Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:
Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
of the Federal Republic of Germany

Improved Management of Extreme Events through Ecosystem-based Adaptation in Watersheds (ECOSWat)

Planning of Ecosystem-based Adaptation (EbA) Measure for Water Supply and Flood Prevention for the Royal Initiative Huai Ta Poe Reservoir Project, Mukdahan Province in Thailand

Thailand

Inception Report

Presented to

GIZ Project Improved Management of Extreme Events through Ecosystem-based Adaptation in Watersheds

March 2017

Imprint

Published by
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

Bureau of International Cooperation,
Department of Water Resources
Ministry of Natural Resources and Environment
180/3 Rama VI Road Soi 34, Samsennai, Phayathai,
Bangkok 10400

Email roland.treitler@giz.de
Internet www.giz.de

Responsible on behalf of GFA Consulting Group GmbH
Klaus Sattler
Phone +49 40 60306552
Fax +49 40 60306259
Email klaus.sattler@gfa-group.de

Authors
Hubert Lohr
Klaus Sattler

Implementation
GFA Consulting Group GmbH

GFA
Consulting Group

Place and date of publication

Hamburg, March 2017

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

AR4	Fourth Assessment Report
DWR	Department for Water Resources
DEM	Digital Elevation Model
EbA	Ecosystem-based Adaptation
ECOSwat	GIZ Project: Improved Management of Extreme Events through Ecosystem-based Adaptation in Watersheds
EIA	Environmental Impact Assessment
GFA	GFA Consulting Group GmbH
GIZ	Deutsche Gesellschaft für Internationale (Technische) Zusammenarbeit GmbH
IPCC	Intergovernmental Panel for Climate Change
IWRM	Integrated Water Resources Management
REA	Rapid Environmental Assessment
RID	Royal Irrigation Department
ROS	River Operating Systems
TA	Technical Assistance
THB	Thai Baht
ToR	Terms of Reference
WUA	Water Users Association

1 Introduction

1.1 Ecosystem-based Adaptation in Thailand

Thailand will likely be one of the most affected countries of Climate Change given its geography, economy and level of development. For example, based on analysis of a subset of models used for the Fourth Assessment Report (AR4) of the IPCC the mean daily maximum temperature of the Bangkok Metropolitan Region will increase between 1.2 to 1.9°C by 2050[1]. The warming of the global climate system will have even stronger impacts on monsoon-driven climates as they prevail in Thailand. Both the number of rainy days and the level of precipitation have decreased. These findings are supported by several droughts in recent years. Research prognoses a decrease in net amount of total precipitation with shorter duration of precipitation events, however combined with an increase in intensity in the form of storms and floods[2].

In adaptation to climate change Ecosystem-based measures gain more and more attention and importance as robust and effective mitigation strategies. In a very simplified form, EbA means "Nature helps people to adapt".

Well-functioning ecosystems enhance natural resilience to adverse impacts of hydrological variability. The resilience of these ecosystems leads to a reduced vulnerability of the local population, if and when these measures are understood by local stakeholders and ownership of these measures can be created. As such, EbA can be an alternative to traditional actions such as infrastructure development or complement these traditional mitigation measures. Aside from protection against climate change effects, EbA also provides many benefits such as clean water, food, and other ecosystem services crucial for livelihood and human well-being. EbA measures aim at the conservation, rehabilitation and sustainable management of ecosystem, such as forests, water bodies and agriculture. The main focus of this project lies on water-related EbA measures.

The GIZ ECOSWat project addresses and supports Thailand in building a climate change resilient society and implements concrete pilot measures on local/regional levels.

1.2 Inception Report

GFA Consulting Group has been selected for the provision of consulting services for the Study "Improved Management of Extreme Events through Ecosystem-based Adaptation in Watersheds (ECOSWat). Planning of Ecosystem-based Adaptation (EbA) Measure for Water Supply and Flood Prevention for the Royal Initiative Huai Ta Poe Reservoir Project, Mukdahan Province in Thailand".

In March 2017 the GFA Consulting Team commenced its services by working with representatives of GIZ and the Royal Irrigation Department. This Inception Report summarized findings from its First Field Trip to Mukdahan Province and recommendations for achieving objectives of this Technical Assistance.

1.3 Objectives of the assignment

The objectives of this consultancy feed directly into the overall objective of the GIZ project and the current project's situation. At the beginning of the ECOSWat project in 2013, the partner institutions DWR and RID, especially RID, strongly favoured grey water infrastructure. The GIZ project, together with the partner institutions, conducted vulnerability assessments in the pilot areas, proposed measures to tackle vulnerabilities and evaluated these measures economically. During those processes the institutions changed their view on green infrastructure. In August 2015, RID

[1] World Bank, 2009: Climate Change Impact and Adaptation Study for Bangkok Metropolitan Region: Final Report.

[2] Marks, 2011: Climate Change and Thailand: Impact and Response Contemporary Southeast Asia, Institute of Southeast Asian Studies (ISEAS), 2011, 33, 229-258

requested support from ECOSWat to review 20 existing medium term projects and to elaborate alternative EbA measures, when feasible.

Overarching GIZ project objective

Outcome: The Department for Water Resources (DWR) and the Royal Irrigation Department (RID) or other public water management institutions with budgetary responsibility in the field of water management have approved and financed at least 3 EbA measures in the area of drought-/ flood-prevention in catchments.

Output 2: At least one EbA measure in the field of drought-/flood-prevention in the Chi, Tha Di and Lam Pa Chi catchment areas is implemented respectively (so far water storage and retention measures in the catchment areas are "grey" infrastructure).

Specific objective of this consultancy

The Royal Initiative Huai Ta Poe Reservoir Project located in Kham Cha I District, Mukdahan Province (16° 42.094'N 104° 17.872'E) which aims to store water for both flood prevention as well as water supply for the agricultural and domestic sector, with a construction period of 4 years and a budget of 180 Million Thai Baht (overview in attached document)

Outcome: The construction of at least one alternative or complementing EbA measure for the Huai Ta Poe Reservoir in Mukdahan Province is planned.

Output 1: Support RID in the redesigning process of an already planned water infrastructure project for the Huai Ta Poe Reservoir so that local stakeholder needs are represented.

Output 2: Propose EbA measures as alternatives or complements to the already planned grey infrastructure measures.

1.4 Overview of activities

The preliminary timetable of activities as laid out in the technical proposal is given as follows:

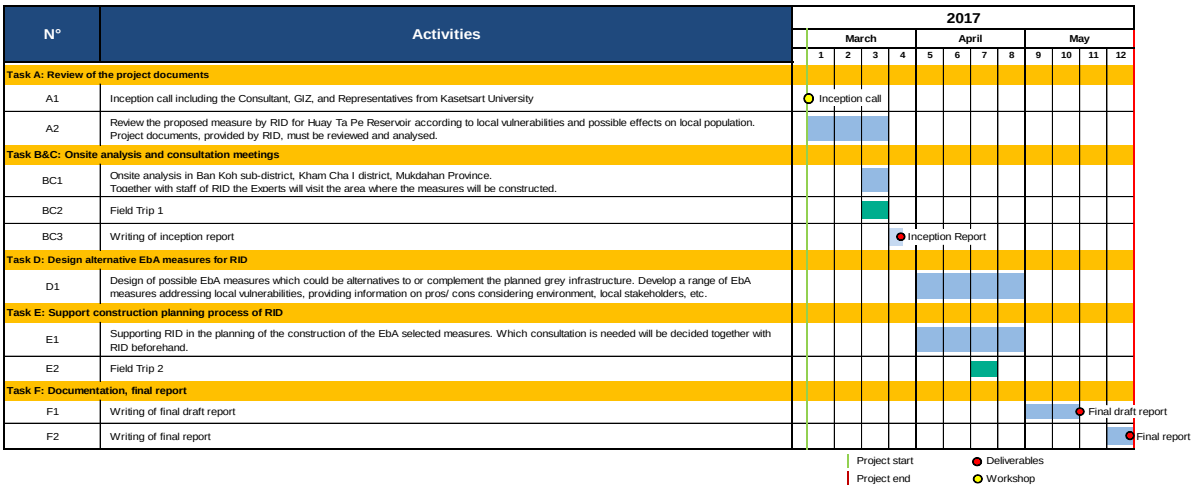

Figure 1: Preliminary timetable of activities

The official starting date of this assignment was 1st March 2017.

Prior to Field Trip 1, specifically between 13th – 17th of March, Professor Nat Marjang, Department of Water Resources Engineering at Kastesart University and responsible for the EIA of the Huai Ta Poe Reservoir, provided the study team with basic information on the catchment, reservoir, irrigation area, and dam features. This information included the provision of maps containing the boundaries of the different areas and points of major significance and allowed the study team to get familiar with the project area and dimensions of the reservoir project.

During the same time period, up to 17th of March, the study team made itself familiar with the project area to the extent possible and specifically through the use of available maps and satellite images.

The Field Trip 1 was carried out from 20th – 29th March, which consisted of the following:

On 20th of March, a **kick-off meeting** was held with representatives of the GIZ project at the GIZ office at the Department of Water Resources, Ministry of Natural Resources and Environment. The objectives and approach of the study were discussed and a common understanding established.

On the same day, the study team developed a questionnaire to be used at the Field Trip, which was translated by the GIZ team into Thai language.

The days 21st – 24th March were spent in the project area in **Mukdahan Province**.

On 27th March, the **preliminary findings were presented to and discussed with** the GIZ Programme manager Mr Roland Treitler.

On 28th March, the study team finalised the Inception Report.

An overview of the activities is presented in the Annex.

2 Field Trip 1

2.1 Reservoir background information

This project is a King Initiative Project and is the 8th dam development project in the wider forest conservation and wildlife conservation area running parallel to the Bang Sai River. The main purpose of the dam development is to provide water to counter dry spells with irrigation and water supply are major drivers. The water amount for irrigation outstrips water supply by far.

The dam is being erected at the Huai Ta Poe River which is a tributary of the Bang Sai River which flows into the Mekong upstream of Mukdahan.

Mean annual discharge at the dam site is estimated to 25 Mio.m³. The reservoir volume at fulll supply level runs up to 20 Mio.m³.

The normal pool water surface area will be 3.44 km².

The pool area lies within a national park and wildlife conservation area, and is almost entirely covered by forest.

According to RID, combating drought is considered as the major problem while flooding is of minor importance.

The number of beneficiaries in the project area is estimated by RID to 320 households, or ~1,600 persons.

An overview of technical specifications on the reservoir is provided in the Annex.

Figure 2: Project area

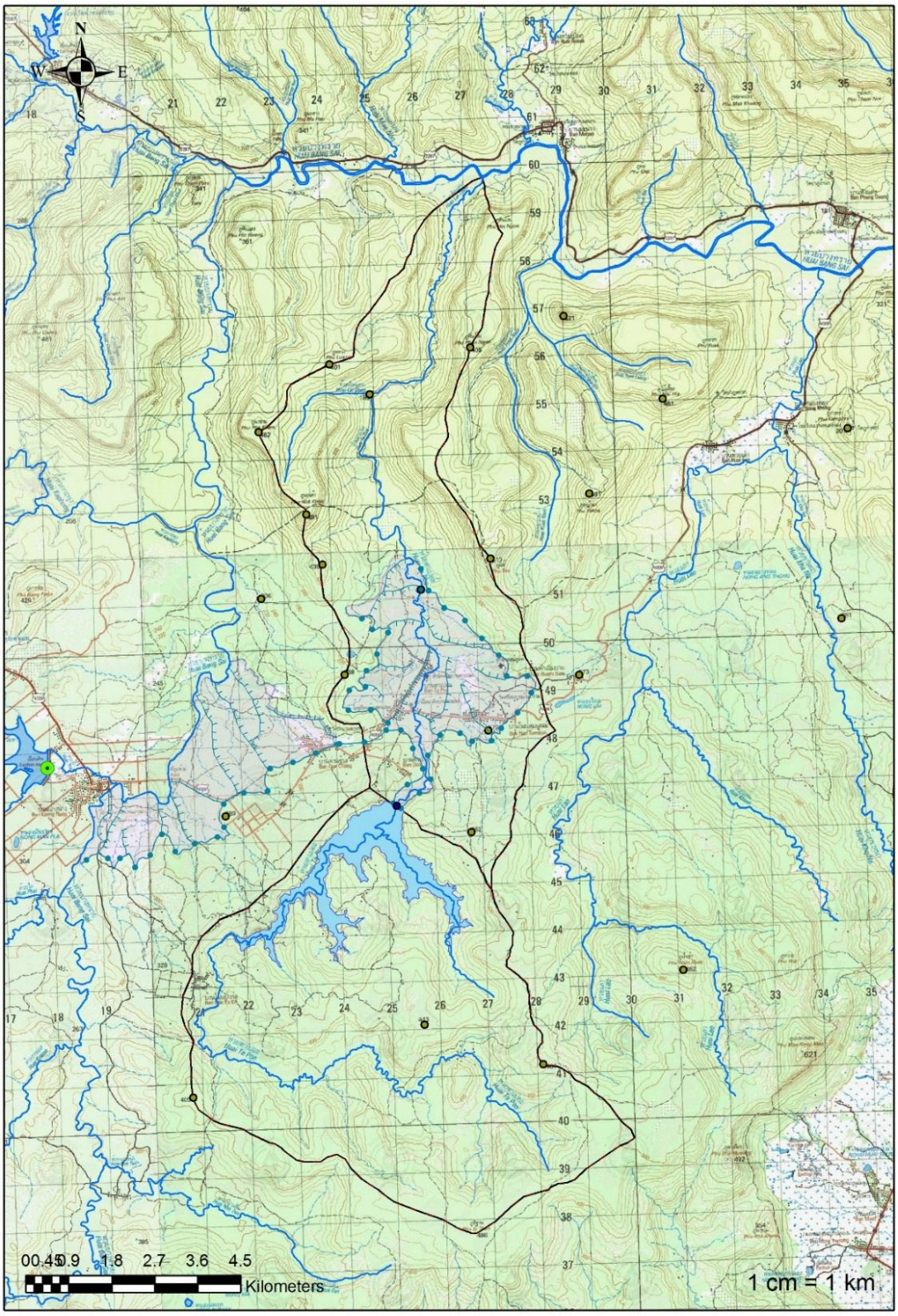

Figure 3: Project area 2

2.2 Reservoir project status and course of action

Begin of construction dates back to 2014 when the budget was allocated. A pre-feasibility study was carried out assessing water demand and outlining the basics of the project. Dam construction is estimated to be finished during September 2017. The EIA report by Prof. Nat Marjang has been drafted to 2016 and submitted to ONEP. ONEP has asked for clarification. Thus, approval is on-going and is supposed to be given with a not yet specified date. A revised version of the EIA will be submitted by Prof. Nat Marjang to ONEP by around end of April. Three weeks after submission, a meeting with ONEP will be held. Following the meeting, ONEP may approve the EIA.

The water distribution system is under design, but for the construction of the system RID has to wait for budget approval in fiscal year 2018. They can start to construct the system already before approval of EIA by ONEP. Finalisation of the distribution system is estimated to be ready in 2019.

Filling of the reservoir may not start prior to the approval of ONEP.

Clearing the reservoir area (forest) is associated with the approval of ONEP and must not start before.

The process of construction start prior to EIA approval is the exemption in Thailand. The reason may be related to the fact that the project runs under the King Initiative, however this remains uncertain.

2.3 Documentation of the Field Trip

2.3.1 Overview

The Field Trip comprised two full days. Day 1 concentrated on the dam site and the area downstream the dam which is called *irrigation area right* according to the irrigation scheme of the Huai Ta Poe Project. Day 2 was conducted focussing on the reservoir and *irrigation area left*.

The points visited were selected to obtain an insight about river stretches, tributaries, confluences, land use management practices and mainly affected areas downstream, upstream and within the irrigation zones.

In total, 16 points on Day 1 and 32 points on Day 2 were targeted. Local navigators, RID staff, Prof. Nat Marjang from the Kasetsart University, GIZ staff and the authors took part in the Field Trip.

It is important to note that prior to the Field Trip there were three days of exceptional rain. This is unusual for March and brought about considerable flow. Thus, river flow conditions in the pictures do not necessarily reflect average conditions and show more water than it could be expected during March otherwise.

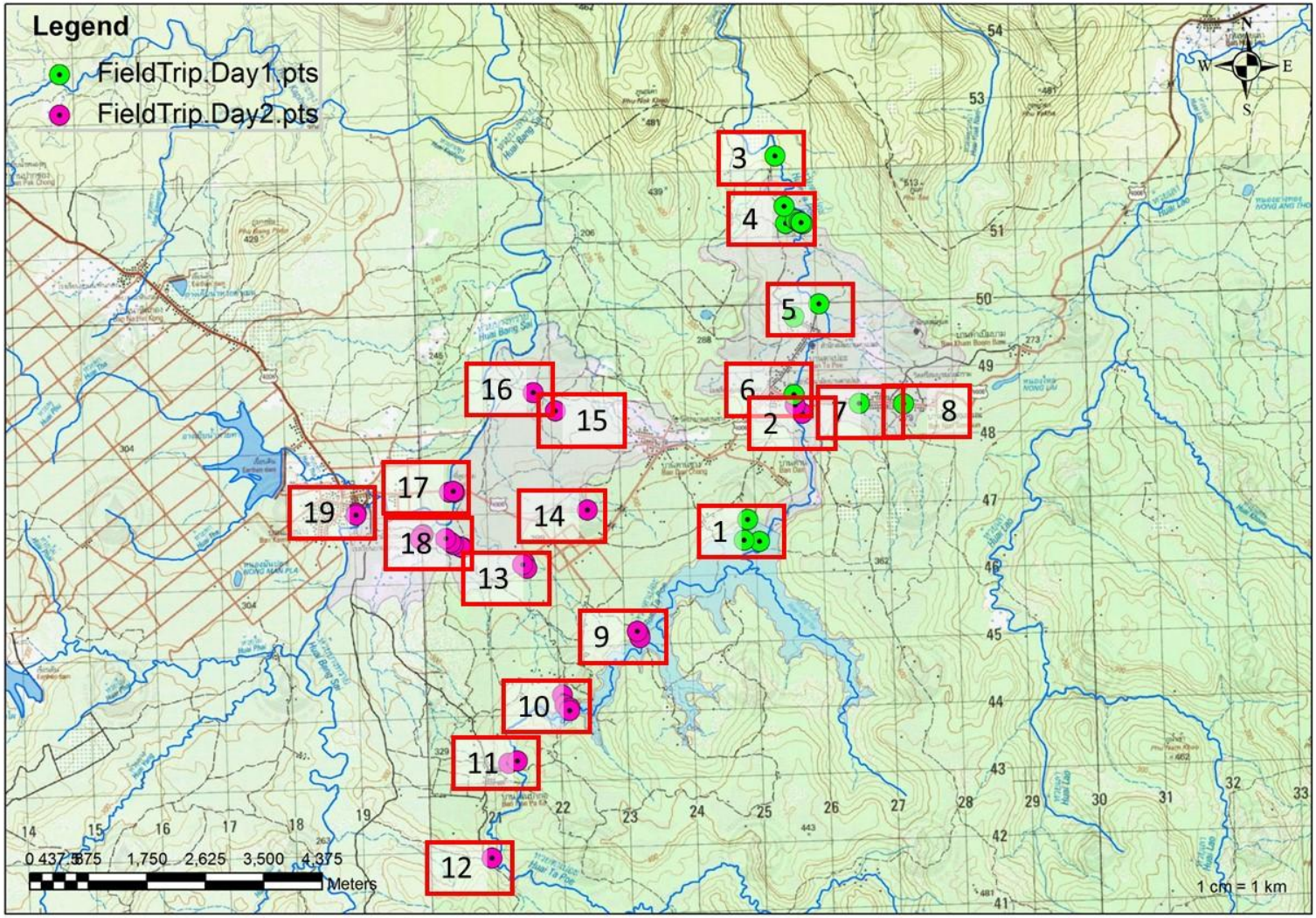

Figure 4: Overview about the Field Trip and points visited

2.3.2 Dam site

Figure 5: Dam site

2.3.3 Irrigation area right – downstream the dam

Figure 6: Huai Ta Poe downstream the dam site

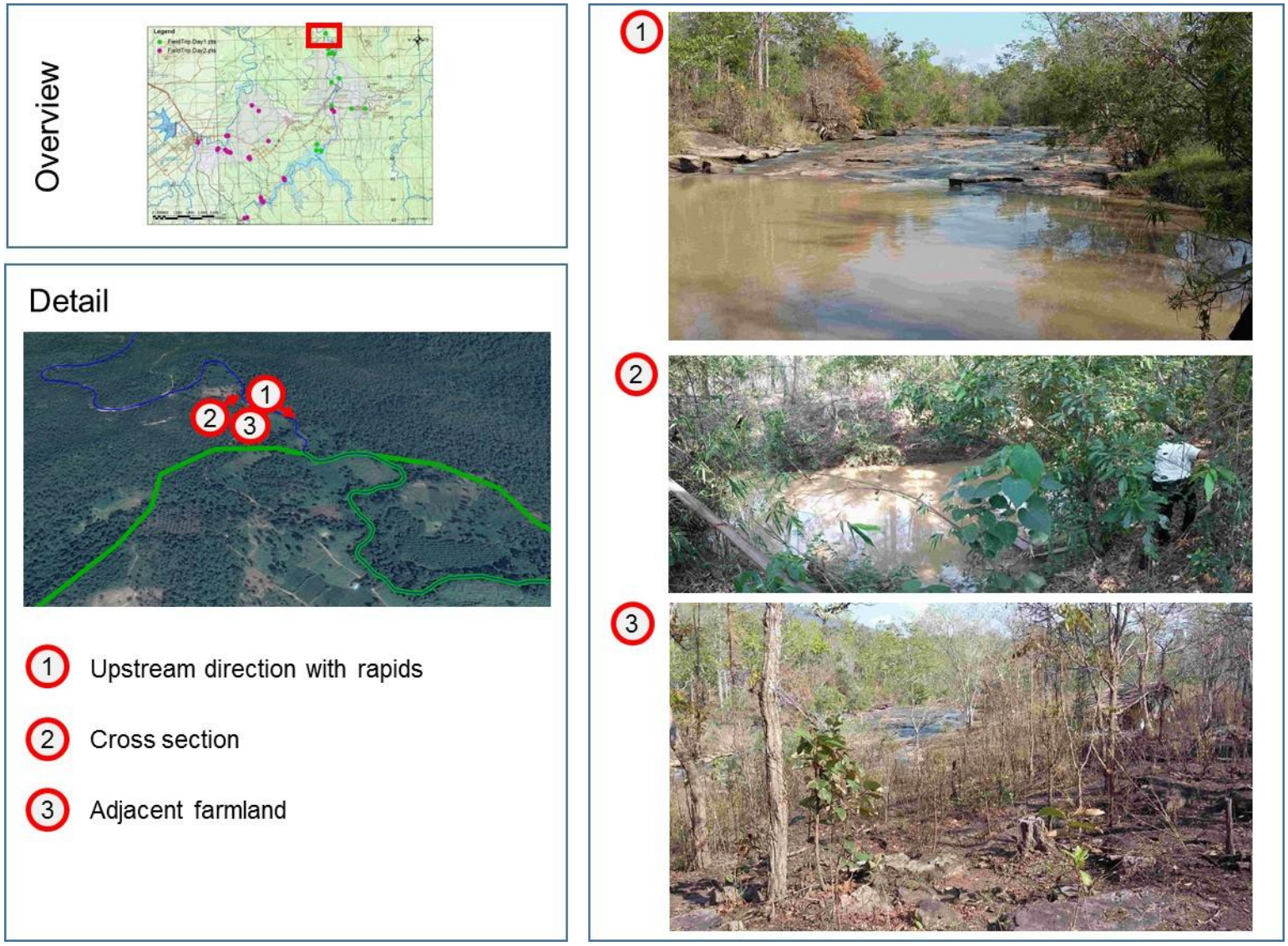

Figure 7: End of project area, close to border of national park

Figure 8: Huai Ta Poe Weir

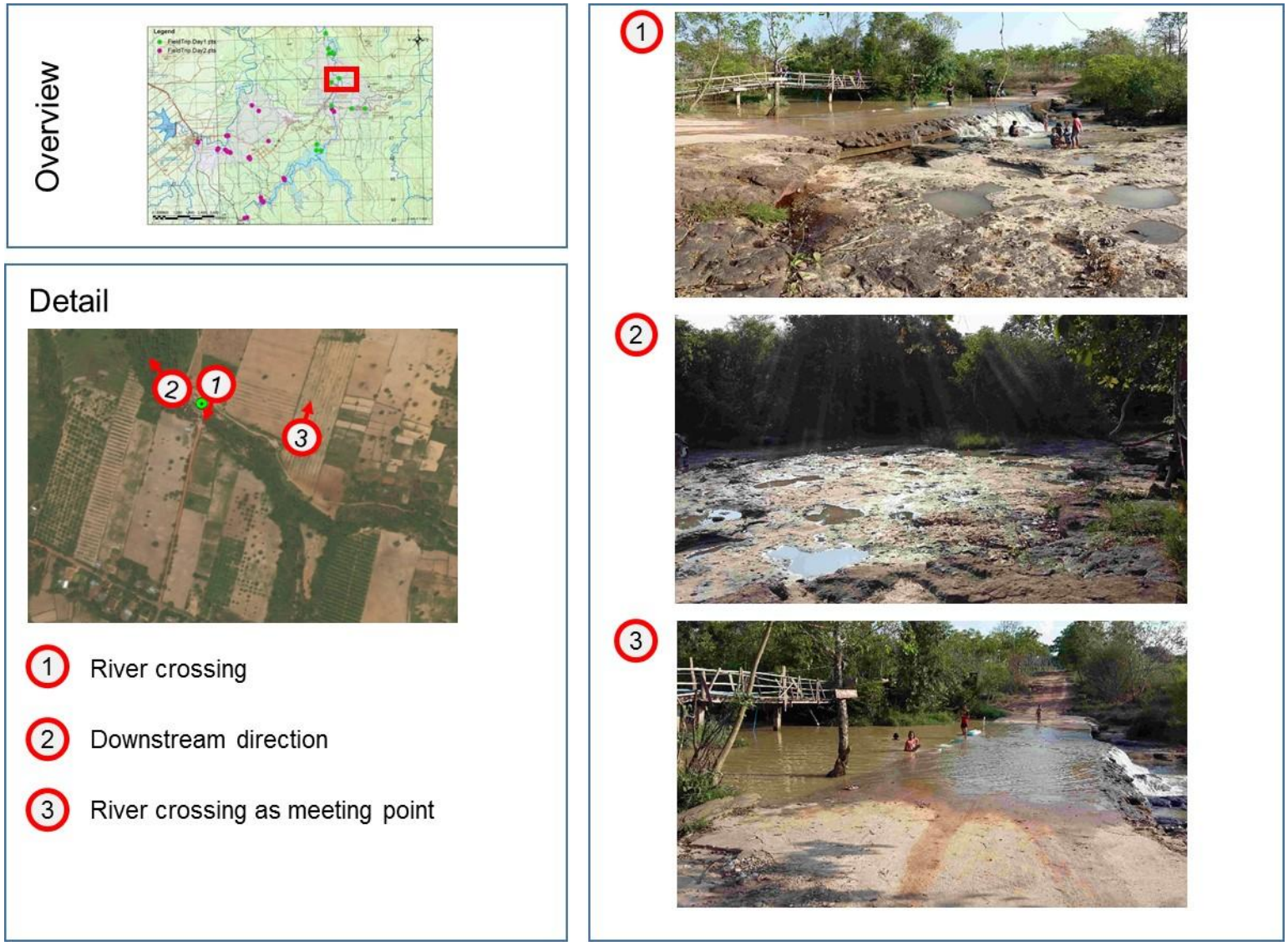

Figure 9: River crossing over main River Huai Ta Poe

Figure 10: Huai Ta Poe River crossing next to village

Figure 11: Tributary 1 River crossing

Figure 12: Tributary 2 River crossing

2.3.4 Reservoir

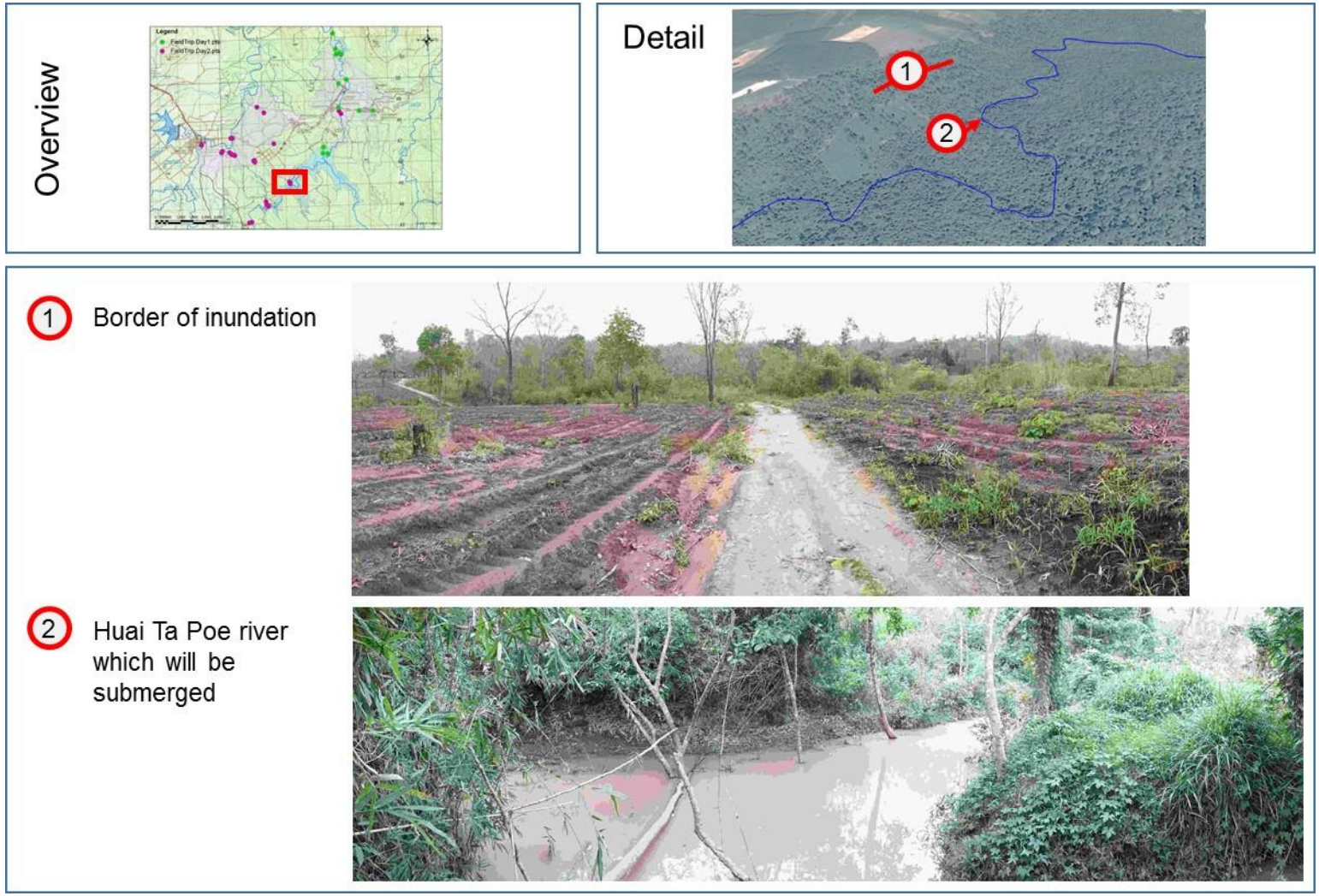

Figure 13: Inundated area after flooding of the reservoir (1)

10

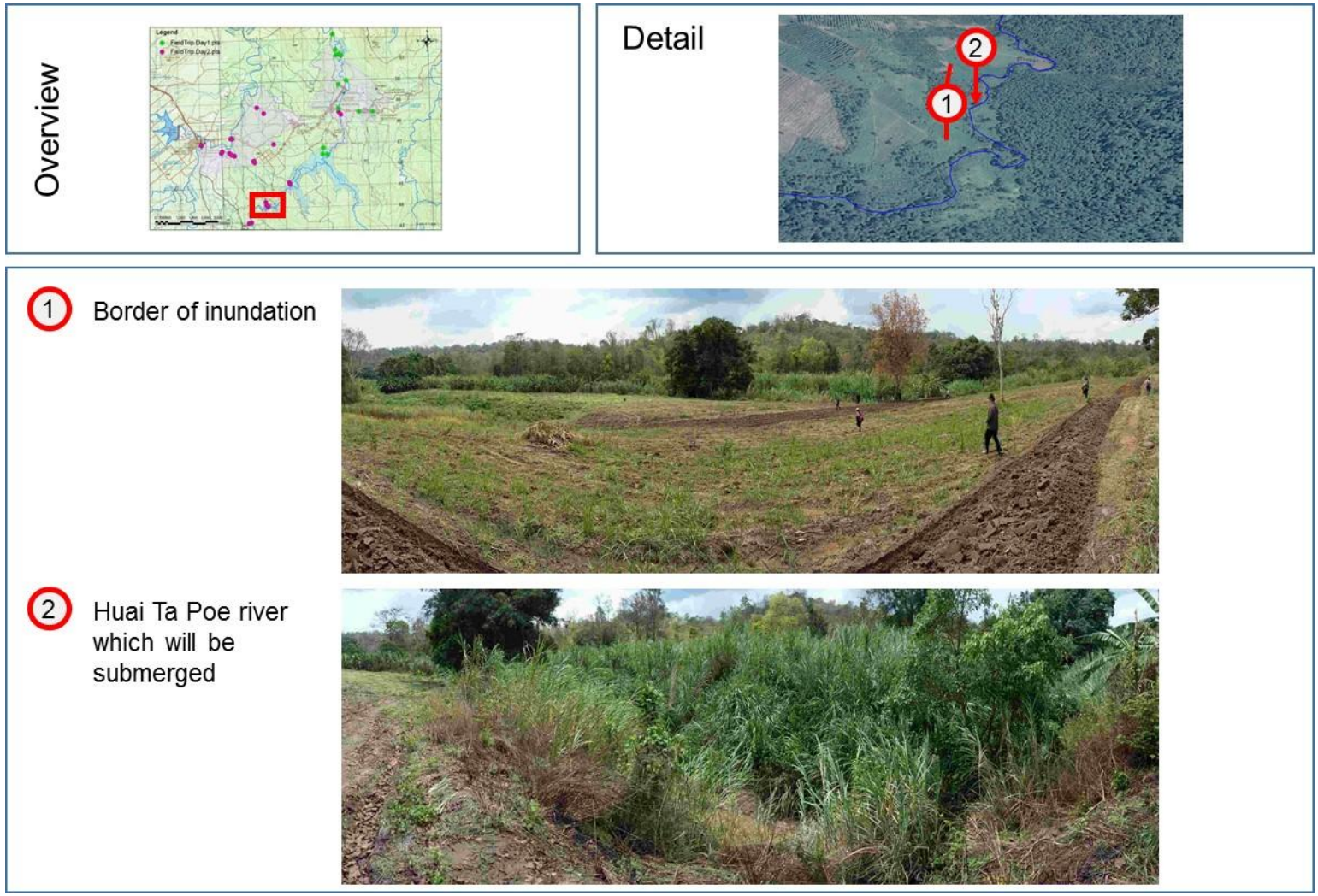

Figure 14: Inundated area after flooding of the reservoir (2)

11

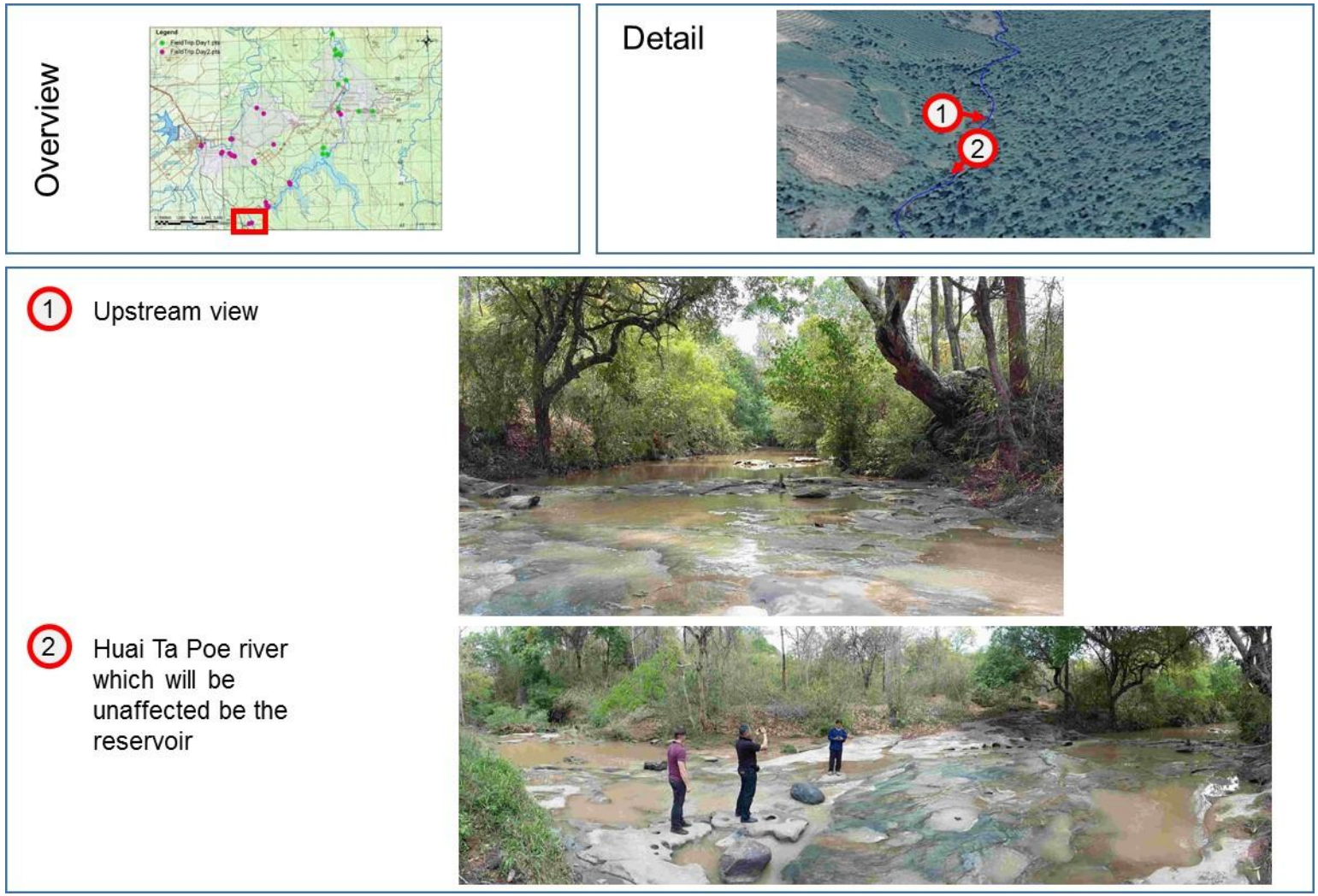

Figure 15: Unaffected Huai Ta Poe River upstream reservoir

12

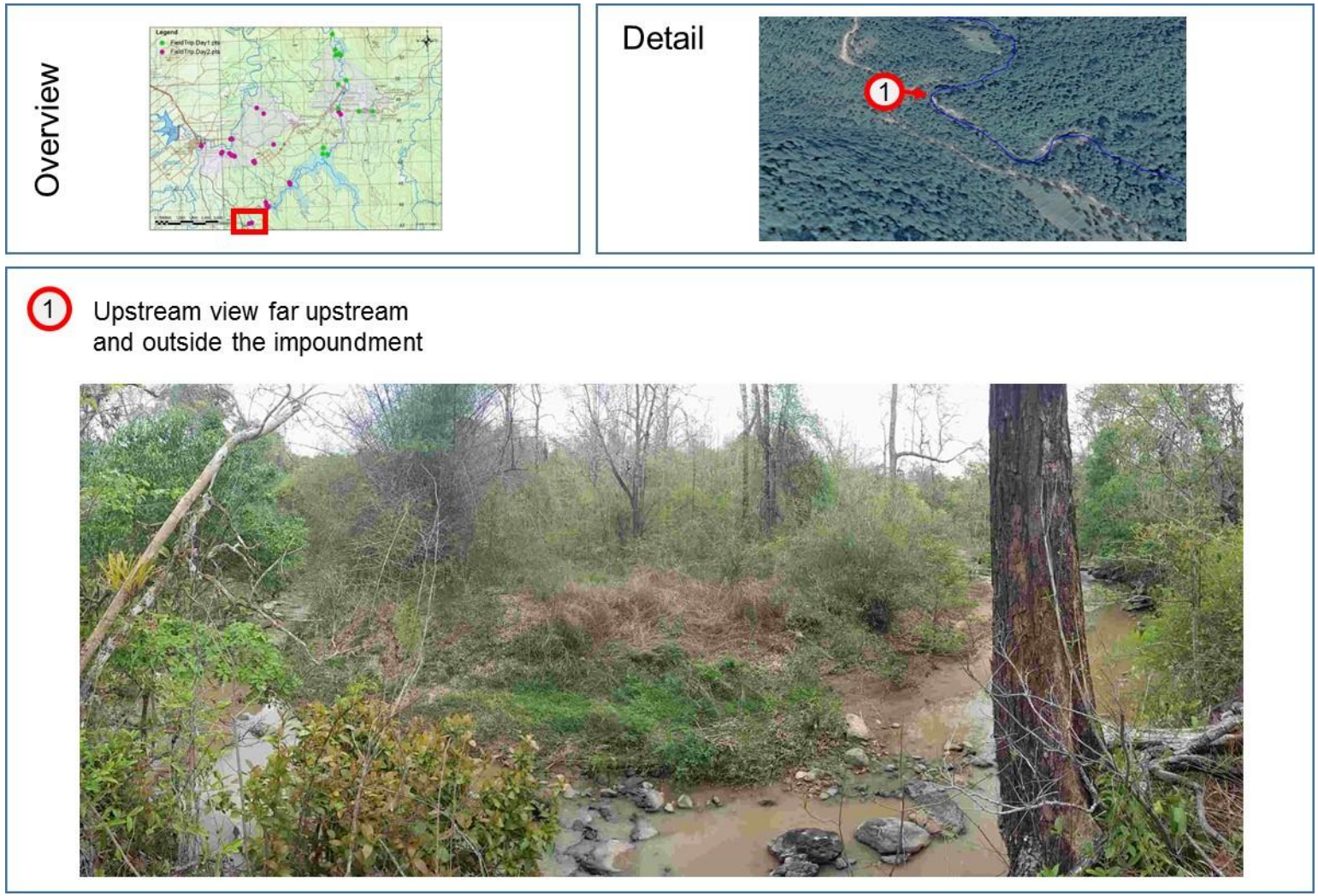

Figure 16: River bend of Huai Ta Poe upstream, remains unaffected

2.3.5 Irrigation area left

13

Figure 17: Confluence of minor tributaries

14

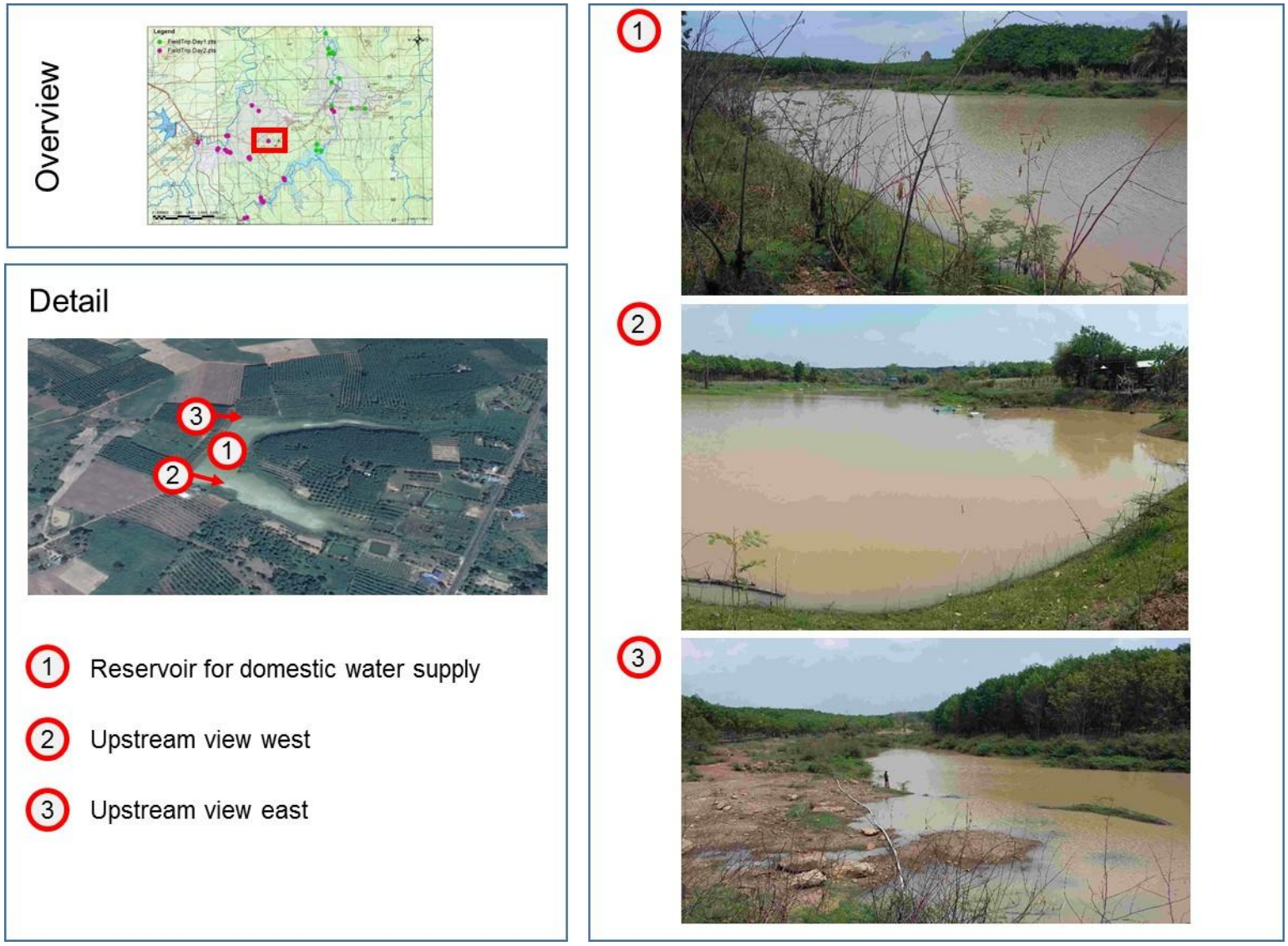

Figure 18: Reservoir for domestic water supply

15

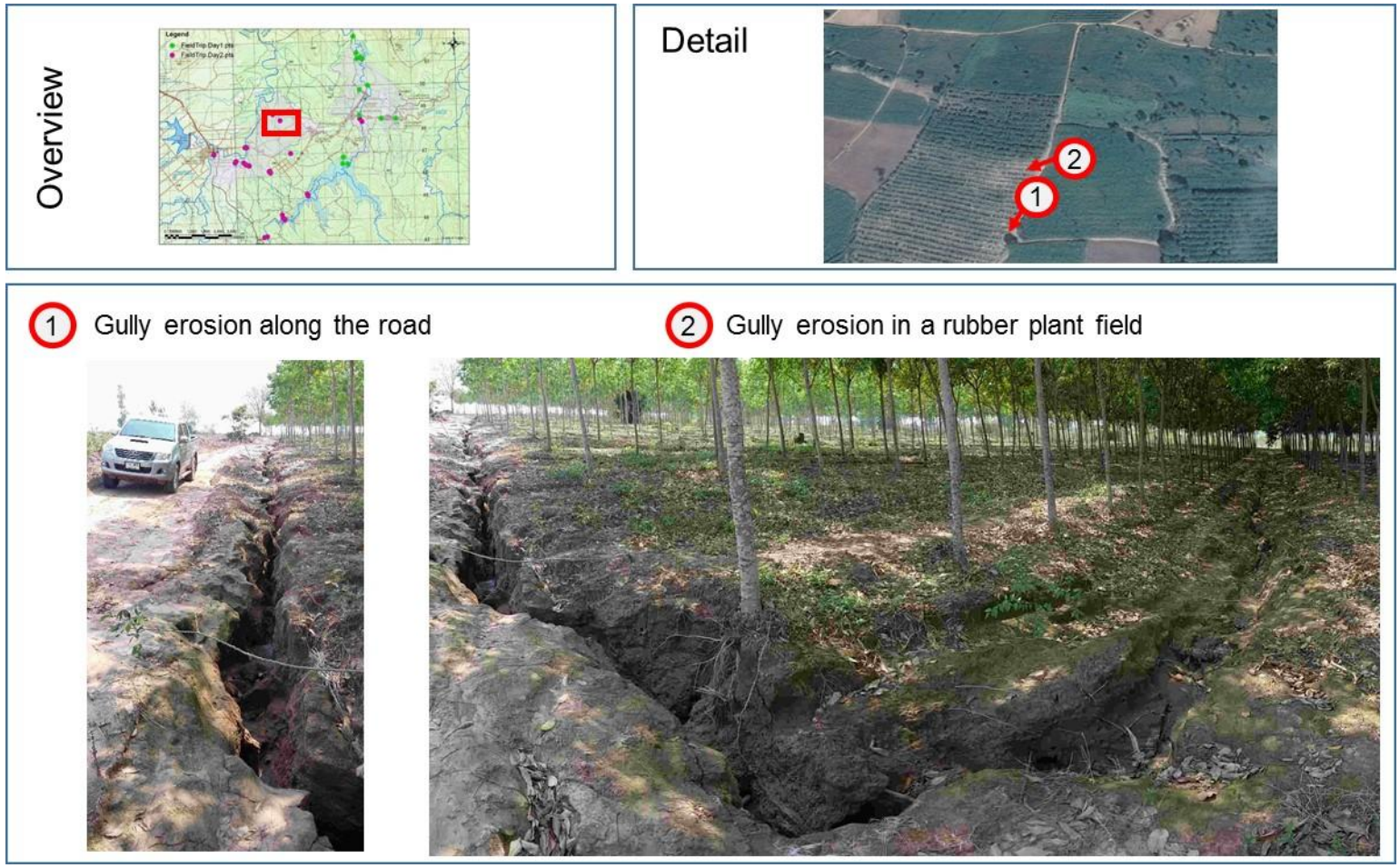

Figure 19: Gully erosion at rubber plants

16

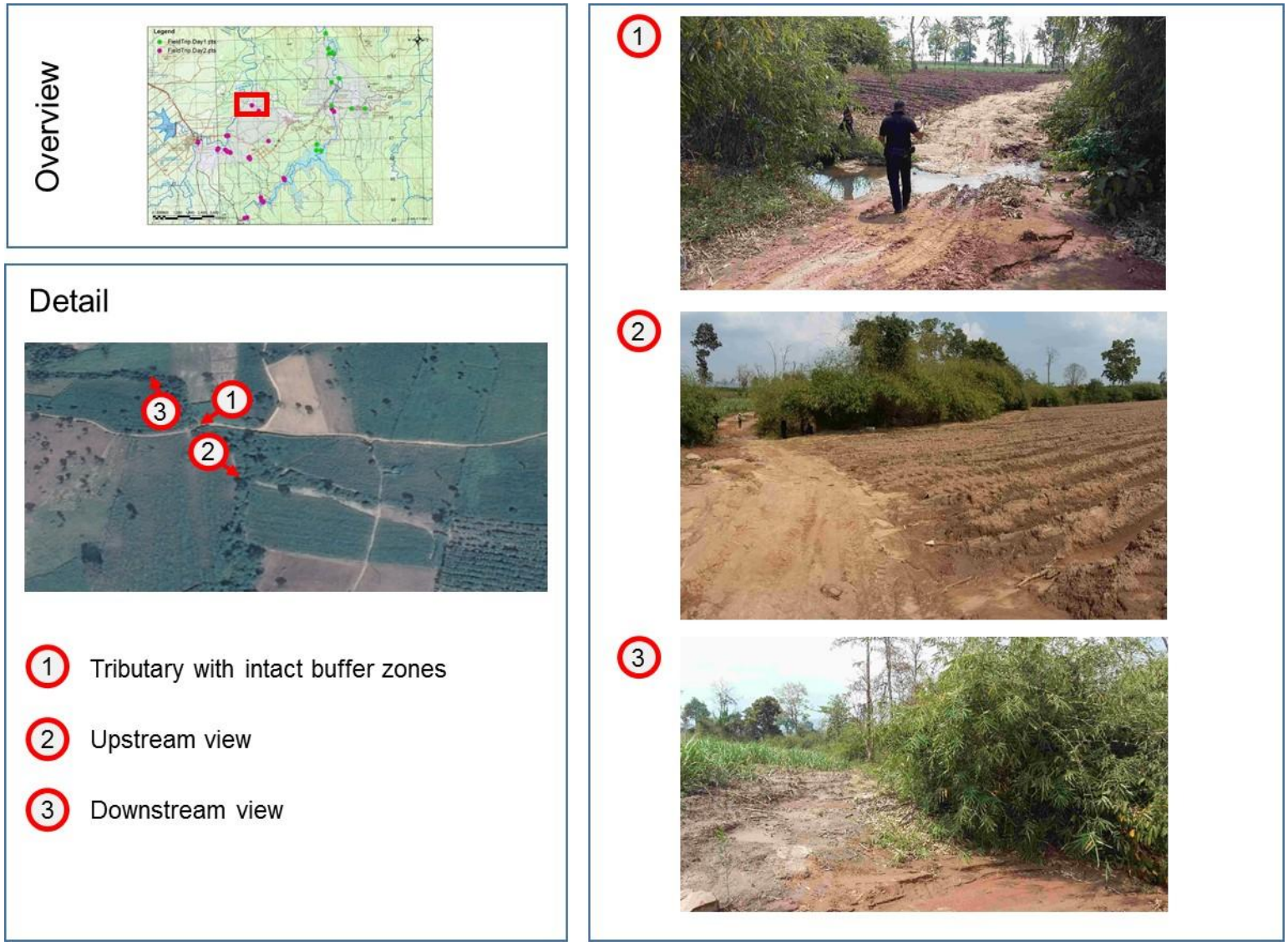

Figure 20: Tributary with intact buffer zones

Figure 21: Largest tributary in the irrigation area left

Figure 22: Minor tributaries, usually dry outside the rainy season

Figure 23: Main River in the irrigation area left

2.4 Compensation and mitigation measures

The EIA foresees the following measures for mitigation of reservoir impacts:

COMPENSATION	DESCRIPTION
Compensation payments to affected people	A total of around 5 Mio. THB shall be paid to farmers for loss of agricultural land, which will be inundated by the reservoir.
Compensation for affected wildlife	A total of 1.56 Mio. THB shall be used for the relocation of affected species. 109 species have been identified in the reservoir area. The process is to first cut down the trees, to then increase the water levels step by step, so that wildlife will be given time to move out of the reservoir area.
Compensation for lost forest	The main aspect of compensation concerns the forest area which will be flooded. The reservoir area is almost entirely covered by forests. The size of the reservoir is about 320 ha, of which 157 ha are national park, and 134 ha wildlife conservation area. The land to be flooded is almost entirely under governmental ownership. Only at some areas of the future maximum levels of the reservoir, some privately owned farmland is currently being cultivated. RID has to pay 3900 THB per rai to the Forest Department. In this project, a total of 55 Mio THB are to be paid by RID to the Forest Department. This procedure is part of a national regulation between the Forest Department, RID (or maybe other water resources developers) and ONEP. The general rule is to reforest the same area within the same river basin. The rule is that 2 or 3 times (unclear) the area size of the lost forest has to be afforested elsewhere. ONEP is responsible to monitor the national balance between forest converted and new forest planted. It was mentioned that this particular area of forest is already in process of being informally converted into palm trees and is regarded as being in a poor state. If the state of the forest regulates the price per rai is unknown. Forest Department has to submit the progress report about the reforestation project to RID about 3 times per year. For a total of 3.75 Mio. THB, RID has to build an office for the Department of Forestry in the project area for monitoring and protection.
Setting up Water Users Associations	For a total of 2.6 Mio. THB, Water Users Associations shall be established. These WUAs are associations of farmers, and are responsible for coordinating the distribution of water together with the RID. Until now, no WUAs are in place in the area supplied by the reservoir.
Compensation for impact on fisheries	Compensation for potential loss of fishery is not an issue in this project, as the Huai Ta Poe River runs dry regularly. However, this was contradicted by stating that fishery contributes to the livelihood of local residents. It was said that people in the area usually only do fishing during rainy season (as during dry season rivers are mostly dried out), and will be able to also do so in future.
Health and safety for population	3.6 Mio. THB shall be used for general health and safety measures for the local population.
Health measures against mosquito diseases	~6 Mio. THB shall be used for health measures, including awareness raising and education for the local population, to prevent mosquito transmitted diseases.
Prevention of diseases from parasites	3 Mio. THB are foreseen for measures to prevent diseases from parasites.
Prevention of chemicals in agricultural practice	3 Mio. THB are to be applied for measures preventing use of heavy chemicals in agricultural activities.
Monitoring and inspections	Monitoring and inspection of reservoir impacts after project finish is to be carried out.

Table 1: Overview of mitigation measures in EIA for Huai Ta Poe Reservoir

2.5 Water distribution and dam operation

In this project area, water supply for domestic use and irrigation are the competing sectors for water while industrial use is not included in the purposes of this reservoir and thus play no role. Flooding is not considered a major threat in the area, hence also keeping the purpose of flood protection of this reservoir at a low level.

However, it shall be mentioned, that the rather low risk of severe flooding may also be strongly impacted by the good natural shape of the rivers and catchment area, which to a large extent is covered by forest. This only increases the importance of maintaining the ecosystems.

It is estimated by RID that the share of demand for domestic use does not exceed 10% of the total demand for agricultural consumption. For irrigation purposes, a total of 10.48 m^3 per year have been estimated in the EIA.

The allocation of water from the reservoir is organized by the RID together with Water Users Groups.

In the irrigation areas, Water Users Groups will be established, which are responsible for the planning of water distribution together with RID, and for managing the allocation of water between farmers.

General operating rules will be in line with the RID internal procedure on Reservoir Operation Standards (ROS). ROS determines RID standards on how to operate the dam including a release policy. However, this will be adjusted based on practical experience after a couple of years as explained below:

The management of water released from the reservoir to the irrigation area is based on an annual cycle which involves a multitude of planning, revision, and monitoring steps. The cycle starts at the end of the rainy season with the total amount of water available in the reservoir as starting point. Based on the water demand stated by the WUAs, the water distribution scheme is planned for the entire season. Steps for revisions and adaptations of the planned scheme are provided in this management circle. At the end of each irrigation season an analysis is envisaged for improving planning in the following year.

WUAs do not have to pay RID for the allocation of water. However, individual farmers have to pay into the WUA budget. This money is mostly used for the operation and maintenance of the irrigation canals, which is under the responsibility of the WUAs.

This last point is of potential relevance to the existing natural rivers within the irrigation area. Farmers will be responsible to clean out the irrigation canals prior to the start of the irrigation season. It can well be assumed that this material removed will be disposed in the natural channels. Depending on the amount of such material, this might influence the shape of the rivers. Based on experience from other regions in Thailand, an additional load of organic matter, which stems from harvest procedures, can be additionally expected to be disposed into the rivers.

Another relevant aspect to be considered in the project area is the government's programme to provide land to the poor who do not yet own land. As a result, land with unclear landownership and thus not yet under cultivation will be given to those having no land yet. This brings about additional uncertainty associated with land use and can constitute a potential problem with respect to room for EbA measures and can adversely affect rivers.

The final design and location of the irrigation canals has not been made yet which, in turn, poses a potential socio-economic problem, may affect the use of land and rivers, and impedes the planning process for any EbA measures.

Currently, during dry season, 381.76 ha are under irrigation. The water for this mostly comes from small ponds dug or developed through weirs (see map), and from individual pumping of water directly from the existing rivers, for as long as they provide water. There were no clear signs of small ponds or weirs informally constructed by farmers for water usage. However, rainwater harvesting was found at most household premises, probably mostly for domestic use, indicating the necessity of storing water for the dry season.

All of these observations lead to the following assumptions:

- Water availability is a concern in the project area, however not to a level of clear scarcity
- During dry season, water is still available for domestic use, however not abundant
- During dry season, in addition to domestic use, some water still remains for irrigation purposes (381.76 ha), although not much
- The primary purpose for increasing the water availability through the development of a reservoir is not to maintain the status quo. Maintaining the status quo of domestic use and farming or even reducing the current water stress during dry season could also be achieved through much smaller infrastructure measures
- The main purpose of the reservoir thus is *expansion*, not just the maintaining, of agricultural activities, from the current 381.76 ha of irrigation area to a total of 1,755.04ha

It is of major relevance for this study to address the risk of potential changes in the conditions of rivers in the project area, which may be caused by an expansion of farming lands due to increased water availability, and a change of farming practices such as the plantation of more water-demanding plants. For such an assessment of the potential for increased risks to the rivers, the potential abstraction of water from those is analysed.

The annual future demand of water for irrigation is estimated at:

10.48 Mio. m³ per year.

Assuming that water demand for domestic purposes does not exceed 10% of the demand for irritation, this leads to a water demand for domestic purposes of around:

1 Mio. m³ per year

The net reservoir capacity will be: 17.48 Mio. m³

Average annual inflow into the reservoir is: 25.56 Mio. m³

This leads to an average annual excess between water availability and water demand of ~ +7 Mio. m³ which remain available.

This future surplus of available water may even have the consequence that the amount of *water abstracted from the rivers for irrigation purposes is going to be reduced.* Hence, the reservoir may have two different consequences for downstream rivers:

➔ During rainy season, due to the filling of the reservoir, the runoff downstream of the reservoir will be reduced

➔ During dry season, the runoff in the rivers within the catchment might be increased due to reduced abstraction of water for irrigation, as the amount of water provided through the reservoir is more than sufficient.

One rather large uncertainty, however, is the remaining volume of water in the reservoir at the end of the dry season. The uncertainty was substantiated with a likely behaviour change in terms of water consumption. The pre-feasibility study comprises such evaluations but should be considered with caution.

As for the environmental flow from the reservoir, this is regulated at a minimum of 0,1m m³ per month. A potential lack of water availability should not be a concern for such provision. It was observed that even three days after heavy rains, most rivers in the project area were still carrying water, despite their small sub-catchment areas. Such flows will not be affected by the reservoir.

2.6 Reasons for healthy status of ecosystems

The study team found all rivers within the catchment area and downstream of the future reservoir in healthy state and with intact ecosystems. It can be said that the current shape and conditions of the rivers found would usually be the objective of EbA measures.

On the last day of the Field Trip, the study team discussed with RID representatives the potential reasons for this, as in many other areas of Thailand with similar agricultural activities conditions of river ecosystems are often to be found worse.

The following thoughts were presented to the study team:

REASONS	DESCRIPTION
Location	The reservoir and future irrigation area is located next to / within a national park and a wildlife conservation area, within which human activities are largely restricted.
Buffer zones	By regulation, around the reservoir buffer zones will be established within which no farming activities are allowed. Another provincial law ensures buffer zones between river banks and farming areas. In these buffer zones, no farming activities are allowed. The marine department is responsible for the protection of these buffer zones.
Topography	The downstream areas and river banks are often very steep and not suitable for farming activities, reducing the options of farmers to extend their farmlands up until to the river banks.
Availability of land resources	Earlier, land in the project area was allocated to the farmers by the government. For this reason, farmers in the irrigation area have relatively sufficient land available, leading to a reduced pressure on land resources.
Population density	The population density in the area is relatively low, leading to a comparatively low pressure on land use.
Responsibilities	In the project area, Mukdahan Province / the mandates and responsibilities between different authorities are clear, leading to a high efficiency in enforcing existing regulations.
Mindset	The awareness and understanding of people in the project area towards the importance of environmental protection may be higher than in other regions of Thailand.

Table 2: Potential reasons for good state of rivers in project area

From these mentioned thoughts and ideas on potential reasons for the relatively good conditions of river ecosystems in the project area, two aspects are of particular interest and worth following up:

First, of particular interest is the provincial law mentioned by RID, which regulates buffer strips between rivers and cultivated or otherwise used land, thus aiming at protecting river banks and keeping them in good condition. In previous studies in other Provinces (Sae Or, Huai Sai Bat), such law was not mentioned and river banks were often found in poor conditions. It would however be unusual, if such law would only exist in the Mukdahan Province, as it probably comes under a national regulation. This raises the question of why such law was not mentioned previously in other areas, and if existing, why such law is not being strictly enforced in those areas.

The second aspect of major importance is the mentioning of the factors topography, population density, and overall availability of land and resources. These are all factors that come more or less “naturally”, or are at least difficult to regulate. To a large extent, the conditions of rivers in this area may be caused by the given key conditions, resources availability and low population density rather than by specific actions undertaken by authorities or the inhabitants.

This point is crucial to consider, as a different environment, which will be caused by the development of the reservoir and the irrigation scheme, is likely to lead to changing farming and land use practices. If no specific actions, taken by the authorities and population, have led to the current conditions, there is no guarantee that these conditions will be maintained in a different scenario. The only factor mentioned above which could however ensure the maintaining of the current status of rivers is the enforcement of the provincial law for river bank buffer zones, but as has been observed in other areas, if pressure on land use gets above a certain level, such law becomes much more difficult to be enforced. This point is further discussed in our suggestions for this study.

2.7 Rapid Environmental Assessment

Field Trip participants were asked by the study team to complete a Rapid Environmental Assessment.

This activity was conducted for two purposes. The study team used the survey to collect additional information related to the reservoir project with regards to irrigation, water supply, and river basin planning. Second, the REA allowed to gain an understanding of the perception of stakeholders towards the impact of the reservoir.

A REA is the attempt to establish a systematic way to incorporate environmental impact assessment into the development of ecosystem-based adaption measures (EbA). It is considered as a starting point which should be carried out prior to the process of evaluating, localising and designing of ecosystem-based measures.

Apart from bringing relevant topics with a systematic approach into focus, it is meant to be a mechanism to create awareness and common understanding between different parties. The REA should be conducted by the following target users:

- Experts evaluating the project area of concern and assuming the responsibility to suggest and design possible EbA measures
- Executing or implementing agency

and, ideally, (if possible)

- Nominated representatives of communities and/or stakeholder groups or organisations

The questionnaire was disseminated at the beginning of the Field Trip and the parties involved were asked to return the filled document to the study team who evaluated the results and incorporated them into their analysis.

The whole process could be seen as good practice in terms of providing a common knowledge base and needs support on how to fill it in, especially for non-experts. This can be backed with eLearning tools and complementary guidelines.

In the Huai Ta Poe Reservoir Project, it was assumed that RID has the expertise to carry out the procedure without additional assistance by tools, guidelines or training courses.

The checklist is applied with respect to the current situation, that is, the assumption of “without mitigation measures”. When EbA measures are conceived, the experts apply the checklist again assuming the suggested measures are in place.

The filled in questionnaires are provided in the Annex.

3 Suggestions for study objectives and approach

3.1 Key findings

The two objectives of this consultancy as laid out in the ToR are:

Output 1: Support RID in the redesigning process of an already planned water infrastructure project for the Huai Ta Poe Reservoir so that local stakeholder needs are represented.

Output 2: Propose EbA measures as alternatives to or complementing the already planned grey infrastructure measures.

The study team entered Field Trip 1 in Ban Koh sub-district, Huai Ta Poe Reservoir, keeping those two objectives in mind. The purpose of the Field Trip was to carry out an on-site analysis and consultation meetings in order to collect all required information for both supporting RID in a potential redesigning process and for being able to propose and design adequate EbA measures.

At this point, it is important for the study team that the findings of the Field Trip were somewhat unexpected and have a significant impact on the study's objectives and approach. These key findings of concern are the following:

Key finding 1: Status of the Huai Ta Poe Reservoir dam construction

According to the information obtained prior to carrying out the Field Trip, the dam for developing the Huai Ta Poe Reservoir was currently under planning. In fact, the respective dam is already under construction. Begin of construction dates back to 2014 as the budget was allocated and dam construction is estimated to be finished during September 2017.

This finding has a major consequence for Output 1 - Support RID in the redesigning process of an already planned water infrastructure. At this stage, ***entering a redesigning process of the infrastructure under construction is deemed neither feasible nor appropriate by the study team.***

Secondly, the objective lays out that the proposed redesigning process shall ensure that stakeholder needs are represented. According to the information obtained during the Field Trip, the local beneficiaries and local stakeholders are much in favour of the infrastructure project due to current insufficiencies in water availability.

Key finding 2: Purpose of the dam

Following the information provided in the ToR for this study, the study team assumed three main purposes of the Huai Ta Poe Reservoir: i) store water for flood prevention; ii) water supply for the agricultural sector; iii) water supply for the domestic sector.

From the discussions with RID and interviews with local farmers and village representatives, the study team obtained the information that flooding is not considered a major problem in the area, while droughts and lack of sufficient water for agricultural and domestic use is the key concern of the local population. ***The absence of flood prevention as one of the major purposes of the dam has an impact on proposing EbA measures (Objective 2), as the purpose of any EbA measures suggested must consider the needs of the beneficiaries, which in this case focus on increased water availability.***

Key finding 3: Condition of rivers and ecosystem in the study area

Based on previous studies with similar focus carried out in Thailand, the study team expected rather strong signs of a deteriorating river ecosystem, such as lack of a buffer zone between riv-

ers and agriculture fields, lack of riverbank plants, strong riverbank erosion, poor river conditions hindering presence of aquatic life, etc.

The study team was quite surprised to see rivers within the catchment area (downstream of the future reservoir) in quite good shape. This finding applies to all points of observation conducted during the Field Trip. As was shown in the chapter above, at all observation points, including both the right side and the left side irrigation area, rivers and small streams were in good condition. Buffer strips between the rivers and agricultural fields are the norm; all river banks were densely covered by plants; river shapes generally were in natural state; erosion points were rare and very local; etc.

In short, the EbA measures that would usually be proposed to improve ecosystems and their services, are already much in place.

This finding has a significant impact on Objective 2 of this study – the proposal and design of EbA measures as alternatives to or complementing the development of the reservoir.

Based on these three key findings from Field Trip 1, we suggest an adaptation of the objectives and activities as laid out in the ToR, and propose the following instead.

3.2 Suggested study objectives and approach

A shift of the study focus is suggested due to the facts that the dam design cannot be influenced at this stage, and because the good state of river ecosystems within the project area makes an implementation of EbA measures unnecessary.

Nonetheless, by giving this study a different direction, we see these findings as a great opportunity for the ECOSWat project.

Due to the prevalence of several healthy rivers surrounded by farming land, the project area is **highly suitable to serve as a good practice example** for maintaining ecosystems and the services they provide.

This study can make use of this positive project example by addressing these three objectives:

OBJECTIVE	DESCRIPTION
1: Knowledge Exchange	By analysing this project area and presenting it as a positive example for the benefits of healthy river ecosystems, this study can be distributed to other RID project sites of worse conditions. By direct comparison of the positive example of Huai Ta Poe with project sites in much worse condition, such as in the Sae Or, Huay Sai Bat areas, the benefits of EbA (e.g. in flood prevention, erosion prevention, water retention, ecological benefits, etc.) could be shown clearly in a qualitative, and potentially also quantitative, way. The study would also be of benefit in any field trips carried out to Huai Ta Poe for presenting a positive example.
2: Preservation of ecosystems in good state	In the project area under this study, the major objective is not to implement any EbA measures, but rather to ensure and maintain the good state of river ecosystems also after the new constructed dam starts operating. There is a risk that with additional water availability, farmers will change their practices or may extend their fields, leading to a deterioration of ecosystems. Thus, we consider it as crucial to demonstrate the values and benefits that currently existing ecosystems have for the local population, including their needs for agricultural and domestic water.
3: Increase understanding of the value of EbA	It is our understanding that while rivers at the project area are in good shape, this is not necessarily the case due to a particular understanding of the related benefits, but rather caused by given natural factors, in particular resources availability and low population density. Only through increasing the understanding of the direct benefits of ecosystems in good condition their preservation can be ensured in the long term.

OBJECTIVE	DESCRIPTION
	The comparison of ecosystems in good and in bad condition, with highlighting the clear positive/negative consequences these contain, shall help to increase the perception of target groups, such as decision makers at RID as well as farmers in project areas, towards the value that EbA measures and healthy ecosystems provide. For this purpose, the study could be used both in areas of currently healthy ecosystems with the purpose of preserving those, as well as in areas of currently bad conditions, in order to increase motivation for implementing EbA measures.

Table 3: Suggested adaptations of study objectives

3.3 Adapted outputs of this study and further suggestions

The findings of the Field Trip were presented to the GIZ ECOSWat project and the potential adaptation of study objectives and approach as laid out above discussed. GIZ welcomed the suggestions and a brainstorming was conducted on how the ECOSWat project can best make use of this study and which specific outputs it would need thereof. The results of the discussion are the following.

The Final Report will include:

PRODUCT	DESCRIPTION
Ecosystem Inventory	An **Ecosystem Inventory** of the project area will be developed. Instead of suggesting EbA measures, the ecosystem inventory will map out the various ecosystem functions which are already in place in the project area. This inventory will contain ecosystem elements that would usually be suggested as EbA measures for rivers with already deteriorated ecosystems, but which in this case are still naturally in place.
Suggestions on Ecosystem Services to be maintained → Conservation plan	The study team will develop **suggestions on ecosystem services in the project area that should be maintained**. The suggestions will be provided in a map, highlighting the various ecosystem services which are already in place. A correlated description of the benefits these highlighted ecosystem services provide will be developed.
Catalogue of good vs. bad examples	A **catalogue which shows "good vs. bad" examples of ecosystems** will be developed. Each A4 page will include a photo of an intact and of a deteriorated ecosystem. The services which an intact ecosystem provides will be summarized, and the resulting benefits be illustrated.

Table 4: Products for Final Report

The discussion with GIZ led to the suggestion of the following additional activities:

ADDITIONAL ACTIVITIES	DESCRIPTION
Development of a precipitation-runoff model t demonstrate effects with and without ecosystem services	The study team could develop a a precipitation-runoff model to demonstrate the effects on the hydrologic regime in terms of flood and drought with and without eco-system services. This would could be seen as a preparation for the development of a 2D hydraulic model as mentioned as second additional activity.
Development of 2D hydraulic model of 2 scenarios: with and without ecosystem services	The study team could develop a 2D model of the runoff of rivers in the project area with 2 scenarios, one scenario "with functioning ecosystem services", and one scenario "without functioning ecosystem services". This model could be of great benefit in impressively animating and highlighting the benefits related to ecosystem services.
Field Trip to irrigation areas neighbouring the Huai Tai Poe reservoir (West and North-West)	Conduct a Field Trip to the neighbouring areas, in which 7 reservoirs and related irrigation schemes are already under operation. These reservoirs are Huai Tha, Huai Phai (these two reservoirs also feed into the left irrigation scheme of the Huai Ta Poe Reservoir), Huai Phu, Huai Hoi, Ang Kep Nam, and Kaphung. Such a Field Trip would be useful to investigate the conditions of ecosystems in the neighbouring farming areas. The assumption is: if river ecosystems in those areas, in which more intensive and irrigation-fed agriculture has been conducted for several years, are also in good condition, this could be an indicator that specific actions (e.g. protection of buffer zones; good cooperation between related authorities) in Mukdahan Province, or at least in the Kham Cha District, have a significant influence. However, if conditions are worse, this would rather indicate that the current state of ecosystems in the Huai Ta Poe project area is rather coincidental.
Field Trips to Huai Tai Poe project area	The project area of the Huai Ta Poe Reservoir could be used for future field trips for presenting a good example of maintained ecosystem services
Place poster signs in Huai Tai Poe project area of "good vs. bad" examples.	The "Catalogue of good vs. bad examples" (product of this study) could be transformed into large posters, which could be put on signs and placed at the Huai Ta Poe project area. These signs would help raise awareness to increase the understanding of the intrinsic value of EbA and could be used during potential field trips.
Discussions with ONEP on protected areas in Huai Ta Poe irrigation area	The revised EIA will be submitted to ONEP by Prof. Nat. Marjang at around mid-April. Along with this EIA, discussions with ONEP could be held at which the suggestions on ecosystem services to be maintained (product of this study) could be presented. Potentially, ONEP could a) declare these ecosystems protected areas b) determine the preservation of these ecosystems as mandatory compensatory measures This would eliminate the risk of potential future transformation into agricultural land.

ADDITIONAL ACTIVITIES	DESCRIPTION
Discussions with the Department of Marine and Coastal Resources on buffer zones protection	Protection of buffer zones between rivers and used land is under the responsibility of the Department of Marine and Coastal Resources. Discussion with representatives of this department responsible for the Mukdahan Province could be held to get a better understanding of the potential reasons for the good state of identified rivers.
Application of the ecosystem inventory to the Sao-Or project area	The methodology of conducting a development plan for EbA could be applied to the Sae-Or project area. The reservoir in the Sae-Or project area is still in planning and its design is subject to change. A development plan of ecosystem services including hydrological modelling could be used to re-design the water infrastructure foreseen. This was not yet possible due to lack of data provided and difficulties in the understanding of benefits associated to EbA. However, it could now be promoted by means of a good practice example of the Huai Ta Poe area, which has the potential to create momentum in other water resources development projects under RID's responsibility.

Table 5: Potential additional activities

ANNEXES

Annex 1: Time table of activities

DAY	ACTIVITY
6th – 17th March	Collection of information on reservoir project and area, and analysis thereof
20.3.2017	Meeting with GIZ project representatives; development of questionnaire for Field Trip
21.3.2017	Field Trip Day 1: Meeting and discussion with RID representatives
22.3.2017	Field Trip Day 2: Visit of project area
23.3.2017	Field Trip Day 3: Visit of project area
24.3.2017	Field Trip Day 4: Meeting and discussion with RID representatives
25.3.2017	Writing of Inception Report
26.3.2017	Writing of Inception Report
27.3.2017	Presentation and discussion of Field Trip findings to GIZ, writing of Inception Report
28.3.2017	Writing of Inception Report

Annex 2: Participants in Field Trip 1 and list of discussion partners

Name	Organisation	Position
MrHubert Lohr	GFA	Consultant
Mr Klaus Sattler	GFA	Consultant
Mr Roland Treitler	GIZ	ECOSWat Programme Manager
Mr Pasu Kongapai	GIZ	ECOSWat Programme Advisor
Mr Ketpharima Sansud	GIZ	ECOSWat Programme Advisor
Prof. Nat. Marjang	Department of Water Resources Engineering at Kastesart Universiyi	Professor; Responsible for EIA of the Huai Ta Poe Reservoir
Ms Warangluck Nasom	RID Bangkok	Environmentalist
Ms Supaporn Pansuk	RID Bangkok	Economist
Ms Walaiporn Preshasoontornrat	RID Bangkok	Environmentalist
Mr Pracha Kessalee	RID	Head of General for Engineering
Mr Chalongpan Siriopas	RID	Head of General for Construction 1
Mr Chakkrit Paoviman	RID office of reginal 7, Mukdahan Province	Head of General for Engineering
Mr Tuan	RID office of reginal 7, Mukdahan Province	Operation and Maintenance officer

Annex 3: Technical specifications of the Huai Ta Poe Reservoir

1)	**Hydrology**		
	Catchment area	50.00	sq.km.
	Average annual inflow	25.56	MCM/year
	Average annual rainfall	1,205.4	mm./year
2)	**Reservoir**		
	Minimum pool area	0.738528	sq.km.
		73.85	ha
	Normal pool area	3.443136	sq.km.
		344.31	ha
	Maximum pool area	3.932848	sq.km.
		393.28	ha
	Minimum pool level	+285.51	m.MSL.
	Normal pool level	+294.00	m.MSL.
	Maximum pool level	+295.59	m.MSL.
	Minimum pool capacity	1.41	MCM
	Normal pool capacity	18.89	MCM
	Maximum pool capacity	24.85	MCM
3)	**Dam**		
	Type	Homogeneous Dam	
	Crest level	+297.50	m.MSL.
	Maximum dam height	23.50	m.
	Crest width	8.00	m.
	Crest length	537.50	m.
	Upstream slope	1 : 3.0	
	Downstream slope	1 : 2.5	
4)	**Spillway**		
	Location	Right side of dam	
	Type	Side Channel	
	Weir crest level	+294.00	m.MSL.
	Weir length	50.0	m.
	Maximum discharge at return period 500 yr.	291.52	cu.m./sec.
5)	**Canal Outlet**		
	Type	Concrete coated steel pipe	
	Number of pipe	2	pipes
	Diameter		
	- Left side: 1.20 m. at the upstream and decrease downstream		
	- Right side: 1.00 m. at the upstream and decrease downstream		
	Pipe invert	+285.00	m.MSL.
	Maximum flow	1.02	cu.m./sec.
6)	**Irrigation Project Area**		
	- Right side	487.84	ha
	- Left side section 1	396.16	ha
	- Left side section 2	871.04	ha
	- Total	1,755.04	ha
7)	**Irrigation Area**		
	- Wet season	1,600.00	ha
	- Dry season	381.76	ha

Annex 4: Rapid Environmental Assessment

Checklist – Irrigation

X: RID 1
O: RID 2
I: Prof. Nat

	SCREENING QUESTIONS	Yes	No	REMARKS
	Potential Impacts			
	Will the Project cause…			
1.	• loss of precious ecological values (e.g. result of encroachment into forests/swamplands or historical/cultural buildings/areas, disruption of hydrology of natural waterways, flooding of agri-cultural/forest areas, and wild lands and wildlife habitat; de-struction of fish spawning/breeding and nursery grounds and disruption of fish migration route)?	O	X	
2.	• conflicts in water supply rights and related social conflicts?		XO	-framework on water usage amongst users exists
3.	• dislocation or involuntary resettlement of people?		X	
4.	• potential social conflicts arising from land tenure and land use issues?		OX	-the flooded areas are reservation areas and do not belong to the people
5.	• impediments to daily or regular movements of people?	O	X	-the flooded areas are reservation and wildlife conservation areas
6.	• impediments to migration routes of animals?		X	
7.	• potential ecological problems due to increased soil erosion and siltation, leading to decreased stream capacity?	O	X	
8.	• surface soil erosion?	O	X	
9.	• soil erosion before compaction and lining of canals?		X	-no data
10.	• insufficient drainage leading to salinity intrusion?	O	X	
11.	• over pumping of groundwater, leading to salinisation and ground subsidence?	O	X	
12.	• impairment of downstream water quality and therefore, impair-ment of downstream beneficial uses of water?	O	X	
13.	• waterlogging and soil salinisation due to inadequate drainage and farm management?		X	-no data

14.	• eaching of soil nutrients and changes in soil characteristics due to excessive application of irrigation water?		XO	
15.	• reduction of downstream water supply?		XO	
16.	• soil pollution, polluted farm runoff and groundwater due to the application of fertilizers and pesticides?	O	X	
17.	• soil pollution, polluted farm runoff and groundwater with the potential to lead to public health risks due to excessive application of fertilizers and pesticides?	O	X	
18.	• scouring of canals?		X	-not sure
19.	• logging of canals by sediments?	O	X	
20.	• clogging of canals by weeds?	O	X	
21.	• introduction of increase in incidence of waterborne or water related diseases?	O	X	
22.	• increase in peak and flood flows?	O	X	
23.	• loss of downstream beneficial uses (water supply or fisheries)?		OX	
24.	• impairment of ecological and recreational opportunities?		OX	
25.	• impairment of beneficial uses of traditional forests?	OX		
26.	• any loss of precious ecology?	O	X	
27.	• Loss of downstream ecological and economic functions due to any construction of social infrastructure (e.g. road, training or information centre, office or housing)?		X	
28.	• uncontrolled in-migration with opening of roads to forest area and overloading of social infrastructure?	O	X	
29.	• unnecessary loss of ecological value and decreased biodiversity?		OX	
30.	• technology or land use modification that may change present social and economic activities?	O	X	
31.	• loss of precious ecological values due to flooding of agricultural/forest areas, and wild lands and wildlife habitat; destruction of fish spawning/breeding and nursery grounds and disruption of fish migration routes?		OX	
32.	• loss of archaeological, historical or cultural monuments?	O	X	

33.	• environmental degradation from increased pressure on land?		OX	
34.	• decreased production from capture fisheries due to submersion of river stretches and associated flood channels, and resultant destruction of fish breeding and nursery grounds?	O	X	
35.	• proliferation of aquatic weeds in reservoir and downstream impairing dam discharge, irrigation systems, navigation and fisheries, and increasing water loss through transpiration?		X	-not sure
36.	scouring of riverbed below dam?	O	X	
37.	• depletion of dissolved oxygen by large quantities of decaying plant material, fish mortality due to reduced dissolved oxygen content in water, algal blooms causing successive and tempo-rary eutrophication, growth and proliferation of aquatic weeds?	O	X	-there are many creeks and people use them for fishing activities
38.	• deterioration of water quality in reservoir?		XO	-some impact during construction
39.	• decline or change in the fisheries below dams due to reduced peak flows and floods and water quality changes?		XO	
40.	• loss of migratory fish species due to the impediment posed by the dam?		X	-cannot identify
41.	• formation of sediment deposits at reservoir entrance, creating backwater effect and flooding and waterlogging upstream?	O	X	-to forecast the water volume in the reservoir, calculation of the sediment volume (dead storage for sediment) will be done
42.	• sedimentation of reservoir and loss of storage capacity?	O	X	
43.	• alteration of water quality due to evaporation in reservoir, low-ered temperatures during low flow periods, silt concentration in density currents, low dissolved oxygen, and high levels of iron and manganese?	O	X	
44.	• environmental problems arising from uncontrolled human mi-gration into the area, made possible by access roads and transmission lines?	O	X	
45.	• temporary silt runoff due to construction?	O	X	
46.	• contamination of surface and ground waters due to improper waste disposal?		OX	
47.	• competing uses of water, particularly with water supply?		X	

Checklist – Water Supply

	SCREENING QUESTIONS	Yes	No	REMARKS
	Potential Impacts			
	Will the Project cause…			
1.	• hazard of land subsidence caused by excessive ground water pumping?	O	X	
2.	• conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?	O	X	-water users groups are established for this reason
3.	• unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	O	X	
4.	• delivery of unsafe water to distribution system?	O	X	
5.	• inadequate protection of intake works or wells, leading to pollution of water supply?	O	X	
6.	• excessive algal growth in storage reservoir?		X O	
7.	• increase in production of sewage beyond capabilities of community facilities?		X O	
8.	• inadequate disposal of sludge from water treatment plants?		X O	
9.	• inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		X O	
10.	• health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		X O	
11.	• delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		X O	
12.	• delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		X O	
13.	• excessive abstraction of water affecting downstream users?	O	X	
14.	• competing uses of water, particularly with agricultural use?	O	X	
15.	• increased sewage flow due to increased water supply	O	X	

Checklist – River Basin Planning

	SCREENING QUESTIONS	Yes	No	REMARKS
1.	• Does a river basin planning and management framework exist at national and provincial levels?	X O		
2.	• Is there broad stakeholder participation across sectors within this framework?	X O		
3.	• Are there arrangements for data management and sharing (from local to national levels)	X O		
4.	• Do conflict resolution and coordination mechanisms (from local to national levels) exist, and do these include stakeholders at all levels?	X O		
5.	• Are there mechanisms for cross sectoral coordination to address sustainability considerations?	X O		
6.	• Have risk and EIA studies used adequate baseline data, applied the precautionary principle and are consultative?	X O		
7.	• Does a national policy and regulatory framework for dam development exist that promotes sustainable development and IWRM principles? Is it being implemented?	X O		-project is part of overall development plan in Huai Bang Sai River basin
8.	• Do RBO's, national and provincial water resource agencies and water user groups exist?	X	O	-WUAs do exist
9.	• Are RBO's, national and provincial water agencies and water user groups consulted in dam development planning studies, impact assessment studies and the design and implementation of mitigation plans and operating rules for projects.	X	O	-because this project is not located in national river basin
10.	• Do irrigation projects collaborate with other basin stakeholders on IWRM including environmental and social management and monitoring Programmes for the basin?	X O		
11.	• Do regulatory and planning frameworks contain allocation of roles, responsibilities and mechanisms for integrated water and energy planning for hydropower?	X	O	-no energy planning for hydropower because not enough water for producing energy
12.	• Do they include requirements for co-operation, consultation and information sharing?	X	O	-not sure, no data
13.	• Stakeholder mapping and analysis has been conducted for the basin to identify key stakeholder groups in relation to water resources and their use?	X O		

14.	• Lines of communication amongst river basin stakeholders groups on river basin planning issues are institutionalised through mechanisms such as representative committees, RBOs and other relevant institutions?	X O		
15.	• Are basin wide cumulative assessment of water resource development scenarios conducted?	O	X	
16.	• Is there ongoing and systematic environmental baseline and regular monitoring being conducted in the basin to identify environmental changes and hotspots, and fill knowledge gaps associated with hydropower risks?	X O		
17.	• Is there regular State of the Basin reporting which identifies the environmental baseline condition, key pressures and trends?	X		-cannot identify this issue
18.	• Does basin-wide baseline data include aquatic and terrestrial species abundance, biodiversity, habitat range, reproductive behaviour, and critical habitats?	O	X	
19.	• Have strategies been developed in the dam development planning processes to site, design and operate projects to maintain ecosystem connectivity at the basin level?	X O		
20.	• Have dam development options and ranking studies tried to avoid project sites and designs that have negative impacts on biodiversity, environmental hot spots or protected areas.	X O		
21.	• Do policy and regulations for environmental protection exist and are they enforced.	X O		
22.	• Are biodiversity conservation zones are legally protected from negative impacts?	X O		-just regulation not a law
23.	• Does baseline data exist on water availability, demand and consumptive and non-consumptive water use, including navigation and fisheries?	X O		
24.	• Has a hydrological model been developed for the basin, which addresses different water use scenarios?	O	X	
25.	• Has the effect of climate change on future water availability and flows been assessed?	X		-no data
26.	• Is monitoring of water use conducted?	X	O	-not each activity for water use is monitored