ミャンマー連邦共和国
天然資源環境保全省

ミャンマー国
水環境管理及び環境影響評価制度の
能力向上プロジェクト
（水環境管理分野）

事業完了報告書

第 1 巻

平成 30 年 6 月
（2018 年）

独立行政法人
国際協力機構（JICA）

日本工営株式会社

環境
JR
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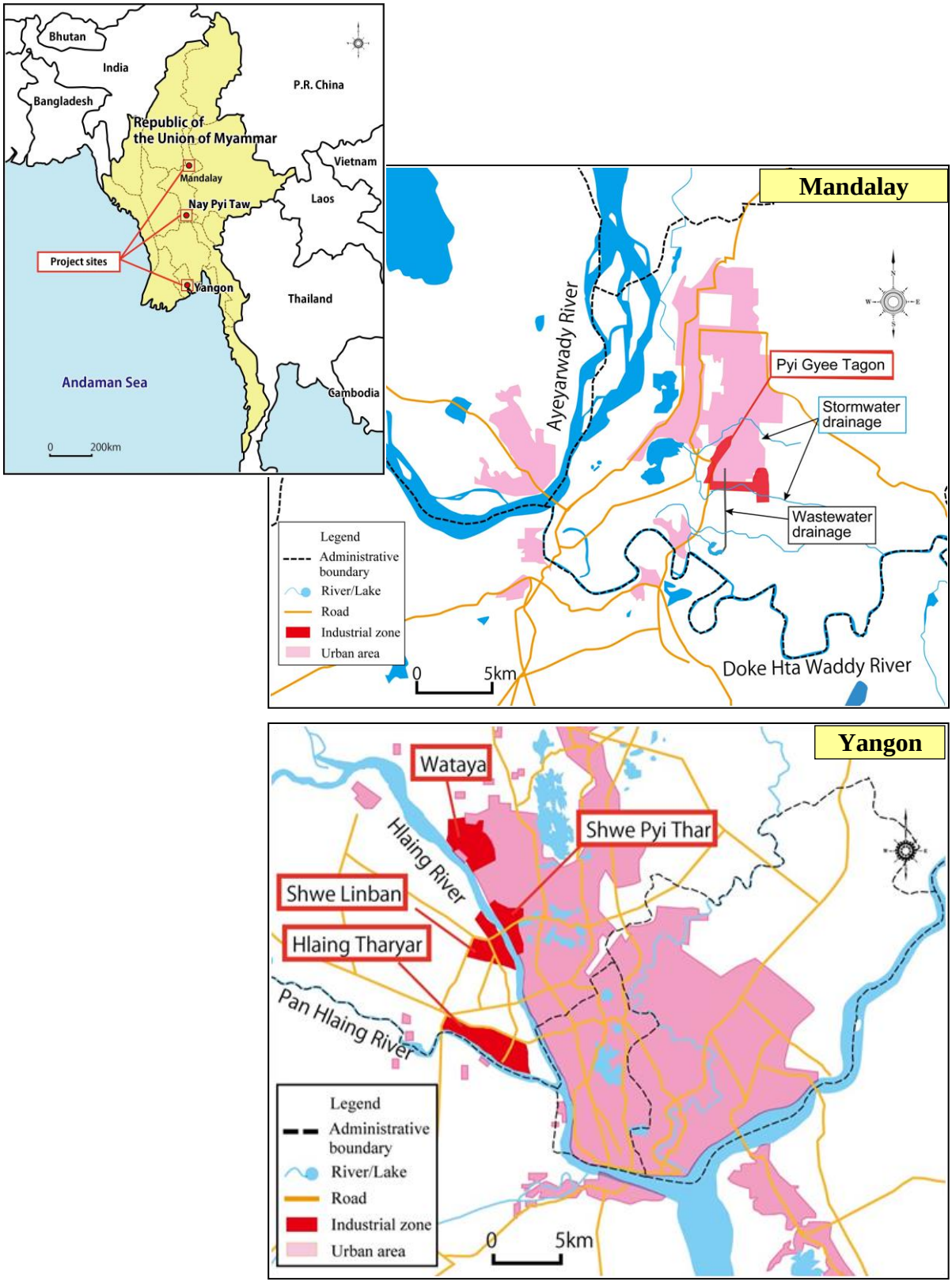
通貨換算率（2018 年 5 月 2 日時点）
参照元：ミャンマー中央銀行（Central Bank of Myanmar）
USD 1.00 = MMK 1,340.0
JPY 100 = MMK 1,220.3


Bhutan
India
Bangladesh
P.R. China
Republic of
the Union of Myammar
Vietnam
Laos
Thailand
Cambodia
Andaman Sea
Mandalay
Nay Pyi Taw
Yangon
Project sites
0
200km
Mandalay
Ayeyarwady River
Pyi Gyee Tagon
Stormwater
drainage
Wastewater
drainage
Doke Hta Waddy River
Legend
Administrative
boundary
River/Lake
Road
Industrial zone
Urban area
0
5km
Yangon
Wataya
Shwe Pyi Thar
Hlaing River
Shwe Linban
Hlaing Tharyar
Pan Hlaing River
Legend
Administrative
boundary
River/Lake
Road
Industrial zone
Urban area
0
5km

プロジェクト対象地域

概要

背景

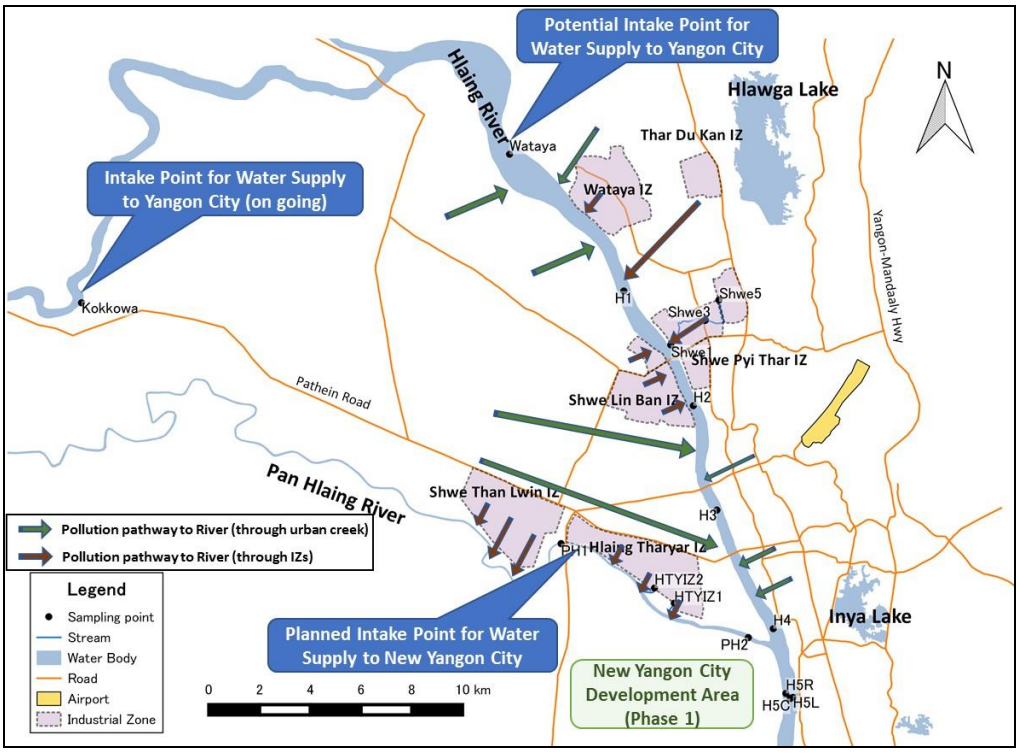
- 本プロジェクトはミャンマーの環境当局の水環境管理および環境影響評価（EIA）審査の能力強化を目的に実施されたものである。活動は2014年12月に当時の環境保全森林省（MOECAF）と国際協力機構（JICA）の間で交わされた討議議事録（R/D）に基づき実施された。プロジェクトには水環境管理分野と EIA 分野の 2 分野があり、本報告書は水環境分野の業務完了報告書である。下表にプロジェクトの上位目標、プロジェクト目標および成果をまとめる。

表 ES-1　プロジェクトの上位目標、プロジェクト目標および活動

Item	Contents		Component
Overall Goal	Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.		
Project Purpose	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.		
Outputs	Output 1	Inspection procedure is standardized.	Water environment management
	Output 2	Capacity for implementing water quality survey to obtain reliable information is enhanced.	Water environment management
	Output 3	Database of water pollution sources and river water quality is developed.	Water environment management
	Output 4	Capacity of interpreting the information for water pollution control measures is enhanced.	Water environment management
	Output 5	Necessary technical manuals and forms for the EIA review are developed.	EIA
	Output 6	Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced.	EIA
Duration	June 2015 – May 2018 (3 years)		

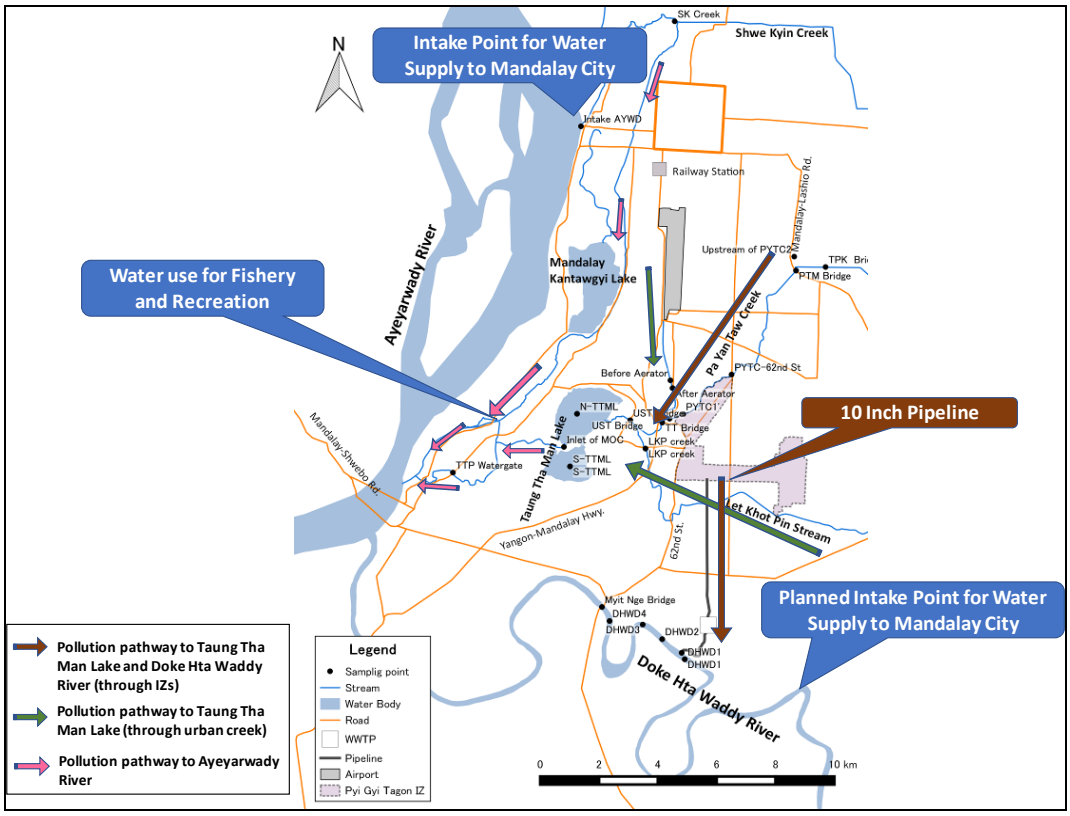
Source: JET

- 水環境管理分野は成果 1～4 を対象にしており、活動は天然資源環境保全省（MONREC、2016 年に MOECAF の後継機関として発足）、ヤンゴン市開発委員会（YCDC）、マンダレー市開発委員会（MCDC）および JICA 専門家チームの協働で実施された。活動の多くは、工業活動の河川への影響を調査するために設定された二つのパイロット地域であるヤンゴンの Hlaing 川流域とマンダレーの Doke Hta Waddy 川流域で実施された（裏表紙の地図を参照）。
- プロジェクト対象地域の Hlaing 川流域及び Doke Hta Waddy 川流域における主な汚染経路を下図に示す。なお、これらは成果 4 に基づき作成されたものである。



Source: JET

図 ES-1　Hlaing 川流域の汚染経路



Source: JET

図 ES-2　Doke Hta Waddy 川流域の汚染経路

成果 1（インスペクション）

- 成果 1 は MONREC の環境保全局（ECD）、YCDC および MCDC による工場のインスペクション手順を標準化する目的で実施された。成果 1 の活動と指標を下表に示す。

表 ES-2　成果 1（インスペクション）の活動と指標

Output 1	Inspection procedure is standardized.
Activities	1-1 To collect information on water pollution sources 1-2 To evaluate present inspection procedures 1-3 To develop an inspection manual 1-4 To implement trial inspection based on the inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To evaluate the trial inspection procedures
Indicator	Inspections are implemented according to the inspection manual by YCDC, MCDC and ECD.

Source: JET

- インスペクション手順を標準化するためにインスペクションマニュアルが作成された。マニュアルは職員がインスペクション手順の重要なステップを理解し、知識や経験の不足から起こり得る過ちを最小化するように設計されている。ECD ヤンゴンと ECD マンダレーは、2016 年にマニュアル案を配布してから 2016-17 会計年度が終わるまでに合計で約 80 回のインスペクションを実施した。ECD 地方事務所、YCDC および MCDC は概ねマニュアルが役に立つとしている。現在、ECD は全国の ECD でマニュアルを正式に採用するため翻訳を進めている。
- インスペクション手順の標準化に加えて、職員や事業所関係者の排水管理に関する学習をサポートするため、排水処理に関するワークショップを複数回開催した。ワークショップでは様々な排水処理技術、個別排水処理方式と合同/集中排水処理方式の比較など、技術的および現実的な課題を取り上げるようにした。
- 集中排水処理は工業団地の排水処理には魅力的なオプションである。しかし、ヤンゴンのほとんどの工業団地では未だにそのような施設が整備されていない。よって、プロジェクトでは関係者による協議を推進するため、Hlaing Thar Yar 工業団地を対象とした小規模なケーススタディを行い、2017 年 10 月にワークショップを開催した。このケーススタディでは、集中排水処理を設計・建設・稼働させるに当たって、工業団地の管理会社の設立の検討を含む関係機関の責任の明確化、政府財政補助の可能性を含む投資コストの確保、政府による最低流量保証を含むコスト回収、各工場の排水量・質の推定、処理施設や付帯施設のための土地確保、など様々な現実的な課題を解決する必要があることが明確になった。ヤンゴンの工業団地の集中排水処理施設の整備については、ヤンゴン管区政府がイニシアティブを取っている。
- これらの活動を通して、ミャンマーの環境関連法令では、事業所に対する詳細かつ法的拘束力のある要求事項がほとんど整備されておらず、これが原因で環境規制が困難かつ受動的になっていることが明確になった。よってプロジェクトでは環境要求事項を明確にするための提案を行っている。2018 年 1 月には天然資源環境省が 9 つの重要セクターの工場に対して、2018 年中に環境管理計画（EMP）を作成して環境許認可（ECC）を取得するよう命令を出しており、これらの提案は現在のミャンマーの環境行政にとって重要な事項である。

成果 2（水質調査）

- 成果 2 はヤンゴンの Hlaing 川流域およびマンダレーの Doke Hta Waddy 川流域における水質調査を通した能力強化を中心に実施した。

表 ES-3　成果 2（水質調査）の活動と指標

Output 2	Capacity for implementing water quality survey to obtain reliable information is enhanced.
Activities	2-1 To select a private or governmental laboratory which can provide reliable services of sampling and chemical analysis 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters, etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To verify the results of the water quality survey using the water quality survey manual 2-9 To prepare a water quality survey report
Indicator	Water quality survey reports are prepared in the pilot area by YCDC and MCDC.

Source: JET

- 水質調査はプロジェクト期間中に 5 回（2016 年 2 月、2016 年 6 月、2017 年 1-2 月、2017 年 9 月および 2018 年 2 月）実施された。後述するように最初の 3 回の調査では、信頼できる結果の確保に様々な課題があったことから、これらの流域の水質は第 4 回と第 5 回の調査結果をもとに評価した。
  - 雨季（2017 年 9 月）の Hlaing 川および Pan Hlaing 川の水質は浮遊物質量（TSS）及び大腸菌群を除いて水生生物の保全、灌漑、水運に適した水質レベルであった。乾期（2018 年 2 月）では水質が悪化し、複数の地点で比較的高濃度の COD が、また全採水地点でオイル＆グリースが検出された。Hlaing 川の上流域（Shwe Pyi Tar 橋より上流）は、TSS、大腸菌およびオイル＆グリースを除いて乾期でも灌漑や水運に適した水質であった。Shwe Pyi Tar 工業団地の水路の水質は、地域の蒸留酒工場の一時閉鎖を受けて 2017 年 9 月には改善したが、工場の稼働が再開した後の 2017 年 2 月には再び悪化していた。
  - Doke Hta Waddy 川は、通常の水処理を備えた水道水の供給にとって適切な水質であるといえる。有機汚染のレベルは高くなく、高濃度の有害物質も検出されなかった。季節や地点ごとの水質変動は大きくないとみられる。Taung Tha Man 湖の水質は、リンや窒素濃度が高く、DO は比較的低く、COD と pH は高く、富栄養化状態であるといえる。同湖の水質は雨季と比較して乾期には著しく悪化した。
- 調査を通じて、職員はモニタリング計画の策定、機器（携行水質計や流量計）の使用、サンプリング、現場測定、モニタリング結果の比較検証、といった活動を実際に体験した。また 2017 年 11 月～2018 年 2 月には報告書作成トレーニングが実施され、職員は JET のサポートのもと自分達で水質調査報告書を作成した。
- データの信頼性は成果 2 における重要な課題であった。第 3 回調査までは、試料の分析はミャンマーとタイで行われたが、これらの分析機関は分析方法が統一できていなかった他、品質管理に問題のある分析機関もあった。この問題を把握・克服するため様々な努力がされたにも拘らず、データの信頼性を確保することが困難であった。よって第 4 回と第 5 回調査の大部分の項目の分析は日本で行われた。この経験に基づいて、将来のモニタリングデータの信頼性を確保するため、様々な提言がされた。
- またミャンマーには公共用水域の水質環境基準がなく、調査結果は他国の基準と比較するしかなかった。環境基準は環境にかかわる意思決定に不可欠であり、ECD は現在水質環境基準を含む環境基準の整備を進めている。将来にはミャンマーの環境当局が全国で環境モニタリングを実施し、自国の基準で水質を評価できるようになることが望まれる。

成果 3（データベース構築）

- 成果 3 は汚染源と河川水質のデータベース構築を目標に実施した。河川水質データは成果 2 の活動で収集されていることから、本成果は汚染源情報の収集に注力した。

表 ES-4　成果 3（データベース構築）の活動と指標

Output 3	Database of water pollution sources and river water quality is developed.
Activities	3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results 3-2 To develop a system concept 3-3 To design the database based on the system concept 3-4 To collect additional information required to develop the database 3-5 To develop the database 3-6 To conduct training on operation and utilization of the database 3-7 To develop an operation and maintenance manual of the database
Indicator	At least 150 factories' information is accessible on the database. Results of water quality survey is accessible on the database

Source: JET

- プロジェクト初期には DISI などから収集可能な情報をもとに汚染源データベースを構築しようと試みたが、汚染源を評価するために必要な生産量、水使用量、汚染削減策、排水処理施設、といった情報が不足していた。よって 2016 年と 2017 年に 202 事業所の質問票調査と延べ 100 事業所における排水サンプリングから構成される汚染源調査を実施した。
- これらの調査は、職員が様々な事業所の環境管理を詳細に確認し、100 以上の排水試料をサンプリングして分析結果を国家環境質（排出）ガイドライン(NEQEG)（2015）と比較する機会となった。尚、調査の時点で同ガイドラインは法的拘束力を持ったものではなかった。調査は対象地域の事業所の 10%程度しかカバーしていなかったが、結果は示唆に富むものであった。
  - 2016 年の質問票調査の結果によれば、水使用量を把握するため量水計を設置しているのはヤンゴンの工場の 10%、マンダレーの工場の 2%に過ぎなかった。大部分の工場は水使用量も排水量も測定していないとみられる。
  - 排水処理施設を有していると回答した工場はヤンゴンで 53%、マンダレーで 46%しかなかった。大部分は固形廃棄物やスラッジを除去するためのスクリーンや沈殿池であった。排水中の有機物（BOD や COD）を除去するための二次処理施設を有している事業所は 5%程度しかなかった。
  - 2017 年の排水分析結果によれば、事業所の 89 % が BOD について、64%が COD について NEQEG (2015)を満足していなかった。NEQEG (2015)の BOD および COD の基準を満足するには通常は二次処理が必要であることを考えると、この結果は予想通りであった。また排水濃度はセクターによって大きく異なっており、蒸留酒、食品・飲料、革なめし、製紙などのセクターは NEQEG (2015)が示す BOD や COD の要求事項を大幅に上回っていた。栄養塩に関しては、総窒素については事業所の 43%が、総りんについては 45%が NEQEG (2015) を上回っていた。
  - 有害物質については、高濃度の鉛、亜鉛及び水銀が複数の電池工場（半導体セクターに区分）から検出された。また複数の皮なめし工場の排水から高濃度のフェノール、硫酸塩、クロムが検出された。さらに繊維工場の一つから亜鉛が検出された。環境当局はこれらのセクター/工場を監視し、必要に応じて対応を迫る必要がある。
  - 2016 年の質問票調査の結果によれば、マンダレーの事業所の多くが適切な排水処理施設を設置できない主要な原因は、専門家の不在と土地の不足とみられる。ヤンゴンについては明確な傾向はなかった。

- 2016 年と 2017 年の汚染源調査の結果に基づいて、汚染源データベースが構築された。データベースには 202 社の情報が含まれており、GIS ソフトとリンクされている。成果 2 の水質調査結果も河川水質データベースに格納された。職員は GIS ソフトを含むデータベースの使用についての複数のトレーニングを受けた。
- これらの活動から水環境管理に関する様々な教訓を得ることができた。まず大部分の事業所について水環境管理に不可欠な水使用量や排水の水質といった情報がすぐに入手できないことが明らかとなった。また信頼できるデータの入手も困難だった。事業所の多くは水使用量を測定しておらず、事業所の管理者は環境管理の問題に疎かった。また排水の分析結果には品質管理の問題があることが多かった。よってプロジェクトでは事業所からの情報収集及び水使用や排水の水質データに関する信頼性改善について提案をした。
- また汚染源調査の結果、多くの事業所では汚染防止や排水処理対策が不足しており、NEQEG (2015) を満足していないことが明らかになった。環境当局は規制を強化するとともに事業所を支援する必要がある。事業所サイドも汚染管理や生産効率の最大化について検討が必要である。

成果 4（情報解釈）

- 本成果は汚染管理の戦略策定に向けて環境情報を解釈する能力の向上を中心に実施された。

表 ES-5　成果 4（情報解釈）の活動と成果

Output 4	Capacity of interpreting the information for water pollution control measures is enhanced.
Activities	4-1 To collect the information necessary for the water quality status report 4-2 To interpret the collected information 4-3 To prepare a water quality status report
Indicator	Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC.

Source: JET

- 情報解釈の様々な技術を習得するため、プロジェクト活動を通じて収集した情報を使って以下の 5 つのケーススタディを協働で実施した。
  - ケーススタディ 1：ヤンゴンのパイロットエリアでの汚濁負荷量の算出
  - ケーススタディ 2：マンダレーのパイロットエリアでの汚濁負荷量の算出
  - ケーススタディ 3：Hlaing Tharyar 工業団地の集中排水処理設備の設置
  - ケーススタディ 4：将来的な水資源管理に資する Doka Hta Waddy 川の水量変動に伴う環境容量の初期評価
  - ケーススタディ 5：国レベルの産業工業排水対策の検討
- ヤンゴン（ケーススタディ 1）とマンダレー（ケーススタディ 2）における汚濁負荷量の算出は、工業セクターだけでなく、家庭排水（下水）やノンポイント汚染源が Hlaing 川や Doke Hta Waddy に関わる全体的な汚濁負荷にどの程度の寄与をしているかを把握するために実施された。結果によれば場所によってこれらの汚染源の寄与率は大きく異なり、汚染管理をするためには汚染機構を把握することが不可欠であることが示された。
- ケーススタディ 3 は、成果 1 の一環として実施された Hlaing Thar Yar 工業団地の集中排水処理整備のためのケーススタディである。結果は成果 1 のセクションに説明した。
- ケーススタディ 4 はマンダレーの Doke Hta Waddy 川について、流量の季節変動、上流の Yeywa ダムの運転、灌漑や計画されている上水道への取水、そして建設中の集中排水処理施設の稼働が、河川水質にどのような影響を及ぼすか検討したものである。結果はこれらの要因によ

って水質が大きく影響される可能性があることを示し、河川の水質を維持するための関係者間の調整が提案された。

- ケーススタディ 5 は、国家レベルで検討すべき政策課題についての ECD 職員との一連の協議である。

提言

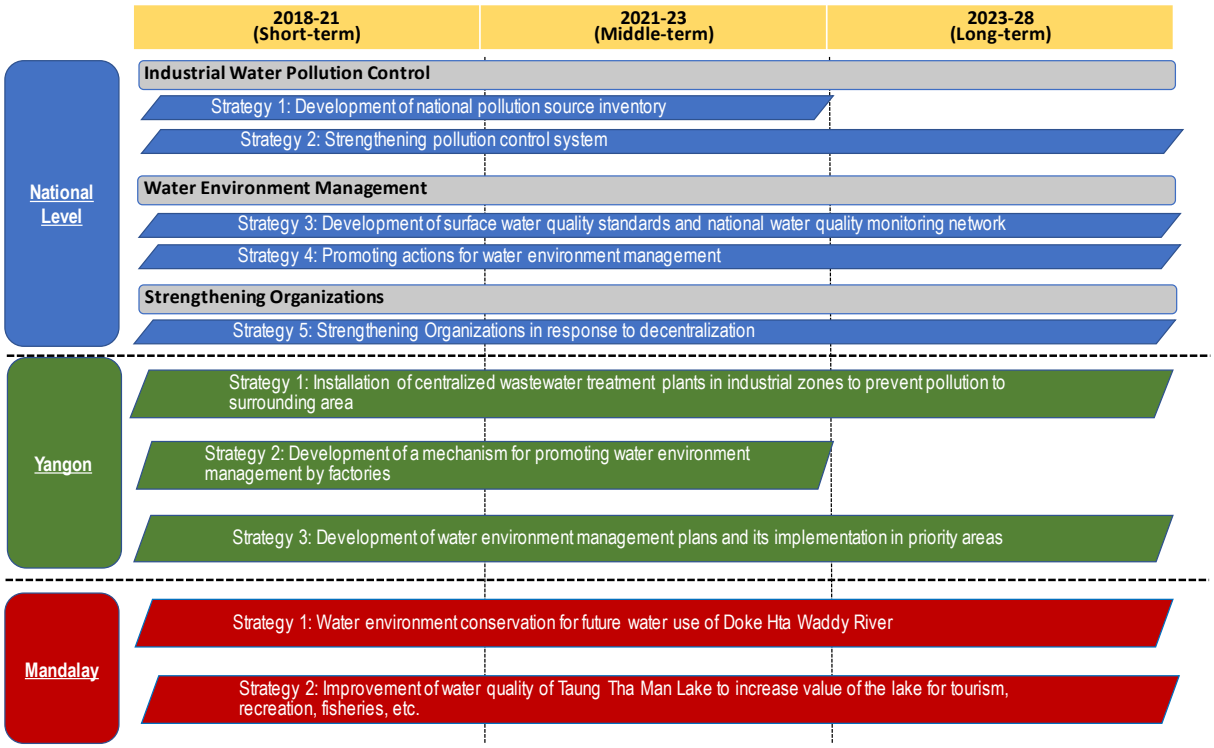
- 成果 1～3 の活動を通して得られた水環境管理に関わる提案を下表にまとめる。

表 ES-6　成果 1～3 の活動に基づく提案

Output	Suggestions	Summary
Output 1 (Inspection)	Clarification of Environmental Requirements	Implement sectoral studies, and set requirements considering the best practices in each sector.
	Clarification of Inspection Procedures for Each Environmental Requirement	Once environmental requirements for factories are set, clarify the detailed inspection procedure for each environmental requirement. Revise the manual accordingly.
	Support to Factories on Pollution Control	Organize workshops and consultation events to educate regulated communities focusing on both procedural and technical issues. Workshops for specific sector or area should be considered.
Output 2 (Water Quality Survey)	Improvement of monitoring data quality in Myanmar	Standardize analytical methodologies and establish QA/QC, including proficiency testing and accreditation system. Also obtain more reliable data as the basis for comparison with monitoring data.
	Development of proper water environmental standard	Develop the surface water quality standard that has proper criteria and is also implementable with the capacity of monitoring organizations.
	Regular Surface Water Monitoring	Plan and implement regular surface water monitoring programs by responsible authorities. Ensure reporting of results from regional ECDs to ECD Headquarters. For important cases, implement special investigations to elucidate detailed, site-specific pollution mechanisms.
Output 3 (Database Development)	Gathering Information from Factories	Collect relevant information from factories through EMP and as part of reporting requirements of ECC. Or implement a questionnaire survey similar to the one implemented in this project.
	Development of Database of Pollution Sources	For managing ECC, expansion of the EIA database may be appropriate. Limit the information to be digitized if digitizing work is overwhelming.
	Improving Reliability of Measurement of Water Usage and Wastewater Qualities	Include installation of water meters and measurement of water usage as part of ECC requirements. Standardize analytical methodologies and introduce a system of QA/QC.
	Improving Environmental Measures by Factories	Enforce realistic environmental regulations and implement support measures. Regulate groundwater abstraction. Request regulated communities to take their own initiatives for pollution control and efficient production, possibly spearheaded by MOI and/or industrial associations.

Source: JET

- 下図に成果 4 で検討された水環境管理の戦略を示す。これらの戦略には成果 1～3 からの提案と成果 4 のケーススタディの結果を反映している。戦略はヤンゴン、マンダレーおよび国家レベルについて別々に策定され、アクションは短期（3 年以内）、中期（5 年以内）、長期（10 年以内）に区別された。カウンターパート機関にはこれらの戦略についてさらに協議し、正式書類を作成し、許可を得た上で、これらのアクションを実行に移すことを提案する。



Source: JET

図 ES-3　水環境管理のための戦略

- これらの戦略を実施するために、本レポートではさらにトップマネジメントに対して、以下の提言をした。提言には、(i) 環境当局間の責任体系の明確化、(ii) 現実的な環境要求事項の策定、(iii)被規制側の行動変化の誘導、(iv) 周辺住民・NGO・業界組合などのステークホルダーの関与、さらに (v)環境当局の所掌を超えた活動のための地域内調整が含まれる。

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概要

添付資料（1/2）

目次（第 2 巻）

* 添付資料 14 及び添付資料 15 は CD-R に格納

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図目次

略語表

ADB	Asian Development Bank
ASEAN	Association of South East Asian Nations
BOD	Biochemical Oxygen Demand
BOO	Build-Operate-Own
BOT	Build-Operate-Transfer
C/P	Counterpart
CD	Cleansing Department
COD	Chemical Oxygen Demand
DICA	Directorate of Investment and Company Administration
DISI	Directorate of Industrial Supervision and Inspection
DO	Dissolved Oxygen
DOA	Department of Agriculture
EC	Electrical Conductivity
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
ECD HQ	Environmental Conservation Department, Head Quarter
EHS	Environmental Health and Safety
EIA	Environment Impact Assessment
EMP	Environmental Management Plan
FY	Fiscal Year
GAD	General Administration Department
GIS	Geographic Information System
GPS	Global Positioning System
HHWL	Highest High Water Level
IEE	Initial Environmental Examination
IFC	International Finance Corporation
ISO	International Standards Organization
IZ	Industrial Zone
IZMC	Industrial Zone Management Committee
JCC	Joint Coordinating Committee
JET	JICA Expert Team
JICA	Japan International Cooperation Agency
MCDC	Mandalay City Development Committee
M/M	Minutes of Meeting
MOALI	Ministry of Agriculture, Livestock and Irrigation
MOE	Ministry of Education
MOE	Ministry of Environment in Japan
MOECAF	Ministry of Environmental Conservation and Forestry
MOEE	Ministry of Electricity and Energy
MOHS	Ministry of Health and Sports
MOI	Ministry of Industry
MONREC	Ministry of Natural Resources and Environmental Conservation
MOPF	Ministry of Planning and Finance
MOTC	Ministry of Transport and Communications
MPA	Myanmar Port Authority
MS	Microsoft
MWL	Mean Water Level
NECCCCC	National Environmental Conservation and Climate Change Central Committee
NEQEG	National Environmental Quality (Emission) Guideline
NGO	Non-Governmental Organization
ODA	Official Development Assistance

OECD-DAC	Development Assistance Committee of Organization for Economic Co-operation and Development
ORP	Oxidation-Reduction Potential
OVI	Objectively Verifiable Indicators
Pb	Lead
PCB	Polychlorinated Biphenyls
PCCD	Pollution Control and Cleansing Department
PCD	Pollution Control Department
PCM	Project Coordination Meeting
PDM	Project Design Matrix
pH	Potential of Hydrogen
PO	Plan of Operations
Ppm	Parts per million
PPP	Public Private Partnership
QA/QC	Quality Assurance/Quality Control
Q-GIS	Quantum Geographic System
R/D	Record of Discussions
SEZ	Special Economic Zone
SS	Suspended Solid
TDS	Total Dissolved Solid
TN	Total Nitrogen
TOR	Terms of Reference
TP	Total Phosphorus
TSS	Total Suspended Solid
UMFCCI	Union of Myanmar Federation of Chambers of Commerce and Industry
UNIDO	United Nations Industrial Development Organization
USEPA	United States Environmental Protection Agency
WHO	World Health Organization
WP	Work Plan
WQSR	Water Quality Status Report
WSD	Water and Sanitation Department
WWF	World Wide Fund for Nature
WWTP	Wastewater Treatment Plant
YCDC	Yangon City Development Committee
YRG	Yangon Regional Government

第 1 章 序論

1.1 背景

ミャンマーでは工業および都市/農村セクターの開発に関わる国内および海外からの投資が増えるにつれて環境管理の問題が大きくなってきている。この環境問題に対処するため、ミャンマー政府は 2012 年に環境保全法を制定し、同年には環境保全森林省（(MOECAF) [1] を設立、2014 年には環境保全規則を発行した。しかし、環境保全法（2012）および環境保全規則（2014）に基づいて環境管理を実施するには、MOECAF の環境保全局（ECD）の能力強化が必要となっている。

地方レベルではヤンゴン市開発委員会（YCDC）やマンダレー市開発委員会（MCDC）が事業許認可の枠組みの中で事業所のインスペクションを行い、汚染管理に関わる技術指導をしてきた。この経験から、これらの機関は環境管理に関する基礎的な能力を培ってきた。しかし、これだけでは増大する環境問題に対処するのは困難である。このような背景の中、ECD の設立と環境影響評価（EIA）の導入に際して、より望ましい環境管理のニーズに応えるため、これらの機関の能力を整合性のある形で強化することが望まれていた。

そこでミャンマー政府は国際協力機構（JICA）に ECD および他の関連機関の能力強化に関わる支援を要請した。JICA はこれに応えて詳細計画策定調査を派遣し、2014 年 12 月 23 日に本プロジェクトを実施するための討議議事録（R/D）が当時の MOECAF と JICA の間で署名された。

1.2 プロジェクトの枠組み

1.2.1 上位目標、プロジェクト目標および成果

下表に R/D に基づいたプロジェクトの枠組みを示す。本プロジェクトには水環境コンポーネントと EIA コンポーネントの二つがあり、水環境コンポーネントは成果 1（インスペクション）、成果 2（水質調査）、成果 3（データベース）および成果 4（情報解釈）の 4 つの成果を対象としている。一方、EIA コンポーネントは成果 5 と成果 6 を対象にしているが、水環境コンポーネントとは別途に実施されたことから、本報告書では EIA コンポーネントについては言及していない。

表 1.2-1 上位目標、プロジェクト目標および成果

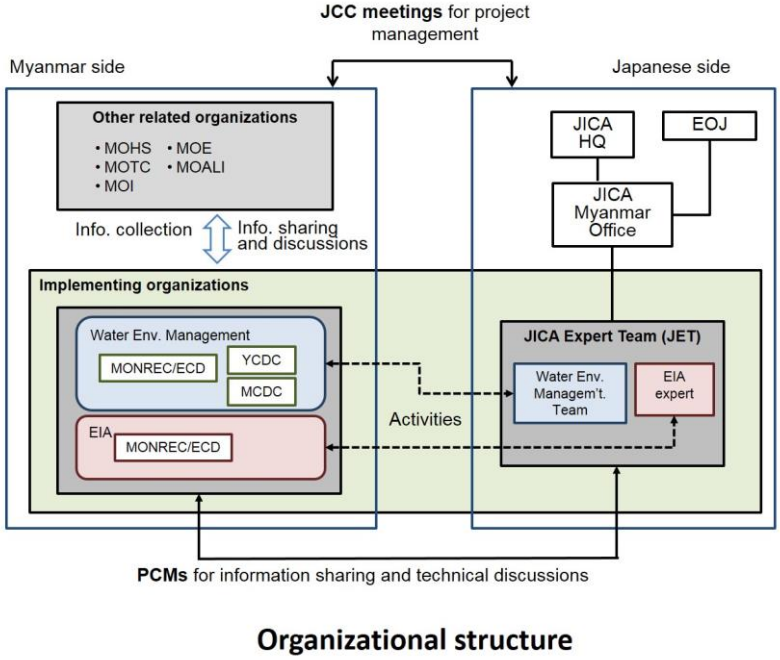
Item	Contents		Component
Overall Goal	Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.		
Project Purpose	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.		
Outputs	Output 1	Inspection procedure is standardized.	Water environment management
	Output 2	Capacity for implementing water quality survey to obtain reliable information is enhanced.	Water environment management
	Output 3	Database of water pollution sources and river water quality is developed.	Water environment management
	Output 4	Capacity of interpreting the information for water pollution control measures is enhanced.	Water environment management
	Output 5	Necessary technical manuals and forms for the EIA review are developed.	EIA
	Output 6	Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced.	EIA

Source: JET

[1] MOECAF は 2016 年に天然資源環境保全省（MONREC）に再編された。

1.2.2　組織体制

図 1.2-1 にプロジェクトの組織体制を示す。主要なカウンターパート機関（C/P）は 2016 年に MOECAF の後継機関となった天然資源環境保全省（MONREC）の ECD、そして YCDC、MCDC であり、全ての活動は R/D に基づいて C/P 機関と JICA 専門家チーム（JET）が協働で実施した。さらに保健スポーツ省（MOHS）、運輸コミュニケーション省（MOTC）、工業省（MOI）、教育省（MOE）および農業畜産灌漑省（MOALI）が参加機関としてプロジェクトに参加した。



Source: JET

図 1.2-1　プロジェクトの組織体制

活動計画を策定し、プロジェクトの全体的な進捗を管理するため、合同調整委員会（JCC）がプロジェクト期間中に 5 回組織された。JCC 委員は各機関から正式に推薦され、2015 年 7 月の第 1 回 JCC 会議で任命され、その後必要に応じて交代した。2018 年 5 月時点の JCC 委員のリストを表 1.2-2 に示す。

表 1.2-2　2018 年 5 月現在の合同調整委員会メンバー

No.	Name	Title	Organization
Members from Myanmar Side			
1	Mr. Hla Maung Thein	Director General (DG)	ECD, MONREC
2	Mr. Sein Htoon Linn	Deputy Director General (DDG)	ECD, MONREC
3	Mr. Htun Naing Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), Ministry of Transport and Communications
4	Dr. San Oo	Director	ECD, MONREC
5	Dr. Kyi Lwin Oo	Director	Occupational and Environmental Health Sub-Department, Department of Public Health, Ministry of Health and Sports
6	Dr. Thar Htet Kyaw	Deputy Director (DD)	Research and Innovation Department, Ministry of Education
7	Ms. Mya Mya Thet	Assistant Director (DD)	Department of Industrial Inspection and Supervision, Ministry of Industry
8	Mr. Bawi Chung	Deputy Director	Pollution Control and Cleansing Department, Yangon City Development Committee
9	Mr. Khin Mg Thinn	Assistant Director (Engineering)	Water and Sanitation Department, Mandalay City Development Committee

No.	Name	Title	Organization
10	Mr. Tun Tun Aung	Assistant Director	MOALI
11	Mr. Min Maw	Director	ECD, MONREC
12	Dr. Tin Aung Win	Assistant Director	ECD, MONREC
Members from Japanese Side			
13	Mr. Masayuki Karasawa	Chief Representative	JICA Myanmar Office
14	Mr. Senro Imai	Project Advisor	JICA
15	Dr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team
16	Dr. Kanji Usui	EIA Technical Manual and Review Process	JICA Expert Team
17	Mr. Shunsuke Hieda	Water Quality Survey	JICA Expert Team
18	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team
19	Mr. Hiroaki Nakagawara	Database Development with GIS	JICA Expert Team
20	Mr. Toshiyuki Nishio	Industrial Effluent Treatment	JICA Expert Team

Source: JET

JCC の詳細については 2.2.1 項を、JCC の議事録については添付資料 5 を参照のこと。また JCC に加えて、成果を共有し、技術的事項を協議するためにプロジェクト調整会議（PCM）がプロジェクト期間中に 5 回開催された。PCM の詳細については 2.2.2 項を参照のこと。

1.3 PDM および PO の改訂

上位目標、プロジェクト目標、成果、指標（objectively verifiable indicators、OVI）、外部条件、投入およびプロジェクト実施スケジュールを含めるプロジェクトの枠組みは R/D に添付されているプロジェクト・デザイン・マトリックス（PDM）および活動計画（PO）に 規定されている。下述のとおり PDM と PO はプロジェクトの全体的な枠組みを変えることなく、2 回改訂された。PDM と PO については添付資料 1 を参照のこと。

(1) 第 2 回 JCC 会議におけるプロジェクト活動の追加

ミャンマーにおけるプロジェクト活動は 2015 年 6 月に開始された。プロジェクト開始から 7 カ月目の 2015 年 12 月には、プロジェクト活動をより効果的にするため表 1.3-1 の活動が追加になった。変更は第 2 回 JCC の議事録をもって承認された。

表 1.3-1　2015 年 12 月の第 2 回合同調整委員会会議で合意された水環境コンポーネントに関わる PDM の変更

Output	Activities Added	Reason of Revision
Output 1 (Inspection)	Activity 1-5 To provide training on measures to control industrial effluent	To learn technologies and issues of controlling industrial effluent
Output 2 (Water Quality Survey)	2-8 To verify the results of the water quality survey using the water quality survey manual	To learn how to check accuracy of analytical data
Output 3 (Database)	3-4 To collect additional information required to develop the database	To implement a pollution control survey and collect additional information about pollution sources.

Source: JET

(2) 合同中間レビューチームの提言に基づく PDM の改訂

2016 年 10～11 月の中間レビューにおいて、合同中間レビューチームはプロジェクトの進捗を確認した上で、PDM の改訂を提案した。これらの改訂は 2016 年 11 月 9 日の第 3 回 JCC 会議におい

て正式に合意された。水環境コンポーネントに関係した主要な変更を表 1.3-2 にまとめる。これがプロジェクト期間中に行われた最後の PDM の改訂であった。

表 1.3-2　2016 年 11 月の第 3 回合同調整委員会会議で合意された水環境コンポーネントに関連した PDM の変更

Item	Before Revision PDM (18 Dec. 2015)	After Revision PDM (9 Nov. 2016)	Reason of Revision
Overall Goal (OVI 2)	Guidelines for wastewater management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF.	Written strategies for wastewater management in industrial zones are developed by YCDC, MCDC in coordination with MONREC.	Changes to the level achievable in three years
Output 1 (OVI 1)	More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.	Inspections are implemented according to the inspection manual by YCDC, MCDC and ECD.	Difficult to quantify no of inspections thus focused more on using inspection.
Output 3 (OVI 2)	Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.	Results of river water quality survey is accessible on the database.	Adjusted to the outcomes of Output 3.
Output 1 Activity 4	To implement inspection based on the developed inspection manual.	To implement trial inspection based on the inspection manual	Inserted trial as inspection is yet to be defined.
Output 1 Activity 6	To revise the inspection manual	To evaluate the trial inspection procedures	

Source: Joint Mid-term Review Team

第 2 章 プロジェクト活動

2.1 イントロダクション

本プロジェクト中に実施された主要な活動を表 2.1-1 にまとめる。

表 2.1-1 主要なプロジェクト活動

Year	Date	Activity
2015	11 Jun.	Kickoff meeting
	12-30 Jun.	Meetings with ECD, YCDC and MCDC to draft the Work Plan
	1-6 Jul.	Visiting laboratories
	8 Jul.	JCC Meeting No.1
	Jul – Sep.	Capacity assessment
	Sep.	Distribution of finalized Work Plan
	Oct. – Nov.	Collection and digitization of factory data and river water quality data
	17,18 Nov.	Meetings with MOHS, MOTC, MOI, MOAI
	Nov.	Evaluation of present inspection procedure
	25 Nov. - 1 Dec.	Meeting with Industrial Zone Management Committee in Mandalay and Yangon
	4, 10 Dec.	GIS Workshop in Yangon and Mandalay
	Dec.	Development of Progress Report No.1
	17 Dec.	PCM Meeting No.1
	18 Dec.	Signing of the MM of JCC No.2 on revision of PDM and PO
2016	17 - 24 Feb.	Water quality survey No.1 in Mandalay and Yangon
	2-9 Mar.	Survey of impact of tide in Yangon
	May	Development of Progress Report No.2
	22 May - 28 May	Study program in Japan No.1
	1, 2 Jun.	Workshop on Water Quality Status Report No.1 in Yangon and Mandalay
	6 Jun.	PCM No.2
	20 - 28 Jun.	Second water quality survey in Yangon and Mandalay
	Aug.	Development of Inspection Manual
	Aug. – Nov.	Pollution source survey in Yangon and Mandalay (Questionnaire survey and wastewater sampling)
	27 Sep. -18 Oct.	Study program in Japan No.2
	24 Oct. - 9 Nov.	Mid-term Review
	9 Nov.	Meeting of Joint Coordinating Committee No.3 and Mid-term Review
	Nov.	Development of Progress Report No.3
	8 Dec.	Project Coordination Meeting No.3
2017	Jan.	Industrial Wastewater Treatment Workshops in Yangon and Mandalay
	23 Jan. - 1 Feb.	Third water quality survey in Yangon and Mandalay
	Mar.	Development of technical materials; (i) Criteria for Selecting Sampling Points, Sampling Time and Measurement Parameters, (ii) Water Quality Survey Plan, (iii) Water Quality Survey Manual, (iv) Water Quality Survey Report for Period 1, and (v) Database Manual
	21 Jun.	PCM No.4
	28 Aug. - 14 Sep.	Study program in Japan No.3
	Aug. - Nov.	Pollution source survey in Yangon and Mandalay (Additional wastewater sampling and questionnaire survey)
	18 Sep. -3 Oct.	Fourth water quality survey in Yangon and Mandalay
	30 Oct.	Industrial Wastewater Treatment Workshop in Yangon (C/Ps in Nay Pwi Taw and Mandalay were also joined.)
	Nov. – Feb. 2018	Joint training for water quality survey report writing and database development in Yangon and Mandalay
	24 Nov.	Inspection training in Yangon (for YCDC)
	Nov. - Dec.	Development of Progress Report No.4
	8 Dec.	PCM No.5
2018	2 - 23 Feb.	Terminal Evaluation
	22 Feb.	JCC Meeting No.4
	19 - 27 Feb.	Fifth water quality survey in Yangon and Mandalay
	9 May	Final Seminar in Mandalay
	15 May	Final Seminar in Yangon
	17 May	JCC No.5 and Final Seminar in Nay Pyi Taw

Source: JET

2.2 全成果に共通な活動

2.2.1 合同調整委員会

活動計画を策定し、プロジェクトの進捗を管理するため合同調整委員会（JCC）が 5 回開催された。合同調整員会の会議の要約を表 2.2-1 に示す。会議の議事録は添付資料 5 を参照のこと。

表 2.2-1 合同調整委員会会議の概要

No.	Date	Summary
No.1	8 Jul 2015	This was the first JCC meeting organized after the project activities were started in Myanmar in May 2015. The main agenda of this meeting was (i) to introduce the project to all JCC members, (ii) to present related activities of relevant organizations, and (iii) to confirm proposed work plans of both water environment management and EIA components.
No.2	18 Dec 2015	Considering the changes in the circumstances since the project had been formulated in 2014, the JCC members agreed to add the following activities to the PDM and the PO to make the project even more effective and practical: (i) training on industrial wastewater treatment (Activity 1-5 on Inspection), (ii) verification of results of water quality survey using the Water Quality Survey Manual (Activity 2-8 on Water Quality Survey), (iii) additional collection of data on pollution sources (Output 3-4 on Database). Also, there were some changes to the EIA component (Output 5 and Output 6). Due to the difficulty in organizing a JCC, the JCC members were consulted in writing, and the minutes of the meeting was signed on 18th December 2015.
No.3	9 Nov 2016	This JCC was held as part of the Mid-term Review. Following presentations by ECD (PCD), YCDC, MCDC, ECD (EIA) and JET (EIA) on progresses, findings and challenges of project implementation, the Joint Mid-term Review Team presented the results of the Mid-term Review. Then, participants discussed and agreed on the changes to the PDM suggested by the Joint Mid-term Review Team.
No.4	22 Feb 2018	This JCC was held as part of the Terminal Evaluation of the project. Following presentations by ECD on the water environment management component and the EIA component, the Terminal Evaluation Team explained the results of the evaluation, and the participants discussed the results and the ways forward.
No.5	17 May 2018	This JCC was held to close the project.

Source: JET

2.2.2 プロジェクト調整会議

合同調整委員会に加えて、プロジェクトの成果を共有して技術的な事項を協議するためプロジェクト調整会議（PCM）が 5 回開催された。これらの会議の概要を表 2.2-2 にまとめた。

表 2.2-2 プロジェクト調整会議の概要

No.	Date	Remarks
No.1	17 Dec 2015	The first Project Coordination Meeting (PCM) was held in December 2015 in Nay Pyi Taw to discuss technical aspects of (i) database development, (ii) development of inspection manual, (iii) drafting of Water Quality Status Report No.1, and (iv) the proposed revision of the PDM and the PO. The draft version of the Progress Report No.1 was distributed in the PCM meeting, which was finalized in April 2016.
No.2	6 Jun 2016	The second Project Coordination Meeting (PCM) was held on 6 June 2016 in Nay Pyi Taw to discuss the progresses of project activities until May 2016 and proposed activities until November 2016. The draft version of Progress Report No.2 was distributed for review.
No.3	8 Dec 2016	The third PCM was organized in December 2016 for the following objectives: (i) to introduce results of water quality survey (Output 2), (ii) to introduce results of pollution source survey (Output 3), (iii) to make comments on inspection manual from Myanmar Side and how to collaborate each organization to implement inspection (Output 1), and (iv) to make comments on Water Quality Status Report and clarify the objective of Water Quality Status Report (Output 4).
No.4	21 Jun 2017	The forth PCM was organized (i) to summarize achievements made in Period 1 (June 2015 – April 2017), and (ii) to explain the Work Plan for Period 2 (June 2017 to June 2018). The

No.	Date	Remarks
		members discussed the results of the evaluation with the evaluation team members.
No.5	8 Dec 2018	This PCM was organized (i) to report progress of each output in this period (June to November 2017), (ii) to report training in Japan in August to September 2017, and (iii) to explain the Work Plan for reaming period (Dec 2017 to May 2018).

Source: JET

2.2.3 キャパシティ・アセスメント

プロジェクト開始当時の 2015 年 8-9 月に主要なカウンターパート（C/P）機関の能力を個人および組織のレベルで確認するため、キャパシティ・アセスメントの質問票調査が実施された。まず各 C/P 機関の組織体制を調査し、職員に規則や工場の法的責任、特定の産業セクター（例、食品、蒸留酒、製紙、繊維など）の典型的な環境問題、排水処理についての基礎知識、産業排水のサンプリングなど、インスペクションや許認可に関する個人の能力を 5 段階評価してもらった。

尚、ミャンマーの水環境管理は、プロジェクト期間中に大幅に変わったことを指摘しておく必要がある。特に重要な変化としては ECD の環境管理の責任が EIA を主要な手段に大幅に増出したこと、そして地方自治の中心として管区政府が出現したこと、が挙げられる。これらの変化は現在も進行中であるが、その結果、管区政府の調整のもと YCDC/MCDC が担っていた産業公害コントロールの主要責任が ECD に移行されてきている。ただし、2018 年初頭の段階では ECD の能力はまだ限定的で、産業公害の問題は管区政府の指導の元で ECD、YCDC/MCDC、DISI、GAD、そして他の機関が合同で行っているのが実状である。

2.3 成果 1 インスペクション

表 2.3-1 に最終的な PDM に基づいた成果 1 の成果、活動および指標をまとめる。成果 1 は工場排水に関連した工場のインスペクション手続きの標準化を目指したものである。2015 年 12 月の第 2 回合同調整委員会で「活動 1-5：水質汚染源対策の強化に関わるトレーニング」が成果 1 に追加になった。また成果 1 の活動および指標が 2016 年 10-11 月の中間レビューの際に改訂されている。

表 2.3-1 成果 1（インスペクション）に関わる活動と指標

Output 1	Inspection procedure is standardized.
Activities	1-1 To collect information on water pollution sources 1-2 To evaluate present inspection procedures 1-3 To develop an inspection manual 1-4 To implement trial inspection based on the inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To evaluate the trial inspection procedures
Indicator	Inspections are implemented according to the inspection manual by YCDC, MCDC and ECD.

Source: JET based on amended PDM

2.3.1 水質汚染源に関する情報収集（活動 1-1）

プロジェクトでは、2015 年と 2016 年に関連機関より収集可能な Hlaing 川流域と Doke Hta Wddy 川流域の汚染源情報を収集した。ミャンマーでは会社名、セクター、製品、従業員数といった事業所の基礎情報は、開発委員会（YCDC や MCDC）や工業省（MOI）傘下の DISI が事業許認可や事業登録のために収集しているので、基本的に収集可能である。

例えば、DISI は民間企業法（1990）に基づいた民間企業の登録データを管理している。2015-2016 会計年度にはヤンゴン管区に 6,177、マンダレー管区に 7,545 の事業所が登録されており、これらの事業所については企業名、セクター、製品、売上などの情報が入手可能である。ただし、これらの事業所に関わる環境情報は限られている。

また 2012-14 年には PCCD-YCDC が管内の工場に対して質問票調査を実施し、事業所名、住所、原材料、水使用量、排水の BOD、COD、SS、pH、温度などの主要情報を収集している。このデータは様々な工場の環境管理を分析するには有効だが、電子化されておらず、また事業者の申告データで、一部のデータについては信憑性が懸念された。

よってプロジェクトでは汚染源データベースを構築するために成果 3 の一環として 2016 年 9-11 月（第 1 次調査）および 2017 年 8-11 月（第 2 次調査）に汚染源調査を実施した。第 1 次調査は(i) 200 工場に対する質問票調査、および(ii) 50 工場における排水サンプリングおよび分析、から構成されており、いずれもヤンゴンとマンダレーのパイロット地域を対象にしていた。第 1 次調査の結果の一部には信憑性の問題があったので、2017 年には第 2 次調査として 50 工場において排水のサンプリングおよび分析を行った。詳細については、下述の成果 3 の節を参照のこと。

2.3.2　現行のインスペクション作業手順の評価（活動 1-2）

(1)　汚染管理の法的メカニズム

表 2.3-2 にミャンマーの製造業に関わる汚染管理の法規則をまとめる。

表 2.3-2　製造業の汚染管理に関わる法制度

Level	Law and Regulation	Relevance
National	Law on Environmental Conservation Law (Law No. 9/2012)	・ Chapter VII (Environmental Conservation) stipulates that businesses, which cause pollution, are required to install on-site facility and monitor, control, manage, reduce, or eliminate environmental pollution. ・ Chapter VII also stipulates that a person or organization operating business in the industrial estate to contribute the stipulated cash or in kind for environmental conservation. ・ Other articles pertinent to industrial pollution control include discharge/emission standards in Chapter VI, prior permission for industrial operation in Chapter X, and environmental emergency in Chapter V.
	Environmental Conservation Rules (2014)	・ In relation to the Environmental Conservation Law (2012), the roles and responsibilities of the Environmental Conservation Committee, MONREC, and other governmental organizations are described in the Environmental Conservation Rules (2014).
	National Environmental Quality (Emission) Guidelines (2015)	・ Annex 1 sets out the general and sector-specific effluent guideline values based primarily on International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines. ・ The guidelines are expected to apply to new projects subject to EIA Procedure. As for the existing projects, less stringent levels or measures may be adopted at the discretion of MOECAF. ・ A new national effluent standard is already in discussion and the guidelines are expected to be succeeded by the standard in the near future.
	Environmental Impact Assessment Procedure (2015)	・ MOECAF has the right to conduct monitoring and inspection regarding the requirements of Environmental Management Plan (EMP) or other requirements in the Environmental Compliance Certificate (ECC).
	Private Industrial Enterprise Law (Law No. 22/1990)	・ Chapter V describes the duties of powers of supervisory bodies in the states and divisions in recommending a grant of registration of a private industry considering “no cause of being injurious to the health of the public residing in the vicinity” and “no cause of being a nuisance to the environment and not cause of there being any pollution”.
	Standing Order No. 3 of the Ministry of Industry (1), Water and Air Pollution Control Plan (1995)	・ This standing order requires factories to adopt uniform preparatory measures beforehand for the prevention of pollution and destruction of the environment. ・ Chapter III of the standing order is devoted to water pollution control, requiring factories to report monitoring result of wastewater, to set a timeframe for treatment of wastewater, and to complete the installation of the facility. ・ Annexure (C) provides a sample specification of allowable waste effluent standard.
Development Committees	Law of Yangon City Development Committee (2013)	・ Article 62 of the Law of Yangon City Development Committee (2013) stipulates that no one is allowed to discharge wastewater from any factory, industry, and enterprise into the drainages and rivers without treating it in accordance with the standard set by the committee.
	By-law of Yangon City	・ This has not been officially approved and is being used as an internal

Level	Law and Regulation	Relevance
	Development Committee (2015), activities of PCCD	document.
	Law of Mandalay City Development Committee (2014)	・ Chapter 24 of the Law of Mandalay City Development Committee (2014) stipulates that no one must dispose or discharge wastewater from factory/workshop and business to drains, rivers and agricultural land, without treating it in accordance with the specification set by the committee.
	By-law of Mandalay City Development Committee, activities of CD (2009)	・ Chapter 2 of Environmental Conservation and Cleansing By-law of MCDC (2009) states that MCDC shall take action against anyone/ anything that cause environmental damage/ degradation/ and destruction.

Source: JET

ミャンマーにおける汚染管理は、関連省庁および開発委員会の事業許認可の枠組みの中で行われてきた。今日でもこれが主要な汚染管理のメカニズムで、環境インスペクションも事業許認可や事業登録に関連して行われている。ただし、環境保全法（2012）および EIA 手続き（2015）の導入に基づき、各事業者が提出する環境管理計画（EMP）と ECD が発行する環境許認可（ECC）によって汚染管理をすることになったため、状況は大きく変わってきている。産業公害を規制するためには、これまでの事業許認可/登録、新しく導入される ECC の両方が重要なことから、ここではこれらの手続きをインスペクション手順に絡めて説明する。

(2) 事業許認可/登録とインスペクション

1) 事業許認可/登録

ミャンマーで事業をするには、当該セクターの管轄省庁から事業許認可を取得する必要がある。製紙、皮革、化学など製造業の大部分は工業省が管轄省庁であり、民間企業法（1990）に基づいて DISI への事業登録が必要となる。蒸留酒工場やビール工場のようなアルコール製造業の場合は、内務省の General Administration Department (GAD) の許認可も必要となる。また事業を YCDC や MCDC の管轄内で行う場合は、上述した管轄省庁からの許認可に加えて YCDC や MCDC の事業許認可を取得する必要がある。表 2.3-3 に YCDC、MCDC および DISI の事業許認可/登録事業者数、環境上の要求事項および関連組織をまとめる。

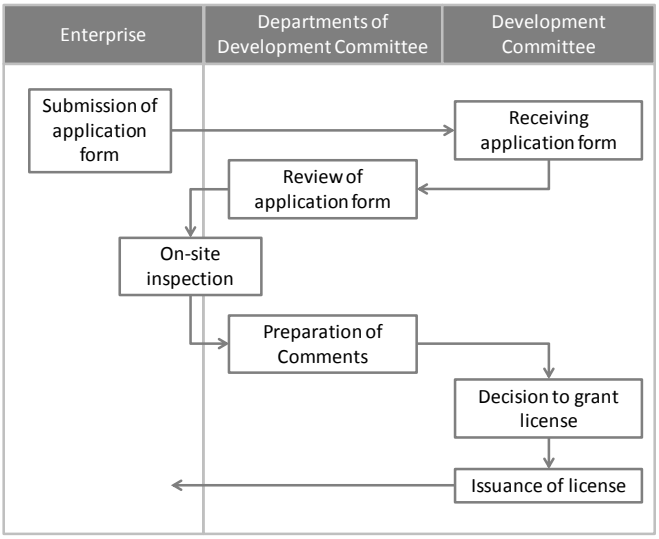
表 2.3-3　事業許認可/登録とインスペクション

System	Relevant Law	Environmental Requirements	Number of Licenses issued in 2014	Organization Involved in Review Process	Organization Responsible for Licensing
YCDC Business License (Annual)	Yangon City Development Committee Law (2013)	- Article 62 of the Law requires factories to treat wastewater in accordance with the standard set by the committee. - There are no officially approved detailed requirements (e.g., by-law) and external guidelines, such as MONREC's new effluent guideline, WHO's drinking water guideline, etc., are referred to.	3,474 enterprises (This is limited to factories in industrial zones)	PCCD, WSD, other relevant departments of YCDC	YCDC
MCDC Business License (Annual)	Mandalay City Development Committee Law	- Chapter 24 of the Law forbids factories to discharge wastewater without treatment according to specification set by the committee. - There is a by-law but detailed licensing conditions are not specified.	16,997 enterprises (This seems to include small enterprises)	CD, WSD, other relevant departments of MCDC, ECD Mandalay	MCDC (CD)
DISI Business Registration	Private Industrial Enterprises Law (1990)	- Standing order requires factories to adopt uniform preparatory measures beforehand for the prevention of pollution and	6,177 enterprises in Yangon District and	MOI (DISI), regional ECD, MOHS, and other	MOI (DISI)

System	Relevant Law	Environmental Requirements	Number of Licenses issued in 2014	Organization Involved in Review Process	Organization Responsible for Licensing
(Annual)	including Standing Order No.3 of Ministry of Industry (1), Water and Air Pollution Control Plan (1995)	destruction of the environment. - Chapter III of the standing order is devoted to water pollution control, requiring factories to report monitoring result of wastewater, to set time frame for treatment of wastewater, and to complete the installation of the facility. - Similarly, Chapter IV stipulates requirements for air pollution control. - Annexure (C) provides a sample specification of allowable waste effluent standard.	7,545 enterprises in Mandalay District	organizations	
ECD Environmental License (ECC) (5 years)	Environmental Conservation Law (2012) and EIA Procedure (2015)	- EIA Procedure (2015) requires all projects and expansion projects having the potential to cause adverse impacts to undertake IEE or EIA or to develop an EMP and to obtain an ECC in accordance with this Procedure. - According to Chapter II of the procedure, any existing projects are also required to undertake environmental compliance audit, develop IEE, EIA, or EMP, and obtain ECC. MOECAF has the right to conduct monitoring and inspection regarding the requirements of Environmental Management Plan (EMP) or other requirements in Environmental Compliance Certificate (ECC). - Licensing conditions are to be stipulated in the ECC of each firm.	Not issued yet	ECD	ECD

Source: JET

図 2.3-1 に YCDC や MCDC の事業許認可手続きをまとめる。手続きは事業者側の申請書類の提出で始まり、開発委員会の様々な部署および他の関連機関による書類チェック、現場インスペクション、各組織によるコメントの作成、開発委員会による決定、そしてライセンスの発行という手続きである。



Source: JET

図 2.3-1　開発委員会における事業許認可の承認手続き

DISI の事業登録の手続きも類似している。DISI に登録されるには、事業者は YCDC/MCDC の事業許認可、保健局の労働衛生証明書、ECD による環境問題についてのレター、消防局のレター、その他の関連組織からのレターが必要である。登録は毎年更新が必要である。

これらの政府機関による事業許認可や登録制度では、関連する法制度に基づいて、事業者が環境配慮することが求められている。ただし、これらの許認可/登録制度の主目的は環境問題をコントロールすることがではなく、法的拘束力のある排水基準や汚染対策施設の技術的基準といった具体的な環境要求事項があるわけではない。よって政府が事業者の汚染問題に介入するのは、汚染による周辺住民の土地、生活手段、健康への被害ついての苦情が引き金になることが普通である。問題解決は一般的な損害賠償の示談に似た形で、YCDC/MCDC の上下水道部、保健局、DISI などが協力して行う。最近では政権交代と地方分権の流れから、管区政府がこのような調整を行っており、特に重要なケースではそうである。この決定に従って事業許認可/登録に関わる法が求める環境配慮の欠如を事由に、汚染者への警告、罰金の賦課、最終的には事業許認可の一次差止や剥奪といった行政処分がされることになる。

これが汚染問題をコントロールする主要な手段であるが、様々な課題もある。まずこれは起こった問題への対処手段にしか過ぎず、汚染の未然防止を推進することができない。また対応がケース・バイ・ケースで予想が難しく、ビジネス判断に関わるリスクを把握したい投資家や事業者、そして広く公平な指導をすることが求められる環境当局にとっては理想的な状況ではない。さらに比較的小規模なケースについても、多くの調整が必要となるのも問題である。

2) 事業許認可/登録に関わるインスペクション

現在のミャンマーの環境インスペクションは、事業許認可/登録の手続きに関連して(i) 事業許認可/登録に関係した要求事項の遵守インスペクションと、(ii) 苦情対応のためのインスペクション、に分けることができる。

(a)　事業許認可/登録に関わる基準遵守インスペクション

このタイプのインスペクションは、原則としては事業所が YCDC や MCDC の事業許認可あるいは DISI の事業登録の条件を満たしているか確認するために行われている。

YCDC の事業許認可については、YCDC の管理部が事業許認可の発行を担当しているが、汚染に関連した事項について技術的な審査を行い勧告をする主要な組織は汚染清掃部（PCCD）である。

PCCD はインスペクション票を使って工場より排水処理施設の有無や排水濃度の自己モニタリング情報などの収集するようになってきており（成果 3 の節を参照）、工場からの返答や現場インスペクションの結果をもとに汚染についての技術的提言をしている。

状況は MCDC でも類似しており、清掃部（CD）が許認可の発行を担当し、上下水道部（WSD）が排水について技術的提言を行っている。

DISI の事業登録については、DISI の工業検査部が環境インスペクション票を有しており、廃棄物、排水、排気、労働環境、健康と危険、火事などの検査分野が規定されている。DISI をサポートするため、ECD ヤンゴンは事業所の環境パフォーマンスについて所見を記載するため毎月インスペクションを行っている。ECD マンダレーも工業省の事業登録に関連して、週に 5-6 回のインスペクションを実施している。

上述の通り、汚染管理を既存の許認可/登録制度に組み込み、個々の事業所の環境パフォーマンスをインスペクションする様々な努力がされてきている。しかし、関連する法規則は事業所が環境配慮することを要求しているだけで、詳細かつ法的拘束力のある要求事項があるわけではないことから、事情は他国の基準遵守インスペクションとはかなり異なっており、事業許認可/登録に関連する YCDC や MCDC、DISI のインスペクションでは、事業所内を簡単に確認して環境配慮の大幅な逸脱による環境問題があるかどうかチェックするだけである。

(b) 環境苦情に対処するためのインスペクション

事業許認可/登録に関連した法律では汚染管理の法的根拠が明確とは言えないため、行政の介入は主に地域住民等の苦情に基づいて行われている。苦情対処のためのインスペクションは、苦情がどの組織に提出され、誰が命令を出すかによって、YCDC、MCDC、ECD、DISI、あるいはその他の組織が対応している。最近では管区政府がこのような意思決定の中心となってきているが、命令が中央政府の MONREC などの組織から出されることもある。このようなインスペクションはヤンゴン、マンダレーのどちらでも年間 10-20 回程度実施されており、苦情の内容によって単独あるいは合同（例、保健局と合同）で実施されている。インスペクションの主要な目的は問題処理であり、環境当局が積極的に対応策を提案することもある。また必要と判断される場合は、事業許認可/登録の一時停止が検討されることもある。このタイプのインスペクションはケース・バイ・ケースで行われるもので、標準化されているわけではない。

(3) ECC に基づいた環境許認可とインスペクション

1) 環境許認可のスキーム

環境保全法（2012）と EIA 手続き（2015）の導入で状況は急速に変わってきている。EIA の枠組みでは、新規事業の提案者は EIA/IEE のフレームワークに基づいて事業の環境影響を評価して、環境管理計画（EMP）を策定し、環境遵守許可（ECC）を取得することになっている。その後、事業者は EMP と ECC に基づいて環境対策を実施して、事業を継続するためには ECC の要求事項を満足した状況を維持する必要がある。既存事業の事業者も EMP を策定し、ECC を取得して、ECC の要求事項に遵守した状況を維持する必要がある。

この枠組みは近い将来産業公害をコントロールする主要メカニズムになると思われ、そうなれば環境管理は現在より予防に基づき、予測可能で、調整も少なくてすむものになると思われる。ちなみに 2018 年 1 月 10 日に MONREC は主要 9 産業セクター（蒸留酒/発酵酒/ビール、食品・飲料加工、農薬、セメント・石灰、繊維・染色、鋳業・精錬、なめし皮製造、パルプ・製紙、および製糖）の事業所に対して EMP を策定し、9-12 カ月以内に ECC を取得する命令を発出している。

このメカニズムでは EMP と ECC の条件が法的拘束力を持つ要求事項および基準遵守インスペクションの対象になると思われる。現状では ECC が工場に対して次の条件を求めることが想定されている：

- 一般条件
- 環境パフォーマンス条件
- 環境管理条件
- モニタリング、報告および ECC 遵守条件
- プロジェクト・コミットメント
- 苦情対処条件

例えば国家環境質（排出）ガイドライン（NEQEG、2015）遵守は環境パフォーマンス条件の要求事項の一つになると思われる。しかし、これらの条件の詳細はまだ設定されておらず、これらの要求事項を設定・遵守するのは、環境当局にとっても被規制側にとっても、大きな課題となると思われる。例えば NEQEG（2015）の要求事項に遵守するためには大部分の工場は排水処理施設を新たに設置する必要があるが、多くの工場はそのような施設を設置する資金的目処や敷地がなく、排水に関する要求事項を設定するのは簡単ではない。また ECD は他の要求事項も設定しなくてはならない。よってこれらの要求事項の詳細を議論するには、まだ時期尚早である。

尚、ECC に加えて環境保全法（2012）には事業所をコントロールするために”Prior Permission”と呼ばれるメカニズムがあるが、このメカニズムはまだ導入されていない。

2) 環境許認可に関する基準遵守インスペクション

ECC におけるインスペクションの役割は、EMP や ECC の要求事項の遵守状況をチェックし、違反者に対する対応を検討することである。しかし、上述のとおり ECD はまだ ECC の要求事項を明確にしておらず、ECC を取得している事業所はほとんどない。

既に EMP を作成している事業所は存在し、ECD はそのような事業所に対して EMP を基にしたインスペクションを開始している。しかし、そのような事業所も非常に少なく、EMP をベースにしたインスペクションの枠組みもなく、EMP があっても ECC なしでは法的拘束力がない。よって、今のところ EMP に基づいたインスペクションも事業許認可/登録に関連したインスペクションと同様に、一般的な簡単な立入検査になっている。

2.3.3 インスペクションマニュアルの作成（活動 1-3）

上述した通り YCDC、MCDC および DISI による事業許認可/登録はミャンマーにおける公害対策の主要メカニズムとなっているが、EIA/IEE および EMP に基づいた ECC の導入で状況は大幅に変わってきている。よってプロジェクトのインスペクションマニュアルは ECC に基づいた新しい環境管理システムを想定して策定することとした。表 2.3-4 にインスペクションマニュアルの目的、対象および目次を示す。

表 2.3-4 インスペクションマニュアルの目的、対象および目次

Objectives	- To standardize inspection procedures so that officers in charge of inspection can minimize undetected serious pollution problems - To provide officers with general information on current laws and regulations pertinent to inspection activities - To provide officers with basic information on pollution control measures in typical industrial sectors in Myanmar - To provide sources of more detailed information on environmental management	
Target	Junior officers with limited experiences	
Table of Contents	Introduction	Background and introduction to the inspection manual

	Legal systems	Brief summary of current legal systems for pollution control
	Inspection Procedures	Explanation about recommended procedures for pre-inspection preparation, on-site inspection, and post-inspection activities
	Appendix 1: Checklist	A checklist to be used by an officer to standardize inspection procedure

Source: JET

新制度が導入された際にはインスペクションに関わる職員の主要な業務は、個々の事業所について ECC で規定される具体的な要求事項の遵守状況を確認することである。このタイプのインスペクションは「基準遵守インスペクション」と呼ばれる。手順は他国のインスペクションと同様で、(i) 立入検査前準備、(ii) 立入検査、そして (iii) 立入検査後の活動、となることが想定される。よってマニュアルの枠組みは、これらのステップについて IMPEL (1999)[1]、Ministry of Environment Japan (2006)[2]、OECD (2004)[3] および US EPA (2002)[4]など、他国で使われている基準遵守インスペクションのマニュアルを参考に作成した。尚、マニュアルは ADB と協働で策定した。

マニュアルの対象は、経験があまりない ECD 職員であり、彼らは 2018 年内に ECC を取得する必要がある 9 産業セクターの事業所の ECC に基づいた基準遵守インスペクションを担当することになると想定している。経験がない職員が犯す典型的な失敗としては (i) 職員がインスペクションで何を達成すべきか（目的）をよく考えず、立入検査の前に充分な準備をしない、(ii) 職員が立場をわきまえず、権限を濫用して事業所との関係を悪化させる、(iii) 職員が関連した法制度や手続きに詳しくなく、インスペクションの結果が後で無効とされる、(iv) 職員が他の法制度や事業者の権利に抵触する、(v) 職員の知識と経験が不足しているため、何をどうインスペクションするかわからない、(vi) 職員が結果を適切に報告せず、インスペクションのフォローアップをしない、などが考えられる。マニュアルはこれらの失敗を最低限にすることを目的に作成した。大部分の課題はマニュアルの中で取り上げられている。ただし、上記の(v)は EMP や ECC の要求事項がまだ明確にされていないため、カバーすることが難しかった。マニュアルのこのセクションについては、ECD が ECC に基づいたインスペクションを実施する基礎的な経験を得た段階で改訂すると良い。

また基準遵守インスペクションを実施するに当たって、職員は法制度を熟知している必要がある。よってマニュアルには憲法（2008）、環境保全法（2012）、民間企業法（1990）、YCDC 法（2013）および MCDC 法（2014）の環境要求事項や、事業者と環境当局の法的責任についてのセクションを含む法律の章を用意した。

マニュアルは主に ECC に基づいた遵守インスペクションを念頭に策定したが、YCDC、MCDC や DISI の職員が事業許認可や登録に関連したインスペクションをするにも役立つと思われる。

2.3.4　インスペクションの実施支援（活動 1-4）

(1) ECD によるインスペクション

表 2.3-5 に 2016 会計年度（2016 年 4 月～2017 年 3 月）に ECD が実施したインスペクションをまとめる。

[1] IMPEL, IMPEL Reference Book for Environmental Inspection, 1999.
[2] Ministry of Environment Japan, Guideline for Developing Inspection Manual based on Water Pollution Control Act, 2006.
[3] OECD, Assuring Environmental Compliance, A toolkit for building better environmental inspectorates in Eastern Europe, Caucasus and Central Asia, 2004.
[4] US EPA, Conducting Environmental Compliance Inspection, 2002.

表 2.3-5　2016 年 4 月～2017 年 3 月の ECD によるインスペクション

State/ Region	Types of Inspection	Number of Inspections (Apr. 2016 – Mar. 2017)	Number of Inspections (Dec. 2016 – Mar. 2017)
Yangon	1) Regular Inspection of ECD (Yangon)	83	28
	2) Inspection by ECD (Yangon) according to Complaints	7	2
	3) Inspection by ECD (Yangon) according to instruction of Union Minister	2	2
	4) Inspection by ECD (Yangon) according to instruction of Region Government	3	2
	Sub-Total	95	34
Mandalay	1) Regular Inspection of ECD (Mandalay)	46	6
	2) Inspection by ECD (Mandalay) according to Complaints	16	4
	3) Inspection by ECD (Mandalay) according to instruction of Union Minister	18	13
	4) Inspection by ECD (Mandalay) according to instruction of Region Government	108	21
	Sub-Total	188	44
Total of Other Area (except Yangon & Mandalay)	1) Regular Inspection of ECD	593	-
	2) Inspection by ECD according to Complaints	39	-
	3) Inspection by ECD according to instruction of Union Minister	50	-
	4) Inspection by ECD according to instruction of Region Government	91	-
	Sub-Total	773	-
Total		1,056	-

Source: JET based on information provided by ECD

インスペクションマニュアル案は 2016 会計年度中の 2016 年 11 月に C/P 機関に正式に配布され、配布後にヤンゴンとマンダレーにおいて合計で 34 回および 44 回のインスペクションが実施されている。マニュアルは一般的なインスペクション手続きをまとめており、C/P 機関から概ね肯定的に評価され、受け入れられている。しかし、必ずしも C/P 機関が全面的にマニュアルを導入したわけではない。詳細については 2.3.6 節を参照のこと。

(2) PCCD-YCDC のためのインスペクションマニュアルの利用に関わるトレーニング

2017 年 11 月初旬に PCCD-YCDC 部長からインスペクションマニュアルの活用についてのトレーニングの要請があった。協議結果に基づいて PCCD-YCDC と JET は i) インスペクションマニュアルの説明、ii) ケーススタディ 1：日本の水質汚濁防止法における行政指導/行政命令の説明、iii) ケーススタディ 2：Thilawa SEZ 管理委員会による環境管理システムの紹介、そして iv) 環境管理についてのグッドプラクティスを学習するための Thilawa SEZ の日本の食品工場および繊維工場の視察、から構成されるプログラムを作成した。

トレーニングは 2017 年 11 月 24 日に実施した。PCCD 本部および PCCD タウンシップ監督者より 60 名が参加し、50 名が現場視察にも参加した。現場視察では工場の代表者が排水処理施設、汚泥管理、処理水のモニタリング施設、薬品や有害物質の漏えい事故の予防、ボイラーからの排ガスのコントロール、発電機からの騒音防止装置、有害廃棄物の分離、廃棄物の貯留、従業員へのトレーニングなどの説明をした。図 2.3-2 にインスペクションマニュアルの利用についてのトレーニングの写真を示す。

	
Lecture by JET	Site visit to the factories in Thilawa SEZ

Source: JET

図 2.3-2 PCCD-YCDC のためのインスペクションマニュアルの利用に関わるトレーニングの写真

2.3.5 水質汚染源対策の強化に関わるトレーニング（成果 1-5）

(1) 排水処理技術に関わるワークショップ

2016 年に実施した汚染源調査（成果 3 の節を参照のこと）では大部分の工場が充分な排水処理施設を有していないことが明らかになった。近い将来にこれらの工場は ECC に基づいて適切な排水処理施設を設置する必要があり、また環境当局の職員はこれらの施設を ECC に基づいてインスペクションしなくてはならない。これらのタスクを実施するに当たって、現在、ミャンマーにある排水処理に関する技術情報は非常に限られている。よって職員および事業者を対象にした排水処理技術に関わる一連のワークショップを実施した。ワークショップ資料は添付 14 を参照。

最初のトレーニングは 2016 年 11 月 30 日にマンダレーで、同年 12 月 2 日にヤンゴンで行われ、JET が YCDC、MCDC および ECD 地方事務所の職員に講義をした。このワークショップは排水処理施設の設計、建設、稼働に焦点を置いたもので、排水を処理するためにどのように様々な技術が組み合わされるか、典型的な一次、二次、高次処理の技術と機能、セクター別の典型的な処理方法、工業団地における集中排水処理の整備などの内容を含んだものであった。

	
Lecture in Mandalay on 30th November	Lecture in Yangon on 2nd December

Source: JET

図 2.3-3 排水処理技術専門家による講義の写真

第 2 回目のトレーニングは 2017 年 1 月にヤンゴン、マンダレー、ネピドーで実施された。ここでは個別の工場での個別処理、近隣工場の合同処理、特定のセクターにおける合同処理、そして集中排水処理がどのようにアプローチされ、様々なアプローチで処理コストがどのように異なるかが説明された。図 2.3-4 にベトナムのコスト情報をもとにワークショップで発表された代替案の比較例を示す。

CASE	WWTP for	Capacity of WWTP (m3/day)	Treatment Process	Unit Fee for 10 years (USD/m3ww)	Operation and Management of WWTP
1	Each factory	100	Optimum for specific industry	0.50	By each factory
2	10 Neighbors	100 x 10 factories = 1,000	Common for various industries	0.46	By Neighbor factories? By IZ committee?
3	10 factories of same industry	100 x 10 factories = 1,000	Optimum for specific industry	0.36	By IZ committee?
4	All (50) factories in IZ (Central WWTP)	100 x 50 factories = 5,000	Common for various industries	0.40	By IZ committee?

Source: JET

図 2.3-4 排水処理に関わる代替案の例

(2) 集中排水処理に関わるワークショップ

多くの工場は排水処理の代替案について検討を開始する必要があり、特に 2018 年中に ECC を取得しなくてはならない 9 つの重要セクターの工場はそうである。工業団地の事業者にとっては集中排水処理の設置は、 (i) スケールメリットのため個別処理よりコストが安いことが期待できる、(ii) 個々の工場が技術的/資金的な資源を必要とする本格的な排水処理施設を運営しなくて良い、(iii) 個々の工場が排水の最終的な処理/排水に関わる全面的な法的責任を負わなくても良い、など

の理由から望ましいオプションである。勿論、他の ECC の要求事項や集中排水処理の運営者の要求事項を満たす必要はある。

一方で集中排水処理施設の整備は簡単ではない。よってミャンマーの工業団地における集中排水処理施設の整備のオプションや課題を明らかにするため、Hlaing Thar Yar 工業団地を対象とした簡単なケーススタディを 2017 年夏に実施した。このケーススタディでは工業団地の第 1 区および第 1～4 区の排水を処理するオプションが検討され、また政府と排水処理サービス会社の建設中および運営段階の責任分担が検討された。結果は 2017 年 10 月 30 日に開催された排水処理に関するワークショップで発表された。ワークショップではマンダレー（建設中）、ヤンゴンの Thilawa SEZ およびベトナムの工業団地の集中排水処理についても発表がされた。

Opening Speech by Chief Minister of Yangon Region

Presentation by ECD

Source: JET

図 2.3-5　排水処理に関わるワークショップの写真

このワークショップでは集中排水処理施設整備に関して以下の主要課題が明確にされた：

- 工業団地の全体的な管理をする会社の設立
- 集中排水処理施設の建設および運営に関わるスキーム（公共事業、BOO、BOT 等）
- 投資コストの資金調達
- 各工場の排水量および排水質の推定方法
- 集中排水処理施設および付帯施設の建設地の確保
- 工場からのコストの回収および最低流量の保証

ミャンマーの多くの工業団地は水道、電気、道路など他のユーティリティ/インフラについても同様の課題を抱えている。また多くの工業団地は明確な管理体制がない。よって管理体制の確立が集中排水処理施設の整備に先駆けた最初のステップかもしれない。

2.3.6　インスペクション手順の評価（活動 1-6）

インスペクションマニュアルは C/P 組織から肯定的に評価されたが、C/P 組織がマニュアルを全面的に導入できないでいるのも事実である。これはマニュアルが明確で法的拘束力のある要求事項を前提とした基準遵守インスペクション手続きを念頭に作成されているのに対して、ECD がまだそのような要求事項を導入していないことが重要な理由である。またマニュアルは行政手続法、環境問題・行政問題・差止要求に関わる訴訟など、他国では環境規制や紛争処理のために存在する法的メカニズムを前提にしているが、現在のミャンマーには従来の公的規制のメカニズムや紛争解決の手段があることなどから、このようなメカニズムが完全に存在するわけでない。しかし

環境法や行政機構、紛争処理のメカニズムは急速に変わってきており、ECC を基にした規則の導入によって、マニュアルは将来のミャンマーの状況により則したものになっていくと思われる。ECD 本部ではプロジェクトで作成したマニュアルを全ての地方管区事務所に共有し、コメントをもらい、翻訳して、これらの事務所で正式に活用できるように手配を進めている。これらから考えて、本プロジェクトの活動の成果はあったものと思われる。

2.3.7　成果 1 に関わる課題と提言

本セクションでは成果 1 に関連して明らかになった課題と JET の提言をまとめる。

(1)　環境要求事項の明確化

課題：インスペクションに関わる主要な課題の一つは、事業所に対する具体的な環境要求事項の欠如である。産業公害は環境保全法（2012）、YCDC 法（2013）、MCDC 法（2014）、民間企業法（1990）などで触れられているが、現段階ではこれらのどの法律にも詳細かつ法的拘束力のある要求事項がない。このことが環境行政を恣意的なものにしており、事業所側およびインスペクションをする職員の双方が事業所の操業が関連法令を遵守しているかどうか自信を持って判断できない状況にある。よって、工場に対する明確かつ法的拘束力のある要求事項を設定することが重要である。MONREC は 2018 年 1 月に 9 つの産業セクターの工場に対して EMP を策定して、9-12 カ月の間に ECC を取得するよう命令している。この命令が執行されれば、この命令に関連した個々の事業所は EMP および ECC に基づいた法的拘束力のある要求事項を有するようになる。しかし、EMP の作成は基本的に各工場に任せられている。よっておそらく ECD は単独の産業セクターについてでさえ、様々な質や内容の EMP を受領することになると思われる。EMP の中には全く現実的でないものや、様々な理由から特別な配慮を要求するものもあるであろう。このような状況では規則の執行は非常に困難になる。

提言：ECD が一連のセクター調査を実施して、各セクターのベスト・プラクティスを参考にセクター毎に要求事項を設定することを提案する。これには数年がかかるが、実施できればインスペクションを含む環境管理がやり易くなると考えられる。

(2)　各要求事項に対応したインスペクション手順の明確化

課題：インスペクションをする職員は EMP や ECC に規定される各環境要求事項をどのようにチェックするか知っている必要がある。しかし、法的要求事項が明確でないため、現段階では詳細を明確にすることが困難である。

提言：全般的なインスペクション手順については、インスペクションマニュアルに記載されたもので当面は問題ない。また IMPEL (1999)、日本の環境省(2006)、OECD (2004)および US EPA (2002)など、上述した国際的なマニュアルを参照すると良い。現場での排水サンプリングについては、Environment Canada (2005)[1]も役立つ。詳細な要求事項が設定されたら（例、EMP や ECC に基づく）、環境当局は様々な状況下でどうやってインスペクションをして結果の判断をするかを決定するため、試験的なインスペクションをするべきである。充分なインスペクションの経験が蓄積できた段階で、必要に応じてインスペクションマニュアルの改訂をするべきである。 多くの技術的/手続き的な課題を明確にする必要が発生すると思われる。例えば NEQEG (2015) は「ガイドライン値は、希釈なしに、年間の稼働時間に基づいて計算して 95%の時間において、満足している必要がある」としている。よってインスペクションをする職員は原則として、製造過程の汚水と下水が混合されていたらどうするか、1 回や 2 回の測定値から 95%の時間の測定値をどう判断するか、稼働時間をどのように計算するか、などを知っている必要がある。

(3)　汚染管理に関わる工場のサポート

課題：本プロジェクトでは様々な排水処理技術、個別処理と合同/集中処理の利点と問題点など、事業者がどうやって汚染管理をするかについて啓蒙する機会を作ってきた。しかし、工場の所有

[1] Environment Canada, 2005, The inspector's field sampling manual (2nd issue).

者や管理者の知識は汚染管理について意思決定するには非常に限られていることから、工場に対してさらにサポートをすることを提案する。

提言：環境当局が事業者の啓蒙のためワークショップやコンサルテーションをすることを推奨する。手続き的な課題と技術的な課題の両方が重要である。セクター内では問題や解決案が類似していることが多いので、産業セクターに特化したワークショップをすると良い。また特定の地域（例、工業団地）を対象にしたワークショップは合同/集中排水処理をプロモートするのに役立つ。技術的なワークショップには学術経験者や汚染管理や汚染防止の分野の専門家を招聘すると良い。

2.4 成果 2 水質調査

成果 2 では、ヤンゴンの Hlaing 川流域とマンダレーの Doke Hta Waddy 川流域を対象にした水質調査を実施した。表 2.4-1 に成果 2 の活動および指標を示す。

表 2.4-1　成果 2（水質調査）の活動及び指標

Output 2	Capacity for implementing water quality survey to obtain reliable information is enhanced.
Activities	2-1 To select a private or governmental laboratory which can provide reliable services of sampling and chemical analysis 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters, etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To verify the results of the water quality survey using the water quality survey manual 2-9 To prepare a water quality survey report
Indicator	Water quality survey reports are prepared in the pilot area by YCDC and MCDC.

Source: JET based on amended PDM

水質調査は、2016 年から 2018 年の乾期と雨期に計 5 回実施された。以下に、成果 2 に関連する活動結果をまとめる。

2.4.1　民間および政府系分析機関の試料採取、化学分析に係る信頼性の評価（活動 2-1）

当初、成果 2 のサンプリング及び水質分析作業は、ミャンマーの環境コンサルティング会社及びラボラトリへ委託する計画だった。そこで、JET は 2016 年 2 月に複数の関連会社及び事業所を訪問し、類似業務の経験、サンプリング及び分析の方法及び手順、品質管理システム、人材や資材の適性を確認した。

サンプリング、現場測定及び試料の輸送に関わる作業については、十分な類似業務経験と能力を有する会社が複数存在したことから、第 1 年次（第 1 回~第 3 回水質調査）・第 2 年次（第 4 回～第 5 回水質調査）それぞれにおいて、これら候補企業から再委託先を選定した。

一方、水質分析を委託するラボについては、2016 年 2 月初旬に第 1 年次調査の委託先を選定し、実際のパフォーマンスを評価しながら、適宜委託先を変更する対応をとった。これらのラボは、当初収集した情報から慎重に選定されたものであるものの、第 1 回～第 3 回水質調査において一部の結果の分析精度が十分に得られないという問題が生じた（詳細は 2.4.8 節に記載）。同一試料を複数のラボで分析したが、ラボ間での結果のばらつきが大きく、ミャンマーでは信頼性の高いラボを特定することができなかった。

第 2 年次の第 4 回・第 5 回調査では第 1 年次の教訓を生かし、C/P と協議した上で、BOD と大腸菌群を除く測定項目を日本で認証されたラボに委託することとした。一方で、サンプルの保存可能期間が短い BOD と大腸菌群用の分析はヤンゴンのラボに委託した。

2.4.2　河川の水文、潮位、水利用、状況に関する情報収集（活動 2-2）

モニタリング計画を策定するために、対象流域に関する気候、水文、汚染源及びその他の特性に関する情報を収集した。

(1) Hlaing 川流域

収集した情報を表 2.4-2 に要約する。Hlaing 川はヤンゴン市の西部を流れ、Pan Hlaing 川と合流し、ヤンゴン川として Andaman 海に流れている。Hlaing 川に関して既存の文献から得られる情報は限られており、感潮域の空間及び時間的変動の詳細は明らかになっていなかった。都市部を流れる Hlaing 川沿岸の主な水質汚染源は、生活排水及び工場排水であるとみられ、両岸には複数の工業団地が立地しており、工場からの排水流出先となっている水路では水質が悪化している。しかしながら、プロジェクト開始時点において Hlaing 川への水質への影響は明らかになっていなかった。

表 2.4-2　Hlaing 川流域の水質調査に関する収集情報

Category		Summary
Meteorology		- The highest precipitation (approx. 600 mm/month) is observed in July while it hardly rains in the dry season especially from Nov. to Mar. (JICA, Final Report of The Project for the Strategic Urban Development Plan of the Greater Yangon, 2013)
Hydrology	River information	- The water level data of Hlaing River was unavailable.
	Tidal information	- Lately the tide has not been observed by Myanmar Port Authority (MPA). The available historical data at Yangon Port up to 1936 showed that the highest high water level (HHWL) was at +6.74 m and mean water level (MWL) was at +3.121 m in Yangon River at Yangon Port Station. (JICA, Final Report of The Project for the Strategic Urban Development Plan of the Greater Yangon, 2013) - The saltwater intrusion has been observed along the Hlaing River; however the spatial distribution of brackish water and its fluctuation are unknown.
Pollution Source		- Several industrial zones (IZs), including Shwe Pyi Thar IZ, Shwe Linban IZ and Hlaing Tharyar IZ, are located along the river. The effluent from factories such as battery, alcohol, and seafood factories, seems to deteriorate the surface water quality in drainage channels. Domestic sewage is also directly discharged to the Hlaing River. The detailed information on factories was collected in Output 3 (Database). - The upstream and rural area of Hlaing River receive agricultural wastewater.
Past water quality data		- In total 10 river water samples and 20 wastewater samples were analyzed in 2013 for 11 analytical parameters. The level of COD was not high, and varied from 9 to 25 mg/L. (University of Public Health and YCDC, Water quality assessment of Hlaing River Near Industrial Zone, Yangon, 2013) - It seems the wastewaters from factories flow into the channels and its adverse effect on water quality is obvious. However, concentrations of many pollutants as well as their main sources are not clear.
Water use		- YCDC plans to construct a water intake facility and water treatment plant in Kokkowa upstream of the Hlaing River to distribute drinking water to Yangon City. - YCDC is seeking the possibility of taking water from the Hlaing River to Hlawga Lake, which is one of the important water intake points for urban water supply, in order to restore the water storage in dry season. - The Hlaing River serves for flood control, river transportation and fisheries.

Source: JET

(2) Doke Hta Waddy 川流域

収集した情報を表 2.4-3 に要約する。Doke Hta Waddy 川はマンダレー市の南部を流れ、エーヤワディー川と合流する。Pyi Gyi Tagon タウンシップには、3 区域に分かれる大型工業団地が立地し、この工業団地からの排水は、南側の Doke Hta Waddy 川及び西側の Taung Tha Man 湖に流出している。南方へ流れる工場排水は 2016 年以降、直径 10 インチのパイプラインを経由して Doke Hta Waddy 川に直接放流されている。なお、放流地点の上流では、MCDC が将来、上水の取水施設を建設する計画を進めている。一方で、工場排水及び下水による汚濁負荷は、当該工場団地の西部に位置する Taung Tha Man 湖の水質に影響を及ぼしている。Taung Tha Man 湖は古都 Amarapura

の観光地として有名であり、漁業資源にも恵まれている。しかしながら、2015 年 4 月～5 月及び 9 月～10 月に、工場排水を原因とすると推測される大量の魚の斃死事故が発生し、MCDC の WSD は湖及び周辺水路の水質モニタリングを開始した。

表 2.4-3　Doke Hta Waddy 川流域の水質調査に関する収集情報

Category	Summary
Meteorology	- High precipitation (more than 100 mm/month) is observed in the rainy season from May to October while it hardly rains in the dry season especially from Dec. to Mar. (www.weather-and-climate.com)
Hydrology	- The river water level in the Ayeyarwady River varied from 3.6 m to 11.5 m in 2014. According to the 13-year monitoring data available from MCDC, the minimum river water level is observed in May, June, or December and the maximum level is in July, August, or September. - The monthly-average water level at Myintge Bridge of the Doke Hta Waddy River is relatively high from July to October and low from December to May (Department of Meteorology and Hydrology, 2005-2016)
Pollution Source	- The wastewater from the industrial zone in Pyi Gyi Tagon Township is discharged to Doke Hta Waddy River basin through the 12,000 feet and 10-inch-diameter pipeline. The pipeline has been constructed to reduce the pollution load in Pa Yan Taw Creek and intend to be connected to the wastewater treatment plant under construction. - The surrounding factories are allowed to discharge wastewater only at night time. - The detailed information on factories was collected in Output 3 (Database).
Past Water Quality Data	- WSD-MCDC has been monitoring water quality of Doke Hta Waddy River weekly as a potential source of supplied water (e.g., BOD varies from 3.5 to 5.3) (MCDC, from Mar. 2014 to Mar. 2015) - The water temperature, pH, color, DO, BOD and COD in Taung Tha Man Lake and a connected channel have been monitored by WSD-MCDC. Concentrations of COD (48 mg/L - more than 150 mg/L) and BOD (19 – 98 mg/L) are rather high. (MCDC, Oct. 2015) - Many dead fishes were found on the coastline of north Taung Tha Man Lake in April and September 2015, and it was suspected that it was caused by low level of oxygen and pollution load from factories. - Some data of wastewater quality discharged from factories have been collected. - Water quality of Ayeyarwaddy River is monitored by the Ministry of Transport and Communications.
Water Use	- MCDC plans to use the Doke Hta Waddy River as an additional source of supplied water in the near future. - The upstream of Doke Hta Waddy River has been used for hydropower plant. - The other key uses are irrigation, flood control and artisanal fisheries.
Category	**Summary**
Meteorology	- High precipitation (more than 100 mm/month) is observed in the rainy season from May to October while it hardly rains in the dry season especially from Dec. to Mar. (www.weather-and-climate.com)
Hydrology	- The river water level in the Ayeyarwady River varied from 3.6 m to 11.5 m in 2014. According to the 13-year monitoring data available from MCDC, the minimum river water level is observed in May, June, or December and the maximum level is in July, August, or September. - The monthly-average water level at Myintge Bridge of the Doke Hta Waddy River is relatively high from July to October and low from December to May (Department of Meteorology and Hydrology, 2005-2016)
Pollution Source	- The wastewater from the industrial zone in Pyi Gyi Tagon Township is discharged to Doke Hta Waddy River basin through the 12,000 feet and 10-inch-diameter pipeline. The pipeline has been constructed to reduce the pollution load in Pa Yan Taw Creek and intend to be connected to the wastewater treatment plant under construction. - The surrounding factories are allowed to discharge wastewater only at night time. - The detailed information on factories was collected in Output 3 (Database).
Past Water Quality Data	- WSD-MCDC has been monitoring water quality of Doke Hta Waddy River weekly as a potential source of supplied water (e.g., BOD varies from 3.5 to 5.3) (MCDC, from Mar. 2014 to Mar. 2015) - The water temperature, pH, color, DO, BOD and COD in Taung Tha Man Lake and a connected channel have been monitored by WSD-MCDC. Concentrations of COD

	(48 mg/L - more than 150 mg/L) and BOD (19 – 98 mg/L) are rather high. (MCDC, Oct. 2015) - Many dead fishes were found on the coastline of north Taung Tha Man Lake in April and September 2015, and it was suspected that it was caused by low level of oxygen and pollution load from factories. - Some data of wastewater quality discharged from factories have been collected. - Water quality of Ayeyarwaddy River is monitored by the Ministry of Transportation.
Water Use	- MCDC plans to use the Doke Hta Waddy River as an additional source of supplied water in the near future. - The upstream of Doke Hta Waddy River has been used for hydropower plant. - The other key uses are irrigation, flood control and artisanal fisheries.

Source: JET

2.4.3 水質調査に係る選定項目の設定（活動 2-3）

成果 2 のパイロット調査の主な目的は対象流域の汚染状況を確認し、工場排水による Hlaing 川及び Doke Hta Waddy 川への影響を把握することである。サンプリング地点、時間、測定項目等の選定基準は下表に示す通りである。これらは、第 1 回調査前に策定され、各回の調査結果や最新の現場状況を反映しながら最適化された。

表 2.4-4 サンプリング地点、時間、測定項目の選定基準

Item	Important Points to Consider	Criteria for Selection	
		Hlaing River Basin	Doke Hta Waddy River Basin
Sampling Point	Locations of pollution sources, water usage, change in water quality and flow rate etc.	- Pollution control point: major routes of pollution (e.g., channels from factories) and downstream locations in the river after sufficient mixing of wastewater and river water - Water usage control point: upstream of (future) water intake - Baseline point: upstream and downstream of confluent point, as well as the lowest point in the watershed	
Sampling Time/ Frequency	Seasonal fluctuation (e.g., rainy /dry season), tidal fluctuation, other characteristics	- Precipitation and river discharge: dry and rainy seasons - Tide: basically, at the time of spring tide and ebb tide in tidal area - Stability of water quality: on a day after several days of good weather (dry season)	- Precipitation and river discharge: dry and rainy seasons - Stability of water quality: on a day after several days of good weather (dry season)
Parameters	Parameters to characterize river waters and industrial wastewaters	- Relevant standards: Key parameters to monitor river water quality with reference to Japanese environmental standard, which will be replaced with the Myanmar Environmental Quality Standard after it is specified in the future. - Pollution sources: Discharge standard and main pollutants in the effluent In addition, existing water quality data, analytical capacity of laboratory, and other factors also shall be considered.	

Source: JET

2.4.4 水質調査計画の策定（活動 2-4）

策定された水質調査計画を下表に示す。計画の原案は 2.4.3 に示した選定基準に従って 2015 年下旬に作成された。その後、現場の状況や既往の調査結果に応じて微修正・最適化された。

表 2.4-5 Hlaing 川流域における水質調査計画の概要

Item	Contents
Sampling Point	- Hlaing River: 3 – 5 points, depending on the survey time - Channels in Shwe Pyi Thar IZ: 3 points - Channels in Hlaing Tharyar IZ: 0 – 2 points, depending on the survey time - Pan Hlaing River: 2 points - Kokkowa River: 0 – 1 point, depending on the survey time
Sampling Time	[Season] - 1st survey: dry season in 2016 - 2nd survey: rainy season in 2016 - 3rd survey: dry season in 2017 - 4th survey: rainy season in 2017 - 5th survey: dry season in 2018 [Time]

Item	Contents
	- At the time of ebb tide near spring-tide day as much as possible
Measurement Parameters	[All points] - pH, EC, DO, TDS, salinity, turbidity, water temperature, ORP [Basic points] - Flow rate (if available), TSS, BOD, COD, oil and grease, total coliform [Representative points] - Total phosphorus, total nitrogen, cyanide, phenols, zinc, total chromium, hexavalent chromium, arsenic, total mercury, cadmium, and lead - Color, odor, iron and manganese in the 1st survey - Copper, phosphate, ammonia nitrogen, nitrate nitrogen and nitrite nitrogen in the 1st – 3rd surveys [Only one or two points] - Pesticides* and PCB

* Total organic chlorine pesticides and total organic phosphorus pesticides for 2nd and 3rd surveys

* Aldrin, atrazine, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endosulfan, endosulfan sulfate, endrin, HCH-alpha (benzene hexachloride-alpha), HCH-beta, HCH-delta, HCH-gamma(Lindane), alachlor, diazinon, chlorpyrifos, dimethoate and imidacloprid for 4th and 5th surveys

Source: JET

表 2.4-6　Doke Hta Waddy 川流域における水質調査計画の概要

Item	Contents
Sampling Point	- Doke Hta Waddy River: 3 – 4 points, depending on the survey time - Wastewater pipeline discharging to Doke Hta Waddy: 1 point - Taung Tha Man Lake: 2 – 3 points - Flow path to Taung Tha Man Lake :4 – 7 points depending on the survey time - Ayeyarwaddy River: 0 – 1 point, depending on the survey time - Shwe Kyin Creek: 0 – 1 point, depending on the survey time
Sampling Time	- 1st survey: dry season in 2016 - 2nd survey: rainy season in 2016 - 3rd survey: dry season in 2017 - 4th survey: rainy season in 2017 - 5th survey: dry season in 2018
Measurement Parameters	[All points] - pH, EC, DO, TDS, salinity, turbidity, water temperature, ORP [Basic points] - Flow rate (if available), TSS, BOD, COD, oil and grease, total coliform [Representative points] - Total phosphorus, total nitrogen, cyanide, phenols, zinc, total chromium, hexavalent chromium, arsenic, total mercury, cadmium, and lead - Color, odor, iron and manganese in the 1st survey - Copper phosphate, ammonia nitrogen, nitrate nitrogen and nitrite nitrogen in the 1st – 3rd surveys [Only one or two points] - Pesticides* and PCB

* Total organic chlorine pesticides and total organic phosphorus pesticides for 2nd and 3rd surveys

* Aldrin, atrazine, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endosulfan, endosulfan sulfate, endrin, HCH-alpha (benzene hexachloride-alpha), HCH-beta, HCH-delta, HCH-gamma(Lindane), alachlor, diazinon, chlorpyrifos, dimethoate and imidacloprid for 4th and 5th surveys

Source: JET

2.4.5　水質調査マニュアルの策定（活動 2-5）

C/P 機関による水質調査の質および信頼性を向上することを目的として、水質調査マニュアルを作成した。同マニュアルには、サンプリング計画、機器の校正、サンプリングおよび現地測定、サンプルの保存、分析データの確認、レポートの作成方法等が含まれている。

2.4.6　水質調査の実施（活動 2-6）

全 5 回の水質調査は、C/P 機関および JET の監督のもと、ローカルコンサルタントが実施した。下記の調査日程に示す通り、毎年、雨期・乾期に各 1 回ずつ採水を行った。

表 2.4-7 Hlaing 川流域における水質調査日程

Survey	Sampling Period	Note
First water quality survey	21-23 Feb 2016	-
Second water quality survey	20 and 21 Jun 2016	-
Third water quality survey	30 Jan–1 Feb 2017	-
Fourth water quality survey	18-20 Sep 2017	It rained heavily in the afternoon of 19 Sep.
Fifth water quality survey	19–21 Feb 2018	-

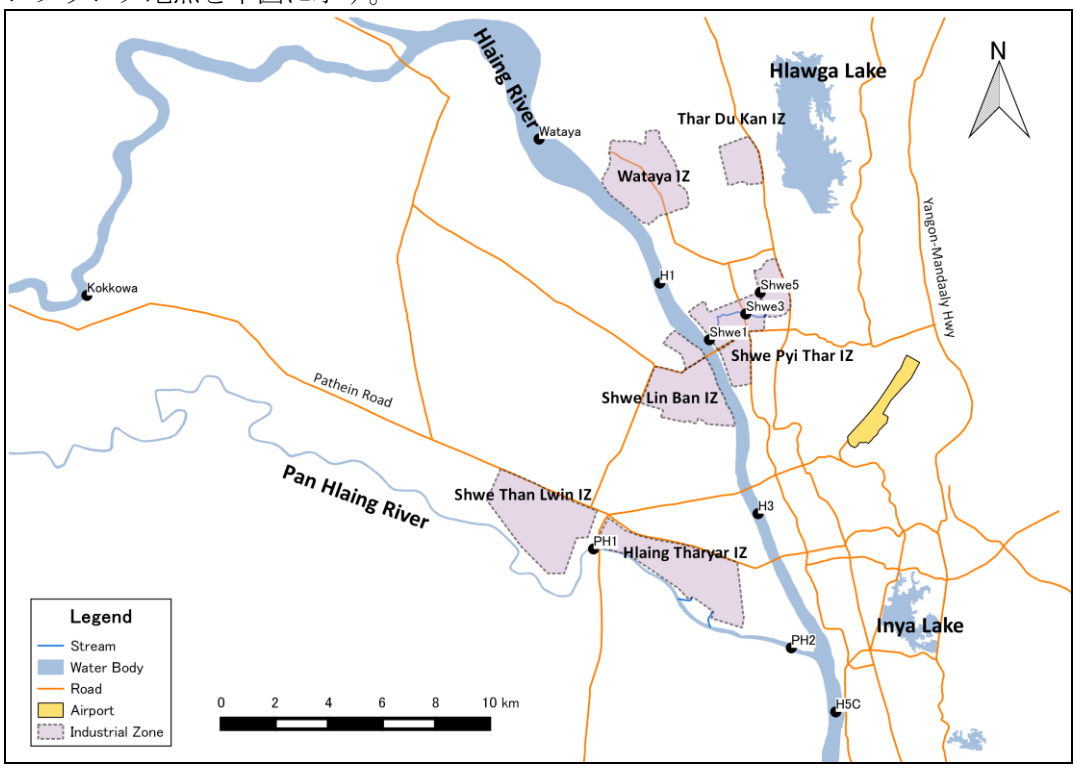
Source: JET

表 2.4-8 Doke Hta Waddy 川流域における水質調査日程

Survey	Sampling Period	Note
First water quality survey	17, 18 and 25(re-sampling) Feb 2016	Since the survey team found the sample volume was not enough for analysis after the survey, they went to the site again to retake the samples on 25 Feb.
Second water quality survey	20 and 21 Jun 2016	The samples of Doke Hta Waddy River were taken at night time.
Third water quality survey	30 Jan–1 Feb 2017	-
Fourth water quality survey	25 and 26 Sep 2017	-
Fifth water quality survey	26–27 Feb 2018	-

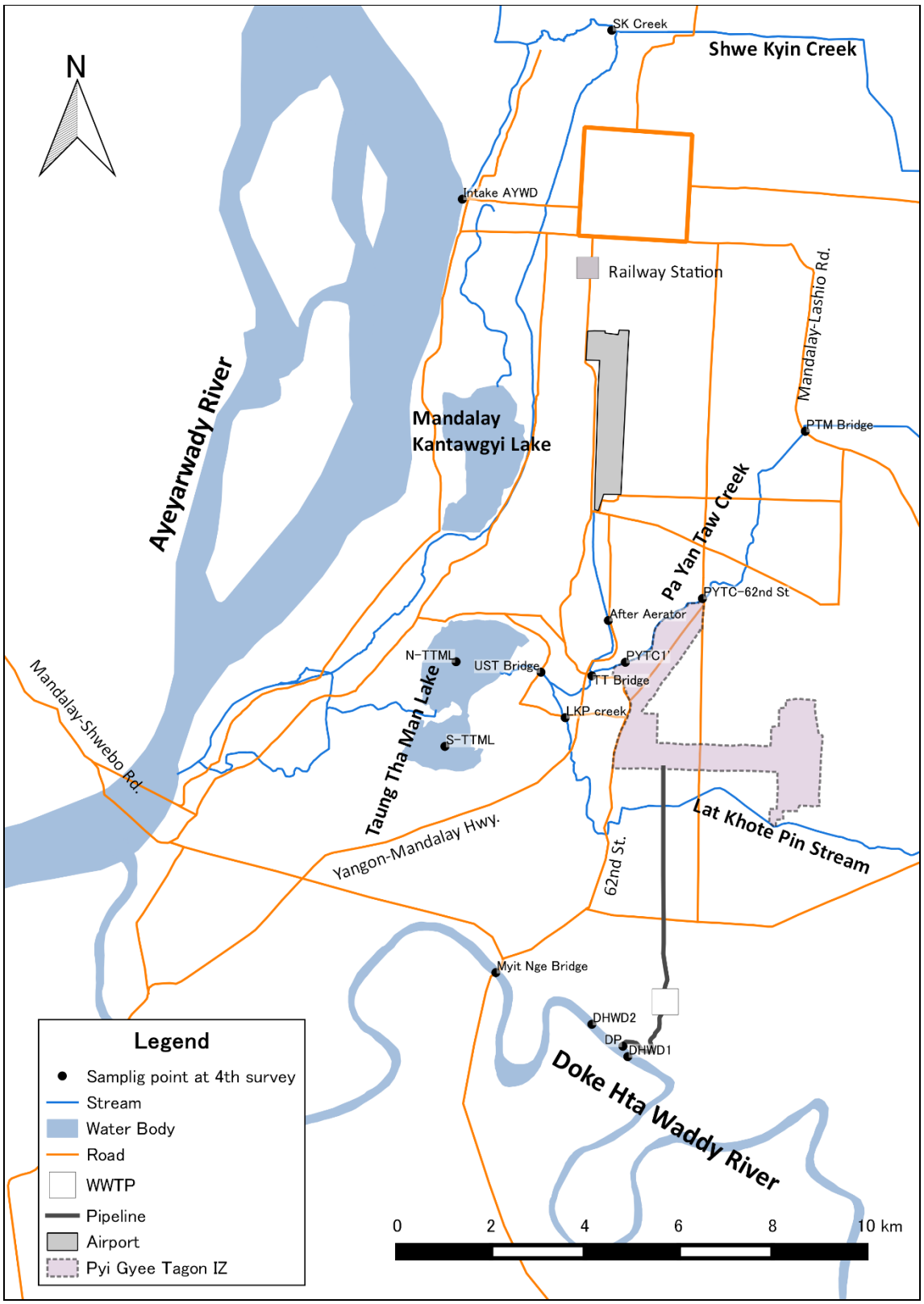
Source: JET

サンプリング地点を下図に示す。



Source: JET

図 2.4-1 主要なサンプリング地点（Hlaing 川流域）



Source: JET

図 2.4-2　主要なサンプリング地点（Doke Hta Waddy 川流域）

2.4.7　水質調査マニュアルを参考にサンプリング作業の確認（活動 2-7）

ヤンゴンの現場作業は、ECD ヤンゴン、PCCD-YCDC 及び WSD-YCDC が監督し、マンダレーの現場作業は、ECD マンダレー及び WSD-MCDC が監督した。（図 2.4-3 参照)。現場での指導・監督内容には、採水、現場での水質測定、サンプル保存及び流量観測の手順や野帳の記録方法を含む。

サンプルは、外注先のラボのほか、C/P 機関のラボ（WSD-YCDC の上水試験所及び下水試験所、WSD-MCDC のラボ）でも分析された。

Water Sampling in Yangon

Sample Preservation in Yangon

On-site Water Quality Measurement in Mandalay

Water Flow Measurement in Mandalay

Source: JET

図 2.4-3　水質調査の状況写真

2.4.8　水質調査マニュアルを参考にした水質調査結果の検証（活動 2-8）

水質調査マニュアルの内容に従い、水質調査結果の妥当性を C/P 機関の技術スタッフと共に確認した。チェック内容には、基準値、過去の調査結果、他の関連するパラメーターの結果との比較、品質管理サンプルを用いた分析精度の確認、他のラボの結果とのクロスチェックが含まれる。これらの検証の結果、第 1 回～第 3 回調査の分析精度は十分ではないと判断された。これは、複数の 2 重分析（同一試料を 2 つ用意し、同じ手順で分析した結果を比較することで精度を確認する）結果において 20%を超える差を示したことからも明らかである。また、COD、BOD、カドミウム、鉛といった幾つかの項目の測定結果は、真の値よりも高い可能性が指摘された。これらの技術的課題はいずれ克服されるべきものであるが、このような検証及び精度の改善を行う過程において、ミャンマーの水質分析の現状における以下の重要な知見を得ることができたことは有益である。

- ラボによって異なる分析法（簡易分析法や独自の分析法を含む）を用いていることが、ラボによる分析結果の大きなばらつきを生じさせる一因となっている。国際的に認定された分析

法や信頼性のある分析法を適用しているラボは少なく、そのような方法が適用されている分析項目も一部に限られる。ミャンマーでの環境水質分析の公定法の設定が求められる。

- 一部のラボでは、従うべき分析法の手順や条件を遵守していない。分析方法の理解不足、不十分な分析スキル、試薬や器具の入手が困難であること等が理由として挙げられる。分析室内部の適切なデータマネジメント、技能試験やラボ間クロスチェックの実施や ISO17025 に代表されるラボの認証システムの確立といった広範の QA/QC（品質保証・品質管理）体制を整備することが重要である。

第 1 年次（2015 年 6 月～2017 年 4 月）ではデータの質を向上する工夫を重ねたにも関わらず、妥当性の高い結果を得ることが困難であった。第 2 年次にて 2.3.2 に上述した通りラボの選定方法を改善した結果、第 4 回・第 5 回調査ではデータの精度を向上することができた。これらの背景から、本調査では第 4 回・第 5 回調査の結果を主に評価し、第 1 回～第 3 回の結果は参照データとして用いることとした。

加えて、WSD-YCDC の上水試験所及び WSD-MCDC の上下水試験所を対象として、水質分析の能力・技術の向上を目的とした OJT を実施した。YCDC の上水試験所では窒素分析のクロスチェックを行い、MCDC のラボでは、COD 分析方法の確認と BOD 分析方法のアップグレードを指導した。

2.4.9 水質調査報告書 (Water Quality Survey Report)の作成（活動 2-9）

(1) 水質調査結果

ミャンマーでは水質の環境基準がまだ制定されていないため、水質の評価にあたっては対象とされた水域の種類と水利用に応じて、ミャンマー・近隣国・日本のいくつかの参考基準・ガイドライン値を参照した。主なものとして、i) 表流水の水質に関するベトナム国家技術規定(QCVN 08, 2015)、ii) 日本の湖沼の水質汚濁に係る環境基準（環境庁告示 59 号、2016 年改正）、iii) 国家飲料水質ガイドライン案（MOHS、2014）、国家環境質（排出）ガイドライン（MONREC、2015）が挙げられる。これまでの調査結果に基づく各対象流域の水質の概要を以下に示す。

1) Hlaing 川流域の水質調査結果

Hling 川流域の水質の概況を以下に示す。

a) Hlaing 川と Pan Hlaing 川の汚染レベル

- 雨期（2017 年 9 月）の Hlaing 川及び Pan Hlaing 川の水質は、浮遊物質量（TSS）及び大腸菌群を除いて水生生物の保全、灌漑、水運に適した水質レベル（ベトナム表流水質ガイドライン値）を満たした。乾期（2018 年 2 月）では水質が悪化し、複数の地点で高濃度の COD が、また全採水地点でオイル&グリースが検出された。上述の TSS、大腸菌群及びオイル&グリースを除くと、灌漑及び水運に適した水質レベルを示した地点は Hlaing 川の上流域（Shwe Pyi Thar 橋の上流）のみである。2018 年 2 月時点の Pan Hlang 川の中流（Hlaing 橋上流）は、河川水が非常に懸濁しており、低濃度の DO、高濃度の BOD 及び COD 値が観測された。これは、潮流による底泥の巻き上げその他の影響と思われる。BOD 及び COD の結果は、表 2.4-9 に示す。
- これら河川において、人の健康に影響を及ぼすレベルの有害物質は観測されなかった。微量(0.058mg/L)の鉛が 2018 年 2 月に Pan Hlaing 川の下流で検出されたが、底泥に含まれる自然由来の重金属だと考えられる。

表 2.4-9　Hlaing 川流域の BOD と COD レベルの分類

Unit: mg/L

Target		BOD						COD					
		Rainy Season(Sep 2017)			Dry Season(Feb 2018)			Rainy Season(Sep 2017)			Dry Season(Feb 2018)		
		Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
River	Hlaing River	1.2	2.3	1.6	2.4	3.7	3.0	10	14	12	20	71	44
	Pan Hlaing River	0.7	1.6	1.1	3.8	44.6	24.2	12	14	13	63	3400	1732
	Kokkowa River	3.7			5.7			8.3			5.2		
Creek	Creek in Shwe Pyi Tar IZ	5.4	32	14	134	268	222	19	44	28	230	5700	3610

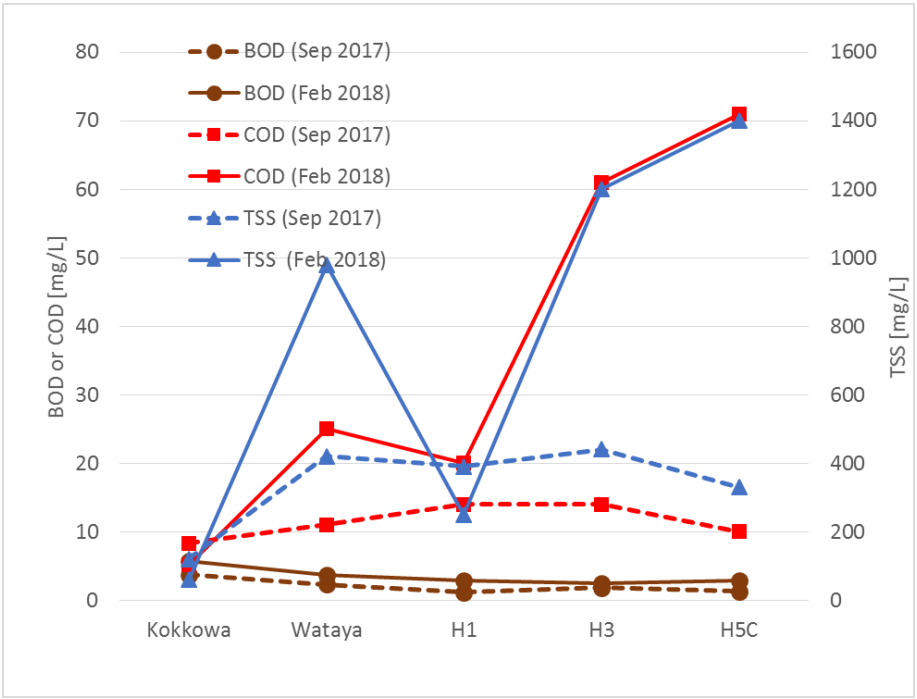
Vietnamese Environmental Standard(QCVN08:2015) for reference

Water Usage		BOD	COD
A1	For domestic water supply	4	10
A2	For domestic water supply with treatment and conservation of aquatic lives	6	15
B1	For irrigation	15	30
B2	For water transportation and other purposes with demand for low-quality water	25	50
Less than B2		>25	>50

Source: JET

b) Hlaing 川における汚染の分布：上流から下流にかけての水質変化

- Hlaing 川では、流下方向の明確な水質低下は確認できなかった。（図 2.4-4 参照）
- 乾期の BOD 値は地点間で大きな差がなかったものの、COD 値は上流から下流にかけて増加した。下流域の乾期の高い COD は、河川水に含まれる懸濁物質由来であると示唆される。
- Hlaing 川における表流水の水質の平面分布と経時変化を把握するためには、より多くのモニタリングデータが必要である。

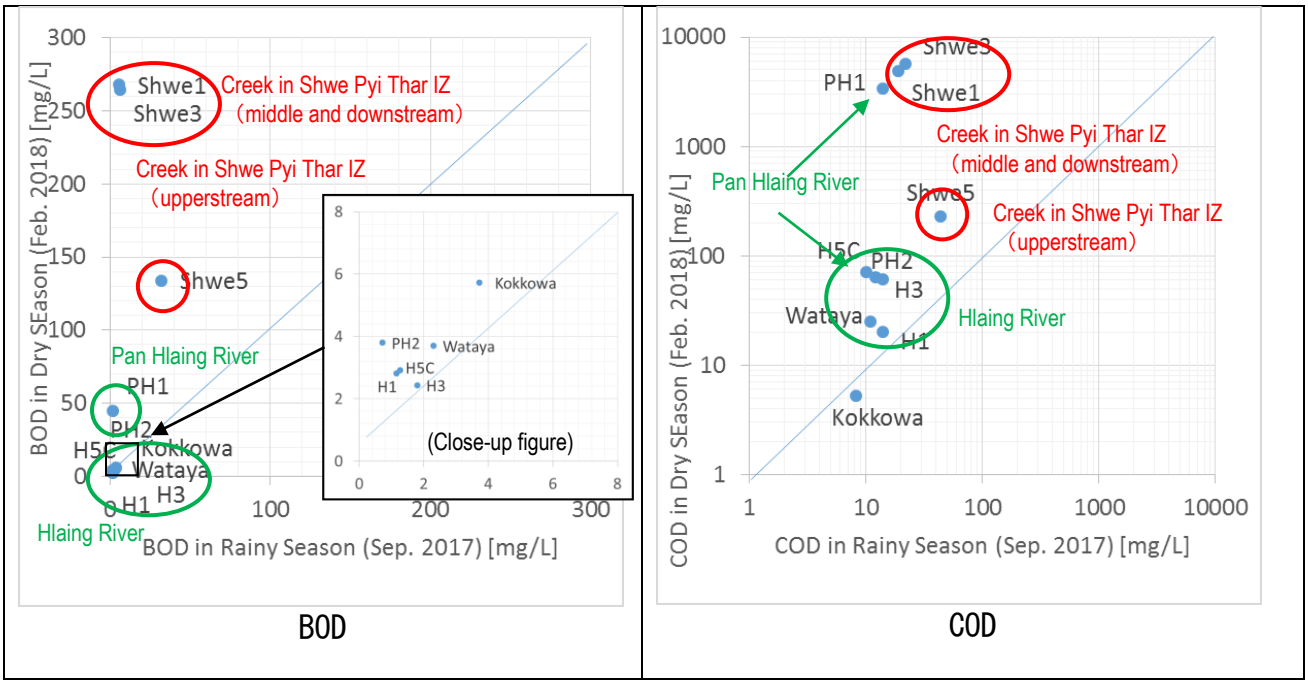


Source: JET

図 2.4-4　Hlaing 川流域における水質の状況（第 4 回調査、BOD）

c) 水質の季節変動

乾期の汚染物質濃度は、ほとんどの地点及びほとんどの項目について、雨期よりも高かった。代表的な結果として、BOD 及び COD のデータを図 2.4-5 に示す。本図から、雨期は雨水によるこれら汚染物質の希釈効果が大きく、河川への汚染インパクトを緩和していることがわかる。一方、乾期は流域における工場排水及び家庭排水の汚染インパクトが大きくなり、Hlaing 川では望ましい水質を維持することが難しくなっているといえる。



Source: JET

図 2.4-5 雨期と乾期の水質変化（Hlaing 川流域）

d) 工業地帯からの汚染の影響

- Shwe Phy Thar 工業地帯から Hlaing 川に流れる水路の水質は、2017 年 2 月までの過去の調査回においては、低い DO、高濃度の COD、BOD、オイル&グリース、栄養塩その他に表されるように、排水の流入のために著しく悪化していた。
- 2017 年 9 月調査時に水質は改善していた。水路沿いの蒸留酒工場の運転が一時停止されたことが理由と思われる。ヤンゴン管区政府は、2017 年 7 月・9 月に 6 件の蒸留酒工場の運転を停止していた。しかしながら、蒸留酒工場から新しくパイプラインが敷設された後、水路の水質は再び悪化した。（図 2.4-6 参照）
- 当該水路の水質は、これら工場の排水の影響に依存しているとみられる。これら汚染源からの排水の影響のモニタリングを継続し、工場の運転状況や排水処理施設の稼働状況に応じて水質が改善するか、または悪化するかを注視することが重要である。
- 概況として、局所的な汚染の影響は懸念されるものの、Hlaing 川はこれら水路から流入する排水を十分に希釈するだけの水量があり、Hlaing 川への汚染の影響は高くはないといえる。

Pollution plume from a pipeline discharging the wastewater in the creek in Shwe Pyi Tar IZ(downstream of Shwe-3)

Brown-colored water flow in the creek to Hlaing River (downstream of Shwe-1)

Source: JET

図 2.4-6　Shwe Pyi Tar IZ の水路における汚染プルーム

e) Kokkowa 川及び Wataya 地点における水道の取水のための水質

- Kokkowa と Wataya のサンプリング地点は、将来のヤンゴン市内への水道の取水の可能性のある地点として調査された。Hlaing 川の上流にあたる Kokkowa 川の沿岸には、浄水施設が建設予定である。また、WSD-YCDC は、乾期の Hlawga 湖の水位低下の対応策として、Hlaing 川から Hlawga 湖に給水できないかどうか検討している。結果から判断するに、Kokkowa と Wataya の水質は、ろ過や通常の浄水方法を備えた水道の供給に対応できる可能性があるといえる。本調査の測定項目のなかでは、2017 年 9 月・2018 年 2 月の両地点における濁度、2018 年 2 月の Wataya 地点における全クロム及び鉛を除き、国家飲料水ガイドライン値（MOHS、2014）を満足していた（表 2.4-10 参照）。クロムと鉛の濃度は高くなく、懸濁物質に含まれる自然由来の重金属であると推定されるものの、上水処理の過程における挙動については確認する必要がある。
- 農薬は、2017 年 9 月及び 2018 年 2 月の両調査において検出されなかったものの、農繁期を含む他の季節に調査をする必要がある。
- Wataya 周辺の Hlaing 川沿岸には、潜在的な汚染源が複数存在する。水試料は大潮の順流時に採取された。しかしながら、汚染レベルは農繁期、干潮後の逆流時に変動する可能性がある。年間にわたって、潮位周期を考慮した日変動や大潮・小潮間の変動を連続観測することが重要である。
- なお、本調査は、成果 2 の環境調査の一環として実施されたものであり、飲料水その他の目的における安全性を保証するものではない。測定項目は限られており、全てのガイドライン項目を網羅していない。従って、日変動や大潮・小潮間の潮汐サイクルを含めて、広範な項目の水質を年間にわたって、継続的に調査することが重要である。

表 2.4-10 Hlaing 川流域の水道取水計画のための飲料水質基準案との比較

Parameter	Unit	Kokkowa		Wataya		MOH Draft National Drinking Water Quality Std(2014)
		Sep 2017	Feb 2018	Sep 2017	Feb 2018	
pH	-	7.89	8.35	7.61	8.21	6.5 - 8.5
Turbidity	NTU	545	169	618	>1000	5
TDS	mg/L	66	140	81	156	1000
Cyanide(total)	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	0.07
Zinc (Zn)	mg/L	0.029	0.014	0.054	0.13	3
Total chromium (T-Cr)	mg/L	0.019	0.010	0.048	0.11	0.05
Arsenic (As)	mg/L	0.0016	0.0015	0.0026	0.011	0.05
Copper (Cu)	mg/L	0.010	0.0054	0.017	0.045	2
Total Mercury (Hg)	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.001
Cadmium (Cd)	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	0.003
Lead (Pb)	mg/L	< 0.005	< 0.005	0.0097	0.024	0.01
Pesticides (total 17 paramete	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	Specified for some parameters respectively

: Satisfied with reference standard
: Not satisfied with reference standard

Source: JET

2) Doke Hta Waddy 川流域の水質調査結果

Doke Hta Waddy 川の水質の概況を以下に示す。

a) 工場排水から Doke Hta Waddy 川への汚染の影響

- Doke Hta Waddy 川は、ろ過及び通常の浄水方法を備えた水道水の供給にとって適切な水質であるといえる。有機汚染のレベルは高くなく、高濃度の有害物質も検出されなかった。季節や地点ごとの水質変動は大きくないとみられる。表 2.4-11 は BOD と COD の結果を示し、表 2.4-は将来の取水地点の飲料水質ガイドライン値と比較した水質を示す。
- 2017 年 2 月の第 3 回水質調査まで、10 インチパイプラインからの排水は、有機汚濁及び栄養塩類に加え、オイル&グリース、フェノール類、六価クロムなど高濃度の汚染物質を含んでいた。これらの濃度は、排水に適用されるガイドライン値（環境質（排出）ガイドラインにおける一般適用条項、2015）よりも高かった。ただし、この 10 インチパイプラインからの排水の、Doke Hta Waddy 川の水質に対する汚染影響は、局地的な汚染及び排出地点近傍の周辺住民に対する悪臭といった負の影響は紛れもないものの、河川の希釈効果のために限定的であった。
- 2017 年 6 月-8 月以降にマンダレー管区政府及び MCDC の指導により Phy Gyi Tagon 工業地帯の蒸留酒工場が一時的に操業停止となった後、10 インチパイプラインからの汚染負荷は低減したとみられる。しかしながら、パイプラインの排水地点からはいまだにオイル&グリースやフェノール類が流出している。
- 乾期の汚染物質の濃度は、Hlaing 川の傾向と同様にほとんどの採水地点のほとんどの項目について、雨期の濃度よりも高かった（図 2.4-7）。この結果は、雨期にはより多くの有機物質が上流から土壌と共に河川に流出することを示唆する。ただし、河川の希釈効果のために有機汚濁濃度は乾期よりも低い。

表 2.4-11　Doke Hta Waddy 川流域における BOD と COD レベルの分類

Unit: mg/L

Target		BOD						COD					
		Rainy Season(Sep 2017)			Dry Season(Feb 2018)			Rainy Season(Sep 2017)			Dry Season(Feb 2018)		
		Min	Max	Average	Min	Max	Average	Min	Max	Average	Min	Max	Average
River	Doke Hta Waddy River	1.1	5.4	3.7	4.7	5.7	5.0	4.2	6	5.2	2.8	5.2	3.6
	Ayeyarwaddy River	5.4			4.7			11			4.4		
Lake	Taung Tha Man Lake	5.4	6.0	5.7	23	357	190	28	28	28	130	280	205
Creek	Inflow to Taung Tha Man Lake (LKP Stream, UST Bridge, Pa Yan Taw Creek, Columbo Creek)	2.3	6.6	4.4	9.8	354	206	14	70	32	21	540	209

Vietnamese Environmental Standard(QCVN08:2015) for reference

Water Usage		BOD	COD
A1	For domestic water supply	4	10
A2	For domestic water supply with treatment and conservation of aquatic lives	6	15
B1	For irrigation	15	30
B2	For water transportation and other purposes with demand for low-quality water	25	50
Less than B2		>25	>50

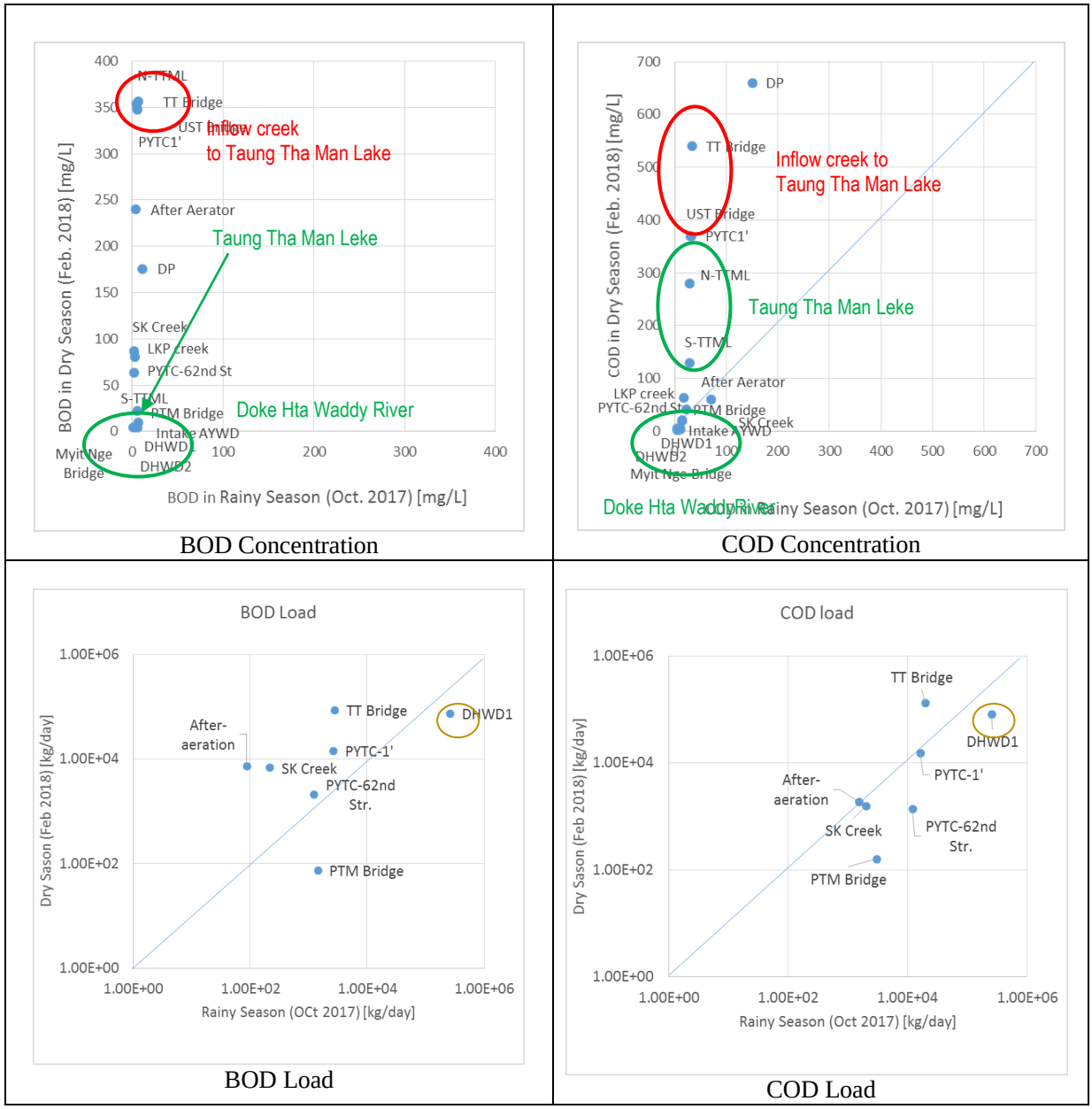
Source: JET

表 2.4-12　既存/将来の家庭用水道水質と飲料水質基準との比較（Doke Hta Waddy 川流域）

Location Name	Unit	DHWD1		Intake AYWD		MOH Draft National Drinking Water Quality Std(2014)
		Sep 2017	Feb 2018	Sep 2017	Feb 2018	
pH	-	8.40	8.15	7.88	8.06	6.5 - 8.5
Turbidity	NTU	39.5	9.5	74.1	80	5
TDS	mg/L	160	0.245	133	0.101	1000
Cyanide(total)	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	0.07
Zinc (Zn)	mg/L	0.0081	< 0.005	0.0087	0.0078	3
Total chromium (T-Cr)	mg/L	0.0058	< 0.005	0.0056	< 0.005	0.05
Arsenic (As)	mg/L	0.0016	0.0023	0.0017	0.0013	0.05
Copper (Cu)	mg/L	< 0.005	< 0.005	< 0.005	0.014	2
Total Mercury (Hg)	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.001
Cadmium (Cd)	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	0.003
Lead (Pb)	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	0.01
Pesticides	mg/L		-	< 0.0005	< 0.0005	Specified for some parameters respectively

: Satisfied with reference standard
: Not satisfied with reference standard

Source: JET



Source: JET

図 2.4-7 雨期と下記の水質と汚染負荷量お比較（Doke Hta Waddy 川流域）

b) Taung Tha Man 湖の汚染レベル

- Taung Tha Man 湖の水質は、リンや窒素濃度が高く、富栄養化状態であるといえる。一般的な富栄養化の目安（USEPA、栄養塩基準に関する技術指針アニュアル、2000）とされる全りん 0.01 mg/L、全窒素 0.15 mg/L よりも濃度が高く、低い DO 濃度、高い COD 濃度や pH によっても富栄養化が暗示されている。
- 全体として、湖の水質は、雨期と比較すると乾期に著しく悪化した（表 2.4-及び図 2.4-8）。2018 年 2 月の北湖の栄養塩レベルは非常に高い(全りん 4.3mg/L、全窒素 25mg/L)。この時期の湖の水位は非常に低く、水域は閉鎖性状態であったことから、流入する栄養塩は湖に蓄積する。このような状況下で藻類や植物性プランクトンは増加し、有機物の内部生産により富栄養化は更に進行する。湖は過富栄養化状態であるといえる。しかしながら、当該水域にお

ける富栄養化のメカニズムは複雑で明らかではない。湖の水質は経時的に大きく変動しているため、湖の汚染メカニズムを調査するためにはより多くの調査データが必要である。

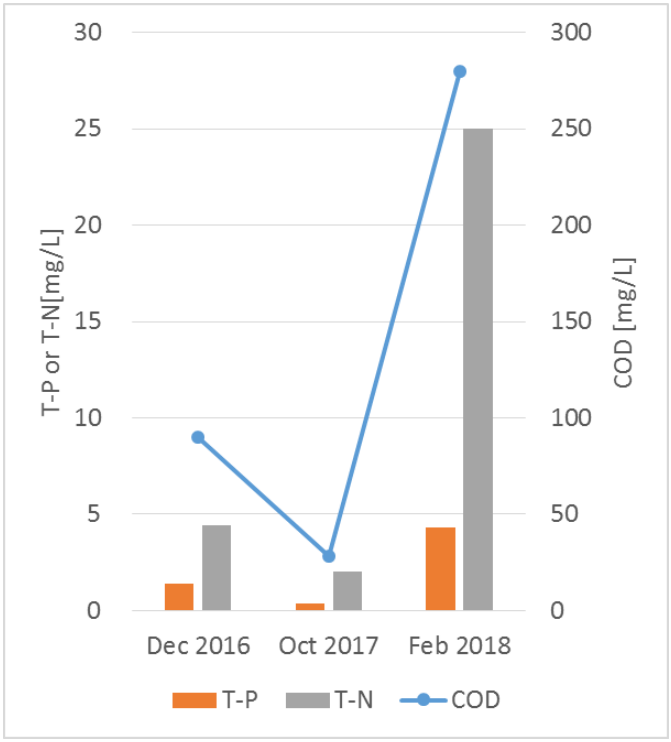
- U Shwe Taung 橋を経由する水路は、Pa Yan Taw 川と、Let Khot Pin 川及び Columbo 川が合流したものであり、Taung Tha Man 湖に至る主要な汚染経路のひとつである。これらの水路で比較すると、有機汚濁及び栄養塩の濃度は、乾期の全窒素を除いて Pa Yan Taw 川が最も高かった。この 3 つの水路のなかで Pa Yan Taw 川が、Taung Tha Man 湖への汚染負荷を低減させるための汚染管理対策において大きな重要度を有しているということを示唆する。汚染負荷に基づく汚染管理対策は、成果 4 で議論される。
- これらの水路では BOD 及び COD に加えて、家庭排水及び工場排水由来と思われる一定のオイル＆グリース（最大 10mg/L）及びフェノール（最大 0.06mg/L）が検出された。
- 健康に影響のあるレベルの重金属等有害物質は検出されなかった。

表 2.4-13　Taung Tha Man 湖の栄養塩レベル

mg/L

Location Name		Total Phosphorus		Total Nitrogen	
		Oct 2017	Feb 2018	Oct 2017	Feb 2018
N-TTML		0.38	4.3	2.0	25
S-TTML		0.36	1.7	1.7	9.2
Comparison with Japanese Environmental Standard (lake) for reference					
I	Conservation of natural environment	0.005 mg/L or less		0.1 mg/L or less	
II	Water supply for purify water using filters and other simple means, fishery for salmon/troun, sweetfish, bathing etc.	0.01 mg/L or less		0.2 mg/L or less	
III	Water supply for purify water using pre-treatment and other advanced methods	0.03 mg/L or less		0.4 mg/L or less	
IV	Fishery for smelt etc.	0.05 mg/L or less		0.6 mg/L or less	
V	Fishery for smelt etc., industrial water, agricultural water, and conservation of the environment	0.1 mg/L or less		1 mg/L or less	
Remarks	1 Standard values are based on daily average values. 2 Standard values for total phosphorous are not applicable to water for agricultural use.				

Source: JET

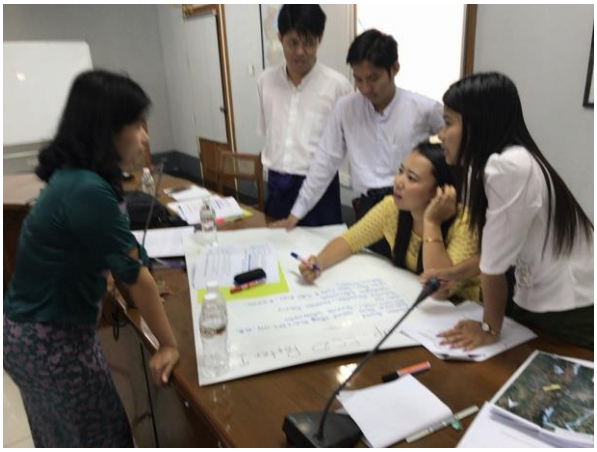


Source: JET

図 2.4-8 Taung Tha Man 湖の北湖における水質変化

(2) 水質調査報告書の作成

2017 年 11 月～2018 年 2 月にかけて、水質調査報告書を作成するための一連のセミナーを、ECD（ECD 本部、マンダレー管区事務所、ヤンゴン管区事務所）、YCDC 及び MCDC の技術スタッフを対象として実施した。これは、各 C/P 機関の調査目的に基づいて調査結果を評価し、水質環境分野におけるレポートのライティングスキルを向上させることを目的としたものである。成果 2 の活動に関与した C/P 職員は、5 つの作業グループ（Hlaing 川流域：ECD グループ、PCCD-YCDC グループ及び WSD-YCDC グループ、Doke Hta Waddy 川流域：ECD グループ及び WSD-MCDC グループ）に分かれ、各々の水環境管理の責務と関心事項に対応した水質調査報告書を作成した。また、JET はこれらの調査結果を総括する水質調査報告書を追加で作成した。




Seminar in Yangon　　Seminar in Mandalay

Source: JET

図 2.4-9　水質調査報告書作成のためのセミナーの写真

2.4.10 成果 2 に関わる課題と提言

本セクションでは成果 2 に関連して明らかになった課題と JET の提言をまとめる。

(1) ミャンマーにおけるモニタリングデータの質の向上

課題: 2.1.8 で述べた通り、プロジェクト期間前半の活動において、調査データの品質管理は大きな課題であった。分析データの妥当性確認に係る一連のプロセスにおいて、現地のラボの正確さ及び精確さは、環境水質を評価する上で必ずしも十分ではなかったことが判明した。疑義があったデータは、おそらく分析方法又はラボでの分析操作が不適切であったために生じたと考えられる。例えば、簡易的な分析方法を採用しているラボがあるが、モニタリングの目的や水質サンプルの性質によっては、それは必ずしも適切な方法ではないことがある。たとえラボが妥当な分析方法を採用していたとしても、分析方法の理解や分析スキルが不十分なことや、試薬・器具・装置が入手できないという理由により、その方法で定められた手順や要求に従うことが困難なケースも見受けられた。さらにいえば、ラボの能力を判断するための国のラボ認定システムも未整備である。ミャンマーにおけるラボの能力向上は、信頼性のあるデータを入手する上で重要な課題である。

提言：ECD は、環境分析ラボの技術ガイドラインやガイダンスを示す必要がある。必要な施策には、環境分析方法の標準化やラボでの適切なデータ管理を確保するための広範な QA/QC（品質保証・品質管理）システムの構築が含まれる。モニタリング方法は、国の表流水水質基準が設定さ

れた時点で、その基準項目に応じて指定されなければならない。QA/QC 活動には、技能試験やクロスチェックの実施、ISO17025 に代表されるラボの認定システムの確立が含まれる。今後得られた結果を、異なる地点や時期のデータと比較・検証し妥当性を確認していくためにも、より多くの信頼できる表流水水質データを蓄積することが重要である。

(2) 適切な水環境基準の設定

課題:ミャンマーでは表流水水質基準が未だ設定されていないため、環境行政を含む関係機関が、対象水域で維持することが望ましい水質についての共通の理解を持つことが難しい。現在の水質について水質基準を基に評価し、基準を達成又は維持するために必要な環境管理施策を検討するためにも、環境基準は重要である。

提言：表流水水質基準を含む国家環境質基準は、環境保全法(2012)第 10 条に従って、ECD が検討を進めている。表流水水質基準は、各水域の性質や水利用、モニタリング機関の財政面・技術面の能力に応じた適切な基準とすべきである。成果 2 の水質調査で得られたモニタリングデータが、ミャンマーの適切な表流水水質基準の設定検討に活用されることが望ましい。

(3) 表流水質の常時監視

課題：国及び地域政府が、その行政判断のために公共用水域の水質を監視し、場所間の違いや経時的な変化を把握できるデータを取得することは非常に重要である。しかしながら、公共用水域の水質モニタリングの義務や責任を定めた法律等は規定されていない。加えて、水環境の保全及び管理上の国又は地域政府による全国・広域の水質モニタリングは実施されていない。技術的な観点においても、対象水域の水質の空間的及び経時変化の詳細は明らかになっていない。本プロジェクトの調査で得た水質データも、土砂流出や一時的な排水の流出、底質の掘削といった特定の理由による影響を受けている可能性がある。加えて、それらの水質が季節変化だけではなく、月毎又は日毎の変動を有しているかもしれない。年間 2 回だけの採水調査では、これらの変動メカニズムや理由を明らかにすることはできない。環境水質モニタリングにおいては、代表地点・項目について少なくとも毎月のデータを得ることが必要である。

提言：責任を有する機関が水質の常時監視を、計画・実施・報告することを提言する。環境保全法第 13 条には、ECD が全国の環境モニタリングプログラムを作ることが規定されている。そのような国のプログラムや指示のもと、各地域の ECD が対象地域の詳細なモニタリング計画を作成・実施し、ECD 本部及び関係機関に報告することが期待される。初めにそのような包括的なモニタリングプログラムが規則に基づいて実施されるべきである。更に、Hlaing 川の感潮域や Taung Tha Man 湖といった特定の懸案がある地域について、水質汚染の詳細な調査を実施する必要がある。Hlaing 川では水質が潮流によってどのように変化しているかを明らかにするためには、各季節の日毎・月毎の干潮サイクルのなかでの深度方向調査が必要である。Taung Tha Man 湖の富栄養化問題についても、栄養塩がどのように湖に流入し、水中の酸素がどのように消費され、窒素・リン成分が底質・水質・植物プランクトン・その他の媒体間でどのように移動しているのか、といったメカニズムは解明されていないからである。

2.5 成果 3 データベース構築

成果 3 の目的は、汚染源データベースおよび河川水質データベースの構築である。表 2.5-1 に成果 3 の成果、活動、指標をまとめる。当初の PDM と PO では成果 3 を達成するために 6 つの活動を実施することになっていたが、既存情報だけではデータベースを構築するには不十分だったため、活動 3-4「不足しているデータの収集」が 2015 年 12 月に PDM と PO を改訂する際に追加された。また成果 3 の指標と活動の整合性を考慮し、指標の一つが「YCDC および MCDC で作成されたインスペクションレポートがデータベースに蓄積される」から「データベースに水質調査結果が蓄積される」に修正され、成果 3 で構築する 2 つのデータベースが指標に含まれることとなった。

表 2.5-1　成果 3（データベース構築）の活動及び指標

Output 3	Database of water pollution sources and river water quality is developed.
Activities	3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results 3-2 To develop a system concept 3-3 To design the database based on the system concept 3-4 To collect additional information required to develop the database 3-5 To develop the database 3-6 To conduct training on operation and utilization of the database 3-7 To develop an operation and maintenance manual of the database
Indicator	At least 150 factories' information is accessible on the database. Results of water quality survey is accessible on the database

Source: JET based on amended PDM

2.5.1　水質汚濁源情報、インスペクションの結果、水質調査結果の収集・整理（活動 3-1）

2015 年および 2016 年に、Hlaing 川流域および Doke Hta Waddy 川流域において排水の流出がある事業所のリスト等、既存の汚染源情報を YCDC および MCDC から収集した。ヤンゴンでは、汚染管理および適正な事業許認可のための活動の一環として、YCDC が表 2.5-2 に示すようなフォームを使って事業所から情報収集を実施・整理していた。しかし、記入後のフォームは紙媒体でしか存在しなかったため、データベース構築の試行を目的として、YCDC と JET は排水の流出がある 68 事業所[1]の情報をデジタル化した。

表 2.5-2　YCDC-PCCD のインスペクションフォーム

Inspection Form of Environmental Pollution Status
concerning water pollution caused by industrial waste discharged from Industrial Zones
in YCDC boundary area
(----------) Industrial Zone
(----------) Factory

1. Name of Factory ----------
2. Name of Owner/ Address/Contact No ----------
3. Area ----------
4. Raw Material ----------
5. Production Capacity (daily) ----------
6. Water resource/Water use ----------
7. Mixing Chemical Substances ----------
8. Energy Consumption ----------
9. Type of Filtration Tank ----------
10. Size of Filtration Tank ----------
11. Current waste water quality discharged from factory (2012-2014)

(A) BOD (Biological Oxygen Demand) ----------
(B) COD (Chemical Oxygen Demand)----------
(C) TS (Total Solid) ----------
(D) SS (Suspended Solid) ----------
(E) pH ----------
(F) Temperature C ----------
(G) Other Contents ----------

12. Whether measuring weight of solid waste at the time of departure from factory or not
    If yes, ----------, If no, ----------
    List of solid waste amount (monthly or annual) in (ton or m^3)
    (1) ----------
    (2) ----------
    (3) ----------
    etc.
13. Solid waste management

Type of solid waste	Reuse	Recycle	Dispose at factory	Dispose at other place (dumping

[1] Hlaing 川流域の Hlaing Tharyar、Shwe Linban、Shwe Pyi Thar 工業団地内にそれぞれ存在。

					site/ incinerator)

Other related document of solid waste disposal (e.g., Name of solid waste disposal/treatment factory and authorized organization, weighting of solid waste)

14. Name of Contact Person from factory/Address/Signature

Source: YCDC

同様に、マンダレーでも 2015 年に関連情報を収集した。MCDC は既に Pyi Gyi Tagon 工業団地南部に集中排水処理施設の建設を検討しており、10 インチのパイプラインを敷設し、主要工場からの排水を回収できる状態であった。さらに、Taung Tha Man 湖において 2015 年に魚類の大量斃死が発生したため、MCDC およびその他組織は当該地域の工場へのインスペクションを実施するよう求められていた。このような事情から、MCDC から一部情報を入手できた。

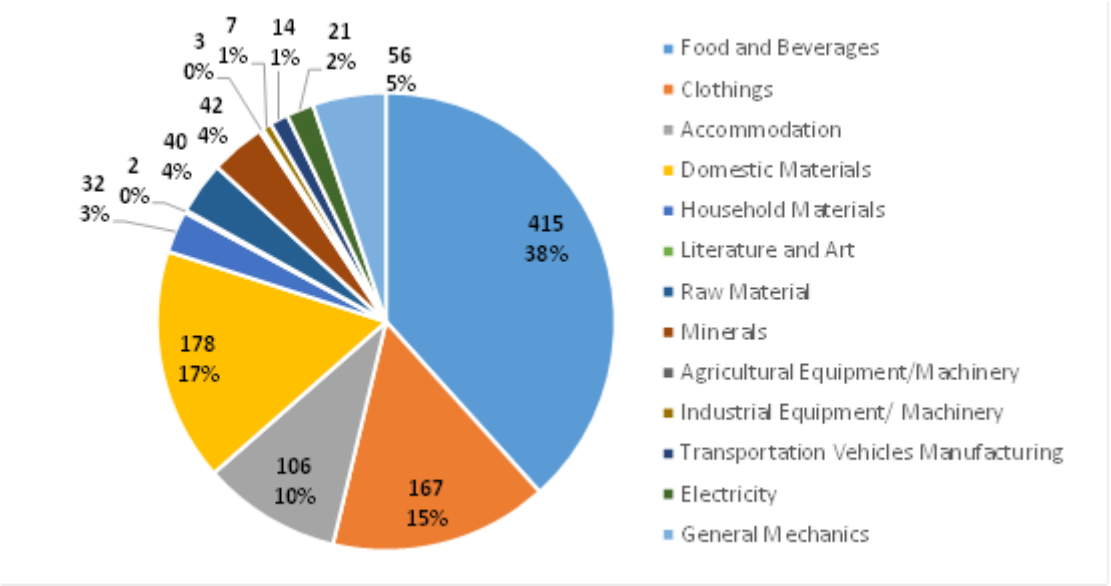
一方、DISI は事業登録時の情報をデジタル化しており、また工業団地管理組合から同様の情報を入手することが可能だった。よって 2016 年 7 月までにヤンゴンでは DISI から、マンダレーでは Pyi Gyi Tagon 工業団地管理組合より収集した。2015 年 12 月まで、2016 年 7 月までにそれぞれ入手できた情報を表 2.5-3 に示す。

表 2.5-3　収集した既存情報

	Until December 2015	**From January to July 2016**
Hlaing River Basin (Yangon)	● Number of Factories: 68 (only the factory which discharge wastewater) ● Source: YCDC ● Description (Answer for Inspection Form which YCDC prepared − Name of Factory/ Type of Business/ Products − Owner name/ type of ownership − Location − Energy Usage (Horse Power, HP) − Results of some parameters of wastewater, etc.	● Number of Factories: 1,083 (all factories in the target area) ● Source: DISI (January 2015; collected via ECD Yangon Office) ● Description − Name of Factory/ Type of Business/ Products − Owner name/ type of ownership − Location − Registration Number/Registration Date − Investment Value, Yearly Production Value − Energy Usage (Horse Power, HP) − Number of Employee/ Labors, etc.
Doke Hta Waddy River Basin (Mandalay)	● Number of Factories: 97 (only the factory which discharge wastewater) ● Source: MCDC ● Description − Name of Factory/ Type of Business/ Products − BOD and pH of wastewater − Water Usage, etc.	● Number of Factories: 1,276 (all factories in the target area; 1,228 according to DISI) ● Source: Pyi Gyi Tagon Industrial Zone Management Committee (data from DISI were collected later) ● Description − Name of Factory/ Type of Business − Owner name − Location (Address)

Source: JET

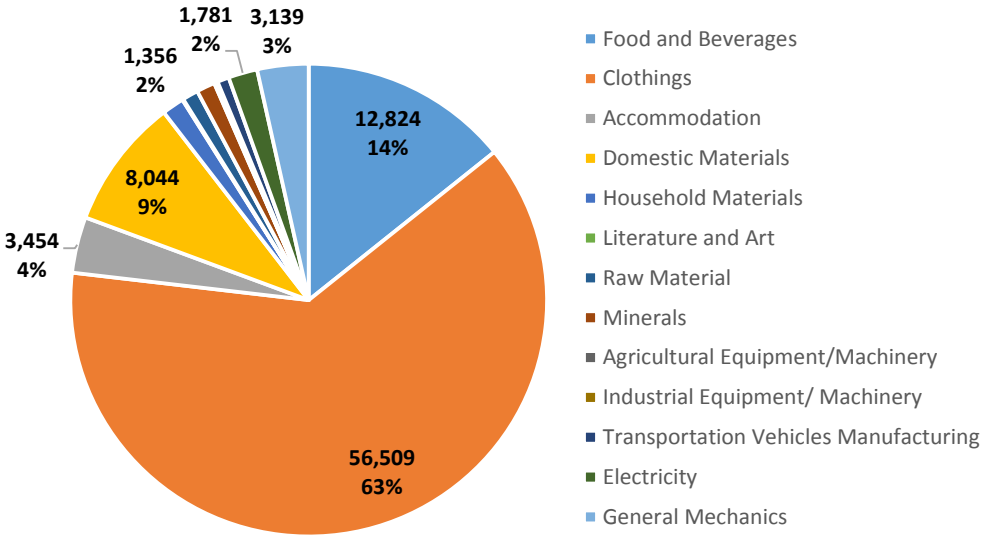
ヤンゴンでは約 3,500 の事業所が YCDC の管理下にあり、DISI から入手した 2015 年 1 月時点のデータによると、対象としている 6 つの工業団地内には 1,083 事業所がある（図 2.5-1）。「Food and Beverage」セクターが最も多く全体の 38%を占め、「Clothing」が 15%と続いている。



Source: JET based on DISI's data

図 2.5-1 Hlaing 川流域の工業団地における事業所数

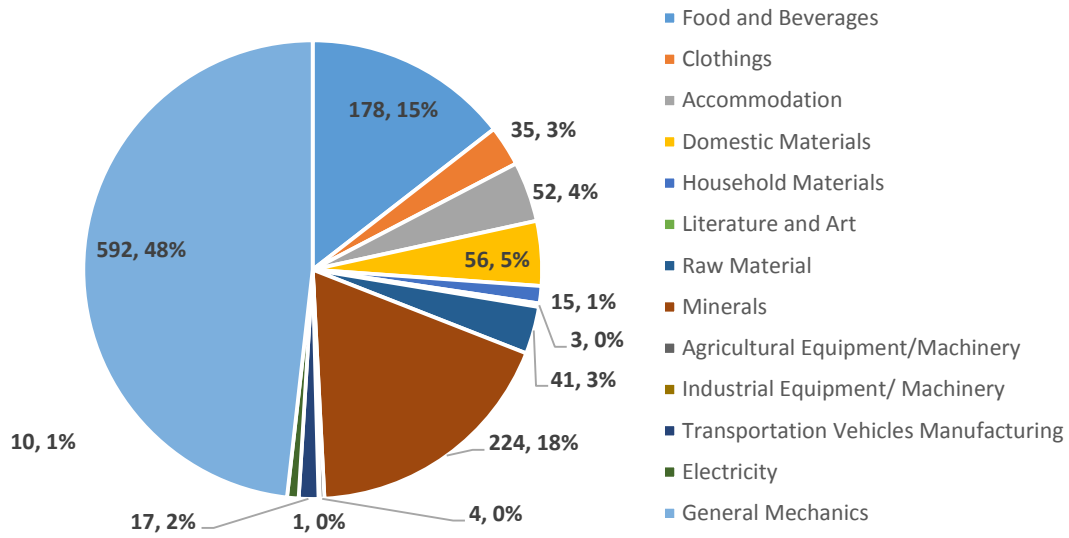
これらの 1,083 事業所には、計 90,211 人の従業員が勤務しており、「Clothing」セクターが全体の 63%を占めている。



Source: JET based on DISI's data

図 2.5-2 Hlaing 川流域の工業団地における従業員数

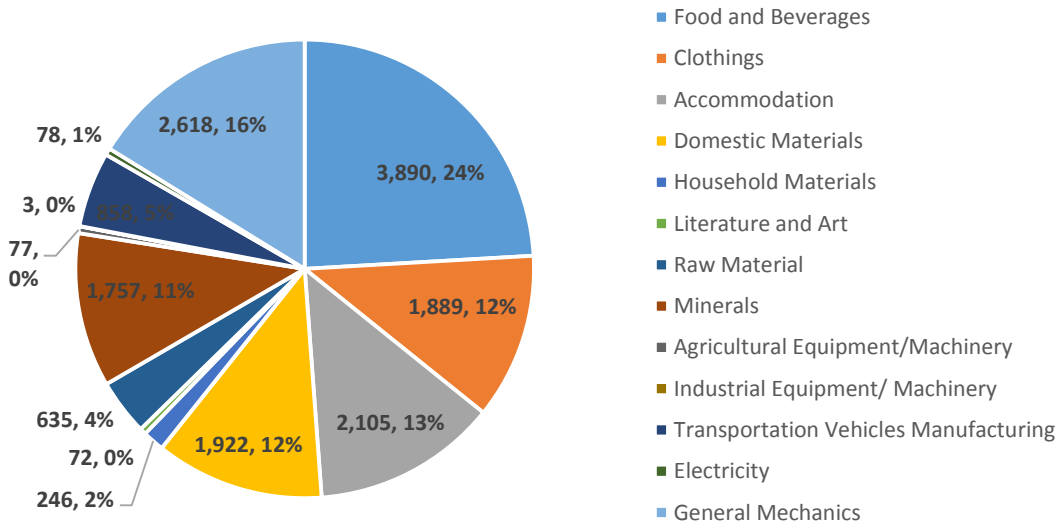
同様にマンダレーでは、Pyi Gyi Tagon 工業団地において 1,228 の事業所が DISI によって登録されているが、セクター割合はヤンゴンと異なり、機械関連を取り扱う小規模な「General Mechanics」セクターが 48%を占めた。



Source: JET based on DISI's data

図 2.5-3 Doke Hta Waddy 川流域の工業団地における事業所数

マンダレーの Pyi Gyi Tagon 工業団地内の事業所数（1,228 事業所）はヤンゴンの Hlaing 川流域の工業団地内に存在する事業所数（1,083 事業所）と比較的近いにも関わらず、従業員数はマンダレーで 16,150 人、ヤンゴンで 90,211 人と大きく異なる。Hlaing 川流域の工業団地と比較し、Pyi Gyi Tagon 工業団地内の事業所は、小規模なものが多いといえる。



Source: JET based on DISI's data

図 2.5-4 Doke Hta Waddy 川流域の工業団地における従業員数

上述のデータを分析した結果、各事業所の事業所名、セクター、住所、投資／売上高といった基礎的情報は、大規模工場だけでなく中小工場についても存在・整理可能な状況であることが確認された。また、C/P 機関の現場レベルの職員は各工場の現状に詳しいことも判明した。

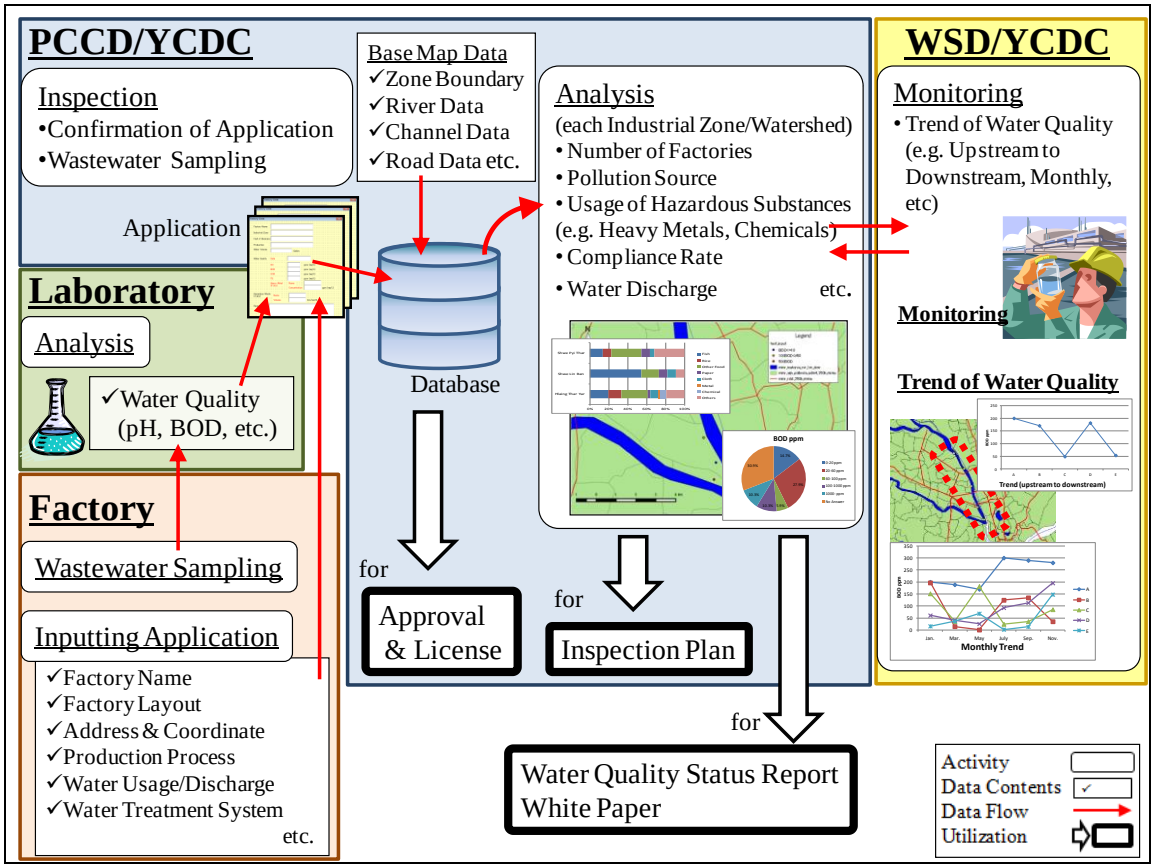
一方、既存情報には各事業所の環境管理に関わる詳細データは含まれておらず、また既存情報は基本的に自己申告によっていることからデータの精度も高いとは言えない状況であった。そのため、2016 年夏より汚染源調査を実施することとなった。

2.5.2 データベースの基本設計（活動 3-2）

2015 年および 2016 年前半に、YCDC、MCDC、ECD および JET 間で、データベースの基本設計について以下のとおり協議・合意した。

- 「汚染源データベース」と「公共用水域の水質データベース」の二種類のデータベースを開発する。
- データベースは GIS システムとリンクし、地理情報を表示・分析可能なものとする。
- フリーのソフトウェアであり、かつ一般的な水環境管理に関わる基本機能を有する Quantum GIS（QGIS）を用いる。
- データベースは、次の 2 ステップで構築する。1) 既存情報を基にしたパイロットデータベースをまず構築し、2) 既存情報およびプロジェクト活動中に得られた新規情報を基にした YCDC および MCDC の水環境管理に資するデータベースを構築する。
- 利便性および持続性を考慮し、データベースは入力・更新がしやすい設計とする。
- 将来的に MONREC-ECD が異なる地方のデータを分析・比較しやすいように、できる限り標準化する。

図 2.5-5 に PCCD-YCDC を例とした、汚染源、インスペクション、分析に関わるデータベースの基本設計を示す。なお、基本設計の協議時においては、YCDC、MCDC および DISI による事業認可／登録システムが存在し、また 2015 年 12 月には MOECAF（現 MONREC）が EIA 手続きを発表していた。しかし、データベース設計のベースにする汚染管理の要求事項が明確になっていなかった。（詳細は成果 1 を参照のこと）。そのため、データベースは汚染源の現状分析を行い、分析結果を政策決定者へ報告することを主目的に開発することとした。



Source: JET based on DISI's data

図 2.5-5 YCDC-PCCD を対象にしたデータベースの基本設計

2.5.3 データベースの詳細設計（活動 3-3）

上記データベースの基本設計（活動 3-2）に基づき、データベースの詳細設計を行い、以下の項目のデータを Microsoft Excel 形式で格納できるようにした。

表 2.5-4 各データベースに格納された情報

Pollution Source Database			
1. Basic Information	- Factory Name - Address/ IZ - Coordinate	- Type of Business - Product - Area	- Number of Employee etc.
2. WWTP	- Existence - Type (Primary Treatment) - Type (Secondary Treatment), etc.		
3. Water Quality of Wastewater	On-site Measurement - Flow Rate - Date & Time - Sampling Method - Existence of Centralized WWTP - Wastewater Type	- Color - Turbid - Sediment - pH - Water Temperature - Turbidity	- Turbidity - EC - Salinity - DO - ORP etc.
	Laboratory Analysis - Chemical Oxygen Demand (COD) - Total Nitrogen - Total Phosphorus - Total Suspended Solids - Other parameters based on NEQEG (2015)		
Surface Water Quality Database			
1. Basic Information	- Location Name - Coordinate	- Date & Time - Weather	- Air Temperature
2. Surface Water Quality	On-site Measurement - pH - Water Temperature - EC	- Salinity - Turbidity - ORP	- TDS - DO
	Laboratory Analysis - Total Suspended Solids - Total Dissolved Solids - Biochemical Oxygen Demand (BOD) - Chemical Oxygen Demand (COD) - Color (Pt-Co unit)	- Odor - Cyanide - Oil & Grease - Total Phosphorus - Phosphate - Total Nitrogen - Ammonia - Nitrate Nitrogen - Nitrite Nitrogen - Total Coliform	- Zinc - Chromium - Hexavalent Chromium - Arsenic - Copper - Mercury - Cadmium - Lead etc.

Source: JET

2.5.4 不足しているデータの収集（活動 3-4）

(1) 汚染源調査の概要

既存情報を整理した結果、水使用量、排水量、排水施設の有無、排水量の削減対策、排水管理に関わる各事業所の抱える課題、といった汚染源に関わる詳細情報が不足していることが判明した。そのため、これらの情報の収集を目的として汚染源調査を実施することとなった。汚染源調査は第 1 年次（2016 年）と第 2 年次（2017 年）の 2 回に分けて実施された。表 2.5-5 に概要、図 2.5-6 に調査の実施状況の写真を示す。詳細な結果は汚染源調査報告書（2018 年）に記載した。

表 2.5-5 追加情報収集に関わる汚染源調査の概要

Item	Period 1 (2016)	Period 2 (2017)
Purpose /Activity	To collect additional information of pollution source (especially factories in Industrial Zones in the target river basin)	Same as Period 1
Survey	- Hlaing River basin in Yangon	Same as Period 1

Item	Period 1 (2016)	Period 2 (2017)
Area	- Doke Hta Waddy River basin in Mandalay	
Scope	- Questionnaire Survey: total 200 factories (Yangon and Mandalay each has 100 factories) - Wastewater Sampling and Analysis: total 50 factories (Yangon and Mandalay each has 25 factories) *Wastewater samples were analyzed in Myanmar or Thailand *All target factories of wastewater sampling and analysis are included in the target factories of the questionnaire survey.	- On-site investigation of wastewater management: total 50 factories (Yangon and Mandalay each has 25 factories) - Estimation of wastewater flow rate: total 50 factories (Yangon and Mandalay each has 25 factories, same factories of on-site investigation) - Wastewater Sampling and Analysis: total 50 factories (Yangon and Mandalay each has 25 factories, same factories of on-site investigation) *18 wastewater samples out of 50 were analyzed not only in Myanmar nor Thailand but in Japan. *Some target factories are overlapped with those in Period 1.
Schedule	− June to first half of August 2016: Finalization of Questionnaire and Terms of Reference (TOR) for Sub-Contract Work − 2nd half of August to first half of Nov 2016: Implementation of Survey (both Questionnaire Survey and Wastewater Sampling)	− Jul 2017: Finalization of Terms of Reference (TOR) for Sub-Contract Work − 2nd half of August to Sep 2017: Implementation of Survey
Attendance	− Yangon: Staff from PCCD in YCDC and ECD Yangon − Mandalay: Staff from WSD in MCDC, ECD Mandalay	Same as Period 1
Others	Workshops for explanation and prior announcement to target factories were held as follows. In Yangon, PCCD in YCDC, ECD Yangon, each Industrial Zone Management Committee and JET, on the other hand, in Mandalay, WSD in MCDC, ECD Mandalay, Industrial Zone Management Committee and JET. [Yangon] − 24 Aug 2016 for Shwe Pyi Thar and Wataya Industrial Zones − 5 Sept 2016 for Hlaing Tharyar and other Industrial Zones [Mandalay] − 23 Aug 2016 for all target factories in Mandalay	Workshops for explanation and prior announcement to target factories were held as follows. In Yangon, PCCD in YCDC, ECD Yangon, each Industrial Zone Management Committee and JET, on the other hand, in Mandalay, WSD in MCDC, ECD Mandalay, Industrial Zone Management Committee and JET. [Yangon] − 10 Aug 2017 for all target factories in Yangon [Mandalay] − 15 Aug 2017 for all target factories in Mandalay

Source: JET

Workshop in Yangon

Wastewater Sampling in Mandalay
(On-site Measurement)

Source: JET

図 2.5-6　再委託業務の実施状況

(2) 質問票調査

2016 年に実施したデータベース構築のための汚染源調査では、200 工場を対象とした質問票調査（Hlaing 川流域：100 工場、Doke Hta Waddy 川流域：100 工場）を実施した。質問票調査の対象工場は YCDC／MCDC、ECD および JET の協議を通して選定され、セクター、環境負荷、位置情報

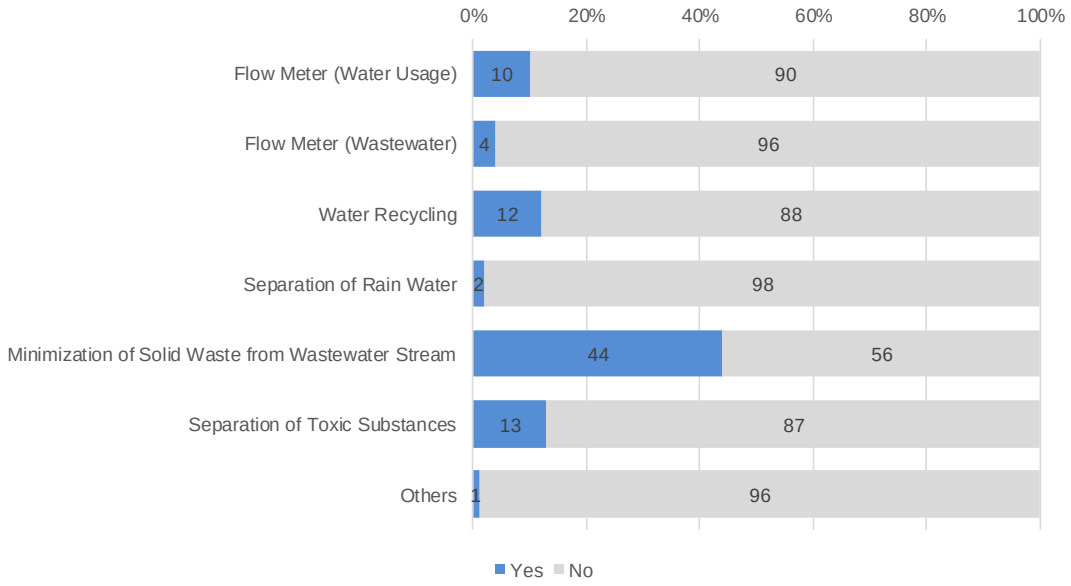
などの観点から主要な工場に絞ることで合意された。調査に用いた質問票は、関係機関、JET、ノルウェーの有害廃棄物管理プロジェクトが合同で内容を検討し、ミャンマー語に翻訳して配布された。質問票には 47 の質問が 6 つのカテゴリーに分けて記載されており、工場の稼働状況や対象工場の環境管理について確認する内容となっている。

- 基礎情報（15 質問事項)
- 原材料およびユーティリティ（４質問事項）
- 工場の配置図および製造過程（２質問項目）
- 排水（９質問項目）
- 廃棄物（４質問項目）
- 環境管理（１３質問項目）

質問票は200対象工場に事前に配布して各工場の管理者に回答を依頼､後日ECD､YCDC／MCDC、JETおよび再委託先の合同チームが回収する、という方式をとった。

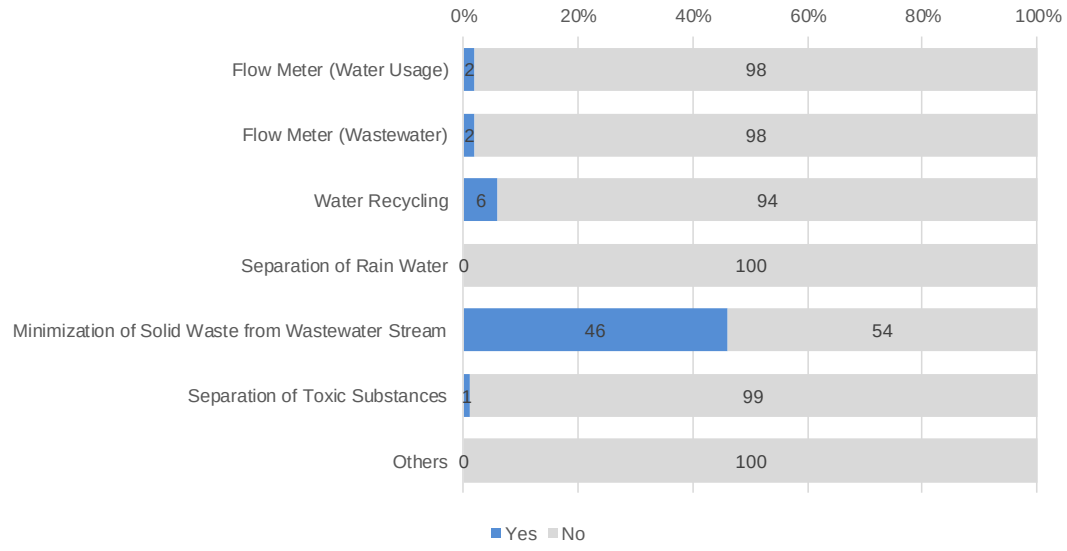
調査によって判明するのは 200 対象工場の状況のみであり、対象地域の全工場の結果を示すものではないが、ヤンゴンおよびマンダレーの工場における環境管理の現状を示すのに極めて役立つ結果を得た。質問票は包括的なものであり、全ての結果を本セクションに示すのは困難であるため、主要な結果を抽出して示す（詳細な結果は汚染源調査報告書（2018 年）を参照のこと)。

汚染の最小化については、水使用量を管理するために量水計を設置している工場はヤンゴンでは 10%、マンダレーでは 2%しかないことが判明した。多くの工場はどれぐらい水を使っているか把握していないようである。一方、200 工場の約半分は廃棄物が排水系統に混入するのを防ぐ努力をしていると回答した。



Source: JET based on Pollution Source Survey in 2016

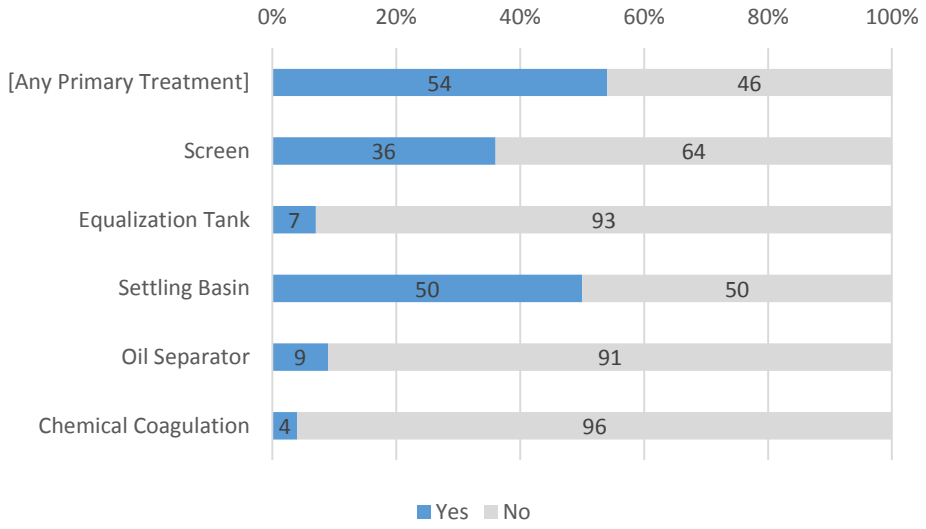
図 2.5-7 Hlaing 川流域の工場の水質汚濁の未然防止策



Source: JET based on Pollution Source Survey in 2016

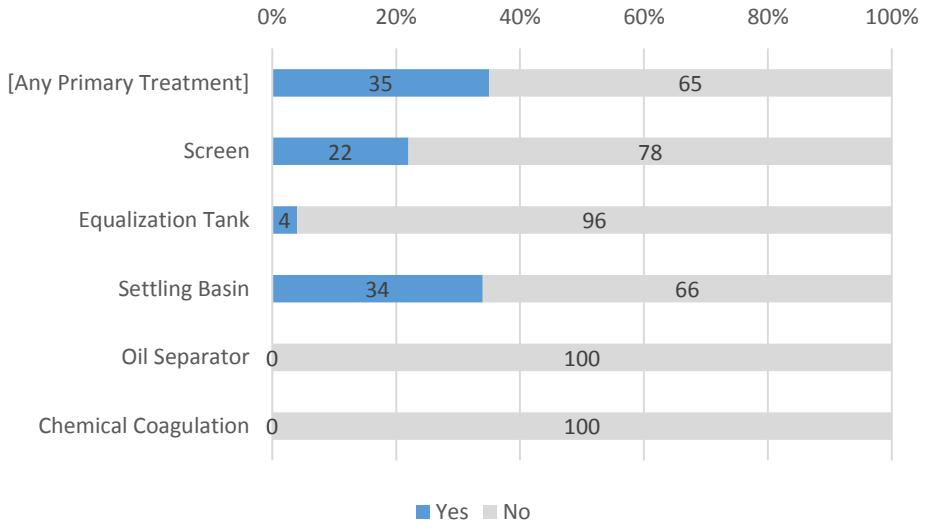
図 2.5-8 Doke Hta Waddy 川流域の工場の水質汚濁の未然防止策

排水処理についての主要な確認事項の一つは、主に固形物の除去を目的とした一次排水処理施設を備えている工場が、どの程度の割合で存在しているか、であった。2016 年の質問票調査結果によると、Hlaing 川流域の 100 工場のうちの 54%が何かしらの一次排水処理施設を備えており、図 2.5-9 に示すように簡易な沈殿池が最も典型的な一次処理施設である。Pyi Gyi Tagon 工業団地では 35%の工場が何らかの一次処理施設を有している（図 2.5-10 を参照）。スクリーンと沈殿池が典型的な一次処理施設である。



Source: JET based on Pollution Source Survey in 2016

図 2.5-9 Hlaing 川流域の一次処理施設の状況

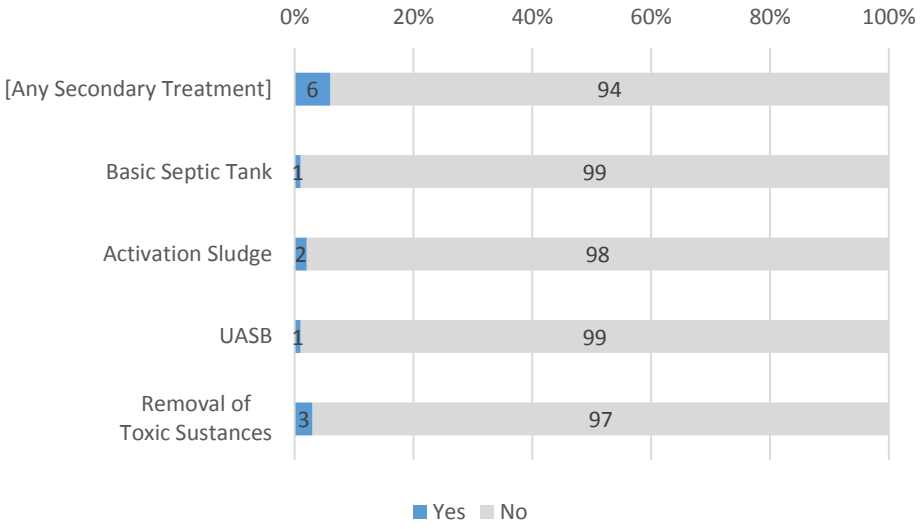


Source: JET based on Pollution Source Survey in 2016

図 2.5-10 Doke Hta Waddy 川流域の一次処理の状況

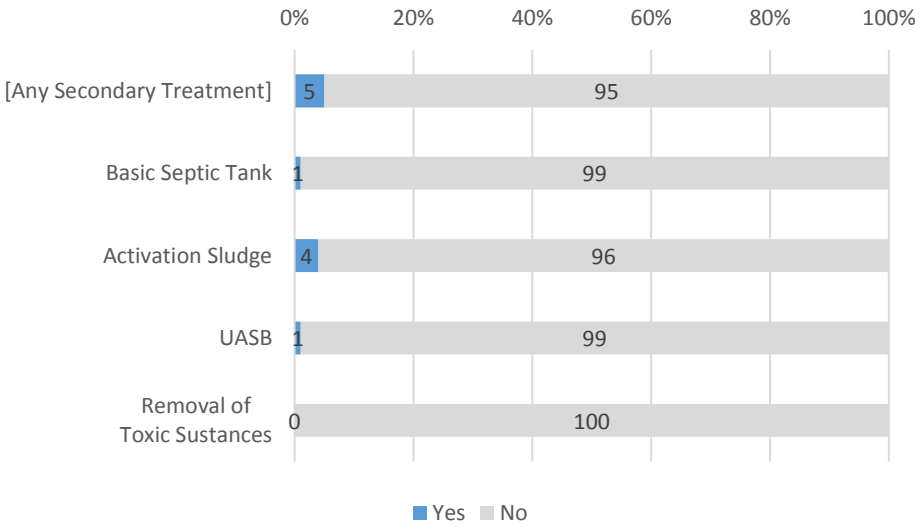
有機汚濁を除去する目的で実施する二次処理[1] については、2016 年時点で Hlaing 川流域の工業団地にある工場の 6%が何らかの施設を有していた（図 2.5-11）。マンダレーの Pyi Gyi Tagon 工業団地については、5%の工場が何らかの二次処理施設を有しているという結果であった。（図 2.5-12）。

[1] 本調査では簡単な腐敗槽も二次処理に含めている。また有害物質の処理もこの分類に含めているが、有害物質の除去プロセスは通常化学的なもので、生物的なものではない。



Source: JET based on Pollution Source Survey in 2016 and 2017

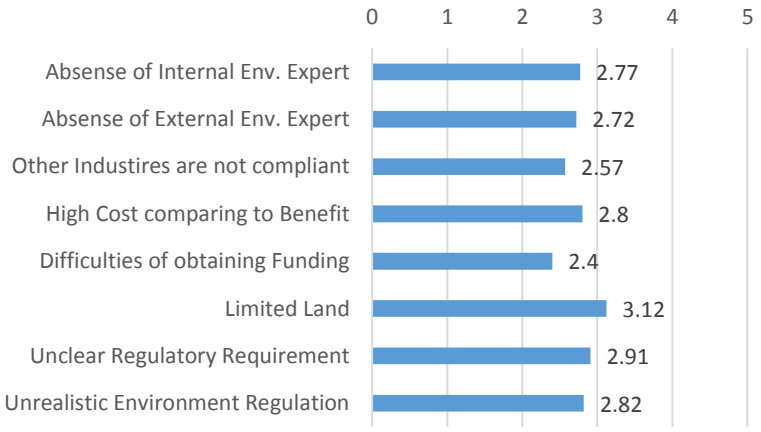
図 2.5-11 Hlaing 川流域における二次処理施設の状況



Source: JET based on Pollution Source Survey in 2016 and 2017

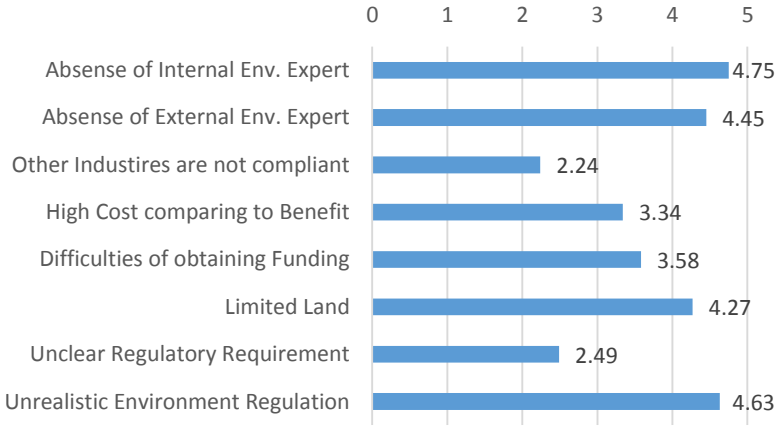
図 2.5-12 Doke Hta Waddy 川流域における二次処理施設の状況

他の重要な質問としては、これらの工場が適切な排水処理施設（WWTP）を設置するに当たってどのような問題に直面しているかである。内部あるいは外部の専門家の不足、他の工場が基準遵守していない、便益に比べてコストが高すぎる、場所がない、など様々な理由が考えられる。Hlaing 川流域の工場では、大部分の工場が指摘するような主要な理由はなかった（図 2.5-13）マンダレーでは専門家の不在、現実的でない規則、土地の不足が排水処理施設を設置するにあたって一番重要な問題のようである（図 2.5-14）。



Source: JET based on Pollution Source Survey in 2016

図 2.5-13 Hlaing 川流域における排水処理施設設置の困難さ



Source: JET based on Pollution Source Survey in 2016

図 2.5-14 Doke Hta Waddy 川流域における排水処理施設設置の困難さ

ちなみに排水処理施設を有している事業所数は近年大幅に増えている。データは 2016 年と 2017 年の両年に排水サンプリングを行ったヤンゴンとマンダレーの 48 事業所に限定されているが、1 次処理施設を有する事業所は 35 から 45 事業所に、2 次処理施設を有する事業所は 6 から 12 に増加している（表 2.5-6）。しかし、多くの工場は未だに高度な排水処理施設を設置する必要がある。

表 2.5-6 2016 年から 2017 年にかけての排水処理施設を有する事業所数の増加

City	**Yangon**		**Mandalay**		**Total**	
Year	**2016**	**2017**	**2016**	**2017**	**2016**	**2017**
Number of factories investigated both in 2016 and 2017	25		23		48	
Any Primary Treatment	**21**	**22**	**14**	**21**	**35**	**43**
Screen	11	13	5	7	16	20
Equalization Tank	5	6	2	7	7	13
Settling Basin	19	22	14	20	33	42
Oil Separator	4	4	0	0	4	4
Chemical Coagulation	3	5	0	0	3	5
Any Secondary Treatment	**3**	**9**	**3**	**3**	**6**	**12**
Basic Septic Tank	0	3	1	1	1	4
Activated Sludge	1	6	2	2	3	8
UASB	1	1	0	1	1	2
Removal of Toxic Substances	2	5	0	2	2	7

Source: JET

(3) 排水サンプリングおよび分析

質問票調査の対象工場から排水量が多く、産業セクターを代表とする事業所 50 工場を選定し、2016 年夏に排水のサンプリングと分析を行った。分析項目は NEQEG（2015）の遵守率がわかるよう、NEQEG (2015)の当該セクターの規制項目を基に選定した。2016 年の調査結果は、対象地域の工場における環境管理の現状を把握する上で意義ある資料となったが、分析結果の一部（総窒素など）に課題があった。そのため第 2 年次では 2017 年 8 月から 9 月にかけてフォローアップ調査を行い、また品質を確保することを目的に排水サンプルの一部はミャンマー国・タイ国だけでなく、日本国内でも分析した。結果を以下にまとめる。2016 年と 2017 年の両方の調査結果は汚染源報告書に詳述した。

1) 現地排水ガイドライン（NEQEG）との比較結果

表 2.5-7 および表 2.5-8 に、排水の BOD および COD 値をまとめる。NEQEG (2015)では多くのセクターについて BOD は 50 mg/L、COD は 250 mg/L がガイドライン値として与えられている。第 1 年次と第 2 年次では調査の対象工場が一部異なるが、多くの工場がガイドライン値を満足していない傾向は変わらなかった。また、表 2.5-9 に BOD、COD、全窒素および全リンについての、ガイドライン値の遵守状況を示す（ガイドライン値は、セクターによって異なることに留意）。2017 年には 89%（44 事業所のうち 39 事業所)、64%（44 事業所のうち 28 事業所）、43%（40 事業所のうち 17 事業所）、および 45%（44 事業所のうち 20 事業所）が BOD、COD、全窒素、全りんの NEQEG (2015)値を超過していた。

表 2.5-7　BOD の比較結果（第 1 年次および第 2 年次）

COD	1st Period			2nd Period		
	Yangon	Mandalay	Total	Yangon	Mandalay	Total
0 – 100 mg/L	9	1	10	0	0	0
100 – 250 mg/L	2	2	4	1	1	2
250 – 1,000 mg/L	7	4	11	6	2	8
1,000 – 2,000 mg/L	1	1	2	15	9	24
2,000 – mg/L	4	11	15	3	13	16
No Data	2	6	8	0	0	0
Total	**25**	**25**	**50**	**25**	**25**	**50**

Source: JET

表 2.5-8　COD の比較結果（第 1 年次および第 2 年次）

COD	1st Period			2nd Period		
	Yangon	Mandalay	Total	Yangon	Mandalay	Total
0 – 100 mg/L	9	1	10	0	0	0
100 – 250 mg/L	2	2	4	1	1	2
250 – 1,000 mg/L	7	4	11	6	2	8
1,000 – 2,000 mg/L	1	1	2	15	9	24
2,000 – mg/L	4	11	15	3	13	16
No Data	2	6	8	0	0	0
Total	**25**	**25**	**50**	**25**	**25**	**50**

Source: JET

表 2.5-9　ガイドラインの遵守状況（第 2 年次）

Category	BOD	COD	TN	TP
Equal to or under NEQEG Value	5	16	23	24
Over NEQEG Value	39	28	17	20
No Evaluation[1)]	6	6	10	6
Total	50	50	50	50

1) 製紙セクターはガイドライン値をもつが、単位が異なる（kg/Air dried metric ton）ため今回は基準との比較対象から外した。また他にガイドライン値をもたないセクターについても、同様に比較対象から外した。
Source: JET

2) セクター別の排水分析結果

第 1 年次において、セクター別の排水分析結果を整理したが、一部の分析結果の信頼性に課題があった。そのため、フォローアップ調査を実施した 50 工場のうち、各セクターを代表する 18 工場を対象に日本の分析機関でも排水を分析した。対象工場は、各セクターの水環境に与える影響の大きさ（排水量、BOD や COD といった主要な水質項目の濃度、重金属の排出有無、等）を考慮し、蒸留酒、繊維、皮なめしといったセクターから選定した。対象となった各セクターの工場数は非常に限られている（表 2.5-10 を参照）ものの、以下のような一般的な特徴が見られた。

- 蒸留酒、皮なめし、製紙のセクターの工場の排水は、他のセクターよりも高い COD 濃度を示した。
- 皮なめし、魚加工セクターの工場排水は、他のセクターよりも高い全窒素濃度を示した。加えて、同セクターの 2 つの工場の全窒素濃度は、比較的近い値を示している（ばらつきが見られなかった）。
- また魚加工セクターの排水は、全リン濃度についても、高い値を示した。蒸留酒、飲食料品、皮なめしのセクターの排水も高い全リン濃度を示したが、同じセクターでも工場によってばらつきが見られた。
- フェノール（4.6 mg/L、9.6 mg/L）、硫酸塩（410 mg/L、550 mg/L）が、皮なめしセクターの両工場の排水から検出された。
- 全クロム（4.5 mg/L）が、皮なめしセクターの一方の工場の排水から検出された。尚、ミャンマー国における多くの皮なめし工場では、植物タンニンなめしによる手法を採用している。
- 半導体・その他電化製品のセクターからは、電池を製造する 2 工場が選定された。鉛（6.8 mg/L）が一方の工場の排水から、亜鉛（170 mg/L）と水銀（0.057 mg/L）がもう一方の工場の排水から検出された。
- 亜鉛（0.27 mg/L、0.34 mg/L）が、繊維工場から検出されたが、上記の電池の製造工場と比較すると、濃度は低い。

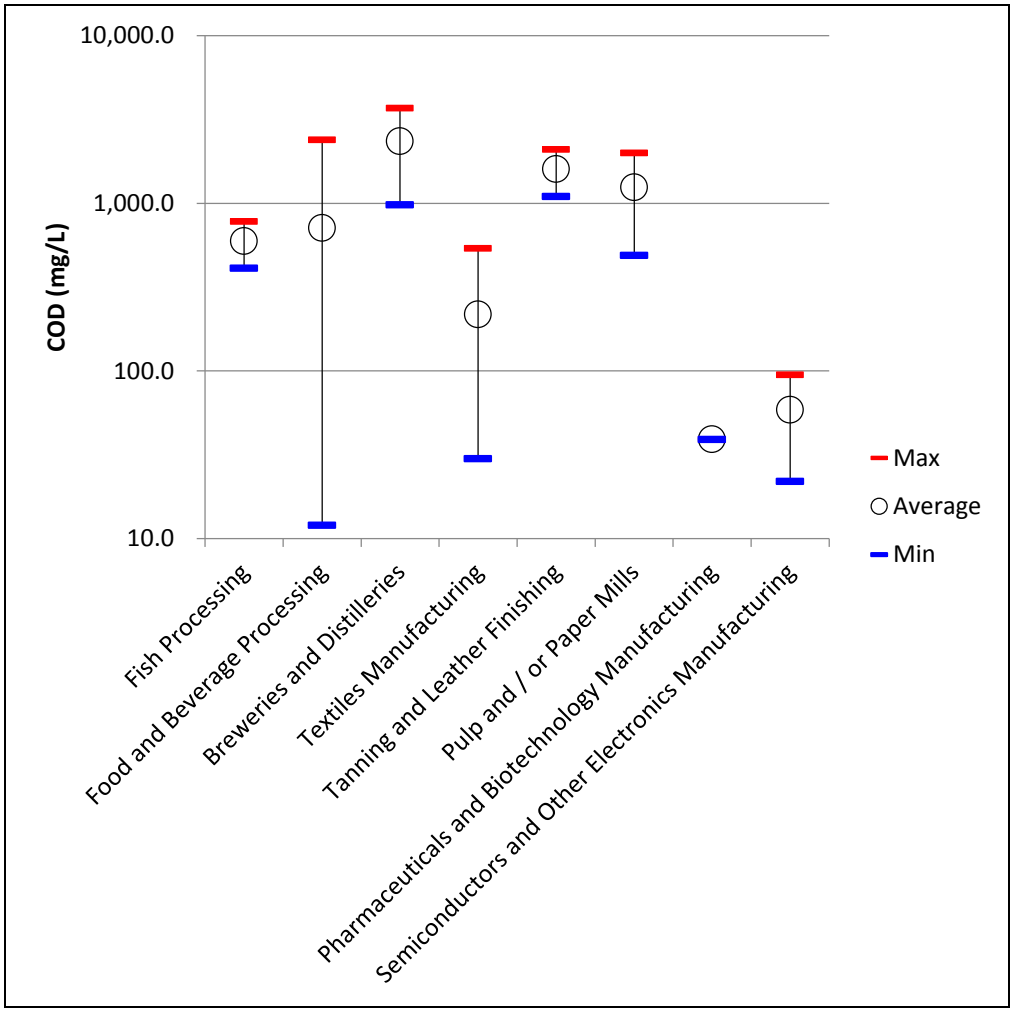
※以下のグラフは対数軸であることに留意。

表 2.5-10　日本での分析対象となった工場数（セクターごと）

No.	Serial Number (NEQEG)	Sector	Number of Factories
1	2.3.1.3	Fish Processing	2
2	2.3.1.4	Food and Beverage Processing	4
3	2.3.1.8	Breweries and Distilleries	2
4	2.3.2.1	Textiles Manufacturing	3

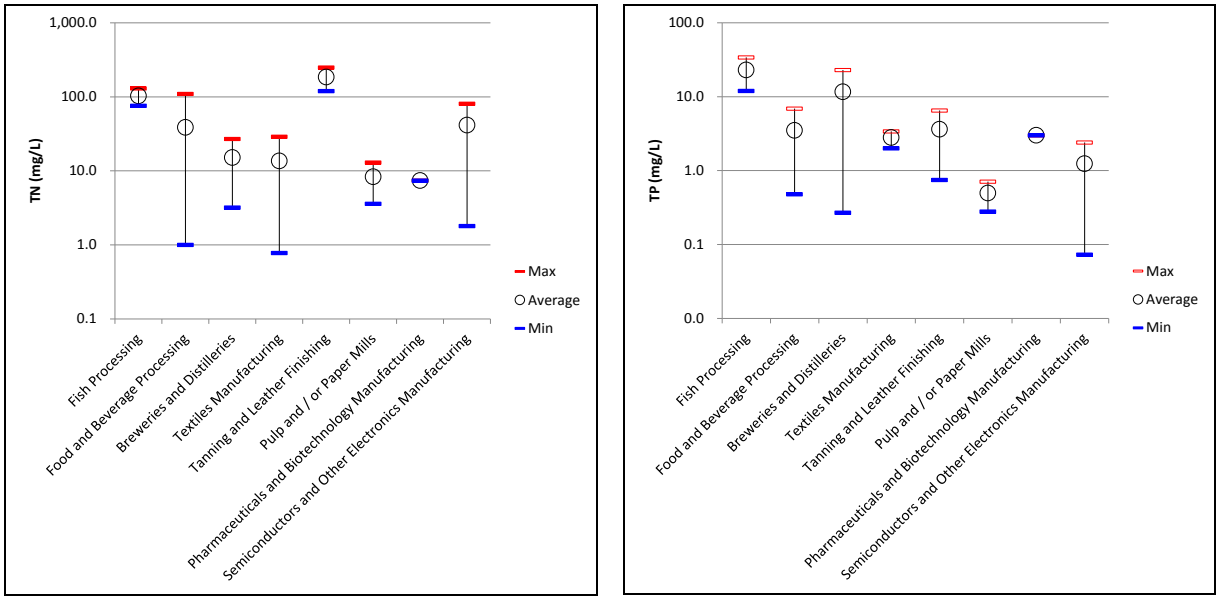
No.	Serial Number (NEQEG)	Sector	Number of Factories
5	2.3.2.2	Tanning and Leather Finishing	2
6	2.3.3.3	Pulp and / or Paper Mills	2
7	2.3.4.8	Pharmaceuticals and Biotechnology Manufacturing	1
8	2.3.7.5	Semiconductors and Other Electronics Manufacturing * Battery factories were selected.	2
Total			18

Source: JET



Source: JET

図 2.5-15 セクター別排水分析結果（COD）



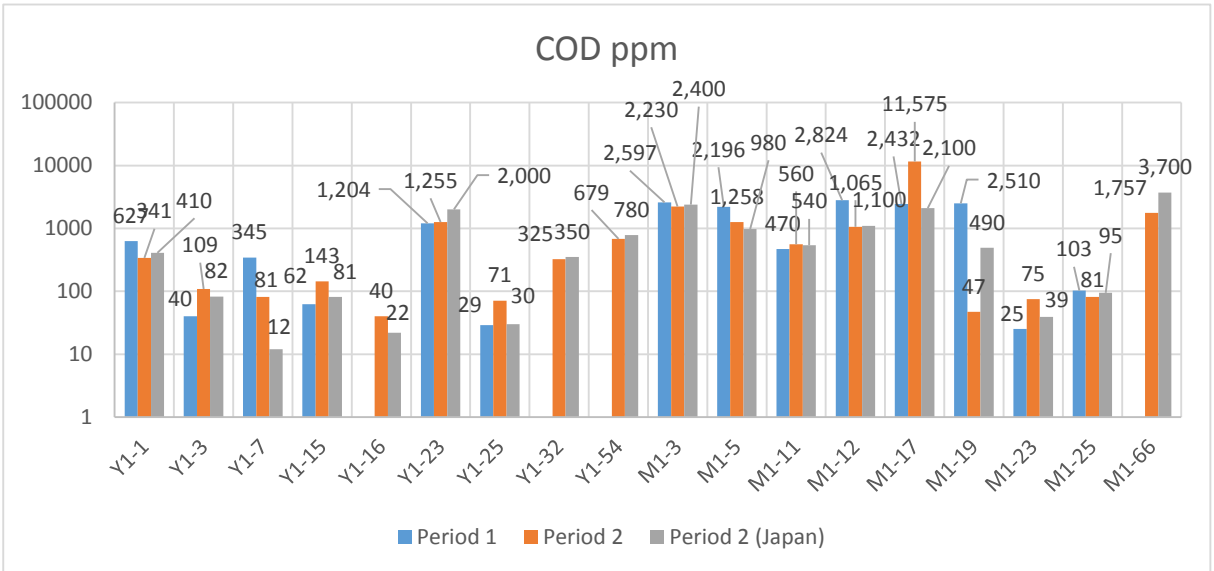
Source: JET

図 2.5-16　セクター別排水分析結果（全窒素（左）・全リン（右））

(4) 第 1 年次および第 2 年次の排水分析結果の比較（COD・全窒素・全リン）

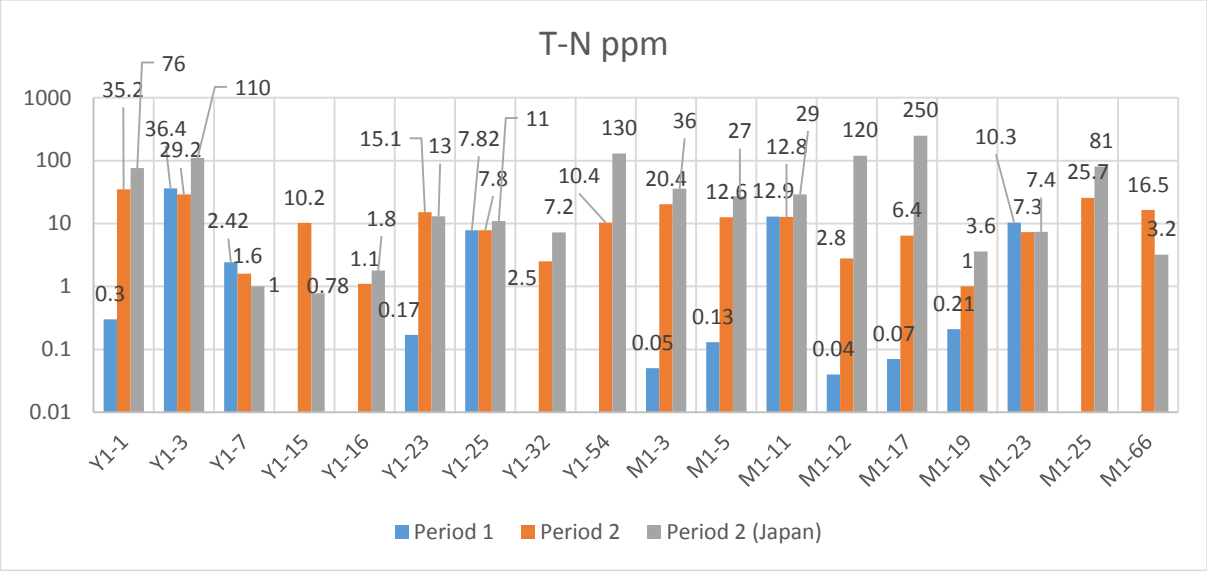
分析結果の信頼性は、第 1 年次の調査における主要な課題の一つであった。そのため、第 1 年次のミャンマー国・タイ国での分析結果、第 2 年次のミャンマー国・タイ国での分析結果、第 2 年次の日本での分析結果を比較できるよう、第 2 年次の排水分析の対象工場のうちいくつかは、第 1 年次の対象工場と重複させる形で選定した。図 2.5-17 から図 2.5-19 に、COD、全窒素（TN）、全リン（TP）の比較結果を示す（これらのグラフは対数軸を用いていることに留意）。

同一サンプルに対する各ラボの分析結果について、COD および全リンの濃度は、全窒素と比較すると近しい値を示しているが、各データを詳細に確認するとやはり大きな差異が見受けられる。分析手法や分析に関わる品質管理の違いが、これらのデータのばらつきを生んだ主要因と考えられる。排水基準を用いて工場排水を規制する前に、まずはこの課題を解決する必要がある。



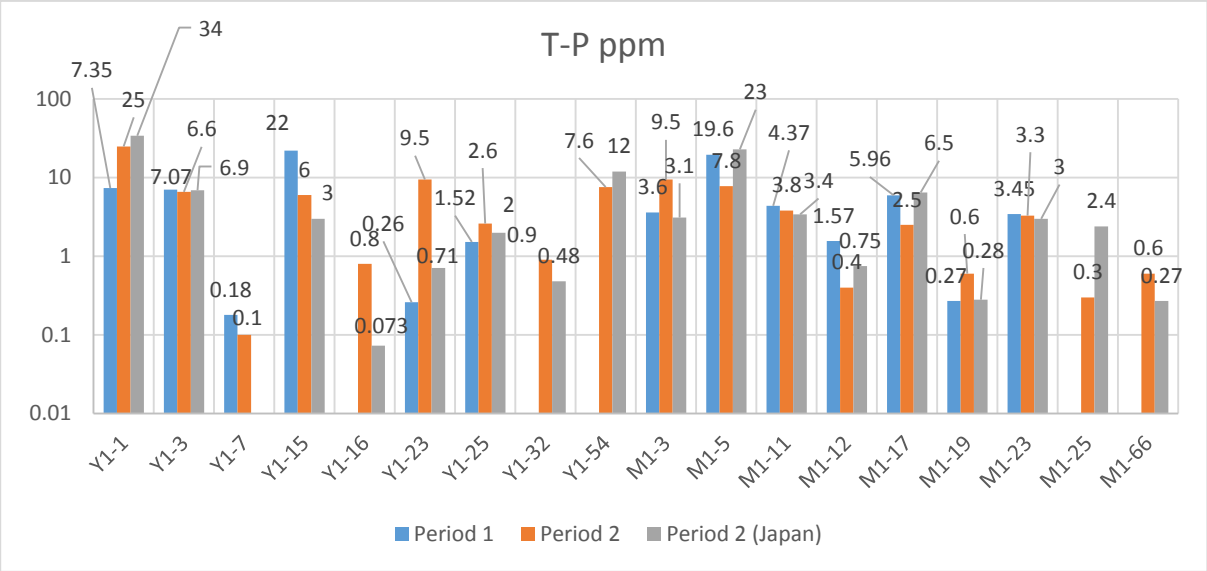
Source: JET

図 2.5-17　排水分析結果の比較（COD）



Source: JET

図 2.5-18　排水分析結果の比較（全窒素）



Source: JET

図 2.5-19　排水分析結果の比較（全リン）

2.5.5　データベースの構築（活動 3-5）

プロジェクト活動を通して、「汚染源データベース」と「公共用水域の水質データベース」の 2 つのデータベースを構築した。表 2.5-11 にこれらの 2 つのデータベースの概要を示す。

表 2.5-11　プロジェクトで構築した 2 種類のデータベースの概要（汚染源・公共用水域の水質）

Pollution Source Database (collected through the pollution source survey in Period 1 and 2)						
(Activity 3-4) To collect additional information required to develop the database						
Data Type	Number of Data (Factory)					Remarks
	Total	Yangon		Mandalay		
		Period 1	Period 2	Period 1	Period 2	
(i) Basic Information collected by Questionnaire Survey1)	202	100	0	100	2	Two additional factories were selected as target in

							Mandalay in Period 2.
	(ii)-1 Wastewater Analysis Result by Wastewater Sampling and Analysis (Myanmar/Thailand)	100	25	25	25	25	33 factories (17 factories in Yangon and 16 factories in Mandalay) are overlapped..
	(ii)-2 Wastewater Analysis Result by Wastewater Sampling and Analysis (Japan)	18	0	9	0	9	18 factories out of 50 were selected in Period 2.
Surface Water Quality Database (collected through the water quality survey in Period 1 and 2)							
	(Activity 2-6) To implement a water quality survey based on the water quality survey plan						
	Data Type	Number of Data (Samples)					Remarks
		Total	Yangon		Mandalay		
			Period 1	Period 2	Period 1	Period 2	
	(i) Results of On-site Measurement	117	29	20	38	30	1st, 2nd and 3rd surveys were implemented in Period 1, and 4th and 5th surveys were implemented in Period 2.
	(ii) Results of Laboratory Analysis	50	0	20	0	30	Samples of the 4th and 5th surveys were analyzed in Myanmar/Japan.

Source: JET

(1) 汚染源データベース

活動 3-4 の結果を基に、汚染源データベースを構築した。計 202 工場に関わる情報（100 サンプルの排水分析結果（第 1 年次・第 2 年次でそれぞれ 50 サンプル）を含む）が収集され、これらのデータはエクセル形式および GIS のシェープファイル形式で蓄積されている。下表にデータベース内の情報、下図にデータベースを GIS 上で確認した際のスナップショットを示す。

表 2.5-12　汚染源データベースに格納されている情報

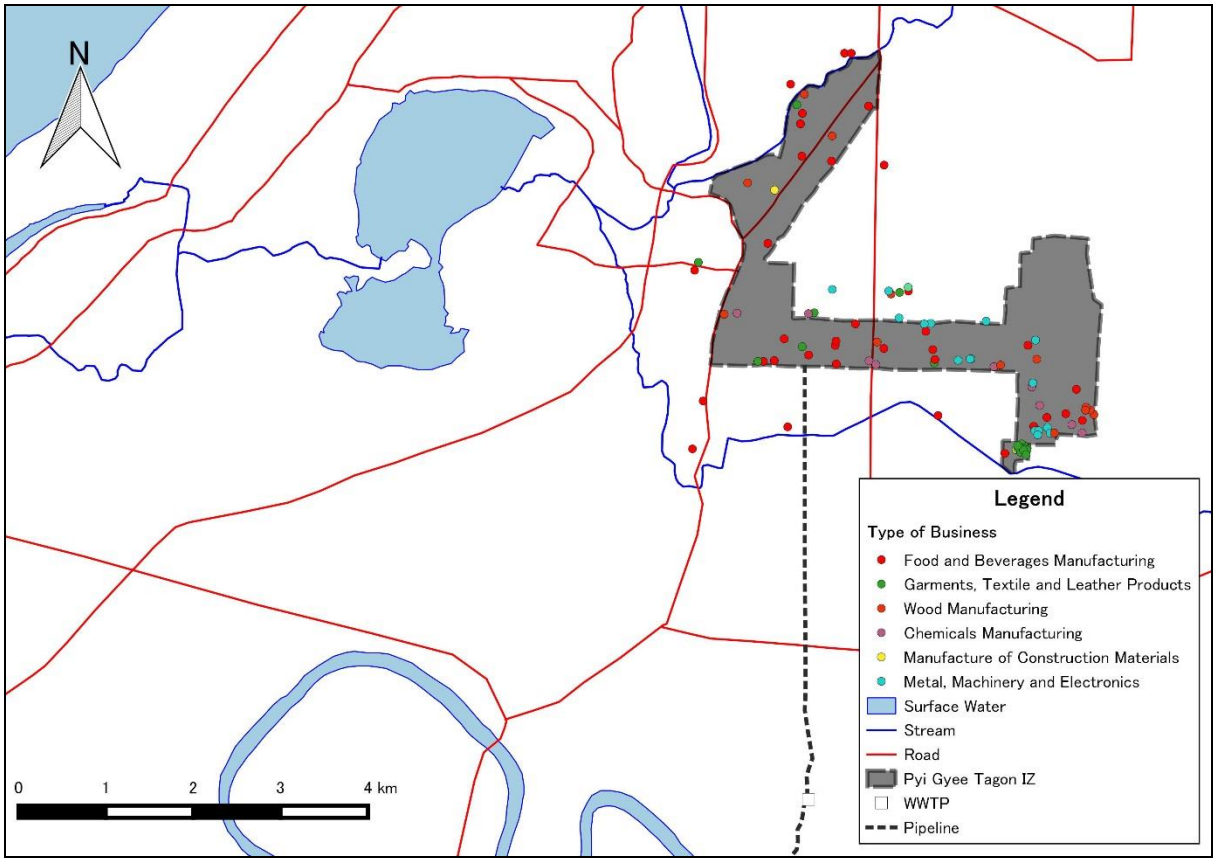
Data Type	Description	Number of Data	Remraks
(i) Basic Information	− Name of factory and coordinates of the location − Type of business (based on NEQEG) − Number of employees − Self evaluation on environment management − Type of WWTP	Total: 202 − Yangon: 100 − Mandalay: 102 (100 in Period 1 and 2 in Period 2)	− Mainly collected by questionnaire survey in Period 1 − Confirmed by site visit in Period 2 (only for 50 target factories in Period 2)
(ii) Results of Wastewater Analysis Result	− Date of wastewater sampling − Sampling method − Existence of pipeline to central WWTP − Type of wastewater − Analysis result for each parameter (e.g., BOD, COD, TN, TP, heavy meatals, etc.) according to NEQEG	Total: 100 − Yangon: 50 (25 each in Period 1 and Period 2) − Mandalay: 50 (25 each in Period 1 and Period 2)	− Analyzed by wastewater sampling and analysis in Period 1 and Period 2 − 18 samples were analyzed in Japan in Period 2

Source: JET

Area	No.	Factory Name	Period	Questionnaire Survey	Wastewater Sampling	Analysis in Japan		Sampling Method	Combined to Central WWTP	Type of Wastewater	Flow rate (Gal/day)	pH	DO (mg/l)	BOD (mg/l)	CO (mg
Yangon	Y1-1	[redacted]	2016	Yes	Yes		10:20	Composite			2,002	7.6	7.6	224	
Yangon	Y1-1		2017		Yes		11:20	Composite	No	Industrial Only	8,500	7.3	7.3	223	
Yangon	Y1-1		2017			Yes									
Yangon	Y1-2		2016	Yes	Yes		12:15	Composite			1,540	7.7	7.7	1950	
Yangon	Y1-2		2017		Yes		10:50	Grab	No	Industrial Only	8,500	4.5	4.5	123	
Yangon	Y1-3		2016	Yes	Yes		13:00	Composite			65,991	8.6	8.6	ND	
Yangon	Y1-3		2017		Yes		11:10	Grab	No	Industrial Only	228,096	6.5	6.5	63	
Yangon	Y1-3		2017			Yes									
Yangon	Y1-4		2016	Yes	Yes		11:20	Composite			6,599	7.2	7.2	3.1	
Yangon	Y1-4		2017		Yes		9:50	Grab	No	Mixed	7,656	6.8	6.8	78	
Yangon	Y1-5		2016	Yes	Yes		15:45	Composite			33,435	10.1	10.1	104	
Yangon	Y1-5		2017		Yes		11:05	Grab	No	Mixed	13,200	9.3	9.3	25	
Yangon	Y1-6		2016	Yes	Yes		11:10	Composite			65	3.9	3.9	2940	
Yangon	Y1-7		2016	Yes	Yes		11:30	Composite			440	8.6	8.6	225	
Yangon	Y1-7		2017		Yes		11:00	Grab	No	Industrial Only	4,224	7.9	7.9	50	
Yangon	Y1-7		2017			Yes									
Yangon	Y1-8		2016	Yes	Yes		12:00	Composite			6.8-9.5	6.8	6.8	293	
Yangon	Y1-8		2017		Yes		13:05	Grab	No	Industrial Only	8,716	7.3	7.3	83	
Yangon	Y1-9		2016	Yes	Yes		11:30	Composite			1.9-10.0	8.8	8.8	6.2	
Yangon	Y1-10		2016	Yes	Yes		16:00	Composite				5.8	5.8	377	
Yangon	Y1-10		2017		Yes		14:00	Grab	No	Industrial Only	31,314	4.5	4.5	800	
Yangon	Y1-11		2016	Yes	Yes		15:30	Composite			288	12.3	12.3	6150	
Yangon	Y1-12		2016	Yes	Yes		15:20	Grab			2.0-2.6	4.5	4.5	3060	
Yangon	Y1-13		2016	Yes	Yes		17:15	Composite			52	3.4	3.4	2250	
Yangon	Y1-14		2016	Yes	Yes			Grab			8	7	7	6	
Yangon	Y1-15		2016	Yes	Yes			Grab			330	6.8	6.8	22.8	

Source: JET

図 2.5-20　汚染源データベースの表示例（ヤンゴン）



Source: JET

図 2.5-21　質問票調査の対象 100 工場の位置図（マンダレー）

(2)　公共用水域の水質データベース

活動 2-6 として実施された第 1 回から第 4 回の水質調査結果を基に、公共用水域の水質データベースを構築した。計 92 の現場測定結果（第 1 回～第 4 回調査）および計 25 のラボでの水質分析結果（第 4 回調査のみ）が、エクセル形式および GIS のシェープファイル形式で蓄積されている（第 1 回～第 3 回調査のラボでの水質分析結果は、十分な精度を保証できないことから対象から除外）。プロジェクト完了までに、第 5 回の水質調査結果も追加される予定である。

下表にデータベース内の情報、下図にデータベースを GIS 上で確認した際のスナップショットを示す（詳細は活動 2-6 の項を参照のこと）。

表 2.5-13　公共用水域の水質データベースに格納されている情報

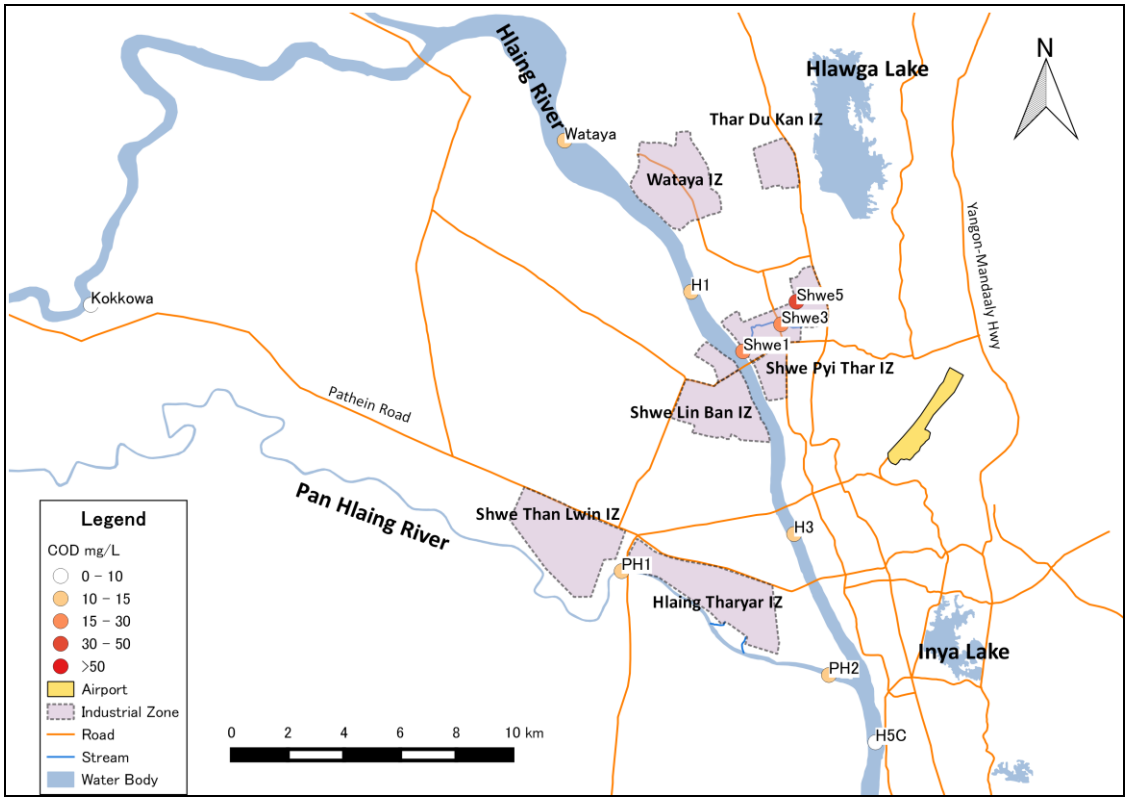
Data Type	Description	Number of Data	Remraks
(i) Results of On-site Measurement	− Sampling Site/Name − Period of the Survey − Coordinate of the Sampling Point − Sampling Date/ Time − Analysis Results of Basic Paramter (e.g. Temperature (Air/Water), pH, EC, Salinity, TDS, DO, etc.)	Total 117 − Yangon: 49 (29 in Period 1 and 20 in Period 2) − Mandalay: 68 (38 in Period 1 and 30 in Period 2)	− 1st, 2nd and 3rd survey were implemented in Period 1. − 4th and 5th surveys were implemented in Period 2.
(ii) Results of Laboratory Analysis	− Analysis Results of Important Parameter for Surface Water (e.g. BOD, COD, TN, TP, TSS, Total coliform, heavy metals, phenol, pesticides, etc.)	Total 50 − Yangon: 20 (Period 2) − Mandalay: 30 (Period 2)	− Only the Results of 4th and 5th surveys in Period 2 were stored.

Source: JET

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1															
2		Basic Information										On-site Measurement			
3		No.	Sampling Site	Name	Period	Latitude	Longitude	Sampling date	Sampling time	Weather	Air Temper	pH	Water Tem	EC ms/cm	Salinity
43		40	DHWD2	Doke Hta Wad	4th	21.8322	96.0871	2017/10/3	11:30		38.55	8.30	29.00	0.100	
44		41	Myit Nge Bridg	Myit Nge Bridg	4th	21.8421	96.0673	2017/10/3	14:11		38.60	7.96	29.43	0.100	
45		42	DP	Discharge Poir	4th	21.8280	96.0935	2017/10/3	12:01		29.27	7.59	38.00	0.200	
46		43	LKP creek	Lat Khoke Pin	4th	21.8909	96.0816	2017/10/2	16:10		35.67	8.03	33.47	0.200	
47		44	UST Bridge	U shwe Taung	4th	21.8996	96.0766	2017/10/2	16:50		34.33	7.77	33.06	0.200	
48		45	TT Bridge	Tagon Taing Bi	4th	21.8989	96.0871	2017/10/2	14:36		35.77	7.46	31.60	0.200	
49		46	PYTC-62nd St	PYTC-62nd St	4th	21.9137	96.1099	2017/10/2	11:50		31.90	7.86	30.65	0.200	
50		47	PYTC1'	Pa Yan Taw Ci	4th	21.9015	96.0940	2017/10/2	15:30		34.50	7.82	31.71	0.200	
51		48	After Aerator	After Aerator	4th	21.9095	96.0905	2017/10/2	12:55		35.94	7.93	31.59	0.500	
52		49	N-TTML	North of Taun	4th										
53		50	S-TTML	South of Taun	4th										
54		51	PTM Bridge	Paw Taw Muu	4th										
55		52	SK Creek	Shwe Kyin Cre	4th										
56		53	Intake AYWD	Intake point of	4th										
57															
58															
59															

Source: JET

図 2.5-22　公共用水域の水質データベースの表示例（マンダレー）



Source: JET

図 2.5-23　ヤンゴンの水質マップ例（対象：COD）

2.5.6　データベースの運用に係るトレーニング（活動 3-6）

データベースの操作と利用に関わる第 1 回トレーニングとして、「GPS データの収集」、および「初歩的な GIS データベースの構築トレーニング」を、2015 年 11 月および 12 月にヤンゴンとマンダレーでそれぞれ開催した。これらのトレーニングの詳細は、プロジェクト業務進捗報告書 No.1 および No.2 に記載した。また 2017 年 1 月には第 2 回トレーニングを開催し、試行版データベースの活用方法について説明した。第 1 年次の活動で収集・整理された情報およびマニュアルに基づき、参加者は QGIS を用いてどのようにアウトプット図面を作成するかを学習した。

上記のトレーニングを通じて、多くの参加者はエクセルや GIS に不慣れであることが判明したことから、2017 年 8 月に開催したトレーニングでは、これらのソフトウェアの基本操作を学ぶ機会を提供した。さらに 2017 年 11 月に開催した第 4 回トレーニングでは、本プロジェクトを通じて構築されたデータベースに基づいて、どのようにアウトプット図面を作成するかを学習した。

表 2.5-14　データベース構築に関わるトレーニングの実施状況

Period	Contents	Date of Training		
		Yangon	Mandalay	Nay Pyi Taw
1st Training	GPD Data Collection	30 Nov – 1 Dec 2015	25, 26 Nov and 8 Dec 2015	-
	Initial GIS Database Development	4 Dec 2015	10 Dec 2015	-
2nd Training	Trial Database Utilization	13 Jan 2017	12 Jan 2017	-
3rd Training	Basic Practice on Excel/GIS	21 – 22 Aug 2017	14 – 18 Aug 20171)	24 -25 Aug 2017
4th Training	Map Preparation	20 Nov 2017	23 Nov 2017	-2)

Note
1): 2 day-training were planned as 2nd training, however, 5 day-training was implemented because of the strong demand from MCDC.
2) One staff joined the training in Yangon and another one joined that in Mandalay.
Source: JET

	
3rd GIS Training in Nay Pyi Taw	4th GIS Training in Mandalay

Source: JET

図 2.5-24　第 3 回・第 4 回の GIS トレーニング実施状況

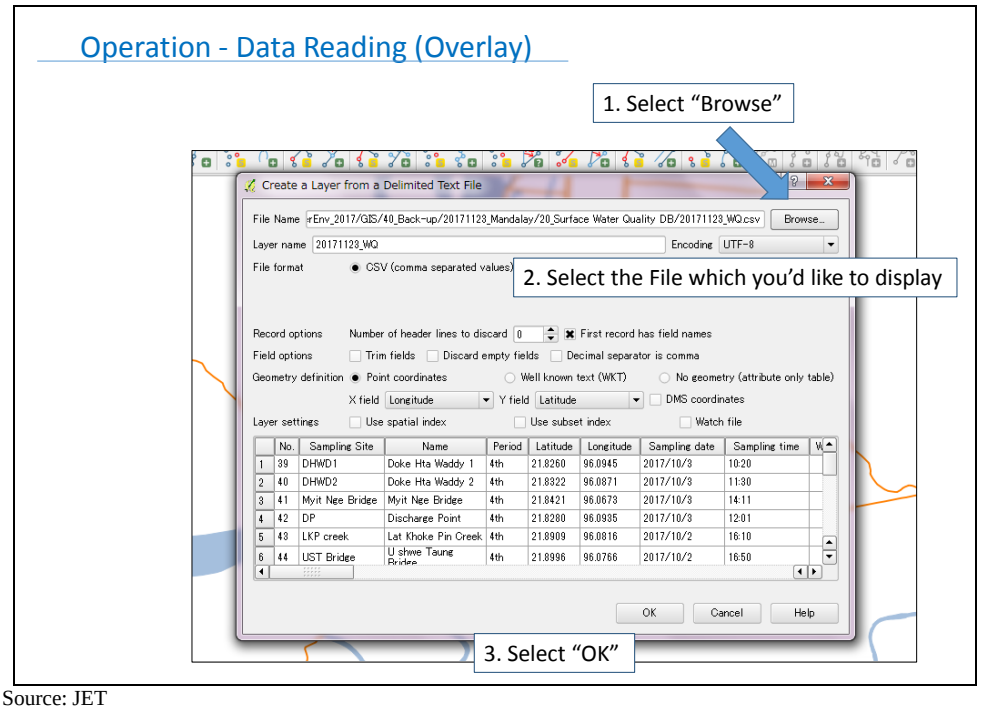
2.5.7　データベースの運営・管理マニュアル（活動 3-7）

2017 年 1 月、データベースの運営・管理マニュアルの第 1 回ドラフトを作成し、活動 3-6 のトレーニングへの参加者および管理職に配布した。参加者から得たフィードバックや、参加者の習得状況を踏まえ、同マニュアルは同 3 月、11 月にも更新された。

表 2.5-15　データベースの運営・管理マニュアルの更新状況

Version	Preparation Schedule	Remarks
Ver. 1 (First Draft)	Jan 2017	Draft version for the pollution source database was developed based on the results of pollution source survey in Period 1.
Ver. 2	Mar 2017	Comments on Ver.1 was reflected to Ver.2.
Ver. 3	Nov 2017	Results of pollution source survey in Period 2 and 4th water quality survey were considered.
Ver. 4 (Final)	Dec 2017	Comments on Ver. 3 will be reflected to Ver.4.

Source: JET



Source: JET

図 2.5-25　運営・管理マニュアル（Ver.3）（抜粋）

2.5.8　成果 3 に関わる課題と提言

(1)　事業所からの情報収集

課題：現段階では環境当局は環境管理に必要な工場の情報（例、製造量、水使用量、採用されている汚染防止・処理策、有害物質の使用、モニタリング結果、過去の環境問題、緊急時の計画など）を有しておらず、またこれらの情報は DISI や工業団地組合のデータに入れられていない。このような情報がないと、どの工場が規制の対象になるか、あるいは環境管理上重要か判断することができない。

提言：環境当局はこのような情報を ECC あるいは事業許認可/登録の一環として収集しなくてはならない。MONREC は既に 9 つの重要セクターの工場に EMP を提出するよう命令しており、EMP は情報収集には適当な出発点になると思われる。しかし、工場の状況は変化するので、毎年基礎情報を収集する必要がある。よって ECC や事業許認可/登録の報告義務の一つとして、このような情報の提出を入れておくべきである。尚、EMP を通した情報収集に時間がかかりすぎる場合は、本プロジェクトで実施したような質問票調査を実施すると良い。.

(2)　汚染源データベースの構築

課題：本プロジェクトで明らかにされたように、電子データベースは環境情報を管理するのに非常に役立つ。ただし、本プロジェクトで構築された汚染源データベースは、主に汚染源の現状を分析するために構築されたものであり、ECC や事業許認可/登録のために特別に設計したわけではない。よって環境要求事項の枠組みが決まったら、新しいデータベースを改めて設計する必要がある。

提言：基本的にはデータベースは許認可制度やデータベースの最終的な利用目的（例、公的文書や非公式文書の管理、インスペクション活動の管理、事業者側から提出された情報の管理、上級管理職への報告書の作成）を考慮して作成する必要がある。ECC についてのデータベースは、新しいデータベースを作成するのではなく、EIA データベースを拡張する方がいいかもしれない。尚、情報のデジタル化には非常に労力が必要である。よって、当面はデータベースで管理する情報を限定して、他の情報はハードコピーで管理する方がいいかもしれない。将来的には事業者側が電子化した情報を提出できるようになると思われる。

(3)　水使用量と排水水質の測定に関わる信頼度の向上

課題：排水量と排水の水質は水質汚濁を管理する上で最も重要な情報だが、本プロジェクトではこれらの測定に非常に苦労した。水使用量は製造過程で非常に変動するので、1 回や 2 回の現場測定で正確に水使用量（そして排水量）を把握することはできない。水使用量を把握するために量水計を設置している工場は 10%以下であるため、水使用量は貯水タンクのサイズや他の情報から推定するしかなかった。水質についてはラボの分析結果は必ずしも信頼できるとは言えず、本プロジェクトではサンプルを日本に持ち帰って分析せざるを得なかった。この課題は環境当局が水質データを基に汚染管理をすることを考えると、非常に深刻である。

提言：水使用については、少なくとも水使用量の多い事業所については、量水計の設置と水使用量の測定を ECC や事業許認可/登録の要求事項に入れるべきである。ラボデータの信頼性については、環境当局は分析方法を標準化して、環境ラボの認証システムを導入し、認証ラボには一連の品質保証/管理手続きを実施させるべきである。成果 2 のセクションを参照のこと。

(4)　事業所の環境対策の改善

課題：汚染源調査の結果、ミャンマーの汚染源の多くでは環境管理が進んでいないことが明らかになった。大部分の事業所は二次処理を導入していない他、水や他の原材料を含む、資源管理そのものが未発達なようである。

提言：汚染を管理するためには、環境当局がセクター調査等を参考に、現実的な規制と支援をする必要がある。この点については他のセクションでも言及しているので、ここでは述べない。また水使用、特に地下水利用の規制も必要と思われる。ヤンゴンでは塩水遡上も懸念されることか

ら、地下水の勝手な汲み上げは規制すべきである。これらの政府側からの規制に加えて、事業者側も汚染管理だけでなく、生産効率の改善の観点や労働安全の観点からも、資源と環境管理の調査をすべきである。このような調査は工業省や産業団体がイニシアティブを取ることが考えられる。

2.6 成果 4 情報解釈

表 2.6-1 に成果 4 の成果、活動及び指標をまとめる。成果 4 の指標については、2016 年 11 月の中間レビューの際に更新されている。

表 2.6-1　成果 4（情報解釈）の活動及び指標

Output 4	Capacity of interpreting the information for water pollution control measures is enhanced.
Activities	4-1 To collect the information necessary for the water quality status report 4-2 To interpret the collected information 4-3 To prepare a water quality status report
Indicator	Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC.

Source: JET based on amended PDM

2.6.1 水質報告書（Water Quality Status Report）に必要な情報を収集する（活動 4-1）

水質報告書に必要な情報の収集に係る活動は、①水質報告書 No.1 に必要な情報の収集（第 1 年次）、及び②最終版の水質報告書に必要な情報の収集（第 2 年次）の二期に分けられる。水質報告書 No.1 では、C/P 機関、関係省庁、管区地方事務所、ミャンマー統計年鑑から収集した水環境管理に係るデータ及び情報、更には第 1 年次での成果 1、2、3、4 の各種活動の結果をとりまとめた。水質報告書では、パイロットエリアにおける汚染源と表流水の水質状況の関係性の解釈を目的としたケーススタディの結果をとりまとめている。表 2.6-2 は水質報告書で収集した主要なデータ及び情報、情報源を示す。

表 2.6-2　水質報告書で収集した主要なデータ及び情報

Category	Key Information	Information Source
Common	Natural condition (meteorology, hydrology, geography, etc.)	Myanmar statistic year book, digital elevation map, township statistic report, universities, etc.
	Social conditions (administrative boundary, population)	Myanmar statistic year book, township statistic report, etc.
	Organizations (organization chart and its activities related to water environment management)	Union level ECD, regional ECD, YCDC, MCDC, and Industrial Management Committees
Inspection	Inspection activities	Output 1/ ECD
Water quality	Results of water quality survey	Output 2
Industrial pollution source	Pollution source survey	Output 3
Water use	Water use, channel network	Ministry of Energy and Electricity/ Irrigation Department of MOALI/ YCDC/ MCDC
[Information Interpretation-1] Pollution load analysis in townships in Yangon in Taung Tha Man Lake (Case Studies 1 and 3)	List of the industries including sector, address, no. of employees, investment cost	DISI, MOI
	Population of each ward	Township GAD
	List of facilities related to commercial activities, slaughter houses, and disposal site	YCDC/ MCDC
	Common water treatment system for household, residential area, commercial, hotels, slaughter houses, etc.	YCDC/ MCDC
	List of hotels and number of beds	Ministry of Hotel and Tourism/ regional ECD
	List of hotels and clinic and number of bed	MOHS/ regional ECD
	Number of livestock	Livestock Breeding and Veterinary Department, MOALI

Category	Key Information	Information Source
	Aquaculture activities (only for Mandalay)	Department of Fishery, MOALI
	Land use information	YCDC/ MCDC
	Area of agriculture land, type of crop and its calendars, and amount of application of fertilizer and pesticide	Department of Agriculture/ Plant Protection Department, MOALI
[Information Interpretation-2] Installation of centralized wastewater treatment system in zones (Case Study 2, under activity of Output 1)	Results of case study for installation of centralized wastewater treatment system in Hlaing Thar Yar Industrial Zones (Zone 1 to Zone 4)	Output 1
[Information Interpretation-3] Examination of estimation of cumulative water quality capacity of the Doke Hta Waddy River (Case Study 4)	Water discharge data from hydrological dam	Ministry of Energy and Electricity
	Seasonal trend of wastewater use for irrigation and water discharge data from irrigation dam/ gate	Irrigation Department of MOALI
	Future plans of water use of the Doke Hta Waddy River	MCDC/ EPGE/ MOALI
[Preparation of Road Map for Water Environment Management] Industrial water pollution control measures at the national level (Case Study 5)	Existing and future pollution control measures/ Policies of water environmental management at the national level	ECD

Source: JET

2.6.2　収集情報を解釈する（活動 4-2）

2.6.1 節に既述した収集データを基に、ヤンゴン及びマンダレーのパイロットエリアにおける水質の状況について評価を行った。2.6.2.1 節に示すとおり、政策意思決定者に対して、水質の現状、想定される汚染源と水質の関係性及び考えうる対応策を説明するために、5 つのケーススタディを実施した。ヤンゴンにおけるケーススタディの結果を 6.2.2.2 節に、マンダレーにおける結果を 2.6.2.3 節に示す。尚、これらの水質情報及びケーススタディの結果は、水質報告書に反映されている。

2.6.2.1　主要な水質状況を解釈するためのケーススタディ

ヤンゴン、マンダレー及びネピドーのそれぞれの C/P との協議を通じて、5 つのケーススタディを選定した。これらのケーススタディは、以下のとおり i) 優先的に排水対策を行うセクターを把握するための汚濁負荷量の推定、及び ii) 有効な水環境管理対策の検討（工業排水管理、将来的な水資源管理に資する環境容量の推定、国レベルの工業排水対応案の検討）の二つに分けて実施した。

【優先的に排水対策を行うセクターを把握するための汚濁負荷量の推定】
ケーススタディ 1： ヤンゴンのパイロットエリアでの汚濁負荷量の算出（2.6.2.2 節参照）
ケーススタディ 2： マンダレーのパイロットエリアでの汚濁負荷量の算出（2.6.2.3 節参照）

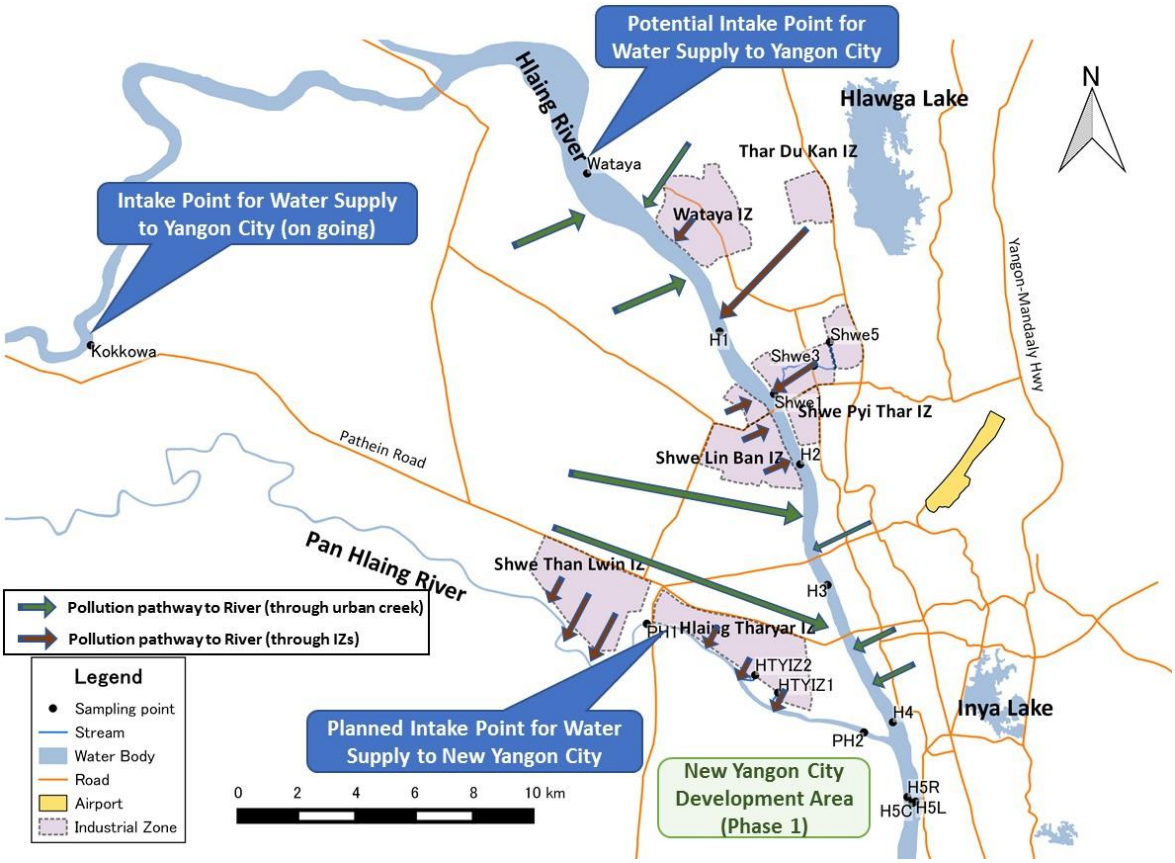
【有効な水環境管理対策の検討】
ケーススタディ 3： Hlaing Tharyar 工業団地の集中排水処理設備の設置（成果 1 に係る活動、2.3.5 節参照）
ケーススタディ 4： 将来的な水資源管理に資する Doka Hta Waddy 川の水量変動に伴う環境容量の初期評価（2.6.2.3 節参照）
ケーススタディ 5： 国レベルの産業排水対策の検討（2.6.2.4 節参照）

これらのケーススタディの結果は次節に示す。また、ケーススタディの詳細は、水質報告書を参照のこと。

2.6.2.2 ヤンゴンのパイロットエリアにおける水質状況（Hlaing 川流域）

(1) 河川への汚染経路概略

図 2.6-1 は、ヤンゴンのパイロットエリアにおける Hlaing 川及び Pan Hlaing 川への汚染経路、工業団地、上水供給のための取水計画地点の位置を示したものである。汚染経路は、Hlaing 川の左岸（東側）、Hlaing 川の右岸（西側）、Pan Hlaing 川の左岸（北側）の 3 つのエリアに分けられる。各エリアで発生した汚染物質は、小河川や排水溝を通って河川に流れ込む。工業団地内を流れる小河川や排水溝も存在する。現在、河川からの取水地点に関しては 3 つの計画があり、i) YCDC による上水供給プロジェクトにおける Kokkowa 川の Kokkowa 地点、ii) YCDC による将来の上水供給プロジェクトにおける Hlaing 川の Wataya 地点、そして、iii) 新ヤンゴン市開発区への給水計画における Pan Hlaing 川の Hlaing Tharyar 工業団地と Shwe Than Lwin 工業団地間の地点である。



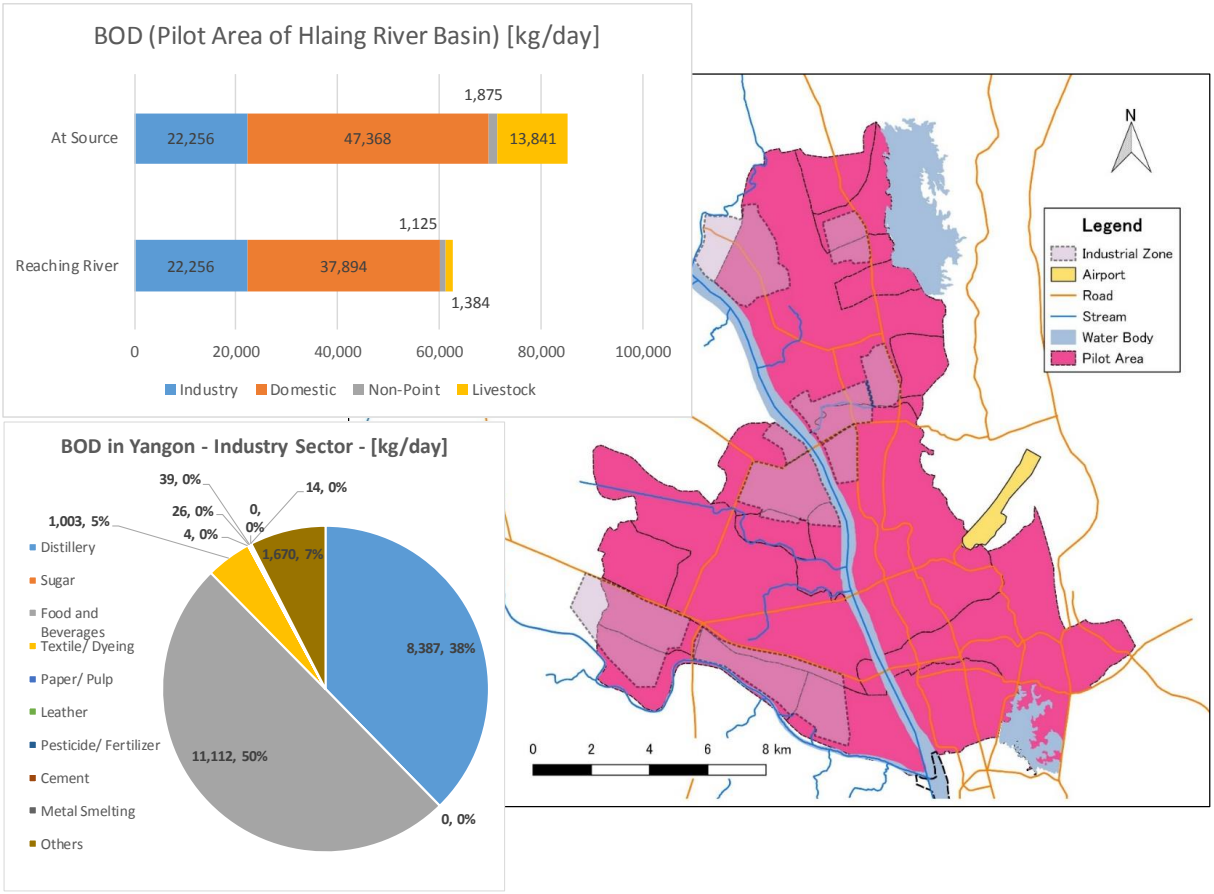
Source: JET based on dataset prepared by MIMU

図 2.6-1 ヤンゴンのパイロットエリアにおける河川の汚染経路、工業団地、上水給水のための取水計画地点

(2) 汚濁負荷量の推定結果

ヤンゴンのパイロットエリアにおける汚濁負荷量の推定結果を図 2.6-2 に示す。この分析では、汚染源調査結果や他国で使用されている各種汚染源からの汚濁負荷単位量を用いて、産業排水、生活排水、及び農地等のノンポイント汚染源からの汚濁負荷量を推定した。推定結果によると、Hlaing 川流域において、ヤンゴン市のタウンシップ（Hlaingtharya, Mayangone, Insein, Hlain, Shwepyithar）では 85,000 kg/日の BOD 汚濁負荷量が発生し、そのうち 63,000 kg/日が Hlaing 川及び Pan Hlaing 川に流入している。河川に流入している 63,000 kg/日のうち、60%は生活排水から、36%は工場排水から、4%は畜産農業及びノンポイント汚染源から発生したものと推定される。明らかに家庭からの下水が BOD 汚濁負荷の主要な汚染源であるが、工業団地からの汚染も主要な汚染源となっている。工業セクターのうち、大規模な汚濁負荷量を発生させている業種は、蒸留酒

製造、飲食料品、繊維製品であり、発生する汚濁負荷量のうちこれら 3 つの業種からの汚濁負荷量が約 93%を占める。



Source: JET based on dataset prepared by MIMU

図 2.6-2 ヤンゴンのパイロットエリアにおける汚濁負荷量の推定結果 （左上：汚染源別の汚濁負荷量及び河川への流入量、左下：工業セクターにおける各業種からの汚濁負荷量）

この章では BOD に関する結果のみ記載したが、汚染源は汚染物質により大きく異なる。詳しくは水質報告書を参照のこと。

(3) 河川の水質汚濁評価

1) Hlaing 川上流域

Hlaing 川上流域の Kokkowa 地点の直近の雨季（2017 年 9 月）及び乾季（2018 年 2 月）における河川の水質は、浮遊物質量（TSS）及び大腸菌群数以外はベトナム国の地表水質基準の Class A1（生活用水に利用可能）及び Class A2（処理後に生活用水として利用可能及び水生生物の保護）を満たしていた。これは上流域には大規模な都市、工業団地、集約農業・畜産農業が存在しないためである。更に、現時点では上流域における新都市開発、工業団地開発計画は立案されていないため、Kokkowa 地点における水質は現時点のレベル（ベトナムの表流水質ガイドラインに従うと、今後 5～10 年は上水供給が可能）が維持されると考えられるが、より詳細な評価が必要である。

2) Hlaing 川下流域

Hlaing River 川下流域（Wataya、Hlaing-1、3、5 地点）の直近の雨季における河川の水質は、浮遊物質量（TSS）及び大腸菌群数以外はベトナム国の地表水質基準の生活用水レベル（Class A1 及び Class A2）を満たしていた。直近の乾季では、水利用の重要なパラメーターのひとつである COD Cr

値は、Shwe Pyi Thar 工業団地より上流の Wataya 地点及び Hlaing-1 地点ではベトナム国の水質基準の Class B1（灌漑用水として利用可能）の 30mg/L を下回ったが、当該工業団地より下流の Hlaing-3 地点及び Hlaing-5 地点ではベトナム国水質基準の Class B2（水運目的での利用）の 50mg/L を上回った。2.4.9 節で記載したとおり、この地域における高濃度の COD Cr 値は、水中の浮遊物質に伴う有機物（溶解性以外）が原因であると推測できる。これは各地点で BOD 値に大きな差が見られなかった事から推測されるが、確定にはさらなる調査が必要である。COD Cr 値の上昇は、次に挙げるような汚染を引き起こす各種要因の直接的・間接的な影響が原因であることも推測できる： i) 工業用水、下水等の排水による影響を希釈できる流量（環境容量）の不足[1]、ii) Myaung Dagar 工業団地からの汚染及び Wataya 地点から 25km 上流に位置する Hmawbi タウンシップからの生活排水、iii) Shwe Pyi Thar 工業団地からの汚染、及び潮汐現象による逆流の際に流入する Shwe Phyi Tar タウンシップからの生活排水、iv) 海水浸入による下流域での流速の低下及び限定的な海水混合、等。今後、Wataya 取水地点での水質が上水として利用可能かどうか更なる調査が必要であるが、そのためには、長期的な水質モニタリングデータ、水文データ、水利用に関する情報に基づいて、汚染メカニズムを解明する必要がある。

工場汚染の水質への影響については、Hlaing 川の支流で Shwe Pyi Htar 工業団地を通って Hlaing 川に流れ込む Ta Gu Chan Creek が工場排水の水質への影響の仕組みを観察する代表的な事例である。この河川の下流地点 Shwe 1 は、乾季において産業排水や下水によって汚染されていることが確認されており、有機物質及び栄養塩の水準が高く、BOD 値が 267mg/L、COD Cr 値が 4,900mg/L、全窒素 130mg/L、全りん 10mg/L を記録した。また、鉛濃度も若干高く 0.066mg/L を記録した。このように、乾季における Hlaing 川の水質汚濁の原因のひとつは工業団地からの影響であるが、流量の低下や生活排水による影響も重要な要素となる。

3) Pan Hlaing 川

直近の雨季における Pan Hlaing 川の水質は、大腸菌群数及び TSS 以外はベトナム国の地表水質基準の Class A2（処理後に生活用水として利用可能及び水生生物の保護）及び Class B1（灌漑用水として利用可能）の間のレベルである。Pan Hlaing 川の水質は、Hlaing 川より若干悪くなっているが、これは Hlaing 川と比較して Pan Hlaing 川は生活排水や産業排水を受け入れる環境容量が小さいことが要因だと考えられる。

また、新ヤンゴン開発の取水計画地点である Hlaing Tharyar 工業団地と Shwe Than Lwin 工業団地間に位置する PH1 地点の直近の乾季における水質は、河川流量が限定的でかつ河川に底質が懸濁したため、雨季時の水質より悪化したと推定される。PH1 地点の有機物及び栄養塩のレベルは高く、BOD 値が 47mg/L、COD 値が 3,400mg/L、全窒素が 92mg/L を記録している。一方、Hlaing 川との合流前の PH2 地点の水質は、潮汐流により河川水が混合するため、Hlaing-5 地点と同じ水質レベルであった。なお、重金属のひとつがベトナム国の水準（鉛：0.058mg/L）を超えていたが、これは、自然由来の鉛が含まれた堆積物が攪拌された結果だと想定される。Pan Hlaing 川の水質汚濁への影響については、乾季における河川流量の減少による影響の他に、i) Shwe Than Lwin 工業団地からの汚染及び新ヤンゴン上水供給計画の取水計画地点から 500m 上流に位置する工業団地周辺からの下水、ii) Hlaing Tharyar 工業団地からの汚染及び取水地点から 100m～5km 下流の工業団地周辺からの下水（潮汐現象により逆流した場合）、iii) 潜在的な取水地点（PH1 地点）より下流域における海水侵入による限定的な海水混合及び流速の低下と汚染された底質の懸濁、による影響が考えられる。しかし、汚染メカニズムについては、長期的な水質モニタリングデータ、水文データ、水利用に関する情報に基づいて、更なる検討が必要である。

(4) 工業団地及びその他の汚染源からの水質汚濁対策に向けた戦略

工業団地やその他の汚染源からの水質汚濁対策に関わる戦略を構築する第一段階として、プロジ

[1] ヤンゴン港の Delft3D-FLOW Model によると、Bago 川との合流前における Yangon 川への排水量は、最低月（4 月）の約 200m³/秒から最高月（8 月）の約 7,000m³/s 秒と推定される。(R.J. DE KOING & M.P.J. Janssen).

ェクト活動の一環として実施したインスペクション、水質調査、汚染源調査、データベース構築及び情報解釈に係る活動を参考に、C/P とのブレインストーミングを通じて、下記に示す重要戦略に関するフレームワーク案を策定した。

- 重要戦略 1:　周辺地域への汚染対策としての工業団地への集中排水処理設備の導入
- 重要戦略 2:　工場の水環境管理を促進させるメカニズムの開発
- 重要戦略 3:　優先エリアにおける水環境管理計画の策定及び実行

上位目標の指標が達成しプロジェクトが終了してから数年以内に、C/P 機関は上述の戦略案を策定する。

1) 重要戦略 1: 周辺地域への汚染対策としての工業団地への集中排水処理設備の導入

工業団地における汚染対策に関しては、現在、工業団地監督委員会で、電気、給水、排水処理、固形廃棄物処理サービス等のユーティリティサービスを改善するために、官民連携（PPP）スキームを最大限活用して既存の工業団地のインフラを更新することを協議している。ヤンゴン管区政府（YRG）は、ヤンゴン市を含むヤンゴン地域にある既存の工業団地に対して集中排水処理設備の導入を促進することができる立場にある機関である。現在、ヤンゴン管区政府、1990 年代に日本のデベロッパーとともに Mingaladon 工業団地に集中排水処理設備を導入した経験のある建設省都市住宅開発部（Urban and Housing Development Department of Ministry of Construction）、及び UNIDO を含めた他の関係機関は、既存の工業団地に集中排水処理施設をパイロット的に導入する事業を開始したところである。この事業での集中排水処理施設の導入及び運用の経験は、今後他の工業団地への導入の際に活用できる。

集中排水処理施設の導入は、工業団地における重要な水質汚濁対策のひとつである。ただし処理施設の導入の際の最も重要な課題は、資金調達である。処理施設導入の際の財政負担軽減のために、政府からの助成金（或いは ODA ローン）の確保、工場にユーティリティ・サービス（電気、水、排水処理、廃棄物処理）を提供できる政府機関のパートナー（或いは出資者）の確保など、財政面の対策が処理施設導入を実現させる鍵となる要素である。更に処理施設の導入の際に PPP を活用する場合は、土地や最低処理排水量の政府保証、政府及び民間の責任範囲の明確化などの課題がある。このように、ヤンゴン管区政府による集中排水処理施設導入に向けた的確なイニシアティブは、工業団地における排水管理に関する重要な戦略である。

2) 重要戦略 2: 工場の水環境管理を促進させるメカニズムの開発

現在、C/P が実施するほとんどの活動は、政府による工場に対する規制強化に関連するものである。しかし、パイロットエリアの工業団地における工場の多くは小・中規模の事業体であり、予算、人材、土地等が十分に確保できない等、水質汚濁対策を改善させるには様々な制約を抱えている。そのため、政府は、工場への監視を強化するだけでなく、工場による自発的な水質汚濁対策の導入を促進させるような支援ツールを開発することが必要である。将来的には、政府が以下のような地方レベルのツールを開発することが求められる。

- ミャンマーでの汚染対策のグッドプラクティスを紹介するようなセミナーの開催
- 地方／タウンシップレベルの ECD 事務所におけるコンサルテーションデスクの設置及び工場への汚染対策に関する情報や助言の提供
- 工場に対する表彰制度の構築及びインセンティブの提供（モニタリング頻度の削減、減税等）
- 工業が排水処理施設やその他汚染対策用設備を導入する際の低金利ローンの設立

3) 重要戦略 3: 優先エリアにおける水環境管理計画の策定及び実行

ヤンゴンのパイロットエリアにおける水環境管理の重要事項のひとつは、ヤンゴン新都市開発区への上水供給のための Pan Hlaing 川における取水計画地点及びヤンゴン市への上水供給のための Hlaing 川における取水計画地点（Kokkowa 地点及び Wataya 地点）の水質を保全することである。このため、これらの取水計画地点を優先エリアとして選定し、これらの優先エリアでの水環境管理計画を策定する必要がある。

- 水利用目的に適合した水質目標値の設定
- 将来の社会経済開発シナリオの設定
- 将来の取水計画地点の環境容量の算出
- 各セクターにおける主要な汚染源に対する水質汚濁対策の検討
- 工場及び施設に対する汚染対策に係る支援プログラムの策定
- 水質モニタリング計画の策定
- 水環境管理実施のための予算計画の策定
- 上述の検討を踏まえた優先エリアにおける各セクターの水環境管理計画のとりまとめ

(5) 工業団地及びその他の汚染源に対する水質汚濁対策に係るアクションプラン

既述の戦略案を基に、YCDC、ECD ヤンゴンおよび JET 間で行われた一連の協議やワークショップを通じて、工業団地やその他の汚染源に対する水質汚濁対策のために必要な活動が特定された。ヤンゴンのパイロットエリアにおける工業団地に対する水質汚濁対策に係るアクションプランの概要を表 2.6-3 に示す。アクションプランにおける各活動は、短期（3 年以内）、中期（5 年以内）、長期（10 年以内）の三期にわけられている。

表 2.6-3　ヤンゴンのパイロットエリアにおける工業団地に対する水質汚濁対策に係るアクションプラン概要

Goal	To contribute to a part of water environment management in upgrading existing industrial zones to “Eco-industrial Zones”
Target Year	Short term: FY2020-21 (from October 2018 to September 2021) Middle term: FY2022-23 (from October 2021 to September 2023) Long term: FY2027-28 (from October 2023 to September 2028)
Key Strategies	Key Strategy 1: Installation of centralized wastewater treatment plants in industrial zones to prevent pollution in the surrounding area Key Strategy 2: Development of a mechanism for promoting water environment management by factories Key Strategy 3: Development of water environment management plans and their implementation in priority areas
Actions and Schedule	Key Strategy 1: Installation of centralized wastewater treatment plants in industrial zones to prevent pollution in the surrounding area [Yangon Region Government] AY1-1: Setting policy for installation of centralized wastewater treatment plants in industrial zones (short term) AY1-2: Construction and operation of a pilot centralized wastewater treatment plant in an industrial zone (short term to middle term) AY1-3: Formulation of PPP scheme on construction and operation of centralized wastewater treatment plants in priority industrial zones (short term) AY1-4: Construction and operation of centralized wastewater treatment plants in priority industrial zones (middle term to long term)
	Key Strategy 2: Development of a mechanism for promoting water environment management by factories [YCDC] AY2-1: Improvement of inspection activities for issuing/renewing licenses by YCDC Administration Department in accordance with the revised YCDC law to be enacted (short-term)

	AY2-2: Strengthening on-site monitoring such as wastewater monitoring, noise monitoring, air emission monitoring (short-term) AY2-3: Examining the possibility to introduce wastewater discharge fee system in Yangon City, such as research for similar systems in ASEAN countries (middle-term) [ECD Yangon Region] AY2-1: Collection of information on existing factories which have been requested to prepare EMPs in accordance with the Notification No. 03/2018, and identification of important factories associated with large pollution load through guidance seminars to each industrial zone for collection of target factories and awareness raising to factories by ECD Yangon Region, collection of information from DISI/MOI, collection through inspection activity by ECD Yangon Region, DICA/MOPF and collection from PCCD/YCDC (short-term) AY2-2: Establishment of monitoring/supervising system to check status of preparation of EMPs by the prioritized factories, such as monitoring/supervising through inspection activities (short-term) AY2-3: Organizing seminars for introduction of good practice on pollution control in Myanmar (short-term) AY2-4: Setting consultation desks in district/township ECD offices to provide advices/information to factories on pollution control (middle-term) AY2-5: Examining the possibility to promote water environment management (e.g. award system with some incentives, establishment of low interest fund, consultation on cleaner production) in Yangon Region, through research for similar systems in ASEAN countries (middle-term)
	Key Strategy 3: Development of water environment management plans and its implementation in priority areas [YCDC] AY3-1: Improvement of domestic and commercial wastewater of existing factories (short-term to middle-term) AY3-2: Expansion of sewerage areas (middle-term to long-term) AY3-3: Development of water environment management plans in the priority areas (short-term to middle term) [ECD Yangon Region] AY3-4: Establishment of water quality testing laboratory (middle-term) AY3-5: Starting-up and implementation of surface water quality monitoring in rivers in the region (middle-term to long-term) AY3-6: Implementation of water environment management plans in the priority areas (middle term to long term)

Source: YCDC, ECD Yangon Region, and JET

2.6.2.3 マンダレーのパイロットエリアにおける水質状況（Doka Hta Waddy 川流域、Taung Tha Man 湖流域）

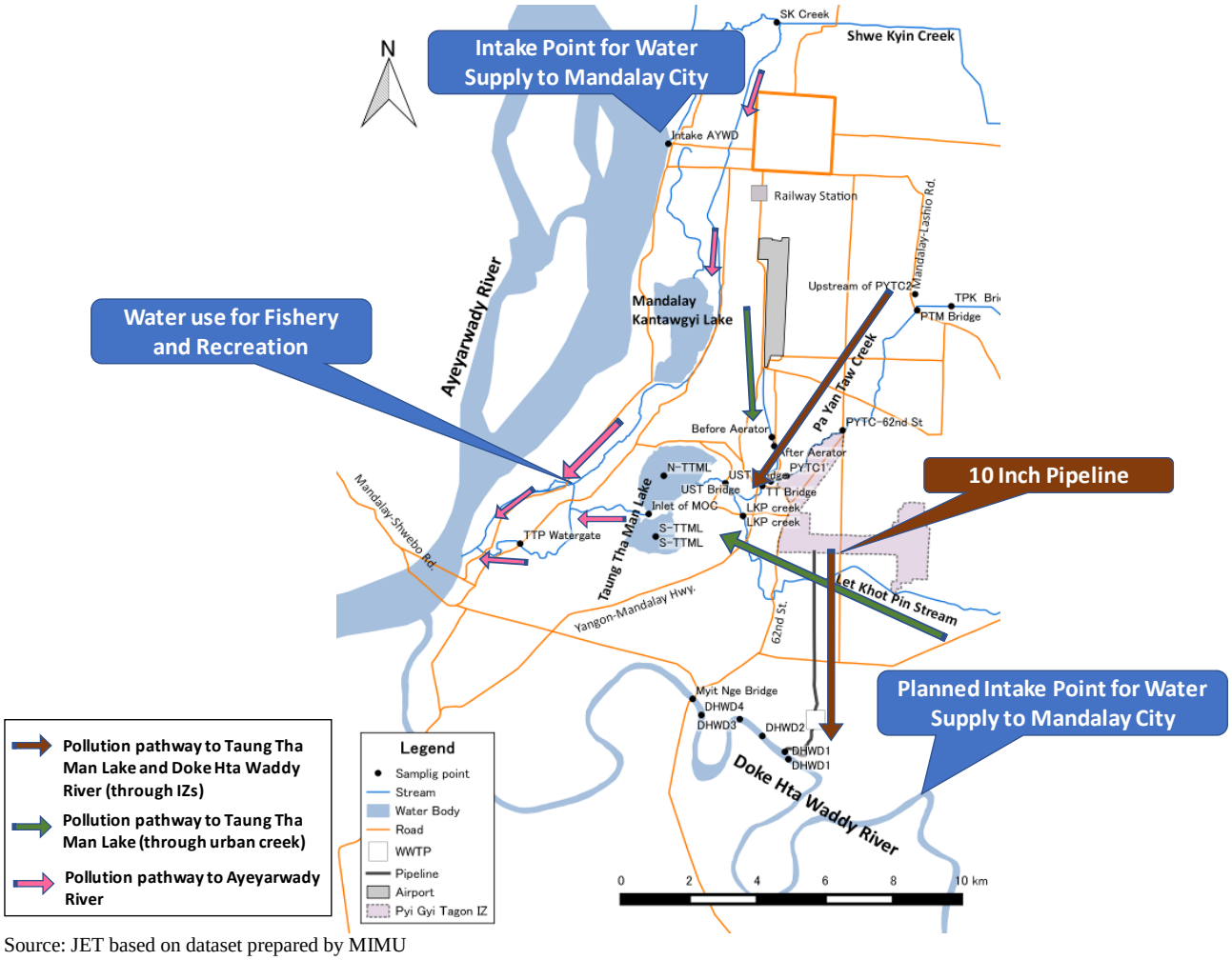
(1) 河川及び湖への汚染経路概略

図 2.6-3 は、マンダレー市及び周辺の工業団地における汚染経路、工業団地及び上水供給のための取水地点の位置を示したものである。マンダレー市からの汚染経路は、i) マンダレー市中央及び東部の Taung Tha Man 湖流域、及び ii) マンダレー市西部の Shwe Kyin 川、Mandaly Kantawgyi 湖及び小河川、の二つの地域に分けられる。マンダレー市の中央及び東部では、Pa Yan Taw Creek や Let Khot Pin Creek、その他の小河川や排水溝からの汚染が Thaung Tha Man 湖に到達し、Ayeyarwaddy 川に流れ込む。小河川のうち、Pa Yan Taw 川は Pyi Gyi Tagon 工業団地を通過して湖に流れ込む。一方、マンダレー市西部では、Shwe Kyin Creek、Mandaly Kantawgyi 湖、更にいくつかの小河川からの汚染が直接 Ayeyarwaddy 川に流れ込む。マンダレー市西部の排水は Doke Hta Waddy 川にはつながっていないため、この地域はパイロットエリアから削除した。

Doke Hta Waddy 川はマンダレー市の南部に位置し、Pyi Gyi Tagon 工業団地の排水は、MCDC が導入した 10 インチのパイプラインを通って収集され、この河川に排出されている。MCDC は、パイプラインの河川への放流口前のエリアにおいて集中排水処理施設の建設を BOT スキームで民間企業に委託した。

上水供給のための取水地点は、既存地点及び MCDC による計画地点がある。これらは、i) マンダレー市への上水供給のための Ayeyarwaddy 川からの取水地点、及び ii) Doke Hta Waddy 川における 10 インチパイプラインの放流口から 10km 上流の取水計画地点である。他の水利用方法について

は、Taung Tha Man 湖は漁業、リクリエーション、洪水調節として、Doke Hta Waddy 川は灌漑、水運、リクリエーション及び川沿いの居住者のための生活用水として使われている。



Source: JET based on dataset prepared by MIMU

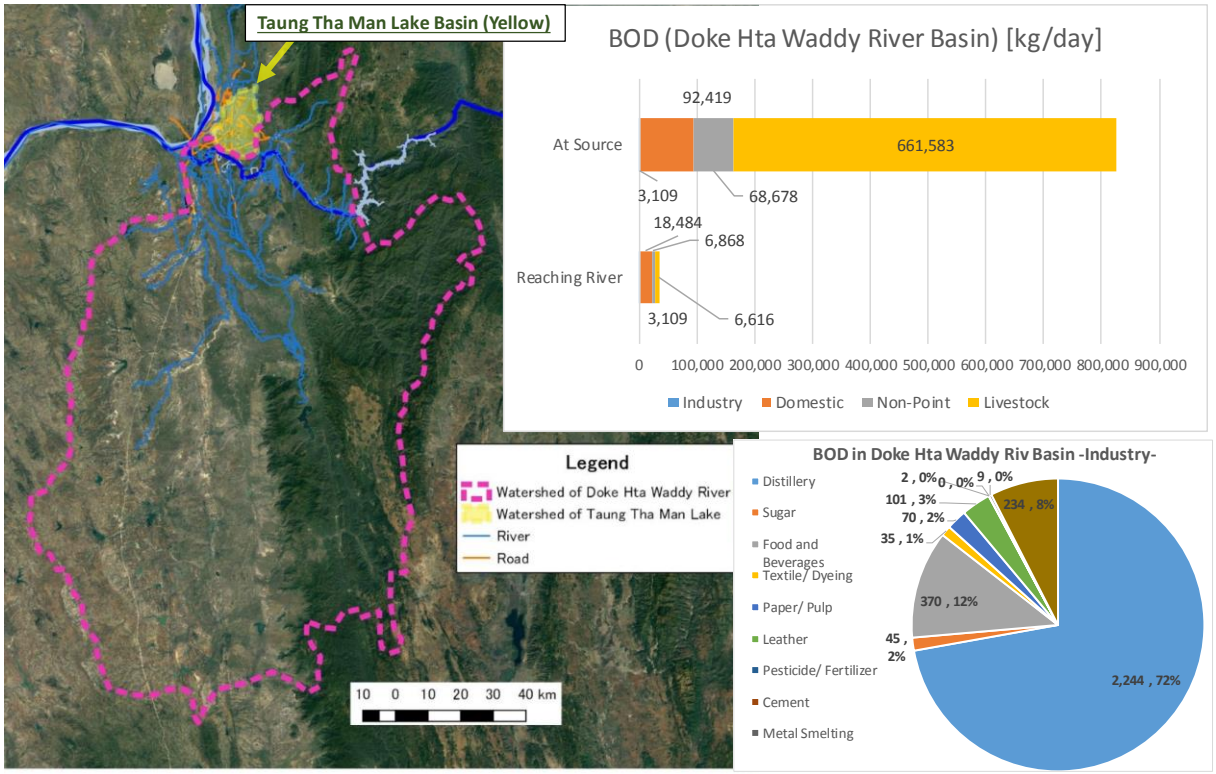
図 2.6-3 マンダレーのパイロットエリアにおける河川の汚染経路、工業団地、上水給水のための取水地点（既存及び計画）

(2) 汚濁負荷量の推定結果

1) Doke Hta Waddy 川流域

Doke Hta Waddy 川流域（Yeywa ダムから Ayeyawaddy 川合流前までの流域 17,000km^2）の汚濁負荷量の推定結果は図 2.6-4 に示すとおりである。この流域では 825,000kg/日の BOD 汚濁負荷量が発生し、そのうち 35,000kg/日が Doke Hta Waddy 川に流入している。河川に流入している 35,000kg/日のうち、53%が生活排水から、9%[1]が産業排水から、19%が畜産業及びノンポイント汚染源から発生したものである。河川に流入する汚濁負荷量の割合は自浄作用のため平均で 10%以下で、特に農村部においてその傾向が大きい。大規模な汚濁負荷を発生させている業種は、蒸留酒製造及び飲食料品であり、これらの 2 つの業種からの BOD 汚濁負荷量が約 84%を占める。

[1] Pyi Gyi Tagon 工業団地からの工場排水は、10 インチのパイプラインを通って Doke Hta Waddy 川へ排出されるか、小河川を通って Thaung Tha Man 湖に排出される。排水量は、それぞれ半々である。

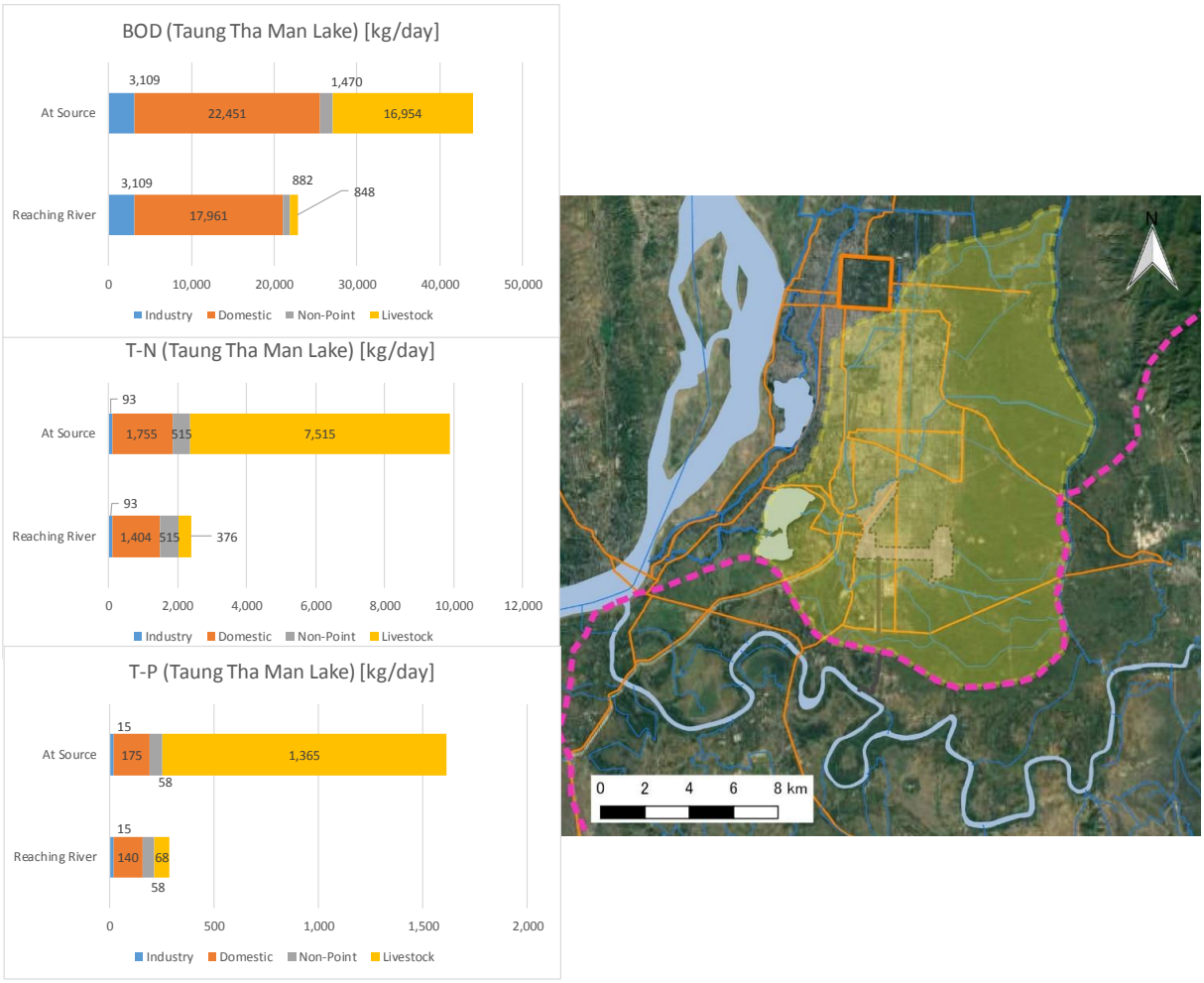


Source: JET based on dataset prepared by MIMU

図 2.6-4 Doke Hta Waddy 川流域における汚濁負荷量の推定結果（右上：汚染源別の汚濁負荷量及び河川への流入量、右下：工業セクターにおける各業種からの汚濁負荷量）

2) Taung Tha Man 湖流域

Taung Tha Man 湖流域における BOD、全窒素及び全りんの汚濁負荷推定量は図 2.6-5 に示すとおりである。BOD の汚濁負荷量は、汚染源においては 44,000kg/日、湖に流入する量は 23,000kg/日である。湖に流入する 23,000kg/日のうち、79%が生活排水、13%が産業排水、4%が畜産業からの排水、4%がノンポイント汚染源からの排水から発生している。富栄養化に関連する全窒素及び全りんの汚濁負荷量については、全窒素は 10,000kg/日が汚染源で発生し、2,400kg/日が湖に流入している。全りんについては 1,600kg/日が汚染源で発生し、300kg/日が湖に流入している。湖に流入する全窒素及び全りんの汚濁負荷量のうち、生活排水起因は 59%（全窒素）及び 50%（全りん）、産業排水起因は 4%（全窒素）及び 5%（全りん）、畜産業からの排水起因は 16%（全窒素）及び 24%（全りん）、ノンポイント汚染源からの排水は 16%（全窒素）及び 21%（全りん）である。全窒素及び全りんの主要な汚染源は、BOD と同様に生活排水であり、次に畜産業からの排水、ノンポイント汚染源からの排水と続く。これらの割合は BOD 汚濁負荷量の場合と比較して相対的に高い。



Source: JET based on dataset prepared by MIMU

図 2.6-5 Taung Tha Man 湖流域の汚濁負荷量の推定結果（汚染源別の汚濁負荷量（(BOD、全窒素、全りん）及び河川への流入量）

(3) 河川及び湖の水質汚濁評価

1) Doke Hta Waddy 川

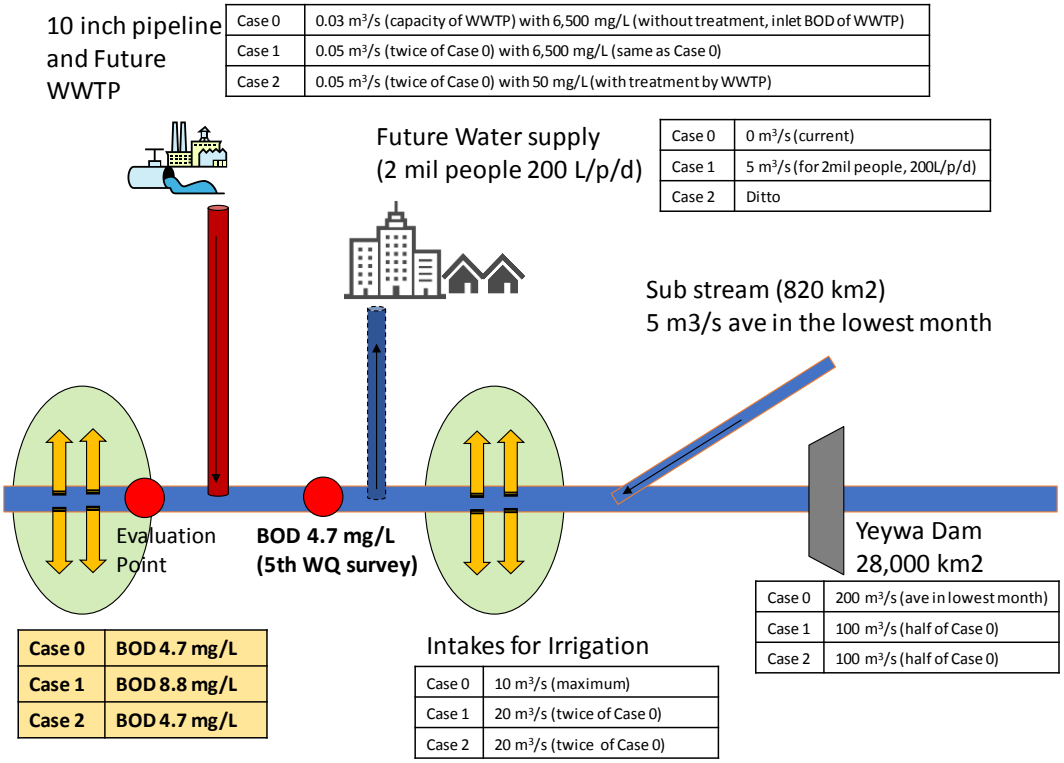
直近の雨季（2017 年 9 月）及び乾季（2018 年 2 月）におけるマンダレー市近郊の Doke Hta Waddy 川（DHWD1, DHWD2, Myint Nge 橋）の水質は、雨季における大腸菌群数以外は、ベトナム国の生活用水に係る水質基準（ClassA1 及び Class A2）を満たしていた。これは以下の要因による：

- 河川上流部に、大規模な都市、工業団地、集約的農業・畜産業が存在しない。
- 河川は 10 インチのパイプラインを通って排出される Pyi Gyi Tagon 工業団地からの未処理排水を受け入れるだけの流量がある[1]。
- 10 インチのパイプラインからの排水量は水質調査の実施時には限定的であった。

MCDC は将来、Doke Hta Waddy 川において 10 インチパイプライン排出口から上流の地点から、上水供給のために取水する計画である。一方、当該河川においては、Yeywa ダム開発に加えて、Upper Yeywa ダムプロジェクトや Deedoke 水力発電プロジェクトなどの新しい水力発電開発プロ

[1] 電力エネルギー省ミャンマー発電会社提供の 2016 年の日次データによると、毎月の Yeywa ダムからの放流量は最低月（7 月）で 200m^3/秒、最高月（8 月）で 1,100 m^3/秒である。

ジェクトが計画されている。将来、これらの水力発電開発や工業団地・新都市開発が実施された場合、ダムからの河川流量の減少や開発された工業団地及び新都市からの水質汚濁物質流入の増加により、Doke Hta Waddy 川の水質は悪化すると考えられる。これらの影響を評価するために、成果 4 のケーススタディとして Doke Hta Waddy 川の環境容量の初期調査を行った。この評価結果を図 2.6-6 に示す。現況（Case 0）と比較して、ダムの運用、灌漑及び上水供給の増加により河川流量が低下し、集中排水処理施設の建設が行われずに 10 インチパイプラインからの産業排水量が増加した場合（Case 1）、10 インチパイプライン排出口より下流の BOD 値は 2 倍になると推定される。なお、集中排水処理施設が作動した場合（Case 2）は、河川流量は減少するが下流域の水質は現況のレベルに保たれると推定される。



Source: JET

図 2.6-6 Doke Hta Waddy 川の環境容量に関する初期評価結果

2) Taung Tha Man 湖

水質調査の結果に関する節で既述したとおり、Taung Tha Man 湖は、直近の雨季（2017 年 9 月）及び乾季（2018 年 9 月）において、りん及び窒素が高濃度で、DO 値が比較的低く COD 値が高い状態であるため、富栄養状態にあるといえる。Taung Tha Man 湖に流れ込む主要河川・小河川は、Let Khot Pin Creek、Pa Yan Taw Creek 及び Colombo Creek であり、これらの河川・小河川には、都市からの下水や Pyi Gyi Tagon 工業団地の工場のうち 10 インチパイプラインに接続していない工場からの排水、畜産業やノンポイント汚染源からの排水が流れ込む。特に乾季は湖の水位が低くなるため、湖の水質が悪化する。ただし、湖の水質は、季節や時期により劇的に変化・変動するため、湖の水質汚濁のメカニズムを解明するためには更なるモニタリングデータが必要である。一方で、MCDC が産業排水を Doke Hta Waddy 川に排出するように 10 インチパイプラインを導入し、MCDC の指導により大半の大規模工場がこのパイプラインに接続したため、産業排水による湖への水質汚濁の影響は年々減少している。

(4) 工業団地及びその他の汚染源からの水質汚濁対策に向けた戦略

工業団地からの水質汚濁への対策に向けた戦略を構築する第一段階として、C/P とのブレインス

トーミングを通じて、関連プロジェクトにおけるインスペクション、水質調査、汚染源調査、データベース構築及び情報解釈に係る活動を参考に、下記に示す重要戦略に関するフレームワーク案を策定した。

- 重要戦略 1:　Doke Hta Waddy 川の将来利用のための水環境保全
- 重要戦略 2:　観光業、リクリエーション、漁業等のために湖の価値向上に資する Taung Tha Man 湖の水質改善

上位目標の指標が達成しプロジェクトが終了してから数年以内に、C/P 機関は上述の戦略案を策定する。

1) 重要戦略 1: Doke Hta Waddy 川の将来利用のための水環境保全

Doke Hta Waddy 川流域の水質は現時点では良好であり、Yeywa 水力発電ダムの運用により乾季でも十分な河川流量が確保されている。更に、この流域には Pyi Gyi Tagon 工業団地の 10 インチパイプラインからの産業排水の流入以外にはほとんど汚染源が存在しない。MCDC 主導による Doke Hta Waddy 川流域の水質汚濁対策として、水利権に係る調整委員会の設置及び維持流量の設定という二つの主要なアクションが計画されており、また集中排水処理施設が建設中である。更に、水質汚濁改善及び水保全の観点から、上述の戦略に加えて以下のようなアクションが検討されるべきである。

- Pyi Gyi Tagon 工業団地における未使用区画で更なる工場が稼働する場合に備えて、工業団地からの産業排水を処理する集中排水処理施設の能力を増強させる
- 上流部における Doke Hta Waddy 川からの大規模な取水及び当河川への排水排出を伴う事業に関する規則やルールを設定する

2) 重要戦略 2:　観光業、リクリエーション、漁業等のための湖の価値向上に資する Taung Tha Man 湖の水質改善

MCDC 及び ECD マンダレーは、新設の大規模工場に対する排水処理システムの導入に係る通達や、DOA マンダレーが実施中の農家に対する適切な肥料の適用に関する意識向上活動への参画、対象 9 業種の既存の工場に対する EMP 策定に係る通告のフォローアップ等、既にいくつかの活動を実施及び計画している。汚濁負荷量分析の結果を踏まえると、湖への汚濁負荷量を削減するには、下水の管理が非常に重要であると考えられ、MCDC は将来的には下水サービスエリアを拡大する計画である。

一方、湖の水質及び水文は、季節や時期により劇的に変化・変動するため、湖の水質汚濁のメカニズムを解明するためには更なるモニタリングデータが必要である。更に、日本を含めた先進国の経験を踏まえると、湖の水質を改善するにはある程度の時間を要すると考えられる。したがって、Taung Tha Man 湖の水質汚濁のメカニズムの詳細な検討結果に基づいた流域の水質汚濁削減計画の策定について、戦略に追記する必要がある。

(5) 工業団地及びその他の汚染源に対する水質汚濁対策に係るアクションプラン

上述の戦略案を基に、MCDC、ECD マンダレー管区事務所や JET 間で行われた一連の協議やワークショップを通じて、マンダレーの工業団地やその他の汚染源に対する水質汚濁対策のために必要な活動が特定された。マンダレーのパイロットエリアにおける工業団地に対する水質汚濁対策に係るアクションプランの概要を表 2.6-4 に示す。アクションプランにおける活動は、短期（3 年以内）、中期（5 年以内）、長期（10 年以内）の三期にわけられる。産業排水対策に係る主要な活動（排水の流出先を転じるための 10 インチのパイプラインの建設、集中排水処理設備の建設、大規模工場における個々の排水処理施設の導入等）のなかには、MCDC や他のステークホルダー

が既に取り組み始めた、或いは、完了させたものも含まれる。

表 2.6-4　マンダレーのパイロットエリアにおける工業団地に対する水質汚濁対策に係るアクションプラン概要

Target year	Short term: FY2020-21 (from October 2018 to September 2021) Middle term: FY2022-23 (from October 2021 to September 2023) Long term: FY2027-28 (from October 2023 to September 2028)
Key Strategies	Key Strategy 1: Water environment conservation for future water use of the Doke Hta Waddy River. Key Strategy 2: Improvement of water quality of Taung Tha Man Lake to increase the value of lake resources for tourism, recreation, fisheries, etc.
Actions and Schedule	Key Strategy 1: Water environment conservation for future water use of the Doke Hta Waddy River [MCDC] AM1-1: Setting a coordination committee among DWIR/MOTC, MOALI, MOEE, ECD Mandalay Region, MCDC for water use right and setting the maintenance flow of the Doke Hta Waddy River (short term) AM1-2: Completion of the construction and starting operation of the centralized wastewater treatment plant (ongoing, short term to middle term) AM1-3: Installation of the water supply system from the Doke Hta Waddy River (middle term) [ECD Mandalay Region] AM1-4: Collection of information on existing factories, which are requested to prepare EMPs in accordance with Notification No. 03/2018, and identification of important factories associated with large pollution load through guidance seminars to each industrial zone, collection from DISI/MOI, collection through inspection activity by ECD Mandalay Region, and collection from CD/MCDC out of Mandalay City (short term) AM1-5 Establishment of a monitoring/supervising system to check the status of preparation of EMPs by the prioritized factories, such as monitoring/supervising through inspection activities out of Mandalay City (short term) AM1-6: Starting-up and implementation of surface water quality monitoring in rivers in the region out of Mandalay City (middle term to long term)
	Key Strategy 2: Improvement of water quality of Taung Tha Man Lake to increase value of the lake for tourism, recreation, fisheries, etc. [MCDC] AM2-1: Monitoring of connection status of the 10-inch-pipeline (started, short-term) AM2-2: Issuing a notification of installation of wastewater treatment system to new large scaled facilities, such as housing, commercial, hotel, hospital, and school development (drafting, short-term) AM2-3: Participation in awareness raising activities for farmers by the Department of Agriculture (DOA) in Mandalay Region regarding proper application of fertilizer to reduce the impact of nitrogen and phosphorus to Taung Tha Man Lake and collaboration of the activities with DOA (already implemented by DOA, short term) AM2-4: Establishment of a plan for monitoring of eutrophication status in Taung Tha Man Lake including water quality, flow rate, and water level (short term) AM2-5: Expansion of the sewerage area in Mandalay City (middle term to long term) [ECD Mandalay Region] AM2-6: Collection of information on existing factories, which are requested to prepare EMPs in accordance with the Notification No. 03/2018, and identification of important factories associated with large pollution load (short-term) AM2-7: Establishment of monitoring/supervising system to check the status of preparation of EMPs by the prioritized factories, such as monitoring/supervising through inspection activities (short-term)
	Other actions to support the implementation of key strategies [ECD Mandalay Region] AM3-1: Organizing seminars for the introduction of good practice on pollution control in Myanmar (short term) AM3-2: Setting consultation desks in district/township ECD offices to provide advices/information to factories on pollution control (middle term) AM3-3: Examining the possibility to promote water environment management (e.g. awarding system with some incentives, establishment of low interest fund, consultation on cleaner production) in Yangon Region, through research on similar systems in ASEAN countries (middle-term) AM3-4: Arrangement of ad hoc coordination meetings to exchange information on pollution sources and results of inspections among DISI, MCDC, and ECD Mandalay Region (short term)

Source: MCDC, ECD Mandalay Region, and JET

2.6.2.4 国レベルの工場の水質汚濁対策及び水環境管理のための戦略

MONREC における ECD 本部内の汚染管理部は、インスペクション活動の ECD 地方・管区レベルへの拡大、国家環境質（排出）ガイドラインの策定、オンサイト測定機器を用いた水質モニタリングの実施等、産業排水対策に関する様々な取り組みを展開している。汚染管理部は、国際協力機関の技術支援を受けて有害廃棄物管理に係るマスタープラン及び地表水の水質基準案を策定している。しかし、汚染管理部は時間軸を考慮した包括的な水質汚濁対策計画はまだ策定していない。したがって、本プロジェクトの成果 4 のケーススタディとして、汚染管理部は JET との協議を通じて、工業セクターからの水質汚濁対策に重点的に取り組む水環境管理の主要な戦略に係るフレームワーク案を策定した。上位目標の指標が達成しプロジェクトが終了してから数年以内に、汚染管理部は上述の戦略案を策定する。

水環境管理の主要な戦略に係るフレームワークを策定する第一段階として、以下の三点の指針を設定した。

- ECD 中央による地方化戦略の方向性にしたがって、ECD 事務所の県・タウンシップレベルへの拡大等、地方 ECD の機能を最大限活用する。
- 汚染管理部が 2018 年 4 月以来、汚染対策局と環境質基準局に分割されたため、水質汚濁対策及びそれ以外の環境管理に係る活動を別々に展開する。
- EIA 手続き、国家環境質（排出）ガイドライン、対象 9 業種の既存の工場に対する EMP 策定に係る通告など、現在の汚染管理に係る規制ツール及び活動を活用する。

上述の三点の指針に基づいて、国レベルの水環境管理（工場からの水質汚濁への対策）に向けた戦略及びそのアクションプランを策定した。成果 1（2.3.7 節）、成果 2（2.4.10 節）および成果 3（2.5.8 節）の課題と提案も考慮に入れた。

戦略に向けた活動は、短期（3 年以内）、中期（5 年以内）、長期（10 年以内）の三期にわけられる。国レベルの工場の水質汚濁対策及び水環境管理に係るアクションプランを表 2.6-5 に、詳細なアクションと実施スケジュールを表 2.6-6 にそれぞれ示す。

【工業汚濁対策】

- 戦略 1：国レベルの汚染源インベントリーの策定
- 戦略 2：汚染コントロールシステムの強化

【水環境管理】

- 戦略 3：地表水の水質基準の設定及び国レベルの水質モニタリングネットワークの構築
- 戦略 4：水環境管理に係る活動の推進

【組織強化】

- 戦略 5：地方分権化に資する組織強化

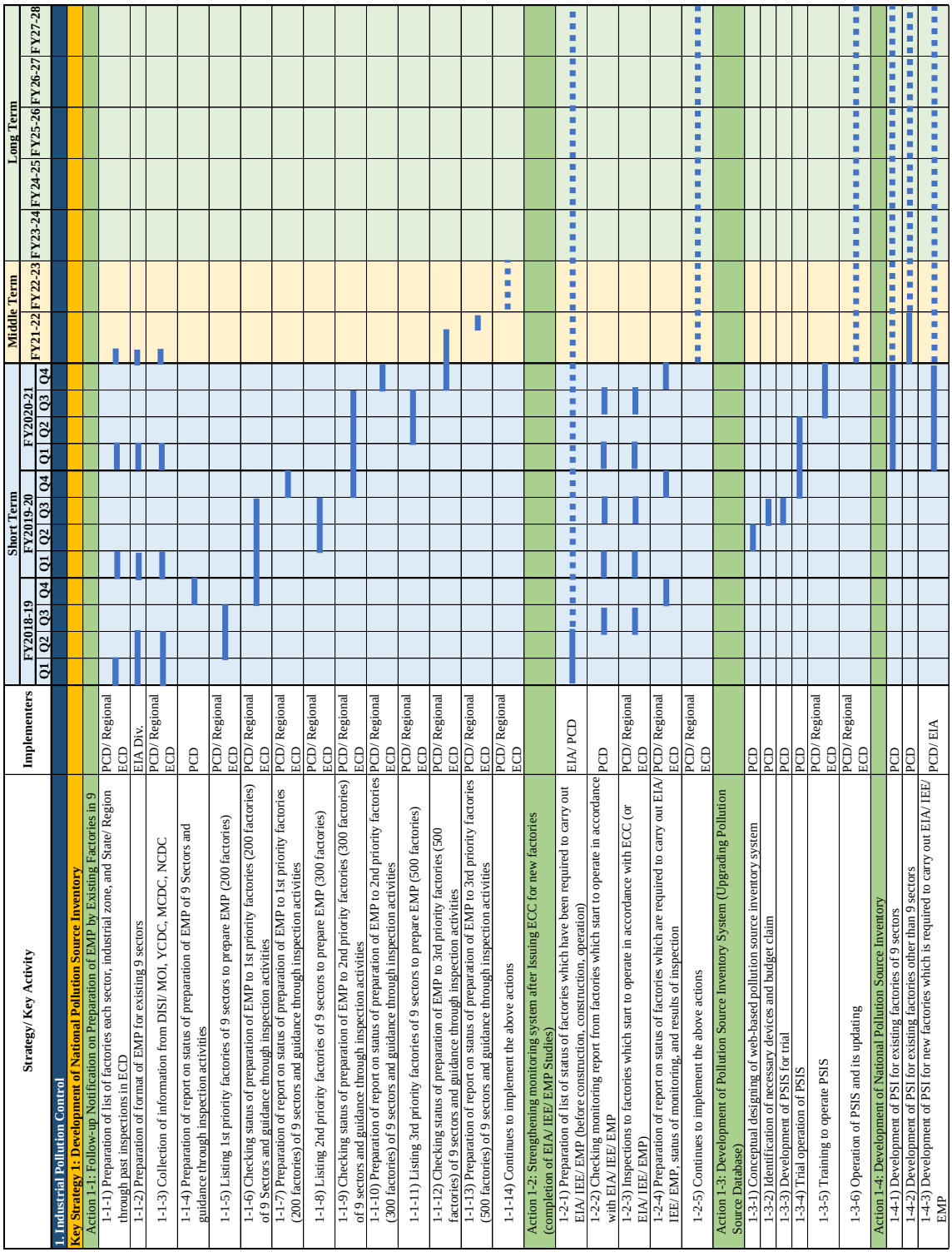
表 2.6-5　国レベルの産業排水による水質汚濁への対策及び環境管理に関するアクションプラン概要

Goal	Short term goal:	Important industrial pollution sources associated with large pollution emission in the country are identified and surface water quality in key rivers at national level are started to be monitored by FY 2020-21
	Middle term goal:	All of the industrial pollution sources in the country are identified and some pollution control tools are introduced by FY 2022-23
	Long term goal:	Industrial pollution control and environmental management system by government organizations are in the level of ASEAN top five by FY2027-28
Target year	Short term:	FY2020-21 (from October 2018 to September 2021)
	Middle term:	FY2022-23 (from October 2021 to September 2023)
	Long term:	FY2027-28 (from October 2023 to September 2028)

Key Strategies	[Industrial Pollution Control] Key Strategy 1: Development of National Pollution Source Inventory Key Strategy 2: Strengthening Pollution Control System [Water Environmental Management] Key Strategy 3: Development of Surface Water Quality Standards and National Water Quality Monitoring Network Key Strategy 4: Promoting Actions for Water Environment Management [Strengthening Organizations] Key Strategy 5: Strengthening Organizations in Response to Decentralization
Key Actions and Schedule	[Industrial Pollution Control] Key Strategy 1: Development of National Pollution Source Inventory NA 1-1: Follow-up the notification on preparation of EMP by existing factories in nine sectors (short to middle Term) NA1-2: Strengthening monitoring system after issuing ECCs (or completion of EIA/ IEE/ EMP Study) (short to middle Term) NA1-3: Development of pollution source inventory system (upgrading pollution source database) (short to middle Term) NA1-4: Development of National Pollution Source Inventory (middle term) Key Strategy 2: Strengthening Pollution Control System NA2-1: Strengthening Enforcement and Promotion of Environmental Compliance (Short Term) NA2-2: Formulating National Environmental Quality (Emission) Standards (short term) NA2-3: Promotion of centralized wastewater treatment plants (short to long term) NA2-4: Strengthening inspection activities (short to middle term) NA2-5: Development of pollution control tools (short to long term) [Water Environmental Management] Key Strategy 3: Development of Surface Water Quality Standards and National Water Quality Monitoring Network NA3-1: Formulating Surface Water Quality Standards (short term) NA3-2: Development of national surface water quality monitoring network (short to long term) nA3-3: Establishment of Water Quality Testing Laboratory and Standardization of Environmental Analytical Method (short to long term) Key Strategy 4: Promoting Actions for Water Environment Management NA4-1: Preparation of environmental statistics (short term) NA4-2: Promoting environmental awareness (short to long term) NA4-3: Preparation of the state of pollution report (middle term to long term) [Strengthening Organizations] Key Strategy 5: Strengthening Organizations in Response to Decentralization NA5-1: Training for industrial pollution control (short to middle term) NA5-2: Training for Water environment management (middle to long term)

Source: ECD and JET

表 2.6-6　国レベルの産業排水による水質汚濁への対策及び環境管理に関する詳細アクションプラン及び実施スケジュール

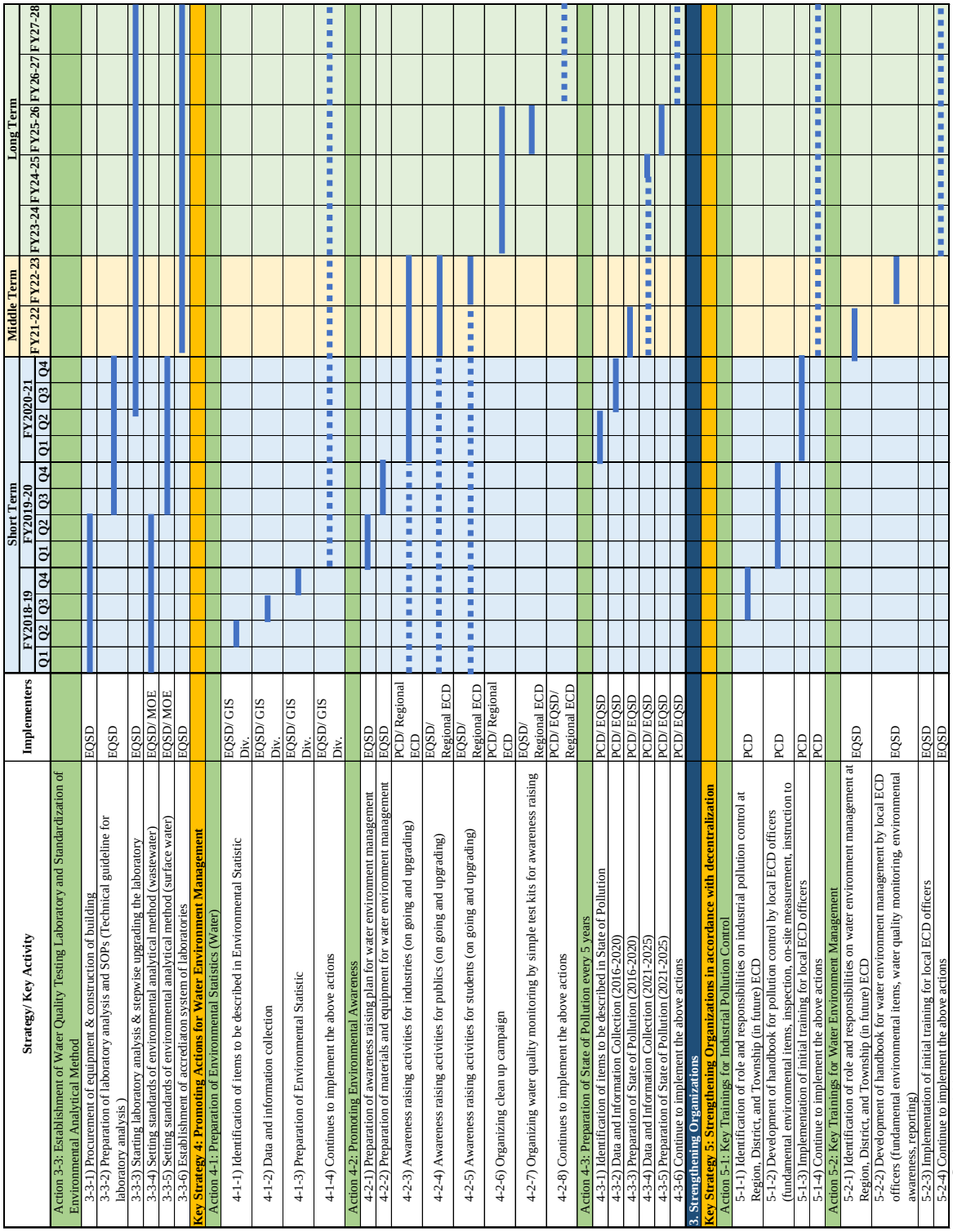


Source: ECD and JET

Strategy/ Key Activity	Implementers	Short Term												Middle Term			Long Term				
		FY2018-19				FY2019-20				FY2020-21				FY21-22	FY22-23	FY23-24	FY24-25	FY25-26	FY26-27	FY27-28
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4							
Key Strategy 2: Strengthening Pollution Control																				
Action 2-1: Strengthening Enforcement and Promotion of Environmental Compliance																				
2-1-1) Selection of priptoty target sectors to be Investigated	PCD																			
2-1-2) Analyzing operation and environmental performance of key target industrial	PCD																			
2-1-3) Strengthening enforcement of environmental law and regulations	PCD																			
2-1-4) Strengthening promotion and facilitation of environmental compliance	PCD																			
2-1-5) Development of a roadmap to control industrial pollution	PCD																			
Action 2-2: Formulating Wastewater Quality Standards																				
2-2-1) Development of draft Wastewater Quality Standards	PCD																			
2-2-2) Public consultations	PCD																			
2-2-3) Issuing Wastewater Quality Standards and its updating	PCD																			
Action 2-3: Promotion of Centralized Wastewater Treatment Plant																				
2-3-1) Issuing notification of instruction of measurement water usage and wastewater qualities	ECD																			
2-3-2) Checking status of installation of water flow meter and monitoring wastewater quality by priority factories	PCD/ Regional ECD																			
2-3-3) Checking status of installation of Centralized Wastewater Treatment Plant (WWTP) in existing/ new industrial zones and preparation of the report	PCD/ Regional ECD																			
2-3-4) Discussions how to promote installation of Centralized WWTP in NECCCCCC	ECD HQ																			
2-3-5) Issuing Instruction from Presidential Office to Regional Governments to promote Installation of Centralized WWTP in industrial zones	ECD HQ/ NECCCCCC																			
Action 2-4: Strengthening Inspection Activities																				
2-4-1) Inspection by Regional/ State ECDs and its reporting to ECD HQ	PCD/ Regional ECD																			
2-4-2) Inspection by District ECDs and its reporting to Regional ECD and ECD HQ	PCD/ Regional ECD																			
2-4-2) Inspection by Township ECDs and its reporting to District/ Regional ECD and ECD HQ	PCD/ Regional ECD																			
2-4-4) Inspection by ECD HQ and summarize inspection report at national level	PCD																			
2-4-5) Updating Inspection Manual	PCD																			
Action 2-5: Development of Pollution Control Tools																				
2-5-1) Investigation of Pollution Control Tools in ASEAN countries	PCD																			
2-5-2) Formulation of National Water Pollution Control Strategies	PCD																			
2-5-3) Formulation of Wastewater Discharge Fee System	PCD																			
2-5-4) Development of Performance Rating and Awarding System	PCD																			
2-5-5) Development of Pollution Control Manager System	PCD																			
2-5-6) Establishment of Cleaner Production Technology Center	PCD																			
2-5-7) Establishment of Pollution Control Agreement Scheme	PCD																			
2-5-8) Formulation of Pollution Control Act	PCD																			
2. Water Environment Management																				
Key Strategy 3: Development of Surface Water Quality Standards and National Water Quality Monitoring Network																				
Action 3-1: Development of Surface Water Quality Standards																				
3-1-1) Development of draft Surface Water Quality Standards	EQSD																			
3-1-2) Public Consultations	EQSD																			
3-1-3) Issuing Surface Water Quality Standards and its updating	EQSD																			
Action 3-2: Development of National Surface Water Quality Monitoring Network																				
3-2-1) Setting demarcation of Surface Water Quality Monitoring between Central ECD and Regional ECDs	PCD/ Regional ECD																			
3-2-2) Identification of important water bodies to be conserved at rivers and lakes at National Level	EQSD/ Regional ECD																			
3-2-3) Phasing to develop National Surface Water Quality Monitoring Network (3 Phases)	EQSD/ Regional ECD																			
3-2-4) Trial Surface Water Quality Monitoring (1st Phase) and Report Preparation	EQSD/ Regional ECD																			
3-2-5) Starting National Surface Water Quality Monitoring (1st Phase)	EQSD/ Regional ECD																			
3-2-6) Development of National Surface Water Quality Monitoring Network (2nd	EQSD																			
3-2-7) Starting National Surface Water Quality Monitoring (2nd Phase)	EQSD																			
3-2-8) Development of National Surface Water Quality Monitoring Network (3rd	EQSD																			
3-2-9) Starting National Surface Water Quality Monitoring (3rd Phase)	EQSD																			

Continuous activities
Intermediate activities

Source: ECD and JET

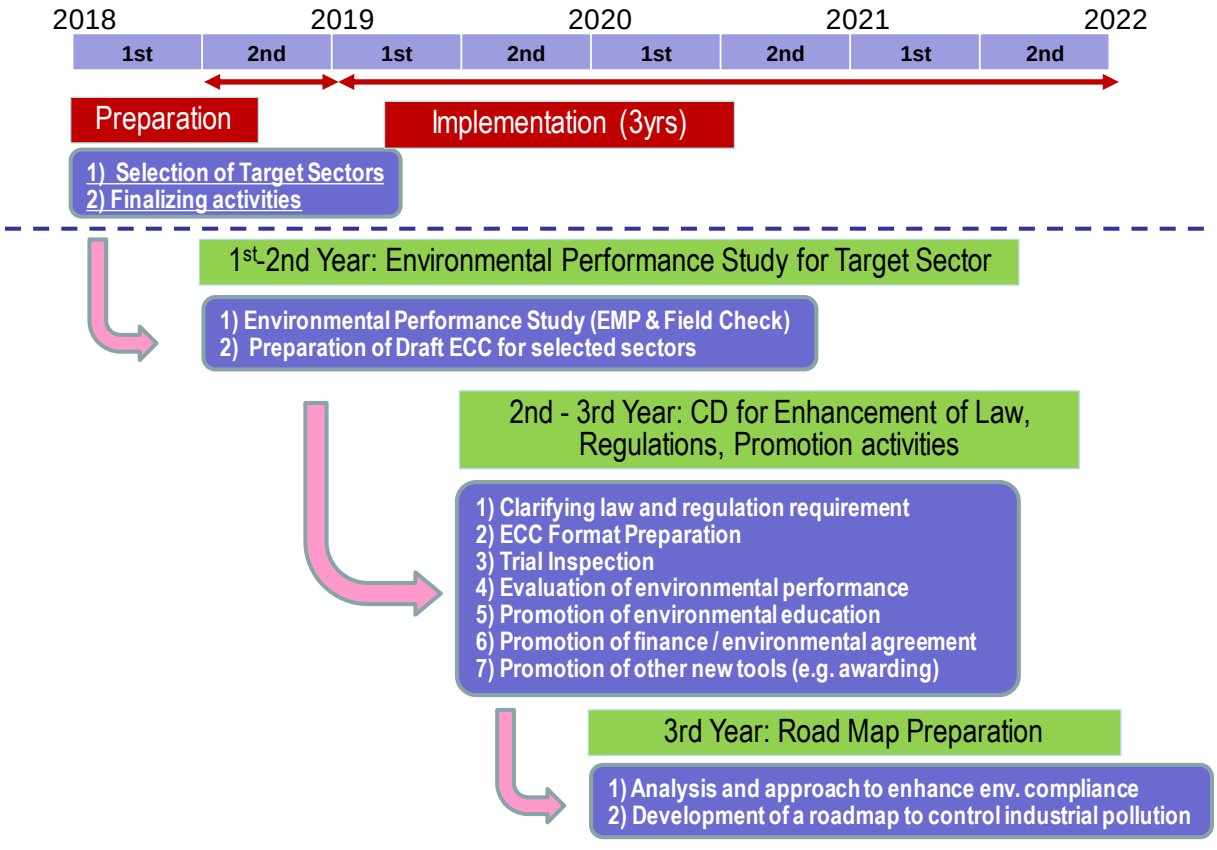


Source: ECD and JET

国レベルの工場の水質汚濁対策及び水環境管理のための戦略のうち、「環境法令遵守の実施及び促進に関する強化（NA2-1）」については、緊急性の高いアクションプランの一つである。環境法遵守認証（ECC）は、環境影響評価手続きに関する省令（EIAP 、2015）に規定される環境法令遵守に関する仕組みの一つであるが、大部分の工場は ECC を取得していない状況である。加えて、MONREC は 9 つの重要セクター（1. アルコール、ワイン、ビール工場、2. 食品飲料製造工場、3. 農薬製造・調整・包装工場、4. セメント及び石灰製造プラント、5. 繊維及び染色工場、6. 各種鋳造事業、7. 皮なめしを行う事業、8. 紙・パルプ製造業、9. 製糖プラント）の既存の大規模

工場に対して、EIAP に準拠して環境管理計画（EMP）を作成し、2018 年 10 月もしくは 2019 年 1 月までに ECC を取得する事を義務付ける通達（MONREC 通達 03/2018 号）を発行している。したがって、短期のアクションとして、ECC 並びに環境保全法（2012）年の要求事項に沿った環境法令遵守の遵守及び促進の強化を行うため、以下の活動を含むプロジェクトの実施が望まれている。図 2.6-7 に環境法令遵守の実施及び促進に関する強化プロジェクトの概要を示す。

1) 優先対象業種の選定
2) 選定された業種の環境パフォーマンスの分析
3) 環境法令の実施に関する強化
4) 環境法令遵守の促進強化
5) 産業公害対策に関するロードマップの策定



Source: ECD and JET

図 2.6-7 環境法令遵守の実施及び促進に関する強化プロジェクトの概要

2.6.3 水質報告書を作成する（活動 4-3）

上述の活動を踏まえて水質報告書を作成した。目次を表 2.6-7 に示す。同報告書は以下に示す各 C/P 機関の政策意思決定者に説明を行う予定である。

- MONREC/ECD が提示した国家環境保全気候変動中央委員会（NECCCCC）の汚染コントロールに係るサブワーキンググループ
- ヤンゴン管区首相、YCDC 委員長（及び／或いは書記官、委員会メンバー）（YCDC 汚染管理清掃部（PCCD））

- マンダレー管区首相、MCDC 委員長（及び／或いは委員会メンバー）（MCDC 上下水道部（WSD））

表 2.6-7　水質報告書の目次

1 Introduction
- 1.1 Background
- 1.2 Objectives
- 1.3 Procedures of Preparation of Water Quality Status Report
- 1.4 Case studied for Information Interpretation for Water Quality Status

2 Water Quality Status in the Pilot Area of Yangon (Hlaing River Basin)
- 2.1 Natural Conditions
- 2.2 Social Conditions
- 2.3 Government Organizations Related to Water Environment Management
- 2.4 Water Quality
- 2.5 Industrial Water Pollution Source
- 2.6 Overall Pollution Pathways to Rivers
- 2.7 Results of Pollution Load Estimation
- 2.8 Impact of Pollution on River Water Quality

3 Water Quality Status in the Pilot Area of Mandalay (Doke Hta Waddy River Basin and Taung Tha Man Lake basin)
- 3.1 Natural Conditions
- 3.2 Social Conditions
- 3.3 Government Organizations Related to Water Environment Management
- 3.4 Water Quality
- 3.4 Industrial Water Pollution Source
- 3.6 Other Water Pollution Source
- 3.6 Overall Pollution Pathways to Rivers And Lake
- 3.7 Impact of Pollution on River Water Quality

4 Strategy for Water Pollution Control from Industries and Water Environment Management
- 4.1 Approaches for Development of Framework of Strategy For Water Pollution Control from Industries and Water Environment Management
- 4.2 Strategy for Strategy for Water Pollution Control from Industries and Water Environment Management at National Level
- 4.3 Strategy for Water Pollution Control from Industries and Water Environment Management in the Pilot Area of Yangon
- 4.4 Strategy for Water Pollution Control From Industries and Water Environment Management in the Pilot Area of Mandalay

5 Conclusion and Recommendations

Appendices
- Case Study 1: Pollution load analysis in the pilot area of Yangon
- Case Study 2: Pollution load analysis in the pilot area of Mandalay
- Case Study 3: Installation of centralized wastewater treatment system in Hlaing Thar Yar Industrial Zones in Yangon
- Case Study 4: Preliminary estimation of dilution capacity for water quality leading to future water resource management in the Doke Hta Waddy River

Source: JET

2.7 他の活動

2.7.1 本邦研修

(1) 第 1 回本邦研修

プロジェクト期間中に合計 3 回の本邦研修の機会があった。第 1 回本邦研修は 2016 年 5 月 22-28 日に実施された。表 2.7-1 および表 2.7-2 に第 1 回本邦研修の概要と日程をまとめる。また第 1 回本邦研修の写真を図 2.7-1 に示す。合計で 6 名（ECD から 3 名、YCDC から 1 名、MCDC から 2 名）が研修に参加した。

表 2.7-1　第 1 回本邦研修の概要

Item	Contents
Title	1st study program in Japan for the Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar
Period	22nd May (Sun) – 28th May (Sat) 2016 (for a total of seven days)
Number of Trainees	Six participants (three participants from MOECAF, one participant from YCDC, and two participants from MCDC)
Main Places for Training	Tokyo
Program	表 2.7-2 参照
Language	Myanmar – Japanese

Source: JET

表 2.7-2　第 1 回本邦研修のプログラム

Day		Time	Activities	Lecturer /Venue	Relevant Outputs
-	21 May (Sat)	21:45	- Departure from Yangon for Narita	-	-
1	22 May (Sun)	06:50	- Arrival at Narita Airport	-	-
		– 09:30	- Move to TIC	-	-
2	23 May (Mon)	09:15 – 10:30	- Briefing of the training in Japan - Orientation of the training course	TIC JET	-
		11:30 – 12:00	- Courtesy visit to JICA	-	-
		13:30 – 15:00	- Lecture on necessary policies and effective measures for water pollution / case studies of water quality improvement in Japan	Tokyo Metropolitan Research Institute for Environmental Protection	Output 1, Output 2
		16:30 – 17:10	- Site visit: Sumida River	Sumida River	Output 1, Output 2
		19:00 – 20:30	- Meeting for exchange of opinions	JET	Outputs 1, 2, 3 and 4
3	24 May (Tue)	10:00 – 12:00	- Lecture on policies and system for water environment management (watershed) and administrative measures for water pollution in Japan - Courtesy visit to the Ministry of Environment (MOE)	Ministry of Environment (Japan)	Outputs 1 and 2
		14:20 – 14:45	- Site visit: Giant Ushiku Amida Buddha (Cultural understanding)	-	-
		15:30 – 17:30	- Site visit: Water environment of Lake Kasumigaura	Ibaraki Kasumigaura Environmental Science Center	Outputs 1 and 2
4	25 May (Wed)	09:00 – 11:30	- Lecture on measures for water pollution in Kawasaki City (local government)	Kawasaki City	Outputs 1 and 2
		13:00 – 16:00	- Assignments of the Kawasaki Environment Research Institute (KERI) - Lecture on research and study on water pollution - Laboratory tour (KERI)	Kawasaki Environment Research Institute	Outputs 1, 2 and 3
		17– 17:30	- Site visit for viewing Keihin Industrial Area	JET	-
5	26 May (Thu)	10:00 – 11:00	- Site visit for water treatment and management of wastewater	Haga Town, Tochigi Pref.	Outputs 1, 2 and 3
		14:00 – 16:30	- Lecture and discussion on issues of water environmental management and measures toward resolution	Dr. Senro Imai	Outputs 1, 2, 3 and 4

Day		Time	Activities	Lecturer /Venue	Relevant Outputs
6	27 May (Fri)	10 – 12	- Presentation and discussion	JET	-
		13:00 – 15:00	- Evaluation of the training course - Certificate Ceremony	TIC	-
7	28 May (Sat)	11:00	- Departure from Narita to Yangon (Departure from TIC at 7:00)	-	-

Source: JET

Site Visit to Water Treatment Facility (Haga Town)

Certificate Ceremony

Source: JET

図 2.7-1　第 1 回本邦研修の写真

(2) 第 2 回本邦研修

第 2 回本邦研修は管理職と技術レベル職員のニーズを勘案して 1 週間コースと 3 週間コースに分け、1 週間コースは 2016 年 9 月 27 日～10 月 4 日に、3 週間コースは 9 月 27 日から 10 月 18 日に実施された。表 2.7-3 および 表 2.7-4 に両コースのプログラムの概要をまとめる。

表 2.7-3　第 2 回本邦研修の概要

Course	Item	Contents
1-week course	Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (1-week)
	Period	27 September (Sun) – 4 October (Sat) 2016 (for a total of 7 days)
	Number of Trainees	3 delegates (1 participant from MOECAF, 1 participant from YCDC, and 1 participant from MCDC)
	Main Places for Training	Tokyo
	Program	表 2.7-4 参照
	Language	Myanmar – Japanese
3-week course	Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (3-weeks)
	Period	27th September (Tue) – 18th October (Sun) 2016 (in total 22 days)
	Number of Trainees	7 participants (3 participants from MOECAF, 1 participant from YCDC and 2 participants from MCDC)
	Main Places for Training	Tokyo, Yokohama and Kansai
	Program	表 2.7-4 参照
	Language	Myanmar – Japanese

Source: JET

表 2.7-4　第 2 回本邦研修のプログラム

1-week	3-week	Date		Time	Activities	Lecturer /Venue
1	1	27 (Tue)	Sep	-	PM: Departure from Yangon to Tokyo	-

1-week	3-week	Date		Time	Activities	Lecturer /Venue
2	2	28 (Wed)		AM	Arrival at Tokyo, Move to hotel	-
				15:20-15:50	Briefing by the JICA Expert Team	Nippon Koei Co., Ltd.
				15:50-16:20	JCM project formulation for energy conservation and environmental improvement	Nippon Koei Co., Ltd.
				16:30-18:15	Development of approaches for environmental protection and challenges for SDGs in Japan	Mr. Senro Imai, JICA advisor
				18:30-20:30	Welcome party	-
3	3	29 (Thu)		10:00-12:30	Briefing and orientation	TIC
				14:30-15:00	Courtesy call to JICA	JICA HQ
				15:00-16:30	Environmental administration in Myanmar and Japan	Dr. Itaru Okuda, Team Leader of the JICA Expert Team
4	4	30 (Fri)		9:00-12:00	Lecture on measures for water pollution in Kawasaki City	Kawasaki City
				13:00-14:30	Introduction of the Kawasaki Environment Research Institute/ Laboratory tour	Kawasaki Environment Research Institute, Kawasaki City
				15:00 – 17:00	Site visit for wastewater treatment facility and management (food industry)	Ajinomoto Co., Inc. Kawasaki Plant
5	5	1 (Sat)	Oct	10:00 – 12:00	Environmental policy framework and administration in Japan	Prof. Hitoshi Ushijima, Chuo University
				PM	Free time	
6	6	2 (Sun)		9:00 – 17:00	Holiday (private sightseeing tour in Kamakura)	-
7	7	3 (Mon)		9:00 – 11:30	Site visit for river water treatment facilities	Katsunan Public Works Office, Chiba Prefecture
				12:50 – 13:50	Lunch meeting with JICA HQ	-
				14:00 - 15:30	Water environment administration of Japan	Water Environment Division, Environment Management Bureau, Ministry of the Environment
				16:00 – 17:30	Wrap-up presentation and certificate ceremony for the 1-week program	JICA HQ
8	8	4 (Tue)		AM	[Attendees of the 1-week program] Leave Japan for Myanmar	-
-				9:00 – 17:00	[Attendees of the 3-week program] Training on water quality monitoring	Private lab, Osumi Co., Ltd
	9	5 (Wed)		9:00 – 16:30	Training on water quality analysis	Private lab, Osumi Co., Ltd
	10	6 (Thu)		9:00 – 17:00	Training on water quality analysis	Private lab, Osumi Co., Ltd
	11	7 (Fri)		9:30-12:00	How to develop a water quality monitoring plan and report/ Good practice of inspection activities in other countries	Nippon Koei Co., Ltd.
				13:30 – 15:30	Preparation of wrap-up presentation	-
	12	8 (Sat)		9:00 – 14:00	Holiday (private sightseeing tour in Asakusa/ Tokyo)	-
	13	9 (Sun)		-	Move from Tokyo to Otsu	-
	14	10 (Mon)		10:00 – 12:00	Lake Biwa cruise	-
				14:00 – 16:00	Lake Biwa Museum	
	15	11 (Tue)		10:00 – 12:00	Lecture on lake environmental management/ Laboratory tour	Lake Biwa Environmental Research Institute
				14:00 – 16:00	Site visit for wastewater treatment facility and management (alcohol and beverage industry)	Kirin Co., Ltd. Shiga Factory
	16	12		9:30 – 12:00	Site visit for wastewater treatment facility	Shimadzu Corporation,

1-week	3-week	Date	Time	Activities	Lecturer /Venue
		(Wed)		and management (manufacturing industry)	Sanjo Works
			14:00 15:00	Environmental education and environmental activities in Kyoto City	Miyako Ecology Center
			16:15 – 17:00	Sightseeing at Kinkakuji (Golden Pavilion)	Kinkakuji
	17	13 (Thu)	9:00 – 12:00	Lecture on practice and challenges in industrial wastewater treatment	Mr. Chuzo Nishizaki
			14:00 – 16:30	Site visit for wastewater treatment facility and management (paper mill)	Rengo Co., Ltd., Amagasaki Mill
	18	14 (Fri)	9:00 – 12:00	Sewage system in Kobe City / site visit to a sewage treatment plant	Kobe City
			14:00 -16:00	Site visit for wastewater treatment facility and management (power plant)	Kobelco Eco-Solutions Co., Ltd.
	19	15 (Sat)	-	Holiday (sightseeing tour in Kyoto)	-
	20	16 (Sun)	-	Move from Kobe to Tokyo	-
	21	17 (Mon)	9:30 – 11:30	Central wastewater treatment plant in industrial zone	Yokohama City
			13:30 – 17:00	Wrap-up presentation and certificate ceremony for the 3-week program	JICA HQ
	22	18 (Tue)	-	Departure from Tokyo to Yangon	-

Source: JET

Lecture by the Ministry of Environment Japan

Wrap-up Presentation by Delegates

Source: JET

図 2.7-2　第 2 回本邦研修の写真

(3) 第 3 回本邦研修

第 3 回本邦研修は 2017 年 8 月 28 日から 9 月 14 に実施された。この研修では主要 C/P 機関である ECD、YCDC および MCDC に加えて関連省庁からの参加者が参加した。プログラムは管理職および技術レベル職員用にコース 1 とコース 2 に分けたが、多くの内容は両コースに共通とした。

ミャンマー政府内の手続きの遅れの問題で、コース 1 （管理職レベル）の参加者のうちエネルギー省からの参加者以外の参加者 8 名が最初のプログラムに参加できず 2017 年 9 月 1 日から研修に参加することになった。また天然資源環境保全省からの参加者 1 名は 2017 年 8 月のミャンマー政府の内部手続きの変更の影響で参加できなくなった。表 2.7-5 および表 2.7-6 に概要と日程を示す。

表 2.7-5　第 3 回本邦研修の概要

Item	Contents
Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (2)
Period	28 Aug (Mon) – 14 Sep (Thu) 2017 (for a total of 17 days)

Item	Contents
Number of Trainees	A total of 14 delegates - 10 delegates for Course 1 (management level): 3 participants from MONREC, 1 participant from YCDC, MCDC, MOT, MOHS, MOE, MOI and MOALI. - 4 delegates for Course 2 (technical-level): each has 2 participants from YCDC and MCDC
Main Places for Training	Tokyo, Shiga and Kansai
Language	Myanmar – Japanese

Source: JET

表 2.7-6　第 3 回本邦研修のプログラム

Date			Activities		Lecturer /Venue	
28	Aug	Mon	PM: Departure from Yangon to Tokyo		-	
29		Tue	AM: Arrival at Tokyo PM: Free time		TIC	
30		Wed	AM: Briefing and orientation PM: Courtesy call to JICA/Lecture on the Development of Approaches for Environmental Protection and Challenges for SDGs in Japan		AM: TIC PM: JICA, Dr. Imai	
31		Thu	Lecture on measures for water pollution in local government		Kawasaki Municipality	
1	Sep	Fri	AM: Site visit for centralized wastewater treatment facility for industrial zone PM: Courtesy call to the Ministry of Environment (MOE) and lecture on necessary policies and effective measures for water pollution		AM: Haga Town PM: MOE	
2		Sat	AM: Japan's Environmental Law and its implementation		AM: Professor from Chuo University	
3		Sun	Holiday		-	
4		Mon	Lecture on water quality monitoring		Laboratory (Nippon Koei)	
5		Tue	Course 1: Lecture on water environment management in Southeast Asia	Course 2: Training on water quality monitoring and analysis	Course1: IGES	Course 2: Laboratory (Nippon Koei)
6		Wed	Course 1: AM: Lecture on financial support mechanism related to environmental measures for factories PM: Lecture on coordination for environmental management for factories	Course 2: Training on water quality monitoring and analysis	Course1: AM: Development Bank of Japan PM: Japan Environmental Management Association for Industry	Course 2: Laboratory (Nippon Koei)
7		Thu	AM: Move to Kansai PM: Lecture on environment of Shiga Prefecture		PM: International Lake Environment Committee	
8		Fri	AM: Site visit for agricultural wastewater treatment PM: Lecture on eco-friendly farming Site visit to Biwa Lake (boat tour) Move to Kyoto		AM: Kusatsu City PM: Shiga Prefecture	
9		Sat	AM: Site visit to Lake Biwa Museum		AM: Biwa Lake	
10		Sun	Holiday		-	
11		Mon	AM:		AM:	

Date			Activities	Lecturer /Venue
			- Regulation on industrial wastewater for sewerage - Lecture on pollution control measures by industries / experience of developing wastewater treatment system in Vietnam PM: Site visit to wastewater treatment facilities or sewage treatment plant	Kobe City KOBELCO PM: Suntory Takasago Factory
12		Tue	AM: Environmental education and activities in Kobe City PM: Move to Tokyo	AM: Kobe environment and future museum
13		Wed	AM: Presentation preparation PM: Wrap-up presentation and certificate ceremony	AM:TIC PM: JICA
14		Thu	Move from Japan to Myanmar	-

Source: JET

Laboratory of Nippon Koei

Wrap-up and Certificate Ceremony

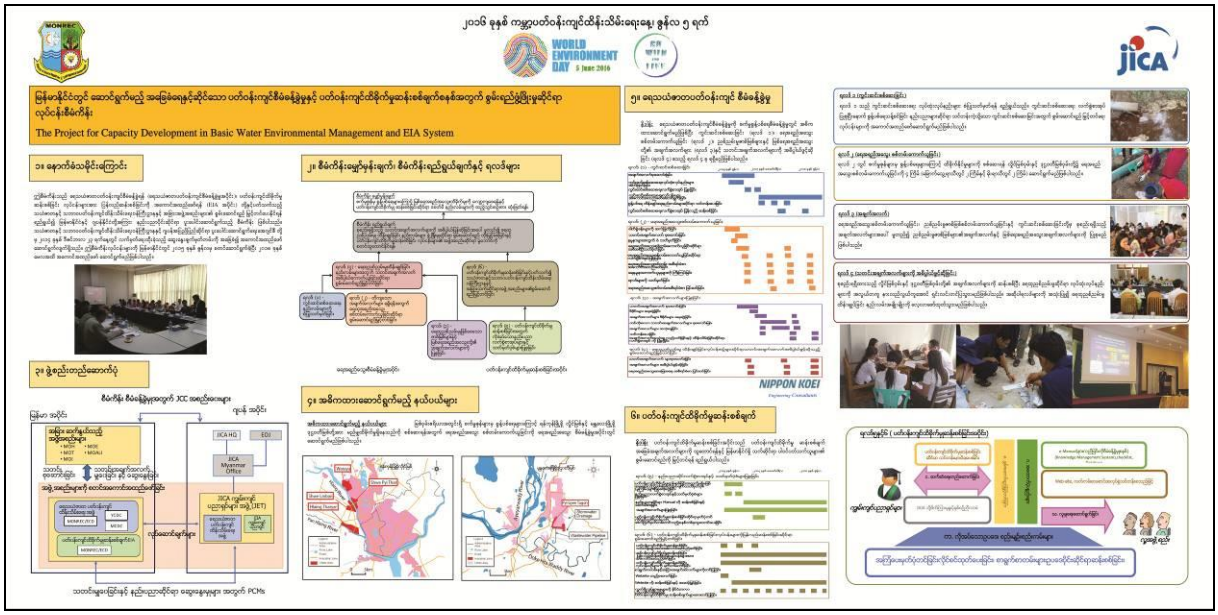
Source: JET

図 2.7-3　第 3 回本邦研修の写真

2.7.2　広報活動

(1)　環境デーのポスター

2016 年 5 月に Nay Pyi Taw で開催された環境デーのイベントのため、ポスターを作成し、参加者にプロジェクト活動を説明した。プロジェクトのブースには当時のミャンマーの大統領 Mr. Htin Kyaw および天然資源環境保全大臣の Mr. Ohn Win も立ち寄った。



Source: JET

図 2.7-4　2016 年 6 月 5 日の世界環境デーのポスター

Source: JET

図 2.7-5　大統領と大臣への説明

(2)　プロジェクト・ウェブサイト

プロジェクトのウェブサイトはミャンマー語、英語、日本語で作成し、プロジェクトの枠組みについて紹介した「プロジェクト」のページ、プロジェクトの組織体制を説明した「組織体制」のページ、そしてプロジェクト活動や成果を説明した 30 程度の記事を作成した。ウェブサイトの URL は次のとおり：“http://myanmar-waterenvironment.com”。

Source: JET

図 2.7-6　プロジェクトのウェブサイト

(3) ニュースレター

プロジェクト情報を幅広く関係者に紹介するため、プロジェクト期間中にニュースレターを１回発行した。

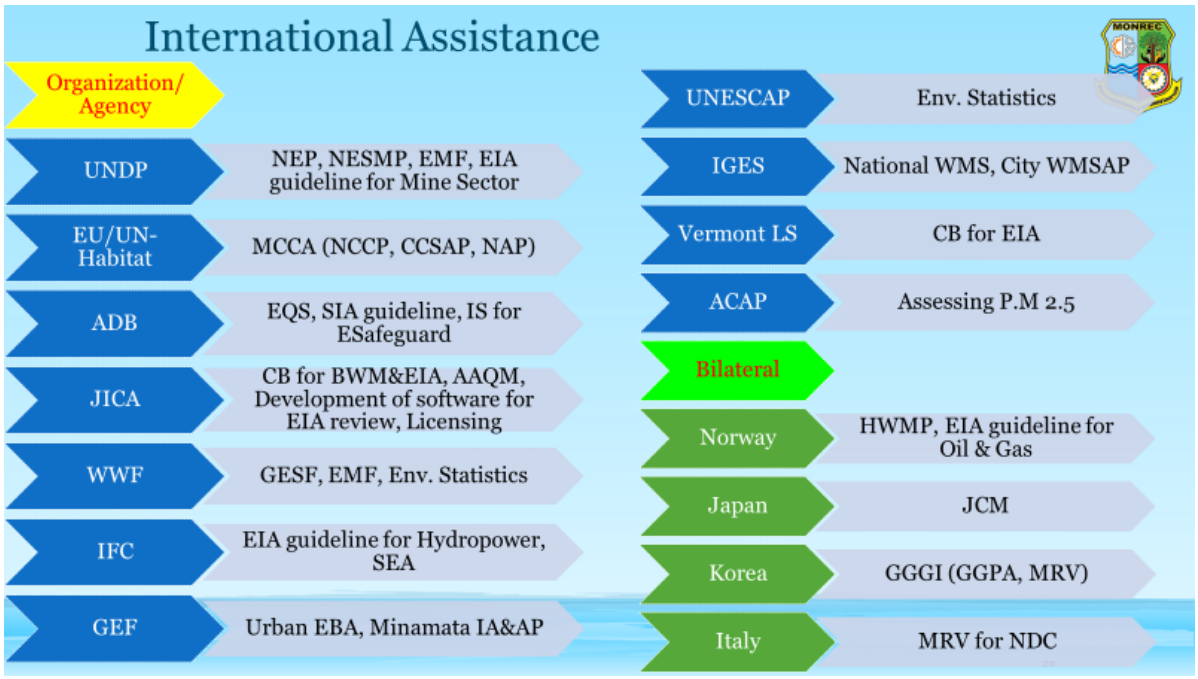
Newsletter No.1

Source: JET

図 2.7-7　プロジェクトのニュースレター

2.7.3　他ドナー、民間企業の活動に係る継続的情報収集

図 2.7-8 に環境保全分野における進行中の国際プロジェクトや活動をまとめる。プロジェクト実施中に様々なドナーや地元組織が関連したプロジェクトや活動を実施した。本プロジェクトはそのようなドナーや地元組織（例、ADB、ノルウェー政府プロジェクト、WWF、UMFCCI）と積極的に情報交換を行った。また一部の活動は他のドナーと合同で行った（例、汚染源調査はノルウェーのチームと、インスペクションマニュアルの作成は ADB プロジェクトと一緒に行った）。



Source: MONREC-ECD

図 2.7-8　環境保全に関わる国際協力（2017 年 9 月現在）

第 3 章 プロジェクト実施運営上の工夫、教訓

第 4 章に記載したとおり、本プロジェクトはプロジェクト活動を通した能力強化に積極的な C/P の協力および C/P と JET の良好な関係に恵まれ、全体的には滞りなく実施された。全体的に見て、プロジェクトの実施で大きな問題はなかった。しかし、プロジェクト実施中に起こったプロジェクト管理の課題がどのように克服されたか、そして経験から得られた教訓を記載しておくことは、将来のプロジェクトの実施に際して参考になると思われる。

3.1 制約条件の中での有効な能力強化活動の実施

(1) 課題

ミャンマーは環境保全法（2012）に基づいた汚染管理を導入したところで、国家レベルにおける効果的な政策立案から現場レベルの職員による規制活動に至るまで、全ての分野で膨大な能力強化の需要がある。このような需要に対して本プロジェクトができることは限られていたため、プロジェクトの制約条件の中でどうやって効果が最大になるように活動を実施するかは、常にプロジェクト実施上の重要な事項であった。以下の課題が特に重要と考えられた。

- プロジェクト活動は 3 都市（ヤンゴン、マンダレー、ネピドー）で 7 つの組織（ヤンゴン管区 ECD、PCCD-YCDC、WSD-YGN、マンダレー管区 ECD、WSD-MCDC、CD-MCDC および ECD-HQ）を対象に実施された。このためプロジェクトの時間と資源は異なる都市および組織の間に薄く配分せざるをなかった。

- プロジェクトは C/P 機関が産業公害をコントロールする新しいアプローチを導入することをサポートすることを目的にしており、プロジェクト活動の多く（例、基準遵守インスペクション、汚染源調査、河川の水質環境モニタリング、集中排水処理に関わる協議など）は C/P 機関の平常業務を超えるものであった。C/P メンバーの多くは平常業務で多忙であり、平常業務とプロジェクト活動のバランスを考えるのは簡単ではなかった。

- 汚染管理や環境モニタリングを習得するには大学レベルの環境化学、分析化学、化学工学、水文学などを数年間勉強している必要がある。多くの職員はこのようなバックグラウンドがなかったため、これを補うのが大変であった。

(2) 工夫と教訓

制約条件を考慮しながら活動を最も有効に実施するため、以下の対応がされた。

- 担当 JET メンバーが現地にいない期間も、現地ベースの JET メンバーとローカルスタッフのチームが活動の準備、課題について C/P と協議、そして活動のフォローアップに対応した。汚染源調査、GIS トレーニング、レポート作成トレーニングなどの活動はこのような対応をした好例である。また現地ベースの JET メンバーが Thilawa SEZ の環境問題に対処した経験等を有しており、この現地経験、現地のリソース、そして現地の人間関係がプロジェクトに大きなプラスとなった。

- 短期間での学習を可能にするため、プロジェクトでは過去の正式なトレーニング無しでも水環境管理の大切なポイントを個人の経験から学べるよう、現場経験や実務を通した学習を重視した。このために以下の活動を追加した：(i) C/P 機関のラボによる河川の水質データの比較チェック、(ii) レポート作成トレーニング、 (iii) 202 工場の質問票調査と 100 工場の排水サンプリング、 (iv) 追加の GIS トレーニング、および(v) インスペクションに関わるトレーニングの一環としての Thilawa SEZ の視察。

- トレーニング項目の中には系統立った学習が望ましいものもあった（例、排水処理技術やモニタリング計画についてのトレーニング）。しかし多くの職員は長時間の講義に参加するには多忙であった。よって講義タイプの活動は、半日から一日程度に留め、必要に応じて繰り返

すようにした。具体的な例としては (i)排水処理技術に関わるトレーニング、および(ii) レポート作成トレーニング、が挙げられる。GIS トレーニングについては、1 週間コースとデータベースの使用についての数回の 1 日のトレーニングの両方を行った。排水処理技術のトレーニングについては、日本人の専門家によるトレーニングに追加して、ベトナム人専門家を招聘して ASEAN 諸国の一つであるベトナムでは同様な課題にどのように対処しているかの講義を行った。

C/P 機関も JET も能力強化の強度や深度は適当だったと考えている。しかし、能力強化に関わる需要は非常に大きく、プロジェクトは需要の一部しか満たすことができなかった。これはプロジェクトの後半に多くの職員を雇用した ECD で特にそうであった。もう少し多くの資源と時間があれば、もっと能力強化の活動が可能だったかもしれない、一方で多少活動を強化しても抜本的に能力を向上させるのは簡単ではなかったとも言える。プロジェクトの終了は、プロジェクトの経験と成果 4 で作成した戦略をもとに能力強化活動を再デザインするには妥当なタイミングであったと思われる。

3.2 ミャンマーの環境行政の変革への調整

(1) 課題

ミャンマーの環境行政は近年大幅に変わってきており、プロジェクトは新しい状況に常に合わせて行く必要があった。プロジェクトに関連した変更としては以下が挙げられる：

- プロジェクトが開始された 2015 年には、ECD は小さな機関で汚染管理は主に YCDC や MCDC といった他機関が事業許認可の枠組みの中で行っていた。しかし、ECD の役割はプロジェクト期間中に大きく拡大し、2017 年末までに ECD は汚染管理の主要な責任組織になった。また管区政府の役割も 2016 年の政権交代から拡大してきている。これらの変化は YCDC や MCDC の製造業の汚染管理に関わる役割にも影響を及ぼしている。

- 汚染管理に関わる法規制の観点からは、2015 年にプロジェクトを開始した当時は YCDC 法や MCDC 法は最も重要な法律であった。しかし、2015 年 12 月に当時の MOECAF が環境保全法（2012）に基づいて EIA 手続き（2015）および NEQEG（2015）を発行し、これらの規則が重要になってきている。より最近では 2018 年 1 月に天然資源環境省が 9 つの重要産業セクターに対して EMP を作成し ECC を取得するよう命令を出している。これらの発展にもかかわらず、ECC の条件はこれから明確にされるところである。

(2) 工夫と教訓

これらの変化はプロジェクト管理や活動の実施に大きな影響を与えた。この変化に対応するため行った主要な調整としては以下が挙げられる。

- プロジェクトは PDM の全般的な枠組みの中で柔軟に実施された。キャパシティ・アセスメントおよび C/P・JICA との一連の協議のあと、現地の状況を勘案して PDM が 2015 年 12 月に変更され、排水処理技術に関するトレーニング、汚染源調査といった活動が追加になった。活動をより有効にするため、同様な調整はプロジェクト期間を通して行われた。

- プロジェクトはまず汚染源や河川の状況を現場で調査して、この過程で得た現場レベルの知識や経験を政策提言に向けて利用して行く、ボトムアップ的なアプローチを取った。現場での活動は多くの時間と努力を要したが、当時は汚染源や河川水質について信頼できる情報がほとんどなく、プロジェクトを通して得た経験は新しい汚染管理システムの開発についての意見交換を進めるのに役に立った。

- 単に変化に対応しただけでなく、変化を予想して、新しい水環境管理への転換がスムーズに行くよう、転換の場を積極的に作るようにした。良い例としてはヤンゴンの集中排水処理に関わるケーススタディとその後に開催された 2017 年 10 月のワークショップが挙げられる。

このケーススタディは ECD が近い将来 ECC の要求事項を法執行する際に直面する困難を想定した上で、ヤンゴン管区政府のリーダーシップのもと、ヤンゴンの工業団地に集中排水処理施設を整備する際の課題を明確にする目的で実施された。またインスペクションマニュアルも ECD や他の機関がより厳格な基準遵守インスペクションを実施することを前提に作成された。また被規制側となる事業者側との連携が将来重要になることを想定して UMFCCI との関係なども重視した。

成果 5 で述べるとおり将来の課題はいろいろあるが、これらのプロジェクト活動を通して C/P 機関が水環境管理に関わる新しいアプローチを導入する準備を進めることができたのであれば良い。

3.3 オフィスとカウンターパート費用

(1) 課題

- R/D に基づいて ECD 本部はネピドーの ECD 内に JET 用に良好なオフィスを提供したが、JET のスタッフを含む大部分のローカルエキスパートがヤンゴンをベースにしていたこと、そして活動の大部分はヤンゴンかマンダレーで実施されたこともあって、JET はヤンゴンのオフィスを必要とした。

- また C/P はプロジェクト活動に精力的に参加したが、現場でのサンプリング等、プロジェクト活動に従事する C/P の日当、旅費などの C/P 費用が課題となった。この課題はプロジェクト形成当時から予想されていたが、プロジェクト実施の初期から障害になった。

(2) 工夫と教訓

- JET のオフィスについては、2015 年に ECD と YCDC が問題を協議したが、解決することは難しかった。よって JICA が費用を負担することとなった。

- C/P 費用については、ECD、YCDC、MCDC および JET の間で多くの協議がされた。しかし、このような費用を JICA が捻出することが決定されたのは 2016 年 11 月の JCC 会議の場であり、JET が作成したポリシー書が合意された。これ以降、C/P 費用の一部は JICA が負担した。

尚、このような措置は本プロジェクトのみに限定された例外的なものである。

第 4 章 プロジェクト目標の達成度

本章ではプロジェクト目標の達成度を 2016 年 10-11 月の中間レビューおよび 2018 年 2 月の終了時評価に基づいてまとめる。尚、これらのプロジェクト評価では EIA コンポーネントを含んだプロジェクト全体の評価を行ったが、本章では水環境コンポーネントに関わる達成のみを取り上げる。詳細については第 3 回と第 4 回 JCC 議事録に添付された中間レビューおよび終了時評価の報告書を参照のこと（添付資料５）。

4.1 中間レビュー

ミャンマー側と日本側のメンバーで構成された中間レビューチームは、プロジェクト実施期間の中間地点に当たる 2016 年 10 月 23 日～11 月 10 日にプロジェクトの中間レビューを行った。レビューには以下の 5 つの目的があった：

- 中間レビューチームによる共同のレビューを行う。
- 投入、活動および成果の達成の実績およびプロジェクト目標の達成の可能性を確認する。
- OECD-DAC の 5 評価項目である妥当性、有効性、効率性、インパクトおよび持続性のクライテリアに基づいてプロジェクトを評価する。
- 関連組織と協議して残りのプロジェクト期間およびその後に実施すべき事項について提案をする。
- レビューの結果を確認し、レビュー報告書に調印することで合意する。

中間レビューの結果、中間レビューチームはプロジェクト活動が大きな遅滞なく実施されていることを確認した。またレビューチームは成果の達成は概ね順調だが、PDM の修正が必要であることを明らかにした。さらにチームはドナー調整、現場作業に関わる予算問題、インスペクションの定義、などプロジェクト実施に関わる主要な課題を指摘した。

中間レビューの評価レポートは 2016 年 11 月 9 日に実施された第 3 回 JCC で発表された（添付資料 5 を参照）。チームは結論・提案および PDM の修正案を提示し、全ての内容と提案が全員一致で合意された。

Presentation by Counterpart

Signing of MM

Source: JET

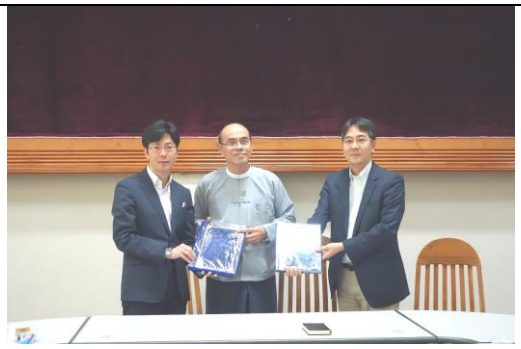
図 4.1-1　中間レビューの写真

4.2 終了時評価

プロジェクトの終了時評価はプロジェクト終了まで 3 カ月の時点である 2018 年 2 月 2 日～23 日に実施された。プロジェクト評価の目的は以下である。

- プロジェクトの成果を公表することでミャンマーと日本のステークホルダーに対するアカウンタビリティを確保すること
- 評価結果を残りのプロジェクト活動および相手国政府による将来の活動にフィードバックして、プロジェクトサイクルマネジメントを改善すること

Discussion during the Terminal Evaluation



Signing of MM

Source: JET

図 4.2-1　終了時評価の写真

4.2.1　プロジェクト目標の達成

表 4.2-2 に各成果、プロジェクト目標および上位目標に関わる指標に関する達成の評価をまとめる。成果 1～3 には終了時評価までに「達成された」と、また成果 4 とプロジェクト目標も「達成される可能性が高い」と評価された。終了時評価を受けて残りの活動は予定通り実施されたことから、成果 4 およびプロジェクト目標も達成されたと想定している。

4.2.2　DAC 評価項目に基づいた評価

プロジェクトは OCDC の DAC が設定した 5 評価項目（妥当性、有効性、効率性、インパクトおよび持続性）についても評価された。結果は表 4.2-1 に示すとおりである。

表 4.2-1　終了時評価のまとめ

Criteria	Concept	Result	Reasons
Relevancy	Whether project design and approach are appropriate to key policies and beneficiaries' needs	High	The project was consistent with the policies and needs and the project design was appropriate.
Effectiveness	Whether six outputs all together have achieved the project's primary objective	High	Given the context and achievements, the project was successful.
Efficiency	Whether inputs and activities are managed efficiently	Relatively High	Although the project lacked some inputs and coordination in the first year, the members were highly committed, and the project was managed well.
Impact	Impact over time and across sectors	Relatively High	Because the overall goals are likely to be achieved, and knowledge-sharing has been observed.
Sustainability	Whether activities and outcomes of this project will last	Moderate	For some CPs, the mandate and the staff assignment still need to be clarified, and capacity development should continue.

Source: Terminal Evaluation Team

妥当性、有効性および効率性はそれぞれ「高い」、「高い」、「かなり高い」という評価であった。このことはプロジェクトの設計および実施には大きな課題がなく、プロジェクトは滞りなく実施されたことを示している。インパクトはかなり高いという評価だったが、これはプロジェクトが C/P 機関の活動に長期的にインパクトを与える可能性があることを示している。持続性は「中

程度」という評価で、これは様々な機関の責任の明確化、プロジェクトを通じて得た個人レベルの経験・知識の組織レベルの経験・知識への向上、プロジェクトで開発されたツールの活用・改善、活動の継続およびそのための予算・他の資源の確保の必要性を意思決定者が認識、といった重要な将来の課題が残されているからである。

4.2.3　活動の進捗と活動計画

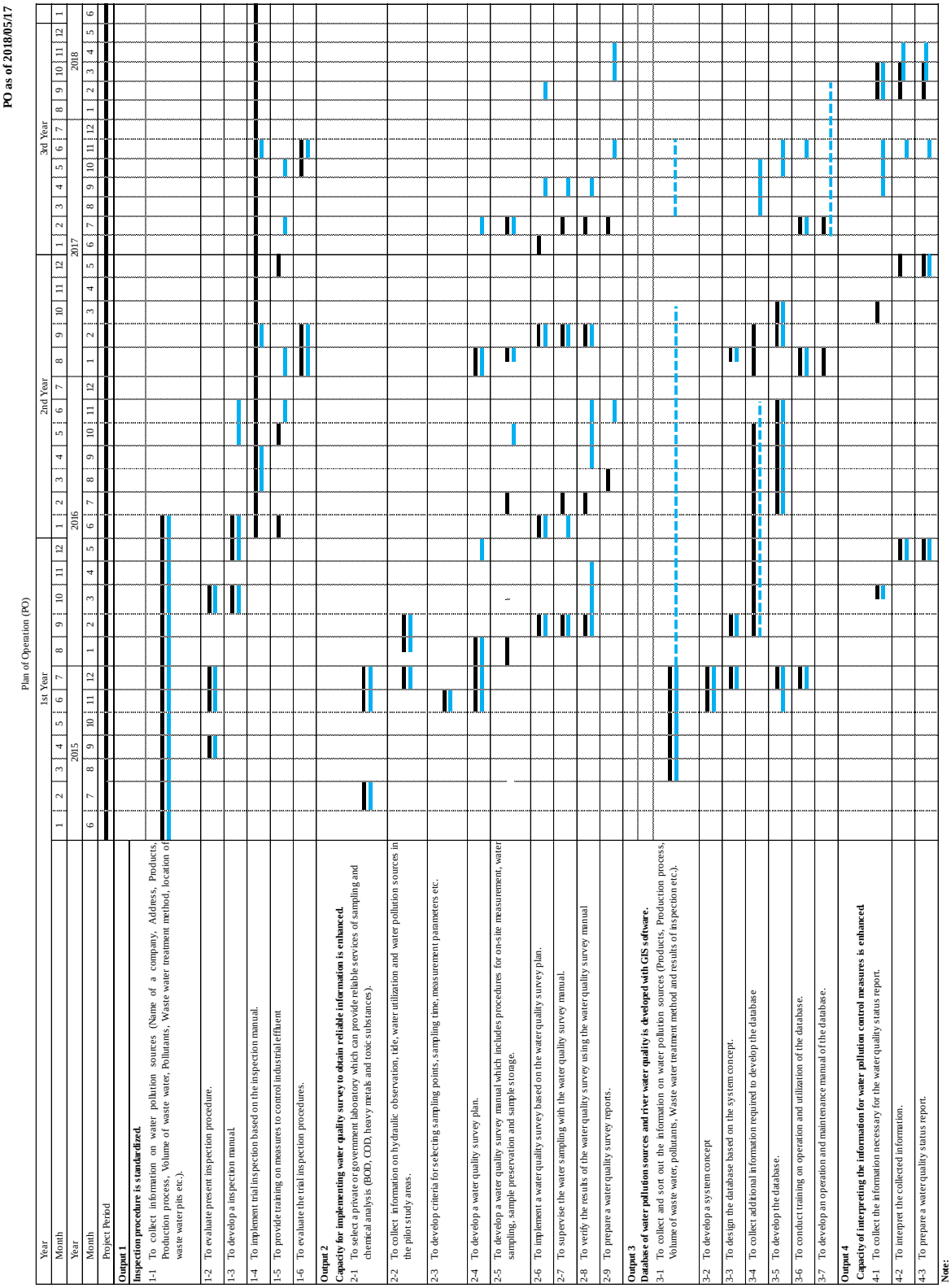
表 4.2-3 に活動の進捗を活動計画と比較した。プロジェクト実施中に遅れが発生した活動もあったものの、大部分のプロジェクト活動は予定通り実施され、最終的に無事終了した。

表 4.2-2　プロジェクトの達成（水環境コンポーネント）

Narrative Summary	Objectively Verifiable Indicators (amended in Nov 2016)	Means of Verification (amended in Nov 2016)	Important Assumptions	Achievements based on Terminal Evaluation in Feb 2018	Remarks
<Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.	The number of factories having wastewater treatment plants increases compared with the number at the beginning of the project.	Regulations, number of plants by a simple questionnaire	-	Likely to be achieved	· According to the results of the pollution source survey, only half of the factories in Yangon and Mandalay are equipped with primary treatment facilities. The number of factories with secondary treatment is in the order of a few to several %. · Many distilleries have recently installed or are installing wastewater treatment facilities in 2017-18. · In January 2018, MONREC issued an order to businesses in nine prioritized sectors to develop EMPs and obtain ECCs within 9-12 months. This is a significant step toward improving the situation of wastewater management at the factory level.
	Written strategies for wastewater management in industrial zones are developed by YCDC and MCDC in coordination with MONREC.	Written strategy	-	Depends on the C/P	· Based on the recommendation of the terminal evaluation, brainstorm meetings were organized to discuss the strategies needed to manage wastewater in IZs. · In Mandalay, construction of a centralized wastewater treatment facility is already on-going. Also, regional government is coordinating the efforts to promote environmental management of nine sectors based on the order from MONREC. · Similarly, the Yangon Region Government started the discussions to improve management of industrial zones, but there are many issues to overcome before proper environmental management is established in IZs.
<Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.	Consideration for the water status in the pilot study area is made.	Survey report	National effluent standard is developed.	Likely to be Achieved	· In Mar-Apr 2018, the C/P members discussed the current status of pollution in the pilot study areas, and the roadmap to progress water environment management in the future. · The National Environmental Quality (Emission) Guideline has been issued in December 2015, but the legally-binding national effluent standard was not released within the project period.
Output 1 Inspection procedure is standardized.	Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD.	Records of Inspection	Responsibilities of MONREC, YCDC, and MCDC for water pollution control do not change. YCDC and MCDC do not stop inspection system as a water pollution control measure. Responsibility of MONREC for EIA review does not change. Relevant legislation of EIA does not significantly change. The draft final of the general technical guidelines prepared by the ADB team is submitted to MONREC.	Achieved	· Although the Inspection Manual has been developed, regulatory requirements for pollution control in factories are not clearly defined in the laws and regulations. · Roles of MONREC, YCDC and MCDC have changed over the course of the project. Now ECD assumes the main responsibility for pollution control.
Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.	Water quality survey reports are prepared in the pilot area by YCDC and MCDC.	Survey report		Achieved	· The number of monitoring was increased from four-times to five-times.
Output 3 Database of water pollution sources and river water quality is developed.	At least 150 factories' information are accessible on the database.	Database		Achieved	· Information of 202 factories in Yangon and Mandalay has been stored in the database.
	Results of river water quality survey are accessible on the database.	Database		Achieved	· The results of all monitoring activities have been stored in the database.
Output 4 Capacity of interpreting the information for water pollution control measures is enhanced.	Results of water quality status report in the pilot areas are presented to the decision makers by MONREC, YCDC, and MCDC.	Presentation Materials		Likely to be Achieved	· The Water Quality Status Report, which had not been prepared at the time of the Terminal Evaluation, was successfully produced based on discussions with C/P organizations.

Note: Contents related to the EIA component have been removed from this table.
出典：JET

表 4.2-3　プロジェクト活動の進捗と活動計画の比較



Source: JET

第 5 章 上位目標の達成に向けての提言

5.1 はじめに

本章では本プロジェクトに基づいて 4-6 年程度で達成すべきプロジェクトの最終ゴールである上位目標の達成に関わる提言をまとめる。表 5.1-1 にまとめたとおり、本プロジェクトの上位目標は工場排水の河川水質への影響を緩和することであり、排水処理施設を備えた工場の増加、工業団地における排水管理に関する戦略の策定、という二つの指標が設定されている。

表 5.1-1 上位目標とその指標

Overall Goal	Objectively Verifiable Indicators	Evaluation in Terminal Evaluation in February 2018
Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.	The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project.	Likely to be achieved
	Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC.	Depending on C/Ps

Source: JET

終了時評価チームは表 5.1-2 にまとめた将来のアクションについて提言（水環境管理に関係するものだけを提示）しており、これらを考慮に入れる必要がある。

表 5.1-2 終了時評価チームの提言

Recommended Actions	CPs in charge of the Actions				
	ECD-PCD	ECD-EIA	ECD regional	YCDC	MCDC
(1) Utilize the data and information obtained from the Project for the preparation of future policies, guidelines and standards, including the Environmental Quality Standard, or the environmental statistics.	X	-	-	-	-
(2) Start the preparation of the written strategies for waste water management mentioned in (4) of “Actions for before the end of the Project”, in cooperation with MONREC and with other relevant ministries such as Ministry of Construction and Ministry of Industry.	-	-	-	X	X
(3) Ensure that the outputs and tools developed through the Project are utilized in the future, including the manuals, databases, the EIA Tracking System, and the E-manual.	X	X	X	X	X
(4) Integrate the monitoring of the key parameters for water quality -- such as the ones selected for the Project’s water quality surveys—into the routine tasks of each organization.	-	-	X	X	X

Source: Terminal Evaluation Team

全般的に見れば上位目標の達成に向けて充分な推進力がある。例えば、2018 年 1 月に MONREC は汚染強度が高い 9 セクターの事業所に対して 9-12 カ月以内に EMP を提出して ECC を取得することを命令している。排水処理施設の設置はこの命令の一部と考えられる。マンダレーでは既に集中排水処理施設の建設が進行中で、ヤンゴンでは複数の工業団地に集中排水処理施設を設置するイニシアティブがある。しかし、将来想定される課題も多い。

5.2 成果 1～3 からの教訓

成果 1 ～3 は基本的に水環境管理を改善するため設計された技術的活動で、これらの活動を実施する中で様々な教訓を得ることができた。これらの活動からの提案を表 5.2-1 に要約する。詳細については、成果 1 については 2.3.7 節を、成果 2 については 2.4.10 節を、成果 3 については 2.5.8 節を参照のこと。

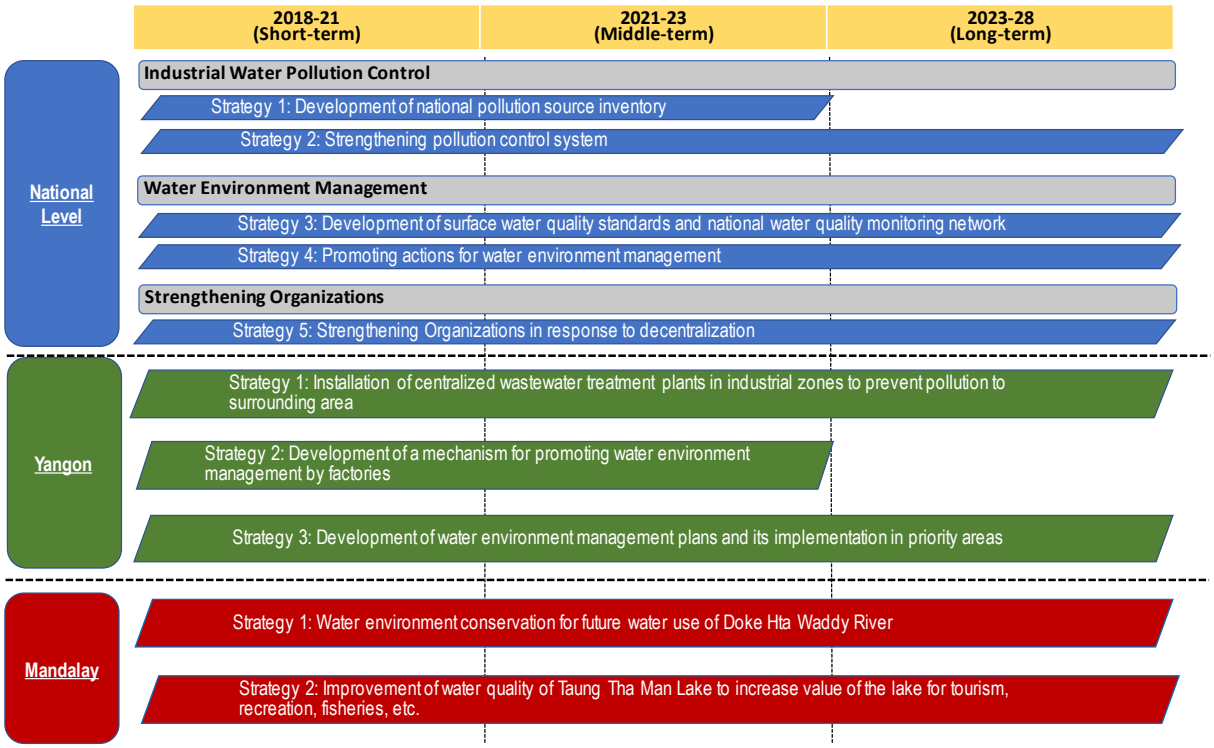
表 5.2-1　成果 1～3 の活動からの提案

Output	Suggestions	Summary
Output 1 (Inspection)	Clarification of Environmental Requirements	Implement sectoral studies, and set requirements considering the best practices in each sector.
	Clarification of Inspection Procedures for Each Environmental Requirement	Once environmental requirements for factories are set, clarify the detailed inspection procedure for each environmental requirement. Revise the manual accordingly.
	Support to Factories on Pollution Control	Organize workshops and consultation events to educate regulated communities forcusing on both procedural and technical issues. Worskhops for specific sector or area should be considred.
Output 2 (Water Quality Survey)	Improvement of monitoring data quality in Myanmar	Standardize analytical methodologies and establish QA/QC, including proficiency testing and accredication system. Also obtain more reliable data as the basis for comparison with monitoring data.
	Development of proper water environmental standard	Develop the surface water quality standard that has proper criteria and is also implementable with the capacity of monitoring organizations.
	Regular Surface Water Monitoring	Plan and implement regular surface water monitoring programs by responsible authorities. Ensure reporting of results from regional ECDs to ECD Headquarters. For important cases, implement special investigations to elucidate detailed, site-specific pollution mechanisms.
Output 3 (Database Development)	Gathering Information from Factories	Collect relevant information from factories through EMP and as part of reporting requirements of ECC. Or implement a questionnaire survey similar to the one implemented in this project.
	Development of Database of Pollution Sources	For managing ECC, expansion of the EIA database may be appropriate. Limit the information to be digitized if digitizing work is overwhelming.
	Improving Reliability of Measurement of Water Usage and Wastewater Qualities	Include installation of water meters and measurement of water usage as part of ECC requirements. Standaradize analytical methodologies and introduce a system of QA/QC.
	Improving Environmental Measures by Factories	Enforce realistic environmental regulations and implement support measures. Regulate groundwater abstraction. Request regulated communiteis to take their own initiatives for pollution control and efficient production, possibly spearheaded by MOI and/or industrial associations.

Source: JET

5.3 水環境管理のための戦略

今後の方針を協議するため、C/P と JET はプロジェクトの最後の期間にヤンゴン、マンダレー、そして国家レベルでの戦略とアクションを明確にするため数回のブレインストーミング協議を行った。成果 1～3 の提案も考慮に入れた。アクションは短期（3 年以内）、中期（5 年以内）、および長期（10 年以内）に分けられた。C/P 機関にはこれらの戦略についてさらに協議し、正式文書を作成し、承認を得て、アクションを実現することが期待されている。詳細は成果 4 のセクションにおいて説明した。



Source: JET

図 5.3-1 水環境管理のための戦略

これらの戦略に基づいたアクションおよび終了時評価チームの提言を実現するのが本プロジェクトからの最も重要な提言である。

5.4 意思決定者への追加の提言

これらの戦略を実現する上で視野に入れるべきこととして、特に上位意思決定者には以下の提言も追記した。

5.4.1 環境当局の責任分担の明確化

ミャンマーでは管区政府、ECD、DISI、YCDC/MCDC や GAD など多くの機関が環境管理に従事している。これは過去の意思決定が協調的にされてきたこと、そして環境問題は新しく、環境問題を実効的に処理するメカニズムがないことが理由と思われる。調整に基づいた現在のメカニズムはミャンマーにおける環境管理の必要不可欠な要素である。しかし、調整による意思決定のメカニズムは、小規模な問題に対処するにも多くの時間が必要で、機関によって意見が異なると関係者に混乱をもたらす可能性がある。責務の重複を最小化して、環境行政および意思決定の効率を最大化するには、関連機関の責任分担を明確にすることが重要である。

例えば、ECD の ECC、YCDC/MCDC の事業許認可、DISI の事業登録は全て環境コンポーネントがあるが、これらの証明/許認可/登録がどのように機能し、各機関の役割が何かを明確にする形で整理する必要がある。この検討過程で、各システムに関して明確かつ法的拘束力のある要求事項を設定して、事業所、様々な汚染管理の責任機関、そして各証明/許認可/登録の発行機関の全てが、どのような環境パフォーマンスをすれば事業所の事業活動が容認されるかを明確にすることが重要である。

この整理の過程でこれらの機関は重複した活動、混乱をもたらす意思決定、そして頻繁な調整の必要性を削減し、より多くの時間と資源を他の業務や、より深刻な課題の解決に使うことができるようになると思われる。

5.4.2　現実的な環境要求事項の開発

環境要求事項の設定には様々な思想やアプローチがある。一つのアプローチとしては先進国の環境要求事項などに基づいた、厳しい要求事項を設定することである。このアプローチは被規制者側に環境パフォーマンスの改善が必要なことについて明確なメッセージを送る点では望ましい。外国企業の支援があるような大きな事業所は要求事項を満たせるかもしれない。しかし、能力が限られている事業所は要求事項を満たすことができず、すぐにアクションを取らずに他の事業所がどのように要求事項に対応するか見極めようとすると思われる。また環境当局にとってはこのような事業所に要求事項を実施させ、違反ケースに対処するのが難しいだろう。また要求事項を満たしている事業所は、環境当局は不公平で二重の基準を有していると感じるだろう。住民は環境当局は充分な能力がないと感じるかもしれない。

よって、エンフォースメントに焦点を合わせたより現実的なアプローチを取ることを提言する。遵守率が 30%以下程度と低い場合、被規制者側は規制を無視するかもしれない。よって遵守率の目標を高めに設定して、目標を 4-5 年で満たせるように制度設計すると良い。工業団地の排水については、事業者がきちんと管理された集中排水処理施設に接続されれば、多くの事業所が要求事項の重要な部分を満たすと思われる。よって集中排水処理を推進することが望ましい。より広範な環境管理については、セクター調査をかけて、達成可能な目標を各産業セクターのベストプラクティスを基に設定するのが良い。また遵守やエンフォースメントに使える資源が事業者側も環境当局側も限られていることに鑑み、優先度や現実的な遵守に必要な現実的な時間を考慮して、規則の範囲を限定することが重要である。

5.4.3　行動変化の誘導

環境当局によるコマンド&コントロールは被規制側の環境遵守を誘導する主要なメカニズムである。しかし、環境当局ができることには限界がある。最近の ECD の職員数の増員にも拘らず、交通手段や分析ラボの能力といった他の資源は非常に限られている。さらに頻繁なインスペクション、行政指導/ガイダンス、罰則などでも事業所の環境パフォーマンスを抜本的に改善することは難しいかもしれない。

よってどうしたら前向きでない被規制側が意識を変えて環境パフォーマンスを改善するか検討することが重要である。表 5.4-1 に被規制側の環境規則への対応に関して行動変化を起こす可能性のある要素をまとめた。

表 5.4-1　行動変化の要素の例

Element	How the Element Influences Behavior
Fear	Whether not complying with the regulation would result in punishment, revocation of license, loss of reputation, and other negative consequences?
Benefit	Whether complying with the regulation brings significant benefit, such as good reputation.
Subjective norm	Whether other factories are complying with the regulation?
Response-efficacy	Whether complying with the regulation would prevent negative impact (fear) from happening.
Self-efficacy	Whether the firm has enough confidence in making the decision (e.g., availability of reliable technical and business advises)
Barrier	Whether there is a barrier to meet the regulation, such as budget and land to install a wastewater treatment facility.

External	Whether there are external factors, such as an order from the parent company or a plan to change orientation of the business.

Source: Terminal Evaluation Team

何が行動変化を誘導するかによって、異なった戦略を用いることができる。事業所の中には単にどうしたらいいか助言する人がいないため、環境パフォーマンスを改善する意思決定に躊躇しているものもある。そのような事業所については、どのように環境パフォーマンスを改善するかあるいは基準を遵守するか、技術的および手続き的な情報提供するのが望ましい戦略である。また対策のための資金が主要な障害の場合は、環境ファンドや税制優遇措置が役に立つかもしれない。日本の初期の汚染管理では、環境ファンドを管理している組織が資金的な援助だけでなく、技術的あるいは経営アドバイスもしていたため、資金を借りる事業者側も自信を持って意思決定ができた。評判が変革の重要な原動力である場合は、環境パフォーマンスの良い/悪い事業所の情報公開が効果的な戦略になるかもしれない。

5.4.4　ステークホルダーの関与

環境規制では被規制側と環境当局の関係が利害対立で緊張する。これはやむを得ないところがある。しかし、第三者が入ることでこの対立が変わることがある。例えば、規制が当該セクターのベストプラクティスに基づいて設計される場合、環境当局はセクター内の公平な競争の審判の役割を担うことになるかもしれない。これは環境当局にとっても被規制側にとっても望ましく、本プロジェクトでセクター調査を提案したのもこのためである。環境当局にとっては、敵対的な関係になりにくいことが考えられる。また競争力を維持するために製造効率を改善したい事業者にとっては、通常環境に配慮した工場は製造効率が高い傾向にあることから、このような規制はプラス面も多いと思われる。また規則がより現実的で公平だと感じる可能性もある。多くの国では、産業組合が共同して当該セクターに特有なニーズを環境管理に反映し、また一部の会社の悪い評判が業界全体の問題にならないよう、メンバーに対して環境パフォーマンスについて内部規則を設けている。産業組合によるこのようなイニシアティブを推進することも推奨できる。

周辺住民や環境 NGO の環境管理における役割も重要である。事業を続けるには、事業者は周辺住民との良好な関係を維持することが重要であり、これは環境配慮にとっては良い原動力である。また住民の声は議員/政治家が重要な環境問題を優先的に取り上げるのに重要である。住民の環境教育はそのような原動力を高める可能性がある。尚、ミャンマーでは事業許認可を取得するのに周辺住民のレターが必要であり、特筆に値する。

5.4.5　地域調整の推進

第 5.3 節に説明したとおり、責任体制の明確化は特に重要である。一方で活動の中には環境当局の能力や責任を超えたものもあることを認識することも重要である。特に集中排水処理施設の整備は様々な関係者の調整が必要となる。他の機関ではそのような対策のための調整ができないことから、管区政府にはそのような対応をリードすることが望まれる。ここで正式な戦略を策定することは特に重要であるが、これは戦略を作る過程で、各機関の役割や責任を明確にすることができるからである。

添付資料

添付資料 1:

PDM 及び PO
PDM and PO

Annex I

Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar
Project Period: 3 years from October 2014 to October 2017
Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing Riverand the Doke Hta Waddy River.
Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

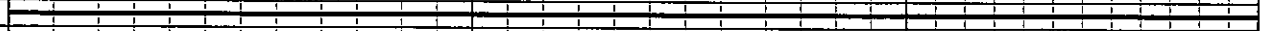
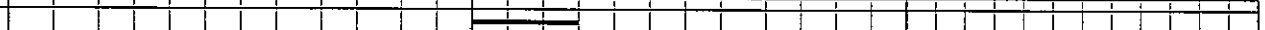
Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.	1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. 2. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF. 3. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.	· Regulations · Guidelines · Annual report	
<Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.	1. Consideration for the water status in the pilot study area is made. 2 More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.	· Survey report · EIA documents	1. National effluent standard is developed.
Output 1 Inspection procedure is standardized.	1. More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.	· Inspection report	1. Responsibility of MOECAF, YCDC and MCDC for water pollution control does not change. 2. YCDC and MCDC do not change inspection system as a water pollution control measures. 3. Responsibility of MOECAF for EIA review does not change. 4. Relevant legislation of EIA does not significantly change. 5. The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAF.
Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.	I. Water quality survey reports are prepared in the pilot area by YCDC and MCDC.	· Survey report	
Output 3 Database of water pollution sources and river water quality is developed.	1. At least 150 factories' information is accessible on the database. 2. Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.	· Database · Database	
Output 4 Capacity of interpreting the information for water pollution control measures is enhanced	1. A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.	· Status report	

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 5 Necessary technical manuals and forms for the EIA review are developed.	1. The technical manual covers every sector of development projects and every step of the EIA procedure. 2. The draft official forms are internally approved.	・ Technical manual and forms	
Output 6 Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.	1. EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more. 2. EIA works by MOECAF are presented to an international conference.	・ Evaluation report of EIA ・ Proceedings	
<Activities> **Output 1: Inspection procedure is standardized.** 1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1-2 To evaluate present inspection procedure 1-3 To develop an inspection manual 1-4 To implement inspection based on the developed inspection manual 1-5 To revise the inspection manual	<Inputs> Japanese side ・ Experts. ・ Training in Japan and other country. ・ Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others. Myanmar side ・ Counterpart personnel. ・ Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)		
Output 2: Capacity for water quality survey is enhanced. 2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To prepare a water quality survey report			

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 3: Database of water pollution sources and river water quality is developed with GIS software.			
3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results			
3-2 To develop a system concept			
3-3 To design the database based on the system concept			
3-4 To develop the database			
3-5 To conduct training on operation and utilization of the database			
3-6 To develop an operation and maintenance manual of the database			
Output 4: Capacity of interpreting the information for water pollution control measures is enhance.			
4-1 To collect the information necessary for the water quality status report			
4-2 To interpret the collected information			
4-3 To prepare a water quality status report			
Output 5: Necessary technical manuals and forms for the EIA review are developed.			
5-1 To draft necessary Official Forms for the EIA			
5-2 To develop a technical Manual of the EIA process for review			
5-3 To evaluate and update the Manual to meet the practical EIA review works			
5-4 To develop a database for recording the EIA review operation			
5-5 To establish an evaluation system for issuing license to EIA consultants			
Output 6: Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.			
6-1 To implement EIA Training incl. Screening, Scoping, EIA review, EMP, EMoP and so on			
6-2 To implement EIA review works based on the EIA procedure			
6-3 To record the EIA review operation			
6-4 To present leaflets and other materials for dissemination of EIA system			
6-5 To prepare a periodical report on the EIA review works			
6-6 To develop a WEB site to disclose EIA works based on the new EIA system			<Preconditions>
6-7 To review and update the WEB site			1. Japanese experts are assigned
6-8 To presented activities on EIA review to an international conference			2. C/Ps are assigned.

Tentative Plan of Operation (PO)

Year	1st Year												2nd Year												3rd Year											
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Project Period																																				
Output 1																																				
Inspection procedure is standardized.																																				
1-1 To collect information on water pollution sources (Name of a company, Address, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.).																																				
1-2 To evaluate present inspection procedure.																																				
1-3 To develop a inspection manual.																																				
1-4 To implement inspection based on the developed inspection manual.																																				
1-5 To revise the inspection manual.																																				
Output 2																																				
Capacity for implementing water quality survey to obtain reliable information is enhanced.																																				
2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances).																																				
2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas.																																				
2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc.																																				
2-4 To develop a water quality survey plan.																																				
2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage.																																				
2-6 To implement a water quality survey based on the water quality survey plan.																																				
2-7 To supervise the water sampling with the water quality survey manual.																																				
2-8 To prepare a water quality survey reports.																																				
Output 3																																				
Database of water pollution sources and river water quality is developed with GIS software.																																				
3-1 To collect and sort out the information on water pollution sources (Products, Production process, Volume of waste water, pollutants, Waste water treatment method and results of inspection etc.).																																				
3-2 To develop a system concept																																				
3-3 To design the database based on the system concept.																																				
3-4 To develop the database.																																				
3-5 To conduct training on operation and utilization of the database.																																				
3-6 To develop an operation and maintenance manual of the database.																																				
Output 4																																				
Capacity of interpreting the information for water pollution control measures is enhanced.																																				
4-1 To collect the information necessary for the water quality status report.																																				
4-2 To interpret the collected information.																																				
4-3 To prepare a water quality status report.																																				
Output 5																																				
Necessary technical manuals and forms for the EIA review are developed.																																				
5-1 To draft necessary Official Forms for the EIA.																																				
5-2 To develop a technical Manual for the EIA review works.																																				
5-3 To evaluate and update the Manual to meet the practical EIA review works.																																				
5-4 To develop a database for recording the EIA review operation.																																				
5-5 To establish an evaluation system for issuing license to EIA consultants.																																				

Output 6 **Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.** 6-1 To implement an EIA Training incl. Screening, Scoping, EIA review, EMP, EMoP and so on	
6-2 To implement the EIA review works based on the new EIA procedure	
6-3 To record the EIA review operation	
6-4 To present leaflets and other materials for dissemination of EIA system	
6-5 To prepare a periodical report on the EIA review works	
6-6 To develop a WEB site to disclose EIA works based on the new EIA procedure	
6-7 To review and update the WEB site	
6-8 To presented activities on EIA review to an international conference.	

Attachment 1: Amendment of Project Design Matrix

as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.	1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. 2. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF. 3. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.	• Regulations • Guidelines • Annual report	
<Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.	1. Consideration for the water status in the pilot study area is made. 2 More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.	• Survey report • EIA documents	1. National effluent standard is developed.
Output 1 Inspection procedure is standardized.	1. More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.	• Inspection report	1. Responsibility of MOECAF, YCDC and MCDC for water pollution control does not change. 2. YCDC and MCDC do not change inspection system as a water pollution control measures.
Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.	1. Water quality survey reports are prepared in the pilot area by YCDC and MCDC.	• Survey report	3. Responsibility of MOECAF for EIA review does not change. 4. Relevant legislation of EIA does not significantly change.
Output 3 Database of water pollution sources and river water quality is developed.	1. At least 150 factories' information is accessible on the database. 2. Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.	• Database • Database	5. The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAF.
Output 4 Capacity of interpreting the information for water pollution control measures is enhanced	1. A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.	• Status report	

Note: The changes agreed by JCC members are shown in red.

as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 5 Necessary technical manuals and forms for the EIA review are developed.	1. The technical manual covers every sector of development projects and every step of the EIA procedure. 2. The draft official forms are internally approved.	・ Technical manual and forms	
Output 6 Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.	1. EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more. 2. EIA works by MOECAF are presented to an international conference.	・ Evaluation report of EIA ・ Proceedings	
<Activities> **Output 1: Inspection procedure is standardized.** 1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1-2 To evaluate present inspection procedure 1-3 To develop an inspection manual 1-4 To implement inspection based on the developed inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To revise the inspection manual	<Inputs> Japanese side ・ Experts. ・ Training in Japan and other country. ・ Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others. Myanmar side ・ Counterpart personnel. ・ Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)		
Output 2: Capacity for water quality survey is enhanced. 2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To verify the results of the water quality survey using the water quality survey manual 2-9 To prepare a water quality survey report			

Note: The changes agreed by JCC members are shown in red.

Attachment 1-2

Attachment 1: Amendment of Project Design Matrix

as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

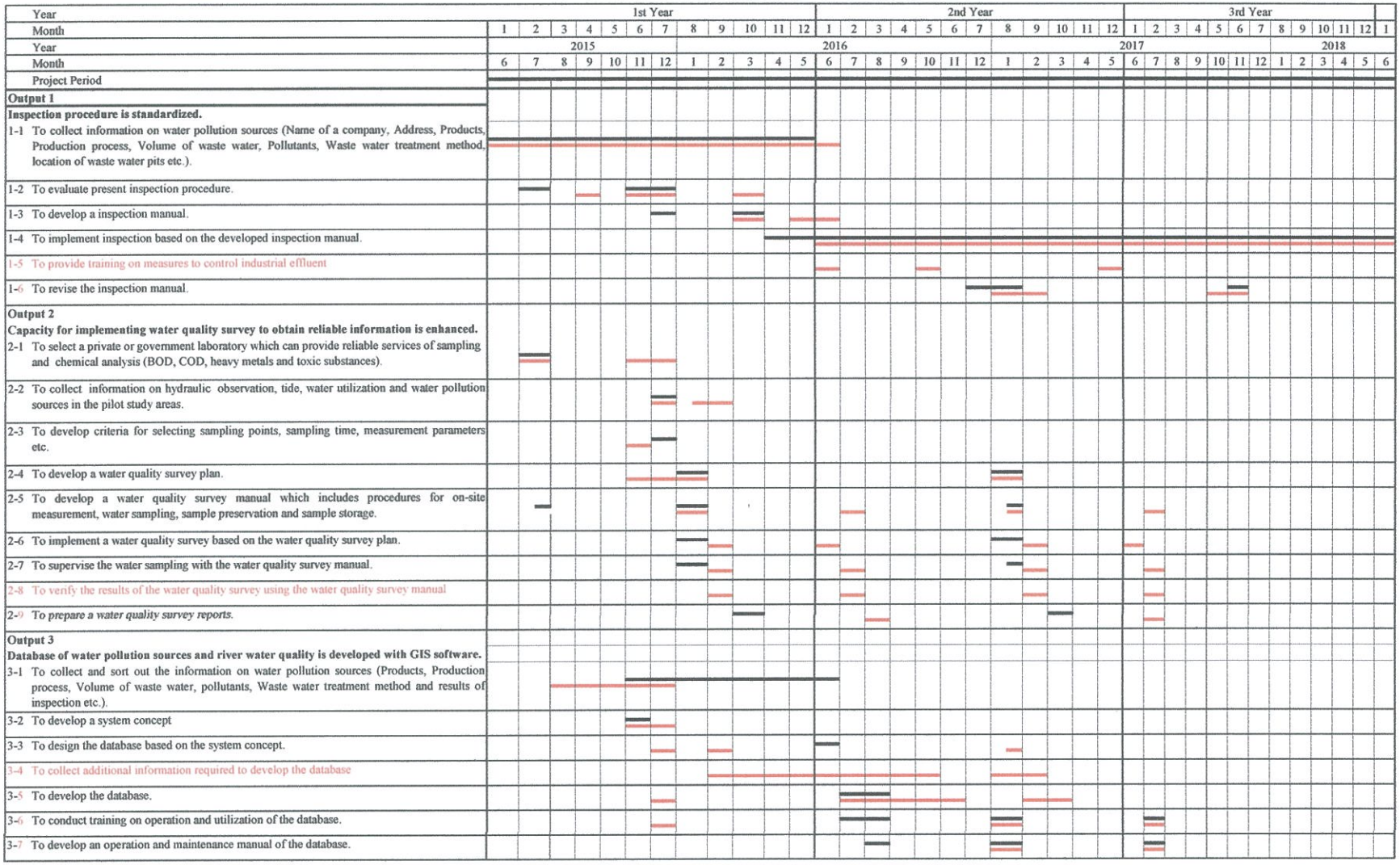
Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 3: Database of water pollution sources and river water quality is developed with GIS software.			
3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey			
3-2 To develop a system concept			
3-3 To design the database based on the system concept			
3-4 To collect additional information required to develop the database			
3-5 To develop the database			
3-6 To conduct training on operation and utilization of the database			
3-7 To develop an operation and maintenance manual of the database			
Output 4: Capacity of interpreting the information for water pollution control measures is enhance.			
4-1 To collect the information necessary for the water quality status report			
4-2 To interpret the collected information			
4-3 To prepare a water quality status report			
Output 5: Necessary technical manuals and ~~forms~~ legislation for the EIA ~~review~~ operation are developed.			
5-1 To draft necessary legislation including Official Forms for the EIA.			
5-2 To develop a technical Manual of the EIA process for review			
5-3 To evaluate and update the Manual to meet the practical EIA review works			
5-4 To develop a database for recording the EIA review operation			
5-5 To establish an evaluation system for issuing license to EIA consultants			
Output 6: Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.			
6-1 To implement basic and advanced EIA Training ~~incl. Screening, Scoping, EIA review, EMP, EMoP and so on~~			
6-2 To implement EIA review works based on the EIA procedure			
6-3 To record the EIA review operation			
6-4 To present leaflets and other materials for dissemination of EIA system			
~~6-5 To prepare a periodical report on the EIA review works~~			
6-5 To develop a WEB site to disclose EIA works based on the new EIA system			<Preconditions>
6-6 To review and update the WEB site			1. Japanese experts are assigned
6-7 To presented activities on EIA review to an international conference			2. C/Ps are assigned.

Note: The changes agreed by JCC members are shown in red.

Attachment 2-1

as of 2015/12/18

Amendment of Plan of Operation (PO)



Note: Black lines show the original schedule, and the red lines show the amended schedule.

Attachment 2: Amendment of Plan of Operation

as of 2015/12/18

Amendment of Plan of Operation (PO)

Year	1st Year												2nd Year												3rd Year											
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1
Year	2015							2016												2017												2018					
Month	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
Project Period																																					
Output 4 **Capacity of interpreting the information for water pollution control measures is enhanced.** 4-1 To collect the information necessary for the water quality status report.																																					
4-2 To interpret the collected information.																																					
4-3 To prepare a water quality status report.																																					
Output 5 **Necessary technical manuals and forms legislation for the EIA review operation are develope** 5-1 To draft necessary legislation including Official Forms for the EIA.																																					
5-2 To develop a technical Manual for the EIA review works.																																					
5-3 To evaluate and update the Manual to meet the practical EIA review works.																																					
5-4 To develop a database for recording the EIA review operation.																																					
5-5 To establish an evaluation system for issuing license to EIA consultants.																																					
Output 6 **Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.** 6-1 To implement basic and advanced EIA Training ~~incl. Screening, Scoping, EIA review, EMP, EMoP and so on~~																																					
6-2 To implement the EIA review works based on the new EIA procedure																																					
6-3 To record the EIA review operation																																					
6-4 To present leaflets and other materials for dissemination of EIA system																																					
~~6-5 To prepare a periodical report on the EIA review works~~																																					
6-5 To develop a WEB site to disclose EIA works based on the new EIA procedure																																					
6-6 To review and update the WEB site																																					
6-7 To presented activities on EIA review to an international conference.																																					

Note: Black lines show the original schedule, and the red lines show the amended schedule.

Attachment 2-2

Attachment 2: Amendment of Plan of Operation

as of 2016/11/04

Annex 10 Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.	1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. 2. Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC. 3. Improvement of EIA procedure is identified by ECD through EIA reviews.	· Database (baseline) Questionnaire · strategy · Proposal for EIA procedure revision	
<Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.	1. Consideration for the water status in the pilot study area is made. 2 More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project.	· Survey report · EIA documents	1. National effluent standard is developed.
Output 1 Inspection procedure is standardized.	1. Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD.	· Records of Inspection	1. Responsibility of MONREC, YCDC and MCDC for water pollution control does not change. 2. YCDC and MCDC do not stop inspection system as a water pollution control measures. 3. Responsibility of MONREC for EIA review does not change. 4. Relevant legislation of EIA does not significantly change. 5. The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAF.
Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.	1. Water quality survey reports are prepared in the pilot areas by YCDC and MCDC.	· Survey report	
Output 3 Database of water pollution sources and river water quality is developed.	1. At least 150 factories' information is accessible on the database. 2. Results of river water quality survey is accessible on the database.	· Database · Database	
Output 4 Capacity of interpreting the information for water pollution control measures is enhanced	1. Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC.	· Presentation materials	

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 5 Necessary technical manuals and forms for the EIA review are developed.	1. The technical manual covers every sector (1) of development projects and every major stage indicated in the EIA procedure. 2. The draft official forms are internally approved.	・ Technical manual and forms	
Output 6 Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.	1. More than 80% of ECD officers in charege of EIA reviews received completion certificates from the Advanced EIA trainings. 2 Statistics of EIA reviews are presented. 3 EIA works by MONREC are presented at an international conference.	・ Evaluation report of EIA ・ Proceedings	
<Activities> **Output 1: Inspection procedure is standardized.** 1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1-2 To evaluate present inspection procedure 1-3 To develop an inspection manual 1-4 To implement trial inspections based on the inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To evaluate the trial inspection procedures **Output 2: Capacity for water quality survey is enhanced.** 2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To verify the results of the water quality survey using the water quality survey	<Inputs> Japanese side ・ Experts. ・ Training in Japan and other country. ・ Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others. Myanmar side ・ Counterpart personnel. ・ Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)		

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
manual 2-9 To prepare a water quality survey report			
Output 3: Database of water pollution sources and river water quality is developed with GIS software. 3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey 3-2 To develop a system concept 3-3 To design the database based on the system concept 3-4 To collect additional information required to develop the database 3-5 To develop the database 3-6 To conduct training on operation and utilization of the database 3-7 To develop an operation and maintenance manual of the database			
Output 4: Capacity of interpreting the information for water pollution control measures is enhance. 4-1 To collect the information necessary for the water quality status report 4-2 To interpret the collected information 4-3 To prepare a water quality status report			
Output 5: Necessary technical manuals and-legislation for the EIA operation are developed. 5-1 To draft legislation on demand including Official Submission Forms for the EIA 5-2 To develop a technical Manual of the EIA review process 5-3 To evaluate and update the Technical Manual to meet the ongoing EIA review processes 5-4 To develop a database for recording the EIA review			
5-5 To draft legistraions for issuing licenses to EIA consultants			
Output 6: Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced. 6-1 To implement basic and advanced EIA trainings 6-2 To implement EIA review works based on the EIA procedure 6-3 To record the EIA reviews 6-4 To present leaflets and other materials for dissemination of EIA system 6-5 To develop a WEB site to disclose EIAs based on the new EIA system 6-6 To review and update the WEB site 6-7 To present activities on EIA review to an international conference			<Preconditions> 1. Japanese experts are assigned 2. C/Ps are assigned.

Note: The changes agreed by JCC members are shown in red.

(1) sectors are indicated in Annex A of EIA procedure.

添付資料 2:

専門家派遣実績
Assignments of Experts

Manning Schedule for the Project for Capacity Development in Basic Water Environment Management and EIA System
(Water Environment Management Team)

		Position	Name	2015 5	6	7	8	9	10	11	12	2016 1	2	3	4	5	6	7	8	9	10	11	12	2017 1	2	3	4	5	6	7	8	9	10	11	12	2018 1	2	3	4	5	6	Man-Month First Period	Second Period
				First Period																				Second Period																			
Assignment in Myanmar	1	Leader and Industrial Effluent Management	Mr. Itaru Okuda																																							6.74	4.43
	2	Assistant Leader and Water Quality Survey	Mr.Shunsuke Hieda																																							0.70	0.73
	3	Water Sampling and On-site Measurement	Ms.Tomoe Takeda																																							6.13	4.07
	4	Database Development with GIS	Mr. Hiroaki Nakagawara																																							5.37	2.67
	5	Industrial Effluent Treatment	Mr. Toshiyuki Nishio																																							0.93	0.90
				Rain season				Dry/hot season				Water Festival Period				Rain season				Dry/hot season				Water Festival Period				Rain season				Dry/hot season				Water Festival Period				Sub-total 19.87	Sub-total 12.80
Assignment in Japan	1	Leader and Industrial Effluent Management	Mr. Itaru Okuda																																							0.20	0.35
	2	Assistant Leader and Water Quality Survey	Mr.Shunsuke Hieda																																							6.25	3.60
	3	Water Sampling and On-site Measurement	Ms.Tomoe Takeda																																							0.00	0.00
	4	Database Development with GIS	Mr. Hiroaki Nakagawara																																							0.00	0.00
	5	Industrial Effluent Treatment	Mr. Toshiyuki Nishio																																							0.50	0.50
	6	Training planning(1)	Ms.Tomoe Takeda																																							0.80	0.70
	7	Training planning(2)	Mr. Hiroaki Nakagawara																																							0.70	0.25
			Joint Coordination Committee (JCC)/ Project Coordination Committee (PCM)			JCC/PCM				PCM				PCM				PCM				JCC/PCM				PCM				PCM				JCC/PCM				JCC		Sub-total 8.45	Sub-total 5.40
		: Assignment in Myanmar : Noncontiguous assignment in Myanmar : Assignment in Japan	Mid-term review/ Terminal evaluation																			Mid-term review																Terminal evaluation				Total 28.32	Total 18.20
			Report					WP-1			PRR-1					PRR-2						PRR-3						WP-2					PRR-4						PCR		Grand Total (First and Second Period])	46.52
			Group and region focused training /Training in Japan				Group and region focused training								Training in Japan(1)						Training in Japan(2)								Training in Japan(3)													

WP：Work Plan, PRR：Progress Report, PCR：Project Completion Report

Note: Mr.Hieda has noncontiguous assignments in Myanmar which enable his flexible activity.
The reports to be prepared in Japanese and submitted to JICA is not included in this table.

添付資料 3:

研修員受入実績
Records of Study Programs in Japan

APPENDIX 3 Records of Study Programs in Japan

(1) First Program

Summary of Study Program in Japan No.1

Item	Contents
Title	1st study program in Japan for the Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar
Period	22nd May (Sun) – 28th May (Sat) 2016 (in total 7 days)
Number of Trainees	Six participants (three participants from MOECAF, one participant from YCDC, and two participants from MCDC)
Main Places for Training	Tokyo
Language	Myanmar – Japanese

Source: JET

Schedule of Study Program in Japan No.1

Day		Time	Activities	Lecturer /Venue	Relevant Outputs
-	21 May (Sat)	21:45	- Departure from Yangon for Narita	-	-
1	22 May (Sun)	06:50	- Arrival at Narita Airport	-	-
		– 09:30	- Move to TIC	-	-
2	23 May (Mon)	09:15 – 10:30	- Briefing of the training in Japan - Orientation of the training course	TIC JET	-
		11:30 – 12:00	- Courtesy visit to JICA	-	-
		13:30 – 15:00	- Lecture on necessary policies and effective measures for water pollution / case studies of water quality improvement in Japan	Tokyo Metropolitan Research Institute for Environmental Protection	Output 1, Output 2
		16:30 – 17:10	- Site visit: Sumida River	Sumida River	Output 1, Output 2
		19:00 – 20:30	- Meeting for exchange of opinions	JET	Outputs 1, 2, 3 and 4
3	24 May (Tue)	10:00 – 12:00	- Lecture on policies and system for water environment management (watershed) and administrative measures for water pollution in Japan - Courtesy visit to the Ministry of Environment (MOE)	Ministry of Environment (Japan)	Outputs 1 and 2
		14:20 – 14:45	- Site visit: Giant Ushiku Amida Buddha (Cultural understanding)	-	-
		15:30 – 17:30	- Site visit: Water environment of Lake Kasumigaura	Ibaraki Kasumigaura Environmental Science Center	Outputs 1 and 2
4	25 May (Wed)	09:00 – 11:30	- Lecture on measures for water pollution in Kawasaki City (local government)	Kawasaki City	Outputs 1 and 2
		13:00 – 16:00	- Assignments of the Kawasaki Environment Research Institute (KERI) - Lecture on research and study on water pollution - Laboratory tour (KERI)	Kawasaki Environment Research Institute	Outputs 1, 2 and 3
		17– 17:30	- Site visit for viewing Keihin Industrial Area	JET	-
5	26 May (Thu)	10:00 – 11:00	- Site visit for water treatment and management of wastewater	Haga Town, Tochigi Pref.	Outputs 1, 2 and 3
		14:00 – 16:30	- Lecture and discussion on issues of water environmental management and measures toward	Dr. Senro Imai	Outputs 1, 2, 3 and 4

Day		Time	Activities	Lecturer /Venue	Relevant Outputs
			resolution		
6	27 May (Fri)	10 – 12	- Presentation and discussion	JET	-
		13:00 – 15:00	- Evaluation of the training course - Certificate Ceremony	TIC	-
7	28 May (Sat)	11:00	- Departure from Narita to Yangon (Departure from TIC at 7:00)	-	-

Source: JET

List of Participants of Study Program in Japan No.1

No.	Name	Position/Organization
1	Mr. Zaw Moe	Environmental Conservation Department (Yangon), MONREC1) Deputy Director
2	Ms. Thin Thin Nu	Environmental Conservation Department (Ayeyarwaddy), MONREC 1) Assistant Director
3	Mr. Zaw Tun Aung	Environmental Conservation Department (Mandalay), MONREC 1) Staff Officer
4	Mr. Myint Sein	Engineering Department (Water & Sanitation), YCDC) Assistant Head of Department
5	Mr. Zaw Zaw Tun	Agriculture and Livestock Breeding Department（), MCDC3) Staff Office
6	Ms. Thwe Hnin Aung	Water and Sanitation Department, MCDC3) Assistant Engineer

Source: JET

(2) Second Program

Summary of Study Program in Japan No.2

Course	Item	Contents
1-week course	Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (1-week)
	Period	27 September (Sun) – h October (Sat) 2016 (in total 7 days)
	Number of Trainees	3 delegates (1 participant from MOECAF, 1 participant from YCDC and 1 participant from MCDC)
	Main Places for Training	Tokyo
	Language	Myanmar – Japanese
3-week course	Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (3-week)
	Period	27th September (Tue) – 18th October (Sun) 2016 (in total 22 days)
	Number of Trainees	7 participants (3 participants from MOECAF, 1 participant from YCDC and 2 participants from MCDC)
	Main Places for Training	Tokyo, Yokohama and Kansai
	Language	Myanmar – Japanese

Source: JET

Schedule of Study Program in Japan No.2

1-week	3-week	Date		Time	Activities	Lecturer /Venue
1	1	27 (Tue)	Sep	-	PM: Departure from Yangon to Tokyo	-
2	2	28 (Wed)		AM	Arrival at Tokyo, Move to hotel	-
				15:20-15:50	Briefing by the JICA Expert Team	Nippon Koei Co., Ltd.
				15:50-16:20	JCM project formulation for energy conservation and environmental improvement	Nippon Koei Co., Ltd.
				16:30-18:15	Development of approaches for	Mr. Senro Imai, JICA

1-week	3-week	Date		Time	Activities	Lecturer /Venue
					environmental protection and challenges for SDGs in Japan	advisor
				18:30-20:30	Welcome party	-
3	3	29 (Thu)		10:00-12:30	Briefing and orientation	TIC
				14:30-15:00	Courtesy call to JICA	JICA HQ
				15:00-16:30	Environmental administration in Myanmar and Japan	Dr. Itaru Okuda, Team Leader of the JICA Expert Team
4	4	30 (Fri)		9:00-12:00	Lecture on measures for water pollution in Kawasaki City	Kawasaki City
				13:00-14:30	Introduction of the Kawasaki Environment Research Institute/ Laboratory tour	Kawasaki Environment Research Institute, Kawasaki City
				15:00 – 17:00	Site visit for wastewater treatment facility and management (food industry)	Ajinomoto Co., Inc. Kawasaki Plant
5	5	1 (Sat)	Oct	10:00 – 12:00	Environmental policy framework and administration in Japan	Prof. Hitoshi Ushijima, Chuo University
				PM	Free time	
6	6	2 (Sun)		9:00 – 17:00	Holiday (private sightseeing tour in Kamakura)	-
7	7	3 (Mon)		9:00 – 11:30	Site visit for river water treatment facilities	Katsunan Public Works Office, Chiba Prefecture
				12:50 – 13:50	Lunch meeting with JICA HQ	-
				14:00 - 15:30	Water environment administration of Japan	Water Environment Division, Environment Management Bureau, Ministry of the Environment
				16:00 – 17:30	Wrap-up presentation and certificate ceremony for the 1-week program	JICA HQ
8	8	4 (Tue)		AM	[Attendees of the 1-week program] Leave Japan for Myanmar	-
-				9:00 – 17:00	[Attendees of the 3-week program] Training on water quality monitoring	Private lab, Osumi Co., Ltd
	9	5 (Wed)		9:00 – 16:30	Training on water quality analysis	Private lab, Osumi Co., Ltd
	10	6 (Thu)		9:00 – 17:00	Training on water quality analysis	Private lab, Osumi Co., Ltd
	11	7 (Fri)		9:30-12:00	How to develop a water quality monitoring plan and report/ Good practice of inspection activities in other countries	Nippon Koei Co., Ltd.
				13:30 – 15:30	Preparation of wrap-up presentation	-
	12	8 (Sat)		9:00 – 14:00	Holiday (private sightseeing tour in Asakusa/ Tokyo)	-
	13	9 (Sun)		-	Move from Tokyo to Otsu	-
	14	10 (Mon)		10:00 – 12:00	Lake Biwa cruise	-
				14:00 – 16:00	Lake Biwa Museum	
	15	11 (Tue)		10:00 – 12:00	Lecture on lake environmental management/ Laboratory tour	Lake Biwa Environmental Research Institute
				14:00 – 16:00	Site visit for wastewater treatment facility and management (alcohol and beverage industry)	Kirin Co., Ltd. Shiga Factory
	16	12 (Wed)		9:30 – 12:00	Site visit for wastewater treatment facility and management (manufacturing industry)	Shimadzu Corporation, Sanjo Works
				14:00 15:00	Environmental education and environmental activities in Kyoto City	Miyako Ecology Center
				16:15 – 17:00	Sightseeing at Kinkakuji (Golden Pavilion)	Kinkakuji
	17	13 (Thu)		9:00 – 12:00	Lecture on practice and challenges in industrial wastewater treatment	Mr. Chuzo Nishizaki
				14:00 – 16:30	Site visit for wastewater treatment facility	Rengo Co., Ltd.,

1-week	3-week	Date		Time	Activities	Lecturer /Venue
					and management (paper mill)	Amagasaki Mill
	18	14 (Fri)		9:00 – 12:00	Sewage system in Kobe City / site visit to a sewage treatment plant	Kobe City
				14:00 -16:00	Site visit for wastewater treatment facility and management (power plant)	Kobelco Eco-Solutions Co., Ltd.
	19	15 (Sat)		-	Holiday (sightseeing tour in Kyoto)	-
	20	16 (Sun)		-	Move from Kobe to Tokyo	-
	21	17 (Mon)		9:30 – 11:30	Central wastewater treatment plant in industrial zone	Yokohama City
				13:30 – 17:00	Wrap-up presentation and certificate ceremony for the 3-week program	JICA HQ
	22	18 (Tue)		-	Departure from Tokyo to Yangon	-

Source: JET

List of Participants of Study Program in Japan No.2

No.	Name	Position/Organization
1-week course		
1	Mr.Min Maw	Director, Pollution Control Department, Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation
2	Mr.Myo Thein	Deputy Head of Department, Engineering Department (Water & Sanitation), Yangon City Development Committee
3	Mr.Khin Maung Thin	Deputy Head, Assistant Director, Water and Sanitation Department, Mandalay City Development Committee
3-week course		
4	Mr.Bawi Kyone	Assistant Head of Department, Pollution Control and Cleansing Department, Yangon City Development Committee
5	Ms.Thwe Naing Oo	Assistant Chief Engineer, Engineering Department (Water & Sanitation), Yangon City Development Committee
6	Mr.Win Swe	Assistant Supervisor, Cleansing Department, Mandalay City Development Committee
7	Mr.Aung Zaw Moe	Junior Engineer, Water and Sanitation Department, Mandalay City Development Committee
8	Ms.Khin Myo Sat Aye	Deputy Staff Officer, Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation
9	Mr.Pyae Phyo Kyaw	Deputy Staff Officer, Environmental Conservation Department/ Mandalay Region, Ministry of Natural Resources and Environmental Conservation
10	Ms.Thet Wai Hnin	Deputy Staff Officer, Environmental Conservation Department/ Yangon Region, Ministry of Natural Resources and Environmental Conservation

Source: JET

(3) Third Program

Summary of Study Program in Japan No.3

Item	Contents
Title	Planning and Implementation of Water Quality Monitoring and Pollution Source Control (2)
Period	28 Aug (Mon) – 14 Sep (Thu) 2017 (in total 17 days)
Number of Trainees	Total 14 delegates - 10 Delegates for Course 1 (management level): 3 participants from MONREC, 1 participant from YCDC, MCDC, MOT, MOHS, MOE, MOI and MOALI.

Item	Contents
	- 4 Delegates for Course 2 (technical-level): each 2 participants from YCDC and MCDC
Main Places for Training	Tokyo, Shiga and Kansai
Language	Myanmar – Japanese

Source: JET

Schedule of Study Program in Japan No.3

Date			Activities		Lecturer /Venue	
28	Aug	Mon	PM: Departure from Yangon to Tokyo		-	
29		Tue	AM: Arrival at Tokyo PM: Free time		TIC	
30		Wed	AM: Briefing and orientation PM: Courtesy call to JICA/Lecture on the Development of Approaches for Environmental Protection and Challenges for SDGs in Japan		AM: TIC PM: JICA, Dr. Imai	
31		Thu	Lecture on measures for water pollution in local government		Kawasaki Municipality	
1	Sep	Fri	AM: Site visit for centralized wastewater treatment facility for industrial zone PM: Courtesy call to the Ministry of Environment (MOE) and lecture on necessary policies and effective measures for water pollution		AM: Haga Town PM: MOE	
2		Sat	AM: Japan's Environmental Law and its implementation		AM: Professor from Chuo University	
3		Sun	Holiday		-	
4		Mon	Lecture on water quality monitoring		Laboratory (Nippon Koei)	
5		Tue	Course 1: Lecture on water environment management in Southeast Asia	Course 2: Training on water quality monitoring and analysis	Course1: IGES	Course 2: Laboratory (Nippon Koei)
6		Wed	Course 1: AM: Lecture on financial support mechanism related to environmental measures for factories PM: Lecture on coordination for environmental management for factories	Course 2: Training on water quality monitoring and analysis	Course1: AM: Development Bank of Japan PM: Japan Environmental Management Association for Industry	Course 2: Laboratory (Nippon Koei)
7		Thu	AM: Move to Kansai PM: Lecture on environment of Shiga Prefecture		PM: International Lake Environment Committee	
8		Fri	AM: Site visit for agricultural wastewater treatment PM: Lecture on eco-friendly farming Site visit to Biwa Lake (boat tour) Move to Kyoto		AM: Kusatsu City PM: Shiga Prefecture	
9		Sat	AM: Site visit to Lake Biwa Museum		AM: Biwa Lake	
10		Sun	Holiday		-	
11		Mon	AM: - Regulation on industrial wastewater for sewerage - Lecture on pollution control measures by industries / experience of developing wastewater treatment system in Vietnam		AM: Kobe City KOBELCO	

Date			Activities	Lecturer /Venue
			PM: Site visit to wastewater treatment facilities or sewage treatment plant	PM: Suntory Takasago Factory
12		Tue	AM: Environmental education and activities in Kobe City PM: Move to Tokyo	AM: Kobe environment and future museum
13		Wed	AM: Presentation preparation PM: Wrap-up presentation and certificate ceremony	AM:TIC PM: JICA
14		Thu	Move from Japan to Myanmar	-

Source: JET

List of Participants of Study Program in Japan No.3

No.	Name	Position/Organization
Course 1		
1	Ms. Khin Thida Tin	Director, Environmental Conservation Department/ Yangon Region, Ministry of Natural Resources and Environmental Conservation
2	Mr. Bawi Kyone	Assistant Head of Department, Pollution Control and Cleansing Department, Yangon City Development Committee
3	Mr. Tun Tun Aung	Assistant Director, Irrigation and Water Resource Management Department, Ministry of Agriculture, Livestock and Irrigation
4	Mr. Thant Zin Tun	Assistant Director, Environmental Conservation Department/ Mandalay Region, Ministry of Natural Resources and Environmental Conservation
5	Ms. Khaing Khaing Soe	Assistant Director, Public Health Department, Ministry of Health and Sports
6	Ms. Saw Sanda Win	Assistant Director, Directorate of Water Resources and Improvement of River System, Ministry of Transportation
7	Ms. Swai Thi Htut	Assistant Director, Department of Industrial Supervision and Inspection, Ministry of Industry
8	Mr. Kyaw Zin Tun	Assistant Director, Research and Innovation Department, Ministry of Education
9	Mr. Zaw Min Oo	Deputy Staff Officer, Cleansing Department, Mandalay City Development Committee
Course 2		
10	Ms. Kyawt Kay Khaing	Junior Engineer, Assistant Director, Water and Sanitation Department, Mandalay City Development Committee
11	Mr. Aung Khin Myint	Junior Engineer, Assistant Director, Water and Sanitation Department, Mandalay City Development Committee
12	Mr. Soe Zaw	Deputy Supervisor, Pollution Control and Cleansing Department, Yangon City Development Committee
13	Ms. Yadanar Wuttyi Soe	Deputy Supervisor, Pollution Control and Cleansing Department, Yangon City Development Committee

Source: JET

添付資料 4:

供与機材実績
List of Equipment Handed Over to the Myanmar Side

LIST OF EQUIPMENT HANDED OVER TO THE MYANMAR SIDE

No.	Article Name	Standard and Product Number	Present Location	Date of Handover
1.	Desktop computer	HP 20-C0381 (i3)	ECD HQ	17 May 2018
2.	UPS	Powertree S650BX	ECD HQ	17 May 2018
3.	Laptop computer	Lenovo G4070	ECD HQ	17 May 2018
4.	Laptop computer	Lenovo G4070	ECD HQ	17 May 2018
5.	Projector	Epson E03	ECD HQ	17 May 2018
6.	Color Printer	Fuji Xerox, DocuCentre-V C2265	ECD HQ	17 May 2018
7.	Black-White Printer	Canon Copier IR-2520	ECD HQ	17 May 2018
8.	Multi-Parameter Water Quality Meter	Horiba, U52G	ECD HQ	17 May 2018
9.	Current meter	Global Water, FP111	ECD HQ	17 May 2018
10.	GPS	GARMIN, GPSMAP 64s	ECD HQ	17 May 2018
11.	Scanner	Canon, CanoScan LiDE220	ECD HQ	17 May 2018
12.	Camera	Cannon, Cannon Digital Camera Power Shot D30	ECD HQ	17 May 2018
13.	Desktop computer	HP 20-C0381 (i3)	ECD Yangon Region	15 May 2018
14.	UPS	Powertree S650BX	ECD Yangon Region	15 May 2018
15.	Multi-Parameter Water Quality Meter	Horiba, U52G	ECD Yangon Region	15 May 2018
16.	Current meter	Global Water, FP111	ECD Yangon Region	15 May 2018
17.	Desktop computer	HP 20-C0381 (i3)	ECD Mandalay Region	15 May 2018
18.	UPS	Powertree S650BX	ECD Mandalay Region	15 May 2018
19.	Multi-Parameter Water Quality Meter	Horiba, U52G	ECD Mandalay Region	15 May 2018
20.	Current meter	Global Water, FP111	ECD Mandalay Region	15 May 2018
21.	Desktop computer	HP 20-C0381 (i3)	YCDC-PCCD	15 May 2018
22.	UPS	Powertree S650BX	YCDC-PCCD	15 May 2018

No.	Article Name	Standard and Product Number	Present Location	Date of Handover
23.	Multi-Parameter Water Quality Meter	Horiba, U52G	YCDC-PCCD	15 May 2018
24.	Flow meter	Global Water, FP111	YCDC-PCCD	15 May 2018
25.	GPS	GARMIN, eTrex 20	YCDC-PCCD	15 May 2018
26.	COD analysis set	HACH DR3900 spectrometer, HACH DRB200	YCDC-PCCD	15 May 2018
27.	Digital Reactor for digestion of total nitrogen	HACH, DRB 200	YCDC-WSD	15 May 2018
28.	Desktop computer	HP 20-C0381 (i3)	YCDC-WSD	15 May 2018
29.	UPS	Powertree S650BX	YCDC-WSD	15 May 2018
30.	Desktop computer	HP 20-C0381 (i3)	MCDC-WSD	9 May 2018
31.	UPS	Powertree S650BX	MCDC-WSD	9 May 2018
32.	Desktop computer	HP 20-C0381 (i3)	MCDC-WSD	9 May 2018
33.	UPS	Powertree S650BX	MCDC-WSD	9 May 2018
34.	Multi-Parameter Water Quality Meter	Horiba, U52G	MCDC-WSD	9 May 2018
35.	Current meter	JFE Advantech, AME1-DA	MCDC-WSD	9 May 2018
36.	Flow meter	Global Water, FP111	MCDC-WSD	9 May 2018
37.	GPS	GARMIN, eTrex 20	MCDC-WSD	9 May 2018

添付資料 5:

合同調整委員会開催記録
Minutes of Joint Coordinating Committee Meetings

MINUTES OF MEETING OF JOINT COORDINATING COMMITTEE

MEETING NO.1

PROJECT FOR CAPACITY DEVELOPMENT IN BASIC WATER ENVIRONMENT MANAGEMENT AND EIA SYSTEM IN THE REPUBLIC OF THE UNION OF MYANMAR

Nay Pyi Taw, 8th July, 2015

Dr. Itaru Okuda
Leader, JICA Exert Team

Mr. Sein Htoon Linn
Deputy Director General,
on behalf of Mr. Nay Aye
Director General
Environmental Conservation Department
Ministry of Environmental Conservation and Forestry

for 稲田圭輔

Mr. Keiichiro Nakazawa
Chief Representative
JICA Myanmar Office

These are the minutes of the Joint Coordinating Committee (hereinafter referred to as "JCC") meeting No.1 of the project entitled "Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar", which is being implemented in accordance with the Record of Discussions (hereinafter referred to as "R/D") agreed on 23rd December 2014 between Ministry of Environmental Conservation and Forestry (hereinafter referred to as "MOECAF") and Japan International Cooperation Agency (hereinafter referred to as "JICA").

The meeting was held on 8th July 2015 at the conference room of Environmental Conservation Department (hereinafter referred to as "ECD") of MOECAF in Nay Pyi Taw. The agenda of the meeting and the list of participants are given in Attachments 1 and 2.

Following the opening remarks by the Director General of ECD, Mr. Nay Aye, and the representative of JICA Myanmar Office, four presentations were made by the representatives of ECD, Yangon City Development Committee (hereinafter referred to as "YCDC") and Mandalay City Development Committee (hereinafter referred to as "MCDC") on their activities on water environment management and review works of environmental impact assessment (hereinafter referred to as "EIA"). Also, two presentations were made by the JICA Expert Team (hereinafter referred to as "JET") on the work plans of the water environment management component and the EIA component of the project.

After the presentations, the JCC members agreed on the following matters based on the discussion.

(1) Members of Joint Coordinating Committee

The committee members nominated by relevant organizations were appointed as the members of the Joint Coordinating Committee of the project. The list of members and member organizations is given in Attachment 3.

(2) Work Plans of Water Environment Component and EIA Component

With respect to the work plan of the water environment component, the JCC members agreed that:

(i) the work plan of the water environment management component is in consistent with the R/D, and overall the contents are acceptable, and

(ii) comments on the work plan should be submitted to ECD and JET by the end of July 2015. ECD and JET are responsible for finalizing the work plan by the end of August 2015 in consultation with relevant organizations. The finalized work plan shall be distributed to

the JCC members in electronic format.

With respect to the work plan of the EIA component, the members agreed that at this point no further revision of the work plan is necessary. Should the need to revise the work plan arise, ECD and JET are responsible for revising the plan.

(3) Information Sharing

The JCC members agreed that information essential for implementation of the project, such as relevant data, schedules, other donors' activities, urgent issues and change in personnel, shall be shared with JET.

End

Attachments:
Attachment 1: Agenda of the Joint Coordination Committee meeting No.1
Attachment 2: List of participants
Attachment 3: List of members of Joint Coordinating Committee member

The Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar

Agenda of Joint Coordinating Committee Meeting No.1

Objectives: - To introduce the project to all JCC members
- To present related activities of relevant organizations
- To confirm proposed work plans of water environment management and EIA components

Date and Time: July 8th (Wednesday), 2015, 10:00-12:30

Place: Meeting Room of ECD, MOECAF

Participants: ECD/MOECAF, YCDC, MCDC, MOH, MOT, MOI, MOST, MOAI, JICA, Embassy of Japan

Language: English (consecutive translation available for discussions)

Time	Contents	Speaker
10:00-10:05	Opening remarks	Representative of MOECAF
10:05-10:10	Opening remarks	Representative of JICA
10:10-10:20	Introduction to the Project	JET (Dr. Okuda)
10:20-10:35	PCD/ECD's activities on water environment management	PCD/ECD/MOECAF
10:35-10:50	YCDC's activities on water environment management	YCDC
10:50-11:05	MCDC's activities on water environment management	MCDC
11:05-11:25	Work plan of water environment management component of the Project	JET (Water Environment Management Team)
11:25-11:40	EIA/ECD's activities on EIA review	NRC&EIA/ECD/MOECAF
11:40-12:00	Work plan of EIA component of the Project	JET (Dr. Usui)
12:00-12:25	Discussions (consecutive interpretation in English/Myanmar)	-
12:25-12:30	Closing remarks	Representative of MOECAF
12:30-	Lunch	-

List of participants of Joint Coordinating Committee Meeting No.1

No.	Name	Title	Name of Organization
Members of Myanmar Side			
1	Mr. Hla Maung Thein	Deputy Director General (DDG)	ECD, MOECAF
2	Mr. Sein Htoon Linn	Deputy Director General (DDG)	ECD, MOECAF
3	Mr. Than Aye	Director	ECD, MOECAF
4	Dr. San Oo	Director	ECD, MOECAF
5	Mr. Min Maw	Deputy Director (DD)	ECD, MOECAF
6	Mr. Zayar Oo	Staff Officer (SO)	MOAI
7	Mr. Aung Zaw Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), MOT
8	Ms. May Kyi Khing	Deputy Director (DD)	MOI
9	Mr. Htay Win	Deputy Director (DD)	MOH
10	Dr. Thar Htat Kyaw	Deputy Director (DD)	MOST
11	Mr. Bawi Kyone	Assistant Head of Department	YCDC
12	Mr. Khin Maung Thin	AE, Head of Section	MCDC
Members of Japanese Side			
13	Ms. Noriko Sakurai (for Mr. Keiichiro Nakazawa)	Project Formulation Advisor	JICA Myanmar Office
14	Mr. Senro Imai	Project Advisor	JICA
15	Dr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team
16	Dr. Kanji Usui	EIA Technical Manual and Review Process	JICA Expert Team
17	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team

Observers

No.	Name	Title	Name of Organization
Myanmar Side			
1	Dr. Tin Tun	Deputy Director (DD)	MOH
2	Dr. Khin Saw Hla	Deputy Director (DD)	Food & Drug Administration Department, MOH
3	Mr. Zaw Nyut	Assistant Director (AD)	Traditional Medicine Department, MOH
4	Dr. Chaw Nande		Medical Service Department, MOH
5	Dr. Khang Khaing Soe	Assistant Director (AD)	Occupational & Public Health Division, PHD, MOH
6	Mr. Zaw Min	Executive Engineer (EE)	WSD, YCDC
7	Mr. Zaw Win	Assistant Director (AD)	ECD, MOECAF
8	Mr. Hein Latt	Staff Officer (SO)	ECD, MOECAF
9	Ms. Saint	Deputy Staff Officer (SO)	ECD, MOECAF
10	Mr. Banyar Aung	Deputy Staff Officer (SO)	ECD, MOECAF
11	Mr. Sa Aung Thu	Assistant Director (AD)	ECD, MOECAF
12	Ms. Thin Thin	Staff Officer (SO)	ECD, MOECAF
13	Ms. Yin Yin Mar	Deputy Staff Officer (DSO)	ECD, MOECAF
Japanese Side			
14	Ms. Thet Thet Zaw	Secretary	JICA Myanmar Office
15	Mr. Htein Lin	Project Coordinator	JICA Expert Team
16	Ms. Betty Ni Ni Chan	Project Coordinator	JICA Expert Team

List of members of Joint Coordinating Committee

No.	Name	Title	Name of Organization
Members of Myanmar Side			
1	Mr. Nay Aye	Director General (DG)	ECD, MOECAF
2	Mr. Sein Htoon Linn	Deputy Director General (DDG)	ECD, MOECAF
3	Mr. Than Aye	Director	ECD, MOECAF
4	Dr. San Oo	Director	ECD, MOECAF
5	Mr. Min Maw	Deputy Director (DD)	ECD, MOECAF
6	Mr. Zayar Oo	Staff Officer (SO)	MOAI
7	Mr. Aung Zaw Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), MOT
8	Ms. May Kyi Khine	Deputy Director (DD)	MOI
9	Mr. Htay Win	Deputy Director (DD)	MOH
10	Dr. Thar Htet Kyaw	Deputy Director (DD)	MOST
11	Mr. Bawi Kyone	Assistant Head of Department	YCDC
12	Mr. Khin Maung Thin	AE, Head of Section	MCDC
Members of Japanese Side			
13	Mr. Keiichiro Nakazawa	Chief Representative	JICA Myanmar Office
14	Mr. Senro Imai	Project Advisor	JICA
15	Dr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team
16	Dr. Kanji Usui	EIA Technical Manual and Review Process	JICA Expert Team
17	Mr. Shunsuke Hieda	Water Quality Survey	JICA Expert Team
18	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team
19	Mr. Hiroaki Nakagawara	Database Development with GIS	JICA Expert Team

MINUTES OF JOINT COORDINATING COMMITTEE MEETING NO.2

PROJECT FOR CAPACITY DEVELOPMENT IN BASIC WATER ENVIRONMENT MANAGEMENT AND EIA SYSTEM IN THE REPUBLIC OF THE UNION OF MYANMAR

Nay Pyi Taw, 18th December, 2015

Dr. Itaru Okuda
Leader, JICA Exert Team

Mr. Sein Htoon Linn, Deputy Director General, Environmental Conservation Department,
on behalf of
Mr. Nay Aye, Director General
Environmental Conservation Department
Ministry of Environmental Conservation and Forestry

Mr. Keiichiro Nakazawa
Chief Representative
JICA Myanmar Office

These are the minutes of the Joint Coordinating Committee (hereinafter referred to as "JCC") meeting No.2 of the project entitled "Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar", which is being implemented in accordance with the Record of Discussions (hereinafter referred to as "R/D") agreed on 23rd December 2014 between Ministry of Environmental Conservation and Forestry (hereinafter referred to as "MOECAF") and Japan International Cooperation Agency (hereinafter referred to as "JICA").

The members of the JCC were officially consulted in writing on the issues of amending the Project Design Matrix (PDM) and the Plan of Operation (PO) of the project, and agreed on the following points:

- Minor changes and adjustments are made to the PDM and the PO as shown in Attachment 1 and Attachment 2.
- JICA dispatches an expert on Industrial Effluent Treatment to the project in addition to the members in the five areas already agreed in the R/D.

End

Attachments:
Attachment 1: Amendment of Project Design Matrix
Attachment 2: Amendment of Plan of Operation
Attachment 3: List of members of Joint Coordinating Committee

as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.	1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. 2. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF. 3. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.	· Regulations · Guidelines · Annual report	
<Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.	1. Consideration for the water status in the pilot study area is made. 2 More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.	· Survey report · EIA documents	1. National effluent standard is developed.
Output 1 Inspection procedure is standardized.	1. More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.	· Inspection report	1. Responsibility of MOECAF, YCDC and MCDC for water pollution control does not change. 2. YCDC and MCDC do not change inspection system as a water pollution control measures. 3. Responsibility of MOECAF for EIA review does not change. 4. Relevant legislation of EIA does not significantly change. 5. The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAF.
Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.	1. Water quality survey reports are prepared in the pilot area by YCDC and MCDC.	· Survey report	
Output 3 Database of water pollution sources and river water quality is developed.	1. At least 150 factories' information is accessible on the database. 2. Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.	· Database · Database	
Output 4 Capacity of interpreting the information for water pollution control measures is enhanced	1. A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.	· Status report	

Note: The changes agreed by JCC members are shown in red.

Attachment 1-1

Attachment 1: Amendment of Project Design Matrix

as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 5 Necessary technical manuals and forms for the EIA review are developed.	1. The technical manual covers every sector of development projects and every step of the EIA procedure. 2. The draft official forms are internally approved.	・ Technical manual and forms	
Output 6 Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.	1. EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more. 2. EIA works by MOECAF are presented to an international conference.	・ Evaluation report of EIA ・ Proceedings	
<Activities> **Output 1: Inspection procedure is standardized.** 1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1-2 To evaluate present inspection procedure 1-3 To develop an inspection manual 1-4 To implement inspection based on the developed inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To revise the inspection manual	<Inputs> Japanese side ・ Experts. ・ Training in Japan and other country. ・ Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others. Myanmar side ・ Counterpart personnel. ・ Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)		
Output 2: Capacity for water quality survey is enhanced. 2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To verify the results of the water quality survey using the water quality survey manual 2-9 To prepare a water quality survey report			

Note: The changes agreed by JCC members are shown in red.

Attachment 1-2

Attachment 1: Amendment of Project Design Matrix

as of 2015/12/18

Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

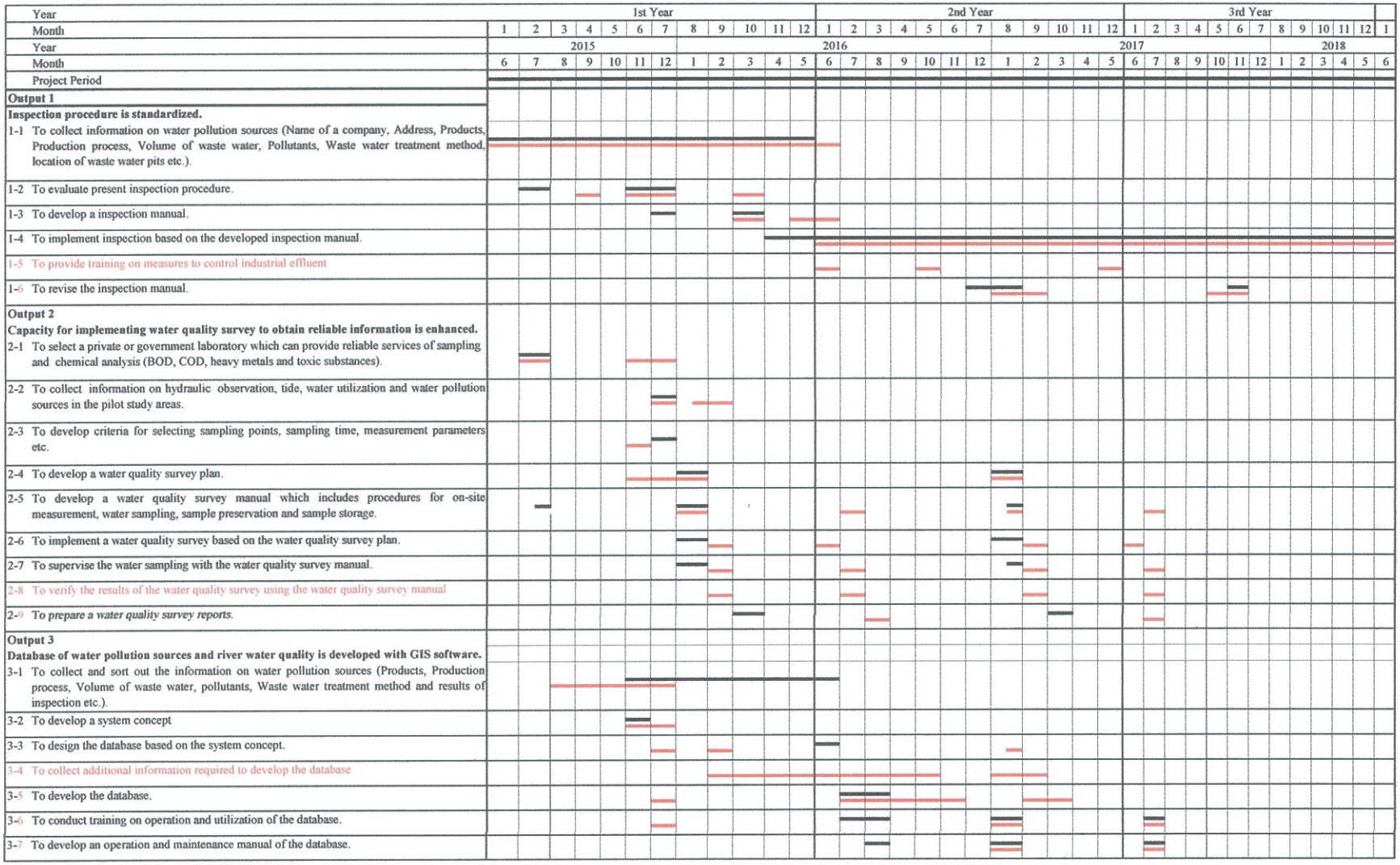
Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 3: Database of water pollution sources and river water quality is developed with GIS software.			
3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey			
3-2 To develop a system concept			
3-3 To design the database based on the system concept			
3-4 To collect additional information required to develop the database			
3-5 To develop the database			
3-6 To conduct training on operation and utilization of the database			
3-7 To develop an operation and maintenance manual of the database			
Output 4: Capacity of interpreting the information for water pollution control measures is enhance.			
4-1 To collect the information necessary for the water quality status report			
4-2 To interpret the collected information			
4-3 To prepare a water quality status report			
Output 5: Necessary technical manuals and ~~forms~~ legislation for the EIA ~~review~~ operation are developed.			
5-1 To draft necessary legislation including Official Forms for the EIA.			
5-2 To develop a technical Manual of the EIA process for review			
5-3 To evaluate and update the Manual to meet the practical EIA review works			
5-4 To develop a database for recording the EIA review operation			
5-5 To establish an evaluation system for issuing license to EIA consultants			
Output 6: Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.			
6-1 To implement basic and advanced EIA Training ~~incl. Screening, Scoping, EIA review, EMP, EMoP and so on~~			
6-2 To implement EIA review works based on the EIA procedure			
6-3 To record the EIA review operation			
6-4 To present leaflets and other materials for dissemination of EIA system			
~~6-5 To prepare a periodical report on the EIA review works~~			
6-5 To develop a WEB site to disclose EIA works based on the new EIA system			<Preconditions>
6-6 To review and update the WEB site			1. Japanese experts are assigned
6-7 To presented activities on EIA review to an international conference			2. C/Ps are assigned.

Note: The changes agreed by JCC members are shown in red.

Attachment 2-1

as of 2015/12/18

Amendment of Plan of Operation (PO)



Note: Black lines show the original schedule, and the red lines show the amended schedule.

Attachment 2: Amendment of Plan of Operation

as of 2015/12/18

Amendment of Plan of Operation (PO)

Year	1st Year												2nd Year												3rd Year											
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1
Year	2015							2016												2017												2018					
Month	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
Project Period																																					
Output 4 **Capacity of interpreting the information for water pollution control measures is enhanced.** 4-1 To collect the information necessary for the water quality status report.																																					
4-2 To interpret the collected information.																																					
4-3 To prepare a water quality status report.																																					
Output 5 **Necessary technical manuals and forms legislation for the EIA review operation are develope** 5-1 To draft necessary legislation including Official Forms for the EIA.																																					
5-2 To develop a technical Manual for the EIA review works.																																					
5-3 To evaluate and update the Manual to meet the practical EIA review works.																																					
5-4 To develop a database for recording the EIA review operation.																																					
5-5 To establish an evaluation system for issuing license to EIA consultants.																																					
Output 6 **Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.** 6-1 To implement basic and advanced EIA Training ~~incl. Screening, Scoping, EIA review, EMP, EMoP and so on~~																																					
6-2 To implement the EIA review works based on the new EIA procedure																																					
6-3 To record the EIA review operation																																					
6-4 To present leaflets and other materials for dissemination of EIA system																																					
~~6-5 To prepare a periodical report on the EIA review works~~																																					
6-5 To develop a WEB site to disclose EIA works based on the new EIA procedure																																					
6-6 To review and update the WEB site																																					
6-7 To presented activities on EIA review to an international conference.																																					

Note: Black lines show the original schedule, and the red lines show the amended schedule.

Attachment 2-2

Attachment 2: Amendment of Plan of Operation

List of members of Joint Coordinating Committee

No.	Name	Title	Name of Organization
Members of Myanmar Side			
1	Mr. Nay Aye	Director General (DG)	ECD, MOECAF
2	Mr. Sein Htoon Linn	Deputy Director General (DDG)	ECD, MOECAF
3	Dr. San Oo	Director	ECD, MOECAF
4	Dr. Kyi Lwin Oo	Director	MOH
5	Mr. Min Maw	Deputy Director (DD)	ECD, MOECAF
6	Mr. Aung Zaw Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), MOT
7	Ms. May Kyi Khine	Deputy Director (DD)	MOI
8	Dr. Thar Htet Kyaw	Deputy Director (DD)	MOST
9	Mr. Bawi Kyone	Assistant Head of Department	YCDC
10	Mr. Khin Maung Thin	AE, Head of Section	MCDC
11	Dr. Tin Aung Win	Assistant Director (AD)	ECD, MOECAF
12	Mr. Zayar Oo	Staff Officer (SO)	MOAI
Members of Japanese Side			
13	Mr. Keiichiro Nakazawa	Chief Representative	JICA Myanmar Office
14	Mr. Senro Imai	Project Advisor	JICA
15	Dr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team
16	Dr. Kanji Usui	EIA Technical Manual and Review Process	JICA Expert Team
17	Mr. Shunsuke Hieda	Water Quality Survey	JICA Expert Team
18	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team
19	Mr. Hiroaki Nakagawara	Database Development with GIS	JICA Expert Team

MINUTES OF MEETINGS
OF
JOINT COORDINATING COMMITTEE No. 3
AND
THE MID-TERM REVIEW ON
THE JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR CAPACITY DEVELOPMENT IN BASIC WATER ENVIRONMENT MANAGEMENT AND EIA SYSTEM
IN
THE REPUBLIC OF THE UNION OF MYANMAR

To review the Project for Capacity Development in Basic Water Environment Management and EIA System (hereinafter referred to as "the Project"), the Japan International Cooperation Agency (hereinafter referred to as "JICA") sent the mid-term review team (hereinafter referred to as "the Team") headed by Dr. Mimpei ITO from October 23 to November 11, 2016.

During its stay, both the Team and authorities concerned of Government of the Republic of the Union of Myanmar (hereinafter referred to as "GOM") had a series of discussions and exchanged views on the Project based on the field observations.

As a result of the discussions, the both sides agreed to the matters referred to in the attached document.

Nay Pyi Taw, 9 November, 2016

Mr. Keiichiro NAKAZAWA
Chief Representative
Myanmar Office
Japan International Cooperation Agency

Mr. Sein Htoon Linn
Deputy Director General,
On Behalf of
Mr. Hla Maung Thein
Director General
Environmental Conservation Department
Ministry of Natural Resource and
Environmental Conservation
Myanmar

THE ATTACHED DOCUMENT

1. Amended Project Design Matrix

Based on the series of discussions with the Myanmar side and with JICA expert team about the current situation and progress of the project, the revised version of Project Design Matrix (hereinafter referred to as "PDM") was proposed from the Team. Both Myanmar side and JICA agreed with the contents of amended PDM.

2. Financial support for outdoor water sampling activities

The Myanmar side requested JICA to support the water sampling activities in outdoor. In principle, JICA does not support such activities done by the counterparts, though, considering the situation in Myanmar, the Team recognized that it is important to provide the financial support for the smooth implementation of the project and decided to support the outdoor water sampling activities financially.

The team explained to the Myanmar side that this measure is an exception and it is necessary that GOM provide such kind of support to local authorities after the accomplishment of this project.

Detailed policy of the support will be informed later to the counterparts directly from the JICA expert team.

3. Information sharing

The Myanmar side agreed to share the relevant materials to EIA review operation prepared by other development partners with JICA e.g. report, guidelines, manuals, and any other output from the partners, even if those outputs are draft, for the smooth implementation of the Project.

4. Donor coordination

The Team recommended to the Myanmar side to appoint a donor Coordination Officer in charge of coordination and management of donor –related activities in the field of EIA so as to avoid the duplication or overlapping of activities supported by the donors. The Myanmar side agreed to do so.

Appendix I THE JOINT MIDTERM REVIEW REPORT ON THE PROJECT FOR CAPACITY DEVELOPMENT IN BASIC WATER ENVIRONMENT MANAGEMENT AND EIA SYSTEM IN MYANMAR

THE JOINT MIDTERM REVIEW REPORT
ON
THE PROJECT FOR
CAPACITY DEVELOPMENT IN BASIC WATER ENVIRONMENT MANAGEMENT AND EIA SYSTEM IN MYANMAR

November 9th, 2016

JOINT MIDTERM REVIEW TEAM

Dr. Mimpei ITO
Leader
Midterm Review Team
Japan International Cooperation Agency

Mr. Sein Htoon Linn
Deputy Director General,
On Behalf of
Mr. Hla Maung Thein
Director General
Environmental Conservation Department
Ministry of Natural Resource and
Environmental Conservation
Myanmar

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Abbreviations

ADB	Asian Development Bank
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
CP	Counterpart
DISI	Directorate of Industrial Supervision and Inspection
DO	Dissolved Oxygen
ECC	Environmental Conservation Certificate
ECD	Environmental Conservation Department
ECL	Environmental Conservation Law
ECR	Environmental Conservation Rule
EIA	Environmental Impact Assessment
GIS	Geographic Information System
GoM	Government of Myanmar
GPS	Global Positioning System
HIA	Health Impact Assessment
IAIA	International Association for Impact Assessment
IFC	International Finance Cooperation
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
MCDC	Mandalay City Development Committee
MLSS	Mixed Liquor Suspended Solids
M/M	Minutes of Meeting
MOECAF	Ministry of Environmental Conservation and Forestry
MONREC	Ministry of Natural Resources and Environmental Conservation
MoU	Memorandum of Understanding
NPT	Nay Pyi Taw
NGO	Non-Governmental Organization
OECD-DAC	Organization for Economic Co-operation and Development – Development Assistance Committee
OVIs	Objectively Verifiable Indicators
PCCD	Pollution Control and Cleansing Department
PCM	Project Coordination Meeting
PDM	Project Design Matrix
pH	potential of Hydrogen
PO	Plan of Operation
R/D	Record of Discussion
SEA	Strategic Environmental Assessment
SIA	Social Impact Assessment
SS	Suspended Solid
SVI	Sludge Volume Index
TS	Total Solid
YCDC	Yangon City Development Committee

WSD	Water and Sanitation Department

1. Outline of the Midterm Review

1-1 Background of the Project

Myanmar has been facing considerable challenges in the management of the environment due to rapidly increasing domestic and foreign investments in the industrial, urban and rural development sectors. In this regard, Environmental Conservation Law (ECL) with the objective of enabling to implement the Myanmar National Environmental Policy, was enacted in 2012 and Environmental Conservation Rules (ECR) has been developed for the implementation of the Law. According to the prescription of environmental conservation law and rules, it is urgently needed to develop technical tools for Environmental Impact Assessment (EIA) and Environmental Quality Standards, effluent and emissions standards. In this context, there are many obstacles such as the lack of baseline information on environmental quality standards, and limited technical capacity for environmental monitoring systems in Myanmar.

To overcome these obstacles, at national level, it is immediately needed to strengthen capacity of Environmental Conservation Department (hereinafter, ECD). ECD has been newly established in the Ministry of Environmental Conservation and Forestry (hereafter, MOECAF)[1] as the focal institution for environmental management, EIA review, and other environmental conservation issues.
At municipality level, although, Yangon City Development Committee (hereinafter, YCDC) and Mandalay City Development Committee (hereinafter, MCDC) have been carrying out the regular inspections on pollution sources, further improvements of inspection are required.

Based on the present status on environmental management in Myanmar described above, Government of Myanmar (hereinafter, GoM) requested Japan International Cooperation Agency (hereinafter, JICA) to support and enhance the capacity of MOECAF and overall environmental management in Myanmar. Record of Discussion (R/D) was signed for "The Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar" (hereinafter, the Project) on December 2014.

The Project launched in May 2015 and will be completed in May 2018. This Midterm Review (hereinafter, "the Review") was organized at the turning point of the implementation period with the objective to confirm Project's inputs, activities and achievements of Outputs and Project Purpose. The Project will be reviewed based on the five evaluation criteria and recommendations for the implementation of remaining project period will be proposed.

1-2 Objective of Midterm Review

The objectives of the Review are:
1) To conduct a joint review by the Midterm Review Team (hereinafter, the Team);
2) To confirm actual inputs, activities and the degree of achievements of the outputs, and the prospect of achieving the project purpose;
3) To assess the Project based on OECD-DAC's five evaluation criteria - Relevance, Effectiveness, Efficiency, Impact and Sustainability;
4) To make recommendations on the measures to be taken during the remaining cooperation period and beyond in consultation with agencies concerned; and
5) To confirm the results of the Review, and to agree by signing of the Review report.

1-3 Members of Joint Review Team

MANMAR member

[1] In April 2016, MOECAF was merged with Ministry of Mining and became Ministry of Natural Resources and Environmental Conservation (MONREC).

1. Hla Maung Thein	Leader	Director General Environmental Conservation Department Ministry of Natural Resources and Environmental Conservation Myanmar

JAPANESE members

1. Mimpei Ito	Leader	Director Environmental Management Team 1 Environmental Management Group Global Environmental Department Japan International Cooperation Agency
2. Mizuki Hosokai	Evaluation Planning	Program Officer Environmental Management Team 1 Environmental Management Group Global Environmental Department Japan International Cooperation Agency
3. Hiroko Sugimoto	Evaluation and Analysis	Evaluation Analysis Japan Development Service Co., Ltd.

1-4 Schedule of Midterm Review

The Review was carried out from 23rd October to 10th November 2016. The detail of the Midterm Review schedule is shown in Annex 1.

1-5 Outline of the Project

The Project outline is shown in Table 1. The detail of the Project is described in Project Design Matrix (PDM) approved on 18th Dec. 2015 and Plan of Operation (PO) in Annex 2 and 3.

Table 1. Project Outline

(Based on PDM approved on 18 Dec. 2015)

Overall Goal	Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.
Project Purpose	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.
Outputs	1. Inspection procedure is standardized.
	2. Capacity for implementing water quality survey to obtain reliable information is enhanced.
	3. Database of water pollution sources and river water quality is developed.
	4. Capacity of interpreting the information for water pollution control measures is enhanced.
	5. Necessary technical manuals and forms for the EIA review are developed.
	6. Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.

(Source: Project)

2. Midterm Review Methodology

2-1 Review Procedure

The aims of the Review are: to examine project achievements based on R/D, PO, and PDM; to evaluate Project Outputs, Project Purpose and Overall Goal by using five evaluation criteria shown in Table 2; to propose recommendations for the Project.

During the Review, the Team collected and analyzed data and information, and examined project achievements based on PDM. Then, the Team evaluated the project achievements so far, and proposed recommendations for the remaining project period. The result of the Review was compiled as a Review report and presented to the Joint Coordinating Committee (JCC) for the approval. The approved Review report is signed by the representatives from Japan and Myanmar.

2-2 Component of Review Report

The Review report is composed of three components. 1. Verification of Achievement; 2. Implementation Process; 3. Review based on Five Evaluation Criteria. The detail of each component is described below.

2-2-1 Verification of Achievement

Verification of achievement was measured in terms of Project Outputs, Project Purpose and Overall Goal by using Objectively Verifiable Indicators (OVIs) described in current PDM (as of 18. Dec. 2015). Table 2 summarizes the terms and definitions used in PDM.

Table 2 Terms and Definitions Used in PDM

Items in PDM	Definitions
Overall Goal	Development effect expected as a result of the achievement of project purpose in about 3-5 years after the completion of project.
Project Purpose	Objective that is expected to be achieved by the end of project. It should be described as a specific benefit or impact given to target group.
Outputs	Outputs are objectives to be realized by project in order to achieve Project Purpose through implementing a series of project activities.
Activities	Activities are specific actions intended to produce project outputs by effective use of project inputs.
Important Assumption	Important assumptions are conditions required for a success of project but exist outside the control of project.
Preconditions	Preconditions are requirements prior to the launch of project. Project cannot be expected to be successful if it is started before pre-conditions are met.
Objectively Verifiable Indicators	Indicators to verify achievements of Project Outputs, Purpose and Overall Goal. Indicators should be objectively verifiable and measurable.
Means of Verification	The data sources required to verify OVIs.
Inputs	Inputs are human, financial, and material resources required for each project activity.

(Source: JICA Project Evaluation Guideline 2010)

2-2-2 Implementation Process

For the implementation process, the Team reviewed functionality of project implementation such as decision making process, implementation management, communication, budget, and progress monitoring. Obstacles and/or facilitating factors affecting the implementation of the Project were identified.

2-2-3 Review Based on Five Evaluation Criteria

The Team evaluated project achievements so far by using OECD-DAC's Five Evaluation Criteria shown in Table 3.

Table 3 Five Evaluation Criteria

1. Relevance	Whether the project is consistent with the priority of both counterpart and Japanese governments; whether the project responds to the needs of target group and society; whether the methodology taken in the project is appropriate to address and needs and/or developmental strategy of the country or target group.
2. Effectiveness	Likelihood of Project Purpose to be achieved at the end of project. Relevance of Output for achieving Project Purpose; Effects by important assumptions as well as contributing/hampering factors for achieving Project Purpose.
3. Efficiency	Appropriateness of activities to produce Output: appropriateness of quality, quantity, and timing of project inputs for activities; Efficiency of input against output produced.
4. Impact	Likelihood of achieving Overall Goal; Impact for developmental goal of the country; Positive and negative impacts that are not intended originally.
5. Sustainability	Sustainability of achieved Project Purpose after the completion of cooperation of JICA assessed in policy, institutional, financial, and technological aspects.

(Source: JICA Project Evaluation Guideline, 2010)

2-3 Data Collection and Analysis

The Team used following methods to collect information and data.

- Document review: Collecting data and information from existing materials such as experts' work completion reports, policy documents, JCC meeting minutes, and Japan's assistance strategy for Myanmar, materials produced by the Project, and other documents relating with the Project. The results of review were compiled in the Evaluation Grid (Annex 4).

- Questionnaires: The Team sent questionnaires to Japanese Experts and Myanmar Counterparts (CPs), responses were collected and analyzed.

- Interviews: The Team conducted key informant interviews with Experts, CPs and other relevant stakeholders of the Project.

- Site visits: The Team visited pilot water survey points and observed water sampling activities.

3. Verification of Achievement

The results of project achievements (Inputs, Outputs and Project Purpose) are presented in this section.

3-1 Project Inputs

The Project inputs from JICA and Myanmar, in terms of personnel, equipment and facility, trainings in Japan, and operational costs are shown below.

Table 4 summarizes inputs from JICA. By the time of Review, five (5) Japanese Experts has been dispatched. The list of Experts, organization, and area of expertise is shown in Annex 5. By the time of Review, 16 CPs have been trained in Japan (Annex 6). Equipment such as computers, projector, printers, GPSs were provided by JICA (Annex 7).

Table 4 Summary of Inputs by JICA

1) Japanese Experts	5 Experts were dispatched (804 man/month, at the time of Review)
2) Equipment	Computers, printers, photocopier, projector, and GPSs have been provided.
3) CP trainings in Japan	16 CPs have been trained in Japan
4) Operational Costs	At the time of Review, approximately 32.5 million yen[2] has been spent on the Project.

(Source: Project)

By the time of Review, 30 CPs have been involved in the Project. (Annex 8) Working space was provided in ECD headquarters in Nay Pwi Taw and the expenses of utilities were covered by Myanmar side. Table 5 summarizes the inputs from Myanmar side.

Table 5 Summary of Inputs by Myanmar

1) Counterparts	30 CPs have been engaged in the Project.
2) Office and facilities	Office space for Experts in Nay Pwi Taw and its utilities
3) Operational costs	Travel cost of CPs and other costs.

(Source: Project)

Some of the notable issues regarding Project inputs are as follows.

1. Office space in YCDC and MCDC
ECD provided office spaces for the Experts in Nay Pwi Taw. However, in Yangon and Mandalay where activities of Output 1 to 4 are taking places, no office spaces were provided by the Myanmar side. Experts involved in Output 1 to 4 had to prepare its own office since there was no agreements made for providing office spaces in Yangon and Mandalay.

2. Cost incurred for CP's participation to the field activities
R/D signed on December 2014 between JICA and MOECAF stipulates that the operation costs required for the participation of the Project activities by CPs are responsible of the Myanmar side. However, YCDC, MCDC and ECD regional offices cannot allocate the costs of CPs to participate in the field work. Therefore, the matter

[2] Due to separate accounting systems, total amount presented is the combined budgeted amount for Output 1-4 and actual expenses for Output 5&6.

will be discussed and agreed at JCC.

3-2 Achievement of Outputs

3-2-1 Output 1

The focus of Output 1 is to standardize inspection procedure. The majority of activities in Output1 were implemented without delay. Inspection manual indicated in OVI 1 has been drafted and it is under the review. Table 6 indicates the summary of Output1.

Table 6 Summary of Output 1

Output 1	Inspection procedure is standardized.
OVI	More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.
Activity	1.1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1.2 To evaluate present inspection procedure. 1.3 To develop an inspection manual. 1.4 To implement inspection based on the developed inspection manual. 1.5 To provide training on measures to control industrial effluent. 1.6 To revise the inspection manual.

The Review Team confirmed the following status of implementation of activities.

Activity 1.1	To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.)

General information about company such as location, sector, products and production processes have been collected from existing data sources shown below.

a. Yangon

Table 7 Data Sources of Yangon

Data source	No of companies	Data contents
YCDC (PCCD) *	3,474 (24 industrial zones) ***	name; location; materials; water usage amount: discharge (BOD, COD,TS, SS, pH and temperature)
DISI**	1083	name; type of business; products; owner name; location; energy usage; investment value; no of employees

*PCCD: Pollution Control and Ceasing Department of YCDC. (Source: Project)
** Directorate of Industrial Supervision and Inspection, Ministry of Industry
***Information of YCDC is based on responses of 2012-14 PCCD Inspection questionnaire

From the data sources above, information of 69 factories that were discharging waste water was digitalized for the database and analyzed.

b. Mandalay

Table 8 Data Sources of Mandalay

Data source	No of companies	Data contents
MCDC(WSD)*/ ECD Mandalay	1292	name; type of business; products; waste water (BOD, pH: for some factories) ; water usage

*Water and Sewage Department (Source: Project)

From the data source above, information of 97 factories that were discharging waste water was digitalized for the database and analyzed.

Further, the Project employed sub-contractor to collect additional more detailed information such as waste water treatment plants, and contents of discharged water. The questionnaire survey have been conducted for 200 factories (100 in Yangon and 100 in Mandalay). In addition, 50 waste water samples (25 in Yangon, 25 in Mandalay) will be collected from the selected factories. The survey is expected to complete by early December 2016.

Activity 1.2	To evaluate present inspection procedure.

To understand the current inspection procedures, the Experts conducted reviews of current inspection activities of YCDC, MCDC, and ECD, environmental compliances and/or inspections of other countries, Myanmar's laws and regulations about industrial waste management. From the reviews, the Experts identified two types of inspections were carried out by CP organizations: 1. Inspection for licensing and registration; 2. Inspection based on complains to resolve environmental complains.

1. Inspection for licensing and registration
Meeting laws and sub-laws is the prerequisite for the industry/business to receive licensing/registrations administered by YCDC, MCDC, DISI, and ECD. Inspections are carried out by these organizations to check whether industries/businesses are in compliance with the requirements. Table 9 below summarizes the inspection activities of YCDC, MCDC and ECD.

Table 9 Summary of Inspection activities

Organization	Inspection methodology	Contents of inspection
YCDC/PCCD	Inspection through questionnaires to the factories (2012-2014)	Factory is to provide: name, address, materials, water usage, waste water contents (BOD, COD, TS, SS, pH and temperature)
MCDC/ Cleansing department	Inspection through questionnaires at the renewal of license/ registration	Factory is to provide: name, address, water source, existence of waste water treatment plant
ECD	Document review and on-site inspection to check conditions of businesses submitting EIA	Factory to provide: EIA documents explaining proposed project, mitigating measures, monitoring plan

(Source: Project)

However the lack of clear and legally binding regulatory requirements such as effluent quality standard makes it ambitious for the licensors (YCDC and MCDC) to enforce relevant laws and sub-laws. MONREC issued National Environmental Quality (Emission) Guideline supported by Asian Development Bank (ADB) in December 2015. However this guideline is not legally-binding and designed for newly established businesses under the framework of EIA. To make the requirements binding, the requirements have to be incorporated into the permitting conditions of the Environmental Conservation Certificate (ECC). Most existing factories are yet to apply for ECC. As for YCDC and MCDC, annual business licensing is already in place, though legal requirements are not clearly stipulated in relevant documents.

During interviews, ECD officials emphasized the importance of follow-up monitoring and inspection of EIA.

A company whose EIA has been approved is required to follow what is proposed in EIA. It is ECD's mandate to follow up and monitor the compliance by ECD regional offices. Similarly, YCDC and MCDC are aware of the need to monitor the compliance.

However, for the reasons mentioned above, there is no organization (YCDC, MCDC, ECD Yangon and Mandalay) conducting regular compliance monitoring and inspection for industrial water discharge.

2. Inspection based on complains to resolve environmental complains

YCDC, MCDC and ECD regional offices conduct on-site inspection when they receive complains about pollution from the public and/or other stakeholders. Complains are often submitted to the regional governments or city mayors then the relevant departments and/or offices must react on complains. It is an ad-hoc inspection and there seems be no standard way to conduct inspection nationwide. A complain is usually dealt with case-by case. One example is the pollution case of Taung Thaman Lake in Mandalay where the death of fish caused public outcry. Since the issue was raised, MCDC has been regularly monitoring the water quality of the lake.

Activity 1.3	To develop an inspection manual

Initial reviews of inspection procedures found that ECD, YCDC, and MCDC do not have inspection manuals. To assess the needs for the inspection manual, the Project conducted capacity assessments by requesting officers involved with licensing to self-assess their capacity. Based on the results and review of inspection manuals in Activity 1.2, the objective and contents of the inspection manual were identified as below.

Table 10 Suggested Content of Inspection Manual

Objective	- To standardize inspection procedures in order to minimize undetected serious pollution problems - To provide officers with general information on current laws and regulations - To provide officers with basic information on pollution control measures in typical industrial sectors - To provide sources of more detailed information
Target	Novice officers with limited experiences on inspection
Contents	Background and introduction to the inspection manual Brief summary of current legal systems for pollution control Inspection Procedures. Explanation about recommended inspection procedures to develop an inspection plan, implement an on-site inspection, report results, etc. Appendix 1: Checklist: to be used by an officer to standardize inspection procedure Appendix 2: Good practices for pollution control: to provide brief technical information on different industrial sectors, waste water treatment technologies, environmental issues, etc.

(Source: Project)

A check list for inspection has been developed in March 2016 to standardize the regular inspection procedure of ECD, YCDC and MCDC. Then, the inspection manual was drafted in August 2016. At the time of the Review, checklist and manual are under the review by ECD.

Activity 1.4	To implement inspection based on the developed inspection manual.

Since the draft inspection manual is still under the review, the activity 1.4 has not been implemented at the time of Review.

Activity 1.5	To provide training on measures to control industrial effluent.

An Expert on waste water treatment technology will be assigned in late Nov. 2016. After initial assessment, he will conduct trainings on waste water treatments. MCDC and YCDC requested to organize a seminar on waste water treatment and invite factory owners and other relevant groups to raise awareness of waste water

treatment.

Activity 1.6	To revise the inspection manual

As the draft inspection manual is still under the review, the activity 1-6 has not been implemented at the time of Review.

OVI 1.1	More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.

The inspection manual has already been drafted and is currently reviewed by ECD. The findings from the evaluation of existing inspection indicate that currently YCDC, MCDC or ECD do not conduct regular compliance inspections to the factories. Onsite inspections are conducted to respond to complains. In addition, the lack of rules and regulations about inspection makes difficult to determine what and how to inspect by officials. Through discussions with CPs, it was agreed that current draft inspection manual to be shared with CPs and additional discussion will be held to determine how to conduct inspection by using the manual. Based on the discussion, the Review Team suggests that the revision of OVI to adjust current condition. The suggested revision is referred in Annex 9.

3-2-2 Output 2

The focus of Output 2 is to enhance the capacity to obtain reliable information through the water quality survey. The activities are implemented as planned without major delay. Water quality survey report indicated in OVI will be complied once additional survey is completed. Table 11 indicates the summary of Output 2.

Table 11 Summary of Output 2

Output 2	Capacity for implementing water quality survey to obtain reliable information is enhanced.
OVI	Water quality survey reports are prepared in the pilot areas by YCDC and MCDC.
Activity	2.1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2.2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas. 2.3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2.4 To develop a water quality survey plan. 2.5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2.6 To implement a water quality survey based on the water quality survey plan. 2.7 To supervise the water sampling referring to the water quality survey manual. 2.8 To verify the results of the water quality survey using the water quality survey manual. 2.9 To prepare a water quality survey report

The Review Team confirmed the following status of implementation of activities.

Activity 2.1	To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances)

The Project identified government and private laboratories for the water quality survey as follows.

Three (3) private laboratories and a government laboratory were initially selected for the first sampling survey.

For the chemical analysis, there were no laboratories in Myanmar that could analyze all the required parameters of the Project. Thus, parameters that are testable or time-sensitive are tested in Myanmar but for the other parameters such as testing for pesticide and PCB etc., samples will be sent to neighborhood country such as Thailand for the analysis.

Because none of the CP organizations have an in-house laboratory designed for the environmental analysis, and strengthening of analytical capacity is beyond the scope of this Project. Nevertheless, Water and Sanitation Department (WSD) of YCDC has small laboratories to test drinking water sources and sewage water (24 parameters as of 2015). Similarly, MCDC WSD has laboratory that can test 30 parameters related with drinking and sewage water as of 2015. MCDC laboratory will soon be able to offer biological testing. These laboratories of YCDC and MCDC took part in the water quality survey, and analyzed parameters they could analyze in order to verify obtained data.

Deputy Director of ECD Yangon indicated that a laboratory has been constructed next to their office but they do not have budget to obtain equipment for the laboratory or human resources to run the laboratory. Similarly, many ECD officials, regardless headquarters or regional offices, expressed their desire to have own laboratories to test water quality related with environmental pollution.

Activity 2.2	To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas.

Hlang river basin in Yangon and Doka Hta Waddy river basin in Mandalay were identified as pilot study areas. To propose monitoring plan, following information was collected in 2015: meteorology; hydrology; pollution source; past water quality data; and water use. At the time of Review, meteorological and hydrological information and data[3] have not been provided by relevant authorities yet, but remaining information and data has been collected.

Activity 2.3	To develop criteria for selecting sampling points, sampling time, measurement parameters etc.

Based on the collected information in Activity 2-2, the Project developed the criteria for selection of sampling points, time and measurement parameters. The main objectives of water sampling are to assess the status of water pollution in the pilot study areas and to identify the effects of pollution sources of river environment.

Activity 2.4	To develop a water quality survey plan.

The water quality survey plan has been developed based on the meetings and workshop with MCDC, YCDC and ECD regional offices. The summary of plans as of December 2015 is shown below. This survey plan has been slightly revised at each survey based on the site conditions, results of previous surveys, and suggestions from CPs.

Table 12 Hlang River Basin Survey Plan

Item	Contents
Sampling point	Total 10 sampling points at each sampling time. Surface water only.
Sampling timing	Total four (4) samplings. 1st sampling : Feb. 2016 (spring tide) 2nd sampling : June 2016 3rd sampling: Feb. 2017 4th sampling: June 2017 Timing: Low tide and high tide (only at the representative point)
Parameters	Every sampling: pH, Salinity, Turbidity, Water temperature, ORP, Flow rate and water depth, TSS, TDS, BOD, COD, Color, Odor, Oil and grease, Total phosphorus, Total

[3] The Project currently uses alternatively sourced meteorological and hydrological data.

	nitrogen, Total Coliform Additional 16 samples will be taken for 2nd and 3rd sampling and two (2) additional samples will be taken at 3rd sampling.

(Source: Project)

Table 13 Doka Hta Waddy River Basin Sampling Plan

Item	Contents
Sampling point	Total 10 sampling points at each sampling time. Surface water only.
Sampling timing	Total four (4) samplings. 1st sampling : Feb. 2016 (spring tide) 2nd sampling : June-July 2016 3rd sampling: Feb. 2017 4th sampling: June 2017 Timing: Low tide and high tide (only at the representative point)
Parameters	Every sampling: pH, Salinity, Turbidity, Water temperature, ORP, Flow rate and water depth, TSS, TDS, BOD, COD, Color, Odor, Oil and grease, Total phosphorus, Total nitrogen, Total Coliform Additional 16 samples will be taken for 2nd and 3rd sampling and two (2) additional samples will be taken at 3rd sampling.

(Source: Project)

Activity 2.5	To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage.

Drafting of water quality survey manual has been ongoing at the time of Review. The manual aims at improving quality and reliability of water quality survey by CPs. It will summarize: methodologies for developing a sampling plan; preparation and calibration of equipment for sampling and on-site measurement; methodology of sampling and on-site measurement; storage and preservation of samples and review of analytical data, etc.

Activity 2.6	To implement a water quality survey based on the water quality survey plan.

By the time of Review, 1st and 2nd river water samplings have been completed. The summary of each sampling is shown below. The 3rd survey is to be implemented in December 2016.

Table 14 Summary of Hlang River Basin Survey

	Date	Participants	Contents
1st	Feb. 22-24, 2016	Sub-contractor (sampling) YCDC (PCCD and WSD) ECD Yangon Experts	Water sampling in Hlaing river basin
2nd	Jun. 20-21, 2016	Sub-contractor (sampling) YCDC (PCCD and WSD) ECD Yangon Experts	Water sampling in Hlaing river basin Sediment sampling in Hlaing river as a supplemental survey

(Source: Project)

Table 15 Summary of Doke Hta Waddy River Basin Survey

	Date	Participants	Contents
1st	Feb. 17-18, 25, 2016	Sub-contractor (sampling) MCDC-WSD	Water sampling in Doke Hta Waddy river basin

		ECD Mandalay Experts	Sediment sampling in Thaung Tha Man Lake as a supplemental survey
2nd	Jun. 27-28, 2016	Sub-contractor (sampling) MCDC-WSD ECD Mandalay Experts	Water sampling in Doke Hta Waddy river basin

(Source: Project)

During interviews, CPs who were participated to the river water quality surveys expressed following skills and knowledges they gained through conducting the surveys with the Experts.

- It is important to identify sampling point and to consider the tide, water depth and other conditions when taking samples.
- It is important to properly preserve and transport collected samples.
- It is important to take safety measures during sampling activities such as wearing boots and life jackets.

Activity 2.7	To supervise the water sampling referring to the water quality survey manual.

This activity will be implemented after the water quality survey manual has been completed. Key components of the manual, such as a field recording form, a water flow measurement form as well as a check list of water quality data, have already been developed and used in the past surveys.

Activity 2.8	To verify the results of the water quality survey using the water quality survey manual.

This activity will be implemented upon the completion of the water quality survey manual. Meanwhile, the results of the past water quality survey have been checked with CPs, and short seminars on analytical quality control were held in Mandalay on 24th June 2016 and for Yangon on 1st July 2016 to provide basic scientific knowledge and techniques for data validation.

Activity 2.9	To prepare a water quality survey report

The draft of first water quality survey report containing the results of 1st and 2nd water quality surveys was available at the time of Review.

OVI 2.1	Water quality survey reports are prepared in the pilot area by YCDC and MCDC.

The draft first water quality survey report have been complied. The report include the general characteristics of industries in pilot study areas. Currently more detailed survey about waste water treatment for 200 factories has been conducted and water samples from 50 selected factories will be collected, tested and analyzed. Once these information become available, water quality survey report will be completed. CPs have been participating river and industrial water samplings, and questionnaires surveys.

3-2-3 Output 3

Output 3 focuses on building database of water pollution. The Collection of information is still in process, other activities regarding database development are ongoing. By the end of additional survey, information of 200 factories will be accessible on the database. (OVI 1) The Team suggests the revision of OVI 2 to adjust the current situation of the Project. Table 16 indicates the summary of Output 3.

Table 16 Summary of Output 3

Output 3	Database of water pollution sources and river water quality is developed.
OVI	3.1 At least 150 factories' information is accessible on the database.
	3.2 Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.
Activity	3.1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results. 3.2 To develop a system concept. 3.3 To design the database based on the system concept. 3.4 To collect additional information required to develop the database. 3.5 To develop the database. 3.6 To conduct training on operation and utilization of the database. 3.7 To develop an operation and maintenance manual of the database.

The Review Team confirmed the following status of implementation of activities.

Activity 3.1	To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results.

For the purpose of developing database, the following information and data have been collected and complied into the prototype databases in 2015.

a. Hlaign River basin pilot study area: information of selected 69 factories that discharge waste water.

b. Doke Hta Waddy River basin pilot study area: information of selected 97 factories that discharge waste water.

Initially collected data and information were far from adequate for analyzing the situations of pollution sources in these pilot study areas. Hence, the Project decided to implement an additional pollution source survey. At the time of the Review, an additional questionnaire survey has already been completed to collect detailed information from 200 factories. In addition, waste water samples from 25 factories of each pilot study area are being collected and analyzed by the sub-contractor.

Activity 3.2	To develop a system concept.

In 2015, YCDC, MCDC, ECD and the Experts discussed and agreed about following direction and concept of database system.

- Two types of database will be developed: 1. Pollution source database; 2. Water quality database.
- Database will be developed in two steps: 1. at initial step, prototype (pilot) database based on existing information and data will be developed; 2. in the secondary step, database will include existing information, as well as new data such as results of project activities.
- Database should be user-friendly so that it will be used sustainably. It will be linked with GIS system so that geographical analysis can be conducted for the pollution sources.
- As much as possible, the format of database will be standardized so that ECD or regional governments can also use the database to compare and analyze information and data at regional and national levels.

Activity 3.3	To design the database based on the system concept.

A prototype database has been developed in later 2015 by using existing information to assess database design and data requirements. This process has been on-going.

Activity 3.4	To collect additional information required to develop the database.

As previously mentioned, the questionnaire survey has been completed and currently collecting water samples of selected factories. Upon the completion of additional surveys, detailed information of 200 factories and water quality results of 50 water samples from selected factories will be available for the database.

Activity 3.5	To develop the database.

When all the necessary data become available, the database will be finalized.

Activity 3.6	To conduct training on operation and utilization of the database.

Trainings about database and GIS have been conducted in Yangon and Mandalay as shown below.

Table 17 Summary of Database/GIS trainings

Subject	Yangon	Mandalay
GPS data collection	30th Nov. and 1st Dec. 2015	25, 26th Nov. and 8th Dec. 2015
Initial GIS database development	4th Dec. 2015	10th Dec. 2015

(Source: Project)

In GPS data collection training, participants collected geographical coordinates of selected factories using GPS (Yangon: 25 factories, Mandalay: 20 factories). In the initial GIS database development training, participants learned how to map such data using a GIS software.

During interviews, participants of the trainings expressed that the training was too short and they would like to have additional trainings on GIS.

Activity 3.7	To develop an operation and maintenance manual of the database.

Operation and maintenance manuals for the database will be developed in early 2017.

OVI 3.1	At least 150 factories' information is accessible on the database.

The Project has already collected general information of factories (70-Yangon, 97-Mandalay). Therefore, this OVI has already been partially achieved. At the end of additional survey, detailed information of 200 factories and analysis of water qualities of 50 factories will be available in the database. When collected data are incorporated into the database, OVI 3.1 is considered as achieved.

OVI 3.2	Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.

As mentioned in OVI of Output1, contents of inspection will be determined after the inspection manual is shared by CPs. Therefore it is not possible to assess OVI 3.2. The Review Team suggests the revision of OVI 3.2 to adjust current situation of the Project. The suggested revision is referred in Annex 9.

3-2-4 Output 4

Output 4 focuses on building capacity of CPs to analyze and evaluate information collected from activities 1 through 3 and to compile as a water quality status report. As the information is still being collected, the remaining activities will be implemented when all the information become available. Table 18 indicates the summary of Output 4.

Table 18 Summary of Output 4

Output 4	Capacity of interpreting the information for water pollution control measures is enhanced
OVI	A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.
Activity	4.1 To collect the information necessary for the water quality status report. 4.2 To interpret the collected information. 4.3 To prepare a water quality status report.

The Review Team confirmed the following status of implementation of activities.

Activity 4.1	To collect the information necessary for the water quality status report.

Water quality status report aims at providing overall picture of status of water pollution in pilot study areas of Yangon and Mandalay. Information collected in Outputs 1, 2 and 3 will be analyzed, evaluated and complied into the water quality status report. The proposed contents of status report are shown below. At the time of Review, readily available information has already been summarized in the zero draft of the water quality status report.

Table 19 Proposed Content for Water Status Report

Section	Contents
Introduction	Policies of water environmental management at national level
Water Quality Status in Hlaing River Basin	1 Natural condition 2 Social Conditions Administrative boundary, population 3 Organizations related to water environment management 4. Water quality 5. Pollution sources 6. Inspection to the factories 7. Identified issues on water environmental management
Water Quality Status in Doke Hta Waddy River Basin	1 Natural condition 2 Social Conditions Administrative boundary, population 3 Organizations related to water environment management 4. Water quality 5. Pollution sources 6. Inspection to the factories 7. Identified issues on water environmental management
Actions for next step for better water environmental management	
Conclusions and Recommendations	

(Source: Project)

Activity 4.2	To interpret the collected information.

Two workshops were held to discuss about water quality status and problems regarding water environmental management in the pilot study areas in Yangon and Mandalay in June 2016. The summary of preliminary results of workshops are shown below. Similar workshops will be held when updated and upgraded information and data become available.

Table 20 Summary of Interpretation Workshop

Pilot sites	Water quality status	Identified issues in water environmental management to be addressed
Hlaing River Basin	1) Water Pollution Level	1) Organic Pollution

	2) Industrial Pollution Sources 3) Other Pollution Sources 4) Water Use	2) Environmental impact by toxic, reactive, corrosive and other hazardous substances. 3) Eutrophication 4) Measures for Water Pollution Control
Doke Hta Waddy River Basin	1) Water Pollution Level 2) Industrial Pollution Sources 3) Other Pollution Sources 4) Water Use	1) Organic Pollution 2) Environmental impact by toxic, reactive, corrosive and other hazardous substances. 3) Eutrophication 4) Measures for Water Pollution Control

(Source: Project)

Activity 4.3	To prepare a water quality status report.

The first water quality status report has been drafted.

OVI 4	A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.

When all the information become available, the water quality status report will be prepared. However, it is challenging to draft all of the contents of the water quality status report by ECD, YCDC and MCDC without substantial support from the Experts. Therefore the Review Team suggests to modify OVI to fit the current situation of the Project. The suggested revision is referred in Annex 9.

3-2-5 Output 5

Output 5 aims at developing documents, technical manual and database to support EIA reviewing processes of ECD. Technical E-manual has been reviewed and redesigning is on-going (OVI 5.1).
Official Submission Form has been already submitted for the approval (OVI 5.2). Table 21 indicates the summary of Output5.

Table 21 Summary of Output 5

Output 5	Necessary technical manuals and forms for the EIA review are developed.
OVI	The technical manual covers every sector of development projects and every step of the EIA procedure.
	5.2 The draft official forms are internally approved.
Activity	5.1 To draft necessary legislation including Official Forms for the EIA.
	5.2 To develop a technical Manual of the EIA process for review
	5.3 To evaluate and update the Manual to meet the practical EIA review works
	5.4 To develop a database for recording the EIA review operation
	5.5 To establish an evaluation system for issuing license to EIA consultants

The Review Team confirmed the following status of implementation of activities.

Activity 5.1	To draft necessary legislation including Official Forms for the EIA.

Draft Official Submission Forms have been submitted to the Minister of MONREC for its approval.

Activity 5.2	To develop a technical Manual of the EIA process for review

As supporting tools for the ECD staff to review EIAs "Quick Assessment Guidance Note" was developed. The Note will be included in the E-manual which is now redesigned to improve the processing speed. When completed, E-manual can increase efficiency of EIA reviewing process of ECD staff by helping them making recommendations to EIA proponents. At the time of Review, coding of E-manual has been completed and data

input has just started.

Two types of checklists has been drafted: 1. General checklist based on the E-manual was drafted and it has been used by ECD staff; 2. Sector specific checklists for 50 sectors is 20% completed.

Activity 5.3	To evaluate and update the Manual to meet the practical EIA review works

This activity will be implemented after the completion of E-manual.

Activity 5.4	To develop a database for recording the EIA review operation

Initial database has been redesigned to improve its efficiency. The final validation test is ongoing during this Review. CPs who have been initially trained and engaged in the building of database with the Expert left the division for transfers and for further study. An additional staff was assigned and has been trained by the Expert.

Activity 5.5	To establish an evaluation system for issuing license to EIA consultants

Final draft of Consultant Licensing Scheme for licensing of EIA consultants have been completed. However, ADB has also been involved with technical assistance of Consultant Licensing Scheme and there seems to be confusion of demarcation of tasks between the JICA Project and ADB. The matter is already been addressed to the Director General of ECD to resolve the situation.

Public consultations on licensing of EIA consultants were held three (3) times. (2014[4], August 2015 in Yangon, March 2016 in Nay Pyi Taw) Comments proposed during these consultations were incorporated into the draft documents.

OVI 5.1	The technical manual covers every sector of development projects and every step of the EIA procedure.

E-manual is comprehensive that is covering all the sectors indicated Annex 1 of EIA Procedure and major steps indicated in the Procedure. As previously mentioned, E-manual is still undergoing its redesigning stage, once it is completed, OVI 5.1 is considered as achieved.

Already E-manual has been getting attention within ECD and externally. During the meeting with the Minister of MONREC in the Review, Director General of ECD expressed his high expectation on E-manual. Also, CPs and the Expert presented E-manual during IAIA international conference and they have been receiving inquiries from other countries.

OVI 5.2	The draft official forms are internally approved.

Draft Official Submission Forms have been completed and submitted to the Minister for his approval. Hence OVI 5.2 has been achieved.

3-2-6 Output 6

Output 6 aims at building the capacity of ECD staff for EIA review processes. Activities such as conducting trainings, development of database for tracking system, public awareness materials such as leaflet and Website are on the track. Since E-manual is still under the development, achievement of OVI 6.1 will be upon the completion of manual. ECD staff had presented their EIA review process during international conference. (OVI 6.2) Table 22 indicates the summary of Output 6.

[4] First public consultation was held before the commencement of Project.

Table 22 Summary of Output 6

Output 6	Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.
OVI	EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more.
	6.2 EIA works by MOECAF are presented to an international conference.
Activity	6.1 To implement basic and advanced EIA Training.
	6.2 To implement EIA review works based on the EIA procedure.
	6.3 To record the EIA review operation.
	6.4 To present leaflets and other materials for dissemination of EIA system
	6.5 To develop a WEB site to disclose EIA works based on the new EIA system
	6.6 To review and update the WEB site
	6.7 To presented activities on EIA review to an international conference

The Review Team confirmed the following status of implementation of activities.

Activity 6.1	To implement basic and advanced EIA Training.

Following EIA related trainings were conducted by the time of Review. Advanced EIA trainings are planned in mid-December 2016. Trainings were provided in two days so that ECD staff can adjust their schedules. Training contents included theory, case studies and group work so that ECD staff can reflect the trainings into their daily EIA review works.

Table 23 List of EIA Trainings Provided

Title	Types	Data and venue	No. of participants
Off shore petroleum development	Advanced (sector specific)	12 Oct. 2015 JICA office , NPT	9 ECD staff (NRC and EIA division)
Hydropower development	Advanced (sector specific)	13 Nov. 2015 JICA office , NPT	9 ECD staff (NRC and EIA division)
1. Air Pollution 2. Water Pollution	Advanced (EIA)	9 Mar. 2016 ECD, NPT	25 ECD and line ministries
3. Integrated evaluation for EIA 4. Ecosystem service evaluation 5. Strategic Environmental Assessment	Advanced (EIA)	10 Mar. 2016 ECD, NPT	25 ECD and line ministries
1. Introduction of EIA, screening, scoping 2. Impact prediction 3. Alternative and impact evaluation	Basic (EIA)	25 July 2016 ECD, NPT	30 ECD (14 from branch offices, 13 NR&EIA, 1 Policy, 2 Administration)
4. Mitigation measure, management and monitoring 5. EIA quality review 6. Public consultation 7. Various EIA	Basic (EIA)	26 July 2016 ECD, NPT	30 ECD (14 from branch offices, 13 NR&EIA, 1 Policy, 2 Administration)

(Source: Project)

Activity 6.2	To implement EIA review works based on the EIA procedure.

The Expert provides his support for ECD staff to conduct EIA reviews. Since expert's office is located next to the ECD staff, the staff are encouraged to bring questions about reviews of EIA reports. One interviewee expressed that this kind of support from the Expert is very useful as the staff have limited knowledge but have to review extensive sectors of EIA reports.

Activity 6.3	To record the EIA review operation.

CPs have been recording EIA review processes in the database. Database is updated regularly by designated officer making EIA review process easily traceable.

Activity 6.4	To present leaflets and other materials for dissemination of EIA system

Draft leaflet introducing EIA procedure is currently reviewed by ECD.

Activity 6.5	To develop a WEB site to disclose EIA works based on the new EIA system

Website (EIA portal) has been created adjunct with ECD's website and is operational at the time of Review. Translation of website to Burmese is ongoing which is expected to be completed soon.

Activity 6.6	To review and update the WEB site

The contents of website will be updated when documents or new information become available.

Activity 6.7	To presented activities on EIA review to an international conference

Three representatives from EIA division and the Expert participated in the Asia Environmental Impact Assessment Conference and 16th International Association for Impact Assessment (IAIA), Nagoya, Japan in 10-14 May 2016. They presented the project activities and issues related about EIA in Myanmar.

The Expert said that E-manual had collected attention from other participants. Participations of these conferences were very useful for CPs to establish network among EIA practitioners and researchers of other countries. Later, they were invited to another seminar organized in Thailand.

OVI 6.1	EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more.

Since E-manual is still under development, it is not possible to determine the achievement of this OVI. The Review Team suggest this OVI to revise to focus on capacity building activities of Output 6. The suggested revision is referred in Annex 9.

OVI 6.2	EIA works by MOECAF are presented to an international conference.

CPs and the Expert presented about the development of EIA in Myanmar during Asia EIA Conference and IAIA in May 2016. The exposure to outside of country to present their work and establishing network with participants with other countries were beneficial to CPs at ECD.

3-3 Likelihood for Achieving Project Purpose

Table 24 Summary of Project Purpose

Project Purpose	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.
OVI	1. Consideration for the water status in the pilot study area is made.
	2. More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.

OIV 1. Consideration for the water status in the pilot study area is made.

Compiled water quality status report aims at analyzing and evaluating the results of water sample tests and questionnaire surveys, and identifying issues in water environmental management. This process will be completed once all the data and information were collected in the remaining project period. At the time of Review, there is no challenges were observed regarding this process, therefore OVI 1 is expected to be achieved by the end of the Project.

OVI 2 More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.

At this moment, Project Outputs and activities do not refer any safeguard policies of international organizations thus this OVI may not precisely reflect the Project Outputs and Activities. Therefore, the Review Team suggests to revise the OVI to fit with the Project. The suggested revision is referred in Annex 9.

3-4 Prospects for Achieving the Overall Goal

The Overall Goal will be measured 3-5 years after the project completion as a result of the achievement of Project Purpose. At this point, the likelihoods of achieving Overall Goal were assessed.

Table 25 Summary of Overall Goal

Overall Goal	Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.
OVI	1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project.
	2. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF.
	3. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.

At this point, it is not possible to determine the likelihood of achieving OVIs of Overall Goals.

OVI 1 The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project.

The Project is compiling the database about information of waste water treatment plants of factories in pilot study areas in Yangon and Mandalay. The database can provide the baseline information of industrial waste water in Yangon and Mandalay.

As the Experts point out, the key challenge of environmental water management is the lack of operational regulations and rules to enforce Environmental Conservation Laws and Rules. Similarly YCDC and MCDC have laws indicating no discharge of industrial waste water. Nevertheless, the only legally available enforcement is the issuing of business permit. Thus, the compliance of these laws remains as challenge.

Officials from YCDC, MCDC and ECD pointed out the needs for raising public and factory owners' awareness about industrial water pollution is necessary to increase the number of factories to have waste water treatment plants. The awareness raising to the factory owners are as important as the enforcement of laws to manage industrial water pollution.

During interviews with officials of YCDC and MCDC, needs to enhance knowledge and skills about waste water treatment were expressed. To respond to their requests, an Expert on waste water treatment will be

dispatched in December 2016. The Expert will hold workshops on waste water treatment in early 2017 to increase the knowledge about waste water treatment of CPs.

OVI 2 Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF.

The needs for setting up the standards for the industrial waste water were expressed by CPs officials. However, it is less likely that the guidelines will be developed by YCDC and MCDC within three years. The Review Team suggest the revision of this OVI to fit with the current situation. The suggested revision is referred in Annex 9.

OVI 3 Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.

Other donors are interested in providing assistance for development of environmental safeguard in Myanmar. ADB has been implementing project to build capacity of EIA review processes. Other donors such as Norway and IFC will develop EIA sector specific guidelines. At this moment, it is not possible to assess the possibility of development for advanced approaches of EIA as the donors are focused on the development of EIA. Therefore, the Review Team suggest to revise this OVI. The suggested revision is referred in Annex 9.

4. Implementation Process

Joint Coordinating Committee (JCC)

Record of Discussion stipulates that the function of JCC as follows:

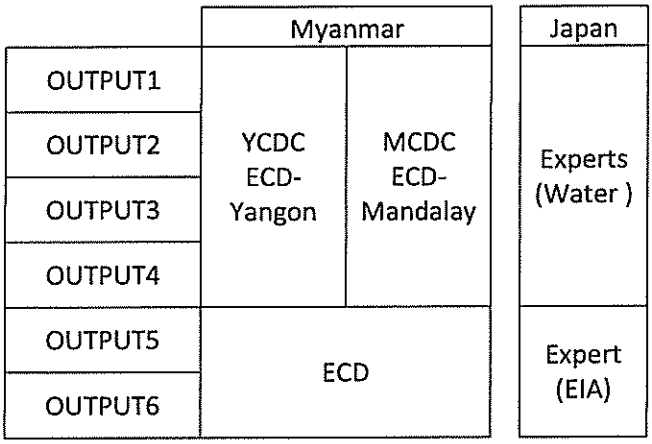
- To formulate the annual work plan of the Project;
- To review and control overall progress of the Project in accordance with plans and RD;
- To discuss any other issue(s) pertinent to the smooth implementation of the Project.

By the time of Review, JCC have been held twice. Project Annual Work Plan has been approved by the first JCC. The first revision of PDM was approved at the second JCC in Dec. 2015. JCCs have been participated by ministry representatives such as Ministry of Transport, Health, Industry and Science and Technology, in addition to MONREC/ECD, YCDC, and MCDC.

In addition to JCC, Project Coordination Meeting (PCM) has been established to discuss technical issues of the Project implementation. PCM has been organized every 6 months and attended by CP officials involved with the implementation of the Project.

Implementation Structure

Figure 1 presents the participation of CP organizations and Experts in each Output. Outputs 1-4 are implemented by YCDC and MCDC, ECD regional offices in Yangon and Mandalay. Output 5 and 6 are implemented by EIA and Natural Resources division of ECD with an Expert specialized in EIA.



(Source: Review team)

Figure 1 Implementation of Project Outputs

Experts for Output 1 to 4 (Water) are mainly based in Yangon and travel to Mandalay or Nay Pyi Tow for the meetings and activities. They are not housed in YCDC and MCDC, this may limit the communication and interaction with CPs only to the meetings and activities. Staff responded in the interviews that the amount of time the experts spend with CPs is better to be increased so that they can gain more knowledge and skills from them.

The Expert for Output 5 and 6 (EIA) is based in ECD headquarters in Nay Pyi Tow. Since his office is located next to the ECD EIA division, this makes interactions between expert and CPs more accessible.

Implementation based on PO

At the time of Review, the Project activities have been implemented in line with PO without any major delay.

Communication

From the respondents of questionnaires, communication among CPs and the Experts are considered as good and no particular issues were observed.

Budget

One of the key issues of implementation of the Project in Output 1 to 3 is the cost of CPs to participate water quality survey and other field activities. These costs are currently supported by JICA contrary to the agreement stipulated in RD. The matter is raised for JCC to be solved officially.

Implementation monitoring

The project activities are monitored by submission of monitoring sheets to JICA by the Experts. Activity reports describing detailed activities and key results of activities were compiled by the Experts shared among JCC members.

5. Result of the Midterm Review

Based on collected information and data, the Team evaluated the Project achievements so far by using five evaluation criteria.

5-1 Relevance

Relevance with the National Strategy and Plan
In 2012, Myanmar enacted ECL and ECR which prescribe the urgent need to develop technical tools for EIA and Environmental Quality Standards such as effluent and emission standards. The same Law stipulates that businesses causing the pollution are required to install on-site facility in order to manage environmental pollution. Similarly, YCDC and MCDC have its own by-laws prohibit disposing or discharging waste water from industrial sources. The Project is to build capacity of ECD staff on EIA review process and basic human capacity to obtain data and information about industrial water pollution of Yangon and Mandalay which is in line with the environmental policy of Myanmar.

Needs of target group and areas
The results of interviews and questionnaires indicates the following key needs of environmental management of Myanmar are identified.

Lack of human capacity to be able to review EIAs: ECD was established in 2012 to implement ECL. Previously, environmental issues were dealt by the Forestry Department and the majority of ECD's staff have background in forestry related fields and fewer staff have other areas of expertise required for reviewing EIAs. Thus capacity building through EIA trainings and development of E-manual are responding to the needs of ECD.

Lack of data and information for water pollution source: Even though the by-laws of YCDC and MCDC prohibit the discharge of polluted waste water from factories, YCDC and MCDC lack detailed information about sources of discharged waste water and status of water quality. The Project is building the basic capacity of staff at YCDC, MCDC and ECD regional offices to collect and evaluate the information of industrial waste water therefore it is corresponding to the needs of CP organizations.

Relevance with Japan's assistance policy to Myanmar
The one of the pillars of Japan's assistance polity to Myanmar is the development of infrastructures for sustainable economic growth. Although environmental sector is not included as priority of Myanmar's assistance policy, infrastructure developments must take into account of environmental impacts. Strengthening capacity of EIA review and management of water pollution may fit to the assistance policy of Japan.

5-2 Effectiveness

The Project Purpose is clear and the achievements of Project Outputs will lead to the achievement of Project Purpose. Considering the degree of achievements of outputs at the point, it is likely that Project Purpose will be achieved by the end of the Project.

Some revisions of PDM were suggested to reflect the current implementing situation of the Project. The suggested changes of PDM are indicated Annex 9.

External factors
Several donors are involved with capacity building of EIA review process. Although the majority of donor activities are coordinated, some activities are overwrapping. As a result, similar documents intended for the same usages were created by more than one donor. The matter has been already addressed and it is expected to be dissolved soon. Overlapping of activities may create unnecessary confusions among CPs or requires extra effort and time for adjusting or coordinating. Engagements of donors, including JICA, are better to be

coordinated in advance to avoid unnecessary confusions.

5-3 Efficiency

In general, project activities are implemented as planned and Outputs have been achieving. The Project is implemented efficiently considering the limited times allocated by Experts and CPs. One respondent suggested if Output 1 to 4 is implemented in one location instead of two, with current inputs of experts, capacity building activities may have been strengthened. As mentioned in the Effectiveness, well coordinate donor activities can contribute more efficient contributions for CPs as avoiding the duplication of activities so that resource can be reallocated for other activities.

5-4 Impact

At this point, it is not possible to assess the likelihood of achieving Overall Goal. However, achievement of Project Purpose, such as enhanced capacity of staff, water quality status reports, and E-manual for EIA review are expected to contribute for the achievement of Overall Goal of the Project.

Interviews of ECD officials indicate that responsibilities currently bared by ECD headquarters such as EIA reviews and follow-up of monitoring of ECC will be delegated to ECD regional offices once the ECD restructuring process is completed. In that case, E-manual and EIA tracking database developed can be utilized in regional offices as well as the headquarters
ADB is planning to develop guidance documents for monitoring, compliance and supervision of ECC. They are aware of the inspection manual for water quality testing developed by the Project and they may utilize the documents as a part of their activities.

5-5 Sustainability

Policy level
Current policy of environmental management is expected to continue in Myanmar. The development of EIA related tools is on-going and others donors such as ADB, Norway and IFC are involved in the sector specific guidelines. ECD is currently undergoing organizational restructuring to decentralize and delegate some of the tasks of headquarters to regional and lower level offices. Efforts to streamline and enhance EIA review process is expected to continue.

Pollution in Taung Thaman Lake in Mandalay brought pubic attention on water environmental pollution. MCDC and YCDC are aware of adverse effects of industrial waste water and need to control them. Precise development of policies regarding waste water in YCDC and MCDC are unknown. Nevertheless the efforts to control and monitor the water pollution are expected to be continued.

Human resources
Majority of responses of questionnaires showed their willingness to continue project activities after the completion of Project and the respondents are confident that they have enough human resources to continue.

The lack of expertise in specific environmental sectors and weak capacity of ECD staff remains as challenge. This will be crucial when responsibilities of EIA review and monitoring of EIA are delegated to ECD regional offices where the staff capacity is more limited compared with headquarters. The Project need to be conscious about this trend so that the trainings can be participated by staff from ECD regional offices.

Financial resources
Limited financial resources are the key constrains for continuation of project activities after the assistance from JICA is ended. This is particularly true for the activities that require collecting information of waste water to update water quality database, conducing on-site inspection and water sampling testing. YCDC, MCDC and ECD are advised to consider securing budget to continue project activities after the completion of Project.

6. Conclusion

Based on the available information, the Review Team reviewed 1. Verification of Achievement; 2. Implementation Process; 3. Review based on Five Evaluation Criteria.

As conclusion, the Project activities were implemented as planed without any major delays. Achievements of Project Outputs are on the track although some adjustments of PDM are required. Some notable issues such as donor coordination, budgetary issues regarding participation to field activities, and definition of inspections are all addressed and solutions have been proposed. There was no significant issues regarding implementation process as well.

In terms of the Relevancy, the Project is responding to the needs of CPs such as lack of human capacity in EIA reviewing processes of EDC and water pollution management at YCDC, MCDC and ECD, and lack of data and information for water pollution source. Those capacities are all required to implement Myanmar's Environmental Conservation Law and Rules.

As for the Effectiveness, although the Project purpose is clear and logic linking purpose and Outputs is sound, some revisions of PDM were suggested to reflect the implementation of the Project. Involvement by other donors to similar areas may be an important external factor to be addressed.

As for the Efficiency, the Project is implemented on time and efficiently as Project Outputs have been achieved or expected to be achieved considering the limited time allocated by Experts and CPs.

As for the Impact, it is too early to assess the likelihood of achieving Overall Goal of Project. Outcomes of the Project such as inspection manual and water quality database of Output 1 to 4 and E-manual and EIA tracking database of Output 5 and 6 can be potentially used by other organizations or in other regions.

As for the Sustainability, policies on EIA and pollution control and management are expected to be continued. CPs are willing to continue project activities after the completion of JICA's support. Financial sustainability may be a concern, without budget allocated activities, it will not be sustainable to continue project activities.

7. Recommendations

Based on the conclusion, the Review Team recommends the followings.

7-1 Recommendations for the Project

1. Revision of PDM and PO
Current PDM and PO do not necessarily reflect the current implementation of the Project. For achievement of Project Purpose and Outputs effectively, the Team recommends revisions of PDM indicated in Annex 9.

2. Inspection manual to be shared by YCDC and MCDC
Through the discussion and interviews with Experts and CPs, the Review Team found that the term "inspection" is not understood in the same way by Japanese and by CPs. Since inspection is the key activities of Output 1, it is important that both Experts and CPs agree on common understanding about inspection.

Therefore the Review Team recommends that current draft inspection manual to be sherd among CPs participating in Output 1 activities and to agree on the definition of inspection and its activities that fit to the implementation situations of Yangon and of Mandalay.

7-2 Recommendation for ECD

1. Coordination of donor activities
As indicated in previous sections, the overlapping of activities by multiple donors will cause confusion among CPs and require extra effort and time for adjustment. Also, the resources used of the same activities can be allocated other necessary activities. It is the responsibility of Myanmar side who is the owner of donor funded projects to coordinate the activities of donors. Therefore, the Review Team recommends that ECD and other CPs to make efforts to coordinate donor involvements to avoid unnecessary duplications of work by donors.

2. Preparation for legal framework of inspection
The above confusion of "inspection" partly comes from the lack of legal document, clearly specifying the roles, responsibilities, definition, etc., on the environmental management system. Currently the GoM has Environmental Conservation Law and Environmental Conservation Rules, but during the course of development of environmental management system in the country, it would be needed to develop additional legal documents so as to operationalize the system. Therefore, it is recommended for ECD to prepare such legal framework in a near future.

7-3 Recommendation for YCDC, MCDC and ECD

1. Secure the budget for continuation of activities
The Team recognizes that the securing the budget for the field activities by CPs is challenging. Therefore temporally measures will be made by JICA during the implementation of Project. However, the Team recommends YCDC, MCDC and ECD to consider to prepare budget for the continuation of project activities such as data collection and on-site inspection for database so that capacity of staff build by the Project can be further developed.

	A	B	C	D	E	F
1				Consultant (Ms.Sugimoto)	JICA Mission (Mr. Ito and Ms. Hosogai)	
2	Day	Date	Time	Activities	Time	Activities
3	22-Oct	Sat				
4			PM	Nairobi >16:35 EK 720 via Dubai		
5	23-Oct	Sun	AM	Arrive in Yangon International airport 11:40		
6				Hotel in Yangon		
7	24-Oct	Mon	10:00 AM	Interview at YCDC office (PCCD / WSD),		
8			02:00 PM	Interview at ECD Yangon office, stay in		
9	25-Oct	Tue	10:00 AM	Move to Mandalay from Yangon, Interview at		
10			PM	Stay in Mandalay		
11	26-Oct	Wed	10:00 AM	Interview at ECD Mandalay office		
12			PM	Move to Nay Pwi Taw (by air, UB131 17:35-18:05), Stay in Nay Pwi Taw		
13	27-Oct	Thu	AM	Stay in Nay Pyi Taw		
14			1:00 PM	Interview at MONREC-ECD (DG/DDG and PCD), stay in Nay Pyi Taw		
15	28-Oct	Fri	AM	Move to Yangon from Nay Pwi Taw		
16			PM	Stay in Yangon		
17	29-Oct	Sat	AM	Drafting report		
18			PM	Drafting report, stay in Yangon		
19	30-Oct	Sun	AM	Drafting report		
20			PM	Drafting report, stay in Yangon		
21	31-Oct	Mon	AM	Interview at Yangon	11:00	Leave Narita for Yangon [NH813]
22			PM	Interview at Yangon	16:30	Arrive at Yangon
23			Evening	Meeting with the team	Evening	Internal meeting
24	1-Nov	Tue	AM	Move to Nay Pwi Taw, Meeting with Acting DG and DDG of ECD	AM	Move to Nay Pwi Taw, Meeting with Acting DG and DDG of ECD
25			PM	Courtesy call to Minister of MONREC, Meeting w/ NR & EIA Div. / Meeting w/ Pollution Control Div.	PM	Courtesy call to Minister of MONREC, Meeting w/ NR & EIA Div./ Meeting w/ PCD
26	2-Nov	Wed	AM	Interview with MOECA/ECD	AM	Move from Nay Pwi Taw to Mandalay (air)
27			PM	Interview with MOECA/ECD	PM	Courtesy call to Mayer and Committee Member of MCDC, Field Trip 1 in the pilot site of Mandalay
28	3-Nov	Thu	AM	Move to Yangon	AM	Meeting with MCDC and ECD-Mandalay
29			PM	Interview with YCDC /ECD Yangon office	PM	Field Trip 2 in the pilot site of Mandalay
30					Evening	Move to Yangon from Mandalay by air

ANNEX 1 : Mid-term review schedule

	A	B	C	D	E	F
31	4-Nov	Fri	AM	Courtesy call to Mayor and Committee Member of YCDC/ Meeting with YCDC	AM	Courtesy call to Committee Member of YCDC/ Meeting with YCDC
32			PM	Meeting with ECD Yangon	PM	Meeting with ECD Yangon
33	5-Nov	Sat	AM	Drafting report	AM	Field Trip in the pilot site of Yangon
34			PM	Drafting report	PM	meeting with review team
35	6-Nov	Sun		Drafting report and team meeting	All day	Documentation and team meeting
36	7-Nov	Mon		Drafting report	AM	Meeting at JICA Myanmar Office
37				Move to Nay Pwi Taw from Yangon	PM	Move to Nay Pwi Taw from Yangon (air), Meeting with Dr. Usui
38	8-Nov	Tue		Preperation of JCC	All day	Preparation of JCC
39	9-Nov	Wed		JCC	All day	JCC
40				Leave NPT to Yangon	17:40	Leave NPT to Yangon (air)
41					18:25	Arrive at Yangon
42					22:10	Leave Yangon for Narita, Japan [NH814]
43	10-Nov	Thu	16:00	Leave Yangon to Kansai (MH)	6:45	Arrive at Narita, Japan

Annex II

as of 2015/12/18

Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.	1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. 2. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF. 3. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.	· Regulations · Guidelines · Annual report	
<Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.	1. Consideration for the water status in the pilot study area is made. 2 More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.	· Survey report · EIA documents	1. National effluent standard is developed.
Output 1 Inspection procedure is standardized.	1. More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.	· Inspection report	1. Responsibility of MOECAF, YCDC and MCDC for water pollution control does not change.
Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.	1. Water quality survey reports are prepared in the pilot area by YCDC and MCDC.	· Survey report	2. YCDC and MCDC do not change inspection system as a water pollution control measures.
Output 3 Database of water pollution sources and river water quality is developed.	1. At least 150 factories' information is accessible on the database. 2. Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.	· Database · Database	3. Responsibility of MOECAF for EIA review does not change. 4. Relevant legislation of EIA does not significantly change.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 4 Capacity of interpreting the information for water pollution control measures is enhanced	1. A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.	• Status report	5. The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAF.
Output 5 Necessary technical manuals and forms for the EIA review are developed.	1. The technical manual covers every sector of development projects and every step of the EIA procedure. 2. The draft official forms are internally approved.	• Technical manual and forms	
Output 6 Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.	1. EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more. 2. EIA works by MOECAF are presented to an international conference.	• Evaluation report of EIA • Proceedings	
<Activities>	<Inputs>		
Output 1: Inspection procedure is standardized.	Japanese side		
1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.)	• Experts. • Training in Japan and other country. • Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others.		
1-2 To evaluate present inspection procedure			
1-3 To develop an inspection manual	Myanmar side		
1-4 To implement inspection based on the developed inspection manual	• Counterpart personnel.		
1-5 To provide training on measures to control industrial effluent			
1-6 To revise the inspection manual	• Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)		
Output 2: Capacity for water quality survey is enhanced.			
2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances)			
2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas			
2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc.			
2-4 To develop a water quality survey plan			
2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage			
2-6 To implement a water quality survey based on the water quality survey plan			

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	
2-7 To supervise the water sampling referring to the water quality survey manual				
2-8 To verify the results of the water quality survey using the water quality survey manual				
2-9 To prepare a water quality survey report				
Output 3: Database of water pollution sources and river water quality is developed with GIS software.				
3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey				
3-2 To develop a system concept				
3-3 To design the database based on the system concept				
3-4 To collect additional information required to develop the database				
3-5 To develop the database				
3-6 To conduct training on operation and utilization of the database				
3-7 To develop an operation and maintenance manual of the database				
Output 4: Capacity of interpreting the information for water pollution control measures is enhance.				
4-1 To collect the information necessary for the water quality status report				
4-2 To interpret the collected information				
4-3 To prepare a water quality status report				
Output 5: Necessary technical manuals and-legislation for the EIA operation are developed.				
5-1 To draft necessary legislation including Official Forms for the EIA.				
5-2 To develop a technical Manual of the EIA process for review				
5-3 To evaluate and update the Manual to meet the practical EIA review works				
5-4 To develop a database for recording the EIA review operation				
5-5 To establish an evaluation system for issuing license to EIA consultants				
Output 6: Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.				
6-1 To implement basic and advanced EIA Training.				
6-2 To implement EIA review works based on the EIA procedure				
6-3 To record the EIA review operation				
6-4 To present leaflets and other materials for dissemination of EIA system				
6-5 To develop a WEB site to disclose EIA works based on the new EIA system			<Preconditions>	
6-6 To review and update the WEB site			1. Japanese experts are assigned	
6-7 To presented activities on EIA review to an international conference			2. C/Ps are assigned.	

ANNEX 3 PO as of 18/12/2015

as of 2015/12/18

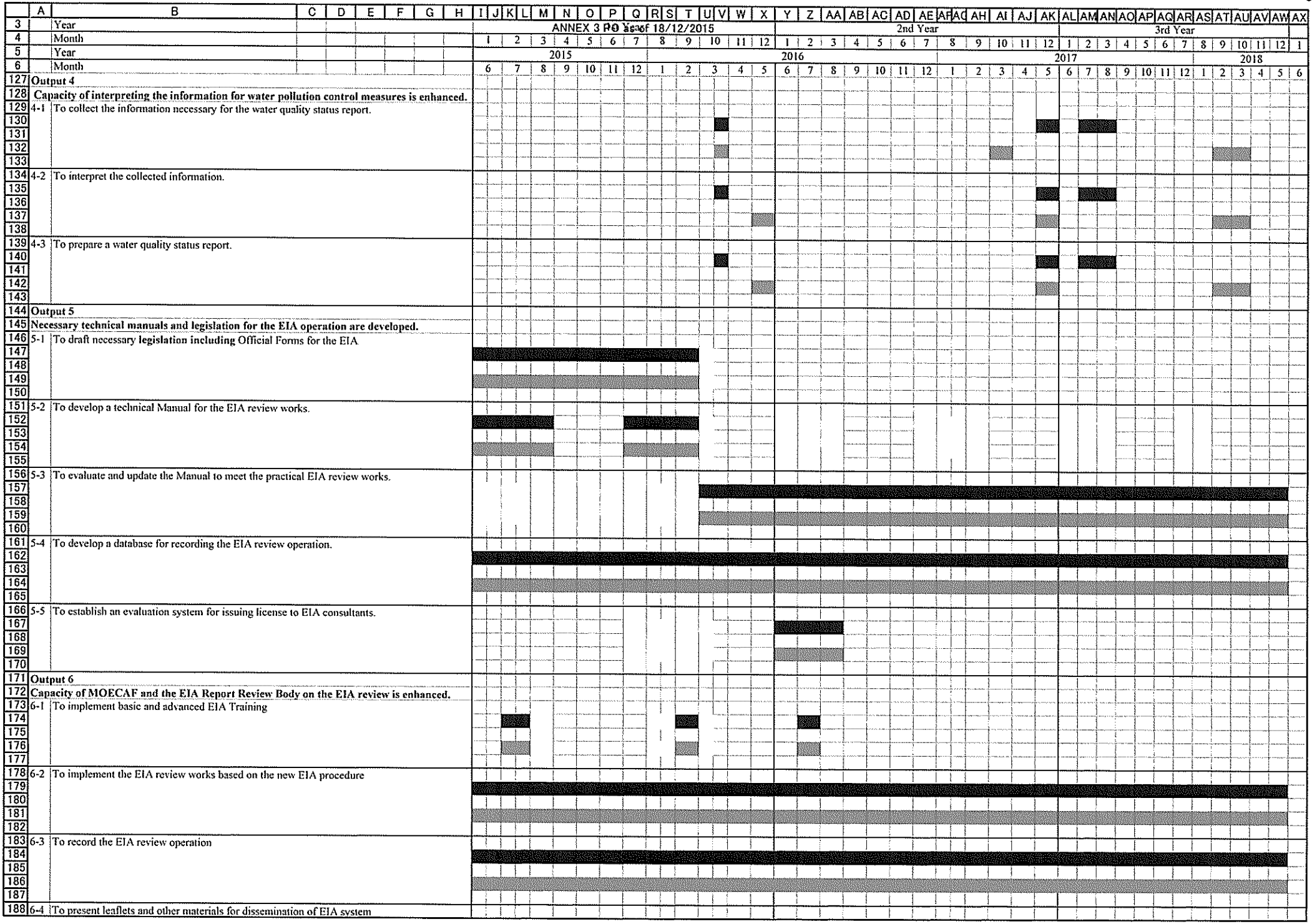
Plan of Operation (PO)

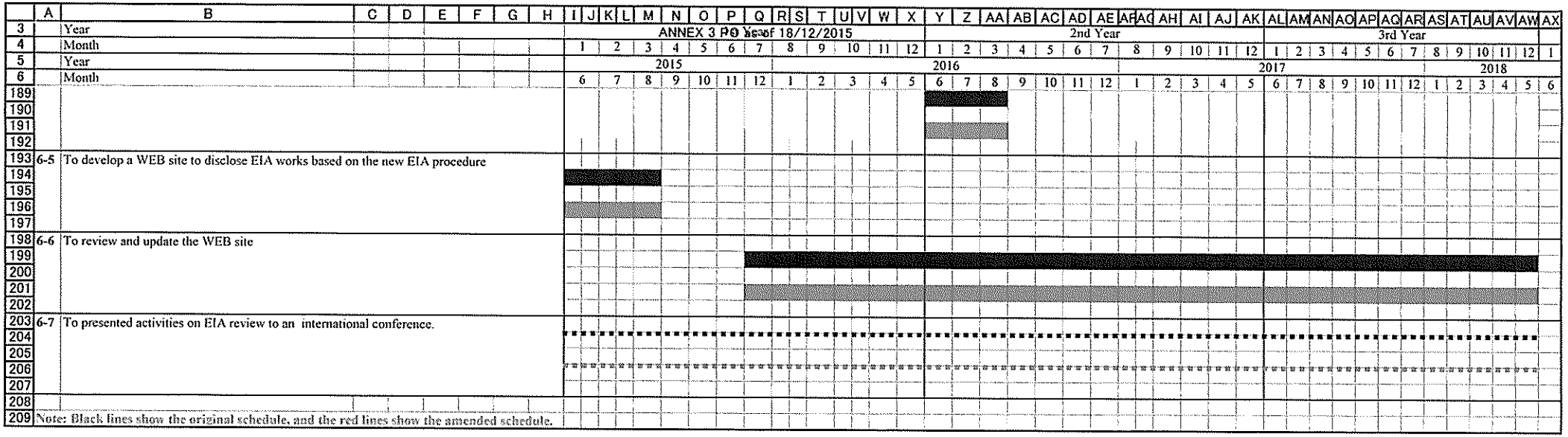
			1st Year												2nd Year												3rd Year											
		Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1
		Year	2015												2016												2017							2018				
		Month	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
		Project Period																																					
	Output 1																																						
	Inspection procedure is standardized.																																						
1-1	To collect information on water pollution sources (Name of a company, Address, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.).																																						
1-2	To evaluate present inspection procedure.																																						
1-3	To develop a inspection manual.																																						
1-4	To implement inspection based on the developed inspection manual.																																						
1-5	To provide training on measures to control industrial effluent																																						
1-6	To revise the inspection manual.																																						
	Output 2																																						
	Capacity for implementing water quality survey to obtain reliable information is enhanced.																																						
2-1	To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances).																																						
2-2	To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas.																																						
2-3	To develop criteria for selecting sampling points, sampling time, measurement parameters etc.																																						
2-4	To develop a water quality survey plan.																																						
2-5	To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage.																																						

ANNEX 3 PO as of 18/12/2015

Row	A	B
3		Year
4		Month
5		Year
6		Month
67		
68		
69		
70	2-6	To implement a water quality survey based on the water quality survey plan.
71		
72		
73		
74		
75	2-7	To supervise the water sampling with the water quality survey manual.
76		
77		
78		
79		
80	2-8	To verify the results of the water quality survey using the water quality survey manual
81		
82		
83		
84		
85	2-9	To prepare a water quality survey reports.
86		
87		
88		
89		
90	**Output 3**	
91	**Database of water pollution sources and river water quality is developed with GIS software.**	
92	3-1	To collect and sort out the information on water pollution sources (Products, Production process, Volume of waste water, pollutants, Waste water treatment method and results of inspection etc.).
93		
94		
95		
96		
97	3-2	To develop a system concept
98		
99		
100		
101		
102	3-3	To design the database based on the system concept.
103		
104		
105		
106		
107	3-4	To collect additional information required to develop the database
108		
109		
110		
111		
112	3-5	To develop the database.
113		
114		
115		
116		
117	3-6	To conduct training on operation and utilization of the database.
118		
119		
120		
121		
122	3-7	To develop an operation and maintenance manual of the database.
123		
124		
125		
126		

Schedule columns (I–AX): 1st Year months 1–12 (2015: 6–12; 2016: 1–5); 2nd Year months 1–12 (2016: 6–12; 2017: 1–5); 3rd Year months 1–12 (2017: 6–12; 2018: 1–6).


ANNEX 3 PO as of 18/12/2015
2nd Year
3rd Year
2015
2016
2017
2018
Output 4
Capacity of interpreting the information for water pollution control measures is enhanced.
4-1 To collect the information necessary for the water quality status report.
4-2 To interpret the collected information.
4-3 To prepare a water quality status report.
Output 5
Necessary technical manuals and legislation for the EIA operation are developed.
5-1 To draft necessary legislation including Official Forms for the EIA
5-2 To develop a technical Manual for the EIA review works.
5-3 To evaluate and update the Manual to meet the practical EIA review works.
5-4 To develop a database for recording the EIA review operation.
5-5 To establish an evaluation system for issuing license to EIA consultants.
Output 6
Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.
6-1 To implement basic and advanced EIA Training
6-2 To implement the EIA review works based on the new EIA procedure
6-3 To record the EIA review operation
6-4 To present leaflets and other materials for dissemination of EIA system


ANNEX 3 PO as of 18/12/2015
1st Year
2nd Year
3rd Year
2015
2016
2017
2018
6-5 To develop a WEB site to disclose EIA works based on the new EIA procedure
6-6 To review and update the WEB site
6-7 To presented activities on EIA review to an international conference.
Note: Black lines show the original schedule, and the red lines show the amended schedule.

Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H
1		**Questions**	**Questions in detail**		**Necessary data**	**Data source**	**Data collection method**	**Results**
2	**A Confirmation of achievement**	Likelihood of achieving for overall goal	Are overall goal OVIs likely to be achieved within a few years of project completion?	OVI1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project.	No of factories with waste water treatment facilities (Baseline + current)	Regulations, factory visits, gov. reports/statistics	Literature review, field visits, interview	Likely
3				OVI2. Guidelines for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF.	Guidelines	Guidelines		Likely
4				OVI3. Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.	SEA, HIA, SIA	SEA, HIA, SIA , Government reports		Changed to fit to the Project Purpose
5		Likelihood of achieving for project purpose	Are Project purpose OVIs likely to be achieved at the end of Project?	OVI1. Consideration for the water status in the pilot study area is made.	considerations in the survey reports	Survey area reports	Literature review, field visits, interviews, questionnaires	Likely
6				OVI2. More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.	Analysis of EIA reports	EIA, EIA reports of projects		Change to fit to the project Outputs
7		Likelihood of achieving for project outputs	Is OP1-OVI likely to be achieved?	OVI1.More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.		project reports, Opinions(experts+CPs)		Inspection need to be defined to evaluate
8				Are there any contributing and/or humpering factors for the achievement of OP1?	Analysis of inspection reports	Inspection manual, inspection reports, project reports	Literature review, field visits, interviews, questionnaires	
9			Is OP2-OVIs likely to be achieved?	OVI 2.Water quality survey reports are prepared in the pilot area by YCDC and MCDC.		project reports, Opinions(experts+CPs)		Data collection and drafting on going
10				Are there any contributing and/or humpering factors for the achievement of OP2?	Water quality reports	Water quality reports of pilot area by YCDC/MCDC	Literature review, field visits, interviews, questionnaires	
11			Are OP3-OVIs likely to be achieved?	OVI 3.1 At least 150 factories' information is accessible on the database.		project reports, Opinions(experts+CPs)		Achieved
12				OVI 3.2 Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.	no of organization in the data base	Database	database, literature review, interviews, questionnaires	
13				Are there any contributing and/or humpering factors for the achievement of OP3?		Inspection reports in the database		
14			Is OP4-OVIs likely to be achieved?	OVI4.1 A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.		project reports, Opinions(experts+CPs)		Drafting is on going
15				Are there any contributing and/or humpering factors for the achievement of OP4?	Water quality analysis byMOECAF/YCDC/MCDC	Analysis reports of the pilot areas.	literature review, interviews, questionnaires	
16			Are OP5-OVIs likely to be achieved?	OVI 5.1 The technical manual covers every sector of development projects and every step of the EIA procedure.		project reports, Opinions(experts+CPs)		Redesigning of E-manual is ongoing
17				OVI5.2 The draft official forms are internally approved.	Confirmation of sectors and steps in tech manual	Developed Technical manual	literature review, interviews, questionnaires	Achieved
18				Are there any contributing and/or humpering factors for the achievement of OP5?	Approved Draft EIA	approved draft EIA		
19			Are OP6-OVIs likely to be achieved?	OVI6.1 EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more.		project reports, Opinions(experts+CPs)		Waiting for e-manual

Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H
20				OVI6.2 EIA works by MOECAF are presented to an international conference.	Analysis of EIA reports	Technical guide. EIA evaluation reports	literature review, interviews, questionnaires	Achieved
21				Are there any contributing and/or humpering factors for the achievement of OP6?		Conference proceedings, presentations/papers		Donor activities need to be coordinated
22		Delivery of Project inputs	Have inputs from Japan been delivered as planned (quantity, quality, timing)?			project reports, opinions(experts+CPs)		Experts time allocation can be increased.
23			Have inputs from Myammer been delivered as planned (quantity, quality, timing)?		Equipment/tools,	project reports, experts/CP lists, expenditure reports, opinions(experts+CPs)	document review, interviews, questionnaires	Activities fees are not supported by Myanmar
24			Are there any persistant issues regarding delivery of project inputs?					Budget for cost of activity

Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H
25	B. Implement ation varification	Implementation of Project activities	Are there any activities delayed to be implemented? If so, what is the reason of delay?					Additonal data collection may delay Output 2-4
26			Are there pursistant issue(s) regarding the implemention of activities?			project reports, opinions(experts+CPs)	document review, interviews, questionnaires	No
27			If there are issues, have the issues been addressed?					
28		Project management	Is JCC functioning according to its mandate to support implementation?			JCC minutes, project reports,opinons(experts +CPs)	document review, interviews, questionnaires	Yes
29			Is implementation system efficient to implement the project?			project reports, opinions(experts+CPs)		Activites in distanced 3 cities make less efficient
30			Are there serious issues regarding management of project?			JCC minutes, project reports,opinons(experts		
31			Are existing regulations,rules,culture of Myammer negatively or positively affecting on the implementation?			project reports, opinions(experts+CPs)	document review, interviews, questionnaires	Lack of rules/regulation for inspection/ weak
32			Are there any significant issues regarding management of project implementaion?			project reports, opinions(experts+CPs), monitoring reports		
33			Is the project implementation monitering system functioning?					OK
34			Have the results of monitoring been reflectd in the project implementation?			project reports, opinions(experts+CPs)	document review, interviews, questionnaires	Yes
35		Communication	Do Japanese experts and C/Ps communicate well in the Project ?					Yes
36			Does C/P communicate each other well in the Project ?					Yes
37			In case of any communication related issues, has any solution been proposed and implemented?			budget, project reports, opinions(experts+CPs)		
38		Project Budget	Has project budget for each activities been obtained?					Not for budget for the participation of CPs
39			In case of budget related issues, has any solution been addressed and implemented?			opinions(experts+CPs		Yes proposal will be discussed
40		Initiative/ownership of Project	(for Experts) Do CPs demonstrate initiative/ownership of the Project?			project reports, opinions(experts+CPs)	document review, interviews,	Yes
41			(for CPs) Do experts encourage C/Ps to have initiative/ownership of Project?	Status of equipment/tools		project reports, opinions(experts+CPs), tools/equipment	document review, interviews,	To extent yes. But burden of works of CP and weak capacity
42		Others	Are the tools and equipment required for the Project maintained properly?			project reports, opinions(experts+CPs)	questionnaires, site visits	Yes
43			Are there any internal/external factors to promote the implementation?					Strong interests by administrators
44			Are there any internal/external factors to hamper the implementation?			opinions(experts+CPs+ others)	document review, interviews, questionnaires	Involvement of other donors

Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H
45	C Relevance	Needs of target area/target group	Does the achievement of project purpose contribute for the improvement of Myammer's environmental management capacity?					Yes
46			Are the needs for improving environmental management capacity of target groups high?					Yes
47			Are the selection of tareget groups appropriate?			Aid policy	document review, interviews, questionnaires	Yes
48		Japan's assitance policy for Myammer	Does the Project correspond to Japan's aid strategy for Myammer?			opinions(experts+ JICA)		Yes
49			Does the Project demonstrate Japan's advantage such as technology?			project reports, opinions(experts+CPs)		Yes
50	D.Effectiveness	Achievement of Project purpose and outputs	Would Project purpose be achieved at the end of the Project?				document review, interviews, questionnaires	Yes
51			Would the achievement of Project purpose and outputs improve target groups' capacity for water environmental management?					Yes
52			Would the achievement of Project purpose and outputs improve target groups' capacity for EIA based evaluation?					Yes
53			Are there any external factors that may humper or contribute for achieveing project purpose/outputs ?			project reports, opinions(experts+CPs), experts +CP lists, lists of training participants	document review, interviews, questionnaires, site visits	
54	E. Efficiency	Appropriateness of project inputs to promote sound implementation	Are the human resource inputs from Japan (numbers, timing, duration, experties) appropriate for the efficient implementation of activities?					No. Timing for expert is short. Additional expert needed
55			Are the equipment related inputs from Japan (quantity, timing, quality) appropriate for the efficient implementation of activities?					Need to hurry up for testing devise
56			Are the human resources inputs from Myammer (numbers, timing, experties) approprite for the efficient implementation of activities?t					CPs were burdened with other tasks/ limited experties
57			Are the other inputs from Myammer (quantity, timing, quality) appropriate for the efficient implementation of activities?					Budget for cost of activity
58			Are there any humpering factors for efficient imputs to the Project?			project reports, opinions(experts+CPs)	document review, interviews, questionnaires	
59		Efficiency of project approach to achieve outputs and purpose	Is the approach taken most efficient to achieve project purpose and outpus?					More or less
60			Is there more cost effective approach to produce project purpose than current one?					
61			Are there any humpering or contributing factors for cost effective achievement of project purpose /outputs?			project reports, opinions(experts+CPs)	document review, interviews, questionnaires	
62	F.Impact	Lincage between project purpose and overall goal	Judging from the current progress of project purpose, what is the likelihood of achieving overall goal?					Difficult to judge
63			Would achieveing project purpose lead to the improvement of water quality in tareget area?					Yes
64			Would achieveing project purpose lead to more complecated EIA related problems in Myammer?					Yes
65			Does the project have any plan/strategy for achieving over all goal?			project reports, pre-feasibility report, opinions(experts+CPs)	document review, interviews, questionnaires	No
66		External factors for achieving overall goal	Are there any external factors that may humper or contribute for achieveing overall goal?					Establishiment of necessary rules, labolatory,
67			Have any external factors been changed since inception of project?			project reports, opinions(experts+CPs)	document review,	New guideline on waste water

Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H
68		Unexpected impacts of the Project	Are there any impacts (positive/negative) besides achievement of purpose that were not expected by the Project?				interviews, questionnaires	No
69			Are the project Impacts affecting outside of target groups?			project reports, opinions(experts+CPs)	document review, interviews,	Not yet but likely

Annex 4 Midterm Review Grid

	A	B	C	D	E	F	G	H
70	G.Sustainability	Sustainability of policy and strategy on water pollution and EIA	Have the policies and strategy for water pollution / EIA been changed sinced inception of Project?				questionnaires	Yes new ww guideline
71			Are current policies and strategy for water pollution / EIA expected to be continued?					Yes
72			Are there any political, social factors that may affect the Project?			project reports, opinions(experts+CPs)	document review, interviews, questionnaires	
73		Project sustainabiltiy by the target area/group after the completion of Project	Would target groups/governments like to continue after the completion fo JICA support?					Yes
74			For the continuation, do the group/government have enough financial resources?					No (water)
75			For the continuation, do the group/government have enough organizational/human resources?					Yes
76			If not continued, what is the reason of discontiuation?					
77			Are there any plans to expand or continue knowledge and technical skills aquired by the Project?			project reports, pre-feasibility report, opinions(experts+CPs)	document review, interviews	Not yet but likely
78		Other	Has any issues/concerns indicated during detailed planning survey been tackled?			experts/CP/JICA opinion, reports		

Annex 5 List of Experts

Name	Expertise	Organization	Man Month (day)
Itaru Okuda (Dr.)	Leader/Industrial Effluent Management	Nippon Koei	138
Shunsuke Hieda	Water Quality Survey	Nippon Koei	116
Tomoe Takeda	Water Sampling and On-site Management	Nippon Koei	133
Hiroaki Nakagawara	Database development with GIS	Nippon Koei	107
Kanji Usui (Dr.)	EIA Technical Manual and Reviewing Process	Independent	310
Total			804

(Submitted by the Project for the Midterm Review)

Annex 6 List of Counterpart Trained in Japan

	Name	Organization	Date
1	Mr. Zaw Moe	MONREC	May 22-28, 2016
2	Mr. Thin Thin Nu	MONREC	May 22-28, 2016
3	Mr. Zaw Tun Aung	MONREC	May 22-28, 2016
4	Mr. Myint Sein	YCDC	May 22-28, 2016
5	Mr. Zaw Zaw Tun	MCDC	May 22-28, 2016
6	Ms. Thwe Hnin Anug	MCDC	May 22-28, 2016
7	Mr. Min Maw	MONREC	Sep.28 – Oct.4, 2016
8	Mr. Myo Thein	YCDC	Sep.28 – Oct.4, 2016
9	Mr. Khin Maung Thin	MCDC	Sep.28 – Oct.4, 2016
10	Mr. Bawi Kyone	YCDC	Sep.28 – Oct.18, 2016
11	Ms. Thwe Naing Oo	YCDC	Sep.28 – Oct.18, 2016
12	Mr.Win Swe	MCDC	Sep.28 – Oct.18, 2016
13	Mr. Aung Zaw Moe	MCDC	Sep.28 – Oct.18, 2016
14	Ms. Khin Myo Sat Aye	MONREC/ECD	Sep.28 – Oct.18, 2016
15	Mr.Pyae Phyo Kyaw	MONREC/ECD	Sep.28 – Oct.18, 2016
16	Ms. Thet Wai Hnin	MONREC/ECD	Sep.28 – Oct.18, 2016

(Submitted by the Project for the Midterm Review)

Annex 7 List of Equipment Provided by Japan

Output	Item	Amount
Output 1-4	Laptop computer	2
	Color printer	1
	Projector	1
	GPS	3
	Photocopier	2
Output 5&6	Laptop computer	2
	Desktop computer	4

(Submitted by the Project for the Midterm Review)

Annex 8 List of Counterpart

Organization	Name	Title	Output
MONREC/ECD	Mr. Hla Maung Thein	Director General	
MONREC/ECD	Mr. Sein Htun Linn	Deputy Director General	
MONREC/ECD	Mr. Than Aye	Deputy Director General	
MONREC/ECD/PCD	Mr. Min Maw	Director	Output 1-4
MONREC/ECD/PCD	Dr. Tin Aung Win	Assistant Director	Output 1-4
MONREC/ECD/PCD	Ms. Mya Theingi	Staff Officer	Output 1-4
MONREC/ECD/PCD	Ms. Khin Myo Sat Aye	Deputy Staff Officer	Output 1-4
ECD Mandalay	Mr. Ko Ko Aye	Director	Output 1-4
ECD Mandalay	Mr. Thant Zin Htun	Assistant Director	Output 1-4
ECD Mandalay	Mr. Pyae Phyo Kyaw	Deputy Staff Officer	Output 1-4
ECD Yangon	Ms. Khin Thidar Tin	Director	Output 1-4
ECD Yangon	Mr. Aung Lay	Assistant Director	Output 1-4
ECD Yangon	Ms. Thet Wai Hnin	Deputy Staff Officer	Output 1-4
ECD/ NR&EIA Div.	Dr. San Oo	Director	Output 5&6
ECD/ NR&EIA Div.	Mr. Htin Aung Kyaw	Assistant Director	Output 5&6
ECD/ NR&EIA Div.	Ms. Yi Yi Cho	Staff Officer	Output 5&6
YCDC PCCD	Dr. Aung Myint Maw	Assistant Chief Engineer	Output 1-4
YCDC PCCD	Mr. Bawi Kyone	Assistant Head of Dept.	Output 1-4
YCDC WSD	Mr. Thwe Naing Ooo	Assistant Head of Dept.	Output 1-4
YCDC WSD	Ms. Khin Aye Myint	Executive Engineer	Output 1-4
YCDC WSD	Ms. Aye Thuzar	Assistant Engineer	Output 1-4
YCDC WSD	Ms. Ei Khaing Mon	Assistant Engineer	Output 1-4
MCDC Cleansing	Mr. Than Htut	Assistant Director	Output 1-4
MCDC Cleaning	Mr. Win Swe	Staff Officer	Output 1-4
MCDC WSD	Mr. Tun Win	Deputy Assistant Supervisor	Output 1-4
MCDC WSD	Mr. Khin Mg Thin	Division Chief, Deputy Head of Dpt.	Output 1-4
MCDC WSD	Ms. Tin Tin Hla	Laboratory Supervisor	Output 1-4
MCDC WSD	Mr. Aung Khin Myint	Junior Engineer	Output 1-4
MCDC	Ms. Su Su Mon		Output 1-4
MCDC	Ms. Hnin Yi Phue		Output 1-4

(Submitted by the Project for the Midterm Review)

Annex 9 Suggested Changes of PDM

	PDM (18 Dec. 2015)	PDM (suggested)	Reason
Overall Goal (OVI 2)	**Guidelines** for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MOECAF.	**Written strategies** for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC.	Changed to the level achievable in three years
Overall Goal (OVI 3)	Advanced approaches of EIA field such as SEA, HIA, SIA and so on are taken into account in order to solve more complicated issues than project level EIA.	Improvement of EIA procedure is identified by ECD through EIA reviews	Refocused on EIA procedure than other documents
Project Purpose (OVI 2)	More than 80% of the EIA documents satisfy safeguard policies of international organizations such as WB, ADB and so on.	More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project.	Refocused on project outputs (EIA) instead of other policies
Output 1 (OVI 1)	More than 80% of the inspection is implemented according to the inspection manual by the end of the Project.	Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD.	Difficult to quantify no of inspections thus focused more on using inspection manual
Output 3 (OVI 2)	Inspection reports of YCDC and MCDC prepared during the Project period are stored in the database.	Results of river water quality survey is accessible on the database.	Adjusted to the outcomes of Output 3.
Output 4 (OVI 1)	A water quality status report in the pilot areas is prepared by MOECAF, YCDC and MCDC.	Results of water quality status report in the pilot areas is **presented to the decision makers** by MONREC, YCDC and MCDC.	Refocused on understanding of the content of report
Output 5 (OVI 1)	The technical manual covers every sector of development projects and every step of the EIA procedure.	The technical manual covers every sector* of development projects and every major stage indicated in the EIA procedure. (*sectors are indicated in Annex A of EIA procedure.)	Reference is added to clarify
Output 6 (OVI1)	EIA review works by MOECAF are implemented based on the technical manual with a 80 % or more.	More than 80% of ECD officers in charge of EIA reviews received completion certificates from the Advanced EIA trainings.	Focus on achievements of capacity building
Output 6 (OVI2)	Added	Statistics of EIA reviews are presented.	
Output 1 Activity 4	To implement inspection based on the developed inspection manual	To implement **trial** inspections based on the inspection manual	Inserted trial as inspection is yet to be defined.
Output 1 Activity 6	To revise the inspection manual.	To evaluate **the trial** inspection procedures	

Following suggested changes are: change of organization's name or grammatical amendments.

	PDM (18 Dec. 2015)	PDM (suggested)
Output 6 OVI2	EIA works by MOECAF are presented **to** an international conference.	EIA works by MONREC are presented **at** an international conference.
Output 6	Capacity of **MOECAF** and the EIA Report Review Body on the EIA review is enhanced.	Capacity of **MONREC** and the EIA Report Review Body on the EIA review is enhanced.
activity 5-1	To draft necessary legislation including Official Forms for the EIA.	To draft legislation **on demand** including Official **Submission** Forms for the EIA.
activity 5-2	To develop a technical Manual of the EIA **process for review.**	To develop a technical Manual of the EIA **review process.**
activity 5-3	To evaluate and update the Manual to meet the **practical** EIA review works.	To evaluate and update the **Technical** Manual to meet the **ongoing** EIA **review processes.**
activity 5-4	To develop a database for recording the EIA **review operation.**	To develop a database for recording the EIA **review.**
activity 5-5	To **establish an evaluation system** for issuing license to EIA consultants.	To draft **legislations** for issuing licenses to EIA consultants
activity 6-1	To implement basic and advanced EIA **Training.**	To implement basic and advanced EIA **trainings.**
activity 6-3	To record the EIA **review operation.**	To record the EIA **reviews.**
activity 6-5	To develop a WEB site to disclose **EIA works based** on the new EIA system.	To develop a WEB site to disclose **EIAs based** on the new EIA system
activity 6-7	To presented activities on EIA review **to** an international conference.	To **present** activities on EIA review **at** an international conference

as of 2016/11/04

Annex 10 Amendment of Project Design Matrix (PDM)

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar

Project Period: 3 years from June 2015 until June 2018

Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.

Target Group: Environmental Conservation Department of the Ministry of Environmental Conservation and Forestry, Pollution Control and Cleansing Department of Yangon City Development Committee, and Water Supply and Sanitation Department of Mandalay City Development Committee.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.	1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. 2. Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC. 3. Improvement of EIA procedure is identified by ECD through EIA reviews.	· Database (baseline) Questionnaire · strategy · Proposal for EIA procedure revision	
<Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.	1. Consideration for the water status in the pilot study area is made. 2 More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project.	· Survey report · EIA documents	1. National effluent standard is developed.
Output 1 Inspection procedure is standardized.	1. Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD.	· Records of Inspection	1. Responsibility of MONREC, YCDC and MCDC for water pollution control does not change. 2. YCDC and MCDC do not stop inspection system as a water pollution control measures. 3. Responsibility of MONREC for EIA review does not change. 4. Relevant legislation of EIA does not significantly change. 5. The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAF.
Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.	1. Water quality survey reports are prepared in the pilot areas by YCDC and MCDC.	· Survey report	
Output 3 Database of water pollution sources and river water quality is developed.	1. At least 150 factories' information is accessible on the database. 2. Results of river water quality survey is accessible on the database.	· Database · Database	
Output 4 Capacity of interpreting the information for water pollution control measures is enhanced	1. Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC.	· Presentation materials	

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 5 Necessary technical manuals and forms for the EIA review are developed.	1. The technical manual covers every sector (1) of development projects and every major stage indicated in the EIA procedure. 2. The draft official forms are internally approved.	・ Technical manual and forms	
Output 6 Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.	1. More than 80% of ECD officers in charege of EIA reviews received completion certificates from the Advanced EIA trainings. 2 Statistics of EIA reviews are presented. 3 EIA works by MONREC are presented at an international conference.	・ Evaluation report of EIA ・ Proceedings	
<Activities> **Output 1: Inspection procedure is standardized.** 1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1-2 To evaluate present inspection procedure 1-3 To develop an inspection manual 1-4 To implement trial inspections based on the inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To evaluate the trial inspection procedures **Output 2: Capacity for water quality survey is enhanced.** 2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual 2-8 To verify the results of the water quality survey using the water quality survey	<Inputs> Japanese side ・ Experts. ・ Training in Japan and other country. ・ Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others. Myanmar side ・ Counterpart personnel. ・ Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)		

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
manual 2-9 To prepare a water quality survey report			
Output 3: Database of water pollution sources and river water quality is developed with GIS software. 3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey 3-2 To develop a system concept 3-3 To design the database based on the system concept 3-4 To collect additional information required to develop the database 3-5 To develop the database 3-6 To conduct training on operation and utilization of the database 3-7 To develop an operation and maintenance manual of the database			
Output 4: Capacity of interpreting the information for water pollution control measures is enhance. 4-1 To collect the information necessary for the water quality status report 4-2 To interpret the collected information 4-3 To prepare a water quality status report			
Output 5: Necessary technical manuals and-legislation for the EIA operation are developed. 5-1 To draft legislation on demand including Official Submission Forms for the EIA 5-2 To develop a technical Manual of the EIA review process 5-3 To evaluate and update the Technical Manual to meet the ongoing EIA review processes 5-4 To develop a database for recording the EIA review			
5-5 To draft legistraions for issuing licenses to EIA consultants			
Output 6: Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced. 6-1 To implement basic and advanced EIA trainings 6-2 To implement EIA review works based on the EIA procedure 6-3 To record the EIA reviews 6-4 To present leaflets and other materials for dissemination of EIA system 6-5 To develop a WEB site to disclose EIAs based on the new EIA system 6-6 To review and update the WEB site 6-7 To present activities on EIA review to an international conference			<Preconditions> 1. Japanese experts are assigned 2. C/Ps are assigned.

Note: The changes agreed by JCC members are shown in red.

(1) sectors are indicated in Annex A of EIA procedure.

MINUTES OF MEETING

BETWEEN

JAPAN INTERNATIONAL COOPERATION AGENCY

AND

ENVIRONMENTAL CONSERVATION DEPARTMENT, MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL CONSERVATION OF THE REPUBLIC OF THE UNION OF MYANMAR

ON

THE TERMINAL EVALUATION AND 4th JOINT COORDINATING COMMITTEE

FOR

THE PROJECT FOR THE CAPACITY DEVELOPMENT IN BASIC WATER ENVIRONMENT MANAGEMENT AND EIA SYSTEM IN MYANMAR

The Japan International Cooperation Agency (hereinafter referred to as "JICA") has dispatched the Terminal Evaluation Survey Team to Myanmar (hereinafter referred to as "the Team"), from 2nd to 23rd of February, 2018 to conduct the Terminal Evaluation Survey of "The Project for the Capacity Development in Basic Water Environment Management and EIA System in Myanmar" (hereinafter referred to as "the Project") through the discussion with the Environmental Conservation Department, Ministry of Natural Resources and Environmental Conservation (hereinafter referred to as" ECD-MONREC") and relevant counterpart organizations.

During the survey, the Team and the all counterpart organizations had a series of discussions and exchanged views for the purpose of working out the detailed contents of the Terminal Evaluation Report, as well as the 4th Joint Coordinating Committee (JCC) meeting were held.

As a result of the discussions, both sides confirmed the contents described in the attached report.

Nay Pyi Taw, 22nd February, 2018

岩井伸夫

Mr.Nobuo IWAI
Senior Representative
Myanmar Office
Japan International Cooperation Agency

HMThei

Mr.Hla Maung Thein
Director General
Environmental Conservation Department
Ministry of Natural Resources and Environmental Conservation
the Republic of the Union of Myanmar

伊藤 文平

Dr.Mimpei ITO
Leader
Terminal Evaluation Survey Team
Japan International Cooperation Agency

Main Points Discussed

1. The Team confirmed that the great effort made by the Myanmar side and basic tools developed by the Project, such as the manual for inspection, water quality survey and EIA related technical manuals contributed a lot for the improvement of environmental management of Yangon City Development Committee, Mandalay City Development Committee and ECD-MONREC. The Team expects that continuous practices by the Myanmar side to accumulate experiences are necessary to utilize above mentioned tools effectively and also ECD-MONREC plays further roles as leading agency to push the environmental management forward.

2. Now the roles and responsibilities of the organizations related to the field of environmental management are still in the development and in the near future, this situation needs to be settled by setting the legal framework up based on Environmental Conservation law, 2012 and other relevant laws and regulations. Still sector based individual regulations, national environmental standards and guidelines are necessary to prepare with the aim of strengthen the enforcement of laws and regulations. This kind of discussion will also be included in the process of roadmap making in Output 4.

3. The Team stressed that the significance of establishment of a national environmental laboratory to monitor an accurate environmental data, since the reliable data is the very fundamental for setting up a national environmental standards. Currently most of available data measured by domestic laboratory has a wide range results and it is difficult to tell which data is accurate or not.

4. Both side recognized the importance of collaborative work among the reginal government, City Development Committee, Ministry of Industry, Ministry of Construction and ECD-MONREC for making written strategy in line with Environmental Management Plan and Environmental Compliance Certificate for waste water management in industrial zones. The Team recommended that building the centralized waste water treatment facility could be one of the reasonable options therefore conducting feasible study for the construction of the facility as soon as possible is necessary.

5. For the EIA component, the second phase project will be designed the main target will be the improvement of existing tools, policy reviews and providing recommendations on current EIA system. Also the second phase will continuously focusing on the capacity development of EIA staffs through providing training workshops. In the field of EIA, several donors are actively working together with EIA Division in ECD. ECD shall take necessary action for the effective and smooth coordination of each project by avoiding the overlap of the activities done by donors.

Attachments:

1) TERMINAL EVALUATION REPORT
2) Presentation materials made by the counterpart organizations

THE PROJECT FOR CAPACITY DEVELOPMENT IN BASIC WATER ENVIRONMENT MANAGEMENT AND EIA SYSTEM IN MYANMAR

TERMINAL EVALUATION REPORT

February 22, 2018

JICA Evaluation Team

TABLE OF CONTENTS

ANNEX

ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
CP	Counterpart
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
EIA	Environmental Impact Assessment
GIS	Geographic Information System
IAIA	International Association for Impact Assessment
IEE	Initial Environmental Examination
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
MCDC	Mandalay City Development Committee
M/M	Minutes of Meeting
MOECAF	Ministry of Environmental Conservation and Forestry
MONREC	Ministry of Natural Resources and Environmental Conservation
OECD-DAC	Organization for Economic Co-operation and Development – Development Assistance Committee
PCCD	Pollution Control and Cleansing Department
PCM	Project Coordination Meeting
PDM	Project Design Matrix
R/D	Record of Discussion
YCDC	Yangon City Development Committee
WSD	Water and Sanitation Department

1. OUTLINE OF TERMINAL EVALUATION

1. 1 Background

"The Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar ("the Project")" is a bilateral technical cooperation implemented by the Government of the Republic of the Union of Myanmar ("the government"), with support from the Japan International Cooperation Agency (JICA). The objectives of the Project are to 1) enhance the capacity of the city development committees in Yangon and Mandalay to develop basic water pollution control measures, based on obtained and interpreted information, and to 2) strengthen the institutional framework for Ministry of Natural Resources and Environmental Conservation(MONREC) to review the environmental impact assessment(EIA).

Launched in June 2015 and implemented for three years, the Project will complete its activities in June 2018. To review the outcomes and impacts of this Project, JICA organised a three-member evaluation mission in February 2018, in accordance with the Project's Record of Discussion (R/D) which requires a terminal evaluation six months before the end of the Project. This Terminal Evaluation Report presents the findings of the mission, the evaluation of the achievements and outcomes to date, and the recommendations of future actions to be taken by the Project and by the CP organisations.

1. 2 Purpose and process

1.2.1. Purpose of the Terminal Evaluation

The main objective of evaluating JICA-supported projects are to 1) ensure accountability to project stakeholders in Myanmar and Japan, by making the project's outcomes public, and to 2) improve the project cycle management, by feeding evaluation results to the remaining project activities as well as for the future activities by the government. For the terminal evaluation of this Project, the assessment of its effectiveness, efficiency, and sustainability (see 1.2.3), and the recommendation of future actions, will be the main objectives of its evaluation.

1.2.2. Process of Evaluation

(1) **STEP1: take stock of the Project's achievements.** The Evaluation Team carried out literature review, a questionnaire survey, and interviews with CPs, to see the extent to which the agreed performance indicators in the Project Design Matrix (PDM) (Annex 1) are met. In the process, outcomes and challenges not captured in the PDM were also noted.

(2) **STEP2: Evaluate the achievements against five OECD's evaluation criteria.** The Project's performance in attaining the indicators was assessed in light of the "*Relevance*", "*Effectiveness*", "*Efficiency*", "*Impact*", and "*Sustainability*" of this Project, five criteria proposed by the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD) (see 1.2.3). For each criterion, the Evaluation Team assigned a rating such as "high", "relatively high", "moderate", or "low".

(3) **STEP 3: Identify future actions and lessons learned.**
The Team then drew lessons learned from the evaluation results as a feedback for other JICA projects in the future, and recommended the actions to be taken by each CP organisaion.

1.2.3. Evaluation Criteria

Concept[1]	*Key Evaluation Questions*
RELEVANCE Whether Project's design and approach are appropriate to key policies and beneficiary's needs	• Is the Project consistent with policies of both the Myanmar- and Japanese government? • Does the Project respond to Myanmar's development needs? • Does the Project meet capacity needs of counterpart organisations? • Is the project design/approach appropriate to achieve the project objective?
EFFICIENCY Whether inputs and activities are managed efficiently	• Is the implementation process (i.e., project management) efficient? • Were adequate inputs from CPs and from JICA provided in a timely manner? • Was there any effort to improve project's efficiency (e.g. cooperation with other donors)?
EFFECTIVENESS Whether six Outputs all together have achieved Project's primary objective	• Has the Project achieved its primary objective ("Project Purpose"), and the indicators to assess the achievement of the Purpose? • How useful were project activities to achieve the Project Purpose? • What factors were useful or detrimental to achieving the Project Purpose?
IMPACT Impact over time and across sectors	• Is the Project's Overall Goal (see 3.3) likely to be attained 3-5 years after the Project? • Were there other noteworthy impacts from the Project, whether positive or negative?
SUSTAINABILITY Whether activities and outcomes of this Project will last	• Are the policies in place to sustain the outcomes of this Project? • Within or among CP organisations, are the roles and responsibilities for future activities clear? Are appropriate staff members assigned to manage future activities and monitor the outcomes? • Is the capacity of the CPs sufficient to continue the now expert-supported activities on their own? • Is sufficient financial resources secured for future activities?

1.2.4. Data collection

[1] These definitions and key questions are not direct citations from the OECD guidance document, but were prepared in reference to the OECD papers and to JICA's evaluation guidelines.

Data collection method	*Source of information*
1) Literature review	• The Project's progress reports; its written outputs including Inspection Manual (2016), Pollution Source Survey Report(2016), the presentation on the Water Quality Status report; official forms for EIA; the records of inputs • JICA's Detailed Design Survey and Mid-term Review reports for this Project • Government's documents, including the Environmental Conservation Law (2012), Environmental Conservation Rules(2014), National Environmental Quality (Emission) Guidelines (2015), and the Environmental Impact Assessment Procedure(2015)
2) Questionnaires	A set of evaluation questions responded by the Project's counterpart (CP) organisations (see Table xx) and by Japanese expert team (JET).
3) Interviews	Individual interviews with the CPs and JET in Yangon, Mandalay, and Nay Pyi Taw (see Annex 2 for the List of key CPs).
4) Direct observation	Visits to the factories and pilot sites in Yangon and Mandalay, and the observation of written products, databases, and the equipment provided by JICA.

1.3 Schedule and Members

1.3.1 Schedule

The evaluation in Myanmar took place on 2 - 23 February 2018, as shown in Annex 3.

1.3.2 Evaluation Team Members

Mimpei ITO - Team Leader Director, Environmental Management Team 1 Global Environmental Department's Environmental Management Group- JICA
Mizuki HOSOKAI - Evaluation Planning Program Officer, Environmental Management Team 1 Global Environmental Department's Environmental Management Group- JICA
Emi YOSHINAGA - Evaluation Analysis Evaluation Specialist - Japan Development Service Co. Ltd

1.4 Constraints

Due both to the number of stakeholders for the WEM component and to the availability of the CPs, there were more meetings arranged with the WEM members. The information in this report, therefore, inevitably contains more facts on the WEM component.

2. OUTLINE OF THE PROJECT

2.1 Background to the Project[2]

Myanmar has faced considerable challenges in environmental management, ever since the country's transition to civilian rule in 2011 fuelled investments and industrial growth. To address the challenges, the Environmental Conservation Law (ELC) was enacted in 2012, followed by the development of Environmental Conservation Rules (ECR) in 2014 to implement the Environmental Conservation Law. The two regulations were the first and only laws existent in the country that served as guidance documents for the government, until other regulations are issued in 2015.

There are numerous regulations and guidance to be prepared for the implementation of the ECL, among others the standard for environmental quality. However, both the baseline data and the capacity of a newly-established Environmental Conservation Department (ECD) of the former Ministry of Environmental Conservation and Forestry (MOECAF) were insufficient for effective environmental monitoring. Likewise, the capacity development for the efficient EIA review was urgent, as the industrial development suddenly increased the number of projects for EIA reviews.

Based on the situation surrounding environmental management in Myanmar, the government requested JICA the implementation of "The Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar", to enhance the capacity of the now MONREC for efficient EIA review, and the capacity of Yangon City Development Committee (YCDC) and Mandalay City Development Committee (MCDC) for effective water environmental monitoring. The cooperation started in May 2015, for the period of three years.

2.2 Basic Information

2.2.1 Activities, Outputs, and Goals

(See also the Project Design Matrix (PDM) in Annex 1 for details of activities)

(1) ***Structure*** (Table 2-1). The Project has two components: 1) water environmental management (WEM), to enhance capacity for developing basic water pollution control measures based on obtained and interpreted information, and 2) the development of the institutional framework of the EIA reviews. Each component has its own implementation arrangements and indicators, but they all together are meant to contribute to the government capacity for improved environmental management and monitoring.

(2) ***Members and their roles and responsibilities***. See Table 2-2 for details.

(3) ***Venues of Pilot Activities.***

[2] Quoted from the Midterm Review Report and revised.

For water quality surveys (Output 2), water samples were collected from Hlaing River in Yangon, and Doke Hta Waddy River in Mandalay[3].

Table 2-1. Project Structure

	WEM	EIA
Overall Goal	Impact of industrial effluents from industrial zones on river water quality is alleviated.	Advanced EIA approach for complicated issues is taken into account.
Project Purpose	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.	Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.
Outputs	Output 1. Inspection procedure is standardized. Output 2. Capacity for implementing water quality survey to obtain reliable information is enhanced. Output 3. Database of water pollution sources and river water quality is developed. Output 4. Capacity of interpreting the information for water pollution control measures is enhanced.	Output 5. Necessary technical manuals and forms for the EIA review are developed. Output 6. Capacity of MOECAF and the EIA Report Review Body on the EIA review is enhanced.
Venue of activities	Yangon and Mandalay	Nay Pyi Taw (MONREC-ECD headquarters)

Table 2-2. Members and their Roles and Responsibilities

	Participating agencies		*Responsibilities*
1)	MONREC-ECD	Senior management	Overall supervision of the Project
		EIA division	Implementation of Output 5-6 activities
		Pollution Control Department(PCD)	Supervision of Output 1-4 activities
2)	Yangon City Development Committee (YCDC)	Pollution Control and Cleansing Department (PCCD)	Implementation of Output 1-4 activities
		Water and Sanitation Department(WSD)	Implementation of Output 2 activities (water quality survey, laboratory analysis, data-basing and reporting)
3)	Mandalay City Development Committee(MCDC)	WSD	Implementation of Output 1-4 activities
		Cleansing Department(CD)	Implementation Output 1 and 3 activities
4)	ECD Regional Offices in Yangon and Mandalay		Participation to Output 1-4 activities

3. PROGRESS AND ACHIEVEMENTS

3. 1 Progress in achieving Output Indicators

OUTPUT 1: "Inspection procedure is standardized."

1-1 "Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD."

(ACHIEVED)

- The objective of Output 1 is to help the CP organisations in Yangon and in Mandalay develop a standard practice for environmental compliance inspections. The Project did so by reviewing the information on the sources of water pollution, studying the types of existing inspections, training the CPs on industrial effluent control measures, and preparing an inspection manual as a common reference for novice officers.
- Drafted in August 2016 and updated in October 2017 to reflect the recent policy developments (see 3.5 for details) the manual is the first government's guidance document for environmental compliance inspection. The Burmese version of the manual was also prepared and distributed to the ECD regional offices nation-wide, and is used to train new officers at the ECD headquarters. During the interviews, the CPs uniformly praised the usefulness of the Output 1 activities and of the manual, to understand the basic process of inspection.
- Even so, MCDC and YCD Yangon responded that they don't fully use it for current inspections, mainly for the following reasons.

  (1) The inspections in response to the complaints are hard to standardise, because each case is different and is better dealt respectively.
  (2) Some CPs currently do not conduct regular inspections, for which this manual could be useful.

The Evaluation Team also noted that the information in the manual is kept to basic rather than specific, to accommodate future policy updates. For the manual to be more specific, relevant government's legal framework – such as environmental quality guideline and water quality standard - is prepared.

To sum, if taken at face value, the indicator is attained only to some extent; the Evaluation Team nevertheless concluded that the reasons for not always utilising the manual are plausible, that the preparation of the manual as the first guidance on inspection was meaningful, and that the objective of Output 1 was satisfactory met.

OUTPUT 2: Capacity for implementing water quality survey to obtain reliable information is enhanced.

2-1 "Water quality survey reports are prepared in the pilot areas by YCDC and MCDC."

(ACHIEVED)

- The purpose of Output 2 is to help the CPs in Yangon and Mandalay plan, implement, and prepare reports on the results of the water quality surveys of Hlaing River and of Doke Hta Waddy River. Because the focus of the activities was on raising the CPs' awareness on the river water quality and on improving their skills for quality report-writing, the implementation of the water quality surveys and the laboratory analysis were outsourced to private companies.
- By the end of 2017, four water quality surveys were carried out, and the fifth last survey is to take place in February 2018. According to the interview with the ECD headquarters, the data collected through surveys helped unveil the situation of the two rivers that have long been unknown, and serve as critical references for the preparation of water quality standard in the near future.
- The indicator was achieved also by the end of 2017, because the result of the fourth survey was summarised into a report by the each CP department. For the first three surveys, the laboratory analysis results were not reliable enough; for the fourth, water samples were analysed in Japan to ensure accuracy. The experience suggests the importance of the capacity of the laboratory as a pre-requisite for water quality monitoring[1].
- Participants to the water quality report-writing training were limited to three for each department, to ensure the depth and effectiveness of the training. The expectation is for the limited number of training beneficiaries serve as the knowledge hubs of their departments. Such a knowledge-sharing is important particularly for the regional ECD offices, whose staff is rapidly increasing in number.

OUTPUT3:

"Database of water pollution sources and river water quality is developed."

3-1: At least 150 factories' information is accessible on the database.

(ACHIEVED)

- The objective of Indicator 3-1 is to develop a database as a tool to manage pollution source information, and to encourage an evidence-based reporting and decision-making for pollution source control.
- This indicator has been achieved by the end of 2017. The information on 202 factories (100 in Yangon and 102 in Mandalay) was collected through two outsourced Water Pollution Source Surveys conducted in 2016 and 2017, and was made available in an excel database linked to the GIS. The same surveys also collected waste water samples from total 100 factories, the results of their

[1] To note, the ECD headquarters plans to establish an environmental laboratory by 2019, and ECD regional offices are gradually being equipped with necessary laboratory supplies, which may provide solution to the accuracy issue.

analysis are accessible also on the database. ECD Mandalay is even taking a further initiative to apply the format for other sector data management.

- The interviews with relevant stakeholders revealed that the Pollution Source Surveys has attracted an attention of the Project participants and donors. The results contain the details of factories and of the impacts of their activities that were hard to obtain before the Project, and indicate the importance of raising factory owners' awareness on the environmental impacts of their activities. For the survey, good cooperation was made with Norway to harmonise the questionnaire format.
- Although the CPs are being trained in the database operations, the future of the database within some CP organisations appears somewhat uncertain. This relates either to 1) the unavailability of staff (the data management staff is or cannot be not assigned, for the lack of clear roles and responsibilities within the organisation, or for the frequent staff turnover) or 2) the limited availability of computers and the shortage of knowledge on excel, or 3) the lack of clarity for each organisation which data and parameters they should regularly monitor. Making the purpose and mandate of monitoring clear, and making data management an organisational practice, is critical for the future environmental monitoring.

3-2: Results of river water quality survey is accessible on the database.

(ACHIEVED)

- The objective of Indicator 3-2 is to develop a database, to help manage the monitoring data and encourage an evidence-based reporting and decision-making for water quality control.
- This indicator is achieved. By the end of 2017, the data collected through four water quality surveys under Output 2 were made available on the database. The WSD of YCDC is taking even a further step to apply the format of the database for other sector data management.
- As with Indicator 3-1, the prospect for the database to be updated and managed is uncertain, for the reasons described in Indicator 3-1.

OUTPUT4:

"Capacity of interpreting the information for water pollution control measures is enhanced."

4-1: Results of water quality status report in the pilot areas is presented to the decision makers by MONREC, YCDC and MCDC.

(LIKELY TO BE ACHIEVED)

The indicator is not yet achieved, but likely to be, if further training is provided.

- The water quality status report is a synthesis report summarising data and analysis collected through Output 1-3, prepared by the Japanese experts. The objective of this Indicator is to develop the CPs' capacity to understand the report, and to communicate their understanding to policy makers so that the outputs from this Project will be utilised at policy level.
- The indicator is yet to be attained, because the preparation of the report is still ongoing. According to the Japanese experts, the basic concept of the report was discussed with the CPs in Nay Pyi Taw, Yangon and Mandalay in late-January to early February, and further explanation sessions will be provided in February-March to ensure that the CPs understand the report. The report will then be finalised by March 2018.
- Once the report is prepared, MONREC-ECD will present the report to its Minister, and the MCDC, to the Committee members and the mayor of Mandalay city, according to their questionnaire responses. YCDC said in the interview that it will decide whom to present after

scrutinising the report. Before presenting the report to the decision makers, however, MCDC and ECD Mandalay voiced the need for further explanation to really understand the analysis shown in the report. If some more training is provided to reinforce CPs' understanding of the report, the attainment of the Indicator appears likely for most of the CP organisations.

OUTPUT5:

"Necessary technical manuals and forms for the EIA review are developed."

5-1: The technical manual covers every sector (1) of development projects and every major stage indicated in the EIA procedure.

(LIKELY TO BE ACHIEVED)

- The objective of this Indicator is to develop a technical manual as a tool to help the ECD conduct the EIA reviews, efficiently and in accordance with the EIA Procedure issued in December 2015. With this tool, the Project expects that the EIA reviews will improve in terms not only of the speed but also of the quality. The sector here includes the nine sectors in which the Initial Environment Examination (IEE) or the EIA may be required for any business. The nine sectors and its 141 sub-sectors are listed in the Annex A of the Procedure[5].
- The manual being developed by the Project is an electronic knowledge management system called the 'E-expert', composed of two sub-systems: 1) an automated reasoning system, and 2) a knowledge database that saves necessary data for all nine sectors. Two together, the technical manual will cover all the nine sectors above and every major stage of the EIA review.
- The indicator is likely to be achieved by the end of the Project. As of February 2018, the development of 1) is complete; for 2), eight of the nine sectors except for mining are still under construction. The preparation of the manual has taken time because the volume of information included in the system was added upon the government's request, to embrace not only the nine sectors but also their 141 subsectors. Nevertheless, the work is expected to be complete by April 2018.
- While waiting for the manual, the Project produced a general- and sector-specific checklist as a guidance for the reviews, which has so far utilised fully.

5-2: The draft official forms are internally approved.

(ACHIEVED)

- The objective of this indicator is to have in place various templates to be attached to the application for the EIA review submitted by project proponents.
- The indicator is achieved by January 2017. The forms including the Project Proposal, Consultant Selection, EIA report, IEE report, EMP Report, and Monitoring Report were prepared, approved by MONREC Minister on 31 January 2017. The forms were supposed to be posted online for the proponents to download; as of February 2018, however, the forms are not uploaded yet, reportedly because of the trouble between the ECD and the web company. The Evaluation Team urges the ECD to take a soonest action to solve the trouble, so that the forms can fully serve their original purpose.

[5] http://www.myanmar-responsiblebusiness.org/resources/environmental-impact-assessment-procedures.html

- As part of Output 5 activities, the Consultant Licencing Scheme was prepared by the ECD with assistance from the Project. Although the discussion to finalise the scheme is on-going ever since, the ECD hopes to make the scheme operational April 2018.

OUTPUT6:
"Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced."

6-1: More than 80% of ECD officers in charge of EIA reviews received completion certificates from the Advanced EIA trainings.

(ACHIEVED)

- The objective of this Indicator is to strengthen the capacity of the ECD staff at the headquarters in Nay Pyi Taw for the EIA review. The advanced training will be provided only to the staff who completed the basic training also organised by the Project. By the end of the cooperation, total 197 government officers, including ECD regional offices and line ministries, are expected to complete the advanced training.
- According to the ECD's PCD, there are 20 officers at the ECD's EIA division designated to undertake the EIA reviews. From the interview with the EIA division and with JET, all of the staff received the EIA division has received the advanced training, although new staff are constantly updated and have to be trained on a regular basis.

6-2: Statistics of EIA reviews are presented.

(ACHIEVED)

- The Indicator aims to ensure that the EIA Tracking System created under Activity 5-4 are utilised. The system is a comprehensive database that shows the progress of all the reviews.
- This indicator is achieved. The spreadsheet as a basis for the Tracking System was developed in 2015, and was converted to the Tracking System that was developed in December 2016. The information on the review is recorded in the database ever since, and is presented to the ECD management upon their request.

6-3: EIA works by MONREC are presented at an international conference.

(ACHIEVED)

This indicator is achieved by the time of the Midterm Review in November 2016. The ECD presented the overview of it EIA work at the 16th annual conference of the International Association for Impact Assessment (IAIA) in Nagoya-Japan in May 2016 and at the IAIA's 17th annual conference in Montreal-Canada in November 2016. The ECD's knowledge on the EIA works was also shared with another EIA project in Cambodia supported by JICA, when its mission visited Myanmar in October 2017.

3.2 Progress in Achieving Project Purpose Indicators

Project Purpose:
"Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established."

Indicator 1:

"Consideration for the water status in the pilot study area is made."

(LIKELY TO BE ACHIEVEMENT, under certain conditions)

- The objective of the Project Purpose Indicator 1 is to encourage the government to utilise the Project's outcomes for policy-making, when "the results of water quality status report in the pilot areas are presented to the decision makers by MONREC, YCDC and MCDC (Output Indicator 4-1)".
- The indicator is likely to be achieved fully, if:

  (1) further explanation sessions for Output 4 is provided, so that the CPs can present the water status with confidence (see Output Indicator 4-1 for the reason).
  (2) appropriate opportunities are arranged, for the CPs to present the Project's work to senior officials.
  To note, MCDC and the Japanese experts respectively indicated that they may organise the Project's completion ceremony, inviting stakeholders across sectors. If realised, such events will augment the prospect for this Indicator to be achieved.

Indicator 2: "More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project."

(ACHIEVEMENT UNLIKELY)

The achievement of this Indicator by the end of this Project appears difficult. The Project can complete the development of the technical, but not the training on the operation of the manual. As explained in Indicator 5-1, the delay in preparing the manual is because the number of sectors and sub-sectors covered in the manual increased from nine to 141 upon the request of the government. The need to increase the scope of work arose only after the Project started, as the number of EIA submission skyrockets in the last two years.

To note, the preparation of the second phase of this Project is currently underway. Because the technical manual is an important output of this Project, the training on the operation of the manual may need to be included in the next phase.

3.3 Prospect for Achieving Overall Goal Indicators

Overall Goal:

"Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approaches for complicated issues are taken into account."

Indicator 1:
"The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project."

(LIKELY TO BE ACHIEVEMENT)

The project members unanimous expressed that the number of factories equipped with waste water treatment facilities would increase, because 1) the number has slightly but certainly increased during the Project, and because 2) the discussion is ongoing/starting to establish central treatment facilities. To what extent the number will actually increase in the future depends on 1) what the baseline data of this indicator is, 2) whether or how soon the central waste water facilities will be realised, and 3) the awareness-raising and incentive for factories to establish ones. There is a need to specify who will monitor the number.

- According to the CPs in Yangon, the number has increased during the Project, as a result that the government has strengthened the inspections in response to the complaints from residents. In Mandalay, too, the number of distilleries with the facilities increased from two to four during the Project. The distilleries in Mandalay – the main source of the river water pollution to date – are also beginning to take initiative to establish their own plants, after the regional government's order to shut down the operations of four distilleries in August 2017.
- Mandalay is discussing the introduction of the central waste management facilities in industrial zones, and so has Yangon just begun considering the option[6]. But many challenges are ahead in realising the scheme, from the issues of cost-sharing, community organisation, to awareness-raising of factory owners and the incentive for them to cooperate, indicating that the facilities may not be established anytime soon.
- The baseline for this indicator could be the number of plants with the *primary* waste water treatment facilities[7], to ensure more factories will undertake the minimum treatment of their waste water. The results of the first Pollution Source Survey, that investigated 100 factories in Yangon and another 100 in Mandalay in August to November 2016, provide a reference baseline data (Table 3-1).

Table 3-1 The Number of Factories with Waste Water Treatment Facilities /100 factories surveyed in Yangon and in Mandalay each

[6] Depending on the types of facilities required for factories, the introduction of secondary treatment facilities could impose enormous financial burden if each individual factory should set ones up on their own. The facilities also require significant plot of land to be made available. The central facilities, if realised, are likely to provide a solution to this challenge.

[7] Including screens, equalisation tank, settling basin, oil separator, and chemical coagulation, among others.

	# of factories with primary facilities	# of factories with secondary facilities /100
Yangon	53	4
Mandalay	46	1-4, depending on the types of facilities

Source: *Pollution Source Survey Report* (March 2017), prepared by the Project

Indicator 2:
"Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC."
(DEPENDS ON THE CP)

The need for creating waste water management strategies in industrial zones exists at all level. Whether any specific strategy will be drafted in 3-5 years, however, depends on the CP organisation. Whether they can gain cooperation from relevant government stakeholders is a key to achieving this goal.

- For YCDC, the achievement of the indicator appears difficult at this moment. Based in Myanmar's most populated city, YCDC has more stakeholders to coordinate than its counterparts in Mandalay, and feels that its authority to make decisions on creating such as strategy is limited. For YCDC to continue the activities they learned from the Project in the future, the involvement of the regional government will be necessary, as well as the clarification of the roles and responsibilities for waste water management among government stakeholders in Yangon.
- For MCDC, the attainment of the indicator is realistic. The city is more compact in size, and its government structure less complex than Yangon, allowing faster decision-making. With the cooperation from relevant stakeholders such as Ministry of Industry and MONREC-ECD, MCDC believes that it can formulate a unique action plan for waste water management.

Indicator 3:
"Improvement of EIA procedure is identified by ECD through EIA reviews."
(ACHIEVEMENT LIKELY)

- According to the Midterm Review of this Project, the intention of this Indicator is to ensure that the ECD will utilise the outcomes of the Project for further improvement of the EIA reviews in the future. The EIA procedure here could include both the general EIA review process, and the EIA Procedure as a legal framework for the review.
- The achievement of this indicator is highly likely, because the ECD's EIA division feels the need for improving the EIA review process. The areas of improvements as felt by the EIA division are:
  - the number of sectors/sub-sectors for the EIA review, shown in the Annex A of the EIA Procedure,
  - the method of negotiating with factories, particularly in mining sector, to gain their understanding on the need for the EIA, and
  - The number of ECD staff and their capacity for the review

3.4 Inputs for the Project

3.4.1 Inputs from Myanmar side

1. Counterpart staff	Assigned as per the R/D, from the ECD headquarters, the ECD's regional offices in Yangon and Mandalay, the YCDC, and the MCDC. See "Table 2-2 Members and their Roles and Responsibilities" for participating departments.
2. Office space and other necessary facilities	The R/D stipulates that some "suitable office space with necessary equipment such as telephone and internet connection" be provided to the JET. • For the WEM team, an office space was offered in the ECD headquarters Nay Pyi Taw, although the team preferred to be based in Yangon and did not take the offer. • For the EIA expert, an office space is provided in the ECD headquarters.
3. Other inputs	• Transportation cost for training was borne by each CP organisations. • Accommodation cost during the EIA training, and miscellaneous payment for surveys organised by the WEM team were incurred by JET. Although the issue with the payment for the WEM surveys was discussed and settled during the Midterm Review, the issue indicates the need for aligning each other's expectation to JICA assistance before any cooperation starts. • Means of transport for the EIA expert within Nay Pyi Taw was offered, if not utilised.

3.4.2 Inputs from the Japanese side

1. Japanese Experts

As per the R/D, following Japanese experts were assigned.

Name	Expertise	Organization	Total inpu (# of days)[8]
Itaru Okuda	Leader/ Industrial Effluent Management	Nippon Koei	277
Shunsuke Hieda	Water Quality Survey	Nippon Koei	203
Tomoe Takeda	Water Sampling and On-site Management	Nippon Koei	256
Hiroaki Nakagawara	Database development with GIS	Nippon Koei	236
Toshiyuki Nishio	Industrial effluent treatment	Nippon Koei	55
Kanji Usui	EIA Technical Manual and Reviewing Process	Independent	546

2. Equipment (Annex 4)	Equipment for office and for surveys was provided by the Japanese side. The detail is shown in Annex 4.
3. C/P Training (Annex 5)	Three training courses were organised in Japan, with total 29 participants from CP organisations and line ministries. The list of participants and overview of the courses are shown in Annex 5.
4. Other operational cost	Total 341,762,192 Kyat, including the planned expense for the WEM team and the expense for four laptop- and two desktop computers for EIA work, were borne by the Japanese side. The main expenditure items are transport and vehicles, local consultants for surveys, air faire and communication, among others.

[8] Actual inputs in Myanmar as of December 2017.

3.5 Implementation Progress and Process

3.5.1 Developments within the Project

(1) Implementation since the Midterm Review

- Activities for WEM are generally on time. All the planned activities are expected to complete by the end of this Project in June 2018.
- Some activities for Output 5 are taking more time than planned, due to the reasons described in Output 5 Indicators; activities related to Output 6 are implemented as planned, although the need for the Project to implement more EIA training for regional ECD offices is increasing.

(2) Progress in implementing the key recommendations of the Midterm Review

- *Sharing of the inspection manual*: the inspection manual has been translated into Burmese and distributed by MONREC-ECD to all the ECD offices in the country, as well as to the new staff. Among the CPs, YCDC fully utilised it for inspection; ECD in Mandalay 60%, and ECD Yangon and MCDC has not yet utilised it but refer to it as appropriate.
- *Donor coordination*: as far as the Evaluation Team understood, the overlap of activities between JICA and other donors was naturally settled as the donors coordinate their activities as the need arise. Because the donors for EIA are increasing, constant efforts are necessary in the future, for the ECD to set up a coordination mechanism both with the government and among the donors.
- *Budget*: at the time of the Midterm Review, miscellaneous payment for field activities was an issue for the water environment management component of the Project. This issue was settled in the latter half of the Project, through preparing and agreeing on the detailed agreement between the CPs and JET. Although the discussion on the cost-sharing has ever since not recurred in the latter half of the Project, it indicates the importance of aligning each other' expectation to JICA's assistance before any project starts.

3.5.2. Developments surrounding the Project

(1) The change in the government's leadership, organisations, environmental management policy.

Ever since President Htin Kyaw assumed the office on 30 March 2016, several changes were observed in the government organisations and in environmental management policies, such as following.

- The former MOECAF was transformed into MONREC, combining the natural resources, forestry, and mining into one ministry.
- The political attention on the environmental issues and management has increased, according to the interviews with the CPs.
- The responsibility of the ECD, both of headquarters and its regional offices, has expanded. On 10th January 2018, MONREC issued a notification to the factories operating in nine prioritised industrial sectors to prepare an Environmental Management Plan (EMP), and to obtain an Environmental Compliance Certificate (ECC) from the ECD[9]. The notification has several implications to the Project: first, the mandate and workload of the EIA division of the ECD will increase, because the division is responsible not only for the EIA/IEE review, but also for assessing the EMP and issuing the ECC; second, the mandate of the regional ECD offices will likewise expand, to monitor estimated total 30,000 EMP implementation in the future. To secure enough human resources to deal with the mounting tasks, the ECD has just initiated a process to raise its staffing level to 20,000 over the next nine years. The training for growing number of new recruits is, therefore, the centre of the ECD's attention at this moment.

(2) Donor activities

- ADB's Project for "Environmental Safeguard Institutional Strengthening[10]" (26 Jan 2015 - 31 Dec 2018) has activities in the areas of assistance of this Project, providing training and the assistance for preparing related policies and guidelines. ADB recently focuses its work on the development of national water quality standard, the environmental compliance audit in mining sector, and the preparation of the EIA guideline in the sector.
- Norway provides support to MONREC's Forest Department, through its "Integrated Water Resources Management – Institutional Building and Training Project (2015-2018) ". The project has water quality monitoring and data-basing component in Inly Lake and the Bago river basin, and both JICA and the Project are regularly exchanging information with the Norway's activities. Other donors who reportedly provide support in waste water management includes the Netherlands and France in Mandalay, and the United Nations Industrial Development Organisation for waste water treatment facility construction in Yangon.
- For EIA, donors other than ADB also support the preparation of sector-specific EIA guidelines, including the International Financial Corporation for hydro-energy, Norway for oil and gas, and the Vermont School of Law for public consultation. The Netherlands reportedly plans to support the preparation of the Strategic Environmental Assessment guidelines, but the details need further investigation.

[9] Notification No.3/2018, "To undertake Environmental Management Plan –EMP for On-going Factories under Nine Prioritised Sectors" (tentative translation by the Project).
[10] https://www.adb.org/projects/48145-001/main#project-pds

4. EVALUATION RESULTS

4. 1 Relevance

Key Evaluation Criteria for "Relevance"
- Consistency with policies of both the Myanmar- and Japanese governments
- Relevance to Myanmar's development needs and to the capacity needs of CP organisations
- Relevance of the Project's design/approach appropriate to achieve the project objective

The relevance of this Project is HIGH, for the following reasons.

(1) ***Relevance to the government's policies***

By government policies it means for ECD the Union government's Law on Environmental Conservation (Law No.9/2012), the Environmental Conservation Rules (2014), and the Environmental Impact Assessment Procedure (2015)[11]; for YCDC and MCDC, the regulations of the city government committees such as the YCDC law (2013) and the MCDC law (2014) provides a basis for their involvement in the environmental monitoring in Yangon and Mandalay. The government's order in January 2018on the stronger environmental compliance audit in nine sectors (see 3.5 Implementation Process) only re-enforced the relevance of the project activities.

(2) ***Consistency with the social demand and with the capacity needs of the CP organisations***

- The Project started amid of a rising social demand for better environmental pollution control, as the country's transition to civilian rule in 2011 fuelled investment and rapid industrial growth. Of different types of pollutions caused by the industrial growth, untreated industrial waste water in industrial zones in major cities was the most urgent, but the government had neither the reliable data that are critical for assessing the seriousness of the pollution and its impacts, nor the know-how to collect, monitor, and analyse the information. The implementation of this Project was timely and highly appropriate to both the social backdrop in Myanmar and to the needs of the government.
- Industrial growth has augmented the need for EIA as a policy tool to control the pollution. As of this evaluation, the number of the EIA reports to be reviewed is reportedly ten times more than in 2012[12]; the EIA division has only ten staff to review 2,300 projects that are outstanding. The introduction of the EMP will add the number of the reviews for existing operations, and will make the improvement of the EIA review process even more necessary. The assistance for faster and quality reviews, through the creation of necessary tools, is highly relevant to this context.

(3) ***Consistency with Japan's aid policy and it comparative advantage***

[11] Created with the support from ADB, specifying the MONREC's responsibility and authority to review, monitor and inspect the activities that may have adverse impacts on environment, to whose implementation both the EIA and water environment components of this Project directly contribute to.
[12] According to the EIA division, there were some 200-300 applications at the time the ECD was established.

The Project was found consistent with Japan's aid strategy in the environmental sector, with the priority of its assistance for Myanmar[13], and with Japan's comparative advantage in environmental management.

(4) *The design of the Project* is generally appropriate. Its focus and the relationship between outputs are clear, and are understood well by the CPs. Nevertheless, the Evaluation Team also noted that the changing role and responsibilities among regional- and local stakeholders needs to be taken into consideration for the future project design. As the government decentralises, the role of the regional governments in environmental management appears increasing, particularly in Yangon. Its involvement is more important than ever, when the city government makes policy decisions.

4. 2 Effectiveness

Key Evaluation Criteria for "Effectiveness"

- The extent to which the Project Purpose and its indicators were met
- Usefulness of the Project's activities and outputs to achieve the Project Purpose
- The factors that were useful or detrimental to achieving the Project Purpose

The Effectiveness of this Project is HIGH, for the following reasons.

(1) ***The level of the attainment of the Project Purpose Indicators is, overall, acceptable.***

- Indicator 1. "*Consideration for the water status in the pilot study area is made.*" is likely to be achieved, if Output 4-1 indicator is achieved; Output Indicator 4-1 will be attained, if some more explanation sessions on the water status report is provided to the CPs, and if and an appropriate opportunity is set up to present the Project's outcomes.
- The attainment of Indicator 2."*More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project.*" is unlikely during the Project, because the scope of work significantly increased during the Project (see Project Purpose Indicator 2). The reason for the Project to take time to develop the technical manual is, therefore, justifiable.

(2) ***Given the context surrounding the Project, the Project was successful.***

The history of environmental management in Myanmar is extremely short, and the Project had to start from the scratch in building the concept. In assessing the effectiveness of this Project, the context surrounding the Project is as important as the level of attaining each performance indicators. The Project started when the government had very limited legal documents or institutional memory, thus no guidance to refer to; before the birth of the ECD in 2012, the

[13] Of three focus areas of Japan's assistance in Myanmar, both the water environment and EIA components of this Project directly contribute to the 'Capacity Building and Institution Development / System improvement that support sustainable economic and social development', and 'Development of Infrastructure and Related Systems which requires sustainable economic development'.

ministry had only the forestry background, and the city governments in Yangon and Mandalay did not have experience in such a rush industrial growth. The system related industrial pollution control and environmental compliance audit is still very much in the making.

Given the context, the Project was successful in stimulating the awareness and capacity development of the CP organisations, made available the important tools and information, and in paving the way for future discussions and activities.

(3) ***That said, the experience and results of the Project depends on the context of each city.***

Among the CPs involved in this Project, the members in Mandalay appeared to have more reasons to commit themselves to this Project, ever since the city experienced a critical fish-death incident in early 2015. The timing of the Project coincided well with the needs. The decision-making for the Project-related issues might have been more difficult in Yangon than in Mandalay, because the city is larger in size, and because the roles and responsibilities between the regional government and YCDC is changing.

To sum, the factors that contributed to the Project Purpose are:

- the growing and more explicit social demand for improved environment,
- political attention, and
- the interest and commitment of each CP member/organisation.

The factors that posed challenges to the implementation may include:

- the context of each city, including the changing role that the regional government plays in the WEM, and
- the sudden increase of the ECD work, especially of the ECD's EIA division, when the division is still understaffed.

4. 3 Efficiency

Key Evaluation Criteria for "Efficiency"

- Efficiency of project management and implementation
- Appropriateness of inputs in terms of quantity and quality
- Any other efforts or events that increased/decreased efficiency, such as donor coordination

The Efficiency of this Project is RELATIVELY HIGH.

(1) ***Project management***

- For a project involving a wide range of stakeholders in three cities, the Project is managed well. Even though all the CPs are extremely busy, they are well-informed of the objectives and activities of the Project, and are committed. Owing to their commitment, the

activities did not experience a major delay[14], and the key outputs are expected to be produced by the end of the Project in June 2018.

- At respective Output level, the water quality report-writing training under Output 2 was less than planned. The shortage of reliable laboratories was the reason (see 3-1, Output 2 Indicators).

(2) *Inputs.* As described in "*3.5 Implementation Process*", the payment for the field-level activities – such as transportation for meeting and per diem - was an issue for the water environment component of the Project. The issue suggests the importance of aligning each other's expectation to JICA's assistance before any project starts.

(3) *Coordination*. For the WEM component, some good practice of donor coordination was observed, such as the harmonisation of a pollution survey questionnaire format with the Norwegian Institute for Water Research or the coordination of inspection-related training with ADB. For the EIA component, identifying the Project's roles and responsibility in relation to other donors was a huge challenge at the beginning. The issue was naturally settled as both the donors and the ECD coordinates their activities as the need arise. Because the donors for EIA are increasing, constant efforts are necessary in the future for the government to host an inclusive platform for aid coordination.

4. 4 Impacts

Key Evaluation Criteria for "Impact"

- The prospect for the Overall Goal of the Project to be achieved
- Whether other impacts/spill-over effects have been observed, whether positive or negative

Impact of this Project is RELTIVELY HIGH, because the outcomes of the Project satisfy the criteria, as follows:

- ***The attainment of Overall Goal Indicators is likely for two out of three indicators.*** For Indicator 2. "*Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC*", cooperation is necessary from wider stakeholders, such as the regional government. See "3.3 Prospect of Achieving Overall Goal Indicators" for detailed explanation.
- ***Knowledge sharing and application is taking place.***
  - Knowledge on inspections: the method of inspection from this Project has been applied to air pollution inspections by the CP members, as well as to Ministry of Industry and General Affairs Department with whom the CPs jointly conduct environmental compliance inspections.
  - Database applied to other sectors: some CPs informed that they are replicating the database format from Output 3, to manage the data for other sector work they have.
  - Pollution Source Survey is referred to not only by the CPs, but also by other donor.

[14] Except for the technical manual development, for a justifiable reason. See Project Purpose Indicator 2 for details.

4. 5 Sustainability

Key Evaluation Criteria for "Sustainability"

- Whether policies are in place to sustain the outcomes of this Project
- Within or among CP organisations, whether are the roles and responsibilities for future activities clear
- Whether the capacity of the CPs is sufficient to continue the now expert-supported activities on their own?
- Whether financial resource is secured for future activities?

Sustainability of this Project is MODERATE.

(1) *Policy environment*. In terms of policies, the activities and the outcomes of the Project are highly sustainable.

As described in 4.1, water pollution control and of the efficient EIA review are at the heart of the government's policy and political attention, and its importance is expected to augment further with the industrial growth. For the sustainability of each Output activities, specific laws and guidance – such as the water quality standard, comprehensive river water monitoring system, and the guidance on the regional implementation of the EMP monitoring, for example – will need articulating in the near future[15]. The existing guidelines may also need revising, to reflect more up-to-date situation of environmental management in Myanmar[16].

For pollution control measures to be effective, the awareness-raising of the factory owners are also critical (see Output Indicator 3-1 for more information).

(2) *Organisational issues*. For some CP organisations, their current mandate and the staff assignment may pose a challenge for the sustainability.

- The ECD will continue to play a key role in environmental management, as its mandate expands with the introduction of the EMP and ECC.
- For MCDC, frequent staff turnover is a hindrance to the lasting institutional memory, although so far the clear policy guidance has helped bind the organisation.
- For YCDC to continue the activities particularly related to WEM, the roles and responsibilities for a comprehensive river water monitoring in Yangon needs to be better defined. Without such a framework, some parts of the water quality monitoring and data management may fall through the cracks.
- Although the ECD's EIA division has a clear and lasting mandate, the staff to undertake the EIA review is insufficient. The efficiency of the EIA work in the future depends both on how

[15] According to the interview, ADB is currently assisting the ECD for the preparation of water quality guideline.
[16] Including updating of the reference values of the National Environmental Quality (Emission) Guideline, or the Annex A of the EIA Procedure.

well the technical manual will be utilised to reduce the volume of work, and how much staff increase the division can afford.

(3) ***Knowledge and skills***. There are some technical capacity challenges to sustainability.

- The Project was highly successful as an introductory project, stimulating awareness and capacity development in the field of the Project's assistance. There are activities that will continue once the CPs know why and how[17]; for other activities, such as the data interpretation under 4, the CPs do not yet feel full-fledged to perform them by their own.
- For ECD regional offices, the education for the growing number of new staff is a bottleneck to the future monitoring of the EMP implementation. For the project outcomes to contribute to their assignment, knowledge-dissemination from the project members to the new staff will be the key.
- For EIA, to have the technical manual in place, and to continue the EIA training for new recruits and for ECD regional offices is essential to sustain the work of the EIA division. Because the volume of work and the number of the staff in ECD regional offices are rapidly increasing, the capacity development needs will stay as huge as ever.

(4) Utilisation of the tools.

- Output1: Inspection manual is expected to be used in the future, as per the interview with the ECD headquarters (see Indicator 1-1).
- Output 3: The future of the databases for pollution sources and water quality depends on the purpose of monitoring the data is better defined in laws and regulations, as well as the roles and responsibilities among different organisations to undertake the monitoring.
- EIA: The tracking system is already in use, and is likely to be used in the future. Some stakeholders expect that the technical manual could be more user-friendly so that it will continuously be used without the guidance from the Japanese expert. Because the electronic technical manual is still under construction, insufficient time for the training of the manual cast a concern over sustainability, to which the second phase of this Project is likely to provide a solution.

(5) ***Budget***. So far as the Evaluation Team understood, the budget for future activities in the field of the Project's assistance – compliance inspections, water quality monitoring, data management, among others -- is not the most critical bottleneck. If the CPs know their priorities, and if they are able to present well to decision-makers, the budget is likely to follow. For this very reason, the Project focused on training the reporting skills of the CPs, and has made the development of a written strategy by YCDC and MCDC an indicator for the Overall Goal (see 3.3). The continuation of the activities from this Project by all the CPs, and the brainstorming for such a strategy/action plan by YCDC and MCDC, are keys to sustainability and to the attainment of the Overall Goal.

[17] The activities such as inspection procedures, and the frequency and spots of water sampling.

5. CONCLUSION

5. 1 Summary Progress and Findings

Launched in May 2015, the Project will complete its three-year cooperation in May 2018.

The Project started when the government had very limited legal documents or institutional memory, thus no guidance to refer to. All the CPs were extremely busy, but they were well-informed of the objectives and the activities of the Project, and committed. Owing to their commitment, the activities did not experience a major delay, and most of the key outputs are expected to be produced by the end of the Project in June 2018. The overall level of the attainment of the Project Purpose Indicators is also acceptable. Given the context surrounding the Project and the achievement it has made, it is fair to assess that the Project was successful.

5. 2 Key outputs and outcomes

(1) WEM: The Inspection Manual, which is now the first government's guidance document for environmental compliance inspection/ Water Quality Survey Report and Water Status Report/ Pollution Source Survey Report, which helped unveil the pollution source information that were unknown/pollution Source database and water quality database with GIS/ enhanced capacity in inspection, and water quality survey and analysis method.

(2) EIA: General- and sector-checklists, to guide the EIA reviews / the official forms to be filled out by EIA consultants/ Tracking System, to record the process of the EIA reviews /a prototype of the E-manual in mining sector, to be followed by the full-manual/capacity development for total 197 officers on EIA, including line ministries and ECD regional offices.

5. 3 Bottlenecks and Challenges

- The context of each city, including the changing role that the regional government plays in the WEM
- The sudden increase of the ECD work, especially of the ECD's EIA division, and the shortage of ECD staff

5. 4 Evaluation Result

- Relevance: *High*, for its consistency with policies and needs, and for appropriate project design
- Effectiveness: *High*. Given the context and achievements, the Project was successful.
- Efficiency: *Relatively High*. Although the Project lacked some inputs and coordination in the first year, the members were highly committed, and the Project was managed well.
- Impact: *Relatively High*, because the Overall Goals are likely to be achieved, and knowledge-sharing has been observed.
- Sustainability: *Moderate*. For some CPs, the mandate and the staff assignment still need to be clarified, and capacity development should continue.

6. Recommendations

6. 1 Actions before the end of the Project

Recommended actions	Project members in charge of the actions (Members who will cooperate or participate)					
	ECD-PCD	ECD-EIA	ECD regional	YCDC	MCDC	JET
(1) To the extent possible within the remaining cooperation period, strengthen the capacity development for Output 4. Organise another training session, as necessary.						X
(2) Organise an opportunity to present the water status report to decision-makers, within the current assignment of the Japanese experts.	X		(X)	X	X	
(3) Ensure that the development of the technical manual under Output 5 will complete.						X
(4) Ensure that the official forms for EIA consultants created under Output 5 will be uploaded in the EIA portal site, as soon as the website is renewed in April 2018.		(X)				
(5) As part of Output 4 activities, conduct a brainstorming exercise, for YCDC and MCDC to choose the types of written strategies to be prepared under Overall Indicator 2 "Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC."				X	X	X

6. 2 Actions for the future

Recommended actions	CPs in charge of the actions				
	ECD-PCD	ECD-EIA	ECD regional	YCDC	MCDC
(1) Utilise the data and information obtained from the Project for the preparation of future policies, guidelines and standards, including the Environmental Quality Standard, or the environmental statistics.	X				
(2) Ensure the soonest possible endorsement of the Consultant Licensing Scheme prepared through this Project, and make it operational.		X			
(3) Start the preparation of the written strategies for waste water management mentioned in (4) of "Actions for before the end of the Project", in cooperation with MONREC and with other relevant ministries such as Ministry of Construction and Ministry of Industry.				X	X
(4) Ensure that the outputs and tools developed through the Project are utilised in the future, including the manuals, databases, the EIA Tracking System, and the E-manual.	X	X	X	X	X
(5) Coordinate the donor assistance, so that the demarcation between the donors is clear.		X			
(6) Integrate the monitoring of the key parameters for water quality -- such as the ones selected for the Project's water quality surveys—into the routine tasks of each organisation.			X	X	X
(7) Share the knowledge gained from the Project, within, between, and outside of the CP organisations.	X	X	X	X	X
(8) Take concrete actions to raise awareness of factories and businesses on the environmental impacts of their activities.	X		X	X	X

Annex 1: Project Design Matrix

as of 2016/11/07

Project Title: Project for Capacity Development in Basic Water Environment Management and EIA System in Myanmar
Project Period: 3 years from June 2015 until June 2018
Target Area: Nay Pyi Taw, Yangon, Mandalay, the Hlaing River and the Doke Hta Waddy River.
Target Group: ECD of MONREC, PCCD of YCDC, and WSD of MCDC.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<Overall Goal> Impact of industrial effluents from industrial zones on river water quality is alleviated, and advanced EIA approach for complicated issues are taken into account.	1. The number of factories having waste water treatment plants increases compared to the number at the beginning of the Project. 2. Written strategies for waste water management in industrial zones are developed by YCDC, MCDC in coordination with MONREC. 3. Improvement of EIA procedure is identified by ECD through EIA reviews	• Database (baseline) Questionnaire • strategy • Proposal for EIA procedure revision	
<Project Purpose> Capacity for developing basic water pollution control measures based on obtained and interpreted information is enhanced and the institutional framework of the EIA review works is established.	1. Consideration for the water status in the pilot study area is made. 2 More than 80% of the EIA reviews by MONREC are implemented based on the technical manual developed by the Project.	• Survey report • EIA documents	1. National effluent standard is developed.
Output 1 Inspection procedure is standardized.	1. Inspections are implemented according to the inspection manual by YCDC, MCDC, and ECD.	• Records of Inspection	1. Responsibility of MONREC, YCDC and MCDC for water pollution control does not change. 2. YCDC and MCDC do not stop inspection system as a water pollution control measures. 3. Responsibility of MONREC for EIA review does not change. 4. Relevant legislation of EIA does not significantly change. 5. The draft final of the general technical guidelines prepared by the ADB team is submitted to MOECAF.
Output 2 Capacity for implementing water quality survey to obtain reliable information is enhanced.	1. Water quality survey reports are prepared in the pilot areas by YCDC and MCDC.	• Survey report	
Output 3 Database of water pollution sources and river water quality is developed.	1. At least 150 factories' information is accessible on the database. 2. Results of river water quality survey is accessible on the database.	• Database • Database	
Output 4 Capacity of interpreting the information for water pollution control measures is enhanced	1. Results of water quality status report in the pilot areas is presented to the dicision makers by MONREC, YCDC and MCDC.	• Presentation materials	

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Output 5 Necessary technical manuals and forms for the EIA review are developed.	1. The technical manual covers every sector (1) of development projects and every major stage indicated in the EIA procedure. 2. The draft official forms are internally approved.	• Technical manual and forms	
Output 6 Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced.	1. More than 80% of ECD officers in charege of EIA reviews received completion certificates from the Advanced EIA trainings. 2 Statistics of EIA reviews are presented. 3 EIA works by MONREC are presented at an international conference.	• Evaluation report of EIA • Proceedings	
<Activities> **Output 1: Inspection procedure is standardized.** 1-1 To collect information on water pollution sources (Name of a company, Location, Type of industry, Products, Production process, Volume of waste water, Pollutants, Waste water treatment method, location of waste water pits etc.) 1-2 To evaluate present inspection procedure 1-3 To develop an inspection manual 1-4 To implement trial inspections based on the inspection manual 1-5 To provide training on measures to control industrial effluent 1-6 To evaluate the trial inspection procedures **Output 2: Capacity for water quality survey is enhanced.** 2-1 To select a private or government laboratory which can provide reliable services of sampling and chemical analysis (BOD, COD, heavy metals and toxic substances) 2-2 To collect information on hydraulic observation, tide, water utilization and water pollution sources in the pilot study areas 2-3 To develop criteria for selecting sampling points, sampling time, measurement parameters etc. 2-4 To develop a water quality survey plan 2-5 To develop a water quality survey manual which includes procedures for on-site measurement, water sampling, sample preservation and sample storage 2-6 To implement a water quality survey based on the water quality survey plan 2-7 To supervise the water sampling referring to the water quality survey manual	<Inputs> Japanese side • Experts. • Training in Japan and other country. • Equipment: Multi-parameter water quality meter, PC with GIS software, GPS, digital camera and others Myanmar side • Counterpart personnel. • Office space accessible internet under the secure conditions with desks, chairs, meeting table(s)		

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
2-8 To verify the results of the water quality survey using the water quality survey manual 2-9 To prepare a water quality survey report			
Output 3: Database of water pollution sources and river water quality is developed with GIS software. 3-1 To collect and sort out the information on water pollution sources which was collected by the Activity 1-1, inspection results and the water quality survey results 3-2 To develop a system concept 3-3 To design the database based on the system concept 3-4 To collect additional information required to develop the database 3-5 To develop the database 3-6 To conduct training on operation and utilization of the database 3-7 To develop an operation and maintenance manual of the database			
Output 4: Capacity of interpreting the information for water pollution control measures is enhance. 4-1 To collect the information necessary for the water quality status report 4-2 To interpret the collected information 4-3 To prepare a water quality status report			
Output 5: Necessary technical manuals and legislation for the EIA operation are developed. 5-1 To draft legislation on demand including Official Submission Forms for the EIA. 5-2 To develop a technical Manual of the EIA review process. 5-3 To evaluate and update the Technical Manual to meet the ongoing EIA review processes. 5-4 To develop a database for recording the EIA review. 5-5 To draft legislaions for issuing licenses to EIA consultants			
Output 6: Capacity of MONREC and the EIA Report Review Body on the EIA review is enhanced. 6-1 To implement basic and advanced EIA trainings. 6-2 To implement EIA review works based on the EIA procedure 6-3 To record the EIA reviews. 6-4 To present leaflets and other materials for dissemination of EIA system 6-5 To develop a WEB site to disclose EIAs based on the new EIA system 6-6 To review and update the WEB site 6-7 To present activities on EIA review to an international conference			<Preconditions> 1. Japanese experts are assigned 2. C/Ps are assigned.

Note: The changes agreed by JCC members are shown in red.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption

(1) sectors are indicated in Annex A of EIA procedure.

Annex 2: List of Key Counterparts

Organization	Department	Name	Title
MONREC	ECD	Mr. Hla Maung Thein	Director General
		Mr. Sein Htun Linn	Deputy Director General
	ECD (PCD)	Mr. Min Maw	Deputy Director
		Dr. Tin Aung Win	Assistant Director
		Ms. Khin Myo Sat Aye	Deputy Staff Officer
	ECD (EIA)	Dr. San Oo	Director
		Mr. Htin Aung Kyaw	Assistant Director
	ECD Yangon	Ms. Khin Thidar Tin	Director
		Mr. Aung Aung Lay	Assistant Director
		Ms. Thet Wai Hnin	Deputy Staff Officer
	ECD Mandalay	Mr Tin Min Maung	Director
		Mr. Thant Zin Tun	Assistant Director
		Ms Daw Aye Moe Kyaw	Deputy Staff officer
		(Mr. Pyae Phyo Kyaw)	(Former Deputy Staff Officer)
YCDC	PCCD	Dr. Aung Myint Maw	Deputy Head of Department
		Mr. Bawi Kyone	Assistant Head of Department
		Ms Yadanar Wuttyi Soe	Deputy Supervisor
	WSD	Mr. Wai Lwin	Assistant Chief Engineer
		Ms Daw Khin Aye Myint	Executive engineer
MCDC	WSD	U Myo Thant	Deputy Director
		Mr. Khin Maung Thin	Division Chief/Deputy Head of Department
		Ms. Thwe Hnin Aung	Head of Division
		Mr. Aung Khin Myint	Junior Engineer
		Ms. Tin Tin Hla	Laboratory Supervisor
		Ms. Hnin Yi Phue	Laboratory Staff
	CD	Mr. Than Htut	Head of Division
		Mr. Win Swe	Staff Officer

Created based on the information from JET and from the interviewed CPs.

Annex 3: Evaluation Schedule

Day	Date	Time	Hotel	Activities	
				Evaluation consultant	JICA HQ
February 2	Fri			Departure from Tokyo Arrival in Yangon	
February 3	Sat		Yangon	Meeting with Japanese experts (Water Env team)	
February 4	Sun		Yangon	Preparation for interview	
February 5	Mon		Yangon	Meeting with YCDC (PSSD) Meeting with YCDC(WSD)	
February 6	Tue	AM	Yangon	Meeting with ECD Yangon	
		PM		Meeting with Myanmar Chamber of Commerce (UMFCCI)	
February 7	Wed		Mandalay	Departure for Mandalay Meeting with ECD Mandalay	
February 8	Thu	AM	Mandalay	Courtesy call to MCDC Committee Member Meeting with MCDC (WSD)	
		PM		Factory visit/return to Yangon	
February 9	Fri	AM	Yangon	Visit to JICA Myanmar office	
		PM		Preparation of draft evaluation report	
February 10	Sat	AM	Yangon	Meeting with Norway Insitute for Water Research	
		PM		Preparation of draft evaluation report	
February 11	Sun	AM	Yangon	Preparation of draft report	
		PM			
February 12	Mon	AM	Yangon	Preparation of draft report	
(holiday)		PM			
February 13	Tue		Yangon	Meeting with EIA expert Project site visit (Hlaing Tharyar)	
February 14	Wed	AM	Yangon/ Nay Pyi Taw	Departure for NPT	
		PM	Nay Pyi Taw	Meeting with ECD's Pollution Control Section Meeting with Deputy Director General of MONREC-ECD	
February 15	Thu	AM	Nay Pyi Taw	Preparation of draft evaluation report	
		PM		Meeting with ADB	
February 16	Fri	AM	Nay Pyi Taw	Meeting with ECD's EIA section director	
		PM		Preparation of draft evaluation report	
February 17	Sat	AM	Nay Pyi Taw	Drafting of evaluation report	
		PM			
February 18	Sun		Yangon(JICA HQ) Nay Pyi Taw(Consultant)	Drafting of evaluation report	Departure from Narita Arrival in Yangon
February 19	Mon		Nay Pyi Taw	Internal meeting	Departure from Yangon
February 20	Tue		Nay Pyi Taw	Meeting with Japanese experts Courtesy call to Director General of MONREC-ECD	
February 21	Wed		Nay Pyi Taw	Courtesy call to Union Minister of MONREC Finalisation of the report/preparation for JCC	
February 22	Thu		Nay Pyi Taw /Yangon	JCC Departure from Nay Pyi Taw to Yangon	
February 23	Fri			Reporting to Embassyand JICA office Departure from Yangon for Japan	
February 24	Sat			Arrival in Japan	

Annex 4: List of Equipment Provided

Laptop computers(with GIS)	2
Projector	1
GPS	3
Colour printer	1
Multiple printer(black & white)	1
Multiple printer(colour)	1
Water Flow Meter (for river flow)	1
Desktop computer Inverter UPS for power shortage	7
Portable scanner	1
Camera	1
Water Quality Meter	5
Water Flow Meter (for inspection activity)	5
COD Monitoring Set	1
Total Nitrogen Analysis Set	1
Laptop computer for EIA	2
Desktop computer for EIA	4

Annex 5: List of participants to the training in Japan

	Participants	Organization	Course title
1st training in Japan (22-28 May 2016)			
1	Mr. Zaw Moe	MONREC	1st study program in Japan for the Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar
2	Mr. Thin Thin Nu	MONREC	
3	Mr. Zaw Tun Aung	MONREC	
4	Mr. Myint Sein	YCDC	
5	Mr. Zaw Zaw Tun	MCDC	
6	Ms. Thwe Hnin Anug	MCDC	
2nd training in Japan (28 September – 4 October 2016)			
7	Mr. Min Maw	MONREC	Planning and Implementation of Water Quality and Pollution Source Control (1)
8	Mr. Myo Thein	YCDC	
9	Mr. Khin Maung Thin	MCDC	
10	Mr. Bawi Kyone	YCDC	
11	Ms. Thwe Naing Oo	YCDC	
12	Mr.Win Swe	MCDC	
13	Mr. Aung Zaw Moe	MCDC	
14	Ms. Khin Myo Sat Aye	MONREC/ECD	
15	Mr.Pyae Phyo Kyaw	MONREC/ECD	
16	Ms. Thet Wai Hnin	MONREC/ECD	
3rd training in Japan (28 August – 14 September 2017)			
17	Ms. Khin Thida Tin	MONREC/ECD	Planning and Implementation of Water Quality and Pollution Source Control (2)
18	Mr. Thant Zin Tun	ECD Mandalay	
19	Mr. Bawi Kyone	YCDC	
20	Mr. Soe Zaw	YCDC	
21	Ms. Yadanar Wuttyi Soe	YCDC	
22	Mr. Zaw Min Oo	MCDC	
23	Mr. Aung Khin Myint	MCDC	
24	Ms. Kyawt Kay Khaing	MCDC	
25	Ms. Saw Sanda Win	Ministry of Transportation	
26	Ms. Khaing Khaing Soe	Ministry of Health and Sports	
27	Mr. Tun Tun Aung	Ministry of Agriculture, Livestock and Irrigation	
28	Ms. Swai Thi Htut	Ministry of Industry	
29	Mr. Kyaw Zin Tun	Ministry of Education	

MINUTES OF JOINT COORDINATING COMMITTEE MEETING NO.5

PROJECT FOR CAPACITY DEVELOPMENT IN BASIC WATER ENVIRONMENT MANAGEMENT AND EIA SYSTEM

IN

THE REPUBLIC OF THE UNION OF MYANMAR

Nay Pyi Taw, 17 May 2018

for 岩井伸夫

Mr. Masayuki Karasawa
Chief Representative
JICA Myanmar Office

Mr. Hla Maung Thein
Director General
Environmental Conservation Department
Ministry of Natural Resources and Environmental Conservation

Dr. Itaru Okuda
Leader, JICA Exert Team

These are the minutes of the Joint Coordinating Committee (JCC) meeting No.5 of the project entitled "Project for Capacity Development in Basic Water Environment Management and EIA System in the Republic of the Union of Myanmar", which has been implemented in accordance with the Record of Discussions (R/D) agreed on 23 December 2014 between the then Ministry of Environmental Conservation and Forestry (MOECAF; superseded by Ministry of Natural Resources and Environmental Conservation (MONREC) in 2016) and Japan International Cooperation Agency (JICA).

The meeting was held on 17 May 2018 at the conference room of Environmental Conservation Department (ECD) of MONREC in Nay Pyi Taw. The agenda of the meeting and the list of participants are given in Attachments 1 and 2. Based on the presentations and discussions, the JCC members agreed on the following matters:

(1) Closing of the Project Activities in Myanmar

The committee members confirmed that all project activities in Myanmar have been executed successfully according to the Project Design Matrix (PDM) and the Plan of Operation (PO). The members agreed to close the project activities in Myanmar as of 17 May 2018.

(2) Distribution of Final Report

JET shall finalize the final report of the project (Water Environment Management Component only), and submit the required numbers of hard copies and soft copies to JICA by 5 June 2018. JICA shall send 21 hard copies of the report together with 21 sets of electronic copies of the report to ECD. ECD shall distribute the report to all members of JCC.

(3) Trial Use of EIA E-Manual

ECD shall thoroughly test the EIA E-Manual developed in the project, and feed-back the experiences and issues to JICA.

(4) EIA Consultant Licensing Scheme

ECD shall finalize the Myanmar version of the EIA Consultant Licensing Scheme.

(5) Sharing of the Project Outcomes through the ECD Website

ECD shall share the outcomes of the project widely with the general public through ECD's website and/ or other relevant means of ECD.

End

Attachments:

Attachment 1: Agenda of the Joint Coordinating Committee Meeting No.5

Attachment 2: List of participants

Attachment 3: List of members of Joint Coordinating Committee

JICA Project for Capacity Development
in Basic Water Environment Management and EIA System
in the Republic of the Union of Myanmar

Agenda of Final Seminar in Nay Pyi Taw and Joint Coordination Committee Meeting No. 5

Objectives: - To share final outputs of the Project
- To share recent activities of water environment management in Myanmar
- To conclude the project activities in Myanmar

Date and Time: 17th (Thursday) May 2018, 09:00-12:00

Place: Meeting Room of ECD, MONREC

Participants: Representatives of ECD, Yangon ECD Region, Mandalay ECD Region/ MONREC, YCDC, MCDC, MOH, MOTC, MOI, MOE, MOALI, Embassy of Japan, JICA, and JET

Language: English (consecutive translation available for discussions)

Time	Contents	Speaker
09:30-09:35	Opening remarks	Director General, ECD, MONREC
Session 1: Introduction of Project Activities		
09:35-09:45	Overall project activities	JET (Dr. Itaru Okuda)
09:45-10:05	Water quality monitoring	JET (Ms. Tomoe Takeda)
10:05-10:30	Industrial pollution sources	JET (Dr. Itaru Okuda)
10:30-11:00	Water quality status and case studies for water environment management in Myanmar	JET (Mr. Shunsuke Hieda)
11:00-11:10	Report of activities on EIA Component	EIA Division of MONREC-ECD
Session 2: Water Environment Management Activities in Myanmar		
11:10-11:25	Activities of pollution control and domestic wastewater control in Yangon by YCDC	YCDC-PCCD
11:25-11:40	Activities of pollution control and domestic wastewater control in Mandalay by MCDC	MCDC-WSD
11:40-11:55	Activities of nationwide water environment management by ECD	ECD HQ
11:55-12:25	Discussions and comments on Final Report	-
12:25-12:30	Signing of Minutes of Meetings	Representative of MONREC Representative of JICA Myanmar Office
12:30	Closing remarks	Representative of MONREC Representative of JICA Myanmar Office

List of participants of Joint Coordinating Committee Meeting No.5

No.	Name	Title	Name of Organization
Participants from Myanmar Side			
1.	Mr. Hla Maung Thein	Director General	ECD, MONREC
2.	Mr. Min Maw	Deputy Director General	ECD, MONREC
3.	Dr. Tin Aung Win	Assistant Director	ECD, MONREC
4.	Ms. Saw Sandar Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), MOT
5.	Dr. Khaing Khaing Soe	Deputy Director	MOHS
6.	Dr. Thar Htet Kyaw	Deputy Director	MOST
7.	Mr. Tun Tun Aung	Assistant Director	MOALI
8.	Ms. Swe Thi Htut	Assistant Director	MOI
9.	Mr. Bawi Kyone	Assistant Department Head	PCCD, YCDC
10.	Mr. Wai Lwin	Assistant Department Head	WSD, YCDC
11.	Mr. Khin Maung Thinn	Assistant Director	WSD, MCDC
12	Ms. Thin Thin	Assistant Director	ECD Mandalay
13.	Ms. Thet Wai Hnin	Deputy Staff Officer	ECD Yangon
14.	Mr. Tin Min Htoo	Assistant Director	ECD, MONREC (EIA)
15.	Dr. Tin Tin Than	Deputy Director	ECD, MONREC (EQS)
16.	Dr. Win Win Mar	Assistant Director	ECD, MONREC
17.	Ms. Mya Thandar Tin	Assistant Director	ECD, MONREC
18.	Ms. Pan Ei Phyu	Staff Officer	ECD, MONREC
19.	Ms. Myat Su Yee	Staff Officer	ECD, MONREC
20.	Ms. Aye Ma	Staff Officer	ECD, MONREC
Participants from Japanese side			
21.	Mr. Nubuo Iwai	Representative JICA Myanmar Office	JICA Myanmar

22.	Mr. Hayato Nakamura	Project Formulation Advisor	JICA Myanmar
23.	Ms. Thet Thet Zaw	Assistant Program Officer	JICA Myanmar Office
24.	Mr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team
25.	Mr. Shunsuke Hieda	Deputy Team Leader, Water Quality Survey	JICA Expert Team
26.	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team
27.	Ms. Ei Ei Mon	Environmental Expert	JICA Expert Team
28.	Ms. Ni Lar Wynn	Environmental Expert	JICA Expert Team
29.	Ms. Betty Ni Ni Chan	Project Coordinator	JICA Expert Team
30.	Ms. Thet Su Su Hnin	Assistant Environmental Expert	JICA Expert Team
31.	Ms. May Thinzar Kyaw	Junior Assistant Environmental Expert	JICA Expert Team

List of members of Joint Coordinating Committee

As of 17 May 2018

No.	Name	Title	Organization
Members from Myanmar Side			
1	Mr. Hla Maung Thein	Director General (DG)	ECD, MONREC
2	Mr. Sein Htoon Linn	Deputy Director General (DDG)	ECD, MONREC
3	Mr. Htun Naing Win	Director	Directorate of Water Resources and Improvement of River Systems (DWIR), Ministry of Transport
4	Dr. San Oo	Director	ECD, MONREC
5	Dr. Kyi Lwin Oo	Director	Occupational and Environmental Health Sub- Department, Department of Public Health, Ministry of Health and Sports
6	Dr. Thar Htet Kyaw	Deputy Director (DD)	Research and Innovation Department, Ministry of Education
7	Ms. Mya Mya Thet	Assistant Director (DD)	Department of Industrial Inspection and Supervision, Ministry of Industry
8	Mr. Bawi Chung	Assistant Department Head	Pollution Control and Cleansing Department, Yangon City Development Committee
9	Mr. Khin Mg Thinn	Assistant Director (Engineering)	Water and Sanitation Department, Mandalay City Development Committee
10	Mr. Tun Tun Aung	Assistant Director	MOALI
11	Mr. Min Maw	Director	ECD, MONREC
12	Dr. Tin Aung Win	Assistant Director	ECD, MONREC
Members from Japanese Side			
13	Mr. Masayuki Karasawa	Chief Representative	JICA Myanmar Office
14	Mr. Senro Imai	Project Advisor	JICA
15	Dr. Itaru Okuda	Leader, Industrial Effluent Management	JICA Expert Team

No.	Name	Title	Organization
16	Dr. Kanji Usui	EIA Technical Manual and Review Process	JICA Expert Team
17	Mr. Shunsuke Hieda	Water Quality Survey	JICA Expert Team
18	Ms. Tomoe Takeda	Water Sampling and On-site Measurement	JICA Expert Team
19	Mr. Hiroaki Nakagawara	Database Development with GIS	JICA Expert Team
20	Mr. Toshiyuki Nishio	Industrial Effluent Treatment	JICA Expert Team