

資料5. ソフトコンポーネント計画書

ミャンマー国

マンダレー市上水道整備計画協力準備調査

ソフトコンポーネント計画書

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1. ソフトコンポーネントを計画する背景

1.1 背景

現在マンダレー市の市全体の上水道普及率は 66.5%であるが、北部 4 タウンシップ（アウンミエターザン、チャンイエターザン、マハーアウンミエ及びチャンミャータージー）の水道普及率が 60～90%に達している一方、南部 2 タウンシップ（ピジーダゴン及びアマラプラ）においては 6%にも達していない。特にピジーダゴンタウンシップは、近年の人口増や商業施設等の建設による急激な水需要の増加が顕著にも拘わらず、上水道普及率が 5.7%に留まっており、貧困率も 35.3%と高い。多くの住民は家庭排水等によって水質が悪化した非衛生的な浅井戸の利用により、下痢等の水因性疾患に晒されている。また、マンダレー市の上水道システムの 95%は地下水を水源とし、残りの 5%は表流水を緩速濾過により浄化の上給水しているが、いずれも水道水の消毒処理は行われておらず、上水道普及地域においても安全な飲料水供給を行っているとは言い難い。

「ミャンマー国マンダレー市上水道施設整備計画」は、ミャンマー国（以下、「ミ」国）マンダレー市において、ピジーダゴンタウンシップを対象にした上水道施設の新規整備、および既存施設への消毒施設の導入を行い、対象地域の給水状況を改善することを目的として実施する。事業スコープは、ピジーダゴンタウンシップ内における取水設備（生産井戸 3 本、電気機械設備、配水池への送水管）、配水池、配水ポンプ場及び配水管網の整備、及びマンダレー市内の塩素消毒施設の整備である。

1.2 ソフトコンポーネントの必要性

本案件で支援予定の井戸を含む地下水利用設備について、MCDC は維持管理の知見を十分に有している。また、消毒施設については現在実施中の草の根技術協力「マンダレー市における浄水場運転管理能力の向上事業（2014 年 1 月～2016 年 12 月）」により運転維持管理にかかる支援が実施中である。他方、以下の点については、事業の持続性及び効果発現確保のためソフトコンポーネントによる技術移転が必要と考えられる。

・配水管理

これまで MCDC は、給水区域の配水量及び配水圧等の基本データの蓄積を行っておらず、配水施設の設備容量から基本データを推定していた。しかし、その基本データの信頼性は低く、配水区域別の配水量や無収水率が不明であることから、配水状況が把握できない、適切な配水施設の維持管理ができない等、配水管理を適切に実施することができていない。本計画では、新規水道システムにおいて配水管網を DMA（最小計量区、DMA: District Metering Area）で分割し、各 DMA におけるモニタリング設備の導入により基本データの蓄積を行うことで、配水管理に必要な基本データを取得することを目指している。しかし、現在の MCDC の水供給衛生局職員の無収水量の把握に関する知識およびモニタリング設備の設置・操作に関する技術水準は、未だ不十分であり職員の配水管理に係る能力向上についてソフトコンポーネントを通じて支援する必要がある。

- ・新規接続顧客の確保

本計画のコンポーネントの1つには未給水区域に対する新規上水道整備がある。これまで無料の私有井戸を利用してきた未給水区域の住民が新規接続に伴い課せられる料金支払いに対して抵抗感を頂く恐れが懸念される。そのため、住民への啓発・普及活動を通して、上水道サービスの直接的・間接的な便益や価値について住民の理解を深めることが重要と考えられる。

- ・地下水位モニタリング体制の強化と観測結果の活用

MCDCにおいて、これまで十分な地下水モニタリング（地下水位観測）が実施されなかった要因として、①生産井が容易に地下水位を測定できる構造を有していなかった、②観測井がなく、またその代替となる井戸の設定が不十分であった、ことなどが挙げられる。

これらの問題に対して、本プロジェクトではBPS No.7 周辺の新規開発井戸においては地下水位が測定できる井戸仕上げにするとともに観測井も設置する。これらの井戸を利用した観測仕様を設定して継続観測を行い、生産井周辺の地下水位管理を行なう必要がある。

新たな水源としてBPS No.7 の周辺で3本の新規生産井を整備する計画を立案した。MCDCはBPS No.7 の敷地内に2本の既存生産井を保有しており、計5本から成る井戸群を形成することになる。

上記の地下水開発を計画するに当たり地下水位の低下量を推計する。推計は試掘井の揚水試験結果を基に理論式を用いて行うが、より精度の高い解析を行ない、井戸群各井戸の適切な管理・運転を行うためには地下水位データの蓄積が必要となる。

また、その他のMCDC管理生産井においても、ソフトコンポーネントの活動の中で、生産井近傍の地下水位観測が可能な既存井戸を選定して、定期的な観測を実施する体制構築を目指す必要がある。

さらに、マンダレー市全域の地下水位の状況が把握できるように、市全体を網羅する観測体制の構築をソフトコンポーネントの活動の中で提案していく必要がある。

2. ソフトコンポーネントの目標

マンダレー市開発委員会（MCDC）の職員が、1) 配水管理に必要な知識及び技能、2) 住民への啓発・普及活動、3) 地下水位モニタリング体制の強化と観測結果の適切な活用に必要な知識及び知見を習得し、水道システムを持続的に運営・維持管理が可能となるよう能力の向上を図る。

3. ソフトコンポーネントの成果

ソフトコンポーネントの実施による成果は以下のとおりである。

[成果1]：MCDCの配水管理能力が向上する。

[成果2]：MCDCの住民への啓発・普及能力が向上する。

[成果3]：MCDCの地下水管理能力が向上する。

4. 成果達成度の確認方法

成果達成度の確認方法を次表に示す。

表1 ソフトコンポーネント成果の確認方法

成果	内容	達成度の確認項目	確認方法
1. 配水管理能力が向上する。	配水システムの 水理状況が把握 される。	<ul style="list-style-type: none"> ・維持管理におけるモニタリング業務の重要性を認識しているか ・パイロット地区*1において必要な配水データを適切に収集、集計、分析及び図表化できるか ・パイロット地区における集計結果を適切に解釈できるか 	研修・演習実施記録 筆記試験（データ分析）
	配水データが配 水管理（無収水 管理含む）に活 用される。	<ul style="list-style-type: none"> ・パイロット地区において集計された配水データと徴収水量（検針水量）を比較し無収水量が推定できるか ・揚水量に応じた配水方法が設定されているか 	研修・演習実施記録 筆記試験（データ分析）
	上記活動に関連 するマニュアル 類が整備され る。	<ul style="list-style-type: none"> ・配水管理マニュアルが作成されているか 	配水管理マニュアル の有無の確認
2. 住民への啓 発・普及能力が 向上する。	啓発・普及活動 促進のための体 制構築がされ る。	<ul style="list-style-type: none"> ・MCDCが啓発・普及活動を促進する体制を整えているか ・実施機関によって、プロジェクト対象の各ワードでの説明会が開催できるか ・住民の水道システム及び給水サービスに関する理解と衛生意識が向上したか 	啓発・普及担当職員 の選定の有無の確認 プロジェクト対象地 区（ワード）での説 明会の開催の確認 説明会後のアンケ ートによる確認
	上記活動に関連 するガイドライ ンが整備され る。	<ul style="list-style-type: none"> ・啓発・普及活動ガイドラインが作成されているか 	啓発・普及活動ガイ ドラインの有無の確 認
3. 地下水管理 能力が向上す る。	地下水位観測・ 整理・解析技術 が習得される。	<ul style="list-style-type: none"> ・地下水位観測のために観測野帳や観測台帳が作成されたか ・観測記録の精度確認ができるか ・地下水位変動記録を整理できるか ・地下水位分布図が理解できるか 	研修実施記録 筆記試験
	地下水位変動に 応じた揚水量が 設定される	<ul style="list-style-type: none"> ・揚水試験解析方法を理解しているか ・水理公式を用いた予測水位解析を理解しているか ・揚水量と地下水位変動の関係を理解しているか 	研修実施記録 筆記試験
	上記活動に関連 するマニュアル 類が整備され る。	<ul style="list-style-type: none"> ・地下水位モニタリング・揚水量管理マニュアルが作成されているか 	地下水位モニタリン グ・揚水量管理マニ ュアルの有無の確認

*1 給水管布設工事まで完了した DMA をパイロット地区として設定し研修を実施する。行政区であるワード 2、4、5、6、10 の 5ワードがそれぞれ DMA に設定されており、その内、1ワードをパイロット地区として選定する。

5. ソフトコンポーネントの活動（投入計画）

成果		活動
1	配水管理能力の向上	配水データの管理・分析、配水管理（無収水管理含む）へのデータの活用にかかる研修実施、マニュアルの作成支援等
2	住民への啓発・普及能力の向上	住民への啓発・普及活動の研修、実施支援（住民説明会の開催、個別世帯訪問等）、及びガイドラインの作成支援等
3	地下水管理能力の向上	地下水位観測技術（携帯式水位計・自記水位計）、地下水位データを用いた揚水量管理方法の研修実施、マニュアルの作成支援等

ソフトコンポーネント活動（投入計画）の詳細内容を、次表に示す。

表2 [成果1]の投入計画

番号	項目	投入	
		日本国側	「ミ」国側参加人数
1)	準備		
①	国内準備（配水管理専門家）		
D-1	技術移転計画書作成	1名×1日=1人日	—
D-2	テスト作成・質問票作成・研修用テスト(案)準備	1名×4日=4人日	—
	渡航	1名×1日=1人日	—
②	実施準備・導入技術説明会（配水管理技術者）		
②-1	研修室確保・C/P打合せ・実施準備・説明会準備	1名×4日=4人日	2名×4日=8人日 局長及び配水課長
②-2	研修生の選定（研修前テスト・アンケート・評価・選定）	1名×3日=3人日	2名×3日=6人日
②-3	実施説明会	1名×1日=1人日	20名×1日=20人日 MCDC 水供給衛生局 13名、5 DMAs から各1名及びタウンシップ職員2名
	小計	14人日	34人日
2)	配水データ管理（配水管理専門家）		
①	配水データの分析・活用		
①-1	配水データ収集の目的及び機器の紹介、平常・異常値の説明（流量計、水圧計（座学））	1名×2日=2人日	9名×2日=18人日 MCDC 水供給衛生局配水課4名及び5 DMAs から各1名
①-2	配水データの収集（モーター設備に送信された流量データ結果の収集方法の説明及びデータの取得方法の説明、（座学及び演習））	1名×3日=3人日	9名×3日=27人日
①-3	パイロット地区の配水データの分析（収集された水量及び水圧データの時間、日、季節変動の分析とその評価、（座学及び演習））	1名×2日=2人日	9名×2日=18人日
	小計	7人日	63人日
3)	配水管理（配水管理専門家）		
①	配水管理及び無収水管理へのデータの活用（パイロット地区の配水データの評価結果を踏まえた流量、水圧の管理方法の説明、徴収料金データと比較した無収水量の把握とその原因分析（座学及び演習））	1名×5日=5人日	9名×5日=45人日
	小計	5人日	45人日
4)	上記活動に関連するマニュアル類の整備		
①	配水管理マニュアルを作成する。	1名×2日=2人日	2名×2日=4人日
	小計	2人日	4人日
5)	総合報告（配水管理専門家）		

①	総合セミナー		
①-1	総合セミナー準備	1名×2日=2人日	9名×2日=18人日
①-2	総合セミナー	1名×1日=1人日	20名×1日=20人日
②	報告書作成		
②-1	ソフトコンポーネント評価	1名×1日=1人日	—
②-2	総合報告書作成・提出	1名×1日=1人日	—
	小計	5人日	38人日
	渡航	1名×1日=1人日	—
	合計	34人日	184人日

注)「ミ」国側の人数は参加が望ましい部署と人数を想定した値である。

表3 [成果2]の投入計画

番号	項目	投入	
		日本国側	「ミ」国側参加人数
1)	準備		
①	国内準備(組織開発/住民啓発・普及専門家)		
D-1	技術移転計画書作成	1名×1日=1人日	—
D-2	質問票作成・研修用テキスト(案)、住民啓発用資料準備	1名×4日=4人日	—
	渡航(1回目)	1名×1日=1人日	—
2)	啓発・普及活動促進体制の支援		
①	促進体制の構築支援(住民啓発・普及)		
①-1	C/P打合せ、担当職員の選定、支援体制の検討	1名×5日=5人日	2名×5日=10人日 局長及び収入課
①-2	担当職員との打合せ、啓発・普及活動計画の策定	1名×5日=5人日	2名×5日=10人日
	小計	16人日	20人日
3)	住民への啓発・普及活動の促進-		
①-1	住民説明会の開催準備・調整(C/P、TS事務所)、資料準備・作成	1名×7日=7人日	5名×7日=35人日 収入課5名
①-2	住民説明会の開催(全5回)	1名×5日=5人日	5名×5日=25人日
4)	新規接続の個別契約促進		
①-1	個別世帯訪問による契約促進	1名×6日=6人日	5名×6日=30人日
	渡航	1名×1日=1人日	—
	小計	19人日	90人日
	渡航(2回目)	1名×1日=1人日	—
5)	住民への啓発・普及活動のモニタリング		
①-1	個別契約状況の進捗モニタリング及びフォローアップ	1名×10日=10人日	5名×10日=50人日
	小計	11人日	50人日
6)	上記活動に関連するガイドラインの整備		
	啓発・普及活動ガイドラインを作成する。	1名×2日=2人日	2名×2日=4人日 収入課2名
	小計	2人日	4人日
7)	総合セミナー(住民啓発・普及)		
①	総合セミナー		
①-1	総合セミナー準備	1名×2日=2人日	2名×2日=4人日
①-2	総合セミナー	1名×1日=1人日	2名×1日=2人日
②	報告書作成		
②-1	ソフトコンポーネント評価	1名×1日=1人日	—
②-2	総合報告書作成・提出	1名×1日=1人日	—
	小計	5人日	6人日
	渡航	1名×1日=1人日	—
	合計	54人日	170人日

注)「ミ」国側の人数は参加が望ましい部署と人数を想定した値である。

表4 「成果3」の投入計画

番号	項目	投入	
		日本国側	「ミ」国側参加人数
1)	準備		
①	国内準備（地下水管理専門家）		
D-1	技術移転計画書作成	1名×1日=1人日	—
D-2	質問票作成・研修用テキスト(案)	1名×4日=4人日	—
	渡航（1回目）	1名×1日=1人日	—
2)	地下水位に関連する観測技術の習得		
①-1	地下水位観測及び観測井についての基礎的な座学を実施する。	1名×1日=1人日	10名×1日=10人日 MCDC 水供給衛生局 井戸・電気・機械課に属する地下水開発担当、既存水道施設運転管理者の8名
①-2	携帯式水位計を用いた水位測定とデータ整理法を習得する。	1名×1日=1人日	10名×1日=10人日
①-3	自記水位計のデータ整理法を習得する。	1名×1日=1人日	10名×1日=10人日
①-4	地下水位変動量の整理と解析法を習得する。	1名×1日=1人日	10名×1日=10人日
①-5	地下水位分布の整理と解析法を習得する。	1名×1日=1人日	10名×1日=10人日
	小計	11人日	50人日
3)	地下水位データを用いた揚水量管理方法の習得		
①-1	揚水量試験解析法と水理公式を用いた水位変動予測法を習得する。	1名×2日=2人日	10名×2日=20人日
①-2	予測計算水位と実測水位データを用いた揚水量管理の方法を習得する。	1名×2日=2人日	10名×2日=20人日
	小計	4人日	40人日
4)	上記活動に関連するマニュアル類の整備		
①-1	地下水位モニタリング・揚水量管理マニュアルを作成する。	1名×2日=2人日	2名×2日=4人日
	小計	2人日	4人日
5)	総合セミナー		
①	総合セミナー		
①-1	総合セミナー準備	1名×2日=2人日	2名×2日=4人日
①-2	総合セミナー	1名×1日=1人日	2名×1日=2人日
②	報告書作成		
②-1	ソフトコンポーネント評価	1名×1日=1人日	—
②-2	総合報告書作成・提出	1名×1日=1人日	—
	小計	5人日	6人日
	渡航	1名×1日=1人日	—
	合計	23人日	100人日

本ソフトコンポーネントで習得した技術の効果及び持続性を高めるため、研修員の人選が適切に行われる必要がある。以下を必要要件として、MCDC及び本邦コンサルタントが慎重に人選を行う。

- ① 配水管理（[成果1]）の業務経験
- ② 顧客対応及び住民説明（[成果2]）の業務経験
- ③ 地下水開発に係る業務経験（[成果3]）
- ④ コンピューターの基本的な操作方法の習得
- ⑤ 基本ソフト（MS-Excel及びMS-Word）の操作方法の習得
- ⑥ 十分な研修時間の確保（1日3時間程度）

⑦ 本研修に関する高い関心、意欲

MCDCには研修室がないため、ピジータゴンタウンシップ事務所又はMCDC内に別途に研修場所を確保する必要がある。MCDCは研修参加者に対し研修場所までの交通費及び日当の負担が必要となる。

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では、以下の3名の本邦コンサルタントを現地に派遣する。

また下記に述べるような現状と必要性から判断して、本邦コンサルタントの活用が適当であり、本ソフトコンポーネントは直接支援型で実施することとする。

(1) 配水管理専門家

配水管理に精通している本邦コンサルタントを1名派遣する。

本技術者は、水理学の知識、配水運用計画の策定に係る経験に加えて「ミ」国技術者と意思疎通を行うための語学力、開発途上国における配水システムの維持管理上の問題点を理解していることが求められる。

また、本ソフトコンポーネントは本邦コンサルタントにより設計され工事監理等の一連の本体業務の後に実施されるもので、本プロジェクトの計画、工事段階で知り得た技術を会得している本邦コンサルタントの技術者が実施するのが適切である。

(2) 組織開発/ 啓発・普及活動専門家

組織開発や住民への啓発・普及に精通している本邦コンサルタントを1名派遣する。

水供給衛生局には、水道事業の啓発・普及を行う担当部署は存在しないため、その知見やノウハウの基盤が十分に整っていない。住民への啓発・普及活動に関わるMCDC担当職員を、実施部署である水供給衛生局職員から選定し、組織的な取り組みが行えるよう体制整備を支援する。啓発・普及担当職員が、プロジェクトで建設される新規の水道システムの啓発・普及活動の促進を適切に行い、新規接続顧客の確保を促進するための支援である。啓発・普及計画の作成、住民説明会や個別訪問の実施を通して、担当職員に顧客関係管理の重要性についての意識醸成を支援する。なお、新規の個別接続の促進活動についてはその立ち上げを支援し、一定期間後にその結果をモニタリングし、改善のためのフォローアップを行う。また、新規建設される水道システムのメリットを最大限に広報活動すること、現在では十分に醸成されていない顧客重視の事業サービスの概念や事業展開を将来的に促進するためにも、直接支援が必要となる。

本ソフトコンポーネントは詳細設計時から開始される。組織開発/ 啓発・普及活動専門家は、詳細設計のための現地調査を実施する本邦コンサルタントと水道事業の概要や給水管の設計内容、工事及び工事監理等に係る情報を共有し、その内容を踏まえた新規接続顧客の確保のための啓発・普及活動支援を行う必要がある。従って、本邦コンサルタントの技術者が実施するのが適切である。

(3) 地下水管理専門家

地下水管理に精通している本邦コンサルタントを1名派遣する。

本技術者は、水理地質学の知識、井戸掘削等、地下水開発に係る経験に加えて「ミ」国技術者と意思疎通を行うための語学力、開発途上国における地下水システムの維持管理上の問題点を理解していることが求められる。

また、本ソフトコンポーネントは本邦コンサルタントにより設計され工事監理等の一連の本体業務の後に実施されるもので、本プロジェクトの計画、工事段階で知り得た技術を会得している本邦コンサルタントの技術者が実施するのが適切である。

要員配置計画の詳細を下表に示す。

表5 ソフトコンポーネントの要員配置計画

要員分野	人数	所属	内 容
配水管理	1	本邦	<p>本邦の配水管理技術を現地の状況及び研修員の技術水準に応用し以下の事項を実施する。</p> <ul style="list-style-type: none"> ▪ 研修テキストの作成、研修の実施 ▪ テスト、レポート宿題の作成・評価 ▪ マニュアルの作成 ▪ 各種フォーマットの整備 ▪ セミナーの実施 ▪ データの収集・編集・モデル化 ▪ 評価
組織開発/啓発・普及活動	1	本邦	<p>本邦で計画されたプロジェクト内容を踏まえた組織開発及び住民啓発・普及活動方法を現地の状況及び研修員の技術水準に応用し、以下の事項を実施する。</p> <ul style="list-style-type: none"> ▪ 啓発・普及活動計画の作成 ▪ 住民説明会資料の作成 ▪ 住民説明会の実施 ▪ 個別世帯訪問による契約促進 ▪ 情報・データの収集 ▪ 評価 ▪ C/P との協議 ▪ ガイドラインの作成
地下水管理	1	本邦	<p>本邦の地下水管理技術を現地の状況及び研修員の技術水準に応用し以下の事項を実施する。</p> <ul style="list-style-type: none"> ▪ 研修テキストの作成、研修の実施 ▪ テスト、レポート宿題の作成・評価 ▪ マニュアルの作成 ▪ 各種フォーマットの整備 ▪ セミナーの実施 ▪ データの収集・編集・モデル化 ▪ 評価

7. ソフトコンポーネントの実施工程

(1) 配水データ管理と配水管理

本ソフトコンポーネントでは、新設されるモニタリング設備で測定される配水量及び水圧のデータが必要となるため、施設建設完了後に開始する。対象箇所は計画給水区域の全てではなく、給水管布設工事まで完了した DMA をパイロット地区として設定し研修を実施する。行政区であるワード2、4、5、6、10の5ワードがそれぞれ DMA に設定されており、その内、1ワードをパイロット地区として選定する。パイロット地区以外での配水データ管理と配水管理については MCDC が本支援による成果を活かして、MCDC 自身が実施する。

モニタリング設備の操作については MCDC の担当職員に対してソフトコンポーネント開始前に、機器の取り扱いを日本の納入業者により OJT を通じて訓練される。ソフトコンポーネントで必要人日は以下のとおりである。

実働日数：	34 日	国内準備 5×1 名=5 日、現地 29×1 名=29 日
換算月数：	国内：0.25MM 現地：1.45MM	国内準備期間：0.25MM×1 名=0.25MM (5 日/20=0.25MM) 現地派遣期間：1.45MM×1 名=1.45MM (29 日/20=1.45 MM)

(2) 住民の啓発・普及活動

本ソフトコンポーネントは、詳細設計の現地調査実施時を目安に実施する。住民の給水管接続の意志は本事業の施工開始前に確認し、給水管布設が円滑に実施できるよう調整する必要がある。

住民への啓発・普及活動は 2 回に分ける。第 1 回目の専門家派遣時には啓発・普及活動の準備やその実施への支援が行われ、その後 MCDC に啓発・普及活動が引き継がれ、第 2 回目の派遣時には MCDC が引き継いだ啓発・普及活動のモニタリングを中心に行われる。第 2 回目の派遣のタイミングは第 1 回目の派遣後、1～2 ヶ月程度とする。

給水管布設工事は、工事着工後、水道メータの製作及び調達が完了する 5～6 ヶ月目に開始されると想定している。これは、先の 2 回の専門家派遣及び MCDC への啓発・普及活動引継ぎ後に実施されることから、住民の給水管接続に係る合意・契約を順次進めた上で工事が実施できる工程となっている。住民に対する啓発・普及活動時には、MCDC が水道事業の概要として水道水質の向上、水道料金及び接続料金についての説明を適宜行い、住民の水道事業への理解の向上を図る。

実働日数：	54 日	国内準備 5×1 名=5 日、現地 49×1 名=49 日
換算月数：	国内：0.25MM 現地：2.45MM (1.50+0.95)	国内準備期間：0.25MM×1 名=0.25MM (5 日/20=0.25MM) 現地派遣期間（1 回目）：1.50MM×1 名=1.50MM (30 日/20=1.50MM)

		現地派遣期間（2回目）：0.90MM×1名=0.90MM (19日/20=0.95MM)
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(3) 地下水位モニタリング体制の強化と観測結果の適切な活用

本ソフトコンポーネントは、本事業の井戸工事の完了後に実施する。ソフトコンポーネントで必要人日は以下のとおりである。

実働日数：	23日	国内準備 5×1名=5日、現地 18×1名=18日
換算月数：	国内：0.25MM 現地：0.90MM	国内準備期間：0.25MM×1名=0.25MM (5日/20=0.25MM) 現地派遣期間：0.90MM×1名=0.90MM (18日/20=0.90MM)

ソフトコンポーネントの実施工程計画を次表に示す。

表6 実施計画（〔成果1〕）

活動内容	工事完了後1ヵ月目				工事完了後2ヵ月目			
	第1週	第2週	第3週	第4週	第1週	第2週	第3週	第4週
工事完了後（EN後33ヵ月目）より、配水管理に係るソフトコンポーネントを開始する。								
【成果1】								
国内準備	■	■						
実施準備・導入技術説明会		■	■	■				
1-1. 配水データ管理								
1-1-1. 配水データの分析・活用				■	■	■	■	
1-2. 配水管理								
1-2-1. 配水管理及び無収水管理へのデータの活用					■	■	■	■
総合報告（総合セミナー、報告書作成・提出）							■	■

表7 実施計画（〔成果2〕）

活動内容		詳細設計開始より1ヵ月目				詳細設計開始より2ヵ月目				詳細設計開始より3ヵ月目				詳細設計開始より4ヵ月目				詳細設計開始より5ヵ月目							
		第1週	第2週	第3週	第4週	第1週	第2週	第3週	第4週	第1週	第2週	第3週	第4週	第1週	第2週	第3週	第4週	第1週	第2週	第3週	第4週				
住民啓発・普及活動の推進に係るソフトコンポーネントは詳細設計開始より1ヵ月目から開始する。	詳細設計現地調査					■	■	■	■	■	■	■	■												
【成果2】 住民への啓発・普及活動が促進され、新規接続顧客が確保される																									
国内準備		■	■																						
2-1. 啓発・普及活動促進体制の構築支援																									
2-1-1. 啓発・普及担当職員の選定			■	■																					
2-1-2. 啓発・普及活動計画の策定支援				■	■																				
2-2. 住民説明会の開催（2区対象）																									
2-2-1. 住民説明会の準備・調整業務					■	■	■	■	■																
2-2-2. 住民説明会の開催（プロジェクト対象各区）						■	■	■	■																
2-3. 新規接続の個別契約促進																									
2-3-1. 個別世帯訪問による契約促進											■	■	■												
MCDCによる啓発・普及活動の継続		← 第1回派遣期間				→ MCDCによる啓発・普及活動の継続																			
2-4. 住民への啓発・普及活動のモニタリング																									
2-4-1. 個別契約状況の進捗モニタリングおよびフォローアップ																							■	■	■
総合報告（総合セミナー、報告書作成・提出）																								■	■

表8 実施計画（〔成果3〕）

活動内容		井戸建設工事終了後1ヵ月目			
		第1週	第2週	第3週	第4週
地下水管理に係るソフトコンポーネントは井戸建設工事の終了後より開始する。					
地下水管理	〔成果3〕				
	国内準備	■			
	3-1. 地下水位観測及び観測井についての基礎的な座学		■		
	3-2. 携帯式水位計を用いた水位測定とデータ整理		■		
	3-3. 自記水位計のデータ整理		■		
	3-4. 地下水位変動量の整理と解析		■		
	3-5. 地下水位分布の整理と解析		■		
	3-6. 揚水試験解析と水理公式を用いた地下水位変動予測			■	
	3-7. 揚水量管理方法の検討			■	
	3-8. 地下水位モニタリング・揚水量管理マニュアルの作成				■
総合報告(総合セミナー、報告書作成・提出)					■

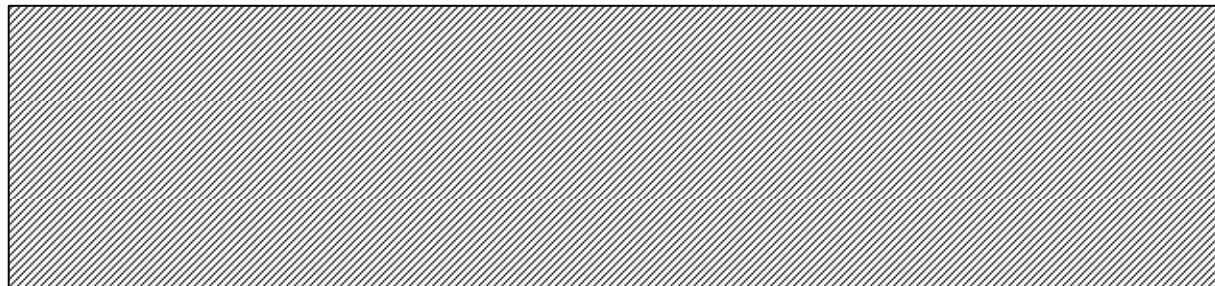
8. ソフトコンポーネントの成果品

ソフトコンポーネントの成果品は、以下のとおりである。

成果品	提出時期
ソフトコンポーネント計画書	開始時
ソフトコンポーネント実施状況報告書	成果1の活動開始時
ソフトコンポーネント完了報告書	完了時
〔成果1〕：配水管理能力の向上 研修資料、入力済み配水データ、配水管理マニュアル	完了時
〔成果2〕：住民への啓発・普及能力の向上 研修資料、啓発・普及活動計画、広報活動資料、住民説明会の参加者名簿、新規接続顧客契約者リスト、啓発・普及活動ガイドライン	完了時
〔成果3〕：地下水管理能力の向上 地下水位モニタリング・揚水量管理マニュアル	完了時

9. ソフトコンポーネントの概算事業費

本ソフトコンポーネントの投入は、本邦コンサルタントの5.55M/Mであり、概算事業費は次表に示すとおりである。別紙に概算事業費の詳細を示す。



10. 相手実施機関の責務

(1) 責務

ソフトコンポーネントに関する MCDC の責務は以下の通りである。

1. MCDC 主導で実施する。
2. 必要な時期にタイムリーに必要な要員（各担当者及び研修受講者）を配置する。
3. 研修員への日当・交通費を支給
4. モニタリング業務（配水管理と地下水管理）を実施する。

(2) 実施可能性

1) 配水データ管理と配水管理

MCDC 水供給衛生局はモニタリング設備を配水管網の維持管理をする上で必要な設備として認識している。この認識は意思決定者である局長（チーフエンジニア）及び配水課長レベルで有しており、本コンポーネントの実施は可能である。さらに今後、主な研修の対象者であり、モニタリング設備の操作担当者として想定されている BPS No.7 の運転維持管理職員、ピジータゴンタウンシップ職員及びワード職員もその認識を持つ必要がある。

2) 住民の啓発・普及活動

MCDC 水供給衛生局が住民への啓発・普及活動の担当者を決定する予定であり、局長（チーフエンジニア）をはじめとする局の上層部がその重要性を十分に認識しているため、実施は可能である。

3) 地下水位モニタリング体制の強化と観測結果の適切な活用

現在の水道事業で利用されている主たる水源は地下水であり、地下水開発に係る MCDC 水供給衛生局の担当者が既に配置されていることから、局長（チーフエンジニア）をはじめとする局の

上層部がその重要性を十分に認識しているため、実施は可能である。さらに今後、本プロジェクトにおいて建設される観測井のモニタリング担当者を配置する必要がある。

(2) 阻害要因及び対策

阻害要因は、研修途上での研修受講者の配置換えや日常業務多忙により、研修参加がおそろかになることが挙げられる。対策として受講者の配置換えは控えるよう要求する。また、これまで遂行してきた日常業務により追加業務の時間を割くことが難しい場合は、研修受講者がモニタリング設備の管理を一括して実施する担当者として任命するよう担当上級職員に提言を行う。

(3) 継続的な取組み

1) 配水データ管理と配水管理

MCDCはソフトコンポーネントの目標を達成するため、取得した内容を踏まえ、モニタリング設備から得られるデータを用い、毎月、配水管理報告書を意思決定者に提出する必要がある。

2) 住民の啓発・普及活動

MCDC水供給衛生局はソフトコンポーネントの目標を達成するため、構築された活動体制が機能するよう監督するとともに、タウンシップ事務所と協力して、啓発・普及活動を継続的に実施していくことが必要となる。

3) 地下水位モニタリング体制の強化と観測結果の適切な活用

MCDCはソフトコンポーネントの目標を達成するため、取得した内容を踏まえ、モニタリング活動から得られるデータを用い、毎月、地下水管理報告書を意思決定者に提出する必要がある。

別添




資料 6. 参考資料

6-1. テクニカルノート

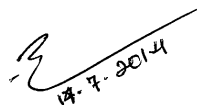
TECHNICAL NOTES
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR URGENT IMPROVEMENT OF WATER SUPPLY SYSTEM
IN MANDALAY CITY
IN THE REPUBLIC OF THE UNION OF MYANMAR

Based on the Minutes of Discussions (hereinafter referred to as "M/D") on the Preparatory Survey on the Project for Urgent Improvement of Water Supply System for Mandalay City (hereinafter referred to as "the Project") signed on 2nd May, 2014 between the Preparatory Survey Team (hereinafter referred to as "the Team") of Japan International Cooperation Agency (hereinafter referred to as "JICA") and Mandalay City Development Committee (hereinafter referred to as "MCDC"), of the Government of the Republic of Union of Myanmar, the consultant members of the Team had a series of discussions and conducted field surveys from 3rd May to 26th June, 2014. As a result of the discussions and the surveys, both sides confirmed the technical conditions described as per Attachments.

Mandalay, 14th July, 2014



OKAGA Toshifumi
Chief Consultant,
JICA Preparatory Survey Team
Project for Urgent Improvement of Water
Supply System for Mandalay City



U Tint Lwin
Head of Department,
Water and Sanitation Department
Mandalay City Development Committee
The Government of the Republic of
Union of Myanmar

ATTACHMENT 1
(Water Supply Plan)

MCDC and JICA Study Team confirmed the following technical issues on May 17, 2014:

MCDC: U Tint Lwin (Head of Department, Water and Sanitation
JICA Survey Team: Toshifumi OKAGA (for Water Supply Plan)

Jint Lwin
17.5.2014

U Tint Lwin

1. Service Area of Water Supply System in Pyi Gyi Tagon Township

The water supply candidate service areas are proposed 5 alternatives drawings based on the priority wards recommended by MCDC. Finally, it is determined depend upon the project cost of Japanese grant aid.

2. Population and Growth Rate of Pyi Gyi Tagon Township

The population (from year 2008 to 2011) of the Township over which MCDC has jurisdiction is based on the population data year 2012 (by General Administration Department of Mandalay Region) used by Water and Sanitation Dept. (WSD) with reference to the result of the follow-up study implemented by JICA year 2012. Accordingly the population year 2020 and 2025 is forecasted based on the said population data.

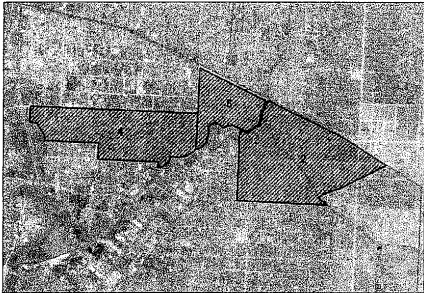
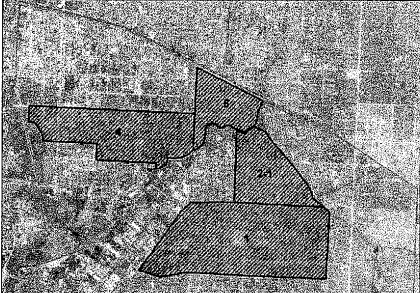
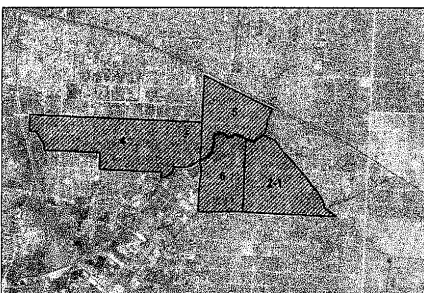
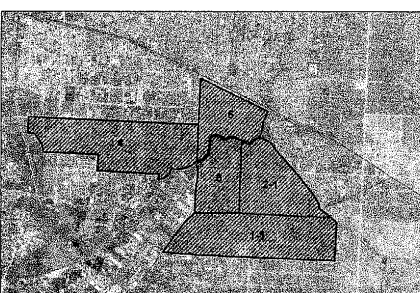
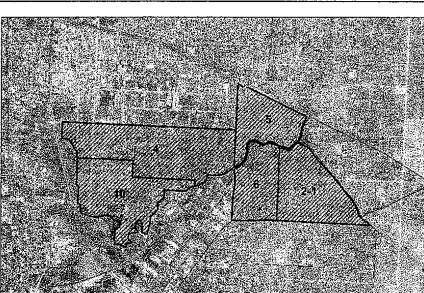
The detailed population data in Pyi Gyi Tagon is based on Planning for Water Supply in Pyi Gyi Tagon issued by WSD in April 2014. However, the total population is revised in order to accord data of General Administration Department.

The annual population growth rate is taken as 1.5 %. The Concept Plan Version 2040 by Department of Human Settlement and Housing Development (DHSHD) written in the Inception Report for Urban Services Improvement Project (2014) implemented by ADB assumes an annual average growth rate between 1.01 and 2.1% for 30 years commencing from 2011. This medium percentage is about 1.5 %. Meanwhile, according to the Statistic Year Book 2011, the annual population growth rate from year 2010 to 2011 is 1.1 %. Accordingly the annual population growth rate of 1.5 % is deemed to be adequate. Based on this growth rate, the population of each township is calculated.

Pyi Gyi Tagon is planned as total population of 154,741 year 2012 and annual

population growth rate of 1.5 %. But the population in a part of the ward (Sa, Thin Pan Kone) where water supply is conducted by ADB or MCDC is excluded from the plan. Based on these conditions, the population of each word and service areas are calculated and shown in the table below.

Alternative Water Supply Target Areas

CASE I	CASE II
	
CASE III	CASE IV
	
CASE V	
	

Note: ward1: Sa Lone, ward 2: Thin Pan Kone, ward 4: Ga, ward 5: Ghagyi, ward6: Nga

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Case I Population served

No.	Ward	Area (km2)	Population in 2012					Projected Population Served in 2012	Projected Population Served in 2020	Projected Population Served in 2025
			No. of Block	No. of House Hold	Population	Existing Population Served	Rate of Project service area			
1	Sa Lone	2.36	59	3,150	19,734	4,200				
2	Thin Pan Kone	2.87	78	4,480	25,399	250	100%	25,149	28,330	30,520
3	Ka	0.86	23	816	4,406	704	16%	3,702		
4	Ga	0.88	23	1,082	5,571		100%	5,571	6,276	6,761
5	Ghagyi	0.42	18	2,037	11,879		100%	11,879	13,382	14,416
6	Nga	0.56	11	622	3,343	2700	81%	643		
7	Sa Lain	1.08	83	2,921	14,923	704	5%	14,219		
8	Za	0.60	45	1,595	7,976					
9	Zha	10.18	422	2,120	10,651					
10	Ngwe Taw Kyi Kone	2.52	31	2,123	12,339					
11	Chan Mya Thar Yar	1.61	11	1,688	8,248					
12	Kha	0.10	24	994	5,010					
13	Tagon Tai	3.40	12	2,936	15,418					
14	Htain Kone	0.96	3	890	4,158					
15	Taung Myint	1.40	10	781	3,602					
16	Yar Taw	0.52	4	479	2,085					
	Total	30.31	857	28,714	154,741			42,599	47,987	51,696
					1.056			27.5%		

Case II Population served

No.	Ward	Area (km2)	Population in 2012					Projected Population Served in 2012	Projected Population Served in 2020	Projected Population Served in 2025
			No. of Block	No. of House Hold	Population	Existing Population Served	Rate of Project service area			
1	Sa Lone	2.36	59	3,150	19,734	4,200	95%	14,547	16,388	17,654
2	Thin Pan Kone	2.87	78	4,480	25,399	250	52%	16,259	18,316	19,732
3	Ka	0.86	23	816	4,406	704	16%	3,702		
4	Ga	0.88	23	1,082	5,571		100%	5,571	6,276	6,761
5	Ghagyi	0.42	18	2,037	11,879		100%	11,879	13,382	14,416
6	Nga	0.56	11	622	3,343	2700	81%	643		
7	Sa Lain	1.08	83	2,921	14,923	704	5%	14,219		
8	Za	0.60	45	1,595	7,976					
9	Zha	10.18	422	2,120	10,651					
10	Ngwe Taw Kyi Kone	2.52	31	2,123	12,339					
11	Chan Mya Thar Yar	1.61	11	1,688	8,248					
12	Kha	0.10	24	994	5,010					
13	Tagon Tai	3.40	12	2,936	15,418					
14	Htain Kone	0.96	3	890	4,158					
15	Taung Myint	1.40	10	781	3,602					
16	Yar Taw	0.52	4	479	2,085					
	Total	30.31	857	28,714	154,741			48,257	54,361	58,562
					1.056			31.2%		

Case III Population served

No.	Ward	Area (km2)	Population in 2012					Projected Population Served in 2020	Projected Population Served in 2025	
			No. of Block	No. of House Hold	Population	Existing Population Served	Rate of Project service area			Population Served in 2012
1	Sa Lone	2.36	59	3,150	19,734	4,200				
2	Thin Pan Kone	2.87	78	4,480	25,399	250	52%	16,259	18,316	19,732
3	Ka	0.86	23	816	4,406	704	16%	3,702		
4	Ga	0.88	23	1,082	5,571		100%	5,571	6,276	6,761
5	Ghagyi	0.42	18	2,037	11,879		100%	11,879	13,382	14,416
6	Nga	0.56	11	622	3,343		100%	3,343	3,765	4,056
7	Sa Lain	1.08	83	2,921	14,923	2700	18%	12,223		
8	Za	0.60	45	1,595	7,976	704	9%	7,272		
9	Zha	10.18	422	2,120	10,651					
10	Ngwe Taw Kyi Kone	2.52	31	2,123	12,339					
11	Chan Mya Thar Yar	1.61	11	1,688	8,248					
12	Kha	0.10	24	994	5,010					
13	Tagon Tai	3.40	12	2,936	15,418					
14	Htain Kone	0.96	3	890	4,158					
15	Taung Myint	1.40	10	781	3,602					
16	Yar Taw	0.52	4	479	2,085					
	Total	30.31	857	28,714	154,741			37,052	37,973	40,908
					1,056			23.9%		

Case IV Population served

No.	Ward	Area (km2)	Population in 2012					Projected Population Served in 2020	Projected Population Served in 2025	
			No. of Block	No. of House Hold	Population	Existing Population Served	Rate of Project service area			Population Served in 2012
1	Sa lone	2.36	59	3,150	19,734	2,800	70%	11,014	12,407	13,366
2	Thin Pan Kone	2.87	78	4,480	25,399	250	52%	12,958	14,597	15,725
3	Ka	0.86	23	816	4,406	704	16%	3,702		
4	Ga	0.88	23	1,082	5,571		100%	5,571	6,276	6,761
5	Ghagyi	0.42	18	2,037	11,879		100%	11,879	13,382	14,416
6	Nga	0.56	11	622	3,343		100%	3,343	3,765	4,056
7	Sa Lain	1.08	83	2,921	14,923	2700	18%	12,223		
8	Za	0.60	45	1,595	7,976	704	9%	7,272		
9	Zha	10.18	422	2,120	10,651					
10	Ngwe Taw Kyi Kone	2.52	31	2,123	12,339					
11	Chan Mya Thar Yar	1.61	11	1,688	8,248					
12	Kha	0.10	24	994	5,010					
13	Tagon Tai	3.40	12	2,936	15,418					
14	Htain Kone	0.96	3	890	4,158					
15	Taung Myint	1.40	10	781	3,602					
16	Yar Taw	0.52	4	479	2,085					
	Total	30.31	857	28,714	154,741			44,764	50,426	54,323
					1,056			28.9%		

Case V Population served

No.	Ward	Area (km2)	Population in 2012						Projected Population Served in 2020	Projected Population Served in 2025
			No. of Block	No. of House Hold	Population	Existing Population Served	Rate of Project service area	Projected Population Served in 2012		
1	Sa lone	2.36	59	3,150	19,734	2,800	14%	0	0	0
2	Thin Pan Kone	2.87	78	4,480	25,399	250	52%	12,958	14,597	15,725
3	Ka	0.86	23	816	4,406	704	16%	3,702		
4	Ga	0.88	23	1,082	5,571	0	100%	5,571	6,276	6,761
5	Ghagyi	0.42	18	2,037	11,879	0	100%	11,879	13,382	14,416
6	Nga	0.56	11	622	3,343	0	100%	3,343	3,765	4,056
7	Sa Lain	1.08	83	2,921	14,923		0	0	0	0
8	Za	0.60	45	1,595	7,976		0	0	0	0
9	Zha	10.18	422	2,120	10,651		0	0	0	0
10	Ngwe Taw Kyi Kone	2.52	31	2,123	12,339	0	100%	12,339	13,900	14,975
11	Chan Mya Thar Yar	1.61	11	1,688	8,248	2700	33%	5,548	0	0
12	Kha	0.10	24	994	5,010	704	14%	4,306	0	0
13	Tagon Tai	3.40	12	2,936	15,418		0	0	0	0
14	Htain Kone	0.96	3	890	4,158		0	0	0	0
15	Taung Myint	1.40	10	781	3,602		0	0	0	0
16	Yar Taw	0.52	4	479	2,085		0	0	0	0
	Total	30.31	857	28,714	154,741	7,158	4.6%	46,089	51,919	55,932
					1,056			29.8%		

3. Unit Water Demand (L/c/d)

The unit water demand is shown in the below table.

	Descriptions	Unit	Notes
1.	Domestic water use	130 L/c/d	WSD
2.	Non domestic water	10% of domestic use	Site investigation
3.	Leakage water	10% of total distribution	Design criteria
4.	Factor of daily maximum	1.1	Same as YCDC
5.	Factor of hourly maximum	1.5	Same as YCDC

4. Water flow capacity calculation

Based on above design criteria, flow capacity of each case (service area) is calculated as follow,

Case I

Unit Water Demand and Design Criteria				Water Flow Capacity		
No.	Description	Unit	Notes	Year 2020	Year 2025	
No.	Unit water demand	L/c/d	Note	47,987	51,696	Population
1	Domestic use	130	DWS data	6,238	6,720	m3/d
2	Nondomestic use	13	Domestic use x 10%	624	672	m3/d
3	Leakage	16	10%, $(130+13) \times (1/(1-0.1)-1)$	695	821	m3/d
	total	159		7,557	8,214	m3/d
4	Factor of Daily maximum	1.1		8,312	9,035	m3/d
5	Factor of hourly maximum	1.5		520	565	m3/h

CaseII

Unit Water Demand and Design Criteria				Water Flow Capacity		
No.	Description	Unit	Notes	Year 2020	Year 2025	
	Unit water demand	L/c/d	Note	54,361	58,562	Population
1	Domestic use	130	DWS data	7,067	8,336	m3/d
2	Nondomestic use	13	Domestic use x 10%	707	834	m3/d
3	Leakage	16	10%, $(130+13) \times (1/(1-0.1)-1)$	864	1,019	m3/d
	total	159		8,637	10,189	m3/d
4	Daily maximum (m3/d)	1.1		9,501	11,207	m3/d
5	Hourly maximum (m3/h)	1.5		594	700	m3/h

CaseIII

Design Criteria				Water Flow Capacity		
No.	Description	Unit	Notes	Year 2020	Year 2025	
	Unit water demand	L/c/d	Note	37,973	40,908	Population
1	Domestic use	130	DWS data	4,937	5,318	m3/d
2	Nondomestic use	13	Domestic use x 10%	494	532	m3/d
3	Leakage	16	10%, $(130+13) \times (1/(1-0.1)-1)$	603	650	m3/d
	total	159		6,034	6,500	m3/d
4	Daily maximum (m3/d)	1.1		6,637	7,150	m3/d
5	Hourly maximum (m3/h)	1.5		415	447	m3/h

CaseIV

Unit Water Demand and Design Criteria				Water Flow Capacity		
No.	Description	Unit	Notes	Year 2020	Year 2025	
	Unit water demand	L/c/d	Note	50,426	54,323	Population
1	Domestic use	130	DWS data	6,555	7,062	m3/d
2	Nondomestic use	13	Domestic use x 10%	656	706	m3/d
3	Leakage	16	10%, $(130+13) \times (1/(1-0.1)-1)$	801	863	m3/d
	total	15.9		8,012	8,631	m3/d
4	Daily maximum (m3/d)	1.1		8,813	9,494	m3/d
5	Hourly maximum (m3/h)	1.5		551	593	m3/h

Case V

Unit Water Demand and Design Criteria				Water Flow Capacity		
No.	Description	Unit	Notes	Year 2020	Year 2025	
	Unit water demand	L/c/d	Note	51,919	55,932	Population
1	Domestic use	130	DWS data	6,750	7,271	m3/d
2	Nondomestic use	13	Domestic use x 10%	675	727	m3/d
3	Leakage	15.9	10%, $(130+13) \times (1/(1-0.1)-1)$	825	889	m3/d
	total	159		8,249	8,887	m3/d
4	Daily maximum (m3/d)	1.1		9,074	9,776	m3/d
5	Hourly maximum (m3/h)	1.5		567	611	m3/h

ATTACHMENT 2
(Undertakings of Service Pipe and Water Meter)

MCDC and JICA Study Team confirmed the following technical issues on May 29, 2014:

MCDC: U Tint Lwin (Head of Department, Water and Sanitation)
JICA Study Team: Atsuo Ohno (for Operation and Maintenance)

Ohno
29.5.2014
大野敦生

1. Options for Undertakings of Service Pipe and Water Meter by the Project

It is confirmed that the following two options are considered as the possible options.

From the standpoint of the project effectiveness and the soundness for the poor, Option 1 could be better.

MCDC expresses their preference on Option ① rather than Option ②.

It is finally determined depending upon further consideration.

Option	Service pipe		Water meter		Connection Fee
	Procurement	Installation Works	Procurement	Installation Works	
①	J	J	J	J	Official permission
②	J	M	J	M	Official permission Labor work costs

J --- Japanese Side, M --- Myanmar Side

2. Connection Fee

The burden of connection fee of Option ① could be cheaper than that of Option ② for new customer. While, the exemption of the full charge of new connection fee is also possible as necessary, according to MCDC.

In case of ②, it is confirmed that it is necessary to consider subsidy for new customer's connection fee, especially for the poor household. The reduction of the connection fee could be one of the options

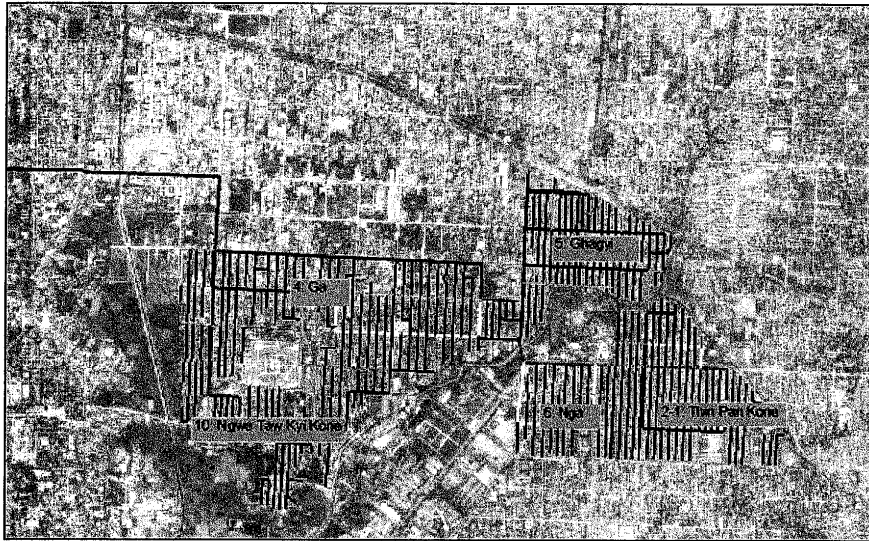
3. Identification of the Poor

It is difficult to identify the poor household because there is no complete statistics for all household income.

In case of subsidy provision for connection fee, MCDC proposed that all supply areas by the Project should be targeted, because all wards are relatively poor

areas. Also, if only some wards are selected for subsidy provision, severe customer complaints could be occurred according to MCDC.

Water Supply Target Areas



Note: ward1: Sa Lone, ward 2: Thin Pan Kone, ward 4: Ga, ward 5: Ghagyi, ward6: Nga, ward 10: Ngwe Taw Kyi Kone

ATTACHMENT 3
(Water Supply Facility)

MCDC and JICA Study Team confirmed the following technical issues on June 12, 2014:

MCDC: U Tint Lwin (Head of Department, Water and Sanitation)

JICA Survey Team: Masashi KAWAMURA (Water Supply Facility)

 2014. 6. 12
河村正

1. Target water supply area

MCDC and JICA Survey Team confirmed that the target water supply area was CASE V in which ward 4, 5, 6, 10 and western side of ward 2 are included. The water supply in ward 3, 11, 12 and eastern side of ward 2 will be considered by using existing pipeline and MCDC's own budget. On the other hand, the water supply in southern area of Pyi Gyi Tagon Township other than the target water supply area in the Project will be considered, when the future Project for new water supply system using surface water is implemented by using other fund.

2. Exclusion of the existing water supply area

According to the result of field survey and discussion with MCDC, we confirmed that there is the existing water supply system which has pipe network and house connections. Therefore, the water supply area for the existing water supply system is excluded from the target water supply area of the Grant Aid Project. The followings are the detail of the existing water supply system.

Items	Detail
Name of system	MCDC 7976
Location	Between Min Ye Kyaw Swar Rd. and Bo Ba Htoo Rd. From 58 th St., 6 streets to east direction
Facility	Deep well, elevated tank with capacity of 450 m ³ , pipe network
Population served	250 persons

3. Pipe material

Pipe materials for the proposed pipelines are defined as below.

Transmission pipeline (From wells to service reservoir): Ductile iron pipe

Distribution pipeline:

More than 200mm: Ductile iron pipe



100mm and 150mm: PVC (Polyvinyl chloride pipe)
Less than 50mm: PE (Polyethylene pipe)

4. Gate Valve, Air Valve and Fire Hydrant

In the proposed distribution pipeline, gate valves, air valves and fire hydrants will be installed. The each location of gate valves and air valves will be selected based on pipe layout and topographic condition. In order to carry out firefighting appropriately, the locations of fire hydrants will be selected.

5. Pipe laying method

In the proposed pipeline, there are railway and national road; namely "Mandalay-Yangon road". When the proposed pipeline crosses railway and national road, following methods are applied.

- Railway: Pipe jacking method
- National road (Mandalay-Yangon road): Open cut (night work)

6. Water pressure in the end of the distribution pipeline

In the proposed water supply system, we confirm that we secure enough water pressure to supply treated water to the individual house with enough water pressure. The residual water pressure is set as mentioned below.

- Minimum dynamic water pressure: more than 0.15 Mpa

7. Distribution system

In principle, distribution system from the reservoir to service area is recommended by gravity flow. However, the gravity flow system is not possible to adopt due to topographic conditions in Pyi Gyi Tagon Township and the booster pump system is applied.

8. Capacity of the proposed service reservoir

The distribution reservoir has the function of regulating the fluctuation in daily consumption especially hourly maximum water demand. According to the water consumption pattern in Figure 1, the consumption during day time is high compared to night time. Therefore, the reservoir tank charges water in the night time in order to prepare for peak consumption. The storage water in the reservoir can be equal to demand in the peak consumption time. The capacity needs to have storage for 6 hours of daily maximum water.

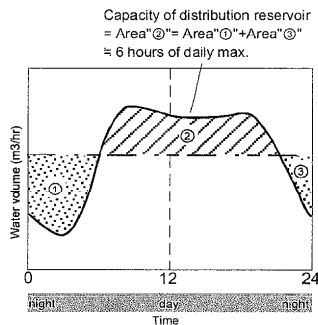


Figure 1 Pattern of Daily Water Consumption

It also facilitates the water supply for certain duration in case of emergency such as occurrence of facilities failure or in case of suspension of intake facilities due to some unavoidable reasons.

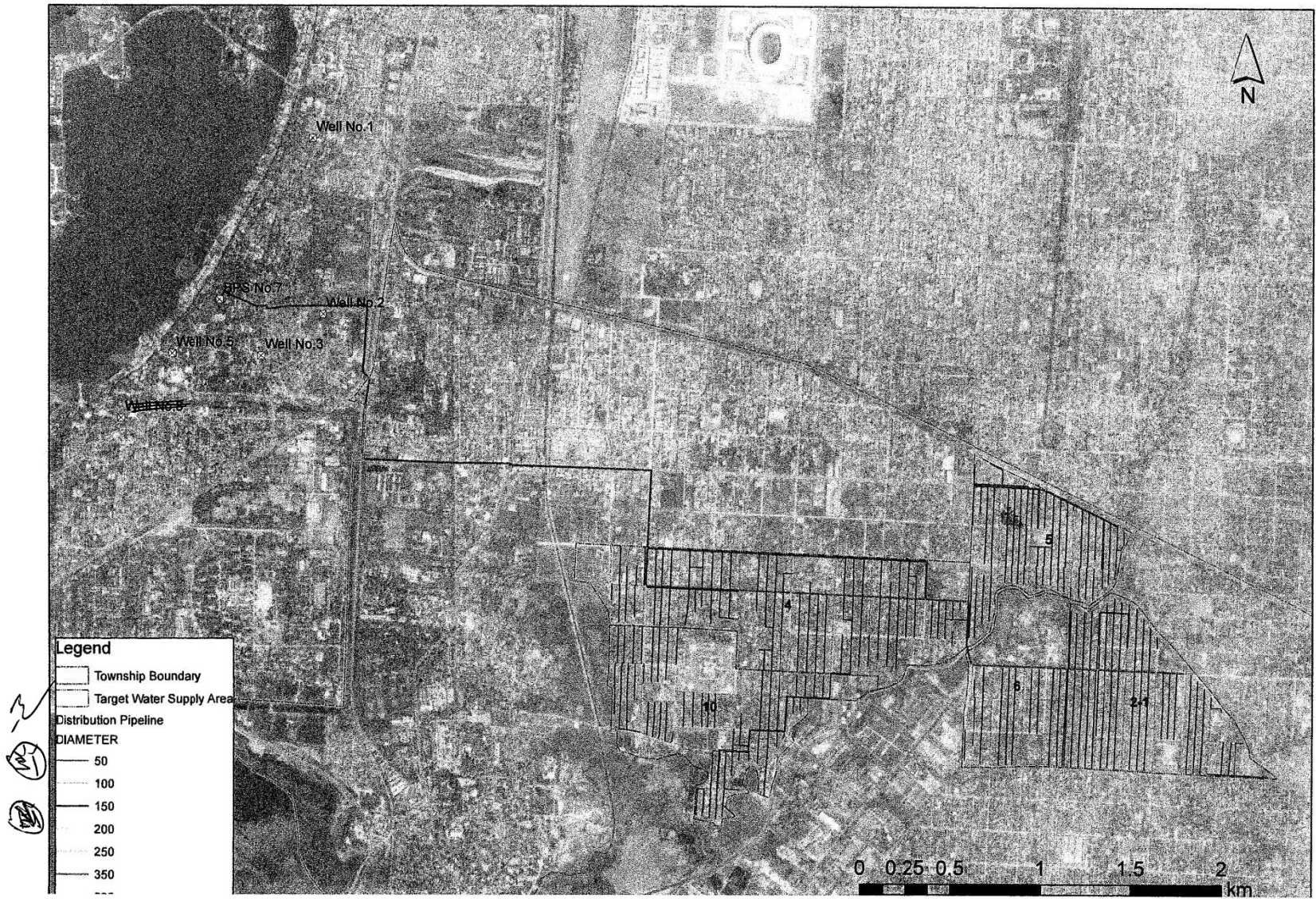
Therefore, it is better to have some allowance in the capacity. Taking this into consideration, the retention time or capacity of each reservoir is to have storage for 8 hours of daily maximum water in the design.

9. Setting of DMA (District Metering System)

The whole distribution network in the target area in Pyi Gyi Tagon Township is divided into the DMAs from the viewpoint of administrative district boundaries, topography and geography. According to the result of population forecast in 2020, the range of population in 5 wards is from approx. 4,000 to 15,000. If it is converted to number of house connections, it will be from approx. 700 to 2,700. As for a scale of DMA, according to Non-Revenue Water Control in World Bank Project or other similar Project, about 2,000 house connections per DMA are recommended. Therefore, it results 5 DMAs in the target water supply area in Pyi Gyi Tagon Township.

10. Monitoring System

In order to understand Non-Revenue water and secure the safety water, water flow, water pressure and residual chlorine shall be monitored in each DMA. In the Project, water flow meters, pressure transmitters and residual chlorine gauges are installed in the inlet of each DMA, and the central monitoring station monitors residual chlorine, pressure and flow data.



ATTACHMENT 4
(Disinfection Facilities)

MCDC and JICA Study Team confirmed the following technical issues on June 13th, 2014;

MCDC: U Tint Lwin (Head of Department, Water and Sanitation)

JICA Survey Team: Norio TANAKA (Disinfection Facility)

15.6.2014
田中規夫

1. Selection of Chlorine Disinfectant

There are eleven main distribution facilities, i.e. service reservoirs, water treatment plants and elevated tanks, which require installation of disinfection facilities, in Mandalay City. Disinfection facility has been installed in the site of No.8 WTP and will be installed in the site of No.4 WTP under technical cooperation of Japan. Electrochlorination system, which produces sodium hypochlorite on the site, is adapted for these facilities. Therefore, the same system is selected for this Project owing to the advantages in unifying chlorine disinfectant for procurement of chemical, operation and maintenance.

2. Targeted Existing Facilities

Nine exiting distribution facilities except for No.4 WTP and No.8 WTP are targeted in this Project. Targeted existing facilities are as below.

- No.1 Pump Station & Service Reservoir
- No.2 Pump Station & Service Reservoir
- No.3 Pump Station & Service Reservoir
- No.5 Pump Station & Service Reservoir
- No.6 Pump Station & Service Reservoir
- No.7 Pump Station & Service Reservoir
- Mandalay Hill Service Reservoir (*1)
- No.1 Elevated Tank
- No.2 Elevated Tank

*1: Mandalay hill service reservoir receives water from two resources. One is groundwater from No. 28, No. 29 and No. 33 wells and the other is treated water from No.8 WTP. Treated water from No.8 WTP will be disinfected in No.8 WTP. Hence, groundwater from the wells is targeted in this Project. Disinfection facility will be installed in the site of No. 28 well in order to make possible to operate disinfection facility with the wells.

3. Centralized System

It results in increases of workload for operation and maintenance of the facilities to install electrochlorination system at every site of nine main distribution facilities, at the same time that it increases initial investment and operating cost. Therefore, the concept of centralized production of sodium hypochlorite by choosing key stations from nine main distribution facilities is adapted. In this concept, the other main distribution facilities are planned to use sodium hypochlorite transported from these key stations. No.1 Pump Station & Service Reservoir and No.7 Pump Station & Service Reservoir are selected as the key stations.

4. Targeted Residual Chlorine

Water quality standard for water supply in Myanmar does not regulate minimum requirement on residual chlorine. WHO guideline recommends securing not less than 0.5 mg/l of free residual chlorine after chlorination. Hence, targeted residual chlorine of distribution water is set not less than 0.5mg/l at the outlet of distribution facilities.

5. Chlorine Injection Rate

Chlorine demand of water distributed by each targeted existing facility has been estimated from experimental trial in order to set chlorine injection rates. Chlorine demand of water is not more than 0.5mg/l (results: 0.2-0.4mg/l). Targeted residual chlorine is set not less than 0.5mg/l at the outlet of distribution facilities. Hence, chlorine injection rate is set for the design purpose as shown below.

Average Chlorine Injection Rate	Maximum Chlorine Injection Rate
1.0 - 1.5 mg/l	2.0 mg/l



Average chlorine injection rate should be optimized monitoring free residual chlorine at the end of distribution networks. Maximum chlorine injection rate is set 2.0mg/l considering the margin and seasonal fluctuation of water quality. Furthermore, production equipment is planned to have 120% of required capacity for maximum chlorine injection rate considering safety factor.

6. Facilities Planning

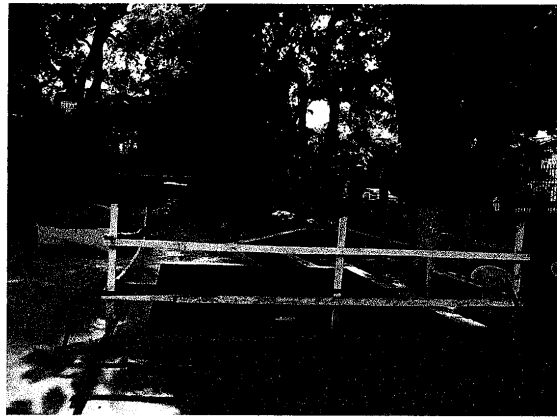
Chlorination facilities are installed at the location shown below in the site of the targeted existing distribution facilities.

6.1 No.1 Pump Station & Service Reservoir

Production and injection equipment of sodium hypochlorite will be installed at the existing rooms of No.1 Pump Station shown below. Underground tanks for making saturated salt solution will be constructed at the space shown below.

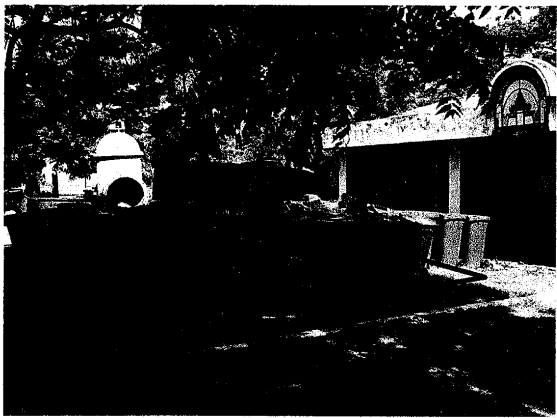
	<p>Existing room: 10.7*11.2m Production equipment of sodium hypochlorite</p>
	<p>Existing room: 7.4*11.2m Injection equipment of sodium hypochlorite (tanks and pumps) (including repair works of existing basement)</p>



	<p>Underground tank size: approx. 3m x 9m</p> <p>Salt storage tank</p> <p>Salt dissolution tank</p> <p>Saturated salt solution pumps (including removal of existing concrete structure)</p>
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6.2 No.2 Pump Station & Service Reservoir

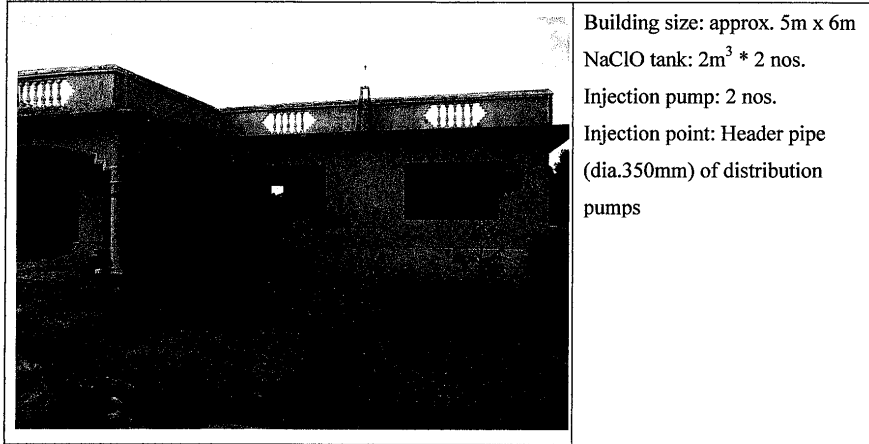
The building for injection equipment of sodium hypochlorite will be constructed at the space shown below.

	<p>Building size: approx. 6m x 7m</p> <p>NaClO tank: 6m³ * 2 nos.</p> <p>Injection pump: 2 nos.</p> <p>Injection point: Header pipe (dia.400mm) of distribution pumps</p>
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6.3 No.3 Pump Station & Service Reservoir

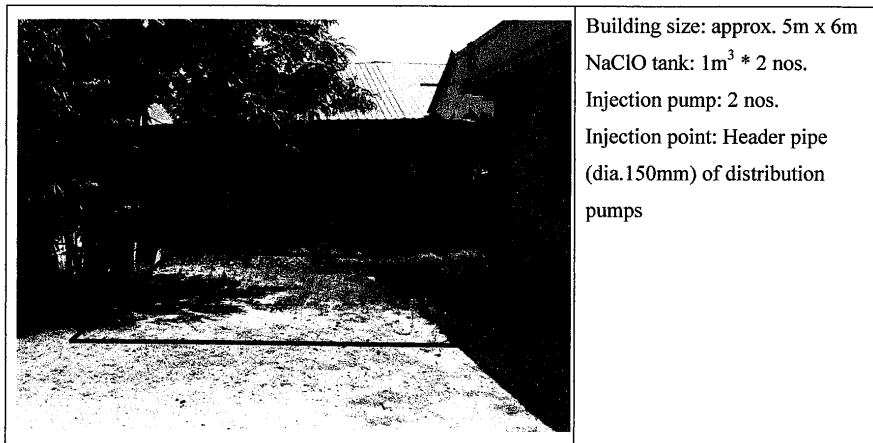
The building for injection equipment of sodium hypochlorite will be constructed at the space shown below.

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6.4 No.5 Pump Station & Service Reservoir

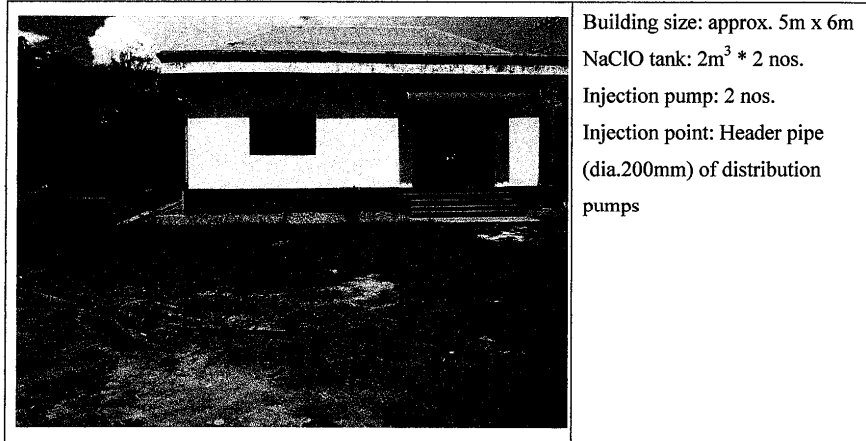
The building for injection equipment of sodium hypochlorite will be constructed at the space shown below.



6.5 No.6 Pump Station & Service Reservoir

The building for injection equipment of sodium hypochlorite will be constructed at the space shown below.



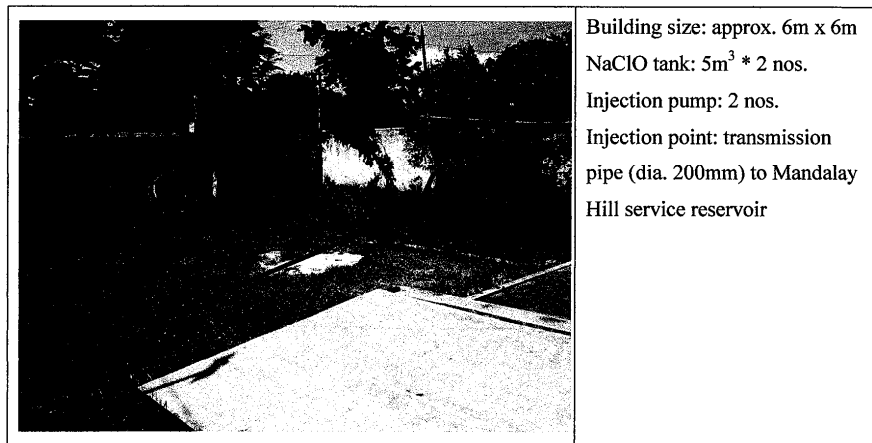


6.6 No.7 Pump Station & Service Reservoir

Disinfection facility including production and injection equipment of sodium hypochlorite will be installed in the same building planned for new distribution pumps. The existing system will be injected from new building. Also, production equipment will produce sodium hypochlorite for No.2, No.3, No.5, No.6 Pump Station & Service Reservoir, No.28 Well and No.1, No.2 Elevated Tank.

6.7 No. 28 Well

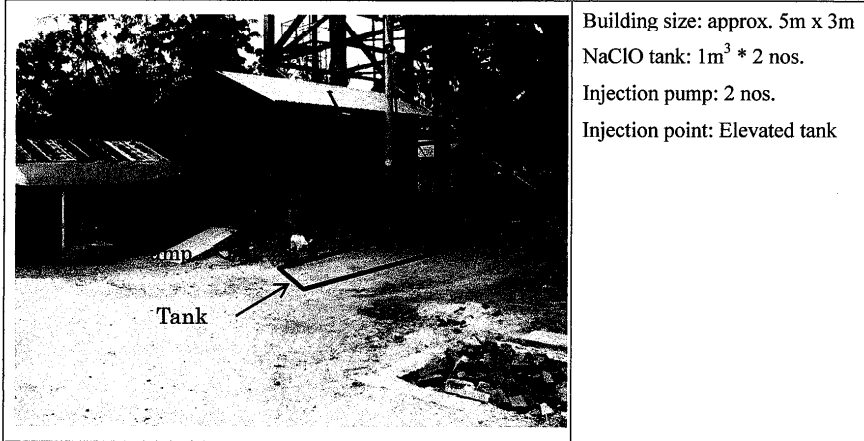
The building for injection equipment of sodium hypochlorite will be constructed at the space shown below.



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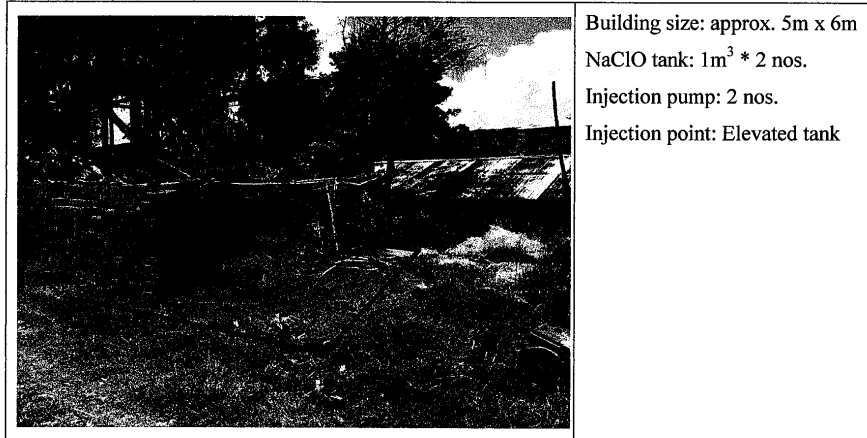
6.8 No.1 Elevated Tank

Injection equipment will be installed at the space shown below. Injection pump will be installed in the existing small house. Tanks will be installed in new building.



6.9 No.2 Elevated Tank

The building for injection equipment of sodium hypochlorite will be constructed at the space shown below.



7. Transportation of Sodium Hypochlorite



Sodium hypochlorite which is produced at the key stations is transferred to the other main distribution facilities. Tanks will be procured in this Project. You are kindly requested to arrange trucks to carry these tanks filled with sodium hypochlorite.

8. Commissioning and Trainings

The following commissioning and OJT trainings will be implemented by the Contractor.

- Inspection on quality of equipment and installation
- Trail operation
- Preparation of operating and maintenance manual
- Trainings on operation and maintenance of equipment
- Trainings on trouble shooting

9. Spare Parts

Adequate amount of spare parts for electrochlorination system is included in the Contract to secure sustainability of operation.



ATTACHMENT 5
(Groundwater Development)

MCDC and JICA Study Team confirmed the following technical issues on June 20, 2014;

MCDC: U Tint Iwin (Head of Department, Water and Sanitation

JICA Study Team: Mitsuyoshi SAITO (for Groundwater Development)

U Tint Iwin
19.6.2014
Mitsuyoshi SAITO

1. Quantity of new well

The planned daily maximum water supply is estimated approximately 9,000 m³/day in the water supply target area, and then total quantity of new wells are three in consideration of the pumping capacity, 3,000 m³/day for each well. However, in the case if the capacity is less than 3,000 m³/day, quantity of well should be increased. Though it was planned 5 new wells of 12 inch diameter in the initial plan, the new wells should be planned to acquire the pumping capacity of approximately 9,000 m³/day in the detailed design plan.

2. Location of new well site

The locations of 5 candidates' well sites are shown in figure 1. They are No.1, No.2, No.3, No.5 and No.9. Final well sites should be selected from them in consideration of the pumping capacity which will be obtained by pumping test at test well, well interference, land-use approval, etc.

3. Land-use approval of new well site

The location, land owner, and land administrator of 5 candidates' well sites are shown in the table 1. MCDC should be gotten participator's approval for 5 well sites by October, and the evidence of them should be acquired before the beginning of detailed design plan.

4. Well structure

Basically well structure should be referenced the Test Well's structure is shown in figure 2 and final structure should be decided by the geological section and geophysical logging data of each well.

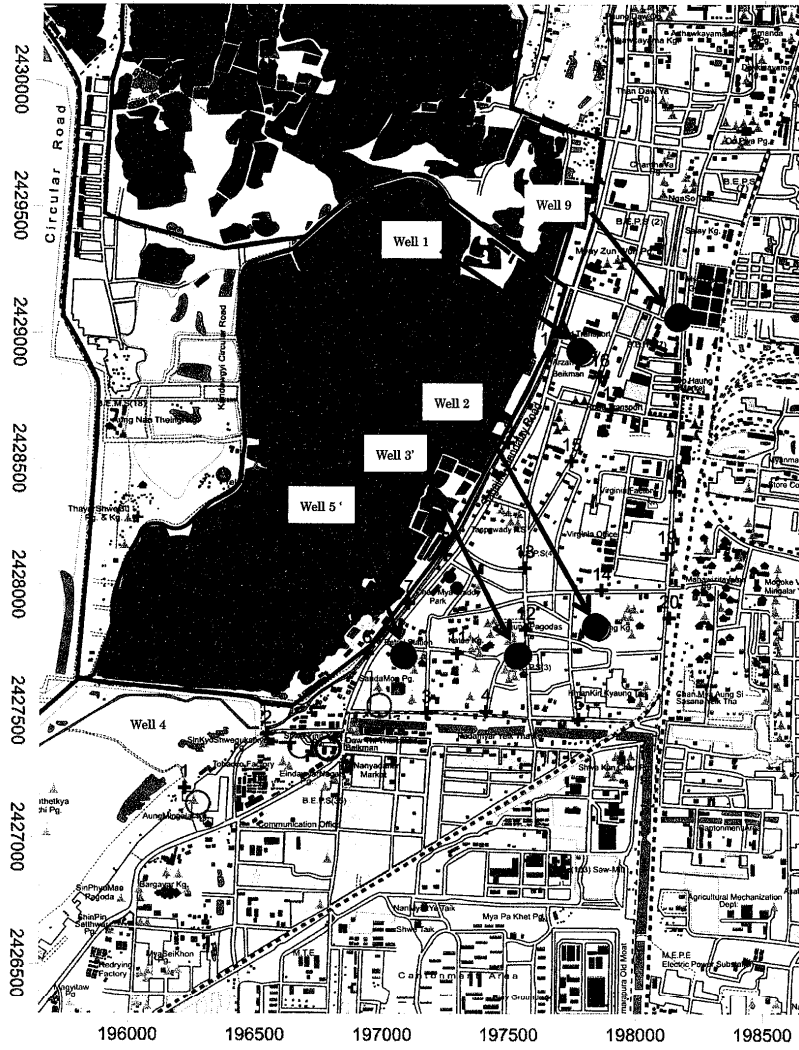


Figure 1 Well location map

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Table 1 Candidate Well Sites Information

Well No.	Location	Landowner	Administrator	Approval	Evidence
1	Next to Martyr memorial	Dept. of Play Ground and Garden, MCDC	Dept. of Play Ground and Garden, MCDC	Approved	None
2	Play ground Next to transformer station	Dept. of Play Ground and Garden?, MCDC	Dept. of Play Ground and Garden?, MCDC	Applied to dept. of City Planning and Land Administration, MCDC	None
3'	In front of Yinn Taw, Su Taung Pyae Pagoda & Aung Myay Bon San Ka Toe Kyaung, side by KOICA well	Pagoda and Monastery ?	Dept. of City Planning and Land Administration ?, MCDC	Applied to dept. of City Planning and Land Administration, MCDC	None
5'	Behind New day gas station, near Sanda Mon Pagoda	Sanda Mon Monastery	Dept. of City Planning and Land Administration, MCDC	Applied to dept. of City Planning and Land Administration, MCDC	None
9	Park in front of BEHS(7)	Dept. of Play Ground and Garden, MCDC	Dept. of Play Ground and Garden, MCDC	Send the letter to Committee from DWS and waiting the replay	None

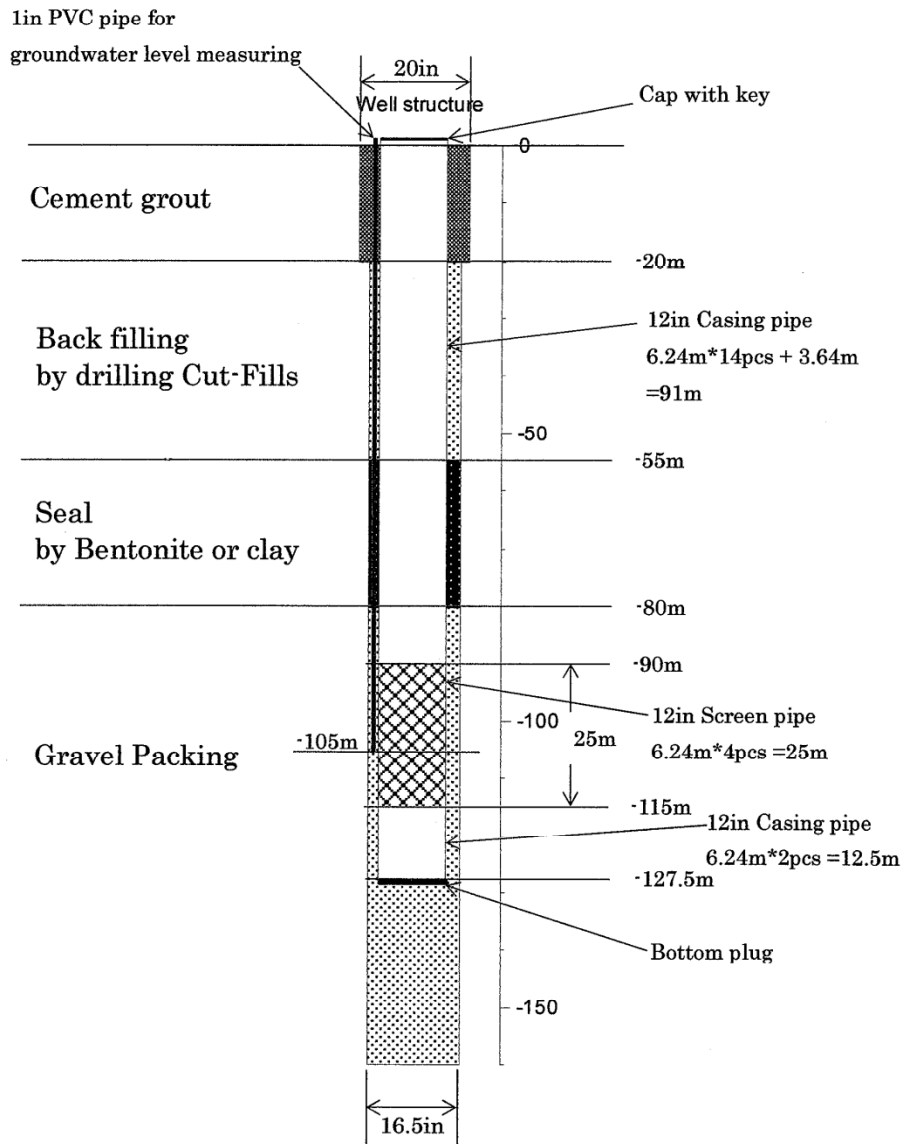


Figure 2 Well structure

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6 – 2. 環境社会配慮別添資料

6 – 2 – 1. Screening Format

Screening Format (1st Draft: 26th June 2014 ver.)

Name of Proposed Project:

The Project for Urgent Improvement of Water Supply System in Mandalay City

Project Proponent:

Mandalay City Development Committee (MCDC)

Name, Address, Organization, and Contact Point of a Responsible Officer:

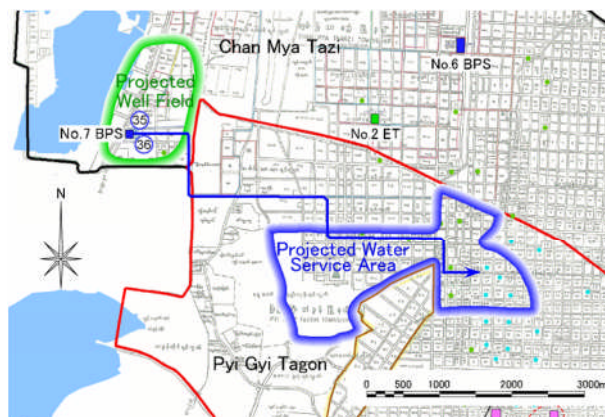
Name: U Tint Lwin
Title: Head of Department, Water and Sanitation Department
Address: Corner of 26th & 72nd Street, Mandalay, Republic of the Union of Myanmar
Organization: Mandalay City Development Committee (MCDC)
Tel: (+95) 2-35928
Fax: (+95) 2-36170
E-Mail: kotauk04@gmail.com
Date:
Signature:

Check Items

Please write “to be advised (TBA)” when the details of a project are yet to be determined.

Question 1: Address of project site

See the figure below.



Location map

Question 2: Scale and contents of the project

2-1. Project profile

- 1) Installation of disinfection equipment at 9 groundwater reservoir systems
- 2) Construction of water supply system in Pyi Gyi Tagon Township (Max. Q; 9,000 m³/d):
Intake well, transmission pipe line, reservoir tank, disinfection equipment, booster pump sets and distribution pipe network.

2-2. How was the necessity of the project confirmed?

Is the project consistent with the higher program/policy?

- YES: Please describe the higher program/policy.
 NO

2-3. Did the proponent consider alternatives before this request?

- YES: Please describe outline of the alternatives
 NO

2-4. Did the proponent implement meetings with the related stakeholders before this request?

- Implemented Not implemented

If implemented, please mark the following stakeholders.

- Administrative body (Divisional Secretariats of relevant divisions)
 Local residents
 NGO
 Others (ADB)

Question 3: Is the project a new one or an ongoing one? In the case of an ongoing project, have you received strong complaints or other comments from local residents?

- New Ongoing (with complaints) Ongoing (without complaints)
 Other

Question 4: Is an Environmental Impact Assessment (EIA), including an Initial Environmental Examination (IEE) required for the project according to a law or guidelines of a host country? If yes, is EIA implemented or planned? If necessary, please fill in the reason why EIA is required.

- Necessity Implemented Ongoing/planning)

(Reason why EIA is required: _____)

Not necessary

Other (The Government has not yet established own EIA/IEE system.)

Question 5:

In the case that steps were taken for an EIA, was the EIA approved by the relevant laws of the host country? If yes, please note the date of approval and the competent authority.

<input type="checkbox"/> Approved without a supplementary condition	<input type="checkbox"/> Approved with a supplementary condition	<input type="checkbox"/> Under appraisal
---	--	--

(Date of approval: _____)

Under implementation

Appraisal process not yet started

Other

Question 6:

If the project requires a certificate regarding the environment and society other than an EIA, please indicate the title of said certificate. Was it approved?

Already certified

Requires a certificate but not yet approved

Title of the certificate: (Permission of the land use for well drilling. _____)

Not required

Other

Question 7:

Are any of the following areas present either inside or surrounding the project site?

Yes No

If yes, please mark the corresponding items.

National parks, protection areas designated by the government (coastline, wetlands, reserved area for ethnic or indigenous people, cultural heritage)

Primeval forests, tropical natural forests

Ecologically important habitats (coral reefs, mangrove wetlands, tidal flats, etc.)

Habitats of endangered species for which protection is required under local laws and/or international treaties

Areas that run the risk of a large scale increase in soil salinity or soil erosion

Remarkable desertification areas

Areas with special values from archaeological, historical and/or cultural points of view

Habitats of minorities, indigenous people, or nomadic people with a traditional lifestyle, or areas

with special social value

Question 8:

Does the project include any of the following items?

Yes No

If yes, please mark the appropriate items.

Involuntary resettlement

Groundwater pumping (scale: 9,000m³/day)

Land reclamation, land development, and/or land-clearing (scale: hectors)

Logging (scale: hectors)

Not calculated yet.

Question 9:

Please mark related adverse environmental and social impacts, and describe their outlines.

Air pollution Water pollution Soil pollution Waste

Noise and vibrations Ground subsidence Offensive odors

Geographical features Bottom sediment Biota and ecosystems

Water usage Accidents Global warming

Involuntary resettlement

Local economies, such as employment, livelihood, etc. Has to be further studied.

Land use and utilization of local resources Has to be further studied

Social institutions such as social infrastructure and local decision-making institutions

Existing social infrastructures and services

Poor, indigenous, or ethnic people. Has to be further studied

Misdistribution of benefits and damages

Local conflicts of interest. Has to be further studied

Gender Children's rights Cultural heritage

Infectious diseases such as HIV/AIDS

Other ()

Outline of related impact:

Noise and vibrations:

Noise and vibration will be foreseen since heavy machineries will be operated during construction phase.

However, the duration is just limited.

Question 10:

In the case of a loan project such as a two-step loan or a sector loan, can sub-projects be specified at the present time?

Yes No

Question 11:

Regarding information disclosure and meetings with stakeholders, if JICA's environmental and social considerations are required, does the proponent agree to information disclosure and meetings with stakeholders through these guidelines?

Yes No

6 – 2 – 2. Check List

Environmental check list (the 1st Draft: 26th June 2014 ver.)

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) N (b) – (c) – (d) –	(a) However, implementation of the IEE level survey is recommended taking into account that the Myanmar Government has followed the ADB's Guideline conventionally. (b) – (c) – (d) –
	(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) Stakeholder consultation with relevant parties such as residents' representatives held on 12th June 2014 in the MCDC hall. The project proponent shall continue to conduct adequate consultations at each stage of the Project implementation. (b) The project proponent has already obtained comments from the stakeholders and is now considering for them.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Several alternative plans regarding groundwater development and water supply area have already 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) –	(a) There is no concern that air pollution is occurred since every chemical including chloride compound will be managed properly. (b) The Government doesn't have such standards. However, occupational health and safety conditions will be secured by the project proponent.
	(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) N	(a) There are no effluent standards in the country. However, no water pollution is expected by the facility operations.
	(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) The project proponent shall conduct necessary measures so that wastes will be handled in accordance with the regulations of the local authorities.
	(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) Noise and vibrations will be occurred due to operation of construction machinery. The Project sites are located in urban area. Therefore, sound/sonic barriers will be built as the situation demands. For safety precaution as well, monitoring should be conducted properly.

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
3 Natural Environment	(1) Protected Areas	(a) Is the project site 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) There are no protected areas or international treaties and conventions in the Project sites.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)?	(a) N	(a) Proposed project locations are not within primeval forests or tropical rain forests.
		(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?	(b) N	(b) The protected habitats of endangered species are not found.
		(c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	(c) Y	(c) If significant impacts will be identified during the study, mitigation measures will be implemented under the supervision and in accordance with recommendations of the relevant government agency.
	(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	(d) There would be no negative impact on the aquatic environments by the Project.	
	(3) Hydrology	(a) Is there a possibility that the amount of water used by the project will adversely affect surface water and groundwater flows?	(a) Y	Quantity of ground water may decrease in accordance with the drawdown amount from the well.

4 Social Environment	(1) Resettlement	<p>(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?</p> <p>(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?</p> <p>(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?</p> <p>(d) Are the compensations going to be paid prior to the resettlement?</p> <p>(e) Are the compensation policies prepared in document?</p> <p>(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?</p> <p>(g) Are agreements with the affected people obtained prior to resettlement?</p> <p>(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?</p> <p>(i) Are any plans developed to monitor the impacts of resettlement?</p> <p>(j) Is the grievance redress mechanism established?</p>	<p>(a) N</p> <p>(b) —</p> <p>(c) —</p> <p>(d) —</p> <p>(e) —</p> <p>(f) —</p> <p>(g) —</p> <p>(h) —</p> <p>(i) —</p> <p>(j) —</p>	<p>(a) Resettlement of residents will not occur.</p> <p>(b) —</p> <p>(c) —</p> <p>(d) —</p> <p>(e) —</p> <p>(f) —</p> <p>(g) —</p> <p>(h) —</p> <p>(i) —</p> <p>(j) —</p>
	(2) Living and Livelihood	<p>(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?</p> <p>(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?</p>	<p>(a) N</p> <p>(b) N</p>	<p>(a) No adverse impact is expected on the living conditions of inhabitants, they rather have positive impacts on local economy.</p> <p>(b) There would be no negative impact on the existing water uses and water area uses.</p>
	(3) Heritage	<p>(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?</p>	<p>(a) N</p>	<p>(a) There are no local archeological, historical, cultural and religious heritages in the project sites.</p>
	(4) Landscape	<p>(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?</p>	<p>(a) N</p>	<p>(a) No adverse impact is expected on the local landscape by the Project.</p>
	(5) Ethnic Minorities and Indigenous Peoples	<p>(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?</p> <p>(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources to be respected?</p>	<p>(a) N</p> <p>(b) N</p>	<p>(a) There are no any ethnic minorities in the Project site.</p> <p>(b) Same as above. There would be no negative impact on ethnic minorities.</p>

	(6) Working Conditions	<p>(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?</p> <p>(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?</p> <p>(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.?</p> <p>(d) Are appropriate measures being taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?</p>	<p>(a) -</p> <p>(b) Y</p> <p>(c) Y</p> <p>(d) Y</p>	<p>(a) Laws and regulations related to working conditions are not yet established.</p> <p>(b) The safety considerations should be prepared by the contractor.</p> <p>(c) The safety training such as wearing working clothes and work shoes, use of temporarily toilet, traffic safety and public health should be provided by the contractor.</p> <p>(d) The education such as behavior and tongue to the citizen, the action to the complaint etc. should be provided to the security guard by the contractor.</p>
5 Others	(1) Impacts during Construction	<p>(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?</p> <p>(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?</p> <p>(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?</p> <p>(d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?</p>	<p>(a) Y</p> <p>(b) N</p> <p>(c) N</p> <p>(d) Y</p>	<p>(a) Effective mitigation measures such as properly maintenance of construction vehicle, idling off and installation of mufflers should be taken. The excavated soil also should be disposed of at the existing landfill.</p> <p>(b) No adverse impact is expected.</p> <p>(c) No adverse impact is expected.</p> <p>(d) There is a possibility that traffic congestion may occur temporarily during construction. The mitigation measures such as prior notice of construction, provision of proper notice at site and alternative routes should be taken in cooperation with traffic police.</p>

	(2) Monitoring	<p>(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?</p> <p>(b) What are the items, methods and frequencies of the monitoring program?</p> <p>(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</p> <p>(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?</p>	<p>(a) Y</p> <p>(b) N</p> <p>(c) Y</p> <p>(d) N</p>	<p>(a) Groundwater level and noise/vibration will be monitored by the project proponent and constructor.</p> <p>(b) Monitoring program has not yet stipulated and the followings are recommended. -The design/construction phases: Noise (4 times/year), vibration (2 times/year) and groundwater level (1time each in rain/dry season) will be investigated. -The operation phase: Noise (2 times/year), vibration (2 times/year) and groundwater level (2 times /year) will be also monitored.</p> <p>(c) Environmental & Social Consideration Team will be established in MCDC and JICA study team should support it in the Detail Survey period.</p> <p>(d) Reporting system of environmental monitoring has not yet established in the Government.</p>
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) –	Checklist of other sectors shall be considered to refer after details of the water supply plan finalized.
	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) –	Diesel motor pumps emit CO ₂ ; however, there would be no large scale generators to be installed as to give negative impact on global warming.

NATURAL ENVIRONMENT MONITORING FORM (Sample)

If environmental reviews indicate the need of monitoring by JICA undertakes monitoring for necessary items that are decided by environmental reviews. JICA undertakes monitoring based on regular reports including measured data submitted by the project proponent. When necessary, the project proponent should refer to the following monitoring form for submitting reports.

When monitoring plans including monitoring items, frequencies and methods are decided, project phase or project life cycle (such as construction phase and operation phase or development, operation and mine closure) should be considered.

As a result of the environmental due diligence, JICA undertakes monitoring of the following items through documents or the answers filled in this form to be provided by MCDC.

1. Responses/Actions to Comments and Guidance from Government Authorities and the Public

Monitoring Item	Monitoring Results during Report Period
Progress of land acquisition and resettlement activities including process of relocation activities, status of livelihood rehabilitation program	(Quarterly basis)
Complaints on Environmental Impacts during construction/operation stage	(Monthly basis in construction stage)
Complaints on land acquisition and resettlement issues	(2 times/year for 3 year since operation stage)
Comments and Guidance from Government Authorities	

2. Mitigation Measures

- Air Quality (Ambient Air Quality)

1) Design and Construction stage

Item	Averaging Time	Unit	Measured Value (Mean)	Measured Value (Max.)	National Standards (Max.)	WHO Guidelines ^{*2}	Remarks					
							Location	Frequency	Implementa-tion	Supervision		
SO ₂	24 hours	µg/m ³				20		Design stage:	1 time as a base-line data	Constructor through	approved the authority	MCDC
	8 hours					-						
	1 hour					-						
NO ₂	24 hours	µg/m ³				-						
	8 hours					-						
	1 hour					200						
	1 year					40						
CO	8 hours	µg/m ³				10,000						
	1 hour					30,000						
O ₃	8 hours	µg/m ³				100						
	1 hour					-						
Lead compounds	24 hours	µg/m ³										
	1 year					0.5						
PM ₁₀	24 hours	µg/m ³				20						
	1 year					50						
SPM	1 hour	µg/m ³				-						
	3 hours					-						
	8 hours					-						
	24 hours					-						
	1 year					-						

*: WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide (2006)

2) Operation stage

Item	Averaging Time	Unit	Measured Value (Mean)	Measured Value (Max.)	National Standards (Max.)	WHO Guidelines*	Remarks			
							Location	Frequency	Implemen-tation	Supervision
SO ₂	24 hours	µg/m ³				20		2 times/year for 2 years	Constructor through approved the authority	MCDC
	8 hours					-				
	1 hour					-				
NO ₂	24 hours	µg/m ³				-				
	8 hours					-				
	1 hour					200				
	1 year					40				
CO	8 hours	µg/m ³				10,000				
	1 hour					30,000				
O ₃	8 hours	µg/m ³				100				
	1 hour					-				
Lead compounds	24 hours	µg/m ³								
	1 year					0.5				
PM ₁₀	24 hours	µg/m ³				20				
	1 year					50				
SPM	1 hour	µg/m ³				-				
	3 hours					-				
	8 hours					-				
	24 hours					-				
	1 year					-				

*: WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide (2006)

- Water Quality (Effluent/Wastewater)

1) Design and Construction stage

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	National Standards (Max.)	International Guidelines	Remarks			
						Location	Frequency	Implementation	Supervision
EC	S/m				-		Design stage: 1 time as a base-line data Construction stage: 4 times/year for 2 years	Constructor through approved monitoring authority	MCDC
pH	-				6-9 ^{*1}				
DO	mg/L				-				
Turbidity	mg/L				<0.2 ^{*2}				
TSS	mg/L				50 ^{*1}				
BOD ₅	mg/L				30 ^{*1}				
Lead	mg/L				0,01 ^{*1}				
Oil & grease	mg/L				10 ^{*1}				
Coliform	MPN/100mL				400 ^{*1}				

2) Operation stage

Item	Unit	Measured Value (Mean)	Measured Value (Max.)	National Standards (Max.)	International Guidelines	Remarks			
						Location	Frequency	Implementation	Supervision
EC	S/m				-		2 times/year for 2 years	Constructor through approved monitoring authority	MCDC
pH	-				6-9 ^{*1}				
DO	mg/L				-				
Turbidity	NTU				<0.2 ^{*2}				
TSS	mg/L				50 ^{*1}				
BOD ₅	mg/L				30 ^{*1}				
Lead	mg/L				0,01 ^{*1}				
Oil & grease	mg/L				10 ^{*1}				
Coliform	MPN/100mL				400 ^{*1}				

*1: IFC EHS general guideline, for Sanitary Sewage Discharge (2007)

*2: ADB Guidelines & Standards In Relation To Wastewater Reuse (2011), Main usage-"All nondrinking water uses"

- Noise

1) Design and Construction stage

Item	One hour LAeq	Unit	Measured Value (Mean)	Measured Value (Max.)	National Standards (Max.)	World Bank Guidelines *	Remarks			
							Location	Frequency	Implemen-tation	Supervision
Noise ^{*1}	Daytime (7:00 – 22:00) Design/	dB(A)				55		<u>Design stage:</u> 1 time as a base-line data <u>Construction stage:</u>	Constructor through approved monitoring authority	MCDC
	Night time (22:00 – 7:00) Design/					45				

2) Operation stage

Item	One hour LAeq	Unit	Measured Value (Mean)	Measured Value (Max.)	National Standards (Max.)	World Bank Guidelines *	Remarks			
							Location	Frequency	Implemen-tation	Supervision
Noise ^{*1}	Daytime (7:00 – 22:00)	dB(A)				55		2 times/year for 2 years	Constructor through approved monitoring authority	MCDC
	Night time (22:00 – 7:00)					45				

*: Residential area, IFC EHS general guideline, for General Health, and Safety (EHS) Guidelines (2007)
 Noise should not exceed the levels presented in Table 3 or result in a maximum increase in background levels of 3dBA at the nearest off-site receptor

- Vibration

1) Design stage

Item	Unit	Frequency band	Measured Value (Mean)	Measured Value (Max.)	National Standards (Max.)	Inter-national Guidelines	Remarks			
							Location	Frequency	Implementation	Supervision
Vibration	mm/sec	0-10 Hz						1 time with identification of noise barriers requirement locations*	Constructor through approved monitoring authority	MCDC
		10-50 Hz								
		Over 50 Hz								

2) Construction stage

Item	Unit	Frequency band	Measured Value (Mean)	Measured Value (Max.)	National Standards (Max.)	Inter-national Guidelines	Remarks			
							Location	Frequency	Implementation	Supervision
Vibration	mm/sec	0-10 Hz						Every 6 months during the stage, and on complain at the construction site	Constructor through approved monitoring authority	MCDC
		10-50 Hz								
		Over 50 Hz								

3) Operation stage

Item	Unit	Frequency band	Measured Value (Mean)	Measured Value (Max.)	National Standards (Max.)	Inter-national Guidelines	Remarks			
							Location	Frequency	Implementation	Supervision
Vibration	mm/sec	0-10 Hz						Every 6 months during the stage for 3 years	MCDC through approved monitoring authority	MCDC
		10-50 Hz								
		Over 50 Hz								

- Groundwater Level

Item	Unit	Stage	Measured Value (Mean)	Measured Value (Max.)	Remarks			
					Location	Frequency	Implementation	Supervision
Groundwater level	m	Design stage				2 times during dry and wet season	Constructor through approved monitoring authority	MCDC
		Construction stage				On complains		
		Operation stage				2 times with an interval of 6 months for 3 years (total 6 times)	MCDC through approved monitoring authority	

- Waste/Spoil disposals

Monitoring Item	Monitoring Results during Report Period
Adequateness of slope drainage designs	
Protection of drainage outfalls against score and erosion.	
Complaints on land acquisition and resettlement issues	
Disruption of drinking or irrigation water	
Adequateness of spoil tipping away	

6 – 2 – 4. Attendees List of Stakeholder Meeting

NO.	NAME	POSITION	AFFILIATION
1	U TUN KYI	Committee Member(1)	MCDC
2	U HAN SOE	Committee Member(3)	MCDC
3	U TIN WAN	Committee Member(4)	MCDC
4	Dr.TWIN KYAW KYAW	Committee Member(5)	MCDC
5	U THIT LWIN	Head of Department	MCDC
6	U HTAY WIN	Assistant Director	MCDC
7	DAW KHIN MAY HTAY	Head of Department	MCDC
8	U KHIN MG MYINT	Head of Department	MCDC
9	U NAY WIN MYINT	Head of Department	MCDC
10	U KHIN MG NYUIT	Assistant Engineer	MCDC(STREET & Bridge)
11	DAW THAN THAN SWE	Assistant Engineer	MCDC(STREET & Bridge)
12	DAW THAN THAN SINT	Assistant Engineer	MCDC(STREET & Bridge)
13	U YE TUN	Assistant Director	MCDC(BUILDING)
14	U THIN MG WIN	Assistant Director	MCDC(BUILDING)
15	U HTET AUNG	Ecusective Officer	PYIGYITAGON TOWNSHIP
16	DAW NUN NUN TUN	Assistant Director	MCDC(BUILDING)
17	DAW LEI LEI KHAING	Assistant Engineer	MCDC(BUILDING)
18	U THAN OO	Assistant Engineer	MCDC(WATER&CLEAN)
19	DAW THAN MYAT OO	Assistant Engineer	MCDC(WATER&CLEAN)
20	U YE KYAW SWA	Ecusective Officer	MCDC
21	U ZAW WIN NAING	Ecusective Officer	MCDC
22	DAW TIN MG KYAW	Assistant Director	MCDC
23	DAW SAN DAR MON	Assistant Director	MCDC
24	U AUNG NAING	Assistant Engineer (Elec.Power)	MCDC
25	DAW EI EI PHYO	Assistant Engineer (Civil)	MCDC
26	U SOE MG HLA	Assistant Engineer (Mech)	MCDC
27	U OHN KYAW	Assistant Engineer	MCDC
28	U ZAY YA	Assistant Director	MCDC
29	U HTUN LIN SAW	Ecusective Officer	MCDC
30	U MYO SAW WIN		MCDC
31	U TAUNG MYINT	ADB	ADB
32	U KIN MG WIN		MCDC
33	DAW KHIN THIDA AUNG	Sub Assistant Engineer	MCDC
34	DAW LYDIA NAUNT NATUN	Sub Assistant Engineer	MCDC
35	DAW THU ZAR AUNG	OFFICE SAFF	MCDC
36	U MG MG LAY	WARD OFFICER	WARD
37	U TUN	WARD STAFF	WARD
38	U PAW THEIN	WARD RESIDENT	WARD
39	U MG MG AUNG	WARD RESIDENT	WARD
40	U THAN SWE	WARD STAFF	WARD
41	U BO WIN	WARD STAFF	WARD
42	U TIN HLAING	TOWNSHIP OFFICER STAFF	WARD
43	U MYA TWAE	WARD STAFF	WARD
44	U MYINT MIN	WARD STAFF	WARD
45	U PAN NEW	WARD.4	WARD.4 COMMITTEE LEADER
46	U HTAY AUND	WARD.4	WARD.4
47	U WIN BO	WARD.4	WARD.4
48	U THAN THU AUNG	WARD.4	WARD.4
49	U ZAW LIN OO	WARD.4	WARD.4
50	U TIN MG AYE	WARD.4	WARD.4
51	U MG MG MYINT	WARD.4	WARD.4
52	U YE WIN	WARD.4	WARD.4
53	U KYAW MIN	SECRETARIAT	WARD.4
54	U NYO LONE	TOWNSHIP OFFICER	PYIGYITAGON TOWNSHIP
55	U MIN MIN TUN	SECRETARIAT	PYIGYITAGON TOWNSHIP
56	U NAING LIN	WARD OFFICER	PYIGYITAGON TOWNSHIP
57	DAW SAGAR WAR SWE	TOWNSHIP OFFICER	WARD AND TOWNSHIP DEVELOPMET
58	U SOE AYE	STAFF	WARD 10
59	U THEIN SOE	WARD OFFICER	WARD 10
60	U MYINT OO	WARD RESIDENT	WARD 10
61	U THEIN NWET	WARD RESIDENT	WARD 10
62	U MG KYAW SOE	WARD 2 OFFICER	WARD 6
63	U KHIN MG MYINT	WARD OFFICE STAFF	WARD 6
64	U HLA NAING	WARD OFFICE STAFF	WARD 6
65	U MYO MYINT ZAW	WARD OFFICE STAFF	WARD 6
66	U WIN THEIN	WARD OFFICE STAFF	WARD6
67	U KYAW AYE	WARD OFFICE STAFF	WARD 6
68	U SOE LWIN	WARD OFFICER	WARD 5
69	U WIN MAW	SECRETARIAT	WARD 5
70	U MG SAN	WARD STAFF	WARD 5
71	U KYAW SOE	WARD STAFF	WARD 5
72	U AYE MIN TUN	WARD STAFF	PYIGYITAGON TOWNSHIP
73	U MIN KO	WARD STAFF	WARD 5
74	U MYAT THU	VICE WARD OFFICER	WARD AND TOWNSHIP DEVELOPMET
75	U CHUN	WAERD STAFF	WARD 5