

Environmental Monitoring Report

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VIE: Phuoc Hoa Water Resources Project

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AFD	Agence Française de Développement
DARD	Department of Agriculture and Rural Development
DTPW	Department of Transport and Public Works
DOC	Department of Construction
DOF	Department of Finance-Pricing
DONRE	Department of Natural Resources and Environment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographical Information System
HCMC	Ho Chi Minh City
ICOE	Institute of Coastal and Offshore Engineering
ICMB9	Investment and Construction Management Board No.9
IDA	International Development Association (of the World Bank)
JBIC	Japan Bank for International Cooperation
MARD	Ministry of Agriculture and Rural Development
MONRE	Ministry of Natural Resources and Environment
PAF	Project Affected Families
PHWRP	Phuoc Hoa Water Resources Project “the Project”
RAP	Resettlement Action Plan
RFP	Request for Proposals
RPF	Resettlement Policy Framework
TOR	Terms of Reference
WB	World Bank

NOTES

- The fiscal year (FY) of the Government of Vietnam and Ministry of Agriculture and Rural Development ends on 31 December. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2011 ends on 31 December 2011.
- In this report, "\$" refers to US dollars.

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FOREWORD

Phuoc Hoa Water Resources Project (Project) consists of two parts: Part A – Support for Institutional and Integrated Development, and Part B – Construction of Water Resources Infrastructure. Currently, the project has implemented a series of components including construction of the Headworks of Phuoc Hoa reservoir, Phuoc Hoa – Dau Tieng transfer canal, and Tan Bien irrigation Main Canal. These construction activities and their effect on the natural and hydrological conditions in the area have caused different negative and positive impacts to the environment. The aim of the Environmental Packages (Packages) is to collect environmental indicators regularly and other related issues, record and detect different impacts of the Project to the environment in order to adjust, overcome and mitigate any negative environmental impacts.

For the purpose of coordination, monitoring, and implementation of the EMP packages, this six-monthly progress report will summarize all activities and the implementation status of these Packages. The report will also orientate and guide in implementing the tasks of EMP packages as well as monitor and speed up the implementation progress of the tasks as in proposed schedules. In addition, the report also monitors the current situation in the project area and its vicinity, and develops the database for the environmental management programs of the Project. Meanwhile the report aims to ensure that project implementation can be made in compliance with the EMP and the Environmental Protection Law of Vietnam.

The six-monthly progress report is a basis for ICMB9 to upgrade their tasks of management and coordination and it also helps ADB and others to monitor the implementation status of the project as well as the concerned environmental changes.

1. Introduction

1.1. Phuoc Hoa Project Introduction

- (i) Phuoc Hoa Water Resources Project is funded jointly by the Asian Development Bank (ADB) and Agence Française de Développement (AFD) with a total amount in loans and Special Drawing Rights (SDR) equivalent to 217.27 million USD. The loans were agreed in 2 phases, for the 1st phase in 2003 and for the 2nd phase in 2011/2012. The closure dates are in 2014 and 2017 for ADB and AFD loans respectively.

All loans are summarized in the table below.

Loans	Amount (US\$ million)	Date		
		Approval	Signed	Effective
ADB loan	SDR 63.042 million equivalent to US\$ 90 million	27 November 2003	08 April 2004	23 August 2004
Two AFD loans	EUR 29.6 million equivalent to US\$ 2.270 million	20 November 2003	20 August 2004	20 August 2004
ADB loan supplemental	SDR 38.594 million equivalent to US\$ 60 million	27 May 2011	27 May 2011	30 September 2011
AFD loan supplemental	EUR 20 million equivalent to US\$ 25 million	25 May 2012	7 September 2012	7 September 2012
Total	217.27			

- (ii) The project objective is to provide additional water to Sai Gon River and Vai Co East River for agriculture development (with irrigation) and enhance current water sources supply in order to control salinity, domestic, municipal industrial water supply (DMI) to Ho Chi Minh City and neighbouring provinces. This project will use the approach of integrated development to increase agricultural production by enhancing effective and sustainable water resources management.
- (iii) The Project consists of two parts: Part A – Support for Institutional and Integrated Development, and Part B – Construction of Water Resources Infrastructure.
- (iv) The Project will support construction of the Phuoc Hoa barrage and transfer canal to convey water from the Be River to the existing Dau Tieng reservoir on the Saigon River. Under Phase 2, two new irrigation areas will be constructed: Tan Bien irrigation system in Tay Ninh Province; and Duc Hoa irrigation system in Long An Province. The ADB loans are financing the main infrastructure: Phuoc Hoa barrage, Phuoc Hoa – Dau Tieng transfer canal and the 2 main irrigation canals as well as project management costs. The AFD loans are financing infrastructure development of tertiary canals for the irrigation systems and support for the on-farm and social development

program (OSDP).

- (v) The executing agency (EA) is the Ministry of Agriculture and Rural Development (MARD), which originally provided overall management and coordination through its Central Project Office (CPO) based in Hanoi. In order to improve project management and coordination, from November 2006, MARD assigned the overall responsibility for project implementation to Investment and Construction Management Board No.9 (ICMB9) in Ho Chi Minh City (HCMC), and Departments of Agriculture and Rural Development (DARDs) of four provinces (Binh Duong, Binh Phuoc, Tay Ninh and Long An). ICMB9 provides an interface with the ADB and AFD, and is directly responsible for management and construction of the Phuoc Hoa Barrage, Phuoc Hoa – Dau Tieng transfer canal, and main canals for the two irrigation systems, and for transfer of infrastructure to Dau Tieng Irrigation management company (IMC) for management and operation. The role of ICMB9 is to provide overall management assistance and coordination, and to provide instruction to the DARDs and PPMBs with assistance of Black & Veatch International (BVI) Consultants.
- (vi) Project environmental management and Environmental Impact Assessment (EIA) study was prepared by Black & Veatch International (BVI) in September 2001 (BVI 2001a and approved by the Asian Development Bank (ADB) in March 2003 (ADB 2003a). In accordance with Vietnamese environmental law, a third EIA report (ENTEC 2007) was carried out in April 2005 by the Environmental Technology Centre (ENTEC), under contract (A41) to ICMB9 from 2005 - 2007. This EIA was revised and submitted to the Ministry of Natural Resources and Environment (MONRE) for approval in September 2007. MONRE approved the project EIA in early 2008.

As required by ADB, a follow-up Environmental Management Plan (EMP) for the Project was prepared by BVI in late 2006 – 2007 period (BVI 2007c). The EMP was approved by MARD and ADB in January 2008. The EMP documents provide details of the environmental management, monitoring and protection programmes.

1.2. Package OP4 Introduction

1.2.1. The Scope of Works of OP4 Package comprises:

- Overall management, co-ordination, supervision and monitoring of the Phuoc Hoa Water Resource Project environmental and EMP implementation programmes;
- Supervision and monitoring of environmental programmes and EMP implementation consultants and contracts;
- Collection, storage and distribution of EMP monitoring data, technical reports

and civil contracts or EMP techniques for project extension, providing the information of progress and budgets from EMP consultants and other Provincial sources, and presenting these data in accordance with an appropriate format;

- Carry out field surveys and keep contact with provincial governments and communities to inspect the environmental conditions in the project area and its vicinity as well as downstream areas in order to ensure that construction contracts, EMP and project activities are implemented in accordance with environmental laws, safeguards and signed agreements;
- Provide main information of the report and comments to ICMB9 regarding problems and solutions relating to the EMP implementation, EMP consultants' performance, environmental trends in the project area or within river basin of the project and environmental impacts from the project;
- Acting as a spokesman for the environmental aspect of the project and representing ICMB9 in general scope and official forums relating to ministerial, provincial levels and communities as well as media liaison;
- Provide six-monthly reports to ICMB9, MARD, ADB, AFD, MONRE, and local governments, PPCs in the project areas as well as organisations and individuals that are in charge of the above mentioned tasks. Environmental staffs, the environmental division of ICMB9, consultants and contractors must comply with environmental requirements of the Project.

1.2.2. Specific Tasks of OP4 Package

- Understanding the existing and proposed Phuoc Hoa water resources project environmental management programme;
- Management, supervision and monitoring the work of EMP implementation contractors and contracts;
- Supervision and monitoring of EMP implementation programmes and environmental compliance;
- Supervision and monitoring of environmental outputs, environmental trends and project environmental impacts;
- Ministerial, provincial and public liaison;
- Reporting and data distribution.

2. Activities of OP4, BVI and ICMB9 in the last six months 2012

2.1. Activities of OP4

Based on the TOR, and in order to implement the tasks of coordination and supervision of EMP packages, OP4 consultant has carried out activities including meetings with EMP consultants, employer, donors, local authorities and others relating to relevant issues of the project as follows:

- On 13rd November 2012, had a briefings meeting with representatives of ICMB9, BVI, OP4, EMP packages.
- On 21st November 2012, had a meeting with representatives of ICMB9, BVI, MT2, MT4 packages on the preparing for the semi-flooded areas management, catchment and aquiculture protection of Phuoc Hoa Reservoir workshop.
- On 4th January 2013, attended the semi-flooded areas management, catchment and aquiculture protection of Phuoc Hoa Reservoir conference with participation of representatives of MARD, ADB, ICMB9, BVI, Phuoc Hoa – Dau Tieng IMC, MT2, MT4 packages, and local authorities.
- On 20th March 2013, had a briefings meeting with representatives of ICMB9, BVI, OP4, and EMP packages.
- On April 2013 had a meeting with representatives of ICMB9, OP4, and EMP packages to check up on the outstanding issues of each packages that were mentioned on the Aide Memoire of ADB, and setting up the implementation plan for solving there issues above (see the detail of contents in Item 10.1.3).

In addition to aforementioned meetings, the OP4 consultant has also cooperated with relevant agencies to involve in field surveys in the project area and worked with local authorities, such as on 17th October 2012 cooperated with representatives of ICMB9 and MT8 package carried out surveying, assessing construction activities of monitoring stations, installation of environment and water level monitoring equipment at Bien Hoa, Binh Duong, and Long An station.

In accordance with each package's TOR, the review and assessment activities of implementation results of EMP packages through progress reports have also been carried out frequently.

2.2. Activities of ICMB9

In the last six months of 2012, ICMB9 cooperated with BVI and OP4 consultants to carry out some main contents as follows:

- Overall management on the progress and implementation of EMP packages;
- Organized meetings with the relevant authorities in order to monitor supervise

and speed up the progress as well as to solve outstanding issues of EMP packages.

- Worked with local authorities regarding the implementation of packages MT1, MT2, MT8, MT7, MT4;
- Inspected, speeded up EMP packages to implement the aide memoir of ADB on 2nd May 2012.
- Inspected, evaluated and requested construction contractors to implement the Environmental Management Plan of the project seriously.

2.3. Activities of BVI

The main activities of BVI consultant in the last six months of 2012 included:

- Supported ICMB9 in carrying out the management and implementation of EMP packages.
- Cooperated with OP4 Consultant to comment and assess the implementation results of EMP packages through their progress reports of consultants.
- Attended and organized meetings between the EMP consultants and local authorities.
- Cooperated with ICMB9 and relevant environmental consultants such as MT2, MT4, MT7, MT8, OP4, and others to implement works as indicated in the Aide-Memoir of ADB dated 2nd May 2012.
- Supported ICMB9 and MT2, MT4 packages arranged the semi-flooded areas management, catchment and aquiculture protection of Phuoc Hoa Reservoir conference successfully.
- Supported ICMB9 in preparing the documents for additional Packages that are going to be tendered such as MT1, MT9 and OP3.

3. Implementation of EMP packages in the last six months of 2012

3.1. Package MT1

The contract agreement of Package MT1 was signed in September 2012. Consultant has carried out Inception Conference in the Lo Go – Xa Mat National Park. At the same time, the Inception Report was completed according to proposal schedule. At present, Consultant is implementing their coming tasks.

3.2. Package MT2

The contract agreement of Package MT2 was signed in April 2010. The consultant has carried out office works and field surveys. In the last six months of 2012, the consultant submitted the Quarterly reports III and the second Interim report.

According to the TOR, package MT2 consists of two specific tasks: Task I: study on the Be River catchments protection; Task II: Phuoc Hoa reservoir reforestation and forest management programme. Each main task consists of detailed tasks. Based on the implementation results in the last six months, the implementation of the package MT2 can be assessed as follows:

Task I-A '**Erosion risk survey, report and data collection**': this task has been finished up to the report time.

Task I-B '**Field survey of risk erosion sites**': in the last six months, the flow of Be River downstream (after the Phuoc Hoa dam) was not fluctuated a lot, therefore, Consultant was not conducted field surveys.

Task I-C '**Catchment Protection Site Selection**': The consultant finished the forest GIS database.

Task I-D '**Scoping and Awareness Workshop**': under the support of MARD, BVI, ICMB9, Consultant joined in arranging the semi-flooded areas management, catchment and aquaculture protection of Phuoc Hoa Reservoir conference

Task I-E '**Follow-up Planning Meetings and Workshops**': Although large-scale workshops were not held, discussions were made during the implementation.

Task I-F '**Species, Planting Configuration and Management Options**': this task is substantially completed. The set of criteria for the selection of trees for forestation is established. Trees that will be selected for the forestation include *Hopea odorata*; *Lagerstroemia loudoni*; *Dipterocarpus alatus*; *Dalbergia tonkinensis*; *Pterocarpus macrocarpus*, etc;

Task I-G '**Nurseries and Plant Material Supply Review**': the consultant made contact with the seedling suppliers for the forestation.

Task I-H '**Development of Catchment Protection Investment Plans**': this

task has been implemented by the consultant. However, some issues regarding the forestation for catchment protection, particularly the semi-flooded areas are arising.

Task I-I '**Development of Monitoring, Evaluation and Management Framework**': this task was carried out in the previous period. In the last six months of 2012, the consultant only reviewed and finalised the anti-erosion and reforestation framework.

Task II-A '**Nurseries & Plant Material Supply**': because some issues with the forestation for catchments protection are arising, this task is being suspended.

Task II-B '**Forest & Agro-forest Establishment**': is underway.

Task II-C '**Monitoring, Evaluation & Protective Management**': is underway.

Problems, causes, and remedial measures:

Problem 1: *Erosion downstream of Be River when the dam is impounded.*

Problem 2: *Some areas with elevations between +42.90 m and +44.00 m are being flooded with varying frequencies.*

Problem 3: *the reoccupation of project acquired land by the local communities for rubber tree plantation.*

Problem 4: *The forestation in semi-flooded area.*

On the aforementioned issues, the conference on 4th January 2013 analysed and concluded that the project semi – flooded areas have been compensated and revoked to serve the reservoir protection purposes. Therefore, these areas need to be managed by the government agencies, and obey the decree No.112/2008/NĐ-CP and the circular No.03/2012/TT-BTNMT, at the same time, in order to satisfy the project objectives, the semi – flooded areas need to be cover with vegetation cover to reduce erosion as follows:

- Dam Owner coordinates with communes in project areas to conduct setting up landmarks for the semi – flooded areas, after that hand over to Commune People's Committees for management.
- Commune People's Committees coordinates with District People's Committees conduct land use planning for the semi – flooded areas obey Vietnamese law and satisfy the project objectives.
- MT2 consultant has stopped conducting the reforestation task, and this task will be replaced with supporting the Dam Owner, District and Commune People's committees carry out land use planning for the semi – flooded areas.

3.3. Package MT3

The contract agreement of Package MT3 was signed on 21 September 2011 and the consultant has carried out his tasks as required in the consulting contract. The implementation status can be evaluated as follows:

Task 1 '***Understanding of the domestic water supply program for Be river basin and Duc Hoa area***' this task has been finished.

Task 2 '***Investigation, choice of location and technology, and preparation of cost estimate for water supply station in Be river basin***'

The Domestic water supply system in Cay Truong Commune, Ben Cat District, Long An Province, the following reports have been finished:

- Feasibility Study;
- Design documents and drawings;
- Design cost estimate;
- Bidding documents;

Task 3 '***Investigation, choice of location and technology, and preparation of cost estimate for water supply station for Duc Hoa area***'

The Domestic water supply system in Tan My Commune, Duc Hoa District, Long An Province, the following reports have not been finished yet:

- Feasibility Study;
- Design documents and drawings;
- Design cost estimate;
- Bidding documents (is underway).

3.4. Package MT4

The contract agreement of Package MT4 was signed in January 2010. At present, the MT4 consultant completed the Inception report, and the annual reports of 2010, 2011, the first interim report, the first six monthly of 2012. The consultant has not yet submitted the last six-monthly report of 2012.

In the last six months of 2012, the consultant continued to implement the tasks as required in TOR but the progress of preparation and submission of reports was still slow. According to the TOR, package MT4 consists of 09 specific tasks. We, OP4 consultant assessed the implementation status up to now as follows:

Task I "***Understanding the proposed Be River and Phuoc Hoa fishery, Reservoir and Fish pass management program***": this task has been implemented early, the basic information was collected and analysed. Recently, the consultant has

continued to update the statistic data of the fishery sector of Binh Duong and Binh Phuoc provinces in 2011 and 2012.

Task II “**Monitoring Hydrology and environmental flows management**”: This task has been done regularly and continuously. The main data was collected from the data of packages MT5 and MT6.

Task III “**Monitoring the fish pass construction**”: During the reporting phase, The MT4 consultant supervised and monitored the construction of the fish pass. Up to now, the construction of the fish pass was finished. In the last six months of 2012, the consultant conducted 2 field surveys respectively.

Task IV “**Establishment of Be River and Phuoc Hoa forest and fisheries association**”: This is one of the key tasks of the package. On 9 December 2012, the consultant held a meeting with representatives of ICMB9, BVI, MT4, and Binh Phuoc aquiculture Centre to discuss the establishment of Phuoc Hoa Fishery Resources Exploitation And Protection Association.

Task V “**Operation and Protection of Fish Pass**”: Recently, Consultant also conducted two field inspections to the fish pass on 27 June and 9 December 2012. Due to during the survey time the fish pass was empty then they could not catch fish to make a check.

Task VI “**Phuoc Hoa reservoir fishery management plan**”: in the last six months of 2012, relating to this task, Consultant also conducted field surveys together with fish pass surveys.

Task VII “**Social support and compensation for affected fishermen**”: Consultant has continued to collect further relevant information of Binh Duong Province. According to MT4’s report, land acquisition and compensation were implemented quite well.

Task VIII “**Management of Be River and lower Dong Nai fishery**”: The main contents of this task are to prepare fishery management plans and action plans for Be - Dong Nai Rivers basin. Recently, main activities were the collection of relevant documents/data collection, training for the aquatic resource protection and conducting field surveys, etc.

Task IX “**Monitoring and evaluation of Be River fishery management program**”: the consultant is studying, aimed at understanding the fisheries management models of other provinces with a similar program so that the consultant will be able to apply these similar programs for the Be River basin in future.

In general, up to now, the remaining workload of package MT4 is still quite big, the key tasks of this package are underway such as establishing the Phuoc Hoa Fisheries Association, O&M manual for the fish pass is underway. The operation

methodology of the fish pass is discussing with Dau Tieng – Phuoc Hoa IMC. In recent, Consultant has sent to ICMB9 temporary regulation of operation and management the fish pass.

According to plan, MT4 package is going to end in 2013, therefore, with the remaining tasks, Consultant need to have a implementation plan promptly, because of the dependence of these tasks on local agencies are so much.

3.5. Package MT5:

Up to the end of December 2012, the consultant has monitored the water flow at 7 stages. The details of these measurements are presented in Table 1. The monitoring activities have been made seriously and sufficiently. These monitoring activities were consistent with current governmental norms and regulations and met the requirements of the TOR. However, the submission of reports of MT5 consultant is still behind the schedule.

Table 1: Monitoring stages of water flow of package MT5

No.	Date		No. monitoring stations	Monitoring stations	Notes
	From	To			
1	17/10/2009	22/10/2009	6	From Q1 to Q6	
2	20/04/2010	25/04/2010	6	From Q1 to Q6	
3	7/10/2010	12/10/2010	6	From Q1 to Q6	
4	20/04/2011	25/04/2011	6	From Q1 to Q6	
5	13/10/2011	18/10/2011	6	From Q1 to Q6	Monitoring station Q5 was moved to upstream with a distance of 1.0 km as proposed by BVI.
6	23/04/2012	28/04/2012	8	From Q1 to Q8	Provided 2 additional monitoring stations at the fish pass and downstream of the dam.
7	02/10/2012	07/10/2012	8	From Q1 to Q8	

At present, the field surveys have been made as scheduled. The monitoring activities have been implemented in accordance with current governmental norms and regulations on the hydraulic monitoring and measurement.

3.6. Package MT6:

The contract agreement of package MT6 was signed in November 2009. Up to now, the consultant completed their Inception Reports and monitoring result reports in 2010 and 2011. The measurement and sampling activities at sites have been made timely.

In comparison with the TOR, most of the tasks have been implemented quite

well such as providing additional monitoring locations for the operation stage, taking water samples at field sites, and analysing the quality of surface water, groundwater and industrial wastewater.

According to the TOR, in the third year of operation stage, the salinity-monitoring network will have some changes. For example, the consultant will not take water samples at streams of Be River such as Chon Thanh stream, Nuoc Trong stream and Giai stream (WQ2, WQ3, and WQ8), the details of these changes have been shown in the first six months report of 2012.

In the last six months of 2012, Consultant carried out two monitoring stages: Stage 1 in June 2012 focus on monitoring surface water; Stage 2 in October 2012 consist of surface water, groundwater, industrial wastewater, irrigation area, aquatic, and Operation and Management House.

The outstanding issues of this package have been mentioned in the previous reports, which are happening such as Consultant was not active in contacting and cooperating with local authorities. Therefore, the information of monitoring systems as well as monitoring data from local agencies was not mentioned in the reports of this package. Moreover, the preparation and submission of reports in 2011 as well as monitoring result reports were made very slowly.

Relating to the above-mentioned issues, we request that the MT6 consultant prepare and submit their report as soon as possible.

3.7. Package MT7

The contract agreement of package MT7 was signed in October 2008, and has finished in October 2012. According to TOR, MT7 package have to supervise 9 construction packages, however, due to Binh Long main canal package is not be done, hence have 8 remaining packages as follow:

- 1A package: Head work;
- 1B package: water transfer canal and hydraulic structures on the canal from Km 0+000 to Km 12+192;
- 1C package: water transfer canal and hydraulic structures on the canal from Km 12+192 to Km 26+550;
- 1D package: water transfer canal and hydraulic structures on the canal from Km 26+550 to Kc (Km 40+483);
- 1E package: Administration Houses, 22 Kv electronic line and transformer station;
- 1F package: Construction road in Head work;
- PH3 package: Tan Bin main canal;

- PH4 package: Duc Hoa main canal.

In the eight aforementioned packages, PH4 package has just been commenced, therefore, the monitoring could not conduct recently.

For implementation contents, according to TOR, Package MT7 consists of six specific tasks. The implementation of each task in the last six months of 2012 can be assessed as follows:

Task A '***To propose a structure of quarterly environmental monitoring report for contractors***': This task was completed early by the consultant before implementing other tasks.

Task B '***To Propose the Supervision and Environmental Monitoring Schedule***': This task was already completed during the preparation of the inception report.

Task C '***Details of environmental Monitoring Programs for Contractors***': Five sub-tasks of this task implemented sufficiently in the last six months of 2012. However, as mentioned in previous reports, the Sub-task C3 "*To verify the construction contractor's monitoring results by taking water samples at the sites and analysing these samples independently*" was not carried out because none of the contractors did take samples to analyse environmental factors as required in the EMP.

Task D '***Environmental monitoring implementation***': This task consists of seven sub-tasks. Most of these sub-tasks have been implemented well. This task was finished in Quarter II of 2012 due to structure items also finished, except the PH4 package.

Task E '***Report preparation***': the preparation and submission of reports has been sufficiently and timely. Up to now, MT7 consultant finished and handed over reports: Inception Report, Framework Report, 15 Quarterly Reports. They have submitted the final report of 1A, 1B, 1C, 1D, PH3 packages.

Task F '***Operation Phase***': This task is "*before the construction will be finished, the consultant is to advise ICMB9 and PPMBs on the implementation of EMP requirements for the operation phase.*" Consultant has combined this task with the contents of previous reports, however, to make it is easy to implement in the coming time, they should be separated this content into a independent report.

In general, most of tasks that were indicated in the TOR have been implemented by the MT7 consultant. At present, the construction activities of the first Phase of the Project are going to finish but serious environmental incidences have not occurred. This achievement is a joint effort of relevant stakeholders. However, the MT7 consultant is still requested to consider finalizing the package on schedule.

3.8. Package MT8:

The contract agreement of package MT8 was signed on 30 June 2011. At

present, the Package MT8's contract is expired. However, the consultant has finished the purchase of monitoring equipment and the selection of locations for the construction and installation of monitoring equipment on the Sai Gon, Dong Nai and Vam Co Dong Rivers. The conduction of national elevation and calibration water level measurement data have been carried out on 28 and 29 January 2013.

Since the consultant has not met the requirements of the proposed work schedule many times, we requested that MT8 consultant should prepare a detailed working program, increase the numbers of their staffs and implement contents as indicated in the consulting contract. The MT7 is requested to closely cooperate with the Employer, BVI, OP4 and local departments during the implementation.

3.9. Package MT10

Up to now, the tasks of package MT10 were finished. The effects of this package have been recorded and evaluated through the process of EMP packages implementation. These evaluations have been combined and performed more details in Item 9 "Environment Awareness" of this report.

4. Environmental management program at construction sites

4.1. Main construction activities at the sites

Up to the end of July 2011, all construction packages were completed. At present, the infrastructure construction related to the completion of the basin transfer of Phuoc Hoa Water Resources Project is substantially finished, including Headwork, transfer canal, management houses, and operation road of head works.

Table 2: Information of construction packages

Information	Name of package				
	1A	1B	1C	1D	PH3
Contract award (commencement)	(3/2008)	9/2008 (10/2008)	10/2008 (11/2008)	8/2008 (12/2008)	12/2008 (5/2/2009)
Completion date of contract	24/06/2011, additional works: fences, roads in the project: 10/2011	6/2011	6/2011	6/2011	7/2011
Contract value (adjusted), billion VND	685	284 (280,244)	215 (301,862)	302 (274.6)	120 (149.2)

Sources: ICMB9

Up to the end of Quarter II/2012, the project (construction packages 1A, 1B, 1C, 1D) has been handed over to the Dau Tieng – Phuoc Hoa IMC for 7 months (the handing over was made in December 2011).

4.2. Impacts to be caused by construction activities

The impacts of construction activities at work sites have been monitored, considered frequently during construction time as follows:

- Unexploded Ordinance, Land Mines and Toxic Waste;
- Reinstatement of Temporary Working Areas;
- Work in public highway, inside and outside the sites;
- Site drainage;
- Sanitation and site facilities;
- The protection of the surrounding landscape.

Up to now, the attentive issues that were mentioned above have not yet occurred any serious problems. These tasks have been paid attention to implement by relevancies.

4.3. Environmental monitoring results at the sites

According to the agreement contract, this package was finite in October 2012, and the construction activities at 1A, 1B, 1C, 1D, 1E, 1F, PH3 packages were

also finished on 30 June 2012, PH4 package has not yet conducted. Therefore, the monitoring activities in work sites have just conducted in the first two quarters of 2012 and have been reported in the first six months report.

5. Water Environment

5.1. Changes of the water flow and erosion status at riverbanks

5.1.1. Changes of the water flow

General changes of the water flow:

The water flow in the rainy season depends on tidal regime, rain, upstream reservoirs regulatory regime. The monitoring results in the rainy season (April)¹ show that the water flow at monitoring locations Q1 to Q6 were higher than in the same period of 2011, the main reason is due to the rainy season of 2012 occurred quite soon, during the monitoring stage in April 2012, it rained at dusk in South Eastern Provinces. And they are also the reason of increasing of the average water flow in rivers in comparing with the same period of years.

Considering the changes of the water flow through the monitoring stages saw that the discharge in the previous rainy season and the next dry season are in direct proportion, the rainfall of previous rainy season and the discharge of next dry season have a close correlation.

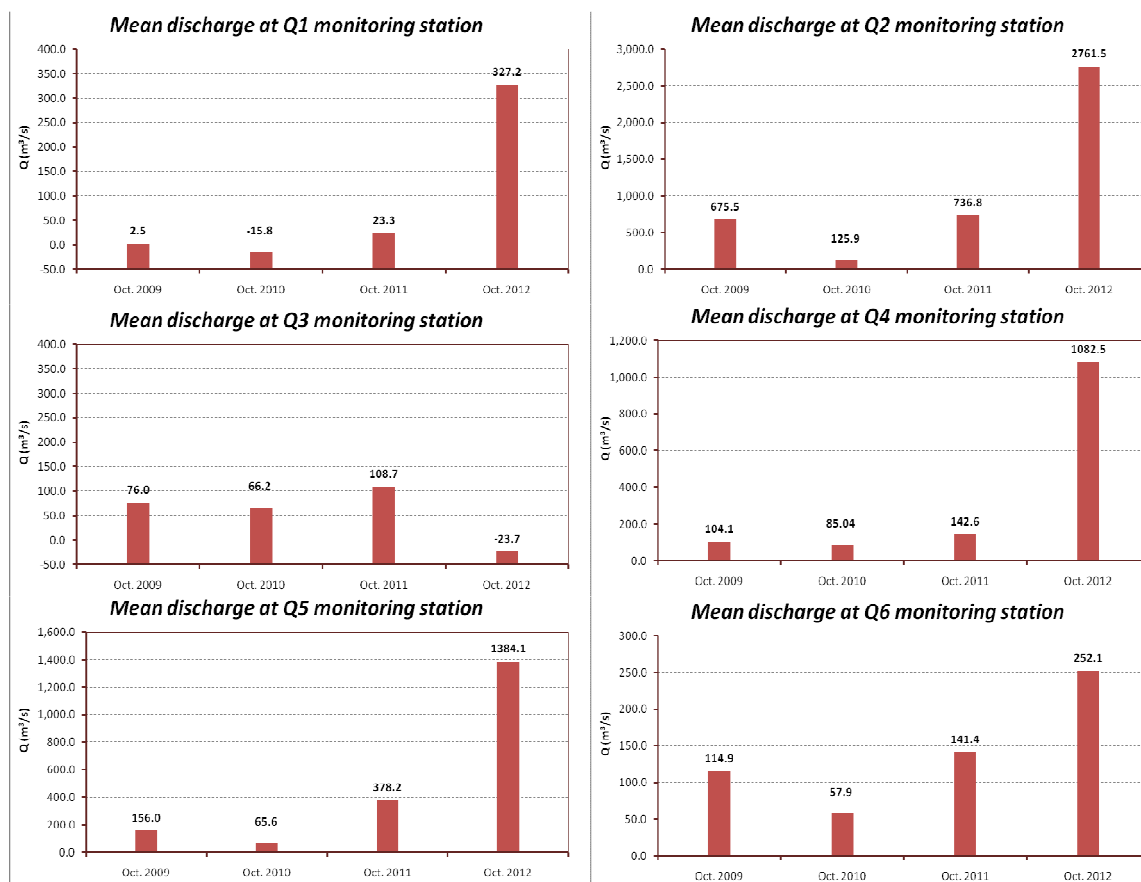


Figure 1: Changes of discharge at monitoring stations in the rainy season of years 2010, 2011 and 2012

¹ See the First Six-Monthly Environmental Report 2012 – Package OP4 for more information.

Changes of the water flow upstream and downstream Phuoc Hoa dam

• **Upstream:**

The monitoring results of the station Q4 (Nha Bich bridge) in the upstream area of the Phuoc Hoa dam in 2010, 2011 and 2012 show that water flow and water level measured in the year 2012 were much higher than in the same period of the previous stages. The mean water level measured in October 2012 is +45.5 m, which was higher than the top of Labyrinth spillway (in term of designing, +42.9 m), approximately 2.5 m.

Causes:

- In 2010, the rainfall is low, the water levels in Srock Phu Mieng and Can Don hydropower plants were lower than in 2009. In order to maintain the power supply during the dry season of 2011, the release of above-mentioned reservoirs was less than in 2010.
- In 2011, there were floods in the upstream areas while the rainfall from August to October was higher than 2010. Besides the discharges used for producing electricity, there were a discharges for safety purposes. This made the water flow and water level at monitoring stations increase significantly over the same period of 2010.
- In 2012, it rain soon, due to can not forecast the end of rainy season (usually at the end of November each year) then the upstream reservoirs raise the amount of released water in comparison with the previous years to catch flood. At the beginning of October 2012, the water flow measured at station Q4 was much higher than in the same period of years.

• **Downstream:**

Up to October 2012, Phuoc Hoa – Dau Tieng transfer canal has not been operated yet. In addition, Phuoc Hoa Dam does not play a role in regulating the flow, it is used as a weir, and therefore Phuoc Hoa Dam does not have any effect on the lower flow.

Preliminary forecast on the salinity intrusion possibility in the Sai Gon and Dong Nai Rivers:

Up to the last monitoring stage in October 2012, Phuoc Hoa – Dau Tieng transfer canal has not been operated. Therefore, we can conclude that Phuoc Hoa Project has not impact on the salinity intrusion in the Sai Gon, Dong Nai Rivers.

The monitoring results of stage 7 measured from October 2009 to October 2012 show that there is a close interrelationship between the volume and time of rainfall in the two season of year.

- In the dry season of 2011, the water flow from upstream to downstream areas was lower than that in 2010, therefore the level of salinity intrusion was more serious in 2011.
- In the rainy season of 2011, the water flow was greater than in the years 2010, 2009. Therefore, the salinity intrusion in 2012 is less serious than in the previous 2 years.
- In 2012, the rainy season came and ended soon, it's mean that the dry season also ends soon. In addition, the flow season of 2012 was smaller than forecast, the water discharge came to the upstream reservoirs was small. In coordination with drolonged drought that will make salinity intrusion raises in the Sai Gon, Dong Nai, Vam Co Dong Rivers in the dry season of 2013.

The updated information shows that in March 2013 Phuoc Hoa Reservoir have to transfer water to Dau Tieng Reservoir. In addition, from the beginning of February 2013, Dau Tieng Reservoir has to release water 3 times to push salinity for Tan Hiep Water supply Company.

5.1.2. The status of riverbanks erosion

As mentioned in the previous reports, there were 09 minor eroded locations. Up to now, these old erosions are stable and new erosion locations have not been found. The natural vegetation along both sides of the river was overgrown and stable. For downstream areas, there were 66 eroded locations 4 days after the dam had been impounded due to slides caused by groundwater pressure. So far, these erosions have been stable and new erosions did not occur. Vegetation on both sides of the river is growing stably.

5.1.3. Variables of the vegetation along the Be riverbanks.

Regarding the surveying results of the MT2 package, along both sides of Be River consists of 2 kinds of vegetation: natural vegetation and artificial vegetation.

The natural vegetation mainly distributes on the left bank of Be River (viewed upstream to downstream), including 04 main types: Type 1: *Pure thorny bamboo forest*; Type 2: *Thorny bamboo forest mixed with broad-leaved species*; Type 3: *Sparse broad-leaved forest and shoot regenerating forest*; and Type 4: *Grass and shrubs*. The artificial vegetation includes rubber forest, cashews, orchards and short-term crops, which are mainly grow both side of Be River on the land managed by people. All artificial vegetation as mentioned above types one species with one-layer, which is relatively uniform in size and coverage. Depending on the growth of plants, the current coverage ranges 50 - 60%. Most types of artificial vegetation typically distribute from the river inclined edges about 5 -10 m.

5.2. Changes of the water quality

5.2.1. Surface water quality

❖ Be River basin:

There are 8 monitoring locations: Nha Bich (WQ01), Phuoc Hoa dam (WQ04), Phuoc Hoa bridge (WQ05), Ma Da (WQ09), Downstream of Be river (WQ10), and springs flowing into Be River such as Thon spring (WQ02), Nuoc Trong (WQ03), and Giai spring (WQ8).

Monitoring results in the last six months of 2012:

- Value of pH was stable in the range from 6.63 – 7.38, there is no considerably difference among sampling periods.
- Value of EC was low, ranging from 3 to 8 mS/m, and equivalent salinity not greater than 0.05 g/l. In the upstream of the dam, value of EC in June was 2 times higher than in April and October. In general, EC value in the upstream of the Dam was higher than that in the downstream of the Dam, and EC value of Be River was highest in June and lowest in October.
- Value of TSS of 3 sampling periods in 2012 indicated that TSS behind the Dam (WQ04) was lower than that inside the reservoir and before the dam (WQ0 and WQ01).
- The nutrient content was rather low, total nitrogen (T-N) in the range from 0.2 to 1.5 mg/l, total phosphorous (T-P) in the range from 0.07 to 0.70 mg/l. The trend of Nitrogen content changes from Nha Bich Bridge to Phuoc Hoa Bridge is no significant; it increased so much at areas after the junction with Ma Da Spring. Moreover, the Nitrogen content in the rainy season was higher than that in the dry season at the upper areas of Phuoc Hoa Bridge and lower than the dry season at the confluent areas with Ma Da Spring.
- Dissolved oxygen values (DO) at monitoring locations in Be River were greater than 4 mg/l. Up to October (rainy season), the DO value was higher than with greater discharge.
- Organic content show a weak increase to downstream. The COD values in the range from 2.0 to 4.4 mgO/l, BOD₅ in the range range from 0.4 to 3.7 mg/l. The COD value in April and June is higher than in October, this indicate that organic content has an increasing trend in the dry season and at beginning of the rainy season.
- The Fecal Coliform value is lower than 1000 MPN/100 ml.

Comparison with the standard QCVN 08:2008/BTNMT

- The water quality in Be river was quite good, equivalent to the water resource

range **A1 – A2 under the standard QCVN 08:2008** (it is good for domestic water supply, aquatic conservation and other demands which need a lower water quality).

- The impact of Phuoc Hoa dam construction to TSS content only occurred clearly at the downstream area.
- DO values was suitable for protection of aquatic life according to the Standard QCVN 38:2008 and meet the level A2 of the standard QCVN 08:2008.
- COD values and BOD₅ values are equivalent to the level A1 and A2 of the standard QCVN 08:2008.
- Total oil and heavy metal content are equivalent to normal values of metal that naturally occur in surface water.

Comparison of monitoring results through the years:

Assessment of yearly trend of Be River water quality in this report do not include springs such as Thon Spring (WQ02), Nuoc Trong (WQ03) and Giai Spring (WQ08), because these stations was not monitored continuously in 2012.

- The TSS content in 2012 was higher than the average of many years at WQ09 and WQ10, mainly because of the great increase of TSS in October 2012 compared to same period of previous years. At stations downstream the dam to Phuoc Hoa Bridge, TSS content was rather stable, not change much [Figure 2].
- COD values in 2012 were lower than the average of many years, but not great difference. At station right after the dam, this content has a biggest change, approximately 1 mg/l. Especially at WQ10 that is before the junction with Dong Nai River, COD content in 2012 was higher than the average of many years, however the increasing level was not significant [Figure 3].
- The fact that DO contents decreasing inside of the reservoir and increasing strongly at the downstream of the dam in April and June, because of the water storage of the reservoir in this period of time, agree with assessment of the EIA report. The DO value in the Phuoc Hoa reservoir significantly decreased in the early stage of Impoundment, because decomposition of dead plant and solid waste. In October, due to the water discharge from upstream was quite great, the water discharge ran over the spillway was also great, hence the trend of DO decreased appeared from Phuoc Hoa Reservoir to Ma Da, and was back to increased at the confluence with Dong Nai River (WQ10) due to the flood discharge of Tri An Reservoir.
- Field information show that although there are much submerged plant, but the

decomposition process still did not occur, may trees did not decompose. Therefore, organic content of Be River did not increase in this period.

(See the results of the monitoring stage in April of years in the First Six-Monthly Report 2012 – Package OP4).

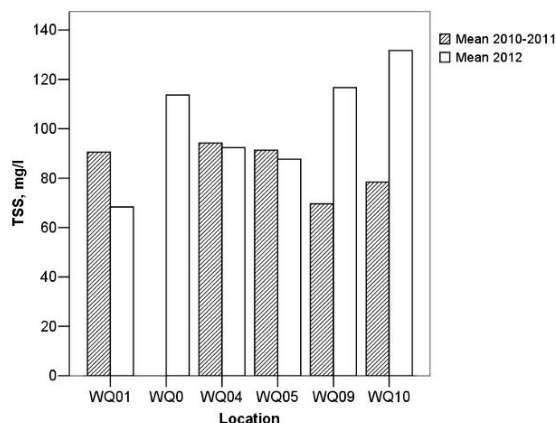


Figure 2: TSS comparison of 2012 with annual average of Be River

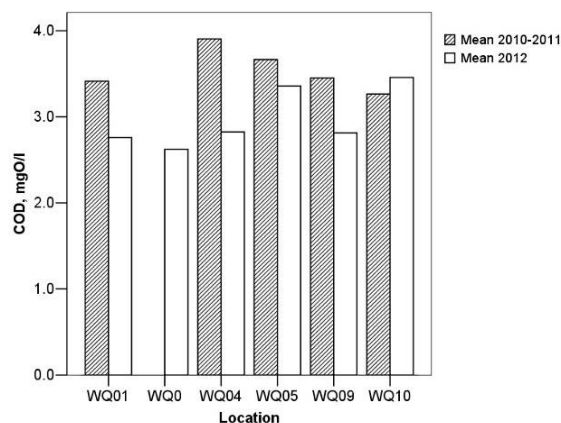


Figure 3: COD comparison of 2012 with annual average of Be River

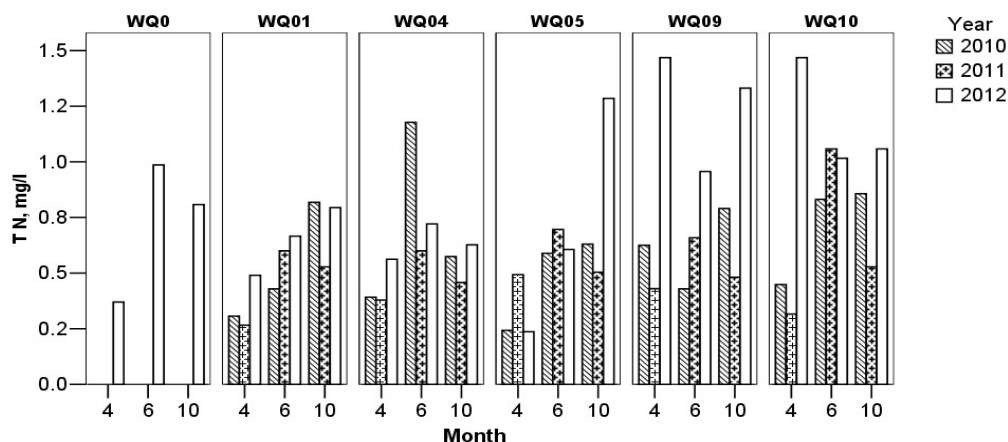


Figure 4: Total Nitrogen of Be river, 2010-2012

❖ Dong Nai River:

The monitoring stations in Dong Nai River are located in the downstream area of Tri An reservoir (WQ11), Bien Hoa City (WQ12), downstream area of Hoa An Bridge (WQ13), Nhon Trach area (WQ18) and before the junction with Sai Gon River at Nha Be district (WQ19).

Monitoring results in the last six months of 2012:

- pH values were stable and fluctuated in range of 6.10 to 7.68 during the two monitoring stages of the end of 2012. And they had no great difference among stations as well as among sampling period in 2012 concurrently.
- In the monitoring stage of June 2012, highest salinity values at Nha Be were 2.18 mg/l. In the rainy season (October), the salinity at most of stations were

decreased, approximately 0 mg/l.

- In the last six months of year 2012, contents of nutrient, organic matters were low generally. T-N value was varied in the range from 0.2 to 1.7 mg/l, T-P value was varied in the range from 0.04 to 0.15 mg/l. The lower areas of Nhon Trach and Nha Be (WQ18, WQ19) had nutrient content higher than of the upstream stations as Tri An and Hoa An (WQ11, WQ13) because they are affected by towns such as Bien Hoa, Nhon Trach, Ho Chi Minh City.
- Oxygen demand contents of Dong Nai River were low, meet the level A2 of the standard QCVN 08:2008, with COD in the last six months of 2012 ranging from 1.8 to 4.5 mg/l and BOD₅ ranging from 1.5 to 2.6 mg/l. Most DO values meet the level A2 of the standard QCVN 08:2008. The lowest DO was 3.07 mg/l, occurs at Nha Be at beginning of the rainy season (June).
- The amount of Fecal Coliform in the upstream area of the Dong Nai River was low, fluctuating from 4 to 230 MPN/100ml.
- The values of the monitoring stage in June and October 2012 show that, Pb value was in the range from 0.002 – 0.007 mg/l, Cd value from 0.0000 – 0.0015 mg/l, Cu value from 0.002 – 0.010 mg/l, Mn value from 0.020 – 0.053 mg/l. In general, the content of heavy metal measured at monitoring stations was low in compared with the level A2 of the standard QCVN 08:2008.

Comparison with the standard QCVN 08:2008/BTNMT

- In general, the water quality of upper Dong Nai River is good at monitoring stations equivalent to the Rank **A1 and A2 of the standard QCVN 08:2008**. The water resource in lower areas were influenced by salinity intrusion in the dry season which could not be used for domestic and irrigational purposes. At monitoring periods in April 2012, there was not any significant change in the Dong Nai River's water quality that could have been affected by the Phuoc Hoa reservoir.
- The amount of Fecal Coliform was equivalent to the standard QCVN 39:2011 for irrigational purpose. At Nhon Trach, the amount of Fecal coliform of 3 sampling period were over the standard, the highest value is 9,300 MPN/100ml in June 2012. At Nha Be, the amount of Fecal Coliform was over the standard QCVN39:2011 in June and October. The amount of Fecal Coliform at Nha Be in April is due to inhibition of salinity to Coliform growth.

Comparison of monitoring results through the years:

- According to the analyzed results of ANOVA method (Analysis Of Variance) show that these parameters such as EC, salinity, Cl, SO₄, NO₃-N, total N, PO₄-P, COD and DO have significant difference among years of 2010 - 2012.

- Salinity at Nhon Trach in April 2012 is lower than the average value of previous years. At Nhon Trach and Nha Be stations that are impacted by salinity intrusion and tidal regime, in the dry season of 2011, salinity increased lightly in comparison with the same period of 2010. However, the general trend of the 2010-2012 period shows that salinity decreased lightly in this areas in the dry season.
- Chloride and sulphate content (Cl , SO_4) at these stations were closely related to salinity, therefore, they have the same trend as salinity in the 2010-2012 period.
- The $\text{NO}_3\text{-N}$ content at Hoa An (WQ13) in 2012 increased significantly in comparison with the year 2011, with average increase about 0.25 mgN/l. At other locations, the $\text{NO}_3\text{-N}$ content did not change much among years. Total N content changed much at Nha Be (WQ19), with the value in 2012 higher than year 2011 about 0.52 mgN/l. At other locations, both $\text{NO}_3\text{-N}$ and total N contents did not change significantly among years [Figure 6, 7].
- The $\text{PO}_4\text{-P}$ content at most stations did not change significantly among years, except 0.02 mg/l increase at Nhon Trach (WQ18) in 2012 in comparison with the year 2011 [Figure 8].
- The change of water quality monitoring parameters of Dong Nai River in the 2010 – 2012 period are suitable to the monitoring results of national monitoring networks and also water resources sector. The changes of water quality are caused by development activities in lower areas such as navigation, sand exploitation, and the impact of weather changes such as rainfall increase, tide regime, and sea water level rise. The monitoring results of MT6 package have not discovered any relationship between activities of Phuoc Hoa project (preparation, construction, and testing operation) with those changes of water quality in Dong Nai River in the 2010-2012 period.
- In comparison with March 2003 at the WQ12 (Tan Mai, which located before Rach Cat bridge about 300 m in the Dong Nai river), the monitoring results in April 2012 show that there were no significant difference on the absolute value of parameters measured among these periods, except the COD content measured in March 2003, which was 4 times higher than in April 2010, and 6 times higher than in April 2011 and April 2012. The reason was that the sampling location in 2003 was located in Tan Mai fish-breeding village; therefore, the water quality was affected by the wastewater from the fish-breeding village.

(See the results of the monitoring stage in April of years in the First Six-Monthly Report 2012 – Package OP4).

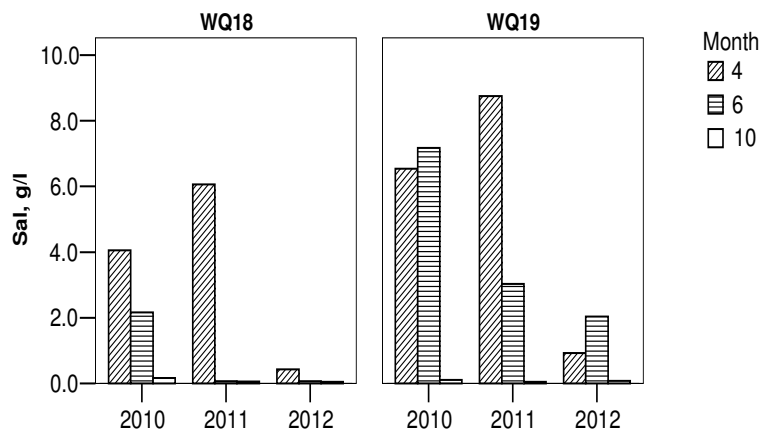


Figure 5: Salinity value in Dong Nai River downstream, period 2010 - 2012

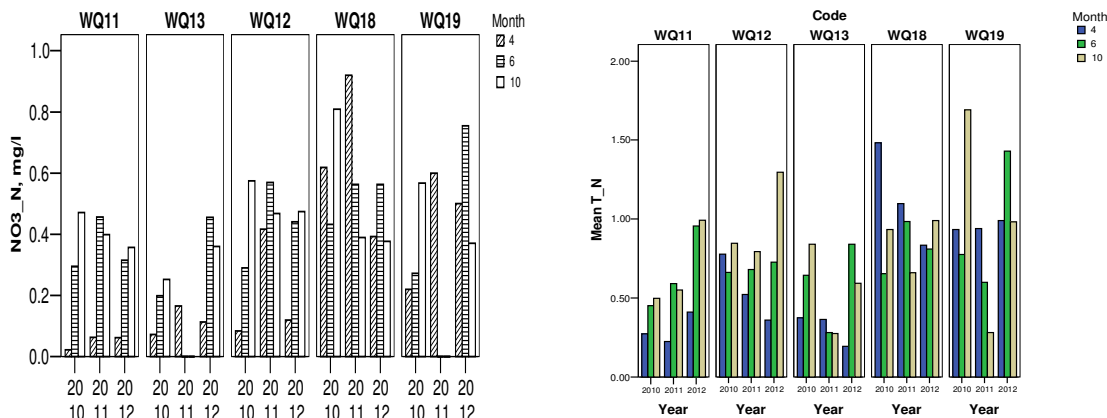


Figure 6: NO₃-N value in Dong Nai River downstream, period 2010 - 2012

Figure 7: Total N in Dong Nai River downstream, period 2010 - 2012

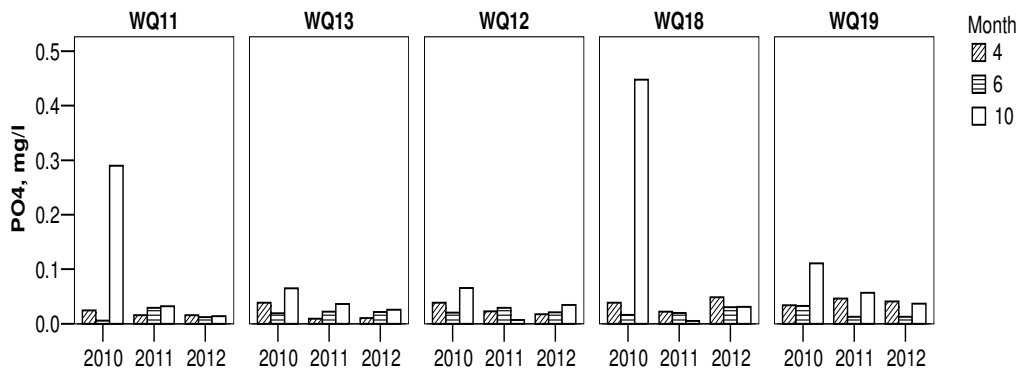


Figure 8: PO₄-P value in Dong Nai River downstream, period 2010 - 2012

❖ Sai Gon River:

Monitoring stations in Sai Gon River located at the Ben Than water treatment plant in Cu Chi district (WQ14), the confluence with Thi Tinh River (WQ15), Dau Tieng Township in Binh Duong Province (WQ16) and downstream of Sai Gon River in Tan Thuan (WQ17).

Monitoring results in the last six months of 2012:

- In the two monitoring stages in the end of 2012, pH value was stable and fluctuated between 6.0 and 7.4 at all monitoring locations; the impact of acid sulphate soils on Sai Gon River was not significant. pH value at Tan Thuan (6.99) was higher than other upper locations due to tidal impact.
- In the last six months of 2012, salinity fluctuated from 0.02 to 1.68 g/l, at the confluence of Sai Gon and Dong Nai River (WQ19) and at Tan Thuan position (WQ17), this area is affected by tide causing salinity intrusion in the dry season. This affects the domestic water supply and irrigation. The highest salinity measured at Tan Thuan was 0.68 g/l in June 2012.
- TSS content fluctuated from 29 – 194 mg/l in Sai Gon River; the highest value was measured at Ong Co Bridge in Thi Tinh River. At Ben Than location, the turbidity was highest causing by sand exploitation, construction material transportation along the river from An Nhon Tay to Ben Than.
- Total N value fluctuated from 0.6 to 2.5 mg/l, and total P value fluctuated from 0.06 to 0.3 mg/l in the two monitoring stages in the end of 2012. At Ben Cui (WQ16), nutrient parameters such as total N, total P were low. The measured highest value of total N was 2.5 mg/l at Tan Thuan (WQ17) in October, and the measured highest value of total P was 0.3 mg/l in the confluence of Thi Tinh River (WQ15) in April 2012.
- Highest value of COD, BOD occurred in June at Tan Thuan, average value of COD was 9.2 mg/l, and BOD was 7.4 mg/l.
- Amount of Fecal Coliform in Sai Gon River was fluctuated so much, from 0 to 2.400 MPN/100ml, highest at the confluence of Thi Tinh River, the number of micro organism increased due to the impacts of residential areas.
- The heavy metal concentration of 3 stations that receive waste sources such as WQ14, WQ15 and WQ17 were very low in the last six months of 2012.

Comparison with the standard QCVN 08:2008/BTNMT

- Water at stations WQ15 and WQ 16 were similar to the rank **B1 under the standard QCVN 08:2008** in accordance with water resources specification. Water at stations WQ14 and WQ17 were similar to the rank **B2 under the standard QCVN 08:2008** in accordance with navigation purpose.
- The monitoring values of Sai Gon River in the last six months of 2012 show that the water quality was impacted by waste sources from towns, industrial parks, agricultural zones, especially in the lower areas. The results from monitoring networks of Nation and the General Department of Water Resources also find the degradation of water quality of Sai Gon River in

period 2001-2012.

Comparison of monitoring results through the years

- pH value was stable and not significantly different to the years 2010 and 2012.
- Nutrient contents at stations WQ14 and WQ15 in Cu Chi and Thi Tinh respectively were higher than in 2010 and 2011. While the nutrient contents in the downstream areas were lower than the same periods of 2010 and 2011.
- Similar to nutrients, the content of organic matters at monitoring stations in the downstream of Sai Gon River in April 2012 were lower than the same periods of 2010 and 2011.
- There was a significant difference of Coliform amount among the monitoring stations. The highest amounts, measured at Tan Thuan and Ben Than, were 4,300 and 2,400 MPN/100ml respectively. These amounts were much higher than those in Thi Tinh and Dau Tieng.
- The metal contents were low at 04 monitoring stations, the Cd content fluctuated from 0.001 – 0.003 mg/l, Pb content fluctuated from 0.001- 0.009 mg/l, Cu content fluctuated from 0.001-0.014mg/l.
- In comparison the monitoring results in April of the years (2010, 2011 and 2012) with those in March 2003 at the station WQ14 (Ben Than, Cu Chi district in the Sai Gon River) see that there were no significant differences in the absolute value of parameters measured between the 2 periods, except the PO_4^{3-} content measured in April 2012 was 10 – 15 times higher.

(See more results of the monitoring stage in April of years in the First Six-Monthly Report 2012 – Package OP4).

❖ Vam Co Dong River:

Monitoring stations in Vam Co Dong River located at Ben Da in Chau Thanh district, Tay Ninh province (WQ21), Tra Cu in Duc Hoa district, Long An province (WQ22), Ben Luc in Long An province, at the junction with Xang canal (WQ23).

Monitoring results in the last six months of 2012:

- During the monitoring stage, pH value in Vam Co Dong River varied according to space and time, the pH value was high and stable at WQ21 (fluctuated from 6.2 to 7.8), and decreased toward the downstream. At WQ22 and WQ23 locations, the pH value fluctuated so much among times of year it was lowest in June (at WQ22 was 3.8, and at WQ23 was 3.9) because this

month is the end of the dry season and the beginning of the rainy season.

- The salinity intrusion in Vam Co Dong River was not substantially and fluctuating from 0.02 to 0.22 g/l in June and October 2012, the highest salinity measured in Duc Hoa was 0.12 g/l, and Ben Luc was 0.13g/l.
- TSS value was low; the highest value measured with 96 mg/l at Ben Luc (WQ23) in October 2012, and the lowest value at Duc Hoa (WQ22) was 34 mg/l. The TSS value increased a little big at areas in October.
- The total N value in October (0.67 mg/l) was lower than that in June 2012 at Ben Luc. The change trend of total N in Vam Co Dong in the last six month of 2012 was high in the dry season and strongly reduced when flood comes.
- The highest total P was measured at Ben Da approximately 0.3 mg/l in June was 2 times higher than that months of years. The total P has a decrease trend from Ben Da (WQ21) to Ben Luc (WQ22).
- The content of organic matter was quite stable in October, COD value fluctuated from 2.1 to 8.6 mg/l, and BOD₅ value also fluctuated from 1.5 to 4.7 mg/l. COD value was highest at Ben Luc (WQ23) about 8.62 mg/l, and BOD₅ value was highest at Ben Da about 4.7 mg/l.
- The amount of Fecal Coliform in the last six months of 2012 fluctuated quite large from 0 to 9,300 MPN/100ml, the amount of Fecal Coliform was high in June, particularly at Ben Da (WQ21) was up to 9.300 MPN/100ml. Up to October, this value decreased strongly at all stations.

Comparison of monitoring results through the years

- Comparison between monitoring results in April of the years 2010, 2011 and 2012 with March 2003 at the station WQ23 in the beginning of Xang Lon canal of Vam Co Dong river (the results are shown in the First Six Monthly Environmental Report 2012) shows that there were no significant differences in the absolute value of parameters measured among periods.
- Above results are also similar with monitoring results of the water quality measured by local agencies and the Directorate of Water Resources. In addition, the water quality of Vam Co Dong River besides the impacts of natural conditions such as acid sulphates soils, salinity intrusion, also be impact by the waste sources of industrial parks, which has a strong development trend in recent year in Long An and Tay Ninh Provinces.
- There was no relation between the water quality in Vam Co Dong river and the activities of building Phuoc Hoa dam in 2010-2012 periods.

(See the results of the monitoring stage in April of years in the First Six-

Monthly Report 2012 – Package OP4).

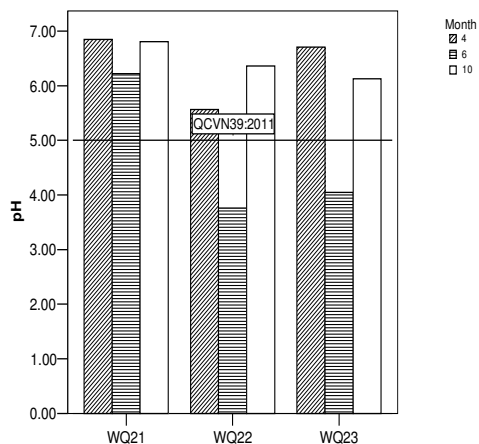


Figure 9: pH value in Vam Co Dong river, 2012

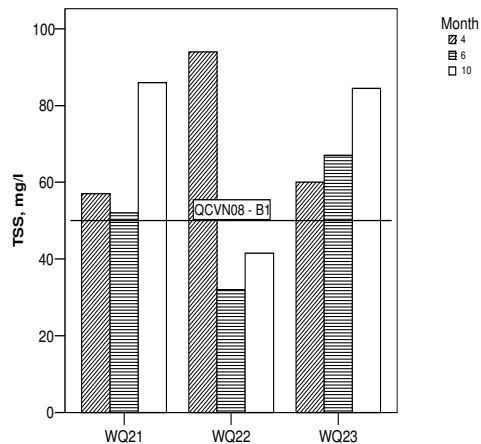


Figure 10: TSS value in Vam Co Dong, 2012

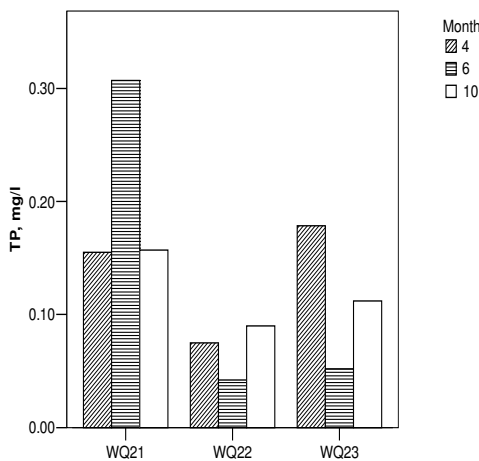


Figure 11: Total N value in Vam Co Dong river, 2012

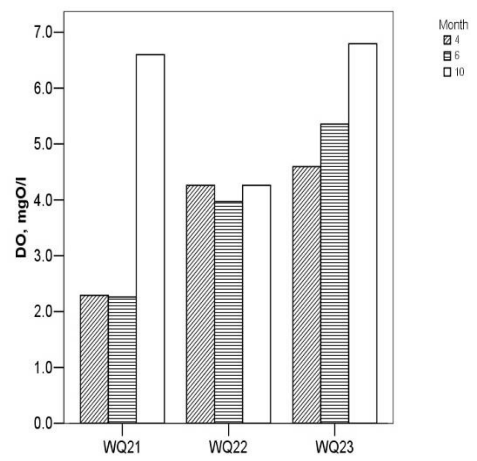


Figure 12: DO value in Vam Co Dong river, 2012

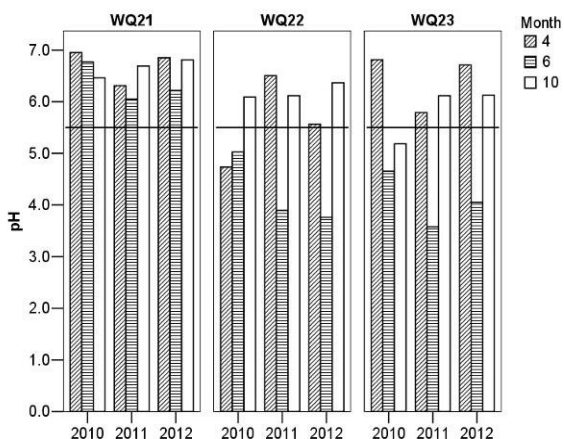


Figure 13: pH value in Vam Co Dong river, the years 2010, 2011, 2012

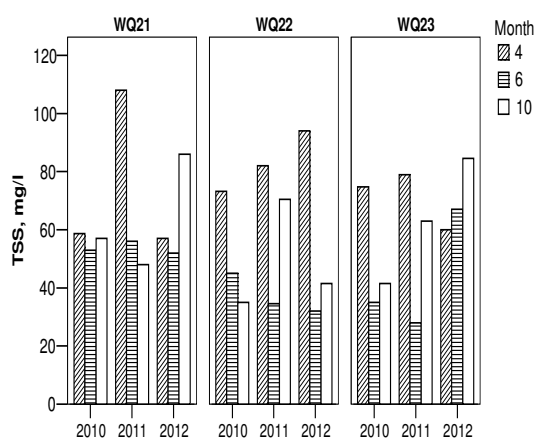


Figure 14: TSS value in Vam Co Dong river, the years 2010, 2011, 2012

❖ **Phuoc Hoa – Dau Tieng Transfer Canal, Duc Hoa and Tan Bien main Canals:**

From April 2012, the MT6 package implement additional monitoring activities at 5 more surface water stations. It includes 02 stations at beginning and ending of Phuoc Hoa-Dau Tieng Water Transfer Canal (WQ25, WQ26), 01 station on Tan Bien Canal (WQ06), and 01 station on Duc Hoa Canal.

Phuoc Hoa – Dau Tieng Transfer Canal:

In 2012, according to Phuoc Hoa – Dau Tieng IMC, the inter-reservoir operating process has not established; therefore, we have not a detailed sluice operation plan to transfer water to Dau Tieng Reservoir. In sampling time of April and June 2012, the project components have been conducted load tests, and hanging over some components. In sampling period in October 2012, Phuoc Hoa Reservoir was opening all the 3 bottom outlet gates. Therefore, amount of water transfer to Dau Tieng Reservoir was not significant, water level of Phuoc Hoa canal was low, partly from remaining of load test and rainwater. Therefore, samples on Phuoc Hoa Canal in 2012 mainly provided information of Phuoc Hoa – Dau Tieng transfer canal's water quality when it does not transfer water, and the decline of water quality along canal as well. In April, due to the water level at beginning of the canal was too low, hence it is impossible to take any samples. The monitoring results of water quality on Phuoc Hoa – Dau Tieng transfer canal in 2012 show the decline of Nitrogen content and microorganism matter at the end of the canal in comparison with the canal head location. Mineralisation at the end of canal was lower than its beginning

In general, the water quality of Phuoc Hoa – Dau Tieng transfer canal was rather good, the water quality parameter values were equivalent to the reservoir inside, except TSS value and microorganism matter were low due to the dilution of rain-water, and the decline of DO due to aquatic plants (algae) at canal and turbulence from flow regime.

Table 3: The water quality of Phuoc Hoa – Dau Tieng water transfer Canal, 2012

Parameters	The beginning of canal			The end of canal			Inside reservoir		
	Apr	Jun	Oct	Apr	Jun	Oct	Apr	Jun	Oct
pH	-	7.10	7.43	6.99	6.21	6.72	6.95	7.33	7.14
Total N (mg/l)	-	0.61	0.99	0.20	0.75	1.38	0.37	0.99	0.81
PO ₄ -P (mg/l)	-	0.06	0.02	0.02	0.05	0.02	0.03	0.27	0.03
Total P (mg/l)	-	0.09	0.08	0.03	0.12	0.07	0.10	0.35	0.15
Fe (mg/l)	-	0.15	0.16	1.24	0.10	0.13	4.29	0.12	3.95
Al (mg/l)	-	0.010	0.018	0.027	0.001	0.012	0.008	0.004	0.003
Fecal. Coli (MPN/100ml)		4	4	230	930	930	400	90	90

West Canal and Tan Bien Canal:

Since the Phuoc Hoa Reservoir has no operating process yet, the transfer of water to Dau Tieng Reservoir has not conducted yet, hence the project has not impacted on the water quality of the West Canal. Tan Bien has been finished, the task of leading water from the West Canal to Tan Bien irrigation area has not been also conducted yet. Comparison between the water quality at the West Canal Head (WQ20) and at the front of Tan Bien sluice (WQ24) show that [Table 4] most of parameters on Tan Bien Canal have not changed in comparison with the water quality of Dau Tieng Reservoir as it flows into the West Canal, except the raise of nutrient contents as N, P and microorganism matter.

In general, the water quality of Tan Bien Canal is suitable for irrigational purpose and agricultural production. However, because of duck farming on the canal, it makes Fecal Coliform amount high, therefore, we need to pay more attention when using this water for vegetable farming.

Table 4: Comparison the water quality of West Canal and Tan Bien Canal

Parameters	Tay Canal	Tan Bien Canal	QCVN39:2011
pH	6.97	6.87	5.5 – 9.0
TSS (mg/l)	60.7	53.7	-
EC (mS/m)	3.20	3.64	-
NO ₃ -N (mg/l)	0.11	0.31	-
Total N (mg/l)	0.66	0.93	-
PO ₄ -P (mg/l)	0.01	0.08	-
Total P (mg/l)	0.05	0.13	-
Fe (mg/l)	0.35	0.51	-
Al (mg/l)	0.005	0.013	-
Fecal. Coli (MPN/100ml)	90	560	200

Duc Hoa Canal:

Duc Hoa Canal is on the process of investigation, compensation, but not yet conducted land clearance, therefore, the samples was taken on Thay Cai Canal near the construction site of the sluice, which be built to lead water to Duc Hoa Irrigation areas.

The initial analyzed results of water quality in this region show that [Figure 5] the water quality of Thay Cai Canal was rather good, meet the standard QCVN 39:2011 for irrigational purposes. However, the nutrient contents as N, P was high, the eutrophication level was average, microorganic matter contents as COD, BOD were higher than that in Dau Tieng Reservoir.

Table 5: The water quality of Thay Cai Canal, 2012

Parameters	Apr	Jun	Oct
pH	6.95	6.43	6.20
TSS (mg/l)	99.0	58.0	46.0
EC (mS/m)	71.30	45.70	9.72
NO ₃ -N (mg/l)	0.10	0.16	0.13
Total N (mg/l)	3.61	3.67	3.43
PO ₄ -P (mg/l)	0.08	0.06	0.06
Total P (mg/l)	0.21	0.23	0.19
Fe (mg/l)	4.65	5.27	4.92
Al (mg/l)	0.023	0.086	0.016
Fecal. Coli (MPN/100ml)	90	40	0

5.2.2. Groundwater quality:

The groundwater is monitored at drilling wells or digging wells depended on characteristics and actual situation of wells in project area. The six wells in Binh Phuoc Province were measured including GW1, 2, 3, 4, 7 and 8; the three wells in Binh Duong Province were measured including GW5, 6 and 9; the three wells in Tay Ninh province were measured including GW13, 14 and 15. And also the three wells the National Lo Go – Xa Mat Forest were measured in including GW10, 11 and 12.

Monitoring results in 2012:

Water level:

- The monitoring results show clearly the difference of groundwater level between the dry and rainy season at all monitoring locations. In 2012, the difference between the two seasons at wells in Binh Duong Province fluctuated from 0.4 – 0.7 m, in Binh Phuoc Province was from 0 – 0.9 m, in Tay Ninh Province was from 1.0 – 1.2 m, and Lo Go – Xa Mat Forest was from 0.1 - 1.0 m. The reason of these seasonal differences is caused from meteorological factors, which impact directly and strongly on the groundwater behaviour.
- In dry season, the groundwater level was declined at the beginning of season, and it reaches the minimum value at the end of season (from the end of April to the beginning of May). Up to the rainy season, the groundwater level have the increased trend due to receive water from rainfall, it reaches the maximum value at the end of rainy season (from October to the beginning of November). Phuoc Hoa Reservoir has not storaged water, hence we do not have any basics to assess the impacts of project on the groundwater behaviour.

Water quality:

- Binh Duong, Binh Phuoc and Tay Ninh regions, pH value was low and met the standard QCVN 09:2008 (pH >5.5). Particularly, pH value fluctuated from 5.65 to 7.61 in Xa Mat area, it met the standard QCVN 09:2008 (5.5 < pH < 8.5).
- The nitrite content was rather low at most of wells in the four monitoring regions, the highest nitrite content was 0.113 mg/l at GW1 in Binh Phuoc (October 2012). Except Tay Ninh regions, the three remaining regions with the nitrite content was high in the rainy season and on the contrary in the dry season.
- The Fe content fluctuated in the range of 0.075 to 4.302 mg/l, lower than the standard QCVN 09:2008 (Fe < 5mg/l). The Fe content in the rainy season was higher than the dry season at all monitoring wells.
- The heavy metal concentrations (Pb, Cd, Cu) were many times less than the standard QCVN 09:2008 and did not change significantly between 2 sampling times as well as among areas.
- Most wells were contaminated by Fecal coliform with 27/30 results being detected. The highest value was 4,600 MPN/100 ml at GW05 in April 2012. Xa Mat areas have the lowest value, the highest was in Binh Duong areas.

In comparison with the standard QCVN 09:2008/BTNMT:

Monitoring results show that most of chemical and physical compositions were stable through the years and these results are *consistent with the groundwater standard QCVN 09:2008* for evaluating the groundwater quality, it is oriented toward many using purposes. There were some changes of the chemical and physical compositions and water levels in 2010, 2011 and 2012. However, these changes were not affected by the operation of the Phuoc Hoa dam.

Comparison of monitoring results through the years:

- Compared with the average groundwater level show that, the average groundwater level in 2011 was higher than 2010 at all monitoring areas. This is consistent with weather condition in 2010 and 2011. In 2011, the rainy season comes early with annual average rainfall higher than that of 2010 which increases the ground water supplement leading to rise of ground water level in 2011. In 2012, rainfall was less than year 2011, but there was no significant difference of groundwater level, it increased a little in Binh Duong and Binh Phuoc areas while not change in Xa Mat and decreased a little in Tay Ninh.
- The statistical results of chemical and physical composition show that total Fe content in 2012 was less than that of 2010 in Binh Duong, Binh Phuoc areas.

Especially, in 2011, total Fe content increased 2 times compared with 2010 in Binh Phuoc area. However, up to 2012 it decreased strongly, even less than the year 2010. Except total Fe content increased in Xa mat area.

- In 2012, NO₂ content decreased compared with 2011, but still higher than that in 2010. As for Tay Ninh, NO₂ content was stable through the years.
- Total heavy metal content was low in 3 continuous years, and did not vary so much. In there, compared the content of total heavy metal that were measured can see that Pb>Cu>Cd.
- The other chemical and physical compositions have not clearly different in 2010 – 2012 period.
- Comparison of data for the chemical and physical composition of groundwater in 2005 with 2010, 2011 and 2012 in Nha Bich commune, Chon Thanh District, Binh Phuoc Province show that there were no significant change of chemical and physical composition [Table 6].

Table 6: Comparison of monitoring data with the data before the implementation of project

No.	Parameters	Sep.2005	Oct.2010	Oct.2011	Oct.2012	QCVN:09
1	pH	6.3	6.0	6.3	6.4	5.5 – 8.5
2	Nitrate (mg/l)	10	0.04	0.05	0.55	15
3	Total Fe (mg/l)	1.0	5.3	1.0	4.3	5
4	Mn (mg/l)	0.2	0.1	0.05	0.1	0.5
5	Fecal Coliform (MPN/100ml)	0	0	90	15	0

Source: Southern Institute of Water Resources Research, Phuoc Hoa EIA report, 2007

5.2.3. Water quality of Duc Hoa irrigation area:

Monitoring results of surface water quality parameters in Duc Hoa – Long An compared to the Rank B1 of the standard QCVN 08:2008/BTNMT are as follow:

- The pH values of monitored water samples ranged from 5.32 to 6.71. Comparison of these values with Rank B1 of the standard QCVN 08:2008/BTNMT shows that most of the samples met the standard.
- The NO₃⁻ content in ground water samples varied from 0.11 to 2.37 mg/l. All monitored samples; the NO₃⁻ content was consistent with QCVN 09:2008/BTNMT for the ground water quality.
- Total nitrogen content in monitored samples varied from 0.97 to 5.22 mg/l. Total phosphorus content in monitored samples changed from 0 to 0.12 mg/l.
- Total Fe content found at monitored locations fluctuates from 0.16 to 3.07 mg/l. In comparison with the standard QCVN, it shows most of the samples

met the standard.

- Al^{3+} content that was found at monitoring locations varied from 0 to 1.18 mg/l. There was significant change of Al^{3+} content among monitored locations. Although there is no standard of the Al^{3+} content for the comparison of the groundwater, but the Aluminum is toxic to human health. Therefore, it needs to be considered the change of their content in the domestic water.

5.2.4. Prediction of the water environment quality trend:

Some preliminary predictions of water quality in the project area are based on monitoring results of 2010 – 2012 periods.

- Water quality of Be River is rather good because this area is not highly populated, production activities has not developed yet, and streams flowing into Be River also has rather good water quality. In future, wastewater of industry and domestic activities will maybe make negative impacts on water quality of Be River and Phuoc Hoa Rservoir, if we do not have any restricted solutions.
- Water quality of Dong Nai River is rather good, especially the area after Tri An Dam. However, at Bien Hoa City, the reach of Bien Hoa River has being impacted by socio-economic activities. The variable trend of water quality of Dong Nai River will be complicated due to the impacts of wasterwater from towns and industrial parks in this area, especially after Hoa An Bridge.
- Water quality of Vam Co Dong River is not only affected by nature conditions, but also by human activities. Especially, it is impacted by acid sulphate soil in the upstream and salinity intrusion in the downstream. The developing trend of production activities in the upstream of this river (belong to Long An Province) can make the water quality to be worse.
- Groundwater quality has averaged, it is predicted that impacts on groundwater caused by project activities are very low.

6. Biodiversity

6.1. Aquatic biodiversity

Assessment the Aquatic biodiversity in the last six month of year based on the results of the monitoring stage in November of 2012 of Package MT6.

6.1.1. Fishes and shrimps

Total of 168 species fish and shrimp were identified at eleven surveyed stations belong to 13 orders, 37 families. The abundant of species composition at stations was rather high showed in species level, families level and order level.

There are 73 families in 13 orders, in there the dominating orders are *Perciformes* with 14 families (37.84%), *Siluriformes* with 6 families (16.22%), and the remaining orders contain from 1 to 3 families (2.70 – 8.11%). Within the 13 orders, the 3 orders dominated with the highest number of species including *Cypriniformes* with 68 species (40.48%), *Perciformes* with 39 species (23.21%), *Siluriformes* with 29 species (17.26%). However, the remaining orders contain from 1 to 7 species (0.60 – 4.17%). There are 168 species in 37 families, the dominating families are *Cyprinidae* with 60 species (35.71%), *Bagridae* with 13 species (7.74%), the remaining families contain from 1 to 7 species (0.60 – 4.17%).

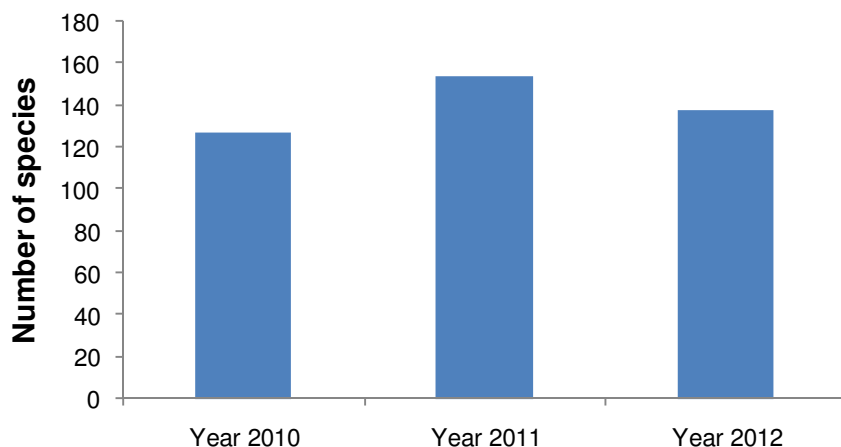


Figure 15: Graph on variables of number of species fish in three years

Figure 16 indicated that there were slightly variables of the number of species fish through the years. The highest number of species was 154 species in 2011, the lowest was 127 species in 2010, and 138 species in 2012.

6.1.2. Phytoplankton

In three surveyed years, the species composition of phytoplankton was 270 species. The variables of species composition through the years was showed at Figure 24. The species composition was focused on six phylums, the dominant species of the algae phylum is classified by the following rank:

- The phylum *Bacillariophyta*: 100 species (37.04%)

- The phylum *Chlorophyta*: 95 species (35.19%)
- The phylum *Cyanophyta*: 38 species (14.07%)
- The phylum *Euglenophyta*: 29 species (10.74%)
- The phylum *Dinophyta*: 6 species (2.22%)
- The phylum *Chrysophyta*: 2 species (0.74%)

Through 11 monitoring stations, the most diverse algal species was found at the station TS2 with 38 species (44.19%). The number of algal species found at the station TS1 was 28 (32.56%). The number of algal species was found at the station TS6 was 26 species (30.23%). Algal species found at the remaining stations varied from 12 to 17 species, equivalent to 12.79 to 19.77% of the total species.

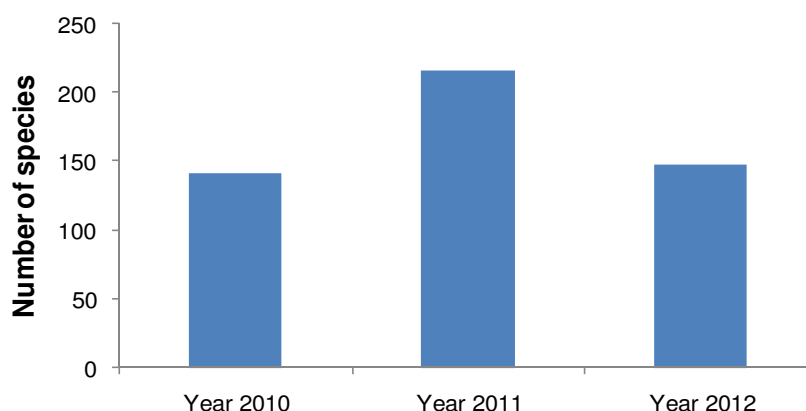


Figure 16: the variables of number of phytoplankton species through the years

Figure 16 showed that there was on variable of number of phytoplankton species through the years. The highest variable was year 2011 with 217 species and the lowest was year 2010 with 142 species. Year 2012 was with 148 species.

Almost of species at survey stations was fresh water species, they are good food for fishes and shrimps. Especially, there were no any toxic species such as *Pseudonitzschia spp.* and *Dinophysis caudata*.

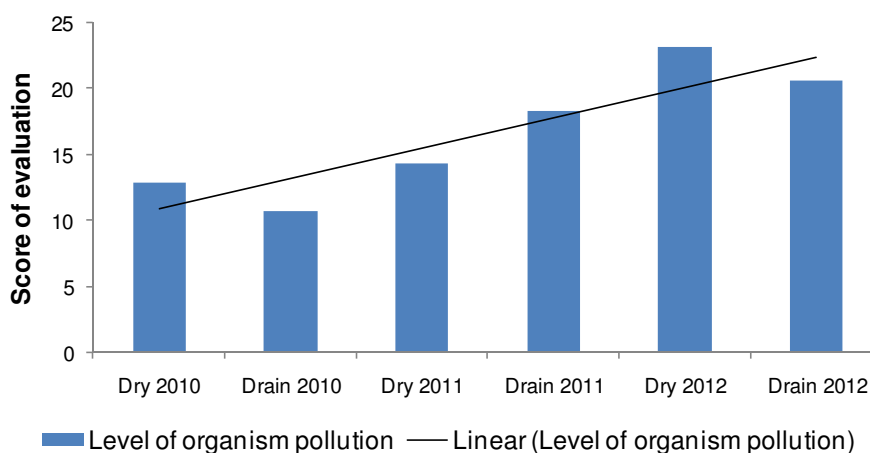


Figure 17: Graph on the variable of organism pollution level through the years

From the analyzed results of Phytoplankton density presentation at genus level in samples show that, there was heavy organism pollution of water quality in both seasons of 2012. The level of organism pollution increased [Figure 17].

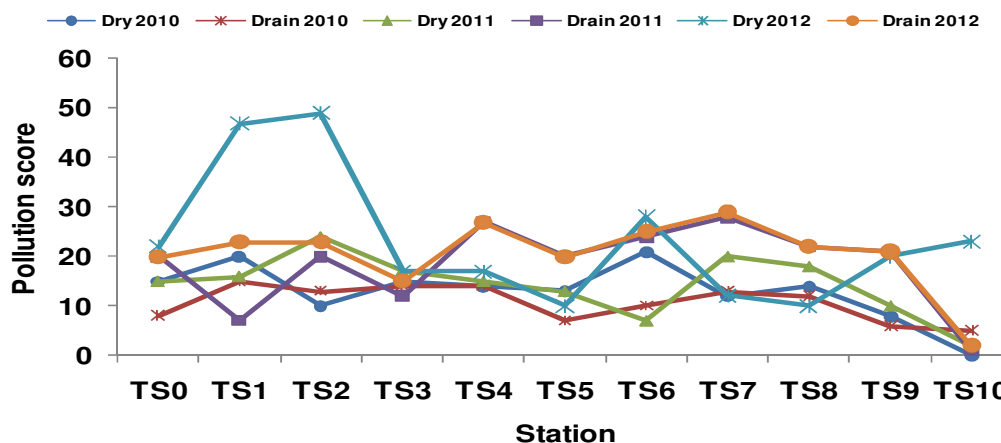


Figure 18: Graph on the level of organism pollution at surveyed stations

From the Figure 18 shows that there was a strong variable of heavy organism pollution of water quality at surveyed stations. The heavy organism pollution stations consist of TS0, TS1, TS2 and TS6 stations in the dry season of 2012. The increase in organism pollution at above stations mainly focused on year 2012. However, the remaining stations have not polluted yet, but they are alarming such as TS8, TS9, and TS10. Palmer Index (1g0uu969) is used to evaluate the pollution level of water by presentation of alga species in the water sample. [Table 7]

Table 7: Rate of marks of algae density appeared at the monitoring stations

Station	TS0	TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9	TS10
Dry 2010	15	20	10	15	14	13	21	12	14	8	0
Drain 2010	8	15	13	14	14	7	10	13	12	6	5
Dry 2011	15	16	24	17	15	13	7	20	18	10	2
Drain 2011	20	7	20	12	27	20	24	28	22	21	1
Dry 2012	22	47	49	17	17	10	28	12	10	20	23
Drain 2012	20	23	23	15	27	20	25	29	22	21	2

Score ≥ 20 : high organic pollution

Score 15-20: probable organic pollution

Score < 15 : less organic pollution

Source: Monitoring results in 2012 – Package MT6 – Phuoc Hoa project

6.1.3. Zooplankton

In six surveyed stages, found 52 species of zooplankton distributed to 11 monitoring stations belong to 5 phyla as follows:

- Phylum *Annelida*: 1 species with 1.92%
- Phylum *Mollusca*: 2 species with 3.85%

- Phylum *Protozoa*: 3 species with 5.77%
- Phylum *Aschelminthes*: 11 species with 21.15%
- Phylum *Arthropoda*: 34 species with 67.31%

Phylum *Arthropoda* was the highest number of species contain 34 species (occupy 67.31%), within sub-class *Cladocera* and sub-class *Copepoda* with some of common species by *Bosmina longirostris*, *Bosminopsis deitersi*, *Ceriodaphnia rigaudi*, *Eucyclops serrulatus*, *Microcyclops varicans*, *Thermocyclops hyalinus*, etc. next is phylum *Aschelminthes* including sub-class *Rotatoria* with presented by *Brachionus quadridentata*.

6.1.4. Zoobenthos

The species composition of zoobenthos found at 11 surveyed stations contain 24 species belong to 6 classes, 3 phyla. Phylum *Arthropoda* was the highest number of species with 11 species, while the both *Mollusca* and *Annelida* were lower with 7 and 6 species, prepectively. Class *Crustacea* with the highest number of species, 7 species belong to *Arthropoda* (29,17%), class *Gastropoda* belong to *Mollusca* and class *Oligochaeta* belong to *Annelida* contain 4 species (17%), class *Bivalvia* with 3 species, and class *Polychaeta* with 2 species (13%).

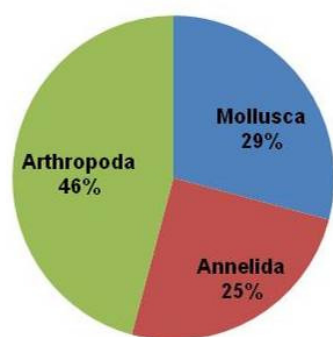


Figure 19: Percentage of zoobenthos composition at all monitoring stations

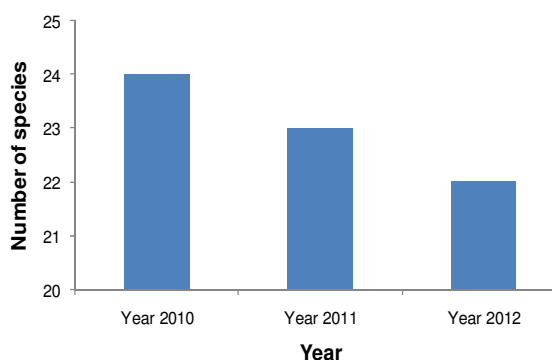


Figure 20: Graph on variables of number of species zoobenthos through the years

Figure 21 shows the difference of the number of zoobenthos, they were declined through the years. the highest number of zoobenthos was year 2010 with 24 species, the next was year 2011 with 23 species and the lowest number of zoobenthos was found in 2012 with 22 species.

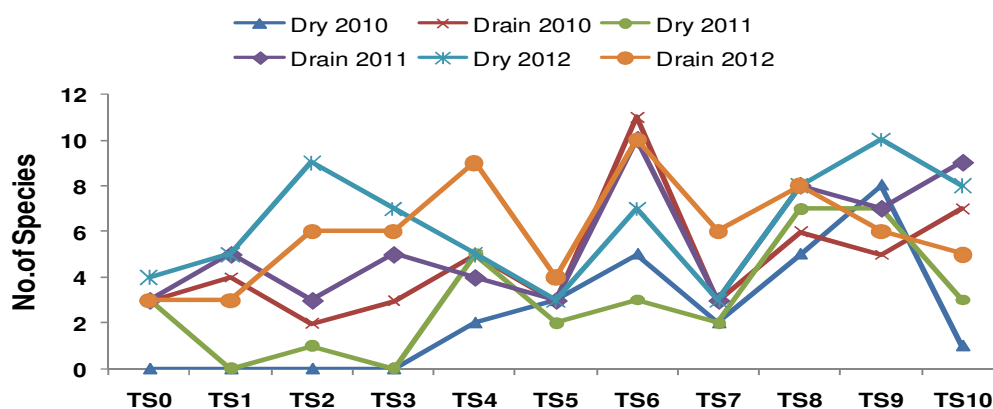


Figure 21: Graph on fluctuation of species composition of zoobenthos at stations

6.1.5. Fishery productivity in Be River

❖ Binh Duong Province:

Based on the data of DARD of Binh Duong Province in 2010, the fishery productivity increased twice in comparison with 2003 (235 tons) and increased 4 times in comparison with 1996 (152 tons). In the Tan Uyen District, the fish production was caught in Dong Nai River and Da Ban Reservoir (55%); In Thuan An District, the fishery production was caught on Sai Gon river (14%). In Phu Giao and Ben Cat Districts, the fishery production was caught in Be and Thi Tinh rivers (11%), in Dau Tieng district, the fishery production was caught in Dau Tieng and Can Nom reservoirs (4-5%).

Based on the data of DARD of Binh Duong Province in 2012 show that, aquaculture productivity in 2012 was nearly 20 times higher than that in 2003 (302 tons) and increased approximately 35 times compared to 1996 (189 tons). In recent times, the increase of aquaculture productivity is rather high [Table 8].

Table 8: Fisheries development situation in Binh Duong Province

No.	Indicators	Unit	2007	2008	2009	2010	2011	2012
1	Aquaculture							
	- Area	Ha	469	495	517	398	420	415
	- Productivity	Ton	4059	4559	4906	5381	6616	-
2	Fishing	Ton	518	468	536	280	264	250
3	Total output	Ton	4577	5027	5442	5661	6880	7200

Source: Binh Duong DARD

Currently, the Economic Division of DARD is managing fisheries activities in Binh Duong province. At district level, the management unit is the district Economic Division and the Commune People's Committee directly manages households.

❖ Binh Phuoc Province:

Based on the annual report of the Binh Phuoc DARD, the total fisheries

productivity in the whole province has increased over the years for both fishing and aquaculture sectors until 2009 [Table 9]. Total fisheries production was 643 tons and aquaculture productivity 7078 tons in 2009. Since 2010, however, fishing and aquaculture productivity have decreased.

The statistics show that between 2007 and 2009 the area of fish cultivation increased by 9%; the aquaculture output rose by 17%; Fisheries output rose nearly 16%, but the productivity of later years has decreased gradually. Fishing in pond and cage are the main types. In 2011, there were 126 cages, a decrease 2010 with 133 cages.

Table 9: Fisheries development situation in Binh Phuoc province

No.		Unit	2007	2008	2009	2010	2011
1	Aquaculture						
	- Area	Ha	2118	2229	2496	2295	2113
	- Productivity	Ton	5269	6102	7078	6393	6052
2	Fishing	Ton	488	559	643	412	357
3	Total output	Ton	5757	6661	7721	6926	6409

Source: Binh Phuoc DARD

It is not similar to Binh Duong Province: the Fisheries Division – Binh Phuoc DARD takes the responsibility to manage fisheries activities, support technologies to fishermen and plays a role as an advisory unit for the DARD on the fishery aspect in the whole provincial area. The fishing activities are managed by the Commune People's Committees.

Status of fishery resources in the Phuoc Hoa reservoir and downstream of the dam: Due to the fact that Phuoc Hoa reservoir is a reservoir with the open ecosystem, the species composition in the reservoir and along Be river did not changed too much. In the temporary report, the consultant presented surveyed species and updated the survey data of package MT6 by seasons that were presented in the six-monthly report and previous annual reports.

The situation of fisheries and aquaculture sectors in upstream reservoir and reservoir areas:

Fishing sector: At present, the local government has not yet conducted an inventory of the numbers of fishery households and the fishing output in the reservoir. Based on the survey results, the consultant MT4 found that many fisherman came from other provinces. These fisherman used many types of fishing gear such as fishing nets, fishing rods, fishing spears and even electrical tackles. This problem has not been addressed by the local government. These fisherman even caught fishes in the fish pass (this information was given by the local people). The government agencies should take action to prevent the exploitation of fish in the fish pass. In addition, the fishing by electric shocks must be prevented.

Aquaculture sector: At present, there are 2 fishing cages in Tan Thanh

Communes along the Be river. In Binh Phuoc Province, some households living in the semi-flooded area are digging fishponds spontaneously (Hamlet 2, Minh Thanh Commune).

6.2. Terrestrial biodiversity of Lo Go – Xa Mat National Park (NP)

Based on the implementation results of package MT1, the terrestrial biodiversity has been mentioned, the mentioned results in MT1 report were the retrospective results of previous studies and the implementation results of package MT1 as follows:

The Birdlife Organization in 2000 reported that NP had many race species with large number of individuals. Institute of Tropical Biology in 2001 reported that have 29 species in which included some important species such as black-shanked douc langur (voọc chà vá chân đen), silver langur (voọc bạc), pig-tailed monkey (khỉ đuôi lợn), etc. There are 149 species of birds (estimated there are 162 to 173 species) in which there are 3 rare species: *Lophura diardi* (gà lôi hồng tía), *Leptotilos javanicus* (già đẫy Java), *Ciconia episcopus* (hạc cổ trắng). About amphibians, there are 23 species, in which mainly contain *Ichthyophis bannanicus* (ếch giun) and *Michryla picta* (nhái bầu); there are 56 species of reptiles including lizards.

The results of investigating 10 monitoring routes and interviewing 6 hunters for common fauna that frequently appear in Lo Go – Xa Mat National Park as follows:

About birds, preliminarily identified 33 species. The most appearance species are *Anthracoseros* (cao cát), *Copsychus* (chích chòe), *Phasianidae* (gà rừng), *Dicrurus paradiseus* (chèu bẻo cò đuôi chẻ), *Streptopelia chinensis tigrina* (cu gáy), *Lophura* (gà lôi). In addition, there are *Fringillidae* (se sẻ), *Accipiter trivirgatus* (ó), *Pycnonotus jocosus* (chào mào), *Megalaima lineata* (cu rốc), *Podargidae* (đớp muỗi), *Polyplectron germaini* (gà tiền mặt đỏ), *Parus major* (khướu bạc má), *Anas platyrhynchos* (le le), *Sturnidae* (sáo nghệ), *Oriolidae* (vàng anh), *Falconidae* (bù cắt), *Dicaeidae* (chim sâu), *Pharacrocoraxniger* (cồng cọc), *Strigidae* (cú mèo), *Treron* (cu xanh), *Gracupica nigricollis* (cường), *Francolinus pintadeanus* (đà đà), *Ardeidae* (diệc), *Accipiter bicolor* (diều hâu), *Muscicapidae* (đớp ruồi), *Buceros bicornis* (hồng hoàng), *Gracula religiosa* (nhồng), *Coraciiformes* (sa sả).

About animals, preliminarily identified some species such as wild pig (lợn rừng), *Macaca fascicularis* (khỉ đuôi dài), *Tragulidae* (cheo cheo), *Viverricula indica* (chồn hương), *Sciuridae* (sóc), *Viverra megaspila* (chồn mướp), *Felis silvestris* (mèo rừng), *Hylopates spadiceus* (sóc bay), *Pholidota* (trút), *Mustelidae* (chồn đen), *Martes flavigula* (chồn vàng), *Nycticebus coucang* (cu li), *Macaca nemestrina* (khỉ đuôi lợn), *Hystriidae* (nhím),...About Reptiles and Amphibians there are snake, *Gecko gecko* (tắc kè), *Varanidae* (kỳ đà), *Daboia russelii* (Rắn hổ bươm), *Pteranodon* (thằn lằn bay), etc.

7. Soil condition

Assessment of the monitoring results in the Duc Hoa irrigation area. In the last six months of 2012 has a monitoring stage in October, as follows:

7.1. Soil

- Soil condition at monitored areas contained a high acid content. The $\text{pH}_{\text{H}_2\text{O}}$ values at monitoring sites varied from 2.27 to 4.56. Most of monitored locations with the $\text{pH}_{\text{H}_2\text{O}}$ value met the standard TCVN 7377:2004 Soil quality - pH indicator value in the land of Vietnam.
- Similar to the same period of 2011, most of the soil samples appeared to have high or very high organic content. The total organic carbon content of soils varied from 1.03% to 7.55%, most of them the standard TCVN 7376:2004 Soil quality – Carbon content indicator value in the land of Vietnam.
- Total Nitrogen content in monitored samples in October 2012 varied from 0% to 0.47%, especially the value was 0 at some locations, while the value was too high at some other locations, exceeding the allowable limit of the standard TCVN 7373:2004 Soil quality – Nitrogen content indicator value in the land of Vietnam.
- Soil at project areas appeared to the poor level of total Phosphorous, all monitored results (October 2012) met the allowable limit of the standard TCVN 7374:2004 Soil quality – Phosphorous content indicator value in the land of Vietnam, fluctuated from 0.01% to 0.33%.

Compared the monitored results of alum soil in 2010 and 2011 with 2012 was significant difference. In comparison with 2010 and 2011, Phosphorous content in soil appeared at most of locations, SO_4^{2-} concentration at some locations did not appeared including S21 and S63 in October 2012, similar to 2011.

7.2. Soil solution

In the monitoring stage, measurement results of pH in water samples show that the soil in monitored areas contains a high acidic content. The pH values varied from 4.69 to 5.67. The lowest value appeared at SW22 and the highest value appeared at SW12, and pH value increased following the depth.

Total Nitrogen content in the soil solution varied from 17.64 to 25.62 ppm. Total Phosphorous content in soil solution varied from 0.54 ppm to 2.17 ppm.

Total Fe content varied from 60.23 to 876 ppm. Value of Al^{3+} in soil solution varied from 32 to 175 ppm. In addition, SO_4^{2-} content in the soil solution varied from 159 to 321 ppm at monitored locations.

SO_4^{2-} concentration in the soil solution at monitored locations varied from 246 ppm to 317 ppm, the lowest value appeared at SW21 and the highest value appeared at SW11. At SW1 location, SO_4^{2-} concentration increased following the depth.

8. Monitoring results of Administration House

At present, the Administration House was transferred to Dau Tieng – Phuoc Hoa IMC. There are about 15 staffs of company working here frequently. Groundwater is used for domestic purpose and the wastewater has been collected into storage containers, deposition tanks and then being penetrated into ground. Domestic solid wastes with mainly organic wastes and small amount have been gathered for drying and burning. The traffic density acrossing dam area is rather low, hence air is fresh and unpolluted.

- Waste water has been collected and flowed into the septic tank and seepage, the tank was constructed following the technical design and located away from the dam about 150 m, There are about 6-10 workers working in the Administration House, so waste water is negligible.
- For the Air quality: the Administration House located far away from residential areas, traffic density is too low, mostly motorbikes. At all monitoring locations, the air quality met the standard QCVN 05:2008, noise was measured with value ranging from 25 – 35 dBA, temperature from 28 to 32°C, and humidity from 67 to 76 %, equivalent to the air, temperature and humidity in this area at the same time.

The Administration House are complied with environmental hygiene requirements, and they do not cause any negative impacts on ambient air quality, as well as surface water and groundwater in this area.

9. Environment Awareness

Construction of Phuoc Hoa Water Resources is going to create a large-scale beneficial area that located in many different provinces, these areas are also impacted by project directly and indirectly on the socio-economic activities, and environmental status is also impacted certainly whereby it shows the need of environmental awareness activities. Besides control and mitigation purposes, it also helps local communities using the project's resources effectively including surface water resources.

Package MT10 belongs to EMP packages of Phuoc Hoa Project is conducted with major objectives as follows:

- Raising stakeholder's and manager's understanding of fundamental concepts and background science of environmental, water resources and natural resources management, as needed within the project development sites, surrounding areas and effected river basins in order to protect the environmental, water and natural resources.
- Enhancing the awareness of Project and EMP stakeholder's and manager's of: the potential environmental impacts of the project, content and function of the EMP framework and monitoring sub-programs applied to address impacts; and the role of the involvement of project managers, contractors, state agencies and the local community in implementation of the Project and in protection of local and regional environment, water and natural resources.

In order to ensure the proposed objectives are well done to raise the environment awareness of local communities, consultant had designed and performed many workshops. These workshops have been performed with many contents in all surrounding provinces in the project region, which concern the effective exploitation and protection of environmental resources. Throughout these workshops saw that manager's and local people's aspiration for learning out about project's information, fundamental concepts of environmental, environmental protection, reasonable natural resources using are too large. It mean that the environmental protection awareness of local communities will improve and enhance a lot if the source of information about project; knowledge of irrigations, environment, agriculture, forestation, and aquaculture, etc are diffused widely and easy to approach by many channel of propagandas.

Nevertheless, throughout these workshops and also community contacts in the process of implementing project could make sure that the present environmental awareness of local communities are still low. It is difficult to change the habit of life and production of local people, which had been shaped for a long time by few training workshops.

In addition, only a small part of local people and managers have opportunity to access and know the major information of the project, so that the propagation is still limited and has not the effective results in the community, the role of local authorities has not performed well. Therefore, right places, where were organized the training workshops, local people still have activities that harm the environment and project. These are the encroachment of the local people on the land that was acquired for the forestation to protect the Phuoc Hoa Reservoir catchments, many people living around the reservoir area built toilets inside the reservoir, fishing in the reservoir by forbidden tackles using electrical shock, and even fishing right the fish pass, etc. For the constructors, although the project has official provisions for environment protection and consequently receipt the reminders and warnings from supervisors, however some constructors has not executed right the environment protection engagements that cause environment pollution and adverse effect on local people.

Overall, it can be concluded that the practices of enhancing propagation, education, training to raise the local communities' and manager's awareness of environment protection are very essential, even when the project put into operation. On the other hand, it needs to pay attention to reasonable and practical sanctions, policy mechanism, and social support programs, etc. Because after all the present harmful activities to the environment also originate from the demand of livelihood of inhabitants.

10. Conclusions and Recommendations

10.1. Conclusions

10.1.1. The natural and social environments

The natural environment was not negatively affected by the project.

In recent, due to Phuoc Hoa reservoir has over the water accumulation time, hence it appeared the DO decrease in the reservoir in April and June, and suddenly increased in the downstream area of the dam. It is suitable to the assessment of EIA report, , the DO decreased in the reservoir in the early stage of the impoundment because of the decomposition dead trees and solid waste in the reservoir, the DO decreased in the reservoir in the early stage of the impoundment because of the decomposition dead trees and solid waste in the reservoir. However, now, the water quality in Phuoc Hoa reservoir is quite good, equivalent to the water source type A of the standard QCVN 08:2008.

Up to the end of 2012, Phuoc Hoa – Dau Tieng transfer canal has not yet operated, hence can concluded that the salinity intrusion in the downstream of main rivers have not impacted by project.

Based on the monitoring results and the information that was provided by EMP packages and ICMB9, social issues related to the environment have not occurred in the project area. The problems of land occupation in the semi-flooded area have a suitable solution.

10.1.2. EMP packages

Package MT1: Based on the implementation results in comparison with the TOR of the consultancy contract, MT1 consultant has implemented the contract in accordance with required schedule and proposed workloads.

Package MT2: MT2 consultant has implemented the contract in accordance with required schedule and proposed workloads. Up to now, Task I was completed, Task II will be adjusted to be suitable for the actual situation.

Package MT3: Based on the implementation results in comparison with the TOR of the consultancy contract up to now, the implementation of this package is behind schedule. In addition, MT3 consultant lacks active in some activities that belong to the regulating missions of OP4 and ICMB9.

Package MT4: as mentioned in previous reports, during the implementation, the MT4 consultant was not active in coordinating with other EMP packages in order to collect necessary monitoring data for the use of the Package. This problem made delay in preparing progress reports and affected the general schedule of the EMP.

Package MT5: The consultant implemented their works timely but the

submission of reports is still delayed. The submission of reports needs to be improved.

Package MT6: in the first six months of 2012, the consultant implemented well the requirements as indicated in the consulting contract. However, the last six-monthly monitoring report of 2012 was not submitted timely.

Package MT7: At present, construction packages were completed. Therefore, the package MT7 should prepare the final report and submit this to the Employer.

Package MT8: Up to now, the key contents of package were completed consist of building stations and installing the monitoring equipments, calibrations, preparing the relevant documents for training and handing over. Consultant is also coordinating with ICMB9 to contact local agencies to training and handing over the stations.

10.1.3. Advantages, disadvantages and outstanding issues:

Advantages:

The implementation of all EMP packages is consistent with the requirements of the proposed schedule and contents. These results have the following advantages:

- Selected consultants are capable and have experiences in implementing the tasks of the package.
- Enthusiastic support from local authorities, agencies, and local people.
- Cooperation, sharing, and support among EMP consultants.
- Coordination and timely supports from ICMB9 in all cases to assist consultant in implementing their works.

Disadvantages:

In the last half of 2012, besides the above-mentioned advantages, the EMP tasks had certain difficulties as follows:

- For EMP packages, only 10 out of 14 packages are under the implementation but the workload is still quite big. In addition, each package implements different missions at different times. Therefore, the coordination between these packages is very difficult.
- The area of Phuoc Hoa reservoir is very large and located in different provinces. Therefore, it was very hard to find out the problems after the reservoir has been impounded.
- Some generated issues in the implementing process of EMP packages need

cooperation, indicator notions of Employer, Sponsor, and also local agencies, therefore impact on the implementing progress of project.

Outstanding issues:

The outstanding issues, which indicated in previous reports, have been solved by consultants. However, there are still some outstanding issues as follows:

- Submission of progress reports and providing information to Employer and supervision consultant on the implementation status of packages is still slow. This affects the data collection of the OP4 consultant. In addition, the consultants did not provide fully 03 sets of reports including hardcopy and CD Rom.
- After having comments from OP4 and BVI consultants, the revision and resubmission of reports to the Employer have not been made promptly.
- During the implementation, the consultants did not inform the detailed working programs to the local government, the Employer and the supervision consultant.
- During the implementation, the consultants did not provide the information of the project implementation to the local government.

For each EMP packages, base on the conclusions of the meeting on 20th March and 10th April 2013 there are some problems that need to be consider carefully, these problems have been considered the outstanding issues in the implementation process, and need to be solved in the coming time as follows:

- ✓ For package MT1: this package has conducted tasks quite good. However, the implementation of 50,000 fruit tree plantation and preparation of a model for buffer zone economic development would be especially considered in the coming time. Hence, the consultant should works with local agencies promptly in order to identify the receiving place.
- ✓ For package MT2: based on the results of the conference on 4th January 2013, the forestation task of MT2 would be not conducted and be replaced with supporting the Dam Owner, District and Commune People's committees carry out land use planning for the semi – flooded areas. Nevertheless, the practice of planning must be obeyed the project's EMP, in there the appropriate authorities need to have more positive behaviours towards preventing local people planting new rubber trees, making fish ponds, and also the other reoccupation of local people in the semi-flooded area.
- ✓ For package MT3: the feasibility study, design and cost estimate have been completed for lower Be River water supply scheme. For Tan My water supply scheme (Long An Province), Consultant need to work directly with BVI to

reach mutual agreement, hence we could be considered that these documents have not completed yet. In addition, Consultant should works with local agencies on handing alternatives, and using engagements after the construction of water supply stations complete.

- ✓ For package MT4: up to now, the remaining workload of this package consists of (i) establishing of Fishing Cooperatives for Binh Duong and Binh Phuoc Provinces; (ii) training in exploitation and protection the Fishery resources for Fishing Cooperatives; (iii) monitoring, evaluating the fish pass. According to the meeting on 10th April 2013, Consultant must be reported on the detail of implementation status to ICMB9 by the end of April 2013.
- ✓ For package MT5: there is a delay in the submission of annual monitoring report in 2012. In the coming time, Consultant should update frequently the water transfer plan of Phuoc Hoa – Dau Tieng canal. For water has not been transferred, hence the previous reports of MT5 package have not any obvious considerations for relevant changes.
- ✓ For package MT6: at the moment, this package conducts their tasks quite good following TOR.
- ✓ For package MT7: PH4 package is constructing, the environment issues need to be consider carefully, hence ICMB9 should negotiates with MT7 consultant about the terms of extension of the contract to monitor the construction impacts continuously.
- ✓ For package MT8: The Ben Luc (Long An) monitoring station has not been handed over to local agencies, this impacts on the environmental monitoring of EMP.

10.2. Recommendations

10.2.1. General recommendations for EMP packages

- The consultants should submit the inception report with three full sets (hard copy and CD Rom).
- Relevant agencies should resolve outstanding issues as mentioned in this report immediately.
- The consultants should take the initiative in delivering and sharing the data with other packages.
- The consultants must comply with the deadline for the submission of reports as required in the TOR. The consultant should also summarise EMP packages implementation results in the middle and the end of the year.
- The consultants need to provide the detailed working plans to the local

government during the implementation.

- For packages MT4, MT5 and MT6: the 6-monthly progress reports must be submitted immediately 15 days after the completion day.

10.2.2. Recommendation for each EMP packages

- ✓ For package MT1: continues to implement next activities on the basis of the TOR. The MT1 consultant should announce work contents and plan as conducts field works to Employer, and BVI, OP4 consultants to advantage them in regulation, supervision, and evaluation the implemented results.
- ✓ For package MT2: Conduct Task II with the contents consistent according the conclusion of the conference on 4th January 2013. Namely supporting the Dam Owner, District and Commune People's committees carry out land use planning for the semi – flooded areas consistent with the Vietnam regulations, satisfy the purposes of project environment protection.
- ✓ For package MT3: The MT3 consultant continues to implement next activities based on the TOR. The consultant should provide the contents and working plans to the Employer.
- ✓ For package MT4: The MT4 consultant needs to recheck all tasks of the Package. Since the Phuoc Hoa reservoir has been impounded, the fisheries management programs need to be prepared as well as the fisheries management team/association needs to be also established.

In addition, the consultant needs to speed up the submission of reports. It is needed to actively collect and summarize data from EMP packages and in contact with local governments. The progress report should be submitted before 10 March 2013.
- ✓ For packages MT5: Similar to the Package MT4, the submission of reports of the Package MT5 is still behind the schedule. Therefore, the MT5 consultant is requested to submit their reports before 10 March 2013.
- ✓ For package MT6: The MT6 consultant should continue to update the information and provide the necessary monitoring data so that the environmental condition in the Project areas can be reflected timely. The submission of reports should be improved so that this problem will not affect the general schedule of the Project.
- ✓ For package MT7: The MT7 consultant is requested to submit the final report of the Package in March 2013. The consultant should also

propose the EMP for the operation stage.

- ✓ For package MT8: the consultant should inform the implementation status, completion and finalization planning in March 2013.

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