VIETNAM ELECTRIC CORPORATION
TRUNG SON HYDROELECTRIC PLANT PROJECT MANAGEMENT UNIT

E2248
v2

PLANNING ON ENVIRONMENT MANAGEMENT ROAD AND BRIDGE ACCESSING TRUNG SON DAMP

ROAD INTO DAM

REPORT

1.**2** - IESE - 2008

Hanoi civil engineering university
Institute of Environment Science and Engineering (IESE)
Address 55 - Giai Phong road – Ha Ba Trung district – Hanoi
Tel: 04.8693045 04.8691604 Fax: 04.8693714

HANOI: 2008

VIETNAM ELECTRIC CORPORATION
TRUNG SON HYDROELECTRIC PLANT PROJECT MANAGEMENT UNIT

PLANNING ON ENVIRONMENT MANAGEMENT ROAD AND BRIDGE ACCESSING TRUNG SON DAMP

ROAD INTO DAM

REPORT

1.2 - IESE - 2008

Institute of Environment Science and Engineering (IESE)

Director

Project director : Master Nguyen Huu Khai
Chief of environment : Vice – professor , doctor Nguyen Van Tin
Transportation and road environment : Engineer Nguyen Van Quy

HANOI: 2008

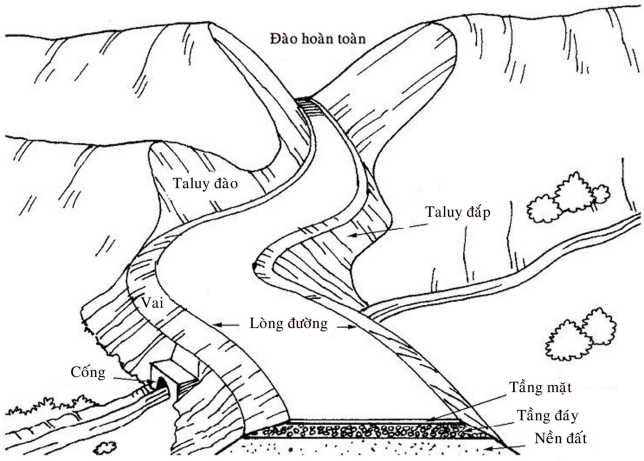


Figure 1: Road Components

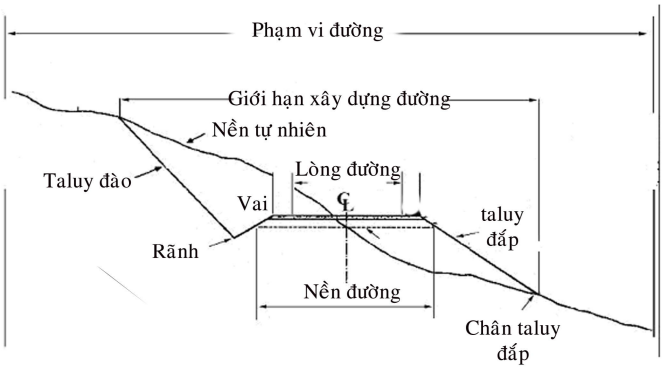


Figure 2: Cross - Section

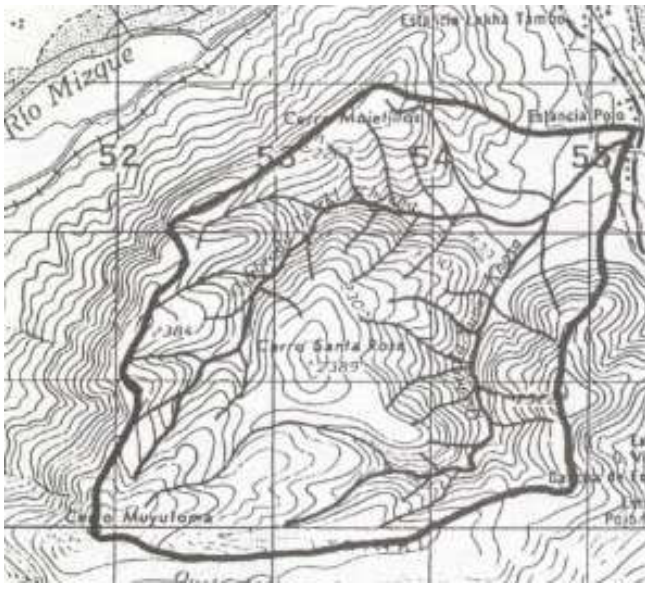


Figure 3: Plan View

RESULT AND DIRECTION

1. Road Components

- **Buttress:** A structure designed to resist lateral forces. It is typically constructed of large riprap rock, gabions, or drained soil to support the toe of a slope in an unstable area
- **Cross-Section:** A drawing deppicting a section of the road sliced across the whole width of the road. Can also apply to a stream, a slope, or a slide.
- **Cut Slope (Back Slope or Cut Bank):** The artificial face or slope cut into soil or rock along the inside edge of the road.
- **Ditch (Side Drain):** A channel or shallow canal along the road intended to collect water from the road and adjacent land for transport to a suitable point of disposal. It is commonly along the inside edge of the road. It also can be along the outside edge or along both sides of the road.
- **Embankment (Fill):** Excavated material placed on a prepared ground surface to contruct the road subgrade and roadbed template.
- **Natural Ground (Original Ground Level):** The natural ground surface of the terrain that existed prior to disturbance and/ or road contruction.
- **Plan View (Map View):** View seen when looking from te sky towards the ground. A drawing with this view is similar to what a bird woud see when flying over a road.
- **Road Center Line:** An imaginary line that runs longitudinally along the center of the road.
- **Roadbed:** Width of the road used by vehicles including the shoulders,

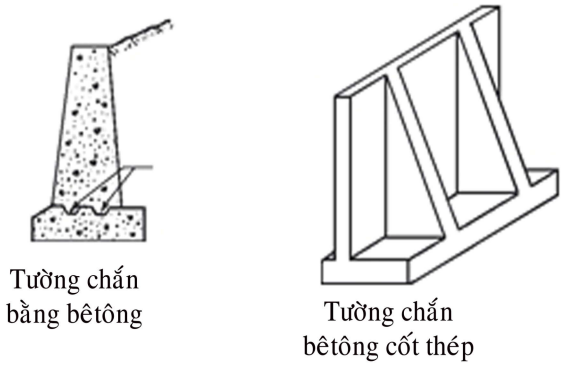


Figure 4: Buttress

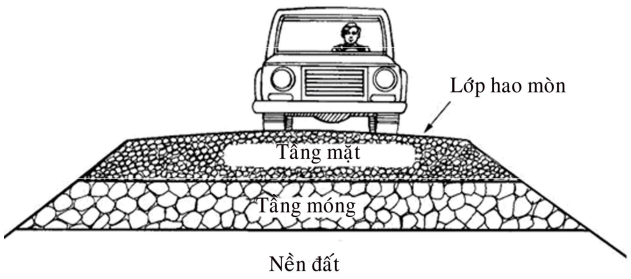


Figure 5: Road Structural Section

Figure 6: Quarry

measured at the top of subgrade.

- Roadway (Construction Limits or Formation Width): Total horizontal width of land affected by the construction of the road, from the top of cut slope to the toe of fill or graded area.

- Traveled Way (Carriageway): That portion of the road constructed for use by moving vehicles including traffic lanes and turnouts (excluding shoulders)

- Slope Ratio (Slope) : A way of expressing constructed slopes as a ratio of horizontal distance to vertical rise.

- Shoulder : The paved or unpaved strip along the edge of the traveled way of the road. An inside shoulder is adjacent to the cut slope. An outside is adjacent to an embankment slope.

- Through Cut: A road cut through a hill slope or, more commonly, a ridge, in which there is a cut slope on both sides of the road.

- Through Fill : Opposite of a through cut, a through fill is a segment of road that is entirely composed of fill material, with fill slopes on both sides of the road.

2. Road Structural Setion And Materials

- Base Course (Base): This is the main load-spreading layer os the trveled way. Base course material normally consists of crushed stone or gravel or of gravelly soils, decomposed rock, sands anf sandy clays stabilized with cement, lime or bitumen.

- Surface Course (Surfacing): The top layer of the road surface, also called the wearing course. Rock, cobble-stone, crushed aggregate and paving, such as Bituminous Surface Treatments and Asphalt Concrete, are types of surfacing

Figure 7: Armor

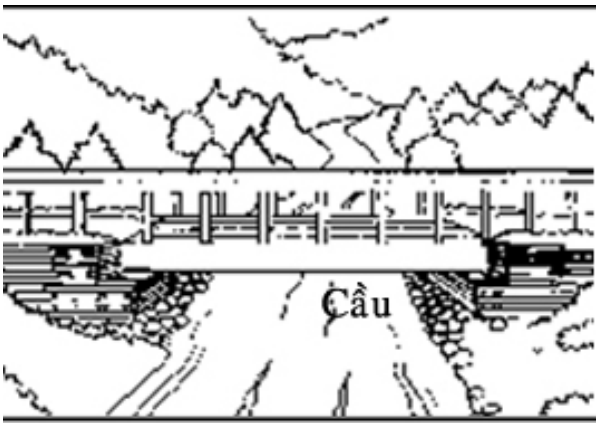


Figure8: Brigde on the road

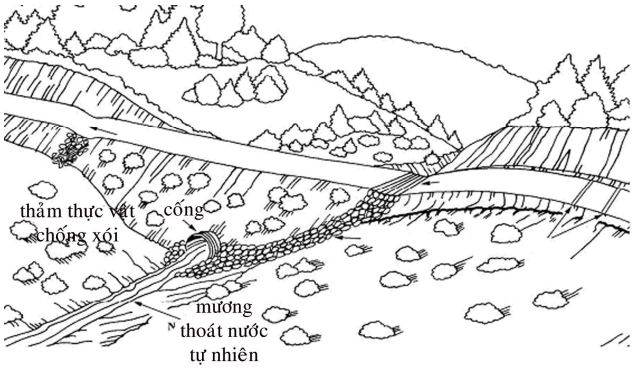


Figure 9: Natural Drainage Crossing with a Culvert

used to improve rider comfort, provide structural support, and weatherproof the road surface gor wet season use.

- **Sub-base:** This is the secondary load-spreading layer underlying the base. It normally consists of a material that has lower strength and duraility than that used in the base… unprocessed natural gravel, gravel/sand or gravel/sand/clay.
- **Subgrade:** The surface of roadbed upon which subbase, base, or surface course are constructed. For roads without base course or surface course, this portion of the roadbed becomes the finished wearing surface. The subgrade is typically at the level of the in-place material.
- **Borrow Pit (borrow site):** An area where xcavation takes place to produce materials for earthwork, such as a fill material for embankments. It is typically a small area used to mine sand, gravel, rock, or soil without further processing
- **Quarry:** A site where stone, riprap, aggregate, and other construction materials are extracted. The material often has to be excavated with ripping or blasting, and the material typically needs to be processed by crushing or screening to produce the desired gradation of aggregate.
- **Raveling:** A process where coarse material on the road surface comes loose and separated from the roadbed because of lack of binder or poor gradation of material. The term also applies to a slope where rock or coarse material comes loose and falls down the cut or fill slope.

3. Surface Drainage

- **Armor:** Rocks or other material placed on headwalls, on soil, or in

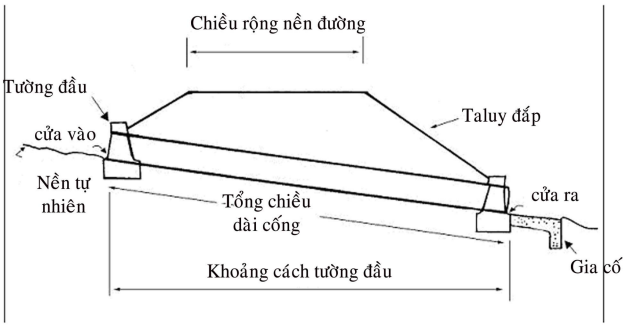


Figure 10: Culvert Compoments

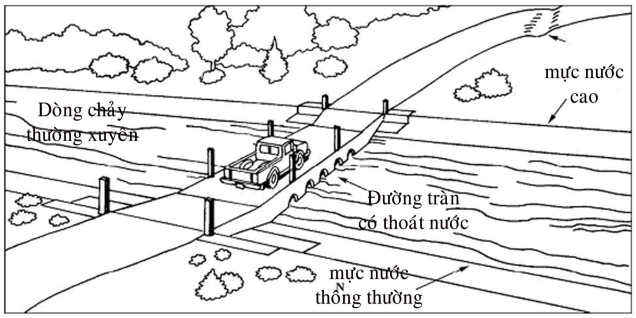


Figure 11: Improved, Vented Ford

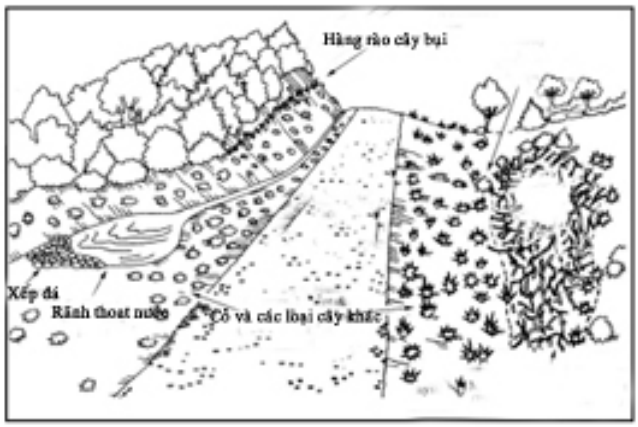


Figure 12: Use of Vegetation, Woody Material anh Rock for Erosion Control

ditches to prevent water from eroding and undercutting or scouring the soil.

- **Drainage Structure:** A structure installed to control, divert, or move water off or across a road, including but not limited to culverts, bridges, ditch drains, fords, and rollig dips.

- **Lead-Off Ditches (Turnouts, Outside Ditch, or Mitre Drains):** Excavations designed to divert water away from the ditch and roadway (at a point where this doesn't occur naturally) in order to reduce the volume and velocity of roadside ditch water.

4. Culverts And Drainage Crossings

- **Culvert:** A drainage pipe, usually made of matal, concrete, or plastic, set benearth the road surface, to move water from the inside of the road to the outside of the road, or under the road. Culverts are used to drain ditches, springs, and streams that cross the road. The invert is the floor or the botto of the structure at its entrance.

- **Headwall:** A concrete, gabion, masonry, or timber wall built around the inlet or outlet of a drainage pipe or structure to increase inlet flow capacity, reduce risk of debris damage, retain the fill material and minimize scour around the structure.

- **Inlet:** The opening in a drainage structure or pipe where the water first enters the structure.

- **Outlet:** The opening in a drainage structure or pipe where the water leaves the structure. The outlet is usually lower than the inlet to ensure that water flows through the structure.

- **Outlet Protection:** Devices or material, such as a headwall or riprap, placed at the outlet of pipes or drainage structures to dissipate the energy of flowing water, reduce its flow velocity, and prevent channel or bank scour.

5. Fords and Low – Water Crossing

- Ford (Low-Water Crossing) (Drift); Simple: A rock or other hardaned structure that is built across the bottom of a swale, gully, or stream channel that is usually dry, to allow improved vehicle passage during periods of low water or no flow.

- Ford (Low-Water Crossing) (Drift); Improved: A masonry, concrete, gabion, or other hardened surface structure built across the bottom of an intermittent or live stream that improves vehicle passage during low flow periods and minimzes channel disturbance or sediment production.

6. Erosion Control

- Erosion Prevention: Preventing erosion before it occurs. Erosion prevention is typically less expensive and more effective than erosion control. Erosion prevention is intended to protect a road,including its drainage structures, cut and fill slopes, and disturbed areas, and to protect water quality.

- Erosion Control: The art of reducing or eliminating on-going erosion caused by raindrop impact, rilling, gullying, raveling, and other surface processes.

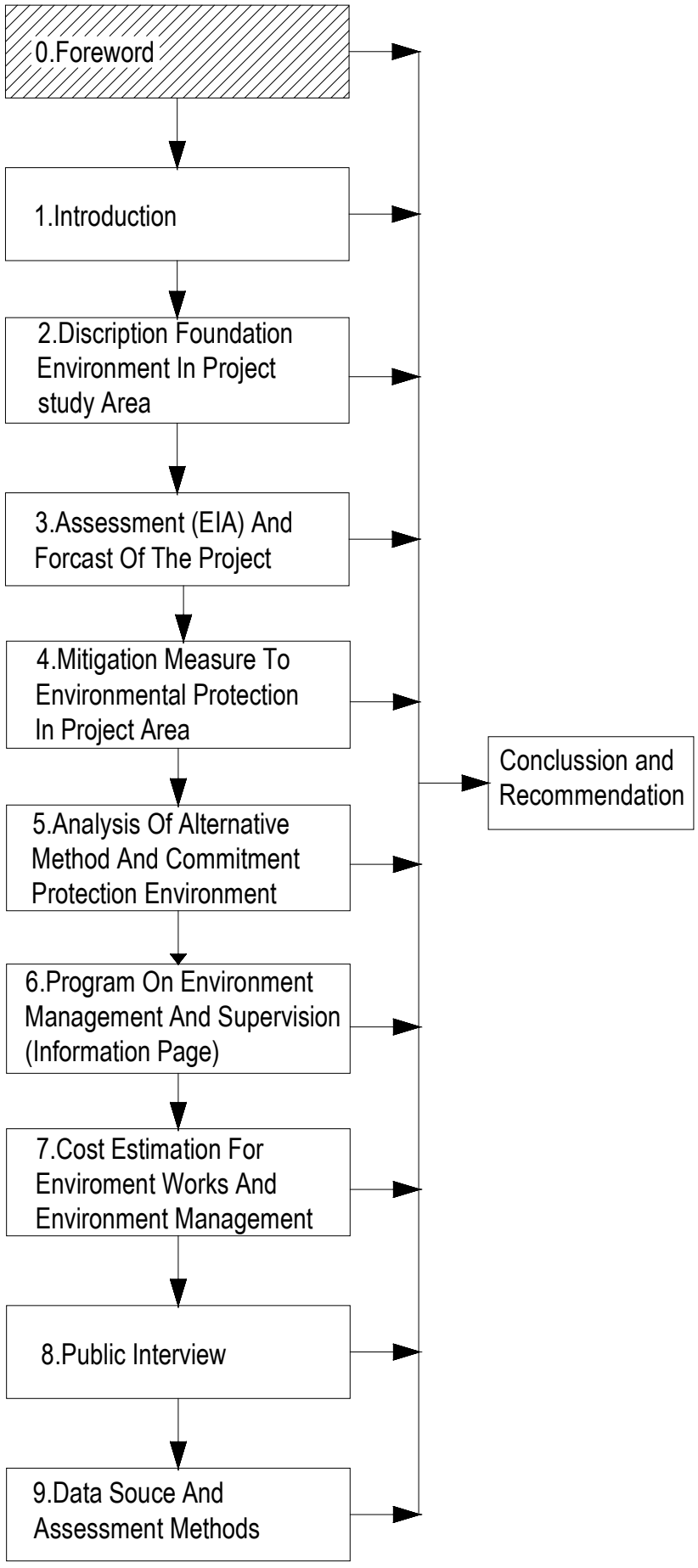
- Erosive Soils: Soils that are relatively prone to erosion and movement by rain drop impact and surface runoff. Fine granular, non-cohesive soils, such as fine sandy sand derived from decomposed granite, silts, or fine sands, are known to be very erosive.

- Sedimentation (Sediment): Soil, most commonly clay, silt and sand, which is eroded from the land or poorly constructed roads and reaches a stream or water course, commonly reducing water quality in rivers, streams and lakes.

- Mulch: Material placed or spread on the surface of the ground to protect it from raindrop, rill, and gully erosion, andto retain moisture to promote the growth of vegetation. Mulches include cut vegetation, grasses, wood chips, rock, straw, wood fiber, and variety of other natural and synthetic materials and mats.

- Sediment Catchment Basin: A constructed basin designed to slow water velocity and trap sediment as it settles out of the water.

INTRODUCTIO



CONTENT

Picture: Co Luong bridge swept away by flood in 2007

NOTED MATTERS FOR ENVIRONMENTAL MANAGEMENT

- Safe production, friendly environment, design ensured for usage demands.

- Protection of water source quality, prevention of polluted water source

- Limitation of occupied land, especially for farming land

- Protection of sensible land area and avoidance impacts to ecosystem

- Avoidance of changing natural flow and living conditions of creatures

- Controlling face flow, setting withdrawn and drained water passing road. Ensuring stability of road-bed.

- Controlling erosion and protection for land area having high risk of erosion.

- Ensuring limit stability of slope

- Avoidance of designing road throught land area being complexly treated.

INTRODUCTION

0.1. Introduction.

- From the past to now, people rarely pay attention to their effects on the environment. Deforesting for milpa, opening traffic road and other economic activities are easily caused to phenomenons of slide and flood … These effects make changes climate, biology, environmental living and other environment groups causing bad influence on living conditions of plants, animals and human-being.
- To learn from experience in the past, as to reduce devastation level, countries had issued their law on environmental protection. Prior to proceed with a big project, one of the most important stage is to write Environmental Impact Assessment Report (EIA) or Environmental Impact Statement (EIS). The Constructor is required to write EIA and submit to the Authority. EIA should be published in range of impacted area so that residents thereat have opportunity to express their view thereof. Subsequent to the consideration on advantages and disadvantages, the Authority would approve or disapprove the Project, or obligate the Constructor to fulfill more perfect.
- Since EIA plays an important role as mentioned, the Constructor is advised to cautiously work out that if measures proposed in the Project has satisfaction for limitation bad level of environmental impact or otherwise if it's possible to find other alternative ways?. In case, for some impacts that avoidance is impossible, how to diminish this impact at the lowest level is given hereby to implement and then, it can be envisaged to properly compensate for the residents living in the impacted area, so on…
- Environment is considered not as only nature, ecology but also as man-made environment. This means that EIA is necessary to evaluate influences of the Project on local society (houses, living, entertainment, traffic, noise, general life quality of people), on economy (jobs, harvests of the overall residents in the area), on belief culture, on historical monument, preservation...

THE DONE THINGS!

- Analysis of environment during the course of planning and development of the project

- Open respective information of the project

- Reference to the community for seeking proper settlements.

AVOIDANCE THINGS!

- Waiting analysis of environemt until Project already implemented or matters developed

- No compliance with procedures of the environmental analysis

- Pursuant to the law of countries (including Vietnam), the Employer should write (normally employ other professional company, except for big companies having sufficient expert) and submit EIA together with Investment Project.
- Trung Son Hydroelectricity Project is subject to project with diversified targets consists of generating power and fighting against flood. The dam is expected to execute at downstream in Lao and the flow stream behind dam flowing in Vietnam area. The dam is built concrete with height of 88m, the length of dam top with 353m, creating water reservoir with capacity 112 million cube meter for against flood , surface area with 13km^2 overflowing land forest. The building will cause impact to about 381 households with 1900 people, almost Thai's ethinic group
- Trung Son Hydroelectricity Project (Uon Village) is built on Ma River. The main build is executed under area of Trung Son Commune, Quan Hoa District, Thanh Hoa Province far away from Hoa Binh province with 95km forward to West – South, far away from Thanh Hoa 195 km forward to West – North, lake entrail is under areas of Son La, Hoa Binh and Thanh Hoa provinces, suitable with terrace programming of hydroelectricity on Ma River which approved by Ministry of Industry.
- Environmental impact assessment of road and bridge of hydroelectricity Trung Son is of paramount importance and obligation as appropriate comprehension for impacts of the project to environment around construction area, and to issue limitation methods for environment such as nature – climate, water environment, air, noise, vibration and other matters regarding general scape and landscape of the road and the area. In addition, prevention methods for sliding and slumpping on the slope, stream flow (such as: small ditch, river, stream at upstream, downstream of drainage passing road...). Combination with abovementioned subject, it's also conducted to have assessment of stable conditions of slope, embankment, gravelly soil and other positions having easy factors for sliding effected by torrential

08 STEPS OF PROCESS OF ENVIRONMENTAL ANALYSIS AND OUTCOME

1. Awareness of project

Awareness of aim and necessity of activities. Developing purposes and full preparation of frame for environmental analysis.

2. Aim

Awareness of matters, opportunity and impacts of activities

3. Collection and clarification data

Collecting data. Awareness of easily occurred impacts of project implementaion.

4. Design of methods

Collecting data. Awareness of easily occurred impacts of project implementaion.

5. Assessment of impacts

Forecast and description environmetal impacts: physics, biology, economy, soicety of proceeding each individual method. Giving 03 ways of impact: Direct, indirect, accumulative.

6. Comparison of methods

Analysis of forcasted impacts of each methods based on the assessment standards.

7. Reference to the community

Better choice method. Receiving critical word and comment from the community

rain, vibration from traffic means travelling. Assessment of environmental impact of road must define unfavourable effects which the road leads to change social environrment, conditions of residents such as: land acquisition, resettlement, job and other relevant matters. Finally, assessment of environmental impact of road is also necessary to assess direct effects on traffic, safety for traffic at intersection points and along the road line; assessment of impact to infrastructure of the community, the living of residents within area caused impacts from the road. Giving a correct assessment of environment and appropriate management plan for environment shall contribute remarkably to the success of the Project.

0.2. Targets of assessment and environmental protection.

Implementation of environmental impact assessment (EIA) and environmental mangement planning (EMP) for road and bridge into Trung Son dam needs to fully combine with environmental impact assessment and environmental management planning of overall project of Trung Son Hydroelectricity, enable to favorably manage environmental impacts when associating with performance of management planning of the whole Project. Environmental management planning for only road and bridge into the dam is undertaken focusing on direct and indirect impacts of environment at ease occurring along side road and focusing on management of impacts caused by the road building. During the course of assessment and making documents for environmental management of road and bridge into Trung Son hydroelectricity must be filled up sufficient stages of preparation, road and bridge execution, Trung Son hydroelectricity execution and meet the demands of transportation for the local area. Targets required for assessment including :

- Assess in details of methods for road and bridge into Trung Son hydroelectricity considering to the circle measure aims to avoidance residents area or using waterway as a part of transportaion service

8. Execution and supervision.

Note results. Implementaion according to the chosen method. Proceeding checking plan and ensuring that environmental analysis will be strictly implemented.

Picture 02: Of Road along River

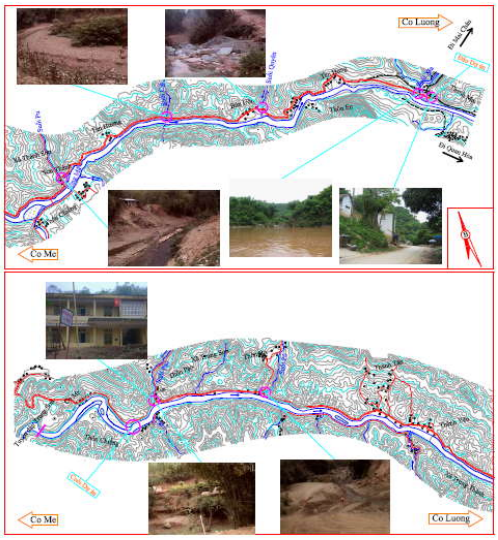


Figure 03: Plan road line

for residents thereat.

- Assess possitive and negative impacts of the project to the environmental surrounding including stages of survey for settle road line , execution and road operation to serve for building hydroelectricty and serve for permanent traffic of the local.

- Assess impacts pertaining to the process of executing road and bridge such as: camping, materials carriage, disposing, operation of machinery for construction, relationship between workers (on site) with local residents and damages of individual assets and facilities of community.

- Propose methods to diminish at the lowest level of these unfavourable impacts to the environment and closely coordinate with the contractor, the relative organisations and the local authority as to earliest find out and resolve environmental problems occuring within the project.

- Overall methods proposed in the project should be realizable, suitable with socioeconomic conditions of the area and the country, necessitate to gain opinions offerred by the local and contractor.

- Reports of impact assessment proposed in the project should be applied in accordance with Vietnam Standard on environment and instructions of WorldBank.

+ For the natural environment, avoidance of impacts to the natural balance is indipensable, especially, consider to factors detailed as follow:

+ Stability natural road-bed, prevention of floor-slumpping, sliding, erosion...

- Protection of natural environmental, limitaion of breaking plants cover, impact to wild animals.

- Air environment, water source, sound vibration and soil environment.

+ Considering to the social environment, execpt benefits obtained from the project, it necessitates to attch special importance to community health, relationship between the labor of project with the local people.

0.3. Legal Documents and Designs of environmental impact assessment (EIA)

Report of EIA of investment project of road and bridge into Trung Son Hydroeclectricity is based on:

- Environmental Law No. 52/2005/QH11 of the eleventh National Assembly, the eighth session approved on 29 November, 2005, takes uniformly effect since the date of 01 July, 2006
- Land Law of Socialist Republic of Vietnam in 2003, takes uniformly effect since the date of 1 July, 2004
- Water Resources Law approved by the tenth National Assemebly, the third session dated 20 May, 1998, takes uniformly effect since the date of 1 January, 1999.
- Forest Protection and Development Law No. 29/2004/QH11 approved by National Assembly on 3 December, 2004, takes uniformly effect since the date of 1 April, 2005.
- Decree No. 80/2006/NĐ-CP dated on 09 August, 2006 of the Government regulation on details and instruction for implementation some provisions promulgated in Environmental Law.
- Decree No. 08/2006/TT-BTNMT dated 08 September, 2006 of Ministry of Environmental Resources on instructions of strategic environmental impact assessment, environmental impact assessment and commitment protection for environment.
- Decision No. 22/2006/QĐ-BTNMT dated 18 December, 2006 of Ministry of Environmental Resources on obligating application Vietnam Standard of environment
- Decision of Minister of Industrial Ministry on appraisal of Programming for steps of Ma River Hydroelectricity No. 1195/QĐ-NLDKdated 31 March, 2005
- Decesion No. 907/QĐ-EVN-HĐQT of Vietnam Electricity Coporation dated 2 November, 2007 on establishment Project Management Board of Trung Son Hydroelectricty

0.4. Scope of assessment, standard of assessment and implementation of works.

0.4.1. Scope of project assessment

Scope of project management: Project of road operation and construction of Trung Son Hydroelectricity is not only as purpose of serving for company construction and operation, but also as important and essential infrastructure serving for development of socioeconomic of the area. Since the road going along the left of Ma River, passing through many residents groups, assessment of environmental impact of the project should be done along the road from Co Luong bridge to Co Me Village. Especially for places of residents groups living and bearing impacts from the proejct.

0.4.2. Standard of Project assessment

For responsibility of the Employer and Investor, we hereby commit to strictly implement assessment standards as follow:

- Standard of Salt water quality TCVN 5942 – 1995;
- Standard of Underground water quality TCVN 5944 – 1995;
- Standard of Air surrounding quality TCVN 5939 – 2005;
- Standard of Industrial waste of dust and inogarnic substance TCVN 6438 – 2001;

- Allowance maximum limit of exhaust for inland traffic vehicles and standard of environemt in field of noise TCVN 5948-1999;
- TCVN 6565-2006: Inland traffic vehicles. Visible exhaust (smoke) from burnt engine by compressed;
- TCVN 6567-2006: Inland traffic vehicles. Burnt engine by compressed, burnt engine forced using liquid petroleum gas and engine using natural gas installed in the car.
- TCVN 6785-2006: Inland traffic vehicles. Eliminate polluted exhaust from the car following fuel using for the engine.

0.4.3. Implementation of works

In order to particularly assess impacts of environment for project, report of EIA shall give out detailed assessments of mentioned matters in item 2 including:

a. Method of road into the dam:

Methods in scale of study such as : waterway, roadway, especially for designed method. This content shall mention to impacts caused by road and bridge into residents area and general environment.

Figure04: Boat on River

1. Waterway:

In process of the execution, waterway is used for waterway transportation of the residents thereat and along Ma River, process of using waterway traffic is an easy way to influence on environmental water and safety for along river. We hereby do not go into the details of analysis of waterway impacts to environment of road system into Trung Son hydroelectricity.

2. Waterway.

+ *Choosing method for road into dam:*

- Road line Alterlative I: From Co Lương to old road, pass Lan Dien village, Don village, Uon village, Choi village (Van Mai commune), Tan Huong village, Pu village, San village, Thanh Tan village (Trung Thanh commune), Po village, Pao village (Trung Son commune). New road line following old road about 13km, for section that elevation of old road > 90m it only partial adjustment; for section that elevation of old road < 90m, it's 4 km new road line should be at higher position than old road for ensuring master plan of Ma river. Total length of road line is 20, 587 km with 74 culverts and 5 midle size bridges

- Road line alterlative II: Road line follow Ma

Picture05: Position of new bridge

Picture06: Experimentof water gas

river bank as same as alterlative I for section from starting point to station Km 11+738.61, pass Ma river by large size bridge, follow right bank of Ma river. It's new construction section passing Tung village, Sach village, Chieng village (Trung Thanh commune) and ending at Co Me bridge. Total length of road line is 20, 702 Km, with 70 culverts, 4 midle size bridge and 1 large size bridge.

- *Road line alterlative III:* Road line follow left bank of Ma river and same as alterlative I for section from starting point to station Km 7+242.02 (Tan Huong village) pass Ma river by large size bridge, follow right bank of Ma river. It's new construction section passing Phai village, Chieng village (Trung Thanh commune), passing Quyet stream with large size bridge and connect to alterlative II at station Km 12A +591.23 and same as alterlative II to ending point. Total length of road line is 20,895 km with 77 culverts and 2 large size bridges

Conclusion:

Anlysis road line alterlatives, culvert and bridge was done by design consultant in basis design document. Choosing alterlative is alterlative I of design consultant is appropriated with environement standards and minimizing measurements. It recomends for alterlative I.

+ Proceeding the designed method for construction road and bridge shall cause influences:

- Changing natural structure condition of the area due to works of excavation, embanking and other constructions.

- Remarkable changes on environmental biology condition because of breaking a part of plants cover, living conditions of plants and animals along two sides road.

- Other influences on social conditions brought by the road : residents thereat can be forced to move their living place, change careers, traffic safety and benefits bringing from people....

b. Major environmetal impacts:

- Effects of settle road line and methods of treatment design.
- Effects of road and bridge construction
- Effects of stability and erosion matters from construction of road and bridge.
- Effects of road activities on the environment:
  + Air environment, especially for exhaust and dust;
  + Salt water and underground water environment
  + Vibration from vehicles travelling
  + Land environment and geological matters
  + Ecology and resources environment ...
- Effects from activities of the road on environmental living, living of residents and social matters as :
  + Life quality on traffic and upgraded intellectual standard of the people which brought by the traffic.
  + Management of safety for traffic will be complicated causing from many lines of traffic vehicles, especially for heavy construction machinery and rudimental transport means of people.
  + Relevant matters on natural landscape...

c. Environmental management planning

Environmental management planning is undertaken accroding to each individual items:

- Environmental management planning is specifically done for each individual road. This content is implemented on formative pages on environment and society in lines.
- Management of road construction works and road operation.
- Interaction community (including correspondence with the community and management of mutual impacts to the community)
- Inspection and supervision

d. Write and hand in report

The report content should be made up pursuant to the Circular 08/2006/TT-BTNMT dated 08 September, 2006 of Ministry of Resources and Environment on instructions of strategical environmental assessment, environmental impact assessment and commitment protection for environment, in addition, contents inscribed in the report should be abiden with requirements promulgated in reference provisions of World Bank.

0.5. Principles of affirming environmental target

- Aspects of environment and community are effected by the project and aspects effect on the project including both positive and negative factors.
- Effects from construction of road, bridge.. shall be completely considered.
- Approach to environment assessment and confirming targets of environmental assessment based on sicence analysis of impact sources, changes tendency of environmental components.
- Inherit study results of preliminary EIA of the project
- Considering opinions referenced from scientist, experts and local people having acknowledgment of impacted area of the project and attching special importance to environmental protection, management of natural resources.

0.6. Using methods for assessment worrk

Environmental impact assessment of the project is undertaken in accordance with " Regulation on environmental impact assessment when making up feasible study project and design of transportation works (22TCN 242 – 98" which is made reference to " Guidance of environmental impact assessment for transportation projects" of Ministry of Resources and Environment. During the course of making EIA of the project, tradditional methods are made full use of, including:

- Statistics method;
- Investigation method, site survey;
- Data analysis and processing in the room;
- Swift assessment method
- Sociology investigation method
- Comparative method
- List and matrix method

0.7. Selection environmental matters following the safe policy of World Bank.

Environmental matters matters following the safe policy of World Bank listed as below:

a. Major impacts of environment be required implementaion:

- The most major direct impacts and easy serious impacts are defined by the said study, shall pertain to the environment and community.
- The petition of community related to matters od worker camping such as: waste disposing, relationship between workers and local people and infrastructure of community.
- Partial impacts of environment caused by construction of road lines, bridge and roundabout route making unstable slope, damages for drainages;
- Management of safety for transport will be more confused with the reason of using combined with heavy machinery of dam construction and amost motobikes and traffic vehicles of the community.

Though resettlement matters shall be resolved based on specific resettlement plans, the respective environmental impacts of resettlement works including construciton and usage

of resettlement area and creation earnings for moving cases should be mentioned and analysed in this respect.

b. Environmental management planning (EMP)

Environmental management planning consits 4 parts as follow:

- Environmental management planning for each individual section of the road line, inscribed in the informative page of environment and society of the road line.
- Management of construction works
- Planning for community relationship.
- Inspection and supervision

In short, Environmental management planning for road and bridge into Trung Son hydroelectricity shall be presented in details in this report according to reference provisions, provided by Project management board and based on the prevalent regulations of Ministry of Resources and Environment (Decree No.08). Herein below are content of the report.

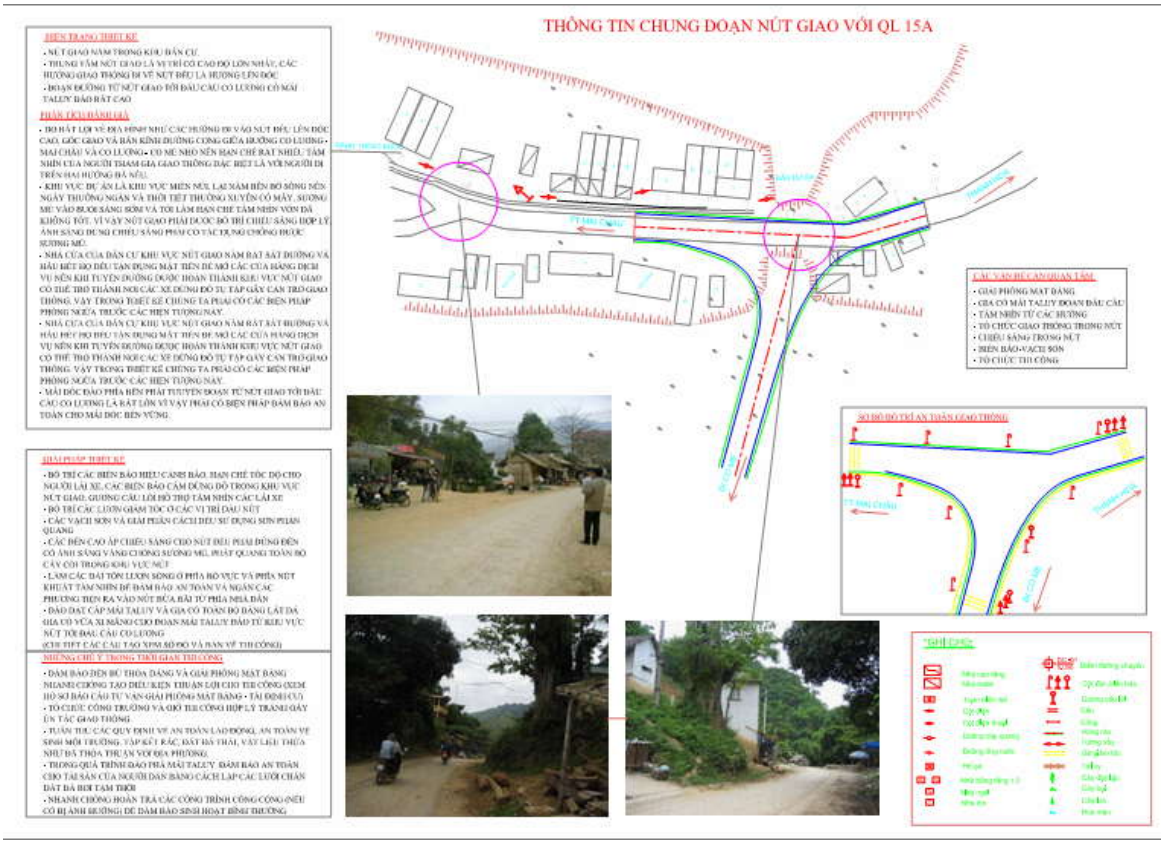
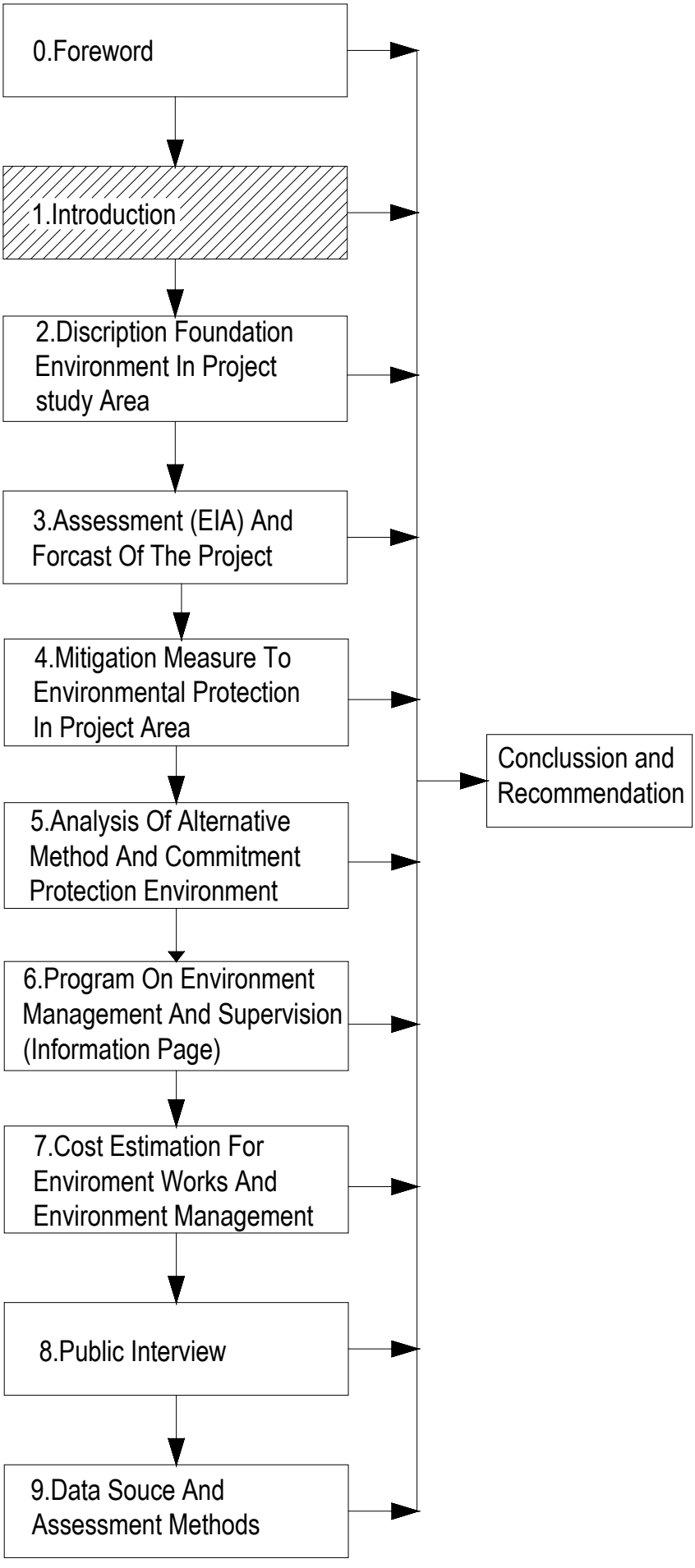


Figure 0.7: Information page (Tor)

CHAPTER 1


0.Foreword
1.Introduction
2.Discription Foundation Environment In Project study Area
3.Assessment (EIA) And Forcast Of The Project
4.Mitigation Measure To Environmental Protection In Project Area
5.Analysis Of Alternative Method And Commitment Protection Environment
6.Program On Environment Management And Supervision (Information Page)
7.Cost Estimation For Enviroment Works And Environment Management
8.Public Interview
9.Data Souce And Assessment Methods
Conclussion and Recommendation

CONTENT

CHAPTER 1: INTRODUCITON

1.1. Name, address and location of Projects

- Name of Project: Trung Son Hydropower Plant.

- Item: Road into Trung Son Hydropower Plant.

- Location:

+ *Starting point*: Co Luong Three way crossroads – Van Mai commune – Quan Hoa – Thanh Hoa.

+ *Finishing point*: Co Me village – Trung Sơn Commune– Quan Hoa – Thanh Hoa.

1.2. Employer

Name of Employer: **Trung Son Hydropower Plant Project Management Board**

Address : **25A - Quang Trung - Ngọc Trao District – Thanh Hoa**.

Telephone : ***0373.726335***

Fax : ***0373.726335***

1.3. Related agencies and type of coordination

1.3.1. Related agencies

- WorldBank Representative Office in Hanoi;
- Trung Son Hydropower Plant Project Management Board;
- Consultant unit for Environment Impact Assessment: IESE (Institution of Environmental Science and Engineer)
- Consultant units for bridge and road design, resettlement;
- People's Committee of Mai Chau district, Quan Hoa district and other related People's Committee;
- Related units: Ministry of Natural Resource and Environment, Department of Natural Resource and Environment of Hoa Binh and Thanh Hoa provinces.

1.3.2. Type of Coordination

- IESE closely steers each unit and support each other to finalize under schedule and good quality.
- Consultant units should keep smooth communication to solve arising matter, catch up schedule and work under construction. Consultant content and report must be submitted correctly and quickly to get timely approval and recommendation of related agencies.

1.4. Estimation of investment cost

Cost estimation for planning of environment supervision and management is showned in chapter 7

1.5. Project Implementation Method

Implementation Method

- Study proposal of management method based on experience, summary from manuals for above works.

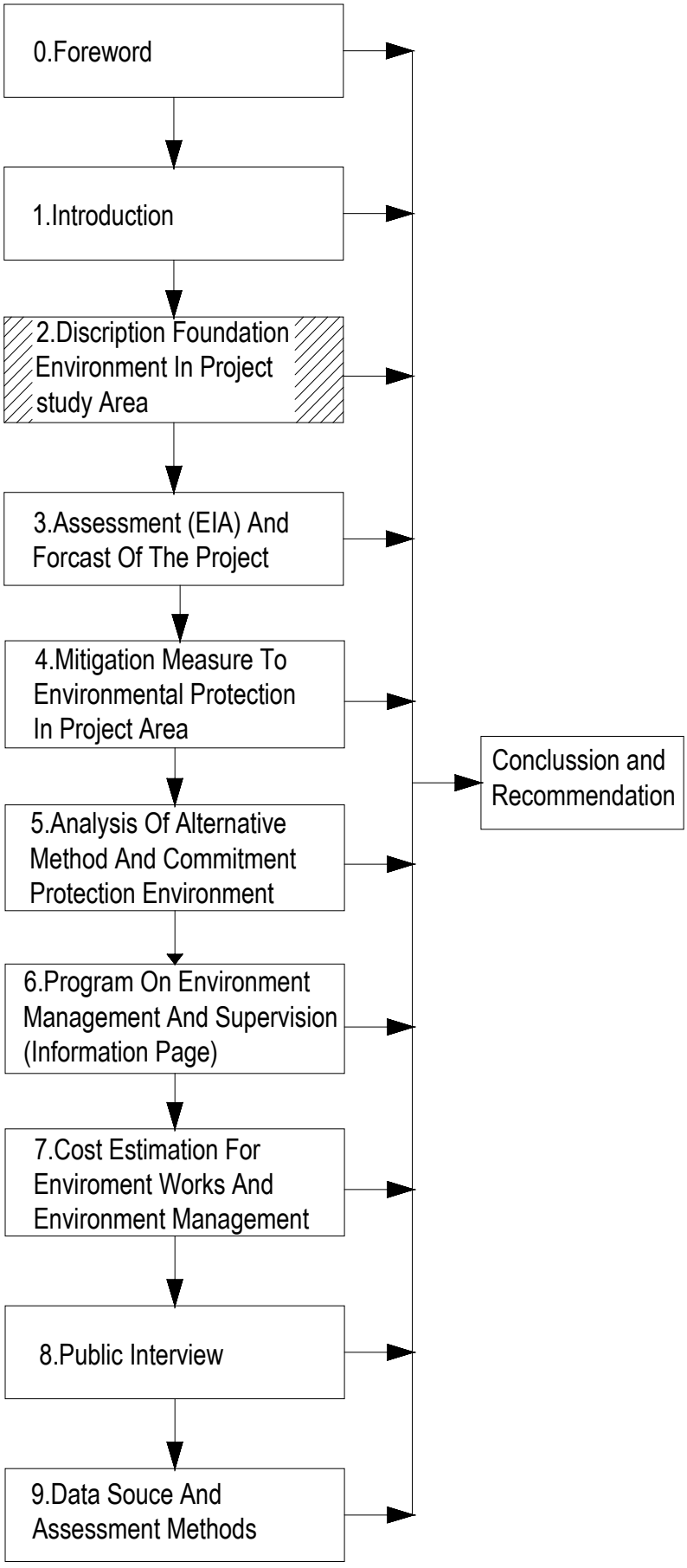
- Study environmental management plan of similar project in Vietnam and region.
- Study current Vietnam regulations and laws.
- Work with related agencies to get recommendations.
- Propose management methods for aforesaid content to construction units, workers and local people.

1.6. Project implementation arrangement

Environment Impact Assessment of Trung Son Hydropower Plant in the period of Investment project is implemented under management of Trung Son Hydropower Plant PMB, Consultant unit in charge of Report is IESE

Employer: **Trung Son Hydropower Plant Project Management Board**
Team Leader: **Ho Sy Bao**
Address: **25A - Quang Trung - Ngọc Trạo - Thanh Hoá.**
Telephone : ***0373.726335***
Fax : ***0373.726335***
Consultant unit : **Institution of Environmental Science and Engineer – (IESE)**
Director : **PGS. TS Nguyen Duy Dong**
Address : **University of Construction, No. 55 Giai Phong Road, Hanoi**
Telephone : **04.869340 - 04.8691604**
Fax : ***04.8693714***

Chapter 2


0.Foreword
1.Introduction
2.Discription Foundation Environment In Project study Area
3.Assessment (EIA) And Forcast Of The Project
4.Mitigation Measure To Environmental Protection In Project Area
5.Analysis Of Alternative Method And Commitment Protection Environment
6.Program On Environment Management And Supervision (Information Page)
7.Cost Estimation For Enviroment Works And Environment Management
8.Public Interview
9.Data Souce And Assessment Methods
Conclussion and Recommendation

Content

Photo 2.1: Survey area. Starting section

Photo 2.2: Survey area. Middle section in Thanh Son commune

Photo 2.3: Survey area. ending section in Trung Son commune

CHAPTER 2: DISCRIPTION FOUNDATION ENVIRONMENT IN PROJECT STUDY AREA

2.1. Natural and eco-social condition of project study are area

2.1.1. Natural condition

a. Specific on topography and geographical condition

Project study are area has feature of northerm forest and mountain. Topography is mountain from north east to west south. Roads to access the site are national road No. 15A at Tong Dau in Mai Chau district – Hoa Binh province and connecting with national road No.217 at Tra village under Quan Hoa district-Thanh Hoa province.

b. Climate features

- Such as other area in northerm part of Viet Nam, it's under the affected of tropical monsoon climate. There is deviding two reasons in year: Winter dry and cold; summer humid and rain.
- Winter from november to april the climate is mainly affected of cold air continent from Xibia that making north west monsoon with cold condition. Rain in this reason maily is small drizzling rain in long time with insignificant volume that only affect to increat the humid of soil in dry reason.
- Summer from may to October, the climate is affected of North west and North east. In circulation of atmosphere. In period of reason changing, north west monsoon remain taking affect but weak than winter.
- In middle period of summer, the weather is affected of catching such as: thunderstorm, eddy, tropical low pressure, converge tropical … that of making the weather varries in rainly and humid. The weather varries consequence of hot and no rain for long time to bring about dry, water insufficient, opposite that of heavy rain in long time and wide area to cause huge flood over effecting people living and production. Symbolic as the peak flood in 2007 sweep away Xia stream bridge. In dry reason, could be passed stream by temporory bridge, but in rain reason the area to be isolated.
- In Quan Hoa the average temprature of year is 22.6^{o}C.

The most coldest time is January with average temprature of 7^{o}C. The hotest time is July with average temprature of 27.8 - 32 ^{o}C. There are 4 months temprature under 20^{o}C in year (from December to Febraury). The highest is 39.7 ^{o}C and the lowest is 0.5 ^{o}C .

- The moiture is quite high with average of 86% in year. High moisture from Febraury to April at same time of spring rainly with average of 87%. Following collected survey documents, the varries of moiture each year is small, and low month to month

Photo 2.4: Xia bridge

- In Mai Chau survey station, everage rain water volume in year is measured about 1660mm-1700mm, 164 rain days. In with it's rain mainly in 3 months (June, July and august) with 800 - 900mm reaching 52% total rain water of year. In rain reason, the total water is 1300mm reach 75% of year. As survey data in the hugest rain per day is 195,9mm on June 13th 1964

+ *Direction of wind*: The direction mainly south east-North west. Everage velocity is 0.9m/s, The highest value is V = 28m/s .

+ *Specification of hydrography*

- Study area is effected of Ma river hydrography. It's alert following 2 reasons.

- Summer is from May to October, with peak flood apearing from July to September.

- Dry reason is from December to April next year, with the lowest water level from Febraury to March.

The difirency of hydrography between dry and flood is showing of water flow volume, water level, sand holdin. water flow volume in flodd period reach 71 - 73%, in dry it's only 27 - 29% per year.

+ *Specification of geological*

Study the site drill data, test result in laboratory and referent geological survey of bridges on the road line, and based on state, soil name, layer is divided as follows:

- Layer 1: Clay with 15% -:- 60% in state of soft thick everage 1-:-3m, colour of grey brown and yellow brown

- Layer 2 : Sandy clay with 15% -:-30% stone, carved stone , state of semi rigid and rigid, colour of

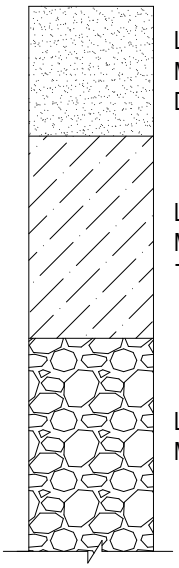


Photo 2.5: Thai and Muong ethnic people

Photo 2.6: Bamboo forest along road side

grey brown, yellow brown, grey yellow

- Layer 3 : Pebbles, small and big carved stone with colour of grey green, brown grey.

Im some section, there are apearing open cast stone or in shallow layer.

2.1.2. Ecomnomic and social condition

a. Adminitrative location

Access road to Trung Son hydroelectric plant starting point is at Co luong in Nation road No. 15A-Quan Hoa district, end point at bridge on Ma river. Road line pass Lan Dien, Xom Don, (under Van Mai comune), Xom Choi (Mai Hich comune), Ban Uon villages (Phu Thanh comune), Tan Huong villages, Son Thanh villages, Thanh Yen villages (Thanh Son comune), Ban Po, Ban Pao village (under Trung Son comune) … See annex detail in **Table 2.1**

b. Population anf labour

Population in study area is mainly Thai, Muong ethnic and few Kinh ethnic. People concentrate living in small villages along side of old road, with simple activitives habit. They are forestry, farming, breeding. Few of them produce, bussness forestry production in small scale such as: chopstick, có quy mô nhỏ như: sản xuất đũa, toopick... (At starting point near nation road No. 15A). There is a few factory, mainly in forestry processing, constrcution mining with human resource very small (25-30). Life matter is limitted due to difference intimate and exchange; insuuficient electrical, runningclean water. Running water is from resource of nature streams; electrical taking from self mini hydroelectric machine. Over that, the life is deprivation. After putting the road in use, it can take more ecomnomic exchang to people here and also improving their life and ecomnomic growing.

c. Land use

Nature land is large, but geographycal to be partition and obstacles, dufficult to develope production in large size. Therefore, main land is forestry using, apart in argriculture of wich rice farming and industry tree planting and resisdent. Forestry land use is hight scale,

Photo2.7: Fruit tree in starting section Km0 to Km3

but mainly short life tree such as bamboo … Due to terrain difficult and passive of irrigation so that land for argriculture is small, productivity low. There no plan of resident land due to habit of shifting cultivation and nomadic.

d. Ecomnomic condition

People here live in farming and forestry. Material facilities and technical for production is primitive and underdeveploped. Due to intimation exchange low, farm and forestry production is dufficult to be comsumed, that the reason of underdeveloped of argriculture here. Therefore, it need to be interested on investment in transportation and infrastruture for this area.

e. Human resource deveplopment condition

Photo 2.8: Bussness in small scale.

Survey data on living condition, culture, infrastructure along road line show that the occasion approach social survices as below:

- Occasion to approach environment resource here is poor: almost household don't use grid electricity (using self supply) small part of them at starting point section using network electricity. Running water is from open stream, not to be from well or other standard domestic water resource.

- Accommodation and living condition is poor. There is a few built house (grade IV), most of thatched house and house on stilts.

- Statistical data on economic – social along road line show that all comunes have prime school, fist aid station. However, it's small scale and simple don't meet the real requirements.

Photo 2.9: Bamboo processing workshop, small.

2.2. State of environment quality on stablity and erosion on study area.

In general, in dry reason, there is no complication on foundation stable and erosion, but its remain hidden unforeseen the risk at hot point on erosion. In rainly reason, erosion is complexible, unstable and slide is common. But there no construction work for this protection. Therefore, employer and design engineer must take measurement in road construction design

document to minimize it.

2.2.1. Exsisting condition of nature slope stable

Photo 2.10: Trung Son Secondary school.

- Over the road line there is varies in slope value. At starting section, from Km0-Km4 slope is gentle and more stable than other. Coming to end point, the slope getting high, and it appear unstable of nature slope.
- Due to geography condition, soil here contain many clay, there of slope stable in dry reason, but in rain reason, it need interest on sliding and erosion.
- In dry reason, clay soil here in good associated, the density could reach K=0.95, all nature slopes are stable, no erosion and sliding. In rain reason, clay soil here to be hold water, bearing ablity and association getting down, slope unstable could be showed, slide increasing specially at high slope and few cover tree. In rivulets with high speed flow water there are partial erosion such as near bridge, sewer.

Photo 2.11: Survey living life

- Therefore, during design and construction stage, using management, it need the appreciation and attention of management unit for this situation to take solution in sensible way, of which the measurements to be applied in design and construction stage is effective.

2.2.2. Stable situation of excavation and embankment slope

Photo 2.12: Starting section, nature slope from right to left. Everage Horisontal slope degree 25-50%. Hill cover of brushwood

- Road line run following Ma river, in mountain side. Mountain side has slope high, so that the up and down slope ia also high. The everage value is from 1:1 to 1:0.75, some place the up slope real vertical.
- Foundation is unite closely semi-clay shape in layer. In dry reason, foundation and slope of excavation and embankment section is stable, there is no sliding. Howerver, in rain reason, semi-caly foundation reduce stability due to clay absort water and wet bloated reaching to liquid limit of soil. The properties of soil such as, inner friction angle and glue force is reduced. In addition, slopr is not consolidated in right way, so that sliding is common., particular where as water flow passing and slope height over 4m.
- Soil surface is almost covered by thick floristic

composition, but the surface layer is from origin of semi stone and jumble, dust, grid so that when rain the excavation slope easy to be slided creating huge sliding curvle. Some place, the sliding curvle reach 50m.

- Due to the road line follow Ma river, some footing of down slope is under water. Wave push in slope, absorbed water to slide at slope footing and then over slide down slope.
- In addition, due to the limited knowledge of transportation safety boundary, people here excavation slope to open dicht or way to access their house or river to destroy the total grid of slope and creating rain dicht on slope push erosion development.
- In rain reason, when rain in area of high slope, there is large volume water flow from up slope passing road. It's easy sliding of excavation and embankment slope. Thus, needing measurements in road design to minimize this situation exsample: supply crown dicht, side ditch, revetment at footing of slope, retail wall ….

Photo 2.13: Midle of road line. Slope degree 50-90%.

Photo 2.13: High degree slope with none consolidation, geography is claydy and laterite that unstable in rain reason

2.2.3. Exsisiting erosion condition

- Area of road passing, terrain is partition of cross valley, slot and water flow. At the locations surface soil unstable with water and surface slope large, collapsion, destroy due to erosion is unavoid. In rain reason, water flow takes away soil, stone and floristic composition where he pass, creating deep slot and collapsion. Water flow when cross road surface could take foundation away and make transportation interruption.
- For small flow, under ground make cave erosion. The collapsion is slowly time by time, if none checking and treatment on time, it may be collapsion and sliding.
- The road line running along the left side of Ma river is also effected of river water erosion. At Thanh Son villige, Km10 river flow direction change from West – east to North west – South East. In flood time, water river push directly to foot of down slope and the risk of collapsion – sliding this area is high.
- There is no measurement to improve this situation so that the road always in high risk. Therefoere, in design stage, it need to apply appreciate measurements for

Photo 2.14: Slope survey

protection of erosion and recommendation to local people.

- With said above geology and high slope surface, the risk of erosion in this area is large. However, the surface is covered of thick and regular floristic composition of which mainly is bamboo forest and multi layer recycle forest so that protect apart of erosion.

Photo 2:15: Submerged slope footing. Easy effect of erosion and unstable

- High risk of erosion could be happened in starting area from station Km0+474 to Km3+900, where as forest to be over exploit, floristic composition only brushwood. Besides, land in this area use in planting fruit tree, short day insductry tree. The habit burn off land for cultivation of Muong ethnic is exsisting so that the recycle of floristic composition to be limited. It's a main reason that thick floristic composition in starting section, uneffective of protection surface erosion due to rain and open flow.…

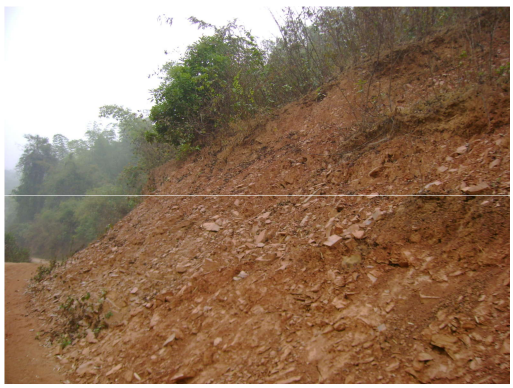


Photo 2.16: 30m Sliding of upper slope at ending section

- Typical erosion is showned on road surface. Example: side ditch to be raised up level, other hand in section of large road longthgitic water flow take side ditch widen and deep, water can't run on right way and over flow road to make unexpected cross ditch and take away soil on road surface to appear varies size of stone with sharp shape difficult for transportation here. Due to farming activitives is simple, local people always make open irriculture chanel cross road surface so that it's wet foundation in case of no rain. Beside, domestic wast water to be dischareged to road so that, the roas passing resident is always in wet situation and operation of vicle, it's partial erosion. Road surface is damange and make difficult for means of transport in active.

Photo 2.17: Road surface to be erosion due to over flow water

- Road management unit takes necessaries technical action and also has coporation with local authorities and local people apply measurements to protection of road erosion other sliding. It's necessary measurement to promote ablity the road benefits and improving people life.

2.3. Situation of traffic environment and traffic safety

Photo 2.18: Erosion slope

Photo2.19: Excavation foundation but no side ditch. Water over flow to make erosion

Photo2.20: Water flow from top mountain crossing road surface, it's a factor to make erosion.

- Due to exsisting infrastructure and the limited of local people awareness, it is no attent and poor in traffic safety and transportation condition. It uncontrol and latent of traffic accident. For environment matter, due to limited of local people awareness the environment isn't carring sensible. Ethnic people (Thai people) exploit forestry at slope along road line, excavation road for the accessment way and irriculture chanel, discharging domestic and breeding wast water to road. It's main reasons destroy road surface and polute environment.
- Thus, concerned authorities such as: employer, contractors in design and contruction stage; management unit need make coporation with local authorities, local people to take reasonable measurements to minimize the environment impacts.

2.3.1. Exsisting traffic situation

1. Road

- The plant locate in Trung Son commune-Quan Hoa district. In this area, there is nation road No. 15A, No. 217, No. 6.
- Nation road No. 15 from the North to Nghe An province, the road connect to nation road No. 6 at Tong Dau-Mai Chau district-Hoa Binh province; nation road No. 217 at Tra village-Quan Hoa district-Thanh Hoa province. Nation road No 15 is constructed as road grade IV; foundation wide=7,5m, surface by asphalt concrete wide= 5,5m.
- Nation road No.6: is the road from Ha Noi to North West passing Hoa Binh and North West provinces. It's being upgraded to meet the requirement of mountain road gade IV.
- As plan, it's could be showed that at the time of contruction Trung Son hydroelectric plant (2005), nation road No.6 to be mountain road gade IV. It could bearing of transportation the huge and supper heavy goods in large volume.

2. Rail way

There is no rail way net work in this area.

3. Water way

Photo 2.21: Serious damange of road surface, making dufficult for traffic. Road services level low.

Photo 2.22: Bendy limited of vision, no protection, damange for vehicle

Photo 2.23: intersection at starting section.

There is dense of river and streams, particular Ma river rising Upper Lao running of Lai Chau, Hoa Binh, Thanh Hoa provinces. The section at Quan Hoa-Thanh Hoa province and Mai Chau district-Hoaf Binh province is mountain region, slope od river bed is high with many supplant so that only small transport could able passing. Thus, transportation of water way here don't expend.

COMMENDATION:

- There is a road that only one way for welfare of people and forestry purpose. The road line follow ma river. The sarting and ending section of exsisting road is the same selected project road line. The middle section of exsisiting road parallel selected project road line but it's at lower position. The road line hasn't got any intersection with other road line. At starting point, there is a intersection to Ban Chieng village. Means of transport here is mainly motorbycle, small truck and the flow is negligible. Commanding on transportation of good and passenger with mechanism mean of transport is not satisfied due to low road quality (using water way mainly.
- Road wide surface range 4m to 5m, some section to be erosion and destroy, the surface is only 3,5m unsafety for mean of transport passing here. There is soiled side ditch at excavation slope, buts they is full nature raised up level to unseen. The road line follow mountain slope so that there are many bendings and limitted line of vision. It's large risk in night time where location as one side is high upper slope, other side is deep lower slope and wetted road surface. There are many long and high horizontal slope (6%-10%), the road surface is always destroyed by erosion of water (in rain) so that it's diffcult for mean of transport passing here normally (human push to pass here).
- Road surface is embankment by mixed of soil and grit. Time by time, under the effect of nature and transportation, it to be serious downgraded. In rain reason, road surface is muddy and sliny to obstacle traffic. In dry reason, there is over dust to limited

Photo 2.24: Water way on Ma river. This mean of transportation is undeverloped. There is small boat operation here due to supplantonriverbed

Photo 2.25: Bamboo connected in mattress to flow water to other area for comsumption

Photo 2.26: Chieng bridge Km11+700

vissionable and making pollution. Over water flow shave surface layer, take away soil and small grit to appearing blade stone that damange tire and obstacle transport, specially two wheel vehicle. Some location, road surface is fully destroyed by heavy truck making deep hole contain water and muddy, vehicle to be stick in mud. In location where as passing stream oe irriculture chanel, there is drainage structure but the road surface is embankment soil can't bearing the erosion effect of water flow so that it's easy to be flow away and transport interruption.

- The road line pass resident of Muong, Thai ethnic people and some Kinh people. They live in small village near by along Ma river and exsisting forestry roads. They work in foresty planting, rice farming, cattle breeding in underdeveloped and simple way. Due to the underdeveloped and simple way of their production action, it effect to road quality and traffic safety. Direction effects to redue road quality and growing risk of accident here are open irriculture chanel passing road surface, cattle free on road, bamboo cross road, material putting on road and discharging domestic wast on road surface. It's public knownedge, that it's not only to take technical measurement but also to take the measurements on campaign and propaganda to upgrade of public knownedge.

2.3.2. Air quality and exhaust condition

- To assess environment quality at time of project study, it's not only collect and processing data but it also take site survey, consisder changable factors by activeties of social – economic.

- Project study area locate in high mountain at West of Thanh Hoa province. Here is resident of ethnic, ecomnomical is argriculture (rice farming and subsidiary scop),

forestry planting. Industry is undevelopement. Thus, air environment is fresh no effect of industry exhaust. In addition, forest is in good quality, and thinly populated, so that the environment is fresh by nature self cleaning.

- To assess air environment quality in project study area, Institute of Environment Scientific Engineering (IESE) surveyed and collected at site sample in March 2008.

Photo 2.27: Air survey point

+ ***Polution source***

Polution source of air environment in project area as following:

- Dust and noxious exhaust from mean of transport operation.
- Dust and noxious air from local people daily domestic activities .

+ ***Survey:***

Air Environment quality evaluation include site sample taking, survey, measure along road line area..

Survey figues of air environment quality as below:

- Meteorological figues (t, φ, v, p, wind direction)
- Mid air dust (SPM)
- Noxious exhaust CO, SO_2 và NO_2

+ ***Survey method***

- Meteorological figues (t, φ, v, p, wind direction) dense of Meteorological figues (t, φ, v, p, wind direction and Noxious exhaust to be measured in day time.
- Sample taking follow Vietnam environment standard (dust following TCVN 5067-1995, SO_2 following TCVN 5971-1995, CO following TCVN 5972-1995, NO_2 following TCVN 6137-1995).

+ ***Equipment for survey and analysis air environment quality:***

Table 2.2: Equipment for survey and analysis air environment (See annex)

+ ***Survey result on air environment quality in project study area.***

Location of survey point: To assess air environment quality in project study area, basis data to set survey points are exsisting topography, main wind direction in dated of survey and surrounding

Table 2.3: Location of survey point (See annex)

Analysis survey results:

Analysis survey results of air environment quality in project study area is showed in following table:

Table 2.4: Analysis survey results of air environment quality (see annex)

Table 2.5: Everage figues on dense of gas and dust (see annex)

Commendation:

- Based on analysis survey results it shown that: In all survey point, everage dense of CO, SO2, NO2 and dust (SPM) is lower than the permitted figues of TCVN 5937-2005.
- Surveying and air environment quality control should be continueing during construction and implementation stage to control the dense of Noxious gas not exceeding permitted to protection living environment and nature environment in project study area.

2.3.3. Noise condition in project study area

To assess noise environment quality in project study area, Institute of Environment Scientific Engineering (IESE) surveyed and collected at site sample in March 2008.

+ *Noise sourcing*

Main source of noise is local domestic activities and effect of traffic on road.

+ *Figues, method and equipment of survey*

- Figues

To evaluation the effect of noise in project study area, the survey figues to be taken following TCVN 5964-1995 :

+ Everage noise equivalent : $L_A$eq (dB_A)
+ Maximun noise level : $L_A$max (dB_A)
+ Unit noise level (percentile noise): L_{A50} (dB_A)

- Survey method

Survey method to be done follow TCVN 5964-1995 và ISO. Equipment is at 1,5m height; 3 time measure per hour and take Everage noise equivalent : LAeq (dB_A)

- Equipments and analysis

Equipments and analysis is listed in table *2.6*

Table 2.6: Equipment and noise level analysis (See annex)

+ *Results of noise survey in project study area*

- Loaction of noise survey point

Based on topography and surround environment, location of noise survey point is sellected as follows:

+ Point N1: Co Me village – Trung Son commune
+ Point N2: Pạo village Trung Sơn commune
+Point N3: Nam Thanh village Thành Sơn commune
+Point N4: Sơn Thành village Thành Sơn commune
+Point N5: Tân Hương village Thành Sơn commune
+ Point N6: Uon village Phú Thanh commune
+ Point N7: Choi village Vạn Mai commune
+ Point N8: Don village Vạn Mai commune
+ Point N9: Nan Dien village Vạn Mai commune
+Point N10: Co Lương crossection Vạn Mai commune

Survey result : The everage of survey figues in project study area is showned in table *2.7 and figues 2.2 (see annex)*

Table 2.7: Noise survey result (see annex)

Figues 2.2. Everage noise equivalent **level in project study area (see annex)**

- Commentation and evaluation:

Basis of evaluation: Following standard TCVN 5949-1998 *(table 2.8).*

Table 2.8. Vietnam standard TCVN 5949-1998

Commendation:

Based on survey result, analysis and comparation Vietnam standard on Everage noise equivalent level at survey points it's showed that there is 3 points exceeding permission level from 1,005 to 1,09 time, đat point N8, N4, N3, other points is below permission level.

2.3.4. Exsisting situation of vibration in project study area

To assess exsisitng situation of vibration in project study area, Institute of Environment Scientific Engineering (IESE) surveyed and collected at site sample in March 2008.

Principle to select vibration vurvey point as bellows:

- Form of land using such as: resident, commercial, argriculture, forestry and sensitive areas
- The area where as intersection of road line and exsisting road.
- Safety area for setting vibration survey equipment.

Location of survey points is below:

- Point V1: Co Me village Trung Sơn commune
- Point V2: Pạo village Trung Sơn commune
- Point V3: Nam Thành village Thành Sơn commune
- Point V4: Sơn Thành village Thành Sơn commune
- Point V5: Tân Hương village Thành Sơn commune
- Point V6: Uôn village Phú Thanh commune
- Point V7: Chói village Vạn Mai commune
- Point V8 : Dồn village Vạn Mai commune
- Point V9 : Nan Điền village Vạn Mai commune

- Point V10 : Co Lương crossection Vạn Mai commune

Survey results and calculation is showed in table 2.9: Result of vibration survey (see annex)

2.3.5. Exsisting situation of safety level and accident in project study area

Photo 2.28: Accident due to road quality

- As said above commentation, exsisiting road does not meet the requirements of traffic and being serious downgraded. The flow of traffic isn't large so that there aren't hit again between vehicle to take accident. However, due to obstacle topography, there is hiding the risk of accident. Accidents here are almost self accident with the main reason is poor road quality, limited vission at small angle bendy, near abyss, no sign board, that is trap for all drivers. There was happened accidents due to driver unseeable road line or spritting out of bending at small angle bendy. Uneven road surface and muddy make difficult for traffic, particular when wet and sliny condition, motorbycle easy to be fallen and stick in muddy
- Besides the risk from road quality and nature, the knownedge of local people on traffic safety is low. Almost of them don't know road traffic law, not using safety helmet when dive motorbycle. Due to limited of knownedge on safety traffic corridor, they excavation road slope for making their access lane to house or river that create sudden conflict points.

Photo 2.29: Muddy road surface

- The habit of product and farming is also a risk of accident. For example, the way of exploiting bamboo, First they cut brushwood to create ditch from hilltop to river bank passing road surface, then thrown bamboo from hilltop passing road. It may be happened damage vehicle and hurt people on road. Cattle is free on road, obstable traffic, in actual, cattle hit passer has happened.
- Thus, when the new construction road put in using, road management unit should apply warning methods, campaign for local people on traffic

safety. When their knownedge upgrade and care about safety, it bring play the effect of technical method to minimize accident..

2.3.6. Situation of safety signboard road guide and protection in project study area

Photo 2.30: Free catle on road

There is no traffic safety signboard, road guide, or traffic signal, responsible force for traffic safety and rescue. There is also no guide pole, km number pole and barie. In section near by abyss to do barie by bamboo, but it's in level of warning. Due to no reponsible unit for maintain, the repairing work for road damange such as clearance, protection of road safety boundary is done by local people based on their self aware.

Indesign, the situation is solved by supplying system of sign boards, bench marks, protection rail … for traffic safety purpose.

2.3.7. Exsisting water environment quality in project study area

Photo 231: Take water sample in Ma river

Analysis and sample taking point is at specific location along road line in project study area.

- Situation of water environment quality

+ Content of survey:

- Sellection location of sample taking, analysis water quality follow basis figues of wast water anf source water.

- Evaluation water environment quality on the basis of collection data and analysis.

+ Water quality analysis method:

Beside the quick test result at site by handle equipment, the physiochemical figues is tested in laboratory and following prevailing Vietnam standards and ISO.

+ Survey and analysis equipment for evaluation water environment quality

Table 2.10: Survey and analysis equipment (see annex)

a. Underground water quality in project study area

+ Loaction of taking underground water sample

GW1: Well of local household in Co Me village - Trung Sơn commune

GW2: Well of local household in Nam Thành village -Thành Sơn commune

GW3*:* Water source of miss Nguyễn Thị Hoàn - Co Lương village- Vạn Mai commune

+ Water quality analysis result in project study area:

Table 2.11: Underground water quality (see annex)

+ Underground water quality:

Analysis result on water environment quality in project study area is showned in table 2.11 and figues 2.3.

Based on the result, it's showed that:

- All the figues of underground water in shadow source in permission.

Figues 2.3: Chart of underground water quality in project study area (see annex)

Photo 2.32:Take water sample at resident

b. Open surface water quality in project study area

+ Loaction of survey point:

W1- Mã river at Pạo village - Trung Sơn commune

W2 - Pu stream at Thanh Sơn commune

W3- Water Tank of Mr. Nguyen Van Hoe Trung Son commune (sourcing from Pao stream).

W4- Xia stream at Co Lương bridge

Analysis result is showed in table 2.12 and figue 2.4.

Table 2.12: Open surface water quality in project study area (see annex)

Figue 2.4: Chart of Open surface water quality in project study area (see annex)

Commendation:

Based on analysis results, it could see that all the

figues of water quality in project study area is in the permission of TCVN 5945-1995. Open surface water sourcing from river and streams along road line study area is unpolluted.

Photo 2.33: Waste water discharge in hloe at road.

General Assessment on nature resources and soil environment

- Soil, water and forest is the most important factors of environment. Based on the quality of the factors it's also showing the quality of environment. Their relationship is as: No forest, soil retroygrade quickly. Poor and exshausted soil is difficult to restore and recreate botanical; Retroygraded soil, water is polluted, productivity down, large investment for intensive cultivation and unstable of argriculture.

- Fertile of soil in project study area is quite middle level, but it dispose in obstacle topography, high and slope. Due to the features, forestry is mixed bussness and protection forest; argriculture is dispersion that concentration on local special food (Nuong rice, Meo cabbage), having high value and suitable with nature environment.

Photo 2.34: Domestic garbish putting on road making environment pollution

Soil erosion

- Effect of erosion is redueing the thick of soil layer, the rich and content fertile; retroygrade productivity of soil. It's also take sliding river bank, slope and dam bank; retroygrade the flow of river, stream, chanel and shorten using time of reservoir, pollution water, destroy water ecosystem…

- Erosion take away small stone, gravel, grit, sand, muddy, odd of fertilizer (both chemical and organic), vegetation cure (insecticide, weedkiller, rat poison), death body of vegetation, animal and nutriment dissolved. They are washed by water flow to lower area. It's the most important thing for environment pollution.

- Main factors of soil erosion in project study area as below:

+ *Type of Soil*: Type of soil in project study area is mainly grit clay in quite good structure that limit the effect of soil erosion due to over flow surface water and wind.

+ *Degree of slope*: Topography of road line area is large degree of slope and partition creating over flow surface water that causing erosion, sliding.

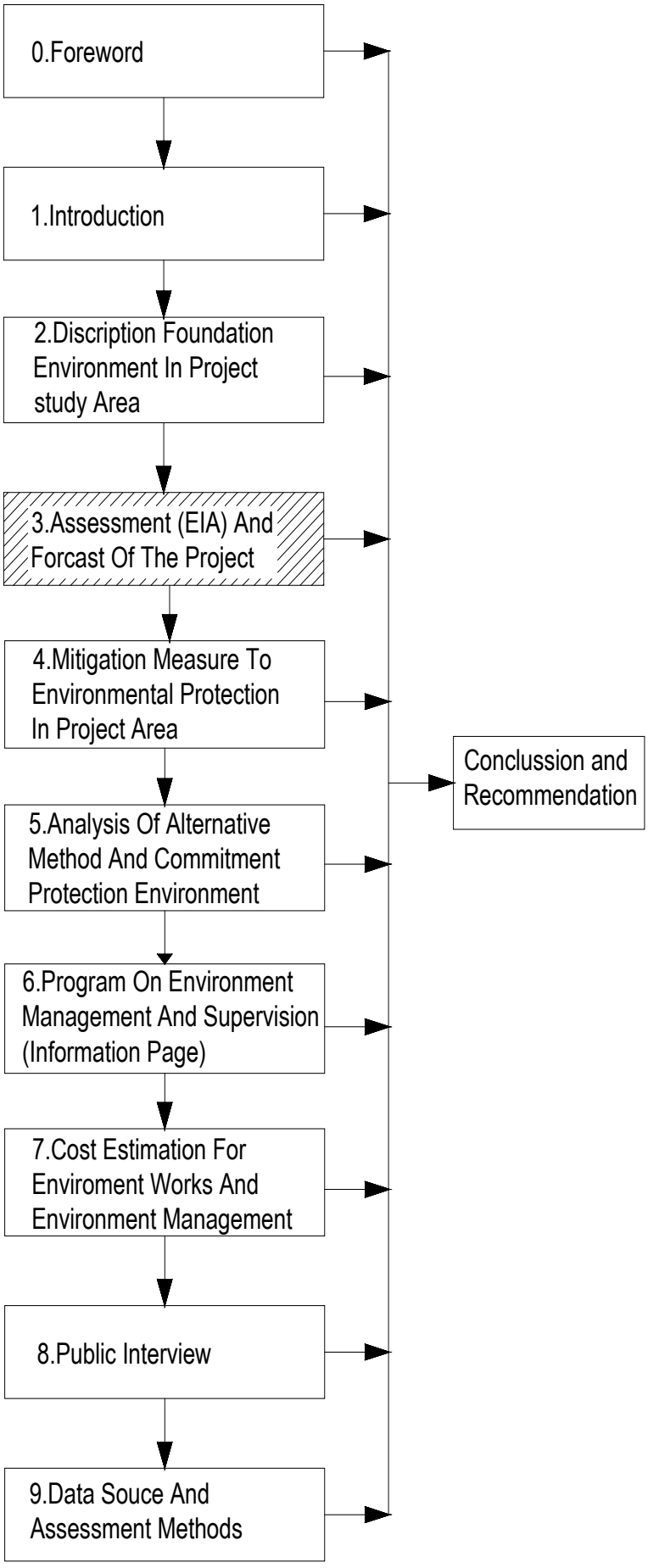
+ *Rain reason*: Rain reason start in May and end September (up stream) or October (down stream). Water volume in rain reason reach 70 - 90% of year, three months having hugest water volume is from June to August or July to September, that's easy happen flood, erosion, sliding particular in project study area with hi gh slopr degree.

+ *Scale of soil covert:* Type of soil covering having effect to protection of soil erosion. As survey result, it' shown that soil cover level in project study area in high quality, lower area arounding road line is plant forest. Other area is nature conservation so that the land using level is low. Forest vegetation include nature recycle forest, bamboo forest (plant); Planting area is small so that action for protection retroygrade, erosion is high.

2.3.8. Situation of solid waste management.

Solid waste is devided in three types follow the resource: Sourcing from dosmestic, from heath caring and industry. There is no remarkable industry action, so that risk of pollution from industry waste is zero. In project study area there is only one bamboo processing workshop, waste from processing is sood and bamboo trifling that using firring purposes. Heath care agent is simple and poor equipment, no doctor. Work as medicosocial, simple treatmen, first aids, protection campaign for epidemic disease. Thus, there isn't heath care waste that no risk for environment. Solid waste is from domestic and breeding. There no particular incharge unit for collection, monitor and management the waste. Due to the habit of domestic living and productivity, local people don't collect and directly discharge into surrounding environment it risk for their living environment, effect to heath. Waste water, none break up waste are easy dissolved in open surface water and bring parasite, disease bacterium, harm fact or into source of local people water using source. In addition, none collection of rubbish so that in hot and wet weather there is stink smell and bring up insect such as mosquito, housefly. The knowledge of local people on environment protection of risk solid waste, habit of daily living, productivity (breeding cage under house; living water from stream, no natrine), long resident area, is difficult for environment quality control.

Chapter 3


0.Foreword
1.Introduction
2.Discription Foundation Environment In Project study Area
3.Assessment (EIA) And Forcast Of The Project
4.Mitigation Measure To Environmental Protection In Project Area
5.Analysis Of Alternative Method And Commitment Protection Environment
6.Program On Environment Management And Supervision (Information Page)
7.Cost Estimation For Enviroment Works And Environment Management
8.Public Interview
9.Data Souce And Assessment Methods
Conclussion and Recommendation

Content

CHAPTER 3: ASSESSMENT (EIA) AND FORCAST OF THE PROJECT

3.1. Major environmental impacts of Project's activities

Project's activities greatly affect to not only nature but also environment and society, beside advantages, project's activities enclose risks that we must assess to take appropriately and effectively preventive measures.

Project's activities will affect to environment in following aspects:

- Instability of nature.
- Erosion of surface soil.
- Ecological balance of on-land animals and vegetation.
- Air environment.
- Water surface environment.
- Sound environment of surrounding.
- Solid waste.
- Impact to human's social environment including:
- Disordering residence of people.
- Demand on changing economic and central structure.
- Traffic.
- Public health.

3.2. Positive effects and expected benefits

Expansion, finalization of road route and construction of works (namely bridge, sewer…) bring a host of positive effects to environment, especially social environment. These effects are expected when project is executed.

3.2.1. Land use and development plan

All planning of land use the scale of road route to be basis of development. Road extension and finalization is to serve for not only construction and operation of Trung Son hydropower plant but also being basic technical infrastructure for goals of socio-economic development as well as motivation for fast development.

3.2.2. Traffic

Road route is to serve Trung Son hydropower plant and ensure smooth traffic in area. Effective transportation and business will create favourable conditions for the development of cultural exchange and economic activities.

3.2.3. Reducing partition impact and ensuring traffic safety.

Designed road route proposes measures to ensure traffic safety in area including overcoming method for locations out of sign, installation of drainage sewer and ditch, retaining wall….in area of water catching joint. Such measures deal with many problems of old route.

Designed route includes warning boards of dangerous areas so that traffic participants can settle and avoid unexpected accidents.

Works such as sewer, bridge and especially crossing point to Highway 15A completely reduce traffic flow crossing road surprisingly and traffic accidents along route.

3.3. Objectives of environment protection

Objectives toward environment protection are to avoid unexpected impacts in project area and go in line with general environmental planning of whole area.

For natural environment, it is necessary to minimize influence to natural balance, detailed factors are follows:

- Stabilize nature ground base, prevent depression, collapse and erosion.
- Protect natural environment, constrain destroying vegetation cover affecting to wild animals.
- Ensure and improve environment of air, water source, sound and solid environment
- Collect, manage and process thoroughly waste arising from the project, especially treat toxic waste, avoid spreading to environment.
- For social environment, besides benefits of the project, public health, relation between project manpower and local people should be paid attention.

3.4. Water and Air Environmental Impact Assessment

3.4.1. Impact on air environment

a. During construction period of the project

- Activities, which relate to project execution such as levelling after land clearance, road excavation and backfill, soft soil treatment, disposal soil transportation, road surface treatment, slope excavation and backfill, channel improvement, excavation and backfill for bridge and sewer works, will cause a large amount of dust into air. Around 1.3 million m3 soil, sand excavated and backfilled during implementing aforesaid works will spread 3.2 tonnes of dust into air. Dust and sand with diameter of d>50 μm will fall back to ground within area of dozens or hundreds of meter far from their source. While dust and sand with diameter of d<50 μm will hang in air and scatter a few km, based on wind velocity.

- Means of road made material transport also contribute a large amount of hanging dust and toxic (SO2, NOx, CO, HC) to air. Volume of main material for the project and road route for transportation are shown in following table:

Table 3.1: Average volume of main material for the project and road route for transportation (Appendix)

- Assessing waste volume of means of transport use parameter of WHO for 3.5 to 16 tonne truck using DO oil. In this assessment, some assumptions are considered: soil, stone from Thanh Tam mine, sand from Thanh Mai, Ma river, cement, steel and iron from Mai Chau – Hoa Binh, density of soil is 1,4 ton/m3, density of stone is 2,2 tấn/m3 , average load of truck is 12 tonnes, sulphur content in DO oil is 1%. From these assumptions, total road route for transportation on 1 truck is 12.325 km.

Waste volume spreading into air during transport is calculated in Table 3.2:

Table 3.2: Total polluted volume spreading into air during transport serving for project (Appendix)

- It is understood that a great volume of hanging dust and toxic air are let out into air inside and around road route area. This impact occurs during construction period of road route. Spreading scope of pollution depends on climate condition of project area namely temperature, wind velocity, rain days, and rain frequency.

b. During using period of the project

- Affecting to surroundings, soil and stone dust when transport for levelling and backfill works, exhaust fume from means of transport.

- During the period of using road for transporting material, equipment, machines to Trung Son hydropower plant, it is estimated that weight of equipment and material to the Plant is about 200.000 thousands tonne (according to data of Trung Son hydropower project), such equipment and material are transported by 30 ton trucks, around 6.666 times.

- Based on calculation load in Table 3.0 and formula of Sutton on calculating concentration of polluted substance

$$C = \frac{0.8E\left\{\exp\left[\frac{-(z+h)^2}{2\delta_Z{}^2}\right] + \exp\left[\frac{-(z-h)^2}{2\delta_Z{}^2}\right]\right\}}{\delta_Z u}$$

Of which:

C: concentration of polluted substance in air (mg/m3)

E: Load of polluted substance from waste source (mg/m/s)

Z: elevation of calculation point (m)

h: elevation of road surface in comparison with ground (m)

u: Average wind velocity in area (m/s)

δ_Z : pollution diffusion coefficient in Z direction (m).

pollution diffusion coefficient δ_Z in Z direction with stability in B area is defined by formula:

$$\delta_Z = 0.53x^{0.73}$$

Of which, x is distance under wind direction in calculation point to waste source (m).

Table 3.3: Model calculation data

Calculation result shows:

- Average concentration of dust on road surface causing by means of transport in construction area with the distance of 20m far from centre of road is 0,184 mg/m3, and 0,191 mg/m3 in summer and winter respectively, lower than allowed limitation of TCVN 5937 - 2005.

- Average concentration of SO2 at calculation point with the distance of 20m the centre of road is 0,017 mg/m3, lower than allowed limitation of TCVN 5937 - 2005.

Thus, traffic activities in this period do not affect to residential area within project area since the nearest residential area is 100m far from the route.

3.4.2. Impacts on water environment

a. Surface water

- Muddy degree is the most affecting factor to surface water around road route. A large volume of soil and sand from dredging and excavating works is backfilled on the alignment of road route of bridge and sewer construction, this will remarkably increase alluvial quantity in surface water, especially in raining season. Dredging work for bridge foundation will also contribute more alluvium in Ma River system. In addition, levelling, excavation and backfill works will destroy natural vegetation cover of area along road route, and appear clearly easy erosive soil layer. It is seen as one of reason to increase the density of suspended substance in water in raining season.

- Channel improvement work in some sections for road expansion toward river bank will pollute downstream. As a result, construction organization will mobilize manpower to catch up schedule to decrease at lowest level influences of construction process to environment.

- Concentration of numerous manpower will produce remarkable volume of domestic waste.

Domestic waste water of workers contains organic substance, suspended substance, dregs, and micro-organism.

Volume of polluted substance produced by each person to environment (without treatment) is shown in Table 3.4

Table 3.4: Polluted substance in domestic waste water (Appendix)

There are about 60 workers at site (mainly for mechanical construction). Volume of polluted substance in domestic waste water in the period of route construction is described in Table 3.5

Table 3.5: Volume of polluted substance in domestic wastewater

Based on volume of polluted substance and wastewater output, concentration of polluted substance in domestic waste water can be calculated. The calculation result is shown in Table 3.6

Table 3.6: Concentration of polluted substance in domestic waste water on construction period (Appendix)

- From the above result, domestic waste water after treated by septic tank will be discharged to general drainage system of project area with BOD5 exceeding 2.2-2.6 times of standard, TTS exceeding 2.2-4.6 times.

- Oil pollution causes by means of material transport, machines and equipment. Oil and gas will penetrate into ground and rainfall will sweep away them to water source. They are toxic waste, so construction unit must take good treatments to avoid impact on environment.

- The next pollution factor is concrete additive arising from concrete pour work and construction of cast-in-place bored pile. These organic substances are toxic, difficult to disintegrate and long-live in water source. Sources, types of pollution and evaluation level are described in Table 3.4.

- Polluted factors in construction period of road route are partial, temporary. Since water has highly cleaning capacity, about 6 – 12 months after construction completion, water can return initial balance status.

Table 3.7: Matrix for evaluating pollution source (Appendix)

b. Underground water

Main factors impact underground water quality in construction process as follows:

- Surface water is main water supply source for underground one, thus pollution of surface water will lead to that of underground water.

- Because underground water in project area is located near ground, during bridge construction (pile driving, drilling, excavating for bridge foundation and pole) surface water is able to connect and pollute underground water layer.

- For superficial underground water, excavation, backfill, levelling may expose ground water artery. Polluted surface water and rainfall will infiltrate and pollute underground water.

3.5. Impact assessment during construction process

3.5.1. Impact of slope Instability during construction process

- During road construction time, activities of excavation, foundation construction will break natural balance and stability of slope, especially the location of high slope, large pitch, geotechnical exchanging area and water catching joint.
- Vibration created by machine's operation will develop cracks, break stability of poor connection location, for example, flour clay, soil layer, areas without compacted as requested. Thus, during construction time, organization unit must take safe measures for people and equipment, reinforce quickly unstable areas as design or use temporary reinforcement.
- Detonation work will cause big noise and strongly shake to surroundings, affect to human and animals. Noise is unavoidable influence during detonation work. However, construction location is located far from residential area, so it is to affect to a few people living and working around. Detonation time is expected to carry out in certain hours of day, avoid lunch time and inform in advance. Vibration of detonation work can create cracks for existing works, erosion or Instability of weak slope in near areas. To avoid these damages, proposed detonation stage is carried out with increasing explosive amount and each time vibration will be measured in suffered works to choose safe detonation distance.
- Following sample is basic construction method for slope to minimize impact of slope Instability in construction:

+ Construction unit use excavator (1.25 m3) and bulldozer (110V) and truck 12ton to transport soil to disposal.

+ In high excavated slope, access road is constructed so that excavators can reach their working location. Excavation is divided into step with 6m long for each, from top to bottom. Excavator and bulldozer will pile up excavated soil into heap and upload to truck. Each excavated soil section, after removing unsuitable component, will be re-used for backfill of road bed.

+ In case of excavating thin talus layer with <3m wide, machine can not be used because height of excavation section is higher than the overhanging length of excavator, manual excavation will be carried up to talus foot where machine can operate.

+ In construction process, some cases such as erosion of negative or positive talus slope will cause rock and soil slide from positive talus layer, threatening to worker's life and neighbour works.

+ In case excavated road is stone class 4, one section is excavated by backhoe with high capacity (1.6 m3) and bulldozer, the other part is carried out by denotation and manual work. Fence and signboard for exploitation boundary are installed.

+ If excavation volume of base is small and excavation depth is less than 1.2m, workers will bore holes on stone by using hand-drill and air compressor. After detonation, bulldozer and grader will make road and horizontally bulldoze toward negative talus for horizontal transport. Excavator and truck will transport stone to disposal for vertical transport.

+ If excavation volume of base is large and excavation depth is more than 1.2m, workers will use hand-drill to create plan for operation of drilling machine. After that, excavator and truck will transport stone to disposal site.

+ Workers use hand-drill to fix talus slope, road form and straight ditch.

3.5.2. Impact of erosion in project construction period

- Erosion in construction period and its consequence threat not only stability and quality of work but also human and economic activities in the area of project, even stability of Ma river's left bank.
- Erosion in construction can be stopped when construction finishes, but erosion along backfilled slope and Ma river's left bank will continue for many years, this results imbalance of nature.

Photo 3.1(Vạn Mai 07/2006). After heavy rain, volunteer young clear sliding muddy from slope on road surface in area of Van Mai people committee office

1. *Impact on residential and community.*

Erosion in hill, mountain, and positive talus will bring sludge, soil, rock to deposit in lower areas where people live along road route.

2. *Impact on agriculture.*

There are many cultivated areas along route, which is main income of farmers. If erosion from talus slope happens, it will overwhelm adjacent field, causing great damage to farmers both agricultural product and cost for field improvement.

3. *Impact on forestry.*

Design route passes mountain area, the left side of route is Ma River, and the other is mountain. In such area, forestry is main branch of residentials (bamboo, neohouzeaua…). Erosion from negative and positive talus,

Photo 3.2(Thanh Sơn 07/2006). Before flood there was farm land. During construction stage, if contractor do not apply flood protection methods the risk should be largeer.

Photo 3.3(Vạn Mai-07/2006). Irrigation channel, garden, road became muddy pond. It effects for long time and need huge cost for repairing.

Photo 3.4(Quan Hóa 08/2006). A excavator is buried in muddy when regroup in lower location. It's expensive experience.

especially in raining and flood season will cause remarkable damage to forestry area. It affects not only trees but also surface soil, grass cover, cover area and recovery of forestry.

4. *Impact on irrigation.*

Irrigation channels crossing route which are mostly constructed by people have small scale and suffer impact of erosion, deposit. During construction time, flow of sludge, soil inundates and deposits to irrigation channels. Moreover, because of demand on plan or design, some parts of irrigation channel must be filled up or temporarily demolished, causing interruption. This factor affects much to cultivation system of farmers, especially wet rice growth.

5. *Impact on cultural infrastructure.*

Most of offices, schools, clinics, cultural house, settlements are located on positive talus side of road route. These works is directly affected by erosion of construction period and from talus top. This impact can be minimized if contractors do not destroy base of adjacent areas, ensure good drainage for talus and limit vibration of machines.

6. *Impact causing unsafety (accidents).*

In construction time, that foundation and works have not achieved designed stability can lead to partial erosion, causing traffic interruption, obstructing material transportation. Thus, construction teams have to overcome breakdowns actively and promptly, keep smooth transport.

7. *Impact on construction activities.*

When raining, erosion will damage unreinforced slope and uncompleted drainage works, loss labour safety, sweep away materials, machines. In addition, erosion can also occur in unforecasted places, therefore construction units should be monitor and prevent timely in order to avoid serious consequences.

COMMENT :

The project's road pass through many place

Photo 3.5 (Tòng Đậu 08/2007). Flood take away embankment part and aproach road of culvert when it is under construction.

with large geotechnical pitch and cut many streams. Thus, erosion is easy to occur in such sections. It is especially dangerous in raining season when water will weaken connectivity and pressure-resistance of soil base, construction units must pay much attention to ensure fast drainage of ditch serving for construction. Construction should not be executed on soft soil and when construction, angle of declination should be created for easier drainage. Contractor should avoid to pipe up material, use backfill soil with high ability of waterproof, and gather materials and machine at safe place.

3.5.3. Impact of erosion, deposit in construction time

Photo 3.6 (Tòng Đậu-08/2007). Sweep flood take retaining wall when it is under construction.

During construction, it is unavoidable erosion in excavating area. It includes following impacts:

- While excavating base, removal cover layer will cause partial erosion as rain or flood comes.

- When raining, unreinforced road base will be erosed, especially parts under construction, erosion can sweep away grain composition, affecting to connectivity and pressure-resistance of soil base.

- Material gathering area without cover is risky to be erosed, discrete materials are partially lost and changed ratio of aggregate.

- When executing, amount of sludge which has not been removed will be swept away and then deposit in drainage ditch and lower places.

Photo 3.7 . Soil and stone to be taken away in to river that obstruct flow

COMMENT:

During construction, ensuring construction plan, expanding secure corridor, exploiting material will loss botanical layer protecting ground surface, create condition to develop erosion. Thus, construction units should endure good surface water drainage by some methods, for example: creating suitable slope for construction layout, reinforcing and reinstating plan of just constructed parts, using material with ability of protecting surface layer.

- Drainage ditches operate effectively,

discharge water to places where minimize impact of sludge and them pour to river.

- It is noted that material gather place can avoid influence of erosion and deposit.

3.6. Forecasting impact of environment in operation period

3.6.1. Impact of Instability of slope in using time

- Impact of Instability of slope is complicated even in construction and operation time, it is impossible to list all impacts.

- As analyzing above, most of natural slope of both sides has large (average >50%). Slopes are located on mixed clay base and as we know instability of old route can be happened in new route, so stability of slope is paid special attention.

- In operation time of road, slopes suffer impact of changes of structure (excavation, backfill), hydrology, and surface cover. These changes will stabilize slopes if structure and protection method are suitable. But in case slope is straight or drainage is not good, slope will be unstable, causing erosion of natural slope.

- Beside impact of natural changes, structure of slopes suffer load of other works, this can cause depression, moreover load and vibration of vehicle can produce cracks, unstable connectivity of slope.

- As a result, in the process of design, construction and operation, measures of monitoring and warning should be taken to deal with instability. Impact of scour in using time

Photo 3.8 . Crack on slope that is under sliding proccessing at station km20+500

3.6.2. Effects of erosion during operation satge

- As analyzing the impacts of erosion above (see 2.2.3), new route may face to same impacts of old one. New route crossed by drainage works will reduce risk of erosion, however, road has changed hydraulic mechanism of streams compared to investigation period, new matters can be arisen. In the location of overfly bridge cross big streams, erosion and deposit must be carefully monitored to take appropriate measures if any.

- When road comes into effect, new road is based on topography of old one, therefore, erosion points of old route also happen in new one.

- From geotechnical characteristics as analyzed above, road base is mixed clay. Physical-mechanical characteristic of clay is that when it rains, clay is flabby at average longitudinal rib of >30%, so erosion is easy to occur. In dry season, soil base is more stable, however, dry soil produces dust, affecting to traffic and polluting air environment in area.

- Along investigation route apprears erosion (seeing detail in information tree)

- Above impacts are potential to cause accidents as well as large influence to area environment, residentials. Thus, during process of design and construction and operation, concrete measures to prevent these impacts should be taken.

3.6.3. Impact of erosion in using time

- To assess impact of erosion in operation time, we refer the result of erosion (see 2.2.4). However, it is forecasted that in operation time, forestry exploitation activities will fast develop and method of cultivation of agriculture and forestry will be changed (growing high-economic effect tree variety for example industrial trees). This will reduce green space preventing erosion. Therefore, erosion of road in particular and area in general will happen strongerly than usual. It is necessary to coordinate with local authority to protect forest in secure corridor and map out general planning for development of nature's solid shield.

- Disadvantage conditions of nature include rain, sun, or temperature change. Too much rain will store water in 2 sides of road base, make wet water and additionally, erosion of rainfall will reduce anti-slipping ability of road base.

- Thus, in process of design, construction and especially operation, construction units, employer and road management agency should take appropriate measure to minimize such impacts. Coordination with forest management agency is needed to protect protective forest against erosion when get bad weather. It is the best and most effective measure.

3.7. Evaluating impact of local road in using time

- Road is constructed to serve for not only construction, operation of Trung Son hydropower plant but also development of area's traffic, indirectly enhancing area's economy. However, there are negative impacts, firstly to residentials in area.

- During road operation, customs and manners of residentials greatly affect to satisfactory ability as well as effect that road brings to.

- Contrary to advantages of new road on traffic and safety, there are many disadvantages. Road route is latent to traffic accidents to residentials, especially (Thai) ethnic people who do not get in touch with safe traffic measures. On the other hand, residentials surrounding project area have no deep knowledge about environmental pollution as well as environmental impact on their health, life and activities.

- Regarding to traffic safety, because of habitation of living along road, after road improvement, risk of accidents happens more than usual. These disadvantages can be assessed absolutely.

- For community's health, people's awareness and knowledge is still poor, thus they may not prepare measure to protect them and reduce bad impact of environment on community's health. Surrounding environment, especially water and air affects directly to their life. It is necessary to propagandize and educate people to protect environment, by this way, we can reduce remarkably bad impacts to residential environment. Information on public heath as well as effects to public heath is showned in the report on public heath preparation by Investment and development environment and heath care service stock company.

- Basically, new road will have same influence as old one, but scope and range of influence will be larger. Bad impacts to community's health include dust in air, noise, vibration of vehicles. New road will attract more households to settle thank to convenient transportation, 2 road sides will appear many alleys connecting to road, and together with higher density of transport, traffic accident in hot point will increase more than usual.

3.8. Impact on public traffic (traffic in area)

Existing status of traffic in investigation area

- Land road.

+ The plant is located in Trung Son commune, Quan Hoa district. High ways 15A, 1217 and 6 pass through

+ Highway 15A, starting from North to Nghe An province, this route connects Highway 6 in Tong Dau under Mai Chau district, Hoa Binh province to Highway 1217 in Tra village, Quan Hoa district, Thanh Hoa province, is constructed by IV, B base = 7.5m, Bm = 5.5m, asphalt concrete.

+ Highway 6 is from Hanoi to Tay Bac, connecting provinces in Hanoi and Hoa Binh to those in Tay Bac. This route is being improved to reach standard of mountainous road class IV.

+ According to planning, when Trung Son – Thanh Hoa commences to construct (2005), the route improvement is completed under standard of mountainous road class IV. Thus, it is possible to transport overload and overweight goods.

Photo 3.10. A exsample: Accessment road to Xesan2 hydropower plant (Tây Nguyên) after completion, it is harmonious with natrue and acmicable to environment. It is our desirable when the road completion.
(Source http:www.songda9.com.vn)

- Railway.

Railway network has not been constructed in this area.

- Waterway.

+ In this area, system of rivers and streams is dense, especially Ma river sourcing from Lao upstream passing Lai Chau, Hoa Binh, Thanh Hoa and lastly to East sea. Ma river section crossing Quan Hoa, Thanh Hoa province and Mai Chau, Hoa Binh

province is highland river, river bed are sloping, there are many waterfalls and rapids, so only vehicle under 1 ton weight can run.

+ Because topographic characteristics of rivers are short, sloping, with many waterfalls, traffic of waterway is limited, reducing transportation capability of vehicle.

+ Road route will have good effects to traffic in area. Transportation demand requires road route to meet increasing need of vehicle flow in accordance with the development of area.

+ The project will mobilize a large quantity of trucks, machines to build hydropower damp, together with spontaneous means of transport of local people, a great flow of transport will be created and thus traffic accidents are in high risk. We need a good traffic management system and public services to avoid traffic accidents, and meet project and local transportation demand. It is a desire of the project.

3.9. Landscape and protection

- In areas the route passes, there is no landscape or cultural works being ranked or for tourism. Thus, landscape protection is to combine appropriately and harmoniously among works of the route and surroundings. Besides, environment of creature, water, air…must be protected to minimize damaging to secondary forest during construction time because it sources for valuable genes of forest and is an effective shield of soil base against flood and erosion.

- Now, secondary forest is popular in this area, short-term forestry trees such as bamboo, neohouzeaua…play role of protective forest However, when new road completes, traffic becomes easier, resource exploitation will be more convenient and product price may increase. Thus, because of short term profits, people will exploit rashly, not follow general forestry planning of area, causing uncovered ground, treeless hill. Landscape of area will be lost and bad impact will prolong for long time. Therefore, it is necessary to take strict management actions to prevent this situation.

- The route along Ma river can create good landscape when it comes into effect. If there is appropriate exploitation method and long term scale, it can become tourist and entertainment areas in future. For this reason, in design and construction stage, design and execution unit should take suitable measures to create harmonious landscape for the route.

3.10. Land environment

- Based on mineral component, type and condition of creation, location, geography and climate condition….there are many different types of soft soil such as soft clay, fine grained sand, peat coat, deposits. In reality, the most popularity is water-saturated soft clayed soil. This kind has both special and typical natures as other soils in general. Investigation area can be divided into layer as follows:

+ *Layer 1:* clay mix 15% -:- 60% of crushed stone, grayish brown, grayish yellow, with width of 1-:-3m.

+ *Layer 2:* clay loam, grayish brown, grayish yellow, with 15% -:-30% stone block of semi-hard and hard.

+ *Layer 3:* Gravel, small and large size, grayish brown, grayish green…

- In some short sections, original base stone is open or very shallow.
- In general, soil base of area is quite good, compactness can be equal to 0.92, however, risk of environment damage still remain high because weather, flood, erosion, intensity of base, backfill and excavation soil, and moreover human activities such as forestry, irrigation…..contribute bad impact to nature of soil environment in area.
- As analyzed, form, connectivity and hydrographical mechanism of soil base are changed by human activities such as excavation, backfill…It is easy to see geological changes, erosion, scour in construction area. These changes need to be monitored during construction and operation period in order to take suitable treatment measures
- Moreover, soil environment is affected by large amount of solid waste from site such as sludge from foundation holes, redundant material, and scattered material. Quantity of such waste is difficult to determine exactly because it depends on sequence ò works and site arrangement of each contractor.
- Beside solid waste, environment is also threatened by toxic chemicals such as battery, waste acid/alkali. It is understood that even this type of waste is not too much but it affects to underground and surface water, main source of domestic water.
- Despite less impact on environment, domestic waste includes easy-disintegrative waste (food) and hard- disintegrative waste (nylon, can…) can pollute surface water.
- For all types of waste affecting to environment in particular and in general, we gather them and if possible treat immediately.
- Accordingly, beside measures to diminish impacts on environment, road management agencies, local authorities should coordinate and guide local people to protect soil environment. It is seen as the most basic measure to reduce impacts on environment.

3.11. Impact on lighting

- Because there is no lighting design on route, we do not study and evaluate this matter. However, I suggest that some areas such as people concentration, gliding angle, out of sign, traffic intersection… should be equipped light to ensure traffic safety
- Lights are to ensure visibility not only at night but also in rain or fog. Lighting degree must meet requirements in design and installation work is only carried out with witness of related agencies such as contractor, employer, electric company…lighting degree and fog diffusion will support traffic participants to avoid accidents.
- Besides warning traffic safety, lighting arrangement on route will create the beauty of road, especially at night. As a result, employer should study on this matter. By this way, the new road will bring into full play in serving for traffic, people and Trung Son hydropower plant.

3.12. Factor of risk and accident

- The factor of risk and accident includes accident caused by execution the work, traffic accident, suddenly weather change, geological change and disease of project staff due to unfamiliarity with local geomancy

Photo 3.11. Site camp of Sexan 2 hydro power plant to be good set and management for limitting risk.

- Accident at work can occur anytime due to lack of accuracy when execution makes trees fall, material and stone fall into people or go into slimy and explore area... or execution unit has not performed all the regulations of safety at work such as unequipped labor safety or exploring without plan. In order to maintain safety at work, execution units have to obey all the regulations of safety at work and high vigilance and to disseminate safety information widely to involved people. Notably, denotation work is warned by alarm signals, inform exploring schedule to local citizen and means of transportation, implemented under regulation by skillful worker.
- Traffic accident is always unexpected, in fact it is difficult to avoid all them, and we try our best to warn and to lighten its results. In working process, management has to arrange a reasonable executing day to avoid centering a lot of machines and other vehicles to cause an obstruction. Materials transportation should not scatter materials into road because in little raining, slippery road is very dangerous. Educating the awareness of traffic safety to all people is needed.
- Regard to accident caused by natural calamity, flood is the most dangerous factor to us. Flood usually happens in this area every year especially from June to August. According to information from local people, annual flood water level can be higher than normal level is 3-4 meters, sweeping away all big trees, stone and houses; XIA stream Bridge was swept away by the flood waters in July 2006. To deal with flood, we have to arrange safety campus for worker and carefully consolidate to work in progress. To other calamity such as earthquake and storm of more than 8-grade, it hardly happens in this area so we have not consider them. The accident caused by project to environment such as running water pollution, irrigation and forest fire.

3.13. Effects of land acquisition and resettlement

Detail sssessment of this effect is preparated by other consultant. In this report, it only main point is raised:

1. Conclusion

- Program of resettlement action for access road of Trung Son hydro power plant is belowing:
- Inform to local people and authorities on basis legal of the road construction and getting support them.

- Determination on scope and scale of land reclaim for road construction is 147 ha including: Overlasting reclaim for construction works 46 ha, Temporary reclaim during construction stage 16 ha aand road protection corridor 85 ha.

- Determination on ceiling data of relocation households is 114 in which 74 households is overlasting reclaim and 40 households is temporary reclaim (sourcing from statistics data in May 2008 of consultant on resettlement)

- Effect land area (temporary and overlasting reclaim) is small. In which, effect to agriculture land is about 8% of households. Effect to Forestry land is 7% of households. Resettlement is for effected households

- Determination method of resettlement is mainly self relocation, in wich employer and local authorities sellect land for their resettlement.

2. Recomendation

- After setting resettlement program, it need continue to take following actions:

- Accuration land reclaim boundary based on approved design: Setting land reclaim boundary bench mark into site for statistics on acquisition land and asset in acquisition land .

- Coordination with local authorities local people for collection commendation and public interview to set legal frame on compensation and supporting for resettlement.

- Accuration effected households and detail survey/ statistic on compensation and relocation mater for construction road Co Lương - Co Me.

- Final sellection for relocation site of each household.

- Coordination with people committee of Thanh Hoa and Hoa Binh provinces for setting conpensation unit of aquisistion land and it's asset to estimate total investment cost for compensation, resettlement supporting.

3.14. Social economic activities.

- Access road to Trung Son hydropower plant has encroached land of almost Thai's ethnic people, many households have to resettle. In the work of resettlement compensation, project has to compensate households in the area of land clearance reasonably and tiny to avoid disagreeing, suing and obstructing land clearance work. It is the failure experience of previous project; many of them come into standstill or have to great expense to solve all the results after that.

- To subjects forced removal resettlement, the work of resettlement work has to be planned and rebuilt reasonably, sufficiently convenient, avoid conflict of culture and ethnic group, violation of material culture and immaterial culture. There are concrete samples of unreasonable resettlement projects for highland ethic minorities. In these projects, the resettlement households resettle isolated areas from producing zone and school, narrow-resettle houses with hot-metal roofing, without breeding facilities and trees, the settle-area with more then 30 households had to share 2 wells, running water was quite adequate but irrigation water was not. These reasons caused the projects failure after only 2-month-implementation. The citizens in ethnic minorities used to live in mountainous village near their fields with airy house on stilts; use surface water source with conduit to home. They became nomadic citizens, so they did not believe in

resettlement projects afterwards while the settlement areas costed a lot of money became bare area.

- The reality of social economic condition in the area is still difficult. The citizens mainly earn their living by conducting agriculture and forestry with low technical and working condition. Due to obstruct in transport so that it is difficult for them to have business with another area, causing their life limitation in only area. Almost people in the area are not equipped national electric network, electric source is mainly originated from mini dynamo of their selves, it only supplies minimum needs. All cultural houses, schools, medical stations are primitive and lack of means of supporting (most of medical station do not have doctors). In general, their life has been hard and difficult. Therefore, the route ought to implement quickly and come into use, create precondition to improve their life in this area
- The investor and contractor have to maintain that after the route is completely built and come into use, people life as social-economic condition in this area is not at least lower than before having project.
- When the route comes into use, on the one hand it not only serves Trung Son hydropower plant but also citizen's life in this area, improve social-economic condition. On the other hand, it opens much more opportunities to exchange economic among areas, create condition to trade business in order enhance people' living standard, impulse the development of economy.
- Regard to culture, the route comes into use to create favourable condition for people here approaching with many new cultures. Social life is improved thank to road and electricity.
- The road also contributes to exchange and trade among areas, appear new economic form such as service supply and goods market. This area has not got market yet, goods and redundant agricultural products are sold to dealers without processing with low cost. After having the road, people here can process all products with high quality and sell them at further area with high cost.
- All system of road are drains and drainages that can be used to irrigation and in agriculture or minimum needs is not affected system of running water and irrigation.

Photo 3.17: Location of Co Luong bridge at starting point

3.15. Evaluation of bridge plans on route

- Large size bridges:

+ Co Luong bridge: Pass Xia stream in area of Van Mai commune – Mai Chau district – Hoa Binh province. Design of this bridge is 4 span L= 33m, simple structure. Drainage aperture meet requirement in rain reason. However, this birdge is near Co Luong conjunction (concentrating resident and heavy traffic), so that, during construction stage, contractor need

Photo3.17: Location of Quyen stream bridge at Km4+488.70

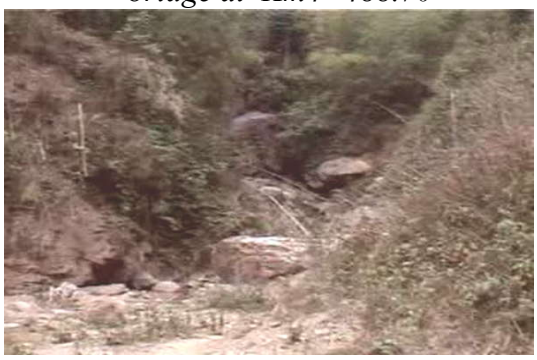


Photo 3.18: Location of Cai stream bridge at Km6+708.74

Photo 3.19: Location of Pu bridge Km9+562.34

Photo 3.20: Location of Po bridge Km17+238.80

apply methods to minimize effect to this area as said in information page.

+ Co Me bridge: Pass Ma river in area of Trung Son commune, Quan Hoa district, Thanh Hoa province. Design of this bridge is 8 span L=33m, simple structure. Drainage aperture meet requirement in rain reason. However, it need pay attention on erosion of abutment. Thus, design sonsultant and construction contractor must apply methods to protection erostion of abutment specially in rain reason. Methods for environment protection, traffic safety is showned in information page.

- Midle size bridge:

+ Following design, there are 5 midle size bridge pass water slot. Seeing detail location in annex part.

+ The bridges is 1 span L=33m. Howerver, embankment of aproach road is high so that risk of erosion is large. Thus, construction contractor need pay attention on consolidation embankment slope at abutment by wet masonry mortar stone for protection destroy of water flow. Besides, upper stream, local people habit of burning forest for farming, so that it's quick and large volume water coming to when rain. It need restore floristic composition at upper and propagandize local people on effect of distroy forest.

3.16. Assessment and conclusion

- In above part, we analyze and assess objectively the positive and negative factors of environment which suffer from and to project. Improving and newly-building bridges, sewers and road route are regarded as one of the impacts of project so that potential influence of project as well as whole route is mentioned comprehensively.

- In principle, besides science analysis on source of impact, changes of environmental components causing to impact on objectives in scope of study and experience from similar

Photo 3.21: Location Pao bridge Km19+679.65

Photo 3.22: Location of Co Me stream bridge

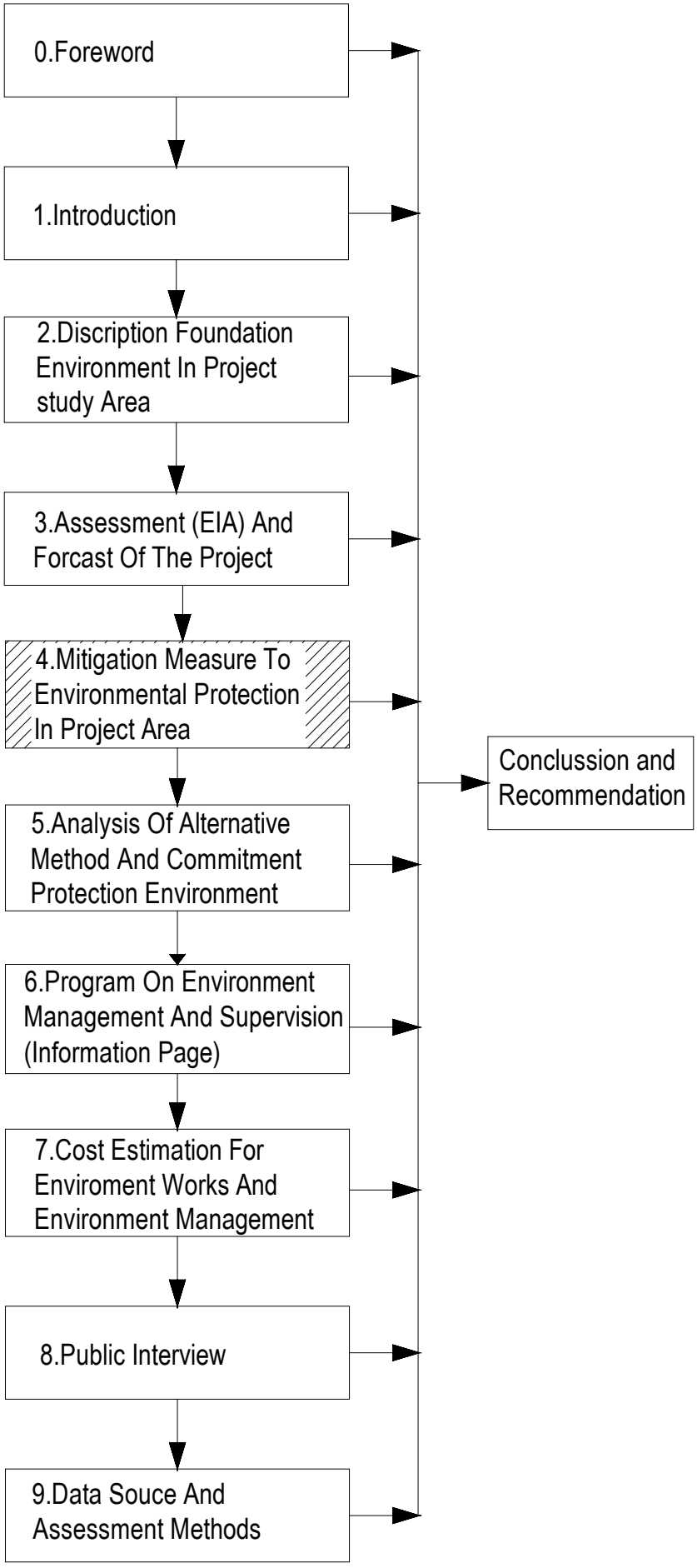
projects as well as situations, impacts on environment is evaluated on the basis of:

+ Inheritance from result of preliminary EIA study of the project.

+ Consideration of advises of scientist, professionals and local people who are familiar with affected area of project and pay attention to environmental protection, natural resource management.

- Based on such impacts, proposed overcome measures should be in accordance with condition of technology, finance. Project owner, employer and related functional agencies must coordinate closely to give out and deal with impact of project on environment to minimize negative influences.

Chapter 4


0.Foreword
1.Introduction
2.Discription Foundation Environment In Project study Area
3.Assessment (EIA) And Forcast Of The Project
4.Mitigation Measure To Environmental Protection In Project Area
5.Analysis Of Alternative Method And Commitment Protection Environment
6.Program On Environment Management And Supervision (Information Page)
7.Cost Estimation For Enviroment Works And Environment Management
8.Public Interview
9.Data Souce And Assessment Methods
Conclussion and Recommendation

Content

CHAPTER 4: MITIGATION MEASURE TO ENVIRONMENTAL PROTECTION IN PROJECT AREA 4-3

CHAPTER 4: MITIGATION MEASURE TO ENVIRONMENTAL PROTECTION IN PROJECT AREA

GENERAL:

Main objective of this program is to provide mitigation measures for negative impacts of project on nature and society which are determined to be mitigated as analysis in Chapter 3. Measures are taken based on sufficient criteria of technology and management in accordance with general planning and saving cost. Objectives suffering impact and activities creating impact will be mitigate as summarised in Table 4.1 Appendix.

BASIC STEPS IN ROAD DESIGN

1. **Plan**
2. **Alignment of road**
3. **Investigation**
4. **Design**
5. **Construction**
6. **Operation**

4.1. Implementation principle

In this part, environment and community factors suffer impact of human, negative impacts of environment on road are mentioned, settled by management and technical methods. Such methods are subject to absolutely solve following matters:

- *On technical side*: achieve maximum effectiveness, comfortable with construction condition, lowest price.

- *On management side*: ensure harmony and suitability to general planning.

WORKS NEED TO BE DONE WHEN IDENTIFYING ROUTE

- Use topographic measuring method to identify route. Designed road route should pass good geo location

- When identifying route, avoid affecting to water quality. Distance from road to river bank must be in line with regulation.

- Route should locate in area of good drainage ability.

- Designed route should harmonize natural topography.

Mitigation measures is also based on scientific analysis on impact source, changing trend of environmental components causing to impact on objectives in scope of study and experience from similar project:

- Inheritance from result of preminary EIA study of the project.

- Consideration of advises of scientist, professionals and local people who are familiar with affected area of project and pay attention to environmental protection, natural resource management.

- Friendship with environment of each measure.

4.2. Diminishing impacts during the process of land clearance and resettlement.

In planning directly relating to project area, there is orientation of planning space along the road alignment. These planning take scope of road route

WORKS NEED TO BE AVOID WHEN IDENTIFYING ROUTE

- Constructing route through unstable topography, rocky mountain, high slope.

- Crossing wet area, bog.

- Crossing area with cross slope >60% because it is difficult to deal with stability.

- Opposite the direction of topography, deep excavation and high embankment.

- Damaging, affecting to ecosystem.

WORKS SHOULD BE DONE DURING CONSTRUCTION

- Follow construction process.

- Set up construction regulation at site.

- Ensure sanitation, obey environment protection including scattering material, waste…

- Avoid damaging to vegetation cover in 2 sides of road, polluting to water source.

- Wash truck inside house to avoid polluting to water source.

- Make sure minimum width for construction.

- Create drainage direction when construction.

- Reinstate after construction, clean construction site…

to be basis for development. The road route is improved, expanded and finalized to not only serve for Trung Son hydropower plant but also be basic technical infrastructure for socio-economic development in area. We must pay attention so that land clearance as well as resettlement planning is satisfactory and suitable with development planning and orientation of the area. Detail statistic data and minimizing methods is prepared by resettlement consultant.

4.2.1. Permanent land encroachment

- It is impossible to deal with impact on environment due to land encroachment, involuntary removal and resettlement. The best measure to lighten negative impacts is compensation according to Resettlement Action Plan (RAP) under current law and local real condition.

- RAP is to ensure that all affected people is compensated appropriately for land clearance or property damage and supply services for removal and economic reconstruction for citizens in project scope (intersection with Highway 15, crossing residential area)

- However, the highest mission of RAP still unchanges. It means that no affected person becomes poorer due to project; compensation level and compensation right of affected people are determined based on policies on land encroachment, removal, and resettlement, especially attending to legal frame, compensation policy, compensation right, institution, community participation and reference, claim, denouncement, supervision and evaluation.

a. Legal frame.

General frame on compensation policy and support for land encroachment, removal and resettlement are shown on:

- Constitution 1992.
- Land law 1993 No. 24-L/CTN approved by the ninth National Assembly in 3rd section of 14/7/1993.
- Land law No. 13/1993/QH 11 approved by the eleventh National Assembly in 4th section of 26/11/1993.
- Ordinance of transportation facility protection dated 02/12/1994 and Decree No. 172/1999/NĐ-CP dated December 7, 1999 of the Government ruling in detail the implementation of the ordinance.
- Circular No. 116/2004/TT-BTC guiding the implementation of the Government's Decree No. 197/2004/ND-CP.

Content of above documents is based on basic principle to protect life of involuntary resettlement people being at least equal to that before resettlement.

b. Legitimacy.

- Objectives receiving land and property compensation and support during land reclamation, removal and resettlement are regulated in Article 8 of Decree 197/2004/NĐ-CP and Part II, III of Circular 116/2004/TT-BTC.
- Deadline for determination of legitimacy is the last day of detailed inventory work. Anyone encroaching to boundary after inventory work is not subject to receive compensation and essential allowance. They are requested to remove their work. If necessary, removal will be enforced.

c. Compensation right.

General objective of compensation policy and right is to help affected people to recover living standard, income and productivity as before. Compensation and support is carried out by following principles:

- Compensation payment is based on replacement price.
- Arrangement on exchanging land–to-land is conducted if replacement land is not enough or affected people request to pay in cash.
- Different allowance and supporting methods are provided for many kinds of affected people.
- Seriously affected people will receive food allowance or training courses or income recovery under supervision of Land clearance management board and other related agencies.

d. Mechanism.

- Ministry of Transport is approval agency for Land Clearance Plan.
- Trung Son hydropower PMB is representative agency for Ministry of Transport to manage and monitor Project, including land clearance work.
- Hoa Binh and Thanh Hoa People's Committees take responsibility to establish Steering Board, Provincials Appraisal Council to supervise and speed up compensation work at district and commune level.

- Land clearance steering board is responsible to organize, propagandize land clearance plan on mass media, build up implementation plans and measures of land clearance in districts, communes, collect and settle all complaints.

- Provincial appraisal council of land clearance compensation is responsible to appraise documents of compensation made by land clearance board.

e. Communication participation and reference.

- Affected people are informed and consulted so that they can join actively in plan and deployment.

- Together with site clearance steering board at provincial level, Trung Son hydropower PMB are responsible to prepare a Public Information Campaign and Project Information Manual for affected people.

f. Complaint and accusation.

- The project ensures that affected people have chance to access effective mechanism in dealing with complaint and accusation. Procedure of settling complaint and accusation is explained clearly in Project Information Manual.

- Affected people can submit and be solved complaint and accusation at any time, first level is from Commune People's Committee. If affected people do not satisfy with decision of Commune People's Committee, they can submit to District People's Committee, Provincial People's Committee and lastly People Court at all levels.

g. Supervision and assessment.

- The project includes internal supervision and assessment. Trung Son hydropower PMB takes key responsibility for internal supervision and assessment, close coordination with provincial and commune compensation council and preparation monthly implementation report.

- Internal supervision and assessment is regularly carried out during the process of resettlement plan.

4.2.2. Temporary land encroachment.

- Scope of land exploitation in hills is quite large. Contractors are requested to follow procedure of asking permission for exploitation and prepare plan for environmental protection. When exploiting, contractors have to submit to project owner license of land exploitation. This is recorded in Contract.

- Contractor is encouraged to hire land under management of Commune People's Committee for installing mixture station or house for workers….In case, contractors hire private land, it is necessary to have agreement of owner.

- In every case, temporary land use will be reinstated as origin under commitment and clean before handing over to owner. These requirements will be included in Contract.

4.2.3. Evaluation on effects of mitigation measures and residual impacts.

- Experience shows that land encroachment and resettlement usually create long term social impact. Impact level depends on effectiveness of resettlement plans.

- Residual impacts will be in acceptable level if supervision work for resettlement plans is well done.

4.3. Mitigation Measures in Construction Period

4.3.1. Minimizing impacts on soil (erosion, scour and sediment accumulation)

As analyzed in Chapter 2, scour and erosion are popular on the route. Therefore, prevention to minimize erosion and scour is of great importance. The following measures to prevent the risk of scour due to run-off, treatment of sediment flow, and overcoming the aftermaths of scour will restrict scour and sediment accumulation to an acceptable level. These proposed mitigation measures shall be made into Technical Standards in construction and bidding provisions by the Employer once they are approved by state agencies on environmental protection. The below measurements is general methods that to be applied for whole road line, specific method for each section is showned in information page.

1. Preventing and minimizing scour and erosion.

- Top soil removal in excavation area shall be implemented in a sequence so as to avoid exposure of a large area of uncovered slope during implementation of foundation, which is beyond the Contractor's scour and erosion control ability.

- Drainage must be taken care of by creating drainage directions during construction period (always ensuring a certain horizontal gradient of the road surface to avoid standin g water on the surface). Road surface for construction must have enough strength so as not to create imprints when construction machines operate.

- Organic soil layer that is removed for construction of the foundation shall not be discharged into watercourses but shall be stored and protected against erosion by run-off for later use in consolidation works.

- Construction material storage area with volume of more than 20m3 shall be covered with roofing felt or other material throughout rainy time.

- Temporary storage of excavated sludge and soil shall not be implemented in Ma River valley, especially in rainy seasons.

- Construction shall be arranged so as to minimize excavated area in rainy season (from May to October). In case excavation of slopes or foundation cannot avoid rainy season or rains, exposed slope area shall be temporarily covered to prevent erosion.

- Excavated or embanked areas shall be tightly compacted and immediately then consolidated with concrete, grass planting and plastics according to the design to prevent erosion due to rains.

- In soil exploitation locations, measures to direct run-offs to flow through exposed area to lowland which are not cultivated land shall be applied. Exposed land shall be re-covered with plants within 15 days after completion of works and plants shall be ensured to develop as original conditions, or at least the surface shall be tightly covered.

2. Minimizing sediment accumulation.

- Storm water overflow shall be impounded and directed to predetermined locations to prevent overflow through construction area or construction site by means of excavated ditches, which can both ensure drainage of surface water for construction site and prevent dirty water from outside flowing into construction site.

- Overflow water containing sediments shall be collected into temporary side ditches beside construction area to flow to grass land or temporary sumps. Grass land shall be at least 20 m away from any water sources. Temporary sumps may be located in low lands on the route or along the route. Deposited sludge shall be treated and used for planting in accordance with design.

- In case the scale of the sludge flow is beyond control, earthwork shall be postponed to improve mitigation measures. Execution shall only be continued after necessary measures have been implemented and approval of Supervision and Construction Consultant has been obtained.

3. Minimizing other socio-economic impacts.

- All cleaning activities shall be carried out promptly so as not to cause socio-economic impacts on the Project area before continuing execution in the following cases:

+ Soil and sludge fall onto cultivated land.
+ Soil and sludge fall and fill water conducting channels or ditches, interrupting irrigation water flow.
+ Soil and sludge fall onto other sensitive works such as schools, residential areas, pagodas and cemeteries.

- Road surfaces and construction sites shall be regularly cleaned to prevent grease roads due to fallen soil and sludge; material transporting vehicles or any construction vehicles shall be cleaned before exiting construction site to prevent soil, sludge or debris shall from falling on the roads.

4. Assessment of mitigation measures and residual impacts.

Erosion is prevented by technological solutions already mentioned in the design. Implementation techniques are simple and within the ability of contractors to implement and allowed fund of the project. These proposed mitigation measures are also feasible measures for mitigation of impacts on aquatic environment. Required investment for prevention and mitigation measures in constructions is still within the resources of the Project and ability of contractors.

4.3.2. Minimizing impacts on hydrological regime.

1. Impacts due to designing of roads and works.

The aforesaid adverse impacts can be minimized mainly by design solutions, including:

- Designing bridge piers in straight line and perpendicular to the water flow.
- Not calculating scour for individual pier but for the combination of all piers in the most adverse hydrological conditions to determine the safest elevation for foundation tops, preventing local scour and sediment accumulation downstream of the bridges which gradually make the waterway shallower and narrower and cause adverse impacts on the ability of flood drainage.
- Installing sewer pipes at the right elevations to ensure easy and complete drainage.
- Consolidating the upstream and downstream of the works in strict compliance with standards so that water flow shall not impact slopes and waterways; and thus shall not impact the environment along the route.

- Providing complete water collection and drainage system, such as side ditches, water collecting ditches, etc. to collect water to the location of road-crossing drainage works. According to road design documents, these ditch systems have been constructed relatively sufficiently. The only remaining issue is their maintenance.

2. During construction period.

The route of the Project cuts across a series of watercourses (mainly water grooves and Ma River). The proposed measures are to minimize impacts that interrupt watercourses and reduce flood drainage ability of Ma River. After obtaining the approval of state agencies on environmental protection, the Employer shall develop the proposed measures into Technical standards in construction and bidding provisions.

- Storage areas of construction materials and disposed materials shall be at least 60m away from water sources. (The locations is agreed between Transportation construction work consultant company No.8 and local authorities, to see detail in annex)

- All excavated soil during construction of sewers and bridges, and disposed sludge during pile work shall be collected and removed out of construction site and river basin to disposal site in accordance with the instructions of Supervision and Construction Consultant after agreement with local authority on the location has been obtained.

3. Assessment of efficiency of mitigation measures and residual impacts.

It is impossible to completely eliminate all impacts on flood drainage regime when floodway must be applied. However, with design solutions for bridges and sewers with sufficient span and length for drainage of flood and water flow from mountain slopes, there is no big environment problem that needs to be solved. Impacts on water drainage regime will be minimized to an acceptable level. Calculation of local and general scour for combinations of bridge piers and proper design of bridge piers are feasible measures to protect piers and restrict scour and sediment accumulation in the river bed downstream. Residual impacts are small.

4.3.3. Assessment on location of disposal sites and material mines

- Seeing location of disposal sites and material mines in annex

- Location of disposal sites and material mines is agreed between Transportation construction work consultant company No.8 and local authorities

- In general, the locations is advantage for transporting material and ensuring transporting and storing material quickly. The locations is spreaded road line.

- All material mines salvaged local material, transportation distant is short that is a condition for ensuring construction schedule

- Howerver, it need pay attention on features that effect to safety, welfare of the people and environment pollution maters:

+ Almost disposal sites is near by river bank, when heavy rain reason and flood apearing that raising water level could flood the sites that pollute water and take away disposal material to lower. Thus, it need recheck elevation of disposal site and nanual water level to apply measurement such as: relocation to other site, raising ground elevation of disposal site … After completion construction, it need restore for the site such as: restoring green cover, covering organic soil layer ….

+ Material mine such as: sand, stone, soil mine and concrete mixed plant are almost at right side and close with design road. Problem of locations are safety during mining material and effect to resident. Thus, it need apply measurements to ensuring safety of mining material, traffic and construction work such as: Strictly following regulation and standard on exploit material, setting safety corridor during construction stage, inform to local people on location of disposal site, construction site. Equipment in exploit processing are meet requirements in standard on noise, vibration and dust to limit effect to surrounding environment.

4.3.4. Environment protection and safety during exploding process

Based on site topography, consultant recommend following mine exploding methods:

- Due to narrow construction site, mine exploding for road bed is inner exploding method to limit soil and stone to be pushed away to fill up river/stream and effect to surrounding houses.

- When design mine exloding near construction work, it must set safety measurement and environement protection methods during construction design statge. The following is methods to be applied to ensure safety and minimize effect to environment:

+ Ought to preparation mine exploding design document for each exploding point

+ Ought to preparation plan of exploding site (The document must be office store during construction period)

+ Ought to Design and set measurement for in case of none exploding mine, missing exploding point ….

+ Ought to following safety regulations on mine exploding

+ Radius of dangerous area must be calculation based on site condition (for exsample: to small exploding the minimize radius of dangerous area is from 300m to 400m)

+ Exploding site must be far away from resident as regulation

+ Exploding direction must be to mountain wattle or none resident and far traffic road.

+ Ought to informing exploding time, signboard and setting warning surrounding exploding area to local people and transportation mean.

+ Informing to local office and people before exploding time and explain legend

+ Beforec exploding, it must be take warning explode at least 15 min, the sound of warning exploding must be huge and far away

+ Evacuation people and casttle out of exploding area. Setting minute of completion preparation safety work for exploding.

+ After exploding, it must be check safety before normal operation of equipment and workers.

- Exploding works must be meet following requirements:

+ Breaking soil and stone and put in right location to take advantage of transportation.

+ Excavation hole after exploding must form similar as design cross section in permission of aberration to minimize of repairation

+ Minimize of destroy slope

+ Crack out of boundary must be smallest

- In case of site condition must be ensure traffic operation, that exploding volume is not biger than ablity of equipment capital for transportation and clearing per one working shift.

- Construction contractor and consultant need check, adding to said above methods for setting best method, economic and match with each site condition in order to ensure safety during construction and minimize effect to surrounding environment.

4.3.5. Minimizing impacts on ambient air quality.

- Proposed mitigation measures focus on three main activities that cause pollution, including: excavation and embankment works, transportation of materials and construction wastes, and operations of concrete mixing plants (if applicable).
- Mitigation measures for adverse impacts on ambient air quality caused by the aforesaid activities shall be developed into Technical Standards in construction and bidding provisions by the Employer after approval of state agencies on environment protection has been obtained.

1. Excavation and embankment works.

- Using water sprinkler to wet construction land and construction site (locations of soil exploitation, road excavation or embankment, slope construction, construction site of bridges and bridge piers, stone grinding) at least twice a day in dry season.

- Storage area for materials such as sand, aggregate stone or other materials that can emit dust, with volume > 20 m3 shall be covered with temporary aprons in at least three sides.

- Outside remarkable source of dust (construction site, material exploitation areas, concrete mixing plants, etc.), monitoring of ambient air quality shall be implemented in a number of sensitive locations throughout construction period.

- During construction, if monitoring result shows that dust concentration exceeds allowable limit in Vietnamese standard TCVN 5937 – 2005 to a level that threatens the health of surrounding residents or workers in construction site, mitigation measures shall be timely adjusted, or works shall be postponed until the impacts have been overcome (to the agreement of supervision and construction consultant).

2. Transportation of construction materials and wastes.

- Means of transportation must satisfy emission standard (TCVN 6438 – 2001- Means of transportation on roads- Maximum allowable emission limit). Through contracts, the Employer shall require contractors to apply this standard in management of construction vehicles.

- Through contract, the Employer shall require contractors for transportation of soil, sand, construction materials to apply necessary measures to minimize sand or dust falling onto the roads.

- Materials and disposed wastes on vehicles shall be wetted before transportation in dry days. Soil, sand or stone transportation vehicles shall be covered with tarpaulins to prevent materials from falling out and emission. Tarpaulins shall be applied all over vehicle body and tightly bound.

3. Operation of concrete mixing plants.

- Concrete mixing plants in construction sites of bridges, sewers, retaining walls, ditches, etc. shall be covered by baffle plates of at least 2 m high to prevent emission of dust to the surrounding environment.

- Through contract, the Employer shall require contractors to provide accompanying treatment works with mixing plants, including: treatment of dust in screening, collection, classification and treatment of waste and waste water before discharging into water sources.

4. Mitigation measures.

a. Measures for minimizing pollution due to xhaust emission

- All transportation vehicles and mechanical construction equipments that are used must satisfy stipulated standards of Department of Registry on technical safety and environment safety.
- Regular checking and periodical maintenance shall be implemented for means of transportation, machines, construction equipment working on construction site.
- Quantity of vehicles in use shall be regulated so as to match time and progress of works, not increasing the density of vehicles on construction site.
- Mitigation measures are simple, easy to apply, highly feasible. As vehicles and machines are tested before operation and regulated properly, amount of emitted exhaust from vehicles and machines is kept at standard allowable limit of emission to the environment.

b. Mitigation measures for dust pollution

- Using tarpaulins to cover trucks, transporting at the right loads, preventing materials from falling onto the road during transportation.
- Watering one a day during levelling or transportation of materials. Depending on the weather conditions (especially when it is sunny and windy in dry season) and traffic flow of motorized means, regular watering may be increased for road surfaces and construction plans close to temporary houses for workers and residential areas.
- Strictly managing the application of water to minimize pollution in areas for material crushing and screening or concrete mixing.
- The aforesaid measures can restrict the majority of dust emission due to construction works, but it is very difficult to minimize dust emission due to mining for construction or material exploitation purposes.
- Covering and sprinkling during construction and transportation are easy to apply and highly feasible.

5. Assessment of the efficiency of mitigation measures and residual impacts.

Mitigation measures for impacts on ambient air quality during construction period are highly feasible as the requirements are suitable to resources of the Project and capabilities of Vietnamese contractors. However, it is very difficult to minimize dust emission in a large-scale project and in a project area with many accumulation sources completely in compliance with the Vietnamese standard TCVN 5937 – 2005. Residual impacts on ambient air quality, therefore, are still a special attention of the Project. Through supervision, the Employer shall enhance necessary measures to maintain air quality at an acceptable level.

4.3.6. Minimizing noise impacts.

Sources of noise and noises in construction include: clearance and grubbing (equipment and means are bulldozers, lifting vehicles and trucks); excavation and transportation of soil (bulldozers, grabbing cranes, trucks); leveling and compacting

(graders, compactors); construction works (cranes, welding machines, concrete mixers, concrete pumps, concrete vibrators, trucks); landscape and clearance (bulldozers, backhoe excavators). It can be seen that, minimizing noise in construction means restricting the impacts of the following objects: fixed or nearly fixed sources of noise (earthwork, leveling, clearing, etc.); transporting of soil within the Project area, and sensitive objects.

1. Fixed and nearly-fixed sources of noise.

These are equipment and machine which are located at one place or moved within a short distance to execute a work item during many hours.

- *Controlling time and activities:* When implementing construction work near pagodas, equipment which generates big noise shall not be used in festival days of the pagodas. In residential areas, working duration shall be regulated to reduce the time of noise impacts. Working time shall be approved by the supervision and construction consultant. Execution is forbidden in this area from 22:00 to 6:00 AM of the next day.

- *Using equipment and applying methods that generate low noise level:* The Employer shall encourage contractors to utilize equipment with low noise level. For example, instead of using leveling machine with noise level of 93dBA, contractors are encouraged to use leveling machine with noise level of 83dBA. Effective reduction of noise also depends on methods of construction. Actually, contractors can be active in reducing noise level by employing methods of construction which select equipment with lowest maximum noise level for each specific work. Based on the requirement of quietness of each sensitive object, the Employer shall request contractors to select proper construction machines if possible to minimize noise impacts on sensitive objects.

- *Controlling the arrangement of equipment generating noise:* Fixed or nearly fixed noise-generating equipment such as mixers, electricity generators shall be located far from sensitive areas (such as schools, medical aid stations, people's committee office of the commune, etc.) if possible, basing on the principle that noise level decreases by 6dBA when distance is doubled. In case such a far location is unfeasible, temporary acoustic barriers shall be used. Or else, material stocks or mounds, etc. may be utilized as acoustic barriers. Depending on the noise level and distance from generating source to receivers, the supervision and construction consultant shall request contractors to select optimal options for location of equipment or utilization of temporary acoustic barriers to minimize noise level at sensitive receivers.

- *Restricting the simultaneous operation of noise-generating equipment:* The Employer shall encourage contractors to arrange time and works properly to restrict simultaneous occurrence of noise generating activities so as to reduce the total noise. As far as possible, if work progress is not seriously affected, number of simultaneously working equipment shall be limited when construction work is carried out near sensitive areas such as schools, pagodas and residential areas.

- *Complying with construction regulations:* serious compliance with construction regulations in proximity of sensitive areas and at necessary time will remarkably reduce noise in construction at low cost or even no cost, including: only operating equipment that are well maintained at site; maintaining equipment throughout construction time; using and maintaining sound-absorbers and acoustic barriers; turning off discontinuously working machines when they are not needed to reduce accumulative noise to the lowest level.

- *Controlling labor protection for workers:* Workers working near electricity generators or piling machines shall be provided with noise-absorption helmets; for large group of workers who live for long time near construction site, they shall be considered a residential community and temporary houses for them shall be arranged at least 400m away from the construction site.

- *Supervising noise*: supervision of noise is a part of construction supervision. Supervision is required not only in areas where there are equipment that generates high noise level but also in sensitive locations to noise throughout construction period.

2. Transportation of soil.

Six measures can be applied to minimize noise impacts caused by transportation of soil, including:

- Not locating vehicle gathering yard or temporary houses for construction in residential areas.

- Limiting the number of working vehicles and transportation means operating simultaneously in an adjacent area to the aforesaid sensitive objects.

- Only utilizing vehicles with low noise generating level (for the same use) for operation near sensitive objects.

- Limiting soil transporting activities in day-time when noise level in the surrounding environment is highest.

- Drivers shall be well educated to right behavior: turning off the engine if not necessary and avoiding unnecessary noise-generating activities when driving the vehicles.

- Speed of utilized vehicles shall be limited in aforesaid areas. Drivers shall be trained on this and requested to comply.

Each location for soil transportation has its own features. Feasibility and efficiency of mitigation measures depend on specific situation. Therefore, the supervision and construction consultant shall cooperate closely with the contractors to select proper measures so that optimal measures shall be applied.

3. Sensitive objects.

In case noise generated in construction at a certain time exceeds allowable limit in accordance with Vietnamese standard TCVN 5949 – 1998, the Employer shall actively work with local people's committee on plan to inform the affected parties of the time and working schedule to get their acceptance of this exceptional situation.

4. Measures to minimize noise

- Arranging working time properly and following a proper regulation regime for equipment, machines and vehicles.

- Arranging working time and regulating the operation of equipment, vehicles and machines to minimize noise are highly feasible and easy for application.

- Regulating vehicles, machines, equipment and arranging working time properly help reduce noise level due to resonance and concentration of so many vehicles and machines at the same time.

5. Assessment of the effectiveness of mitigation measures and residual impacts.

Although the proposed measures ensure reducing noise to an acceptable level, it is very difficult to achieve a resolute perfection, as construction machines can not be replaced completely. Therefore, residual impacts of noise pollution in construction still draw a special attention of the Project. In addition, accumulative impacts also occur in the project area. Therefore, through supervision activities, the Employer shall enhance mitigation measures if necessary to maintain noise at an acceptable level; and meanwhile informing to the affected parties about the time and working schedule so that they are ready to accept any incident that generates noise and support the Project.

4.3.7. Minimize impact on water quality.

In scope of the Project, to maintain the quality of surface and underground water and satisfy irrigation demand, drain away in flood season, it is necessary to minimize negative impacts from 3 main activities namely excavation, bridge and sewerage construction and domestic waste.

1. Route excavation and embankment work.

In construction time, scour, erosion and sediment are unavoidable from influence of rainfall, flood in excavation and embankment areas. To prevent or eliminate suspended substance, floating materials, oil and gas in water flow and reduce deposit component in flow, when constructing near above water source, following measures should be carried out:

- Prevent water overflow with deposit components from increasing suspended substance.

- Toxic chemicals, oil product must be located at least 100m far from water source and can not penetrate directly into water through overflow rainfall and flood.

- Solid waste in construction are collected and moved to disposal under supervision of construction observation unit after getting agreement with local authorities on disposal site so as to avoid surface and underground water pollution.

2. Bridge and sewerage construction.

In order to maintain the quality of flow under different usage purposes, following measures are implemented:

- Location of placing and gathering construction equipment will be far from flow so that oil product can not be penetrated into water source.

- Temporary irrigation system around areas of construction, pier, and sewer will be established to prevent from inundation in heavy rain, waste running into site and from site to flow.

- In case oil and gas storehouse is needed, elevation of oil and gas storehouse must be higher than elevation of flood water P=4% (hydrograph along route); warning board are installed in this area to avoid strike among means of construction.

- Location of concrete mixing station is higher than spillway, at the highest if possible. Simultaneously, take response methods when flood comes.

- Preventing penetration of concrete mortar, oil containing waste into flow: concrete waste is not re-used, concrete mortar and oil containing waste are collected and classified and transported to disposal site as regulation and guideline under supervision of

construction observation unit after getting agreement with local authorities on disposal site avoiding pollution on water source.

- Sludge and waster without contaminant which is arisen from cast-in-place bored pile can be used for other suitable purposes. They are spreaded to create plan or use for agricultural work at on-land area which do not belong to Ma river's valley, under supervision of construction observation unit after getting agreement with local authorities

- Dirty overflowing water such as water from car wash, waster water from concrete mixing station, material wash…containing sediment flowed in temporary ditch to waiting holes. After depositing, surface water is discharged to surroundings, sediments will be gathered and dispose under supervision of construction observation unit after getting agreement with local authorities.

- Oil and gas, other fuels using for vehicles, equipment are well preserved to avoid spill, pouring or damage activities, additionally there are concrete regulation on safety.

- Any fuel spill is treated by collection, oil contaminated soil is transported to disposal under supervision of construction observation unit after getting agreement with local authorities.

- Oil containing waste is moved to disposal in tight tank under supervision of construction observation unit after getting agreement with local authorities.

- Cast-in-place bored pile is completed under process so that dirty water can not run into borehole.

- River and diversion channel will be cleaned after finalizing construction works.

3. Domestic wastewater.

Purpose is to reduce waste from construction camps and give out domestic wasterwater treatment measure, including:

- Collecting domestic wastewater into holes for deposit, installing net to catch solid waste and them burying it, allowing only water to discharge into natural flow.

- Not allow to discharge directly construction waste into water source. Waste is moved to regulated area to avoid affecting to environment and bury under guideline of construction observation unit before transport to new place.

- In order to treat human's waste, Employer encourages Contractors to install movable toilets which is widely sold in market. Sediments can be collected and buried in regulated places under supervision of construction observation unit. In case of not use this kind of toilet, Contractors are requested to construct toilet in each site. Toilet must be 100m far from water well, and distance from toilet's bed to impervious soil layer is 1m.

4. Assessment of the efficiency of mitigation measures and residual impacts.

Implementation ability of mitigation measures for impact on water quality in construction period is high because proposals is not too complicated in respect of technical and accordant with Contractor's capability. Residual impact is no remarkable.

4.4. Measures to diminish environmental impact during operation period.

During operation time of route, it requires measures to assume stability of work base, minimize damages and risk at acceptable level. It also needs traffic control measure to create the most favorable conditions for traffic. These measures should be friendly to environment, economic and accordant with construction condition.

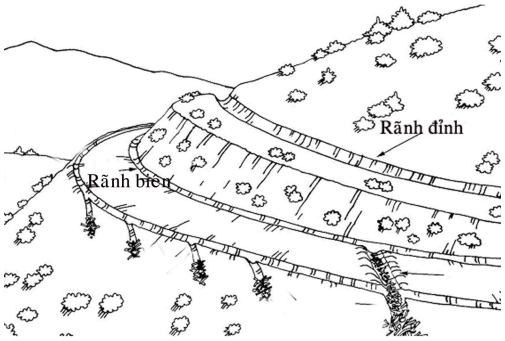


Figure 4.1 : Structure of top ditch

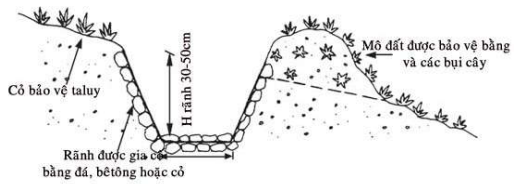


Figure 4.2 : Structure of top ditch

Figure 4.3 : Consolidate ditch by rock

4.4.1. Technical measures for stability of talus slope.

1. Instability calculation method.

- Geo-slope/w software is used to calculate slope stability, select calculation method and treatment for reinforcement design by single structure. Plaxis software is used to calculate slope reinforcement design in complicated complex structure.

- Method of "assumed sliding surface" is used to calculate slope stability on excavation. It is assumed that sliding surface is a circle with the smallest stable coefficient, comparing to allowed coefficient of work under regulation, we can know designed cross section. Fragmentation method of W.Bishop (limitation balance) and Finite Element Method can also be used to calculate slope stability of excavation. This method is simple, small deviation, suitable with actual condition.

2. Common measures

a. Arranging top ditch, drainage ditch.

At slope without surface cover or slim cover, the most risky factors include surface water flow and raining water which cause scour, erosion, reduce connection among soil grains. Flow will deposit sewers, fields in lower area. In such condition, scour can happen at any time and affect to works. A simple and effective measure to eliminate this risk is to design top ditch, drainage ditch to collect over flow on surface and discharge to safe drainage works or stream, river. This kind of ditch limits many risks of damaging flow. Cross section, ditch size and reinforcement depend on capacity of flow, topo slope, and geo surface of area. Top ditch and drainage ditch are located according to their structure or hydraulic and hydrographic calculation.

b. Lower and unload for talus slope.

Calculation shows that high and long soil block is risky to be collapsed and dropped, the safest method for slope stability is to unload and lower slope by excavating into steps and constructing ditch system and reinforcing surface. Advantage of of this method is to improve permanent stability of slope, simultaneously absolutely treat impact of erosion. However, when apply this method,

Figure 4.4 : Talus step

working volume is large, costly in excavation, transport, material…moreover, this method is not friendly with environment because it occupies a large area on vegetational cover which is difficult to restone.

c. Sodding

- *Local planting*: should be used for slope because of its familiarization to local natural condition. The local planting is easy for growing and developing. We don't have to worry about encroachment of planting and otherwise this planting also help to create the landscape.
- *Ventiver grass*: has its roots of 3m long with sweet odor, which used to be material for perfume production, is now used for protecting revetment and road from wave and erosion.

Figure 4.5 : Sodding on talus slop to enhance stability of slope and landscape

d. Soil Improvement

Besides planting for protection, improvement of drainage system, decrease of soil erosion, there is another method, which is used in over the world – using Polymer: polyacrylamide, so called PAM. This is white powder material, which shall be mixed with water with the rate of 10mg/liter and then sprayed over the soil surface after planting. Then, dissolved PAM shall act as addition to combine the soil granular. Accordingly the surface soil can adhere to below soil layer to reduce the soil erosion and minimize the washout of nutrition, newly planted seeds. Beside the soil combination, PAM increases the moisture to 80% and reduces the flow speed on the surface. The good water absorption will help to increase the soil durability and facilitate the growing of trees. However this is not a type of fertilizer but it contains 14-15% nitrogen, useful for planting and microorganism. With those advantages, PAM is material assisting to planting at the slope (hill, bank, road slope, etc). This material can be mixed with planting for stability of slope.

Figure 4.6 : Vetiver grass grows on Ho Chi Minh road, increasing stability of slop and create landscape

e. Gabion.

Gabion for reinforcement of slope foot is a simple but greatly effective method. Gabion construction work is really simple, takes advantage

Figure 4.7 : Gabion in talus slope for consolidation

of situ material (headstone), so price is very cheap. Gabion is effective in reinforcing slope with wet base or swallet, preventing from scouring banks, slope foot where surface water pass through. One more advantage of gabion is easy to set gabion under operation direction and form of base soil layers, so gabion block can suffer well from vertical pressure to base. However, disadvantage of gabion is to not apply for high slope because gabion block can not suffer cross thrust. This measure should be encouraged thank to its friendship to environment.

f. Geotextile and technical net.

- *Geotextile (weaved geotextile (PP):* includes cross and vertical fiber to be weaved together as normal cloth. The deformation of weaved material is tested by two main direction, machine cross direction and machine vertical direction. Its characteristics include high tensile strength and elastic efficiency, good drainage and filter, active appliance in base stability and slope reinforcement against erosion. Embankment consolidation is used to increase stability for high embankment on soft soil. With characteristics of high tensile strength and strain, PP geotextile prevents and eliminates potential collapsion of high embankment.

Figure 4.8 : Geotextile for increasing slope stability and avoiding erosion

+ For soft soil treatment: with characters of high tension and low elongation, PP weaved geotextile is used as an economical and effective method for soft soil treatment.

Figure 4.9: Geotextile below gabion to consolidate slope underwater.

+ For pile bracing: PP weaved geotextile is directly placed on top of reinforcement piles and acted as slab for even distribution of load.

- *Coconut fiber and hemp mesh*: is made by weaving the coconut fiber and hemp to be a net, a durable and self-destroying net. This type of net has effect of avoiding erosion for river slope and bank, enabling development of vegetation. Besides, it not only prevents soil from erosion but also absorbs the moisture, protects soil from erosion and creates a rich soil for vegetation. Through testing, Coconut fiber and hemp have long life of 4 years in

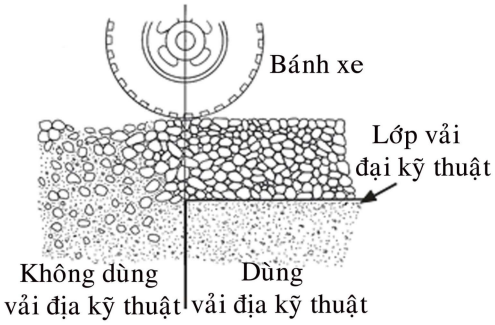


Figure4.10: Using geotextile to separate material layers

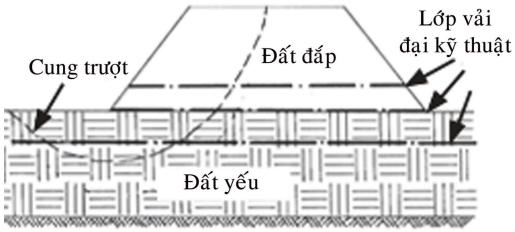
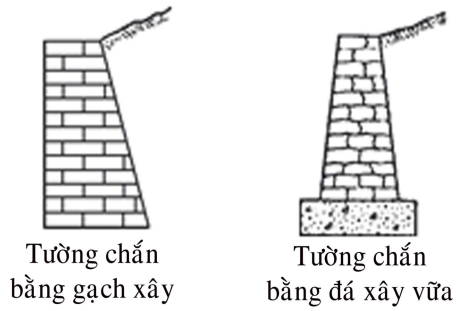


Figure 4.11 : Using geotextile to reinforce soft soil

Figure 4.12: Using masonry revetment to reinforce talus slope



inundation condition. This is new method, which has not used popularly in Vietnam so the advantage of this material has not been experienced. However, at some other countries, such as Thailand or Philippine, this material has being used with much effectiveness and low cost, which should be considered for our country.

- *Geotextile net:* to protect from erosion, it might be used three-dimensional net with biological material so called geotextile net. With soil on the surface the net will be invisible after planting. Geotextile application shall allow using substandard material for construction of embankment slope, which bring back economic, environment and easy-construction advantages. It can help to minimize the land acquisition; limit the soil exploitation at the sensitive area; reduce the embankment quantity; use available local material; facilitate the construction; allow the operation of heavy machine at edge of lope for compaction. Geotextile net is able to allow the construction of 900 slope and reduce embankment area.

g. Reinforcement by masonry.

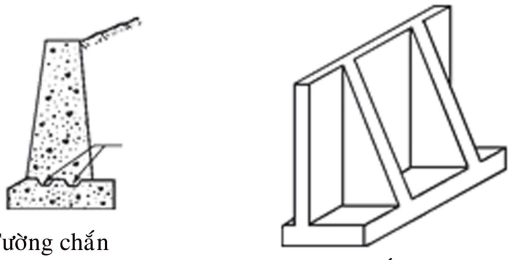
In talus slope, a simple measure usually applied is reinforcement by masonry. This method can take advantage of local materials that can lower price in construction. Masonry revetment limits water to penetrate into slope, reduces erosion of flow…

h. Retaining wall.

- Retaining wall is to support soil pressure, increase stabilization for excavation and backfill slope.
- Materials for retaining wall include brick, masonry, cement concrete…
- Calculation for retaining wall construction must be considered carefully because of route with mountainous topography and large cross slope.

k. Ground anchor.

Anchor drilling method is advance method in over the world. Anchor drilling method creates anchor pole to stabilize cross structures such as retaining wall, embankment… Anchor drilling work is separate work when constructing talus slope. First of all, to horizontally drill into slope



wall for many 4 to 26m-deep holes; After that to fix the steel cable into those holes, which shall be shotcreted later with high grade concrete to form a stable and permanent block. Anchor piles are able to hold the retaining wall by pile tension including anchorage cable tension and friction between pile and soil. Slope with anchor might reach to permanent durability. Erosion effect is eliminated. However this construction method is costly and complicated.

Photo 4.13: Types of retaining wall

4.4.2. Reinforcement for drainage works.

Surface water drainage works for route such as sewer, drainage ditch, bridge abutment … are risky to be destroyed. The reason is that these works are directly affected by water flow or usually sunk under water, so connectivity between soil base and soil block is poor and slow erosion happens in long time. Therefore, such sections should be installed more preventive structures against impacts, ensuring safety and long-term using for works. Besides, drainage works are subject to be deposited, causing to unuseful and damaged works.

Some measures to prevent impacts are listed below:

- Reinforcement by gabion.
- Bamboo and wooden pipe.
- Wet masonry revetment or cement mortar reinforcement for wet masonry revetment.
- Reinforcing for upstream and downstream of sewer, bridge by gabion.
- (Specification of each measure is seen in Item 4.4.1)

4.4.3. Concrete recommendations.

- As mentioned above, recommendation given must be modern, durable, friend with environment, saving and suitable with construction condition. Based on analyzed natural conditions, technical measures and design document approved by employer, we temporarily make some following recommendations:

+ Beginning part of route (km0+0.00 – km4+0.00). Topographic characteristic of area has slope of 1:1 to 1:2, surface is covered by thin vegetation layer, mainly low trees, surface soil is mixed clay containing clay slurry. This area is risky to get erosion. On positive slope, drainage ditch and gully should be installed to discharge water quickly and limit impact of direct erosion of surface water on road and slope. Coordination with recovering cover layer of trees with economic value such as bamboo, neohouzeaua…On slope top and safety corridor of both sides, sodding is carried by normal or veltiver grass.

+ The next route (from km4+0.00 to end of km20+0.00): Topographic charter eristic of area is large cross slope (about 1:1), but some special part of < 1:1. Surface of basin is mostly covered by bamboo, neohouzeaua and multi-layer secondary forest. Geological characteristic is formed by mixed clay of 3-5m, source-bed, and in some part, source-part is open.

- For excavated slope if height of slope is over 6m, it should be lowered by step excavation method in coordination with drainage ditch system and surface reinforcement, sodding and masonry payment.

- Negative slope and embankment are the most affected parts of load as well as thermhygrograph mechanism. In raining season, clay base is easy to be water-penetrated, therefore such slope should be reinforced by grass. In locations near water gap, cross drainage work is located in high and wet embankment. As a result, besides constructing retaining wall to support for slope stability, drainage measure for base by geotextile layer inside retaining wall should be installed to ensure drainage ability for base without sweeping away soil grain.
- In cross drainage works (water opening > 1.5m), beside technical measure mentioned, works should include bank reinforcement design both upstream and downstream of works in order to make sure that water can not damage backfill part of work body.
- Km 18+700.00 to km19+0.00 is bounded by left bank of Ma river where change river's flow so erosion of the river can be happened. Accordingly, river bank needs to be reinforced to prevent strong erosion of the river and wave. Cement concrete reinforcement masonry revetment and geotextile can be constructed to avoid impact of flow and stabilize foundation by underground water drainage.

4.5. Mitigation measure for environmental pollution affecting to residential and workers

4.5.1. Mitigation measure

1. For Employer.

- Employer monitors, evaluates and takes responsibility for social stabilization and economic development of resettlement people.

- Employer coordinated with local authorities to enhance awareness of forest protection as well as forest products for workers, local people and immigrants.

- For management system of local authorities: Employer coordinates with local authorities to manage employed population, security in area.

2. For people

- When construction, Contractor must register temporary residence for their workers with local authorities.

- Applying preventive measures to reduce the spread of epidemic in community and among workers. These measures include propaganding and encouraging living-area sanitation, using clean water, taking vaccination, abolishing mosquito and other insects, increase health equipment, medicine, quantity of doctor, nurses, ambulance…Details are as follows:

+ Cooperating to local clinics to take prevention measures against popular diseases such as malaria, fever, stomachache, dysentery, and propaganding preventive measures to avoid vection from animals, poultries.

+ Preparing mobile medicine cabinets in construction units.

+ Coordinating with local health agency to schedule periodical health check plan for staff, works in sit, spraying chemicals against diseases.

+ Usually checking disease protection guideline against popular diseases among staff and workers.

4.5.2. Advantages and disadvantages of measures

- Awareness of protection on forest natural resource, biological diversification, health for workers and local people is raised up.

- To implement mitigation measures, it is necessary to work closely with employer, local authorities, border soldiers, workers and local people.

- When coordination among related parties, implementation ability of measures becomes higher.

- Implemented measures reduce pressure on social environment, forest natural resource, resource of animals and vegetation, and prevent disease vection ability

*** <u>CONCLUSION:</u>**

- Health of workers and community depends on changing level of soil, air, noise, water and waste treatment producing from project activities. For this reason, impacts of environmental improvement to people must be paid much attention.
- Contrary to advantages of new road on traffic and safety, there are many disadvantages. Road route is latent to traffic accidents to residential, especially (Thai) ethnic people who do not get in touch with safe traffic measures. On the other hand, residential surrounding project area have no deep knowledge about environmental pollution as well as environmental impact on their health, life and activities. Therefore, mitigation measures for environmental pollution on people should be taken as follows:

+ To apply mitigation measures on impact on soil, water, air, noise and waste treatment, these measures are approved by Employer and Contractor.

+ Taking concrete action plans to lighten these impacts.

+ Coordinating between Employer and local authorities to propagandize protection methods for public health.

+ Detail report of assessment on project impact to public welfare is preparated by other consultant, in this report we shown only concerning basis maters.

4.6. Mitigation measure on environmental impacts during road operation

- Environmental pollution in road operation is one complicated and very difficult to give specific statistics. The main impacts are pollution of air, noise and water.
- Therefore, we must have concrete plans as well as pay full attention to minimize bad impacts of environment in this period.

4.6.1. Measures to minimize impact on air environment

- Minimizing impact to air originated from vehicles in this period is a very complicated problem. Absolute solution for this problem belongs to environmental management agency, it goes beyond right and ability of Project.
- The mitigation measures to bad impact on quality of air environment are feasible, suitable with project's ability and capability of Vietnamese contractor. However, minimizing dust in large-scale project becomes very difficult to satisfy Vietnamese standard 5937-2005. Therefore, residual impact on air is a big concern of Project. Via supervision work, employer will enhance the necessary measures to maintain air quality at the level that accepted.

4.6.2. Minimize impact on noise

Noisy impact in operation time is long term and unavoidable. Noisy mitigation measures are to monitor source of noise, reduce noise in sensitive locations, and recommend preventive measures to sensitive objects.

1. Monitor source of noise.

Like air pollution, minimizing noise originated from vehicles belongs to environmental management agent, and goes beyond right and ability of Project. The project will coordinate with local environmental management agency, apply Vietnamese standard 5948 and 5949-2005 to monitor noisy level at the beginning years of operation.

2. For existing sensitive objectives.

Living along noisy route is unexpected but acceptable by residential.

3. Recommendation on the measures to avoid noise to sensitive objects a under new construction plan.

Because the route passing through residential area of two road sides, noisy preventive measure should be recommended for people. For example, construction of office, medical station, school and private house should be far from road, and the main direction of above works should be opposite to road…

4. Assessment of efficiency of mitigation measures and residual impacts.

Proposed measures are to eliminate noise at acceptable level, but construction equipment can be absolutely replaced, these measures are relative. Residual impacts of noise during construction and operation are special concern of the Project. In operation time, minimizing noise in school has to properly be invested based on full research result of anti-noisy technology. The efficiency of minimizing noisy pollution depends on result of controlling noisy source from vehicles.

4.6.3. Minimize impact on water quality.

- Drainage system is mainly located on positive talus slope, top ditch or surface ditch, it causes pollution ability of natural water source because of high accumulation of heavy metal and oil in water source.
- To prevent the impact, the most effective method is to clean the surface of road periodically before raining. By this way, pollution leveling overflow water from the first raining is still very small. After the first rain, overflow raining water within 10 days is free from or less dirt particle.
- The project manager recommends authorities so that Road Management Unit is responsible for clean periodically the route.
- Specific measures are as follows:

1. Measures:

Cleaning vegetation cover :

- Gather all agricultural products including farm produce and perennial.
- Gather all forestry products such as: neohauzeaua, bead-tree (planting forest); timber trees (natural forest) in survey area. Especially area of sloping around residential area, vegetation cover of bamboo, neohauzeaua … should be preserved to prevent erosion.
- Cleaning up trees along planting trees and river side.

2. Advantage, disadvantage and efficiency of the measures:

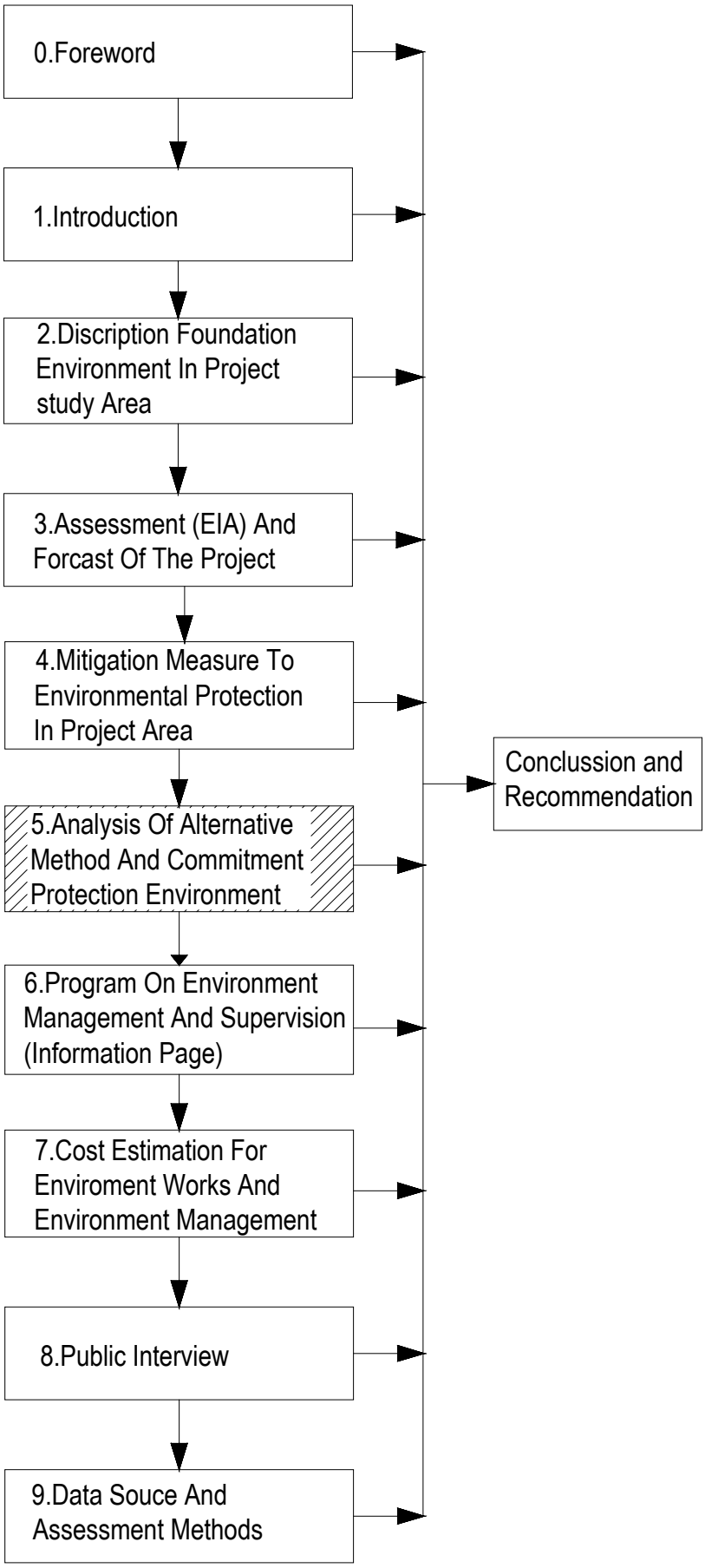
- To maintain the quality of water environment.
- To maintain work landscape
- Cost
- High feasibility

Efficiency of mitigation measures on water quality in operation period do not depend on the project but on satisfaction of Road Management Board for assigned missions.

4.7. Measure to mitigate biological environment pollution and reinstate after construction

- In this area, natural ecosystem is modified while agricultural and forestry ecosystem is fast developed. Agricultural and forestry ecosystem is mainly developed on 2 sides of roads. Distribution of vegetation cover is alternated between agricultural plants and forest. Ability of using energy source and natural potentials is only to serve for economic productivity while biologic productivity remains low.
- Animal-vegetation system is main feature of mountainous one. Low shrub forest develops on both sides of road. Beside land area for road, works on road, house, and remaining area is for short term agriculture and forest. Main gene source of this ecosystem include short term plants such as bamboo, neohauzeaua…, vegetation population, agriculture genes, creatures…
- In general, ecosystem in area is quire natural, thus during project construction and operation, measures to mitigate impact on ecosystem are needed.
- Before construction, execution unit should list biology related matters such as vegetation cover, creatures. Therefore, measures to diminish impacts on biological impacts in process of design, construction and operation.
- During design process, design engineers must have basic knowledge on biological environment in area to avoid bad impact of design to environment.
- During construction period, execution unit must take construction methods which are effective and less impact to biological environment in area. Waster water treatment measure in construction period before disposing to disposal site is agreed between supervision of construction observation unit and local authorities. Coordination with local people in raising their awareness in protect surrounding area.
- After finalizing construction, Contractors is responsible to clean road surface to speed up operation of road, serving for people life. Besides, guideline for people impact of throwing waste into Ma River as well as exploiting exhaustedly natural resource on Ma river, giving out useful measures to ensure the less impact on biological environment in area.
- During road operation, it is necessary to take long term, specific measure in accordance with development of area. Project management board should coordinate with local authorities which road pass to find out and provide solution for bad impacts on surroundings and people.

Chapter 5


0.Foreword
1.Introduction
2.Discription Foundation Environment In Project study Area
3.Assessment (EIA) And Forcast Of The Project
4.Mitigation Measure To Environmental Protection In Project Area
5.Analysis Of Alternative Method And Commitment Protection Environment
6.Program On Environment Management And Supervision (Information Page)
7.Cost Estimation For Enviroment Works And Environment Management
8.Public Interview
9.Data Souce And Assessment Methods
Conclussion and Recommendation

CONTENT

CHAPTER 5: ANALYSIS OF ALTERNATIVE METHOD AND COMMITMENT ENVISONMENT

In order to diminish bad environmental impacts during the course of construction and within operation of the construction work, the Employer commits to comfort to regulations, implementation of protection methods for environement during the course of construction and within operation of the construction work. The Employer commits to perform the most reasonable protection methods for environment.

5.1. Analysis of alternative method and general commitment.

Based on the road method designed by the Consultant in 2006 and based on the analysis parts of environmental impacts presented in the previous chapters. We hereby propose general commitment as follow:

a. For responsibility of the Employer and Investor commit to be strictly abiden by the following contents:

- Environmental protection law No. 52/2005/QH11 appraised on 29 November, 2005 and takes effect uniformly since the date of 1 July, 2006.
- Governmental Decision No. 80/2006/NĐ-CP dated 09 August, 2006 on stipulation details and instructions for implementation conditions inscribed in the environmental law.
- Water resources Law No.08/1998/QH10 appraised by the tenth National Assembly, the third session dated on 20 May, 1999 and takes effect uniformly since the date of 1 January, 1999.
- Land law No. 13/2003/QH11 appraised by National Assembly dated 26 November, 2003 and takes effect uniformly since the date of 1 July, 2004.
- Protection and development forest law No. 29/2004/QH11 appraised by National Assembly dated on 03 December, 2004 and takes effect uniformly since the date of 01 April, 2005.
- Decree No. 17/2006/NĐ-CP dated 27 January, 2006 of Government on addition to or modification of terms and conditions promulgated in instruction decree for land law implementation in 2003.
- Decree No. 149/2004/NĐ-CP dated 27 July 2004 of Government on license regulation of exploratory, exploitation, using water resource, letting out waste water into water supply.
- Implementation of limitation quality methods of salt water and underground water under project area within construction works as requirement for reaching standard of salt water quality TCVN 5942-1995 and underground water TCVN 5944-1995
- Implementaion of air pollution limitation methods as requirement for reaching standard TCVN 5937-2005 – Standard of air surrounding quality; TCVN 5939-2005 – Industrial exhaust standard of dust and ignorganic substance; TCVN 6438 -2001 - The maximum limitation of exhaust for vehicle transport means and environmental standard in field of noise TCVN 5948-1999.
- Commit to attain the standard of environmental protection for exploitation means and material transport means: TCVN 6565-2006: Vehicle transport means. Visible exhaust (smoke) from the burnt engine by compressed. Requirement and test method in

approval type; TCVN 6567-2006: Vehicle transport means. The burnt engine by compressed, the burnt engine by forced using liquefiable petroleum and engine used natural gas installed on the car. Requirement and test method of exhaust pollution in approval type; TCVN 6785-2006: Vehicle transport means. Eliminate pollution gas from the car following material used for engine. Requirement and test method in approval type.

b. The Employer, the Investor commits to strictly implement methods of limitation of bad impacts, prevention and dealing with environemtal problems proposed in the abovementioned after receiving approval from the authorities of environment.

5.2. Commitment for implementation of concrete matters

5.2.1. Implementation of methods of design and management as well as technical treatment for erosion.

- Drainages are reinforced at upstream and downstream.
- Preventing the danger and erosion treatment caused by rain-water in construction for the surface which is removed out, slope, road surface and exploited soil in small scale.
- It should take precaution for some slots collected tide on the line. In the rainy season, stream following gravelly soil causes deposit at the door flowing to Ma River. It is proved that the flow thereat has extreme high speed (estimation v>6m/s) and can have obstruction for stream flow and thus, it should be careful when proceeding construction and exploitation. In the design document, these positions are put bridges and drainages so protection for bridge pier and working out erosion are necessary.
- Prevention and treatment for soil and mud overflowing into surrounding environment as to minimize bad impacts to the residents and community living, farming land, irrigation and historical culture buildings. When disposing soil and construction materials at these areas, cleaning work is required to promptly carry out before go on executing construction.
- Collecting stagnant mud or detritus and burried at the certain position have already agreed by the local authority thereat.
- Frequently make cleaning on the surface road of Trung Son water power and construction materials trucks
- Proceeding with supervision in construction

5.2.2. Implementation of methods of design and management as well as technical treatment for hydrography varies.

- System of pier bridges is designed perpendicular with stream flow to limit erosive stream flow and calculation in design as to diminish partial erosion and deposit at downstream.
- Construction materials and wasted materials are arranged to be away from water supply at least 60 meter
- All of excavated soil from the progrees of drain execution and wasted mud from the progress of bored piles are disposed out of the site and Ma river-valley and then, burry these soil stock pile in accordance with the regulation after reaching agreement on dumping area.

- Site area will be made clear up after completion of the construction work.
- Proceeding with supervision in construction

5.2.3. Application of methods of management and design for diminishing source causing air pollution and limitaion of dust effect in execution of construction

- Trees lines are put along side road
- Prevention of dust from the carriage and materials when transporting construction materials
- Treating dust in progress of sort out at the concrete batching plans; collecting, sorting out and treating waste; prevent oil waste- water from flowing into the water source.
- Waterring site surface and along transporting ways in order to diminish dust amount dispersed into the air environment.
- Materials dump which is strongly dispersed dust will be fully covered.
- Supervision air quality in the previous progress of construction and within execution of the project. Request the authorities to assign Exploitation Project Organisation to continuosly inspect air quality in the early years after completion of construction.

5.2.4. Application of methods of management and design for limitation of source causing noise level and lightening noise level in execution of construction

- Minimze noise level from the fixed equipment and near fixed equipment; control time and activities; use equipments and methods to reduce noise at the lowest level; control equipments causing noise; limit operation and equipments causing noise; apply code for construction; inspect of labor safety for workers.
- Minimize the noise from materials carriage at the place of residents.
- Avoidance of making noise at the sensible existing area.
- Recommend ways of avoidance noise for sensible cases according to new programming development.
- Supervision noise source and impacted noise level in the previous progress of construction and within execution of the project. Request the authorities to assign Exploitation Project Organisation to continuosly inspect noise level in the early years after completion of construction.

5.2.5. Application of methods of management and design for diminishing source causing water pollution and lightening noise level in execution of construction

- Apply the most remedy to prevent and minimize wavering solid, float object, oil in water source and reduce level of mud deposited in water flowing out of river stream when executing works along river routes, especially Ma River
- Stream flows are surely contained the quality following difference usage purposes by collecting strewed materials and wasted materials; preventing oil from flowing.
- Supervision quality of water- stream in the previous progress of construction and within execution of the project. Request the authorities to assign Exploitation Project Organisation to continuosly inspect water quality in the early years after completion of construction.

5.2.6. Application of methods of controlling waste

- Pledge that the Contractor will take full responsibility for controlling materials and waste added within the execution works in accordance with construction quality management which approved.

- Wasted soil and materials after excavation will be sorted out and recycle and fill up at the regulation place approved by the local.

- Chemical waste will be collected and kept and then, dispose to regulation place having guidance of dangerous waste.

- Inspect living waste (solid waste) and collect daily, sort out and treat in accordance with specification

- The Investor, the Employer commits to fully implement requirements in limitation of environmental impacts ensuring qualities of envoironment during the course of construction and work operation inscribed in the mentioned report and subsequently, shall be liable for the law in case of breaking Viet nam Standards in Construction Investment and causing problems polluted environment.

5.3. Analysis of environmental impact when having no project

When having no project, environment area is estimated to further happen as follow:

- Settlment of occuppied land at the area (connecting with Highway 15) is not absolute.

- Dust pollution will be still increased with a negligible speed.

- Salt-water pollution will be put up because of risen waste from economic activities and living.

- Quality of underground water is getting worse which is not subject to the Project.

- Quality of land is being changed which is not subject to the Project.

- Plan of land usage along route will be changed due to high demand of land usage.

- The danger of unsafety will not be improved with reason of having no warns for accidents happenning in the route.

- The danger of unsafety will not be improved with reason of having no conditions for programming resident area at two sides route.

- Conditions for passing the road are limited.

- Scale of Produciton individuals are still small and narrow, indirectly impact to economic development of the area and work creation of the residents and communes located in the area.

- Project, in order to bring bad impacts to environment of area where the route passing and methods of diminishing lowest level of these impacts. Based on those, we are able to overall remark about environment at the area where having project or no project.

Environment situation at the surveyed area is not complicated, however, in which, still occur the risk causing environmental pollution unless we seek associated remedy with stopping their growing.

REMARK

- In order to guarantee methods and environmental protection activities, safety for transportation, production and works construction with effective results, it requires to continuosly update the relative information regarding environment and methods of environmental protection are swiftly given.

Inspection Stations on the route serving for inspection of environmental matters should be set up, especially at the door of site and traffic intersection. These station are assigned to inspect and regulate the respective traffic matters, supervise activities of execution teams and residents having effects on environment. They will control transporting works of materials and waste of the Contractor, other activities as exploitation, construction which are out of management of the project but belongs to area impacted to the project.

Strictly supervise changes of environment such as: air quality, water quality, hydrography, process of erosion, sliding, slumping of surface road; follow changes of plants cover at two road sites

- In oder to facilitate traffic conditions for the project and the residents within execution, it's important to combine with the local authority in work of traffic regulation. Methods as follow: Setting up temporary road, service road for construction and using river trafficto servce for economic activities, exploitation and transportation activities of the residents on rivers aimed to limit transporting on the road. In the exploitation works, harvesting agriculture and forestry should not be concentrated on exploitation at the same time but proceed under regulation ensuring effective…

Water environment in the area. Since the road is on the left side of Ma River, and on the right side of Ma River is slope so it leads to salt water source flows from mountain side passing road into Ma River, this phenomenent is rather common. This phenomenent will cause the danger of depositted salt water source, contain components of the heavy mental….. flowing into the river that put up the risk of pollution at the downstream. Besides, living waste water and litter of the residents thereat are thrown uncontrolled on the road, the river bringing into risks of pollution for salt water, underground water and losing beautiful looking for traffic participants.

5.4. Forming informative page for every cases.

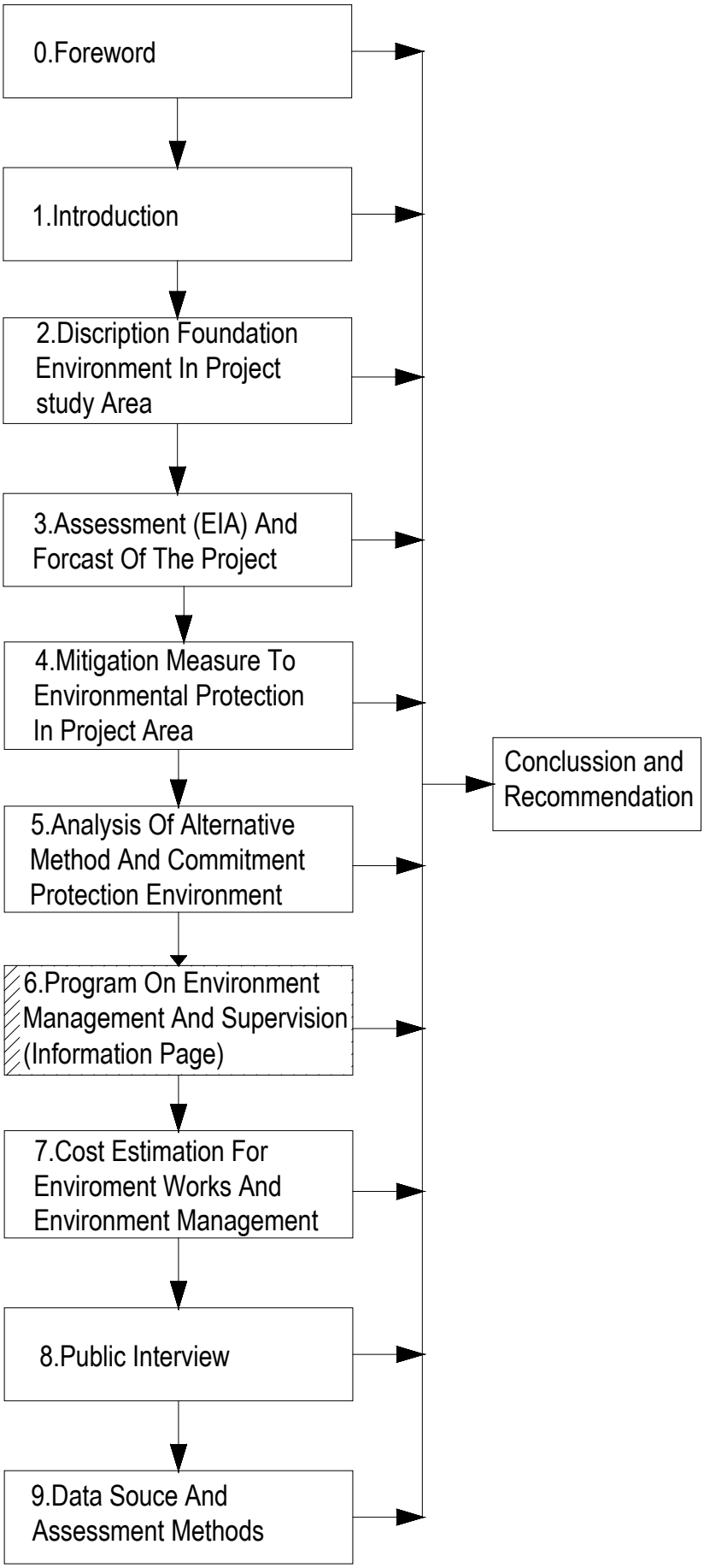
- Collecting and expressing of natural conditions, concerned environment and social matters along the road; in which emphasizes impacts caused by the road. Based on these ones to propose warning methods for limitation of bad effect on environment in the road passing area. This informative page requires to focus on much efforts and intelligence ensuring settlement of mentioned matters.

- Firstly, it should be considered to effects on construction works, especially for activities of high speed motorbike, additional problems from the execution works for living of the residents thereat, and then, consider to the captioned matters for labor forces working on the site.

- Woking teams on site must plant sign- plate and ban-plate for the area having a danger of landslide. Safety guidance for residents moving in the construction area is necessary. Wooden slab or board are used to fully cover excavted holes and plant warning-plate at night for accuracy of residents' safety moving thereat.

- It requires to receive strong support from the residents at the construction areas, creating good conditions for working teams during the execution. Land acquisition needs to be fully approved by the residents.

Chapter 6


0.Foreword
1.Introduction
2.Discription Foundation Environment In Project study Area
3.Assessment (EIA) And Forcast Of The Project
4.Mitigation Measure To Environmental Protection In Project Area
5.Analysis Of Alternative Method And Commitment Protection Environment
6.Program On Environment Management And Supervision (Information Page)
7.Cost Estimation For Enviroment Works And Environment Management
8.Public Interview
9.Data Souce And Assessment Methods
Conclussion and Recommendation

Content

CHAPTER6: PROGRAM ON ENVIRONMENT MANAGEMENT AND SUPERVISION (INFORMATION PAGE) 6-3

CHAPTER 6: PROGRAM ON ENVIRONMENT MANAGEMENT AND SUPERVISION (INFORMATION PAGE)

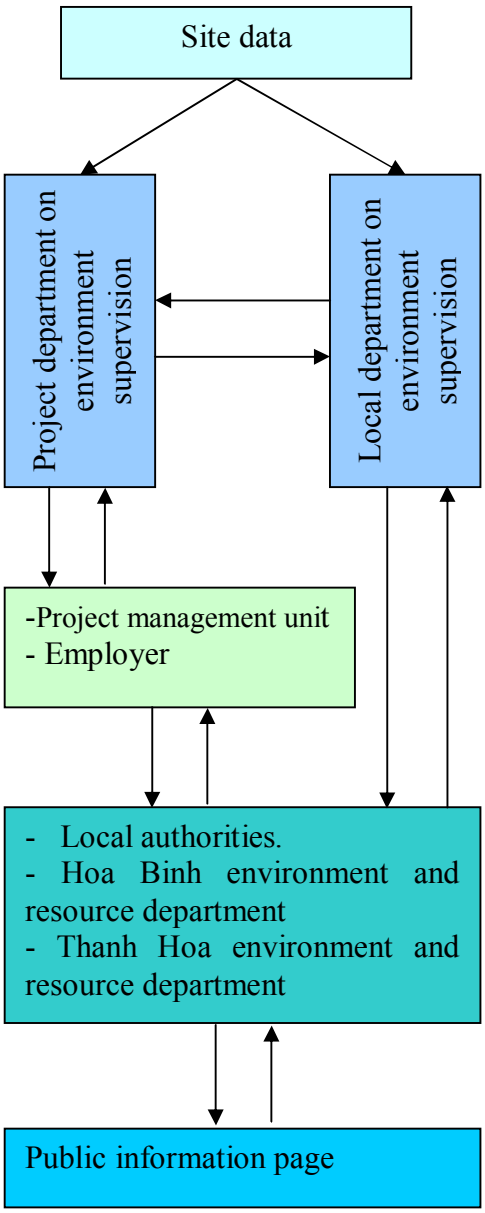
6.1. Target, strategy and implementation index of program on environment management

6.1.1. Target .

All actions in stages of project is able making effect to environment and economic – social. Although all effect type are able forecast that from varies effect maters but it's also proposal feasible solution methods to minimize the effects. The proposal methods are applied in detail design or in other stages of project as said in chapter 4.

Program on environment supervision is applied to ensure that all the impact of project including the effects said in chapter 3 and un-forecast effects will be control, the feasible feature of methods is grown up and all complaint from local social will be solve perfect. Target of program including:

- Checking the accurate of forecast and adjustment;
- Ensuring that all minimize effect methods will be carried out in stages of project and control their effects
- Finding out un-forecast effects
- Recommendation minimize effect methods to un-forecast effects



6.1.2. Strategy and implementation index of environment management program

a. Program on environment management during construction stage.

To management environment protection maters during construction stage, employer establish apartment in charge management, deploy implementation: environment – compensation, support and resettlement – settle agriculture

Tasks:

- Management on environment protection maters during construction stage such as: Management surrounding environment, waste and

prevent environment problems, implementation environment supervision during construction stage.

- Monitor the implementation of minimize effect to environment methods, environment control program of concerned parties.

- Request construction contractor commit with employer on management of their engineers, workers that no trading, store consume, transport and exploit forestry product and hunting wild animal to encroach forest resource, , strict following regulations on waste treatment, full implementation all methods to minimize passive effect in construction actions

- Receive feedback information on environment maters from construction contractors, local people, local authorities, local environment management during project implementation period.

- Consult to employer for settlement environment objects relating with project implementation process..

- Coordination with local authorities and in charge parties to quickly solve environment problems. The environment problem after to be solved, employer will inform the results of treatment to concerned parties.

- Regular report on environment protection to state department on environment protection.

b. Program on environment management during operation stage.

To management all maters on environment protection during operation stage, Trung Son hydroelectric plant management unit arrange 2 officers for environment management.

Task:

- Management on environment protection mater during operation stage such as: Management surrounding environment, management on collection and treatment waste and protect environment problem..

- Monitoring the implementation of minimize effect to environment methods, environment

Conclusion:

Strategy on environemtn need conduct synchronous from design stage to put the work in operation

- *Design stage:* Road line suitable with existing topography to minimize excavation and embankment. Avoid design road pass high slope or poor stable or near water flow. Limit passing river, stream if able

- *Construction stage:* Prevent raising more passive effect to environment. Supplying cover for material truck to prevent dust and drop material in road surface. Ensuring drainage work is sufficient to prevent water stagnate on surface and muddy road surface.

- *Operation stage:* Regular maintain and repair drainage system. Dredging sewer, ditch for their able drainge surface water

- *Social interaction:* Coordination with commune officers to grown up local knowledge for no discharge waste or domestic waste water directly to road. Domestic waste water need to collect and treatment in suitable location before discharge in to Ma river through ditch and sewer system

management program, environment supervision program of concerned parties.

- Management on using water resource.

- Management on exploiting and farming aquatic product along road side (Ma river, ponds, lakes).

- Proposal methods for prevent environment problems would be happened during operation stage: Risk of lacking water, sliding along road line …

- Collection data, supervision all the changing of environment during operation stage.

- Receive feedback information on environment maters from construction contractors, local people, local authorities, local environment management during operation stage.

- Consult trung Son hydroelectric plant management unit for settlement objects relating environment

- Inform and coordination with concerned parties and local social to quickly solve environment problems.

Photo 6-1: Domestic and breeding waste direct discharge into road

6.2. Minimize effect methods

Construction methods must be suitable with stable condition of soil foundation: Stipulating on slope during excavation and embankment; Making step in construction, supplying sheet pile to resist slope and prevent sliding.

- Meeting requirement on compaction when embankment, particular at slope side.

- Ensuring the correct operation of drainage ditch during construction, resist for prevent erosion in construction site.

- Setting regulations on waste treatment, lubricant of construction equipment, cleaning construction equipment and tool …

- Setting regulations on transportation soil, no permit drop: having cover sheet on road, clean tire when out of construction site …

During operation of road it's necessary to apply

Photo 6-2: Taking water from stream for production and domestic using

Photo 6-3: Ma river is water resource for domestic using of local people

minimize effect environment methods. Thus, it's necessary preparing plan and pay attention to minimize effect environment methods in this stage. Particular, paying attention on methods to minimize effect on air environment, noise environment and water environment.

6.3. Program on environment supervision during preparation and construction stage

6.3.1. Supervision program

Table 6.1. Annex

6.3.2. Arrange for supervision actions.

- For supervision foundation environment, employer train or recruit supervision workers, making contract with agent having sufficient ability professional to monitoring, survey and supervision environment.

- For supervision ecological environment, action relating to forestry floristic composite and wild animal system, employer is in charge of making contract local management unit to supervision ecological environment during construction stage.

6.4. Program on environment supervision during operation stage.

Photo 6-4: Taking water from mountain to tank and distribution to households.

After put the road in use and construction completion of Trung Son hydroelectric plant, operation stage count when put the road in use. In operation stage, environment impact happen in large sphere, along road line and construction on road. The impact is happening for long time, some of them is in latent status. At now, it's un-forecast. In Vietnam, the processing of monitoring and assessment the impact of road to surrounding environment may be in many.Thus, detail of program on environment supervision in operation stage as below:

6.4.1. Supervision program

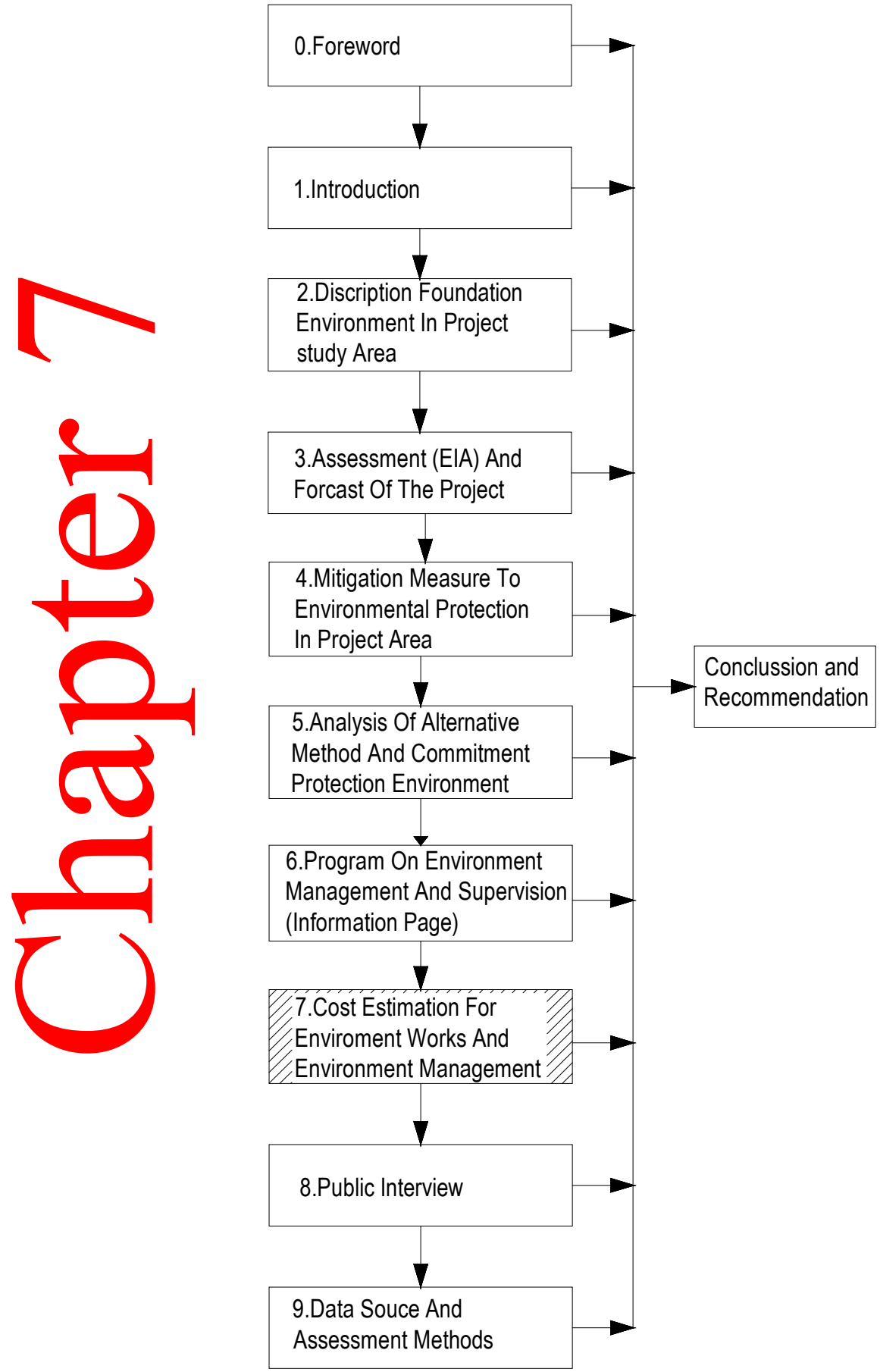
Table 6.2: Annex

6.4.2. Arrangement of supervision action

- Charge in supervision actions is Project management unit - representative of employer. The way of implementation supervision program is contract with supervision consultant and environment experts

- The cost for this action is paid by Trung Son hydroelectric management unit.

Chapter 7


0.Foreword
1.Introduction
2.Discription Foundation Environment In Project study Area
3.Assessment (EIA) And Forcast Of The Project
4.Mitigation Measure To Environmental Protection In Project Area
5.Analysis Of Alternative Method And Commitment Protection Environment
6.Program On Environment Management And Supervision (Information Page)
7.Cost Estimation For Enviroment Works And Environment Management
8.Public Interview
9.Data Souce And Assessment Methods
Conclussion and Recommendation

Content

CHAPETR 7: COST ESTIMATION ENVIRONMENT MANAGEMENT

Estimation cost here is equivalent or reference because the calculated value should be changed based on construction works grade and each works.

To ensure the recommendation on minimize environment effect methods to be followed and implemented, we have proposed program on management, treatment and supervision environment as said in chapter 4 and chapter 6. Estimation cost for treatment environment pollution works and programs on minimize effect to environment at time of preparation project investment as below:

7.1. Treatment works for environment pollution.

7.1.1. Domestic waste water treatment works.

- The cost covering for construction collection and discharge waste water system, waste water tank, biology disintegrate tank, sediment tank, disinfect tank. The cost for the above works is paid by contractor

- Cost for operation and maintain waste water treatment system is in general cost item of contractor.

7.1.2. Treatment work for construction – industry and domestic waste

a. Program on treatment construction- industry waste.

The cost covering for construction works: leveling disposal sites, excavation surrounding ditch for collection storm water, leveling and compaction disposal material. The cost for the above works is paid by contractor

b. Program on treatment domestic waste.

- Cost for construction garbage disposal site .

- Cost for treatment waste is counted in construction cost of contract package.

7.2. Cost for environment supervision

7.2.1. Cost for environment supervision in construction stage

Table 7.1. Cost for environment supervision in construction stage (temporary)

No.	Work item	Frequency	Unit (VND/1 sample)	Cost (Mill VND)
1	**Cost for supervision on waste**			
a	Cost for supervision on domestic liquid waste	4 time/year/ 2 locations * 1 year	360.000 VND/sample	2,880
2	**Cost for supervision surrounding environment**			

No.	Work item	Frequency	Unit (VND/1 sample)	Cost (Mill VND)
a	Cost for supervision air environment	4 time/year/ 10 locations * 1 year	92.000 VND/sample	1,840
b	Cost for supervision river water quality	2 time/year/ 3 locations * 1 year	350.000 VND/sample	2,100
3	**Cost for survey hydrography**			
a	Labour	12 month/ 1 location* 1 year	2.000.000 VND/month/person	24,000
b	Equipment (temporary)		10.000.000	10,000
4	**Other cost for environment supervision**			
a	Cost for supervision on Ecological environment			
	- Construction supervision station	1 year	1.000.000 đ/month	12,000
	- Labour (1 station* 3 person *1 year)		3.000.000 VND/month/person	72,000
b	Supervision on heath care and working safety			
c	Supervision compensation and support resettlement, settle agriculture			
5	**Total**			**124,820**

7.2.2. Cost for environment supervision in operation stage

Table 7.2. Cost for environment supervision in operation satage (temporary)

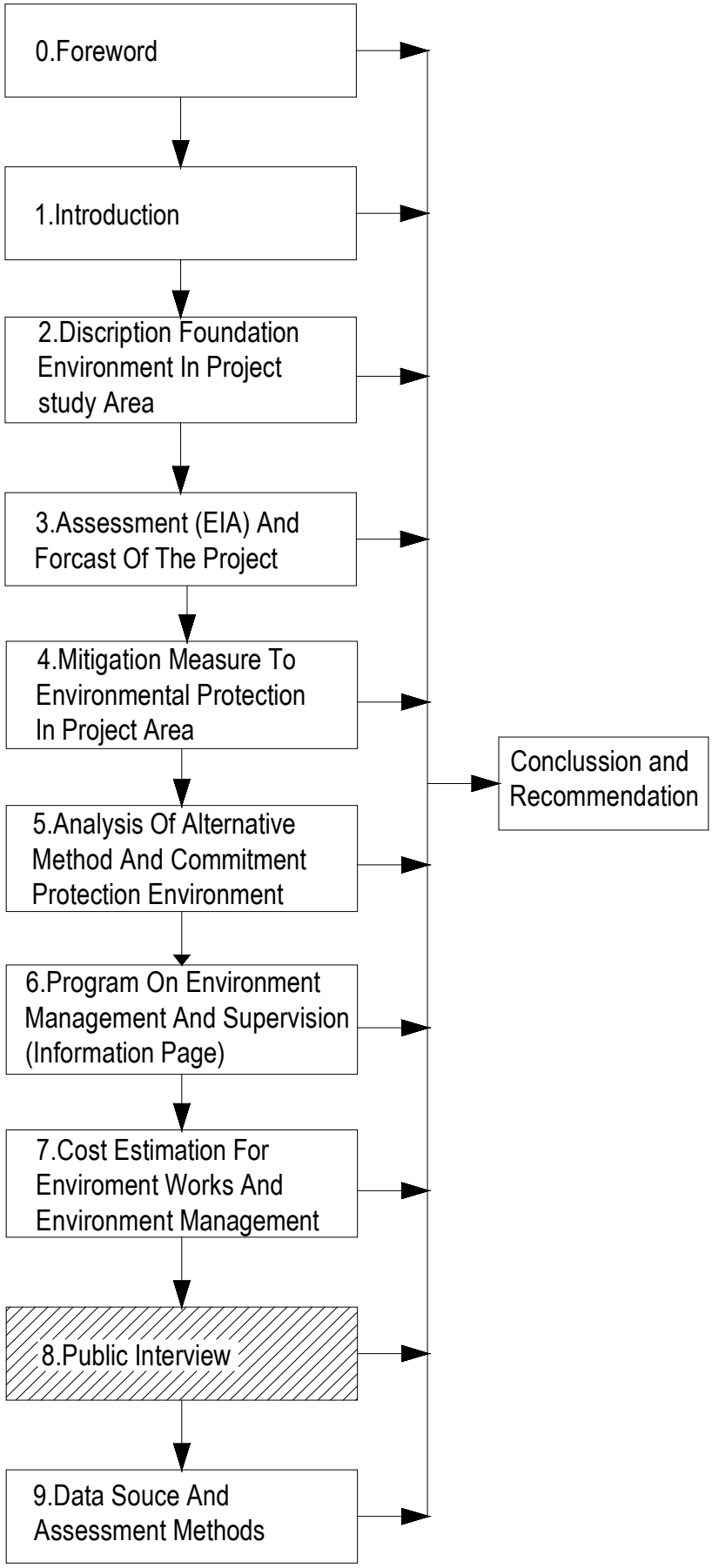
No	Work	Frequency	Unit (VND/sample)	Cost (Mill VND)	Note
1	Supervision traffic safety	1 time/year			Operation cost
2	Supervision on erosion - Survey and drawing - Assessment and report	1 time/year			Operation cost
3	cost for Supervision on Ecological and vegetation .	1 time/year* 1 year	10.000.000 VND/time	10,000	Operation cost
4	Supervision on resettlement				Operation cost
5	Supervision on hydrography water environment	2 location* 2 time/year * 1 year	350.000 VND/sample	1,400	Operation cost
6	Cost for survey hyrography and water				Operation and

	level in lower area				managem ent cost.
	Labour	2 locations *12 month * 1 years operation	2.000.000 VND/month/ person	48,000	Operation and managem ent cost.
7	Cost for collection, treatment domestic waste of worker and local people				Operation and managem ent cost.
8	**Total**			**59,400**	

Table 7.3.Cost sumary of environment work

No.	Work item	Cost (Mill VND)
1	Cost for environment supervision in construction stage	**124,820**
2	Cost for environment supervision in operation stage	**59,400**
3	**Total**	**184,220**

Chapter 8


0.Foreword
1.Introduction
2.Discription Foundation Environment In Project study Area
3.Assessment (EIA) And Forcast Of The Project
4.Mitigation Measure To Environmental Protection In Project Area
5.Analysis Of Alternative Method And Commitment Protection Environment
6.Program On Environment Management And Supervision (Information Page)
7.Cost Estimation For Enviroment Works And Environment Management
8.Public Interview
9.Data Souce And Assessment Methods
Conclussion and Recommendation

Content

CHAPTER 8: PUBLIC INTERVIEW

Figure 8-1: House near by road

Project locate in Van Mai, Mai Hich commune – Mai Chau district – Hoa Binh province, Phu Thanh, Trung Son, Thanh Son commune – Quan Hoa district – Thanh Hoa province.

Employer has taken public interview on all commune people committee and nation people committee

8.1. Purpose and methodology of public interview.

In project plan, public interview has carried out in form and to objects as following:

- Interview and direct exchange with local officer on status of economic – social, environment maters, requirements, their wish relating the project scope and implementation schedule. .

Figure 8-2: Interview on production and life

- Direct random survey and interview effected households in 5 communes along road line: Van Mai, Mai Hich, Phu Thanh, Thanh Son, Trung Son communes on relating mater such as land reclaim and environment protection of project.

- Interview and consult people committee and Nation people committee of the communes on location of project and employer's proposal environment protection methods.

8.2. Methodology of public interview.

Methodology of public interview.

- During process of assessment environment impact, there are to interview and getting comment by survey sheet to local communes people committee and people in project study area. Beside of direct interview and getting comment from local people, it's also to collect sufficient dada on population, economic, infrastructure, public heath, road construction, water level ….

Figure 8-3: Interview and consult on water level of Ma river.

- Collection data in sheet in annex part

8.3. Implementation

The road line pass 5 communes: Van Mai, Mai

Hich, Phu Thanh, Trung Son, Thanh Son. A meeting was hold with the attention of representative of 5 communes authorities and local people. In the meeting, survey party report on road construction project and operation of Trung Son hydroelectric., brief the survey result to be done; inform the benefits and passive effects of road construction. At the end of meeting survey team propagandize to local authorities and people on methods, protection measurement to passive effects.

Note:
- Propagandize *local people on acnkowledge on environment protection, none discharge domestic waste, waste water direct to road that effect environment, muddy road surface, damage to.*
- *After put the road in use, heavy vehicle will be large increat, thus, it should warning local people on the risk of traffic un safety due to action of free cattle and traffic of pupil and farming people*

8.4. Result of survey and interview.

- Survey and design consultant collected interview result of direction effected households (Survey 20 typical households in 5 communes).
- The 20 households is representative of effected household is random collection for interview.

Table 8.1: Annex

Table 8.2: Annex

Table 8.3: Annex

- Summary of interviewing comments

+ *For project:* Perfect support project implementation, wishing soon complete and put road in use to improve life of local people.

+ *Project operation:* In general, concentrating on effects in pre - construction and construction stage. Their wish the satisfactory compensation following state regulations.

Photo 8-4: Farm near road

a. In Re-construction stage

- Local people pay attention on relocation, resettlement, they wish apply suitable policy with regulation and local status.

- All agriculture households to be claimed farm land is worry on their family future . They wish getting the support on training and vocational guidance to change job when reclaimed their farm land..

b. In construction.

- Paying attention on pollution of dust, exhaust gas, water, environment and waste mater.

- Paying attention on pollution of domestic

water, irrigation and effects of social exchange along road sides..

- Paying attention on traffic in project area.

8.5. Brief the comments and recommendation of representative in interview and consult meeting

4 investigation sheets on economic – social was issued to 4 communes People committee along road line..

Photo 8-5: Truck transpoting good mainly bamboo and construction material on road.

8.5.1. Subjects.

- On project .

- Environment protection methods proposed by project.

- Requirements and recommendations of social to project.

8.5.2. Content and result of exchanges.

- *For project:* Road Co Luong – Co Me is importance traffic way for operation of Trung Son hydroelectric plant and it's also basis infrastructure for area development. Local communes people committee and nation committee perfect agreement implementation the project. .

- Local people and authorities pay attention on the impact of project operations in stage of pre-construction and construction..

a. In Pre-construction.

- All people pay attention on reclaim land of project. Local authorities and people wish the compensation and resettlement is strictly carried out following regulations and suitable local status. They also wish get support on training and advantage condition for young people having job after land occupied ..

- Project operations close relate to water system and infrastructure such as irrigation channel … and surrounding environment. Thus, local authorities request construction contractors apply methods to minimize the effects and also having warning policy to people in effect area..

b. In construction stage.

Their worry on environment effect concentrate on the following maters:

- Local authorities concern on dust, noise, exhaust gas, water pollution and traffic safety. They request to minimize the above effects particular in sensitive area such as resident, school , heath care station …

- Officers from communes people committee concern on drainage in construction stage. They wish project apply reasonable construction methods to protect the effect. They request to supply sufficient traffic signboard in construction section road. Traffic safety mater during construction is importance local people and vehicle on road..

- Communes people committee request to select reasonable location of storing construction material, worker camp. It's necessary factor to control effective construction management, work safety, protection environment particular control quality of water resource and solid waste. They also request applying reasonable methods on disposal waste, redundant construction material during construction stage..

Conclusion

In some location Trung Son hydroelectric plant access road pass residents People here mainly is Thai and Muong ethnic. The road will be effect to local people . The road also bring benefit to local people such as increase trade exchange reduce distance way and time …….Beside that it's remain passive effects to: environment tidy, traffic safety, land reclaim and compensation ... But, there is exist contrary comments on road. Thus, It's necessary taking public interview and consult to knowledge local comments, local wish. .From the comment and recommendation, it' should give perfect solutions on road construction.

8.6. Comment from project on recommendations of communes people committee and Nation committee.

Employer commit carry out environment protection following regulations as said comment of communes people committee and Nation committee. .

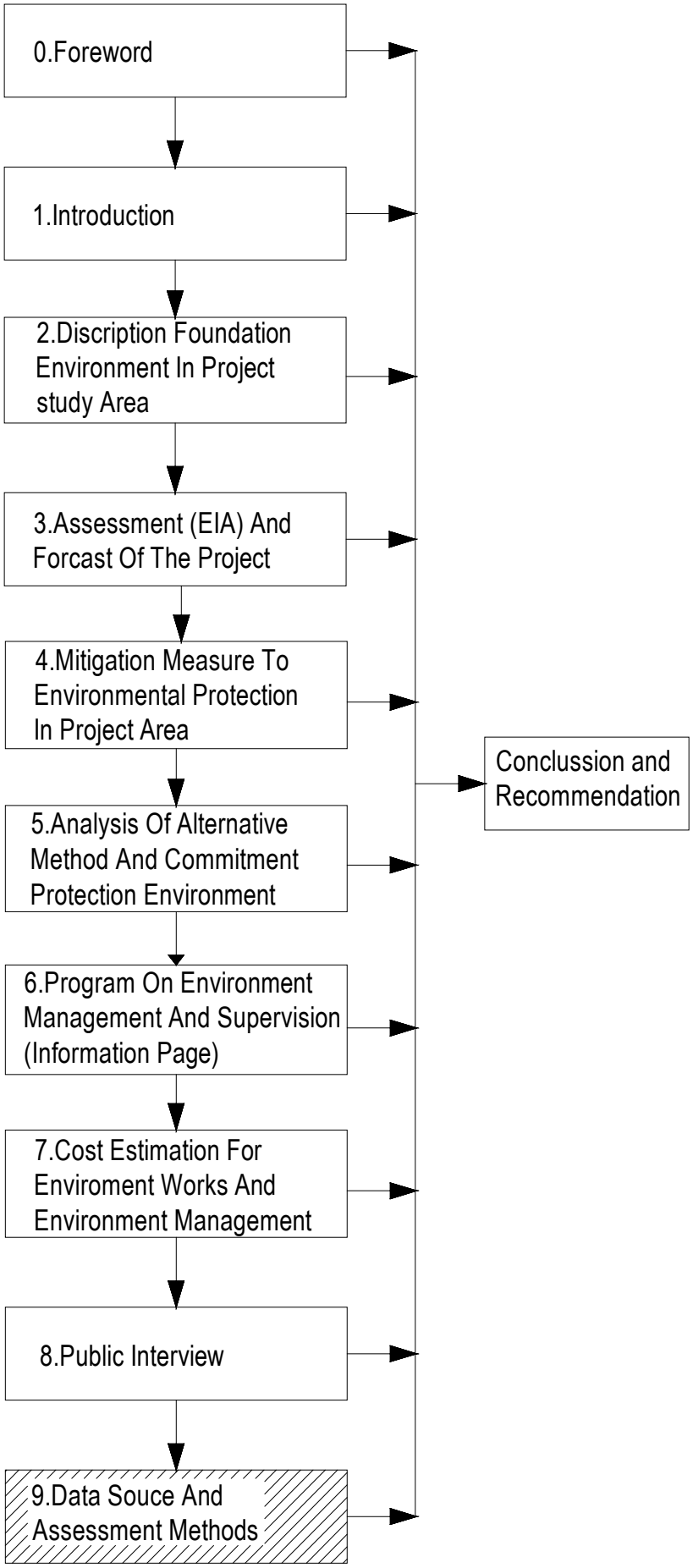
- Apply methods to Minimize passive effects to environment and residents and surrounding areas following way in report on environment impact assessment.

- Compensation, resettlement and support effected people is implemented follow state regulations

- Coordination with local authorities to solve complaint during project implementation (if any).

- Implementation strict concerned regulations said in report on environment impact assessment.

Chapter 9


0.Foreword
1.Introduction
2.Discription Foundation Environment In Project study Area
3.Assessment (EIA) And Forcast Of The Project
4.Mitigation Measure To Environmental Protection In Project Area
5.Analysis Of Alternative Method And Commitment Protection Environment
6.Program On Environment Management And Supervision (Information Page)
7.Cost Estimation For Enviroment Works And Environment Management
8.Public Interview
9.Data Souce And Assessment Methods
Conclussion and Recommendation

Content

CHAPTER 9: DATA SOUCE AND ASSESSMENT METHODS

9.1. Reference document and resource data

9.1.1. Reference document and resource data

In prossecsing of study on environment impact assessment of the project, documentations, scientific data to be used anf reference. They are as below:

- Le Van Can, 1993. Environment impact assessment: Methodlogy and experience Hanoi science publish. 1993.
- Pham Ngoc Dang, 1997. Air environment Hanoi science publish. 1997
- Ngo Quang Toan and nnk, 1999. Surface wheathered by wind and water and sediment IV in Vietnam scale 1:1000000. State Geology and mineral department, Hanoi.
- Report on environement impact of Trung Son hydroelectric plant from 2005 to now.
- Data, documentations, maps on environment factors in project area from Institute of geology and environment, Institute of geographic, Institue of bionomics and organisism resource .
- Annual publication statistics 2005-2007 in Quan Hoa district – Thanh Hoa province; Mai Chau district – Hoa Binh province .
- Collection dat on legal basis: Laws and regulations; concerning international convention on environment protection to be study to define their relation with the project and making legal basis for assessment.

9.1.2. Assessment data resource and reference documentations

Data and documentation have been collected in office and site by employer, consultant during implementation stage. It's data resource concerning to project study area to be collected and studied by authorities offices and branchs so that it's high confidence level.

Economic – social factors is time frequency features, they are always collected, updated following project implementation proccessing.

9.2. Data resource supplying by employer.

9.2.1. Reference data and resource.

- Report on environment impact of access road and construction Trung Son hydroelectric plant is preparation by Institue of environment science engineering.
- Report on reducing flood effect in lower of Ban Uon hydroelectric plant preparation by Hanoi irrigation planning institute, in 2007.
- Investigation and survey data on environment factors in project area, January – March 2008.
- Topography, geography, hydrometeorology data on access road and construction Trung Son hydroelectric plant carried out by Institue of environment science engineering in project investment satage, March 2008.
- Measurement and analysis data on water sample carried out by Institue of environment science engineering in project investment satage, March 2008.

- Documentations and data on economic – social in site survey, carried out by carried out by Institue of environment science engineering in project investment satage, March 2008.

- Result on public interview carried out by carried out by Institue of environment science engineering in project investment satage, March 2008.

- General report on Trung Son hydroelcttric plant, work item: access road and it's operation from Co luong to Co Me bridge, carried out by Transporation consultant stock company, in stage of making construction design drawings, in 2006.

- Concerning Environment data collected by Employer.

9.2.2. Assessment data and documentation from employer resource.

Resource data and documentation from employer is mainly results of survey, measurement, test, sample in the plant site and effected surrounding areas for compensation, resettlement, report on environment impact. The above data and documentation is collected and updated during project implemtation processing. Thus, the data and documetaion is high confidence and updated level..

9.3. Applying methods for assessment environment impact.

9.3.1. Applying methods.

Assessment environment impact is carried out following "Regulation on assessment environment impact in stage of preparation project feasible study and design of transportation works (22TCN 242 – 98)" and reference to "guide on environment assessment of road" from Ministry of mineral and environment. During assessment environment impact processing, 8 generallize methods to be applied, including:

- Statistic method;
- Site investigation and survey method;
- Data analysis and treatment in office;
- Quick assessment method;
- Socail investigation method;
- Comparation and confront with witness method;
- List and matrix method;
- Imitate model method.

a. Statistic method.

- *Content of method:* Using Statistic data collected from local authorities (province, district, commune), and available study documentations on nature environment and economic – social from concerned parties..

- *Method meaning*: Collection and treatment factors on hydrography, economic – social, biological … in project construction site and surrounding area.

b. Site investigation and survey method.

- *Content of method*: Based on available environment data, taking investigation anf survey at project area site..

- *Method meaning*: Updated data and survey existing environment conditions in project area.

c. Data analysis and treatment in office.

- *Content of method*: Taking sample at site and analysis laboratory test results. Comparation the results of analysis with Vietnam standards on foundation environment assessment.

- *Method meaning*: To define parameters on condition of air quality, water quality, noise level in project site and surrounding area..

d. Quick assessment method.

- *Content of method*: Based on experts experience on processing site survey.

- *Method meaning*: Premilinary assessment on the impact of project to environment factors such as; ecological environment, economic – social environment …

e. Socail investigation method.

- *Content of method*: Investigation, direct interviewing local officers on economic – social condition, waste and their requirement, wish relating to project. Investigation, direct interviewing local household to be relocation.

- *Method meaning*: Taking comment of local authorities on passive effect to environment and solution methods.

f. Comparation and confront with witness method.

- *Content of method*: Study environment happening in similar project.

- *Method meaning*: Forecast happening effects to factors such as: geography, hydrography, water quality … to works.

g. List and matrix method.

- *Content of method*: Settle matrix for effects, and value for effect to assessment and synthetize environment impact.

- *Method meaning*: Settle relation between project actions and environment impact.

h. Imitate model method.

- *Content of method*: Investigation, forecast effect of exhaust gas from construction equipment and traffic vehicle.

- *Method meaning*: Using forecast on regulation violate level on noise and exhaust gas from operation of construction equipment and traffic vehicle.

9.4. Assessment on confidence level of the methods

The methods to assess project environment impact is generalize, in which:

- Statistic method and Comparation and confront with witness method is the method to shown quantity result, accurate and confidence.

- Site investigation and survey method, Data analysis and treatment in office, and Socail investigation method to be carried out following process and norm.. Accuration is based on investigator skill, and data, information treatment. In processing of assessment environment impact, to take this task is experience engineers and semi experts. Thus, the data here is high confidence level.

- Quick assessment method and Imitate model method is quantity method to forecast waste discharge volume and sphere of. Calculation method based on the average value in years. In actual, it's few changes so that in implementation stage there need supervision and appropriate adjustment in forecast results..

- List and matrix method is semi quantity method. It's confident level based on skill of investigator and treatment … To avoid disadvantage, assessment result is collected from the analysis of expert on a mater. With the methods, result of forecast is confidence..

9.4.1. Comment on detail and confidence level of assessment.

a. Detail level of assessment.

In processing of project environment impact assessment, each feature to be effected are in sequency as below:

- To inherit previous assessment to be checked in actual..
- To Define and determine (if could do) resource of effect based on each action (or part of operation) to making effect..
- To assess based on size of effect resource, scale on space, time and sensitive of effected mater.

The assessment is not only to study on direct impact of each project action, it's also to check the accumulation impacts and indirect impact such as consequence of environment changing due to the actions. Assessment on project environment impact is in detail.

b. Confidence level of assessment.

Tool for assessment impact is said above methods. As said above, althought it's diffirent confidence level of each method, but the results is confidence. Thus, assessment of impact and their confidence level is acceptable. However, there is a few different of actual waste discharge resource (in future) and survey data it need take supervision and adjust forecast result in construction stage.

RESULT, CONCLUSION AND RECOMMENDATION

A. RESULT

1. Result of assessment on existing environment factors

- Condition of topography, weather, economic – social in project study area (See beginning part).
- Quality of water, air, noise, vibration environment in project study area (See chapter II)

Results:

Environment quality is good, it's in permission of Vietnam standard. The result is showed in table and figure following:

- Table 2.4 (see annex)
- Figure 2.1 (see annex)
- Table 2.5 (see annex)
- Figure 2.2 (see annex)
- Table 2.7 (see annex)
- Table 2.8 (see annex)
- Table 2.9 (see annex)
- Table 2.11 (see annex)
- Figure 2.3 (see annex)

- Table 2.12 (see annex)
- Figure 2.4 (see annex)
- Table 3.2 (see annex)
- Table 3.3 (see annex)
- Table 3.4 (see annex)
- Table 3.5 (see annex)
- Table 3.6 (see annex)
- Table 3.7 (see annex)

- Environment quality in project area is not bearing population pressure and requirement on economic – social.

Results:

+ environment quality is good, it's not effect o public heath, air environment quality in permission of Vietnam standard.

+ However, in some location in road line, particular where passing resident there is remain problem on domestic waste, animal shit on road that pollute environment.

- Environmetn Catastrophes: Due to topography condition of lope, stream, water chamber and near by Ma river it's often happening sweep flood

- Geography in project area is complicated including clay, sediment clay, starch … so that road bed easy changing when slope change or over flow water, obsorb.. due to rain that making deform road surface.

Result:

Erosion, sliding slope, even sliding road, damage to road surface. ..

- Water flow volume is large, hydrography regime is complex, huge sweep flood (annual happening), over flow sewer, damange and destroy construction works.

2. Result on environment impact assessment in construction stage

2.1 Forest protection

- Land using boundary of road is in nature forest, so that the task of protection nature environment (forest) is settle in state regulations on environment and local authorities.

- Uncontrol soil mineral and disposal soil is restrict; Disposal site, construction material mineral location must following local authorities and employer. After completion construction site, effected area must be restore forest floristic composition

2.2 Soil erosion and sliding

- Due to slope topography, high degree of excavation and embankment slope, the risk of sliding in these location is high (Table 2.13 List of typical sliding locations-annex)

- Applying design solution to increase stable capacity of slope such as: grassing, resist works … to minimize the effect..

- Resist slope to protect water absorb passing road bed, slope inconstruction stage .

- Ensuring drainage, reduce uneven, water on road bed, water flow along road bed in construction satge.

2.3 Erosion due to over flow water

- Resist water flow in road area such as rivulet, irrigation channel …

- Drainage aperture is sufficience and supplying protection method for sediment of mud, sand and flow maters.
- Ensuring drainage during construction period.

2.4 Appropriate excavation and embankment during construction stage

- In construction stage, excavation and embankment work must be full done and meet requirements:
  + Requirement on compaction
  + No making stagnant during construction
  + Construction sphere is tidy and not effect to other construction areas

2.5 Transportaion of construction material

- No drop material during transportation
- Traffic safety
- Using equipment and vehicle meet requirements on noise, vibration and exhaust gas.
- Having cover when transportation material
- Transport waste to disposal site

2.6 Environment pollution

- Minimize on pollution on air, vibration and exhaust gas of construction equipment and vehicle (Minimize pollution mehtods)
- Minimize on pollution of soil environment (minimize pollution mehtods)
- Minimize on pollution of surface water (Minimize pollution mehtods)
- Minimize on pollution of underground water (Minimize pollution mehtods)

2.7 Traffic safety

- Traffic safety during construction period
- Applying safety methods for vehicle on road

2.8 Land scape

- Applying appropriate methods that's not effect to surrounding environment
- Minimize effect on nature environment and landscape

3. Result on environment impact assessment in operation stage

3.1 Environment pollution due to dust and toxic gas

- Applying protect methods to limit pollution of dust and toxic (Minimize pollution mehtods)

3.2 Pollution of Vibration, noise soil and water

- Applying methods to minimize the said above pollutions (Minimize pollution mehtods)

3.3 Erosion and sliding

- Regular maintain and repair drainage works and other resist works (Minimize pollution mehtods)

3.4 Traffic accident

- Appropriate design solution on signboard system and protection works (Minimize pollution mehtods)

Table 9.1. Effect level on environment

Effect actions on environment	Assessment of impaction				Negative effect	Solve methods
	None effect	Effect level				
		Small	Middle			
A. Effect due to location of project						
1. Aesthetic reduce	X					
2. Effect to ecological		X				
3. Resettlement	X				If not well in compensation and resettlement there is raising conflict between concerned parties	Coordination with local authorities on studying local people wishing to give sensible policy
B. Existing environment factors						
1. Water environment quality						
1.1 Surface water		X			Pollution surface water	Taking methods to protection surface water quality
1.2 Underground water		X			Pollution underground water	Taking methods to protection underground water quality
2. Air environment quality	X				Damage to heath of public and construction workers	Taking sensible environment protection methods
3. Vibration environment quality		X			Damage to heath of public and construction workers	Minimize vibration resource
4. Noise environment quality		X			Damage to heath of public and construction workers	Minimize noise resource
5. Soil environment quality		X			Unstable of slope and soil surface	Taking protection method to negative effect to soil environment

6. Living environment in resident	X				Effect to heath of resident in project area	Taking method to ensure living quality of local people
7. Effect to slope and structure of slope		X			Unstable existing slopes, un-safety of work, increate construction cost	Strict following slope and soil surface stable methods
8. Effect to hydrography						
8.1 Hydrography regime		X			Changing of hyrography regime	Minimize effect to hyrography regime in project area
8.2 Flood water flow		X			Destroy work, damage to resident area	Regular to monitor of rain and flood processing
8.3 Surface overflow	X				Effect to water quality resource in project area	Taking protection methods to prevent over flow water passing road.
8.4 Erosion		X			Unstable existing slopes, un-safety of work, increate construction cost	Strict following slope and soil surface stable methods
8.5 Sliding		X			Unstable existing slopes, un-safety of work, increate construction cost	Strict following slope and soil surface stable methods
C. Effect in project preparation stage						
1. Survey and design stage						
1.1 Settle road line to appropriate with existing topography			X		If settle un-appropriate road line, it raising the volume of excavation, embankment and destroy nature environment	Following the principal of settle road line in hill and mountain area, meet all technical requirements and prevent destroy nature environment
1.2 Appropriate			X			

design solutions						
a, Appropriate excavation and embankment volume		X			Destroy nature environment	Having appropriate design solutions
b, Maximum using excavation to embankment			X		To prevent excess soil	Having appropriate plan in construction and soil transportation
c, Adequate drainage work		X			If un-sufficient of drainage able, it effect and damage to construction work and production actions of local people	Having appropriate design solution to ensure discharge able in rain reason
d, Appropriate design solutions on road line must fit to development plan in project area			X		Effect to living life of local people along road sides	Design solutions is harmonious and suitable with landscape and resident along road sides
D. Effect in construction stage						
1. Effect to local traffic		X			Traffic jam	Taking traffic safety during construction period
2. Safety of work during construction period			X		Damage to heath of public and construction workers	Strict following work safety methods
3. Pollution of soil, air, surface water, underground water, noise, vibration .. environment		X			Damage to heath of public and construction workers	Using standard construction equipment and having appropriate equipment operation plan during construction period

4. Landscape		X			Effect to landscape and floristic composition ..	Taking appropriate method to limit effect to surrounding area
5. Erosion and sliding		X			Unstable existing slopes, un-safety of work, increate construction cost	Strict follow construction sequence and having appropriate resist methods
E. Effect in operation stage						
1. Air Pollution due to dust and toxic gas		X			Effect to heath and un-safety in traffic	Taking methods to prevent pollution due to dust and toxic gas
2. Erosion, sliding		X			Traffic un-safety, effect to construction life and quality of construction work	Frequency repair and maintain, particular on drainage works and resist works
3. Traffic accident		X			Effect to heath and obstacle traffic	Design solutions road signal board and supply sufficient protection woks

B. CONCLUSSION

After study and assess the effect of construction work to environment factors, we have as following conclusions:

- Access road and Trung Son hydroelectric plant line along Ma river passing 5 communes: Van Mai, Mai Hich commune– Mai Chau district – Hoa Binh province; Phu Thanh, Thanh Son and Trung Son – Quan Hoa district – Thanh Hoa province.

- In stage of project preparation, construction and operation, access road to Trung Son hydroelectric will make some effect to nature environment, economic – social in the area. The effect including passive and positive

a. Passive effects including:

- Land occupation effect to land using, assets: When project implementation, many type of land will be coocupy for sonstruction works, resident, settle agriculture .. to effect land budget and assets on land., effect to income of local people (particular agriculture and forestry land). Occupied land and assets will be compensation following state regulations and local people wishness, that having reference comment from local authorities and effected people.

- Local people life will be disorder during construction period. Road construction will be direct effect to local people life. Households will be relocation. It's huge impact to

economic – social environment, relating state ethnic policies. Thus, it's need to preparation a detail plan on compensation, resettlement, settle agriculture and putting implementation in right way to create advantage condition for local people for development production, upgrade living life and soon stabilize their life after project put in use..

- For animal, vegestigation, ecological environment and forest features

The concenltration of huge construction workers it's not only to complex and disorder culture – social and security of local area but it's also impact to forestry resource, ecological surrounding environment, and conserve, protection of forest due to forest destroy, exploit and illegal hunting, particular impact of construction work to foresty resource..

In general, animal type, multiform of biological in this area is not high.. In reclaim area, there 2 valuable plants: China-root and texture wood. They are plant haing large emplitute ecological (Range distribute large, distribution in unflood area) so that the impact is not large. However to minimize effect to ecological environment, repairing the risk of covering layer, it's recommendation forest planting for reclaim area. Restrict exploiting, take all out of project reclaim land.

Due to place near construction site, noise (traffic vehicle during road construction and operation) It's huge effect to wild animal in reserve and surrounding forest. Thus, wild animal will be replace far way construction site to high mountain and calm for livin g.

Applying minimize methods in chapter 4, the impact will be huge reducing. The impact will be treat after satble of resettlement, settle agriculture and complete construction, put the road in use.

- To meet requirement on construction work, a large equipment will be mobilize to the site. Existing condition of road in area is soil road, equipment is heavy so that it will happen destroy road foundation, sink and increat muddy of road in rain reason and effect to traffic of local people..

- To meet the requirement, road from CO Me – Co Luong connection nation road No. 15 is upgraded. It's one way road to connection with nation No. 15, thus during construction period, it's must ensure safety, heath and traffic of the road.. Detail methods is said in chapter 4.

- Foundation environment will be impact during construction period. Construction actions will be making noise, exhaust gas, domestic waste water, lubricant, disposal material. However, when strictly applying minimize methods, the level of impact will be deep reduce, the effect only in partial, mainly in construction site, resettlement area, settle agriculture, mine and road line Co Me – Co Luong. So that the impact to be assessed is low..

- In first period, water quality change in passive way due to disintegrate of living mass. It's unable protection effect when construction. Existing condition of covering layer of road line is rice, plant forest abd small area of poor nature forest. In which, agriculture tree, planting forest (bamboo, bead tree, texture wood) was taken all before road construction..

- Passive effect mainly happen in construction site, preparation and operation satge. Thus, it need pay attention of concerned parties and local authorities.

b. Possitive impacts:

- When put the road in use, it's not only for the purpose of construction and operation of Trung Son hydroelectric plant, but it's also to improve traffic, development economic – social..
- Increating production activity of local people.
- Water and soil environment surrounding road line will be improved, if construction contractor strict following environment protection methods in project.
- Relocation apart of population out of forest planting is also limit destroy forest, hunting and protection valuable animal in 2 sides of road..
- When road put in use, the advantage for development life in project area, such as: exchange economic – culture with other place, electrical, domestic water will be supply to each house.…

The phere of positive impact is large, it's not only in project area but it's also for economic of general area and nation for long time.

After assessment and forecast the environment impact when construction the road, we realize that passive impacts is high but the positive impact is gain upper hand. It's synthetic benefit on social and economic (ensure source of income in all aspects).

Methods to minimized environment impact, commit to implementation methods for minimized environment impact and supervision program is said in chapter 4, 5, 6, 7 will be carried out by the coporation of employer, construction constrctor, local authorities and concerned parties following resgulations

In brief:

We realize that if implementation methods for minimize environment impact , management grogram, supervision program in right way, the positive impact of construction work to nature environment as well as economic – social will be get high level, large phere and long time. On other hand, on the point of harmonious combination between environment protection and requirement on traffic for trading, production and life of local people as well as nation economic development, the construction of access road to Trung Son hydroelectric plant is necessary and soon implementation.

Passive impacts is hard to give minimize methods because it's exceeding the ablity of employer:

- Noise of construction equipment and exploding mine in construction area, stone mine during construction satge..
- Population control in construction site in construction stage.
- Reduce alluvium volume in lower Ma river due to the effect of project.

C. RECOMMENDATION

- Ministry of resource and environment, and World bank pay attention on checking and approvement the report on environment impact of the construction work for employer carry out the next step in project implementation plan.

- Local authorities: Thanh Hoa and Hoa Binh provinces, communes and districts in project area and concerned parties attent and assist employer, contractor in population control. .

- Local authorities make advantage condition for employer to carry out compensation, resettlement, settle agriculture program so that effected household soon satble their life and programs on supervision and control environment of project.