スリランカ国
コロンボ市無収水削減
能力強化プロジェクト
終了時評価調査
報　告　書

平成 24 年 5 月

(2012 年)

独立行政法人　国際協力機構

地球環境部

環境
JR
12-087

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序　　文

日本国政府はスリランカ国政府の要請に基づき、コロンボ市の無収水削減対策を行うため、計画策定とパイロット活動を実施するものとして、2009 年 10 月から 3 年間の計画で「コロンボ市無収水削減能力強化計画プロジェクト」を実施しました。

国際協力機構は、このたび評価 5 項目における評価の実施と提言・教訓を導き出すための終了時評価調査団を平成 24 年 1 月 25 日から 2 月 17 日の日程で派遣しました。調査団は、スリランカ側メンバーと合同評価チームを構成して現地調査を行い、その結果を合同評価レポートとしてミニッツに取りまとめ、署名交換を行いました。

本報告書は、終了時評価調査時の調査および協議に基づく結果を取りまとめ、今後の協力への活用を通じ、更なる発展に繋がることを目的としております。

終わりに、これら一連の調査及び協議にご協力とご支援を頂いた関係者の皆様に対し、心より感謝申し上げます。

2012 年 5 月

独立行政法人　国際協力機構
地球環境部
部長　江島　真也

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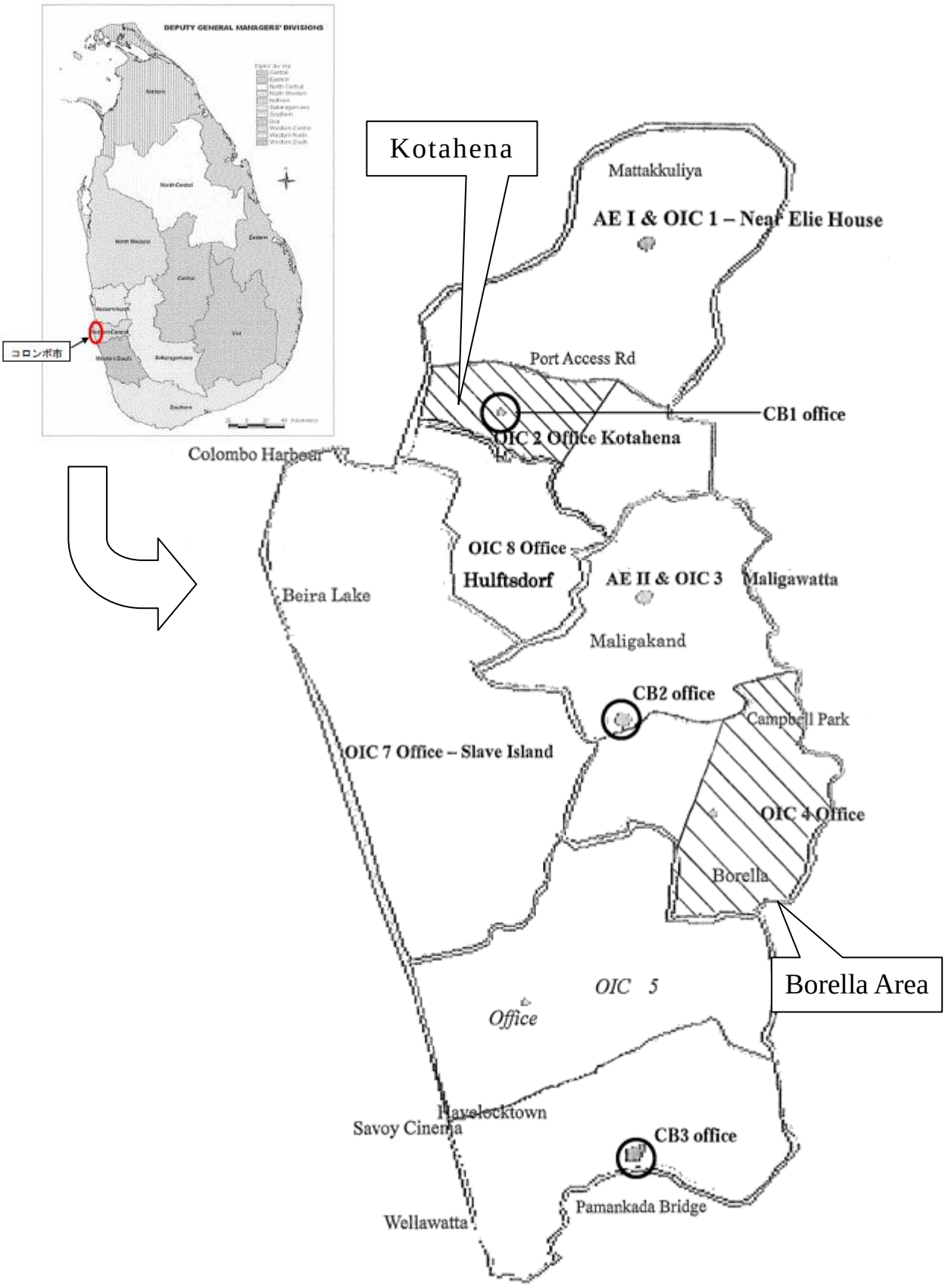
DEPUTY GENERAL MANAGERS' DIVISIONS
コロンボ市
Kotahena
Mattakkuliya
AE I & OIC 1 – Near Elie House
Port Access Rd
CB1 office
OIC 2 Office Kotahena
Colombo Harbour
OIC 8 Office
Hulftsdorf
AE II & OIC 3
Maligawatta
Beira Lake
Maligakand
CB2 office
Campbell Park
OIC 7 Office – Slave Island
OIC 4 Office
Borella
Borella Area
OIC 5
Office
Havelocktown
Savoy Cinema
CB3 office
Pamankada Bridge
Wellawatta

略　語　表

Addl. GM	Additional General Manager	（NWSDB）局長
AE	Area Engineer	エリア・エンジニア
AGM	Assistant General Manager	（NWSDB）課長
C/P	Counterpart	カウンターパート
DGM	Deputy General Manager	（NWSDB）部長
EA	Engineering Assistant	エンジニア・アシスタント
ERD	External Resource Department	財務計画省対外援助局
GIS	Geographic Information System	地理情報システム
GM	General Manager	（NWSDB）総局長
GOJ	Government of Japan	日本政府
GOSL	Government of Sri Lanka	スリランカ政府
JCC	Joint Coordinating Committee	合同調整委員会
JICA	Japan International Cooperation Agency	国際協力機構
JPY	Japanese Yen	日本円
M/M	Minutes of Meetings	会議議事録
MNF	Minimum Night Flow	夜間最小流量
NRW	Non Revenue Water	無収水
NWSDB	National Water Supply and Drainage Board	国家上下水道公社
O&M	Operation and Maintenance	維持管理
ODA	Official Development Assistance	政府開発援助
OIC	Officer-in-Charge	地区担当官
OJT	On-the-Job Training	実地訓練
PDM	Project Design Matrix	プロジェクト・デザイン・マトリックス
PO	Plan of Operation	活動計画表
R/D	Record of Discussions	討議議事録
SKL	Sri Lankan Rupee	スリランカ・ルピー

評価調査結果要約表

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<tr><td colspan="2">分野：上水道</td><td>援助形態：技術協力プロジェクト</td></tr>
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<tr><td rowspan="3">協力期間</td><td rowspan="3">R/D：2009 年 4 月
2009 年 10 月～2012 年 10 月
（3 年間）</td><td>先方関係機関：
プロジェクト監督機関：
プロジェクト実施機関：国家上下水道公社</td></tr>
<tr><td>日本側協力機関：株式会社日水コン</td></tr>
<tr><td>他の関連機関：厚生労働省</td></tr>
<tr><td colspan="3">1-1. 協力の背景と概要
スリランカ国における上下水道施設の多くは国家上下水道公社（NWSDB）が管轄しているが、無収水率の高さ（全国平均約 33%）が経営上の大きな課題となっていた。特に首都コロンボ市は、75～100 年前の英国植民地時代に布設された送配水管が多く、無収水率は 54.1%（2008 年）と全国で最も高くなっていた。NWSDB では、漏水修理、違法接続の摘発・排除、公共水栓の撤去及び戸別接続化、料金請求方法の改善等に取り組んでいるものの、顕著な成果を挙げるに至っていなかった。
NWSDB の事業計画（2007～2011 年）では無収水削減を優先課題の一つとし、無収水削減目標を設定したが、その達成には NWSDB の実施能力・経験が不足しており、ドナー等による支援が必要とされていた。また、2007 年 6 月には「コロンボ市無収水削減戦略的アプローチ」と題する 5 ヵ年計画において実施体制の再編や投入計画を策定したが、予算不足等により開始が遅れている。このような状況においてスリランカ国政府は、2008 年に NWSDB をカウンターパート（C/P）機関とする無収水削減に関する技術協力を我が国政府に要請した。これを受けて JICA は、NWSDB 職員の無収水対策技術の向上のみならず、NWSDB が組織横断的に無収水削減に取り組むための計画立案、実施・運営、情報管理能力の向上を目的とする「コロンボ市無収水削減能力強化プロジェクト」を実施している。

1-2. 協力内容
コロンボ市において、NWSDB 職員を対象に、無収水削減対処能力の向上を図るために、パイロットプロジェクトを通じて技術移転を行う。

(1) 上位目標
コロンボ市の無収水率が削減される

(2) プロジェクト目標
国家上下水道公社（NWSDB）のコロンボ市における無収水対策の遂行能力が強化される</td></tr>
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(3) 成果（アウトプット）

1) 西部州中部地区支援センター所属の上級職員の計画立案・実施管理能力が向上する
2) 西部州中部地区支援センター所属の技術者及び作業員の無収水削減活動を実施するための業務遂行能力（技術力・施工管理能力）が向上する

(4) 投入（終了時評価調査時点）

日本側：

短期専門家派遣： 6 人： 48.62MM（2012 年 1 月時点）
分野： 総括/無収水削減プログラム、副総括/無収水削減モニタリング・評価、漏水探知技術、管路図整備・顧客情報、給水管接続技術、業務調整

海外研修派遣： 本邦研修： 10 人、第 3 国技術交流会 ヨルダン 6 人、インドネシア 6 人が参加（合計 234 日/人）

機材供与： 3798 万円（約 5544 万スリランカルピー）の機材が供与された。

現地業務費： 1 年次： 832 万円（実績）
2 年次：1040 万円（計画）

相手国側：

カウンターパート配置： 維持管理課、無収水対策課の課長、技術者がカウンターパートとしてプロジェクトに従事

ローカルコスト負担：
- 財務計画省のカウンターパート・ファンドより機材に関する税金などに 2554 万ルピー（2010 年、2011 年）が拠出された。2012 年は 2000 万ルピーの承認が下りる予定。
- 以下の費目が NWSDB より負担されている。
  - ✓ カウンターパートの給与、諸手当等（プロジェクト活動によって発生する残業代や夜間作業手当）
  - ✓ パイロット地区での分離化工事、漏水発見後の管網補修、道路開削・復旧のための土木工事費用
  - ✓ プロジェクト事務所の電気、水道、電話、ガス燃料等の費用
  - ✓ JICAからの供与・携行機材の輸入、調達に関連して必要となる関税・税金、税関手続き、保管、国内輸送に要する費用
  - ✓ JICAからの供与・携行機材の維持管理費用
  - ✓ 本プロジェクトに関連するその他の臨時費用

その他：
- NWSDB 内におけるプロジェクトの事務スペースと必要な設備
- プロジェクトの活動に必要な会議室や研修のための場所

2. 評価調査団の概要

調査者

＜日本側＞

担当分野	氏名	所属
総括/ 収水削減	大村 良樹	JICA 国際協力専門員
計画評価	磯辺 良介	JICA 地球環境部　水資源・防災グループ水資源第一課
協力管理	柏原 友子	スリランカ事務所
評価分析	南村 亜矢子	合同会社適材適所

＜スリランカ側＞

担当分野	氏名	肩書
団長	Mr. K. L. L Premanath	General Manager, NWSDB
団員	Mr. S. K. Wijetunga	Additional General Manager (Western) NWSDB
団員	Mr. W.B.G. Fernando	Deputy General Manager (Western Central), NWSDB
団員	Mr. K.W. Premasiri	Assistant General Manager (Development-Western Central), NWSDB
団員	Mr. S.G.G. Rajkumar	Assistant General Manager (NRW-Western Central), NWSDB
団員	Mr. S.A　Rasheed	Assistant General Manager (O&M-Western Central), NWSDB

調査期間	2012 年 1 月 25 日～2 月 17 日	評価種類：終了時評価

3. 評価結果の概要

3-1. 実績の確認

● 成果 1：西部州中部地区支援センター所属の上級職員の計画立案・実施管理能力が向上する

西部州中部地区支援センター所属の上級職員の計画立案・実施管理能力の向上については、ほぼ達成された。

2010 年 5 月に無収水削減マネジメント・チームは 1 年次の無収水削減プログラムを JICA 専門家と共同で作成し、2 年次は 2011 年 6 月にマネジメント・チームだけで作成した。2 年次の活動結果をレビューし、3 年次の年次計画が 2012 年 5 月頃に策定される予定である。2011 年 2 月に実施された中間レビュー調査の結果を受けて、NWSDB はリソースをプロジェクト活動に割り当てるように尽力し、プロジェクト期間の後半、パイロット地区の活動は比較的円滑に実施されるようになった。2011 年の中頃に NRW 削減マネジメント・チームは、6 チームあったタスクチームを 4 チームに再編成し、そのうち 2 チームを各パイロット地区の活動に専従するチームとして（1 地区 1 チーム）、カウンターパートが通常業務で多忙でありパイロット活動に従事する時間が制限されているという問題の解決にあたった。それ以降、パイロット活動は円滑に進むようになった。無収水削減活動に関する予算は、2010 年に NWSDB は 3 年間のプロジェクト活動費として約 2 億ルピーを計上し、カウンターパート・ファンドとして財務計画省に予算を申請した。その結果、2010 年と 2011 年に供与機材の税金分がカバーされた。パイロット活動にかかった人件費、給水管補修等の漏水修理にかかる材料費などの必要経費は NWSDB の通常予算から拠出されている。さらに研修プログラムでカバーされるべきテーマや

トピックスがプロジェクト期間の前半で特定され、無収水削減チームに対する研修が実施されてきた。

- 成果 2 : 西部州中部地区支援センター所属の技術者及び作業員の無収水削減活動を実施するための業務遂行能力（技術力・施工管理能力）が向上する

西部州中部地区支援センター所属の技術者及び作業員の無収水削減活動を実施するための業務遂行能力の向上については、ほぼ達成された。

2011 年の中頃に 6 つのタスクチームが 4 チームに再編成され、パイロット活動に従事するようになってから無収水対策チームもうまく機能するようになった。無収水対策マネジメント・チームと JICA 専門家の支援を受けて無収水対策チームがパイロット地区のワークプランを作成し、活動の進捗に応じてプランを数回見直している。これまで、管路図面情報が正確ではない、予期せぬ場所に配管が接続されている、水圧が低い、地中に埋まったバルブの探査が困難などの要因でコタヘナ地区、ボレッラ地区のサブ・ゾーンの水理的分離作業に予想以上に時間がかかり、活動全体の進捗にやや遅れが生じていた。終了時評価調査の時点でほぼ全てのサブ・ゾーンでの水理的分離作業が完了していたので、今後配水量分析等の活動に移行し、2012 年 6 月頃までには、具体的な数値を収集・分析しパイロット活動の成果がまとめられる予定である。

NWSDB の職員はこれまで漏水箇所の補修や給水管接続などは行えたが、無収水削減活動のステップを細かく設定し、フローチャートを作成して、ひとつひとつ確認しながら活動を進める方法はこれまでに実施したことがなかった[1]。カウンターパートはプロジェクトで導入したこのような体系的な方法をセミナー、ワークショップ、OJT を通じて習得してきており、業務遂行能力が向上しているといえる。また中間レビュー調査後に正式にプロジェクト活動に組み込まれた GIS と PR 活動も順調に進められている。

NRW 削減マネジメント・チームと JICA 専門家によれば、比較的配管の状態がよいボレッラ地区ではプロジェクトで実施した無収水削減活動の効果が上がっているとのことである。例えば、サブ・ゾーン B3 では活動実施前 84.3%であった無収水率が 2 次活動後、28.6%にまで低下した。一方、配管の老朽化が著しいコタヘナ地区から得られたデータを分析した結果、無収水削減活動による一定の効果は認められるが、老朽管の布設替えや他の活動と組み合わせた無収水対策活動が必要であるとのことである。このようにプロジェクトではパイロット活動を通じて、一連の体系化された無収水削減活動がどのような条件の下で実施すれば効果が上がるか、また配管の老朽化が著しい場合の対応策について知見を得つつあるといえる。

- プロジェクト目標の達成 : 国家上下水道公社（NWSDB）のコロンボ市における無収水対策の遂行能力が強化される

NWSDB のコロンボ市における無収水対策の遂行能力は強化され、プロジェクト目標は達成される

[1] 大まかな活動は、サブ・ゾーンの設定（5000 戸程度をカバーした各パイロット地区（ゾーン）をさらに 500 戸程度に分割したサブ・ゾーンで無収水活動を実施している）、水理的分離、流入量の把握、夜間最小水量の測定、漏水探査・修理、違法接続対策、量水器誤差の把握・改善、公共水栓水量の把握・戸別給水栓化等である。

見込みである。

プロジェクトでは当初ローテーション方式[2]を実施して体系的な無収水削減活動を普及することを考えていたが、2011 年 2 月に実施された中間レビュー調査後もローテーション方式は実現しなかった。これは、パイロット地区外でタスクチームを編成してパイロット活動に参加させる場合、タスクチームのメンバーが担当している通常業務を他の職員がカバーしなくてはならないが、NWSDB では全般的に人員が不足しており、タスクチームが編成できなかったためである。ローテーション方式の代わりに、NWSDB では、パイロット地区外のエリア・エンジニア（AE）、担当オフィサー（Officer in charge：OIC）、エンジニアリング・アシスタント（Engineering Assistant：EA）をパイロット活動と週会議に参加させるようにして、知識、技術の習得を促し、さらに週会議では問題点や解決策の共有を図った。これまでコロンボ市南地区の AE、コロンボ市東地区の AE と OIC がセミナー/ワークショップ、OJT、週会議を通じて体系的な無収水削減対策の手法を習得して、それぞれの担当地区で実践している。

活動計画表（Plan of Operations：PO）によれば、プロジェクトではプロジェクト期間の 3 年目に展開計画（案）を作成する予定である。パイロット活動の分析結果とコロンボ市の状況に適応した効果的な無収水対策活動をこの計画（案）で提案する予定であり、無収水対策に必要な費用や人員も算出する。プロジェクトでは既にパイロット活動の結果からいくつかの知見を得ており、今後も水理的分離が終了したサブ・ゾーンにおける活動結果を通じて、展開計画を策定するために必要となるデータや知見をさらに得ることになる。

3-2. 評価結果の要約

(1) 妥当性

プロジェクト開始から今日までスリランカにおける上水道分野の政策に大きな変更はなく、妥当性は高い。2010 年 11 月に財務計画省より発行された「Sri Lanka, The Emerging Wonder of Asia, Mahinda Chintana, Vision for Future 2010- the development policy framework, government of Sri Lanka」では配管による給水率を 2015 年までに 44%に、2020 年までに 60%に引き上げ、2015 年までに全人口の 94%、2020 年までに 100％が安全な水にアクセスできることを目標に掲げている。さらに持続的に安全な水を手ごろな価格で提供することに重点を置いており、そのために 2020 年までに無収水率を 20%にまで削減することを目標としている。プロジェクトが形成された 2008 年時点において、コロンボ市の無収水率は 54.1%で全国平均の無収水率の 33.0%より高かった。NWSDB は新しい事業計画「Corporate Plan 2012-2016」を策定したが、依然として無収水率削減は 2016 年までに達成すべき目標のひとつに掲げられており、2012～2016 年の間にコロンボ市の無収水率を 9.4%削減し、2016 年には全国平均で 26%にまで削減することを数値目標として設定している。NWSDB ではこの数値目標を達成すべく無収水削減の能力を強化する必要があり、この点でプロジェクトの内容は NWSDB のニーズにも合致している。日本政府が 2004 年 4 月に策定した「対スリランカ国別援助計画」の重点分野の中に上水

[2] ローテーション方式は(i) コロンボ市内のパイロット・エリア以外の地区を受け持つタスクチームを維持管理課で 2 つ編成し、コタヘナ地区、ボレッラ地区に 1 チームずつ派遣してパイロット活動に参画し、技術を習得すること、(ii) 本来の担当地区に戻った際に、習得した技術を担当地区で広げていくこと、(iii) その後は、別のパイロット・エリア外の地区より新たにタスクチーム 2 つがパイロット活動に参画し、技術を習得していくことを目的とした方式のことである。

道サービスの改善も含まれており、プロジェクトの内容は日本政府の方針に合致している。

(2) 有効性

プロジェクトの有効性は高いと判断できる。効果的に無収水を削減するためには、現場の技術力の向上と共に、無収水削減に取り組むためのマネジメント面の能力強化も重要であり、これまでプロジェクトではこの両面において NWSDB の能力を強化してきた。パイロット活動に従事している NWSDB の技術職員や作業員は、実践的で体系的な無収水削減活動の実践方法を習得しつつある一方、NRW 削減マネジメント・チームのメンバーはパイロット活動の結果を通じて、どのような方法がコロンボ市で無収水を効果的に削減するのに有効かという知見を多く得ている。プロジェクトの協力期間は 9 ヵ月残されているため、この間にさらにプロジェクトでは体系的な無収水削減の効果等を検証することになる。特に流入量把握、夜間最小流量の測定、水圧の測定、有収/無収水量の把握、違法接続対策、流水器誤差の把握・改善等のパイロット活動を実施した後の具体的な数値を収集して結果を分析し、コロンボ市で効果が上がると考えられる無収水削減活動の方法と、それを実施するために必要となる予算・人員を特定し、展開計画（案）としてとりまとめる予定である。

(3) 効率性

プロジェクトはある程度効率的に運営されてきたと判断できる。計画より遅延している活動もあり、これまでプロジェクトの進捗に影響を与えた要因もいくつかあるが（3-3. 効果発現に貢献した要因/問題点及び問題を惹起した要因参照）、NWSDB と JICA 専門家はプロジェクト活動を推進するためにさまざまな取り組みを行っており、プロジェクトのアウトプットはプロジェクト期間終了までに達成されると考えられる。海外研修を実施した結果、研修に参加した NWSDB 職員は無収水削減対策に対する高いモチベーションを持つようになり、さらに無収水削減に対する部下のモチベーションも上げるよう努力している。ヨルダンとインドネシアで実施された第 3 国技術交流会は、当該国で実践されている無収水対策活動が、自国のプロジェクト活動で実践している活動と同様の手法であり効果があるものだと自信を深める機会となった。これまでの投入の質・量は計画されたアウトプット（成果）を生み出すためにほぼ十分であり、投入はプロジェクト活動に十分活用されてきた。

(4) インパクト

本プロジェクトの上位目標は、「コロンボ市で無収水率が削減される」である。パイロットプロジェクトでも無収水率は削減しており、上位目標は達成される見込みである。プロジェクトでは「展開計画（案）」を作成し、その中でコロンボ市の状況に適合した効果的な無収水対策の戦略や方法を提案し、その方法を実践するために必要となる予算や人員の見積りも含める予定である。NWSDB の幹部が無収水削減活動に対して強い取り組み姿勢を示し、この展開計画（案）に沿って活動を継続していければ、コロンボ市の無収水率の削減に大きく貢献できると期待できる。既にパイロット地区外の AE と OIC がパイロット活動に参加して体系的な無収水削減活動の手法を学んでいるため、NWSDB では無収水削減活動をコロンボ市内で将来展開する基盤ができていると考えられる。プロジェクトの残りの協力期間にコロンボ市内の全ての AE と OIC/EA がプロジェクト活動に参加し、体系的な無収水削減方法の知識、技術、経験を積めば、無収水削減の実現に大きく寄与することになる。ただし一般的に認識されているように、無収水を効果的に削減するためには、漏水探知・修理、違法接続の発

見、公共水栓の削減などのソフト面の対策と、老朽管の布設替えなどのハード面の対策をうまく組み合わせる必要があり、無収水削減活動や老朽管更新のための予算や機材が確保されることも必要である。

(5) 持続性

プロジェクトの持続性は以下で述べる条件が満たされれば確保できると判断できる。

■ 政策・制度面

スリランカ政府は上水道サービスを重要政策のひとつに位置づけており、手頃な価格で継続的に安全な飲料水を提供するために、2020 年までに無収水率を 20%にまで削減する等の必要な措置を取ることを提唱している。このように NWSDB にとって良好な政策環境が今後も維持されると考えられる。

■ 財政面

NWSDB で無収水削減活動に割り当てられた予算を特定するのは困難だが、無収水関連の活動には一定の予算がこれまで配分されてきたと考えられる。2009 年には 4 億 6140 万ルピーが上水道関連の補修と維持に割り当てられており[3]、この中には無収水削減活動に関する費用も含まれている。現在 NWSDB では、維持管理関連の費用は水道料金による収入でカバーされている。2009 年の NWSDB 年次報告書に記載されている財務諸表によれば、NWSDB の 2009 年の財務状況は対外債務に対する返済金額が大きいため赤字であるが、水道事業の売上額（水道料金による収入含む）は直接経費（人件費、ポンプ・薬品費、補修・維持費）を上回っており、維持管理費はある程度カバーされているといえる。さらに、無収水削減マネジメント・チームによれば無収水削減の予算は十分ではないが、一定の額は毎年配分されているとのことである。したがって、無収水対策に関する予算は継続的にある程度配分されると考えられ、NWSDB の幹部が無収水削減活動の効果を十分認識し、その実施に本腰を入れればさらに無収水対策への予算が確保されると考えられる。パイロットプロジェクトの費用はスリランカ側も負担しており、無収水削減チームやマネジメント・チームは存続すると考えられる。

■ 技術面

カウンターパートはプロジェクトで実践してきた体系的な無収水削減の知識や技術を受け入れており、その有効性も認識している。特にパイロット地区やそれ以外の AE や OIC/EA は体系的な無収水削減の実践方法を学んでおり、独自で実践できるよう十分な経験を積んできたといえる。また NWSDB の職員は無収水削減に関する基礎知識や技術を既に有していたため、プロジェクトから学んだ技術を問題なく維持していけると思われる。NWSDB 内での技術的な持続性を確保するためには、展開計画（案）で示される無収水削減方法をどのようにコロンボ市の他地区へ展開するかという点が重要である。ローテーション方式の代替案として残りの 9 ヵ月間にまだプロジェクト活動に参加していないパイロット地区外の AE と OIC/EA をパイロット活動と週会議に参加させ、可能な限りの知識と技術を得られる機会を提供することが重要である。

[3] 2009 年の NWSDB 年次報告書より

供与機材はカウンターパート側で細心の注意を払って維持管理する傾向にあり、プロジェクト終了後も適切に維持されると考えられる。その一方で海外から輸入された電子関連機器も供与機材に含まれており、NWSDB ではこれらの機材に不具合が生じた場合、海外のメーカーに E メールなどを通じてコンタクトを取る必要が将来生じると考えられる。

3-3. 効果発現に貢献した要因

（1）計画内容に関すること

特になし

（2）実施プロセスに関すること

- 無収水削減対策に対して NRW マネジメント・チームが強い取り組み姿勢を示し、プロジェクト活動の推進においてリーダーシップを発揮したこと（本プロジェクトの効果を促進した要因）
- 第 3 国技術交流会によって、カウンターパートはプロジェクトで導入・実践した体系的な無収水削減活動のやり方が他国でも実践され効果を上げていると学び、プロジェクト活動への理解を促進したこと（プロジェクトの実施を促進した要因）

3-4. 問題点及び問題を惹起した要因

（1）計画内容に関すること

特になし

（2）実施プロセスに関すること

- 道路の掘削許可取得などの関連機関からの許可を得るのに時間を要する。また NWSDB 内で許可申請を行うための手続きにも時間を要する。
- NWSDB 内での調整に時間がかかる。例えば、プロジェクト活動を実施するために必要な車輌やドライバーが常に手配されるとは限らず、パイロット活動に影響を及ぼしたこともある。
- 管路図面情報が正確ではない、予期せぬ場所に配管が接続されている、水圧が低い、地中に埋まったバルブの探査が困難などのコロンボ市特有の状況のため、予想以上にパイロット活動におけるサブ・ゾーンの水理的分離作業に時間を要した。
- カウンターパートはプロジェクト活動と通常業務を兼業しているため、プロジェクト活動に専念できないことが多かった。通常業務をこなす必要があったことに加え、緊急の配管布設替えなど NWSDB 内で最重要事項となった活動に急に従事しなくてはならず、パイロット活動に参加できないこともあった。
- JICA 専門家が不在の間、車輌や重機が予定どおり手配されない等の問題が生じた場合、活動が停滞することがあった。

3-5. 結論

プロジェクト期間の終了までに、予定している全ての活動が実施されれば、当初の目標は達成されると考えられる。よって、プロジェクトを予定通り終了すべきである。パイロット活動に遅れが発生したが、NWSDB と JICA 専門家は遅延を最小限に留めるように尽力しており、今日までカウンター

パートの技術面のキャパシティーは計画どおり強化されてきた。残りの協力期間の 9 ヵ月で、プロジェクトはパイロット活動の結果を分析してコロンボ市で効果の上がる無収水削減方法を特定し、「展開計画（案)」にパイロット活動から得られた知見や無収水対策の方針・戦略をまとめる予定である。これら活動の過程で実施される議論は NWSDB が無収水削減方法に関する知見をさらに得る貴重な機会であり、マネジメント面の能力もさらに強化される見込みである。したがって、プロジェクト期間が終了するまでに、NWSDB の技術面、マネジメント面の能力が強化されるといえる。終了時評価調査を実施した結果、プロジェクトの妥当性、有効性は高いといえる。一方、プロジェクトの実施に影響を及ぼした要因がいくつかあり効率性を損ねる原因となっている。NWSDB 幹部が体系的な無収水削減活動を継続的に実施していくことに対して強い取り組み姿勢を見せ、実施の決定を下せば、プロジェクトのインパクトと持続性が確保される確率が高まると考えられる。

3-6. 提言（当該プロジェクトに関する具体的な措置、提案、助言）

（1）プロジェクトの成果の普及

今回のプロジェクトは 2012 年 10 月に終了予定であるが、将来的には Kotahena 地区と Borella 地区の二つのパイロット地区のみならず、コロンボ市全域で無収水削減対策を実施する必要がある。そのため、無収水削減マネジメント・チームはプロジェクト終了時までに、展開計画案を作成する。同時にコロンボ市のすべての地区の OIC または EA が Weekly Meeting やパイロット活動に参加し、本プロジェクトの成果を自分の担当地区で活用することが望まれる。

（2）老朽管の布設替えの実施

中間レビュー後、NWSDB は水セクター開発プロジェクト（1）大コロンボ水リハビリテーションプロジェクトの資金を利用して配管更新を実施するように決めた。この結果は、プロジェクトの中で当初計画された比較分析を遂行するために、非常に重要である。プロジェクトは 9 カ月で終了するため、Kotahena 地区の老朽配水管の更新を 2012 年 6 月までに実施すべきである。それゆえ、NWSDB は配管更新をなるべく早く実施すべきである。

（3）内部手続きの円滑化

NWSDB は運営・維持管理部署の車両と幹部の数を増加させるよう努力してきたが、内部手続きにいくらか困難さが見受けられる。たった 9 ヶ月で協力期間が終了するため、プロジェクトでは時間が重要である。それゆえ、評価チームはさらに円滑な実施を行い、プロジェクトの達成を確実にするため、NWSDB が次の点を準備することを提言する。

- GPS チームと PR 活動のための車両の配置
- 協力期間の終わりまでにデータインプットを完了させるために GIS データ入力を行う GIS オペレーターの仕事効率をレビューすること

（4）無収水削減対策予算と人員の確保

無収水削減活動を実施するには、活動予算と人員が必要であるため、プロジェクト終了後も活動予算と人員をスリランカ側が十分に確保することを提言する。

（5）Kotahena 地区と Borella 地区の人材の他の地区での活用

今回のプロジェクトを通じて、Kotahena 地区と Borella 地区の無収水対策担当者は、適切な無収水対策手法を習得してきている。プロジェクト終了後は今後作成する予定の展開計画に基づいて、プロジェクト事業を展開していくことになるが、Kotahena 地区と Borella 地区で育成された人材を活用し、他の地域での無収水対策活動を実施していくことが望まれる。

（6）管路情報の蓄積とその効率的利用

NWSDB は無収水対策活動の間、管路場所調査を通じて管路情報を更新し、埋設後竣工図を更新し、修理後、フィールドデータを更新すべきである。NWSDB がすべての給水地区でこのような活動を実施することを提言する。

（7）GIS の利用

中間レビュー後、無収水削減活動を支援する効果的な方策として GIS が導入された。現在、Kotahena 地区と Borella 地区のデータが GIS データベースに入力されている。しかしながら、入力データが十分かつ正確かつ常に更新されなければ、GIS の効果は限定的である。それゆえ GIS 活動を継続し、計画と日常運営のために活用することを提言する。

（8）JICA 実施の M/P、ADB プロジェクトとの連携

現在、円借款の余剰金を利用したコロンボ市上水の M/P を作成中で、そのコンポーネントに無収水削減が含まれている。また、ADB はコロンボ市の無収水削減対策を計画している。そのため、M/M にも記載のとおり、本プロジェクトと M/P および ADB プロジェクトが NWSDB の調整の下連携し、今回のプロジェクトの成果を M/P、ADB プロジェクトに活用することが望まれる。

（9）配水本管の漏水管理

NWSDB はパイロットプロジェクト地区に接続されている配水本管も潜在的に漏水していると考えている。それゆえ、現在入手できる機材を特定の地元の条件に適用することを提言する。

（10）無収水対策のコストベネフィット分析

無収水対策活動の財務的インパクトを示すために、無収水削減活動のコストベネフィット分析をすることを提言する。

3-7 教訓

- 物理的な漏水が主要な無収水である。

パイロットプロジェクト地区の無収水の主な原因は物理的な漏水である。無収水の状況は地域地域で異なることから、状況に応じて広い範囲から解決策が選択されるべきである。

- 更新配管は除去されるか切断されるべきである。

フィールドワークの間、無収水チームはいくつかの二次配水本管や給水管が記録されていようといまいと給水中か使用されていないかほとんど認識されていないということを発見した。将来の配管の

更新には異なる色やカラーコーディングが既存の灰色の配管の代わりに導入されるべきである。色を付けることに加え、配管が更新目的で埋設される時には、無収水を削減するために、既存配管は除去されるか適切に切断されるべきである。

The Summary of Terminal Evaluation

<table>
<tr><td colspan="3">1. Outline of the Project</td></tr>
<tr><td colspan="2">Country: the Social Democratic Republic of Sri Lanka</td><td>Project Title：The Capacity Development Project for Non Revenue Water (NRW) Reduction in Colombo City</td></tr>
<tr><td colspan="2">Issue/Sector：Water Supply</td><td>Cooperation Scheme：Technical Cooperation Project</td></tr>
<tr><td colspan="2">Division in charge：Global Environment Dept.
Water Resources Management Division I</td><td>Total Cost：About 310 million Yen</td></tr>
<tr><td rowspan="3">Period of Cooperation</td><td rowspan="3">R/D：April 2009
October 2009 to October 2012</td><td>Partner Country’s Implementation Organization:
National Water Supply and Drainage Board (NWSDB)</td></tr>
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Background of the Project

For the National Water Supply and Drainage Board (NWSDB), which is responsible for water supply and sanitation in the most part of the Democratic Socialist Republic of Sri Lanka, high ratio of Non Revenue Water (NRW) has been a longstanding problem in its operation and management. Especially in Colombo City, where deteriorated pipes still remained in many parts of its distribution system, the NRW rate in 2008 was 54.1%, higher than its nationwide average of 33.0%. To tackle this problem, NWSDB has been working to reduce the rate of NRW in several ways such as leak repair, detection/elimination of illegal connections, removal of public stand posts and converting its users to individual connection, and billing system improvement. However, these measures had not produced satisfactory outcomes. To improve this situation, NWSDB stressed the importance of NRW reduction as one of the most prioritized tasks to be tackled and set a target to reduce NRW in its “Corporate Plan 2007 – 2011.” In order to achieve the target, it was necessary for NWSDB to gainfully utilize external support to improve its capacities of practical implementation in NRW reduction measures. To address these issues, the Government of Sri Lanka (GOSL) requested the Government of Japan (GOJ) for assistance to NWSDB through conducting a technical cooperation project regarding NRW reduction. Based on the above official request by GOSL and information collected through the fact-finding survey, JICA and the officials of Sri Lanka concerned agreed to conduct “the Capacity Development Project for Non Revenue Water Reduction in Colombo City” (hereinafter referred to as “the Project”).

1-1 Project Overview

In Colombo city, technical transfer is conducted through pilot projects to NWSDB’s staff in order to improve the capacity for NRW reduction countermeasures.

(1) Overall Goal

The NRW ratio in Colombo City is reduced.

(2) Project Purpose

NWSDB's capacity to implement NRW reduction activities in Colombo City is strengthened.

(3) Outputs

1) Management capacity of senior officers of the Regional Center (Western-Central) to plan and supervise NRW reduction activities is enhanced.
2) Technical and operational capacity to conduct NRW reduction activities by officers/staff of the Regional Center (Western-Central) is developed.

(4) Input（as of terminal evaluation）

Japanese side：

Dispatch of short term experts：	6 experts：48.62MM（as of January 2012） Position：Chief Advisor/ NRW reduction programming, Deputy Chief Advisor/ NRW reduction monitoring and evaluation, Leak detection Advisor, Arrangement of pipeline drawing and customer data, Service pipe connection advisor, Coordinator
Dispatch of overseas training：	Training in Japan: 10 participants, Third Country Training: 6 participants in Jordan, 6 participants in Indonesia (Total Amount 234 day/person)
Procurement of Equipment：	JPY37.98 million（About 55.44 million SKL）
Local Cost：	First Year：JPY 8.32million Second Year：JPY 10.4 million

Sri Lankan side：

Counterpart allocation: Assistant General Managers and technicians of maintenance division and NRW countermeasures division are engaged as counterparts

Local Cost：

- 22.54 million SLK was disbursed from counterpart funds from the Ministry of Finance and Planning in 2010 and 2011. 20 million SLK is supposed to be approved in 2012.
- The following expenses have been borne by NWSDB.
  a. Salaries, remuneration and other allowance for the counterpart personnel when necessary. (Overtime or nighttime works during the course of the project activities)
  b. Expenses for isolation work of pilot areas, repairing of pipe networks after the detection of leakage and civil work for road opening/reinstatement.
  c. Expenses such as electricity, water supply, telephone, and gas

fuel for the Project offices.

d. Expenses for custom, tax, custom procedure, storage and domestic transport necessary for import and procurement of equipment procured and accompanied by JICA
e. Expenses for maintenance of equipment provided by JICA
f. Other contingency expenses related to the Project

Others：
- Office space and facilities necessary for JICA experts at NWSDB
- Venues and necessary facilities for the Project's activities

2. Evaluation Team

Members of Evaluation Team

＜Japanese side＞

Job title	Name	Position
Leader/NRW Reduction	Mr. Yoshiki Omura	Senior Advisor (Water Supply Development), JICA
Task Manager	Mr. Ryosuke Isobe	Water Resources Management Division I, Water Resources and Disaster Management Group, Global Environment Dept., JICA
Cooperation Management	Ms. Tomoko Kashihara	JICA Sri Lanka Office
Evaluation Analysis	Ms. Ayako Namura	Consultant, Tekizaitekisho LLC

＜Sri Lankan side＞

Job title	Name	Position
Leader	Mr. K. L. L Premanath	General Manager, NWSDB
Member	Mr. S. K. Wijetunga	Additional General Manager (Western), NWSDB
Member	Mr. W.B.G. Fernando	Deputy General Manager (Western Central), NWSDB
Member	Mr K.W. Premasiri	Assistant General Manager (Development-Western Central), NWSDB
Member	Mr. S.G.G. Rajkumar	Assistant General Manager (NRW-Western Central), NWSDB
Member	Mr. S.A. Rasheed	Assistant General Manager (O&M-Western Central), NWSDB

Period of Evaluation	25 Jan 2012- 17 Feb 2012	Type of Evaluation: Terminal Evaluation

3. Results of Evaluation

3-1. Confirmation of Achievement

(1) Output 1: Management capacity of senior officers of the Regional Center (Western-Central) to plan and supervise NRW reduction activities is enhanced.

Enhancement of management capacity of senior officers of the Regional Center (Western-Central) to plan and supervise NRW reduction activities was almost achieved.

The NRW Reduction Management Team formulated the fist-year's annual program in May 2010 in cooperation with JICA experts. This Team prepared the second-year's annual program in June 2011 by its own ability. Reviewing the second year's results of the NRW reduction activities, the third annual program will be prepared around May 2012. Based on the result of Mid-term Review which was implemented in February 2011, NWSDB made efforts to allocate resources to project activities. Then in the latter half of the Project period, activities of pilot areas were implemented relatively smoothly. The NRW Reduction Management Team reorganized the six teams into four teams (two teams for each pilot area) and assigned one team for respective pilot areas to concentrate on the project activities in the middle of 2011. Since then, the pilot activities have progressed more smoothly. NWSDB earmarked approximately 200 million LKR for the three-year project activities in 2010 and requested this as a counterpart fund to the Ministry of Finance and Planning. Then the budget was smoothly disbursed for tax payment of the provided equipment from Ministry in 2010 and 2011. Other expenses necessary for the pilot activities including the personnel costs and materials for service pipe replacement and leak repair have been borne by the regular budget of NWSDB. Moreover the themes or topic to be included in the training program (including seminars/workshops) were clearly identified in the first half of the Project and training for the NRW Reduction Team have been implemented.

(2) Output 2: Technical and operational capacity to conduct NRW reduction activities by officers/staff of Regional Center (Western-Central) is developed.

Enhancement of technical and operational capacity to conduct NRW reduction activities by officers/staff of Regional Center was almost achieved.

NRW Reduction Teams functioned well since they started to be engaged in the pilot activities after 6 teams were reorganized to 4 teams in the middle of 2011. The NRW Reduction Teams prepared the work plan of pilot activities with NRW Reduction Management Team and JICA experts, and they revised the plans several times in accordance with the progress of activities. Until now, the delay of implementation has occurred because the hydraulic isolation work of sub-zones in pilot areas has taken longer time than expected. The situation, such as lack of accurate information on pipeline drawings, unexpected interconnection of pipes, low system pressure and difficulties in valve locating, has caused the counterparts and JICA experts hardship of isolation work in sub-zones. As of terminal evaluation, the hydraulic isolation works were mostly completed in Kotahena and Borella, and the Project will start NRW reduction activities based on the work plan. It is expected that the specific data in all pilot areas will be gained by June 2012.

The members of NWSDB could repair leakage and connect service pipes before. However they had not implemented the method of setting up of NRW reduction activities, making flow chart and proceeding activities checking one by one. Counterparts have learned this systematic method introduced by the Project in seminars, workshops and OJT. Then capacity for executing NRW reduction activities is improved. Also GIS and PR activities which were introduced formally after Mid-term Review are proceeding well.

According to the NRW Reduction Management Team and JICA experts, the remarkable effects of NRW

reduction activities can be observed in Borella where the pipes are relatively in good condition. For example, though NRW ratio in subzone B3 was 84.3% before the activities, it decreased to 28.6% after secondary activities. The data acquired from pilot activities in Kotahena, where pipes are very deteriorated, explains that NRW reduction activities certainly brought some effects but the measures combined with the pipe replacement and other activities would be more effective to reduce NRW ratio. The Project is currently gaining the results of pilot activities, analyzing the conditions that a series of the systematic NRW reduction activities can bring effects toward reducing the NRW.

(3) Achievement of the Project Purpose: NWSDB's capacity to implement NRW reduction activities in Colombo City is strengthened.

NWSDB's capacity to implement NRW reduction activities in Colombo City was strengthened and Project Purpose is likely to be achieved.

The rotation system, which the Project originally planned to implement, has not functioned well even after the Mid-term Review in February 2011. Because of manpower shortage at NWSDB, the rotation team's tasks in their responsible areas could hardly be taken over by the other staff. Instead, NWSDB tried to involve the Area Engineers (AEs), the Officers in Charge (OICs) and EAs of non-pilot areas in the pilot activities and invited them to weekly meetings to share the issues raised in pilot activities. To date, the AE of Colombo City South and the AE and OIC of Colombo City East learned about the systematic methods of NRW reduction by participating in the workshops/seminars, OJT in the pilot areas, and weekly meetings. Then, they have practiced its method in their responsible areas.

According to the Plan of Operations (PO) of the Project, an execution plan will be prepared in the third year of the project implementation. This plan will incorporate the analysis of the results of pilot activities and suggest strategy and effective methods for NRW reduction suitable to the condition in Colombo City along with the cost estimation and required manpower. The NRW Reduction Management Team and JICA experts already obtained some findings from the results of pilot activities and will gain them more and necessary data since the pilot activities will move to next steps after isolation work.

3-2 Summary of Evaluation Results

(1) Relevance

The policy on water supply sector in Sri Lanka has not been changed much since the commencement of the Project and relevance of the Project is high. "Sri Lanka, the Emerging Wonder of Asia, the Mahinda Chinthana, Vision for the Future 2010 – the development policy framework, government of Sri Lanka[4]"clearly specifies the province wise development targets with respect to safe water supply. The overall target to be achieved is 44% piped water connected coverage by 2015 and 60% by 2020. The safe water supply coverage target specified therein is 94% by 2015 and 100% by 2020. The document also addresses the sustainable safe drinking water for all at an affordable price and identifies the specific actions to be taken, such as implementation of non-revenue water (NRW) reduction program to minimize

[4] This document was issued in 2010 by the Department of National Planning, Ministry of Finance and Planning.

the NRW rate up to 20 % by 2020. Colombo City had suffered from high NRW ratio of 54.1%, higher than its nationwide average of 33.0%, as recognized at the stage of project formulation in 2008. NWSDB prepared the draft version of "Cooperate Plan 2012-2016," in which the NRW reduction remains among the goals to achieve by 2016. It addressed the target of "reducing NRW by 9.4 % in Colombo City during the period of 2012 - 2016 and achieving a 26 % national average in 2016." NWSDB still has strong needs of enhancing the capacity of NRW reduction to meet this target; therefore, the components of the Project have been along with the needs of NWSDB. Country Assistance Program for the Democratic Socialist Republic of Sri Lanka formulated in April 2004 includes improvement of water supply service as priority areas for assistance and contents of the Project accord to the policy of Government of Japan.

(2) Effectiveness

The Project is assessed as effective. To pursue the effective NRW reduction, capacity enhancement at both technical and management level is very crucial. To date, the Project has enhanced NWSDB's capacity to implement NRW reduction activities in Colombo City at both levels. NWSDB officers/staff engaged in pilot activities has acquired the practical and systematic techniques for effective NRW reduction. The NRW Management Team has gained a lot of findings on what methods would bring more effects on NRW reduction through project activities. The Project still have nine months to complete the cooperation period and will present more tangible effects on NRW reduction in the remaining period. It is, especially, expected that the specific data on the pilot activities such as system input volume, MNF, pressure, billed/unbilled authorized consumption, illegal use and metering inaccuracies, will be compiled and utilized to identify the most effective options for NRW reduction activities in Colombo City and necessary budget and human resources to implement them. Then an execution plan will be drafted.

(3) Efficiency

The Project is assessed as partly efficient. Although some of the project activities are behind schedule and there are some causes which influenced the progress of the Project (Refer to 3-3 Factors that promoted realization of effects / Factors that impeded realization of effects), various activities have been carried out by NWSDB and JICA experts and the Project Outputs are supposed to be achieved by the end of the Project. The positive aspect is that the overseas training programs promoted the participants' motivation toward NRW reduction, and the participants also encouraged their staff to promote NRW reduction. The technical exchange programs in Jordan and Indonesia gave the participants confidence in the NRW reduction activities which they have been practicing through project activities, by observing the similar methods applied in other countries. In addition, the quality and the quantity of inputs were mostly appropriate and the inputs were fully utilized for project activities to date.

(4) Impact

The Overall Goal of the Project is "the NWR ratio in Colombo City is reduced." NRW ratios are reduced in the pilot projects and overall goal is likely to be achieved. The Project will prepare an execution plan, which suggests strategy and effective methods of NRW reduction activities suitable in Colombo City

along with the cost estimation and required manpower. When the NRW reduction activities are continued by NWSDB based on the execution plan with high commitment of NWSDB's executives, it is expected that the results of the Project will contribute to NRW reduction in Colombo City in the future. Since the Project has involved several AEs or OICs of non-pilot areas in project activities, NWSDB now has a certain level of foothold in extending NRW reduction activities. If every AEs and OICs/EAs in Colombo city will gain systematic way of NRW reduction, knowledge, technique and experience by participating in pilot activities in the remaining cooperation period, the possibility of realizing NRW reduction will be further promoted. As generally recognized, the combination of soft-measures, such as leakage detection/ repair, detection of illegal connection, reduction of stand posts, and hard-measures of pile replacement are very effective to reduce NRW. It is necessary for the budget and equipment for NRW reduction activities and renewal of deteriorated pipes to be secured.

(5) Sustainability

Sustainability of the Project is considered to be secured if the conditions below are satisfied.

■ Policy and Institutional Aspects

The policy environment is still likely to be favorable for NWSDB. The GOSL keeps the improvement of water supply services among its prioritized areas, addressing the sustainable safe drinking water for all at an affordable price and identifying the specific actions to be taken, such as implementation of non-revenue water (NRW) reduction program to minimize the NRW rate up to 20 % by 2020.

■ Financial Aspects

While it is difficult to identify the allocated amount for NRW reduction activities at NWSDB, a certain amount of budget has been allocated and disbursed for NRW related activities. The amount for the repairs and maintenance for water service was 461.4 million LKR in 2009,[5] and this partially include the amount allocated for NRW reduction activities.[6] At NWSDB, the cost associated with O&M is currently covered by water charge. The financial statement in NWSDB Annual Plan of 2009 indicated that the sales of water exceeded the direct cost,[7] while the financial condition of NWSDB was overall in deficit in 2009 due to the large amount of financial cost.[8] In addition, NRW Reduction Management Team mentioned that the budget for NRW reduction is not sufficient but the budget is certainly allocated. Therefore, it can be judged that a certain amount of budget will be continuously allocated when the executives admit the effectiveness of NRW reduction activities and commit to its implementation. The cost of the pilot projects is born by NWSDB and it is estimated that NRW Reduction Management Team and NRW Reduction Teams will exist.

[5] According to the NWSDB Annual Reports in 2009.
[6] Annual Report 2009 reported that 50 million LKR was allocated in 2009 for Northern Central, 15 million each for Central, North Central and North Western, 5 million for Northern, 62 million for 2010 for Southern, Uva Sabaraganuwa &Eastern Provinces to reduce UFW.
[7] The direct cost includes personnel cost, pumping/chemical costs, repair & maintenance
[8] Mostly financial cost is repayment for donor funds.

■ Technical Aspects

The counterpart personnel has well accepted the knowledge and techniques introduced by the Project and recognized the usefulness of the systematic technologies of NRW reduction. Especially, the AEs and OICs/EAs in pilot and non-pilot areas have learned about the systematic techniques to pursue the NRW reduction activities and gained sufficient experiences. Since the counterpart personnel originally had basic knowledge and techniques on NRW reduction, it would not be difficult to sustain their techniques learned from the Project. To ensure the technical sustainability in Colombo City, it is important to consider how the systematic methods of NRW reduction to be proposed in an execution plan will be disseminated to other areas.[9] Since the rotation system, which was a proposed mechanism to disseminate the technologies to non-pilot areas, has not functioned well, it is important to provide opportunities for AEs and OICs/EAs in non-pilot areas to participate in pilot activities and weekly meetings in the remaining cooperation period.

The counterpart personnel has tried to store and maintain the provided equipment with the utmost care. In this respect, the equipment provided by the Project will be maintained after the project cooperation is terminated. On the other hand, it should be noted that some of the equipment, especially electronic products, were foreign products, and NWSDB may need to contact the overseas manufacturers through email when those of equipment have problems.

3-3 Factors that promoted realization of effects

(1) Factors concerning the planning

Nothing special.

(2) Factors concerning the implementation process

- NRW reduction management team showed the strong commitment to NRW reduction measures and executed leadership in promoting project activity (factor to promote effect of the project)
- In the technical exchange programs counterparts learned that the NRW reduction activities which they have been practicing through project activities are implemented and have good effect, which promoted the understanding of the project activities (factor to promote project implementation).

3-4 Factors that impeded realization of effects

(1) Factors concerning the planning

Nothing special

(2) Factors concerning the implementation process

- It took time to get approval from concerned organizations, for example permission of digging the roads. Also it takes time for procedure to apply inside NWSDB.
- It took time to coordinate within NWSDB. For example necessary vehicles and drivers are not

[9] The Project found that the systematic isolation work may not be very effective in Colombo City due to the unique feature in the city. The Project is now considering other better options to isolate areas, measure the water flow and extent the NRW activities.

always allocated which influenced project activities.

- It took more time for isolation in subzone in pilot activities than expected, since as built drawing was not collect, distribution pipes are connected in unexpected places, low water pressure and difficult finding location of valves.
- Counterparts had not only project activities but also ordinary work. Therefore they frequently couldn't concentrate on the project activities. In addition to ordinary work, there were urgent task of emergency pipes replacement which was highly prioritized. Therefore they sometimes couldn't participate at pilot activities.
- While JICA experts were absent, problems sometimes occurred for example, the vehicle and/or heavy equipment were not allocated. Therefore activities slumbered.

3-5 Conclusion

The Project is likely to achieve its intended target to a large extent when all planned activities are completed as scheduled in the remaining cooperation period. Therefore the Project should be terminated as scheduled.

Although the delay of pilot activities has occurred, NWSDB and the JICA experts made lots of effort to minimize its delay. To date, the technical capacity of the counterpart personnel has been enhanced as planned. In coming nine months, the Project will analyze the results of pilot activities, identify the effective methods of systematic NRW reduction suitable in Colombo City, and incorporate the ideas in the execution plan on NRW reduction. The process of discussion to find the effective and appropriate techniques of NRW reduction will be a good opportunity for NWSDB to gain more findings on NRW reduction methods. Therefore, by the end of the cooperation period, the management and technical capacity of NWSDB will be further enhanced. The Terminal Evaluation Team regarded the Project as worth implementing judging from the relevance. The effectiveness was also at the good level. On the other hand, the Project was assessed as partly efficient due to several causes affecting the project implementation. The strong commitment and determination of NWSDB's executives toward the implementation and extension of the systematic NRW reduction activities will increase the possibility to ensure the impact and the sustainability of the Project.

3-6 Recommendations

(1) Dissemination of systematic approach of NRW reduction

This project is supposed to terminate in October 2012. In future NRW reduction measures need to be implemented not only in Kotahena and Borella but also whole Colombo City. To do so, NRW Reduction Management Team will draft an execution plan by the end of the project. At the same time for disseminating methods of NRW reduction, it is recommended that at least the AEs and OICs/ EAs from all OIC areas participate in both the weekly meetings and pilot activities.

(2) Replacement of deteriorated pipeline

After Mid-term review, NWSDB determined to implement the pipe replacement by utilizing foreign fund

of Water Sector Development Project (I) – Greater Colombo Water Rehabilitation Project. The result of this work is very crucial to pursue a comparative analysis originally planned in the Project. Since the Project will be completed in nine months, the pipe replacement work in Kotahena needs to be completed by June 2012. Therefore, NWSDB should proceed with the pipe replacement work as early as possible.

(3) Smooth implementation of internal procedure

While NWSDB has made lots of efforts to increase the number of vehicles and cadre of O&M sections, some difficulties in internal arrangement still have been observed. Time matters for the Project since only nine months remain until the cooperation period is completed. Therefore, the Team recommended that NWSDB arrange the following points to promote the further smooth implementation and ensure the attainment of the Project:

- Allocation for the vehicles for GPS team and PR activities
- Review the working efficiency of GIS operators to promote the data input on GIS to ensure data input completion by the end of cooperation period

(4) Budget and human resources for NRW reduction measures

To ensure the sustainability of NRW reduction activities, sufficient budget and human resources for NRW reduction measures should be secured, even after the Project completion.

(5) Utilization of experienced staff

Staff of NRW reduction in Kotahena and Borella acquired knowledge of NRW reduction through the project activities. The NRW reduction activities will be implemented based on the execution plan which will be supposed to be drafted in 2012. It is strongly recommended to utilize NWSDB's already available human resources of Kotahena and Borella in other areas.

(6) Implementation of updating pipe networks information in routine work and effective utilization of the information

NWSDB should practice updating pipe information with collected data such as pipe locating survey during NRW activities, as-built drawings after installation works, and field data after repair works. NWSDB is recommended to extend such practice to its whole service area.

(7) Establishing GIS and its utilization

GIS was introduced after the Mid-term review as an effective measure for supporting NRW reduction activities. Now data of Kotahena and Borella is being put into GIS database. However the effect of GIS will be limited unless input data are sufficient, precise and always updated. It is recommended therefore to continue GIS activities and utilize it for planning and daily operations.

(8) Coordination with M/P by JICA and other projects

Currently updating M/P of Colombo City is being worked utilizing Yen Loan including the component of

the NRW reduction. Also ADB shows interest in NRW reduction of Colombo City. Therefore NWSDB is recommended to coordinate M/P updating by JICA and other related projects, if any, with the Project to utilize its outputs as written in the Minutes of the Meeting.

(9) Leakage control of distribution main

NWSDB considers that distribution mains connected to the pilot project areas also have substantial leakage. Therefore, it is recommended to apply the currently available equipment to the specific local conditions.

(10)Benefit/Cost analysis of NRW reduction

It is recommended to analyze benefit and cost of NRW reduction activities for presenting financial impact of the activities.

3-7 Lessons Learned

(1) Physical loss contributed to the major losses

The major cause of NRW in the pilot project areas is physical loss (leakage). Since situations of NRW are different from area to area, countermeasures should be selected from wide range of solutions accordingly.

(2) Replaced pipe to be removed or disconnected

During field work, NRW teams found several secondary distribution mains and service pipes, both recorded and unrecorded, were hardly recognized as being in service or abandoned. For future replacement of pipeline, distinctly different color or color coding should be introduced instead of the existing ones such as grey. In addition to coloring, when pipes are installed for replacing purposes, existing pipes should be removed or disconnected properly in order to reduce NRW.

第1章　終了時評価調査の概要

1-1　終了時評価調査の目的

スリランカ国（以下「ス」国）における上下水道施設の多くは国家上下水道公社（NWSDB）が管轄しているが、無収水率の高さ（全国平均約 33%）が経営上の大きな課題となっている。特に首都コロンボ市は、75～100 年前の英国植民地時代に布設された送配水管がその多くを占めており、無収水率は 54.1%（2008 年）と全国で最も高くなっている。NWSDB では、漏水修理、違法接続の摘発・排除、公共水栓の撤去及び戸別接続化、料金請求方法の改善等に取り組んでいるものの、顕著な成果を挙げるに至っていない。

NWSDB の事業計画（2007～2011 年）では無収水削減を優先課題の一つとし、無収水削減目標を設定したが、その達成には NWSDB の実施能力・経験が不足しており、ドナー等による支援が必要とされている。また、2007 年 6 月には「コロンボ市無収水削減戦略的アプローチ」と題する 5 ヵ年計画において実施体制の再編や投入計画を策定したが、予算不足等により開始が遅れている。このような状況において「ス」国政府は、2008 年に NWSDB をカウンターパート（C/P）機関とする無収水削減に関する技術協力を我が国政府に要請した。これを受けて JICA は、NWSDB 職員の無収水対策技術の向上のみならず、NWSDB が組織横断的に無収水削減に取り組むための計画立案、実施・運営、情報管理能力の向上を目的とする本プロジェクト「コロンボ市無収水削減能力強化プロジェクト」を 2009 年 10 月から 2012 年 10 月までの 3 年間の予定で実施している。

協力終了までおおよそ半年前になることから、以下を目的として、終了時評価を実施することとなった。なお、評価は日本およびスリランカの調査団との合同評価を行うこととした。

（1） プロジェクト進捗状況、実施プロセスの確認、評価
（2） プロジェクト終了まで及び終了後のスリランカ側課題に関する提言、類似案件実施の際の教訓の導出

1-2　調査団の構成

スリランカ側

Mr. K. L. L Premanath	NWSDB 総局長
Mr. S. K. Wijetunga	NWSDB 西部地区局長
Mr. W.B.G. Fernando	NWSDB 西中央部部長
Mr. K.W. Premasiri	NWSDB 西中央部開発課長
Mr. S.G.G. Rajkumar	NWSDB 西中央部無収水課長
Mr. S.A. Rasheed	NWSDB 西中央部運営維持管理課長

日本側

大村　良樹	総括／無収水削減	JICA 国際協力専門員
磯辺　良介	計画評価	JICA 地球環境部 水資源第一課
柏原　友子	協力管理	JICA スリランカ事務所
南村　亜矢子	評価分析	合同会社適材適所

1-3 調査期間

終了時評価調査の日程は以下のとおり。

			JICA 団員	コンサルタント団員
1	1 月 25 日	水		11:10 東京→17:45 シンガポール（SQ637） 22:50 シンガポール→
2	1 月 26 日	木		→ 00:05 コロンボ（SQ468） 9:30 JICA 事務所訪問 11:00 NWSDB 表敬
3	1 月 27 日	金		NWSDB 情報収集
4	1 月 28 日	土		情報分析
5	1 月 29 日	日		情報分析
6	1 月 30 日	月		専門家からのヒアリング
7	1 月 31 日	火		NWSDB ヒアリング
8	2 月 1 日	水		NWSDB ヒアリング
9	2 月 2 日	木		NWSDB ヒアリング
10	2 月 3 日	金		資料整理
11	2 月 4 日	土		資料整理
12	2 月 5 日	日		合同評価報告書案作成
13	2 月 6 日	月		合同評価報告書案作成
14	2 月 7 日	火		合同評価報告書案作成
15	2 月 8 日	水	11:10 東京→17:45 シンガポール（SQ637） 22:50 シンガポール→	合同評価報告書案作成
16	2 月 9 日	木	→ 00:05 コロンボ（SQ468） 9:30 上下水道省表敬 10:30 NWSDB GM 表敬 13:00 JICA 事務所打ち合わせ 14:00 ERD 表敬	9:30 上下水道省表敬 10:30 NWSDB GM 表敬 13:00 JICA 事務所打ち合わせ 14:00 ERD 表敬
17	2 月 10 日	金	9:30 NWSDBCP からの聞き取り調査 13:45 プロジェクト専門家からの聞き取り調査	
18	2 月 11 日	土	合同評価報告書案作成、分析整理	
19	2 月 12 日	日	合同評価報告書案作成、分析整理 14:00 団内打ち合わせ	
20	2 月 13 日	月	11:30 パイロットプロジェクトサイト視察（Kotahena） 13:00 合同評価報告書協議 15:00 パイロットプロジェクトサイト視察（Borella）	
21	2 月 14 日	火	11:30 合同評価報告書協議 14:45 Weekly Meeting 参加	
22	2 月 15 日	水	10:00 合同調整委員会 16:00 JICA 事務所報告	
23	2 月 16 日	木	M/M 署名 16:00 大使館報告	
24	2 月 17 日	金	1:20 コロンボ→ 7:50 シンガポール（SQ469） 9:25 シンガポール→17:05 東京（SQ012）	

第2章　終了時評価調査の手法

2-1　終了時評価調査の手法

本終了時評価調査は、「新 JICA 事業評価ガイドライン第 1 版（2010 年 6 月）」に基づき、プロジェクトサイクル・マネジメント（Project Cycle Management）手法で用いられるプロジェクト・デザイン・マトリックス（Project Design Matrix、以下 PDM）を活用して、以下の手順で実施した。

1) PDM に基づいて評価の枠組みをデザインする（評価グリッドの作成（添付資料 3））。
2) プロジェクトの実績を中心としたデータを収集する。
3) 「妥当性」「有効性」「効率性」「インパクト」「持続性」の観点（評価 5 項目、詳細は後述）から収集データを分析する。
4) 分析結果からプロジェクトの残りの実施期間の活動に対する提言を抽出する。また他の類似事業に有益な教訓を得る。

2-2　主な調査項目とデータ収集方法

2-2-1　主な調査項目

調査項目は、プロジェクトの実績、実施プロセスの確認、評価 5 項目の観点による評価に分けられる。

（1） プロジェクトの実績の確認

評価グリッドをもとに、プロジェクトの投入実績、活動実績、アウトプット（成果）の現状、プロジェクト目標の達成見込みを確認・検証する。

（2） プロジェクトの実施プロセスの確認

プロジェクトの実施過程を確認する。主な調査項目は、プロジェクトを円滑に実施するために工夫された点、モニタリングシステムの有無、プロジェクト関係者間の連携状況などである。

（3） 評価 5 項目に基づく分析

プロジェクトの実績と実施プロセスの確認を通じて収集した情報を元に、評価 5 項目の 1) 妥当性、2) 有効性、3) 効率性、4) インパクト、5) 持続性の観点からプロジェクトを評価する。各評価項目の主な視点は次のとおり。

妥当性	プロジェクト目標がターゲットグループのニーズと合致しているか、相手国側の政策との整合性があるのかなど、援助プロジェクトの正当性・必要性を問う。
有効性	プロジェクトの実施により、ターゲットグループに便益がもたされているかを検証し、プロジェクトが有効であるかどうかを判断する。
効率性	プロジェクトの資源の有効活用という観点から効率的であったかどうかを検証する。
インパクト	プロジェクト実施によりもたらされる、より長期的・間接的な効果や波及効果をみる。
持続性	援助の終了後、プロジェクトで発現した効果が持続するかを問う。

2-2-2 データ収集方法

(1) 既存資料のレビューと分析

プロジェクトに関する以下の既存資料をレビューし、情報分析に活用した。

＜既存資料＞

1) 協議議事録（Minutes of Meetings, 以下 M/M）－2009 年 4 月に署名・交換
2) 討議議事録（Record of Discussions, 以下 R/D）－2009 年 4 月に署名・交換
3) PDM_0（上記の 2009 年 4 月に署名・交換された M/M に含まれる）－2009 年 4 月承認
4) PDM_2（2011 年 6 月 22 日に開催された第 5 回 JCC において承認）
5) コロンボ上水道セクター開発基礎情報収集調査報告書（2008 年 12 月）
6) インセプション・レポート（2009 年 11 月）
7) プログレス・レポート（英）
   - 第 1 号（2010 年 5 月）
   - 第 2 号（2010 年 10 月）
   - 第 3 号（2011 年 3 月）
   - 第 4 号（2011 年 10 月）
8) 一年次業務完了報告書（2011 年 3 月）
9) プロジェクト作成資料（JCC 資料、週会議議事録など）
10) 中間レビュー調査報告書（2011 年 4 月）

＜現地調査期間中に入手した資料＞

- これまでの活動の過程でまとめられた資料
- スリランカ側政策関連資料
- NWSDB 事業計画書（Corporate Plan）、年次報告書（Annual Report）

(2) プロジェクト関係者への質問票配布

現地調査に先立ち、評価分析団員がプロジェクトの実績、実施プロセス、評価 5 項目に関する質問票案を作成し、事前にプロジェクトの JICA 専門家、NWSDB の DGM、無収水削減マネジメント・チームのメンバー、無収水削減チームのメンバーに配布した。現地調査中に質問票の回答を回収した。

(3) プロジェクト関係者に対するインタビューの実施

上記質問票の回答をもとにプロジェクトの実績・実施プロセスを確認し、補足情報を収集するために、プロジェクト関係者に個別インタビューあるいはグループインタビューを実施した。

(4) 合同調整委員会への報告

終了時評価調査の結果を「合同終了時評価調査報告書」としてまとめ、2012 年 2 月 15 日に開催された合同調整委員会で評価結果を報告した。その後、内容について協議し、日本・スリランカ側関係機関との間で終了時評価調査の結果に関する協議議事録の署名・交換を行った。

第3章　評価結果

3-1　プロジェクトの実績

3-1-1　投入実績

■ スリランカ側の投入

(1) カウンターパートの配置

1) プロジェクト・ヘッド

- 国家上下水道公社 ジェネラル・マネージャー（General Manager：GM）

2) プロジェクト・ダイレクター

- 国家上下水道公社 西部州 アディショナル・ジェネラル・マネージャー（Additional General Manager）

3) プロジェクト・マネージャー

- 国家上下水道公社 西部州中部地区 デュプティ・ジェネラル・マネージャー （Deputy General Manager：DGM）

4) プロジェクト・リーダー

- 国家上下水道公社 西部州中部地区支援センター アシスタント・ジェネラル・マネージャー（無収水削減）（Assistant General Manager：AGM）

5) 無収水削減チーム

- 無収水削減マネジメント・チームと各パイロット地区に無収水削減チームが設置された。詳細なメンバーリストは、合同終了時評価調査報告書 Annex2 を参照。

(2) プロジェクト活動費

スリランカの財務計画省を通じて以下の費用が支出された。

（単位: LKR）

項目	2010 （実績）	2011 （実績）	2012 （計画）
機材に関する税金	22,000,000	539,826	-
消耗品費（ガソリン代等）	3,000,000	0	-
合計*	25,000,000	539,826	20,000,000**

（*: 上記のプロジェクト活動費は、財務計画省から支出された「カウンターパート・ファンド」である。）

（**: 2012 年の 2000 万ルピーについては、現在財務計画省からの承認待ちである。）

以下の費用が NWSDB から支出されている。

- カウンターパートの給与、諸手当等（プロジェクト活動によって発生する残業代や夜間作業

手当）

- パイロット地区での分離化工事、漏水発見後の管網補修、道路開削・復旧のための土木工事費用
- プロジェクト事務所の電気、水道、電話、ガス燃料等の費用
- JICAからの供与・携行機材の輸入、調達に関連して必要となる関税・税金、税関手続き、保管、国内輸送に要する費用
- JICAからの供与・携行機材の維持管理費用
- 本プロジェクトに関連するその他の臨時費用

(3) 施設や機材の提供

- NWSDB内におけるプロジェクトの事務スペースと必要な設備
- プロジェクトの活動に必要な会議室や研修のための場所

■ 日本側の投入

(1) 専門家派遣

プロジェクト開始から 2012 年 1 月までに派遣された専門家の担当分野と派遣期間は次のとおりである。これまで 6 人の専門家が合計 48.62MM 派遣された。

（単位：人/月）

分野	1 年次 2009/10 – 2011/3	2 年次 (1 月まで) 2011/4 – 2012/1
1 総括/無収水削減プログラム	10.50	4.03
2 副総括/無収水削減モニタリング・評価	7.10	1.80
3 漏水探知技術	6.20	2.53
4 管路図整備・顧客情報	6.80	1.46
5 給水管接続技術	2.40	2.00
6 業務調整	2.80	1.00
小計	35.80	12.82
合計		48.62

(2) 機材の投入（終了時評価調査報告書 Annex3）

プロジェクト開始から終了時評価時点までの期間において、3798 万円（約 5544 万 KLR）の機材が供与されている。プロジェクトで供与された主な機材リストは、合同終了時評価報告書（英文）の Annex4 を参照。

（単位：日本円）

1 年次（2009/10- 2011/3） （実績）	2 年次（2011/4- 2012/3） （実績）	合計
33,364,031	4,615,404	37,979,435

(3) 現地業務費

現地業務費は以下の表に示すとおりである。1 年次には 832 万円（約 1214 万スリランカ・ルピー：

以下ルピー）が支出され、2 年次の予算額は、1040 万円（約 1518 万 KLR）である。

（単位：日本円）

		1 年次 （2009/9- 2011/3） （実績）	2 年次 （2011/4- 2012/3） （計画）
1	一般業務費	7,260,000	8,806,000
2	機材輸送費	262,000	100,000
3	報告書作成費	54,000	12,000
4	海外研修費	739,000	1,479,000
	小計	8,315,000	10,397,000
	合計		18,712,000

（4）海外研修

これまで延べ 22 人が本邦研修、ヨルダン、インドネシアでの第 3 国技術交流会に参加した。本邦研修は 10 人、ヨルダンは 6 人、インドネシアは 6 人が参加した（合計で 234 人／日）。参加者リストは、合同終了時評価報告書（英文）の Annex5 を参照。

3-1-2 アウトプット（成果）の達成状況

PDM_2 に基づいたプロジェクト開始から 2012 年 1 月までのアウトプット（成果）の達成状況とプロジェクト期間終了までの達成見込みは以下のとおり。

（1） アウトプット 1：

要約	指標
西部州中部地区支援センター所属の上級職員の計画立案・実施管理能力が向上する。	1-1. 「無収水削減年次計画」が毎年策定される。 1-2. 十分な予算・資材・人員を確保し、パイロット・エリアでの無収水対策が円滑に実施される。 1-3. 無収水削減に係る研修プログラムがレビューされ、無収水削減チームに対して研修が実施される。

西部州中部地区支援センターの上級職員の無収水対策活動を立案し、実施・管理する能力は強化されてきたといえる。

〈1−1.「無収水削減年次計画」が毎年策定される〉

2010 年 5 月に無収水削減マネジメント・チームは 1 年次の無収水削減プログラムを JICA 専門家と共同で作成し、2 年次のプログラムは 2011 年 6 月にマネジメント・チームだけで作成した。2 年次の活動結果をレビューし、3 年次の年次計画が 2012 年 5 月頃に策定される予定である。

〈1−2. 十分な予算・資材・人員を確保し、パイロット・エリアでの無収水対策が円滑に実施される〉

2011 年 2 月に実施された中間レビュー調査の結果を受けて、NWSDB はリソースをプロジェクト活動に割り当てるように尽力し、プロジェクト期間の後半パイロット地区の活動は比較的円滑に実施されるようになった。まず中間レビュー調査後、NWSDB は維持管理課のエンジニアリング・アシスタント（Engineering Assistant：EA）の空席ポストを埋め、パイロット活動に参加できる人員の増加を試みた。しかし維持管理課の通常業務で多忙となり、新規雇用された EA もプロジェク

ト活動にあまり参加できなかった。また現場レベルでは、無収水対策に携わるタスクチームが 2 つのパイロット地区で合計 6 チーム編成されていたが、タスクチームも本来業務で多忙であり、プロジェクト活動に十分従事することができなかった。そこで 2011 年の中頃に NRW 削減マネジメント・チームはこの問題を解決するために、6 チームあったタスクチームを 4 チームに再編成し、そのうち 2 チームを各パイロット地区の活動に専従するチームとした（1 地区 1 チーム）。それ以降、パイロット活動は円滑に進むようになった。

2010 年に、NWSDB は 3 年間のプロジェクト活動費として約 2 億ルピーを計上し、カウンターパート・ファンドとして財務計画省に予算を申請した。2010 年は 2500 万ルピーが供与機材の税金分として財務計画省から拠出され、2011 年には 97 万ルピーが GIS 関連機材の税金分として拠出された。2012 年は 2000 万ルピーの予算額を財務計画省に申請中であり、現在承認が下りるのを待っている状態である。これまでパイロット活動にかかった人件費、給水管補修等の漏水修理にかかる材料費などの必要経費は NWSDB の通常予算から拠出されている。

<1-3. 無収水削減に係る研修プログラムがレビューされ、無収水削減チームに対して研修が実施される>

プロジェクト期間の初期に JICA 専門家と NRW 削減マネジメント・チームで既存の研修プログラムをレビューし、研修プログラムでカバーされるべきテーマやトピックスを特定した。さらに無収水削減に関するセミナーやワークショップを開催し（これまで実施されたセミナーやワークショップは合同終了時評価報告書の Annex6 を参照）、セミナーやワークショップのプレゼンテーションのほとんどを NRW 削減マネジメント・チームと NRW 削減チームのメンバーが担当した。

(2) アウトプット 2：

要約	指標
西部州中部地区支援センター所属の技術者及び作業員の無収水削減活動を実施するための業務遂行能力（技術力・施工管理能力）が向上する。	2-1. 2 ヶ所のパイロット･エリアで無収水削減チームが組織され、ワークプランに沿った無収水削減活動が実施される。 2-2. 無収水削減チームを構成する技術者および作業員が、漏水調査、給水管接続、管補修に関する適切な技術を身に付ける。 2-3. パイロット・エリアの無収水率がプロジェクト実施前と比べて減少する。

全般的に西部州中部地区支援センターの技術者と作業員の無収水削減活動に関する業務遂行能力は向上してきたといえる。詳細は以下のとおり。

<2-1. 2 ヶ所のパイロット･エリアで無収水削減チームが組織され、ワークプランに沿った無収水削減活動が実施される>

2009 年にエリア・エンジニア（Area Engineer）をリーダーとした無収水対策チームがコタヘナとボレッラのパイロット地区で編成され、その中に各地区 3 チームずつのタスクチームが形成された（合計で 6 チーム）。アウトプット 1 で既述したように、2011 年の中頃に 6 つのタスクチームが 4 チームに再編成され、パイロット活動に従事するようになってから無収水対策チームもうまく機能するようになった。無収水対策マネジメント・チームと JICA 専門家の支援を受けて無収水対策チームがパイロット地区のワークプランを作成し、活動の進捗に応じてプランを数回見直している。

これまで、管路図面情報が正確ではない、予期せぬ場所に配管が接続されている、水圧が低い、地中に埋まったバルブの探査が困難などの要因でサブ・ゾーンの水理的分離作業に予想以上に時間がかかり、活動全体の進捗にやや遅れが生じている。

終了時評価調査の実施時点で、コタヘナ地区とボレッラ地区のほとんどのサブ・ゾーンで水理的分離作業が終了しており、配水量分析等の活動に移行できる状態となった。2012 年 6 月頃までには、具体的な数値もあがってくると予想され、パイロット活動の成果がまとめられることになる。

<2-2. 無収水削減チームを構成する技術者および作業員が、漏水調査、給水管接続、管補修に関する適切な技術を身に付ける>

無収水対策チームのメンバーは、プロジェクト活動を通じて、体系的な無収水削減方法の知識や技術を習得してきたといえる。NWSDB の職員はこれまで漏水箇所の補修や給水管接続などは行えたが、無収水削減活動のステップを細かく設定し、フローチャートを作成して、ひとつひとつ確認しながら活動を進める方法はこれまでに実施したことがなかった[10]。カウンターパートはプロジェクトで導入したこのような体系的な方法をセミナー、ワークショップ、OJT を通じて習得してきた。コタヘナ地区の 4 つのサブ・ゾーン（K3-K6）とボレッラ地区の 4 つのサブ・ゾーン（B2、B4-B6）で水理的分離作業がほぼ終了しているので、カウンターパートは次のステップの活動を順次実施して体系的な無収水削減活動に関する知識、技術、経験をさらに積む予定である。

中間レビュー調査の結果を受けて、2011 年 3 月に NWSDB は GIS と PR 活動に関する提案書を作成・提出し、これらの活動を正式にプロジェクト活動に組み込んだ。GIS に関する研修が実施され（合同終了時評価報告書 Annex7 参照）、現時点でパイロット地区の約 10%をカバーしたベースマップが作成されている[11]。プロジェクトでは、小さな区域である程度の情報が入力できた時点で、その情報を活用して無収水削減のための効果的な GIS の活用方法をカウンターパートに指導する予定である。PR の活動計画は既に作成され、学校での PR 活動が既に実施されている[12]。

<2-3. パイロット・エリアの無収水率がプロジェクト実施前と比べて減少する>

現時点で水理的分離作業が終了している 4 つのサブ・ゾーンで、無収水率やその他の関連データが測定されている。

<コタヘナ地区>

	サブ・ゾーン						
無収水率（%）	K1	K2	K3	K4	K5	K6	K7-K10***
活動実施前	85.3%	78.5%					
1 次活動後*	73.0% (2011/6/20-26)	75.5% (2011/6/30)					
2 次活動後**	60.3% (2011/8/16)	-					

[10] 大まかな活動は、サブ・ゾーンの設定（5000 戸程度をカバーした各パイロット地区（ゾーン）をさらに 500 戸程度に分割したサブ・ゾーンで無収水活動を実施している）、水理的分離、流入量の把握、夜間最小水量の測定、漏水探査・修理、違法接続対策、量水器誤差の把握・改善、公共水栓水量の把握・戸別給水栓化等である。

[11] 既存の配管網はほぼ入力済みであるが、家屋情報を含めるとカバー率が 10%程度である（JICA 専門家からの情報より）

[12] 水の大切さに関するお話しを NWSDB の職員が生徒に行い、その後水の大切さをテーマにしたポスターを書いてもらい、コンクールを行うという活動が実施されている。

	サブ・ゾーン						
無収水率（%）	K1	K2	K3	K4	K5	K6	K7-K10***
無収水削減活動（実施数）							
公共水栓の把握・量水器の設置	14	33					
違法接続の摘発・対策	49	23					
量水器誤差の把握・改善	18	8					
漏水探査・修理	85	71					

（出所：2011 年 10 月作成のプログレス・レポート IV より）

*： 1次活動：無収水の各種数値を得る前に実施する一連の無収水削減活動のことを指す。この1次活動によって無収水削減活動が完了する場合もある。

**： 2次活動：「1次活動」後に実施する一連の無収水対策活動。「2次活動」は「1次活動」で効果が得られない場合に実施する。

***: この地区では、サンプル・ゾーンにおける水理的分離作業を実施し、その後一連の無収水削減活動を実施する予定である。

<ボレッラ地区>

	サブ・ゾーン						
無収水率（%）	B1	B2	B3	B4	B5	B6	B7-B10*
活動実施前	40.3%		84.3%				
1 次活動後	22.5% (2011/9/25)		50.6% (2011/1/21)				
2 次活動後	16.3% (2011/2/2)		28.6% (2011/1/20-21)				
無収水削減活動（実施数）							
公共水栓の把握・量水器の設置	2		0				
違法接続の摘発・対策	8		19				
量水器誤差の把握・改善	7		17				
漏水探査・修理	46		19				

（出所：2011 年 10 月作成のプログレス・レポート IV より）

*: この地区では、サンプル・ゾーンにおける水理的分離作業を実施し、その後一連の無収水削減活動を実施する予定である。

NRW 削減マネジメント・チームと JICA 専門家によれば、比較的配管の状態がよいボレッラ地区ではプロジェクトで実施した無収水削減活動の効果が上がっているとのことである。一方、配管の老朽化が著しいコタヘナ地区から得られたデータを分析した結果、無収水削減活動による一定の効果は認められるが、老朽管の布設替えや他の活動と組み合わせた無収水対策活動が必要であるとのことである。

このようにプロジェクトではパイロット活動を通じて、一連の体系化された無収水削減活動がどのような条件の下で実施すれば効果が上がるか、また配管の老朽化が著しい場合の対応策について知見を得つつあるといえる。

3-1-3　プロジェクト目標の達成度

要約	指標
国家上下水道公社（NWSDB）のコロンボ市における無収水対策の遂行能力が強化される。	1) コロンボ市における無収水削減活動の実績がプロジェクト開始前と比べて増加する。 2) NWSDBのコロンボ市の無収水対策実施のための予算がプロジェクト開始前と比べて増加する。 3) Corporate Planで設定された目標値の達成に資する展開計画（案）が作成され、NWSDBの事業計画に反映される。

〈1）コロンボ市における無収水削減活動の実績がプロジェクト開始前と比べて増加する〉

パイロット地区での無収水削減活動の状況は「3-1-2. アウトプット（成果）の達成状況」の「アウトプット 2」での述べたとおりである。プロジェクトでは当初ローテーション方式[13]を実施し、体系的な無収水削減活動の普及を考えていたが、2011 年 2 月に実施された中間レビュー調査後もローテーション方式は実現しなかった。これは、パイロット地区外でタスクチームを編成してパイロット活動に参加させる場合、タスクチームのメンバーが担当している通常業務を他の職員がカバーしなくてはならないが、NWSDB では全般的に人員が不足しており、タスクチームが編成できなかったためである。ローテーション方式の代わりに、NWSDB では、パイロット地区外のエリア・エンジニア（AE）、担当オフィサー（Officer in charge：OIC）、エンジニアリング・アシスタント（Engineering Assistant：EA）をパイロット活動と週会議に参加させるようにして、知識、技術の習得を促し、さらに週会議では問題点や解決策の共有を図った。これまでコロンボ市南地区の AE、コロンボ市東地区の AE と OIC がセミナー/ワークショップ、OJT、週会議を通じて体系的な無収水削減対策の手法を習得して、それぞれの担当地区で実践している。下表は、これまでパイロット地区外で実践された無収水削減活動の実績である。

	地区名		
	Kirulapana サブ・ゾーン（コロンボ市南地区）*	Kent road サブ・ゾーン（コロンボ市東地区）*	Handala Frerry road サブ・ゾーン（コロンボ市北地区）*
無収水率 (%)			
活動前	18.9%	52.8%	18.3%
活動後	7.0% (2010/12/15)	38.0% (2011/1/19)	-
公共水栓の把握・量水器の設置	-	-	-
違法接続の摘発・対策	4	-	2
量水器誤差の把握・改善	-	-	-
漏水探査・修理	11	29	14

[13] ローテーション方式は(i) コロンボ市内のパイロット・エリア以外の地区を受け持つタスクチームを維持管理課で 2 つ編成し、コタヘナ地区、ボレッラ地区に 1 チームずつ派遣してパイロット活動に参画し、技術を習得すること、(ii) 本来の担当地区に戻った際に、習得した技術を担当地区で広げていくこと、(iii) その後は、別のパイロット・エリア外の地区より新たにタスクチーム 2 つがパイロット活動に参画し、技術を習得していくことを目的とした方式のことである。

〈2〉NWSDB のコロンボ市の無収水対策実施のための予算がプロジェクト開始前と比べて増加する〉

維持管理課と無収水課では、無収水対策関連の活動を各課の通常予算で賄っているため、NWSDB の通常予算から無収水対策関連の予算を算出するのは困難である。財務計画省から支出されたカウンターパート・ファンドの額が NWSDB で計上していた額よりも少なかったので、NWSDB はプロジェクト活動に必要な経費を通常予算から支出してきた。したがって、NWSDB は無収水削減活動にある一定の予算配分をしてきたことになる。

〈3〉Corporate Plan で設定された目標値の達成に資する、展開計画（案）が作成され、NWSDB の事業計画に反映される〉

活動計画表（Plan of Operations：PO）によれば、プロジェクトではプロジェクト期間の 3 年目に展開計画（案）を作成する予定である。パイロット活動の分析結果とコロンボ市の状況に適応した効果的な無収水対策活動をこの計画（案）で提案する予定であり、無収水対策に必要な費用や人員も算出する。プロジェクトでは既にパイロット活動の結果からいくつかの知見を得ており、今後も水理的分離が終了したサブ・ゾーンにおける活動結果を通じて、展開計画を策定するために必要となるデータや知見をさらに得ることになる。また中間レビュー調査で提言されたように、NWSDB では水セクター開発事業（I）の余剰資金を利用してコタヘナ地区の老朽管布設替えを促進することを決定し、この結果を活用してプロジェクトで比較分析を行おうとしている[14]。現時点では、コタヘナ地区の配管布設替え事業もやや遅延傾向にあるため、NWSDB で配管布設替えを可能な限り早期に実施し、ここから得られたデータを活用してプロジェクトで計画していた比較分析をプロジェクト期間終了までに実施されるよう期待される。

3-1-4　上位目標達成の見込み

要約	指標
コロンボ市の無収水率が削減される。	1)　「展開計画」に基づいて無収水対策が市内22ヶ所のゾーン事務所において包括的に実施される。 2)　コロンボ市の無収水の減少率が、2017年の時点で年率1%を超えている。

上位目標は通常プロジェクト終了から 3～5 年後にプロジェクトの効果によって発現が期待される正のインパクトである。「展開計画（案）」で示された無収水削減の手法が NWSDB 内で効果的であると認識され、コロンボ市全域で実施されるようになれば、上位目標であるコロンボ市の無収水率削減に向けて大きく前進することになるといえる。パイロット地区外のコロンボ市東地区や南地区の AE や OIC が既にプロジェクトのパイロット活動に参加して体系的な無収水削減方法の技術や経験を得て、担当地区でそれらを実践している。今後、プロジェクト終了までにさらに多くの AE や OIC/EA がパイロット活動に参加すれば、プロジェクト終了後、コロンボ市のパイロット地区外にも体系的な無収水削減活動を普及するベースができるといえる。

下表は、コロンボ市における無収水率の傾向を示している。無収水率の削減目標値を達成するためには、いくつかの条件を満たす必要もある。これらについては、「3-3-4. インパクト」で詳細を述べ

[14] 老朽管の更新による無収水削減効果と、それ以外の手段による無収水削減効果を比較する予定である。

る。

＜コロンボ市の無収水率＞

(%)

	2005	2006	2007	2008	2009	2010
コロンボ市	51.25	51.83	53.19	53.96	53.05	52.3
スリランカ全体	33.83	34.37	33.09	32.13	31.07	-

出所： 2009 年 NWSDB 年次報告書。2010 年のデータは NWSDB より入手。

3-2 プロジェクトの実施プロセス

NRW 削減マネジメント・チーム、NRW 削減チーム、JICA 専門家の間で毎週会議が開催されており、会議では、パイロット活動のモニタリングや進捗確認だけでなく、パイロット活動における問題点の共有、解決策の協議を行う機会として活用されてきた。パイロット活動のワークプランや PO がプロジェクト活動全体の進捗を確認するツールとして活用されてきた。JCC はこれまで 6 回開催されており、関係者間でプロジェクト活動の進捗確認や意見交換の場として有効に機能してきた。

JCC 以外でも、NWSDB 削減マネジメント・チームや JICA 専門家が NWSDB の幹部に対して適宜プロジェクト活動について報告しており、NWSDB 幹部とのコミュニケーションを図るように配慮している。NWSDB 削減マネジメント・チーム、NWSDB 削減チーム、JICA 専門家間のコミュニケーションは良好であり、うまく連携してプロジェクト活動を進めている。プロジェクト活動で問題が生じた場合なども、常に 3 者で協議して解決するよう努力している。

3-3 評価 5 項目による評価結果

3-3-1 妥当性

プロジェクトは以下に示す点から妥当性が高いと判断できる。

■ スリランカ政府の政策との整合性

プロジェクト開始から今日までスリランカにおける上水道分野の政策に大きな変更はない。2010 年 11 月に財務計画省より発行された「Sri Lanka, The Emerging Wonder of Asia, Mahinda Chintana, Vision for Future 2010- the development policy framework, government of Sri Lanka」では安全な水に関する州ごとの開発目標が明確に設定されている。全体目標は、配管による給水率を 2015 年までに 44%に、2020 年までに 60%に引き上げることである。また 2015 年までに全人口の 94%、2020 年までに 100%が安全な水にアクセスできることを目標に掲げている。さらに持続的に安全な水を手ごろな価格で提供することに重点を置いており、そのために無収水削減プログラム等を実施して、2020 年までに無収水率を 20%にまで削減することを目標としている。したがって、本プロジェクトはスリランカ政府の方針と整合性を保っている。

■ 日本政府の政策との整合性

日本政府が 2004 年 4 月に策定した「対スリランカ国別援助計画」では、(i) 平和の定着と復興に対する支援、(ii) 中・ 長期開発ビジョンに沿った援助の 2 本の柱で援助方針を設定している。重点分野の中には上水道サービスの改善も含まれており、プロジェクトの内容は日本政府の方針にも合致している。

■　対象地区、対象グループのニーズとの整合性

プロジェクトが形成された 2008 年時点において、コロンボ市の無収水率は 54.1%で全国平均の無収水率の 33.0%より高かった。NWSDB の事業計画である「Corporate Plan 2007-2011」では、コロンボ市の無収水率を毎年 1%削減し、全国平均で 30%に削減するという目標を掲げている。NWSDB は新しい事業計画「Corporate Plan 2012-2016」を策定したが、依然として無収水率削減は 2016 年までに達成すべき目標のひとつに掲げられており、2012～2016 年の間にコロンボ市の無収水率を 9.4%削減し、2016 年には全国平均で 26%にまで削減することを数値目標として設定している。NWSDB ではこの数値目標を達成すべく無収水削減の能力を強化する必要があり、この点でプロジェクトの内容は NWSDB のニーズにも合致している。

3-3-2　有効性

プロジェクトの有効性は高いと判断できる。プロジェクトの協力期間は 9 ヵ月残されているため、この間にさらにプロジェクトでは体系的な無収水削減の効果等を検証することになる。特に流入量把握、夜間最小流量の測定、水圧の測定、有収/無収水量の把握、違法接続対策、流水器誤差の把握・改善等のパイロット活動を実施した後の具体的な数値を収集して結果を分析し、コロンボ市で効果が上がると考えられる無収水削減活動の方法と、それを実施するために必要となる予算・人員を特定し、展開計画（案）としてとりまとめることになる。

効果的に無収水を削減するためには、現場の技術力の向上と共に、無収水削減に取り組むためのマネジメント面の能力強化も重要であり、これまでプロジェクトではこの両面において NWSDB の能力を強化してきた。パイロット活動に従事している NWSDB の技術職員や作業員は、実践的で体系的な無収水削減活動のやり方を習得しつつある一方、NRW 削減マネジメント・チームのメンバーはパイロット活動の結果を通じて、どのような方法がコロンボ市で無収水を効果的に削減するのに有効かという知見を多く得ている。この点において、プロジェクトで設定されたアウトプット（成果）は、NWSDB のコロンボ市における無収水対策の遂行能力を強化するというプロジェクト目標を達成するために必要不可欠な要素だったといえる。

本プロジェクトでは、NRW 削減マネジメント・チームのメンバーのリーダーシップと無収水削減に対する強い取り組み姿勢がプロジェクト活動を推進してきた原動力であり、プロジェクト目標の達成にも大きく貢献する要因だと考えられる。プロジェクトに影響を与えている負の要素は見当たらなかった。PDM_2 の外部条件で設定されている「研修を受けた職員が引き続き NWSDB で働く」という点に関しては、NRW 削減マネジメント・チームと NRW 削減チームのメンバーの中には、異動、昇進、あるいは他業務との兼務になった職員もいたが、プロジェクト全体のパフォーマンスに負の影響を及ぼす程ではなかった。

3-3-3　効率性

プロジェクトはある程度効率的に運営されてきたと判断できる。計画より遅延している活動もあるが、これまでさまざまな活動が実施されており、「3-1-2. アウトプット（成果）の達成状況」で既述したようにプロジェクトのアウトプットは順調に達成されつつあるといえる。海外研修を実施した結果、研修に参加した NWSDB 職員は無収水削減対策に対する高いモチベーションを持つようになり、さらに無収水削減に対する部下のモチベーションも上げるよう努力している。2 回実施された本邦研修を通じて、参加した職員は日本で実践されている維持管理業務の考え方や実践方法を学び、その重

要さについて認識を新たにした。さらに規律をもって日々の業務を遂行することの重要性を認識することにつながった。ヨルダンとインドネシアで実施された第 3 国技術交流会は、当該国で実践されている無収水対策活動が、自国のプロジェクト活動で実践している活動と同様の手法であり効果があるものだと自信を深める機会となった。これまでの投入の質・量は計画されたアウトプット（成果）を生み出すためにほぼ十分であり、投入はプロジェクト活動に十分活用されてきた。

管路図面情報が正確ではない、予期せぬ場所に配管が接続されている、水圧が低い、地中に埋まったバルブの探査が困難などのコロンボ市特有の状況のため、予想以上にパイロット活動におけるサブ・ゾーンの水理的分離作業に時間を要した。しかし、水理的分離は無収水量を把握するために必要不可欠な作業であり、NWSDB と JICA 専門家はこの活動から多くの知見を得て、今後どのような方法がコロンボ市で無収水削減を実現するために有効な方法かを検討しているところである。現時点では、ほぼ全てのサブ・ゾーンでの水理的分離作業が完了しつつあり、残りの協力期間で水理的分離による活動の遅れを取り戻せるように活動計画を修正している。さらに、中間レビュー調査以降、NWSDB と JICA 専門家はプロジェクト活動を推進するためにさまざまな取り組みを行っており、特に 2011 年中頃に NRW 削減チームのタスクチームを再編した以降、パイロット活動の進捗が促進されてきた。

プロジェクト開始から今日まで、水理的分離作業以外にもプロジェクトの進捗に影響を及ぼした要因がいくつか確認されている。主な要因は以下のとおり[15]。

- 道路の掘削許可取得などの関連機関からの許可を得るのに時間を要する。また NWSDB 内で許可申請を行うための手続きにも時間を要する。
- NWSDB 内での調整に時間がかかる。例えば、プロジェクト活動を実施するために必要な車輌やドライバーが常に手配されるとは限らず、車輌、人員、重機のどれかが揃わずにパイロット活動が行えないという事態も生じたことがある。
- カウンターパートはプロジェクト活動と通常業務を兼業しているため、プロジェクト活動に専念できないことが多かった。通常業務をこなす必要があったことに加え、緊急の配管布設替えなど NWSDB 内で最重要事項となった活動に急に従事しなくてはならず、パイロット活動に参加できないこともあった。
- JICA 専門家が不在の間、車輌や重機が予定どおり手配されない等の問題が生じた場合、活動が停滞することがあった。

3-3-4 インパクト

本プロジェクトの上位目標は、「コロンボ市で無収水率が削減される[16]」である。プロジェクトでは「展開計画（案）」を作成し、その中でコロンボ市の状況に適合した効果的な無収水対策の戦略や方法を提案し、その方法を実践するために必要となる予算や人員の見積りも含める予定である。NWSDB の幹部が無収水削減活動に対して強い取り組み姿勢を示し、この展開計画（案）に沿って活

[15] 2011 年 2 月に実施された中間レビュー調査でも同様の課題が既に指摘されているが、終了時評価調査では、プロジェクト開始から今日までの課題をまとめているので、中間レビュー調査で既に指摘されている点も重複して記載している。

[16] NWSDB の新しい事業計画「Corporate Plan 2012-2016」では、2012～2016 年までにコロンボ市の無収水率を 9.4%削減し、2016 年には全国平均で 26%にまで削減することを数値目標として設定している。

動を継続していければ、コロンボ市の無収水率の削減に大きく貢献できると期待できる。

既にパイロット地区外の AE と OIC がパイロット活動に参加して体系的な無収水削減活動の手法を学んでいるため、NWSDB では無収水削減活動をコロンボ市内で将来展開する基盤ができていると考えられる。プロジェクトの残りの協力期間にコロンボ市内の全ての AE と OIC/EA がプロジェクト活動に参加し、体系的な無収水削減方法の知識、技術、経験を積めば、無収水削減の実現に大きく寄与することになる。

一般的に認識されているように、無収水を効果的に削減するためには、漏水探知・修理、違法接続の発見、公共水栓の削減などのソフト面の対策と、老朽管の布設替えなどのハード面の対策をうまく組み合わせる必要がある。したがって PDM_2 で述べられているように、上位目標を達成するためには、プロジェクト目標の達成とともに、他の条件を満たす必要がある。その条件とは、無収水削減活動や老朽管更新のための予算や機材が確保されることである。現在、「コロンボ市上水道セクターマスタープラン更新・無収水エンジニアリング調査[17]」が JICA の支援の元で実施されているので、NWSDB は老朽管の更新と無収水対策活動を効果的に組み合わせた全体計画案を手にすることになる。またこのマスタープラン・無収水エンジニアリング調査では、「展開計画（案）」で示す無収水対策の戦略や、パイロット活動から得られた知見・教訓を統合する予定である。この点においても、本プロジェクトの結果は無収水率削減に向けて大きく貢献すると考えられる。

3-3-5 持続性

プロジェクトの持続性は以下で述べる条件が満たされれば確保されると判断できる。

（1） 政策・制度面

スリランカ政府は上水道サービスを重要政策のひとつに位置づけており、手頃な価格で継続的に安全な飲料水を提供するために、2020 年までに無収水率を 20%にまで削減する等の必要な措置を取ることを提唱している。このように NWSDB にとって良好な政策環境が今後も維持されると考えられる。

（2） 財政面

NWSDB で無収水削減活動に割り当てられた予算を特定するのは困難だが、無収水関連の活動には一定の予算がこれまで配分されてきたと考えられる。2009 年には 4 億 6140 万ルピーが上水道関連の補修と維持に割り当てられており[18]、この中には無収水削減活動に関する費用も含まれている[19]。現在 NWSDB では、維持管理関連の費用は水道料金による収入でカバーされている。2009 年の NWSDB 年次報告書に記載されている財務諸表によれば、NWSDB の 2009 年の財務状況は対外債務に対する返済金額が大きいため赤字であるが、水道事業の売上額（水道料金による収入含む）は直接経費（人件費、ポンプ・薬品費、補修・維持費）を上回っており、維持管理費はある程度カバーされているといえる。さらに、無収水削減マネジメント・チームによれば無収水削減の予算は十分

[17] 正式名称（英）は“the study for a master plan update of water supply sector in Colombo City and NRW engineering study”である。

[18] 2009 年の NWSDB 年次報告書より

[19] 2009 年の年次報告書によれば北部中央地区に 5000 万ルピー、中部、北部中央地区、北部西地区にそれぞれ 1500 万ルピー、北部に 500 万ルピー、南部とウバ・サバラガヌワと東部の州に 6200 万ルピー（2010 年の予算）が不明水削減に割り当てられている。

ではないが、一定の額は毎年配分されているとのことである。したがって、無収水対策に関する予算は継続的にある程度配分されると考えられ、NWSDB の幹部が無収水削減活動の効果を十分認識し、その実施に本腰を入れればさらに無収水対策への予算が確保されると考えられる。

(3) 技術面

カウンターパートはプロジェクトで実践してきた体系的な無収水削減の知識や技術を受け入れており、その有効性も認識している。特にパイロット地区やそれ以外の AE や OIC/EA は体系的な無収水削減の実践方法を学んでおり、独自で実践できるよう十分な経験を積んできたといえる。また NWSDB の職員は無収水削減に関する基礎知識や技術を既に有していたため、プロジェクトから学んだ技術を問題なく維持していけると思われる。

技術面の持続性を確保するためには、展開計画（案）で示される無収水削減方法をどのようにコロンボ市の他地区へ展開するかという点が重要である[20]。当初パイロット地区外への技術移転を行うメカニズムとして計画されていたローテーション方式が実現していないので、代替案として残りの 9 ヵ月間にまだプロジェクト活動に参加していないパイロット地区外の AE と OIC/EA をパイロット活動と週会議に参加させ、可能な限りの知識と技術を得られる機会を提供することが重要である。ローテーション方式よりもこの方法のほうが NWSDB に比較的負荷がかからないと考えられる。

供与機材はカウンターパート側で細心の注意を払って維持管理する傾向にあり、プロジェクト終了後も適切に維持されると考えられる。その一方で海外から輸入された電子関連機器も供与機材に含まれており、NWSDB ではこれらの機材に不具合が生じた場合、海外のメーカーに E メールなどを通じてコンタクトを取る必要が将来生じると考えられる。

3-4 貢献要因・阻害要因

本プロジェクトの貢献要因は以下のように考えられる。

- 無収水削減対策に対して NRW マネジメント・チームが強い取り組み姿勢を示し、プロジェクト活動の推進においてリーダーシップを発揮したこと（本プロジェクトの効果を促進した要因）
- 第 3 国技術交流会によって、カウンターパートはプロジェクトで導入・実践した体系的な無収水削減活動のやり方が他国でも実践され効果を上げていると学び、プロジェクト活動への理解を促進したこと（プロジェクトの実施を促進した要因）

一方、本プロジェクトの阻害要因は以下のようにまとめられ、主にプロジェクトの効率性に影響している。

- 道路の掘削許可取得などの関連機関からの許可を得るのに時間を要する。また NWSDB 内で許可申請を行うための手続きにも時間を要する。
- NWSDB 内での調整に時間がかかる。例えば、プロジェクト活動を実施するために必要な車輌や

[20] プロジェクトではコロンボ市の特有な状況を考慮すると、これまで実践してきた体系的な無収水削減方法では時間と費用がかかりすぎるので効果的ではないと考えており、現在水理的分離作業を行う規模や方法、流入量を測定する方法、無収水削減を展開する方法を検討しているところである。

ドライバーが常に手配されるとは限らず、パイロット活動に影響を及ぼしたこともある。

- 管路図面情報が正確ではない、予期せぬ場所に配管が接続されている、水圧が低い、地中に埋まったバルブの探査が困難などのコロンボ市特有の状況のため、予想以上にパイロット活動におけるサブ・ゾーンの水理的分離作業に時間を要した。
- カウンターパートはプロジェクト活動と通常業務を兼業しているため、プロジェクト活動に専念できないことが多かった。通常業務をこなす必要があったことに加え、緊急の配管布設替えなどNWSDB 内で最重要事項となった活動に急に従事しなくてはならず、パイロット活動に参加できないこともあった。
- JICA 専門家が不在の間、車輌や重機が予定どおり手配されない等の問題が生じた場合、活動が停滞することがあった。

3-5 結論

プロジェクト期間の終了までに、予定している全ての活動が実施されれば、当初の目標は達成されると考えられる。パイロット活動に遅れが発生したが、NWSDB と JICA 専門家は遅延を最小限に留めるように尽力してきた。今日までカウンターパートの技術面のキャパシティーは計画どおり強化されてきた。残りの協力期間の 9 ヵ月で、プロジェクトはパイロット活動の結果を分析してコロンボ市で効果の上がる無収水削減方法を特定し、「展開計画（案)」にパイロット活動から得られた知見や無収水対策の方針・戦略をまとめる予定である。これら活動の過程で実施される議論は NWSDB が無収水削減方法に関する知見をさらに得る貴重な機会であり、マネジメント面の能力もさらに強化される見込みである。したがって、プロジェクト期間が終了するまでに、NWSDB の技術面、マネジメント面の能力が強化されるといえる。

終了時評価調査を実施した結果、プロジェクトの妥当性、有効性は高いといえる。一方、プロジェクトの実施に影響を及ぼした要因がいくつかあり効率性を損ねる原因となっている。NWSDB 幹部が体系的な無収水削減活動を継続的に実施していくことに対して強い取り組み姿勢を見せ、実施の決定を下せば、プロジェクトのインパクトと持続性が確保される確率が高まると考えられる。

第4章　提言・教訓

4-1　提言

(1) プロジェクトの成果の普及

今回のプロジェクトは 2012 年 10 月に終了予定であるが、将来的には Kotahena 地区と Borella 地区の二つのパイロット地区のみならず、コロンボ市全域で無収水削減対策を実施する必要がある。そのため、他の地区の無収水削減担当者も Kotahena 地区と Borella 地区において、適切な無収水対策の実施方法を習得し、自分の地区で実践する必要がある。このため、コロンボ市のすべての地区の OIC または EA が Weekly Meeting やパイロット活動に参加し、本プロジェクトの成果を自分の担当地区で活用することが望まれる。

(2) 老朽管の布設替えの実施

老朽管の多い Koatahena 地区では、Borella 地区と比較して、パイロット活動の成果が出なかった。その理由としては、根本的に老朽管が多いため、漏水修理を行っても、別の場所で漏水してしまうという悪循環に入っているためである。老朽管が多い場所では、無収水削減活動を行うとともに、スリランカ側で予算を確保し、老朽管の布設替えを行う必要がある。Kotahena 地区については、NWSDB 自身で給水管の更新を実施したうえで、Greater Colombo Water Rehabilitation Project 等の予算を活用し、Kotahena 地区の老朽配水管の更新を 2012 年 8 月までに実施すべきである。

(3) 内部手続きの円滑化

Boom Truck の利用や機材購入に関する内部手続きの進捗が円滑でない部分があるため、パイロットプロジェクト活動の実施の進捗が円滑に進まない場合もある。そのため、Boom Truck の利用や機材購入に関する内部手続きを円滑にすることを提言する。

(4) 無収水削減対策予算と人員の確保

無収水対策には、老朽管の布設替えも必要であるが、地道な無収水削減活動も同時に必要である。無収水削減活動を実施するには、活動予算と人員が必要であるため、活動予算と人員をスリランカ側が十分に確保することを提言する。

(5) Kotahena 地区と Borella 地区の人材の他の地区での活用

今回のプロジェクトを通じて、Kotahena 地区と Borella 地区の無収水対策担当者は、適切な無収水対策手法を習得してきている。プロジェクト終了後は今後作成する予定の展開計画に基づいて、プロジェクト事業を展開していくことになるが、Kotahena 地区と Borella 地区で育成された人材を活用し、他の地域での無収水対策活動を実施していくことが望まれる。

(6) 管路情報の蓄積とその効率的利用

プロジェクトのパイロット活動の中で、管路情報を蓄積しているところであるが、プロジェクト終了までに、可能な限りの管路情報を蓄積するとともに、その有効利用の方法についても、カウンターパートに技術移転することが望まれる。既存管網の情報をすべて蓄積することは困難でも、新規に配水管等を布設する際には、as built drawing を残し、今後は管路情報を蓄積することが必要不可欠である。また、漏水調査等で管網情報が得られた際には、その都度、管路情報を GIS に蓄積

すべきである。その上で、カウンターパートがプロジェクト終了後、他の地域で管路情報の蓄積とその効率的利用を行うことを期待したい。

(7) GIS の利用

中間レビュー後、GIS を導入したが、データ入力の途上である。GIS は無収水対策に有効であるが、データの入力が進まなければ、その効果も限定的なものとなる。現在、Borella 地区と Kotahena 地区では、各家の配置までのデータを GIS に入力中であり、Borella 地区と Kotahena 地区の約 10 分の１程度の入力が完了している。今後、JICA が実施しているコロンボ上水道の M/P を利用して、GIS のベースマップに既存管路情報を入力することをコロンボ市全域で進めるべきである。そのため、スリランカ側で、予算と車両と人員を確保し、GIS のデータ整備を進めることを提言する。

(8) JICA 実施の M/P、ADB プロジェクトとの連携

現在、円借款の余剰金を利用したコロンボ市上水の M/P を作成中で、そのコンポーネントに無収水削減が含まれている。また、ADB はコロンボ市の無収水削減対策を計画している。そのため、本プロジェクトと M/P および ADB プロジェクトが NWSDB の調整の下連携し、今回のプロジェクトの成果を M/P、ADB プロジェクトに活用することが望まれる。

(9) 配水本管の漏水管理

NWSDB はパイロットプロジェクト地区に接続されている配水本管も潜在的に漏水していると考えている。それゆえ、現在入手できる機材を特定の地元の条件に適用することを提言する。

(10) 無収水対策のコストベネフィット分析

無収水対策活動の財務的インパクトを示すために、無収水削減活動のコストベネフィット分析をすることを提言する。

4-2 教訓

(1) 物理的な漏水が主要な無収水である。

パイロットプロジェクト地区の無収水の主な原因は物理的な漏水である。無収水の状況は地域地域で異なることから、状況に応じて広い範囲から解決策が選択されるべきである。

(2) 更新配管は除去されるか切断されるべきである。

フィールドワークの間、無収水チームはいくつかの二次配水本管や給水管が記録されていようといまいと給水中か使用されていないかほとんど認識されていないということを発見した。将来の配管の更新には異なる色やカラーコーディングが既存の灰色の配管の代わりに導入されるべきである。色を付けることに加え、配管が更新目的で埋設される時には、無収水を削減するために、既存配管は除去されるか適切に切断されるべきである。

添付資料１

スリランカ国「コロンボ市無収水削減能力強化プロジェクト」
終了時評価　主要面談者

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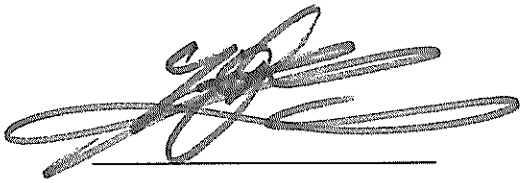
MINUTES OF MEETINGS
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
AUTHORITIES CONCERNED
OF
THE GOVERNMENT OF THE SOCIAL DEMOCRATIC REPUBLIC OF SRI LANKA
ON
JAPANESE TECHNICAL COOPERATION
FOR
THE CAPACITY DEVELOPMENT PROJECT
FOR
NON REVENUE WATER (NRW) REDUCTION IN COLOMBO CITY

The Evaluation Team (hereinafter referred to as "the Team"), organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Yoshiki Omura, visited the Social Democratic Republic of Sri Lanka (hereinafter referred to as " Sri Lanka") from January 25 to February 16, 2012.

During its stay in Sri Lanka, the Team had a series of discussions with the Sri Lankan authorities concerned, and jointly evaluated the present achievements of the Capacity Development Project for Non Revenue Water (NRW) Reduction in Colombo City (hereinafter referred to as "the Project") and exchanged views on the project activities to fulfill the Record of Discussions signed on April 22, 2009.

As a result of discussions, both sides agreed to report to their respective Governments the matters referred to in the document attached hereto.

Colombo, February 16, 2012



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添付資料2

ATTACHED DOCUMENT

THE JOINT REPORT OF TERMINAL EVALUATION ON THE JAPANESE TECHNICAL COOPERATION FOR THE CAPACITY DEVELOPMENT PROJECT FOR NON REVENUE WATER REDUCTION IN COLOMBO CITY IN SRI LANKA

FEBRUARY 16, 2012

LIST OF ABBREVIATION AND ACRONYMS

AE	Area Engineer
AGM	Assistant General Manager
C/P	Counterpart
DGM	Deputy General Manager
EA	Engineering Assistant
ERD	External Resource Department
GIS	Geographic Information System
GM	General Manager
GOJ	Government of Japan
GOSL	Government of Sri Lanka
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
M/M	Minutes of Meetings
MNF	Minimum Night Flow
M/P	Master Plan
NRW	Non Revenue Water
NWSDB	National Water Supply and Drainage Board
O&M	Operation and Maintenance
ODA	Official Development Assistance
OIC	Officer-in-Charge
OJT	On-the-Job Training
PDM	Project Design Matrix
PO	Plan of Operation
R/D	Record of Discussions
SKL	Sri Lankan Rupee

添付資料2

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1LKR＝0.685 JPY（based on JICA exchange rate as of January 2012）
1LKR＝0.0187 USD (ditto)

1. INTRODUCTION

1-1. OBJECTIVES OF THE TERMINAL EVALUATION

The objectives of the Terminal Evaluation on the Project are;

(1) to verify the achievements of the Project referring to actual inputs, achievement of outputs and project purpose;

(2) to evaluate the Project based on the five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact and Sustainability); and,

(3) to make recommendations for the actions to be taken in the future and draw the lessons learned.

1-2. METHOD OF THE TERMINAL EVALUATION

The status of the project progress was reviewed based on the Project Design Matrix (hereinafter referred to as "PDM"), which is a summary table describing the outline of the Project. The Terminal Evaluation examined the following points referring to the PDM version 2 (PDM_2) approved in June 2011 (Annex 1)[1].

(1) Verification of project performance

The degree of project achievements, such as Inputs, Activities, Outputs, and Project Purpose, was assessed with reference to Objectively Verifiable Indicators stated in the PDM_2. To carry out this, various methods were applied including document review, questionnaire survey, interviews, and discussions with the relevant stakeholders.

(2) Examination of Project Implementation Process

The process of the project implementation was examined from the viewpoints of project management.

(3) Evaluation by Five Evaluation Criteria

The following five evaluation criteria are applied to the project evaluation.

Relevance:	An overall assessment of whether the project purpose and overall goal are in line with policy of both sides and with partner country's needs.
Effectiveness:	A measure of whether the project purpose has been achieved. This is then a question to the degree to which the outputs contribute towards achieving the intended project purpose.
Efficiency:	A measure of output's production of the Project in relation to the total resource inputs.
Impact:	The positive and negative changes produced directly and indirectly as the results of the Project.
Sustainability:	An overall assessment of the extent to which the positive changes achieved by the Project can be expected to last after the completion of the project.

[1] The initial PDM (PDM_0), which was attached to the Minutes of Meeting (M/M) between JICA and the Democratic Socialist Republic of Sri Lanka, was signed on April 22, 2009. The 1st JCC Meeting agreed the revision of the PDM_0, changing "the Duration of the Project" and "the Input of Japanese Personnel" (PDM_1). Another revision was made at the 5th JCC Meeting on commencement of the 2nd Project Year (PDM_2).

(4) Recommendations and Lessons Learned

The Terminal Evaluation Team made the recommendations and drew the lessons learned based on the results of the evaluation.

1-3. MEMBERS OF THE TERMINAL EVALUATION

<Sri Lankan Side>

Name	Title
Mr. K.L.L. Premanath	General Manager, NWSDB
Mr. S.K. Wijetunga	Additional General Manager (Western), NWSDB
Mr. W.B.G. Fernando	Deputy General Manager (Western Central), NWSDB
Mr. K.W. Premasiri	Assistant General Manager (Development-Western Central), NWSDB
Mr. S.G.G. Rajkumar	Assistant General Manager (NRW-Western Central), NWSDB
Mr. S.A. Rasheed	Assistant General Manager (O&M-Western Central), NWSDB

<Japanese side>

Name	Job title	Position
Mr. Yoshiki Omura	Leader/NRW Reduction	Senior Advisor (Water Supply Development), JICA
Mr. Ryosuke Isobe	Task Manager	Assistant Director, Water Resources Management Division I, Water Resources and Disaster Management Group, Global Environment Dept., JICA
Ms Tomoko Kashihara	Cooperation Management	Representative, JICA Sri Lanka Office
Ms Ayako Namura	Evaluation Analysis	Consultant, Tekizaitekisho LLC

1-4. SCHEDULE OF THE TERMINAL EVALUATION

A series of meetings and discussions were held from January 26 to February 16, 2012 among Sri Lankan governmental authorities and organizations relevant to execution of the Project, JICA experts, and the Terminal Evaluation Team.

2. OUTLINE OF THE PROJECT

2-1. BACKGROUND OF THE PROJECT

For the National Water Supply and Drainage Board (NWSDB), which is responsible for water supply and sanitation in the most part of the Democratic Socialist Republic of Sri Lanka, high ratio of Non Revenue Water (NRW) has been a longstanding problem in its operation and management. Especially in Colombo City, where deteriorated pipes still remained in many parts of its distribution system, the NRW rate in 2008 was 54.1%, higher than its nationwide average of 33.0%. To tackle this problem,

NWSDB has been working to reduce the rate of NRW in several ways such as leak repair, detection/elimination of illegal connections, removal of public stand posts and converting its users to individual connection, and billing system improvement. However, these measures had not produced satisfactory outcomes.

To improve this situation, NWSDB stressed the importance of NRW reduction as one of the most prioritized tasks to be tackled and set a target to reduce NRW in its "Corporate Plan 2007 – 2011." In order to achieve the target, it was necessary for NWSDB to gainfully utilize external support to improve its capacities of practical implementation in NRW reduction measures.

To address these issues, the Government of Sri Lanka (GOSL) requested the Government of Japan (GOJ) for assistance to NWSDB through conducting a technical cooperation project regarding NRW reduction. The Japan International Cooperation Agency (JICA) conducted a fact-finding survey on water supply sector in Sri Lanka from 2007 to 2008. Based on the above official request by GOSL and information collected through the fact-finding survey, JICA and the officials of Sri Lanka concerned agreed to conduct "the Capacity Development Project for Non Revenue Water Reduction in Colombo City" (hereinafter referred to as "the Project"). Both parties agreed and signed the "Record of Discussions between Japan International Cooperation Agency and the Authorities Concerned of the Government of Democratic Socialist Republic of Sri Lanka on Japanese Technical Cooperation for the Capacity Development Project for Non Revenue Water Reduction in Colombo City" (hereinafter referred to as "R/D") in April 2009.

2-2. OUTLINE OF THE PROJECT

The outline of the project described in the PDM_2, which was agreed on June 22, 2011, is as follows:

(1) Overall Goal
The NRW ratio in Colombo City is reduced.

(2) Project Purpose
NWSDB's capacity to implement NRW reduction activities in Colombo City is strengthened.

(3) Outputs
1) Management capacity of senior officers of the Regional Center (Western-Central) to plan and supervise NRW reduction activities is enhanced.
2) Technical and operational capacity to conduct NRW reduction activities by officers/staff of the Regional Center (Western-Central)[2] is developed.

(4) Project Term
From October 2009 to October 2012 (three years)

[2] It should be noted that the Output 2 stated in PDM2 is "Technical and operational capacity to conduct NRW reduction activities by officers/staff of Western – Central Regional Center is developed."

(5) Pilot Areas

Borella and Kotahena in Colombo City were selected as the pilot areas

3. PERFORMANCE OF THE PROJECT

3-1. INPUTS TO THE PROJECT

3-1-1. INPUTS FROM THE SRI LANKAN SIDE

(1) Counterpart personnel assigned for the Project

1) Project Head
- General Manager, NWSDB

2) Project Director
- Additional General Manager-Western, NWSDB

3) Project Manager
- Deputy General Manager-Western Central, NWSDB

4) Project Leader
- Assistant General Manager- Non Revenue Water, NWSDB

5) Counterpart personnel engaged in the Project
- Members of the NRW Reduction Management Team and the NRW Reduction Team for pilot areas (the details are referred to Annex 2)

(2) Operational Expenses

The Sri Lankan side allocated the operational expenses as below:

(Unit: LKR)

	2010* (actual)	2011* (actual)	2012 (plan)
Tax on equipment	22,000,000	539,826	-
Consumables	3,000,000	0	-
Total	25,000,000	539,826	20,000,000**

(*: These expenses were disbursed from the counterpart funds from the Ministry of Finance and Planning.)

(**: The fund of 20 million LKR in 2012 is currently in process of approval at Ministry of Finance and Planning.)

The following expenses have been borne by NWSDB.

a. Salaries, remuneration and other allowances for the counterpart personnel when necessary. (Overtime or nighttime works during the course of the project activities)
b. Expenses for isolation work of pilot areas, repairing of pipe networks after the detection of leakage and civil work for road opening/reinstatement.
c. Expenses such as electricity, water supply, telephone, and gas fuel for the Project offices.

d. Expenses for maintenance of equipment provided by JICA
e. Other contingency expenses related to the Project

(3) Provision of facilities and equipment

- Office space and facilities necessary for JICA experts at NWSDB.
- Venues and necessary facilities for the Project's activities

3-1-2. INPUTS FROM THE JAPANESE SIDE

(1) Experts (Annex 3)

The table shown below is the expertise and duration of assignments, since the project was commenced until January 2012. For the six (6) experts, the total of 48.62 Man/Month (M/M), has been assigned to the Project.

(Unit: Man/Month)

Position	First Year Oct 2009 - Mar 2011	Second Year (until Jan) Apr 2011 - Jan 2012
1. Chief Advisor /NRW reduction programming	10.50	4.0
2. Deputy Chief Advisor / NRW reduction monitoring and evaluation	7.10	1.80
3. Leak detection Advisor	6.20	2.53
4. Arrangement of pipeline drawing and customer data	6.80	1.46
5. Service pipe connection advisor	2.40	2.00
6. Coordinator	2.80	1.00
Sub-total	35.80	12.82
Grand Total		48.62

(2) Provision of Machinery and Equipment

The total amount of 37.98 million JPY (approximately equivalent to 55.44 million LKR) was allocated for the equipment from the commencement of the Project until now. The list of the equipment provided is referred to Annex4.

(Unit: JPY)

First Year (Oct. 2009- Mar. 2011) Actual	Second Year (Apr. 2011- Mar. 2012) Actual	Total
33,364,031	4,615,404	37,979,435

(3) Operational Expenses

The operational expenses borne by Japanese side was shown in the table below. The total amount of 8.32 million JPY (approximately equivalent to 12.14 million LKR) was allocated for the first year and 10.40 million JPY (approximately equivalent to 15.18 million LKR) is planned to allocate for the second year.

(Unit: JPY)

		First Year (Sep 2009- Mar 2011) Actual	Second Year (Apr 2011- Mar 2012) Plan
1	General Expenses	7,260,000	8,806,000
2	Equipment Shipping Cost	262,000	100,000
3	Report Preparation Cost (Printing and Binding)	54,000	12,000
4	Overseas Training	739,000	1,479,000
	Sub-total	8,315,000	10,397,000
	Total		18,712,000

(4) Overseas Trainings for Counterpart Personnel

A total of twenty-two (22) personnel participated in the training program in Japan and the technical exchange programs: ten (10) in Japan, six (6) in Jordan and six (6) in Indonesia (totally 234 man/days). The detailed list of participants is shown in Annex 5.

3-2. ACHIEVEMENT OF THE PROJECT

3-2-1. ACHIEVEMENT OF OUTPUTS

The achievement level of each Output from the commencement of the cooperation until now is as follows:

(1) Output 1

Narrative Summary	Objectively Verifiable Indicators
Management capacity of senior officers of the Regional Center (Western-Central) to plan and supervise NRW reduction activities is enhanced.	1-1. An annual program for NRW reduction in the pilot area is prepared every year (the programs for 2nd and 3rd years are based on the results of the activity in previous years). 1-2. NRW reduction activities in the pilot areas are conducted smoothly through adequate allocation on NWSDB resources (personnel, equipment, budget etc.) as planned. 1-3. NRW reduction related training programs are reviewed and organized for "NRW Reduction Teams."

Overall, the management capacity of senior officers of the Regional Center (Western-Central) to plan and supervise NRW reduction activities has been enhanced. The details are as follows.

<1-1. An annual program for NRW reduction in the pilot area is prepared every year (the programs for 2nd and 3rd years are based on the results of the activity in previous years).>

The NRW Reduction Management Team formulated the fist-year's annual program in May 2010 in cooperation with JICA experts. This Team prepared the second-year's annual program in June 2011 by its own ability. Reviewing the second year's results of the NRW reduction activities, the third annual program will be prepared around May 2012.

<1-2. NRW reduction activities in the pilot areas are conducted smoothly through adequate allocation on NWSDB resources (personnel, equipment, budget etc.) as planned.>

The smooth project implementation has been promoted in the latter half of the cooperation period compared to the situation in the first half period. In response to the recommendation made by the Mid-term Review Team, NWSDB made substantial efforts to allocate its resources and accelerate the progress of the activities.

After the Mid-term Review, NWSDB filled the cadre of Engineering Assistants (EAs) in the O&M section intending to mobilize the staff into the pilot activities. Despite this effort, lots of regular works at the O&M section still limited the newly hired EAs to devote themselves to project activities. Moreover, all of six teams formulated in two pilot areas could not concentrate entirely on project activities since they also had to serve to their routine works or urgent matters. To cope with this situation, the NRW Reduction Management Team reorganized the six teams into four teams (two teams for each pilot area) and assigned one team for respective pilot areas to concentrate on the project activities in the middle of 2011. Since then, the pilot activities have progressed more smoothly.

NWSDB earmarked approximately 200 million LKR for the three-year project activities in 2010 and requested this as a counterpart fund to the Ministry of Finance and Planning. The amount of 25 million LKR was smoothly disbursed for tax payment of the provided equipment from Ministry in 2010 and 970 thousand LKR for tax payment of the GIS related equipment in 2011. NWSDB, in 2012, obtained the approval for 20 million LKR. To date, other expenses necessary for the pilot activities including the personnel costs and materials for service pipe replacement and leak repair have been borne by the regular budget of NWSDB.

<1-3. NRW reduction related training programs are reviewed and organized for "NRW Reduction Teams.">.

At the early stage of the project activities, the JICA experts and the NRW Reduction Management Team reviewed the existing training programs and have organized the seminars/workshops on NRW reduction. The contents of seminars/workshops held to date are summarized in Annex 6. Through the project activities, the themes or topic to be included in the training program (including seminars/workshops) were clearly identified. Until now, most of the presentation in seminar/workshops has been made by the members of NRW Reduction Management Team and NRW Reduction Team.

(2) Output 2

Narrative Summary	Objectively Verifiable Indicators
Technical and operational capacity to conduct NRW reduction activities by officers/staff of Regional Center (Western-Central) is developed.	2-1. "NRW Reduction Teams" are organized at two (2) pilot areas and implement NRW reduction activities based on the work plan. 2-2. NWSDB officers/staff engaged in "NRW reduction Teams" acquire proper leak detection, plumbing and pipe repairing

Narrative Summary	Objectively Verifiable Indicators
	skills. 2-3. An average NRW ratio in the pilot areas is reduced compared to the initial NRW ratio.

Overall, the technical and operational capacity to conduct NRW reduction activities by officers/staff of Western-Central Regional Center has been developed. The details are as follows.

<2-1. "NRW Reduction Teams" are organized at two (2) pilot areas and implement NRW reduction activities based on the work plan.>

The six NRW Reduction Teams headed by Area Engineers (AEs) were formulated in November 2009: the three teams for each in Kotahena and Borella. After NWSDB reorganized the NRW Reduction Teams into four teams as described in Output 1, the four teams have been engaged in the pilot activities and functioned well. The NRW Reduction Teams prepared the work plan of pilot activities with NRW Reduction Management Team and JICA experts, and they revised the plans several times in accordance with the progress of activities. Until now, the delay of implementation has occurred because the hydraulic isolation work of sub-zones in pilot areas has taken longer time than expected. The situation, such as lack of accurate information on pipeline drawings, unexpected interconnection of pipes, low system pressure and difficulties in valve locating, has caused the counterparts and JICA experts hardship of isolation work in sub-zones.

At this moment, the hydraulic isolation works were mostly completed in Kotahena and Borella, and the Project will start NRW reduction activities based on the work plan. It is expected that the specific data in all pilot areas will be gained by June 2012.

<2-2. NWSDB officers/staff engaged in "NRW reduction Teams" acquire proper leak detection, plumbing and pipe repairing skills.>

The members of NRW Reduction Teams have acquired the knowledge and techniques on systematic methods of NRW reduction, such as sub-zoning, hydraulic isolation, system inflow measurement, measurement of minimum night flow (MNF), leak detection and repair, meter accuracy test and meter replacement, detection/elimination of illegal connection, and meter installation to stand posts, through seminars/workshops and the OJT[3]. Since the activities following the isolation works will be carried out in the sub-zones (K3-K6, B2, B4-B6) where the isolation work is nearly completed, the counterpart personnel will gain more knowledge, techniques and experience on systematic NRW reduction activities.

The proposals on GIS and PR activities were submitted by NWSDB in March 2011 in response to the result of the Mid-term Review and those activities were incorporated into the project activities. The training on GIS has been provided (Annex 7) and the base map has been prepared covering approximately 10% of pilot areas. The Project will focus on how to utilize GIS effectively for NRW reduction in the third year. The Project already made a plan for PR activities and the specific activities

[3] The member of NRW reduction team already had techniques of service pipe connection and pipe repair in their routine work. Through the seminars/workshops, the improvement on their techniques was discussed.

such as school activities are currently carried out in the third year.

<2-3. An average NRW ratio in the pilot areas is reduced compared to the initial NRW ratio.>

The data of four sob-zones in pilot areas are available at this moment where the isolation works were already completed.

<Kotahena>

	Sub-zones						
NRW Ratio (%)	K1	K2	K3	K4	K5	K6	K7-K10*
Before the intervention	85.3%	78.5%					
After Primary Activities[4]	73.0% (June 20-26, 2011)	75.5% (June 30, 2011)	K3-K6: Isolation work is ongoing and completed soon.				
After Secondary Activities[5]	60.3% (Aug 16, 2011)	-					
Activities for NRW reduction (cases)							
Meter installation to stand posts	14	33					
Detection/elimination of illegal connection	49	23					
Meter accuracy test and meter replacement	18	8					
Leak detection and repair	85	71					

(Sources: Progress Report IV issued in October 2011.)

*: The isolation work of the sample zones will be carried out in K7-K10, followed by NRW reduction activities.

<Borella>

	Sub-zones						
NRW Ratio (%)	B1	B2	B3	B4	B5	B6	B7-B10*
Before the intervention	40.3%		84.3%				
After Primary Activities	22.5% (Sep 25, 2011)		50.6% (Jan 21, 2011)	B2, B4-B6: Isolation work is completed soon.			
After Secondary Activities	16.3% (Feb 2, 2011)		28.6% (Jun 20-21, 2011)				
Activities for NRW reduction (cases)							
Meter installation to stand posts	2		0				
Detection/elimination of illegal connection	8		19				
Meter accuracy test and meter replacement	7		17				

[4] Primary Activity: a series of NRW reduction activities conducted before getting the figures of NRW reduction rate. A NRW reduction activity may be concluded with this "Primary Activity."(sources: Progress Report IV issued in October 2011)

[5] Secondary Activity: a series of NRW reduction activities conducted after the "Primary Activity." "Secondary Activity" may be conducted in case that the "Primary Activity" could not gain good result. (sources: Progress Report IV issued in October 2011)

	Sub-zones						
Leak detection and repair	46		19				

(Sources: Progress Report IV issued in October 2011.)
*: The isolation work of the sample zones will be carried out in K7-K10, followed by NRW reduction activities.

According to the NRW Reduction Management Team and JICA experts, the remarkable effects of NRW reduction activities can be observed in Borella where the pipes are relatively in good condition. The data acquired from pilot activities in Kotahena, where pipes are very deteriorated, explains that NRW reduction activities certainly brought some effects but the measures combined with the pipe replacement and other activities would be more effective to reduce NRW ratio.

The Project is currently gaining the results of pilot activities, analyzing the conditions that a series of the systematic NRW reduction activities can bring effects toward reducing the NRW.

3-2-2. ACHIEVEMENT OF THE PROJECT PURPOSE

Narrative Summary	Objectively Verifiable Indicators
NWSDB's capacity to implement NRW reduction activities in Colombo City is strengthened.	1) Number of NRW reduction activity records will increase compared to what was before the Project. 2) The budget to be allocated for NRW reduction will increase compared to what was before the Project. 3) An execution plan to achieve reduction of NRW ratio by one (1) percentage point per annum, as per the Goal 2.1 of "Corporate Plan 2007-2011", is prepared and incorporated into relevant plans/programs of NWSDB.

<1) Number of NRW reduction activity records will increase compared to what was before the Project.)>

The activities of NRW reduction in the pilot areas were described in the results of Output 2. The rotation system, which the Project originally planned to implement, has not functioned well even after the Mid-term Review in February 2011. Because of manpower shortage at NWSDB, the rotation team's tasks in their responsible areas could hardly be taken over by the other staff. Instead, NWSDB tried to involve the Area Engineers (AEs), the Officers in Charge (OICs) and EAs of non-pilot areas in the pilot activities and invited them to weekly meetings to share the issues raised in pilot activities. To date, the AE of Colombo City South and the AE and OIC of Colombo City East learned about the systematic methods of NRW reduction by participating in the workshops/seminars, OJT in the pilot areas, and weekly meetings. Then, they have practiced its method in their responsible areas. The table below shows the NRW reduction activities carried out in non-pilot areas until now.

	Name of Areas				
	Kirulapana sub-zone in Colombo City South*	Kent road sub-zone in Colombo City East*	Handala Frerry road sub-zone in Colombo City North*		
NRW Ratio (%)					

Before	18.9%	52.8%	18.3%		
After activities	7.0% (Dec 15, 2010)	38.0% (Jan 19, 2011)	-		
Activities for NRW reduction (cases)					
Meter installation to stand posts	-	-	-		
Detection/elimination of illegal connection	4	-	2		
Meter accuracy test and meter replacement	-	-	-		
Leak detection and repair	11	29	14		

(Sources: *: Joint Mid-term Review Report in February 2011)

<2) The budget to be allocated for NRW reduction will increase compared to what was before the Project.>

It is rather difficult to extract the budget allocated for NRW reduction activities from the regular budget of NWSDB since O&M section and NRW section carry out the NRW related activities as a part of their routine works. As stated in the achievement level of Output1, NWSDB has managed to allocate the budget necessary for the project activities from its own regular budget due to the delay of the counterpart fund's approval from the Ministry of Finance and Planning. Therefore, it can be concluded that NWSDB has allocated a certain amount of budget for NRW reduction activities.

<3) An execution plan to achieve reduction of NRW ratio by one (1) percentage point per annum, as per the Goal 2.1 of "Corporate Plan 2007-2011," is prepared and incorporated into relevant plans/programs of NWSDB[6].>

According to the Plan of Operations (PO) of the Project, an execution plan will be prepared in the third year of the project implementation. This plan will incorporate the analysis of the results of pilot activities and suggest strategy and effective methods for NRW reduction suitable to the condition in Colombo City along with the cost estimation and required manpower. The NRW Reduction Management Team and JICA experts already obtained some findings from the results of pilot activities and will gain them more and necessary data since the pilot activities will move to next steps after isolation work. Moreover, as recommended in Mid-term review, NWSDB determined to utilize the fund of Water Sector Development Project (I) for pipe replacement in Kotahena and conduct a comparative study[7]. It is expected that pipe replacement work will be implemented as early as possible and the data resulting from this work is utilized for the comparative analysis in the Project.

[6] "Corporate Plan 2012-2016" set the target of "reducing NRW by 9.4 % in Colombo City during the period of 2012 - 2016 and achieving a 26 % national average in 2016."

[7] The Project initially had a plan to carry out the comparative analysis in the pilot areas between NRW reduction by replacement of distribution pipelines in Kotahena as a part of ODA loan (Water Sector Development Project –II) and NRW reduction by other techniques. Due to the limited budget, the length of replacing pipeline was shortened compared to the original plan. Now the Project considers taking the data from two pipe replacement practice by ODA loan and attempts comparative analysis.

3-2-3. PROSPECTS OF ACHIEVING OVERALL GOAL

Narrative Summary	Objectively Verifiable Indicators
The NRW ratio in Colombo City is reduced.	1) NRW reduction activities are comprehensively conducted by 22 zone offices in CMC area in accordance with the execution plan. 2) Decrement of NRW ratio per annum in CMC area exceeds one (1) percentage point up to 2017.

The overall goal, which is the direct impact generated from the Project, is generally expected to be achieved in three to five years after the cooperation period is completed. When methods to be suggested in the execution plan are recognized as effective within NWSDB and applied to other areas in Colombo City, this can be contribute to the reduction of NRW in Colombo City. Some of the AEs and OICs from non-pilot areas have already participated in pilot activities, gained technologies and experiences on systematic NRW reduction activities, and practiced them in their responsible areas. When more number of AEs and OICs are involved in pilot activities in the remaining cooperation period, it will be ensured to extend the systematic NRW reduction activities to other areas in Colombo City.

The table below shows the trend of NRW ratio in Colombo City. To achieve the set target of NRW reduction, there are several conditions which have to be taken into consideration. Those are discussed in "5-4. Impact."

(%)

	2005	2006	2007	2008	2009	2010
CMC	51.25	51.83	53.19	53.96	53.05	52.3
Island wide	33.83	34.37	33.09	32.13	31.07	-

Sources: Annual report of NWSDB in 2009. The data for 2010 is provided by NWSDB.

4. IMPLEMENTATION PROCESS

The weekly meetings held among the NRW Reduction Management Team, NRW Reduction Team, and JICA experts have provided good opportunities to identify the problems and discuss the possible solutions as well as to monitor and share the detailed progress of pilot activities. The work plan of pilot activities and the PO have been major tools to monitor the progress of the project activities. JCC, which was organized six times to date, has functions well to monitor the entire project progress and exchange the opinions among the concerned personnel/organizations.

Apart from JCC meeting, the executives of NWSDB are also informed about the project progress from time to time and keep the good communication with NRW Reduction Management Team and JICA experts. The communications and coordination among NRW Reduction Management Team, NRW Reduction Team and JICA experts have been also good and any difficulties found in the project activities have been discussed among them.

5. EVALUATION RESULTS

5-1. RELEVANCE

The Project is assessed as relevant because of the following points.

The policy on water supply sector in Sri Lanka has not been changed much since the commencement of the Project. "Sri Lanka, the Emerging Wonder of Asia, the Mahinda Chinthana, Vision for the Future 2010 – the development policy framework, government of Sri Lanka[8]"clearly specifies the province wise development targets with respect to safe water supply. The overall target to be achieved is 44% piped water connected coverage by 2015 and 60% by 2020. The safe water supply coverage target specified therein is 94% by 2015 and 100% by 2020. The document also addresses the sustainable safe drinking water for all at an affordable price and identifies the specific actions to be taken, such as implementation of non-revenue water (NRW) reduction program to minimize the NRW rate up to 20 % by 2020. Therefore, the Project still keep the consistency with the policy direction of the GOSL.

The Country Assistant Program for Sri Lanka prepared in April 2004 by the GOJ addresses two pillars of assistance to Sri Lanka: (i) assistance to support the "consolidation of peace" and reconstruction, and (ii) assistance that is in line with the country's long-term vision for development. The prioritized areas include the improvement in water supply. Therefore the Project components are along with the policy of the GOJ.

Colombo City had suffered from high NRW ratio of 54.1%, higher than its nationwide average of 33.0%, as recognized at the stage of project formulation in 2008. "Corporate Plan 2007-2011" set the target of reducing NRW by 1 % per annum in Colombo City and achieving a 30% national average. NWSDB prepared the draft version of "Cooperate Plan 2012-2016," in which the NRW reduction remains among the goals to achieve by 2016. It addressed the target of "reducing NRW by 9.4 % in Colombo City during the period of 2012 - 2016 and achieving a 26 % national average in 2016." NWSDB still has strong needs of enhancing the capacity of NRW reduction to meet this target; therefore, the components of the Project have been along with the needs of NWSDB.

5-2. EFFECTIVENESS

The Project is assessed as effective in achieving its purpose envisaged at planning.

The Project still have nine months to complete the cooperation period and will present more tangible effects on NRW reduction in the remaining period. It is, especially, expected that the specific data on the pilot activities such as system input volume, MNF, pressure, billed/unbilled authorized consumption, illegal use and metering inaccuracies, will be compiled and utilized to identify the most effective options for NRW reduction activities in Colombo City, considering the cost-effective aspects.

To pursue the effective NRW reduction, capacity enhancement at both technical and management level is very crucial. To date, the Project has enhanced NWSDB's capacity to implement NRW

[8] This document was issued in 2010 by the Department of National Planning, Ministry of Finance and Planning.

reduction activities in Colombo City at both levels. NWSDB officers/staff engaged in pilot activities has acquired the practical and systematic techniques for effective NRW reduction. The NRW Management Team has gained a lot of findings on what methods would bring more effects on NRW reduction through project activities. In this respect, two Project Outputs are very essential and sufficient to achieve the Project Purpose.

In this Project, the strong leadership and commitment of the members of NRW Management Team toward NRW reduction has fostered the project activities and will lead to fulfillment of the Project Purpose. Any external factors negatively affecting the Project have not been observed. Some of the members of NRW Reduction Management Team and NRW Reduction Team were transferred, promoted, or assigned to additional work; however, JICA experts and the counterparts have tried to keep up with the activity plan, and this issue has not seriously affected the project performance as a result.

5-3. EFFICIENCY

The Project is assessed as partly efficient. Although some of the project activities are behind schedule, various activities have been carried out and the Project Outputs have been produced as described in "3-2. Achievement of Project." The positive aspect is that the overseas training programs promoted the participants' motivation toward NRW reduction, and the participants also encouraged their staff to promote NRW reduction. Through the training in Japan which was organized twice, the participants promoted their awareness of the importance of O&M practice and learned the well disciplined way of work. The technical exchange programs in Jordan and Indonesia gave the participants confidence in the NRW reduction activities which they have been practicing through project activities, by observing the similar methods applied in other countries. In addition, the quality and the quantity of inputs were mostly appropriate and the inputs were fully utilized for project activities to date.

Since hydraulic isolation work in pilot areas has taken longer time than expected due to local characteristics in water supply system in Colombo City such as lack of accurate information on pipeline drawings, unexpected interconnection of pipes, low system pressure and difficulties in valve locating. It is true that this issue has caused the delay of project progress, but this is also a very important learning for NWSDB and JICA experts to gain experience and lessons learned, and figure out the effective and suitable means in the situation in Colombo City. At this moment, hydraulic isolation works in most of the sub-zones are nearly completed and the Project will make up for the delay until now in the remaining period. In addition, the NWSDB and JICA experts have made lots of efforts to further promote the project activities after Mid-term Review. Especially, after reorganization of the NRW reduction teams in the middle of 2011, the progress of pilot activities have been accelerated.

Other than the issue of isolation work, there are some causes which had adverse effects on the project progress and the efficiency from the beginning until now. Main issues are summarized as below.

- The inter-agency's application process takes very long time to implement NRW reduction activities such as permission for road excavation. The internal process also takes time for NWSDB to submit the application to relevant agencies,

- The internal procedures within NWSDB sometimes take time to make an arrangement. Sufficient numbers of vehicle and driver was not always available for project activities. The vehicles, personnel and heavy equipment were not always arranged together for pilot activities,
- The counterpart personnel has multiple tasks and struggles with difficulties in focusing on the project activities. They have to take care of their routine works and/or other works that is regarded as higher-priority by NWSDB such as the urgent pipe replacement works,
- The project activities have slowed down during the absence of JICA experts, especially when the problems, such as allocation of vehicle or equipment, arose.

5-4. IMPACT

The Overall Goal of the Project is "the NWR ratio in Colombo City is reduced.[9]" The Project will prepare an execution plan, which suggests strategy and effective methods of NRW reduction activities suitable in Colombo City along with the cost estimation and required manpower. When the NRW reduction activities are continued by NWSDB based on the execution plan with high commitment of NWSDB's executives, it is expected that the results of the Project will contribute to NRW reduction in Colombo City in the future.

Since the Project has involved several AEs or OICs of non-pilot areas in project activities, NWSDB now has a certain level of foothold in extending NRW reduction activities. If more number of AEs and OICs/EAs will gain experience by participating in pilot activities in the remaining cooperation period, the possibility of realizing NRW reduction will be further promoted.

As generally recognized, the combination of soft-measures, such as leakage detection/ repair, detection of illegal connection, reduction of stand posts, and hard-measures of pile replacement are very effective to reduce NRW. Therefore, as stated in PDM_2, other conditions to fulfill the Overall Goal need to be satisfied. Those are securing the budget and equipment for scaling up of NRW reduction activities or deteriorated pipe replacement. Currently, "the study for a master plan update of water supply sector in Colombo City and NRW engineering study" are undertaken with the assistance from JICA program, and NWSDB will be able to have more specific plan for NRW reduction including the effective combination of pipe replacement and NRW reduction activities. Since the master plan update and NRW engineering study will incorporate the strategy shown in the execution plan and the lessons learned from the Project, the Project will also contribute to moving forward to reducing NRW ratio.

5-5. SUSTAINABILITY

The project sustainability will be ensured when several conditions identified are satisfied.

■ Policy and Institutional Aspects

The policy environment is still likely to be favorable for NWSDB. The GOSL keeps the improvement of water supply services among its prioritized areas, addressing the sustainable safe drinking water for all at an affordable price and identifying the specific actions to be taken, such as implementation of non-revenue water (NRW) reduction program to minimize the NRW rate up to 20 % by 2020.

[9] NWSDB's new Corporate Plan (2012-2016) addresses the target of "reducing NRW by 9.4 % in Colombo City during the period of 2012 - 2016 and achieving a 26 % national average in 2016.

■ **Financial Aspects**

While it is difficult to identify the allocated amount for NRW reduction activities at NWSDB, a certain amount of budget has been allocated and disbursed for NRW related activities. The amount for the repairs and maintenance for water service was 461.4 million LKR in 2009,[10] and this partially include the amount allocated for NRW reduction activities.[11] At NWSDB, the cost associated with O&M is currently covered by water charge. The financial statement in NWSDB Annual Plan of 2009 indicated that the sales of water exceeded the direct cost,[12] while the financial condition of NWSDB was overall in deficit in 2009 due to the large amount of financial cost.[13] In addition, NRW Reduction Management Team mentioned that the budget for NRW reduction is not sufficient but the budget is certainly allocated. Therefore, it can be judged that a certain amount of budget will be continuously allocated when the executives admit the effectiveness of NRW reduction activities and commit to its implementation.

■ **Technical Aspects**

The counterpart personnel has well accepted the knowledge and techniques introduced by the Project and recognized the usefulness of the systematic technologies of NRW reduction. Especially, the AEs and OICs/EAs in pilot and non-pilot areas have learned about the systematic techniques to pursue the NRW reduction activities and gained sufficient experiences. Since the counterpart personnel originally had basic knowledge and techniques on NRW reduction, it would not be difficult to sustain their techniques learned from the Project.

To ensure the technical sustainability in Colombo City, it is important to consider how the systematic methods of NRW reduction to be proposed in an execution plan will be disseminated to other areas.[14] Since the rotation system, which was a proposed mechanism to disseminate the technologies to non-pilot areas, has not functioned well, it is important to provide opportunities for AEs and OICs/EAs in non-pilot areas to participate in pilot activities and weekly meetings in the remaining cooperation period.

The counterpart personnel has tried to store and maintain the provided equipment with the utmost care. In this respect, the equipment provided by the Project will be maintained after the project cooperation is terminated. On the other hand, it should be noted that some of the equipment, especially electronic products, were foreign products, and NWSDB may need to contact the overseas manufacturers through email when those of equipment have problems.

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[10] According to the NWSDB Annual Reports in 2009.

[11] Annual Report 2009 reported that 50 million LKR was allocated in 2009 for Northern Central, 15 million each for Central, North Central and North Western, 5 million for Northern, 62 million for 2010 for Southern, Uva Sabaraganuwa &Eeastern Provinces to reduce UFW.

[12] The direct cost includes personnel cost, pumping/chemical costs, repair & maintenance

[13] Mostly financial cost is repayment for donor funds.

[14] The Project found that the systematic isolation work may not be very effective in Colombo City due to the unique feature in the city. The Project is now considering other better options to isolate areas, measure the water flow and extent the NRW activities.

6. CONCLUSION

The Project is likely to achieve its intended target to a large extent when all planned activities are completed as scheduled in the remaining cooperation period. Although the delay of pilot activities has occurred, NWSDB and the JICA experts made lots of effort to minimize its delay. To date, the technical capacity of the counterpart personnel has been enhanced as planned. In coming nine months, the Project will analyze the results of pilot activities, identify the effective methods of systematic NRW reduction suitable in Colombo City, and incorporate the ideas in the execution plan on NRW reduction. The process of discussion to find the effective and appropriate techniques of NRW reduction will be a good opportunity for NWSDB to gain more findings on NRW reduction methods. Therefore, by the end of the cooperation period, the management and technical capacity of NWSDB will be further enhanced.

The Terminal Evaluation Team regarded the Project as worth implementing judging from the relevance. The effectiveness was also at the good level. On the other hand, the Project was assessed as partly efficient due to several causes affecting the project implementation. The strong commitment and determination of NWSDB's executives toward the implementation and extension of the systematic NRW reduction activities will increase the possibility to ensure the impact and the sustainability of the Project.

7. RECOMMENDATIONS

7-1 DISSEMINATION OF SYSTEMATIC APPROACH OF NRW REDUCTION

This project is supposed to terminate in October 2012. In future NRW reduction measures need to be implemented not only in Kotahena and Borella but also whole Colombo City. To do so, NRW Reduction Management Team will draft an execution plan by the end of the project. At the same time for disseminating methods of NRW reduction, it is recommended that at least the AEs and OICs/ EAs from all OIC areas participate in both the weekly meetings and pilot activities.

7-2 REPLACEMENT OF DETERIORATED PIPELINE

After Mid-term review, NWSDB determined to implement the pipe replacement by utilizing foreign fund of Water Sector Development Project (I) – Greater Colombo Water Rehabilitation Project. The result of this work is very crucial to pursue a comparative analysis originally planned in the Project. Since the Project will be completed in nine months, the pipe replacement work in Kotahena needs to be completed by June 2012. Therefore, NWSDB should proceed with the pipe replacement work as early as possible.

7-3 SMOOTH IMPLEMENTATION OF INTERNAL PROCEDURE

While NWSDB has made lots of efforts to increase the number of vehicles and cadre of O&M sections, some difficulties in internal arrangement still have been observed. Time matters for the Project since only nine months remain until the cooperation period is completed. Therefore, the Team recommended that NWSDB arrange the following points to promote the further smooth implementation and ensure the attainment of the Project:

- Allocation for the vehicles for GPS team and PR activities
- Review the working efficiency of GIS operators to promote the data input on GIS to ensure data input completion by the end of cooperation period

7-4 Budget and human resources for NRW reduction measures

To ensure the sustainability of NRW reduction activities, sufficient budget and human resources for NRW reduction measures should be secured, even after the Project completion.

7-5 Utilization of experienced staff

Staff of NRW reduction in Kotahena and Borella acquired knowledge of NRW reduction through the project activities. The NRW reduction activities will be implemented based on the execution plan which will be supposed to be drafted in 2012. It is strongly recommended to utilize NWSDB's already available human resources of Kotahena and Borella in other areas.

7-6 Implementation of updating pipe networks information in routine work and effective utilization of the information

NWSDB should practice updating pipe information with collected data such as pipe locating survey during NRW activities, as-built drawings after installation works, and field data after repair works. NWSDB is recommended to extend such practice to its whole service area.

7-7 Establishing GIS and its Utilization

GIS was introduced after the Mid-term review as an effective measure for supporting NRW reduction activities. Now data of Kotahena and Borella is being put into GIS database. However the effect of GIS will be limited unless input data are sufficient, precise and always updated. It is recommended therefore to continue GIS activities and utilize it for planning and daily operations.

7-8 Coordination with M/P by JICA and other projects

Currently updating M/P of Colombo City is being worked utilizing Yen Loan including the component of the NRW reduction. Also ADB shows interest in NRW reduction of Colombo City. Therefore NWSDB is recommended to coordinate M/P updating by JICA and other related projects, if any, with the Project to utilize its outputs.

7-9 Leakage Control of Distribution Main

NWSDB considers that distribution mains connected to the pilot project areas also have substantial leakage. Therefore, it is recommended to apply the currently available equipment to the specific local conditions.

7-10 Benefit/Cost analysis of NRW Reduction

It is recommended to analyze benefit and cost of NRW reduction activities for presenting financial impact of the activities.

8. Lessons Learned

8-1 Physical loss contributed to the major losses

The major cause of NRW in the pilot project areas is physical loss (leakage). Since situations of NRW are different from area to area, countermeasures should be selected from wide range of solutions accordingly.

8-2 REPLACED PIPE TO BE REMOVED OR DISCONNECTED

During field work, NRW teams found several secondary distribution mains and service pipes, both recorded and unrecorded, were hardly recognized as being in service or abandoned. For future replacement of pipeline, distinctly different color or color coding should be introduced instead of the existing ones such as grey. In addition to coloring, when pipes are installed for replacing purposes, existing pipes should be removed or disconnected properly in order to reduce NRW.

Annex 1

Project Design Matrix Version 2

Project title: Capacity Development Project for Non Revenue Water (NRW) Reduction In Colombo City In Sri Lanka
Duration: November 2009-October 2012
Target Area: Colombo City, Sri Lanka
Target Group: Officers and staff of NWSDB (Western-Central Division)
Date: June 22, 2011

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal The NRW ratio in Colombo city is reduced.	1 NRW reduction activities are comprehensively conducted by 22 zone offices in CMC area in accordance with the execution plan. 2 Decrement of NRW ratio per annum in CMC area exceeds one (1) percentage point up to 2017.	1 Annual report of NWSDB 2 Record of NRW ratio	
Project Purpose NWSDB's capacity to implement NRW reduction activities in Colombo city is strengthened.	1 Number of NRW reduction activity records will increase compared to what was before the Project. 2 The budget to be allocated for NRW reduction will increase compared to what was before the Project. 3 An execution plan to achieve reduction of NRW ratio by one (1) percentage point per annum, as per the Goal 2.1 of "Corporate Plan 2007-2011", is prepared and incorporated into relevant plans/programs of NWSDB.	1 Annual report of NWSDB	1 NWSDB secures the budget for scaling-up of the NRW activities. 2 Necessary equipment such as pipes, saddles and meters are provided by NWSDB. 3 Over-aged pipes in selected zone of CMC area are replaced.
Outputs 1 Management capacity of senior officers of Regional Center (Western-Central) to plan and supervise NRW reduction activities is enhanced. 2 Technical and operational capacity to conduct NRW reduction activities by officers/staff of Western-Central Regional Center is developed.	1.1 An annual program for NRW reduction in the pilot area is prepared every year (the programs for 2nd and 3rd years are based on the results of the activity in previous years). 1.2 NRW reduction activities in the pilot areas are conducted smoothly through adequate allocation on NWSDB resources (personnel, equipment, budget etc.) as planned. 1.3 NRW reduction related training programs are reviewed and organized for "NRW Reduction Teams". 2.1 "NRW Reduction Teams" are organized at two (2) pilot areas and implement NRW reduction activities based on the work plan. 2.2 NWSDB officers/staff engaged in "NRW reduction Teams" acquire proper leak detection, plumbing and pipe repairing skills. 2.3 An average NRW ratio in the pilot areas is reduced compared to the initial NRW ratio.	1.1 Annual report of NWSDB 1.2 Project record, Quarterly progress report 1.3 Project record, Quarterly progress report, training materials 2.1 Project record, Quarterly progress report 2.2 Project record, Quarterly progress report 2.3 Project record, Quarterly progress report	1 Officers and staff trained by the project will continue with NRW activities of NWSDB.

添付資料2

Activities	Inputs		
	Japan	Sri Lanka	
1-1 Organize a "NRW Reduction Management Team" at Western-Central Regional Support Center. 1-2 Review "Strategic Approach for Non Revenue Water Reduction in Colombo Metropolitan Region". 1-3 Prepare an annual program of NRW reduction activities for the pilot areas*. 1-4 Review existing training programs related to NRW reduction and conduct the training for "NRW Reduction Teams". 1-5 Assess progress of NRW reduction activities in the pilot areas. 1-6 Review the annual program of NRW reduction activities based on the feedback/lessons learnt in the pilot areas and prepare the program for the following year. 1-7 Evaluate activities in the pilot areas through out the Project period and prepare an "execution plan" to apply the Project outcome to entire area Colombo city 2-1 Select two (2) pilot areas. 2-2 Organize "NRW Reduction Team (a group of OIC**, EA** and gangs***)" at the pilot areas. 2-3 Review and modify pipeline network drawings of the pilot areas by using GIS, which shall be used for the NRW reduction activities 2-4 Isolate the pilot areas and conduct a survey on actual conditions of NRW in the pilot areas including identification of an initial NRW ratio. 2-5 Prepare a NRW reduction work plan for each pilot area incorporating leak detection, pipe repairing, plumbing and activities for the reduction of non- 2-6 physical losses****. 2-7 Conduct on-the-job training on leak detection, plumbing and pipe repairing for "NRW Reduction Team". 2-8 Implement NRW reduction activities according to the work plan. 2-9 Measure results of NRW reduction team's work (NRW ratio etc.) and provide feedback to "NRW Reduction Management Team" for revision of the annual program.	1. Personnel Chief Advisor /NRW reduction programming Deputy Chief Advisor /NRW reduction monitoring and evaluation Leak detection Advisor Arrangement of pipeline drawing and customer data Service pipe connection advisor Coordinator 2. Equipment Leak detector Pipe locator Portable ultrasonic flow meter Vehicle, etc. 3. Overseas Training Overseas Training for NWSDB counterpart personnel	1. Personnel Project Head Project Director Project Manager Counterpart personnel for - "NRW Reduction Management Team" - "NRW Reduction Team" 2. Facilities Office space, furniture and facility. 3. Local cost Cost for the isolation of pilot project areas (including installation of chambers for flow meters) Pipe-repairing Cost Cost for road opening/reinstatement Project management Cost 4. Others	Pre-conditions 1 NWSDB secures the budget for implementation of the NRW activities at pilot areas. 2 Recruitment of personnel to be assigned to the pilot areas is completed.

*: Pilot area corresponds to jurisdiction of "zone officer" (Approx. 5,000 connection). The pilot area will be divided into smaller blocks (Approx. 500 connections) to conduct the program.

**: Proposed positions in "Strategic-Approach for Non-Revenue Water Reduction in Colombo Metropolitan Region" (Feb.2008)

***: A work unit which is composed of plumber, labor etc.

****: Activities for non-physical losses reduction include measures against illegal connections and bypass connections, replacement of defective customer meters and estimated billing.

Annex 2

Capacity Development Project for NRW Reduction in Colombo City

List of Counterpart Personnel

添付資料2

Name	Title and Organization	CP	Remarks
Management Team			
Mr. S.G.G.Rajkumar	AGM (NRW)	CP	
Mr. S.A.Rasheed	AGM (O&M)	CP	
Mr. K.W. Premasiri	AGM (Dev. WC)	CP	
Mr S.S. Devaraja	M (NRW)	CP	Withdrawn from the Project's activities (promoted as AGM (Co-ordination) Head Office in end/Sep/2011)
Mr. T.B.Heekenda	M (NRW)	CP	Newly appointed M (NRW) with effect from 27/Sep/2011
Mr. W.D.L.Chandrasiri	M (O&M) - S/W	CP	
Mr. R.A.N. Dharmasiri	M (O&M) - N/E	CP	
Mr. Premakumara	CE. NRW	CP	
Mr. A.D.K.K.Wijayagunawardana	Senior Engineer		(Mr. Kumudu): Transferred to Head Office
Borella			
Ms. W.C.A.Gunarathna	AE (CC-East)	CP	
Mr. R.L. Wijekularathna	OIC (Borella)	CP	
Mr.W A.W.T.Wickramarachchi	SCO CB2	CP	
Mr. W.W.G.Weerarathne	MRI	CP	
Mr. D.H.R.Hettiarachchi	Zone officer (Borella)	CP	
Mr. K.A.D.C.U.W. Gunarathna	EA	CP	Transferred out of the NRW Project
Mr. M.S.C. Perera	EA NRW	CP	Appointed for full time work with effect from 11/Jul/2011 as replacement for Mr. Gunarathna
Mr. S.N.I.Somaratne	Fitter	CP	
Mr. H.M.Chaminda Pushpakumara	Labourer		
Mr. R.A.D.M.Ranasinghe	Labourer		
Mr. G G.C.Jayalath	Pipe fitter		
Mr. P.A.D.C.Rathnayaka	Labourer		
Mr. K.N.Karunarathna	Labourer		
Kotahena			
Mr. D.A.D.Hemachandra	CE (TNC)		Fomer AE (CC-North) and promoted as Chief Engineer and appointed to P&D Division as of 12/Jul/2010.
Mr. I.R.B.Waruna	AE (CC-North)	CP	Replacement of Mr. Hemachandra after his promotion. Withdrawn from the Project's activities (transferred to RSC Anuradhapura on 22/Jun/11)
Mr. U.K.D Sunil Chandra	AE (CC-North)	CP	Newly appointed AE with effect from Sep/2011 in replacement for Mr.Waruna
Mr.W.W.K.Jayasinghe	OIC (Kotahena)	CP	
Mrs. G.D.Neelakanthy	CO (CCN)	CP	
Mr. B.D.Dharmasena	Supporting Staff MRI	CP	
Mr. P.S.Kariyawasam	EA	CP	
Mr. E.D K. Karunarathna	EA (Illegal)	CP	Transferred out of the NRW Project
Mr. H.G. Ariyatilake	EA NRW	cp	Appointed for full time work with effect from 11th July 2011, as a replacement for Mr. Karunarathna
Mr. G.H.Chandana	Fitter	CP	
Mr. E.L.R.Kamal Perera	Labourer	CP	
Mr. K.Devasagayan	Labourer		
Mr. M.S.Silva	Pipe Fitter	CP	
Mr. S.Dissanayake	Labourer		
Mr. J.T.Biyanwala	Labourer		
Mapping/Support Service			
Mr. M.B.Thilakarathna	Engineer		
Mr. U.L.U.A.Karunarathna	EA		
Mrs. Bulathsinhala	EA		
Others			
Mr. K. Premakumar	S.Eng. NRW		
Mr. R.A.Kumaranayake	EA (Maligawatte)	CP	
Mr. H.W.Gunawardhana	OIC Maligawatte		
Mr. N.P.Tharanga	EA		
Mr. S.K.P Samarasinghe	EA		
Mr. S.A.Lionel	EA (Maligawatte)		
Mr. W.M.D.G.B.Wickramasinghe	OIC Mattakuliya		
Mr. K. Premalal	EA (SP) NRW	CP	
Ms. L.A.K.M. Liyanaarachchi	Eng. Maligakande	CP	
Mr. S. Kandeepan	Eng. (NRW)		
Mr. C.Balasooriya	EA (NRW)		
Mr. P.D.D.Priya Ranjith	EA		
Mr. R.D.S.Wickramaratne	EA Maligawatte		
Mr. W.D.P. Sanjeewa	OIC Maligawatte		
Mr. A.L.Senerathne	AE - CCW		
Mr. A.V.P.Dhammika	AE - CCS		
Mr. B.K.G.D.Rodrigo	EA OIC Mattakuliya		
Ms. P.V.H.K.Suranga	EA		
Mr. M.B.Thilakaratne	Eng. Maligakande		
JET			
Mr. Shinkichi Kobayashi			
Mr. Tetsuji Kawamura			
Mr. Akihiko Okazaki			
Mr. Hiroki Niimura			
Mr. Masami Ogura			
Mr. Toru Aoki			
Mr Mahesh Jayanthipura			
Mr. Tharanga Jayamanna			
Mr. Iroshan Lasaantha Ratnapala			

添付資料2

Annex 3

List of JICA Experts Assigned

Position	Name	MM	
		First Year Oct 2009 - Mar 2011	Second Year (until Jan) Apr 2011 - Jan 2012
1 Chief Advisor /NRW reduction programming	Mr. Shinkichi KOBAYASHI	10.50	4.0
2 Deputy Chief Advisor / NRW reduction monitoring and	Mr. Tetsuji KAWAMURA	7.10	1.80
3 Leak detection Advisor	Mr. Akihiko OKAZAKI	6.20	2.53
4 Arrangement of pipeline drawing and customer data	Mr. Hiroki NIIMURA	6.80	1.46
5 Service pipe connection advisor	Mr. Masami OGURA	2.40	2.00
6 Coordinator	Mr. Toru AOKI	2.80	1.00
Sub-total		35.80	12.82
Grand Total			48.62

Annex 4

添付資料2

List of Equipment Provided

	Equipment	Useage/Specifications	No.	Delivered on	Value
1	Correlation Leak Detector	Leak detection for pipelines at greater depth under high noise level circumstances.	2	03-Apr-10	JPY 3,307,500
2	Electronic Leak Detector	Picking up sound of leak noise that travels across soil.	5	03-Apr-10	JPY 2,026,500
3	Pipe Detector (Non-Metal)	Detecting buried non-metal pipe.	3	03-Apr-10	JPY 1,701,000
4	Data Logger with Pressure Inducer	Mesurring water pressure in a sub-zone.	8	03-Apr-10	JPY 1,125,600
5	Acoustic Rod - Digital Type	Picking up sound of leak noise with amplifier.	5	03-Apr-10	JPY 351,750
6	Pipe Detector (Metal)	Detecting buried metal pipe.	4	03-Apr-10	JPY 1,308,300
7	Laptop Computer	Data analysis for flow and pressure measurement.	2	03-Apr-10	JPY 321,300
8	Listening Stick	Picking up sound of leak noise.	6	03-Apr-10	JPY 144,900
9	Boring Bar	Tools that are used to bore road surface to confirm location of leakage.	2	03-Apr-10	JPY 39,900
10	Drill Bit	Tools that are used to bore road surface to confirm location of leakage.	30	03-Apr-10	JPY 346,500
11	Hammer Drill	Tools that are used to bore road surface to confirm location of leakage.	2	03-Apr-10	JPY 174,300
12	Pressure Gauge for House Connection	Measuring water pressure at a water tap in a sub-zone.	6	03-Apr-10	JPY 97,650
13	Portable Ultrasonic Flowmeter	Measureing flow in a sub-zone.	2	03-Apr-10	JPY 1,369,200
-	Portable Ultrasonic Flowmeter	Measureing flow in a sub-zone.	8	10-Mar-10	JPY 4,143,156
14	Generator	To drive hammer drill.	2	12-May-2010	LKR 166,071
15	DC12V Cable for Ultrasonic Flowmeter	To use car battery for unlrasonic flowmeter	8	5-Oct-2010	JPY 84,000
16	Valves (φ100-200mm)60	To isolate pilot areas	60	26-Mar-2010	LKR 2,568,533
17	Plastic customer meter assembly	To measure water consumption by customer	200	30-Apr-2010	LKR 3,622,000
18	Crew CABs (Double cabin trucks)	To convey tools and equipment together with workforce	2	26-Mar-2010	LKR 5,486,417
19	Pickup trucks	To convey tools and equipment together with workforce	2	23-Apr-2010	USD 26,112 LKR 630,000
20	Micro excavators	To excavate soil for installation of valves and pipes	2	30-Apr-2010	LKR 18,000,000
21	Metal locator (Valve locator)	To find out beried valves	5	16-Mar-2010	LKR 1,001,125
22	High Accuracy Hand-held GPS	Sub meter after post processed differential correction. (Geo Explorer XT 2008 Series Hand Held GPS)	1		LKR 2,083,200
23	Desktop PC	Intel® Core™ i3-550 Processor (3.2 GHz, 4MB total cache) Intel® H57 Express, 4GB Memory DDR3 RAM (2GB DDR3 x 4) 500GB SATA 3.5 1st Hard Drive, HP USB Optical BLK Mouse SATA SuperMulti LightScribe DVD Writer, Realtek ALC888S High Definition audio codec HP S1932 18.5-Inch wide LCD Monitor, HP USB Standard JB Keyboard A/P Integrated Intel Graphics Media Accelerator Core i3, Windows 7 Professional License (64 bit) Integrated Realtek 8111DL Gigabit Ethernet, (3 Years HP Warranty)	6		LKR 609,000
	External HDD	500GB, for system & data backup, compatible with Win7 Pro 64 bit	6		LKR 57,000
	UPS	650 VA	6		LKR 28,896
	MS Office	MS Office Professional 2010, compatible with Win7 Pro 64 bit	6		LKR 430,080
	Virus Protection	Kaspersky Internet Security 2011	6		LKR 11,340
	A3 Printer	A3 size, inkjet w/ spare cartridges (5 magenta, 5 yellow, 5 cyan, 10 black,), compatible with Win7 Pro 64 bit	4		LKR 420,000
	A4 Scanner	A4 size, compatible with Win7 Pro 64 bit	1		LKR 8,100
		Sub tatal	-		LKR 1,564,416
24	Plotter	A0 size, inkjet w/ spare cartridges/printer heads/roll papers, compatible with Win7 Pro 64 bit * Additional Cartridges: - 5 nos. for magenta. - 5 nos. for yellow. - 5 nos. for cyan. - 10 nos. for black. * Additional 4 nos. of printer heads (for magenta, yellow, cyan and black). * Additional 5 nos. of A0 roll paper (plain, 50m).	1		LKR 594,000
25	GIS Software-1	ArcView 10 Desktop, compatible with Win7 Pro 64 bit	2		LKR 697,143
26	GIS Software-2	AutoCAD Map 3D 2011 Commercial New SLM, compatible with Win7 Pro 64 bit	4		LKR 1,656,733
27	Satellite Image	Processed Image, June 2010 or later, 0.50m/0.60m high resolution, multi-spectrum, pansharpened, True Colors, Mosaic Image	100		LKR 154,700
		FTP Conversion	1		

添付資料2

Annex 5

List of Participants for Training Program

Training in Japan

September 8 - 16, 2010

	Name	Title
1	Mr. S.A.Rasheed	AGM (O&M、Wsetern Central)
2	Mr. K.Premakumara,	Chief Engineer (Illegal Connection、Western Central)
3	Mr. R.A.N.Dharmasiri	Manager (O&M、Colomobo City North East)
4	Mr. H.T.R. Wijesooriya	AGM (Rural Water Supply)
5	Mr. K.L. Chandrasiri	Chief Engineer (Construction、North Central)

November 3 - 11, 2011

	Name	Title
1	Mr. A.B Hiyarapitiya	Asst. General Manager (North Central)
2	Mr. L.P.A.P. Perera	Chief Engineer O&M Manager (Kalutara)
3	Mr. Susil Wijerathna	Chief Engineer O&M Manager (Towns North Colombo)
4	Mr.D.A.D.Hemachandra	Chief Engineer (RSC (Western North)
5	Ms W.M.Y.A Wijesinghe	Engineer Cl I (Western Central)

Technical Exchange Program in Jordan

October 9 - 20, 2010

	Name	Title
1	Mr. M.B.Thilakaratne	Engineer, Manager (CC-O&M-North East)
2	Mr. W.A.W.T Wickramarachchi	Senior Commercial Officer, Mattakuliya Area Engineer
3	Mr. R.A.Kumaranayake	Engineering Assistant, Manager (CC-O&M-North East)
4	Mr. J.A.W.W.K Jayashinghe	Engineering Assistant, Kotahena Office
5	Mr. F.D.K Karunarathna	Engineering Assistant, NRW Section
6	Mr. K Premalal Silva	Engineering Assistant, NRW Section

Technical Exchange Program in Indonesia

December 5 - 16, 2011

	Name	Title
1	Mr. Heenkenda Thushantha Bandara	Senior Engineer, Priority Section, Western - Central, NWSDB
2	Mr. Dewasurendra Jayantha	Senior Commercial Officer, Area Engineer's Office (Colombo - South), Western - Central, NWSDB
3	Ms. Fonseka Alias Fernando Hettiyakandage Shanti Chandanie Samanmalie	Engineer Assistant (Special), Area Engineer's Office (Colombo - West), Western - Central, NWSDB
4	Mr. Kalumarakkala Jayasiri	Engineer Assistant (Special), RSC (WC), Western - Central, NWSDB
5	Mr. Gunawardhena Hettipathirannehelage Wasantha.	Engineer Assistant (Special), Officer in Charge, Maligawatte, Western - Central, NWSDB
6	Mr. Perera Illeperuma Arachchige Karunasiri	Engineer Assistant II, Officer in Charge, Soyasapura, Western - South, NWSDB

Annex 6

List of Workshop and Seminar

	Date	Title and Contents	Number of Participants*
1	21/12/2009	The First Seminar - Introduction of the Project - Basic issues of NRW	33
2	31/03/2010	The First Workshop - Techniques in service pipe connection and the present Sri Lankan conditions - Group discussions on NRW reduction activities	32
3	06/04/201	The Second Seminar - Leakage mechanism and techniques in leak detection	39
4	05/07/2010	The First Field Workshop - Leak detection and techniques in service pipe connection	Approx. 25
5	10/10/2010	The Second Field Workshop - The same as the first field workshop	Approx. 25
6	25/10/2010	The Third Field Workshop - The same as the first field workshop	Approx. 25
7	25/01/2011	The Third Seminar - The progress of the pilot activities - Findings in overseas training (Japan/Jordan)	66
8	18/01/2012	Training on Use of GPS - Introduction to GPS - Usage of GPS in the field - Download, visualizing and post processing	15 (Operation Level, not C/P)
9	23/01/2012	Training on Understanding of GPS Usage - Introduction to GPS - Usage of GPS in the field - Actual Problems faced in the field	7 (Management Level, not C/P)
10	End of Feb 2012 (Planned)	Seminar on Interim Progress of the Project - The progress and findings of the pilot activities - Findings in overseas training (Japan/ Indonesia)	Approx. 70 (all related staff of NWSDB)

*This number of participants excludes JICA experts

添付資料2

Annex 7

Capacity Development Project for Non Revenue Water (NRW) Reduction In Colombo City

OJT on GIS

	Date	Role of the Training	Training Place	Number of Participants
1	27/09/2011	Introduction to GIS and Coordinate System	Maligakanda Office	8
2	28/09/2011	Introduction to GIS and Coordinate System	Maligakanda Office	6
3	30/09/2011	Introduction to GPS Technology and Hands on	Maligakanda Office	9
4	2011/3/10	Introduction to GPS Technology and Hands on	Maligakanda Office	8
5	2011/4/10	Introduction to GPS Technology and Hands on	Maligakanda Office	8
6	2011/6/10	Introduction to GPS Technology and Hands on Practice	Maligakanda Office	5
7	2011/7/10	GIS Mapping & Database Updating	Maligakanda Office	4
8	17/10/2011	Introduction to Auto Cad Map	Maligakanda Office	8
9	18/10/2011	GPS Field Work	colombo city area	5
10	19/10/2011	GPS Field Work	colombo city area	7
11	20/10/2011	Introduction to AutoCAD MAP 3D	Maligakanda Office	6
12	24/10/2011	Introduction to AutoCAD MAP 3D	Maligakanda Office	5
13	27/10/2011	Introduction to AutoCAD MAP 3D	Maligakanda Office	4
14	2011/1/11	Introduction to AutoCAD MAP 3D	Maligakanda Office	5
15	2011/3/11	Hands on Training to AutoCAD MAP 3D.	Maligakanda Office	5
16	2011/7/11	Hands on Training to AutoCAD MAP 3D.	Maligakanda Office	4
17	14/11/2011	Hands on Training to AutoCAD MAP 3D.	Maligakanda Office	5

Evaluation Grid of "the Capacity Development Project for Non Revenue Water Reduction in Colombo City"

Achievement and Implementation Process

As of February 25

Items to be checked		Objectively Verifiable Indicators (Criteria /Method for assessment)	Results to date
Main points	Specific Questions		
Achievement/Performance			
- Prospect of achieving Outputs	1 The extent to which management capacity of senior officers of Regional Center (Western-Central) to plan and supervise NRW reduction activities is enhanced.	1-1 An annual program for NRW reduction in the pilot areas is prepared every year (the programs for 2nd and 3rd years are based on the results of the activity in the previous year).	- The NRW Reduction Management Team formulated the fist-year's annual program in May 2010 in cooperation with JICA experts. This Team prepared the second-year's annual program in June 2011 by its own ability. Reviewing the second year's results of the NRW reduction activities, the third annual program will be prepared around May 2012.
		1-2 NRW reduction activities in the pilot areas are conducted smoothly through adequate allocation on NWSDB resources (personnel, equipment, budget, etc.) as planned.	- After the Mid-term Review, NWSDB filled the cadre of Engineering Assistants (EAs) in the O&M section intending to mobilize the staff into the pilot activities. Despite this effort, lots of regular works at the O&M section still limited the newly hired EAs to devote themselves to project activities. Moreover, all of six teams formulated in two pilot areas could not concentrate entirely on project activities since they also had to serve to their routine works or urgent matters. To cope with this situation, the NRW Reduction Management Team reorganized the six teams into four teams (two teams for each pilot area) and assigned one team for respective pilot areas to concentrate on the project activities in the middle of 2011. Since then, the pilot activities have progressed more smoothly. - NWSDB earmarked approximately 200 million LKR for the three-year project activities in 2010 and requested this as a counterpart fund to the Ministry of Finance and Planning. The amount of 25 million LKR was smoothly disbursed for tax payment of the provided equipment from Ministry in 2010 and 970 thousand LKR for tax payment of the GIS related equipment in 2011. NWSDB, in 2012, is waiting for the approval for 20 million LKR. To date, other expenses necessary for the pilot activities including the personnel costs and materials for service pipe replacement and leak repair have been borne by the regular budget of NWSDB.
		1-3 NRW reduction related training programs are reviewed and organized for "NRW Reduction Teams."	- At the early stage of the project activities, the JICA experts and the NRW Reduction Management Team reviewed the existing training programs and have organized the seminars/workshops on NRW reduction. The contents of seminars/workshops held to date are summarized in Annex 6. Through the project activities, the themes or topic to be included in the training program (including seminars/workshops) were clearly identified. Until now, most of the presentation in seminar/workshops has been made by the members of NRW Reduction Management Team and NRW Reduction Team.

Evaluation Grid of "the Capacity Development Project for Non Revenue Water Reduction in Colombo City"

添付資料3

Achievement and Implementation Process

As of February 25

Items to be checked		Objectively Verifiable Indicators (Criteria /Method for assessment)	Results to date
Main points	Specific Questions		
	2 The extent to which technical and operational capacity to conduct NRW reduction activities by officers/staff of Western-Central Regional Center is developed.	2-1 "NRW Reduction Teams" are organized at two (2) pilot areas and implement NRW reduction activities based on the work plan.	- The six NRW Reduction Teams headed by Area Engineers (AEs) were formulated in November 2009: the three teams for each in Kotahena and Borella. After NWSDB reorganized the NRW Reduction Teams into four teams as described in Output 1, the four teams have been engaged in the pilot activities and functioned well. The NRW Reduction Teams prepared the work plan of pilot activities with NRW Reduction Management Team and JICA experts, and they revised the plans several times in accordance with the progress of activities. Until now, the delay of implementation has occurred because the hydraulic isolation work of sub-zones in pilot areas has taken longer time than expected. The situation, such as lack of accurate information on pipeline drawings, unexpected interconnection of pipes, low system pressure and difficulties in valve locating, has caused the counterparts and JICA experts hardship of isolation work in sub-zones. At this moment, the hydraulic isolation works were mostly completed in Kotahena and Borella, and the Project will start NRW reduction activities based on the work plan. It is expected that the specific data in all pilot areas will be gained by June 2012.
		2-2 NWSDB officers/staff engaged in "NRW Reduction Teams" acquire proper leak detection, plumbing and pipe repairing skills.	- The members of NRW Reduction Teams have acquired the knowledge and techniques on systematic methods of NRW reduction, such as sub-zoning, hydraulic isolation, system inflow measurement, measurement of minimum night flow (MNF), leak detection and repair, meter accuracy test and meter replacement, detection/elimination of illegal connection, and meter installation to stand posts, through seminars/workshops and the OJT . Since the activities following the isolation works will be carried out in the sub-zones (K3-K6, B2, B4-B6) where the isolation work is nearly completed, the counterpart personnel will gain more knowledge, techniques and experience on systematic NRW reduction activities.
		2-3 An average NRW ratio in the pilot areas is reduced compared to the initial NRW ratio.	- Specific data should be referred to the joint evaluation report. According to the NRW Reduction Management Team and JICA experts, the remarkable effects of NRW reduction activities can be observed in Borella where the pipes are relatively in good condition. The data acquired from pilot activities in Kotahena, where pipes are very deteriorated, explains that NRW reduction activities certainly brought some effects but the measures combined with the pipe replacement and other activities would be more effective to reduce NRW ratio. The Project is currently gaining the results of pilot activities, analyzing the conditions that a series of the systematic NRW reduction activities can bring effects toward reducing the NRW.

Evaluation Grid of "the Capacity Development Project for Non Revenue Water Reduction in Colombo City"

添付資料3

Achievement and Implementation Process

As of February 25

Items to be checked		Objectively Verifiable Indicators (Criteria /Method for assessment)	Results to date
Main points	Specific Questions		
- Prospect of achieving Project Purpose	- The extent to which NWSDB's capacity to implement NRW reduction activities in Colombo city is strengthened.	1 Number of NRW reduction activity records will increase compared to what was before the Project.	- The activities of NRW reduction in the pilot areas were described in the results of Output 2. The rotation system, which the Project originally planned to implement, has not functioned well even after the Mid-term Review in February 2011. Because of manpower shortage at NWSDB, the rotation team's tasks in their responsible areas could hardly be taken over by the other staff. Instead, NWSDB tried to involve the Area Engineers (AEs), the Officers in Charge (OICs) and EAs of non-pilot areas in the pilot activities and invited them to weekly meetings to share the issues raised in pilot activities. To date, the AE of Colombo City South and the AE and OIC of Colombo City East learned about the systematic methods of NRW reduction by participating in the workshops/seminars, OJT in the pilot areas, and weekly meetings. Then, they have practiced its method in their responsible areas. The specific data should be referred to the joint evaluation report.
		2 The budget to be allocated for NRW reduction will increase compared to what was before the Project.	- It is rather difficult to extract the budget allocated for NRW reduction activities from the regular budget of NWSDB since O&M section and NRW section carry out the NRW related activities as a part of their routine works. As stated in the achievement level of Output1, NWSDB has managed to allocate the budget necessary for the project activities from its own regular budget due to the delay of the counterpart fund's approval from the Ministry of Finance and Planning. Therefore, it can be concluded that NWSDB has allocated a certain amount of budget for NRW reduction activities.
		3 An execution plan to achieve reduction of NRW ratio by one (1) percentage point per annum, as per the Goal 2.1 of "Corporate Plan 2007-2012," is prepared and incorporated into relevant plans/programs of NWSDB.	- According to the Plan of Operations (PO) of the Project, an execution plan will be prepared in the third year of the project implementation. This plan will incorporate the analysis of the results of pilot activities and suggest strategy and effective methods for NRW reduction suitable to the condition in Colombo City along with the cost estimation and required manpower. The NRW Reduction Management Team and JICA experts already obtained some findings from the results of pilot activities and will gain them more and necessary data since the pilot activities will move to next steps after isolation work. Moreover, as recommended in Mid-term review, NWSDB determined to utilize the fund of Water Sector Development Project (I) for pipe replacement in Kotahena and conduct a comparative study . It is expected that pipe replacement work will be implemented as early as possible and the data resulting from this work is utilized for the comparative analysis in the Project.
- Prospect of achieving Overall Goal	- The extent to which the NRW ratio in Colombo city is reduced.	1 NRW reduction activities are comprehensively conducted by 22 zone officers in CMC area in accordance with the execution plan.	- The overall goal, which is the direct impact generated from the Project, is generally expected to be achieved in three to five years after the cooperation period is completed. When methods to be suggested in the execution plan are recognized as effective within NWSDB and applied to other areas in Colombo City, this can be contribute to the reduction of NRW in Colombo City. Some of the AEs and OICs from non-pilot areas have already participated in pilot activities, gained technologies and experiences on systematic NRW reduction activities, and practiced them in their responsible areas. When more number of AEs and OICs are involved in pilot activities in the remaining cooperation period, it will be ensured to extend the systematic NRW reduction activities to other areas in Colombo City.
		2 Decrement of NRW ratio per annum in CMC area exceeds one (1) percentage point up to 2017.	

Evaluation Grid of "the Capacity Development Project for Non Revenue Water Reduction in Colombo City"

添付資料3

Achievement and Implementation Process

As of February 25

Items to be checked		Objectively Verifiable Indicators (Criteria /Method for assessment)	Results to date
Main points	Specific Questions		
Implementation Process			
- Progress of activities	- Whether the activities have been taken as planned to date.	- Comparison between the plan and the actual performance	- Since isolation work in the sub-zones of pilot areas took longer time than expected, the activities have been delayed slightly.
- Monitoring	- Whether the monitoring system of the project is appropriate and effective.	- Whether the monitoring system for project management is established	- The weekly meetings held among the NRW Reduction Management Team, NRW Reduction Team, and JICA experts have provided good opportunities to identify the problems and discuss the possible solutions as well as to monitor and share the detailed progress of pilot activities. The work plan of pilot activities and the PO have been major tools to monitor the progress of the project activities. JCC, which was organized six times to date, has functions well to monitor the entire project progress and exchange the opinions among the concerned personnel/organizations.
	- Whether the results of monitoring have been reflected to the project management.	- Whether the monitoring system was effective to check the progress of the activities	
- Relations between C/Ps and JICA experts	- Whether the communications among related parties and personnel have been established well to manage the project.	- Degree of communications	- The communications and coordination among NRW Reduction Management Team, NRW Reduction Team and JICA experts have been also good and any difficulties found in the project activities have been discussed among them.
	- Whether the relationships among relevant personnel in Sri Lankan side has been good during the project implementation	- Degree of cooperation among relevant parties	- The executives of NWSDB are also informed about the project progress from time to time and keep the good communication with NRW Reduction Management Team and JICA experts.
	- Degree of participation in management by the responsible persons - Attitude of the counterparts	- The extent to which the project directors and project managers have participated in management The extent to which the counterparts have been - involved in project activities Whether the counterparts are self-motivated toward - the project activities	- The attitude of the counterparts and the degree of participation in management by the responsible persons have been good.
- Allocation of counterparts	- Situation of counterparts' allocation	- Whether the counterparts have been allocated appropriately (quality and quantity)	- The counterparts were assigned for NRW Reduction Management Team and NRW Reduction Team in both pilot areas. On the other hand, the rotation system, which the Project originally planned to implement, has not functioned well even after the Mid-term Review in February 2011. Because of manpower shortage at NWSDB, the rotation team's tasks in their responsible areas could hardly be taken over by the other staff.

Evaluation Grid of "the Capacity Development Project for Non Revenue Water Reduction in Colombo City"

Five Evaluation Criteria

As of February 25

Items to be checked		Criteria /Method for assessment	Results to date
Main points	Specific Questions		
Relevance			
- Consistency with the development or sector policy in Sri Lanka	- Whether the project is still line with the water supply sector in Sri Lanka	- Whether the project purpose/overall goal still keeps the consistency with the relevant policy on water supply sector	- The policy on water supply sector in Sri Lanka has not been changed much since the commencement of the Project. “Sri Lanka, the Emerging Wonder of Asia, the Mahinda Chintana, Vision for the Future 2010 – the development policy framework, government of Sri Lanka ”clearly specifies the province wise development targets with respect to safe water supply. The overall target to be achieved is 44% piped water connected coverage by 2015 and 60% by 2020. The safe water supply coverage target specified therein is 94% by 2015 and 100% by 2020. The document also addresses the sustainable safe drinking water for all at an affordable price and identifies the specific actions to be taken, such as implementation of non-revenue water (NRW) reduction program to minimize the NRW rate up to 20 % by 2020. Therefore, the Project still keep the consistency with the policy direction of the GOSL.
- Consistency with Japanese policy	- Whether the project is still line with the Country Strategy developed by Japanese Government	- Whether the capacity building of water supply in Sri Lanka is prioritized in Japanese policy	- The Country Assistant Program for Sri Lanka prepared in April 2004 by the GOJ addresses two pillars of assistance to Sri Lanka: (i) assistance to support the “consolidation of peace” and reconstruction, and (ii) assistance that is in line with the country’s long-term vision for development. The prioritized areas include the improvement in water supply. Therefore the Project components are along with the policy of the GOJ.
- Appropriateness of selection of target groups	- Whether the selection of target groups was appropriate	- To check whether the intended target groups receive the benefits from the project directly	- Colombo City had suffered from high NRW ratio of 54.1%, higher than its nationwide average of 33.0%, as recognized at the stage of project formulation in 2008. “Corporate Plan 2007-2011” set the target of reducing NRW by 1 % per annum in Colombo City and achieving a 30% national average. NWSDB prepared the draft version of “Cooperate Plan 2012-2016,” in which the NRW reduction remains among the goals to achieve by 2016. It addressed the target of “reducing NRW by 9.4 % in Colombo City during the period of 2012 - 2016 and achieving a 26 % national average in 2016.” NWSDB still has strong needs of enhancing the capacity of NRW reduction to meet this target; therefore, the components of the Project have been along with the needs of NWSDB.
- Meeting with the needs of target groups/beneficiaries	- Whether the project purpose meets the needs of target groups	- Whether the project target meets the needs of target groups - To confirm the actual situation	
- Comparative advantage of technology provided by Japanese side	- Whether the cooperation by Japan was relevant to support the capacity development in water supply sector in Sri Lanka	- To confirm whether Japanese side had the know-how to achieve this project purpose	- Since JICA has experienced to implement NRW reduction projects in other countries, and also provide assistance to water supply sector in Sri Lanka, the Japan had technical advantages to provide the technical cooperation.
Effectiveness			
- Probability of achieving the project purpose	- Whether the Project Purpose is likely to be achieved by the end of the project completion	- To verify the degree of achievement based on the indicators of project purpose in PDM	- The Project is assessed as effective in achieving its purpose envisaged at planning. The details were explained in Prospect of achieving Project Purpose.
- Contribution of the outputs to the project purpose	- Whether the effects (project purpose) is likely be generated by the achievement of project outputs	- To check the logic of PDM	- To pursue the effective NRW reduction, capacity enhancement at both technical and management level is very crucial. To date, the Project has enhanced NWSDB’s capacity to implement NRW reduction activities in Colombo City at both levels. NWSDB officers/staff engaged in pilot activities has acquired the practical and systematic techniques for effective NRW reduction. The NRW Management Team has gained a lot of findings on what methods would bring more effects on NRW reduction through project activities. In this respect, two Project Outputs are very essential and sufficient to achieve the Project Purpose.
- External factors affecting project achievements	- Whether the important assumption affects the project achievement	- Whether officers/staff trained by the project will continue with NRW activities of NWSDB.	- Some of the members of NRW Reduction Management Team and NRW Reduction Team were transferred, promoted, or assigned to additional work; however, JICA experts and the counterparts have tried to keep up with the activity plan, and this issue has not seriously affected the project performance as a result.
Promoting / hampering factors	- Promoting factors toward fulfilling the project purpose	- Check the situation	- In this Project, the strong leadership and commitment of the members of NRW Management Team toward NRW reduction has fostered the project activities and will lead to fulfillment of the Project Purpose.
	- Hampering factors disturbing the fulfillment of project purpose	- Check the situation	- Any particular hampering factors have been observed.

Evaluation Grid of "the Capacity Development Project for Non Revenue Water Reduction in Colombo City"

添付資料3

Five Evaluation Criteria

As of February 25

Items to be checked		Criteria /Method for assessment	Results to date
Main points	Specific Questions		
Efficiency			
- Conversion of the input to the outputs	- Whether the Outputs are reasonable for the amount of input (resources)	- Comparison of plan and actual	- Although some of the project activities are behind schedule, various activities have been carried out and the Project Outputs have been produced. Hydraulic isolation work in pilot areas has taken longer time than expected due to local characteristics in water supply system in Colombo City such as lack of accurate information on pipeline drawings, unexpected interconnection of pipes, low system pressure and difficulties in valve locating. It is true that this issue has caused the delay of project progress, but this is also a very important learning for NWSDB and JICA experts to gain experience and lessons learned, and figure out the effective and suitable means in the situation in Colombo City.
	- Whether the inputs are fully used to generate the outputs to date	- Whether any inputs for the project is utilized for other purposes - Comparison of plan and actual	- The inputs were fully utilized for project activities to date.
- Promoting / hampering factors	- Whether the timing, amount, quality of inputs was appropriate	- Comparison of plan and actual	- The quality and the quantity of inputs were mostly appropriate
	- Whether there are any factors influenced to converting input to outputs	- The same as left mentioned	- The inter-agency's application process takes very long time to implement NRW reduction activities such as permission for road excavation. - The internal procedures within NWSDB sometimes take time to make an arrangement. Sufficient numbers of vehicle and driver was not always available for project activities. The vehicles, personnel and heavy equipment were not always arranged together for pilot activities. - The counterpart personnel has multiple tasks and struggles with difficulties in focusing on the project activities. They have to take care of their routine works and/or other works that is regarded as higher-priority by NWSDB such as the urgent pipe replacement works. - The project activities have slowed down during the absence of JICA experts, especially when the problems, such as allocation of vehicle or equipment, arose.
- Coordination with other project supported by other donors/ Japanese cooperation	- Whether this project has coordinated with other projects	- The same as left mentioned	- This is not the issue for the efficiency; however this Project needs to coordinate with other JICA project. As recommended in Mid-term review, NWSDB determined to utilize the fund of Water Sector Development Project (I) for pipe replacement in Kotahena and conduct a comparative study . It is expected that pipe replacement work will be implemented as early as possible and the data resulting from this work is utilized for the comparative analysis in the Project.
Impact			
- Probability of achieving the overall goal	- Whether the overall goal will be achieved through achievement of project purpose of this project	- To check the logic of PDM - To check the important assumption affecting the overall goal	- The Project will prepare an execution plan, which suggests strategy and effective methods of NRW reduction activities suitable in Colombo City along with the cost estimation and required manpower. When the NRW reduction activities are continued by NWSDB based on the execution plan with high commitment of NWSDB's executives, it is expected that the results of the Project will contribute to NRW reduction in Colombo City in the future. - Since the Project has involved several AEs or OICs of non-pilot areas in project activities, NWSDB now has a certain level of foothold in extending NRW reduction activities. If more number of AEs and OICs/EAs will gain experience by participating in pilot activities in the remaining cooperation period, the possibility of realizing NRW reduction will be further promoted.

Evaluation Grid of "the Capacity Development Project for Non Revenue Water Reduction in Colombo City"

添付資料3

Five Evaluation Criteria

As of February 25

Items to be checked		Criteria /Method for assessment	Results to date
Main points	Specific Questions		
			- As generally recognized, the combination of soft-measures, such as leakage detection/ repair, detection of illegal connection, reduction of stand posts, and hard-measures of pile replacement are very effective to reduce NRW. Therefore, as stated in PDM2, other conditions to fulfill the Overall Goal need to be satisfied. Those are securing the budget and equipment for scaling up of NRW reduction activities or deteriorated pipe replacement. Currently, "the study for a master plan update of water supply sector in Colombo City and NRW engineering study" are undertaken with the assistance from JICA program, and NWSDB will be able to have more specific plan for NRW reduction including the effective combination of pipe replacement and NRW reduction activities. Since the master plan update and NRW engineering study will incorporate the strategy shown in the execution plan and the lessons learned from the Project, the Project will also contribute to moving forward to reducing NRW ratio.
- Other impacts	- Whether there will be / are other impacts (positive/negative) generated by the project implementation	- The same as left mentioned	- So far, no other impacts are expected to be generated because of this project implementation.
Sustainability			
(1) Prospect of the effects generated by the project	- Whether the effects generated by the project will be kept after the project completion	- Whether project activities will be continued at respective organizations	- Since the Project has involved several AEs or OICs of non-pilot areas in project activities and the counterparts have acquired necessary techniques on NRW reduction measures, NWSDB now has a certain level of foothold in implementing NRW reduction activities in Colombo City. If more number of AEs and OICs/EAs will gain experience by participating in pilot activities in the remaining cooperation period, the project effects will be certainly sustained. In addition, the strong commitment of NWSDB's executives will be required to sustain NRW reduction measures in the future.
(2) Institutional/political aspects	- Whether the government will keep putting the priorities on water supply sector in Sri Lanka (CMC)	- Policy on water supply sector	- The policy environment is still likely to be favorable for NWSDB. The GOSL keeps the improvement of water supply services among its prioritized areas, addressing the sustainable safe drinking water for all at an affordable price and identifying the specific actions to be taken, such as implementation of non-revenue water (NRW) reduction program to minimize the NRW rate up to 20 % by 2020.
(3) Organizational/ Financial aspects	- Whether sufficient budget for NRW reduction activities will be allocated	- The same as left mentioned	- While it is difficult to identify the allocated amount for NRW reduction activities at NWSDB, a certain amount of budget has been allocated and disbursed for NRW related activities. The amount for the repairs and maintenance for water service was 461.4 million LKR in 2009, and this partially include the amount allocated for NRW reduction activities. At NWSDB, the cost associated with O&M is currently covered by water charge. The financial statement in NWSDB Annual Plan of 2009 indicated that the sales of water exceeded the direct cost, while the financial condition of NWSDB was overall in deficit in 2009 due to the large amount of financial cost. In addition, NRW Reduction Management Team mentioned that the budget for NRW reduction is not sufficient but the budget is certainly allocated. Therefore, it can be judged that a certain amount of budget will be continuously allocated when the executives admit the effectiveness of NRW reduction activities and commit to its implementation.
	- Whether NWSDB will have sufficient capacity of pursuing relevant activities to keep project effects after project completion (staff allocation, decision-making process, planning capacity, execution capacity, etc.)	- Current level of C/Ps - Future plan of NWSDB to disseminate the knowledge, skills and know-how of NRW reduction activities to other areas than project target areas	- NWSDB already has sufficient capacity to pursue the relevant activities after the Project. Since an execution plan will support NWSDB to systematic NRW reduction activities to other areas, it would not be very difficult for NWSDB to do so. On the other hand, to practice systematic NRW reduction activities, the strong commitment of NWSDB's executives is required.
(4) Technical aspects	- Whether the skills/techniques which the project has been enhancing are accepted and further enhanced by C/Ps	- Results of training	- The counterpart personnel has well accepted the knowledge and techniques introduced by the Project and recognized the usefulness of the systematic technologies of NRW reduction. Especially, the AEs and OICs/EAs in pilot and non-pilot areas have learned about the systematic techniques to pursue the NRW reduction activities and gained sufficient experiences.
	- Whether the equipment provided by the Project is likely to be appropriately maintained	- Current and prospect level of the maintenance skills	- The counterpart personnel has tried to store and maintain the provided equipment with the utmost care. In this respect, the equipment provided by the Project will be maintained after the project cooperation is terminated. On the other hand, it should be noted that some of the equipment, especially electronic products, were foreign products, and NWSDB may need to contact the overseas manufacturers through email when those of equipment have problems.

添付資料 4

Form 1: Questionnaire to DGM (Project Manager)

QUESTIONNAIRE

JAPANESE TECHNICAL COOPERATION FOR THE CAPACITY DEVELOPMENT PROJECT FOR NON REVENUE WATER (NRW) REDUCTION IN COLOMBO CITY

The terminal evaluation will be carried out from January 26 to February 16, 2012 to evaluate the Capacity Development Project for Non Revenue Water (NRW) Reduction in Colombo City. The purposes of JICA evaluation are to assess the degree of achievement at the end of the project period, to feedback the gained practical lessons to associated projects, and to confirm the accountability of the JICA assistance projects to the Japanese public as well as the Sri Lankan people. As part of the evaluation team's activities, the different forms of questionnaires have been prepared to receive views from various stakeholders of the project.

This questionnaire is designed to hear views and opinions from the counterpart personnel and solely aims to improve the performance of JICA projects. For this purpose, we would like to receive your frank and straightforward answers, comments and suggestions. The results of the questionnaire survey will not be used for any other purpose. Please write your answers or opinions on this sheet, and submit to Ayako NAMURA, a member of the terminal evaluation team by January 25, 2012 via email. **You may skip the questions that bear no relation to you.** Thank you very much for your cooperation.

JICA Terminal Evaluation Team Ayako Namura (Ms), ayana@tekizaitekisho.org

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Name:
Position/Title:
Organization:
Responsible field in this Project:
Period of working for your organization: years (month /year: / - /)

IMPLEMENTATION PROCESS

1. How has the progress of the project implementation been monitored?

2. Is the monitoring method above mentioned effective to check the status of activities?

❑ Yes ❑ No ❑ Do not know

-If your answer is "No," please specify the reasons.

3. How is the communication among JICA experts, NWSDB Executive, NRW Reduction Management Team, and NRW Reduction Teams?

❑ 4. Very good ❑ 3. Good ❑ 2. Not so good ❑ 1 Need improvement ❑ 0 Do not know

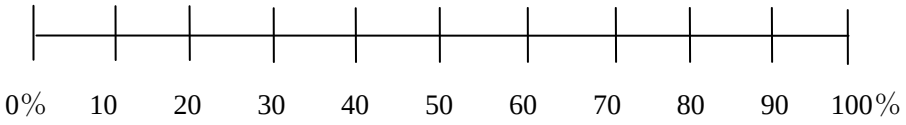
--If your answer is "2," or "1," please specify the reasons.

4. Do you observe any difficulties in project implementation? And if there are any suggestions/comments on the implementation process or the project management, please describe it.

LEVEL OF ACHIEVEMENT OF THE PROJECT

To what extent do you assess the project has achieved/accomplished the following outputs to date? Please circle the appropriate number (%) below. <u>NOTE: "100%" means that the expected/planned output is achieved completely.</u>

5. Project Purpose: To what extent do you think that NWSDB's capacity to implement NRW reduction activities in Colombo city is strengthened?



5-1. Indicator 3: Will an execution plan to achieve reduction of NRW ratio by one percentage point per annum be prepared and incorporated into relevant plans/programs of NWSDB by the end of the cooperation period?

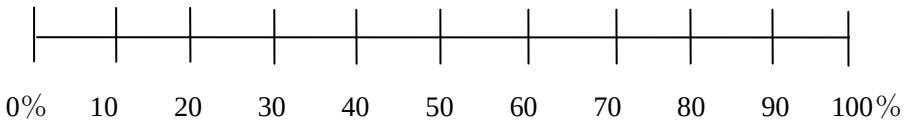
❑ Yes ❑ No

--Please tell us the current progress of preparation of this plan and its integration into relevant plans/programs of NWSDB.

5-2. Please describe the specific capacities which has been enhanced through the implementation of the Project.

5-3. In your opinion, what areas or capacities to reduce NRW ratio have to be strengthened further by the end of the cooperation?

6. Output 1: To what extent do you think that management capacity of senior officers of Regional Center (Western-Central) to plan and supervise NRW reduction activities is enhanced?



6-1. Indicator 1: Do you think that NWSDB now has sufficient capacity to prepare an annual program for NRW reduction in the responsible areas?

❑ Yes ❑ No

--If your answer is "No," please describe the reasons which support your answer.

6-2. Indicator 2: Have NRW reduction activities in the pilot areas been conducted smoothly through adequate allocation on NWSDB resources (personnel, equipment, budget, etc.) as planned?

Overall	❑ Yes	❑ No
Personnel	❑ Yes	❑ No
Equipment	❑ Yes	❑ No
Budget	❑ Yes	❑ No
Other ( )	❑ Yes	❑ No

--If your answer is "No," please describe the reasons which support your answer.

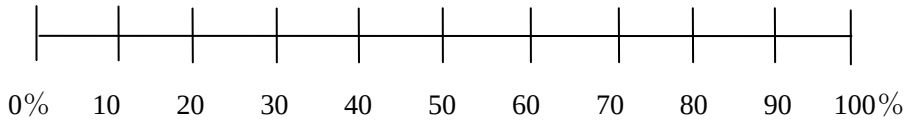
6-3. Indicator 3: Is NWSDB able to plan and manage the training program for NRW reduction?

❑ Yes ❑ No

--If your answer is "No," please describe the reasons which support your answer.

7. Output 2: To what extent do you think that technical and operational capacity to conduct NRW reduction activities by officers/staff of Western-Central Regional Center is developed?

添付資料 4
Form 1: Questionnaire to DGM (Project Manager)



7-1. Indicator 1: Has the NRW reduction activities been conducted by NRW Reduction Teams based on the work plan?

❑ Yes ❑ No

--If your answer is "No," please describe the reasons which support your answer.

7-2. Indicator 2: Has NWSDB officers/staff engaged in "NRW Reduction Teams" acquired proper leak detection, plumbing and pipe repairing skills? Please evaluate the performance of NRW Reduction Teams including other necessary skills.

"4"	**Excellent**
"3"	**Good to some extent**
"2"	**Not so good**
"1"	**Not good at all**
"--"	**I do not know**

		(please write the name of NRW Reduction Teams)			
1.	Sub-zoning				
2.	Hydraulic isolation				
3.	System input measurement				
4.	Measurement of minimum night flow (MNF)				
5.	Leak detection				
6.	Leak repair				
7.	Meter accuracy test				
8.	Meter replacement				
9.	Detection/elimination of illegal connection				
10.	Meter installation to stand posts				
11.	Plumbing				
12.	Others (specify:)				

8. In addition to the achievements made in accordance with the Project Design Matrix (PDM), do you notice any other improvements or achievements made as the results of the Project?

❑ Yes ❑ No

--If your answer is "Yes," please describe it in the box below.

RELEVANCE

Consistency with development policy

9. Have there been any changes in the policy on water supply sector in Sri Lanka? If "Yes," please describe in the box below.

❑ Yes ❑ No

10. Do you think that the Project has met the needs of NWSDB in terms of capacity development to implement NRW reduction activities in Colombo city?

❑ Yes ❑ No

--If your answer is "No," please provide the reasons to explain your answer.

11. What is your assessment on technical or knowledge level of JICA experts?

❑ 4. very good ❑ 3. good ❑ 2. not so good ❑ 1. very poor (low level)

--If your answer is "2" or "1," please provide the reasons to explain your answer.

EFFECTIVENESS

12. The two Outputs were set up to achieve the Project Purpose of "NWSDB's capacity to implement NRW reduction activities in Colombo city is strengthened." Do you think there are ANY OTHER components or conditions which have to be considered to achieve this Project Purpose? If so, please describe your opinions below.

13. Have you observed any negative factors affecting the strengthening of NWSDB's capacity to implement NRW reduction activities in Colombo city?

添付資料 4
Form 1: Questionnaire to DGM (Project Manager)

EFFICIENCY

Conversion of inputs to outputs

14. Have all inputs in the project been fully utilized for the project activities to date?

Appropriateness of quality and quantity of Inputs

15. Are there any inputs (experts, budget, and equipment) which were not delivered timely?

❑ Yes ❑ No ❑ Do not know

-- If "YES," please specify the situation.

16. How was the quality or quantity of inputs of the Project?
❑ 4. Sufficient ❑ 3. Sufficient to some extent ❑ 2. Not so sufficient ❑ 1.Not sufficient at all
❑ 0. Do not know

--If your answer is "2," or "1," please specify the reasons.

Counterpart Training in Japan, Jordan or Indonesia

17. Do you think the counterpart training in Japan, Jordan or Indonesia conducted under the scope of the Project has contributed toward realizing the Outputs of the Project?

❑ Yes ❑ No

--- If your answer is "Yes," please write how it has contributed to realization of the Outputs (or project implementation). If "No," please provide the reasons to support your answer.

IMPACT

Overall Goal

18. After the project is completed, it is expected that "the NRW ratio in Colombo city is reduced." To verify this, two indicators are set up: (1) NRW reduction activities are comprehensively conducted by 22 zone officers in CMC area in accordance with the execution plan, and (2) Decrement of NRW ratio per annum in CMC area exceeds one (1) percentage point up to 2017.

Do you think NWSDB will be able to extend the systematic NRW reduction activities, which have been strengthened by the Project, to other responsible areas in Colombo city? Also, please write the key issues or measures which have to be taken after the project is completed in order to realize the Overall Goal in

the future.

19. Have you ever observed any positive/negative changes in water supply sector in Colombo city or Sri Lanka because this project has been implemented?

SUSTAINABILITY

Prospects of appropriate utilization of the Output and continuation of the Project Activities

20. Please choose the most appropriate answer to support your opinions.

(a) Does "NRW Management Team" have sufficient ability to prepare an annual program for NRW reduction in the responsible areas without support from JICA experts after the project is completed?

❑ Yes ❑ Yes, but need to have some support from JICA experts ❑ Not at all

-Comments if any:

(b) Are "NRW Reduction Teams" able to carry out NRW reduction activities in other responsible areas without any support from JICA experts after the cooperation period is completed?

❑ Yes ❑ Yes, but need to have some support from JICA experts ❑ Not at all

-Comments if any:

(c) Do you think that officers/staff of Western-Central Regional Center are able to transfer their knowledge, skills or know-how about NRW reduction to other centers?

❑ Yes ❑ Yes, but need to have some support from JICA experts ❑ Not at all

-Comments if any:

Financial Aspects

21. Is the financial support to NWSDB from the central government likely to be provided after the project term is ended?

Organizational Aspects

22. Are the sufficient number of officers/staff to pursue NRW reduction activities likely to be assigned at each center of NWSDB after the cooperation is terminated?

Technical Aspects

23. How do you find the skills which project has supported to enhance?

❑ 4. Very useful ❑ 3. Useful to some extent ❑ 2. Not so useful ❑ 1. Not useful at all
❑ 0. Do not know

If your answer is "2," or "1," please describe your opinion specifically. Also write your comments below.

24. Is the maintenance system of equipment provided by the Project firmly established at NWSDB?
- **Is the maintenance work for the equipment provided by the Project carried out regularly?**
- **When the equipment provided by the Project shows some troubles or defects, does the staff know how to manage it, such as repairing within NWSDB or contacting the agencies?**

OTHER ISSUES, SUGGESTIONS AND COMMENTS

25. The Project is going to complete in about nine months. Please describe if there are any remaining issues or concerns that need to be addressed before the end of the project cooperation.

Thank you very much for your time and cooperation.

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QUESTIONNAIRE
JAPANESE TECHNICAL COOPERATION FOR THE CAPACITY DEVELOPMENT PROJECT FOR NON REVENUE WATER (NRW) REDUCTION IN COLOMBO CITY

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JICA Terminal Evaluation Team Ayako Namura (Ms), ayana@tekizaitekisho.org

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Name:
Position/Title:
Organization:
Responsible field in this Project:
Responsible area (for project pilot activities): ❑ Kotahena ❑ Borella
Period of working for your organization: ____ years (month /year: ____ / ____ - ____ / ____)

IMPLEMENTATION PROCESS

1. How has the progress of the project implementation been monitored?

2. Is the monitoring method above mentioned effective to check the status of activities?

❑ Yes ❑ No ❑ Do not know

-If your answer is "No," please specify the reasons.

3. How is the communication among JICA experts, NWSDB Executive, NRW Reduction Management Team, and NRW Reduction Teams?

❑ 4. Very good ❑ 3. Good ❑ 2. Not so good ❑ 1 Need improvement ❑ 0 Do not know

--If your answer is "2," or "1," please specify the reasons.

4. Do you observe any difficulties in project implementation? And if there are any suggestions/comments on the implementation process or the project management, please describe it.

LEVEL OF ACHIEVEMENT OF THE PROJECT

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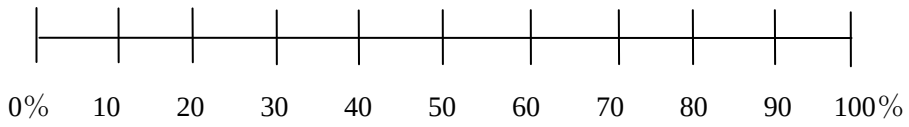
5. Project Purpose: To what extent do you think that NWSDB's capacity to implement NRW reduction activities in Colombo city is strengthened?



5-1. Indicator 3: Will an execution plan to achieve reduction of NRW ratio by one percentage point per annum be prepared and incorporated into relevant plans/programs of NWSDB by the end of the cooperation period?

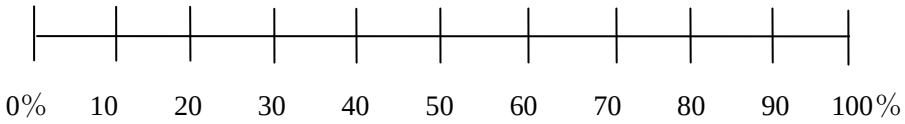
❑ Yes ❑ No

--Please tell us the current progress of preparation of this plan and its integration into relevant plans/programs of NWSDB.

5-2. Please describe the specific capacities which has been enhanced through the implementation of the Project.

5-3. In your opinion, what areas or capacities to reduce NRW ratio have to be strengthened further by the end of the cooperation?

6. Output 1: To what extent do you think that management capacity of senior officers of Regional Center (Western-Central) to plan and supervise NRW reduction activities is enhanced?



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--If your answer is "No," please describe the reasons which support your answer.

6-2. Indicator 2: Have NRW reduction activities in the pilot areas been conducted smoothly through adequate allocation on NWSDB resources (personnel, equipment, budget, etc.) as planned?

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Personnel	❑ Yes	❑ No
Equipment	❑ Yes	❑ No
Budget	❑ Yes	❑ No
Other ( )	❑ Yes	❑ No

--If your answer is "No," please describe the reasons which support your answer.

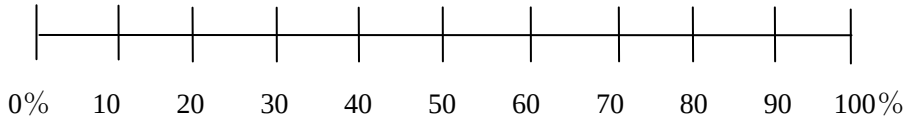
6-3. Indicator 3: Is NWSDB able to plan and manage the training program for NRW reduction?

❑ Yes ❑ No

--If your answer is "No," please describe the reasons which support your answer.

添付資料 4
Form 2: Questionnaire to NRW Management Team

7. Output 2: To what extent do you think that technical and operational capacity to conduct NRW reduction activities by officers/staff of Western-Central Regional Center is developed?



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❑ Yes ❑ No

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"4"	**Excellent**
"3"	**Good to some extent**
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		(please write the name of NRW Reduction Teams)			
1.	Sub-zoning				
2.	Hydraulic isolation				
3.	System input measurement				
4.	Measurement of minimum night flow (MNF)				
5.	Leak detection				
6.	Leak repair				
7.	Meter accuracy test				
8.	Meter replacement				
9.	Detection/elimination of illegal connection				
10.	Meter installation to stand posts				
11.	Plumbing				
12.	Others (specify:)				

8. In addition to the achievements made in accordance with the Project Design Matrix (PDM), do you notice any other improvements or achievements made as the results of the Project?

❑ Yes ❑ No

--If your answer is "Yes," please describe it in the box below.

RELEVANCE

Consistency with development policy

9. Do you think that the Project has met the needs of NWSDB in terms of capacity development to implement NRW reduction activities in Colombo city?

❑ Yes ❑ No

--If your answer is "No," please provide the reasons to explain your answer.

10. What is your assessment on technical or knowledge level of JICA experts?

❑ 4. very good ❑ 3. good ❑ 2. not so good ❑ 1. very poor (low level)

--If your answer is "2" or "1," please provide the reasons to explain your answer.

EFFECTIVENESS

11. The two Outputs were set up to achieve the Project Purpose of "NWSDB's capacity to implement NRW reduction activities in Colombo city is strengthened." Do you think there are ANY OTHER components or conditions which have to be considered to achieve this Project Purpose? If so, please describe your opinions below.

12. Have you observed any negative factors affecting the strengthening of NWSDB's capacity to implement NRW reduction activities in Colombo city?

EFFICIENCY

Conversion of inputs to outputs

13. Have all inputs in the project been fully utilized for the project activities to date?

Appropriateness of quality and quantity of Inputs

14. Are there any inputs (experts, budget, and equipment) which were not delivered timely?

❑ Yes ❑ No ❑ Do not know

-- If "YES," please specify the situation.

15. How was the quality or quantity of inputs of the Project?

❑ 4. Sufficient ❑ 3. Sufficient to some extent ❑ 2. Not so sufficient ❑ 1.Not sufficient at all
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16. Do you think the counterpart training in Japan, Jordan or Indonesia conducted under the scope of the Project has contributed toward realizing the Outputs of the Project?

❑ Yes ❑ No

--- If your answer is "Yes," please write how it has contributed to realization of the Outputs (or project implementation). If "No," please provide the reasons to support your answer.

IMPACT

Overall Goal

17. After the project is completed, it is expected that "the NRW ratio in Colombo city is reduced." To verify this, two indicators are set up: (1) NRW reduction activities are comprehensively conducted by 22 zone officers in CMC area in accordance with the execution plan, and (2) Decrement of NRW ratio per annum in CMC area exceeds one (1) percentage point up to 2017.

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18. Have you ever observed any positive/negative changes in water supply sector in Colombo city or Sri Lanka because this project has been implemented?

SUSTAINABILITY

Prospects of appropriate utilization of the Output and continuation of the Project Activities

19. Please choose the most appropriate answer to support your opinions.

(a) Does "NRW Management Team" have sufficient ability to prepare an annual program for NRW reduction in the responsible areas without support from JICA experts after the project is completed?

❑ Yes ❑ Yes, but need to have some support from JICA experts ❑ Not at all

-Comments if any:

(b) Are "NRW Reduction Teams" able to carry out NRW reduction activities in other responsible areas without any support from JICA experts after the cooperation period is completed?

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-Comments if any:

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-Comments if any:

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OTHER ISSUES, SUGGESTIONS AND COMMENTS

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JICA Terminal Evaluation Team Ayako Namura (Ms), ayana@tekizaitekisho.org

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Name:
Position/Title:
Organization:
Responsible field in this Project:
Responsible area (for project pilot activities): ❑ Kotahena ❑ Borella
Period of working for your organization: ____ years (month /year: ____ / ____ - ____ / ____)

Overall Assessment on the Project

1. **How do you assess the JICA Project which aims to improve the NWSDB's capacity to implement the NRW reduction activities?**

❑ 4. Very effective ❑ 3. effective ❑ 2. Not so effective ❑ 1 Need improvement ❑ 0 Do not know

--If your answer is "4" or "3," please provide what aspects you found very effective.

--If your answer is "2" or "1," please provide your opinions to support your answer.

2. What knowledge, skills/techniques, or know-how have you acquired through the JICA Project? Please list them up in the box below.

3. If you have any opinions or comments that you would like to learn more during the project implementation which remains about ten months, please describe them in the box below.

4. How do you assess the technical guidance provided by the JICA experts?

❑ 4. Very good ❑ 3. good ❑ 2. Not so good ❑ 1 Need improvement ❑ 0 Do not know

--If your answer is "2" or "1," please provide your opinions to support your answer.

5. How do you assess the equipment provided by the Project?

❑ 4. Very suitable to your level ❑ 3. Acceptable ❑ 2. Not so acceptable ❑ 1 Not acceptable at all
❑ 0 Do not know

--If you found any difficulties in equipment provided by the Project, please explain it.

6. If you have any other comments, please describe them in the box below.

Thank you very much for your time and cooperation.

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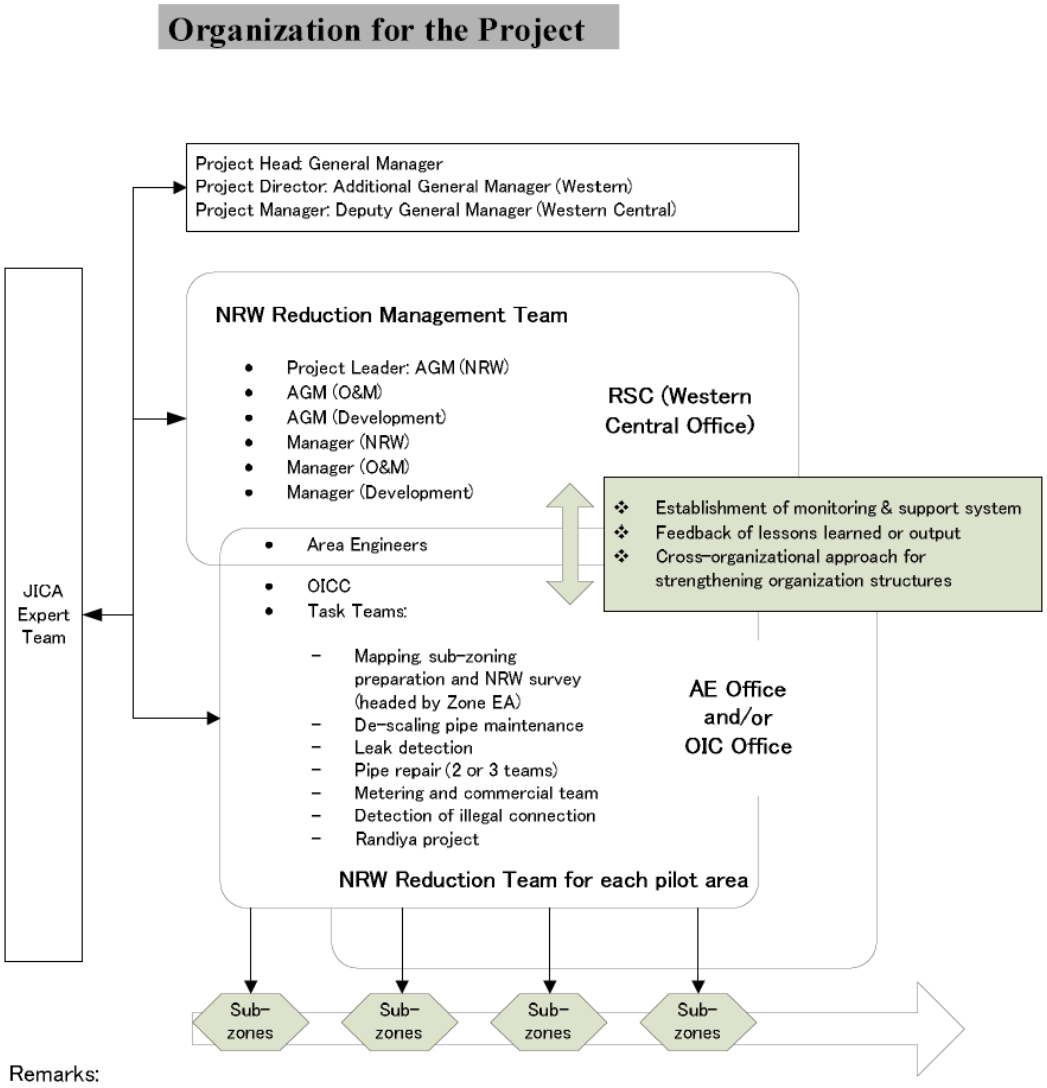
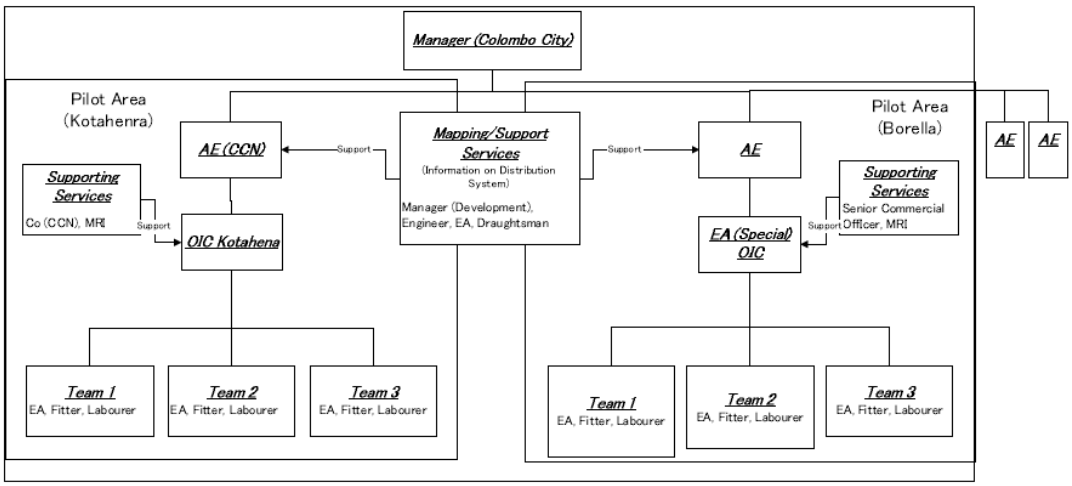
プロジェクトの実施体制図



添付資料 5

Structural Image of NRW Reduction Team



Note:
AE: Area Engineer
CCN: Colombo City-North
Co: Commercial Officer
EA: Engineering Assistant
MRI: Meter-reading Inspector
OIC: Officer in charge