クラスルーム研修 - 配水施設での OJT	- 配水システム技術者(日本人コンサルタント) 企画/準備/報告書/実施： 配水システム：1 名 x 3.5 ヶ月 - 現地コンサルタント技術者：1 名 x 3.0 ヶ月 - 現地通訳・翻訳者：1 名 x 3.0 ヶ月	・配水システム運転･維持管理マニュアル 報告書様式
成果３ 適切な給水管の敷設技術を習得することにより、給水管からの漏水を削減する。	技術： - 給水管敷設技術 業種： - 配管技術	・適切な給水管の敷設が行われていないため、漏水の原因となっている。 ・適切な配管材を使用し、適切な敷設方法を習得し、漏水の削減を図る。あわせて、調達される小型掘削機等の運転方法を習得する。 [施設・資材]配水ネットワーク・小型掘削機・給水管他	◇現地調達可能な配管材料の確認 ◇給水配管敷設方法の理解 ◇給水配管敷設後の水圧試験方法 ◇給水配管の施工記録の作成・保管 [研修項目] 給水管敷設 [対象] Manager/Plumber 他計 22 名	- クラスルーム研修 - 給水管敷設現場での OJT	- 配管技術者(日本人コンサルタント) 企画/準備/報告書/実施： 給水管敷設：1 名 x 2.2 ヶ月 - 現地コンサルタント技術者：1 名 x 2.0 ヶ月 - 現地通訳・翻訳者：1 名 x 2.0 ヶ月	・給水管敷設マニュアル 報告書様式

成果	必要とされる技術・業種	現況の技術レベルと必要とされる技術レベル/施設・資材	活動内容及び研修項目	活動方法	必要な投入量	成果品
成果４ 浄水プロセス、配水ネットワークでの定期的な水質測定により、継続的に浄水、配水水質を管理する。	技術： - 水質測定、配水水質管理 業種： - 水質管理	・浄水場がなく、塩素注入や水質管理も行われていない。 ・水質測定機材を理解し、定期的に水質測定を行い、給水の水質管理を行う。 [施設・資材]浄水場・配水ネットワーク・水質分析機器	◇水質分析機器の使用方法の理解 ◇浄水プロセスごとの水質測定 ◇配水システムの水質測定 ◇配水システムの水質管理 [研修項目] 浄水場、配水システムの水質管理 [対象] Manager/Chemist 他計 10 名	- クラスルーム研修 - 浄水場、配水ネットワークでの OJT	- 水質技術者 (日本人コンサルタント) 企画/準備/報告書/実施： 水質：1 名 x 1.8 ヶ月 - 現地コンサルタント 技術者：1 名 x 1.5 ヶ月 現地通訳・翻訳者： 1 名 x 1.5 ヶ月	・水質測定マニュアル ・配水ネットワーク水質管理マニュアル 報告書様式

注：ソフトコンポーネントは、平成 31 年（2019 年）1 月及び平成 31 年（2019 年）9 月から平成 32 年（2020 年）7 月の間に実施する。

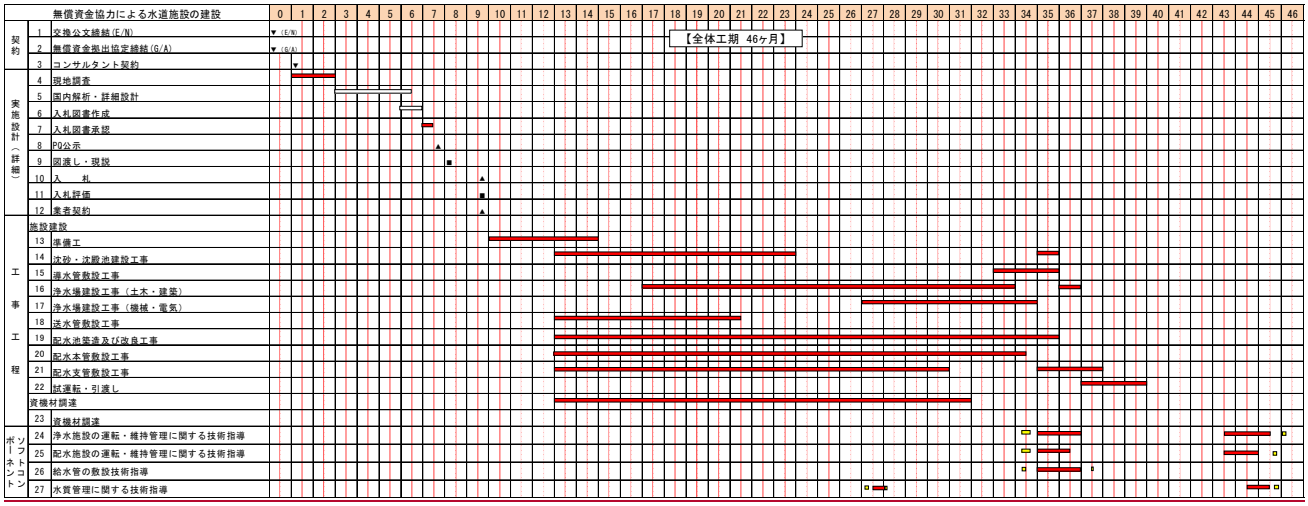
６．ソフトコンポーネントの実施リソースの調達方法

本ソフトコンポーネントは、新規建設される沈砂・沈殿池施設、浄水場設備、配水池および大幅に拡大・更新される配水ネットワークの運転・維持管理に必要な知識・技術の移転を行うものである。現地技術者では対応が難しい技術レベルであり、本邦コンサルタント（4 名）による直接支援型にて実施する。ただし、本邦コンサルタントの支援のため、現地コンサルタント及び通訳・翻訳者を雇用する。

７．ソフトコンポーネントの実施工程

本プロジェクトの全体事業実施工程を表-4 に示す。

表-4　全体事業実施工程



ソフトコンポーネントについては、まず事業決定後 35 ヶ月からの乾季を対象としたソフトコンポーネントを実施し、43 ヶ月後から工事完了後も雨季を対象とするコンポーネントを実施する。ただし、「水質測定・管理」については、施設完成前から原水水質を測定し、浄水場運転に必要な水質データを蓄積するため、事業決定後 27 ヶ月から実施する。

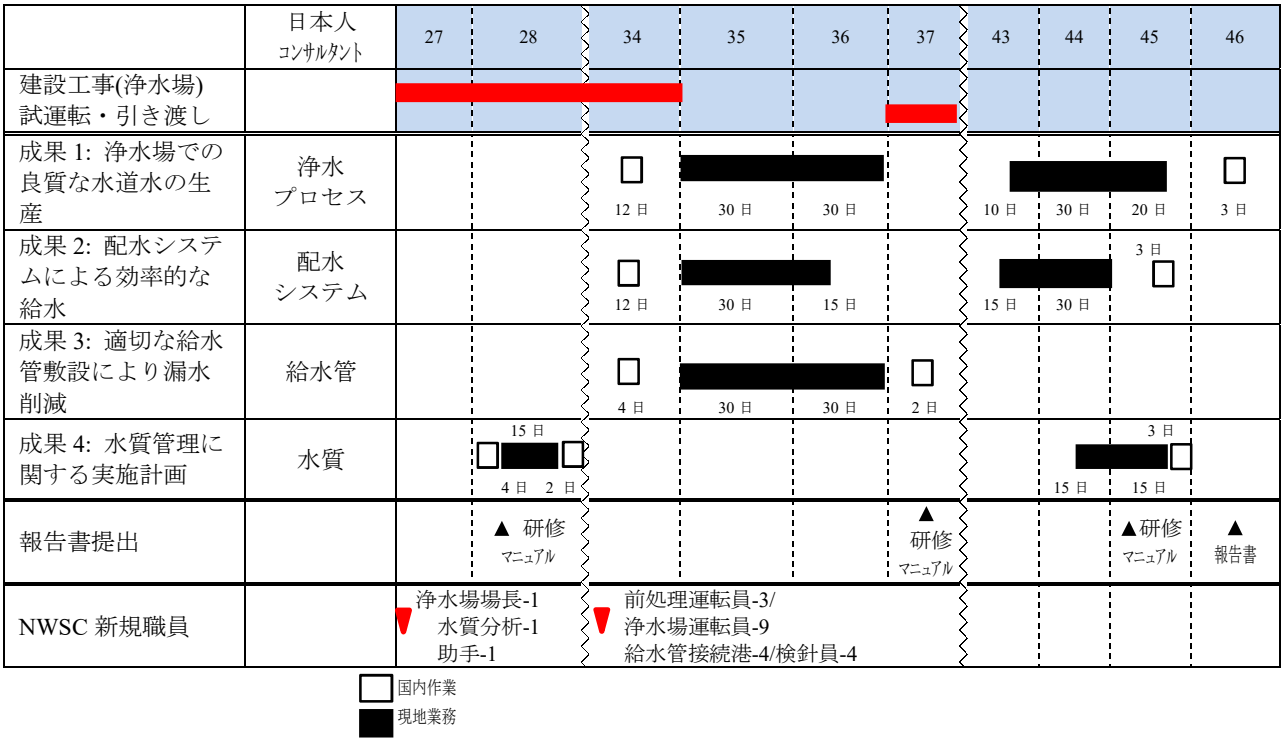
ソフトコンポーネントに実施にあたっては、まず、国内での研修計画を策定することにより、具体的な実施工程・研修手順を決定する。

次に、現地では、初めに、工事完了前、配水管工事が実施されている間に「給水管敷設 施工監理技術」に関する指導を行う。これにより、配水管・給水管の関連等を確認しながら、給水管敷設にかかわる技術の習得を図る。

次に、すべての施設の建設・試運転が完了した後、実施設を使用し、運転・維持管理に関する技術移転を行う（「浄水場 運転・維持管理」「配水システム 運転・維持管理」「水質測定・管理」が対象）。「浄水場 運転・維持管理」に関しては、乾季・雨季で原水水質が変動するため、まず、比較的運転が容易な乾季に、緩速ろ過池による浄水処理技術の習得を図る。その後、雨季の高濁度の原水への対応として、原水濁度の状況を判断し、取水制限・停止の措置が必要な状況を理解する。さらに、沈砂・沈殿池設備を運転し、高濁度の原水の前処理を行った後、緩速ろ過池へ送り、浄水処理を行うため、この前処理施設の運転・維持管理技術の習得を図る。また、配水システムも乾季と雨季において、配水方法が異なるため、乾季・雨季の 2 回に分け、配水システムの適切な運転方法を指導する。「水質測定・管理」は、浄水プロセスの水質管理と配水システムの水質管理が必要であり、「浄水場 運転・維持管理」「配水システム 運転・維持管理」と同時期に実施する。

表-5 にソフトコンポーネントの全体実施工程を示す。

表-5　ソフトコンポーネント全体実施工程



８．ソフトコンポーネントの成果品

本ソフトコンポーネントにおける成果品および提出時期を**表-4** に示す。

表-4　成果品一覧

分類	成果品	内容	提出時期	頁数
マニュアル	沈砂・沈殿池、浄水場運転マニュアル (英語 5 部､ネパール語 20 部)	- 浄水プロセスの機能 - 施設ごとの運転方法 - 運転記録様式	事業開始後 46 か月後	30
	沈砂・沈殿池、浄水場維持管理マニュアル (英語 5 部､ネパール語 20 部)	- 沈砂・沈殿池清掃方法 - ろ過砂掻き取り方法 - ろ過砂洗浄方法 - 維持管理記録様式	事業開始後 46 か月後	20
	配水システム運転・維持管理マニュアル (英語 5 部､ネパール語 20 部)	- 配水システムの機能 - 配水システムの運転方法 - 運転・維持管理記録様式	事業開始後 45 か月後	30
	給水管敷設マニュアル (英語 5 部､ネパール語 30 部)	- 給水管敷設方法 - 給水メータ設置方法 - 既設給水管補修方法	事業開始後 37 か月後	20
	水質測定マニュアル (英語 5 部､ネパール語 15 部)	- 水質測定方法	事業開始後 28 か月後	20
	配水ネットワーク 水質管理マニュアル (英語 5 部､ネパール語 15 部)	- 配水システムの水質モニタリング方法	事業開始後 45 か月後	20
報告書	ソフコン完了報告書 (ネパール・日本側に提出)	- 活動計画と実績 - 活動・成果の達成度 - 成果の達成度に影響を与えた要因 - 成果の持続･発展のための今後の課題・提言等 - 各種マニュアル一式	事業開始後 46 か月後	30

９．ソフトコンポーネントの概略事業費

本ソフトコンポーネントの概略事業費は約 3,840 万円である。その内訳を**表-5** に示す。

表-5　ソフトコンポーネントの概略事業費

項目	金額（千円）	備考
（１）直接人件費	**10,455**	(a)
（２）直接経費	**14,576**	(b) 1)~6)の計
１）現地傭人費	5,187	ローカルコンサルタント、通訳、翻訳
２）旅費	1,875	
３）日当	1,151	
４）宿泊費	3,364	
５）車両費	2,898	
６）その他	100	教材費等
（３）間接費	**13,383**	(c) 1)+2)
１）諸経費	9,410	
２）技術経費	3,973	
合計	**38,414**	(d)=(a)+(b)+(c)

10．相手国側の責務

ソフトコンポーネントの実施に関して、NWSC 側の責務は以下のとおりである。

◇ソフトコンポーネントに必要な人員、講習施設及び資材を確保する。

◇ソフトコンポーネントの活動時に必要な人件費、講習施設及び資材を負担する。

◇ソフトコンポーネント完了後も、活動の継続に必要な人員、資材等を確保する。

Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
List of Progress in Land Acquisition

										1	2	3	4-A	4-B	5	6	7	8	9	10	
Sno	Plot N	Area (Ropani-Aanas-Dnam)	Area (Sqm)	Actual Area to be acquired (sqm)	Land needed to be procured (sqm)	Land Owner's name	Land Owner's father's name	Land Owner's grand father's name	Land owner's address/Contact number	NWSC received information from Survey and Land Revenue offices	VDC inform to landowners about land acquisition, preparation, and date of meeting (or individual contact)	NWSC collected the land ownership certificate from VDC/PSMC office	NWSC contacted the landowner individually or meeting, and explain the project and land acquisition	NWSC checked information of peasants from the landowners	The landowner agreed to release his/her land	The landowner signed the NWSC Application. In this stage, landowner claim their own estimated cost of land.	Land Valuation Committee in Pokhara will estimate the cost of land (comparison to gov and market price). In case gov price is lower, Committee convince landowner to agree on gov price, or price negotiation.	Land Valuation Committee forward the fix amount of the land (total cost) to NWSC Kathmandu	NWSC Kathmandu approves to purchase the land, arrange the fund	The landowner visit NWSC Pokhara and receive compensation. Simultaneously, Ownership of the land change to NWSC	Comments if any
Schedule										4th week of July to 1st Week of August	2nd week of August to 2nd week of Sept	2nd week of August to 2nd week of Sept	3rd week of Sep to 2nd week of Oct	same timing as 4-A	Up to 1st week of November	Up to 4th week of November	1st week of Dec, 2015 to 4th week of Feb, 2016	1st week of March 2016	2nd week to 4th week of March, 2016	1st week of Apr to 4th week of Jul, 2016July, 2016	3rd week to 4th week Oct and 2nd week of Nov Festival period = 22 days
	Site 1																				
1	259	1-2-0-0	572.62	572.62	NWSC owned land	NWSC															
2	276	0-14-2-2	465.26	465.26		NWSC															
3	277	0-12-1-1	391.69	391.69		NWSC															
4	278	0-11-3-0	373.80	373.80		NWSC															
5	279	1-3-2-3	626.31	626.31		NWSC															
6	280	0-7-1-0	230.64	230.64		NWSC															
7	281	0-3-0-0	95.44	95.44		NWSC															
8	283	1-9-2-0	811.21	811.21		NWSC															
9	284	1-1-2-2	560.69	560.69		NWSC															
10	286	0-5-0-3	165.03	165.03		NWSC															
11	287	0-7-3-0	246.55	246.55		NWSC															
12	290	0-1-1-0	39.77	39.77		NWSC															
13	291	0-1-3-2	59.65	59.65		NWSC															
14	293	0-0-3-3	29.82	29.82		NWSC															
15	1280	0-5-1-2	170.99	170.99		NWSC															
16	1504	0-10-1-1	328.06	328.06		NWSC															
17	1505	0-10-1-0	326.08	326.08		NWSC															
18	249	25-3-2-0	12,836.28	1,942.00	GoN land	Gov of Nepal			Hemja-8	6-Sep-15											
19	258	16-12-3-0	8,549.57	6,500.00		Gov of Nepal			Hemja-8	6-Sep-15											
20	237	2-7-3-1	1,266.53	1,266.53	1,266.53	Tulsi Ram Adhikari	Man Pati	Dta Ram	Hemja-8	4-Sep-15											
21	240	1-9-3-0	819.17	819.17	819.17	Gyan Hari Adhikari	Bal Bhadra	Chudamani	Hemja-8	4-Sep-15											
22	255	1-7-3-0	755.54	755.54	755.54	Durga Adhikari	Chuda Mani	Ballav	Hemja-8	2-Sep-15											
23	261	0-9-0-2	290.29	290.29	290.29	Bishnu Prasad Adhik	Tulsi Ram Adhikari		Hemja-8	2-Sep-15											
24	262	0-12-1-3	395.67	395.67	395.67	Sarswoti Adhikari	Tulsi Ram Adhik	Him Lal	Hemja-8	2-Sep-15											
25	264	0-5-3-1	184.91	184.91	184.91	Prajapati Adhikari	Chuda Mani	Chamu	Hemja-8	2-Sep-15											
26	265	0-4-3-2	155.09	155.09	155.09	Khim Lal Adhikari	Chudamani	Chamu	Hemja-8	2-Sep-15											
27	266	0-3-3-3	125.26	125.26	125.26	Kala Dhar Adhikari	Khadu	Him Lal	Hemja-8	2-Sep-15											
28	268	0-3-1-3	109.35	109.35	109.35	Khim Lal Adhikari	Chudamani	Chamu	Hemja-8	2-Sep-15											
29	270	0-5-0-3	165.03	165.03	165.03	Purna Prasad Adhika	Agandhar	Dhan Pati	Hemja-8	4-Sep-15											
30	271	0-3-3-1	121.28	121.28	121.28	Mukti Ram Adhikari	Chuda Mani	Chamu	Hemja-8	4-Sep-15											
31	272	0-3-2-2	115.32	115.32	115.32	Ram Prasad Adhikari	Bishnu Prasad	Tulasi Ram	Hemja-8	2-Sep-15											
32	273	0-2-3-1	89.47	89.47	89.47	Khim Lal Adhikari	Chudamani	Chamu	Hemja-8	2-Sep-15											
33	274	0-2-2-0	79.53	79.53	79.53	Prajapati Adhikari	Prajapati	Chudamani	Hemja-8	2-Sep-15											
34	275	0-8-3-3	284.32	284.32	284.32	Prajapati Adhikari	Chuda Mani	Chamu	Hemja-8	4-Sep-15											
35	285	0-1-3-2	59.65	59.65	59.65	Khadananda Adhikar	Bhadra Lal	Shiva Lal	Hemja-8	4-Sep-15											
36	289	1-11-1-2	870.86	870.86	870.86	Jib Nath Adhikari	Khadananda	Bhadra Lal	Hemja-8	4-Sep-15											
37	292	0-7-2-3	244.56	244.56	244.56	Govinda Adhikari	Chuda Mani	Lachhuman	Hemja-8	4-Sep-15											
38	294	0-3-2-3	117.31	117.31	117.31	Bala Ram Adhikari	Kab Dhar	Himlal	Hemja-8	4-Sep-15											
39	1278	0-0-2-2	19.88	19.88	19.88	Govinda Adhikari	Dandapani	Rabilal	Hemja-8	2-Sep-15											
40	1512	0-1-2-0	47.72	47.72	47.72	Chuda Mani adhikari	Prajapati	Chudamani	Hemja-8	2-Sep-15											
41	1513	0-1-2-0	47.72	47.72	47.72	Chuda Mani adhikari	Prajapati	Chudamani	Hemja-8	2-Sep-15											
Total Land Required for acquisition (sqm):				**20,000.07**	**6,364.46**																
			Ropani	**39.29**	**12.50**																

Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal

List of Progress in Land Acquisition

										1	2	3	4-A	4-B	5	6	7	8	9	10	
Sno.	Plot N.	Area (Ropani-Aanaa-Daam)	Area (Sqm)	Actual Area to be acquired (sqm)	Land needed to be procurred (sqm)	Land Owner's name	Land Owner's father's name	Land Owner's grand father's name	Land owner's address/Contact number	NWSC received information from Survey and Land Revenue offices	VDC inform to landowners about land acquisition, preparation, and date of meeting (or individual contact)	NWSC collected the land ownership certificate from VDC/PSMC office	NWSC contacted the landowner individually or meeting, and explain the project and land acquisition	NWSC checked information of peasants from the landowners	The landowner agreed to release his/her land	The landowner signed the NWSC Application. In this stage, landowner claim their own estimated cost of land.	Land Valuation Committee in Pokhara will estimate the cost of land (comparison to gov and market price). In case gov price is lower, Committee convince landowner to agree on gov price, or price negotiation.	Land Valuation Committee forward the fix amount of the land (total cost) to NWSC Kathmandu	NWSC Kathmandu approves to purchase the land, arrange the fund	The landowner visit NWSC Pokhara and receive compensation. Simultaneously, Ownership of the land change to NWSC	Comments if any
	Site 4																				
1	52	2-0-1-2	1,029.92	17.74	87.74	Ima Giri	Tula Giri	Hima Giri	Puranchaur-9												
2	53	2-0-3-2	1,045.83	19.89	89.89	Uma Devi KC	Dev Bahadur		Armala-1, Kaski												
3	56	5-11-2-3	2,916.79	163.28	163.28	Janaka Gautam (husband Liladhar Gautam)			Puranchaur-8	4-Sep-15											
4	57	19-9-0-2	9,961.24	559.44	559.44	Keshar Bdr Adhikari, Man Bdr Adhikari, Lok Bdr Adhikari, Prem Bdr Adhikari, Tej Bdr Adhikari			Puranchaur-8	2-Aug-15											
5	405	2-3-1-2	1,125.36	67.12	67.12	Jaya Ram Gautam	Tika Ram	Purna Chandra	Puranchaur-9												
6	406	2-3-1-2	1,125.36	65.18	65.18	Maheswor Gautam	Tika Ram	Purna Chandra	Puranchaur-9												
7	407	2-3-1-2	1,125.36	64.29	64.29	Ram Prasad Gautam	Tika Ram	Purna Chandra	Puranchaur-9												
8	408	2-3-1-2	1,125.36	74.47	74.47	Goma Devi Gautam	Tika Ram	Purna Chandra	Puranchaur-9												
9	446	1-15-3-2	1,014.02	159.54	159.54	Hari Pd Poudel	Manahari Poudel	Gajadhar Poudel	Puranchaur-6	30-Jul-15											
10	447	1-15-3-2	1,014.02	124.12	124.12	Hari Pd Poudel	Manahari Poudel	Gajadhar Poudel	Puranchaur-6	30-Jul-15											
11	563	8-1-0-0	4,103.79	121.98	121.98	Sharada Devi Adhikari	Ram Prasad Adhikari	Dilli Ram Adhikari	Puranchaur-9	30-Jul-15											
12	564	2-8-0-0	1,272.49	93.48	93.48	Dhurendra Narayan Poudel	Nanda Prasad Poudel	Bhumi Nanda Poudel	Puranchaur-6	30-Jul-15											
13	565	7-0-0-0	3,562.98	313.39	313.39	Yasoda Poudel	Dhanapati Poudel	Devi Prasad Poudel	Puranchaur-6	30-Jul-15											
14	566	3-8-0-0	1,781.49	152.98	152.98	Satya Parajuli	Durga Dutta Parajuli	Laxmi Kanta Parajuli	Puranchaur-6	30-Jul-15											
15	609	0-11-0-0	349.94	21.87	21.87	Bharat Raj Poudel	Tara Pati	Chiabi Lal	Puranchaur-9												
16	610	0-11-3-1	375.78	84.54	84.54	Bhekh Prasad Poudel	Tara Pati	Chiabi Lal	Puranchaur-9												
17	1145	7-15-1-3	4,054.09	4,054.09	4,054.09	Janaka Chapai	Ram Chandra Chapai	Shyam Lal Chapai	Hemja-9	30-Jul-15											
18	1146	2-10-1-0	1,344.07	1,344.07	1,344.07	Janaka Chapai	Ram Chandra Chapai	Shyam Lal Chapai	Hemja-9	30-Jul-15											
19	1147	2-13-1-1	1,441.50	1,441.50	1,441.50	Janaka Chapai	Gobinda		Hemja-9	2-Sep-15											
20	1148	6-1-2-0	3,101.70	3,101.70	3,101.70	Krishna Bdr Kuwar	Kama Bdr Kuwar	Dev Raj Kuwar	Hemja-9	30-Jul-15											
21	1149	2-14-1-3	1,477.29	1,477.29	1,477.29	Hari Chandra Poudel	Devi Dutta Poudel	Gir Dhari Poudel	Puranchaur-6	30-Jul-15											
22	1153	1-11-0-1	860.92	860.92	860.92	Bel Kumari Kuwar	Ram Bdr Kuwar	Rana Bdr Kuwar Chhetri	Hemja-9	30-Jul-15											
23	1155	3-11-2-2	1,896.81	1,896.81	1,896.81	Bhakta Giri	Nanda Giri	Bhaskar Giri	Puranchaur-9	2-Aug-15											
24	1157	5-2-0-1	2,610.60	2,610.60	2,610.60	Amrit, Ajit, Chet Sarki	Gambhire Sarki	Pahale Sarki	Puranchaur-8	30-Jul-15											
25	1168	4-8-1-1	2,300.43	2,300.43	2,300.43	Krishna Pd Timilsina	Chiranjibi Timilsina	Gokul Timilsina	Sarangkot-3	30-Jul-15											
26	1586	1-11-2-3	880.80	880.80	880.80	Suman Bahadur KC	Gobinda		Lamachaur-3	2-Sep-15											
27	1781	2-15-1-0	1,503.13	1,503.13	1,503.13	Ram Bdr Kuwar	Rana Bdr Kuwar	Chandra Bdr Kuwar	Hemja-7	30-Jul-15											
28	1782	2-15-1-0	1,503.13	1,503.13	1,503.13	Ram Bdr Kuwar	Rana Bdr Kuwar Chhetri	Chandra Bdr Kuwar Chhetri	Hemja-9	30-Jul-15											
29	1793	1-15-2-2	1,006.07	1,006.07	1,006.07	Ram Bdr Kuwar	Rana Bdr Kuwar Chhetri	Chandra Bdr Kuwar Chhetri	Hemja-7	30-Jul-15											

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List of Progress in Land Acquisition

										1	2	3	4-A	4-B	5	6	7	8	9	10	
Sno	Plot N	Area (Ropani-Aanas-Dhami)	Area (Sqm)	Actual Area to be acquired (sqm)	Land needed to be procured (sqm)	Land Owner's name	Land Owner's father's name	Land Owner's grand father's name	Land owner's address/Contact number	NWSC received information from Survey and Land Revenue offices	VDC inform to landowners about land acquisition, preparation, and date of meeting (or individual contact)	NWSC collected the land ownership certificate from VDC/PSMC office	NWSC contacted the landowner individually or meeting, and explain the project and land acquisition	NWSC shouted information of possesin from the landowners	The landowner agreed to release his/her land	The landowner signed the NWSC Application. In this stage, landowner claim their own estimated cost of land	Land Valuation Committee in Pokhara will estimate the cost of land (comparison to gov and market price). In case gov price is lower, Committee convince landowner to agree on gov price, or price negotiation.	Land Valuation Committee forward the fix amount of the land (total cost) to NWSC Kathmandu	NWSC Kathmandu approves to purchase the land, arrange the fund	The landowner visit NWSC Pokhara and receive compensation. Simultaneously, Ownership of the land change to NWSC	Comments (if any
30	1794	3-15-1-1	2,014.12	2,014.12	2,014.12	Lok Bdr Kuwar Chhetri	Rana Bdr Kuwar Chhetri	Chandra Bdr Kuwar Chhetri	Shukranagar-3, Chirwan	30-Jul-15											
31	1817	4-8-2-2	2,310.37	2,310.37	2,310.37	Bek Kumari			Puranchaur-6	2-Aug-15											
32	1824	2-4-1-3	1,159.16	1,159.16	1,159.16	Bodh Raj Adhikari	Purnakhar Adhikari	Kapil Adhikari	Puranchaur-6	30-Jul-15											
33	1880	1-11-3-0	882.79	882.79	882.79	Gurna Gautam	Khimlal		Lamachaur-6	2-Sep-15											
34	1885	1-2-1-0	580.58	580.58	580.58	Sher Bdr Baral	Devi Lal Baral	Bhakta Ram Baral	Kuine Mangale-1, Myagdi	30-Jul-15											
35	1886	1-8-0-3	769.46	769.46	769.46	Krishna Pd Poudel	Devi Pd Poudel	Danda Pani Poudel	Puranchaur-6	30-Jul-15											
36	1887	1-8-1-0	771.45	771.45	771.45	Dhana Pati Poudel	Devi Pd Poudel	Danda Pani Poudel	Puranchaur-6	30-Jul-15											
37	1888	2-8-1-1	1,282.44	1,282.44	1,282.44	Hum Maya Kuwar	Khadga Bdr Kuwar	Chandra Bdr Kuwar	Hemja-9	30-Jul-15											
38	1890	2-8-1-1	1,282.44	1,282.44	1,282.44	Tej Prasad			Puranchaur-6	2-Aug-15											
39	1891	2-8-1-1	1,282.44	1,282.44	1,282.44	Krishna Bdr Kuwar	Kama Bdr Kuwar	Deb Raj Kuwar	Hemja-9	30-Jul-15											
40	1892	2-8-1-0	1,280.45	1,280.45	1,280.45	Krishna Bahadur Kuwar	Kama		Hemja-9	2-Sep-15											
41	1968	2-0-0-0	1,018.00	1,018.00	1,018.00	Purshottam Kuwar	Kama Bdr Kuwar	Deb Raj Kuwar	Hemja-9	30-Jul-15											
42	1969	4-2-3-0	2,123.47	2,123.47	2,123.47	Prem Raj Karki			Puranchaur-6	2-Aug-15											
43	1987	0-5-0-0	159.06	159.06	159.06	Bidhu Adhikari	Chuda Mani		Puranchaur-6	2-Sep-15											
44	1988	0-12-2-0	397.65	397.65	397.65	Shiva Prasad			Puranchaur-6	2-Aug-15											
45	1989	0-5-0-0	159.06	159.06	159.06	Ram Chandra Adhikari	Chuda Mani		Puranchaur-6												
46	1990	0-8-0-0	254.50	254.50	254.50	Ram Chandra Adhikari	Chuda Mani		Puranchaur-6												
47	1991	0-8-0-0	254.50	254.50	254.50	Bidhu Adhikari	Chuda Mani		Puranchaur-6												
48	1992	1-14-2-0	970.28	970.28	970.28	Ram Chandra Adhikari	Chuda Mani		Puranchaur-6												
49	1998	4-0-0-0	2,035.99	2,035.99	2,035.99	Purshottam Kuwar	Kama Bdr Kuwar	Deb Raj Kuwar	Hemja-9												
50	1999	1-15-0-3	992.15	992.15	992.15	Purshottam Kuwar	Kama Bdr Kuwar	Deb Bdr Kuwar	Hemja-9												
51	2036	1-12-1-3	904.66	904.66	904.66	Tanka Nath Adhikari	Durga Dutta Adhikari	Chhabi Lal adhikari	Puranchaur-6												
52	2037	1-12-1-2	902.68	902.68	902.68	Sita Devi Adhikari	Rishi Ram Adhikari	Durga Dutta Adhikari	Puranchaur-6												
53	2038	1-12-1-3	904.66	904.66	904.66	Jagannath Adhikari	Durga Dutta Adhikari	Chhabi Lal adhikari	Puranchaur-6												
54	2088	0-13-0-1	415.55	415.55	415.55	Lakshya Bdr Sarki	Sante Sarki	Mangale Sarki	Puranchaur-8												
55	2089	0-13-0-1	415.55	415.55	415.55	Nar Bdr Sarki	Sante Sarki	Mangale Sarki	Puranchaur-8												
56	2091	2-0-1-0	1,025.95	1,025.95	1,025.95	Lakshya Bdr Sarki	Sante Sarki	Mangale Sarki	Puranchaur-8												
57	2092	2-0-1-0	1,025.95	1,025.95	1,025.95	Nar Bdr Sarki	Sante Sarki	Mangale Sarki	Puranchaur-8												
58	2110	1-2-1-0	580.58	580.58	580.58	Liladhar Adhikari	Damodar Adhikari	Purnakhar Adhikari	Puranchaur-6												
59	2111	1-2-1-0	580.58	580.58	580.58	Shankar Pd Adhikari	Damodar Adhikari	Purnakhar Adhikari	Puranchaur-6												
60	2132	3-5-3-2	1,713.89	1,713.89	1,713.89	Juddi Man Sarki			Puranchaur-6												
61	2133	3-5-3-3	1,715.88	1,715.88	1,715.88	Bode Sarki			Puranchaur-6												
62	2327	1-0-0-0	509.00	509.00	509.00	Man Bahadur			Puranchaur-6												
63	2234	0-8-3-2	282.33	282.33	282.33	Ram Bdr Kuwar	Rana Bdr Kuwar	Chandra Bdr Kuwar	Hemja-9												
64	2235	6-14-3-3	3,529.18	3,529.18	3,529.18	Tek Bdr Kuwar	Ram Bdr Kuwar	Rana Bdr Kuwar	Puranchaur-9												

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List of Progress in Land Acquisition

										1	2	3	4-A	4-B	5	6	7	8	9	10	
S.no.	Plot N.	Area (Ropani-Aanaa-Dhaam)	Area (Sqm)	Actual Area to be acquired (sqm)	Land needed to be procurred (sqm)	Land Owner's name	Land Owner's father's name	Land Owner's grand father's name	Land owner's address/Contact number	NWSC received information from Survey and Land Revenue offices	VDC inform to landowners about land acquisition, preparation, and date of meeting (or individual contact)	NWSC collected the land ownership certificate from VDC/PSMC office	NWSC contacted the landowner individually or meeting, and explain the project and land acquisition	NWSC checked information of peasants from the landowners	The landowner agreed to release his/her land	The landowner signed the NWSC Application. In this stage, landowner claim their own estimated cost of land.	Land Valuation Committee in Pokhara will estimate the cost of land (comparison to gov and market price). In case gov price is lower, Committee convince landowner to agree on gov price, or price negotiation	Land Valuation Committee forward the fix amount of the land (total cost) to NWSC Kathmandu	NWSC Kathmandu approves to purchase the land, arrange the fund	The landowner visit NWSC Pokhara and receive compensation. Simultaneously, Ownership of the land change to NWSC.	Comments if any
65	2284	0-13-0-0	413.56	413.56	413.56	Nar Bahadur Sarki	Yagya Bahadur		Puranchaur-8												
66	2285	0-13-0-1	415.55	415.55	415.55	Surya Kumari Sarki	Him Bdr Sarki	Santa Bdr Sarki	Puranchaur-8												
67	2286	2-0-1-0	1,025.95	1,025.95	1,025.95	Narda Bdr Sarki	Santa Bdr Sarki	Mangal Sarki	Puranchaur-8												
68	2287	2-0-1-0	1,025.95	1,025.95	1,025.95	Surya Kumari Sarki	Him Bdr Sarki	Santa Bdr Sarki	Puranchaur-8												
69	2311	2-7-0-0	1,240.68	1,240.68	1,240.68	Lok Bdr Kuwar Chhetri	Rana Bdr Kuwar Chhetri	Chandra Bdr Kuwar Chhetri	Shukranagar-3, Chitwan												
70	2312	0-8-1-0	262.45	262.45	262.45	Ram Bdr Kuwar	Rana Bdr Kuwar Chhetri	Chandra Bdr Kuwar Chhetri	Hemja-9												
71	2329	1-0-0-0	509.00	509.00	509.00	Chet Bdr Kuwar			Puranchaur-6												
72	2330	0-8-1-1	264.44	264.44	264.44	Khadka Bdr Kuwar			Puranchaur-6												
Total Land Required for acquisition (sqm):				**67,868.23**	**67,868.23**																
			Ropani	**133.34**	**133.34**																

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資料 6-2 モニタリングフォーム（案）

Monitoring Form (Draft)

Part I: Environemental and Social Impact

1. Natural Environment

1-1 Air Quality

	Item	Unit	Measured Value (Mean)	Measured Value (Max.)	Standard in Nepal (Annual/24hours)	Remarks*
1	TPS	µg/m3			-/230	
2	PM10	µg/m3			-/120	
3	Suplhur Dioxide	µg/m3			50/70	
4	Nitrogen Dioxide	µg/m3			40/80	
5	Carbon Monoxide	µg/m3			10,000/100,000**	
6	Lead	µg/m3			0.5/0	
7	Benzene	µg/m3			20/0	

*Location, method, frequency shall be described.
**8hours/15minutes

1-2 Noise and Vibration

	Date	Reported Problem/Complain	Proposed Solution	Solved	In case "Solved-No", describe further action
1				Yes / No	
2					

1-3 Odor

	Date	Reported Problem/Complain	Proposed Solution	Solved	In case "Solved-No", describe further action
1				Yes / No	
2					

1-4 Soil Pollution

No.	Monitoring Factor	Monitoring Place	Monitoring Method	Frequency	Monitoring Result
(1)	Soil erosion and turbidity of surface water	Downstream point near construction site of intake weir and	Measure of turbidity	At the transportation time of sludge	

No.	Monitoring Factor	Monitoring Place	Monitoring Method	Frequency	Monitoring Result
		of outlet of discharge pipes.			

1-5 Solid Waste

No.	Monitoring Factor	Monitoring Place	Monitoring Method	Frequency	Monitoring Result
(1)	Adequate treatment of solid wastes	All construction sites, laborers camps and its neighboring areas	Physical observation	Once/week	

1-6 Working Environment

No.	Monitoring Factor	Monitoring Place	Monitoring Method	Frequency	Monitoring Result
Risk of HIV/AIDS and other infections					
(1)	Control risk of HIV/AIDS	All construction sites	Physical observation	During construction	
Workplace Safety					
(2)	Wear of safety shoes and hats and safety control manners at construction sites	All construction sites	Physical observation	Once/week	
Accidents					
(3)	Adequate safety traffic control manners	Entrance and exit for construction of new water treatment plant, ground reservoir, transmission pipelines, water intake weir.	Physical observation	Two times/week	
(4)	Fallen object and grade of dirtiness of roads	Passage roads of vehicles for transportation of equipment and materials, and surplus excavation soils.	Physical observation	Two times/week	

2. Social Environment

2-1 Resettlement/Land Acquisition

	Date	Reported Problem/Complain	Proposed Solution	Solved	In case "Solved-No", describe further action
1				Yes / No	
2					

2-2 Public Consultation

	Date	Place	Contents of the consultation/main comments and answers
1			Issues (example) ● Chage of livelihood ● Change of economical situation of PAPs ● Other problems related to land acquisition & involuntary resettlement
2			

3. Environmental Standard

3-1 Ambient Air Quality

Table 1: National Ambient Air Quality Standard, 2003

Parameters	Units	Averaging Time	Concentration in Ambient Air, maximum	Test Methods
TSP (Total Suspended Particulates)	µg/m3	Annual	-	-
		24-hours*	230	High Volume Sampling
PM10	µg/m3	Annual	-	
		24-hours*	120	Low Volume Sampling
Sulphur Dioxide	µg/m3	Annual	50	Diffusive sampling based on weekly average
		24-hours**	70	To be determined before 2005 A.D.
Nitrogen Dioxide	µg/m3	Annual	40	Diffusive sampling based on weekly average
		24-hours**	80	To be determined before 2005 A.D.
Carbon Monoxide	µg/m3	8 hours**	10,000	To be determined before 2005 A.D.
		15 minute	100,000	Indicative samplers**
Lead	µg/m3	Annual	0.5	Atomic Absorption Spectrometry, analysis of PM10 samples****
		24-hours	0	-
Benzene	µg/m3	Annual	20*****	Diffusive sampling based on weekly average
		24-hours	-	

***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 NO2 and SO2 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:** Control by spot sampling at roadside locations: Minimum one sample per week taken over 15 minutes during peak traffic hours, i.e. in the period 8am - 10am or 3pm - 6pm on a workday. This test method will be re-evaluated by 2005.

******Note:** If representativeness can be proven, yearly averages can be calculated from PM10 samples from selected weekdays from each month of the year.

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

3-2 Noise

Table 2: National noise quality standard, 2069

Area	Noise Limit (dB)	
	Day	Night
Industrial Area	75	70
Business Area	65	55
Rural Residential Area	45	40
Urban Residential Area	55	50
Mixed Residential Area	63	55
Peace Zones/Area	50	40

Part II: Economic Impact to Project Affected Persons (PAPs)

4.1 Monitoring of Economic Impact to PAPs

Household ID	Name of Household Head	Income revel before the project start* (Unit: NPR/per)	Date of Interview	Income lever at interview date (Unit: NPR/per)	PAPs Opinion of economic situation at interview date compare to before the project start**	Evaluation
					(1) (2) (3) (4) (5)	
					(1) (2) (3) (4) (5)	
					(1) (2) (3) (4) (5)	
					(1) (2) (3) (4) (5)	
					(1) (2) (3) (4) (5)	
					(1) (2) (3) (4) (5)	
					(1) (2) (3) (4) (5)	

*Refer to RAP report of the project
** (1) Obviously bad, (2) Relatively Bad, (3) No change, (4) Relatively better, (5) Obviously better

4-2 Monitoring of Impact to the Involuntary Resettlement Household

Household ID		Name of Household Head		Date of Interview	

Income revel before the project start* (Unit: NPR/per)	Income lever at interview date (Unit: NPR/per)	Opinion of the household in terms of economic situation at interview date compare to before the project start**	Opinion of the household in terms of general situation all over their livelihood	Evaluation
		(1) (2) (3) (4) (5)	(1) (2) (3) (4) (5)	

*Refer to RAP report of the project
** (1) Obviously bad, (2) Relatively Bad, (3) No change, (4) Relatively better, (5) Obviously better

資料 6-3　環境チェックリスト

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanation	(1) EIA and Environmental Permits	(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) Y (b) Y* (c) Y* (d)Y	(a) EIA is stareded to prepare on July 2015. The process of EIA has two stages, first stage is approval of Scoping and TOR, and second stage is approval of EIA Reprot.Approval of Scoping and TOR document will be done on December 2015 since Scoping and TOR documents were already submitted and presentation in MoSTE was done on December15, 2015. Meanwhile, approval of EIA report is planned on May 2015. (b) First stage of EIA approval (approval of Scoping and TOR) had completed in 2015, and final approval is planned on July 2016. (c) No revise was required at the approval of fisrt stage of EIA documentation (Scoping and TOR). Since Scoping and TOR documents explain everything about the project, it is assumed that final EIA report will be approved without major revise and corrections. (d) NWSC is already using the source of the drinking water *i.e.* Mardi Khola

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(2) Explanation to the Local Stakeholders	(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) Y (b) Y	(a) Local people are notified through publication of notice and frequent consultation. There is no objection from local stakeholders to the project. (b) Suggestions provided by the local people are addressed in the EIA report. Project design is yet to finalize
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Alternative for project with no project alternative along with alternative technology is examined.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Are any mitigating measures taken? (b) Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	(a) N (b) Y	(a) Storage shall be done in safe and leakage free storage tank. (b) Chlorine concentration will be as per OHS standard. In addition, the situation has to be sui to National Ambient Air Quality Standards for Nepal, 2003.
	(2) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	(a) Y	(a) Effluents will be disposed safely ensuring minimum environmental impacts. For monitoring, National Drinking Water Quality Standards (NDWQS) shall be applicable.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed in accordance with the country's regulations?	(a) Y	(a) All waste shall be treated in accordance with Solid Waste Management Act 2011. Generated waste will be disposed in safe disposal area at tallo Purunchaur Phant with retaining structures to avoid run off, wash off during rainy season
	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	(a) Y	(a) There is no environemental standard for noise in Nepal. However, significant noise and vibration impact is not expected since noise-free facilities, such as unserwater pump and noise-free generator are used in the project. In case of problems of noise, the project side takes care as per complaints by residents.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) The project will use surface water source of Mardi river. There are no national standards for Subsidence in Nepal.
3 Natural Environment	(1) Protected Areas	(a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) The project will use surface water source of Mardi river, and there is no possibilities of subsidence.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable	(a) N (b) N (c) N	(a) The project does not lie in forest area/ conservation area with high value of ecological importance

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site or discharge area encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(d) N	(b) project site or discharge area don't lie in the protected habitats of endangered species (c)The project does not lie in forest area/ conservation area with high value of ecological importance (d) The project will use water of Mardi khola. However, no dangerous cemicals are applied for water treatment process and discharge water from the plant is environmentaly harmful.
	(3) Hydrology	(a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect surface water and groundwater flows?	(a) N	(a) The project will use water that collected from Mardi khola by exsiting intake facility. New water-source development is carried out, and no impact to hydrogeology.
4 Social Environment	(1) Resettlement	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?	(a) Y (b)Y (c) Y (d) Y	(a) There is a house in the site, and the household have to move out. This household already agreed to involuntary resettelemtn with NWSC, and they are satisfied proposed

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement?	(e) N (f) Y (g) Y (h) N (i) Y (j) Y	compensation for their damages caused by the inovoluntary resettlement. (b) Entitlemtnent, including compensation, is explained several times during public hearing, resettlement survey, and distribution of Application format. (c) Though an implementation of socioeconomic study on this issue is not requirement in Nepal, Resettlement Action Plan (RAP) was prepared according to JICA regudlation. (d) NWSC will have power to control the project site only after landowners and residents will receive compensation and ownership will be changed officially (e) There is no official document of compensation policies which distributed from NWSC to PAPs. However, compensation policies are discussed and recognized in PAPs though public hearings, resettlement survey, and distribution of Application. In addition, RAP is prepared along with JICA's regulation, and all entitlement is written in the RAP report.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(j) Is the grievance redress mechanism established?		(f) Ssocially vulnerable households, sucu as woman-headed households, are reported in RAP. (g) Agreement had made prior to resettlement. In NWSC's system, resettlement can start only after "Appliction" have sumitted. Application is NWSC's document form which shows agreement with affected persons in terms of land acquisition and resettlement. (h) NWSC, the implementing organization, has a system of dealing with resettlement land acquisition, and it has all responsibilities including budget arrangement and implementation of the project. (i) Monitoring for economic situation of PAPs are planned. (j) GRM is prepared to address disputes, and mainly it will be handled in CDC (Chief District Office)
4 Social Environment	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?	(a) Y (b) N	(a) Impact on land acquisition is major issue for local people's life and livelihood. In addition to cash compensation, additional assistance (additional payment) will be made for valunable households such as woman-

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?		headed households and handicapped households. (b) Mardi river is not used for drinking/ irrigation and recreation purpose. So no any adverse impact is predicted on water use issues
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) N	(a) The project area does not have any archaeological sites with historical and cultural value.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a) N	(a) The major construction building is water treatment plant in this project, and this is one story building. Therefore, there is no impact to the surrounding landscape.
	(5) Ethnic Minorities and Indigenous Peoples	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	(a) Y (b) Y	(a) Budgetary provision is made for the upliftment of disadvantage groups and for women empowerment (b) There is no ethnic minorities and indigenous people that applicable for World Bank OP.4.10.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Y (b)Y (c) Y (d)Y	(a) The project will be constructed /operated within all the legal provisions set forth by the GoN (b) Adequate PPEs are proposed for the workers. (c) Workers will be trained well regarding Health and safety matters, appropriate use of PPEs and Safe working procedures (d) OHS will be strictly followed.
5 Others	(1) Impacts during Construction	(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?	(a) Y (b) Y (c) Y (d) Y	(a)Appropriate mitigation measures are proposed to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
		(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? (c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?		(b) Appropriate mitigation measures with sufficient budget is proposed to avoid/minimize/compensate the impact (c) Appropriate mitigation measures with sufficient budget is proposed to avoid/minimize/compensate the impact (d)Traffic signs, speed limits, transportation by covering the materials is proposed.
5 Others	(2) Monitoring	(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a)Y (b)Y (c)Y (d)Y	(a) Monitoring program is proposed with adequate budget (b) Monitoring of physical parameters such as air quality, water quality, noise level, impact due to waste disposal etc are proposed during construction and operation phase. Monitoring of social parameters are also proposed in EIA with regard to project location and project affected people. (c) Monitoring program is proposed with adequate budget (d) Monitoring checklist is attached in the EIA report

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Dam and River Projects checklist should also be checked.	(a)Y	(a) Noted
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a)Y	(a) CO_2 emission by generotor is expected.

*EIA は 2015 年 12 月現在審査が進行中であり、認可発行の予定は 2016 年 6 月である。ただし、EIA 承認プロセスのうち、Scoping & TOR document の提出と科学技術環境省でのプレゼンテーションまで完了している（2015 年 12 月現在)。ネパールの EIA は Scoping & TOR document の提出⇒Scoping & TOR document の認可⇒EIA レポートの作成・提出⇒EIA 認可発行、というプロセスになっているが、EIA 認可を受ける見込みのないものは Scoping & TOR dcoument の提出時点で却下となりプレゼンテーションを実施することができない。一方で、Scoping & TOR document の提出が受理されプレゼンテーションまで終了しているものは、EIA 認可のための審査を受けるに妥当な事業であると判断されたものであり、このプレゼンテーションを完了できた事業は将来的に EIA 認可を受けることができると想定される。当事業では Scoping & TOR documet の提出とプレゼンテーションは完了していることから、EIA 認可を受けることができると考えて問題ない。

資料 6-4　　ポカラ市水道改善事業で使用する管路の種別について

ポカラ市水道改善事業で計画する送配水管路の管種は、次のとおりである。

- 送水管、配水本管：ダクタイル鋳鉄管（T 形）
- 配水支管：ポリエチレン管

送水管および配水本管は基幹管路であることから、より耐久性に優れるダクタイル鋳鉄管を用いる。配水支管は、配水本管から分岐する二次的な管路であり、万が一被災しても影響が少ないことから、ポリエチレン管を用いることとしている。

ここで、管路の耐震性について考える。

ダクタイル鋳鉄管（T 形）およびポリエチレン管の耐震適合性は、厚生労働省の「管路の耐震化に関する検討会報告書」によると、**表 6-4-1** のとおりである。

表 6-4-1　管種・継手ごとの耐震適合性

管種・継手	配水支管が備えるべき耐震性能	基幹管路が備えるべき耐震性能	
	レベル1地震動に対して、生ずる損傷が軽微であって、機能に重大な影響を及ぼさないこと	レベル1地震動に対して、健全な機能を損なわないこと	レベル2地震動に対して、生ずる損傷が軽微であって、機能に重大な影響を及ぼさないこと
ダクタイル鋳鉄管（NS形継手等）	○	○	○
〃（K形継手等）	○	○	注1
〃（A形継手等）	○	△	×
鋳鉄管	×	×	×
鋼管（溶接継手）	○	○	○
配水用ポリエチレン管（融着継手）注2	○	○	注3
水道用ポリエチレン二層管（冷間継手）	○	△	×
硬質塩化ビニル管（RRロング継手）注4	○	注5	
〃（RR継手）	○	△	×
〃（TS継手）	×	×	×
石綿セメント管	×	×	×

出典：管路の耐震化に関する検討会報告書、平成 26 年、平成 25 年度管路の耐震化に関する検討会（厚生労働省）

注） 管種･継手は、厚生労働省「管路の耐震化に関する検討会報告書（ 平成19 年3 月）」を参照した。
注1）ダクタイル鋳鉄管（ K 形継手等）は、埋立地など悪い地盤において一部被害は見られたが、岩盤･洪積層などにおいて、低い被害率を示していることから、よい地盤においては、基幹管路が備えるべきレベル2 地震動に対する耐震性能を満たすものと整理することができる。
注2）水道配水用ポリエチレン管（ 融着継手） の使用期間が短く、被災経験が十分でないことから、十分に耐震性能が検証されるには、なお時間を要すると考えられる。
注3）水道配水用ポリエチレン管（ 融着継手） は良い地盤におけるレベル2 地震（ 新潟県中越地震） で被害がなかった（ フランジ継手部においては被害があった）が、布設延長が十分に長いとは言えないこと、悪い地盤における被災経験がないことから、耐震性能が検証されるには、なお時間を要すると考えられる。
注4）硬質塩化ビニル管（ RR ロング継手） は、RR 継手よりも継手伸縮性能が優れているが、使用期間が短く、被災経験もほとんどないことから、十分に耐震性能が検証されるには、なお時間を要すると考えられる。
注5）硬質塩化ビニル管（ RR ロング継手）の基幹管路が備えるべき耐震性能を判断する被災経験はない。
※ 注を付してあるものも、各水道事業者の判断により採用することは可能である。

備考）
○ ： 耐震適合性あり
× ： 耐震適合性なし
△ ： 被害率が比較的に低いが、明確に耐震適合性ありとし難いもの

ダクタイル鋳鉄管（T 形）は、**表 6-4-1** の「ダクタイル鋳鉄管（K 形継手等）」に該当し、基幹管路が備えるべき耐震性能についてレベル 1 地震動に適合している。またダクタイル鋳鉄管（T 形）は、レベル 2 地震動についても、「良い地盤においては、基幹管路が備えるべきレベル 2 地震動に対する耐震性能を満たす」とされ、良好な地盤ではレベル 2 地震動まで適合していることがわかる。
さらに、ポリエチレン管は配水支管が備えるべき耐震性能に適合していることがわかる。

なお、レベル 1 地震動およびレベル 1 地震動とは、「水道施設耐震工法指針・解説」（日本水道協会）によると、次のとおりである。

- レベル 1 地震動
  当該施設の設置地点において発生するものと想定される地震動のうち、当該施設の供用期間中に発生する可能性の高いもの。
- レベル 2 地震動
  当該施設の設置地点において発生するものと想定される地震動のうち、最大規模の強さを有するもの。

出典：水道施設耐震工法指針・解説、2009 年版、日本水道協会

一般に管路の供用期間は 50 年程度であり、ネパールにおいて 2015 年 4 月 25 日に発生した地震は、1934 年に発生した同程度のマグニチュードの地震以来 81 年ぶりの大地震である[1]。よって本事業における管路の耐震性は、レベル 1 地震動に対応できれば適合するものと考えられるが、ここでは安全性を考慮して、基幹管路についてはレベル 2 地震動まで考えるものとする。

[1]「ネパール大地震、どのようにして起きたか」The Wall Street Journal, 2015 年 4 月 27 日

ダクタイル鋳鉄管（T 形）は、良い地盤においてはレベル 2 地震動に対する耐震性能を満たすとされているが、ここで良い地盤とは、「K 形継手等を有するダクタイル鋳鉄管の耐震適合地盤判定支援ハンドブック」（水道技術研究センター）によると、**表 6-4-2** のとおりである。

表 6-4-2　K 形継手等の耐震適合地盤の判定分類

分類（判定）	K 形継手等の耐震適合地盤（国土数値情報 土地分類メッシュ[注1]）	参考とした既存の知見		
		平成 19 年度水道統計 調査票（厚生労働省）	地震による水道管路の被害予測[注2]（日本水道協会）	液状化地域ゾーニングマニュアル[注3]（国土庁防災局）
耐震適合性有り	大起伏山地、中起伏山地、小起伏山地 山麓地、大起伏火山地、中起伏火山地 小起伏火山地、火山山麓地、大起伏丘陵地、小起伏丘陵地、火山性丘陵地 火山性扇状地、火山灰砂台地、ローム台地、シラス台地、砂礫台地・段丘 岩石台地・段丘、溶岩台地、石灰岩台地	良い地盤 下記に示す悪い地盤以外	良い地盤 良質地盤、 沖積平地、 (改変山地、 改変丘陵地)	液状化なし 台地、丘陵地、 山地
耐震適合性無し	自然堤防・砂州、扇状地性低地・崩積性低地、氾濫原性低地、三角州性低地 砂丘低地、湖沼、河川、旧湖盆地性積低地、人工改変地、埋立地・干拓地・干潟、火山灰砂分布、溶岩原、地滑り地形、崩壊地形	悪い地盤 ①埋立地や盛土地盤 ②液状化及び側方流動の可能性がある地域 ③地すべり地帯、 ④軟弱地盤 ⑤活断層地帯	悪い地盤 谷・旧水部(埋立地)	液状化の可能性あり 上記以外の地盤

備考）「盛土地盤」「活断層地帯」等については別途考慮が必要である。

注1　数値地図ユーザーズガイドを基に、分類コードの異なる地域については整理を行った。
注2　管路の被害予測式における地盤係数を参考とし、表中のように地盤ごとの良し悪しを分類した。
注3　「平成 10 年度版　液状化ゾーニングマニュアル（国土庁防災局）」に示される、レベル 2 地震動における地盤表層の液状化可能性の程度を参考とした。

出典：K 形継手等を有するダクタイル鋳鉄管の耐震適合地盤判定支援ハンドブック（平成 22 年 12 月）、水道技術研究センター

ポカラ市は起伏山地であり、砂礫・岩石台地および段丘にあたる。これは**表 A-5-2** において耐震適合性がある地盤に分類される。地質調査の結果からも、地表から数メートルで N 値 50 以上の地盤が確認されており、良好な地盤と判断される。

よって、レベル 2 地震動においても、ダクタイル鋳鉄管（T 形）は十分な耐震性能を有するものと考えられる。

以上のことから、ポカラ市水道改善事業の送配水管路で使用する管種（ダクタイル鋳鉄管・T 形及びポリエチレン管）は、耐震性を有するものと考えられる。

資料 6-5　プロジェクト完了後の漏水率の設定根拠

本プロジェクト実施前の漏水率は、報告書第 2 章水需要予測に記載したとおり、約 36%と想定する。一方、本プロジェクトによる漏水削減効果としては、「配水本管敷設替え及び配水圧力の適正化による漏水削減」、「配水支管の敷設替えによる漏水削減」、「給水装置（給水管、メータ）更新による漏水削減」が考えられる。

ここでは、上述の 3 つの漏水削減効果について評価のうえ、本プロジェクト完了後の漏水率について設定を行った。**表 6-5-1** にその結果を示す。

表 6-5-1　プロジェクト完了後の漏水率の算定結果

項目		単位	数量	備考	摘要
(1)	配水本管の敷設	km	50	①、設定	表 A-6-2 (1)
(2)	配水支管の敷設	km	50	②、設定	表 A-6-4 (1)
(3)	給水装置の更新	戸	9,000	③、設定	表 A-6-5 (2)
(4)	配水量	m^3/日	54,120	④、実績	※1
(5)	使用水量	m^3/日	21,609	⑤、実績	※2
(6)	損失水量	m^3/日	32,511	⑥=④-⑤	
(7)	漏水量	m^3/日	19,507	⑦=⑥x60%、仮定	※3
(8)	管路更新前の漏水率	%	36%	⑧=⑦/④	
(9)	配水本管敷設による漏水削減効果	m^3/日	3,337	⑨、推定	表 A-6-2 (11)+表 A-6-3 (8)
(10)	配水支管敷設による漏水削減効果	m^3/日	500	⑩、推定	表 A-6-4 (11)
(11)	給水装置更新による漏水削減効果	m^3/日	3,051	⑪、推定	表 A-6-5 (13)
(12)	施策後の使用可能量	m^3/日	29,497	⑫=⑤+⑨+⑩+⑪	
(13)	施策後の漏水率	%	27%	⑬= (④ - ⑫) x60%/④	

試算の結果、プロジェクト完了後の漏水率は約 27%となり、これを用いた。以下に、試算結果の内容について詳述する。

1.　配水本管敷設替え及び配水圧力の適正化による漏水削減効果

配水本管を敷設することによる漏水削減効果は、現在漏水が多発する既設の CI 管を敷設替えすることによる漏水削減効果と、配水区域を設定して配水圧を適正化することによる漏水削減量効果があり、これを評価する。

1.1 配水本管敷設替えによる漏水削減効果

既設の配水本管を敷設替えすることにより削減される漏水量は、**表 6-5-2** に示すとおりである。

表 6-5-2　既設 CI 管敷設替えによる漏水削減量

項目		単位	数量	備考	摘要
(1)	配水本管の敷設延長	km	50	①、設定	

項目		単位	数量	備考	摘要
(2)	うち既設 CI 管敷設替え延長	km	21	②、設定	
(3)	配水量	m^3/日	54,120	③、実績	※1
(4)	使用水量	m^3/日	21,609	④、実績	※2
(5)	配水本管敷設前の損失水量	m^3/日	32,511	⑤=③-④	
(6)	配水本管敷設前の漏水量	m^3/日	19,507	⑥=⑤x60%、仮定	※3
(7)	配水本管敷設前の漏水率	%	36%	⑦=⑥/③	
(8)	給水管からの漏水量	m^3/日	11,700	⑧=⑥x60%、仮定	※4
(9)	配水管からの漏水量	m^3/日	7,803	⑨=⑥x40%、仮定	※4
(10)	既設管敷設替えによる漏水削減率	%	9.5%	⑩=②/220、仮定	※5
(11)	既設管敷設替えによる漏水削減量	m^3/日	740	⑪=⑨x⑩	

1.2 配水圧力の適正化による漏水削減効果

配水池や配水本管を敷設し、配水区域を設定することによって、適正圧力での配水を行う。そのことにより、これまで高圧で配水していた地域の漏水量が削減される。

既存配水池のうち、Bindhabasini 配水池は配水区域内の高低差が大きく、一部地域で配水圧力が高くなっている。一方、Amalabisauni 配水池についても高圧で配水していると考えられるものの、配水区域が明確ではないため、ここでは Bindhabasini 配水池の配水圧が適正化されることによる漏水削減効果を考える。Bindhabasini 配水池からの配水圧力が適正化されることにより削減される漏水量を**表 A-6-3** に示す。

表 6-5-3　配水圧力の適正化による漏水削減量

項目		単位	数量	備考	摘要
(1)	Bindhabasini の現在の配水圧	m	130	①､標高 930～800m に配水と仮定	※6
(2)	Bindhabasini の平均配水圧	m	65	②=①/2	
(3)	配水区域の設定後の配水圧	m	75	③、75m とする	※7
(4)	配水区域の設定後の平均配水圧	m	38	④=③/2	
(5)	配水区域設定後の漏水削減率	%	24%	⑤=1-(④/②)^0.5	※8
(6)	Bindhabasini の現在の配水量	m^3/日	30,000	⑥、実測より	
(7)	Bindhabasini の現在の漏水量	m^3/日	10,800	⑦=⑥x36%	※9
(8)	配水圧力の適正化による漏水削減量	m^3/日	2,597	①　=⑦x⑤	

2.　配水支管敷設替えによる漏水削減効果

配水支管を 50km 敷設する場合に、既設管を敷設替えすることにより削減される漏水量を**表 6-5-4** に示す。

表 6-5-4　配水支管敷設替えによる漏水削減量

項目		単位	数量	備考	摘要
(1)	配水支管の敷設延長	km	50	①、設定	
(2)	うち既設管敷設替え延長	km	14	②、設定	
(3)	配水量	m^3/日	54,120	③、実績	※1
(4)	使用水量	m^3/日	21,609	④、実績	※2
(5)	損失水量	m^3/日	32,511	⑤=③-④	
(6)	漏水量	m^3/日	19,507	⑥=⑤x60%、仮定	※3
(7)	漏水率	%	36%	⑦=⑥/③	
(8)	給水管からの漏水量	m^3/日	11,700	⑧=⑥x60%、仮定	※4
(9)	配水管からの漏水量	m^3/日	7,803	⑨=⑥x40%、仮定	※4
(10)	既設管敷設替えによる漏水量削減率	%	6.4%	⑩=②/220、仮定	※5
(11)	既設管敷設替えによる漏水量削減量	m^3/日	500	⑪=⑨x⑩	

3.　給水装置（給水管、メータ）更新による漏水削減効果

給水装置更新による漏水削減効果は、市の中心部（Ward No.1-10）で給水メータ・給水管を 9,000 戸分更新する場合、それによって給水装置からの漏水量が削減するものとして考えた。給水装置更新により削減される漏水量を**表 6-5-5** に示す。

表 6-5-5　給水装置更新による漏水削減量

項目		単位	数量	備考	摘要
(1)	全給水接続数	戸	34,523	①、実績	
(2)	更新対象の給水装置数	戸	9,000	②、設定	
(3)	配水量	m^3/日	54,120	③、実績	※1
(4)	使用量	m^3/日	21,609	④、実績	※2
(5)	損失水量	m^3/日	32,511	⑤=④-③	
(6)	漏水量	m^3/日	19,507	⑥=⑤x60%、仮定	※3
(7)	漏水率	%	36%	⑦=⑥/③	
(8)	接続当たり使用量	m^3/戸/日	0.63	⑧=④/①	
(9)	一人当たり使用量	L/人/日	130	⑨、仮定	
(10)	接続当たり使用人数	人/戸	4.8	⑩=⑧/⑨	
(11)	給水管からの漏水量	m^3/日	11,704	⑪=⑥x60%、仮定	※4
(12)	配水管からの漏水量	m^3/日	7,803	⑫=⑥x40%、仮定	※4
(13)	給水装置更新による漏水削減量	m^3/日	3,051	⑬=⑪x(②/①)	

※1 「配水量」の計算は、以下のとおりとする。

表 6-5-6　配水量の内訳

水源	能力 (m^3/日)	留意事項
Mardi 川	46,000	JICA 調査団による流量測定の結果
Bhote 川	1,500	
Kali 川	2,000	
Baldara Spring	300	
Deep Well	4,320	1m^3/min×3 箇所 =1,440m^3/日×3 箇所
合計	54,120	

注）Bhote 川、Kali 川、Baldara spring の水量は Pokhara Water Supply Report (2005)を参照した。
Bhote 川、Kali 川は、乾季の最少水量を表す。通年の水量は、次のとおり。
Bhote 川＝1,500~5,000m^3/日、Kali 川＝ 2,000~5,000m^3/日 (Pokhara Water Supply Report、2005)

※2 「使用水量」の計算は、以下のとおりとする。詳細については、報告書本文の水需要予測を参照のこと。

表 6-5-7　使用水量の内訳

内訳	使用水量 (m^3/日)
I. Billed Consumption (A+B+C)	**21,043**
(A) Small Consumer	20,666
(B) Lage Consumer	268
(C) Tourist (well water)	109
II. Unbilled Consumption (D)	**675**
(D) Public faucet	675
Total = I + II	**21,718**

※3 「漏水量」の計算は、下式によるものとする。詳細については、報告書本文の水需要予測を参照のこと。

【漏水量（m^3/日)】＝【損失水量】×60%*

* The Challenge of Reducing Non-Revenue Water in Developing Countries, World Bank (2006)より設定

※4 「給水管及び配水管からの漏水量」は、Nepal- Leak Detection and Waste Control Program, IDA (1995)の記載に基づき、給水管からの漏水を 60%、配水管からの漏水を 40%として求めた。

※5 「既設管敷設替えによる漏水量削減率」は、ポカラ市の総配管延長が約 220km であることから、それに対する既設管敷設替え延長の割合から求めた。

【既設管布設替えによる漏水量削減率(%)】＝【既設管敷設替え延長】/ 220

※6 「Bindhabasini 配水池の現在の配水圧」は、Bindhabasini 配水池の標高の約+930m から、市の南部の標高+800m 付近（NWSC 事務所、Lake Side 地区の標高）の標高差である 130m と仮定した。なお、実際には市の末端の標高+750m 近辺までカバーしているが、実際には区域末端にはほとんど給水されていない。

【Bindabashini 配水池の現在の配水圧】＝930－800＝130m

※7 「配水区域設定後の配水圧」は、報告書第 2 章配水システムより、75m とした。

※8 「配水区域設定後の漏水削減率」は、以下の考え方により設定した。

- ✓ 水圧と漏水量の関係は、漏水孔からの漏水量を一種のオリフィスと考え、一般に次式で表される。

$Q = C \times A \times P^{0.5}$

Q：漏水量
C：漏水孔の形状による係数
A：漏水孔の断面積
P：管内圧力

- ✓ 漏水量は水圧の 1/2 乗に比例するため、漏水削減率は次式により求められる。

【配水区域設定後の漏水削減率】＝

1 －(【配水区域設定後の平均配水圧】/【Bindhabasini 配水池の現在の平均配水圧】) $^{0.5}$

※9 「Bindhabasini 配水池の現在の漏水量」は、ポカラ市の現在の漏水率 36%より、次のように求めた。

【Bindabashini 配水池の現在の漏水量】＝30,000×36%

資料 6-6　Mardi 川他水質調査

現地調査において Mardi 川を含むポカラ市の既存取水源 4 箇所（Mardi 川、Baldhara Spring、 Bhote 川、Kali 川）の原水水質分析及び給水栓の水質調査を行った。乾季および雨季において各地点より採水を行い、ネパール現地及び日本国内の公的水質検査機関への再委託業務により水質分析を実施した。

1.　Mardi 川の水質分析結果

(1)　乾季の水質分析結果

- 採水地点：　既存の取水地点 4 箇所
- 分析回数：　現地 2 回、国内 1 回（第 1 次調査；4 月下旬～5 月初旬）
- 分析項目：　ネパール水質基準項目を含む 30 項目

乾季の水質分析結果として、浄水施設の取水源である Mardi 川の水質分析結果を、**表 6-6-1** に示す。濁度と鉄がネパール基準よりやや高い値となっており、特に鉄に関しては、現地分析及び国内分析の結果においても、ネパール基準である 0.3mg/L をやや上回る結果であった。また、臭気、アルミニウムについても、国内分析結果においては、ネパール基準よりやや高い結果となっている。

表 6-6-1　水質分析結果（乾季）

水質分析項目	日本国内分析結果		ネパール分析結果			ネパール水質基準	日本水質基準
	単位	1回目 4月下旬採水	単位	1回目 4月下旬採水	2回目 5月上旬採水		
Color	度	2	TCU	< 5	< 5	5 (15)	5度以下
Turbidity	度	**4**	NTU	**22**	3	**5 (10)**	**2度以下**
Electrical Conductivity (EC)	μS/cm	171	μS/cm	167	191	1500	
pH	-	7.6	-	8.1	8.1	6.5-8.5	7.5程度
Total Dissolved Solid (TDS)	mg/L	120	mg/L	90	95	1000	
Taste	-	欠測				Non-Objctional	異常でないこと
Odor	-	**微土臭**	mg/L	Odourless	Odourless	**Non-Objctional**	**異常でないこと**
Iron (Fe)	mg/L	**0.76**	mg/L	**1.2**	**0.53**	**0.3 (3)**	**0.3**
Manganese (Mn)	mg/L	0.02	mg/L	< 0.05	< 0.05	0.2	0.05
Arsenic (As)	mg/L	0.001	mg/L	< 0.005	< 0.005	0.05	0.01
Cadmium (Cd)	mg/L	<0.0003	mg/L	< 0.003	< 0.003	0.003	0.003
Chromium (Cr)	mg/L	<0.005	mg/L	< 0.02	< 0.02	0.05	0.05
Cyanide (CN-)	mg/L	<0.02	mg/L	<0.05	<0.05	0.07	0.01
Lead (Pb)	mg/L	<0.001	mg/L	< 0.01	< 0.01	0.01	0.01
Ammmonia (NH3)	mg/L	<0.1	mg/L	0.12	0.12	1.5	
Chloride (Cl-)	mg/L	<1	mg/L	1	1	250	200
Sulphate (SO4--)	mg/L	11	mg/L	1	1	250	
Nitrate (NO3-)	mg/L	<1	mg/L	0.873	0.39	50	10
Copper (Cu)	mg/L	<0.1	mg/L	< 0.02	< 0.02	1	1
Total Hardness	mg/L	84	mg/L	84	92	500	300
Calcium (Ca)	mg/L	22				200	
Zinc (Zn)	mg/L	<0.1	mg/L	< 0.05	< 0.05	3	1
Mercury (Hg)	mg/L	<0.0003	mg/L	< 0.001	< 0.001	0.001	0.0005
Aluminum (Al)	mg/L	**0.39**	mg/L	< 0.05	< 0.05	**0.2**	**0.1**
Fluoride (F+)	mg/L	<0.08	mg/L	< 0.5	< 0.5	0.5-1.5	0.8
E.Coli	MPN/100mL	**64**	CFU/100ml	**TNTC**	**700**	**0**	**0**
Total Coliform	MPN/100mL	**1100**	CFU/100ml	**TNTC**	**TNTC**	**0 in 95% Samples**	
General Bacteria	MPN/mL	**200**					**100MPN/mL**
Selenium (Se)	mg/L	<0.001					0.01
Anionic Surfactant	mg/L	<0.02					0.2
Total Organic Carbon (TOC)	mg/L	0.7	mg/L	<0.02	0.23		3
Magnesium			mg/L	5.24	5		
Phosphate			mg/l	< 0.05	0.06		
Sodium (Na)			mg/L	2.68	3.18		200

(2) 雨季の水質分析結果

- 採水地点： 既存の取水地点 4 箇所
- 分析回数： 現地 1 回、国内 1 回（第 1 次現地調査；5 月下旬）
  - 現地 2 回、国内 1 回（第 2 次現地調査；8 月中旬～下旬）
- 分析項目： ネパール水質基準項目を含む 30 項目
  - クリプトスポリジウム（国内再委託：1 回）

雨季の水質分析結果として、浄水施設の取水源である Mardi 川の水質分析結果を、**表 6-6-2** に示す。乾季同様、濁度と鉄がネパール基準よりやや高く、国内分析ではアルミニウムについてもネパール基準より高い結果であった。また、クリプトスポリジウムについては、検出されなかった。

なお、細菌類に関しては乾季雨季を問わず、Mardi 川を含む全ての水源で検出されたが、本プロジェクトにおいては、浄水施設及び配水施設に塩素注入設備を導入する計画であり、十分な滅菌処理が行えると考える。

表 6-6-2 水質分析結果（雨季）

水質分析項目	日本国内分析結果		ネパール分析結果			ネパール水質基準	日本水質基準
	単位	1回目 8月下旬採水（8月20日）	単位	1回目 8月下旬採水（8月20日）	2回目 8月下旬採水（8月27日）		
Color	度	2	TCU	ND(< 5)	ND(< 5)	5 (15)	5度以下
Turbidity	度	7	NTU	7.6	19	5 (10)	2度以下
Electrical Conductivity (EC)	μS/cm	123	μS/cm	118	143	1500	
pH	-	7.7	-	7.4	7.4	6.5-8.5	7.5程度
Total Dissolved Solid (TDS)	mg/L	82	mg/L	64	65	1000	
Taste	-	欠測				Non-Objctional	異常でないこと
Odor	-	異常なし	mg/L	Odourless	Odourless	Non-Objctional	異常でないこと
Iron (Fe)	mg/L	1	mg/L	0.91	2.62	0.3 (3)	0.3
Manganese (Mn)	mg/L	0.017	mg/L	ND(< 0.05)	ND(< 0.05)	0.2	0.05
Arsenic (As)	mg/L	0.001	mg/L	ND(< 0.005)	ND(< 0.005)	0.05	0.01
Cadmium (Cd)	mg/L	<0.0003	mg/L	ND(< 0.003)	ND(< 0.003)	0.003	0.003
Chromium (Cr)	mg/L	<0.005	mg/L	ND(< 0.02)	ND(< 0.02)	0.05	0.05
Cyanide (CN-)	mg/L	<0.02	mg/L	ND(< 0.05)	ND(< 0.05)	0.07	0.01
Lead (Pb)	mg/L	<0.001	mg/L	ND(< 0.01)	ND(< 0.01)	0.01	0.01
Ammmonia (NH3)	mg/L	<0.1	mg/L	0.12	0.11	1.5	
Chloride (Cl-)	mg/L	<1	mg/L	1	1	250	200
Sulphate (SO4--)	mg/L	4	mg/L	2.88	1.65	250	
Nitrate (NO3-)	mg/L	<1	mg/L	1.71	ND(< 0.2)	50	10
Copper (Cu)	mg/L	<0.1	mg/L	ND(< 0.02)	ND(< 0.02)	1	1
Total Hardness	mg/L	57	mg/L	62	60	500	300
Calcium (Ca)	mg/L	14	mg/L	16	17	200	
Zinc (Zn)	mg/L	<0.1	mg/L	ND(< 0.05)	ND(< 0.05)	3	1
Mercury (Hg)	mg/L	<0.0003	mg/L	ND(< 0.001)	ND(< 0.001)	0.001	0.0005
Aluminum (Al)	mg/L	0.88	mg/L	0.06	0.06	0.2	0.1
Fluoride (F+)	mg/L	<0.08	mg/L	ND(< 0.5)	ND(< 0.5)	0.5-1.5	0.8
E.Coli	MPN/100mL	50	CFU/100ml	94	TNTC	0	0
Total Coliform	MPN/100mL	800	CFU/100ml	TNTC	7100	0 in 95% Samples	
General Bacteria	MPN/mL	1600					100MPN/mL
Selenium (Se)	mg/L	<0.001					0.01
Anionic Surfactant	mg/L	<0.02					0.2
Total Organic Carbon (TOC)	mg/L	0.6	mg/L	0.46	1		3
Magnesium			mg/L	5	4		
Phosphate			mg/l	ND(< 0.05)	ND(< 0.05)		
Sodium (Na)			mg/L	1.11	1.68		200

(３) 雨季の濁度調査結果

1）測定方法

Mardi 川の濁度を 2015 年 7 月 17 日から 9 月 3 日まで、測定できなかった日を除き、36 日間測定した。測定は、概ね午前中に実施した。

測定箇所は、取水堰、φ500mm 導水管 Yamdi 川近く土砂吐き弁、Bindhabasini 配水池で行った。Bindhabasini 配水池は、取水堰から約 10 ㎞あり、堰で取水された水が、配水池に到達ための流下時間約 1.5 時間である。φ500mm 導水管 Yamdi 川近く土砂吐き弁は、取水堰から約 7.7 ㎞に位置する。

2) 測定結果

NTU 測定結果を要約すると、以下のとおりであった。

NTU 測定値	＞10	10－20	20－50	50－100	**100-200**	**200-500**	**＜500**
日数 (日)	13	5	8	4	**3**	**1**	**2**

現地での調査により、降雨、NTU について、以下のことが明らかになった。

① Mardi 川取水堰付近では、降雨の発生が夜間に多い。
② Mardi 川の流域は狭く、そこに集中的に降雨があった場合、高濁度が発生する。
③ 夜間から翌朝にかけ、頻繁に降雨があり、濁度は高く、それが降雨のおさまる翌朝まで継続していると推測される。
④ NTU 500 に達する高濁度があるが、降雨が継続しなければ、概ね、半日から 1 日で NTU 50 以下に下がる。
⑤ 降雨が、断続的に継続する場合は、NTU 200 程度が数日継続することもある。
⑥ 激しい降雨がなければ、雨季でも半分の日が概ね NTU 20 以下である。

2. 雨季における Bindhabasini 配水池の濁度調査結果

表 6-6-10　濁度調査結果

Date	Bindhabasini (NTU)	Yamdi-WashOut (NTU)	Intake (NTU)
2015/7/17	73.4/81.4/82.2	-	70.6/74.5/80.2
2015/7/18	-	-	-
2015/7/19	-	-	8.49/9.04/10.3
2015/7/20	9.14/9.75/11.3	-	7.77/8.42/9.20
2015/7/21	4.66/4.78/4.88	-	-
2015/7/22	5.11/6.15/7.06	-	-
2015/7/23	3.72/3.89/3.95	4.19/4.73/5.97	-
2015/7/24	-	-	-
2015/7/25	-	-	-
2015/7/26	21.6/22.6/24.7	15.7/19/19.8	16.2/16.7/22.0
2015/7/27	18.3/19.8/23.7	18.7/19.9/20.7	-
2015/7/28	57.6/61.2/68.2	33.9/34.4/44.3	17.8/19.1/19.7
2015/7/29	11.5/13.5/13.6	7.91/8.44/11.1	-
2015/7/30	AM:382/401/**419**	-	-
	PM:208/211/221	PM:162/189/193	-
2015/7/31	-	-	AM:142/153/154
2015/8/1	-	-	-
2015/8/2	AM:18.6/22.1/23.5	AM:22.1/27.1/29.3	-
2015/8/3	AM:16.3/16.7/17.0	AM:16.1/21.7/23.1	-
2015/8/4	AM:9.58/12.7/13.2	AM:8.18/8.78/9.37	-
2015/8/5	AM:5.57/6.04/6.62	AM:7.49/7.68/7.89	-
2015/8/6	-	AM:5.62/6.02/6.53	AM:**4.01**/4.76/5.15
2015/8/7	AM:4.67/4.96/5.46	AM:4.97/5.18/5.63	-
2015/8/8	-	-	-
2015/8/9	AM:2.50/3.89/3.99	AM:3.18/4.46/4.71	-
2015/8/10	AM:129/132/148	AM:153/163/172	AM:67.6/68.5/70.5
2015/8/11	AM:146/155/200	AM:156/163/188	-
2015/8/12	AM:27.1/29.4/33.8	-	-
2015/8/13	AM:42.8/46.2/51.7	-	-
2015/8/14	AM:7.64/8.00/8.87	AM:7.15/7.45/7.51	-
2015/8/15	-	-	-
2015/8/16	-	-	-

Date	Bindhabasini (NTU)	Yamdi-WashOut (NTU)	Intake (NTU)
2015/8/17	-	-	-
2015/8/18	AM:23.0/24.7/27.4	AM:18.4/19.6/20.2	AM:14.1/16.9/19.6
2015/8/19	AM:28.8/29.2/30.0	AM:24.8/27.3/28.2	-
2015/8/20	AM:8.69/9.30/9.38	AM:9.40/10.2/11.3	-
2015/8/21	AM:41.6/42.4/54.4	AM:32.3/33.2/33.3	-
2015/8/22	-	-	-
2015/8/23	-	-	-
2015/8/24	-	-	-
2015/8/25	AM:5.51/7.96/7.08	AM:4.90/5.17/4.54	-
2015/8/26	AM:66.5/71.4/58.6	AM:57.4/60.0/61.5	-
2015/8/27	AM:22.8/19.5/21.3	AM:25.5/22.2/17.9	-
2015/8/28	AM:10.9/8.32/9.04	AM:10.2/9.08/7.90	-
2015/8/29	-	-	-
2015/8/30	AM:26.5/27.2/30.4	AM:21.7/28.3/31.4	-
2015/8/31	AM:7.31/6.15/5.92	AM:4.90/4.46/5.20	-
2015/9/1	AM:15.8/13.8/11.3	AM:11.5/12.2/12.9	-
2015/9/2	AM:6.08/5.96/5.07	AM:6.52/5.73/5.08	

※本編の表 4-4-1 に記載している濁度基準値 4～419（NTU）というのは、表 6-6-10 の雨季における Bindhabasini 配水池の濁度調査結果より、赤字示す最低濁度 4.01≒4（NTU）～最高濁度 419（NTU）の値より設定している。

3. Baldhara Spring、Bhote 川、Kali 川の水質分析結果

（1） 乾季の水質分析結果（4 月 22,23 日採水）

表 6-6-3 水質分析結果（1）

水質分析項目	Baldhara Spring				Bhote 川				Kali 川				ネパール水質基準	日本水質基準
	日本国内分析		ネパール分析結果		日本国内分析		ネパール分析結果		日本国内分析		ネパール分析結果			
	単位	結果	単位	結果	単位	結果	単位	結果	単位	結果	単位	結果		
Color	度	<1	TCU	< 5	度	2	TCU	< 5	度	<1	TCU	< 5	5 (15)	5度以下
Turbidity	度	<1	NTU	1	度	<1	NTU	1	度	<1	NTU	1	5 (10)	2度以下
Electrical Conductivity (EC)	µS/cm	369	µS/cm	347	µS/cm	109	µS/cm	115	µS/cm	346	µS/cm	357	1500	
pH	-	7.6	-	8.1	-	7.7	-	7.8	-	8.2	-	8.3	6.5-8.5	7.5程度
Total Dissolved Solid (TDS)	mg/L	240	mg/L	181	mg/L	65	mg/L	56	mg/L	230	mg/L	168	1000	
Taste	-	欠測			-	欠測			-	欠測			Non-Objctional	異常でないこと
Odor	-	異常なし	mg/L	Odourless	-	微土臭	mg/L	Odourless	-	異常なし	mg/L	Odourless	Non-Objctional	異常でないこと
Iron (Fe)	mg/L	0.03	mg/L	0.2	mg/L	<0.03	mg/L	0.23	mg/L	<0.03	mg/L	0.29	0.3 (3)	0.3
Manganese (Mn)	mg/L	<0.005	mg/L	< 0.05	mg/L	<0.005	mg/L	< 0.05	mg/L	<0.005	mg/L	< 0.05	0.2	0.05
Arsenic (As)	mg/L	<0.001	mg/L	< 0.005	mg/L	<0.001	mg/L	< 0.005	mg/L	0.002	mg/L	< 0.005	0.05	0.01
Cadmium (Cd)	mg/L	<0.0003	mg/L	< 0.003	mg/L	<0.0003	mg/L	< 0.003	mg/L	<0.0003	mg/L	< 0.003	0.003	0.003
Chromium (Cr)	mg/L	<0.005	mg/L	< 0.02	mg/L	<0.005	mg/L	< 0.02	mg/L	<0.005	mg/L	< 0.02	0.05	0.05
Cyanide (CN-)	mg/L	<0.02	mg/L	<0.05	mg/L	<0.02	mg/L	<0.05	mg/L	<0.02	mg/L	<0.05	0.07	0.01
Lead (Pb)	mg/L	<0.001	mg/L	< 0.01	mg/L	<0.001	mg/L	< 0.01	mg/L	<0.001	mg/L	< 0.01	0.01	0.01
Ammmonia (NH3)	mg/L	<0.1	mg/L	0	mg/L	<0.1	mg/L	0.03	mg/L	<0.1	mg/L	0.26	1.5	
Chloride (Cl-)	mg/L	2	mg/L	3	mg/L	<1	mg/L	1	mg/L	<1	mg/L	1	250	200
Sulphate (SO4--)	mg/L	1	mg/L	0.82	mg/L	1	mg/L	0.62	mg/L	29	mg/L	0.82	250	
Nitrate (NO3-)	mg/L	2	mg/L	2.423	mg/L	<1	mg/L	0.411	mg/L	<1	mg/L	0.899	50	10
Copper (Cu)	mg/L	<0.1	mg/L	< 0.02	mg/L	<0.1	mg/L	< 0.02	mg/L	<0.1	mg/L	< 0.02	1	1
Total Hardness	mg/L	200	mg/L	118	mg/L	44	mg/L	51	mg/L	180	mg/L	176	500	300
Calcium (Ca)	mg/L	76			mg/L	14			mg/L	37			200	
Zinc (Zn)	mg/L	<0.1	mg/L	< 0.05	mg/L	<0.1	mg/L	< 0.05	mg/L	<0.1	mg/L	< 0.05	3	1
Mercury (Hg)	mg/L	<0.0003	mg/L	< 0.001	mg/L	<0.0003	mg/L	< 0.001	mg/L	<0.0003	mg/L	< 0.001	0.001	0.0005
Aluminum (Al)	mg/L	0.03	mg/L	< 0.05	mg/L	<0.02	mg/L	< 0.05	mg/L	<0.02	mg/L	< 0.05	0.2	0.1
Fluoride (F+)	mg/L	<0.08	mg/L	< 0.5	mg/L	<0.08	mg/L	< 0.5	mg/L	<0.08	mg/L	< 0.5	0.5-1.5	0.8
E.Coli	MPN/100mL	5	CFU/100ml	22	MPN/100mL	28	CFU/100ml	86	MPN/100mL	18	CFU/100ml	26	0 in 95% Samples	
Total Coliform	MPN/100mL	24000	CFU/100ml	331	MPN/100mL	2100	CFU/100ml	2447	MPN/100mL	1000	CFU/100ml	1800	0	0
General Bacteria	MPN/mL	1500			MPN/mL	980			MPN/mL	71				100MPN/mL
Selenium (Se)	mg/L	<0.001			mg/L	<0.001			mg/L	<0.001				0.01
Anionic Surfactant	mg/L	<0.02			mg/L	<0.02			mg/L	<0.02				0.2
Total Organic Carbon (TOC)	mg/L	<0.3	mg/L	<0.02	mg/L	0.7	mg/L	<0.02	mg/L	0.3	mg/L	<0.02		3
Magnesium			mg/L	2.99			mg/L	2.38			mg/L	20.48		
Phosphate			mg/l	< 0.05			mg/l	< 0.05			mg/l	< 0.05		
Sodium (Na)			mg/L	3.14			mg/L	3.76			mg/L	3.14		200

（2） 乾季の水質分析結果（5 月 10,11 日採水）

表 6-6-4 水質分析結果（2）

水質分析項目	Baldhara Spring				Bhote 川				Kali 川				ネパール水質基準	日本水質基準
	日本国内分析		ネパール分析結果		日本国内分析		ネパール分析結果		日本国内分析		ネパール分析結果			
	単位	結果	単位	結果	単位	結果	単位	結果	単位	結果	単位	結果		
Color	度		TCU	< 5	度		TCU	< 5	度		TCU	< 5	5 (15)	5度以下
Turbidity	度		NTU	1	度		NTU	1	度		NTU	1	5 (10)	2度以下
Electrical Conductivity (EC)	µS/cm		µS/cm	378	µS/cm		µS/cm	104	µS/cm		µS/cm	330	1500	
pH	-		-	7.4	-		-	7.8	-		-	7.9	6.5-8.5	7.5程度
Total Dissolved Solid (TDS)	mg/L		mg/L	175	mg/L		mg/L	54	mg/L		mg/L	183	1000	
Taste	-				-				-				Non-Objctional	異常でないこと
Odor	-		mg/L	Odourless	-		mg/L	Odourless	-		mg/L	Odourless	Non-Objctional	異常でないこと
Iron (Fe)	mg/L		mg/L	0.4	mg/L		mg/L	0.2	mg/L		mg/L	0.07	0.3 (3)	0.3
Manganese (Mn)	mg/L		mg/L	< 0.05	mg/L		mg/L	< 0.05	mg/L		mg/L	< 0.05	0.2	0.05
Arsenic (As)	mg/L		mg/L	< 0.005	mg/L		mg/L	< 0.005	mg/L		mg/L	< 0.005	0.05	0.01
Cadmium (Cd)	mg/L		mg/L	< 0.003	mg/L		mg/L	< 0.003	mg/L		mg/L	< 0.003	0.003	0.003
Chromium (Cr)	mg/L		mg/L	< 0.02	mg/L		mg/L	< 0.02	mg/L		mg/L	< 0.02	0.05	0.05
Cyanide (CN-)	mg/L		mg/L	<0.05	mg/L		mg/L	<0.05	mg/L		mg/L	<0.05	0.07	0.01
Lead (Pb)	mg/L		mg/L	< 0.01	mg/L		mg/L	< 0.01	mg/L		mg/L	< 0.01	0.01	0.01
Ammmonia (NH3)	mg/L		mg/L	0.06	mg/L		mg/L	< 0.05	mg/L		mg/L	0.24	1.5	
Chloride (Cl-)	mg/L		mg/L	12	mg/L		mg/L	1	mg/L		mg/L	1	250	200
Sulphate (SO4--)	mg/L		mg/L	1	mg/L		mg/L	1.2	mg/L		mg/L	1.8	250	
Nitrate (NO3-)	mg/L		mg/L	3.71	mg/L		mg/L	0.32	mg/L		mg/L	0.37	50	10
Copper (Cu)	mg/L		mg/L	< 0.02	mg/L		mg/L	< 0.02	mg/L		mg/L	< 0.02	1	1
Total Hardness	mg/L		mg/L	142	mg/L		mg/L	50	mg/L		mg/L	170	500	300
Calcium (Ca)	mg/L				mg/L				mg/L				200	
Zinc (Zn)	mg/L		mg/L	< 0.05	mg/L		mg/L	< 0.05	mg/L		mg/L	< 0.05	3	1
Mercury (Hg)	mg/L		mg/L	< 0.001	mg/L		mg/L	< 0.001	mg/L		mg/L	< 0.001	0.001	0.0005
Aluminum (Al)	mg/L		mg/L	< 0.05	mg/L		mg/L	< 0.05	mg/L		mg/L	< 0.05	0.2	0.1
Fluoride (F+)	mg/L		mg/L	< 0.5	mg/L		mg/L	< 0.5	mg/L		mg/L	< 0.5	0.5-1.5	0.8
E.Coli	MPN/100mL		CFU/100ml	12	MPN/100mL		CFU/100ml	86	MPN/100mL		CFU/100ml	49	0 in 95% Samples	
Total Coliform	MPN/100mL		CFU/100ml	133	MPN/100mL		CFU/100ml	TNTC	MPN/100mL		CFU/100ml	TNTC	0	0
General Bacteria	MPN/mL				MPN/mL				MPN/mL					100MPN/mL
Selenium (Se)	mg/L				mg/L				mg/L					0.01
Anionic Surfactant	mg/L				mg/L				mg/L					0.2
Total Organic Carbon (TOC)	mg/L		mg/L	0.46	mg/L		mg/L	0.23	mg/L		mg/L	0.35		3
Magnesium			mg/L	15			mg/L	1			mg/L	26		
Phosphate			mg/l	< 0.05			mg/l	< 0.05			mg/l	< 0.05		
Sodium (Na)			mg/L	3.33			mg/L	3.92			mg/L	3.54		200

（3） 雨季の水質分析結果（8 月 20,21 日採水）

表 6-6-5　水質分析結果（3）

水質分析項目	Baldhara Spring				Bhote 川				Kali 川				ネパール水質基準	日本水質基準
	日本国内分析		ネパール分析結果		日本国内分析		ネパール分析結果		日本国内分析		ネパール分析結果			
	単位	結果	単位	結果	単位	結果	単位	結果	単位	結果	単位	結果		
Color	度	<1	TCU	ND(< 5)	度	2	TCU	ND(< 5)	度	<1	TCU	ND(< 5)	5 (15)	5度以下
Turbidity	度	<1	NTU	1	度	3	NTU	**10.4**	度	2	NTU	**8**	5 (10)	2度以下
Electrical Conductivity (EC)	µS/cm	365	µS/cm	337	µS/cm	51	µS/cm	61	µS/cm	270	µS/cm	245	1500	
pH	-	7.5	-	7.3	-	7.4	-	7.4	-	8.2	-	7.9	6.5-8.5	7.5程度
Total Dissolved Solid (TDS)	mg/L	230	mg/L	206	mg/L	79	mg/L	32	mg/L	170	mg/L	135	1000	
Taste	-	欠測			-	欠測			-	欠測			Non-Objctional	異常でないこと
Odor	-	異常なし	mg/L	Odourless	-	異常なし	mg/L	Odourless	-	異常なし	mg/L	Odourless	Non-Objctional	異常でないこと
Iron (Fe)	mg/L	<0.03	mg/L	0.19	mg/L	0.2	mg/L	0.19	mg/L	**0.3**	mg/L	**0.32**	0.3 (3)	0.3
Manganese (Mn)	mg/L	<0.005	mg/L	ND(< 0.05)	mg/L	0.005	mg/L	ND(< 0.05)	mg/L	0.01	mg/L	ND(< 0.05)	0.2	0.05
Arsenic (As)	mg/L	<0.001	mg/L	< 0.005	mg/L	<0.001	mg/L	ND(< 0.005)	mg/L	0.001	mg/L	ND(< 0.005)	0.05	0.01
Cadmium (Cd)	mg/L	<0.0003	mg/L	ND(< 0.003)	mg/L	<0.0003	mg/L	ND(< 0.003)	mg/L	<0.0003	mg/L	ND(< 0.003)	0.003	0.003
Chromium (Cr)	mg/L	<0.005	mg/L	ND(< 0.02)	mg/L	<0.005	mg/L	ND(< 0.02)	mg/L	<0.005	mg/L	ND(< 0.02)	0.05	0.05
Cyanide (CN-)	mg/L	<0.02	mg/L	ND(< 0.05)	mg/L	<0.02	mg/L	ND(< 0.05)	mg/L	<0.02	mg/L	ND(< 0.05)	0.07	0.01
Lead (Pb)	mg/L	<0.001	mg/L	ND(< 0.01)	mg/L	<0.001	mg/L	ND(< 0.01)	mg/L	<0.001	mg/L	ND(< 0.01)	0.01	0.01
Ammmonia (NH3)	mg/L	<0.1	mg/L	0.03	mg/L	<0.1	mg/L	0.06	mg/L	<0.1	mg/L	0.19	1.5	
Chloride (Cl-)	mg/L	1	mg/L	1	mg/L	<1	mg/L	1	mg/L	<1	mg/L	1	250	200
Sulphate (SO4--)	mg/L	<1	mg/L	0.82	mg/L	<1	mg/L	1.23	mg/L	11	mg/L	1.65	250	
Nitrate (NO3-)	mg/L	2	mg/L	4.59	mg/L	<1	mg/L	ND(< 0.2)	mg/L	<1	mg/L	0.7	50	10
Copper (Cu)	mg/L	<0.1	mg/L	< 0.02	mg/L	<0.1	mg/L	ND(< 0.02)	mg/L	<0.1	mg/L	ND(< 0.02)	1	1
Total Hardness	mg/L	190	mg/L	200	mg/L	18	mg/L	30	mg/L	140	mg/L	130	500	300
Calcium (Ca)	mg/L	73	mg/L	64	mg/L	6	mg/L	10	mg/L	30	mg/L	29	200	
Zinc (Zn)	mg/L	<0.1	mg/L	ND(< 0.05)	mg/L	<0.1	mg/L	ND(< 0.05)	mg/L	<0.1	mg/L	ND(< 0.05)	3	1
Mercury (Hg)	mg/L	<0.0003	mg/L	< 0.00	mg/L	<0.0003	mg/L	ND(< 0.001)	mg/L	<0.0003	mg/L	ND(< 0.001)	0.001	0.0005
Aluminum (Al)	mg/L	<0.02	mg/L	0.06	mg/L	**0.16**	mg/L	0.06	mg/L	**0.18**	mg/L	0.05	0.2	0.1
Fluoride (F+)	mg/L	<0.08	mg/L	ND(< 0.5)	mg/L	<0.08	mg/L	ND(< 0.5)	mg/L	<0.08	mg/L	ND(< 0.5)	0.5-1.5	0.8
Total Coliform	MPN/100mL	**160**	CFU/100ml	**145**	MPN/100mL	**380**	CFU/100ml	**563**	MPN/100mL	**540**	CFU/100ml	**525**	0 in 95% Samples	
E.Coli	MPN/100mL	**170**	CFU/100ml	**14**	MPN/100mL	**15**	CFU/100ml	**129**	MPN/100mL	**24**	CFU/100ml	**49**	0	0
General Bacteria	MPN/mL	**390**			MPN/mL	**100**			MPN/mL	**150**				100MPN/mL
Selenium (Se)	mg/L	<0.001			mg/L	<0.001			mg/L	<0.001				0.01
Anionic Surfactant	mg/L	<0.02			mg/L	<0.02			mg/L	<0.02				0.2
Total Organic Carbon (TOC)	mg/L	<0.3	mg/L	0.23	mg/L	0.8	mg/L	0.23	mg/L	0.5	mg/L	0.23		3
Magnesium			mg/L	10			mg/L	ND(< 2)			mg/L	14		
Phosphate			mg/l	ND(< 0.05)			mg/l	ND(< 0.05)			mg/l	ND(< 0.05)		
Sodium (Na)			mg/L	1.23			mg/L	1.17			mg/L	1.01		200

（4） 雨季の水質分析結果（8 月 27,28 採水）

表 6-6-6　水質分析結果（4）

水質分析項目	Baldhara Spring				Bhote 川				Kali 川				ネパール水質基準	日本水質基準
	日本国内分析		ネパール分析結果		日本国内分析		ネパール分析結果		日本国内分析		ネパール分析結果			
	単位	結果	単位	結果	単位	結果	単位	結果	単位	結果	単位	結果		
Color	度		TCU	ND(< 5)	度		TCU	ND(< 5)	度		TCU	ND(< 5)	5 (15)	5度以下
Turbidity	度		NTU	1	度		NTU	2.5	度		NTU	3.2	5 (10)	2度以下
Electrical Conductivity (EC)	µS/cm		µS/cm	347	µS/cm		µS/cm	50	µS/cm		µS/cm	241	1500	
pH	-		-	7.2	-		-	7.4	-		-	8.1	6.5-8.5	7.5程度
Total Dissolved Solid (TDS)	mg/L		mg/L	175	mg/L		mg/L	25	mg/L		mg/L	144	1000	
Taste	-				-				-				Non-Objctional	異常でないこと
Odor	-		mg/L	Odourless	-		mg/L	Odourless	-		mg/L	Odourless	Non-Objctional	異常でないこと
Iron (Fe)	mg/L		mg/L	0.16	mg/L		mg/L	0.17	mg/L		mg/L	0.19	0.3 (3)	0.3
Manganese (Mn)	mg/L		mg/L	ND(< 0.05)	mg/L		mg/L	ND(< 0.05)	mg/L		mg/L	ND(< 0.05)	0.2	0.05
Arsenic (As)	mg/L		mg/L	ND(< 0.005)	mg/L		mg/L	ND(< 0.005)	mg/L		mg/L	ND(< 0.005)	0.05	0.01
Cadmium (Cd)	mg/L		mg/L	ND(< 0.003)	mg/L		mg/L	ND(< 0.003)	mg/L		mg/L	ND(< 0.003)	0.003	0.003
Chromium (Cr)	mg/L		mg/L	ND(< 0.02)	mg/L		mg/L	ND(< 0.02)	mg/L		mg/L	ND(< 0.02)	0.05	0.05
Cyanide (CN-)	mg/L		mg/L	ND(< 0.05)	mg/L		mg/L	ND(< 0.05)	mg/L		mg/L	ND(< 0.05)	0.07	0.01
Lead (Pb)	mg/L		mg/L	ND(< 0.01)	mg/L		mg/L	ND(< 0.01)	mg/L		mg/L	ND(< 0.01)	0.01	0.01
Ammmonia (NH3)	mg/L		mg/L	0	mg/L		mg/L	0.06	mg/L		mg/L	0.16	1.5	
Chloride (Cl-)	mg/L		mg/L	3	mg/L		mg/L	1	mg/L		mg/L	1	250	200
Sulphate (SO4--)	mg/L		mg/L	1.85	mg/L		mg/L	0.62	mg/L		mg/L	1.23	250	
Nitrate (NO3-)	mg/L		mg/L	0.9	mg/L		mg/L	ND(< 0.2)	mg/L		mg/L	0.36	50	10
Copper (Cu)	mg/L		mg/L	ND(< 0.02)	mg/L		mg/L	ND(< 0.02)	mg/L		mg/L	ND(< 0.02)	1	1
Total Hardness	mg/L		mg/L	160	mg/L		mg/L	22	mg/L		mg/L	140	500	300
Calcium (Ca)	mg/L		mg/L	26	mg/L		mg/L	8	mg/L		mg/L	8.8	200	
Zinc (Zn)	mg/L		mg/L	NDD< 0.05)	mg/L		mg/L	ND(< 0.05)	mg/L		mg/L	ND(< 0.05)	3	1
Mercury (Hg)	mg/L		mg/L	ND(< 0.001)	mg/L		mg/L	ND(< 0.001)	mg/L		mg/L	ND(< 0.001)	0.001	0.0005
Aluminum (Al)	mg/L		mg/L	0.05	mg/L		mg/L	0.06	mg/L		mg/L	0.05	0.2	0.1
Fluoride (F+)	mg/L		mg/L	ND(< 0.5)	mg/L		mg/L	ND(< 0.5)	mg/L		mg/L	ND(< 0.5)	0.5-1.5	0.8
Total Coliform	MPN/100mL		CFU/100ml	**24**	MPN/100mL		CFU/100ml	**TNTC**	MPN/100mL		CFU/100ml	**TNTC**	0 in 95% Samples	
E.Coli	MPN/100mL		CFU/100ml	**0**	MPN/100mL		CFU/100ml	**TNTC**	MPN/100mL		CFU/100ml	**135**	0	0
General Bacteria	MPN/mL				MPN/mL				MPN/mL					100MPN/mL
Selenium (Se)	mg/L				mg/L				mg/L					0.01
Anionic Surfactant	mg/L				mg/L				mg/L					0.2
Total Organic Carbon (TOC)	mg/L		mg/L	0.58	mg/L		mg/L	0.92	mg/L		mg/L	0.69		3
Magnesium			mg/L	23			mg/L	ND(< 2)			mg/L	29		
Phosphate			mg/l	ND(< 0.05)			mg/l	ND(< 0.05)			mg/l	ND(< 0.05)		
Sodium (Na)			mg/L	1.48			mg/L	1.26			mg/L	1.18		200

4. 一般家庭及びホテル・レストランの蛇口の水質分析

表 6-6-7 蛇口の水質分析結果（1）

JW= jar water TW= ube well HH= household H/R= hotel/restaurant

番号	日付	GPS情報	測定場所	地区番号	水源	ユーザー情報	Parameters			
							濁度 (NTU)	残留塩素 (mg/L)	大腸菌群 (CFU/100mL)	大腸菌 (CFU/100mL)
	ネパール国飲料水水質基準						5(10)	0.1-0.2	0	0
1	27th May 2015	28° 13'09"N/83° 58'34"E	Samishkya marg	5	NWSC	HH	2	ND(< 0.1)	4700	67
2		28° 13'16"N/83° 56'30"E	Male, Patan	5	NWSC	HH	2	ND(< 0.1)	4200	45
3		28° 13'09"N/83° 58'34"E	Male, Patan	5	NWSC	HH	1	ND(< 0.1)	680	60
4		28° 13'7"N/83° 58'34"E	Samishkya marg	5	NWSC	HH	1	ND(< 0.1)	500	42
5		28° 13'1"N/83° 57'35"E	Khare	6	NWSC	HH	2	ND(< 0.1)	492	51
6		28° 12'57"N/83° 57'36"E	Khare	6	NWSC	HH	20	ND(< 0.1)	TNTC	45
7		28° 13'1"N/83° 57'36"E	Khare	6	NWSC	HH	2	ND(< 0.1)	1471	124
8		28° 13'6"N/83° 57'34"E	Badam	6	NWSC	HH	2	ND(< 0.1)	253	127
9	28th May 2015	28° 15'18"N/83° 58'05"E	Amar Dip	16	NWSC	HH	2	ND(< 0.1)	520	72
10		28° 15'32"N/83° 58'34"E	Ghati patan	16	NWSC	HH	6	ND(< 0.1)	TNTC	200
11		28° 15'19"N/83° 58'43"E	Amar Dip	16	NWSC	HH	4	ND(< 0.1)	700	170
12		28° 15'15"N/83° 58'58"E	Amar Dip	16	NWSC	HH	3	ND(< 0.1)	800	120
13		28° 11'18"N/83° 58'32"E	Shanti Path	17	NWSC	HH	46	ND(< 0.1)	2600	2500
14		28° 11'26"N/83° 58'16"E	Shanti Path	17	NWSC	HH	5	ND(< 0.1)	4600	110
15		28° 11'25"N/83° 58'14"E	Shanti Path	17	NWSC	HH	7	ND(< 0.1)	3000	322
16		28° 11'55"N/83° 58'10"E	Dam Side	17	NWSC	HH	18	ND(< 0.1)	TNTC	78
17		28° 11'19"N/83° 58'32"E	Gairi Kulo	17	NWSC	HH	16	ND(< 0.1)	TNTC	165
18		28° 15'56"N/83° 58'02"E	Khatri Tahar	19	NWSC	HH	9	ND(< 0.1)	TNTC	70
19		28° 15'55"N/83° 58'10"E	Lamachaur	19	NWSC	HH	10	ND(< 0.1)	TNTC	44
20		28° 15'49"N/83° 58'12"E	Lamachaur	19	NWSC	HH	14	ND(< 0.1)	TNTC	60
21		28° 15'52"N/83° 58'09"E	Khatri tole	19	NWSC	HH	82	ND(< 0.1)	2600	46
22	29th May 2015	28° 14'36"N/83° 59'12"E	Bhim Bazar	1	NWSC	HH	6	ND(< 0.1)	8000	30
23		28° 14,'35"N/83° 59'12"E	Bhim Bazar	1	NWSC	HH	9	ND(< 0.1)	7800	87
24		28° 14'31"N/83° 59'13"E	Bhim kali, Patan bagar	1	NWSC	HH	4	ND(< 0.1)	6900	185
25		28° 14'36"N/83° 59'10"E	Lampatan marg, Gaighat chowk	1	NWSC	HH	15	ND(< 0.1)	TNTC	224
26		28° 14'31"N/83° 59'12"E	Bhim bazar	1	NWSC	HH	2	ND(< 0.1)	181	20
27		28° 13'52"N/83° 59'06"E	Bhimsen tole	2	NWSC	HH	5	ND(< 0.1)	TNTC	200
28		28° 13'49"N/83° 59'03"E	Nala mukha	2	NWSC	HH	5	ND(< 0.1)	TNTC	231
29		28° 13'53"N/83° 59'07"E	Bhimsen tole	2	NWSC	HH	5	ND(< 0.1)	TNTC	167
30		28° 13'52"N/83° 59'06"E	Bhimsen tole	2	NWSC	HH	5	ND(< 0.1)	TNTC	139
31		28° 14'06"N/83° 59'20"E	Hamal tole	3	NWSC	HH	5	ND(< 0.1)	TNTC	400
32		28° 14'05"N/83° 59'20"E	Hamal tole	3	NWSC	HH	21	ND(< 0.1)	TNTC	112
33		28° 14'05"N/83° 59'20"E	Hamal tole	3	NWSC	HH	17	ND(< 0.1)	1600	400
34		28° 14'05"N/83° 59'19"E	Nadi pur	3	NWSC	HH	23	ND(< 0.1)	702	160
35	31st May 2015	28° 13'47"N/83° 59'02"E	Nala mukha	4	NWSC	HH	2	ND(< 0.1)	TNTC	100
36		28° 13'47"N/83° 59'03"E	Chhbis Kuriya	4	NWSC	HH	1	ND(< 0.1)	2720	94
37		28° 13'48"N/83° 59'02"E	Chhbis Kuriya	4	NWSC	HH	2	ND(< 0.1)	TNTC	180
38		28° 13'39"N/83° 59'01"E	Koirala Birthamarg	4	NWSC	HH	1	ND(< 0.1)	7800	169
39		28° 12'53"N/83° 58'17"E	Shantinagar	7	NWSC	HH	5	ND(< 0.1)	TNTC	33
40		28° 12'54"N/83° 58'16"E	Jagriti marg	7	NWSC	HH	2	ND(< 0.1)	429	22
41		28° 12'55"N/83° 58'15"E	Jagriti marg	7	NWSC	HH	3	ND(< 0.1)	2500	241
42		28° 13'10"N/83° 59'08"E	Shangam	8	NWSC	HH	2	ND(< 0.1)	1500	51
43		28° 13'12"N/83° 59'30"E	Shivalaya	9	NWSC	HH	4	ND(< 0.1)	7100	135
44		28° 13'12"N/83° 59'30"E	Shivalaya	9	NWSC	HH	2	ND(< 0.1)	4900	59
45		28° 13'13"N/83° 59'31"E	Shivalaya	9	NWSC	HH	1	ND(< 0.1)	376	143
46		28° 13'10"N/83° 59'30"E	Shivalaya	9	NWSC	HH	4	ND(< 0.1)	312	61
47	1st June 2015	28° 12'08"N/83° 58'24"E	Rastrya bank chowk	7	NWSC	HH	10	ND(< 0.1)	TNTC	131
48		28° 12'41"N/83° 58'37"E	Prativa marg	8	NWSC	HH	1	ND(< 0.1)	253	41
49		28° 12'11"N/84° 00.08"E	Shuvaraj marg	10	NWSC	HH	2	ND(< 0.1)	298	67
50		28° 13'22"N/83° 59'34"E	Rani pauwa	11	NWSC	HH	1	ND(< 0.1)	18	2
51		28° 13'20"N/83° 59'36"E	Tulsi marga	11	NWSC	HH	1	ND(< 0.1)	1400	43
52		28° 13'15"N/83°59'40"E	Rani pauwa	11	NWSC	HH	2	ND(< 0.1)	2600	125
53		28° 13'15"N/83°59'40"E	Rani pauwa	11	NWSC	HH	3	ND(< 0.1)	TNTC	82
54		28° 11'35"N/84° 01'25"E	Prithivi raj marga	14	NWSC	HH	28	ND(< 0.1)	41	8
55		28° 11'32"N/84° 01'24"E	Chautha chowk	14	NWSC	HH	34	ND(< 0.1)	6000	47
56	2nd June 2015	28° 13'01"N/83° 57'30"E	Khare	6	TW	H/R	3	ND(< 0.1)	2629	8
57		28° 12'53"N/83° 57'30"E	Halan Chowk	6	JW	H/R	1	ND(< 0.1)	4400	6
58		28° 12'53"N/83° 57'30"E	Halan Chowk	6	JW	H/R	1	ND(< 0.1)	310	2
59		28° 12'27"N/83° 57'31"E	Barahi path	6	TW	H/R	1	ND(< 0.1)	420	33
60		28° 12'47"N/83° 57'27"E	Lakeside	6	JW	H/R	1	ND(< 0.1)	7800	100
61		28° 12'32"N/83° 57'26"E	Baidam	6	TW	H/R	1	ND(< 0.1)	506	100
62		28° 12'53"N/83° 57'41"E	Dehiko patan	6	JW	H/R	1	ND(< 0.1)	1457	12
63		28° 12'56"N/83° 57'35"E	Baidam	6	TW	H/R	3	ND(< 0.1)	TNTC	200
64		28° 12'59"N/83° 57'31"E	Pahari marg	6	TW	H/R	2	ND(< 0.1)	133	8
65		28° 12'52"N/83° 57'40"E	Dihiko patan	6	TW	H/R	8	ND(< 0.1)	6300	33
66		28° 12'46"N/83° 57'32"E	Lake side	6	TW	H/R	2	ND(< 0.1)	TNTC	22
67		28° 12'47"N/83° 57'27"E	Baidam	6	TW	H/R	1	ND(< 0.1)	124	35
68		28° 12'53"N/83° 57'38"E	Khara marg	6	TW	H/R	1	ND(< 0.1)	1400	24
69		28° 12'46"N/83° 57'33"E	Lake side	6	TW	H/R	1	ND(< 0.1)	382	237
70		25° 11'33"N/83° 58'27"E	RTO marg	17	TW	H/R	1	ND(< 0.1)	0	0
71		28° 11'49"N/83° 58'11"E	Dam side	17	TW	H/R	1	ND(< 0.1)	TNTC	33
72		28° 11'48"N/83° 58'11"E	Dam side	17	TW	H/R	1	ND(< 0.1)	324	33

表 6-6-8　蛇口の水質分析結果（2）

JW= jar water　TW= ube well　HH= household　H/R= hotel/restaurant

番号	日付	GPS情報	測定場所	地区番号	水源	ユーザー情報	Parameters			
							濁度 (NTU)	残留塩素 (mg/L)	大腸菌群 (CFU/100mL)	大腸菌 (CFU/100mL)
	ネパール国飲料水水質基準						5(10)	0.1-0.2	0	0
73	3rd June 2015	28° 13'00"N/84° 00'01"E	Machapuchhre tole	12	NWSC	HH	3	ND(< 0.1)	**157**	**12**
74		28° 13'03"N/84° 00'0"E	Machapuchhre tole	12	NWSC	HH	1	ND(< 0.1)	**1706**	**45**
75		28° 13'0"N/84° 00'01"E	Machapuchhre tole	12	NWSC	HH	2	ND(< 0.1)	**2029**	**22**
76		28° 12'59"N/84° 00'00"E	Machapuchhre tole	12	NWSC	HH	**8**	ND(< 0.1)	**TNTC**	**29**
77		28° 12'25"N/84° 00'53"E	Indreni marg	13	NWSC	HH	**83**	ND(< 0.1)	**1900**	**100**
78		28° 12'24"N/84° 00'55"E	B.P marg	13	NWSC	HH	**10**	ND(< 0.1)	**TNTC**	**131**
79		28° 12'24"N/84° 00'55"E	B.P marg	13	NWSC	HH	**5**	ND(< 0.1)	**273**	**8**
80		28° 12'24"N/84° 00'54"E	B.P marg	13	NWSC	HH	3	ND(< 0.1)	**16**	**10**
81		28° 11'37"N/84° 00'17"E	Hawali marg	18	NWSC	HH	**29**	ND(< 0.1)	**822**	**39**
82		28° 11'35"N/84° 00'15"E	Hawali marg	18	NWSC	HH	**85**	ND(< 0.1)	**TNTC**	**700**
83		28° 11'35"N/84° 00'15"E	Hawali marg	18	NWSC	HH	**188**	ND(< 0.1)	**TNTC**	**700**
84		28° 11'36"N/84° 00'15"E	Hawali marg	18	NWSC	HH	3	ND(< 0.1)	**8000**	**37**
85	4th June 2015	28° 11'15"N/83° 59'40"E	Gauri marga	10	NWSC	HH	2	ND(< 0.1)	**261**	**45**
86		28° 11'12"N/84° 00'00"E	kalika tole	15	NWSC	HH	**6**	ND(< 0.1)	**118**	**4**
87		28° 11'56"N/83° 59'57"E	Laxmi tole	15	NWSC	HH	**32**	ND(< 0.1)	**TNTC**	**1400**
88		28° 12'30"N/84° 59'50"E	Ram bazar	15	NWSC	HH	2	ND(< 0.1)	**TNTC**	**196**
89		28° 12'01"N/84° 59'57"E	Ram bazar	15	NWSC	HH	**101**	ND(< 0.1)	**TNTC**	**1000**
90		28° 11'56"N/83° 59'51"E	Laxmi marg	15	NWSC	HH	**5**	ND(< 0.1)	**TNTC**	**225**
91		28° 13'16"N/83° 57'22"E	Bangaladi	6	spring	H/R	2	ND(< 0.1)	**TNTC**	**39**
92		28° 12'49"N/83° 57'34"E	Dhiko Patan	6	TW	H/R	1	ND(< 0.1)	**1975**	**27**
93		28° 12'45"N/83° 57'46"E	Dhiko Patan	6	TW	H/R	1	ND(< 0.1)	**10**	0
94		28° 12'43"N/83° 58'38"E	Prativa marg	8	NWSC	HH	1	ND(< 0.1)	**6**	**2**
95		28° 12'36"N/83° 58'36"E	Prativa marg	8	NWSC	HH	**20**	ND(< 0.1)	**TNTC**	**114**
96		28° 12'37"N/83° 58'36"E	Prativa marg	8	NWSC	HH	**6**	ND(< 0.1)	**6700**	**41**
97		28° 12'23"N/83° 59'49"E	Rakshya marg	10	NWSC	HH	3	ND(< 0.1)	**2082**	**31**
98		28° 12'24"N/83° 59'49"E	Rakshya marg	10	NWSC	HH	2	ND(< 0.1)	**2482**	**25**
99		28° 11'34"N/84° 01'24"E	Chautha	14	NWSC	HH	1	ND(< 0.1)	**8**	**6**
100		28° 11'36"N/84° 01'23"E	Chautha	14	NWSC	HH	1	ND(< 0.1)	**TNTC**	**412**

※JW：水瓶、TW：掘り抜き井戸、HH：一般家庭、H/R：ホテル及びレストラン

5. クリプトスポリジウム分析

表 6-6-9 クリプトスポリジウムの分析結果

平成２７年　９月１０日
検体番号 D59-8003～8006

分 析 試 験 結 果 書

東京都八王子市下恩方町３２３－１
株式会社環境管理センター　　様

一般財団法人千葉県薬剤師会検査センター
〒260-0024 千葉市中央区中央港１丁目12番11号
試験責任者　粕谷智浩
水道法第２０条登録検査機関（登録番号第１６号）
計量証明事業登録機関　（千葉県知事第５０７号）

平成２７年　９月　１日　受付した検体について分析試験の結果は、次のとおりです。

１．試料名　　Mardi Khola, Baldhara Spring, Bhote Khola, Kali Khola

２．採取日　　平成－年－月－日

３．採取者　　－

４．分析の項目及び方法

分析項目	分析方法
クリプトスポリジウム	平成19年3月30日 健水発第0330006号（最終改正平成26年3月31日） 別添3「水道に関するｸﾘﾌﾟﾄｽﾎﾟﾘｼﾞｳﾑ等の検出のための試験方法」

５．分析の結果

試料名 ＼ 分析項目（単位）	ｸﾘﾌﾟﾄｽﾎﾟﾘｼﾞｳﾑ（推定値）※1	ｸﾘﾌﾟﾄｽﾎﾟﾘｼﾞｳﾑ（確定値）※2
	個/10L	個/10L
Mardi Khola	0	0
Baldhara Spring	0	0
Bhote Khola	0	0
Kali Khola	0	0

※1 推定値とは、クリプトスポリジウムオーシスト様の蛍光抗体染色陽性の粒子数です。
※2 確定値とは、クリプトスポリジウムオーシスト数であり、推定値のなかで確定（同定）できた個数です。

６．備考　　AH-003

試料採取後24時間以後に試験を実施しました。　　－以下余白－

資料6-7 地質調査結果
（1）沈砂・沈殿池、浄水場用地、配水池用地

Draft Report on

Soil Survey Part I for the Preparatory Survey on

Pokhara Water Supply Improvement Project in Nepal

Prepared For:

NJS Consultants Co., Ltd.
Tokyo, Japan

Submitted By:

Soil Investigation & Solution Pvt. Ltd.
Thapathali, Kathmandu, Nepal

November , 2015

Acknowledgement

Soil investigation & Solution Pvt. Ltd., Thapathali, Kathmandu is grateful to, NJS Consultants Co., Ltd. Tokyo, Japan for entrusting the job "Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal".

We thank all staffs who actively participated in the field and lab works. Special thank goes to Dr. Deepak Raj Bhat (Geotechnical Engineer), for supporting the preparation of this report. The Contractor is indebted to Mr. Indra Lamsal, Mr. Nabin Geologist & Mr. Birat Shrestha (Engineering Geologist) for facilitating and supervising the whole field works.

Soil Investigation & Solution Pvt. Ltd.
Thapathali, Kathmandu, Nepal

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Table of Contents

1.0 GENERAL INTRODUCTION

1.1 Background and Location

The client, NJS Consultants Co., ltd. entrusted the contractor, Soil Investigation & Solution Pvt. Ltd., Kathmandu, Nepal to carry out this Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal.

Figure 1: Location of project sites in Google Map

The geotechnical investigation consist of plotting of bore logs and determining the different properties of soil such as water content, specific gravity/solid density, bulk density and grain size (as per agreements with owner). The scope of works was based on the Terms of Reference provided by the client.

The co-ordinate of borehole sites are BH1 (00492900m E, 03131154m N), BH2 (00492926m E, 03131104m N), BH3 (00492945m E, 03131062 m N), BH4 (00493773m E, 03130298m N), BH5 (00493917m E, 03130139m N), BH6 (00494087m E, 03129897m N), BH7 (00494181m E, 03129776m N), BH8 (00494174m E, 03129724m N), BH9 (00494205m E, 03129669m N), BH10 (00493611m E, 03130412m N), BH11 (00493668m E, 03130346m N), BH12 (00498463m E, 03122849m N), BH13 (00498458m E, 03122844m N), BH14 (00498446m E, 03122872m N). Location of borehole sites in Google Earth is shown in above Figure 1. The locations of boreholes are enlarged in Figures 2-6. Borehole no. BH1, BH2, BH3 are for "Proposed water treatment plant site No.1". Similarly, borehole no. BH4, BH5, BH6 are for "Access road from existing truss-water pipe bridge to proposed water treatment plant site No. 4", boreholes BH7, BH8, BH9 are for "proposed water treatment plant site No. 4" and boreholes no. BH10, BH11 are for "Existing truss water pipe bridge over seti river". Boreholes no BH12, BH13, BH14 are for "Nepal scouts field".

Figure 2: Location of proposed water treatment plant site No.1 in Google Map

Figure 3: Existing truss water pipe bridge over seti river in Google Map

Figure 4: Location of access road from existing truss-water pipe bridge to proposed water treatment plant site No. 4 in Google Map

Figure 5: proposed water treatment plant site No. 4 in Google Map

Figure 6: Location of Nepal scouts field in Google Map

One borehole locations, viz, Boreholes BH1-BH14 on the plots, as show in Figures 1, have been proposed to make Standard Peretration Test (SPT), Dynamic Cone Penetration Test (DCPT) for sub-soil investigation. This report presents the bore logs based on the field test and different properties of soil based on laboratory tests.

1.2 General Geology and Geomorphology

The site is located at Kaski, Pokhara Valley which is a part of lesser-Himalaya of Nepal. The geological formation of this zone is lacustrine deposits of dun-basins like boulders, gravels, sands, silts and clays with vertebrate fossils. The formations are occasionally mixed with local lacustrine clays and marlstones. The land forms of lacustrine deposits are normally to stiff compacted, having low to high bearing capacity.

Generally, the weathered rock mass and flours, and gravel mixed soil are medium to dense in compactness. As a matter of fact, the project site is formed by residual soils having old deposits of clay and silt with fine, medium and course sand and gravel around the vicinity of the site. The deposits are in low medium to medium in state. The limestone gravel and quartz gravel were found near the study area but any exposure of rocks could not find. The gravel of schist and gneiss were also found near the study area.

2.0 OBJECTIVES

The main objectives of this geotechnical investigation are to carry out geo-profile of the project site, the physical properties of the in-situ soil by carrying out different field and various laboratories testing works. In particular, the objectives are:

i. to plot the borelog of the sub-soil
ii. to find the bearing capacity and coefficient of permeability value of the ground strata
iii. to assess the physical properties of the sub-soil

3.0 SCOPE OF THE WORK

The scope of works consist of field work as well as laboratory works. The main scopes of the works are:

i. to drill the fourteen number of borehole (i.e. BH1-BH14) up to different depth (as shown in bore logs) by conducting Standard Penetration Test (SPT), and Dynamic Cone Penetration Test (DCPT) (if necessary)
ii. to perform the permeability tests
iii. to collect the undisturbed and disturbed samples for field and laboratory tests, and
iv. to prepare the Geotechnical Investigation Report based on the results

4.0 METHODOLOGY

The methodologies adopted for whole operation to meet the objectives are described briefly in the following subheadings.

4.1 Field Test

The field work was done from 8th August to 27th September, 2015. At the time of investigation, a team of experts, staff and few workers set-up the Standard Penetration Test (SPT), Dynamic Cone penetration Test (DCPT) test and permeability test equipment and other necessary accessories at the site.

The borehole at project site was advanced by rotary drilling machine. The borehole was drilled up to different depth as requirements. The method of rotary drilling has been selected based on the site observation. Similarly, the permeability tests have been also selected based on the site observation and requirements. The soil extracted during drilling of each hole was observed carefully by the supervisor so as to make site borehole logs.

4.1.1 Penetration Tests (SPT/DCPT)

The Standard Penetration Test (SPT) was conducted from 0 to 2.5 meters and from 3.5 to 20.5 meters in the drill hole. Similary, Dynamic Cone Penetration Test (DCPT) from 2.5 to 3.5 meter depth was conducted in the drill hole. The tests were conducted at every 0.50 m interval. The total number of blow count of a 63.5 kg hammer, falling freely from 75 cm height, required for 2nd and 3rd 150 mm penetration of split spoon sampler or cone were recorded as field N-value. The purpose of the test was to obtain information on relative density of cohesion less soil and consistency of cohesive soils. The samples obtained in the split tube are disturbed but representative samples. They are preserved for determination of the index properties of the soil. The DCPT obtained is again converted in SPT using the correlation given by Central Building Research Institute, Roorkee;

$N_{DCP} = 1.5N_{SPT}$	for depths upto 4m
$N_{DCP} = 1.75N_{SPT}$	for depths between 4 to 9m
$N_{DCP} = 2N_{SPT}$	for depths greater than 9m

4.1.2 Sampling

The disturbed and undisturbed samples were also collected and transported to the laboratory for further investigation. Before any sample was taken, the borehole was cleaned up of loose disturbed soil deposited during boring operation. The samples obtained in the SPT tube were representative samples. They were preserved in air tight plastic bags, labeled properly for identification for determination of the index properties of the soil at laboratory

4.1.3 Permeability Tests

Permeability is property of soil by virtue of which the soil mass allows water to flow through it. Permeability test is required to determine/understand the soil engineering problems involving flow of water through soils. In this study, constant head and falling head permeability test were performed to determine the coefficient of permeability.

4.2 Laboratory test

Depending upon the type of soil and the scope of works, type and number of the laboratory test were determined in consultation with the Geotechnical Engineer. The tests were carried out utilizing standard procedures as specified by IS, BS, AASHTO or ASTM. Following laboratory tests were conducted for the retrieved soil samples to get the physical properties of the sub-soils.

- Water Content Test
- Specific Gravity/Solid Density Test
- Bulk Density Test
- Grain Size Analysis etc.

5.0 TEST RESULTS

5.1 Field test results

Both field tests and laboratory tests were performed to study the soil strata and properties up to the different depths as requirements. Based on field test, analysis of SPT/DCPT test results are presented in the annexes 7.1. Summary of N-value and Allowable Bearing Capacity are shown in Table1. Similarly, the Summary of permeability test results is tabulated in Table 2.

Table 1: Summary of N-value and Allowable Bearing Capacity

Borehole No.	Depth, (m)	SPT Value, N	Standardize SPT Value, N_{60}	Allowable Bearing Capacity for 25 mm permissible settlement, (Mayerhof's), (kN/m^2)
	1.00	26	16	97
	2.00	25	15	105
	3.00	33	20	140
	4.00	25	15	108
	5.00	18	11	76
	6.00	23	14	100
	7.00	30	18	127
	8.00	71	43	303
	9.00	67	40	286
	10.00	49	29	209
BH_1	11.00	62	37	265
	1.00	31	18	115
	2.00	33	20	140
	3.00	34	20	145
	4.00	58	35	248
	5.00	39	23	167
	6.00	48	29	205
	6.12	50	30	214
	8.00	47	28	201
	9.00	45	27	192
	10.00	49	29	209
	10.09	50	30	214
	12.00	61	37	261
	13.00	64	38	274
	14.00	53	32	227
BH2	15.00	58	35	248
	1.00	29	18	110
	2.00	53	32	225
	3.00	26	16	111
	3.11	33	20	142
	5.00	44	26	188
	6.00	51	31	218
	7.00	40	24	171
	8.00	52	31	222
	9.00	47	28	201
	10.00	51	31	218
	11.00	48	29	205
	12.00	58	35	248
	12.06	50	30	214
BH3	14.00	56	34	239

Borehole No.	Depth, (m)	SPT Value, N	Standardize SPT Value, N_{60}	Allowable Bearing Capacity for 25 mm permissible settlement, (Mayerhof's), (kN/m^2)
	0.22	33	20	125
	1.27	33	20	142
	2.12	33	20	142
	3.08	33	20	142
BH4	4.09	29	17	122
	0.11	33	20	125
	1.04	33	20	142
	2.03	33	20	142
	3.02	33	20	142
BH5	4.06	29	17	122
	0.14	33	20	125
	1.16	33	20	142
	2.06	33	20	142
	3.10	33	20	142
BH6	4.12	29	17	122
	0.18	33	20	125
	1.13	33	20	142
	2.03	33	20	142
	3.26	29	17	122
	4.06	29	17	122
	5.07	29	17	122
	6.09	29	17	122
	7.23	29	17	122
	8.11	29	17	122
BH7	10.24	25	15	107
	0.14	33	20	125
	2.00	45	27	194
	3.00	43	26	182
	3.21	33	20	142
	4.28	29	17	122
	6.00	22	13	95
	7.00	39	23	166
	8.00	37	22	159
	8.09	29	17	122
	10.00	39	23	167
BH8	10.24	25	15	107
	0.11	33	20	125
	1.13	33	20	142
	2.14	33	20	142
	3.07	33	20	142
BH9	4.08	29	17	122

Borehole No.	Depth, (m)	SPT Value, N	Standardize SPT Value, N_{60}	Allowable Bearing Capacity for 25 mm permissible settlement, (Mayerhof's), (kN/m^2)
	5.12	29	17	122
	6.11	29	17	122
	7.14	29	17	122
BH9	8.11	29	17	122
	1.00	4	2	15
	2.00	3	2	13
	5.00	5	3	21
	8.00	5	3	21
	8.09	29	17	122
	9.09	25	15	107
	10.11	25	15	107
	11.11	25	15	107
BH13	12.11	25	15	107
	1.00	7	4	26
	2.00	3	2	13
	4.00	3	2	13
	6.18	29	17	122
	7.17	29	17	122
	8.11	29	17	122
	9.10	25	15	107
BH14	10.15	25	15	107

Table 2: Summary of permeability test results

Borehole Number	Test	Depth, m	
		3.0	11.0
BH1	Coefficient of permeability, k (mm/sec)	2.991×10^{-4}	1.146×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	15.0
BH2	Coefficient of permeability, k (mm/sec)	2.319×10^{-4}	4.991×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	14.0
BH3	Coefficient of permeability, k (mm/sec)	4.174×10^{-3}	5.898×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	-
BH4	Coefficient of permeability, k, (mm/sec)	5.543×10^{-3}	-

Borehole Number	Test	Depth, m	
		3.0	5.0
BH5	Coefficient of permeability, k, (mm/sec)	4.273×10^{-3}	5.255×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	5.0
BH6	Coefficient of permeability, k, (mm/sec)	8.757×10^{-3}	2.642×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	-
BH7	Coefficient of permeability, k, (mm/sec)	5.565×10^{-4}	-

Borehole Number	Test	Depth, m	
		3.0	-
BH8	Coefficient of permeability, k, (mm/sec)	8.808×10^{-4}	-

Borehole Number	Test	Depth, m	
		3.0	-
BH9	Coefficient of permeability, k, (mm/sec)	7.671×10^{-4}	-

Borehole Number	Test	Depth, m	
		3.0	-
BH10	Coefficient of permeability, k, (mm/sec)	2.185×10^{-3}	-

Borehole Number	Test	Depth, m	
		3.0	-
BH11	Coefficient of permeability, k, (mm/sec)	3.506×10^{-4}	-

Borehole Number	Test	Depth, m	
		3.0	10.0
BH12	Coefficient of permeability, k, (mm/sec)	1.665×10^{-4}	2.396×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	10.0
BH13	Coefficient of permeability, k, (mm/sec)	8.013×10^{-3}	3.392×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	11.0
BH14	Coefficient of permeability, k, (mm/sec)	7.266×10^{-4}	2.190×10^{-3}

5.2 Laboratory test results

The laboratory tests are conducted to obtain the physical properties of the tested samples. The laboratory test results of water content test, specific gravity/solid density test, bulk density and grain size analysis are presented in Tables 3-6 below respectively.

Table 3: Summary of water content test results

Borehole Number	Test	Depth, m				
		1-2	3-4	8	10	11
BH1	Water Content, w, (%)	20.51	15.97	16.81	16.16	14.59

Borehole Number	Test	Depth, m					
		0-1	2-3	4	4-5	6	6-7
BH2	Water Content, w, (%)	18.58	13.96	5.31	19.00	5.34	13.49

Borehole Number	Test	Depth, m											
		0-1	2-3	4-5	5	5-6	6	8	8-9	10-11	11	12-13	13-14
BH3	Water Content, w, (%)	26.03	23.33	19.10	4.57	21.39	3.75	6.25	12.28	19.61	3.46	25.32	16.33

Borehole Number	Test	Depth, m		
		0-1	1-2	2-3
BH4	Water Content, w, (%)	27.74	12.01	14.61

Borehole Number	Test	Depth, m				
		0-1	2	3	4	5
BH5	Water Content, w, (%)	12.92	7.40	16.71	15.90	14.60

Borehole Number	Test	Depth, m				
		0-1	1-2	2-3	3-4	4-5
BH6	Water Content, w, (%)	13.31	19.55	13.39	15.56	13.29

Borehole Number	Test	Depth, m			
		1-2	4	6	8
BH7	Water Content, w, (%)	18.52	20.18	16.88	18.37

Borehole Number	Test	Depth, m					
		1-2	3	3-4	4-5	5-6	6-7
BH8	Water Content, w, (%)	15.72	20.60	18.54	18.36	19.04	14.69

Borehole Number	Test	Depth, m				
		0-1	2-3	3-4	8-9	9-10
BH9	Water Content, w, (%)	22.85	18.87	22.44	16.66	16.06

Borehole Number	Test	Depth, m				
		1	2	3	4	6
BH10	Water Content, w, (%)	11.89	22.53	16.67	12.86	14.95

Borehole Number	Test	Depth, m				
		0-1	1-2	2-3	5	11
BH11	Water Content, w, (%)	15.64	21.73	22.41	17.10	17.47

Borehole Number	Test	Depth, m						
		1	2	6	7	8	10	11-12
BH12	Water Content, w, (%)	18.00	29.05	23.69	22.10	9.56	21.71	19.83

Borehole Number	Test	Depth, m						
		0-1	1-2	2-3	3-4	7	9-10	12-13
BH13	Water Content, w, (%)	21.64	20.68	18.34	24.04	26.72	19.84	19.83

Borehole Number	Test	Depth, m					
		0-1	2	3-4	5-6	8	10
BH14	Water Content, w, (%)	18.62	23.48	27.92	24.88	21.22	25.26

Table 4: Summary of specific gravity/solid density test results

Borehole Number	Test	Depth, m			
		1-2	3-4	6	8
BH1	Specific Gravity, G, (g/cm^3)	2.704	2.683	2.717	2.691

Borehole Number	Test	Depth, m						
		0-1	2-3	4-5	6-7	8-9	10-11	12-13
BH2	Specific Gravity, G, (g/cm^3)	2.725	2.710	2.707	2.713	2.717	2.709	2.713

Borehole Number	Test	Depth, m							
		0-1	2-3	4-5	6-7	8-9	10-11	12-13	13-14
BH3	Specific Gravity, G, (g/cm^3)	2.699	2.656	2.674	2.663	2.703	2.685	2.686	2.695

Borehole Number	Test	Depth, m		
		0-1	1-2	2-3
BH4	Specific Gravity, G, (g/cm^3)	2.703	2.688	2.670

Borehole Number	Test	Depth, m				
		0-1	2	3	4	5
BH5	Specific Gravity, G, (g/cm^3)	2.677	2.648	2.680	2.695	2.673

Borehole Number	Test	Depth, m				
		0-1	1-2	2-3	3-4	4-5
BH6	Specific Gravity , G, (g/cm^3)	2.699	2.676	2.703	2.686	2.674

Borehole Number	Test	Depth, m			
		1-2	4	6	8
BH7	Specific Gravity, G, (g/cm^3)	2.695	2.691	2.669	2.695

Borehole Number	Test	Depth, m					
		1-2	3	3-4	4-5	5-6	6-7
BH8	Specific Gravity, G, (g/cm^3)	2.652	2.685	2.684	2.654	2.654	2.698

Borehole Number	Test	Depth, m				
		0-1	2-3	3-4	8-9	9-10
BH9	Specific Gravity, G, (g/cm^3)	2.662	2.754	2.663	2.677	2.690

Borehole Number	Test	Depth, m				
		0-1	2	3	4	6
BH10	Specific Gravity, G, (g/cm^3)	2.670	2.681	2.671	2.670	2.667

Borehole Number	Test	Depth, m				
		0-1	1-2	2-3	5	11
BH11	Specific Gravity, G, (g/cm^3)	2.645	2.652	2.650	2.652	2.662

Borehole Number	Test	Depth, m					
		1-2	5-6	7	8	9-10	11-12
BH12	Specific Gravity, G, (g/cm^3)	2.674	2.699	2.698	2.670	2.698	2.706

Borehole Number	Test	Depth, m						
		0-1	1-2	2-3	3-4	7	9-10	12-13
BH13	Specific Gravity, G, (g/cm^3)	2.687	2.691	2.669	2.691	2.706	2.697	2.695

Borehole Number	Test	Depth, m				
		1-2	2-3	3-4	5-6	10-11
BH14	Specific Gravity, G, (g/cm^3)	2.695	2.687	2.677	2.669	2.684

Table 5: Summary of bulk density test results

Borehole Number	Test	Depth, m				
		1-2	3-4	8	10	11
BH1	Bulk Density, ρ_b (g/cm^3)	1.578	1.481	1.442	1.386	1.392

Borehole Number	Test	Depth, m								
		0-1	2-3	4	4-5	6	6-7	10-11	12-13	14-15
BH2	Bulk Density, ρ_b (g/cm^3)	1.583	1.568	1.492	1.434	1.432	1.421	1.445	1.476	1.449

Borehole Number	Test	Depth, m									
		0-1	2-3	4-5	5	5-6	8-9	10-11	11	12-13	13-14
BH3	Bulk Density, ρ_b (g/cm^3)	1.546	1.422	1.431	1.459	1.468	1.493	1.443	1.447	1.543	1.492

Borehole Number	Test	Depth, m		
		0-1	1-2	2-3
BH4	Bulk Density, ρ_b (g/cm^3)	1.552	1.483	1.412

Borehole Number	Test	Depth, m				
		0-1	2	3	4	5
BH5	Bulk Density, ρ_b (g/cm^3)	1.406	1.423	1.504	1.509	1.441

Borehole Number	Test	Depth, m				
		0-1	1-2	2-3	3-4	4-5
BH6	Bulk Density, ρ_b (g/cm^3)	1.423	1.462	1.457	1.438	1.422

Borehole Number	Test	Depth, m			
		1-2	4	6	8
BH7	Bulk Density, ρ_b (g/cm^3)	1.391	1.549	1.491	1.408

Borehole Number	Test	Depth, m					
		1-2	3	3-4	4-5	5-6	6-7
BH8	Bulk Density, ρ_b (g/cm^3)	1.370	1.544	1.463	1.523	1.564	1.564

Borehole Number	Test	Depth, m				
		0-1	2-3	3-4	8-9	9-10
BH9	Bulk Density, ρ_b (g/cm^3)	1.512	1.406	1.467	1.565	1.305

Borehole Number	Test	Depth, m				
		1	2	3	4	6
BH10	Bulk Density, ρ_b (g/cm^3)	1.437	1.445	1.535	1.459	1.492

Borehole Number	Test	Depth, m				
		0-1	1-2	2-3	5	11
BH11	Bulk Density, ρ_b (g/cm^3)	1.498	1.537	1.535	1.395	1.465

Borehole Number	Test	Depth, m	
		9-10	11-12
BH12	Bulk Density, ρ_b (g/cm^3)	1.601	1.568

Borehole Number	Test	Depth, m	
		9-10	12-13
BH13	Bulk Density, ρ_b (g/cm^3)	1.543	1.523

Borehole Number	Test	Depth, m	
		8-9	10-11
BH14	Bulk Density, ρ_b (g/cm^3)	1.592	1.557

Table 6: Summary of grain size analysis test results

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH1	1-2	-	25.65	74.28	0.06	-	0.08	0.22	-	-
	3-4	-	56.97	43.03	-	-	0.015	0.09	-	-
	6	-	5.00	94.76	0.24	0.13	0.31	0.55	4.23	1.34
	8	-	29.55	70.45	-	-	0.075	0.22	-	-
	10	-	22.57	77.4	0.04	-	0.12	0.35	-	-
	11	-	9.49	90.05	0.46	0.08	0.28	0.52	-	-

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH2	0-1	-	10.70	83.47	5.83	0.08	0.18	0.44	5.87	0.98
	2-3	-	17.20	82.36	0.44	-	0.20	0.60	-	-
	4-5	-	27.76	72.04	0.20	-	0.08	0.14	-	-
	6-7	-	8.27	79.90	11.83	0.10	0.50	0.80	8.00	3.13
	9	-	15.62	18.88	65.51	-	1.60	7.00	-	-
	10-11	-	9.36	90.50	0.13	0.080	0.28	0.58	7.25	1.69
	12-13	-	29.11	70.89	-	-	0.09	0.19	-	-
	14-15	-	10.21	89.39	0.400	0.08	0.30	0.54	7.20	2.22

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH3	0-1	-	30.35	69.65	-	-	0.075	0.17	-	-
	4-5	-	30.94	68.91	0.15	-	0.07	0.12	-	-
	5-7	-	59.77	44.23	-	-	-	0.075	-	-
	8-9	-	34.80	65.20	-	-	-	0.19	-	-
	11	-	35.02	64.98	-	-	-	0.18	-	-
	12-13	-	20.33	79.67	-	-	0.15	0.35	-	-
	13-14	-	20.33	79.62	0.05	-	0.16	0.36	-	-

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH4	0-1	-	9.45	89.16	1.39	0.075	0.17	0.31	4.13	1.24
	1-2	-	5.33	91.28	3.39	0.16	0.45	1.30	8.13	0.97
	3	-	7.62	91.13	1.25	0.10	0.32	0.85	8.50	1.20

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH5	0-1	-	5.23	72.30	22.47	0.20	1.00	1.60	8.00	3.13
	2	-	7.28	74.48	18.24	0.15	0.70	1.60	10.67	2.04
	3	-	16.68	81.40	1.93	-	0.30	0.50	-	-
	4	-	18.84	80.46	0.70	-	0.16	0.42	-	-
	5	-	8.59	90.70	0.71	0.08	0.10	0.50	6.25	0.27

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH6	0-1	-	7.35	79.03	13.62	0.10	0.40	1.42	14.20	1.13
	1-2	-	8.31	78.17	13.52	0.09	0.38	1.40	15.56	1.15
	3-4	-	9.66	88.90	1.43	0.08	0.33	1.00	12.50	1.36
	4-5	-	9.99	88.51	1.50	0.07	0.37	1.04	13.68	1.73

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH7	1-2	-	25.51	74.38	0.11	-	0.09	0.27	-	-
	4	-	14.88	83.45	1.66	-	0.17	0.36	-	-
	6	-	19.24	80.49	0.26	-	0.15	0.40	-	-
	8	-	30.82	68.80	0.39	-	0.71	0.31	-	-

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH8	3-4	-	29.01	70.86	0.13	-	0.7	0.12	-	-
	4-5	-	27.17	72.80	0.03	-	0.08	0.13	-	-
	5-6	-	16.04	83.96	-	-	0.15	0.28	-	-

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH9	2-3	-	15.52	83.96	0.52	-	0.15	0.31	-	-
	3-4	-	24.67	74.98	0.35	-	0.09	0.21	-	-
	8-9	-	27.15	72.85	-	-	0.08	0.26	-	-
	9-10	-	17.34	82.65	0.02	-	0.20	0.50	-	-

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH10	0-1	-	4.13	73.42	22.45	0.15	0.30	0.92	6.13	0.65
	2	-	9.91	86.0	4.09	0.075	0.17	1.61	3.20	1.61
	3	-	24.97	70.84	4.18	-	0.08	0.19	-	-
	6	-	24.41	62.78	12.80	-	0.10	0.30	-	-

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH11	2	-	10.49	85.89	3.62	0.07	0.19	0.31	4.31	1.62
	5	-	28.01	71.99	-	-	0.078	0.18	-	-
	8	-	18.97	81.03	-	-	0.13	0.21	-	-
	10	-	7.15	90.73	2.11	0.10	0.26	0.47	4.70	1.44
	11	-	24.84	75.16	-	-	0.08	0.14	-	-

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH12	1-2	-	25.97	55.70	18.33	-	0.08	0.13	-	-
	5-6	-	27.93	54.77	-	-	0.075	0.135	-	-
	9-10	-	11.76	88.12	0.11	-	0.30	0.60	-	-
	11-12	-	22.74	77.15	0.11	-	0.15	0.45	-	-

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH13	1-2	-	26.13	56.06	17.81	-	0.08	0.14	-	-
	3-4	-	26.13	60.29	13.58	-	0.08	0.16	-	-
	7	-	27.43	54.49	18.08	-	0.073	0.145	-	-
	9-10	-	13.38	86.33	0.28	-	0.20	0.49	-	-
	12-13	-	23.58	76.38	0.04	-	0.12	0.40	-	-

Borehole Number	Depth, (m)	Clay, (%)	Silt, (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH14	1-2	-	31.16	37.42	31.42	-	0.07	0.18	-	-
	3-4	-	33.25	66.51	0.24	-	0.06	0.14	-	-
	5-6	-	13.05	76.02	10.93	-	0.09	0.13	-	-
	10-11	-	16.23	83.72	0.05	-	0.20	0.48	-	-

6.0 CONCLUSIONS

The details soil strata up to different depth of BH1-BH14 were observed from the borehole logs. From this, it was found that the low plasticity silt and sand with little gravel are presented throughout the depth. Summary of N-value and Allowable Bearing Capacity of BH1-BH14 were presented in Table1. The Summary of permeability test results was presented in Table 2. Similarly, the laboratory test results (i.e., water content test, specific gravity/solid density test, and bulk density and grain size analysis etc,) of BH1-BH14 were summarized in Tables 3-6.

The Atterberge's limits test, Consolidation test and unified compression test of all tested samples could not conducted due to the presence of higher percentage of silt and sand (i.e. inorganic silts of low plasticity with higher percentage of sand and few gravels) in the test specimens.

7.0 ANNEXES

7.1 Analysis of penetration tests (SPT/DCPT) results

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kaski
Bore Hole No : 01
RL of GWT, m : 196 m
Date : 2015/8/21～22

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	DCPT		6
			0.30	DCPT	Organic materials with fine to medium grained dark grey sand.	24
		1.00	0.45	DCPT	Gravel of gneiss, weathered schist and light grey to dark grey coloured limestone.	15
	1.00					
			1.15	DCPT		21
			1.30	DCPT		19
		1.00	1.45	DCPT	Light grey coloured very fine to medium grained sand. Gravel of gneiss, schist, quartz and dark grey coloured limestone.	18
	2.00					
			2.15	DCPT		20
			2.30	DCPT		28
		1.00	2.45	DCPT	Very fine to medium light grey coloured sand. Gravel of dark grey limestone dolomite and gneiss.	21
	3.00					
			3.15	DCPT		23
			3.30	DCPT		16
		1.00	3.45	DCPT	Very fine to medium light grey sand. Gravel of light grey dolomite and dark grey limestone.	22
	4.00					
			4.15	DCPT		23
			4.30	DCPT		14
		1.00	4.45	DCPT	Medium to fine grained sand, gravel of dark grey coloured limestone.	17
	5.00					
			5.15	DCPT		26
			5.30	DCPT		19
		1.00	5.45	DCPT	Light grey to dark grey limestone gravels.	22
	6.00					
			6.15	DCPT		30
			6.30	DCPT		24
		1.00	6.45	DCPT	Medium to fine grained sand.	28
	7.00					
			7.15	SPT		32
			7.30	SPT		38
		1.00	7.45	SPT	Grey to white coloured, moist, non plastic, slow dilutancy limestone gravel with silt.	33
	8.00					
			8.15	SPT		33
			8.30	SPT		31
		1.00	8.45	SPT	Light grey coloured, medium to course grained sand sludge. (Upto 1 cm depth) grey to white, moist, non plastic slow dilutancy silt with limestone gravel.	36
	9.00					
			9.15	SPT		35
			9.30	SPT		24
		1.00	9.45	SPT	Gravel of dark grey to light grey limestone with dark grey coloured medium to course grained sand. Up to 10 cm depth, gravel of limestone.	25
	10.00					
			10.15	SPT		13
			10.30	SPT		24
		1.00	10.45	SPT	Medium to course grained dark grey coloured sand sludge. (Upto 1 cm depth) grey coloured, moist, non plastic slow dilutancy, limestone gravel with silt.	38
	11.00					

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kiski
Bore Hole No : 02
RL of GWT, m : 1.78 m
Date : 2015/8/24～26

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	DCPT		8
			0.30	DCPT		12
		1.00	0.45	DCPT	Organic materials with fine to medium grained light grey coloured sand. Gravel of with light brown coloured dolomite.	34
	1.00					
			1.15	DCPT		24
			1.30	DCPT		31
		1.00	1.45	DCPT	Medium to course grained dark grey coloured sand. Gravelof light grey to dark grey limestone, gneiss and quartz.	18
	2.00					
			2.15	DCPT		26
			2.30	DCPT		28
		1.00	2.45	DCPT	Medium to course gained grey coloured sand. Gravel of light grey to dark grey limestone.	23
	3.00					
			3.15	SPT		44
			3.30	SPT		20
		1.00	3.45	SPT	Light grey coloured medium to course grained sand with gravel of dolomite and light grey limestone. (Upto 10 cm depth) grey, moist, non plastic slow dilutancy gravel of limestone with silt.	38
	4.00					
			4.15	SPT		40
			4.30	SPT		20
		1.00	4.45	SPT	Gravel of Gneiss and light grey to dark grey limestone. Upto 10 cm, gravel of limestone.	19
	5.00					
			5.15	SPT		21
			5.30	SPT		18
		1.00	5.45	SPT	Medium to fine light grey coloured sand. Upto 10 cm, grey to white, non plastic slow dilutancy silt with gravel.	30
	6.00					
			6.12	SPT		50
		1.00			Medium to course grained light grey coloured sand.	
	7.00					
			7.15	SPT		48
			7.30	SPT		26
		1.00	7.45	SPT	Fine to medium light grey coloured sand. Upto 10 cm light grey, moist, non plastic slow dilutancy gravel with silt.	21
	8.00					
			8.15	SPT		46
			8.30	SPT		23
		1.00	8.45	SPT	Fine to medium light grey coloured sand. Upto 10 cm, grey coloured, non plastic slow dilutancy gravel with silt.	22
	9.00					
			9.15	SPT		27
			9.30	SPT		25
		1.00	9.45	SPT	Dark grey coloured limestone gravels with medium to fine grained sand. Upto 10 cm, grey coloured, moist, non plastic slow dilutancy gravel with silt.	24
	10.00					
			10.09	SPT		50
		1.00			Medium to fine grained dark grey coloured sand.	
	11.00					
			11.15	SPT		36
			11.30	SPT		26
		1.00	11.45	SPT	Medium to course grained light grey sand with gravel of limestone. Upto 10 cm, grey coloured, moist, non plastic slow dilutancy gravel with silt.	35
	12.00					
			12.15	SPT		26
			12.30	SPT		31
		1.00	12.45	SPT	Medium to course grained sand of light grey coloured. Gravel of dark grey, coloured limestone. Upto 10 cm grey coloured. moist, non plastic slow dilutancy silt with gravel.	33
	13.00					
			13.15	SPT		34
			13.30	SPT		26
		1.00	13.45	SPT	Medium to course grained sand sludge of light green coloured. Gravel of dark grey coloured limestone.	27
	14.00					
			14.15	SPT		21
			14.30	SPT		28
		1.00	14.45	SPT	Medium to course sand with limestone dark grey coloured. Upto 10 cm, grey coloured, moist, non plastic slow dilutancy gravel with silt.	30
	15.00					

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kaski
Bore Hole No : 03
RL of GWT, m : 1.56 m
Date : 2015/8/27～28

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.15 0.30 0.45	DCPT DCPT DCPT	Organic materials with medium to fine grained light brown sand. Gravel of dark grey coloured limestone, and marble.	8 13 31
	2.00	1.00	1.15 1.30 1.45	DCPT DCPT DCPT	Medium to fine grained light brown coloured sand.	29 42 37
	3.00	1.00	2.15 2.30 2.45	DCPT DCPT DCPT	Very fine to medium grained brown coloured sand. Gravel of dark grey coloured limestone, and dolomite.	29 18 21
	4.00	1.00	3.11	DCPT	Very fine to medium grained brown coloured sand. Gravel of light grey to dark grey limestone.	50
	5.00	1.00	4.15 4.30 4.45	SPT SPT SPT	Medium to course grained light grey sand. Upto 10 cm, grey coloured, moist, non plastic slow dilutancy silt with limestone gravel.	33 23 21
	6.00	1.00	5.15 5.30 5.45	SPT SPT SPT	Fine to medium grained brown colound sand. Upto 10 cm, light grey coloured, moist, non plastic slow dilutancy gravel.	27 22 29
	7.00	1.00	6.15 6.30 6.45	SPT SPT SPT	Fine to medium grained brown coloured sand and gravel of limestone. Upto 10 cm. grey coloured, moist, non plastic slow dilutancy gravel with silt.	14 19 21
	8.00	1.00	7.15 7.30 7.45	SPT SPT SPT	Dark grey coloured medium to course grained sand. Limestone of light grey coloured and sandstone gravels. Upto 10 cm, grey coloured, moist, non plastic slow dilutancy silt with limestone gravel.	41 25 27
	9.00	1.00	8.15 8.30 8.45	SPT SPT SPT	Medium to fine sand. Gravel of limestone. Upto 10 cm, grey coloured, moist, non plastic slow dilutancy silt with limestone gravel.	41 22 25
	10.00	1.00	9.15 9.30 9.45	SPT SPT SPT	Gravel of limestone light grey to dark grey colored. Upto 10 cm. grey coloured, moist, non plastic slow dilutancy gravel with silt.	39 23 28
	11.00	1.00	10.15 10.30 10.45	SPT SPT SPT	Dark grey to fine grained sand with light grey to dark grey limestone. Limestone of light grey coloured and sandstone gravels. Upto 10 cm. grey coloured, moist, non plastic slow dilutancy silt with gravel.	46 21 27
	12.00	1.00	11.15 11.30 11.45	SPT SPT SPT	Dark grey medium to fine grained sand with gravel of light grey to dark grey limestone. Silt with gravels of limestone.	25 26 32
	13.00	1.00	12.06	SPT	Medium to course grained dark grey coloured sand.	50
	14.00	1.00	13.15 13.30 13.45	SPT SPT SPT	Dark grey coloured medium to course grained sand. Upto 10 cm, grey coloured, moist, non plastic slow dilutancy silt with limestone gravel.	26 27 29

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kaski
Bore Hole No : 04
RL of GWT, m : Not found.
Date : 2015/8/30～31

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.15 0.22	DCPT DCPT	Organic materials with brownish grey coloured medium to course grained sand.	49 50
	2.00	1.00	1.15 1.27	DCPT DCPT	Light grey coloured medium to course grained sand.	14 50
	3.00	1.00	2.12	DCPT	Light grey coloured medium to course grained sand with gravel of dark grey coloured limestone, dolomite and gneiss.	50
	4.00	1.00	3.08	DCPT	Gravel of dolomite	50
	5.00	1.00	4.08	DCPT	Gravel	50

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kaski
Bore Hole No : 05
RL of GWT, m : 3.80 m
Date : 2015/8/26～28

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.11	DCPT	Light grey fine to medium grained sand with gravel of light grey limestone and gneiss.	50
	2.00	1.00	1.04	DCPT	Dark grey fine to medium grained sand with gravel of limestone and gneiss.	50
	3.00	1.00	2.03	DCPT	Light grey, fine to medium grained sand with gravel of limestone.	50
	4.00	1.00	3.02	DCPT	Dark grey, medium to course sand with gravel of limestone, dolomite and gneiss.	50
	5.00	1.00	4.00	DCPT	Dark grey, medium to course sand with gravel of limestone, gneiss and dolomite.	50

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kaski
Bore Hole No : 06
RL of GWT, m : 1.66 m
Date : 2015/8/24～25

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.14	DCPT	Dark grey, fine to medium grained sand.	50
	2.00	1.00	1.15 1.16	DCPT	Dark grey, medium to course sand. Light grey, medium to course grained sand with gravel of dark grey limestone.	22 50
	3.00	1.00	2.06	DCPT	Light grey, medium to course grained sand with gravel of limestone, dolomite, gneiss, dolomite, sandstone and quartz.	50
	4.00	1.00	3.10	DCPT	Limestone, gneiss gravel with light grey. Medium to course sand. Light grey, medium to course grained sand with gravel of limestone. Light grey, fine to medium sand with gravel of limestone, dolomite.	50
	5.00	1.00	4.12	DCPT	Dark grey coloured limestone gravel. Limestone, quartzite with few amounts of calcareous materials, light grey, medium to course sand. Gravel of limestone, quartzite, dolomite, dark grey sand.	50

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kaski
Bore Hole No : 07
RL of GWT, m : Not found
Date : 2015/8/19～22

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.15 0.18	DCPT DCPT	Organic materials with medium to course grained, dark grey coloured sand, light grey to dark grey coloured limestone gravel	22 50
	2.00	1.00	1.13	DCPT	Light grey coloured, fine to medium grained sand.	50
	3.00	1.00	2.03	DCPT	Light grey, medium to course grained sand with gravel of light grey to dark grey limestone.	50
	4.00	1.00	3.15 3.26	DCPT DCPT	Light grey, fine to medium grained sand, gravel of light grey limestone.	23 50
	5.00	1.00	4.06	DCPT	Light grey, medium to course grained sand, gravel of dark grey limestone and calcareous quartzite.	50
	6.00	1.00	5.07	DCPT	Light grey coloured sand, gravel of dark gray limestone.	50
	7.00	1.00	6.09	DCPT	Light grey, medium to course grained sand with gravel of light grey to dark grey limestone, dolomite and gneiss.	50
	8.00	1.00	7.15 7.23	DCPT DCPT	Light grey, fine to medium grained sand with gravel of dolomite and light grey to dark grey limestone.	32 50
	9.00	1.00	8.11	DCPT	Gravel of dark grey coloured limestone, calcareous quartzite and gneiss.	50
	10.00	1.00	9.15 10.24	DCPT DCPT	Gravel of garnetiferous schist and light grey coloured limestone.	23 50

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kaski
Bore Hole No : 08
RL of GWT, m : Not found
Date : 2015/8/12～16

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.14	DCPT	Organic materials with mud and dark grey light brown coloured, medium to course grained sand with gravel.	50
	2.00	1.00	1.15 1.30 1.42	DCPT DCPT DCPT	Fine to medium grained, light grey coloured sand with gness white limestone and white coloured dolomite.	13 18 50
	3.00	1.00	2.15 2.30 2.45	DCPT DCPT DCPT	Dark grey coloured, fine to medium grained sand.	20 28 36
	4.00	1.00	3.15 3.21	DCPT DCPT	Light grey coloured, medium to fine grained sand.	43 50
	5.00	1.00	4.15 4.28	DCPT DCPT	Gravel of light grey coloured limestone.	13 50
	6.00	1.00	5.15 5.30 5.45	DCPT DCPT DCPT	Grey coloured fine to medium grained sand with gravel of light grey coloured limestone and white coloured marble.	7 16 23
	7.00	1.00	6.15 6.30 6.39	DCPT DCPT DCPT	Very fine to fine grained, light grey coloured sand and light grey to dark grey limestone.	11 18 50
	8.00	1.00	7.15 7.30 7.45	DCPT DCPT DCPT	Light grey coloured limestone.	20 33 32
	9.00	1.00	8.09	DCPT	White coloured gneiss and light grey coloured limestone gravel.	50
	10.00	1.00	9.15 9.30 9.38	DCPT DCPT DCPT	Banded gneiss of black and white coloured, white colourec marble and dark grey coloured limestone.	25 28 50
	11.00	1.00	10.15 10.24	DCPT DCPT	Banded gneiss of black and white coloured and grey cobured limestone.	21 50

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kaski
Bore Hole No : 09
RL of GWT, m : Not found
Date : 2015/8/12~16

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.11	DCPT	Medium to fine grained grey to dark coloured sand with dark brown coloured limestone.	50
	2.00	1.00	1.13	DCPT	Banded gneiss of black and white colour, light grey limestone and dark grey coloured limestone.	50
	3.00	1.00	2.14	DCPT	Dark grey to brownish white coloured limestone.	50
	4.00	1.00	3.07	DCPT	Dark brown to light grey coloured limestone.	50
	5.00	1.00	4.08	DCPT	Gneiss of black and white band, light grey to brown coloured limestone, dolomite of light brown colour.	50
	6.00	1.00	5.12	DCPT	Dark grey coloured limestone and banded gneiss of black and white colour.	50
	7.00	1.00	6.11	DCPT	Dark grey coloured limestone.	50
	8.00	1.00	7.14	DCPT	Dark grey coloured limestone.	50
	9.00	1.00	8.11	DCPT	Gneiss with black and white band and white to glassy coloured marble and limestone gravel.	50
	10.00	1.00	9.13	DCPT	Banded gneiss with black and white colour and grey to light grey coloured limestone.	50

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kaski
Bore Hole No : 10
RL of GWT, m : 3.20 m
Date : 2015/8/02~08

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.15 0.27	DCPT DCPT	Gravel of grey coloured limestone, sandstone, and dolomite. Medium to course grained sand.	39 50
	2.00	1.00	1.15 1.30 1.45	DCPT DCPT DCPT	Dark grey limestone, white granite, banded gneiss, shiny schist, gneiss and dolomite.	14 17 21
	3.00	1.00	2.15 2.30 2.44	SPT SPT SPT	Grey to white coloured, moist, non plastic slow dilutancy couse grained sand with gravel. Limestone and banded gneiss.	17 39 50
	4.00	1.00	3.05	DCPT	Blue with white banded schist.	50
	5.00	1.00	4.15 4.30 4.45	DCPT DCPT DCPT	Medium to course grained gneiss, banded gneiss with blackand white colour, banded gneiss, pegmatite and dark grey limestone.	23 27 18
	6.00	1.00	5.15 5.23	DCPT DCPT	Pink coloured calcareous quartzite.	18 50
	7.00	1.00	6.08	DCPT	Dark grey limestone and banded gneiss with white and black coloured.	50
	8.00	1.00	7.08	DCPT	Dark grey to white coloured limestone and gneiss.	50
	9.00	1.00	8.15 8.25	DCPT DCPT	Gneiss of white coloured with small black spots and limestone. Gneiss of banded appearance and grey coloured limestone.	38 50
	10.00	1.00	9.15 9.30 9.45	DCPT DCPT DCPT	Grey coloured sandstone, limestone and gneiss. Dolomite, limestone and banded gneiss.	48 41 42
	11.00	1.00	10.13	DCPT	Dark grey limestone.	50
	12.00	1.00	11.15 11.29	DCPT DCPT	Banded gneiss and dark grey coloured limestone.	37 50
	13.00	1.00	12.15 12.26	DCPT DCPT	Dark grey with dirty white coloured limestone.	37 50
	14.00	1.00	13.07	DCPT	White and black coloured banded gneiss and limestone.	50
	15.00	1.00	14.06	DCPT	Light grey limestone, banded gneiss and calcareous quartzite.	50

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara -27, Kaski
Bore Hole No : 11
RL of GWT, m : 3.60m
Date : 2015/8/03～08

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.15 0.25	DCPT DCPT	Organic materials with grey coloured medium to course grained sand and gravel deposit of limestone, sandstone ;egmatite and dolomite.	41 50
	2.00	1.00	1.15 1.23	DCPT DCPT	Dark grey coloured, medium to course grained sand with limestone dolomite and quartzite deposit.	29 50
	3.00	1.00	2.15 2.30 2.44	DCPT DCPT DCPT	Gravel deposit of light grey coloured limestone and light brown coloured dolomite.	14 22 50
	4.00	1.00	3.15 3.30 3.45	DCPT	White with black banded gneiss, grey limestone, dolomite and calcareous quartzite.	15 19 27
	5.00	1.00	4.13	DCPT	Barded gneiss with black and white colour and grey limestone.	50
	6.00	1.00	5.15 5.30 5.38	DCPT DCPT	Gneiss and calcareous quartzite and limestone.	23 33 50
	7.00	1.00	6.15 6.30 6.43	DCPT	Limestone of grey colour and garnetiferous schist.	37 46 50
	8.00	1.00	7.15 7.30 7.43	DCPT	Light brown coloured quartzite, limestone and dolomite.	50
	9.00	1.00	8.15 8.30 8.45	DCPT DCPT DCPT	Dark grey coloured limestone.	45 34 17
	10.00	1.00	9.15 9.30 9.45	DCPT DCPT DCPT	Grey coloured limestone and quartzite.	49 43 31
	11.00	1.00	10.15 10.29	DCPT DCPT	Light grey coloured limestone.	40 50
	12.00	1.00	11.13	DCPT	Grey coloured limestone, Brownish white quartzite and grey limestone.	50
	13.00	1.00	12.12	DCPT	Grey coloured limestone banded gneiss and quartzite.	50
	14.00	1.00	13.15 13.24	DCPT	Limestone and brownish white quartzite.	42 50
	15.00	1.00	14.11	DCPT	Brownish white, calc-quartzite and grey limestone.	50

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Nepal scout field, Bokhara-4, Kaski
Bore Hole No : 12
RL of GWT, m : Not found
Date : 2015/9/23～24

Scale 1=20cm Each	Depth m	Thickness m	Simpling Depth m	Simpling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.15 0.30 0.45	SPT SPT SPT	Light brown to brownish yellow, moist, low plasticity slow dilatency stiff silty gravels	5 5 4
	2.00	1.00	1.15 1.30 1.45	SPT SPT SPT	Dark brown, moist, non plastic, slow dilatancy soft silty gravels	2 1 1
	3.00	1.00	2.15 2.39	SPT SPT	Silty gravel	1 1
	4.00	1.00	3.35	SPT	Fine silt	1
	5.00	1.00	4.33	SPT	Fine silt	1
	6.00	1.00	5.30 5.48	SPT SPT	Dark brown to brownish yellow, moist, low plasticity slow dilatency very soft silty gravels	1 1
	7.00	1.00	6.15 6.30 6.45	SPT SPT SPT	Dark grey, moist, low plasticity slow dilatency soft silty gravels	1 1 1
	8.00	1.00	7.11	SPT	Light grey limestone pebble with light brown , moist, low plasticity slow dilatency gravel withsilt	50
	9.00	1.00	8.15 8.23	DCPT DCPT	Light grey to dark grey limestone and pebbles	34 50
	10.00	1.00	9.10	DCPT	Light grey limestone and brown dolomite pebbles	50
	11.00	1.00	9.13	DCPT	Gravel	50
	12.00	1.00	10.08	DCPT	Gneiss,light greylimestone and conglomerate pebbles	50

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Nepal scout field, Bokhara-4, Kaski
Bore Hole Nc : 13
RL of GWT, m : Not found
Date : 2015/9/25~26

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	SPT		2
			0.30	SPT		2
		1.00	0.45	SPT	Brownish yellow, moist, non plasticity slow dilatency medium silt	2
	1.00					
			1.15	SPT		3
			1.30	SPT		1
		1.00	1.45	SPT	Brownish yellow, moist, non plasticity slow dilatency soft silty gravels	2
	2.00					
		1.00			Dark brown, moist, low plasticity, slow dilatency very soft silty gravels	
	3.00		2.68	SPT		1
			3.15	SPT		1
		1.00			Dark brown, moist, non plasticity, slow dilatency very soft silty gravels	
	4.00		3.59	SPT		1
			4.15			6
			4.30			2
		1.00	4.45	SPT	Brownish black, moist, non plastic, slow dilatency medium silty gravels	3
	5.00					
			5.15	DCPT		37
			5.30	DCPT		4
		1.00	5.45	DCPT	Conglomerate and light grey limestone pebbles	2
	6.00					
			6.15	SPT		1
		1.00			Brownish yellow, wet, low plastic, slow dilatency very soft silty gravels	
	7.00		6.76	SPT		1
			7.15	SPT		9
			7.30	SPT		3
		1.00	7.45	SPT	Fine silt with gewgravels	2
	8.00					
			8.09	DCPT		50
		1.00			Silty gravels	
	9.00					
			9.09	DCPT		50
		1.00			Course sand with few gravels	
	10.00					
			9.11	DCPT		50
		1.00			Light grey limestone, gneiss and conglomerate pebbles	
	11.00					
			9.11	DCPT		50
		1.00			Light grey limestone, gneiss, dolomite and conglomerate pebbles	
	12.00					
			10.11	DCPT		50
		1.00			Gravels	
	13.00					

BORE HOLE LOG

Project Name : Soil Survey Par I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Nepal scout field, Bokhara-4, Kaski
Bore Hole No : 14
RL of GWT, m : Not found
Date : 2015/9/27~28

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	SPT		3
			0.30	SPT		5
		1.00	0.45	SPT	Light brown, moist, low plasticity, slow dilatency stiff silt	2
	1.00					
			1.15	SPT		2
			1.30	SPT		1
		1.00	1.45	SPT	Dark brown fine to medium sand withconglomerate cobble	2
	2.00					
		1.00			Dark brown fine to medium silty sand with conglomerate cobble	
	3.00		2.54	SPT		1
			3.15	SPT		3
			3.30	SPT		1
		1.00	3.45	SPT	Dark brown fine to medium silty sand	2
	4.00					
			4.15	SPT		
			4.30	SPT		
		1.00	4.45	SPT	Dark brown, moist, non plastic slow dilatency medium silt	1
	5.00					
			5.15	SPT		1
		1.00	5.39	SPT	Dark brown, moist, non plastic slow dilatency very softsilt	1
	6.00					
			6.15	DCPT		16
			6.18	DCPT		50
		1.00			Silty gravel	
	7.00					
			7.15	DCPT		48
		1.00	7.17	DCPT		50
					Silty gravel	
	8.00					
			8.11	DCPT		50
		1.00			Light grey to dark grey limestone and conglomerate pebbles	
	9.00					
			9.10	DCPT		50
		1.00			Light grey limestone, conglomerate, gneiss and dolomite pebbles	
	10.00					
			10.18	DCPT		19
			10.15			50
		1.00			Light grey limestone, conglomerate, gneiss and dolomite pebbles	
	11.00					

（2）配水池、市内河川横断箇所

Draft Report on

Soil Survey Part II for the Preparatory Survey on

Pokhara Water Supply Improvement Project in Nepal

Prepared For:

NJS Consultants Co., Ltd.
Tokyo, Japan

Submitted By:

Soil Investigation & Solution Pvt. Ltd.
Thapathali, Kathmandu, Nepal

December 20, 2015

Acknowledgement

Soil Investigation & Solution Pvt. Ltd., Kathmandu is grateful to, NJS Consultants Co., Ltd. Tokyo, Japan for entrusting the job "Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal".

We thank all staffs who actively participated in the field and lab works. Special thank goes to Dr. Deepak Raj Bhat (Geotechnical Engineer), for supporting the preparation of this report. The Contractor is indebted to Mr. Indra Lamsal, Mr. Nabin B.k , Birat Shrestha (Engineering Geologist) for facilitating and supervising the whole field works.

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Table of Contents

1.0 GENERAL INTRODUCTION

1.1 Background and Location

The client, NJS Consultants Co., Ltd. Tokyo, Japan entrusted the contractor, Soil Investigation & Solution Pvt. Ltd., Kathmandu, Nepal to carry out this "Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal".

Figure 1: Location of project sites in Google Map

The geotechnical investigation consist of plotting of bore logs and determining the different properties of soil such as water content, specific gravity/solid density, bulk density and grain size (as per agreements with owner). The scope of works was based on the Terms of Reference provided by the client.

The coordinate of borehole sites are BH1 (83°58' 43.15"E, 28°13' 23.12"N), BH2 (83°58' 43.88"E, 28°13' 23.92"N), BH3 (83°58' 44.50"E, 28°13' 24.13"N), BH4(83°59' 58.62"E, 28°13' 48.65"N), BH5(83°59' 59.35"E, 28°13' 48.65"N), BH6(83°59' 59.47" E, 28°13' 47.61"N), BH7(83°59'

46.35"E, 28°11' 41.91"N), BH8(83° 59' 45.77"E, 28°11' 42.90"N), BH9(83°59' 47.08"E, 28°11' 43.15"N), BH10(83° 58' 49.16"E, 28°13' 24.89"N), BH11(83°58' 47.62"E, 28°13' 25.28"N), BH12(83°58' 48.04"E, 28°13' 24.79"N), BH13(83°58' 23.57"E, 28°12' 26.75"N), BH14(83°58' 23.71"E, 28°12' 26.36"N), BH15(83°58'52.79"E, 28°13'41.83"N), BH16(83°58'53.15"E, 28°13'42.86"N), BH17(83°59'34.33"E, 28°13'45.93"N), BH18(83°59'33.07"E, 28°13'46.18"N), BH19(83°58'07.45"E, 28°12'44.03"N), BH20(83°58'06.77"E, 28°12'43.44"N), BH21(83°58'11.57"E, 28°11'29.85"N), and BH22(83°58'12.52"E, 28°11'30.05"N). Location of borehole sites in Google Earth is shown in above Figures 1. The locations of boreholes are enlarged in Figures 2-10. Borehole no. BH1, BH2, BH3 are for "Parshyang Reservoir site". Similarly, borehole no. BH4, BH5, BH6 are for "Fulbari Reservoir site", boreholes BH7, BH8, BH9 are for "Kolpatan Reservoir site", boreholes no. BH10, BH11, BH12 are for "Children Park site". Boreholes noBH13, BH14 are for "Firke Khola Masbar-Simalchaur site", boreholes BH15, BH16 are for "Firke Khola Bridge site", boreholes BH17, BH18 are for "Narayanthan Bridge site" boreholes BH19, BH20 are for "Bulaudi Khola site" and boreholes BH21, BH22 are for "Birauta site".

Fig.2: Location of Parshyang Reservoir site in Google Map

Fig.3: Location of Fulbari Reservoir site in Google Map

Fig.4: Location of Kolpatan Reservoir site in Google Map

Fig.5: Location of Children Park site in Google Map

Fig.6: Location of Firke Khola Masbar-Simalchaur site in Google Map

Fig.7: Location of Firke Khola Bridge site in Google Map

Fig.8: Location of Narayanthan Bridge site in Google Map

Fig.9: Location of Bulaudi Khola site in Google Map

Fig.10: Location of Birauta site in Google Map

One borehole locations, viz, Boreholes BH1-BH22 on the plots, as show in Figures 1, have been proposed to make Standard Peretration Test (SPT), Dynamic Cone Penetration Test (DCPT) for sub-soil investigation. This report presents the bore logs based on the field test and different properties of soil based on laboratory tests.

1.2 General Geology and Geomorphology

The site is located in Pokhara Valley which is a part of lesser-Himalaya of Nepal. This zone lies north from siwaliks. The unmetamorphosed young sedimentary rocks of Siwalik Zone is directly come in contact with the metamorphosed rock sequences of lesser himalaya which is separeted from Siwaliks by MBT and from Higher Himalaya by MCT. Geologically this zone mainly composed of low grade metamorphic rocks like slate phyllite schist marble quartzite and sedimentary rocks like limestone, dolomite and shale etc in south. In some region there is some magmatic intrusion like granitesynite, pigmatite etc. in this zone.

Pokhara is a valley mainly formed by glacio-fluvial deposits. There are different types of soil profile. Mainly in Pokhara valley there is silt, gravelly silt sandy silt and clayey silt. We can find the different rock gravel like gneiss, limestone with silt in pokhara. Somewhere we found the quartz gravel with silt. The silt found in pokhara is very weak and cannot bear any load when come to contact with water. Due to presence of silt and also the water somewhere very weak layer also observed. The color of silt found in pokhara valley is yellow, brownish yellow, white and grayish white.

2.0 OBJECTIVES

The main objectives of this geotechnical investigation are to carry out geo-profile of the project site, the physical properties of the in-situ soil by carrying out different field and various laboratories testing works. In particular, the objectives are:

i. to plot the borelog of the sub-soil
ii. to find the bearing capacity and coefficient of permeability value of the ground strata
iii. to assess the physical properties of the sub-soil

3.0 SCOPE OF THE WORK

The scope of works consist of field work as well as laboratory works. The main scopes of the works are:

i. to drill the fourteen number of borehole (i.e. BH1-BH22) up to different depth (as shown in bore logs) by conducting Standard Penetration Test (SPT), and Dynamic Cone Penetration Test (DCPT) (if necessary)
ii. to perform the permeability tests
iii. to collect the undisturbed and disturbed samples for field and laboratory tests, and
iv. to prepare the Geotechnical Investigation Report based on the results

4.0 METHODOLOGY

The methodologies adopted for whole operation to meet the objectives are described briefly in the following subheadings.

4.1 Field Test

The field work was done from 11th September to 2nd October, 2015. At the time of investigation, a team of experts, staff and few workers set-up the Standard Penetration Test (SPT), Dynamic Cone penetration Test (DCPT) test and permeability test equipment and other necessary accessories at the site.

The borehole at project site was advanced by rotary drilling machine. The borehole was drilled up to different depth as requirements. The method of rotary drilling has been selected based on the site observation. Similarly, the permeability tests have been also selected based on the site observation and requirements. The soil extracted during drilling of each hole was observed carefully by the supervisor so as to make site borehole logs.

4.1.1 Penetration Tests (SPT/DCPT)

The Standard Penetration Test / Dynamic Cone Penetration Test (SPT/DCPT) was conducted at every 1.0 m interval. The total number of blow count of a 63.5 kg hammer, falling freely from 75 cm height, required for 2nd and 3rd 150 mm penetration of split spoon sampler or cone were recorded as field N-value. The purpose of the test was to obtain information on relative density of cohesion less soil and consistency of cohesive soils. The samples obtained in the split tube are disturbed but representative samples. They are preserved for determination of the index properties of the soil. The DCPT obtained is again converted in SPT using the correlation given by Central Building
Research Institute, Roorkee;

$N_{DCP} = 1.5N_{SPT}$	for depths upto 4m
$N_{DCP} = 1.75N_{SPT}$	for depths between 4 to 9m
$N_{DCP} = 2N_{SPT}$	for depths greater than 9m

4.1.2 Sampling

The disturbed and undisturbed samples were also collected and transported to the laboratory for further investigation. Before any sample was taken, the borehole was cleaned up of loose disturbed soil deposited during boring operation. The samples obtained in the SPT tube were representative samples. They were preserved in air tight plastic bags, labeled properly for identification for determination of the index properties of the soil at laboratory

4.1.3 Permeability Tests

Permeability is property of soil by virtue of which the soil mass allows water to flow through it. Permeability test is required to determine/understand the soil engineering problems involving flow of water through soils. In this study, constant head and falling head permeability test were performed to determine the coefficient of permeability.

4.2 Laboratory test

Depending upon the type of soil and the scope of works, type and number of the laboratory test were determined in consultation with the Geotechnical Engineer. The tests were carried out utilizing standard procedures as specified by IS, BS, AASHTO or ASTM. Following laboratory tests were conducted for the retrieved soil samples to get the physical properties of the sub-soils.

- Water Content Test
- Specific Gravity/Solid Density Test
- Bulk Density Test
- Grain Size Analysis etc.

5.0 TEST RESULTS

5.1 Field test results

Both field tests and laboratory tests were performed to study the soil strata and properties up to the different depths as requirements. Based on field test, analysis of SPT/DCPT test results are presented in the annexes 7.1. Summary of N-value and Allowable Bearing Capacity are shown in Table1. Similarly, the Summary of permeability test results is tabulated in Table 2.

Table 1: Summary of N-value and Allowable Bearing Capacity

Borehole No.	Depth, (m)	SPT Value, N	Standardize SPT Value, N_{60}	Allowable Bearing Capacity for 25 mm permissible settlement, (Mayerhof's), (kN/m^2)
BH1	1.00	9.00	5	34
	2.00	6.00	4	26
	3.00	14.00	8	60
	4.00	2.00	1	9
	5.00	9.00	5	38
	6.00	29.00	17	124
	6.21	28.57	17	122
	7.06	28.57	17	122
	8.05	28.57	17	122
	9.02	28.57	17	122
	10.01	25.00	15	107
BH2	1.00	5.00	3	21

	2.00	7.00	4	30
	3.00	7.00	4	30
	4.00	36.00	22	154
	4.28	28.57	17	122
	5.09	28.57	17	122
	6.04	28.57	17	122
	7.03	28.57	17	122
	8.03	28.57	17	122
	9.03	25.00	15	107
BH3	1.00	10.00	6	43
	2.00	11.00	7	47
	4.00	2.00	1	9
	5.00	3.00	2	13
	6.00	7.00	4	30
	7.00	11.00	7	47
	8.00	28.57	17	122
	8.91	28.57	17	122
	9.10	25.00	15	107
	10.04	25.00	15	107
	11.04	25.00	15	107
BH4	1.00	22.67	14	97
	2.00	12.67	8	54
	3.00	34.67	21	148
	4.00	3.33	2	14
	5.00	1.14	1	5
	6.00	22.86	14	98
	6.09	28.57	17	122
	7.23	28.57	17	122
	8.06	28.57	17	122
	9.23	25.00	15	107
	10.04	25.00	15	107
BH5	1.00	12.67	8	54
	1.13	33.33	20	142
	3.00	60.00	36	256
	4.00	16.67	10	71
	4.07	28.57	17	122
	5.09	28.57	17	122
	6.17	18.86	11	81
	7.09	28.57	17	122
	8.10	28.57	17	122
BH6	1.00	26.00	16	111
	2.00	6.00	4	26
	3.00	21.00	13	90
	4.00	12.00	7	51
	5.00	32.00	19	137
	6.00	28.57	17	122
	6.06	28.57	17	122
	7.05	28.57	17	122

	8.07	28.57	17	122
	9.09	28.57	17	122
BH7	1.00	16.00	10	68
	2.00	26.00	16	111
	3.00	18.67	11	80
	3.26	28.57	17	122
	4.12	28.57	17	122
	5.07	28.57	17	122
	6.05	28.57	17	122
	7.26	28.57	17	122
BH8	1.00	33.33	20	142
	2.00	33.33	20	142
	3.00	33.33	20	142
	4.00	33.33	20	142
	5.00	28.57	17	122
BH9	1.00	33.33	20	142
	2.00	33.33	20	142
	3.00	33.33	20	142
	4.00	33.33	20	142
	5.00	28.57	17	122
	6.00	28.57	17	122
	7.00	28.57	17	122
	8.00	28.57	17	122
	9.00	28.57	17	122
	10.00	51.50	31	220
BH10	1.00	33.33	20	142
	2.00	33.33	20	142
	3.00	33.33	20	142
	4.00	33.33	20	142
	5.00	16.57	10	71
BH11	1.00	33.33	20	142
	2.00	36.00	22	154
	3.00	35.33	21	151
	4.00	34.00	20	145
	5.00	35.43	21	151
	6.00	29.71	18	127
	7.00	32.57	20	139
	8.00	28.57	17	122
	9.00	28.57	17	122
	10.00	25.00	15	107
	11.00	25.00	15	107
BH12	1.00	33.33	20	142
	2.00	33.33	20	142
	3.00	33.33	20	142
	4.00	33.33	20	142
	5.00	28.57	17	122
BH13	1.00	33.33	20	142
	2.00	33.33	20	142

	3.00	33.33	20	142
	4.00	33.33	20	142
	5.00	28.57	17	122
BH14	1.00	30.67	18	131
	2.00	40.67	24	174
	6.00	148.00	89	633
	7.00	29.71	18	127
	8.00	50.00	30	214
	9.00	34.29	21	147
	10.00	25.00	15	107
	11.00	25.00	15	107
BH15	1.00	33.33	20	142
	2.00	33.33	20	142
	5.00	16.00	10	68
	6.00	28.57	17	122
	7.00	28.57	17	122
	8.00	28.57	17	122
	9.00	28.57	17	122
	10.00	25.00	15	107
BH16	1.00	5.00	3	21
	2.00	30.00	18	128
	3.00	42.00	25	180
	4.00	6.00	4	26
	5.00	12.00	7	51
	6.00	28.57	17	122
	7.00	28.57	17	122
	8.00	28.57	17	122
	9.00	28.57	17	122
	10.00	25.00	15	107
BH17	1.00	13.00	8	56
	2.00	4.00	2	17
	3.00	19.00	11	81
	4.00	33.33	20	142
	5.00	28.57	17	122
	6.00	28.57	17	122
	7.00	28.57	17	122
	8.00	28.57	17	122
BH18	1.00	33.33	20	142
	2.00	33.33	20	142
	3.00	33.33	20	142
	4.00	28.57	17	122
	6.00	28.57	17	122
	7.00	28.57	17	122
	8.00	28.57	17	122
	9.00	28.57	17	122
	10.00	25.00	15	107
BH19	1.00	26.00	16	111
	2.00	33.33	20	142

	3.00	33.33	20	142
	4.00	55.33	33	237
	5.00	28.57	17	122
	6.00	28.57	17	122
BH20	1.00	9.00	5	38
	2.00	11.00	7	47
	3.00	11.00	7	47
	4.00	33.33	20	142
	5.00	28.57	17	122
	6.00	28.57	17	122
	7.00	28.57	17	122
	8.00	28.57	17	122
BH21	1.00	33.33	20	142
	2.00	6.00	4	26
	3.00	4.67	3	20
	4.00	11.33	7	48
	5.00	3.00	2	13
	6.00	28.57	17	122
	7.00	28.57	17	122
	8.00	28.57	17	122
	9.00	28.57	17	122
	10.00	25.00	15	107
BH22	1.00	4.00	2	17
	2.00	6.00	4	26
	3.00	6.00	4	26
	4.00	4.00	2	17
	5.00	5.00	3	21
	6.00	15.00	9	64
	8.00	8.00	5	34
	10.55	50.00	30	214
	12.00	59.00	35	252
	13.00	25.00	15	107

Table 2: Summary of permeability test results

Borehole Number	Test	Depth, m	
		3.0	11.0
BH1	Coefficient of permeability, k (mm/sec)	1.310×10^{-2}	3.249×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	10.0
BH2	Coefficient of permeability, k (mm/sec)	1.721×10^{-4}	3.184×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	12.0
BH3	Coefficient of permeability, k (mm/sec)	2.566×10^{-3}	2.966×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	11.0
BH4	Coefficient of permeability, k (mm/sec)	-	3.277×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	9.0
BH5	Coefficient of permeability, k (mm/sec)	2.072×10^{-4}	6.834×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	10.0
BH6	Coefficient of permeability, k (mm/sec)	9.309×10^{-4}	1.594×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	8.0
BH7	Coefficient of permeability, k (mm/sec)	2.232×10^{-3}	8.937×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	5.0
BH8	Coefficient of permeability, k, (mm/sec)	1.737×10^{-3}	5.421×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	10.0
BH9	Coefficient of permeability, k, (mm/sec)	2.775×10^{-3}	1.045×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	5.0
BH10	Coefficient of permeability, k, (mm/sec)	1.946×10^{-3}	9.155×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	11.0
BH11	Coefficient of permeability, k, (mm/sec)	2.016×10^{-3}	8.334×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	5.0
BH12	Coefficient of permeability, k, (mm/sec)	2.172×10^{-5}	2.392×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	5.0
BH13	Coefficient of permeability, k, (mm/sec)	2.811×10^{-3}	2.209×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	11.0
BH14	Coefficient of permeability, k, (mm/sec)	5.154×10^{-3}	2.618×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	10.0
BH15	Coefficient of permeability, k, (mm/sec)	4.010×10^{-4}	-

Borehole Number	Test	Depth, m	
		7.0	10.0
BH16	Coefficient of permeability, k, (mm/sec)	2.378×10^{-3}	1.458×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	8.0
BH17	Coefficient of permeability, k, (mm/sec)	1.316×10^{-4}	2.284×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	10.0
BH18	Coefficient of permeability, k, (mm/sec)	4.517×10^{-3}	1.351×10^{-3}

Borehole Number	Test	Depth, m	
		3.0	6.0
BH19	Coefficient of permeability, k, (mm/sec)	1.312×10^{-3}	8.445×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	8.0
BH20	Coefficient of permeability, k, (mm/sec)	1.764×10^{-4}	1.697×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	8.0
BH21	Coefficient of permeability, k, (mm/sec)	2.823×10^{-4}	1.697×10^{-4}

Borehole Number	Test	Depth, m	
		3.0	13.0
BH22	Coefficient of permeability, k, (mm/sec)	2.338×10^{-4}	-

5.2 Laboratory test results

The laboratory tests are conducted to obtain the physical properties of the tested samples. The laboratory test results of water content test, specific gravity/solid density test, bulk density and grain size analysis are presented in Tables 3-6 below respectively.

Table 3: Summary of water content test results

Borehole Number	Test	Depth, m				
		0-1	2-3	4-5	5-6	9-9.6
BH1	Water Content, w, (%)	17.51	20.06	19.43	20.19	17.92

Borehole Number	Test	Depth, m				
		1-2	4	6-7	8-9	9-10
BH2	Water Content, w, (%)	18.65	22.35	18.20	18.79	14.85

Borehole Number	Test	Depth, m								
		0-1	2-3	3-4	5	6	7	8	9-10	11-12
BH3	Water Content, w, (%)	29.78	18.68	22.75	19.32	27.11	21.74	13.63	22.02	17.53

Borehole Number	Test	Depth, m			
		0-1	3-4	5	6
BH4	Water Content, w, (%)	21.39	9.57	14.76	12.41

Borehole Number	Test	Depth, m					
		0-1	1-2	2-3	5-6	7-8	8-9
BH5	Water Content, w, (%)	14.03	19.00	19.38	16.42	20.19	18.61

Borehole Number	Test	Depth, m				
		1-2	2-3	6-7	8-9	9-10
BH6	Water Content, w, (%)	20.49	21.49	12.05	16.88	16.36

Borehole Number	Test	Depth, m			
		1-2	2-3	5-6	7-8
BH7	Water Content, w, (%)	14.62	18.30	17.30	20.02

Borehole Number	Test	Depth, m		
		1-2	3-4	4-5
BH8	Water Content, w, (%)	17.85	25.09	22.34

Borehole Number	Test	Depth, m				
		1-2	3-4	5-6	7-8	9-10
BH9	Water Content, w, (%)	17.51	21.65	15.72	18.24	18.41

Borehole Number	Test	Depth, m			
		1-2	2-3	3-4	4-5
BH10	Water Content, w, (%)	18.42	7.75	25.42	21.02

Borehole Number	Test	Depth, m					
		0-1	2-3	4-5	6-7	8-9	10-11
BH11	Water Content, w, (%)	5.89	12.56	7.88	7.15	7.72	14.21

Borehole Number	Test	Depth, m			
		0-1	2-3	3-4	4-5
BH12	Water Content, w, (%)	26.56	9.30	12.43	13.80

Borehole Number	Test	Depth, m		
		1-2	3-4	4-5
BH13	Water Content, w, (%)	4.38	19.50	11.88

Borehole Number	Test	Depth, m				
		0-1	1-2	2-3	6-7	8-9
BH14	Water Content, w, (%)	20.17	19.71	13.38	11.02	12.27

Borehole Number	Test	Depth, m				
		0-1	2-3	6-7	7-8	8-8.4
BH15	Water Content, w, (%)	16.14	15.83	18.69	19.52	14.13

Borehole Number	Test	Depth, m			
		1	6-7	8-9	9-10
BH15	Water Content, w, (%)	26.44	10.50	18.27	16.64

Borehole Number	Test	Depth, m				
		1-2	2-3	5-6	6-7	7-8
BH17	Water Content, w, (%)	22.16	18.00	20.44	14.37	18.98

Borehole Number	Test	Depth, m				
		0-1	4-5	6-7	8-9	9-10
BH18	Water Content, w, (%)	19.89	21.00	16.35	21.47	22.55

Borehole Number	Test	Depth, m			
		0-1	1-2	3-4	5-6
BH19	Water Content, w, (%)	18.78	21.76	25.50	24.70

Borehole Number	Test	Depth, m				
		1	3	5-6	6-7	7-8
BH20	Water Content, w, (%)	18.99	18.43	29.68	29.05	10.41

Borehole Number	Test	Depth, m					
		0-1	1-2	2-3	7-8	8-9	9-10
BH21	Water Content, w, (%)	11.68	13.03	20.02	32.48	31.85	30.93

Borehole Number	Test	Depth, m					
		1	2	3	4	5-6	12
BH22	Water Content, w, (%)	21.31	15.99	22.13	17.34	17.97	12.40

Table 4: Summary of specific gravity/solid density test results

Borehole Number	Test	Depth, m				
		0-1	2-3	4-5	5-6	9-9.6
BH1	Specific Gravity, G, (g/cm^3)	2.70	2.67	2.74	2.68	2.69

Borehole Number	Test	Depth, m		
		2-3	6	9-10
BH2	Specific Gravity, G, (g/cm^3)	2.70	2.69	2.71

Borehole Number	Test	Depth, m			
		2-3	6	9-10	11-12
BH3	Specific Gravity, G, (g/cm^3)	2.70	2.69	2.65	2.66

Borehole Number	Test	Depth, m	
		0-1	3-4
BH4	Specific Gravity, G, (g/cm^3)	2.76	2.68

Borehole Number	Test	Depth, m					
		0-1	1-2	2-3	5-6	7-8	2.89
BH5	Specific Gravity, G, (g/cm^3)	2.68	2.69	2.70	2.71	2.72	2.72

Borehole Number	Test	Depth, m		
		1-2	6-7	9-10
BH6	Specific Gravity, G, (g/cm^3)	2.67	2.68	2.70

Borehole Number	Test	Depth, m		
		1-2	5-6	7-8
BH7	Specific Gravity, G, (g/cm^3)	2.65	2.70	2.72

Borehole Number	Test	Depth, m			
		1-2	3-4	4-5	7-8
BH8	Specific Gravity, G, (g/cm^3)	2.71	2.67	2.73	2.69

Borehole Number	Test	Depth, m				
		1-2	3-4	5-6	7-8	9-10
BH9	Specific Gravity, G, (g/cm^3)	2.70	2.68	2.67	2.69	2.71

Borehole Number	Test	Depth, m		
		1-2	2-3	4-5
BH10	Specific Gravity, G, (g/cm^3)	2.66	2.67	2.72

Borehole Number	Test	Depth, m						
		0-1	2-3	4-5	5-6	6-7	8-9	10-11
BH11	Specific Gravity, G, (g/cm^3)	2.68	2.75	2.67	2.72	2.71	2.69	2.67

Borehole Number	Test	Depth, m			
		0-1	2-3	3-4	4-5
BH12	Specific Gravity, G, (g/cm^3)	2.72	2.69	2.73	2.68

Borehole Number	Test	Depth, m		
		1-2	3-4	4-5
BH13	Specific Gravity, G, (g/cm^3)	2.70	2.68	2.72

Borehole Number	Test	Depth, m				
		1	1-2	6.5	6.5-7	8-9
BH14	Specific Gravity, G, (g/cm^3)	2.67	2.71	2.70	2.71	2.69

Borehole Number	Test	Depth, m				
		0-1	2-3	6-7	7-8	8-8.4
BH15	Specific Gravity, G, (g/cm^3)	2.70	2.67	2.71	2.73	2.72

Borehole Number	Test	Depth, m			
		1	6-7	8-9	9-10
BH16	Specific Gravity, G, (g/cm^3)	2.66	2.70	2.72	2.69

Borehole Number	Test	Depth, m				
		1-2	2-3	5-6	6-7	7-8
BH17	Specific Gravity, G, (g/cm^3)	2.70	2.68	2.69	2.68	2.71

Borehole Number	Test	Depth, m				
		0-1	4-5	6-7	8-9	9-10
BH18	Specific Gravity, G, (g/cm^3)	2.72	2.69	2.73	2.67	2.70

Borehole Number	Test	Depth, m		
		1-2	3-4	5-6
BH19	Specific Gravity, G, (g/cm^3)	2.67	2.73	2.71

Borehole Number	Test	Depth, m				
		1	4-5	5-6	6-7	7-8
BH20	Specific Gravity, G, (g/cm^3)	2.68	2.71	2.74	2.71	2.72

Borehole Number	Test	Depth, m				
		0-1	2-3	7-8	8-9	9-10
BH21	Specific Gravity, G, (g/cm^3)	2.69	2.72	2.73	2.67	2.71

Borehole Number	Test	Depth, m		
		3-4	5-6	10-12
BH22	Specific Gravity, G, (g/cm^3)	2.71	2.70	2.70

Table 5: Summary of bulk density test results

Borehole Number	Test	Depth, m
		8-9
BH2	Bulk Density, ρ_b, (g/cm^3)	1.524

Borehole Number	Test	Depth, m
		11-12
BH3	Bulk Density, ρ_b, (g/cm^3)	1.559

Borehole Number	Test	Depth, m					
		0-1	1-2	2-3	5-6	7-8	8-9
BH5	Bulk Density, ρ_b, (g/cm^3)	1.720	1.744	1.606	1.639	1.807	1.638

Borehole Number	Test	Depth, m		
		1-2	6-7	9-10
BH6	Bulk Density, ρ_b, (g/cm^3)	1.594	1.467	1.592

Borehole Number	Test	Depth, m		
		1-2	5-6	7-8
BH7	Bulk Density, ρ_b, (g/cm^3)	1.655	1.687	1.654

Borehole Number	Test	Depth, m		
		1-2	3-4	4-5
BH8	Bulk Density, ρ_b, (g/cm^3)	1.765	1.936	1.637

Borehole Number	Test	Depth, m				
		1-2	3-4	5-6	7-8	9-10
BH9	Bulk Density, ρ_b, (g/cm^3)	1.823	1.844	1.619	1.691	1.585

Borehole Number	Test	Depth, m			
		1-2	2-3	3-4	4-5
BH10	Bulk Density, ρ_b, (g/cm^3)	1.730	1.481	1.894	1.690

Borehole Number	Test	Depth, m	
		4-5	8-9
BH11	Bulk Density, ρ_b, (g/cm^3)	1.620	1.566

Borehole Number	Test	Depth, m		
		0-1	2-3	4-5
BH12	Bulk Density, ρ_b, (g/cm^3)	1.760	1.634	1.522

Borehole Number	Test	Depth, m		
		1-2	3-4	4-5
BH13	Bulk Density, ρ_b, (g/cm^3)	1.470	1.836	1.664

Borehole Number	Test	Depth, m	
		1-2	8-9
BH14	Bulk Density, ρ_b, (g/cm^3)	1.703	1.534

Borehole Number	Test	Depth, m
		2-3
BH15	Bulk Density, ρ_b, (g/cm^3)	1.722

Borehole Number	Test	Depth, m		
		6-7	8-9	9-10
BH16	Bulk Density, ρ_b, (g/cm^3)	1.512	1.722	1.675

Borehole Number	Test	Depth, m
		6-7
BH17	Bulk Density, ρ_b, (g/cm^3)	1.633

Borehole Number	Test	Depth, m				
		0-1	4-5	6-7	8-9	9-10
BH18	Bulk Density, ρ_b, (g/cm^3)	1.627	1.599	1.580	1.756	1.688

Borehole Number	Test	Depth, m		
		1-2	3-4	5-6
BH19	Bulk Density, ρ_b, (g/cm^3)	1.695	1.756	1.726

Borehole Number	Test	Depth, m			
		4-5	5-6	6-7	7-8
BH20	Bulk Density, ρ_b, (g/cm^3)	1.643	1.652	1.568	1.370

Borehole Number	Test	Depth, m			
		0-1	7-8	8-9	9-10
BH21	Bulk Density, ρ_b, (g/cm^3)	1.540	1.878	1.893	1.891

Table 6: Summary of grain size analysis test results

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH1	0-1	77.24	10.84	11.91	-	-	-	-	-
	4-5	78.98	23.26	7.76	-	-	-	-	-
	9-9.6	22.90	77.10	-	-	0.12	0.31	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH2	1-2	72.12	17.68	10.20	-	-	-	-	-
	6-7	23.68	76.32	-	-	0.09	0.21	-	-
	9-10	43.16	56.84	-	-	-	0.18	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH3	2-3	52.52	18.84	28.65	-	-	0.30	-	-
	6	56.96	20.07	22.97	-	-	0.10	-	-
	9-10	42.55	57.45	-	-	-	0.15	-	-
	11-12	39.16	60.84	-	-	-	0.13	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH4	1	53.26	46.06	-	-	-	0.10	-	-
	3-4	48.63	9.73	41.64	-	-	4.00	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH5	0-1	8.68	70.46	20.86	0.10	0.40	1.30	13.0	1.23
	1-2	35.37	62.99	1.64	-	-	0.20	-	-
	2-3	31.22	66.38	2.4	-	-	0.16	-	-
	5-6	45.67	54.21	0.12	-	-	0.18	-	-
	7-8	37.78	61.90	0.33	-	-	0.28	-	-
	8-9	43.61	55.63	0.76	-	-	0.17	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH6	1-2	44.96	52.95	2.09	-	-	0.11	11.54	1.75
	6-7	10.41	89.09	0.50	0.08	0.35	0.90	-	-
	9-10	15.03	84.71	0.27	-	0.15	0.50	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH7	1-2	17.68	74.98	7.34	-	0.16	0.28	-	-
	5-6	21.26	78.30	0.44	-	0.13	0.31	-	-
	7-8	5.81	91.38	2.81	0.09	0.22	0.51	5.67	1.05

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH8	1-2	12.55	85.52	1.93	-	0.16	1.10	-	-
	3-4	24.05	75.51	0.43	-	0.10	0.29	-	-
	4-5	8.41	91.59	-	0.08	0.21	0.36	4.50	1.53

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH9	1-2	7.02	76.10	16.88	0.12	0.37	1.32	11.0	0.86
	3-4	12.26	85.72	2.02	-	0.26	0.80	-	-
	5-6	12.27	87.19	0.55	-	0.23	0.57	-	-
	7-8	23.71	76.29	-	-	0.11	0.32	-	-
	9-10	11.56	86.63	1.80	-	0.26	0.60	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH10	1-2	1.32	88.51	10.16	0.27	0.59	1.40	5.19	0.92
	2-3	3.18	93.51	3.31	0.17	0.36	0.80	4.71	0.95
	4-5	26.54	69.26	4.20	-	0.82	0.19	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH11	0-1	5.99	58.61	35.40	0.30	1.02	1.85	6.17	1.87
	2-3	37.07	61.57	1.35	-	-	0.55	-	-
	4-5	3.45	96.41	0.15	0.31	0.72	1.30	4.19	1.29
	5-6	4.28	95.51	0.21	0.21	0.52	1.20	6.00	1.13
	6-7	6.41	90.13	3.46	0.15	0.50	1.30	8.67	1.28
	7-8	6.91	91.19	1.89	0.11	0.33	0.85	7.73	1.16
	8-9	9.31	90.41	0.28	0.08	0.26	0.69	8.63	1.22
	10-11	12.50	86.11	1.40	-	0.22	0.57	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH12	0-1	30.11	69.84	0.05	-	-	0.20	-	-
	2-3	11.13	87.10	1.77	-	0.30	0.90	-	-
	3-4	13.64	86.16	0.20	-	0.22	0.70	-	-
	4-5	11.93	86.81	1.26	-	0.30	0.90	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH13	1-2	4.40	95.49	0.11	0.20	0.60	1.30	6.50	1.38
	3-4	28.51	71.41	0.08	-	0.13	0.98	-	-
	4-5	25.94	73.52	0.53	-	0.09	0.37	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH14	1-2	0.3	85.93	13.77	0.12	0.48	1.4	11.67	1.37
	2-3	15.10	84.90	-	-	0.21	0.52	-	-
	6.5-7	33.41	19.72	46.87	-	-	0.41	-	-
	8-9	1.98	94.86	3.16	0.12	0.50	1.2	10.00	1.74

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH15	0-1	7.47	67.78	24.76	0.10	0.26	0.90	9.00	0.75
	2-3	19.34	74.91	5.75	-	0.17	0.51	-	-
	6-7	45.00	55.00	-	-	-	0.19	-	-
	7-8	57.90	41.84	0.26	-	-	0.11	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH16	8-9	21.95	77.93	0.12	-	0.15	0.37	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH17	2-3	74.94	12.12	12.94	-	-	-	-	-
	5-6	13.18	85.18	1.64	-	0.19	0.45	-	-

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH18	4-5	38.35	61.43	0.22	-	-	0.15	-	-
	6-7	26.08	73.81	0.10	-	-	0.21	-	-
	8-9	5.89	94.04	0.07	0.10	0.21	0.37	-	-
	9-10	3.32	96.64	0.05	0.14	0.22	0.47	3.36	0.74

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH19	0-1	1.49	77.91	20.60	0.18	0.30	0.90	5.00	0.56
	1-2	11.16	88.79	0.04	-	0.21	0.39	-	-
	3-4	5.52	93.13	1.34	0.11	0.26	0.51	4.64	1.20

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH20	3	51.89	24.91	23.20	-	-	0.18	-	-
	4-5	41.96	56.60	1.44	-	-	0.14	-	-
	5-6	8.11	91.32	0.57	0.08	0.14	0.22	2.75	1.11

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH21	2-3	61.33	22.24	16.43	-	-	-	-	-
	7-8	5.18	94.82	-	0.14	0.28	0.45	3.21	1.24

Borehole Number	Depth, (m)	Clay/ Silt (%)	Sand, (%)	Gravel, (%)	D10, (mm)	D30, (mm)	D60, (mm)	C_u	C_c
BH22	3-4	54.62	15.87	29.51	-	-	0.16	-	-
	5-6	68.88	19.60	11.52	-	-	-	-	-
	10-12	45.88	21.22	32.90	-	-	0.70	-	-

6.0 CONCLUSIONS

The details soil strata up to different depth of BH1-BH22were observed from the borehole logs. From this, it was found that the low plasticity silt and sand with little gravel are presented throughout the depth. Summary of N-value and Allowable Bearing Capacity of BH1-BH22 were presented in Table1. The Summary of permeability test results was presented in Table 2. Similarly, the laboratory test results (i.e., water content test, specific gravity/solid density test, and bulk density and grain size analysis etc,) of BH1-BH22 were summarized in Tables 3-6.

The Atterberge's limits test, Consolidation test and unified compression test of all tested samples could not conducted due to the presence of higher percentage of silt and sand (i.e. inorganic silts of low plasticity with higher percentage of sand and few gravels) in the test specimens.

7.0 ANNEXES

7.1 Analysis of penetration tests (SPT/DCPT) results

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Prashyang-05, Pokhara (Prashyang Reservoir)
Bore Hole No : 01
RL of GWT, m : NotFound
Date : 2015/09/11～12

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT/UD Value N
	1.00	1.00	0.15 0.30 0.45	SPT SPT SPT	Dark brown, moist, low plasticity, slow dialtency silt to silty clay with few gravels.	3 4 5
	2.00	1.00	1.15 1.30 1.45	SPT SPT SPT	Dark grey limestone and weathered gneiss pebbles with dark brown moist, low plasticity, slow dilatency.	3 2 4
	3.00	1.00	2.15 2.30 2.45	SPT SPT SPT	Dark brown, moist, low plasticity, slow dialtency silt to silty clay with limestone gravels.	3 6 8
	4.00	1.00	3.15 3.30 3.45	SPT SPT SPT	Brownish yellow, moist, low plastiity, slow dialtency, silt with few gravels.	3 1 1
	5.00	1.00	4.15 4.30 4.45	SPT SPT SPT	Light brown, moist, low plasticity, slow dilatency, silt with few gravels.	4 3 6
	6.00	1.00	5.15 5.30 5.40	SPT SPT SPT	Light brown, moist, non-plastic, slow dilatency silt with gravels.	10 7 22
	7.00	1.00	6.15 6.21	DCPT DCPT	Conglomerate with dark grey to light grey limestone pebbles and gravels	20 50
	8.00	1.00	7.06	DCPT	Conglomerate pebbles with dark grey limestone gravels	50
	9.00	1.00	8.05	DCPT	Dark grey to light grey medium grained sand with conglomerate pebble and light grey limestone and dolomite pebbles and gravels	50
	10.00	1.00	9.02	DCPT	Light brown to light grey limestone pebbles and cobble	50
	11.00	1.00	10.01	DCPT	Conglomerate pebbles.	50

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply improvement Project in Nepal
Location : Prashyang-05, Pokhara, Kaski (Prashyang Reservoir)
Bore Hole No : 02
RL of GWT, m : Not Found
Date : 2015/09/13～14

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.15 0.30 0.45	SPT SPT SPT	Dark brown, moist, low plasticity, slow dialtency, silt to sity clay with light grey limestone and gneiss pebbles.	3 2 3
	2.00	1.00	1.15 1.30 1.45	SPT SPT SPT	Light brown, moist, low plasticity, slow dialteacy silt with gravels.	4 3 4
	3.00	1.00	2.15 2.30 2.45	SPT SPT SPT	Dark brown, moist, low plasticity, slow dialtency silt with gravels.	3 4 3
	4.00	1.00	3.15 3.30 3.45	SPT SPT SPT	Dark brown, moist, low plasticity, slow dialtency silt to silty sand with gravels.	2 9 27
	5.00	1.00	4.15 4.28	DCPT DCPT	Fine silt.	29 50
	6.00	1.00	5.09	DCPT	Light grey limestone and dolomite pebbles	50
	7.00	1.00	6.04	DCPT	Limestone and dolomite pebbles.	50
	8.00	1.00	7.03	DCPT	Limestone and conglomerate pebbles	50
	9.00	1.00	8.03	DCPT	Conglomerate and limestone pebbles	50
	10.00	1.00	9.03	DCPT	Limestone and conglomerate pebbles	50

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Prashyang-05, Pokhara (Prashyang Reservoir)
Bore Hole No : 03
RL of GWT, m : Not Found
Date : 2015/09/15～16

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT/UD Value N
	1.00	1.00	0.15 0.30 0.45	SPT SPT SPT	Dark brown to brownish yellow, low plasticity, slow dialtency moist silt.	4 5 5
	2.00	1.00	1.15 1.30 1.45	SPT SPT SPT	White quartz and weathered quartzite pebbles with dark brown, low plasiticiy, slow dialtency sand.	5 6 5
	3.00	1.00	2.15 2.30 2.52	SPT SPT SPT	Dark brown, low plasticity, moist slow dialtency silt.	52 cm/ 1 blows
	4.00	1.00	3.15 3.30 3.47	SPT SPT SPT	Dark brown, low plasticity, moist, slow dialtency silt with few pebbles.	2 32 cm /1 blows
	5.00	1.00	4.15 4.30 4.45	SPT SPT SPT	Dark brown, moist, non plastic, slow dialtency silt with few pebbles.	2 2 1
	6.00	1.00	5.15 5.30 5.40	SPT SPT SPT	Dark brown, moist, low plasticity, slow dialtency silt to silty sand.	2 2 5
	7.00	1.00	6.15 6.30 6.45	SPT SPT SPT	Weathered gneiss and dolomite pebbles with dark brown moist, non-plastic, slow dialtency silt.	3 6 5
	8.00	1.00	7.15 7.27	DCPT DCPT	Weathered dolomite, light grey limestone, gneiss gravels and pebbles	15 50
	9.00	1.00	8.91	DCPT	Light brown to light grey limestone pebbles.	50
	10.00	1.00	9.10	DCPT	Conglomerate, limestone and dolomite pebbles	50
	11.00	1.00	10.04	DCPT	Light grey limestone pebbles.	50
	12.00	1.00	11.04	DCPT	Gravels with fine sand	50

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nep
Location : Pokhara-05, Kaski (Right bank of Phirke Khola)
Bore Hole No : 04
RL of GWT, m : Not Found
Date : 2015/09/03～05

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT/UD Value N
	1.00	1.00	0.15 0.30 0.45	DCPT DCPT DCPT	Organic materials with silty to clayey poorly graded gravels with fine sand. Light grey limestone, gneiss, dolomite, phyllite and quartz cobbles and pebbles	10 12 22
	2.00	1.00	1.15 1.30 1.45	DCPT DCPT DCPT	Light grey to dark grey coloured limestone, gneiss and phyllite cobbles and pebbles	17 12 7
	3.00	1.00	2.15 2.30 2.45	DCPT DCPT DCPT	Light grey limestone, gneiss and matrix supported conglomerate cobbles and pebbles	24 27 25
	4.00	1.00	3.15 3.30 3.45	SPT SPT SPT	Poorly graded gravels of limestone and phyllite with moist sampling condition, plasiticity medium, slow dilatency silty clay.	3 2 3
	5.00	1.00	4.15 4.30 4.45	SPT SPT SPT	Poorly graded gravels of conglomerate, limestone and phyllitewith moist low plasticity slow dilatency silt.	2 1 1
	6.00	1.00	5.15 5.30 5.40	SPT SPT SPT	Dark brown, moist, low plasticity, medium dilatency, silty sand with few gravels.	8 17 23
	7.00	1.00	6.09	SPT	Fine silt with very fine sand.	50
	8.00	1.00	7.15 7.23	DCPT DCPT	Conglomerate and limestone gravel.	47 50
	9.00	1.00	8.06	DCPT	Light grey to dark grey limestone pebbles and light weathered limestone cobble.	50
	10.00	1.00	9.15 9.23	DCPT DCPT	Conglomerate cobbles with light grey to dark grey limestone pebbles and cobbles	27 50
	11.00	1.00	10.04	DCPT	Conglomerate pebbles	50

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara-04, Kaski (Left bank of Phirke Khola)
Bore Hole No : 05
RL of GWT, m : Not Found
Date : 2015/09/07～08

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	DCPT		19
			0.30	DCPT	Light brown to light grey medium to coarse sand. Light grey to dark grey limestone and matrix supported conglomerate pebbles	10
		1.00	0.45	DCPT		9
	1.00					
			1.13	DCPT		50
		1.00			Light brown fine to medium sand. Light grey limestone, gneiss and matrix supported conglomerate gravels and pebbles.	
	2.00					
			2.15	DCPT		16
			2.30	DCPT		40
		1.00	2.33	DCPT	Dark brown, fine to medium sand. Matrix supported conglomerate, light grey limestone gravels and pebbles.	50
	3.00					
			3.15	DCPT		6
			3.30	DCPT		8
		1.00	3.45	DCPT	Fine silt with clay.	12
	4.00					
			4.07	DCPT		50
		1.00			Fine silty clay.	
	5.00					
			5.09	DCPT		50
		1.00			Brownish grey, fine to medium sand.	
	6.00					
			6.15	DCPT		33
			6.17	DCPT		50
		1.00			Conglomerate and light grey limestone pebbles and gravels.	
	7.00					
			7.09	DCPT		50
		1.00			Medium to fine grained sand. Dark grey to light grey limestone gravels and pebbles	
	8.00					
			8.10	DCPT		50
		1.00			Brownish grey coloured, fine to medium grained sand. Light grey to dark grey coloured limestone pebbles.	
	9.00					

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Fulbari-11, Pokhara (Narayanthan Bridge)
Bore Hole No : 06
RL of GWT, m : Not Found
Date : 2015/09/02～03

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	SPT		9
			0.30	SPT		14
		1.00	0.45	SPT	Dark brown coloured, fine grained silty sand	12
	1.00					
			1.15	SPT		8
			1.30	SPT		3
		1.00	1.45	SPT	Dark brown coloured, dine grained silty sand	3
	2.00					
			2.15	DCPT		12
			2.30	DCPT		11
		1.00	2.45	DCPT	Light brown coloured, medium grained sand	10
	3.00					
			3.15	DCPT		6
			3.30	DCPT		7
		1.00	3.45	DCPT	Gravel with pebbles	5
	4.00					
			4.15	SPT		6
			4.30	SPT		10
		1.00	4.45	SPT	Gravel with pebbles	22
	5.00					
			5.15	SPT		29
			5.27	SPT		50
		1.00			Gravel of light grey coloured limestone.	
	6.00					
			6.06	DCPT		50
		1.00			Light brown coloured, coarse grained sand with gravel of light grey limestone.	
	7.00					
			7.05	DCPT		50
		1.00			Light brown coloured, coarse grained sand with gavel of light grey limestone	
	8.00					
			8.07	DCPT		50
		1.00			Light brown coloured, coarse sand	
	9.00					
			9.09	DCPT		50
		1.00			Brown coloured, coarse sand with gravel of limestone and dolomite.	
	10.00					

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Fulbari-11, Pokhara (Narayanthan Bridge)
Bore Hole No : 07
RL of GWT, m : Not Found
Date : 2015/09/07～08

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	SPT		5
			0.30	SPT		5
		1.00	0.45	SPT	Light grey coloured, coarse grained sand with gravel	11
	1.00					
			1.15	SPT		8
			1.30	SPT		13
		1.00	1.45	SPT	Dark brown coloured, fine grained sand.	13
	2.00					
			2.15	DCPT		9
			2.30	DCPT		18
		1.00	2.45	DCPT	Dark brown coloured, medium to coarse grained sand	10
	3.00					
			3.15	DCPT		37
			3.26	DCPT		50
		1.00			Brown coloured, medium to coarse grained sand with gravel of limestone	
	4.00					
			4.12	DCPT		50
		1.00			Dark grey coloured, medium to coarse grained sand with gravel of limestone and dolomite	
	5.00					
			5.07	SPT		50
		1.00			Brown coloured, fine to medium grained sand	
	6.00					
			6.05	DCPT		50
		1.00			Light grey coloured, medium to coarse grained sand with gravel of dolomite.	
	7.00					
			7.15	DCPT		11
			7.26	DCPT		50
		1.00			Light grey coloured, medium to coarse grained sand	
	8.00					

BORE HOLE LOG

Project Name : Soil Survey Par II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara - 11,Fubari, Kaski (Fulbari Reservoir)
Bore Hole No : 08
RL of GWT, m : Not Found
Date : 2015/09/09～09

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.05	DCPT		50
		1.00			Greyish black coloured coarse sand,gneiss of black with white colour	
	1.00					
			1.15	DCPT		30
			1.20	DCPT		50
		1.00			Light grey coloured limestone, black with white coloured gneiss and brownish white dolomite anc medium sand	
	2.00					
			2.15	DCPT		17
			2.20	DCPT		50
		1.00			Grey coloured, medium to fine sand, light grey coloured limestone, dirty white dolomite and black with white gneiss	
	3.00					
			3.12	DCPT		50
		1.00			Fine to medium grained sand, light grey to ash coloured limestone and dirty white coloured dolomite	
	4.00					
			4.13	DCPT		50
		1.00			Grey coloured fine sand, light grey coloured limestone, dirty white dolomite, gneiss and conglomerate	
	5.00					

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara-11, Fulbari, Kaski (Fulbari Reservoir)
Bore Hole No : 09
RL of GWT, m : Not Found
Date : 2015/09/05～08

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.15 0.21	DCPT DCPT	Medium to coarse grained, dark brown coloured sand with pebbles and greyish white limestone and dolomite boulder	35 50
	2.00	1.00	1.06	DCPT	Light grey coloured, coarse grained sand and greyish white limestone boulder	50
	3.00	1.00	2.11	DCPT	Light grey coloured, coarse sand, greyish white limestone, dolomite and conglomerate	50
	4.00	1.00	3.15 3.17	DCPT DCPT	Light grey, medium to coarse sand with white dolomite, gniess and dark grey limestone boulder	30 50
	5.00	1.00	4.03	DCPT	Light grey, medium to coarse sand, dirty white dolomite, black and white coloured gneiss, grey limestone and conglomerate	33
	6.00	1.00	5.07	DCPT	Dark grey coloured, coarse grained sand, white dolomite and banded gneiss.	50
	7.00	1.00	6.10	DCPT	Dark grey coloured, coarse sand, and greyish white limestone and gneiss	50
	8.00	1.00	7.04	DCPT	Dark grey coloured, coarse sand and greyish white limestone and dirty white dolomite	50
	9.00	1.00	8.09	DCPT	Dark grey coloured, medium to coarse sand, greyish white coloured dolomite and limestone gravels.	50
	10.00	1.00	9.15 9.30 9.45	DCPT DCPT DCPT	Dark grey coloured, medium to coarse grained sand, dirty white dolomite and greyish white limestone.	22 49 54

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara-11, Fulbari, Kaski (Fulbari Reservoir)
Bore Hole No : 10
RL of GWT, m : Not Found
Date : 2015/09/10～11

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.11	DCPT	Greyish black coloured, very coarse sand, greyish white limestone and dirty white dolomite gravel	50
	2.00	1.00	1.05	DCPT	Dark grey coloured, very coarse sand, greyish white limestone and dirty white dolomite	50
	3.00	1.00	2.15 2.19	DCPT DCPT	Dark grey coloured, very coarse sand, limestone gravel with quartz vein and dirty white dolomite	33 50
	4.00	1.00	3.12	DCPT	Grey coloured, medium to coarse sand, greyish white limestone, cemented dolomite gravel and white coloured quartz gravel	50
	5.00	1.00	4.15 4.25	DCPT DCPT	Greyish white coloured limestone, dirty white dolomite and calcareous conglomerate	29 50

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara-15, Kolepatan, Kaski (Kolpatan Chok Reservoir)
Bore Hole No : 11
RL of GWT, m : Not Found
Date : 2015/08/26～30

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT/UD Value N
	1.00	1.00	0.15 0.18	DCPT DCPT	Organic materials with coarse sand and limestone gravel	57 50
	2.00	1.00	1.03	DCPT	Grey coloured coarse sand	54
	3.00	1.00	2.15 2.30	DCPT DCPT	Light white coloured dolomite and banded gneiss with black and white colour	45 53
	4.00	1.00	3.15 3.27	DCPT DCPT	Light grey to white coloured limestone and white coloured dolomite gravel	56 51
	5.00	1.00	4.15 4.26	DCPT DCPT	Light grey limestone and dirty white dolomite gravel	24 62
	6.00	1.00	5.15 5.20	DCPT DCPT	Banded gneiss, grey coloured limestone and dolomite gravel	45 52
	7.00	1.00	6.11	DCPT	White coloured dolomite and light grey coloured limestone	57
	8.00	1.00	7.07	DCPT	Banded gneiss, white dolomite and greyish white limestone gravel	50
	9.00	1.00	8.13	DCPT	Banded gneiss of black and white colour, grey liestone and white dolomite	50
	10.00	1.00	9.15 9.23	DCPT DCPT	Light grey coloured limestone gravel	43 50
	11.00	1.00	10.13	DCPT	Light grey coloured limestone and gravel of dolomite	50

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara-15, Kolpatan Chok, (Kolpatan Reservoir)
Bore Hole No : 12
RL of GWT, m : Not Found
Date : 2015/08/31～2015/09/1

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.11	DCPT	Brownish black coloured organic soil and greyish brown to black coloured fine sand	50
	2.00	1.00	1.04	DCPT	Grey coloured coarse sand, black with white coloured gneiss, greyish white limestone and dolomte	50
	3.00	1.00	2.06	DCPT	Grey coloured, coarse sand, greyish white limestone and dirty white with black coloured gneiss	50
	4.00	1.00	3.09	DCPT	Greyish black coloured, coarse grained sand, black with white coloured gneiss and light grey limestone	50
	5.00	1.00	4.10	DCPT	Grey coloured, coarse grained sand, conglomerate with greyish white limestone	50

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara-15, Kolpatan Chok, (Kolpatan Reservoir)
Bore Hole No : 13
RL of GWT, m : Not Found
Date : 2015/09/02～03

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
	1.00	1.00	0.10	DCPT	Greyish white limestone, dirty white dolomite and black with white gneiss	50
	2.00	1.00	1.07	DCPT	Dark grey coloured coarse sand, greyish white coloured limestone, conglomerate, dolomite and gneiss	50
	3.00	1.00	2.15 2.17	DCPT DCPT	Grey coloured, medium to coarse sand, conglomerate, greyish white limestone and dirty white dolomite	40 50
	4.00	1.00	3.15 3.08	DCPT DCPT	Grey coloured, medium to coarse sand, light grey limestone and dirty white dolomite	32 50
	5.00	1.00	4.15 4.22	DCPT DCPT	Grey coloured, fine grained sand, greyish white limestone and dirty white dolomite	43 50

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara - 07, Mastar, Kaski (Right bank of Firke Khola)
Bore Hole No : 14
RL of GWT, m : Not Found
Date : 2015/09/13～15

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT/UD Value N
	1.00	1.00	0.15 0.30 0.45	DCPT DCPT DCPT	Yellowish brown coloured, medium to fine sand, black with white coloured gneiss and greyish white limestone	39 21 25
	2.00	1.00	1.15 1.30 1.45	DCPT DCPT DCPT	Grey coloured, medium-coarse sand, brownish phyllite and dark grey coloured limestone	49 46 15
	3.00	1.00	2.15 2.30 2.45	DCPT DCPT DCPT	Dark grey coloured, medium grained sand, dark grey coloured limestone, white coloured dolomite and marble	4 1 1
	4.00	1.00	3.15 3.30 3.45	SPT SPT SPT	Weathered dolomite of brownish white colour	11 9 1
	5.00	1.00	4.15	SPT	There may be the slary of clavey silt with gravel mixture. So clayey silt easily washed out.	0
	6.00	1.00	5.40	SPT	Yellowish brown coloured, medium plasticity, slow dialatency, sandy silt with gravel	148
	7.00	1.00	6.15 6.30 6.45	DCPT DCPT DCPT	Yellowish grey coloured, moist, low-plasticity, slow dialatency, silt with gravel	14 28 24
	8.00	1.00	7.07	SPT	There may be yellowish clayey silt with gravel. Clayey silt easily washed out by water inserted.	50
	9.00	1.00	8.15 8.30 8.45	DCPT DCPT DCPT	Light to greyish brown coloured, medium grained sand	21 10 50
	10.00	1.00	9.14	DCPT	Greyish white colored limestone pebbles	50
	11.00	1.00	10.10	DCPT	Greyish white colored limestone pebbles	50

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara - 08, Sinalchaur, Kaski (Left bank of Firke Khola)
Bore Hole No : 15
RL of GWT, m : Not Found
Date : 2015/09/16～17

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.11	DCPT		50
		1.00			Yellowish brown colored, medium to fine sand, dark grey colored to greyish white limestone and phyllite	
	1.00					
			1.11	DCPT		50
		1.00			Greyish white limestone gravel and yellowish brown colored conglomerate	
	2.00					
			2.15	DCPT		1
			2.30	DCPT		0
		1.00	2.45	DCPT	Dark grey colored, coarse to medium sand. Greyish white limestone, conglomerate and phyllite	0
	3.00					
			3.15	DCPT		1
			3.30	DCPT		0
		1.00	3.45	DCPT	Loose sand layer with silt	0
	4.00					
			4.15	DCPT		6
			4.30	DCPT		19
		1.00	4.45	DCPT	Loose coarse sand with clayey silt.	9
	5.00					
			5.05	DCPT		50
		1.00			Loose coarse sand with clayey silt	
	6.00					
			6.02	DCPT		50
		1.00			Brownish yellow colored sand with silt, limestone and conglomerate	
	7.00					
			7.02	DCPT		50
		1.00			Light grey coloured, medium to coarse sand, conglomerate, weathered dolomite and limestone	
	8.00					
			8.03	DCPT		50
		1.00			Light grey coloured, coarse sand, greyish white limestone and white dolomite	
	9.00					
			9.15	DCPT		27
			9.17	DCPT		50
		1.00			Greyish white colored limestone pebbles	
	10.00					

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Lakeside, Bulaud (Left bank of Bulaudi Khola)
Bore Hole No : 16
RL of GWT, m : Not Found
Date : 2015/09/17～19

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	SPT		2
			0.30	SPT		3
		1.00	0.45	SPT	Moist, dark brown, low plasticity, slow dilatancy, silty clay with few pebbles	2
	1.00					
			1.15	SPT		15
			1.30	SPT		14
		1.00	1.45	SPT	Fine silt.	16
	2.00					
			2.15	SPT		20
			2.30	SPT		18
		1.00	2.45	SPT	Fine silt	24
	3.00					
			3.15	SPT		7
			3.30	SPT		5
		1.00	3.45	SPT	Fine silt	1
	4.00					
			[illegible]	SPT		4
			4.30	SPT		2
		1.00	4.45	SPT	Dark brown, moist, non plastic, slow dilatancy, gravels with silt	10
	5.00					
			5.07	DCPT		50
		1.00			Conglomerat pebbles	
	6.00					
			6.03	DCPT		50
		1.00			Light grey limestone and gneiss pebbles	
	7.00					
			7.04	DCPT		50
		1.00			Light grey limestone and clast supported conglomerate pebbles	
	8.00					
			8.04	DCPT		50
		1.00			Light grey limestone and clast supported conglomerate pebbles	
	9.00					
			9.14	DCPT		50
		1.00			Light grey light brown limestone pebbles	
	10.00					

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Lakeside, Bulaudi (Right bank of Bulaudi Khola)
Bore Hole No : 17
RL of GWT, m : Not Found
Date : 2015/09/20～21

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	SPT		4
			0.30	SPT		6
		1.00	0.45	SPT	Fine silt	7
	1.00					
			1.15	SPT		3
			1.30	SPT		2
		1.00	1.45	SPT	Gneiss pebbles with dark brown, moist, non plastic, slow dilatancy, silty sand	2
	2.00					
			2.15	SPT		9
			2.30	SPT		8
		1.00	2.45	SPT	Phyllite and gneiss pebbles with dark brown to brownish grey, moist, non plastic, slow dilatancy, silt to silty sand	11
	3.00					
			3.15	DCPT		32
			3.21	DCPT		50
		1.00			Gravels with fine sand	
	4.00					
			4.15	DCPT		35
			4.23	DCPT		50
		1.00			Limestone and conglomerate pebbles	
	5.00					
			5.05	DCPT		50
		1.00			Conglomerate and limestone pebbles	
	6.00					
			6.06	DCPT		50
		1.00			Light grey limestone peboles	
	7.00					
			7.04	DCPT		50
		1.00			Matrix supported and clast supported conglomerate	
	8.00					

BORE HOLE LOG

Project Name : Soil Survey Part I for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara-17, Birata (Right bank of Powerhouse channel)
Bore Hole No : 18
RL of GWT, m : Not Found
Date : 2015/09/22～24

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.14	DCPT		50
		1.00			Brownish black coloured, medium to coarse sand, black with white coloured gneiss	
	1.00					
			1.12	DCPT		50
		1.00			Black with white coloured gneiss, weathered quartz and white coloured limestone	
	2.00					
			2.15	DCPT		38
			2.21	DCPT		50
		1.00			Greyish white colcured limestone and pink coloured dolomite	
	3.00					
			3.12	DCPT		50
		1.00			Greyish white coloured dolomite, limestone and black with white coloured gneiss	
	4.00					
			4.07	DCPT		50
		1.00			Brownish black coloured fine sand, greyish white limestone, white dolomite and black with white gneiss	
	5.00					
			5.08	DCPT		50
		1.00			Grey coloured fine sand, greyish white limestone and white coloured dolomite	
	6.00					
			6.05	DCPT		50
		1.00			Grey coloured fine sand, greyish white limestone and black with white gneiss.	
	7.00					
			7.04	DCPT		50
		1.00			Grey coloured, medium sand, greyish white coloured sand, greyish white coloured limestone, black with white gneiss and white dolomite	
	8.00					
			8.15	DCPT		32
			8.24	DCPT		50
		1.00			Grey coloured, fine to medium grained sand, greyish white limestone, black with white gneiss and white dolomite	
	9.00					
			9.08	DCPT		50
		1.00			Grey coloured medium sand, greyish white limestone and white coloured dolomite	
	10.00					

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara-17, Birauta, Kaski (Left bank of Powerhouse channel)
Bore Hole No : 19
RL of GWT, m : Not Found
Date : 2015/09/25～26

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	DCPT		10
			0.30	DCPT		14
		1.00	0.45	DCPT	Grey coloured, medium to coarse sand, greyish white limestone and dirty white dolomite gravel	25
	1.00					
			1.12	DCPT		50
		1.00			Grey colcured, medium to fine grained sand, black with white colour gneiss, limestone and dolomite	
	2.00					
			2.12	DCPT		50
		1.00			Dark grey coloured, fine sand and greyish white limestone	
	3.00					
			3.15	DCPT		18
			3.30	DCPT		33
		1.00	3.36	DCPT	Grey coloured, medium to coarse sand, greyish white limestone, dolomite and white coloured quartz gravel	50
	4.00					
			4.14	DCPT		50
		1.00			Greyish white coloured limestone and pink coloured dolomite	
	5.00					
			4.06	DCPT		50
		1.00			Dark grey coloured, fine sand, greyish white limestone and dirty white dolomite	
	6.00					

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara, Parshyang,Kaski (Children Park)
Bore Hole No : 20
RL of GWT, m : Not Found
Date : 2015/09/28～29

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	SPT		3
			0.30	SPT		4
		1.00	0.45	SPT	Yellowish brown, moist, non-plastic, silt with gravel	5
	1.00					
			1.15	SPT		15
			1.30	SPT		6
		1.00	1.45	SPT	Yellowish coloured, moist, non-plastic, silt wth gravel	5
	2.00					
			2.15	SPT		7
			2.30	SPT		3
		1.00	2.45	SPT	Black coloured, highly weathered phyllite ard granite	8
	3.00					
			3.07	DCPT		50
		1.00			White coloured granite and conglomerate	
	4.00					
			4.06	DCPT		50
		1.00			Brownish grey coloured fine sand, conglomerate and greyish white coloured limestone	
	5.00					
			5.11	DCPT		50
		1.00			Brownish grey coloured fine sand, greyish white limestone and conglomerate	
	6.00					
			6.03	DCPT		50
		1.00			Brownish grey fine sand and dark grey to greyish white limestone and conglomerate	
	7.00					
			7.04	DCPT		50
		1.00			Brownish grey, medium grained sand, limestone pebble and conglomerate	
	8.00					

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Pokhara, Parshyang, Kaski (Children Park)
Bore Hole No : 21
RL of GWT, m : Not Found
Date : 2015/09/30～2015/10/01

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	DCPT		20
			0.17	DCPT		50
		1.00			Brownish grey, very coarse sand, greyish white limestone gravel and conglomerate	
	1.00					
			1.15	DCPT		5
			1.30	DCPT		2
		1.00	1.45	DCPT	Dirty grey coloured, coarse sand and conglomerate	7
	2.00					
			2.15	DCPT		7
			2.30	DCPT		3
		1.00	2.45	DCPT	Conglomerate, dirty white dolomite and limestone	4
	3.00					
			3.15	DCPT		8
			3.30	DCPT		10
		1.00	3.45	DCPT	Clayey silt with gravel	7
	4.00					
			4.15	SPT		8
			4.30	SPT		3
		1.00	4.45	SPT	Conglomerate	0
	5.00					
			5.03	DCPT		50
		1.00			Conglomerate, greyish white limestone, reddish brown highly weathered dolomite	
	6.00					
			6.03	DCPT		50
		1.00			Conglomerate, limestone and pink dolomite	
	7.00					
			7.03	DCPT		50
		1.00			Brownish grey medium sand, weathered gneiss, conglomerate and limestone	
	8.00					
			8.03	DCPT		50
		1.00			Brownish grey coloured, medium sand, conglomerate and greyish white limestone	
	9.00					
			9.01	DCPT		50
		1.00			Brownish grey medium sand greyish white limestone and conglomerate.	
	10.00					

BORE HOLE LOG

Project Name : Soil Survey Part II for the Preparatory Survey on Pokhara Water Supply Improvement Project in Nepal
Location : Parshyang, Pokhara, Kaski (Children Park)
Bore Hole No : 22
RL of GWT, m : Not Found
Date : 2015/10/02～02

Scale 1=20cm Each	Depth m	Thickness m	Sampling Depth m	Sampling Type	Soil Description	SPT/DCPT Value N
			0.15	SPT		2
			0.30	SPT		2
		1.00	0.45	SPT	Black to brownish yellow coloured, moist, low plasticity, clayey silt with gravel	2
	1.00					
			1.15	SPT		7
			1.30	SPT		3
		1.00	1.45	SPT	Gneiss of black with white colour, yellow coloured highly weathered rock. Silt with gravel	3
	2.00					
			2.15	SPT		3
			2.30	SPT		3
		1.00	2.45	SPT	Brownish yellow, non-plastic, moist, silt with gravel	3
	3.00					
			3.15	SPT		3
			3.30	SPT		2
		1.00	3.45	SPT	Yellowish brown coloured, moist, non-plastic silt with gravel	2
	4.00					
			4.15	SPT		3
			4.30	SPT		1
		1.00	4.45	SPT	Gravely silt with brown colour	4
	5.00					
			5.15	SPT		3
			5.30	SPT		6
		1.00	5.45	SPT	Gneiss of black with white colour, brown highly weathered phyllite, limestone and quartz gravel	9
	6.00					
		1.00		SPT	Clayey silt with gravel	0
	7.00					
			7.15	SPT		4
			7.30	SPT		4
		1.00	7.45	SPT	Yellowish brown, wet, non-plastic, silt with pebble	4
	8.00					
		1.00		SPT	Loose sandy gravel with silt	0
	9.00					
			9.15	SPT		0
			9.30	SPT		0
		1.00	9.45	SPT	Loose sandy gravel with silt	0
	10.00					
		1.00	10.55	SPT	Brownish yellow, wet, non-plastic, silt with gravle	50
	11.00					
			11.15	SPT		5
			11.30	SPT		9
		1.00	11.42	SPT	Yellowish brown, grey coloured, moist, non-plastic, silt with gravel	50
	12.00					
			12.06	DCPT		50
		1.00			Greyish white coloured limestone and conglomerate	
	13.00					

資料 6-8　財務資料

別添 6-8-1　水道料金シナリオ別財務推計（シナリオ①：現状料金）収支計算書推計結果

('000 NRs.)

		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
営業収入														
	営業収入	126,455	180,205	183,622	187,103	190,650	194,265	197,948	201,701	205,525	209,422	213,393	217,438	221,561
	メーター販売			4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148
	本事業による水道料金収入増加額							*57,641*	*57,641*	*57,641*	*57,641*	*57,641*	*57,641*	*57,641*
営業収入合計		**126,455**	**180,205**	**187,770**	**191,251**	**194,798**	**198,413**	**259,737**	**263,490**	**267,315**	**271,211**	**275,182**	**279,228**	**283,350**
営業支出														
	人件費	26,816	27,176	29,033	31,017	33,136	35,400	37,819	40,403	43,164	46,113	49,264	52,630	56,226
	設備維持管理費	1,647	1,164	1,244	1,329	1,420	1,517	1,620	1,731	1,849	1,976	2,111	2,255	2,409
	メーター購入費			*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*
	配管修繕費	6,460	7,034	7,514	8,028	8,576	9,162	9,788	10,457	11,172	11,935	12,750	13,622	14,552
	薬品費	195	136	145	155	165	177	189	201	215	230	246	262	280
	燃料費（車両）	425	499	533	570	608	650	694	742	793	847	905	966	1,032
	燃料費（その他）	15	3	3	3	3	3	4	4	4	5	5	5	6
	電力費	2,942	2,944	3,145	3,360	3,590	3,835	4,097	4,377	4,676	4,996	5,337	5,702	6,092
	車両維持管理費	312	326	349	373	398	425	454	485	519	554	592	632	675
	建物維持管理費	582	675	721	770	823	879	939	1,003	1,072	1,145	1,223	1,307	1,396
	本事業維持管理費							*20,044*	*22,162*	*24,474*	*27,044*	*29,884*	*33,042*	*36,489*
	消耗品費	2,441	2,339	2,499	2,670	2,852	3,047	3,255	3,478	3,715	3,969	4,240	4,530	4,840
	新聞･雑誌	10	11	12	12	13	14	15	16	17	19	20	21	23
	通信費	717	1,033	1,104	1,179	1,260	1,346	1,438	1,536	1,641	1,753	1,873	2,001	2,138
	不動産賃貸費	0	60	64	68	73	78	83	89	95	102	109	116	124
	予備費	282	278	297	318	339	363	387	414	442	472	505	539	576
	その他消耗品費	292	295	315	337	360	384	411	439	469	501	535	571	610
	タンカー運営費	484	525	561	599	640	684	730	780	834	891	952	1,017	1,086
	営業促進費	266	198	212	226	241	258	276	294	314	336	359	383	410
	水道料金貸倒引当金繰入	1,344	1,712	1,829	1,954	2,088	2,231	89,503	96,190	103,392	111,199	119,649	128,819	138,700
	退職給付引当金繰入	15,260	16,303	17,417	18,607	19,878	21,237	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	保険積立金繰入	-73	-78	-83	-89	-95	-101	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	減価償却費	21,496	22,968	25,432	28,065	30,878	33,883	45,430	48,859	52,523	56,438	60,620	65,087	69,860
営業支出合計		**81,916**	**85,602**	**96,583**	**103,788**	**111,486**	**119,709**	156,875	168,378	180,717	193,998	208,281	223,665	240,173
営業損益		**44,539**	**94,603**	**91,186**	**87,463**	**83,313**	**78,704**	102,863	95,112	86,598	77,213	66,900	55,563	43,177
営業外費用														
	固定資産売却損	8	9	9	10	11	11	12	13	14	15	16	17	18
	支払利息	28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
営業外費用合計		**28,812**	**30,781**	**32,884**	**35,131**	**37,531**	**40,095**	**42,835**	**45,762**	**48,889**	**52,229**	**55,798**	**59,610**	**63,683**
経常損益		**15,727**	**63,822**	**58,303**	**52,332**	**45,782**	**38,609**	**60,028**	**49,351**	**37,709**	**24,984**	**11,103**	**-4,047**	**-20,506**

別添 6-8-2　水道料金シナリオ別財務推計（シナリオ①：現状料金）キャッシュフロー計算書推計結果

('000 NRs.)

			2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
I 営業活動によるキャッシュフロー															
	当期純損益		15,727	63,822	58,303	52,332	45,782	38,609	60,028	49,351	37,709	24,984	11,103	-4,047	-20,506
	減価償却費		21,531	23,002	24,573	26,252	28,046	29,962	32,010	34,197	36,533	39,030	41,696	44,545	47,589
	減価償却費調整額		-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34
	未払利息の増減		28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
	水道料金貸倒引当金の増減		1,344	1,712	1,829	1,954	2,088	2,231	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	退職給付引当金の増加		15,260	16,303	17,417	18,607	19,878	21,237	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	保険積立金の増加		-73	-78	-83	-89	-95	-101	-108	-115	-123	-132	-141	-150	-161
	売上債権の増減		-13,445	-17,123	-18,362	-18,710	-19,065	-19,427	-19,795	-20,170	-20,553	-20,942	-21,339	-21,744	-22,156
	前払費用の増減		4,188	0	0	0	0	0	0	0	0	0	0	0	0
	補修部品在庫の増減		13	13	14	15	16	17	19	20	21	23	24	26	28
	流動負債の増減		12,572	13,431	14,349	15,329	16,376	17,495	18,691	19,968	21,332	22,790	24,347	26,010	27,788
	退職給付金引当金の減少		-9,724	-7,569	-8,873	-10,402	-12,194	-14,295	-16,757	-19,644	-23,029	-26,996	-31,647	-37,099	-43,491
	支払生命保険金		-711	-692	-810	-948	-1,110	-1,300	-1,522	-1,781	-2,085	-2,441	-2,858	-3,345	-3,916
	営業活動によるキャッシュフロー		75,453	123,559	121,197	119,427	117,209	114,479	140,424	134,322	127,261	119,064	109,591	98,644	86,079
II 投資活動によるキャッシュフロー															
	固定資産の増減		72,231	92,239	98,541	105,274	112,467	120,152	128,361	137,132	146,502	156,512	167,206	178,631	190,836
	NWSC 負担の設備投資	門･フェンス							3,200						
		受電設備							5,200						
		その他							123,000						
		土地収用費							250,000						
		配管延長 2km/年			18,300	19,550	20,886	22,313	23,838	25,467	27,207	29,066	31,052	33,173	35,440
		浄水場								122,000					
	投資活動によるキャッシュフロー		72,231	92,239	116,841	124,824	133,353	142,465	378,306	284,599	173,709	185,578	198,258	211,804	226,276
III 財務活動によるキャッシュフロー															
	政府からの借入金の増減		4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
	財務活動によるキャッシュフロー		4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
現金および現金同等物の増加額			**7,852**	**142,478**	**64,466**	**58,820**	**52,461**	**45,307**	-314,875	-150,276	-46,448	-66,514	-88,667	-113,160	-140,197
現金および現金同等物期首残高			-	**57,146**											
現金および現金同等物期末残高			-	**199,624**	**121,612**	**180,432**	**232,893**	**278,199**	-37	-187	-233	-300	-389	-502	-642

別添 6-8-3　水道料金シナリオ別財務推計（シナリオ②：2019 年より倍額）収支計算書推計結果

('000 NRs.)

		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
営業収入														
	営業収入	126,455	180,205	183,622	187,103	190,650	194,265	360,410	367,243	374,206	381,301	388,530	395,896	403,402
	メーター販売			4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148
	本事業による水道料金収入増加額							115,282	115,282	115,282	115,282	115,282	115,282	115,282
営業収入合計		**126,455**	**180,205**	**187,770**	**191,251**	**194,798**	**198,413**	**479,840**	**486,673**	**493,636**	**500,731**	**507,960**	**515,327**	**522,833**
営業支出														
	人件費	26,816	27,176	29,033	31,017	33,136	35,400	37,819	40,403	43,164	46,113	49,264	52,630	56,226
	設備維持管理費	1,647	1,164	1,244	1,329	1,420	1,517	1,620	1,731	1,849	1,976	2,111	2,255	2,409
	メーター購入費			*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*
	配管修繕費	6,460	7,034	7,514	8,028	8,576	9,162	9,788	10,457	11,172	11,935	12,750	13,622	14,552
	薬品費	195	136	145	155	165	177	189	201	215	230	246	262	280
	燃料費（車両）	425	499	533	570	608	650	694	742	793	847	905	966	1,032
	燃料費（その他）	15	3	3	3	3	3	4	4	4	5	5	5	6
	電力費	2,942	2,944	3,145	3,360	3,590	3,835	4,097	4,377	4,676	4,996	5,337	5,702	6,092
	車両維持管理費	312	326	349	373	398	425	454	485	519	554	592	632	675
	建物維持管理費	582	675	721	770	823	879	939	1,003	1,072	1,145	1,223	1,307	1,396
	本事業維持管理費							*20,044*	*22,162*	*24,474*	*27,044*	*29,884*	*33,042*	*36,489*
	消耗品費	2,441	2,339	2,499	2,670	2,852	3,047	3,255	3,478	3,715	3,969	4,240	4,530	4,840
	新聞･雑誌	10	11	12	12	13	14	15	16	17	19	20	21	23
	通信費	717	1,033	1,104	1,179	1,260	1,346	1,438	1,536	1,641	1,753	1,873	2,001	2,138
	不動産賃貸費	0	60	64	68	73	78	83	89	95	102	109	116	124
	予備費	282	278	297	318	339	363	387	414	442	472	505	539	576
	その他消耗品費	292	295	315	337	360	384	411	439	469	501	535	571	610
	タンカー運営費	484	525	561	599	640	684	730	780	834	891	952	1,017	1,086
	営業促進費	266	198	212	226	241	258	276	294	314	336	359	383	410
	水道料金貸倒引当金繰入	43,887	44,697	51,988	55,251	58,736	62,460	89,503	96,190	103,392	111,199	119,649	128,819	138,700
	退職給付引当金繰入	1,344	1,712	1,829	1,954	2,088	2,231	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	保険積立金繰入	15,260	16,303	17,417	18,607	19,878	21,237	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	減価償却費	21,496	22,968	25,432	28,065	30,878	33,883	45,430	48,859	52,523	56,438	60,620	65,087	69,860
営業支出合計		**81,916**	**85,602**	**96,583**	**103,788**	**111,486**	**119,709**	**156,875**	**168,378**	**180,717**	**193,998**	**208,281**	**223,665**	**240,173**
営業損益		**44,539**	**94,603**	**91,186**	**87,463**	**83,313**	**78,704**	**322,966**	**318,295**	**312,919**	**306,733**	**299,679**	**291,661**	**282,660**
営業外費用														
	固定資産売却損	8	9	9	10	11	11	12	13	14	15	16	17	18
	支払利息	28,804	30,772	32,874	35,121	37,520	40,084	**42,823**	**45,749**	**48,875**	**52,214**	**55,782**	**59,593**	**63,665**
営業外費用合計		**28,812**	**30,781**	**32,884**	**35,131**	**37,531**	**40,095**	**42,835**	**45,762**	**48,889**	**52,229**	**55,798**	**59,610**	**63,683**
経常損益		**15,727**	**15,727**	**63,822**	**58,303**	**52,332**	**45,782**	**280,131**	**272,534**	**264,031**	**254,504**	**243,881**	**232,052**	**218,977**

別添 6-8-4　水道料金シナリオ別財務推計（シナリオ②：2019 年より倍額）キャッシュフロー計算書推計結果

('000 NRs.)

		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
I 営業活動によるキャッシュフロー														
	当期純損益	15,727	63,822	58,303	52,332	45,782	38,609	**280,131**	**272,534**	**264,031**	**254,504**	**243,881**	**232,052**	**218,977**
	減価償却費	21,531	23,002	24,573	26,252	28,046	29,962	32,010	34,197	36,533	39,030	41,696	44,545	47,589
	減価償却費調整額	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34
	未払利息の増減	28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
	水道料金貸倒引当	1,344	1,712	1,829	1,954	2,088	2,231	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	退職給付引当金の	15,260	16,303	17,417	18,607	19,878	21,237	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	保険積立金の増加	-73	-78	-83	-89	-95	-101	-108	-115	-123	-132	-141	-150	-161
	売上債権の増減	-13,445	-17,123	-18,362	-18,710	-19,065	-19,427	-19,795	-20,170	-20,553	-20,942	-21,339	-21,744	-22,156
	前払費用の増減	4,188	0	0	0	0	0	0	0	0	0	0	0	0
	補修部品在庫の増	13	13	14	15	16	17	19	20	21	23	24	26	28
	流動負債の増減	12,572	13,431	14,349	15,329	16,376	17,495	18,691	19,968	21,332	22,790	24,347	26,010	27,788
	退職給付金引当金	-9,724	-7,569	-8,873	-10,402	-12,194	-14,295	-16,757	-19,644	-23,029	-26,996	-31,647	-37,099	-43,491
	支払生命保険金	-711	-692	-810	-948	-1,110	-1,300	-1,522	-1,781	-2,085	-2,441	-2,858	-3,345	-3,916
	営業活動によるキャッシュフロー	75,453	123,559	121,197	119,427	117,209	114,479	360,527	357,505	353,582	348,584	342,369	334,743	325,561
II 投資活動によるキャッシュフロー														
	固定資産の増減	72,231	92,239	98,541	105,274	112,467	120,152	128,361	137,132	146,502	156,512	167,206	178,631	190,836
	NWSC 負担の設備投資 門･フェ							3,200						
	受電設							5,200						
	その他							123,000						
	土地収							250,000						
	配管延長 2km/			18,300	19,550	20,886	22,313	23,838	25,467	27,207	29,066	31,052	33,173	35,440
	浄水場								119,048					
	投資活動によるキャ	72,231	92,239	116,841	124,824	133,353	142,465	378,306	281,646	173,709	185,578	198,258	211,804	226,276
III 財務活動によるキャッシュフロー														
	政府からの借入金	4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
	財務活動によるキャ	4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
現金および現金同等物の増加額		**7,852**	**142,478**	**64,466**	**58,820**	**52,461**	**45,307**	**-94,772**	**75,859**	**179,874**	**163,006**	**144,112**	**122,939**	**99,285**
現金および現金同等物期首残		**-**	**57,146**											
現金および現金同等物期末残高		**-**	**199,624**	**121,612**	**180,432**	**232,893**	**278,199**	**183,428**	**259,287**	**439,160**	**602,167**	**746,278**	**869,217**	**968,502**

別添 6-8-5　水道料金シナリオ別財務推計（シナリオ③：2019 年より 2.4 倍）収支計算書推計結果

('000 NRs.)

		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
営業収入														
	営業収入	126,455	180,205	183,622	187,103	190,650	194,265	432,492	440,692	449,047	457,561	466,236	475,076	484,083
	メーター販売			4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148
	本事業による水道料金収入増加額							103,754	103,754	103,754	103,754	103,754	103,754	103,754
営業収入合計		**126,455**	**180,205**	**187,770**	**191,251**	**194,798**	**198,413**	**432,271**	**438,421**	**444,687**	**451,073**	**457,579**	**464,209**	**470,964**
営業支出														
	人件費	26,816	27,176	29,033	31,017	33,136	35,400	37,819	40,403	43,164	46,113	49,264	52,630	56,226
	設備維持管理費	1,647	1,164	1,244	1,329	1,420	1,517	1,620	1,731	1,849	1,976	2,111	2,255	2,409
	メーター購入費			*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*
	配管修繕費	6,460	7,034	7,514	8,028	8,576	9,162	9,788	10,457	11,172	11,935	12,750	13,622	14,552
	薬品費	195	136	145	155	165	177	189	201	215	230	246	262	280
	燃料費(車両)	425	499	533	570	608	650	694	742	793	847	905	966	1,032
	燃料費(その他)	15	3	3	3	3	3	4	4	4	5	5	5	6
	電力費	2,942	2,944	3,145	3,360	3,590	3,835	4,097	4,377	4,676	4,996	5,337	5,702	6,092
	車両維持管理費	312	326	349	373	398	425	454	485	519	554	592	632	675
	建物維持管理費	582	675	721	770	823	879	939	1,003	1,072	1,145	1,223	1,307	1,396
	本事業維持管理費							*20,044*	*22,162*	*24,474*	*27,044*	*29,884*	*33,042*	*36,489*
	消耗品費	2,441	2,339	2,499	2,670	2,852	3,047	3,255	3,478	3,715	3,969	4,240	4,530	4,840
	新聞･雑誌	10	11	12	12	13	14	15	16	17	19	20	21	23
	通信費	717	1,033	1,104	1,179	1,260	1,346	1,438	1,536	1,641	1,753	1,873	2,001	2,138
	不動産賃貸費	0	60	64	68	73	78	83	89	95	102	109	116	124
	予備費	282	278	297	318	339	363	387	414	442	472	505	539	576
	その他消耗品費	292	295	315	337	360	384	411	439	469	501	535	571	610
	タンカー運営費	484	525	561	599	640	684	730	780	834	891	952	1,017	1,086
	営業促進費	266	198	212	226	241	258	276	294	314	336	359	383	410
	水道料金貸倒引当金繰入	43,887	44,697	51,988	55,251	58,736	62,460	89,503	96,190	103,392	111,199	119,649	128,819	138,700
	退職給付引当金繰入	1,344	1,712	1,829	1,954	2,088	2,231	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	保険積立金繰入	15,260	16,303	17,417	18,607	19,878	21,237	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	減価償却費	21,496	22,968	25,432	28,065	30,878	33,883	45,430	48,859	52,523	56,438	60,620	65,087	69,860
営業支出合計		**81,916**	**85,602**	**96,583**	**103,788**	**111,486**	**119,709**	**156,875**	**168,378**	**180,717**	**193,998**	**208,281**	**223,665**	**240,173**
営業損益		**44,539**	**94,603**	**91,186**	**87,463**	**83,313**	**78,704**	**418,104**	**369,840**	**365,857**	**361,089**	**355,481**	**348,938**	**341,437**
営業外費用														
	固定資産売却損	8	9	9	10	11	11	12	13	14	15	16	17	18
	支払利息	28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
営業外費用合計		**28,812**	**30,781**	**32,884**	**35,131**	**37,531**	**40,095**	**42,835**	**45,762**	**48,889**	**52,229**	**55,798**	**59,610**	**63,683**
経常損益		**15,727**	**63,822**	**58,303**	**52,332**	**45,782**	**38,609**	**375,269**	**324,079**	**316,968**	**308,860**	**299,684**	**289,327**	**277,754**

別添 6-8-6　水道料金シナリオ別財務推計（シナリオ③：2019 年より 2.4 倍）キャッシュフロー計算書推計結果

('000 NRs.)

		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
I 営業活動によるキャッシュフロー														
	当期純損益	15,727	63,822	58,303	52,332	45,782	38,609	**375,269**	**324,079**	**316,968**	**308,860**	**299,684**	**289,327**	**277,754**
	減価償却費	21,531	23,002	24,573	26,252	28,046	29,962	32,010	34,197	36,533	39,030	41,696	44,545	47,589
	減価償却費調整額	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34
	未払利息の増減	28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
	水道料金貸倒引当金の増減	1,344	1,712	1,829	1,954	2,088	2,231	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	退職給付引当金の増加	15,260	16,303	17,417	18,607	19,878	21,237	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	保険積立金の増加	-73	-78	-83	-89	-95	-101	-108	-115	-123	-132	-141	-150	-161
	売上債権の増減	-13,445	-17,123	-18,362	-18,710	-19,065	-19,427	-19,795	-20,170	-20,553	-20,942	-21,339	-21,744	-22,156
	前払費用の増減	4,188	0	0	0	0	0	0	0	0	0	0	0	0
	補修部品在庫の増減	13	13	14	15	16	17	19	20	21	23	24	26	28
	流動負債の増減	12,572	13,431	14,349	15,329	16,376	17,495	18,691	19,968	21,332	22,790	24,347	26,010	27,788
	退職給付金引当金の減少	-9,724	-7,569	-8,873	-10,402	-12,194	-14,295	-16,757	-19,644	-23,029	-26,996	-31,647	-37,099	-43,491
	支払生命保険金	-711	-692	-810	-948	-1,110	-1,300	-1,522	-1,781	-2,085	-2,441	-2,858	-3,345	-3,916
	営業活動によるキャッシュフロー	75,453	123,559	121,197	119,427	117,209	114,479	312,958	309,253	304,633	298,925	291,988	283,625	273,693
II 投資活動によるキャッシュフロー														
	固定資産の増減	72,231	92,239	98,541	105,274	112,467	120,152	128,361	137,132	146,502	156,512	167,206	178,631	190,836
	NWSC 負担の設備投資 門・フェンス							3,200						
	NWSC 負担の設備投資 受電設備							5,200						
	NWSC 負担の設備投資 その他							123,000						
	NWSC 負担の設備投資 土地収用費							250,000						
	NWSC 負担の設備投資 配管延長 2km/年		18,300	18,300	19,550	20,886	22,313	23,838	25,467	27,207	29,066	31,052	33,173	35,440
	NWSC 負担の設備投資 浄水場								119,048					
	投資活動によるキャッシュフロー	72,231	92,239	116,841	124,824	133,353	142,465	378,306	281,646	173,709	185,578	198,258	211,804	226,276
III 財務活動によるキャッシュフロー														
	政府からの借入金の増減	4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
	財務活動によるキャッシュフロー	4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
現金および現金同等物の増加額		**7,852**	**142,478**	**64,466**	**58,820**	**52,461**	**45,307**	**367**	**127,404**	**232,811**	**217,363**	**199,914**	**180,215**	**158,062**
現金および現金同等物期首残高		-	**57,146**											
現金および現金同等物期末残高		-	**199,624**	**121,612**	**180,432**	**232,893**	**278,199**	**278,566**	**405,970**	**638,782**	**856,144**	**1,056,058**	**1,236,273**	**1,394,335**

別添 6-8-7　水道料金シナリオ別財務推計（シナリオ④：2019 年より 1.7 倍）収支計算書推計結果

('000 NRs.)

		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
営業収入														
	営業収入	126,455	180,205	183,622	187,103	190,650	194,265	306,349	312,157	318,075	324,106	330,251	336,512	342,892
	メーター販売			4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148
	本事業による水道料金収入増加額							*97,990*	*97,990*	*97,990*	*97,990*	*97,990*	*97,990*	*97,990*
営業収入合計		**126,455**	**180,205**	**187,770**	**191,251**	**194,798**	**198,413**	**408,486**	**414,295**	**420,213**	**426,244**	**432,388**	**438,650**	**445,030**
営業支出														
	人件費	26,816	27,176	29,033	31,017	33,136	35,400	37,819	40,403	43,164	46,113	49,264	52,630	56,226
	設備維持管理費	1,647	1,164	1,244	1,329	1,420	1,517	1,620	1,731	1,849	1,976	2,111	2,255	2,409
	メーター購入費			*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*
	配管修繕費	6,460	7,034	7,514	8,028	8,576	9,162	9,788	10,457	11,172	11,935	12,750	13,622	14,552
	薬品費	195	136	145	155	165	177	189	201	215	230	246	262	280
	燃料費（車両）	425	499	533	570	608	650	694	742	793	847	905	966	1,032
	燃料費（その他）	15	3	3	3	3	3	4	4	4	5	5	5	6
	電力費	2,942	2,944	3,145	3,360	3,590	3,835	4,097	4,377	4,676	4,996	5,337	5,702	6,092
	車両維持管理費	312	326	349	373	398	425	454	485	519	554	592	632	675
	建物維持管理費	582	675	721	770	823	879	939	1,003	1,072	1,145	1,223	1,307	1,396
	本事業維持管理費							*20,044*	*22,162*	*24,474*	*27,044*	*29,884*	*33,042*	*36,489*
	消耗品費	2,441	2,339	2,499	2,670	2,852	3,047	3,255	3,478	3,715	3,969	4,240	4,530	4,840
	新聞・雑誌	10	11	12	12	13	14	15	16	17	19	20	21	23
	通信費	717	1,033	1,104	1,179	1,260	1,346	1,438	1,536	1,641	1,753	1,873	2,001	2,138
	不動産賃貸費	0	60	64	68	73	78	83	89	95	102	109	116	124
	予備費	282	278	297	318	339	363	387	414	442	472	505	539	576
	その他消耗品費	292	295	315	337	360	384	411	439	469	501	535	571	610
	タンカー運営費	484	525	561	599	640	684	730	780	834	891	952	1,017	1,086
	営業促進費	266	198	212	226	241	258	276	294	314	336	359	383	410
	水道料金貸倒引当金繰入	43,887	44,697	51,988	55,251	58,736	62,460	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	退職給付引当金繰入	1,344	1,712	1,829	1,954	2,088	2,231	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	保険積立金繰入	15,260	16,303	17,417	18,607	19,878	21,237	-108	-115	-123	-132	-141	-150	-161
	減価償却費	21,496	22,968	25,432	28,065	30,878	33,883	45,430	48,859	52,523	56,438	60,620	65,087	69,860
営業支出合計		**81,916**	**85,602**	**96,583**	**103,788**	**111,486**	**119,709**	**156,875**	**168,378**	**180,717**	**193,998**	**208,281**	**223,665**	**240,173**
営業損益		**44,539**	**94,603**	**91,186**	**87,463**	**83,313**	**78,704**	**251,612**	**245,917**	**239,496**	**232,245**	**224,107**	**214,985**	**204,857**
営業外費用														
	固定資産売却損	8	9	9	10	11	11	12	13	14	15	16	17	18
	支払利息	28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
営業外費用合計		**28,812**	**30,781**	**32,884**	**35,131**	**37,531**	**40,095**	**42,835**	**45,762**	**48,889**	**52,229**	**55,798**	**59,610**	**63,683**
経常損益		**15,727**	**63,822**	**58,303**	**52,332**	**45,782**	**38,609**	**208,777**	**200,155**	**190,608**	**180,016**	**168,309**	**155,375**	**141,174**

別添 6-8-8　水道料金シナリオ別財務推計（シナリオ④：2019 年より 1.7 倍）キャッシュフロー計算書推計結果

('000 NRs.)

			2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
I 営業活動によるキャッシュフロー															
	当期純損益		15,727	63,822	58,303	52,332	45,782	38,609	208,777	200,155	190,608	180,016	168,309	155,375	141,174
	減価償却費		21,531	23,002	24,573	26,252	28,046	29,962	32,010	34,197	36,533	39,030	41,696	44,545	47,589
	減価償却費調整額		-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34
	未払利息の増減		28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
	水道料金貸倒引当金の増減		1,344	1,712	1,829	1,954	2,088	2,231	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	退職給付引当金の増加		15,260	16,303	17,417	18,607	19,878	21,237	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	保険積立金の増加		-73	-78	-83	-89	-95	-101	-108	-115	-123	-132	-141	-150	-161
	売上債権の増減		-13,445	-17,123	-18,362	-18,710	-19,065	-19,427	-19,795	-20,170	-20,553	-20,942	-21,339	-21,744	-22,156
	前払費用の増減		4,188	0	0	0	0	0	0	0	0	0	0	0	0
	補修部品在庫の増減		13	13	14	15	16	17	19	20	21	23	24	26	28
	流動負債の増減		12,572	13,431	14,349	15,329	16,376	17,495	18,691	19,968	21,332	22,790	24,347	26,010	27,788
	退職給付金引当金の減少		-9,724	-7,569	-8,873	-10,402	-12,194	-14,295	-16,757	-19,644	-23,029	-26,996	-31,647	-37,099	-43,491
	支払生命保険金		-711	-692	-810	-948	-1,110	-1,300	-1,522	-1,781	-2,085	-2,441	-2,858	-3,345	-3,916
	営業活動によるキャッシュフロー		75,453	123,559	121,197	119,427	117,209	114,479	289,173	285,127	280,159	274,096	266,798	258,066	247,759
II 投資活動によるキャッシュフロー															
	固定資産の増減		72,231	92,239	98,541	105,274	112,467	120,152	128,361	137,132	146,502	156,512	167,206	178,631	190,836
	NWSC 負担の設備投資	門･フェンス							3,200						
		受電設備							5,200						
		その他							123,000						
		土地収用費							250,000						
		配管延長 2km/年			18,300	19,550	20,886	22,313	23,838	25,467	27,207	29,066	31,052	33,173	35,440
		浄水場								119,048					
	投資活動によるキャッシュフロー		72,231	92,239	116,841	124,824	133,353	142,465	378,306	281,646	173,709	185,578	198,258	211,804	226,276
III 財務活動によるキャッシュフロー															
	政府からの借入金の増減		4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
	財務活動によるキャッシュフロー		4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
現金および現金同等物の増加額			**7,852**	**142,478**	**64,466**	**58,820**	**52,461**	**45,307**	**-166,125**	**3,480**	**106,450**	**88,519**	**68,540**	**46,262**	**21,483**
現金および現金同等物期首残高			**-**	**57,146**											
現金および現金同等物期末残高			**-**	**199,624**	**121,612**	**180,432**	**232,893**	**278,199**	**112,074**	**115,554**	**222,005**	**310,523**	**379,063**	**425,325**	**446,808**

6-8-9　水道料金シナリオ別財務推計（シナリオ⑤：2019 年より 1.16 倍）収支計算書推計結果

('000 NRs.)

		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
営業収入														
	営業収入	126,455	180,205	183,622	187,103	190,650	194,265	306,349	312,157	318,075	324,106	330,251	336,512	342,892
	メーター販売			4,148	4,148	4,148	4,148	209,038	213,001	217,039	221,154	225,347	229,620	233,973
	本事業による水道料金収入増加額							66,864	66,864	66,864	66,864	66,864	66,864	66,864
営業収入合計		**126,455**	**180,205**	**187,770**	**191,251**	**194,798**	**198,413**	**280,050**	**284,013**	**288,051**	**292,166**	**296,359**	**300,632**	**304,985**
営業支出														
	人件費	26,816	27,176	29,033	31,017	33,136	35,400	37,819	40,403	43,164	46,113	49,264	52,630	56,226
	設備維持管理費	1,647	1,164	1,244	1,329	1,420	1,517	1,620	1,731	1,849	1,976	2,111	2,255	2,409
	メーター購入費			*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*
	配管修繕費	6,460	7,034	7,514	8,028	8,576	9,162	9,788	10,457	11,172	11,935	12,750	13,622	14,552
	薬品費	195	136	145	155	165	177	189	201	215	230	246	262	280
	燃料費（車両）	425	499	533	570	608	650	694	742	793	847	905	966	1,032
	燃料費（その他）	15	3	3	3	3	3	4	4	4	5	5	5	6
	電力費	2,942	2,944	3,145	3,360	3,590	3,835	4,097	4,377	4,676	4,996	5,337	5,702	6,092
	車両維持管理費	312	326	349	373	398	425	454	485	519	554	592	632	675
	建物維持管理費	582	675	721	770	823	879	939	1,003	1,072	1,145	1,223	1,307	1,396
	本事業維持管理費							*20,044*	*22,162*	*24,474*	*27,044*	*29,884*	*33,042*	*36,489*
	消耗品費	2,441	2,339	2,499	2,670	2,852	3,047	3,255	3,478	3,715	3,969	4,240	4,530	4,840
	新聞・雑誌	10	11	12	12	13	14	15	16	17	19	20	21	23
	通信費	717	1,033	1,104	1,179	1,260	1,346	1,438	1,536	1,641	1,753	1,873	2,001	2,138
	不動産賃貸費	0	60	64	68	73	78	83	89	95	102	109	116	124
	予備費	282	278	297	318	339	363	387	414	442	472	505	539	576
	その他消耗品費	292	295	315	337	360	384	411	439	469	501	535	571	610
	タンカー運営費	484	525	561	599	640	684	730	780	834	891	952	1,017	1,086
	営業促進費	266	198	212	226	241	258	276	294	314	336	359	383	410
	水道料金貸倒引当金繰入	43,887	44,697	51,988	55,251	58,736	62,460	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	退職給付引当金繰入	1,344	1,712	1,829	1,954	2,088	2,231	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	保険積立金繰入	15,260	16,303	17,417	18,607	19,878	21,237	-108	-115	-123	-132	-141	-150	-161
	減価償却費	21,496	22,968	25,432	28,065	30,878	33,883	45,430	48,859	52,523	56,438	60,620	65,087	69,860
営業支出合計		**81,916**	**85,602**	**96,583**	**103,788**	**111,486**	**119,709**	**156,875**	**168,378**	**180,717**	**193,998**	**208,281**	**223,665**	**240,173**
営業損益		**44,539**	**94,603**	**91,186**	**87,463**	**83,313**	**78,704**	**251,612**	**245,917**	**239,496**	**232,245**	**224,107**	**214,985**	**204,857**
営業外費用														
	固定資産売却損	8	9	9	10	11	11	12	13	14	15	16	17	18
	支払利息	28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
営業外費用合計		**28,812**	**30,781**	**32,884**	**35,131**	**37,531**	**40,095**	**42,835**	**45,762**	**48,889**	**52,229**	**55,798**	**59,610**	**63,683**
経常損益		**15,727**	**63,822**	**58,303**	**52,332**	**45,782**	**38,609**	**80,340**	**69,873**	**58,446**	**45,939**	**32,280**	**17,357**	**1,129**

6-8-10　水道料金シナリオ別財務推計（シナリオ④：2019 年より 1.16 倍）キャッシュフロー計算書推計結果

('000 NRs.)

			2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
I 営業活動によるキャッシュフロー															
	当期純損益		15,727	63,822	58,303	52,332	45,782	38,609	80,340	69,873	58,446	45,939	32,280	17,357	1,129
	減価償却費		21,531	23,002	24,573	26,252	28,046	29,962	32,010	34,197	36,533	39,030	41,696	44,545	47,589
	減価償却費調整額		-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34
	未払利息の増減		28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
	水道料金貸倒引当金の増減		1,344	1,712	1,829	1,954	2,088	2,231	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	退職給付引当金の増加		15,260	16,303	17,417	18,607	19,878	21,237	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	保険積立金の増加		-73	-78	-83	-89	-95	-101	-108	-115	-123	-132	-141	-150	-161
	売上債権の増減		-13,445	-17,123	-18,362	-18,710	-19,065	-19,427	-19,795	-20,170	-20,553	-20,942	-21,339	-21,744	-22,156
	前払費用の増減		4,188	0	0	0	0	0	0	0	0	0	0	0	0
	補修部品在庫の増減		13	13	14	15	16	17	19	20	21	23	24	26	28
	流動負債の増減		12,572	13,431	14,349	15,329	16,376	17,495	18,691	19,968	21,332	22,790	24,347	26,010	27,788
	退職給付金引当金の減少		-9,724	-7,569	-8,873	-10,402	-12,194	-14,295	-16,757	-19,644	-23,029	-26,996	-31,647	-37,099	-43,491
	支払生命保険金		-711	-692	-810	-948	-1,110	-1,300	-1,522	-1,781	-2,085	-2,441	-2,858	-3,345	-3,916
	営業活動によるキャッシュフロー		75,453	123,559	121,197	119,427	117,209	114,479	289,173	285,127	280,159	274,096	266,798	258,066	247,759
II 投資活動によるキャッシュフロー															
	固定資産の増減		72,231	92,239	98,541	105,274	112,467	120,152	128,361	137,132	146,502	156,512	167,206	178,631	190,836
	NWSC 負担の設備投資	門・フェンス							3,200						
		受電設備							5,200						
		その他							123,000						
		土地収用費							250,000						
		配管延長 2km/年			18,300	19,550	20,886	22,313	23,838	25,467	27,207	29,066	31,052	33,173	35,440
		浄水場								119,048					
	投資活動によるキャッシュフロー		72,231	92,239	116,841	124,824	133,353	142,465	378,306	281,646	173,709	185,578	198,258	211,804	226,276
III 財務活動によるキャッシュフロー															
	政府からの借入金の増減		4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
	財務活動によるキャッシュフロー		4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
現金および現金同等物の増加額			**7,852**	**142,478**	**64,466**	**58,820**	**52,461**	**45,307**	**-294,562**	**-126,802**	**-25,711**	**-45,559**	**-67,489**	**-91,756**	**-118,562**
現金および現金同等物期首残高			**-**	**57,146**											
現金および現金同等物期末残高			**-**	**199,624**	**121,612**	**180,432**	**232,893**	**278,199**	**-16,363**	**-143,165**	**-168,876**	**-214,435**	**-281,924**	**-373,681**	**-492,243**

6-8-11　水道料金シナリオ別財務推計（シナリオ⑥：2019 年より 1.62 倍）収支計算書推計結果

('000 NRs.)

		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
営業収入														
	営業収入	126,455	180,205	183,622	187,103	190,650	194,265	291,932	297,467	303,107	308,854	314,709	320,676	326,756
	メーター販売			4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148	4,148
	本事業による水道料金収入増加額							*93,379*	*93,379*	*93,379*	*93,379*	*93,379*	*93,379*	*93,379*
営業収入合計		**126,455**	**180,205**	**187,770**	**191,251**	**194,798**	**198,413**	**408,486**	**414,295**	**420,213**	**426,244**	**432,388**	**438,650**	**445,030**
営業支出														
	人件費	26,816	27,176	29,033	31,017	33,136	35,400	37,819	40,403	43,164	46,113	49,264	52,630	56,226
	設備維持管理費	1,647	1,164	1,244	1,329	1,420	1,517	1,620	1,731	1,849	1,976	2,111	2,255	2,409
	メーター購入費			*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*	*4,237*
	配管修繕費	6,460	7,034	7,514	8,028	8,576	9,162	9,788	10,457	11,172	11,935	12,750	13,622	14,552
	薬品費	195	136	145	155	165	177	189	201	215	230	246	262	280
	燃料費(車両)	425	499	533	570	608	650	694	742	793	847	905	966	1,032
	燃料費(その他)	15	3	3	3	3	3	4	4	4	5	5	5	6
	電力費	2,942	2,944	3,145	3,360	3,590	3,835	4,097	4,377	4,676	4,996	5,337	5,702	6,092
	車両維持管理費	312	326	349	373	398	425	454	485	519	554	592	632	675
	建物維持管理費	582	675	721	770	823	879	939	1,003	1,072	1,145	1,223	1,307	1,396
	本事業維持管理費							*20,044*	*22,162*	*24,474*	*27,044*	*29,884*	*33,042*	*36,489*
	消耗品費	2,441	2,339	2,499	2,670	2,852	3,047	3,255	3,478	3,715	3,969	4,240	4,530	4,840
	新聞･雑誌	10	11	12	12	13	14	15	16	17	19	20	21	23
	通信費	717	1,033	1,104	1,179	1,260	1,346	1,438	1,536	1,641	1,753	1,873	2,001	2,138
	不動産賃貸費	0	60	64	68	73	78	83	89	95	102	109	116	124
	予備費	282	278	297	318	339	363	387	414	442	472	505	539	576
	その他消耗品費	292	295	315	337	360	384	411	439	469	501	535	571	610
	タンカー運営費	484	525	561	599	640	684	730	780	834	891	952	1,017	1,086
	営業促進費	266	198	212	226	241	258	276	294	314	336	359	383	410
	水道料金貸倒引当金繰入	43,887	44,697	51,988	55,251	58,736	62,460	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	退職給付引当金繰入	1,344	1,712	1,829	1,954	2,088	2,231	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	保険積立金繰入	15,260	16,303	17,417	18,607	19,878	21,237	-108	-115	-123	-132	-141	-150	-161
	減価償却費	21,496	22,968	25,432	28,065	30,878	33,883	45,430	48,859	52,523	56,438	60,620	65,087	69,860
営業支出合計		**81,916**	**85,602**	**96,583**	**103,788**	**111,486**	**119,709**	**156,875**	**168,378**	**180,717**	**193,998**	**208,281**	**223,665**	**240,173**
営業損益		**44,539**	**94,603**	**91,186**	**87,463**	**83,313**	**78,704**	**251,612**	**245,917**	**239,496**	**232,245**	**224,107**	**214,985**	**204,857**
営業外費用														
	固定資産売却損	8	9	9	10	11	11	12	13	14	15	16	17	18
	支払利息	28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
営業外費用合計		**28,812**	**30,781**	**32,884**	**35,131**	**37,531**	**40,095**	**42,835**	**45,762**	**48,889**	**52,229**	**55,798**	**59,610**	**63,683**
経常損益		**15,727**	**63,822**	**58,303**	**52,332**	**45,782**	**38,609**	**189,749**	**180,854**	**171,028**	**160,153**	**148,157**	**134,928**	**120,427**

6-8-12　水道料金シナリオ別財務推計（シナリオ⑥：2019 年より 1.62 倍）キャッシュフロー計算書推計結果

('000 NRs.)

			2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26
I 営業活動によるキャッシュフロー															
	当期純損益		15,727	63,822	58,303	52,332	45,782	38,609	189,749	180,854	171,028	160,153	148,157	134,928	120,427
	減価償却費		21,531	23,002	24,573	26,252	28,046	29,962	32,010	34,197	36,533	39,030	41,696	44,545	47,589
	減価償却費調整額		-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34
	未払利息の増減		28,804	30,772	32,874	35,121	37,520	40,084	42,823	45,749	48,875	52,214	55,782	59,593	63,665
	水道料金貸倒引当金の増減		1,344	1,712	1,829	1,954	2,088	2,231	2,383	2,546	2,720	2,906	3,104	3,316	3,543
	退職給付引当金の増加		15,260	16,303	17,417	18,607	19,878	21,237	22,688	24,238	25,894	27,663	29,554	31,573	33,730
	保険積立金の増加		-73	-78	-83	-89	-95	-101	-108	-115	-123	-132	-141	-150	-161
	売上債権の増減		-13,445	-17,123	-18,362	-18,710	-19,065	-19,427	-19,795	-20,170	-20,553	-20,942	-21,339	-21,744	-22,156
	前払費用の増減		4,188	0	0	0	0	0	0	0	0	0	0	0	0
	補修部品在庫の増減		13	13	14	15	16	17	19	20	21	23	24	26	28
	流動負債の増減		12,572	13,431	14,349	15,329	16,376	17,495	18,691	19,968	21,332	22,790	24,347	26,010	27,788
	退職給付金引当金の減少		-9,724	-7,569	-8,873	-10,402	-12,194	-14,295	-16,757	-19,644	-23,029	-26,996	-31,647	-37,099	-43,491
	支払生命保険金		-711	-692	-810	-948	-1,110	-1,300	-1,522	-1,781	-2,085	-2,441	-2,858	-3,345	-3,916
	営業活動によるキャッシュフロー		75,453	123,559	121,197	119,427	117,209	114,479	289,173	285,127	280,159	274,096	266,798	258,066	247,759
II 投資活動によるキャッシュフロー															
	固定資産の増減		72,231	92,239	98,541	105,274	112,467	120,152	128,361	137,132	146,502	156,512	167,206	178,631	190,836
	NWSC 負担の設備投資	門・フェンス							3,200						
		受電設備							5,200						
		その他							123,000						
		土地収用費							250,000						
		配管延長 2km/年			18,300	19,550	20,886	22,313	23,838	25,467	27,207	29,066	31,052	33,173	35,440
		浄水場								119,048					
	投資活動によるキャッシュフロー		72,231	92,239	116,841	124,824	133,353	142,465	378,306	281,646	173,709	185,578	198,258	211,804	226,276
III 財務活動によるキャッシュフロー															
	政府からの借入金の増減		4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
	財務活動によるキャッシュフロー		4,630	111,157	60,110	64,217	68,605	73,293	78,300	0	0	0	0	0	0
現金および現金同等物の増加額			**7,852**	**142,478**	**64,466**	**58,820**	**52,461**	**45,307**	**-185,153**	**-15,821**	**86,871**	**68,655**	**48,387**	**25,815**	**735**
現金および現金同等物期首残高			**-**	**57,146**											
現金および現金同等物期末残高			**-**	**199,624**	**121,612**	**180,432**	**232,893**	**278,199**	**93,046**	**77,226**	**164,096**	**232,752**	**281,139**	**306,954**	**307,689**

Final Report

Socio-Economic Situation of Residents in Pokhara City for Improvement of Water Supply System

Main Report

Submitted to:

NJS Consultants

July, 2015

Location Map

NWSC Pokhara Service Area

Ward No
1. Bagar, 2. Bindhabasini,Miruwa, 3. Nadipur, 4. Gairapatan, 5.Malepatan,Magarthok, 6. Baidam,Lakeside, 7. Ratnachok, 8. Shrijana chok, 9. Nayabazar, 10. Rambazar, 11. Ranipauwa, 12. Matepani,Banjhapatan, 13. Gaundako Mukh, 14Majhariptan, 15. Dhungeshaghu, 16. Batulechaur,chamere gufa, 17. Pardibirauta, 18. Chhine Danda, 19. Lamachaur, 20. Valam, 21. Kalum, 22. Arba bijaya, 23. Nirmal pokhari, 24. KritinachneChaur, 25. Pumdibhumdi, 26. Sarangkot.

Remarks
- NWSC Ward.
- Municipality Ward

Ward no.
a. 01-18 Old Sub Metropolitan City.
b. 19-28 New Merged Area.
① NWSC Ward No.
1 Municipality Ward No.

CONTENTS

THE STUDY TEAM

Core Team		
1	Mr. Madhav Devkota	Team Leader
2	Mr. Ashwasthama Pokherel	Team Member
3	Ms. Dikshya Pokharel Devkota	Coordinator
	Other Experts	(as Proposed)
Field Staffs		
1	Ms. Jananee Magar	Research Surveyer
2	Mr. Arjun Marahatta	Research Surveyer
3	Ms. Upama Wagle	Research Surveyer
4	Ms. Shakuntala Neupane	Research Surveyer
5	Mr. Shiva Prasad Sapkota	Research Surveyer
6	Ms. Pooja Dawadi	Research Surveyer
7	Mr. Deekap Dhungel	Research Surveyer
Data Entry Operators		
1	Mr. Anuj Pokhrel	Data Operator

1. INTRODUCTION

1.1 Background

Pokhara is a sub metropolitan and second largest city of Nepal after Kathmandu. Pokhara is capital of Kaski district, Gandaki zone, Western Development Region in Nepal. The city is 200 KM West of Kathmandu and situated at an altitude variation from 780 meter-1,350 meter. The Pokhara is a city with approximately 250,000 population and around 230,000 tourists are visiting Pokhara in an annual basis.

Despite being one of the touristic places with sizable city population, the water supply situation (both in terms of quantity and quality) is not satisfactory. Because of the old and ineffective drinking water distribution system, the Nepal Water Supply Corporation (NWSC) has been failing to supply water to each and every household in Pokhara on a daily basis. The problem is not the availability or the capacity to reserve the water but distribution and water quality as well. So to improve the water supply situation in Pokhara, several components needs to be improved. In this context, Government of Japan has provided support through Japan International Cooporation Agency (JICA) and the project entitled "Pokhara Water Supply Improvement Project" is initiated aiming to improve supply system including the development of water purification facilities. The project has planned for the improvement of structures including construction of new settling basin, construction of new water treatment plant, and update such as water distribution networks. Hence the project aims to construct augmentation facilities for water supply system improvement in Pokhara Sub Metropolitan.

For planning of construction of any infrastructure development, it is very important to understand the existing socio-economic situation of the beneficiaries. It is in this context, the "Pokhara Water Supply Improvement Project" has also planned for several environmental, social, and technical studies (water quality) prior the beginning of intended infrastructure work for this project. Accordingly, a socio-economic survey, which entitled "Social survey for Preparatory survey on Pokhara Water Supply Improvement Project", had been carried out in 2015. The purpose of this survey is to identify socio-economic situation of residents in Pokhara city for improvement of water supply system, and to collect residents' opinions for current water supply services.

1.2 Objectives

The objectives of the study are:

1. To identify socio-economic situation of the residents of water supply service area in sub-metropolitan city Pokhara for water supply system;
2. To collect residents' opinion and request for current water supply services;

3. To collect the opinion as well as request of the type of hotel owners who are using water as for the business

1.3 Scope of Work

The type of socio-economic information required for fulfilling the objectives as set out in the TOR is as outlined below (Table 1).

Table 1 Survey Outline

Process of the survey	Discription	Duration
a) Survey method	Door to door survey	-
b) Survey location	Water supply service area and non supply area in Pokhara city	-
c) Number of samples	307 NWSC households, 114 Non-NWSC households and 103 hotels/restaurant	-
d) Type of samples	Sample for NWSC and Non-NWSC households and hotels	-
e) Team building	Orientation training to team by team leader and senior staff and Preparation of Household Survey Questionnaire (Format: MS Access and SPSS)	April 1-24, 2015
f) Pre testing of questionnaire	Questionnaire finalization and Printing, Meeting with client and relevant stakeholders, Field Mobilization and Field survey	April 25-May 9, 2015
g) Data entry of Field Level Questionnaire	Template (MS Access), Filled up questionnaire check, QA/QC	May 12-15 and May 28-June 5, 2015
h) Analysis	After door to door survey completion data analysis	June 8-14, 2015
i) Generation of Output	Tables and Analysis of SPSS Outputs	June 8-14, 2015
j) Preparation of Social Survey Report	(Draft Report & Final Report)	June 8-July 23, 2015

1.4 Methodology

The study report is based on both primary and secondery source of information. The scondary information was collected from different sources as CBS (Central Bureau of Statistics), Office of the Pokhara Sub-metropolitan City, NWSC Branch Office - Pokhara and sub-branch office Bidhabasini etc.

The sampling technique used for collecting primary information and sample size were followed as per the TOR provided by the client. The survey items included in the specifications were as follow;

- Basic information of households and hotels (e.g number of household members)
- Household economy (e.g. expenditures)
- Health survey (including waterborne disease)

- Water use (e.g accessibility to safe drinking water, water use by purpose, amount of consumption of water, water fetching activities)
- Opinion and request for current water supply service
- Satisfaction and willingness to pay for water supply

Sample Size

A total household of all the 18 wards of Sub-metropolitan City is 68236. Draw out the percentage of each and every individual wards following the basis of total households. Derived percentage of each ward considered as main basis and that helped for proportional distribution of the samples. Total 300 samples have been proportionately distributed over the 19 wards of former Sub-metropolitan City. Similarly, total households of Non-NWSC segment is 14,634 and the total sample size allocated for the area is 100 and all of them are proportionately on 10 wards of newly added Sub-metropolitan City area (Table 2).

After the pre test of household level questionnaire, it was also dicided to take trial entry of 50 questionnaires from household level to see the performance of pretested questionnaire. In that time 12 out of sample fulfilled from the Non-NWSC segment, which ultimately has become more than proposed in TOR (Table 2).

Before carrying out the survey of hotels and restaurants, related information was collected in Pokhara. In course of the information collection, survey team visited the office of the Paschimanchal Hotel Association Pokhara. Discussions were held with Bharat Raj Parajuli - President of Paschimanchal Hotel Association Pokhara and his office subordinates. In course of discussion they told that about 200 to 250 hotels are concentrated only in Lakeside or Ward No 6 Baidam and rest in Ward No 17 Pardibirauta and few of them in other area of Pokhara valley. On the discussion meeting related documents and additional list of hotels were also collected. The published Hotel Directory (2013) of hotel association was nearly 2 years old, so necessary corrections were made in the meeting and type of hotels were marked with the help of officials from hotel association. The basis was more hotels more weighted, less hotels less weighted (maximum sample in ward no 6, Lakeside and less in ward no 17 Pardi Birauta and rest in other areas.)

They suggested the tentative classification of hotels and restaurant as well. Taking the base of their suggestions the team further worked out the following classification of hotels and restaurants:

1. Tourist Standard Hotels: Including star hotels, other hotels that are able to provide the facilities nearly to the stars hotels level, more than 20 rooms with enough space and well ventilated, quick service, room service, telephone, wifi, enough parking space with vehicle facilities and garden etc.
2. Middle Standard Hotels: 11 to 19 rooms with reasonable space, phone ard wifi facility, room service, reasonable parking space, garden, reasonable tourist flow, vehicle hiring facilities etc.

3. Below Standard Hotels: Less 10 rooms with relatively less space, no meeting place, no phone service in the individual rooms etc.

With the samipling procedure, the sample size of each category was decided in Table 3.

Table 2 Household Sample size

Name of Ward	Ward No	NWSC		Non-NWSC		All	
		N	%	N	%	N	%
Bagar	1	19	6.2			19	4.5
Bindhabasini,Miruwa	2	11	3.6			11	2.6
Nadipur	3	13	4.2			13	3.1
Gairapatan	4	13	4.2			13	3.1
Malepatan,Magarthok	5	17	5.5			17	4.0
Baidam,Lakeside	6	18	5.9	2	1.8	20	4.8
Ratnachok	7	16	5.2			16	3.8
Shrijana chok	8	32	10.4			32	7.6
Nayabazar	9	19	6.2			19	4.5
Rambazar	10	21	6.8			21	5.0
Ranipauwa	11	15	4.9			15	3.6
Matepani,Banjhapatan	12	13	4.2			13	3.1
Gaundako Mukh	13	14	4.6			14	3.3
Majharipatan	14	7	2.3			7	1.7
Dhungeshaghu	15	19	6.2			19	4.5
Batulechaur,chamere gufa	16	17	5.5			17	4.0
Pardibirauta	17	25	8.1	8	7.0	33	7.8
Chhine Danda	18	8	2.6	2	1.8	10	2.4
Lamachaur	19	10	3.3			10	2.4
Kalam	20			8	7.0	8	1.9
Kalam	21			6	5.3	6	1.4
Arba bijaya	22			10	8.8	10	2.4
Nirmal pokhari	23			6	5.3	6	1.4
KritinachneChaur	24			9	7.9	9	2.1
Pumdihumdi	25			14	12.3	14	3.3
Sarangkot	26			14	12.3	14	3.3
Hemja	27			22	19.3	22	5.2
Armala	28			13	11.4	13	3.1
Total		307	100.0	114	100.0	421	100

Note: After the pre test of household level questionnaire, it was also decided to take trial entry of 50 questionnaires from household level to see the performance of pretested questionnaire. It was not decided to take samples from NWSC and Non NWSC segment, so for the sake of quick outcomes and to bring legitimate result, nearest area such as Baidam, Pardibirauta, and Chhine Danda were taken. On the other hand, non NWSC sample households were taken from the recently added 10 wards of Pokhara sub metropolitan city.

Table 3 Sample size of Hotel/Restaurant

Serial No	Ward Settlement	Sample Sector	% of Hotel/ Restaurant	Estimated Sample Hotel/ Restaurant	Actual Sample Hotel/ Restaurant
1	Tourist Standard Hotel	Hotel	25%	25	25
2	Middle standard Hotel	Hotel	40%	40	41
3	Below Standard Hotel	Hotel	15%	15	18
4	Restaurant	Restaurant	20%	20	19
	Total Hotel/Restaurant		100%	100	103

As per the above sample size, the team walked around in Lakeside and other reas, and hotels were selected randomly. After random selection, the survey team took interviews whenever they found either Tourist standard, Middle standard, and Below standard hotel. The survey team visited the prescribed site and required number of samples (as identified above) in each category of hotels was administered. The survey team as continued the survey until the desired number of 100 sample hotels are completed. The quality control was maintained at site and completion of each day of survey by the study team leader by verifying all the surveyed questionnaires.

1.5 Orientation and Training to the Survey Team

The study survey team leader and senior experts provided orientation training to enumerators and the experts accompanied the enumerators during the pre-testing of survey questionnaire. The pre tested questionnaires were findalized by the team leader and statistician. The finalized questionnaire was administered in the field by the survey team. The team leader and experts of the team also accompanied the survey team.

2. HOUSEHOLD LEVEL SURVEY AND FINDINGS

2.1 General Characteristics

2.1.1 House and Population

Total sampled households of the study area for both the segments NWSC and Non-NWSC has been estimated to be 421 of which 307 of the households have been included in NWSC and the rest 114 from Non-NWSC (Chart 1). The family size in both the segment is 4.71 and 4.98 respectively. Total sampled population in both the segments is 2015 AD of which major sharing 72 percent is of NWSC and rest 28 percent belongs to Non-NWSC. By gender perspective sharing of male in NWSC segment is 50.6 percent where as it is 49.4 percent of female. In the case of Non-NWSC segment it is nearly vice versa or that is the sharing of male is 49.6 percent where as it is 50.4 percent of their female counter part. See Table 4 below.

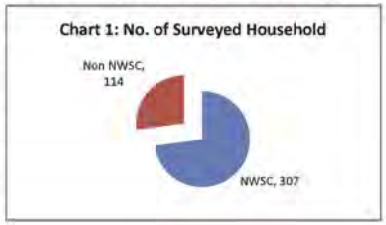


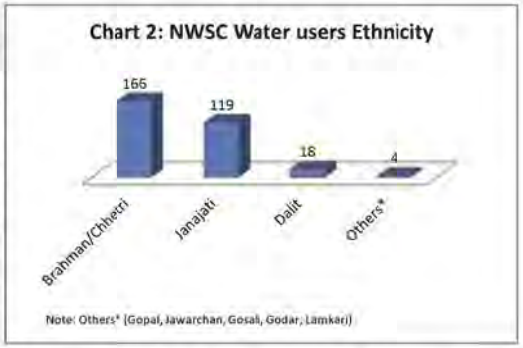
Table 4 General Characteristics

	N. of Surveyed Household	Average of household size	Gender Population					Q9. Type of Resident			
			Male		Female		Total	Independent Housing		Apartment	
			N	%	N	%	N	N	%	N	%
NWSC	307	4.71	732	50.6	715	49.4	1447	307	100.0	0	0
Non-NWSC	114	4.98	282	49.6	286	50.4	568	114	100.0	0	0
Total	421	4.79	1014	50.3	1001	49.7	2015	421	100.0	0	0

Although NWSC and Non-NWSC both the areas are the part and parcel of Sub-metropolitan city Pokhara of which 19 wards are entirely located in the urban area and rest 9 wards in periurban area. As mentioned before these 9 wards are recently included in the Sub-metropolitan city few months before which were 9 VDCs surrounding the periphery of Pokhara city.

Considering the study area as Sub-metropolitan City two type of residents as independent or apartment was included in the questionnaire but in the actual field only independent housing has been reported not the apartment buildings.

2.1.2 Ethnicity



Over all samples consist of 421 households in both of the segments NWSC and Non-NWSC of which the former one shares about 73 percent and the rest 27 percent by the later one. From the view point of ethnicity four broad categories such as Brahman, Chhetri, Janajati, Dalit and others were reported in the study area (Chart 2). Among the 307 Households of NWSC segment Brahman/Chhetri group occupies 55 percent(No: 166), followed by Janajati 39 percent(No. 119), Dalit approximately 6 percent(No. 18) and others has been reported 1 percent(No. 4) (chart 2). As in the case of Non-NWSC segment the number and group representation is slightly different than NWSC. The maximum number of representation has been reported Brahman/Chhetri (59 percent and more) followed by Dalit approximately 22 percent, Janajati 17 percent and others roughly 2 percent. See Table 5 below.

Table 5 Ethnicity by type of NWSC users

	NWSC		Non-NWSC		ALL	
	No	Percent	No	percent	No	Percent
Brahman/Chhetri	166	54.1	68	59.6	234	55.6
Janajati	119	38.8	19	16.7	138	32.8
Dalit	18	5.9	25	21.9	43	10.2
Others*	4	1.3	2	1.8	6	1.4
Total	307	100.0	114	100.0	421	100.0

Note: Others (Gopal, Jawarchan, Gosali, Godar, Lamkari)

2.1.3 Age Group

Of the total 421 respondents 307 were reported from NWSC segment and rest 114 from Non-NWSC segment. Age of the respondents were also noted and grouped. Nearly 8 percent respondents were reported between the age group of 16 to 25 years, followed by 43 percent of the age group between 26 to 45 and is the group of maximum respondents (49 percent) were reported and 46 and Age group in NWSC segment It was also asked in the Non-NWSC segment. Maximum of the 54 percent respondents were between 26 to 45 years of age group followed by 37 percent of 46 years and above age group and the rest 9 percent between the age group of 16 to 25 years. See Table 6 below.

Table 6 Age group of Respondents

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
16 to 25 years	24	7.8	10	8.8	34	8.1
26 to 45 years	132	43.0	62	54.4	194	46.1
46 to above years	151	49.2	42	36.8	193	45.8
Total	307	100.0	114	100.0	421	100.0
Average Age	46.5		41.3		45.1	

Source: Household Survey, Pokhara, 8 to 22 May 2015.

2.1.4 Respondents by Gender

Respondents were collected by the gender perspective to review the participation between the sexes in both NWSC and Non-NWSC segments as well. It has been reported that the maximum numbers of respondents were (55.4 percent) from the female and little bit less 44.6 percent from their counterpart male in NWSC segment. Nearly the same proportion follows by the Non-NWSC segment. See Table 7 below.

Table 7 Gender of Respondents

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Male	137	44.6	51	44.7	188	44.7
Female	170	55.4	63	55.3	233	55.3
Total	307	100.0	114	100.0	421	100.0

2.1.5 Household Head by Sex

It was also minutely observed that the number of household head by the sex in both segments. It has been responded that in the NWSC segment 77 percent (No. 327) of the targeted households are headed by the male and approximately 23 percent (No.94) by their counterpart female. It is also nearly the same proportion as in the case of Non-NWSC segment. See Table 8 below.

Table 8 Household head by sex

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Male	237	77.2	90	78.9	327	77.7
Female	70	22.8	24	21.1	94	22.3
Total	307	100.0	114	100.0	421	100.0

2.1.6 Impact of diarrhea on household

The beneficiary households of NWSC segment were asked for water contamination and diarrheal disease. About 99.2 percent of the population reported no diarrhea at all. But nearly one percent of the population expressed having diarrhea for a few members of the family. In the case of Non-NWSC segment nearly the same 99.6 percent of the households expressed no diarrhea but a negligible that is 0.4 percent of the household reported the impact of diarrhea.

2.1.7 Gender participation on water fetching

Some of Non-NWSC interviee households are required to water fetching since they did not have water fauset in the house. Rearding the person in charge for water fetching, hardly 18 percent male reported fetching water where as 82 percent from the female that is 4 times higher than the male. The data shows that the water fetching activity is major job of female (Table 9). Regarding times (minutes) for water fetching, avarege of duration for water fetching is 8.4 minutes and it varies from "Less than 0 minutes" to "120 minutes" (Table 10A).

On the other hand, some of interviewees in Non-NWSC area go to water fetching outside since there is no water source in the house. In total of 114 of Non-NWSC households, 62 households have water source near the house and meanwhile 52 of them have to go water fetching more than 1 time a day. The average of frequency of daily water fetching is 4.36 times (Table 10B). Average of total water fetching time is 13.36 minutes per day.

Table 9 Gender participation on water fetching

	Gender that contribute to Water Feching					
Segment	Male		Female		Total	
	N	%	N	%	N	%
Non-NWSC	21	18	93	82	114	100

Table 10A Times (minutes) for water fetching

Minutes	<1	1 to 5	6 to 10	11 to 20	21 to 30	31 to 45	46 to 60	120	Total
Non-NWSC	42	34	14	13	6	2	2	1	114

Table 10B Times (frequency) for water fetching

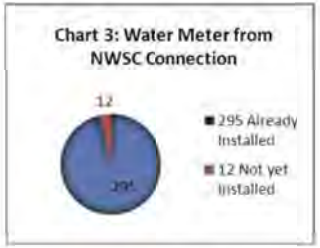
Minutes	<1	1 to 5 times	6-10 times	11-20 times	20<	Average	Total
Non-NWSC	62	45	1	3	3	4.36 times	114

2.2 Connection of NWSC Water Supply

Of the total 421 sampled households 307 reported to have NWSC supply connection and the rest 114 have no connection. The households who have got NWSC water supply connection they have categorized into NWSC segment and those who have not connected the NWSC supply are categorized in the Non-NWSC segment.

2.2.1 Meter Connection

Of the total 307 NWSC supply connection households 96 percent (No.295) reported they have already installed the water meter and 4 percent (No. 12) not yet installed (Chart 3).



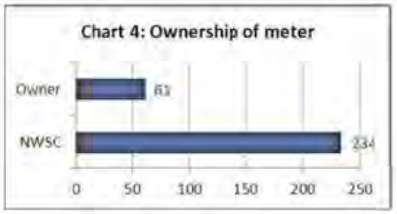
2.2.2 Ownership of the Meter

Among the 295 households of those who had already installed the water meter they were asked about the ownership of the meter. Among them, 79 percent (No. 234) "answered" that the ownership belongs to NWSC and rest 21 percent (NO. 61) told that they themselves bought the meter so that the ownership belongs to themselves (Chart 4).

It may need some consideration for this result. Though the result of survey shows majorities of water meters belong to NWSC, the truth is that water meters are belong to households as personal properties but they just *believe* water meters are belong to NWSC.

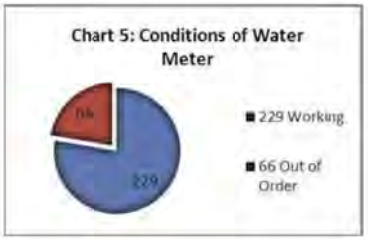
According to NWSC, NWSC had distributed only limited number of water meters, therefore majority of household water meter in Pokhara might have belong to households as their personal properties (personal purchase) since. After the discussion with Nepal locals, some reasons of this confusued situation were figured it out. It seems many of residents were believed that their personal purchace of water maters are belonging to NWSC since they had explained the followings at the timing of water meter purchase and installement, for example:

- *"At the time of supply connection NWSC had no meter, so the NWSC official told that the user households themselves can buy the meter and NWSC would shield the meter officially" and/or,*
- *"User should buy the meter either from NWSC or from the market but for the legalization or validation NWSC officials should shield the water meter, otherwise it would be illegal."*



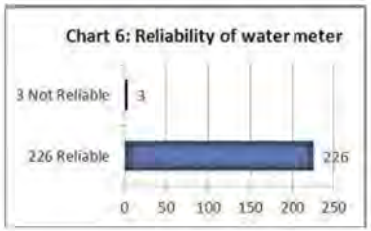
2.2.3 Condition of Water Meter

The condition of water meter either it is working or out of order was also asked with the beneficiary households. Reportedly, of the 295 meters 78 percent (No. 229) are working and rest 22 percent (No. 66) out of order (Chart 5).



2.2.4 Reliability of Water Meter

Of the working water meter approximately 99 percent (No.226) reported reliable and rest 1 percent (No. 3) not reliable (Chart 6).



2.3 Water Supply

2.3.1 Main Sources of Water Supply

NWSC water supply source is not enough for all the user households to meet the major requirements for drinking, cooking, washing clothes, bath, toilet to some extent gardening and also their livestock heads. Major requirements of user households have been accounted to be drinking, cooking, washing, toilet etc. but possible access to resources may be varied depending upon the location, season and well off of the user households. Table 11 depicts both the segments NWSC and Non-NWSC as well, which is the main source mostly used for the particular purpose. It has been clearly indicated that the majority of the households, approximately 97 percent, are being use NWSC house connection for cooking, following 96 percent and more for bath shower and toilet, 95 percent use for washing, nearly 83 percent for drinking, and 44 percent and 9 percent of the households respectively use for gardening and livestock. Approximately 12 percent of the households those who are well off use mineral/jar water for drinking purpose. It is also reported that, in acute shortage of NWSC supply the user households are bound to use other sources which are within their access such as public tap, neighbor's tube well, river and stream etc.

In the case of Non-NWSC segment majority of the households (78 percent) use Non-NWSC public tap for cooking, approximately 74 percent for drinking, followed by toilet, washing and bath shower 70 percent, approximately 67 percent, and 66 percent respectively. Own tubewell has been reported as in second choice and purposively prioritized as bath shower, washing, drinking, cooking and toilet, near about 18 percent, 17 percent and 15 percent respectively. As mentioned earlier, although the area administratively included in the Sub-metropolitan city most of the characteristics have been carrying rural than the urban. Approximately 62 percent of the households are using different sources for watering of their flower garden or the vegetable garden.

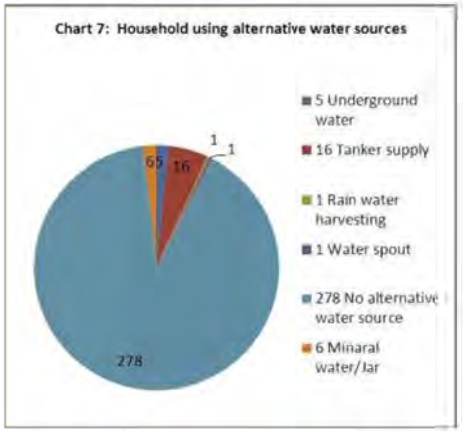
In the case of NWSC segment 47 percent of the households are using different water sources in gardening purpose and just 10 percent of them are using for the livestock. See Table 11 below.

Table 11 Household using main source of water

	NWSC							Non NWSC						
	Drinking	Cooking	Washing	Bathing	Toilet	Gardening	Livestock	Drinking	Cooking	Washing	Bathing	Toilet	Gardening	Livestock
NWSC House connection	82.7	96.7	95.1	96.1	95.8	44.3	8.8	0	0	0	0	0	0	0
NWSC Public tap	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0
Non NWSC Public tap	0.3	0	0.3	0.7	0.7	0	0	73.7	78.1	66.7	65.8	70.2	49.1	37.7
Neighbour tap	0	0	0	0	0	0	0	3.5	3.5	3.5	5.3	5.3	0.9	0.9
Own tubewell/Boring	2.3	0.7	0.7	0.3	0.7	0.7	0	16.7	14.9	16.7	17.5	14.9	8.8	5.3
Neighbour tubewell	0.3	0.7			0.7	0	0	0	0	0	0	0	0	0
Water tanker	0	0.3	1.6	1.3	1.3	0.3	0	0	0	0.9	0	0	0	0
Spring/stream	2.3	0.7	1	0.3	0.3	0.7	0.3	2.6	2.6	2.6	2.6	2.6	1.8	1.8
River/lake/canal water	0	0	1.3	1	0.7	1	0.7	0	0.9	9.6	8.8	7	1.8	1.8
Mineral/jar water	12.1	0.7	0	0	0	0	0	3.5	0	0	0	0	0	0
No	0	0	0	0.3	0	53.1	90.2	3.5	0	0	0	0	37.7	52.6
Column percent	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Total number	307	307	307	307	307	307	307	114	114	114	114	114	114	114

2.3.2 Alternative Sources of Water Supply

Most of the used sources by the user households were asked before. In this context other alternative sources rather than main sources were asked with the respective households (Chart 7). In the case of NWSC segment 91 percent reported not using the other alternative sources rather the used sources which were mentioned above. Of the remaining 9 percent, 5 percent of households expressed using Tanker supply followed by 2 percent Mineral/Jar water, 1 percent underground water, less than one percent reported using the sources from rain water harvesting and water spout. As in the case of Non-NWSC segment 83 percent of the beneficiary households reported not having used of other alternative sources and rest 17 percent of the households expressed having used the other alternative sources. Among the 17 percent, 7 percent having use the water spout, following by mineral/jar water 5 percent rain water harvesting 4 percent and 1 percent reported using the underground water sources.



2.4 Expenditures on Water

2.4.1 Expenditure on Water Sources

Bineficiary households of the study area were asked about the expenditures on water in various purposes for example NWSC water tariff, own well installation, maintenance, water tanker, jar and bottle water etc. Almost all the sampled households pay monthly tariff for water to NWSC that ranges minimum amount of Rs 80/ to maximum Rs 3000/ and average amount Rs 446/ approximately. One household has been reported installed his one well at a cost of Rs 11000/, two households spent Rs 220/ to Rs 300/ for maintenance in regular monthly basic; one household spent Rs 725/only one time for extra fittings; four household spent on an average Rs 717.50/ for community supply; 21 households spent average amount of Rs 1817/for water tanker mostly in acute dry season and 36 households spent Rs 557/ for bottle /jar water. In the case of Non-NWSC segment 19 households spent average Rs 80/ per month for community water supply, one household installed a well in a cost of Rs 50,000/ and 8 households spent Rs 227/ on an average. See Table 12 below.

Average of total expenditure on water is 3,828.2 NPR in NWSC households and 817.0 NPR in Non-NWSC households. To comparea the listed price of water, the payment to water tanker is drastically high compare to others therefore the cost of water tanker may pull up the average.

Meanwhile, tubewell installation cost is recoreded only in 3 households in both NWSC and Non-NWSC. Therefore, the cost of water tanker and tubewell will be deleted and sum up the cost of NWSC, payment to community, and bottle water ((a), (c), and (e) in Table 12) is going to sum up for understanding of relatively normal situation of water cost in household. In this calculation, the cost for water is 1,720.5 NPR in NWSC households and 307.0 NPR in Non-NWSC households.

Table 12 Average expenditure on water for various purposes

Headings of Expenditures		NWSC				Non-NWSC			
		No of HHs	Min	Max	Average	No of HHs	Min	Max	Average
(a) NWSC Water Expenditure (in NRs) per month		307	80	3000	445.8	-	-	-	-
Tubewell	Own well installation (in NRs)	1	11,000	11,000	11,000.0	1	50,000	50,000	50,000.0
	Regular maintenance (in NRs) per month	2	200	300	250.0	2	200	200	200.0
	(b) Average Expenditure on Tubewell*	-	-	-	310.0	-	-	-	470.0
(c) Community (in NRs) per month		4	20	2,000	717.5	69	10	340	80.0
(d)Water Tanker (in NRs) per month		21	100	16,000	1817.6	1	40	40	40.0
(e) Bottle Water (in NRs) per month		36	120	1800	557.2	8	50	480	227.0
Total of (a), (b), (c), (d), and (e)		-	-	-	3,828.2	-	-	-	817.0
Total of (a), (c), and (e)					1,720.5				307.0

**Monthly const of tubewell installation was cauculated 60NPR(in case the cost wasl 11,000NPR) and 270NPR (in case the cost was 50,000NPR)as regular use of 15 years.*

2.5 Water Facility

2.5.1 Water storage facility

The households belonging to NWSC segment reported that the facility available on the household basis is 1 to 4 and among htese facilities a number of 14 households reported that not a single extra facility installed in their house except one single tap. Among the facilities a number of 195 household reported having ground tank, followed by 253 households roof tank, 220 households installed the pump 179 households with filter facility, 3 households reported using drum to substitute the tank facility. As in the case of Non-NWSC segment number of 146 reported having roof tank, followed by filter 37 households, ground tank 32 households pumping facility 18 households and 33 households reported not a single facility installed. See Table 13 below.

Table 13 Water storage facilities

Ficility item	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Ground Tank	195	63.5	32	28.1	227	53.9
Roof Tank	253	82.4	46	40.4	299	71.0
Pump	220	71.7	18	15.8	238	56.5
Filter	179	58.3	37	32.5	216	51.3
No water facility	14	4.6	33	28.9	47	11.2
Drum/tanki	3	1.0	12	10.5	15	3.6
Total	307	100.0	114	100.0	421	100.0

2.6 NWSC Water Supply System

2.6.1 Water supply starting time

The urban households were asked about the starting time of water supply in both the season. Reporting of the user households were varied, so it was grouped. Approximately 87 percent of the targeted households reported from morning 3 to 11 AM, followed by 5 percent from 11 to 7 PM at day time and rest 8 percent 7 to 2 AM at night in dry season. In rainy season also followed the same time and approximately the same percent (Table 14A). Table 14B shows the duration (hours) of water supply that once water supply started. In Dry Season, water is supplied for 24 hours in 76% of the respondents' household, and continues 9 to 12 hours in 20% of the households. In Rainy Season, water is continuously supplied for 24 hours in the 78% of households and it continued for 9 to 12 hours in the 19% of households (Table 14B).

Table 14A Water supply starting time in the household

	Dry Season		Rainy Season	
	N	%	N	%
Morning (3 to 11 AM)	266	86.6	259	84.4
Daytime (11 to 7 PM)	15	4.9	15	4.9
Night (7 to 2 AM)	26	8.5	33	10.7
Total	307	100.0	307	100.0

Table 14B Hours that water supply continues

Hours	Dry Season		Rainy Season	
	N.	%	N.	%
1 to 3 hours	4	1%	1	0%
3 to 6 hours	3	1%	2	1%
6 to 9 hours	3	1%	3	1%
9 to 12 hours	61	20%	59	19%
12 to 15 hours	3	1%	4	1%
24 hours	233	76%	238	78%
Total	307	100%	307	100%

Table 14C shows percentage of households by wards that have (1) 10-12 hour water supply or (2) 24 hours water supply according to the result. In the table, gray color colom shows that (1) more than 30% of households are applicable in case of 10-12hours water supply, and (2) 100% of households are applicable in 24 hours water supply in the ward. Ward 2, 3, 5, 16, 18, and 19 have 24 hours water supply once the supply sturted in both dry season and rainy season. The se area, especially Ward 2, 3, and 4 areas located in the center of Pokhara. On the other hand, Ward 4, 6, 7, 12, 14, and 17 have 10-12 hours water supply in both dry and rainy season. These aras are located relatively peripheral area, such as Ward 14. The resoult shows some area have one whole day of water supply (such as Ward 2, 3, 5, 16, 18, and 19) and other area have half day, suchas the Ward of 4, 6, 7, 12, 14, and 17.

2.6.2 Frequencies of water supply

The frequencies of regular water supply in the study area have been reported various. It is differ from 1 house to the other, although they are closed to each other. It is because of the depression and elevation of the topography, increasing the number of urban households, water source depletion, lack of timely maintenance of supply system etc. Most of the user households were noted not satisfied with the drinking water distribution system. Supply quantity of water reported different in new and old supply line. Less quantity supplied in new one and relatively more in old supply. It was minutely asked with the sampled households of the study area about the frequency of water supply. It was noted different response in ward to ward, in one to another settlement and in some cases one house to another. Of the total 307 households 84 percent expressed their views that the frequency of supply in dry season is 3 days in a week, 8 percent of the households responded 7 days in a week, 4 percent of the households expressed 2 days in a week and 3 percent responded 4 days in a week. It was again asked for the rainy season about the water supply frequency. Of the total households 69 percent responded 3 days in the week, followed by 23

percent all 7 days in a week, 4 percent expressed the views 4 days in a week, 3 percent and 1 percent respectively 2 days and 1 day in a week. See Table 15 below.

Table 14C Ratio of Water Supply Hours by Wards (10-12 hours/24 hours)

Ward #	(1) % of households which have 10-12hours water supply once the supply started N=307		(2) % of households which have 24 hours water supply once the supply started N=307	
	Dry Season	Rainy Season	Dry Season	Rainy Season
1	16%	5%	84%	95%
2	0%	0%	100%	100%
3	0%	0%	100%	100%
4	38%	46%	54%	46%
5	0%	0%	100%	100%
6	39%	39%	50%	50%
7	31%	38%	63%	63%
8	6%	3%	91%	97%
9	11%	11%	89%	89%
10	33%	29%	62%	67%
11	20%	27%	67%	60%
12	31%	31%	62%	62%
13	21%	29%	79%	71%
14	71%	71%	29%	29%
15	26%	21%	63%	63%
16	0%	0%	100%	100%
17	40%	36%	52%	64%
18	0%	0%	100%	100%
19	0%	0%	100%	100%

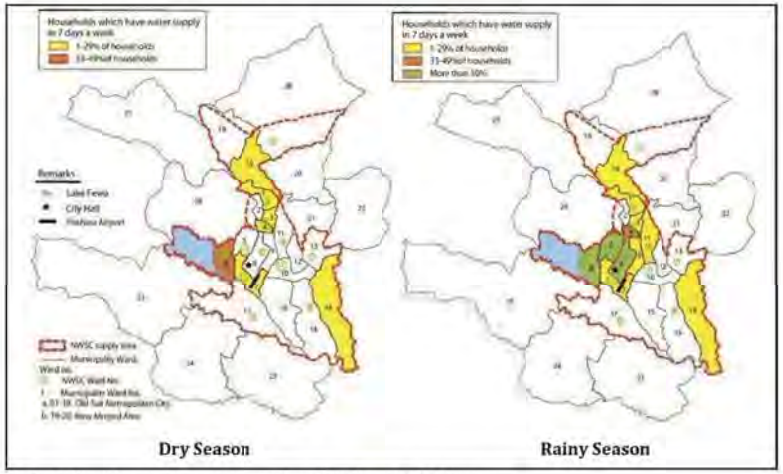
**Gray color colom shows that (1) more than 30% of households are applicable in case of 10-12hours water supply, and (2) 100% of households are applicable in 24 hours water supply in the ward.*

Table 15 Frequencies of water supply in the household

	Dry Season		Rainy Season	
	N	%	N	%
1 day/week	4	1.3	2	0.7
2 days/week	11	3.6	8	2.6
3 days/week	258	84.0	211	68.7
4 days/week	9	2.9	13	4.2
5 days/week	1	0.3	2	0.7
6 days/week			1	0.3
7 days/week	24	7.8	70	22.8
Total	307	100.0	307	100.0

While some of area have only 1 day a week water supply, other have 7 days water supply. How the difference of water supply is allocatecd in geography? Figure 1 shows the wards that have water supply in 7 days a week. Acoording to Figure 1, the area have 7 days a week include important locations of Pokhara, such as Pokhara Municipality, Pokara airport and Lake Side (a tourlist center, so called "Lake-side").

On the other hand, ratios of households which have 7 days water supply is below thirty percent in all of wards expect Ward 6 in dry season, and 7 wards (Ward 1, 3, 7,9,14,16) in rainy season. Therefore, though some of households in the Wards have 7 days a week water supply but the ratio of that kind of households is still low.



Note: No Wards have water supply in more than 50% of households in Dry season.

Figure 1 Wards That Have 7 Day Water Supply A Week

2.6.3 Volume of water supply

After the frequency, the targeted sample households were consulted on the volume of supplied water specifically in dry season. Of the total 307 households about 52 percent (No.159) expressed their view enough supply, followed by 34 percent (No106) not enough but some how acceptable lastly 14 percent (No.42) expressed not satisfying with the supplied volume. But in the case of rainy season it was noted that tentatively 80 percent of the households expressed enough volume, followed by 14 percent supply volume not enough but acceptable and 6 percent of the households explained not satisfactory at all. See Table 16 below.

Table 16 Volume of water supply in the household

	Dry Season		Rainy Season	
	N	%	N	%
Enough	159	51.8	244	79.5
Not enough, but acceptable	106	34.5	43	14.0
Not satisfactory	42	13.7	20	6.5
Total	307	100.0	307	100.0

2.6.4 Quality of water supply

Surveyed households were asked about the quality of NWSC supplied water in dry season. Almost 78 percent of the user households expressed the water quality good, followed by 19 percent sometime turbid, 2 percent explains the water quality turbid and 1 percent expressed the smell supply. In the case of rainy season the result reported relatively negative. More than 65 percent of the targeted households reported the supply turbid, followed by 29 percent sometimes turbid, 9 percent smelling supply, 6 percent bad taste and only 6 percent reported good supply. See Table 17 below.

Table 17 Quality of supplied water by season

Quality	Dry Season		Rainy Season	
	N	%	N	%
Good	240	78.2	18	5.9
Sometimes turbid	58	18.9	89	29.0
Turbid	8	2.6	201	65.5
Smell	2	0.7	27	8.8
Taste	0	0	20	6.5
Total	307	100.0	307	100.0

2.6.5 Pressure on supplied water

The sampled households were asked about the supply pressure for both dry as well as rainy season. In the case of dry season 45 percent (No.140) of the households reported not enough but acceptable, followed by 40 percent (No.122) enough pressure and 15 percent (No.45) not satisfactory. The result for the rainy season reported relatively positive. Enough supply pressure expressed by 71 percent, followed by not enough but acceptable 19 percent and 10 percent not satisfactory. See Table 18 below.

Table 18 Pressure on supplied water system by season

	Dry Season		Rainy Season	
	N	%	N	%
Enough	122	39.7	219	71.3
Not enough, but acceptable	140	45.6	58	18.9
Not satisfactory	45	14.7	30	9.8
Total	307	100.0	307	100.0

Source: Household Survey, Pokhara, 8 to 22 May 2015.

2.6.6 Comments for Watersupply services

Comments on NWSC water supply service from beneficiary households were also collected. Reportedly, type of comments from the users were bad quality 75 percent, followed by 48 percent short service hours, 39 percent low pressure, no good responses of NWSC officials 25 percent 15 percent expressed expensive only 11 percent expressed supply service satisfactory and 1 percent no comments. See Table 19 below.

Table 19: Comments on water supplied service by households

	Number	%
Satisfactory	35	11.4
Short service hours	149	48.5
Low pressure	119	38.8
Bad quality	230	74.9
Expensive	45	14.7
Not good responses of NWSC	77	25.1
No comments	3	1.0
Total	307	100.0

Priorities for the improvement of water supply

Among the 307 households about 74 percent of them suggested to improve the quality on supplied water followed by 19 percent demanded the long service hour, 3 percent suggested supply pressure and 2 percent each supply volume and the price of supplied water. See Table 20 below.

Table 20 Priority for the improvement of water supply

	Number	%
Supply volume	7	2.3
Service hours	57	18.6
Water quality	228	74.3
Supply pressure	9	2.9
Price	6	2.0
Total	307	100.0

2.7 Non-NWSC Water Supply System

2.7.1 Drinking water sources of households

As mentioned above Non-NWSC segment is the periphery of the former sub metropolitan city, Pokhara. The inhabitants of the area are using the sources that are available within their access. The community has made the collection tank taking financial support from the donor as well as the NWSC, Kaski itself. All the management is govern by the community itself. Total sample households of the Non-NWSC segment is 114 and the coverage wards at present are 9 and they are the former 9 VDCs before the inclusion in the Sub-metro Politian city area. The sample household were asked about their drinking water sources and approximately 74 percent of the households reported using Non-NWSC public tap, that means community owned tap, 17 percent followed by own tubewell, other each 3 percent sources are neighbor tap, spring or stream and Jar/mineral water. See Table 21 below.

Table 21 Sources of drinking water using by the Non-NWSC segment

Water source	N	%
Non-NWSC Public tap	84	73.7
Neighbour Tap	4	3.5
Own tubewell	19	16.7
Neighbour tubewell	0	0
Spring or stream	3	2.6
Jar/mineral water	4	3.5
Total	114	100.0

2.7.2 Drinking water quality

Water quality of the used sources were asked with the targeted households and 96 percent and non reported water quality good, rest of others opined equally sometime turbid, Turbid and smell in dry season. For rainy season supply 47 percent of the users opened sometime turbid, followed by

39 pecent good quality, 14 percent expressed turbid and few expressed smell and bad taste as well. See Table 22 below.

Table 22 Quality of drinking water sources of Non-NWSC segment

Water quality	Dry Season		Rainy Season..	
	N	%	N	%
Good	110	96.5	44	38.6
Sometimes turbid	3	2.6	54	47.4
Turbid	2	1.8	16	14.0
Smell	1	0.9	2	1.8
Taste	0	0	3	2.6
Total	114	100.0	114	100.0

2.7.3 Willingness to connect the NWSC water supply

All of the households have no NWSC connection but 89 percent and more households reported that they are willing to connect the NWSC supply but approximately 11 percent of households expressed not interested to connect the NWSC source. See Table 23 below.

Table 23 Willingness to connect the NWSC water Supply water supply

Response	N	%
Yes	102	89.5
No	12	10.5
Total	114	100.0

2.7.4 Willingness to connect or not for NWSC water supply

About 12 households expressed the views not interested for the NWSC connection. Among 12 households, about 67 percent express the view that their presently using source is good, followed by 17 percent opined quality of NWSC supply is not good, another 17 percent each reasoned that the connection fee of NWSC is high, supply is not stable, water tariff of NWSC is high etc. See Table 24 below.

2.7.5 Willingness to pay for the NWSC water supply

Among the Non-NWSC households 89 percent expressed their willingness to pay for the NWSC water supply. They expressed to pay minimum Rs. 50 to maximum Rs 1000 per month. See Table 25 below.

Table 24 Reason for willingness to connect or not

Reason	N	%
Connection Fee of NWSC is high	2	16.7
Water Tariff of NWSC is high	1	8.3
Water supply from NWSC is not stable	2	16.7
Quality of water supplied by NWSC is not good	2	16.7
Current water source is good	8	66.7
NWSC pipes is not installed	1	8.3
Total	12	100.0

Table 25 Willingness to pay for the NWSC water supply

Willingness to pay	Non-NWSC (Rs per month)			
	Number of HHs	Min	Max	Average
Willingness to pay	102	50	1000	163.5

2.8 Waste Management by the Households

2.8.1Waste from toilet

The targeted households were asked about there prevailing practices on different aspects. It was asked that, the management of the waste from toilet. About 97 percent of the beneficiary households reported that the waste from toilet goes to the septic tank, 2 percent reported to soak pit and 1 percent reported direct connection to biogas. In the case of Non-NWSC water user 84 percent reported access to septic tank, 10 percent of the households noted directly connected to biogas, 3 percent of toilet connected to soak pit. See Table 26 below.

Table 26 Management of waste from toilet

Items	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Septic Tank	298	97.1	96	84.2	394	93.6
Pit Latrine	0	0	1	0.9	1	0.2
Soak pit	5	1.6	4	3.5	9	2.1
Upland (Bari)	0	0	2	1.8	2	0.5
Boigas	4	1.3	11	9.6	15	3.6
Total	307	100.0	114	100.0	421	100.0

2.8.2 Waste from the kitchen

The targeted households of the NWSC segment wereb asked that how the waste from the kitchen they are managing. About 43 percent of the households explained that they have connected it with the pit latrine followed by 36 percent connected to soak pit, 15 percent to the septic tank, and the remaining 6 percent made direct connection to their kitchen garden. Likewise, 61 percent of the Non-NWSC households directly left their kitchen waste in the kitchen garden with followed by 19 percent have connected to the septic tank and remaining households have connected to pit latrine and septic tanks as well. See Table 27 below.

Table 27 Management of waste from kitchen

Items	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Septic Tank	46	15.0	9	7.9	55	13.1
Pit Lateran	131	42.7	14	12.3	145	34.4
Soak pit	110	35.8	22	19.3	132	31.4
Upland (Bari)	20	6.5	69	60.5	89	21.1
Total	307	100.0	114	100.0	421	100.0

2.8.3 Waste from the bath

Households of NWSC segment were asked about the management of waste from bath. The connection to the pit latrine 44 percent followed by Soak pit 35 percent, and remaining 21 percent septic tank and kitchen garden. Of the Non-NWSC user households reported 61 percent directly to kitchen garden, followed by 18 percent to soak pit, 11 percent to pit latrine and rest 10 percent to septic tank. See Table 28 below.

Table 28 Management of waste from bath

Items	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Septic Tank	45	14.7	11	9.6	56	13.3
Pit Lateran	134	43.6	12	10.5	146	34.7
Soak pit	108	35.2	21	18.4	129	30.6
Upland (Bari)	20	6.5	70	61.4	90	21.4
Total	307	100.0	114	100.0	421	100.0

2.9 Households Expenditure

2.9.1 Details of household expenditures

Average of monthly expenditure is 38,925.53NPR in all responding housholds.

Average expenditures on major headings in NWSC segment reported relatively maximum 39 percent in fooding, followed by education 28 percent, transportation, communication (cell phone), and clothing reported respectively 8 percent, 5 percent and 4 percent. It has been reported in Non-NWSC segment that 40 percent in fooding, education 21 percent, transportation 12 percent, communication, health and clothing are 7 percent, 5 percent and again 5 percent respectively. Ratio between income, expenditure and surplus reported that the average expenditures in NWSC segment is 86 percent and Non-NWSC segment 80 percent. In the case of surplus amounts, 10 percent in NWSC segment and 0Non-NWSC segment as well. See Table 29 below.

Table 29: Average of Monthly Expenditure (Unit: NPR)

	NWSC (N=307)		Non-NWSC (N=114)		Total (N=421)	
	Average (NPR)	%	Average (NPR)	%	Average (NPR)	%
Education	11,770.20	28%	6,318.42	21%	10,293.94	26%
Health*	2,307.68	5%	1,569.18	5%	2,107.71	5%
Fooding	16,326.38	39%	12,074.56	40%	15,175.06	39%
Clothing*	1,784.77	4%	1,428.73	5%	1,688.36	4%
Transporation	3,411.40	8%	3,519.30	12%	3,440.62	9%
Cell Phone	2,299.66	5%	2,029.82	7%	2,226.59	6%
Surplus*	4,212.73	10%	3,402.19	11%	3,993.25	10%
Total	42,112.82	100%	30,342.21	100%	38,925.53	100%

*This item was asked in yearly-expenditure bases in the interview, and convert to monthly figures

2.10 Water Examination

The result of water examination shows the situation of May 2015.

2.10.1 Color/Turbid water

Among the total NWSC water user households 83 percent have no complain on NWSC supply water and responded is clean and clear whereas 17 percent complained that the NWSC supplied water is turbid.

In the Non-NWSC segment 4 percent households complained turbid water and the rest 96 percent responded the water what they are using. See Table 30 below.

Table 30: Water color/turbid

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
No Appear(Clean)	256	83.4	110	96.5	366	86.9
Color/Turbid	51	16.6	4	3.5	55	13.1
Total	307	100.0	114	100.0	421	100.0

2.10.2 Turbid color

Beneficiary households were asked about the type of color. A number of 51 households complained that the supplied water is turbid, followed by 3 households responded deep color, 20 households complained the using water faintly color and rest of 28 household complained impure. In the case of Non-NWSC water user all 4 households reported the water color faintly. See Table 31 below.

Table 31: Turbid color

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Deep Color	3	5.9	0	0.0	3	5.5
Faintly Color	20	39.2	4	100.0	24	43.6
Impure	28	54.9	0	0.0	28	50.9
Total	51	100.0	4	100.0	55	100.0

Deep color

Of the total 3 households 2 of them complained yellowish color and 1 household whitish color. See Table 32 below.

Table 32: Deep color

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Yellowish	2	66.7	0	0	2	66.7
Whitish	1	33.3	0	0	1	33.3
Total	3	100.0	0	0	3	100.0

Faintly color

Among the 20 households complained by faintly color, 5 households complained brownish, 10 households complained yellowish, 4 households complained whithish and 1 household complained reddish in NWSC segment. From Non-NWSC segment, among the total 4 households, 2 of them complained whitish and 1 brownish and yellowish complained. See Table 33 below.

Table 33: Faintly color

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Brownish	5	25.0	1	25.0	6	25.0
Yellowish	10	50.0	1	25.0	11	45.8
Reddish	1	5.0	0	0	1	4.2
Whitish	4	20.0	2	50.0	6	25.0

Impure color

Of the total 28 households NWSC segment, all they complined the water is impacted by dust and floating. See Table 34 below.

Table 34: Impure color

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Dust and Floating	28	100.0	0	0	28	100.0
Total	28	100.0	0	0	28	100.0

2.10.3 Smell of water

Among the 307 households of theNWSC segment, 294 household expressed the water is smell fresh and rest 13 households complained smelly water. In the case of Non-NWSC segment, all reported positively smell fresh. See Table 35 below.

Table 35: Smell of water

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Smell Fresh	294	95.8	114	100.0	408	96.9
Smelly Water	13	4.2	0	0	13	3.1
Total	307	100.0	114	100.0	421	100.0

Type of smelly water

Of the total 13 households of NWSC segment, 10 of them complained smell of soil, 1 complained smell of fungus and rest of 2 households complained taste and odors caused by chlorine. See Table 36 below.

Table 36: Type of smelly water

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Soil	10	76.9	0	0	10	76.9
Fungus	1	7.7	0	0	1	7.7
Tastes and odors caused by chlorine	2	15.4	0	0	2	15.4
Total	13	100.0	0	0	13	100.0

2.10.4 Taste of water

Of the total 307 households of NWSC segment, 297 of them reported no taste and rest of 10 hosueholds complained bad taste. In the case of Non-NWSC segment, all the 114 households reported to bad taste. See Table 37 below.

Table 37: Taste of water

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
No Taste	297	96.7	114	100.0	411	97.6
Bad Taste	10	3.3	0	0	10	2.4
Total	307	100.0	114	100.0	421	100.0

Type of bad taste

Among the 10 households of NWSC segment, 5 of them reported tarly taste, 4 households complained salty water and rest 1 complained metalized. See Table 38 below.

Table 38: Type of bad taste

	NWSC		Non-NWSC		ALL	
Water taste	N	%	N	%	N	%
Salty Water	4	40.0	0	0	4	40.0
Metalize (Irony)	1	10.0	0	0	1	10.0
Tarly	5	50.0	0	0	5	50.0
Total	10	100.0	0	0	10	100.0

2.10.5 Turbidity of water

Status of highest turbidity in dry season

From NWSC segment of the total 307 households, 239 of them opined less than 10 NTU, 61 household complained 10 NTU, 3 households reported 11 to 29 NTU and 30 NTU reported by 4

households. Of the Non-NWSC segment, 109 Households reported less than 10 NTU and rest of 5 households reported 10 NTU. See Table 39 below.

Table 39: Status of highest turbidity in dry season

	NWSC		Nor-NWSC		ALL	
It	N	%	N	%	N	%
Less than 10 NTU	239	77.9	109	95.6	348	82.7
10 NTU	61	19.9	5	4.4	66	15.7
11 to 29 NTU	3	1.0	0	0	3	0.7
30 NTU	4	1.3	0	0	4	1.0
Total	307	100.0	114	100.0	421	100.0

Duration of highest turbidity in dry season

The highest turbidity continues in dry season in NWSC connection 307 households reported that average days of 1.72. In Non-NWSC reported average days 0.54. See Table 40 below.

Table 40: Highest turbidity continue in dry season

Questions	NWSC				Non-NWSC				ALL			
	N	Min	Max	Average	N	Min	Max	Average	N	Min	Max	Average
Highest turbidity continues in dry season? **(in days)**	307	0	90	1.72	114	0	36	0.54	421	0	90	1.40

Status of highest turbidity in rainy season

From NWSC segment of the total 307 households, 95 households complained 50 NTU, 70 households complained more than 50 NTU, 47 households complained 30 NTU, 43 households complained 10 NTU, 35 households complained 11 to 29 NTU, 9 ho and 8 of them opined less than 10 NTU, 43 household complained 10 NTU, 35 households reported 11 to 29 NTU, 9 households complained 31 to 49 NTU and rest 8 household reported less than 10 NTU. In the case of Non-NWSC segment of the total 114 households, 49 of them reported 10 NTU, followed by 30 households less than 10 NTU, 9 households complained 30 NTU, 8 households complained 11 to 29 NTU, 9 households complained more than 50 NTU, 5 households complained 50 NTU and 4 household complained 31 to 49 NTU. See Table 41 below.

Table 41: Status of highest turbidity in rainy season

	NWSC		Non-NWSC		ALL	
	N	%	N	%	N	%
Less than 10 NTU	8	2.6	30	26.3	38	9.0
10 NTU	43	14.0	49	43.0	92	21.9
11 to 29 NTU	35	11.4	8	7.0	43	10.2
30 NTU	47	15.3	9	7.9	56	13.3
31 to 49 NTU	9	2.9	4	3.5	13	3.1
50 NTU	95	30.9	5	4.4	100	23.8
More than 50 NTU	70	22.8	9	7.9	79	18.8
Total	307	100.0	114	100.0	421	100.0

Duration of highest turbidity in rainy season

The highest turbidity continues in dry season in NWSC connection 307 households reported that average days of 1.72. In Non-NWSC reported average days 0.54. See Table 40 below.

Table 42: Highest turbidity continue in rainy season

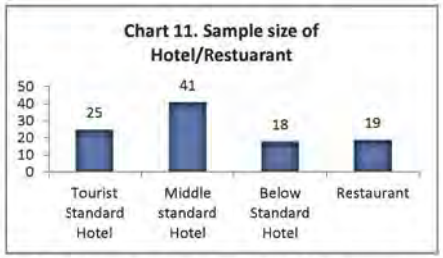
Duration of turbidity	NWSC				Non-NWSC				ALL			
	N	Min	Max	Average	N	Min	Max	Average	N	Min	Max	Average
Turbidity continues in rainy season? **(in days)**	307	0	150	48.43	114	0	99	13.15	421	0	150	38.87

3. HOTELS AND RESTAURANT LEVEL FINDINGS

3.1 Background

3.1.1 General Characteristics

During the Water Supply Condition survey total 103 Hotels/Restaurants had been interviewed. Among them category of the hotels and findings of them have been reported as follows.



- Category Number 1: Tourist Standard hotel that has been categories with more than 20 bed capacity. In this category sample number is 25.
- Category Number 2: Middle Standard hotels with 11 to 19 bed capacity. In this category sample number is 41.
- Category number 3: Below Standard hotel with bed capacity 10 and below. From this category Sample size is 18 category number 4 restaurants where samples were taken from 19 restaurants. See Table 43 below.

Table 43; Sample Size and Location of Hotel/Restaurant

	Ward No	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
		N	%	N	%	N	%	N	%	N
Baidam,Lakeside	6	21	84.0	36	87.8	13	72.2	19	100.0	89
Dhungeshaghu	15	1	4.0	-	-	-	-	-	-	1
Pardibirauta	17	3	12.0	5	12.2	4	22.2	-	-	12
Sarangkot	26	-	-	-	-	1	5.6	-	-	1
Total		25	100	41	100	18	100	19	100	103

Among 103 hotels and resturents, 88 of them have NWSC connection and rest 15 is Non-NWSC. See Table 44 below.

Table 44; Status of Water Supply Connection

Water Users	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
NWSC	19	76.0	38	92.7	15	83.3	16	84.2	88
Non-NWSC	6	24.0	3	7.3	3	16.7	3	15.8	15
Total	25	100.0	41	100.0	18	100.0	19	100.0	103

3.1.2 Respondents by Gender

While looking through the Gender perspective among the total 103 number of interviewee 75 percent were male respondent and 25 percent were Female. From tourist Standard hotel the number of male respondents are higher of which reported 80 percent, in Middle standard hotels male are 74 percent and female are 27 percent, in below slandered male are 72 and female 28 percent and finally in restaurant male are 74 and female are 26 percent. It shows that in the sector of entrepreneur involvement of male is higher than female. See Table 45 below:

Table 45: Respondents by Gender

Gender	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Male	20	80.0	30	73.2	13	72.2	14	73.7	77
Female	5	20.0	11	26.8	5	27.8	5	26.3	26
Total	25	100.0	41	100.0	18	100.0	19	100.0	103

3.1.3 Position of Respondents

While looking to the position of interviewee of the total number of 103 samples, 59 percent interviewees were from owner and 41 percent from employee, Among the hotels from tourist Standard hotel, the percent of owner interviewee is lower that is 36 percent and from the employee 64 percent. In middle standard hotels number of owner interviewee is higher which is 56 percent and from employee 44 percent. Likewise in below standard hotel 89 percent were from owner and 11 percent from employee and finally in restaurant, owner interviewee were 68 percent and employee were 32 percent. It shows that in tourist Standard hotels number of interviewee were higher from the employee and while looking the number of interviewee from middle standard, below standard and restaurant majority were from owner. See Table 46 below:

Table 46: Position of Respondents, Hotel/Restaurant

Position	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Owneer	9	36.0	23	56.1	16	88.9	13	68.4	61
Employee	16	64.0	18	43.9	2	11.1	6	31.6	42
Total	25	100.0	41	100.0	18	100.0	19	100.0	103

3.1.4 Hotels Charecteristics

Guest check in peak season

Minimum and maximum turnover of guests per day, high in peak season was collected in respective sample hotels. Number of guests per day in high peak season reported 30 and 300 in Tourist standards Hotels, in middle standard hotels reported 13 and 120 and in below standard hotel 10 and 40 reported. Check in of the guests in lean season has been reported 12 and 200 in Tourist standard Hotels, 4 and 60 reported in Middle Standard Hotels and 3 and 25 reported in Below Standard Hotels. See Table 47 below:

Table 47: Guest check in peak season (Per day checki-in)

	Total N. of hotels surveyed	High Season			Low Season		
		Min	Max	Ave.	Min	Max	Ave.
Tourist Standard Hotel	25	30	85	40.4	12	85	31.2
Middle standard Hotel	41	6	80	33.6	1	60	17.1
Below Standard Hotel	18	10	40	23.2	2	25	12.5
Total	84	-	-	33.4	--	-	20.3

Guest check in lean season

The response have reported as minimum and maximum guests per day high in lean season of first category hotels noted 5 and 130, 5 and 60 in second standard hotels and in third standard hotels 4 and 25 guests noted. Again repeated the same questions and responded as low arrival of guests in lean season 2 and 90 in tourist standard hotels, 1 and 40 in middle standard hotels and 2 and 15 in below standard hotels. See Table 48 below:

Table 48: Guest check in lean season (Per day checki-in)

	Total N. of hotels surveyed	High Season			Low Season		
		Min	Min	Ave.	Min	Max	Ave.
Tourist Standard Hotel	25	5	60	24.6	3	90	20.9
Middle standard Hotel	41	2	60	16.1	1	40	7.3
Below Standard Hotel	18	4	25	12.6	2	20	5.9
Total	84	-	-	17.8	-	-	11.1

Guest staying

Approximate days of guest staying at types of hotels responded 52 percent of guests 3-4 nights, followed by 32 percent 1-2 night, and 8 percent each 5-6 and 7-8 night in Tourist Standard Hotels. In middle standard hotels 71 percent guest stay 1-2 nights, approximately 17 percent guest 3-4 nights and 10 percent 5-6 nights. In below standerd hotels, 44 percent 1-2 nights, 39 percent guest atay 3-4 nights. See Table 49 below:

Table 49: Guest staying in Hotel

Guest staying	Tourist Standard		Middle standard		Below Standard		Total
	N	%	N	%	N	%	N
One to two nights	8	32.0	29	70.7	8	44.4	45
Three to four nights	13	52.0	7	17.1	7	38.9	27
Five to six nights	2	8.0	4	9.8	1	5.6	7
Seven to eight nights	2	8.0	1	2.4	1	5.6	4
Nine to ten nights	0	0	0	0	1	5.6	1
Avarage of Duration (days)		3.34		2.47		3.16	2.88
Total	25	100.0	41	100.0	18	100.0	84

Employees in Hotel

Numbers of employees engaged ranges from minimum 2 to maximum 200 in star and tourist standard hotels, in second ranked middle standard hotels it ranges 2 to 25 while in below standard hotels it has been reported 2 to 10 employees. See Table 50 below:

Table 50: Average number of employees in Hotel

Average employees	Tourist Standard Hotel				Middle standard Hotel				Below Standard Hotel				Total			
	N	Min	Max	Avg	N	Min	Max	Avg	N	Min	Max	Avg	N	Min	Max	Avg
Number of employees	25	2	200	37.9	41	2	25	5.8	18	2	10	3.4	84	2	200	14.8

Rooms Status in Hotel

In the Star and tourist standard hotels room with bath reported minimum 1 to maximum 25, and room with shower ranges 12 to 200. In middle standard hotel rooms with bath range 1 to 18. In the same hotel rooms with shower, ranges 7 to 19 and in the case of below standard hotel rooms with bath range 1 to 4 when as it is in rooms with shower reported minimum 2 to maximum 10. See Table 51 below:

Table 51: Average room status in Hotel

Room status	Tourist Standard Hotel				Middle standard Hotel				Below Standard Hotel				Restaurant			
	N	Min	Max	Avg	N	Min	Max	Avg	N	Min	Max	Avg	N	Min	Max	Avg
(Hotel) Rooms with Bath	12	1	25	5.8	26	1	18	4.1	10	1	4	2.2	0	0	0	0
(Hotel) Rooms with Shower	25	12	200	41.8	39	7	19	13.1	18	2	10	7.2	0	0	0	0
(Restaurants) Number of Seats	0	0	0	0	0	0	0	0	0	0	0	0	19	16	250	73.1

3.2 Connection of NWSC Water Supply

3.2.1 Number of taps

Tourist Standard Hotel i,e first ranked hotel reported that only 11 percent of hotels have upto 10 taps and 89 percent have more than 21 taps. Up to 10 taps reported by 11 percent of hotels, 11 to 20 taps reported by 13 percent and 76 percent of second ranked hotels or the middle standard hotels reported more than 21 taps. In below standard third ranked hotels upto 10 taps reported about 7 percent, 11 to 20 taps reported 40 percent and 53 percent reported more than 21 taps. As in the case of restaurant 88 percent reported up to 10 taps and 12 percent reported 11 to 20 taps. See Table 52 below

Table 52: Number of taps

Taps connection	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Upto 10 taps	2	11	4	11	0	0	14	88	20
11 to 20 taps	0	0	5	13	7	47	2	13	14
21 to 30 taps	1	5	8	21	6	40	0	0	15
31 to 40 taps	1	5	8	21	2	13	0	0	11
41 to 50 taps	3	16	10	26	0	0	0	0	13
51 <	12	63	3	8	0	0	0	0	15
Average of N. of Taps		51.40		32.66		21.93		5.75	30.22
Total	19	100.0	38	100.0	15	100.0	16	100.0	88

3.2.2 Meter Connection

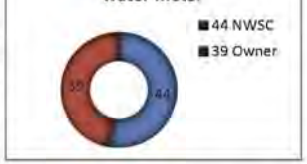
Of the total 25 tourist standard hotels 19 hotels have NWSC connection and rest 6 uses their own source. Among the 19 no of hotels 95 percent of them have already installed the NWSC water meter and rest 5 percent not yet installed. Of the total 41 middle standard hotels 38 hotels have NWSC connection and rest have no connection. Among the 38 middle standard hotels 95 percent already installed in NWSC water meter and rest 5 percent not yet. Among the 15 hotels 93 percent have already installed the NWSC water meter and 7 percent not yet installed. Among the 16 restaurant, 94 percent have already installed the NWSC meter and rest 6 percent not installed. Among the 88

NWSC Users 83 has already instelled the water meter and 5 did not instelled the water meter. See Table 53 below:

Table 53: NWSC meter connection

NWSC Meter connection	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Already Installed	18	95	36	95	14	93	15	94	83
Not yet Installed	1	5	2	5	1	7	1	6	5
Total	19	100	38	100	15	100	16	100	88

Chart 14: Ownership of water meter



3.2.3 Ownership of the meter

In total 18 water meter in tourist standard hotels, NWSC owned 67 percent and the rest owner themselves. Among the total 36 water meter installed hotels of middle standard, 56 percent meter belongs to NWSC and rest 44 the owner itself. Total 14 numbers of below standard hotels, 64 percent ownership of water meter belong to NWSC and rest 36 percent owner itself. In the case of restaurant 80 percent ownership of the water meter reported belongs to owner itself and rest 20 percent ownership with NWSC. In total 83 water meters a number of 44 meter owned by NWSC and rest 39 by the owner itself. See Table 54 below:

Table 54: Ownership of NWSC meter connection

Ownership of NWSC Meter connection	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
NWSC	12	67.0	20	56.0	9	64.0	3	20.0	44
Owner	6	33.0	16	44.0	5	36.0	12	80.0	39
Total	18	100	36	100	14	100	15	100	83

3.2.4 Condition of water meter

About the water meter condition of NWSC user as a whole from Hotel /restaurant 88 percent (NO.73)of water meter are in working condition and 12 percent (No.10) are out of ordered. See Table 55 below:

Table 55: Condition of NWSC meter connection

Condition of NWSC Meter connection	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Working	17	94.0	33	92.0	12	86.0	11	73.0	73
Out of Order	1	6.0	3	8.0	2	14.0	4	27.0	10
Total	18	100	36	100	14	100	15	100	83

3.2.5 Reliability of water meter

About the reliability of NWSC water meters as a whole from Hotel /restaurant reported that except 1 water meter of below standard hotels, rest of others are supposed to be reliable. See Table 56 below:

Table 56: Reliability of NWSC meter connection

Reliability of NWSC Meter connection	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Reliable	17	100	33	100	12	92	11	100	73
Not Reliable	0	0	0	0	1	8	0	0	1
Total	17	100	33	100	13	100	11	100	74

3.3 Main Sources of Water

3.3.1 Drinking Water

For drinking water purpose 44 percent of tourist standard hotels use mineral water, followed by 40 percent NWSC private connection and rest use own tube well and water tanker. Middle standard hotel maximum 49 percent NWSC private connection and 37 percent mineral water and rest own tube well and spring source. For drinking below standard hotel use 50 percent of the NWSC private connection, 44 percent mineral water and 6 percent spring source. Likewise restaurant use 58 percent mineral water for drinking, 37 percent NWSC private connection rest of spring source. Although some of big hotels use NWSC source, repeatedly they have established well filtration system. In total 46 respondents use NWSC water, 45 use mineral water (as people prefer to drink bottle/jar water), 6 of the respondents have own tubewell, and one use the tanker water for drinking using filters and water purifier. See Table 57 below:

Chart 16 : Water source for Drinking

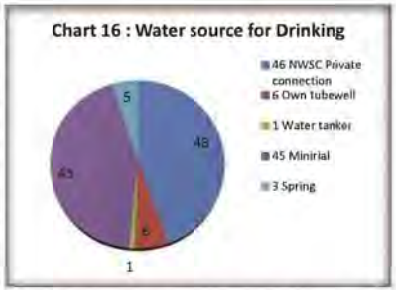


Table 57: Main sources of drinking water

Main sources of drinking water	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
NWSC Private connection	10	40.0	20	48.8	9	50.0	7	36.8	46
Own tubewell	3	12.0	3	7.3	0	0	0	0	6
Water tanker	1	4.0	0	0	0	0	0	0	1
Minerial	11	44.0	15	36.6	8	44.4	11	57.9	45
Spring	0	0	3	7.3	1	5.6	1	5.3	5
Total	25	100	41	100	18	100	19	100	103

3.3.2 Cooking

Tourist standard hotel use 64 percent of NWSC source for cooking, followed by own tube well 24 percent rest spring and mineral water. Second standard hotels more than 85 percent of NWSC private connection, followed by 10 percent own tube well and rest spring and neighbor tube well. Third standard hotel also use maximum 78 percent of NWSC source, followed by 11 percent spring source and rest own tube well and water tanker. In the case of restaurant 84 percent used for NWSC private connection, followed by own tube well 11 percent and rest neighbor tube well. See Table 58 below:

Table 58: Main sources of cooking water

Main sources of cooking water	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
NWSC Private connection	16	64.0	35	85.4	14	77.8	16	84.2	81
Own tubewell	6	24.0	4	9.8	1	5.6	2	10.5	13
Neighbour tubewell	0	0	1	2.4	0	0	1	5.3	2
Water tanker	0	0	0	0	1	5.6	0	0	1
Minerial	2	8.0	0	0	0	0	0	0	2
Spring	1	4.0	1	2.4	2	11.1	0	0	4
Total	25	100	41	100	18	100	19	100	103

3.3.3 Washing

About 52 percent of the Tourist Standard Hotels use their own tube well, followed by 40 percent NWSC private connection and the rest 8 percent use their nearby source spring. The Middle Standard Hotel mainly use (68 percent) NWSC private connection followed by own tube well 27 percent and the rest 5 percent equally use spring source and neighbor tube well. Below Standard Hotels are reported 72 percent dependent on NWSC private connection, followed by own tube well and spring source equally 11 percent and use water tanker by 6 percent. As in the case of Restaurant, about 58 percent use NWSC source followed by 32 percent own tube well and each 5 percent equally use neighbor tube well and water tanker. See Table 59 below:

Table 59: Main sources of washing water

Main sources of washing water	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
NWSC Private connection	10	40.0	28	68.3	13	72.2	11	57.9	62
Own tubewell	13	52.0	11	26.8	2	11.1	6	31.6	32
Neighbour tubewell	0	0	1	2.4	0	0	1	5.3	2
Water tanker	0	0	0	0	1	5.6	1	5.3	2
Spring	2	8.0	1	2.4	2	11.1	0	0	5
Total	25	100	41	100	18	100	19	100	103

3.3.4 Bath Shower

Relatively maximum number of Tourist Standard hotel (52 percent) use own tube well for bath shower, followed by NWSC private connection 40 percent, and rest 8 percent equally use water tanker and spring sources. Middle standard and below standard hotels use 71 and 72 percent respectively use the NWSC private connection followed by own tube well 24 and 11 percent and the rest of the no use other sources as neighbor tube well, water tanker and spring. In the case of restaurant 58 percent use NWSC source followed by 32 percent own underground source and rest neighbor tube well and water tanker as well. See Table 60 below:

Table 60: Main sources of bath shower

Main sources of bath shower	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
NWSC Private connection	10	40.0	29	70.7	13	72.2	11	57.9	63
Own tubewell	13	52.0	10	24.4	2	11.1	6	31.6	31
Neighbour tubewell	0	0	1	2.4	1	5.6	1	5.3	3
Water tanker	1	4.0	0	0	1	5.6	1	5.3	3
Spring	1	4.0	1	2.4	1	5.6	0	0	3
Total	25	100	41	100	18	100	19	100	103

3.3.5 Toilet

Maximum number of first ranked hotels (52 percent) uses underground sources or own tube well for toilet followed by private connection 40 percent and 4 percent equally use water tanker and spring source as well. As in the case of second and third ranked hotel 71 and 72 percent use the NWSC connection, 24 and 11 percent use underground source respectively. To some extent use the source as water tanker and spring source. Likewise Restaurants use 58 percent of NWSC source, followed by 32 percent own underground source and rest neighbor tube well or water tanker as well. See Table 61 below:

Table 61: Main sources of toilet water

Main sources of toilet water	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
NWSC Private connection	10	40.0	29	70.7	13	72.2	11	57.9	63
Own tubewell	13	52.0	10	24.4	2	11.1	6	31.6	31
Neighbour tubewell	0	0	1	2.4	0	0	1	5.3	2
Water tanker	1	4.0	0	0	1	5.6	1	5.3	3
Spring	1	4.0	1	2.4	2	11.1	0	0	4
Total	25	100	41	100	18	100	19	100	103

3.3.6 Gardening

Maximum number of first ranked hotels uses (56percent) underground sources for gardening followed by NWSC sources 20 percent and rest spring sources and other as well. Second and third ranked hotels mainly use 49 and 50 percent of NWSC source respectively. About 16 percent of second ranked and 24 percent of third ranked hotels respectively reported no garden. As in the case of restaurant 50 percent of them use the NWSC source and rest of total 22 percent use spring, water tanker etc and 28 percent reported no garden.

Note: In the heading of water sources use for livestock seems not applicable because the hotel and restaurant do not keep the livestock as the farm households. Only one hotel of third ranked reported livestock but other not reported. See Table 62 below:

Table 62: Main sources of gardening water

Main sources of gardening water	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
NWSC Private connection	5	20.0	20	48.8	9	50.0	3	15.8	73
Own tubewell	14	56.0	9	22.0	1	5.6	4	21.1	1
Neighbour tubewell	0	0	1	2.4	0	0	1	5.3	2
Water tanker	0	0	0	0	1	5.6	1	5.3	2
No garden	4	16.0	10	24.4	5	27.8	10	52.6	9
Spring	2	8.0	1	2.4	2	11.1	0	0	5

3.3.7 Alternative source of water

Amongst the total 52 percent of Star Tourist Standard Hotel each 20 percent reported using spring source and mineral/jar water, followed by tanker supply 8 percent, and underground source 4 percent. About 48 percent of hotels of first ranked (Star + Tourist Standard Hotels) reported no other alternative sources used. Middle standard, below standard and restaurant reported using mineral water 27 percent, 28 percent and 32 percent respectively. Water spout as one of the alternative source were reported using middle and below standard hotels 7 percent and 11 percent respectively. Likewise 7 and 17 percent of second ranked and third ranked hotels are respectively reported using spring source. See Table 63 below:

Table 63: Alternative source of water

Alternative source of water	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Underground water	1	4.0	1	2.4	0	0	2	10.5	4
Tanker supply	2	8.0	2	4.9	0	0	2	10.5	6
Rain water harvesting	0	0	1	2.4	0	0	0	0	1
Water spout	0	0	3	7.3	2	11.1	0	0	5
No alternative water source	12	48.0	20	48.8	8	44.4	9	47.4	49
Spring water	5	20.0	3	7.3	3	16.7	0	0	11
Mineral water	5	20.0	11	26.8	5	27.8	6	31.6	27
Total	25	100	41	100	18	100	19	100.0	103

Volume of alternative source used

Concerning the volume of alternative source used by Tourist slandered hotels on an average, is 2923.9 liter per month, it ranges minimum from 5 to maximum 8400 liters. In Middle standard hotels on an average is 988.2 liters and ranges minimum 10 to maximum 5400 liters per month, that is in below slandered hotels average is 384.3 liters ranges minimum 10 to maximum 2000 liters per month. Likewise from alternative source used by restaurants reported on an average 2488.3 liters and ranges 100 to 8000 liters per month. See Table 64 below:

Table 64: Average volume of alternative source used

Average liters	Tourist Standard Hotel				Middle standard Hotel				Below Standard Hotel			
	N	Min	Max	Average	N	Min	Max	Average	N	Min	Max	Average
Volume of water	14	5	8400	2923.9	17	10	5400	988.2	7	10	2000	384.3

Contd..

Table 64: Contd...average volume of alternative source used

Average liters	Restaurant				Total			
	N	Min	Max	Average	N	Min	Max	Average
Volume of water	12	100	8000	2488.3	50	5	8400	1805.7

3.4 Expenditures for water

3.4.1 Expenditure on Water Sources

Average expenditure on type of water sources from hotels and restaurants have been tentatively collected in course of field survey at Pokhara. While surveying all the type of hotels and restaurants they were asked the type of sources what they are using at present. NWSC supplied source are not sufficient to big hotels, for example the biggest five star hotel Fulbari has not yet connected the NWSC supplied source and it has own private underground source. Another five star hotel - Hotel Shangri-La has made NWSC connection but it can hardly fulfill 10 to 15 percent of its demand. Majority of the hotels and restaurants use only jar/bottle water for drinking purpose. All the hotels and restaurants have to spend on NWSC supplied source, own underground source installation and its maintenance, water tanker, jar water etc. All the hotels and restaurants' on an average 62 percent expenditure is for underground sources, followed by water tanker 14 percent, Jar/bottle water 8 percent and rest of others in other sources. Total average expenditure of tourist standard hotels noted Rs. 84,677 followed by middle standard 49,382, below standard 35, 685 and the restaurants 71,266. See Table 65 below:

Table 65: Average expenditure on water sources

Type of water sources	Tourist Standard Hotel				Middle standard Hotel				Below Standard Hotel			
	N	Min	Max	Average	N	Min	Max	Average	N	Min	Max	Average
NWSC	17	110	6000	1364.4	36	110	9000	1284.2	15	150	6000	1233.7
Own Well Installation	9	10000	99000	51222.2	7	1500	70000	35028.6	1	30000	30000	30000.0
Regular maintenance	7	300	10000	3928.6	1	1500	1500	1500.0	1	400	400	400.0
Other	1	10000	10000	10000.0	1	1500	1500	1500.0	0	0	0	0
Community	2	200	5600	2900.0	1	200	200	200.0	1	50	50	50.0
Water Tanker	2	1600	2400	2000.0	1	8000	8000	8000.0	2	470	3500	1985.0
Bottle Water	19	300	99000	13263.2	34	60	6000	1870.3	12	100	8640	2016.5

Contd...

Table 65: Contd...average expenditure of water sources

Average cost	Restaurant				Total			
	N	Min	Max	Average	N	Min	Max	Average
NWSC	16	110	700	381.3	84	110	9000	1119.4
Own Well Installation	7	300	90000	41685.7	24	300	99000	42833.3
Regular maintenance	3	200	500	300.0	12	200	10000	2525.0
Other	0	0	0	0	2	1500	10000	5750.0
Community	0	0	0	0	4	50	5600	1512.5
Water Tanker	3	600	60000	20466.7	8	470	60000	9671.3
Bottle Water	15	480	73800	8432.0	80	60	99000	5828.4

3.5 Water Facility

3.5.1 Water storage facility

Concerning the water facility existing in tourist Standard hotels : 96 percent of them have ground tank facility, likewise among the same group 92 percent have roof Tank facility similarly, pump facility is also there that is 96 percent and filter 68 percent, pool 16 percent and use of Mineral water is 100 percent. Likewise among the Middle standard hotels 100 percent of them have roof tank, and ground tank and pump facility. Other facility as filter 55 percent facility of filter, 2.5 percent, and 100 percent facility of mineral water. Likewise in below standard hotel 83.3 percent have ground tank, followed by 100 percent roof tank, 94.4 percent pump, 50 percent, filter and 100 percent mineral water facility, this group have no pool facility. Similarly in restaurant 47.4 percent have ground tank, followed by 100 percent roof tank, 84.2 percent pump, 73.7 percent, filter and 100 percent mineral water facility, this group also have no pool facility. See Table 66 below:

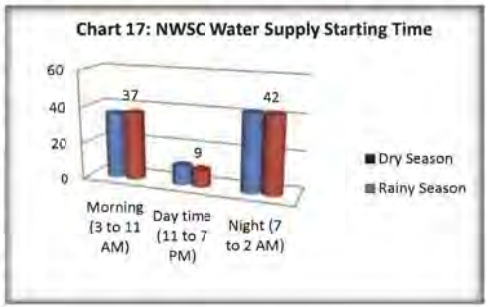
Table 66: Water storage facility

Sources of water storage facility	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Ground Tank	24	96.0	40	100.0	15	83.3	9	47.4	88
Roof Tank	23	92.0	40	100.0	18	100.0	19	100.0	100
Pump	24	96.0	40	100.0	17	94.4	16	84.2	97
Filter	17	68.0	22	55.0	9	50.0	14	73.7	62
Pool	4	16.0	1	2.5	0	0.0	0	0.0	5
Mineral water	25	100.0	40	100.0	18	100.0	19	100.0	102
Total	25	100.0	40	100.0	18	100.0	19	100.0	102

3.6 NWSC Water Supply System

3.6.1 Water supply starting time

About the time of water supply starting of NWSC in dry season in tourist standard hotel have been reported as follows: at morning time (3-11am] 42.1 percent, daytime (11 am-7pm) 15.8 percent and in night (7 pm 2 am) 42.1 percent, likewise in middle standard hotel have been reported as at morning time (3-11 am) 50 percent, daytime (11 am 7 pm) 10.5 percent and in night (7 pm 2 am) 39.5 percent. Similarly, Below Standard hotel have been reported as at morning time (3-11 am) 46.7 percent, daytime (11 am 7 pm) 13.3 percent and in night (7 pm 2 am) 40 percent and in restaurant reported as follows: at morning time (3-11 am) 12.5 percent, daytime (11 am -7 p.m) 6.3 percent and in night (7 pm -2 am) 81.3 percent. In total of all at morning it has been found 40.9 percent, in daytime 11.4 percent and in night 47.7 percent.



Water supply starting time of NWSC in rainy season in all hotels and restaurents also follows the same as in dry season and the reported percent is the same of middle, below standard hotels and restaurent but just few reported percent are different in tourest stanreded hotels.for detail refer to Table 67 below:

Table 67: Water supply starting time in different season

Water supply duration in hours	Dry season				Rainy season			
	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant
	%	%	%	%	%	%	%	%
Morning (3 to 11 AM)	42.1	50.0	46.7	12.5	47.4	50.0	46.7	12.5
Daytime (11 to 7 PM)	15.8	10.5	13.3	6.3	10.5	10.5	13.3	6.3
Night (7 to 2 AM)	42.1	39.5	40.0	81.3	42.1	39.5	40.0	81.3
Total N	19	38	15	16	19	38	15	16

3.6.2 Water supply duration

The water supply duration in dry season in tourist standard hotels 68.4 percent respondent reported 19 to 24 hours supply, similarly 7 to 12 hours supply reported by 10.5 percent and 1 to 6 hours by 21.1 percent. Likewise in middle standard hotels 78.9 percent reported 19 to 24 hours supply, 5.3 percent reported 13 to 18 hours, 13.2 percent reported 7 to 12 hours supply and 2.6

percent reported 1 to 6 hours. In the same way in below standard hotels 60 percent respondents reported of 19 to 24 hours supply, 13.3 percent reported 7 to 12 hours supply and 6.3 percent respondents reported 1 to 6 hours .In the same way in restaurants 87.5 percent respondents reported of 19 to 24 hours supply, 5.3 percent reported 7 to 12 hours supply and 6.3 percent respondets reported 1 to 6 hours supply.

Water supply duration of NWSC in rainy season in all hotels and restaurents also follows the same as in dry season and the reported percent is the same of middle, below standard hotels and restaurent but just few reported percent are different in below stanreded hotels. For detail refer to Table 68 below:

Table 68: Water supply duration in hours

Water supply duration in hours	Dry season				Rainy season			
	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant
	%	%	%	%	%	%	%	%
1 to 6 hours	21.1	2.6	26.7	6.3	21.1	2.6	20.0	6.3
7 to 12 hours	10.5	13.2	13.3	6.3	10.5	13.2	20.0	6.3
13 to 18 hours	0	5.3	0	0	0	5.3	0	0
19 to 24 hours	68.4	78.9	60.0	87.5	68.4	78.9	60.0	87.5
Total N	19	38	15	16	19	38	15	16

3.6.3 Frequency of water supply

Frequency of water supply from NWSC within the week in dry season has been reported in following pattern. In tourist standard hotel highest percent (57.9%) belongs to the category of 3 days/week in the same way 31.6 percent belongs to 7 days/week, 5.3 percent belongs 4 days/week and 5.3 percent belongs 2 days/week. Similarly middle standard hotel highest percent (63.2) belongs to the category of 3 days/week in the same way 31.6 percent belongs to 7 days/week, and 5.3 percent belongs 2 days/week. Likewise in below standard hotel highest percent (66.7) belongs to the category of 3 days/week and 33.3 percent belongs to 7 days/week. And the findings report of restaurant is highest percent (62.5) belongs to the category of 3 days/week in the same way 12.5 percent belongs to 7 days/week, 18.8 percent belongs 4 days/week and 6.3 percent belongs 2 days/week. In total 62.5 percent belongs to 3 days/week, 28.4 percent 7 days/week, 4.5 percent 4 days/ week and 4.5 belongs on 2 days /week. Frequency of water supply from NWSC within the week in rainy season has been reported.

Among tourist standard hotel highest percent consist of 58 percent belongs to the category of 3 days/week by the same way 31.6 percent belongs to 7 days/week, 5.3 percent belongs 4 days/week and 5.3 percent belongs 2 days/week. Similarly middle standard hotel highest 63.2 percent belongs to the category of 3 days/week and the same way 31.6 percent belongs to 7 days/week. Likewise, among below standard hotels, highest 62.5 percent belongs to the category of

3 days/week and 33.3 percent belongs 7 days/week. Likewise among below standard hotels highest 62.5 percent belongs to the category of 3 days/week and 33.3 percent belongs to 7 days/week. And report of restaurant is 62.5 highest percent belongs to the category of 3 days/week and the same way 18.8 percent belongs to 4 days/week. In total 3 days/week has been noted is highest frequency in both seasons. See Table 69 below:

Table 69: Water supply frequency in different season

Water supply frequency	Dry season				Rainy season			
	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant
	%	%	%	%	%	%	%	%
1 day/week	0	0	0	0	0	0	0	0
2 days/week	5.3	5.3	0.0	6.3	5.3	2.6	0.0	6.3
3 days/week	57.9	63.2	66.7	62.5	52.6	47.4	60.0	43.8
4 days/week	5.3	0.0	0.0	18.8	10.5	13.2	0.0	25.0
7 days/week	31.6	31.6	33.3	12.5	31.6	36.8	40.0	25.0
Total N	19	38	15	16	19	38	15	16

3.6.4 Volume of water supply

Of the total 19 Tourist Standard Hotels 42 percent reported enough volume of supply even in dry season followed by 16 percent opined that the volume not enough but somehow acceptable and again 42 percent expressed their view that the volume of supply is not satisfactory. About 50 percent middle standard hotel owners expressed their views that the supply volume is enough, followed by 10 percent not enough but satisfactory and 40 percent opined not satisfactory. Below standard hotels also reported nearly the same as middle standard hotels. The reporting of restaurant is basically different. About 13 percent reported enough volume of supply, followed by 6 percent not enough but satisfactory and large section of restaurant owner that is about 81 percent reacted the supply volume is not satisfactory at all.

Of the total 19 hotel of Tourist Standard group 47 percent expressed the view that the water supply volume in rainy season enough, followed by not enough but acceptable 11 percent and not satisfactory expressed by 42 percent. Rest of the other figure of middle standard, below standard and restaurant are likely the same that have been presented in dry season. See Table 70 below:

Table 70: Volume of Water supply in different season

Water supply duration in hours	Dry season				Rainy season			
	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant
	%	%	%	%	%	%	%	%
Enough	36.8	39.5	66.7	43.8	57.9	60.5	73.3	68.8
Not Enough, but Acceptable	36.8	28.9	6.7	31.3	31.6	26.3	13.3	25.0
Not Satisfactory	26.3	31.6	26.7	25.0	10.5	13.2	13.3	6.3
Total N	19	38	15	16	19	38	15	16

3.6.5 Quality of water supply

Quality of NWSC supplied water was asked then the response from group tourist standard hotels are- 79 percent expressed good followed by sometime good 16 percent and just 5 percent turbid. Middle standard hotel also expressed good supply by 87 percent and just 13 percent sometime turbid. Below standard hotel also reported 93 percent good supply and the restaurant expressed 81 percent supply good.

Supply quality of water in rainy season reported good by 16 percent of the tourist standard hotel, followed by 26 percent sometime turbid, and 58 percent reported turbid. The middle standard hotel reported sometime turbid by 37 percent, majority of the hotel owner that is about 63 percent reported turbid and some hotel owner reported smell 7 percent. From the below standard hotel expressed the quality turbid by 33 percent, followed by 60 percent sometime turbid 60 percent and just 7 percent reported good. Also, nearly the same by the restaurant that is only 6 percent good, 50 percent sometime turbid and 33 percent turbid. See Table 71 below:

Table 71: Quality of water supplyin different season (Multiple answer)

Water supply duration in hours	Dry season				Rainy season			
	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant
	%	%	%	%	%	%	%	%
Good	78.9	86.8	93.3	81.3	15.8	0	6.7	6.3
Sometimes turbid	15.8	13.2	6.7	18.8	26.3	36.8	60.0	50.0
Turbid	5.3	0	0	0	57.9	63.2	33.3	43.8
Smell	0	0	0	0	0	7.9	0	0
Total N	19	38	15	16	19	38	15	16

3.6.6 Water pressure of water supply

Supply pressure in dry season was also asked with all three types of hotel and restaurant as well, First ranked hotel reported enough by 32 percent, followed by 47 percent not enough, but acceptable and 21 percent not satisfactory. It was expressed by the middle standard hotel nearly

the same: 32 percent enough, 50 percent not enough but acceptable and 18 percent not satisfactory. Below standard hotel expressed enough 60 percent followed by 20 percent not enough but acceptable 20 percent and another 20 percent not satisfactory. In the same issue restaurant reported 44 percent enough, followed by 25 percent not enough but acceptable and 31 percent not satisfactory.

Tourist standard hotel reported enough by 58 percent followed by 32 percent not enough but acceptable and 10 percent not satisfactory. Middle standard hotel also expressed likely the same and below standard hotel 73 percent enough, 20 percent not enough but acceptable and 7 percent not satisfactory. Restaurant also reported same as below standard hotel. See Table 72 below:

Table 72: Water pressure of water supply in different season

Water supply duration in hours	Dry season				Rainy season			
	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant
	%	%	%	%	%	%	%	%
Enough	31.6	31.6	60.0	43.8	57.9	57.9	73.3	68.8
Not Enough, but Acceptable	47.4	50.0	20.0	25.0	31.6	36.8	20.0	25.0
Not Satisfactory	21.1	18.4	20.0	31.3	10.5	5.3	6.7	6.3
Total	19	38	15	16	19	38	15	16

3.6.7 Comments for water service

About 6-7 options for comments was given to the hotels and restaurant owner and the response were noted as tourist standard hotel: satisfactory reported by 37 percent, followed by 47 percent short service hours, 53 percent low pressure, 53 percent bad quality and 26 percent reported not good responses of NWSC officials. Middle standard hotels commented as follows: Just 5 percent satisfactory, followed by short service hours 63 percent, low pressure 45 percent, 90 percent bad quality, 5 percent expensive and 21 percent not good response of NWSC officials. Below standard hotel reported as 60 percent bad quality, followed by 33 percent each satisfactory and short service hour,7 percent expensive and not good responses of NWSC officials. 13 percent restaurant also commented as:bad quality 68 percent followed by 56 percent short service hours, low pressure 50 percent, satisfactory 31 percent and 19 percent not good responses of NWSC officials. See Table 73 below:

Table 73: Comments for water services

Comments for water services	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Satisfactory	7	36.8	2	5.3	5	33.3	5	31.3	19
Short Service Hours	9	47.4	24	63.2	5	33.3	9	56.3	47
Low Pressure	10	52.6	17	44.7	0	0.0	8	50.0	35
Bad Quality	10	52.6	34	89.5	9	60.0	11	68.8	64
Expensive	0	0.0	2	5.3	1	6.7	0	0.0	3
Not Good Responses of NWSC	5	26.3	8	21.1	2	13.3	3	18.8	18
Total	19	100.0	38	100.0	15	100.0	16	100.0	88

3.7 Non-NWSC Water Supply System

3.7.1 Drinking water sources of hotel/restaurants

Jar water using hotel from tourist standard reported 4, followed by 3 from middle standard hotel, 2 from below standard and 3 from restaurants. It is also noted using underground or tube well. Hotels numbering 4 from tourist standard, 1 from middle standard and 2 from restaurant and spring water using hotels also noted 1 from tourist standard and 1 from below standard. See Table 74 below:

Table 74: Drinking water sources of hotel/restaurants

Drinking water sources	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Jar water	4	66.7	3	100.0	2	66.7	3	100.0	12
Own tubewell/well	4	66.7	1	33.3	0	0.0	2	66.7	7
Spring water	1	16.7	0	0.0	1	33.3	0	0.0	2
Total	6	100	3	100	3	100	3	100	15

3.7.2 Drinking water quantity of hotel/restaurants

Four number of tourist standard hotels reported enough quality of water, 1 hotel from the same category reported not enough but acceptable, again 1 hotel reported not satisfactory at all; 3 hotels from middle standard reported enough supply quality, 1 from below standard hotel reported enough and 3 restaurants also reported supply sources enough.

About 4 hotels from tourist standard reported enough supply and 1 expressed supply not satisfactory; 3 hotels from middle standard, 1 from below standard and 3 restaurants expressed

enough supply. 2 hotels from tourist standard, 1 from below standard reported not satisfactory water supply. See Table 75 below:

Table 75: Drinking water quantity of hotel/restaurants in different season

Water supply duration in hours	Dry season				Rainy season			
	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant
	%	%	%	%	%	%	%	%
Enough	4	3	1	3	4	3	1	3
Not Enough, but Acceptable	1	0	1	0	0	0	1	0
Not Satisfactory	1	0	1	0	2	0	1	0
Total	6	3	3	3	6	3	3	3

3.7.3 Drinking water quality of hotel/restaurants

Quality of drinking water in dry season for tourist standard hotels, middle standard hotels and also restaurant from Non-NWSC group 100 percent of respondent reported good quality. Likewise of the below standard hotels 66.7 percent respondents reported good quality and 33.3 precent reported some time turbid.

In rainy season 83 percent of tourist standard hotels reported the water is good and rest 17 reported some time turbid, likewise among middle standard hotels 100 percent of respondent reported good quality and similarly 33 percent of below standard hotel reported water quality good. Almost 67 percent of the Restaurant reported that supply quality is good. See Table 76 below:

Table 76: Drinking water quality of hotel/restaurants in different season (Multiple answers)

Water supply duration in hours	Dry season				Rainy season			
	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant	Tourist Standard Hotel	Middle standard Hotel	Below Standard Hotel	Restaurant
	%	%	%	%	%	%	%	%
Good	100.0	100.0	66.7	100.0	83.3	100.0	33.3	66.7
Sometimes turbid	0	0	33.3	0	16.7	0	33.3	33.3
Turbid	0	0	0	0	0	0	33.3	0
Smell	0	0	0	0	0	0	33.3	0
Taste	0	0	0	0	0	0	33.3	0
Total	6	3	3	3	6	3	3	3

3.7.4 Reason of not connecting the NWSC water supply

Off the selected 25 tourist standard hotels only 7 hotels suggested the reasons as supply volume not enough by 50 percent followed by another 50 percent supply frequency not enough, 17 percent pointed out the quality supply is a problem. Total 5 out of 41 of middle standard hotels reasoned

that the supply volume not enough 35 percent, followed by quality supply as a problem 33 percent, another 33 percent noted water cost expensive, supply frequencies not enough 67 percent. Only 1 from below standard hotel reasoned quality water supply as problem. Only 3 out of 19 restaurants suggested as: supply volume is not enough 67 percent, followed by problem of quality water 33 percent and again 33 percent currently using water source is good. See Table 77 below:

Table 77: Reason of not connecting the NWSC water supply (Multiple answers)

Reasons	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Water volume supplied by NWSC is not enough	3	50.0	1	33.3	0	00	2	66.7	6
Quality of water supplied by NWSC is problem	1	16.7	1	33.3	1	33.3	1	33.3	4
Water cost for NWSC is expensive	0	0	1	33.3	0	0	0	0	1
Water Supply (frequency) by NWSC is not enough	3	50.0	2	66.7	0	0	0	0	5
If water supply continue for 1 1hours/day, we will connect to NWSC supply	1	16.7	0	0	0	0	0	0	1
No problem for water source currently use	1	16.7	1	33.3	2	66.7	1	33.3	5
Total	17	23	33	44.6	13	17.6	11	14.9	74

3.7.5 Willingness to connect NWSC water supply

It was also asked to the respective hotels and restaurants either they are interested or not to connect the NWSC supply. All the 6 hotels responded ready to connect the supply, among 3 hotels from middle standard -67 percent said yes and rest 33 percent responded not interested; and 3 from below standard i.e 100 percent expressed yes to connect the NWSC supply. And lastly 2 restaurants out of 3 that are 67 percent expressed no and the rest 33 percent positively responded for the NWSC supply connection. See Table 78 below:

Table 78: Willingness to connect NWSC water supply

Willingness to connect	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Yes	6	100.0	2	66.7	3	100.0	1	33.3	12
No	0	0	1	33.3	0	0	2	66.7	3
Total	6	100	3	100	3	100	3	100	15

3.7.6 Reason for No willingness to connect

One from the middle standard hotel responded NWSC supply connection fee high, and 33 percent (No.1) from restaurant expressed that the NWSC water tariff high and 67 percent (NO.2) water supply is not stable. See Table 79 below:

Table 79: Reason for no willingness to connect (Multiple answer)

Reasons	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Connection Fee of NWSC is high	0	0	1	100.0	0	0	0	0	1
Water Tariff of NWSC is high	0	0	0	0	0	0	1	50.0	1
Water supply from NWSC is not stable	0	0	0	0	0	0	2	100.0	2
Total	0	0	1	100	0	0	2	100	3

3.7.7 Willingness to pay for the NWSC water supply

Among the Non-NWSC hotel/restaurants 80 percent expressed their willingness to pay for the NWSC water supply. Tourist standard hotel expressed to pay minimum Rs, 110 to maximum 19,000, middle standard hotel 500, below standard hotel 110 to maxmum 500 and restaurant upto 3000 per month. See Table 80 below.

Table 80: Average amount willingness to pay for the NWSC water supply NRs/Month

Hotel/Restaurant	N	Minimum	Maximum	Average
Tourist Standard Hotel	6	110	19000	6668
Middle standard Hotel	2	500	500	500
Below Standard Hotel	3	110	500	303
Restaurant	1	3000	3000	3000
Total	12	110	19000	3743

3.8 Hotel/Restaurants Waste Water Management

3.8.1Waste from toilet

About 88 percent of toilets have been connected to the septic followed by 12 percent to soak pit reported as from the tourist standard hotels; middle standard hotels reported about 93 percent connection to the septic tank and rest pit latrine and soak pit as well and below standard hotels and restaurant each reported 100 percent connection to the septic tank. See Table 81 below:

Table 81: Waste from toilet

Waste water toilet	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Septic Tank	22	88.0	38	92.7	18	100.0	19	100.0	97
Pit Lateran	0	0.0	1	2.4	0	0.0	0	0.0	1
Soak Pit	3	12.0	2	4.9	0	0.0	0	0.0	5
Total	25	100	41	100	18	100	19	100	103

3.8.2 Waste from kitchen

About 68 percent of the kitchen outlets have been connected to soak pit followed by 28 percent to the septic tank and 4 percent to drains reported from the tourist standard hotels: followed by middle standard hotels. Kitchen outlet connected to soak pit 80 percent, to the septic tank 15 percent and 5 percent to drains; from the below standard hotels 67 percent kitchen outlet connected to soak pit, 28 percent to the septic tank and rest to drains; 68 percent of the kitchen outlet of restaurant connected to soak pit, 26 percent septic tank and rest to drains. See Table 82 below:

Table 82: Waste from kitchen

Waste water kitchen	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Septic Tank	7	28.0	6	14.6	5	27.8	5	26.3	23
Drains	1	4.0	2	4.9	1	5.6	1	5.3	5
Soak Pit	17	68.0	33	80.5	12	66.7	13	68.4	75
Total	25	100	41	100	18	100	19	100	103

3.8.3 Waste from bath

Almost 68 percent of the outlet from bath of tourist standard hotels reported connecting to soak pit, 78 percent of bath outlet from middle standard, 72 percent of below standard and 68 percent of restaurant have been reported connecting to soak pit. See Table 83 below:

Table 83: Waste from bath

Waste water bathing	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
	N	%	N	%	N	%	N	%	N
Septic Tank	7	28.0	7	17.1	4	22.2	5	26.3	23
Drains	1	4.0	2	4.9	1	5.6	1	5.3	5
Soak Pit	17	68.0	32	78.0	13	72.2	13	68.4	75
Total	25	100	41	100	18	100	19	100	103

3.9 Improvement of water supply service by NWSC

About 5 improvement options but with only one selection was given to the objectively targeted organization. Their selected improvements priorities are: water quality improvement by 74 percent, followed by 21 percent service hours and supply volume 5 percent were given by tourist standard hotels. Middle standard hotel suggested 76 percent water quality improvement and improvement of service hour 24 percent. Likely the below standard hotel suggested water quality improvement 80 percent, followed by 13 percent service hour and 7 percent for price. Ultimately the restaurant expressed as:63 percent improvements in water quality, followed by service hour 31 percent and supply volume 6 percent. See Table 84 below:

Table 84: Improvement of water supply service by NWSC

	Tourist Standard		Middle standard		Below Standard		Restaurant		Total
Improvement	N	%	N	%	N	%	N	%	N
Supply Volume	1	5.3	0	0	0	0	1	6.3	2
Service Hours	4	21.1	9	23.7	2	13.3	5	31.3	20
Water Quality	14	73.7	29	76.3	12	80.0	10	62.5	65
Price	0	0	0	0	1	6.7	0	0	1
Total	19	100	38	100	15	100	16	100	88

3.10 Water Examination

The result of water examination shows the situation of May 2015.

3.10.1 Color/Turbid

Among the total 103 hotels/restaurants, 2 middle standard hotel and 1 tourist standard hotel and restaurant complained turbid water where as all hotels/restaurants have reported clean and clear water. See Table 85 below:

Table 85: Color/Turbid

	Tourist Standard Hotel		Middle standard Hotel		Below Standard Hotel		Restaurant		ALL	
	N	%	N	%	N	%	N	%	N	%
No Appear/Clean	24	96.0	39	95.1	18	100.0	18	94.7	99	96.1
Color/Tribute	1	4.0	2	4.9	0	0	1	5.3	4	3.9
Total	25	100	41	100	18	100	19	100	103	100

3.10.2 Turbid Color

Among the 4 hotels/restaurants who complained they have colored water, 1 hotel/restaurant 25 percent complained about the deep color and 3 hotels/restaurants complained about the impure water from their source. See Table 86 below:

Table 86: Water color/turbid

Table 86: Water color/turbid

	Tourist Standard Hotel		Middle standard Hotel		Below Standard Hotel		Restaurant		ALL	
	N	%	N	%	N	%	N	%	N	%
Deep Color	1	100.0	0	0.0	0	0	0	0.0	1	25.0
Impure	0	0.0	2	100.0	0	0	1	100.0	3	75.0
Total	1	100	2	100	0	0	1	100	4	100

Deep color

In total 1 hotel/restaurant complained about the deep color in water they are using and he complained about the yellowish color in wate. See Table 87 below:

Table 87: Deep color

	Tourist Standard Hotel		Middle standard Hotel		Below Standard Hotel		Restaurant		ALL	
	N	%	N	%	N	%	N	%	N	%
Yellowish	1	100.0	0	0	0	0	0	0	1	100.0
Total	1	100.0	0	0	0	0	0	0	1	100.0

Impure color

.In total 3 hotels/restaurants complained about the impure water and all of them complained about the dust and floating in water. See Table 88 below:

Table 88: Impure color

	Tourist Standard Hotel		Middle standard Hotel		Below Standard Hotel		Restaurant		ALL	
	N	%	N	%	N	%	N	%	N	%
Dust and floating	0	0	2	100.0	0	0	1	100.0	3	100.0
Total	0	0	2	100.0	0	0	1	100.0	3	100.0

3.10.3 Smell of water

Among the103 Hotel/restaurants, 102 99 percent did not have any smell in water where as 1 hotel/restaurant 1 percent complained smelly water from the tourist standard hotel. See Table 89 below:

Table 89: Smell of water

	Tourist Standard Hotel		Middle standard Hotel		Below Standard Hotel		Restaurant		ALL	
	N	%	N	%	N	%	N	%	N	%
Smell Fresh	24	96.0	41	100.0	18	100.0	19	100.0	102	99.0
Smelly Water	1	4.0	0	0.0	0	0.0	0	0.0	1	1.0
Total	25	100	41	100	18	100	19	100	103	100

Type of smelly water

Among 103 hotels/restaurants most of them 102 hotels/restaurants 99 percent said they have fresh smell water and only 1 hotel/restaurant 1 percent said he has smelly water and it smell s like soil. See Table 90 below:

Table 90: Type of smelly water

	Tourist Standard Hotel		Middle standard Hotel		Below Standard Hotel		Restaurant		ALL	
	N	%	N	%	N	%	N	%	N	%
Soil	1	100.0	0	0	0	0	0	0	1	100.0
Total	1	100.0	0	0	0	0	0	0	1	100.0

3.10.4 Taste of water

Among the total hotel/restaurant, 103 water users, only 2 hotel/restaurant (1.9%) complained they have bad taste in water. See Table 91 below:

Table 91: Taste of water

	Tourist Standard Hotel		Middle standard Hotel		Below Standard Hotel		Restaurant		ALL	
	N	%	N	%	N	%	N	%	N	%
No Taste	24	96.0	40	97.6	18	100.0	19	100.0	101	98.1
Bad taste	1	4.0	1	2.4	0	0.0	0	0.0	2	1.9
Total	25	100	41	100	18	100	19	100	103	100

Type of bad taste

Among the 103 hotels/restaurants only 2 hotels/restaurants 1.2 percent complains about the salty taste in the water. See Table 92 below:

Table 92: Type of bad taste

	Tourist Standard Hotel		Middle standard Hotel		Below Standard Hotel		Restaurant		ALL	
	N	%	N	%	N	%	N	%	N	%
Salty Water	1	100.0	1	100.0	0	0	0	0	2	100.0
Total	1	100.0	1	100.0	0	0	0	0	2	100.0

3.10.5 Turbidity of water

Status of highest turbidity in dry season

In water turbid classification the result shows that 86 hotels/restaurants 84 percent has less than 10 NTU, 16 hotels/restaurants 16 percent has 10 NTU and 1 hotel/restaurant 1 percent has 30 NTU. See Table 93 below

Table 93: Status of highet turbidity in dry season

	Tourist Standard Hotel		Middle standard Hotel		Below Standard Hotel		Restaurant		ALL	
	N	%	N	%	N	%	N	%	N	%
Less than 10 NTU	21	84.0	34	82.9	13	72.2	18	94.7	86	83.5
10 NTU	4	16.0	7	17.1	4	22.2	1	5.3	16	15.5
30 NTU	0	0.0	0	0.0	1	5.6	0	0.0	1	1.0
Total	25	100	41	100	18	100	19	100	103	100

Duration of highest turbidity in dry season

The highest turbidity continues in dry season in 307 hotels/restaurants, minimum is 0 and maximum is 90 days, See Table 94 below:

Table 94: Highest turbidity continue in dry season

	N.	Highest turbidity in rainy season? **(in days)**		
		Min	Max	Ave.
Tourist Standard Hotel	25	0	15	0.8
Middle standard Hotel	41	0	15	1.1
Below Standard Hotel	18	0	20	1.6
Restaurantl	19	0	8	0.4
Total	103	0	20	1.0

Status of highest turbidity in rainy season

In water turbid classification 12 hotel/restaurant have 12 percent less than 10 NTU, 38 hotels/restaurants 37 percent have 10 NTU, 20 hotels/restaurants 19 percent have 11 to 29 NTU, 10 hotels/restaurants 10 percent have 30 NTU, 19 hotels/restaurants 18 percent have 50 NTU and 4 hotels/restaurants 4 percent have more than 50 NTU. See Table 95 below:

Table 95: Status of highest turbidity in rainy season

	Tourist Standard Hotel		Middle standard Hotel		Below Standard Hotel		Restaurant		ALL	
	N	%	N	%	N	%	N	%	N	%
Less than 10 NTU	4	16.0	5	12.2	2	11.1	1	5.3	12	11.7
10 NTU	8	32.0	14	34.1	9	50.0	7	36.8	38	36.9
11 to 29 NTU	4	16.0	11	26.8	0	0.0	5	26.3	20	19.4
30 NTU	2	8.0	2	4.9	1	5.6	5	26.3	10	9.7
50 NTU	6	24.0	7	17.1	5	27.8	1	5.3	19	18.4
More than 50 NTU	1	4.0	2	4.9	1	5.6	0	0.0	4	3.9
Total	25	100	41	100	18	100	19	100	103	100

Duration of highest turbidity in rainy season

The highest turbidity continues in rainy season in 307 hotels/restaurants, average 31.6 days. See Table 96 below:

Table 96: Highest turbidity continue in rainy season

	N.	Highest turbidity in rainy season? **(in days)**		
		Min	Max	Ave.
Tourist Standard Hotel	25	0	99	28.3
Middle standard Hotel	41	0	99	36.0
Below Standard Hotel	18	0	90	30.0
Restaurantl	19	0	99	27.9
Total	103	0	99	31.6

3.11 Situation of Water Use of Non-NWSC Hotel/Restaurant

Answers of Non-NWSC Hotel/Restaurant will be useful to know what is the environment and situation without water connection. Though the number of answers is fifteen, but it may show some charactristics of the situation of without NWSC connections. Therefore, answers of Non-NWSC Hotel and Restaurant will be focused in this section. Three topis are going to be discussed, such as

- Use of water by purpose
- Possession of Water Facility
- Expenditure for Water

3.11.1 Use of water by purpose

Most of answers of drinking and cooking water source is categolized either in "Own tubewell" or "Other" (Table 97). The "Other" might have included "jar water", which is water provided with big plastic bottle (approximately 20 liters) with water survinc devices. On the other hand, "Own tubewell" is the major water suce in Washing, Bath, and Toilet. If these hotels/ restaurants will connect to NWSC future, the ratio of "Own tubewell" will be decrease in drinking and cooking according to the result of household survey.

3.11.2 Possession of Water Facility

Table 98 shows the possession of water facility in Non-NWSC user hotels and restaurant. The most popular facility is "Pump"(93%) and "Roof tank" (80%) and "Ground Tank" (73%) are following. It seems the Non-NWSC user hotel/restaurants area pumping up the ground water and keep it in tanks for daily use. If these hotels/restarurants connect to NWSC future, they may use these facilities for keeping NWSC supplied water.

3.11.3 Expenditure for Water

Table 99 shows monthly expenditure for water purpose. Amount of expenditure was asked in tubewell installation, tubewell maintenance, other purpose in tubewell, payment for community, water tanker, bottle water and no users of water tanker was recoreded. The average of expenditure of water is 13,936 NPR. However, this result may higher that actual situation of average amount since some of hotel/restaurant spent a lot of money (e.g. 99,000NPR per month). In case the amount of Bottle Water was not included, the amount of 3,263NPR and it would be normal situation as a monthy expenditure of hotel/restaurant.

Since willingness to connect to NWSC is high in Non-NWSC hotels and restaurant (Table 78), they may willingly pay for NWSC water charges since their current expenditure for water is around 3,000NPR.

Table 97 Use of water by purpose in Hotel/Restaurant of Non-NWSC Users

	Drinking	Cooking	Washing	Bath	Toilet
Own Tubewell	6	8	11	11	11
Neigbor Well	2	1	3	2	2
Water Tanker	0	0	0	0	0
Other	7	6	1	2	2
Total	15	15	15	15	15

Table 98 Possession of Water Facility in Hotel/Restaurant of Non-NWSC Users

Type of Property	N. of Possession	Ratio %
Ground Tank	11	73%
Roof Tank	12	80%
Pump	14	93%
Filter	8	53%
Pool	4	27%
Other	3	20%

Table 99 Expenditure for Water in Hotel/Restaurant of Non-NWSC Users in Monthly

Purpose	Min	Max	Average
1) Tubewell Installation*	11,500†	99.000†	400
2) Tubewell Maintenance	500	10,000	1,480
3) Tubewell Other	1,500	10,000	767
4) Community	50	5,600	377
5) Water Tanker	0	0	0
6) Bottle Water	100	99,000	10,853
7) Other	500	2,160	180
Total of 1) to 7)	-	-	13,936
Total of 1), 2), 3) 4) and 7)	-	-	3,263

Unit: NPR
** Monthly cost of tubewell installation was cauculated 60NPR(in case the cost wasl 11,000NPR) and 270NPR (in case the cost was 50,000NPR)as regular use of 15 years.*
†It shows total cost of tubewell installation

4. CONCLUSION

According to resdients' opinion for water supply services, water quality and service hours (duration of hours that water supply continues) are their major concerns. Most of residents are wishing improvement of water quality as first priorty. Turbidity of supplied water is very high in rainy season, and this is because no sedimatation basin and no water treatment plant were constructed in Pokhara. This situation will be improved after the implementation of "Pokhara Water Supply Improvement Project" since the construction of sedimentation basen and treatment plant is major components in the project.

Water supply hour is the residents' second concern. Currently, water suppy continues for 24 hours once the supply start but supply interval is 3 days in a week in majority. Though water is not suppled everyday, this issue is not the first priority issue compare to the improvement of water quality. It may because residents somewhat get used to current situation of serive hours. Many residents have their own facility, such as roof top tank, and control for keeping water for daily use.

Regarding the opinion Non-NWSC users, most of the respondents answered that they were wish to connect to NWSC once the service pipes were installed nearby. Answers of Hotel/Restaurant survey show the same trend. Future NWSC users may increase in case NWSC service area will be expanded.

The improvement of water supply service will reveal positive impacts to the residents' health and lifestyle. NWSC users are tend to use supplied water in drinking, cooking, and most of household works though several kinds of water, such as supplied water, groundwater, and water bought by tanker, are used in different purpose in domestic works in Nepal. Therefore, importance of quality of water and dependency of water supply will became high in future, and the project will contribute to provide solustions and avoid problems for future Pokhara.

資料 6-10. ポカラ市の水道サービス改善に向けた将来的な対策（提言）

報告書作成にあたり、将来の水道サービス改善に向けた提言としては、以下のようなものが確認できた。提言を設備整備、運転・維持管理、経営改善、人材育成、その他に分類し、以下にまとめた。

項　　目	参照ページ
1. 施設整備	
・　水源からの取水量の増加、浄水場拡張 （Mardi 川にまだ十分な水量があるので、導水管の増設によって Mardi 川からの取水を増やし、浄水場の拡張を図る）	P.2-18
・　導水管への排泥弁設置	P.2-26
・　Bhote 川、Kali 川への浄水処理の導入	P.3-24/3-46
・　Amalabisauni 配水池の増設	P.3-46
・　積極的な漏水対策の実施および管路の更新	P.3-54, 57
・　ポカラ市の改善内容、能力強化の成果の NWSC 全体への波及 例えば、新規の水道施設の建設および既設の取水施設等の改修、補修・敷設替え用の配水管等の資機材調達が必要なこと	―
2. 運転・維持管理	
・　配水時間の変更の周知や、節水啓発	P.3-62/3-144
・　残り約 2,000 の故障メータ更新	P.3-126
・　本事業によって水圧が上昇するエリアの迅速な漏水修理、破裂事故対策	-
・　本事業で設置する流量計を用いた配水量分析	-
・　給水装置設置基準や標準図面の作成、施工品質の改善	-
・　給水メータ管理ポリシーの整備、故障メータの迅速な交換の定着	P.3-126
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・　固定資産台帳の再整備	P.3-144
・　料金徴収率の向上	P.2-11
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・　中長期計画の策定とそれを踏まえた料金見直し等の中長期経営計画の検討	P.3-143
4. 人材育成	
・　トレーニングの体系的な実施、人材育成体制の強化	P.2-14

資料 6-11. キャパシティアセスメントの結果

基本ツール④：水道事業体用基本チェックリストーBasic Tool ④：Utility Basic Checklist(UBC)

(1)本体部分―Main Part

※Level 4 は、途上国が目指すべきラインである。 (Level 4 reflects the conditions which water utilities in developing countries should aim for in the foreseeable future.)

Category			Project Type (援助形態)	Priority(優先度)	Question (Reference No. of the same indicator if it is included in BT①：LPI)	Level					Answer (1 - 5)			Specific Situation
						1：Very Serious	2：Serious	3：Not Good Enough	4：Good	5：Very Good	Last Time	C/P	JICA Survey Team	
Large	Medium	Small				This level reflects the conditions of water utilities which need all-round assistance in all fields.	This level reflects the conditions of water utilities which need broad assistance in many fields.	This level is reflects the conditions of water utilities which need partial assistance in some fields.	This level reflects the conditions which water utilities in developing countries should aim for in the foreseeable future.	This level reflects the conditions of water utilities in developed countries.				
Aspects to be improved mainly by Facility Investment(FI)	Overall		FI/CD	1st	Q1：Existence of long or mid-term plan for facility expansion, rehabilitation, etc.	Long or mid-term plan for facility expansion, rehabilitation, etc. does not exist at all.	Long or mid-term plan for facility expansion, rehabilitation, etc. exists but its target year has already passed.	Long or mid-term plan for facility expansion, rehabilitation, etc. exists but it has not been updated, although its target year has not yet passed.	Updated long or mid-term plan for facility expansion, rehabilitation, etc. exists but there are problems with its timely implementation.	Updated long or mid-term plan for facility expansion, rehabilitation, etc. exists and has encountered few or no problems in its implementation.	1	4	2	Report in 2004
			FI/CD	1st	Q2：Continuity of supply	Mostly intermittent supply, averaging approx. every 4 days or less.	Mostly intermittent supply, averaging approx. every 1-3 days, with some served areas receiving continuous supply.	Intermittent supply and continuous supply are both common in the served areas.	Mostly continuous supply, but still there are some served areas with intermittent supply due to small utilities inability to employ operators for 24 hours, high water demand during summer, etc.	Continuous supply in all served areas except for special cases such as serious drought.	3	2	2	Frequencies of water supply[**19] Season / Dry / Rain 3day / 84% / 69% 7day / 8% / 23%
		Average Overall									2.0	3.0	2.0	-
	Expansion	Water supply service coverage	FI	1st	Q3：Overall water supply coverage(IBI 1.1)[**1]	Less than 50%	50-69%	70-84%	85-94%	95%-100%	3	3	2	52.1% = (served pop.:159,000 / pop. :304,869) in 2015
			FI/CD	1st	Q4：Water supply coverage for low income groups	Majority of low income groups (including the urban poor) do not have piped water supply (including public taps/standpipes)	Around a half of low income groups (including the urban poor) do not have piped water supply (including public taps/standpipes).	Majority of low income groups (including the urban poor) have piped water supply (including public taps/standpipes).	Almost all the low income groups (including the urban poor) have piped water supply (including charged public taps/standpipes but excluding free public taps/standpipes).	Almost all the low income groups have house connections.	NA	NA	NA	There is NOT definite low income groups in the served area. Household ratio of income below 1.25$/person/day[**20] is approx. 3.3%[**19]
		Purification plant	FI	1st	Q5：Surplus purification capacity OI_2)[**2]	Less than - 30%	Less than -10%	Less than 0%	0-5%	More than 5%	2	NA	1	No purification plant (water treatment plant) in Pokhara. Lock of pipe capacity
		Average Expansion									2.5	3.0	1.5	-
	Rehabilitation/ replacement	Conditions of facilities	FI	1st	Q6：Civil structures (such as basins and chambers in water purification plants)	Water leakage from civil structures is common, and some of these problems can only be solved by replacement rather than partial repair.	Water leakage from civil structures is common, but these problems can probably be solved by partial repair.	Water leakage from civil structures happens sometimes.	Water leakage from civil structures is rare.	Water leakage from civil structures almost never happens unless a strong earthquake hits, as regular assessments of facility strength are undertaken.	4	5	4	Civil structures have been checked visually.
			FI	1st	Q7：Transmission and distribution mains[**3]	More than 75% of transmission and distribution mains are as best as pipes, old cast iron pipes (excluding ductile cast iron) or old steel pipes, with rust significantly blocking flow.	50-75% of mains are as best as pipes, old cast iron pipes (excluding ductile cast iron) or old steel pipes, with rust significantly blocking flow.	25-49% of mains are as best as pipes, old cast iron pipes (excluding ductile cast iron) or old steel pipes, with rust significantly blocking flow.	10-24% of mains are as best as pipes, old cast iron pipes (excluding ductile cast iron) or old steel pipes, with rust significantly blocking flow.	Less than 10% of mains are as best as pipes, old cast iron pipes (excluding ductile cast iron) or old steel pipes, with rust significantly blocking flow.	4	1	2	Water is conveyed less than pipe capacity
			FI	1st	Q8：Service connections[**4]	95-100% of house connections are more than 25 years old.	80-94% of house connections are more than 25 years old.	60-79% of house connections are more than 25 years old.	40-59% of house connections are more than 25 years old.	0-39% of house connections are more than 25 years old.	NA	5	5	New house connections: 1,200 nos/year
			FI/CD	1st	Q9：Mechanical and electrical equipment[**5]	More than 30% of installed major mechanical and electrical equipment (such as pumps, electrical transformers and generators) are not operated due to serious failures.	10-30% of installed major mechanical and electrical equipment (such as pumps, electrical transformers and generators) are not operated due to serious failures.	Less than 10% of installed major mechanical and electrical equipment (such as pumps, electrical transformers and generators) are not operated due to serious failures.	Most or all installed major mechanical and electrical equipment (such as pumps, electrical transformers and generators) are operated, however some or many operate with low performance or low efficiency.	Most or all installed major mechanical and electrical equipment (such as pumps, electrical transformers and generators) are operated. Most operate with appropriate performance and efficiency.	4	2	2	High Turbidity makes a meter clogging and malfunctioning. Two chlorine dosing pumps and a deep tube well pump are out of order.
		Average Rehabilitation/Replacement									4	3.3	3.3	-
	Average(FI)										2.8	3.1	2.3	-

Category			Project Type (援助形態)	Priority(優先度)	Question (Reference No. of the same indicator if it is included in BT①:LPI)	Level					Answer (1 - 5)			Specific Situation
						1:Very Serious	2:Serious	3:Not Good Enough	4:Good	5:Very Good				
Large	Medium	Small				This level reflects the conditions of water utilities which need all-round assistance in all fields.	This level reflects the conditions of water utilities which need broad assistance in many fields.	This level is reflects the conditions of water utilities which need partial assistance in some fields.	This level reflects the conditions which water utilities in developing countries should aim for in the foreseeable future.	This level reflects the conditions of water utilities in developed countries.	Last Time	C/P	JICA Survey Team	
Aspects to be improved mainly by Capacity Development(CD)	Technical aspects	Overall	CD	1st	Q10:O&M of the facilities	Facilities do not have any O&M manuals.	Facilities have O&M manuals which are not effective, leading to O&M deficiencies.	Facilities have O&M manuals which are not effective, however the current O&M is adequate.	Facilities have effective O&M manuals, which are followed reasonably well.	Facilities have effective and comprehensive O&M manuals, which are followed strictly.	1	1	1	No O&M manuals/SOPs for water supply facilities
		Distribution network management	CD/FI	1st	Q11:Drawings of pipe facilities	Available paper drawings of existing transmission and distribution trunk mains are quite limited.	Paper drawings are available for most of the existing transmission and distribution trunk mains, but drawings for branch distribution mains are limited.	Small/Medium utilities:Paper drawings are available for most of the existing distribution mains including branch distribution mains. Large utilities: As above, and a primitive GIS has been established for transmission mains, trunk distribution mains, etc.	Small/Medium utilities:Updated CAD files are available for most of the existing transmission and distribution mains. Large utilities: A GIS has been well-established and updated for management of transmission mains and distribution mains, with reasonable accuracy.	Small/Medium utilities:A map book of existing mains has been prepared for referencing and is periodically updated using CAD. Large utilities: A GIS has been well-established and updated for management of transmission, distribution mains, customer information, etc. with good accuracy.	4	2	1	Pipeline Layout only developed by World Bank 20 years ago
			CD/FI	1st	Q12:Zoning of distribution network[**6]	Proper zoning of distribution areas and proper sub-zoning of networks in each distribution area, based on considerations of topology and/or different water sources, rarely exist or do not exist at all.	Proper zoning of distribution areas exists to some extent, but proper sub-zoning of networks in each distribution area rarely exists or does not exist at all.	Most distribution areas are properly zoned, but proper sub-zoning of networks in each distribution area is still limited.	All the distribution areas are properly zoned, and most distribution areas have proper sub-zoning in their distribution network.	All the distribution areas are properly zoned, and most distribution areas have proper sub-zoning in their distribution network. Multiple water sources, multiple lines of distribution trunk mains, and mutual connections between distribution areas and sub-zones are also considered for improving the stability of water supply.	2	2	2	Disproportionate water supply pressure has occurred due to NOT reducing pressure valves on pipelines. In controllable conveyed water due to unseparated between transmission and distribution pipelines.
			CD/FI	1st	Q13:Water pressure at customer meter points[**7]	At most or all points, pressure is not between 5-45m.	At approximately half of the points, pressure is not between 5-45m.	At approximately a quarter of the points, pressure is not between 10-45m.	At most points, usual pressure is between 10-45m but pressure drops significantly in the season of maximum water demand.	At most points, pressure is between 15-45m without significant pressure drop in the season of maximum water demand;or continuous and direct water supply with higher pressure to high buildings without using customers' receiving and elevated tanks has been introduced for water quality control.	1	1	1	Insufficient pressure and water in some areas. Enough Pressure on supplied water[**19] Dry: 39.7% / Rainy: 71.3%
		NRW reduction	CD/FI	1st	Q14:NRW ratio (IBI_6.1)[**8]	More than 50%	36-50%	21-35%	10-20%	Less than 10%	NA	4	1	52.6% (estimate value in 2015)
			CD/FI	1st	Q15:Customer meters[**9]	There are no customer meters due to a flat-rate system, or the majority of existing customer meters are not functioning.	Functioning customer meters are supposed to be installed for every household, but more than 30% of them are missing or not working well.	Functioning customer meters are supposed to be installed for every household and replaced with new ones periodically, but more than 10% of them are missing or not working well.	Most households have well-functioning customer meters due to rigorous periodical meter exchange.	Almost all households have well-functioning customer meters with good accuracy.	2	2	2	NWSC Monthly Tap Report (2015), Missing: 3,465 (10%), Out of order: 7,402 (21%), 10,867 (31%) out of total 34,523 is "missing" or "out of order"
			CD/FI	1st	Q16:Bulk meters[**10]	Bulk meters for accurate measurement of water production and basic control of distribution are not installed at most of the places where they should be;or most of the existing bulk meters do not work well due to lack of maintenance.	There are not enough functioning bulk meters installed at the places requiring them for accurate measurement of water production and basic control of distribution; and existing bulk meters are not well maintained.	There are enough functioning bulk meters for accurate measurement of water production and basic control of distribution, but not enough for calculating NRW ratio of each sub-zone (DMA) for effective NRW reduction. Majority of the existing bulk meters are well maintained.	There are enough functioning bulk meters installed for calculating NRW ratio of each sub-zone (DMA) for effective NRW reduction. Most of the existing bulk meters are well maintained, and important meter readings are recorded periodically.	There are enough functioning bulk meters installed (with good accuracy) for calculating NRW ratio of each sub-zone (DMA) for effective NRW reduction. All of the existing bulk meters are well maintained, and important meter readings are recorded periodically and analyzed effectively.	1	1	1	No bulk meter at two existing reservoirs 3 bulk meters are out of order
		Water quality control	CD	1st	Q17:Water quality parameters tested at purification plants	Water quality testing is based on a visual observation of water cleanliness.	Water quality testing is based on periodical simple water quality tests for pH, turbidity, chlorine, etc., using handheld water quality testers or pack test kits. The treated water usually meets existing standards for the parameters tested.	Water quality testing is based on periodical laboratory water quality tests for micro-organisms such as coliforms, and general physical and chemical water quality parameters. The treated water usually meets existing standards for the parameters tested.	Water quality testing is based on continuous and daily water quality monitoring using appropriate water quality testing methods and well-maintained apparatus. The treated water usually meets existing standards for basic parameters selected with reference to the WHO guidelines, etc.	Water quality testing is based on continuous and daily water quality monitoring using appropriate water quality testing methods and well-maintained apparatus. The treated water almost always meets existing standards for comprehensive parameters selected in reference to the WHO guidelines, etc.	2	2	2	Periodical tested parameters at Pokhara office are 9 out of 37; Turbidity, Residual Chlorine, Color, pH, Taste & Odor, Chloride, Iron, Ammonia, Total Hardness
			CD	1st	Q18:Drinkability of tap water[**11]	In many areas, tap water does not meet water quality criteria for some key parameters (including residual chlorine) and it is not drinkable in some areas even after boiling.	In some areas, tap water does not meet water quality criteria for full list of parameters (including residual chlorine), but it become drinkable after boiling in all areas.	In some areas, tap water does not meet water quality criteria for some key parameters (including residual chlorine) but it become drinkable after boiling in all areas.	In all areas, tap water meets the criteria for the full list of parameters (including residual chlorine) with some exceptions (e.g. in the case of seasonal degradation of water source quality). it is usually drinkable directly from the tap with some risk of water quality degradation due to accidental stoppages of water supply, etc.	In all areas, tap water almost always meets all criteria for the full list of parameters (including residual chlorine), and it is almost always drinkable directly from tap without risk, as long as receiving tanks at end users do not contaminate the water.	1	3	3	Improper operation of dosing chlorine at the reservoirs Drinking water quality (Rainy Season)[**19]: Good: 38.4% Sometimes turbid: 47.4% Turbid: 14.0%
		Average Technical									1.8	2.0	1.6	-

Category			Project Type (援助形態)	Priority(優先度)	Question (Reference No. of the same indicator if it is included in BT①:LPI)	Level					Answer (1 - 5)			Specific Situation
						1:Very Serious	2:Serious	3:Not Good Enough	4:Good	5:Very Good				
Large	Medium	Small				This level reflects the conditions of water utilities which need all-round assistance in all fields.	This level reflects the conditions of water utilities which need broad assistance in many fields.	This level is reflects the conditions of water utilities which need partial assistance in some fields.	This level reflects the conditions which water utilities in developing countries should aim for in the foreseeable future.	This level reflects the conditions of water utilities in developed countries.	Last Time	C/P	JICA Survey Team	
Aspects to be improved mainly by Capacity Development(CD)	Non-technical aspects	Financial improvement	CD	1st	Q19:Cost recovery level (OI_4 is the same as IBI_24.1 If the utility provides water supply services only)**12	Only part of the O&M costs (excluding depreciation of water supply facilities) are covered by water charges.(O1_4<1)	ALL O&M costs (except for depreciation of water supply facilities) are fully covered by water charges.(O1_4≧1)	All O&M and depreciation costs are covered by water charges.(O1_12≧1, if not, check OI_14)	All O&M, depreciation and financial costs (interest & capital repayments) are covered by water charges.(1≦O1_13 ＜1.01, If not check O1_16)	ALL O&M, depreciation and financial costs (interest and capital repayments), and costs for own-capital-funded expansion of facilities (to some extent) are covered by water charges.(OI_13 ≧ 1.01)	2	1	3	In NWSC, Operating revenue > Operating expenses in 2014/15 However, 2011/12 – 2013/14: revenue < expenses in 2014/15
			CD	1st	Q20:Collection ratio (IBI_23.2)**15	Less than 60%	60-74%	75-89%	90-94%	More than 95%	4	5	4	Collection ratio: 91% (2014/15)
		Organizational development	CD	1st	Q21:Effective personnel management rules and regulations including incentives**14	Working regulations and base salary systems are not clear.	Working regulations and base salary systems are clear, but there is no incentive scheme in place.	Working regulations and base salary systems are clear, but existing incentive scheme are ineffective.	Working regulations and base salary systems are clear, there are effective incentive scheme in place. Some critical rules on occupational health and safety are communicated to staff.	Working regulations and base salary systems are clear, and there are effective incentive scheme in place. Full set of regulations on occupational health and safety are communicated to staff.	1	NA	4	The By-Law stipulates the regulation on work and condition included in incentive scheme.
			CD	1st	Q22:Implementation of training**15	Training is quite rare or not provided at all.	A limited number of training programs on some aspects are provided, however there are no incentives for staff to undertake training programs.	There are minimum levels of training required for important aspects, but incentives for staff to undertake training programs are limited.	An adequate number of training programs are provided on important aspects, including management and technical matters. There are enough incentives for staff to undertake training programs.	A wide range of training programs are available. The completion of these training programs is generally a condition of promotion.	1	1	1	Unsystematic training program due to an oral instruction only
		Public relations	CD	1st	Q23:Complaint handling	A procedure or information system for complaint handling has not been established, and complaints are currently dealt with on an ad-hoc basis.	A procedure or information system for complaint handling has been established, but there is a large backlog of unresolved complaints.	A procedure or information system for complaint handling has been established, but there are usually some complaints resolved.	An effective procedure and information system for complaint handling has been established, and data is recorded and analyzed. There can however be a backlog of complaints in a particular season.	An effective procedure and information system for complaint handling has been established, and data is recorded and analyzed. Even in peak complaints season, there is no backlog.	2	4	4	Customer's complaints such as water leakage and soiled meter have been recorded, but some complaints (quality, quantity) are not treated.
			CD	1st	Q24:Awareness-raising on NRW reduction, water saving, collection of water charges, etc.**16	No or minimal effective awareness-raising activities have been implemented.	A few effective awareness-raising activities have been implemented.	Several effective awareness-raising activities have been implemented.	Many effective awareness-raising activities have been implemented.	Many effective awareness-raising activities are being implemented continuously.		5	3	Using non-regular medias such as Radio, Newspapers and Public meeting
		Average Non-technical									2.0	3.2	3.2	-
	AVERAGE(CD)										1.9	2.6	2.4	-
OVERALL AVERAGE(CD)											2.4	2.9	2.4	-
Aspects to be improved mainly by program Approach			CD/FI	1st	Q25:Laws and regulations covering the water sector**17	A water supply service act or its equivalent does not exist.	A water supply service act or its equivalent exists, but it does not require your utility to have an independent double-entry accounting system.	A water supply service act or its equivalent exists, and it requires your utility to have an independent double-entry accounting system.	Most of the required laws and regulations listed in note**17 have been established.	All of the required laws and regulations listed in note**17 are well established.	2	3	3	NWSC has the By –law and double entry accounting system.
			FI	1st	Q26:Sewerage coverage (IBI_2.1)**18	0%	Less than 5%	Less than 30%	Less than 50%	More than 50%	1	1	1	No sewerage system in Pokhara
Average Program Approach											1.5	2.0	2.0	-

**1: Overall water supply coverage = (Population served)/(Population within responsible area of the utility)*100 or (Number of households served)/(Number of households within responsible area of the utility)*100 If responsible areas are not clearly understood, please assume the areas where the water utility will hold responsibility in the foreseeable future. The population served includes those who have direct water supply, yard taps and public taps/standpipes.

**2: Surplus purification capacity = ((Daily treatment capacity - Maximum daily treatment capacity) / Daily treatment capacity) * 100 (unit: %). The daily treatment capacity (m^3/day) is the volume of water per day purified in the current purification plant. The capacity of failed facilities and those under repair facilities is excluded. The maximum daily treatment capacity (m^3/day) is the recorded maximum volume of water per day supplied by the plant in a year.

**3: An example of expected lifetime of water mains is 50 years.

**4: Expected lifetime of house connections can be 25 years or more if using corrosion-resistant materials.

**5: Examples of expected lifetime of mechanical/electrical equipment and instruments are 20 years and 15 years respectively.

**6: Proper zoning and sub-zoning of distribution networks is a basic requirement for good pressure control, effective reduction of NRW, etc. The concept of zoning and sub-zoning is explained in *(2) Supporting Figures and Table*.

**7: Conversion table for different units of pressure is shown in *(2) Supporting Figures and Table*.

**8: NRW (Non-Revenue Water) ratio = (1-(Annual water charged)/(annual water produced))*100 If all the bulk meters necessary for this calculation are not installed, estimation of this average NRW ratio can be carried out based on some data of NRW in some areas. The difference between NRW and UFW (Unaccounted for Water) is explained in *(2) Supporting Figures and Table*.

**9: Expected lifetime of customer meters is usually between 8 and 10 years, depending on their type and quality.

**10: Recommended calibration intervals for bulk flow meters are 5 years for wheel/mechanical type and 1 year for electromagnetic and ultrasonic types. The size of district meter area (DMA) is recommended to be about 1000 - 3000 households.

**11: Key water quality parameters are assumed to be residual chlorine, turbidity, colour, odour, taste, toxic matter and coliform count. Coverage of testing parameters and standards for water quality criteria can refer to the WHO standards if country-specific water quality standards have not been established.

**12: This assessment should be based on financial statements. The supporting financial indicators for judging the level of cost recovery are shown in *(2) Supporting Figures and Table*.

**13: Billing customers and collecting revenue are two different things. The effectiveness of the collections process is measured by this indicator, while NRW ratio (Q14) is based on amount billed and water production. Collection ratio = (Collected revenue at the end of fiscal year)/(Annual amount billed)*100

**14: Personnel management rules and regulations include: 1) working regulations, 2) base salary system, 3) incentive schemes, and 4) occupational health and safety regulations.

**15: Training programs are required for engineers, technicians, administration staff, managers, etc.

**16: Public awareness can be enhanced through: 1) general public relations & publicity, 2) special promotional programs, 3) monitoring research, 4) painting/writing contests, 5) school education, etc.

**17: Laws and regulations include: 1) water supply service act, 2) independent "double-entry bookkeeping" accounting requirement for the water utility, 3) water supply service ordinances, 4) regulations related to water intake, including groundwater regulations, 5) labour standards act, 6) road traffic act, etc.

**18: It is assumed that sewerage development does not usually commence until GDP per capita reaches about US$3,000; and becomes full-scale at a GDP per capita of about US$5,000. It is highly possibility that sewerage is minimally developed in the countries and suburban cities where economic levels are low. It is recommended that the water utility explain the level of sanitary facility (toilet) coverage, particularly if it has answered the question on sewerage coverage as level 1(0%) or level 2 (5% or less).

**19: Social Condition Survey Result Report (2015), JICA Survey Team

**20: World Bank: Ravallion, Martin; Chen Shaohua & Sangraula, Prem *Dollar a day* The World Bank Economic Review, 23, 2, 2009

資料 6-12. O&M 費算定根拠

（資料編）

O&M 費算定根拠

1. Personnel Expenses

Year	2020	2025
Price escalation ratio	32.3%	81.6%

	Salary Scale	Grade No.	Grade rate	Grade	Providence	Fund	Allowance	Total Salary
	①	②	③	④=② x ③	⑤	⑥	⑦	①+④+⑤+⑥+⑦
Level 1	12,980	4	160	640	1,362	68	1,560	16,610
Level 2	13,780	10	180	1,800	1,558	78	1,560	18,776
Level 3	14,670	10	200	2,000	1,667	83	1,560	19,980
Level 4	17,730	10	220	2,200	1,993	100	1,560	23,583
Level 5	18,800	12	240	2,880	2,168	108	1,560	25,516
Level 6	24,400	12	320	3,840	2,824	141	1,560	32,765
Level 7	25,940	12	360	4,320	3,026	151	1,560	34,997

Unit: NPR/person/month

Personnel Expenses	2015	2020	2025
Level 1	16,610	21,975	30,164
Level 2	18,776	24,841	34,097
Level 3	19,980	26,434	36,284
Level 4	23,583	31,200	42,826
Level 5	25,516	33,758	46,338
Level 6	32,765	43,348	59,502
Level 7	34,997	46,301	63,555

Unit: NPR/person/month

				Salary (NPR/person/month)			Salary (NPR/year)		
New Facility	Portion	No. of person	Level	2015	2020	2025	2015	2020	2025
Calculation		①			②	③		② x ① x 12	③ x ① x 12
Grid Chamber	Worker/Guard	2	1	16,610	21,975	30,164	398,642	527,404	723,935
	Operator	1	2	18,776	24,841	34,097	225,311	298,086	409,164
WTP	Manager	1	7	34,997	46,301	63,555	419,968	555,617	762,661
	Operator 1*	3	2	18,776	24,841	34,097	675,932	894,259	1,227,493
	Operator 2*	3	1	16,610	21,975	30,164	597,964	791,106	1,085,902
	Maintenance	1	5	25,516	33,758	46,338	306,197	405,098	556,053
	Helper	1	1	16,610	21,975	30,164	199,321	263,702	361,967
	Office Assistan	1	1	16,610	21,975	30,164	199,321	263,702	361,967
	Chemist 1	1	6	32,765	43,348	59,502	393,182	520,180	714,019
	Chemist 2	1	5	25,516	33,758	46,338	306,197	405,098	556,053
	Sub-total	12					3,098,082	4,098,762	5,626,117
Reservoir 1	Worker/Guard	2	1	16,610	21,975	30,164	398,642	527,404	723,935
Reservoir 2	Worker/Guard	0	1	16,610	21,975	30,164	0	0	0
OHT	Worker/Guard	2	1	16,610	21,975	30,164	398,642	527,404	723,935
Valve Operator		4	1	16,610	21,975	30,164	797,285	1,054,808	1,447,869
Meter Reader		4	3	19,980	26,434	36,284	959,057	1,268,832	1,741,647
Total		27					6,275,662	8,302,700	11,396,601

*Operator/Worker/Guard

2. Chemical Costs

Year	2020	2025
Price escalation ratio	32.3%	81.6%

Bleaching powder consumption	WTP	175.7	kg/day
	Reservoir 1&2	64.3	kg/day

Chemical Costs

Year	2015	2020	2025
Unit Price (NPR/kg)	34	45.0	61.7
WTP (NPR/day)	5,974	7,903	10,848
Reservoir 1&2 (NPR/day)	2,186	2,892	3,970
Total (NRs/day)	8,160	10,796	14,819
Total (NRs/year)	2,978,400	3,940,423	5,408,774

3. Electricity

Electricity Bill

Facility	Electricity Bill (NPR/month.)	Electricity Bill (NPR/year)
Water Treatment Plant	13,519	162,231
Grit Chamber/Sedimentation Tank	3,190	38,277
Prasyang Reservoir (New 1)	3,672	44,066
Fulbari Reservoir (New 2)	3,672	44,066
Col Patan Chowk Resernoir (NEW-3)	3,672	44,066
Bindabashini Reservoir (Existing 1)	23,274	279,283
Amlabisauni Resernoir (Existing 2)	4,254	51,045
Generator Fuel	-	328,050
Total	55,252	991,084
	Annual Total	992,000

Year	2020	2025
Price escalation ratio	32.3%	81.6%

Electricity Cost

Year	2015	2020	2025
Total (NPR/year)	992,000	1,312,416	1,801,472

4. Equipment Repair Costs

Item	Cost	Unit	Remarks
Mechanical/electrical equipment costs	52,450,000	JPY	
5% of the above costs	2,622,500	JPY	0.82 JPY/NPR
	3,198,171	NPR	
→	3,198,200	NPR	

Year	2020	2025
Price escalation ratio	32.3%	81.6%

Equipment Repair Costs

Year	2015	2020	2025
Cost (NPR)	3,198,200	4,231,219	5,807,931

5. Office Expenses, Communication Expenses and Consumable Costs

Providing 15% of personnel expenses, chemical costs, electricity and equipment repair costs

6. Water Quality Test

Year	2020	2025
Price escalation ratio	32.3%	81.6%

Water Quality Test Expenses Unit: NPR/year

Item	2015	2020	2025	Test Frequency	2015	2020	2025
TDS	180	238	327	0	0	0	0
E.C.	40	53	73	0	0	0	0
Cadmium	350	463	636	4	1,400	1,852	2,542
Chromium	150	198	272	4	600	794	1,090
Fluoride	200	265	363	4	800	1,058	1,453
Lead	225	298	409	4	900	1,191	1,634
Sulphate	150	198	272	4	600	794	1,090
Nitrate	125	165	227	0	0	0	0
Copper	225	298	409	4	900	1,191	1,634
Zinc	225	298	409	4	900	1,191	1,634
Mercury	350	463	636	4	1,400	1,852	2,542
Aluminum	240	318	436	4	960	1,270	1,743
Iron	225	298	409	4	900	1,191	1,634
Manganese	225	298	409	4	900	1,191	1,634
Arsenic	350	463	636	4	1,400	1,852	2,542
Calcium	225	298	409	4	900	1,191	1,634
Cyanide	350	463	636	4	1,400	1,852	2,542
Total					13,960	18,469	25,351

資料 6-13　定量的効果指標（給水頻度）の算定

表 6-13-1　定量的効果指標（給水頻度）

給水頻度	人口（人）※1		割合※2
	2015	2023	2015
	基準値	目標値	%
7日/週	64,600	385,700	**21%**
3-4日/週	171,800	0	**56%**
1-2日/週	68,500	0	**23%**
計	304,900	385,700	**100%**

※1：表 6-13-1 の 2015 年の人口（基準値）は、表 6-13-2 の「給水頻度」ごとに各 Ward の人口を合計した数値である。

※2：表 6-13-1 の「割合」は 2015 年時点の各給水頻度の割合を示す。

表 6-13-2　給水区域内人口

Municipality Ward No.		Population (All Area)		Served Area (%)	Population (NWSC Served Area)		Average Yearly Increase Number y=ax+b				給水頻度※3
		2001	2011		2001	2011	Growth per year	Growth rate (%)	Population		日/週
									2015	2023	
Pokhara	1	12,037	15,513	100%	12,037	15,513	347.6	1.72	16,903	19,684	3～4
	2	4,859	8,729	100%	4,859	8,729	387.0	3.09	10,277	13,373	3～4
	3	6,962	9,462	100%	6,962	9,462	250.0	1.99	10,462	12,462	3～4
	4	5,988	9,119	100%	5,988	9,119	313.1	2.49	10,371	12,876	7
	5	6,829	14,803	100%	6,829	14,803	797.4	3.63	17,992	24,371	3～4
	6	10,663	14,729	100%	10,663	14,729	406.6	2.06	16,355	19,608	7
	7	8,241	12,875	100%	8,241	12,875	463.4	2.60	14,728	18,435	7
	8	16,112	26,080	100%	16,112	26,080	996.8	2.73	30,067	38,041	3～4
	9	12,111	16,626	100%	12,111	16,626	451.5	2.04	18,432	22,044	3～4
	10	12,433	18,470	100%	12,433	18,470	603.7	2.39	20,884	25,714	3～4
	11	7,408	12,338	100%	7,408	12,338	493.0	2.84	14,310	18,254	3～4
	12	7,369	11,613	100%	7,369	11,613	424.4	2.63	13,310	16,705	3～4
	13	6,739	13,154	100%	6,739	13,154	641.5	3.35	15,720	20,852	3～4
	14	2,314	6,427	100%	2,314	6,427	411.3	4.15	8,072	11,362	1～2
	15	10,099	17,027	100%	10,099	17,027	692.8	2.88	19,798	25,340	1～2
	16	10,068	14,950	100%	10,068	14,950	488.2	2.39	16,902	20,808	7
	17	12,706	26,752	100%	12,706	26,752	1,404.6	3.55	32,370	43,607	1～2
	18	3,374	6,798	100%	3,374	6,798	342.4	3.43	8,167	10,906	1～2
Lamachour	19	5,019	7,027	80%	4,015	5,622	160.6	2.13	6,264	7,548	7
Sarang Kot	26	6,612	8,354	15%	992	1,253	26.1	1.60	1,357	1,566	3～4
Armala	28	5,348	5,328	40%	2,139	2,131	-0.8	-0.03	2,128	2,121	3～4
Total		173,291	276,174		163,458	264,471	10,288.3	2.41	304,869	**385,677**	

※3：表 6-13-2 の「給水頻度」は、表 6-13-3 窓口調査結果と社会条件調査結果の総括表より引用している。

表 6-13-3　窓口調査結果と社会条件調査結果の総括表（単位：人）

Q81	週１回	週２回	週３ - ４回	週５ - ６回	週7回	総計
Ward 1	0	2	24	1	19	46
Ward 2	0	1	41	1	10	53
Ward 3	0	1	35	0	8	44
Ward 4	0	0	20	1	21	42
Ward 5	4	3	27	3	16	53
Ward 6	0	0	16	5	18	39
Ward 7	2	1	31	1	8	43
Ward 8	7	10	47	4	5	73
Ward 9	1	2	32	1	4	40
Ward 10	4	8	41	1	4	58
Ward 11	5	4	71	1	10	91
Ward 12	0	3	49	3	8	63
Ward 13	1	1	38	3	1	44
Ward 14	13	1	12	0	1	27
Ward 15	18	27	25	1	0	71
Ward 16	0	0	18	4	59	81
Ward 17	27	23	26	0	3	79
Ward 18	17	3	7	1	0	28
Ward 19	0	1	17	3	12	33
総計	4	11	258	9	24	1,008

※**表** 6-13-3 は、**表** 6-13-4 窓口調査結果と**表** 6-13-5 社会条件調査結果の合計した値であり、最も割合の高い数値（黄色のハイライトで示す）の給水頻度を**表** 6-13-2 で採用している。

表 6-13-4　社会条件調査結果表（単位：人）

Ward	1 days/week	2 days/week	3~4 days/week	5~6 days/week	7 days/week	総計
1	0	0	14	0	5	19
2	0	0	11	0	0	11
3	0	0	12	0	1	13
4	0	0	10	0	3	13
5	0	0	17	0	0	17
6	0	0	10	0	8	18
7	1	0	11	0	4	16
8	1	0	31	0	0	32
9	0	0	18	1	0	19
10	0	1	20	0	0	21
11	0	0	15	0	0	15
12	0	0	13	0	0	13
13	0	1	13	0	0	14
14	1	0	5	0	1	7
15	0	0	19	0	0	19
16	0	0	15	0	2	17
17	0	8	17	0	0	25
18	1	1	6	0	0	8
19	0	0	10	0	0	10
総計	4	11	267	1	24	307

表 6-13-5　窓口調査結果（単位：人）

Ward No.	0 days/week	1 days/week	2 days/week	3~4 days/week	5~6 days/week	7 days/week	Total
1	0	0	2	10	1	14	27
2	0	0	1	30	1	10	42
3	0	0	1	23	0	7	31
4	0	0	0	10	1	18	29
5	0	4	3	10	3	16	36
6	0	0	0	6	5	10	21
7	0	1	1	20	1	4	27
8	2	6	10	16	4	5	43
9	1	1	2	14	0	4	22
10	0	4	7	21	1	4	37
11	0	5	4	56	1	10	76
12	0	0	3	36	3	8	50
13	0	1	0	25	3	1	30
14	2	12	1	7	0	0	22
15	2	18	27	6	1	0	54
16	0	0	0	3	4	57	64
17	0	27	15	9	0	3	54
18	0	16	2	1	1	0	20
19	0	0	1	7	3	12	23
Total	7	95	80	310	33	183	708

※各調査において最も割合の高い値を黄色のハイライトで示す。

資料 7 その他の資料・情報

7-1 資料収集リスト

資料番号	資料内容	詳細	資料形態				入手先
資料1	気象・水文データ	2014年12月から過去10年間	1	枚	A-4	コピー	DHM(Department of Hydrology & Meteorology)
資料2	河川データ	2007-2010年	1	式	データファイル	コピー	DHM(Department of Hydrology & Meteorology)
資料3	Nepal Population and Housing Census	2011年版	1	冊	A-4	コピー	Nepal Central Bureau of Statistics
資料4	Kaski州センサス	2011年版	1	冊	A-4	オリジナル	Nepal Central Bureau of Statistics
資料5	Pokharaセンサス	2001年, 2011年版	2	冊	A-4	オリジナル	Nepal Central Bureau of Statistics
資料6	Annual Report	2013/2014	1	冊	A-4	オリジナル	NWSCポカラ支所
資料7	Standard Drawings for Road Element		1	式	A-3	コピー	Department of Road
資料8	水河湖関連資料		1	式	データファイル	コピー	ISIMOD
資料9	メーター設置数内訳	2015年1月分	5	枚	A-4	コピー	NWSCポカラ支所
資料10	Montyly Consumption Report	給水区域毎の水道使用量データ, 2011-2014年	73	枚	A-4	コピー	NWSCポカラ支所
資料11	Monthly Tap Record	給水メータの用途別内訳、2014年分	15	枚	A-4	コピー	NWSCポカラ支所
資料12	National Urban Development Strategy	2015年	1	冊	PDF	コピー	Ministry of Urban Development
資料13	The Challenge of Reducing Non-Revenue Water in Developing Countries	2006年	1	冊	PDF	コピー	World Bank
資料14	Nepal Tourism Statistics	2013年	1	冊	PDF	コピー	Ministry of Culture, Tourism & Civil Aviation
資料15	Pokhara Water Supply Report	2005年	1	冊	A-4	コピー	
資料16	Nepal-Leak Detection and Waste Control Program	1995年	1	冊	データファイル	コピー	
資料17	NWSC漏水修理記録		2	枚	A-4	コピー	NWSCポカラ支所
資料18	ポカラ市の計画停電スケジュール		1	枚	A-4	コピー	ネパール電力公社(NEA)
資料19	建設用地地籍図	送水ポンプ場用地:Lahachowk, Ward #1 浄水場用地:PartnChar, Ward #7, Hemja, Ward #2 配水池1用地:Pokhara, Ward #5 配水池2用地:Pokara, Ward #11 配水池3用地:Chinedada, Ward #7	6	枚	A-4	コピー	Survey Office, Kaski
資料20	NWSC財務諸表	2011-13年	34	枚	A-4	コピー	NWSC本部
資料21	NWSCポカラ支所財務諸表書	2013-14年	8	枚	A-4	コピー	NWSCポカラ支所
資料22	NWSC体制図	2015年	1	枚	A-4	コピー	NWSCポカラ支所
資料23	NWSCポカラ支所体制図	2015年	1	枚	A-4	コピー	NWSCポカラ支所
資料24	NWSCポカラ支所　給与支払額一覧	2015年	1	冊	PDF	コピー	NWSCポカラ支所
資料25	NWSC水道料金表	現行および(2061-2070)版	2	枚	A-4	コピー	NWSCポカラ支所
資料26	NWSC支所別料金請求額・徴収額	2015年	1	枚	A-4	コピー	NWSCポカラ支所
資料27	Water Tariff Fixation Commission Regulation 2064		1	冊	PDF	コピー	Water Supply Tariff Fixation Commission
資料28	降雨量データ（2007-2010）		1	式	データファイル	コピー	DHM(Department of Hydrology & Meteorology)
資料29	φ500mm導水管　発注図面		1	式	A-3	コピー	NWSC図書室
資料30	φ400mm導水管　配置図		1	式	A-4	コピー	NWSCポカラ支所
資料31	Salary Maintained	2011年, 2013年, 2014年	3	枚	A-4	コピー	NWSCポカラ支所
資料32							
資料33							
資料34							
資料35							
資料36							
資料37							
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