

# Initial Environmental and Social Examination Report – Annex A-2

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## Proposed Loan and Administration of Loans Da Nhim - Ham Thuan - Da Mi Hydro Power Joint Stock Company Floating Solar Energy Project (Viet Nam)

Prepared by ERM for Asian Development bank (ADB) and Da Nhim - Ham Thuan - Da Mi Hydro Power Joint Stock Company

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**LIST OF CODE**

FSR	: Feasibility Study Report
BOD <sub>5</sub>	: Biochemical Oxygen Demand at 20 degree within 5 days
MOIT	: Ministry of Industry and Trade
MOLISA	: Ministry of Labor, Invalids and Social Affairs
MOF	: Ministry of Finance
MONRE	: Ministry of Natural Resources and Environment
EP	: Environmental Protection
COD	: Chemistry Oxygen Demand
SR	: Socialist Republic
GOV	: Government
DW	: Dangerous waste
SW	: Solid waste
DO	: Dissolved oxygen concentration
EIA	: Environmental Impact Assessment
EVN	: Vietnam Electric
EVN SPC	: Southern Power Corporation
IEC	: International Electrotechnical Commission
Socio-economic	: Socio-economic
kV	: kilovolts
Transformer	: Transformer
Decree	: Decree
LOC	: Line of connection
TPP	: Thermal power plants
PP	: Power Plant
Weight	: Weight
FPF	: Fire prevention and fighting
EM	: Equipment and material
TRVN	: Vietnamese Technical Regulations
Decision	: Decision
PM	: Project Management
EM	: Environmental Management
DONRE	: Department of Natural Resources and Environment
DOT	: Department of Traffic
FS	: Floating solids
Substation	: Substation
VNS	: Vietnamese Standard
CS	: Construction Standard
THC	: Total Hydrocarbons
NRE	: Natural Resources and Environment
Country	: Country

Circulars : Circulars  
FFC : Fatherland Front Committee  
PC : People's Committee  
VNĐ : Vietnam dong  
WHO : World Health Organization

## **INTRODUCTION**

### **1. PROJECT DESCRIPTION**

#### **1.1. Summary of origin, the birth of the Project**

In order to meet the commitments of the Prime Minister in the 21st meeting of the Parties to the United Nations Framework Convention on Climate Change (COP21) in November 2015, Decision No. 2068/QĐ-TTg dated November 25, 2015 of the Prime Minister approving the development strategy of renewable energy of Vietnam by 2030 with a vision to 2050 and Decision No. 428/QĐ-TTg dated 18 March 2016, the approval of revisions to the national power development plan from 2011 to 2020 with visions extended to 2030. Decision No. 974/QĐ-BCT dated March 22, 2017 of Ministry of Industry and Trade approving the adjustment and supplement of the power development plan of Binh Thuan province in 2011-2015, with a vision to 2020. Decision No. 11/2017/QĐ-TTg of the Prime Minister dated 11 April 2017 on the mechanism for encouragement of the development of solar power projects in Vietnam. This will take the total capacity of solar power from a negligible level to about 850MW by 2020, about 4,000MW by 2025 and about 12,000MW by 2030. Therefore, the investment in the construction of power plants using renewable energy in general, solar energy in particular in the current period is absolutely urgent for the sustainable development of electricity power for the country.

In order to meet the growth rates for the period 2016-2020 and in the later stages and avoid a shortage of electricity in the dry season, electrical systems must increase their power and grid capacity to meet the load demand in the following years of Binh Thuan province and neighboring provinces.

The advantages of using clean energy to produce electricity are excluded greenhouse gas emissions and environmental pollution. Therefore solar power plants in Da Mi hydropower reservoir, Binh Thuan province is suitable project with the policy of Binh Thuan province on socio-economic development in association with environmental protection

Solar power is a clean energy, cost of power production does not fluctuate according to the price of input fuels as other forms of energy. With endless resources, solar power contributes to ensuring energy security for local and country in the following stage. According to the result of capacity balance, local power supply is not enough to meet the demand of Binh Thuan province in the period up to 2030. The solar power plant at Da Mi hydro power reservoir, Binh Thuan province will be constructed to supply significant electricity resource during the time of consuming load of the day.

With the features aboved, the investment of the solar power plant at Da Mi hydro power reservoir using less land resources with a capacity of 47,5MW is suitable with the current development trend, aim to supply power and meet the increasing demand of Binh Thuan province's load, contribute to stabilize the national power system and energy security.

## **1.2. The competent authority for approval for feasibility research report**

The project of "floating solar power plant in Da Mi hydropower reservoir, Binh Thuan province" is a new construction project. Project was approved by Da Nhim - Ham Thuan - Da Mi Hydro Power Joint Stock Company (according to Article 60 of Construction Law No. 50/2014).

Pursuant to Section 28, Appendix 2 of the Government's Decree No. 18/2015 / ND-CP dated February 14, 2015 on the regulations on environmental protection planning, strategic environmental assessment, impact environmental assessment and commitment to environmental protection; Project is under the group of projects on electronics, energy and radioactivity (part of the project on construction of power transmission lines of 110 kV or higher), thus it's necessary to make EIA reports and submit them to the People's Committee of Binh Thuan province for appraisal and approval (according to Article 14 of Decree 18/2015 / ND-CP).

## **1.3. Relationship of the project with the development plan of the local**

The project of "floating solar power plant in Da Mi hydropower reservoir, Binh Thuan province" is created in compliance with the local's policies as the followings:

- Electricity Law No. 28/2004/QH11 dated December 14, 2014 of National Assembly;
- Law No 24/2012/QH13 dated November 20, 2012, amending and supplementing a number of articles of the Electricity Law;
- Construction Law No. 50/2014/QH13 dated June 18, 2014 of the National Assembly;
- Law on Environmental Protection No. 55/2014/QH13 dated June 23, 2014 of the National Assembly;
- Investment Law No. 67/2014/QH13 dated November 26, 2014 of the National Assembly;
- Decision No. 428/QD-TTg dated March 18, 2016 of the Prime Minister approving the adjustment of the National Electricity Development Plan for 2011-2020 with a vision to 2030;
- Decision No. 2068/QD-TTg dated November 25, 2015 of the Prime Minister approving Vietnam's renewable energy development strategy up to 2030 with a vision to 2050;
- Decree No.137/2013/ND-CP dated October 21, 2013 of the Government detailing the implementation of a number of articles of the Electricity Law and the Law amending and supplementing a number of articles of the Electricity Law;
- Decree No. 59/2015/ ND-CP dated June 18, 2015 of the Government on management of construction investment projects;
- Ordinance No. 32/2001/PL-UBTVQH10 of April 4, 2001 of the National Assembly Standing Committee on the exploitation and protection of irrigation works;

- Circular No. 39/2015 / TT-BCT dated November 18, 2015 of the Ministry of Industry and Trade regulating the power distribution system;
- Decision No. 974/QĐ-BCT dated March 22, 2007 of the Ministry of Industry and Trade approving the adjustment and supplement of the power development planning of Binh Thuan province in 2011-2015 with a vision to 2020;
- Decision No. 11/04/2017 of the Prime Minister on mechanisms to encourage the development of solar power projects in Vietnam;
- Contract No. 322/TĐHD-PECC4 dated March 08, 2017 between Da Nhim - Ham Thuan - Da Mi Hydroelectric Joint Stock Company and Power Engineering Consulting Joint Stock Company No. 4 on making feasibility study report for the project of floating solar power plant in Da Mi hydropower reservoir, Binh Thuan province;
- Contract No. 26/TĐHD-PECC4 dated February 14, 2017 between Da Nhim - Ham Thuan - Da Mi Hydroelectric Joint Stock Company and Power Engineering Consulting Joint Stock Company No. 4 on preparation of environmental impact assessment report for the project of floating solar power plant in Da Mi hydropower reservoir, Binh Thuan province.

## **2. LEGAL AND TECHNICAL MEASURES OF IMPLEMENTATION OF ENVIRONMENTAL IMPACT ASSESSMENT PROCESS**

### **2.1. Legal documents, standards and technical guidelines on the environment for the basement of the implementation of EIA and EIA report of the project.**

#### **a) Legal documents**

- Law on Environmental Protection No. 55/2014/QH13 approval by the National Assembly of the Socialist Republic of Vietnam at its 6th session on July 23, 2014 and taking effect on January 1, 2015;
- Law on water resources No. 17/2012/QH13 approval by the XIII<sup>th</sup> National Assembly of the Socialist Republic of Vietnam at term XIII at its 3<sup>rd</sup> session on June 21, 2012;
- Law on Electricity No. 28/2004/QH11 approval by the XI<sup>th</sup> National Assembly of the Socialist Republic of Vietnam at its 6<sup>th</sup> session on December 3<sup>rd</sup>, 2004;
- Law No 24/2012/QH13 dated November 20, 2012 approval by the National Assembly on amending and supplementing a number of articles of the Electricity Law No. 28/2004/QH11
- Law on land No. 45/2013/QH13 approval by the XIII<sup>th</sup> National Assembly of the Socialist Republic of Vietnam at its 6<sup>th</sup> session dated November 29, 2013, taking effect on July 1, 2014;
- Decree No. 46/2015/NĐ-CP dated May 12<sup>th</sup>, 2015 approval by National Assembly on quality management and maintenance of construction works
- Decree No. 59/2015/NĐ-CP dated June 18, 2015 approval by National Assembly on project management of construction investment;

- The construction law No. 50/2014/QH13 approval by National Assembly dated June 18, 2014 and taking effect on January 1, 2015

- Law on fire prevention and fighting No. 27/2001/QH10 approval by the X<sup>th</sup> National Assembly at its 9<sup>th</sup> session dated June 29, 2001.

- Law No. 40/2013/QH13 on amending and supplementing a number of articles of law on fire prevention and fighting approval by the XIII<sup>th</sup> National Assembly at its 6<sup>th</sup> session dated November 22, 2003 ;

- Decree No. 18/2015/ND-CP dated February 14, 2015 approval by the National Assembly on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection plans

- Decree No. 179/2013/NĐ-CP dated November 14, 2013 approval by the National Assembly on the sanction of administrative violations in the domain of environmental protection.

- Decree No. 43/2014/ND-CP dated May 15, 2014 approval by the National Assembly detailing the implementation of a number of articles of the land law;

- Decree No. 47/2014/ND-CP dated May 15, 2014 approval by the National Assembly regulating on compensation, support and resettlement upon land expropriation by the state;

- Decesion No. 08/2015/QĐ-UBND dated March 2, 2015 approval by Binh Thuan People Committee regulating on compensation, support and resettlement upon land expropriation by the state;

- Decesion No. 05/2015/QĐ-UBND dated February 13, 2015 approval by Binh Thuan People Committee regulating on principles and unit price of compensation for property damage upon land expropriation by the state for construction in Binh Thuan;

- Decree No. 14/2014 / ND-CP dated February 26, 2014 approval by the Government detailing the implementation of the Electricity Law on Electricity Safety

- Decree No. 38/2015/ND-CP dated April 24, 2015 approval by the Government on waste and scrap management;

- Decree No. 134/2013/ND-CP dated October 17, 2013 approval by the Government stipulating sanctions against administrative violations in the field of electricity, hydropower dam safety, efficiency energy use and energy-saving use;

- Decree No. 79/2014/ND-CP dated July 31, 2014 of the Government detailing the implementation of a number of articles of the Law on fire prevention and fighting and the Law amending and supplementing a number of articles of the Law on fire prevention and fighting.

- Circular No. 27/2015/TT-BTNMT, dated May 29, 2015 of the Ministry of Natural Resources and Environment detailing a number of articles of Decree No. 18/2015/ND-CP dated February 14, 2015 of the Government on the regulations on environmental protection planning, strategic environmental assessment, environmental impact assessment and environmental protection commitments.

- Circular No. 31/2014/TT-BCT dated October 2, 2014 approval by the Ministry of Industry and Trade regulating some details on electrical safety.
- Circular No. 36/2015/TT-BTNMT dated June 30, 2015 of the Ministry of Natural Resources and Environment on dangerous waste management.

#### **b) Standards**

- Promulgating Labor hygiene standards attached to Decision No. 3733//2002/QD-BYT dated October 10, 2002
- QCVN 05:2013/BTNMT - National Technical Regulation on Ambient Air Quality.
- QCVN 26:2010/BTNMT - National Technical Regulation on Noise.
- QCVN 03-MT:2015/BTNMT - National Technical Regulation on the allowable limits of heavy metals in the soils
- QCVN 09-MT:2015/BTNMT - National Technical Regulation on Ground water Quality.
- QCVN 08-MT:2015/BTNMT - National Technical Regulation on Surface Water Quality
- QCVN 14:2008/BTNMT - National Technical Regulation on Domestic Wastewater.

#### **2.2. Documents related to the project**

- Decision No. 974/QD-BCT dated March 22, 2017 of MOIT approving the adjustment and supplement of the power development planning of Binh Thuan province in stage of 2011-2015 with a vision to 2020.
- Contract No. 322/TDHD-PECC4 dated March 08, 2017 between Da Nhim - Ham Thuan - Da Mi Hydroelectric Joint Stock Company and Power Engineering Consulting Joint Stock Company No. 4 on making feasibility study report for the project of floating solar power plant in Da Mi hydropower reservoir, Binh Thuan province;
- Contract No. 26/TDHD-PECC4 dated February 14, 2017 between Da Nhim - Ham Thuan - Da Mi Hydroelectric Joint Stock Company and Power Engineering Consulting Joint Stock Company No. 4 on preparation of environmental impact assessment report for the project of floating solar power plant in Da Mi hydropower reservoir, Binh Thuan province.

#### **2.3. Sources of data and data generated by the project's owner are used in the EIA process**

- Explanation of Feasibility Study Report for the project "Solar power plant in Da Mi hydro Power reservoir, Binh Thuan province" was published by PECC4 in May 2017.
- Explanation of basic design "Solar power plant in Da Mi hydro Power reservoir, Binh Thuan province" was published by PECC4 in May 2017
- The survey report was prepared by Power Engineering Consulting Joint Stock Company 4 in March 2017
- The survey data on environmental, residential and economic factors in the project area was conducted in February 2017.

- Results of measurement and analysis of environmental samples of the project area in April 2017

### 3. ORGANIZATION OF IMPLEMENTATION OF ENVIRONMENTAL IMPACT ASSESSMENT

#### 3.1. To organize the elaboration of EIA report

- Collecting documents related to the project area, researching all options for implementing environmental surveys in the field.

- Carrying out field surveys on natural environmental factors (water environment, air environment, land environment) and social environment of the project area.

- Studying subjects and making report on environmental impact assessment .

The EIA report of solar power plant in Da Mi Hydro Power reservoir was conducted by Da Nhim - Ham Thuan - Da Mi Hydro Power Joint Stock Company with the supporting from the consulting agency of PECC4

Consulting agency: **Power Engineering Consultant Joint Stock Company 4**

Representative authority: Mr. Pham Minh Son - General Director

Address: No.11 Hoang Hoa Tham Street - Nha Trang City - Khanh Hoa Province

Tel: 02583.563.999; Fax: 02583.563.888.

Email: [tv4@pecc4.vn](mailto:tv4@pecc4.vn)

#### 3.2. Participants in preparing EIA reports

List of participants in preparing EIA reports of the project

No	Name	Specialized	Role	Signature
<b>A</b>	<b>The Employer:</b> Da Nhim Ham Thuan Da Mi Hydro Power Joint Stock Company			
1	Mr. Do Minh Loc		Deputy Director General	
2	Mr. Tran Duc Trong	Mechanical Engineer	Deputy Department of Construction and Investment	
3	Mr. Vu Duc Trieu	Construction engineer	Monitor	
<b>B</b>	<b>Consultant:</b> Power Engineering Consulting J.S. Company 4			
<b>List of major reporters</b>				
1	Mr. Nguyen Quang Trung	Master of Electrical Engineering	Manager of FSR	
2	Mr. Nguyen Khac Tuan	Hydrology – Environment Engineer	Major reporters	
3	Mr. Nguyen Huy Han	Hydrology – Environment Engineer	Editor of FSR	
4	Nguyen Van Thanh	Technical-Environmental engineer	Reporter	
<b>List of participants in the report</b>				

No	Name	Specialized	Role	Signature
1	Mr. To Dang Hai Hoang	Environmental Physics Engineer	In charge of sampling location map	
2	Mr. Ngo Sach Chinh	Master of Agriculture	Assessment of biodiversity	
3	Mr. Pham Hong Thai	Meteorology - Hydrology – Oceanography engineer	Assessment of the background environment	
4	Mrs. Pham Th Thanh Nhan	Meteorology - Hydrology – Oceanography engineer	Assessment of soil, water, air impact environmental	
5	Mr. Phan Van Luan	Hydrological engineer	Community consultation	

#### 4. METHODS APPLIED IN THE ENVIRONMENTAL IMPACT ASSESSMENT

In the process of analyzing, forecasting, evaluating and making impact assessment reports for the project, the following methods shall be applied.

##### 4.1. Methods of EIA

- *Preliminary Assessment Method:* With the experts's experiences during the field survey, preliminary assessment shall be conducted to some environmental factors such as ecological environment, vegetation cover status, animals; Socio-economic situation; the status of the air environment, water environment, ...

Based on the pollution coefficient proposed by the World Health Organization (WHO), this will be applied in the assessment process of the pollutant load from the project activities.

- *Comparison Method:* Based on the results of measurements for background environment in site, the analysis results of laboratory criteria and theoretical calculations compared with the National Technical Regulation on the environment to evaluate the quality of the background environment in construction area of the project

- *Expert method:* The report has the participation of specialists in meteorological and hydrographic environment, geography, landscape ecology, hydrology and environment, environmental technology, natural resources school,...

- *Experimental calculation method:* Using the experimental formulas of local authors, foreign authors, WHO, etc., to calculate the emission of gases, dust and noise causing air pollution; Forecasting the amount of wastewater, waste generated; Forecasting the change in water quality, ...

- *Listing method:* indicating the environmental impacts caused by project construction and operation; the minimize methods of impacts from the project, ...

##### 4.2. Other methods

- Field survey method: survey of the present status of the natural environment, socio-economic; survey, preliminary determination of damage caused by the project

- *Field collection method* : coordinating with the specialized agency - the Research Center for Environmental Technology and Services to carry out the measurement, collection of water, air and soil samples

- Inheritance method: The socio-economic data collected at the local authority of the commune or district where the project is located

- Statistical methods: Data collection and analysis of natural conditions (meteorology, hydrology, topography, geology ...) and socio-economic survey data collected during the process of collecting data from local authorities. local people, ... to determine the current status of the natural environment and socio-economic conditions in the project area.

- *Method of community consultation*: During the preparation of the EIA report, the Consultant Unit coordinated with the Employer have conducted community consultations to the content of the report on environmental impact assessment of the project " solar plant in Da Mi hydro power reservoir, Binh Thuan province " in accordance with Circular 27/2015/TT-BTNMT.

## **Chapter 1**

### **DESCRIPTION OF THE PROJECT SUMMARY**

#### **1.1. NAME OF THE PROJECT**

**“Solar plant in Da Mi hydro power reservoir, Binh Thuan province”**

#### **1.2. THE EMPLOYER**

The Employer: Da Nhim - Ham Thuan - Da Mi Hydro Power Joint Stock Company

Headquater: No.80A - Tran Phu Street - Loc Son Ward - Bao Loc City - Lam Dong

Tel: 0263.3728717

Representative: Mr. Le Van Quang

Position: Director General

#### **1.3. LOCATION OF THE PROJECT**

The project "Solar power plant in Da Mi hydro power reservoir, Binh Thuan province" is loacted in La Ngau commune, Tanh Linh district and La Da commune, Da Mi commune, Ham Thuan Bac district including main items as the follows:

##### **a) Location of solar power plant**

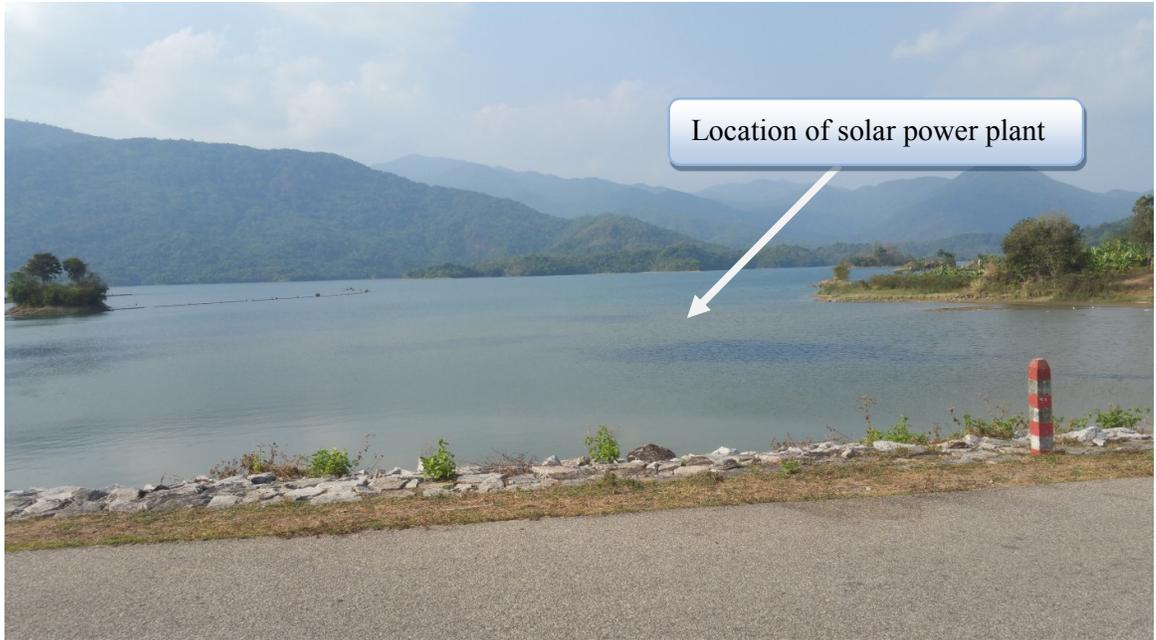
The floating solar power plant shall be installed at the Da Mi hydro power reservoir in La Ngau commune, Tanh Linh district, Binh Thuan province. Factory area's geographical location as the follows:

North : Bordered by shore of Da Mi hydro power reservoir;

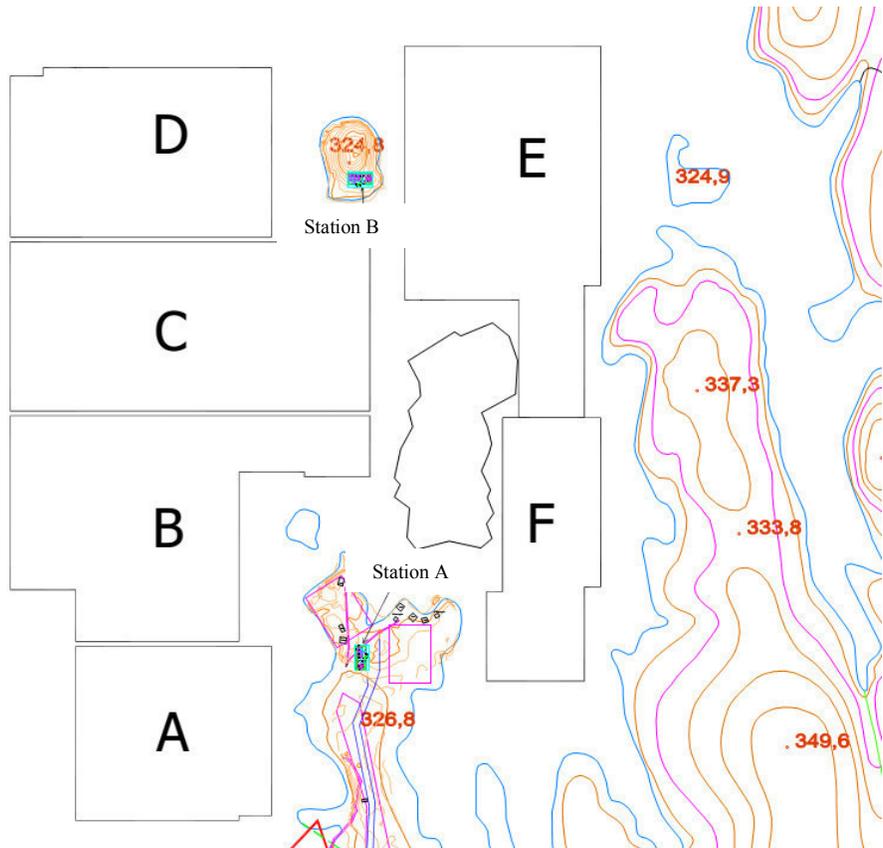
South : Bordered by shore of Da Mi hydro power reservoir;

West : Bordered by Tam Long Da Mi Joint Stock Company;

East : Bordered by shore of Da Mi hydro power reservoir.



Pic 1: The area where the solar power plant is located on the surface of the hydro power reservoir



Pic 2: Partitioning PV module array

Table 1.1: Plant location coordinates

(Coordinate system VN 2000 Binh Thuan with 3 degrees of meridian projection, axis 108°30')

Point	Coordinate VN2000 – meridian projection 3°- axis 108°30		Coordinates WGS84 - zone 48	
	X	Y	X	Y
<b>PV module array A</b>				
A1	1243977	428029	1245286	810488
A2	1243977	428278	1245289	810738
A3	1243677	428278	1244989	810741
A4	1243677	428029	1244986	810492
<b>PV module array B</b>				
B1	1244200	427946	1245135	810309
B2	1244200	428403	1245140	810767
B3	1244122	428403	1245062	810768
B4	1244122	428278	1245434	810736
B5	1243983	428278	1245295	810737
B6	1243983	427946	1245291	810405
<b>PV module array C</b>				
C1	1244422	427946	1245357	810307
C2	1244422	428403	1245362	810764
C3	1244206	428403	1245146	810767
C4	1244206	427946	1245141	810309
<b>PV module array D</b>				
D1	1244644	427946	1245579	810304
D2	1244644	428320	1245957	810772
D3	1244428	428320	1245741	810774
D4	1244428	427946	1245363	810307
<b>PV module array E</b>				
E1	1244634	428448	1245575	810807
E2	1244634	428696	1245578	811055
E3	1244347	428697	1245664	811153
E4	1244347	428676	1245664	811132
E5	1244198	428676	1245141	811040
E6	1244198	428593	1245140	810957
E7	1244348	428593	1245290	810955
E8	1244348	428448	1245289	810810
<b>PV module array F</b>				
F1	1244198	428572	1245140	810936
F2	1244198	428697	1245142	811061
F3	1243982	428697	1244925	811064
F4	1243982	428676	1244925	811043
F5	1243832	428676	1244775	811044
F6	1243832	428552	1244774	810920
F7	1243975	428551	1245290	811011

Point	Coordinate VN2000 – meridian projection 3 <sup>0</sup> - axis 108 <sup>0</sup> 30		Coordinates WGS84 - zone 48	
	X	Y	X	Y
F8	1243975	428572	1245291	811032

(Explanning on the feasibility study report of the Project published by PECC4 in May/2017)

In which:

- Zone A, B and F (PV modules): connect to inverter A station, total area of floating installation about 18,7 ha and inverter A station with 0,25 ha area.

- Zone C, D and E (PV modules): connect to inverter B station, total area of floating installation about 26,2 ha, inverter station B with 0,1 ha area.

The coordinate of the inverter stations is shown in the following table:

Table 1.2: The coordinate of the inverter station

(Coordinate system VN 2000 Binh Thuan with 3 degrees of meridian projection, axis 108030')

Point	Coordinate VN2000 – meridian projection 3 <sup>0</sup> - axis 108 <sup>0</sup> 30		Coordinates WGS84 - zone 48	
	X	Y	X	Y
<b>inverter A station</b>				
IA1	1243907	428385	1244847	810752
IA2	1243907	428402	1244847	810769
IA3	1243875	428402	1244815	810770
IA4	1243875	428385	1244815	810753
<b>inverter B station</b>				
IB1	1244511	428375	1245451	810735
IB2	1244511	428407	1245451	810767
IB3	1244492	428407	1245432	810767
IB4	1244492	428375	1245432	810735

(Explanning on the feasibility study report of the Project published by PECC4 in May/2017)

#### b) Location of 110kV substation

The 110kV substation with area of 0,5ha is expected to locate in the shore of Da Mi hydro power reservoir in La Ngau commune, Tanh Linh distric, Binh Thuan province. Geographic coordinate are shown as the follows:

Table 1.3: Coordinate of substation location

(Coordinate system VN 2000 Binh Thuan with 3 degrees of meridian projection, axis 108<sup>0</sup>30')

<b>Table of the project coordinate</b>
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Point	Coordinate VN2000 - meridian projection 3 <sup>0</sup> - axis 108 <sup>0</sup> 30		Coordinate WGS84 - zone 48	
	X	Y	X	Y
<b>22/110kV substation</b>				
T1	1243368	428415	1244308	810789
T2	1243323	428460	1244263	810834
T3	1243293	428429	1244233	810804
T4	1243338	428384	1244277	810758

(Thuyết minh NCKT dự án do TVĐ4 lập tháng 5/2017)

### c) Wireline

Wireline of 110kV is described as follow:

- Voltage level : 110kV
- Number of circuit : 02 circuits
- Start point: Wire at the column of 24-25, belonged to line of 110kV Ham Thuan - Duc Linh.
- End point: Busbar 110kV of the 110kV inverter station A of Da Mi solar power plant.
- Length of route: 3.331m (option).
- Wire: Wire of ACSR 185/29
- Anti-lightning wire: All routes shall have 02 anti-lightning wires with type of GSW-50.

Table 1.4: Coordinate of wireline location 110kV

(Coordinate system VN 2000 Binh Thuan with 3 degrees of meridian projection, axis 108<sup>0</sup>30')

Coordinate list of <b>110kV line</b>				
Point	Coordinate VN2000 - meridian projection 3 <sup>0</sup> – axis 108 <sup>0</sup> 30		Coordinate WGS84 - zone 48	
	X	Y	X	Y
ĐĐ	1244128	431587	1245480	814048
G1	1244212	430351	1245175	812716
M1	1243799	429502	1244752	811871
ĐC	1243292	428460	1244232	810835

(Explanning on the feasibility study report of the Project published by PECC4 in May/2017)

Table 1.5 Description of the project “Solar power plant in Da Mi hydro power reservoir, Binh Thuan province”

No	Substation /Route	Substation area/Length of route	Description of route/ substation	Geographical conditions	Land use status	Loaction of substation / line passing through
1	Plant	44,9ha	Lay on Da Mi's surface water	Surface water	Surface water	La Ngau Commune, Tanh Linh Distric (approved the land use for DHD's energy project)
2	Inverter station A; B	0,35ha	Shore of Da Mi Hydro Power	Topographic is relatively flat	Land of old trees (Station A)	La Ngau Commune, Tanh Linh Distric (approved the land use for DHD's energy project)
3	Substation	0,5ha	Shore of Da Mi Hydro Power	Topographic is relatively flat	Land of old trees (soil for planting)	La Ngau Commune, Tanh Linh Distric (approved the land use for DHD's energy project)
4	Line section of 110kV	Length of 3.331m (5,25ha)	Start from substation, the line route shall pass through the land with old trees of the local then connect to line of 110kV Ham Thuan - Duc Linh	Topographic is relatively flat	Land for planting old trees	La Ngau Commune, Tanh Linh Distric (approved the land use for DHD's energy project)
5	Line section of 22kV	0,55ha	Start from inverter station A to substation of 110kV. 2/3 (380m). the line route shall pass through the land with old trees of the local, 1/3 of this line	Topographic is relatively flat	Land of old trees	La Ngau Commune, Tanh Linh Distric (approved the land use for DHD's energy project)

No	Substation /Route	Substation area/Length of route	Description of route/ substation	Geographical conditions	Land use status	Loaction of substation / line passing through
			(about 170m) was belonged to the land granted for DHD			

## 1.4. SCOPE OF THE PROJECT

### 1.4.1. Goal of the Project

The project of solar power plant in Da Mi hydro power reservoir, Binh Thuan province is invested with the following specific objectives:

- The project of solar plant in Da Mi hydro power reservoir in Binh Thuan province was aimed at the addition of a clean energy for National electricity system, meet to demand for electricity network in generall and Binh Thuan Province in particurlar
- The other goal of the Project shall be one of the first solar projects in Viet Nam, contribute to develop clean energy from solar. This complies already with the development trend of the government, MOIT and EVN.

### 1.4.2. Volume and size of the project

#### 1.4.2.1. Volume and size of the main items

##### a) Application Technology

The plant shall apply the technology of PV module panels installed on the surface of Da Mi hydro power, use inverter center to convert DC into AC, upon transformers to upgrade to the 0.4 / 22kV and 22 /110kV for connection with the electrical system

##### b) Size of capacity

Table 1.6: Size of plant capacity

No	Categories	Total capacity
I	Solar power plant	47,5 MW
1	PV module pannel 72 cell - 330Wp	47,5 MW
2	Inverter station A	
2.1	Inverter 2.500 kW	17,5 MW
2.2	Booster transformer 0,6/22kV - 2.500kVA	17,5 MVA
3	Inverter station B	
3.1	Inverter 2.500 kW	25 MW
3.2	Booster transformer 0,6/22kV - 2.500kVA	25 MVA
II	Substation 22/110kV	63MVA
1	Boosting voltage transformer 22/110kV - 63MVA	63 MVA

*(Explanning on the feasibility study report of the Project published by PECC4 in May/2017)*

**c) Diagram of main electrical connection**

- Inverter station A và B:
  - + Side of 0,4kV: 3 inverters shall be connected to 1 transformer of 0,4/22kV which have 3 low voltage rolls.
  - + Side of 22kV: With diagram of one busbar has segment using indoor cabinets of 22kV, each station has two outbounds of 22kV connecting to substation of 110kV
- Substation of 110kV:
  - + Side of 22kV: With diagram of one busbar has segment using indoor cabinets of 22kV that include 4 outbounds of 22kV connected from inverter station A and B.
  - + Side 110kV: Using the diagram of “H-missing” and having capability for a transformer expansion in the future.

**d) Protection Control System**

- Control System shall be controlled by computer control system for remote controll
- Monitoring Control system, SCADA includes PLC programm controllers, LAN controllers, control computers, data base computers, uninterruptible power supplies
- The substation protection system uses digital relays with the IEC61850 protocol to connect to computers and SCA systems.

**e) Telecommunications information system, operation mode**

- The plant is equipped with a STM-1 optical communication system, which is configured as a terminal connecting the plant information to the A2 (national) power level regulation (A0) via the connecting point of Ham Thuan hydro power plant,
- The telecommunication system supports the transmission of SCADA data of the plant, transmits the measured data of commercial electricity to the Southern Electricity Corporation.
- Cable transmission line using the internal information cable of Ham Thuan - Da Mi plant is set in the self-powered supply line of Da Mi plant and used ADSL fiber optic cable on the self-powered supply line of 22kV of solar plant. The length of connection is about 0.4km
- The information system is equipped with a self-powered supply of DC 48V.

**f) Self-powered system**

- AC power system: The Plant uses 02 self-powered transformers of 22/0,4kV-250kVA that shall receive power from distribution system of 22kV of station and local grid of 22kV.
- DC power system: 02 sets of battery named Nikem-Cadmi (NiCd) with the voltage of 220VDC and the volume of 200Ah/5h shall be used

**k) Grounding system against lightning**

- Grounding system uses pile - bar system, combined with grounding well. Grounding piles are galvanized steel piles with  $\Phi 22$  and length of 3m; grounding wires are galvanized steel wire with  $\Phi 14$ . Using of chemicals to reduce soil resistivity for grounding nets and wells.

- Direct anti-lightning uses lightning collecting needles arranged on bus bar columns and independent lightning rods.

- Anti-lightning spreader uses valve lightning installed at the inlet and outlet of the power train.

**h) Lighting system**

- Indoor and outdoor lighting system use the LEDs which have time settings via the PLC to automatically turn on at night and off during the day

**1.4.2.2. Volume and size of auxiliary items**

**a) Device gathering yard**

- Laying out at the planning location of 110kV substation with 1,2 ha area (belonged to DHD Company's which are not mentioned in Table 1.4) with ground leveled to make a solar collector in compliance with conditions of monolithic cargo boxes and standards of sea transport batteries and floats from the gathering yard to the combined yard

**b) Device combined yard**

- Due to laying out the total surface of solar power plant on both sides of the main floating bridge, 2 combined yards at the two sides shall be convenient to move arrays from the combined yard to the definite location on lake

- It is expected that two combined yards at the two sides of Inverter station A, with the area of 60x40m will be constructed as sloping floors to move the PV module array from land into water. (The boundary of the lake is excluded in the table. 1.4).

- The floor of combined yard is expected to be concrete of M200 that is sufficient to bear the load of vehicle and folk lift

**c) Electricity and water for construction**

**- Water resource for construction:**

+ Water supply: During construction of the Project, water resource used for living life and fire prevention work shall be pumped from Da Mi lake (the amount of water for using is not significant)

+ Outlet of water: rain water drains in the sloping direction of the surface station then flows directly into the water intake around the station and flows in the d system of the existing Da Mi Hydropower Plant

- Construction electricity: the power supplying line is expected to be connected to the local 22kV line at the road folks of the Da Mi spillway

### **1.4.3. Methods of construction organization, technology construction of construction items project**

#### ***1.4.3.1. Main construction solutions***

##### ***1.4.3.1.1. Construction solution of float system, floating bridge, anchoring***

###### **a) Float system and the bearing frame of PV module**

The float system for PV solar is a pre-cast float:

- Precast float which is made of HDPE (High Density Polyethylene) plastic molded material is molded by mold. The float system is popular in the world and is required to import. The main components of this floating include:

- + The main float for PV module installation
- + The subsidiary float for motorway of installation and connection to the main float

- The advantages of this float are simple construction, easy installation without lots of accessories, short time for installation, less correction requirements. This type of float is precast by material of HDPE which is suitable for environment often used in solar power projects with the large capacity in the world.

###### ***a1) Requirements for floor bearing system, working platform***

- The structure of the anti-brace system will be designed to withstand the load itself, the load of the equipment, the wind load, the impact of the flow... In addition, the structure of this system must be complied to connect to PV module panels and connect to other parts

- Material of anti-brace system, bearing frame: Beside the selection of traditional materials such as aluminum and steel is considered, the design will consider optimum selection of the latest materials and must be able to withstand all the impact loads, corrosive by the impact of the environment

###### ***a2) Requirements for float system***

- The float system is designed with floating capability to ensure the lifting of all types of impact loads, including the load itself. The dry side height of static load and distribution activities shall not be less than 250mm in case of static load; the height of the dry side shall not be less than 50 mm in the most dangerous case

- The selected shapes must be ensured stability, reduced pressure caused by flow and wind.

- The structure of the float must be able to withstand all loads including static load and impact load: structural weight, wind load, flow effect, distributed activity, others focus ...

- Material: Besides the selection of traditional materials is plastic of HDPE, the design will consider optimum selection of the latest materials and must be able to withstand all the impact loads, corrosive by the impact of the environment. In addition, available materials in the market will be considered for using to reduce costs.

### **b) Floating bridge system**

- Solar power plant shall be installed in the Da Mi hydro power reservoir with high capacity, the impacts of the flow and wind waves and the structure of the floats themselves can not bear the force to hold the whole floats. So it is necessary to design the floating bridge system for anchoring the big PV module arrays stable under the impacts of wave, wind and flow.

- Floating bridge is used as a motorway for the operation, maintenance, repairing and the corridor for connecting electrical cables

- Requirements/tasks of type no.1 of floating bridges: The floating bridge has the main task of anchoring stable PV module arrays stable under the impacts of wind, wave and flow that force to shore anchors and bottom anchor

- The type No.1 of floating bridge is 3m wide, including cable corridor at both sides

- The function of type no.2 of floating bridge has also the same as no.1 which used as a motorway for the operation, maintenance, repairing and the corridor for connecting electrical cables. However, the connection between Inverter A and Inverter B has the cable volume on the floating bridge larger than the type no. 1 so it must be 4.5m wide including cable corridor at both sides.

#### **Requirements for the floating bridge system**

- The floating bridge system is designed to ensure to lift all types of impact loads, including the load itself during operation. The dry side height of static load and distribution activities shall not be less than 250mm in case of static load; the height of the dry side shall not be less than 50 mm in the most dangerous case.

- The selected shape of float must be ensured stability, reduced pressure caused by flow and wind.

- Material: Besides the selection of traditional materials is plastic of HDPE, fiber glass... the design will consider optimum selection of the latest materials and must be able to withstand all the impact loads, corrosive by the impact of the environment. In addition, available materials in the market will be considered for using to reduce costs.

### **b) Anchoring system**

Anchoring system includes: Bottom anchoring and shore anchoring.

- Bottom anchoring system: Each PV module is be around by floating bridge and connected by the bottom anchoring This includes anchoring wire, anchoring block of M200 reinforced concrete (pre-casting) or other connection method to connect to the bottom lake (each bottom anchoring includes about 3 blocks in which each block has a reinforced concrete block B15 (M200) precasted with the demension of 2,5 x 2,5 x 0,6m), top of anchoring cable shall be connected to floating bridge system to ensure the construction and operation stage stably in the future. Distance between anchoring line (anchoring point) shall be from 10m to 15m in compliance with the demension of each module in the area of insatllled PV pannel. All bottom anchoring system are must be ensured to keep PV module stable during the Project

- Shore anchoring system: For location of nearby PV module, they will be designed to anchor the shoreline. This includes anchoring blocks of B15 (M200) reinforced concrete which is anchored in non-submerged locations near the area of system of PV module panels. The advantages of shore anchoring systems are little construction volume, easy construction as well as simple operation. Therefore, the maximum arrangement of the shore anchoring system or the combination of bottom anchoring and shore anchoring system is very necessary to reduce the cost of construction, improve the efficiency of the project.

#### **1.4.3.1.2. Solution of substation and inverter station**

##### **a) Solution of ground clearing**

- The area of transformer station and inverter station is located in highland area, not flooded. The surface of the land is mainly ruins and the weathering products of the granite include clay, macadam clay. The elevation ranges from + 332 m to + 344 m (system of VN 2000)

- The working of ground clearing is mainly based on the balance of soil excavation and filling in place and considered to the possibility of connecting roads from outside to the station.

- On the basis of ground excavation volume and the ability of connecting roads in the station to the outside, the proposed elevation of scraping shall be as the follows:

- Substation : + 342,5m

- Inverter station A : + 327m

- Inverter station B : + 329m

##### **b) Outdoor structure solution**

- Bus bar foundation, foundation bearing device: Using single foundation made of reinforced concrete which are dumped in

- Foundation of transformer: Installing transformer of 22/110kV-63MVA.

- Beam, column, pier bearing device: Hot-dipped galvanized steel and **BTLT** columns, welding joints and bolts.

##### **c) Water supply and drainage system**

- Water supply: During the construction process, water for daily life and in case of fire prevention shall be pumped from Da Mi reservoir (the amount of water used is negligible).

- Water drainage system: Rain water drains in the direction of the slope of the station, flows directly into the water intake around the station and the drainage system of the existing Da Mi hydro power plant. For work of fire prevention, water tanks, sandbanks, foamers, CO2 containers and hand tools such as ladders, buckets, shovels ... should be equipped to protect indoor and outdoor appliances

##### **d) House for operation manager and inverter station**

The house for operation manager includes the control room and a 22kV single-floor distribution room with a floor space of 12x20 m, and a ceiling height of 3.6m. The main

force-bearing structure is reinforced by a reinforced concrete frame.

- Inverter station A consists of inverter, transformer of medium voltage and 22kV cabinet with single-floor, size of (17x32) m, height to the ceiling of 3.6m. The main force-bearing structure is reinforced by a reinforced concrete frame.

- Inverter station B consists of inverter, transformer of medium voltage and 22kV cabinet with single-floor, size of (20x32) m, height to the ceiling of 3.6m. The main force-bearing structure is reinforced by a reinforced concrete frame.

**e) Motorway in the station**

- Motorways in the station have the top face of concrete B20 (M250), 2x4 stone with thickness up to 20cm, the next layer is rocks and macadams, the bottom is compacted soil. The road slopes to two sides with the slope of 2%. There are two types of roads with width of 3.5m and 4m, the road edge is made of concrete B10, 1x2 longitudinal stone

**f) Oil tank for accident**

- Oil tank with the volume of 36 m<sup>3</sup>, size of (4x5) m is made of reinforced concrete marking B15 (M200), with lid. At the bottom of the tank, there are oil pipelines. The tank shall be built under the ground, surrounded by a layer of macadam, the tank wall shall be arranged with steel steps

**k) Force cable drain and control cable drain**

- There are two types of force cable drain including crossing type and no crossing type with the width of 1.1m. This is made of concrete B12,5 (M150) with the lid, bottom of the drain shall slope towards the water hole

- There are two types of control cable drain including indoor and outdoor, the different widths of the drain are 0.6m 0.9m and 1.1m. control cable drain is made of concrete B12,5 (M150), top cover), bottom of the drain shall slope towards the water hole

**1.4.3.2. Construction organization**

**1.4.3.2.1. Site organization**

**a) Equipment gathering yard**

- Placed at the planning site of 110kV transformer station with area of 1.2 hectares, set up to be solar gathering area in the condition of monolithic cargo box in compliance with sea transport standards.

- Forklifts, pickup trucks that transport PV modules, floats from the solar gathering area to the complex

**b) Equipment complex yard**

- Due to the layout of the solar power plant on the two sides of the main floating bridge so it is necessary to arrange two complex yards at both sides to transfer PV module arrays easily from the complex yard to the location of definite point on lake.

- It is expected that two complex yards at both sides of inverter station A, which is 60x40m area, will be constructed as a sloping floor to move the arrays from land to water.

- Equipped by concrete flooring, M200 is sufficiently loaded with truck for equipment transportation, forklifts for working.

**c) Construction motorway on land**

- Construction motorway shall be on the route (when the Project finishes) from the gathering yard to the inverter station A. After completion of construction, this way will be improved to be the operation way.

**d) Construction motorway on the lake**

- Construction motorway on the lake is expected to be used to transport electrical equipment installed at Inverter station B from the temporary pier on the east of the spillway to the receiving pier next to the inverter station B on the island.

- Expected vehicles for transportation are barges with a floating possibility of no less than 25 tons, a barge width of 8 meters and a width of 20 meters for traffic.

**e) 22kV power supply line for construction**

- The power supply line is expected to connect the existing 22kV line that is next to the project area

**1.4.3.2.2. Major construction options**

**a) Construction of floating bridge**

- A floating bridge is used for the purpose of anchoring a large array of PV module and also as motorway for installation. The main floating bridge has an important task to anchor all of the solar arrays. The main floating bridge is anchored by the double anchored bulkhead abutments located in the inverter station A and B

- Construction option of anchored bulkhead abutments at two heads of the main floating bridge:

+ 01 on the shore of the start point of inverter station A - PHC pile structure with reinforced concrete

+ 01 on the shore of the start point of inverter station B - abutment structure with reinforced concrete, combined with equipment receiving floor

+ Installation of floats, supporting frame by segment of steel cable length

+ Positioning 2 heads cable of anchored abutment;

+ Alignment of length, tension of cable

+ Positioning the floating bridge with other anchor points at the bottom of lake and semi-flooded area

+ Installation of motorfloor, cables installation corridor on both sides of the floating bridge

+ Arrangement of the total surface of the anchor shown in the drawing of the floating bridge and the anchor

+ The construction method of floating bridges is similar to main floating bridges

in which the volume of holding cable is used less and bottom anchoring float is mainly

**b) Construction plan of the bottom anchor**

- The floating bridges are identified with the number of bottom anchoring, the expected bottom anchoring points based on the lake map in the flat position, good anchorage stability
- In construction stage, the contractor shall use the navigation, special devices of depth measuring to re-determine the actual conditions and record the lake map in narrow spaces in order to accurately determine the position of the anchor.
- It is planned to use the barge to anchor in a decided position, put the anchor blocks, check the position;
- Connect the cable to the float, check the load stability after placing the anchor block
- Install auxiliary floating bridges;
- Connect the anchor cable of the bottom anchor to the cable cable of auxiliary floating bridge;
- Align bottom anchor cable;
- Install motorway for auxiliary floating bridges.

**1.4.4. Production technology, operation**

Now, there are two main types of solar technology: concentrated solar power (CSP) and photovoltaic (PV) module. Basically, CSP uses solar energy to heat steam to turn turbines as the principle of thermal power plants. PV solar technology uses solar radiation energy to generate electricity based on the photovoltaic effect

CSP solar power plant is necessary to have many auxiliary systems attached. The direct composition of the solar power source can only be used. Therefore, the installation capacity is limited. Meanwhile, PV solar plant with simple technology, easy installation conditions and suitable for different places should be widely developed

The scope of the project of solar power plant in Da Mi hydro power reservoir in Binh Thuan province shall generate directly electricity to the national grid with a large capacity. PV solar technology and direct grid connection shall be only used without storage.

Explanation of photovoltaic (PV) technology:

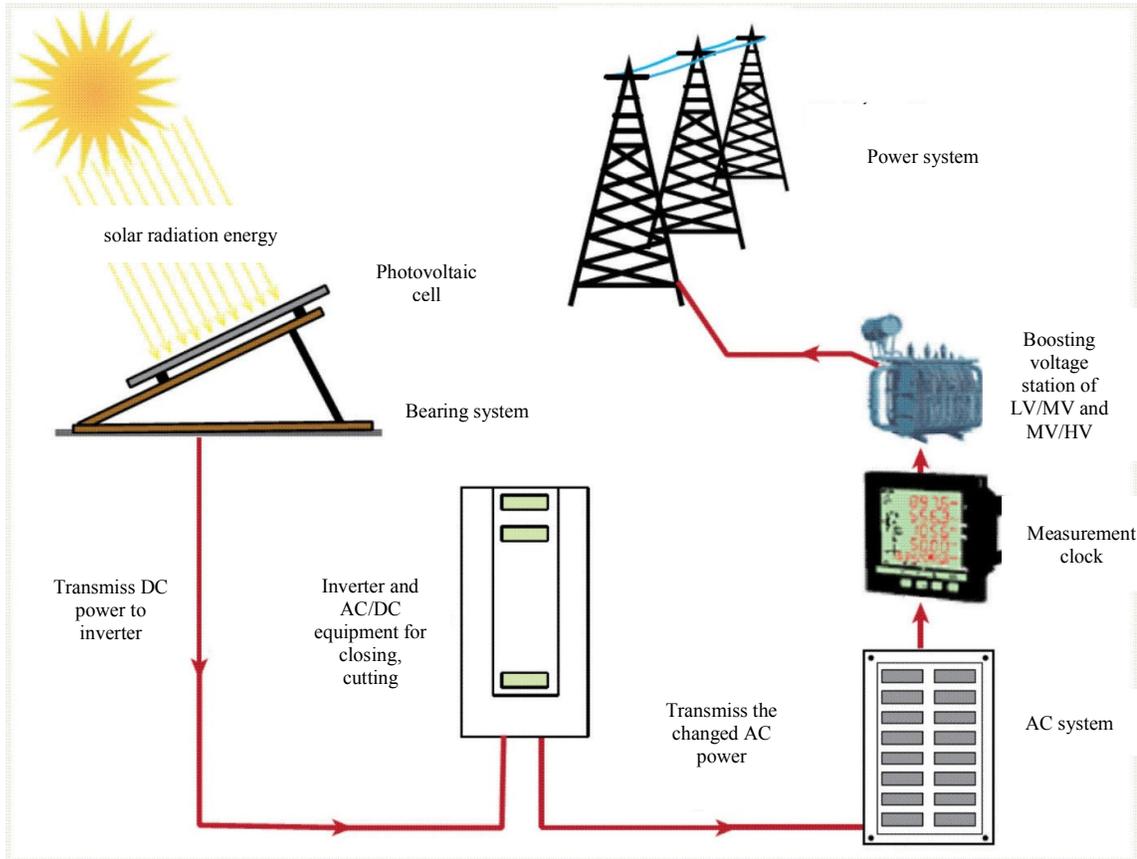


Table 3: Overview of solar photovoltaic power plants

- PV module: is a component that converts directly solar radiation into DC electricity through a photovoltaic effect with a completely clean process and does not require moving components such as ordinary rotary power. Each photovoltaic pannel consist of several photovoltaic cells connected to each other. Photovoltaic panels are connected to string and parallel to the array to achieve the requirements DC output power
- Inverter: is a power electronic device that converts DC current into AC current suitably for connecting to the grid.
- Supporting frame system: This system allows fixed photovoltaic panels. The system can be designed with a fixed angle or sun-tracking system.
- Transformer (0.4/22kV): The purpose of this is to raise the output voltage from the inverter to a higher voltage level that is suitable for connection to the power system. Infrastructure for grid connection: is the infrastructure for the connection of the plant to the grid. Specifically, this is a substation, which will include protection, measurement and control equipment

#### 1.4.5. List of estimated machinery and equipment

Table 1.7: Motorcycles, main construction equipment

No	Name of equipment	Specifications	Quantity	Note
1	Bulldozers D4C-11(4S)	1,89m <sup>3</sup>	02	Clearing the ground
2	Excavators E0-2621a	0,25m <sup>3</sup>	03	digging the foundation
3	Tower crane	H=25m, Q=5T	01	
5	Car ben	15m <sup>3</sup>	03	Transporting Sand, rock
6	Concrete mixers	> 0,25m <sup>3</sup>	02	
7	Shock Damage	1,5	03	concrete mortar
8	Vibratory	2,5	01	-
9	Vibratory DY-48A	12T	01	the grounding pond rammer, foundation
10	Pumper	2HP	02	Pumping water
11	Welder		02	

(Resource: Explanning on the feasibility study report of the Project published by PECC4 in May/2017)

#### 1.4.6. Raw materials, inputs (inputs) and outputs (outputs) of the project

##### a) Construction stage

##### 1/ Supplying resource and equipment

- Sand, gravel, cement: taken from the local
- Reinforcing steel, grounding: taken from local and fabricate at site.
- Plated steel and all kinds of bolt: taken from the local of processing facility
- Wire, accessories, insulation, equipment: warehouse of A board or warehouse of contractors depending on this category by whom.

##### 2/ Transport distance

- Electrical equipment: 70 km
- Plated steel, bolts: 70 km

Transformer shipment: It is expected that the transformer will be transported from Cat Lai port to the site. Demand for human: During the construction process, skilled worker need to be transferred to, about 10 people. To the rest works, requirement for high level worker is not necessary so local staff will hired instead.

For workers moving to: Camps shall be built for workers at the station who are not from the local. Local workers will comback home after work finishing

##### b) Operation stages

After completing the project, the task of transmitting electricity in the operation stage is not required for materials, fuel, input materials. However, periodically, the station will perform the maintenance activity. The material can be replaced according to the manufacturer's regulation.

Workers at the station: The station has built operation house to serve workers' living

#### 1.4.7. Schedule of the Project

Expected time for the main works of the project are as follows:

Estimated schedule of the Project: 2017-2019, in which:

- Submitting additional planning and approval: Quater IV/2016 - Quater I/2017
- Submitting Feasibility Study Report and approval: Quater I - II/2017
- Publishing Bid Document and Bidder Selection : Quater III/2017 - Quater II/2018
- Implementing the Project: Quater II/2018 - Quater II/2019
- Operation stage: Quater II/2019

#### 1.4.8. Investment capital

Table 1.8: Total investment capital of the project

*Unit: mil dong*

No.	Content of cost	Amount before taxes	VAT	Amount after taxes
1	Costs of compensation, support and resettlement	5.599	-	5.599
2	Construction costs	547.506	54.751	602.257
3	Equipment costs	604.444	60.444	664.888
4	Project management costs	11.243	-	11.243
5	Costs of for construction investment consultancy	32.305	3.231	35.536
6	Other	78.549	2.638	81.187
7	Redundancy costs	126.334	12.421	138.755
	<b>TOTAL</b>	<b>1.405.979</b>	<b>133.484</b>	<b>1.539.464</b>

*(Resource: Explanning on the feasibility study report of the Project published by PECCA in May/2017)*

#### \* Investment capital for environmental protection activities

Total investment capital for environmental protection activities is **30.000.000 dong** (excluded operation cost) as follows:

Table 1.9 Investment capital for environmental protection activities

No.	Catergogy	Total amount
<b>I</b>	<b>ENVIRONMENTAL MONITORING AND WASTE MONITORING</b>	
<i>1</i>	<i>Construction stage</i>	

No.	Catergogy	Total amount
a	Cost for measuring the quality of the air environment (02 samples x 2 times = 04 samples)	Estimated <b>20.000.000 dong</b> <i>(Included in the project's reduntdancy costs)</i>
<b>II</b>	<b>OTHER</b>	
<b>I</b>	<b>Construction stage</b>	
a	Monitoring in collection and disposal of waste at the site: 02 times x 2.500.000 dong/time = 5.000.000 dong (estimated)	estimated <b>5.000.000 dong</b> <i>(Calculated in construction costs, section of the project's unspent costs)</i>
b	Supervising the health and safety at work site for workers: 02 times x 2.500.000 dong/time = 5.000.000 dong (estimated)	estimated <b>5.000.000 dong</b> <i>(Calculated in construction costs, section of the project's unspent costs)</i>
<b>2</b>	<b>Operation stage</b> Cost of electric field monitoring (50.000đ/point x 03 points)/06 months and implementing during the operation time	

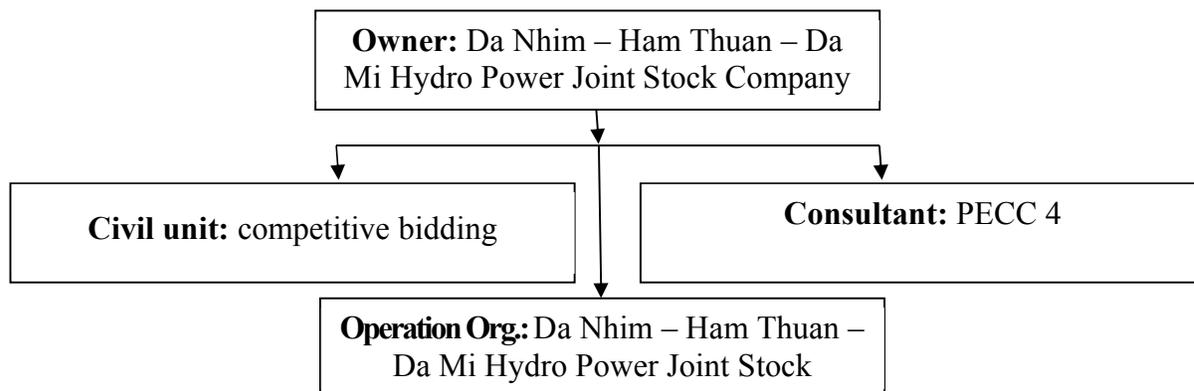
*Note: This cost may be changed depending on time*

#### 1.4.9. Management organization and implementation of project

The participating agencies are participated as follows

- Owner: Da Nhim – Ham Thuan – Da Mi Hydro Power Joint Stock Company
- Supplier: Biddder selection with method of international competitive bidding
- Civil unit: Biddder selection with method of national competitive bidding.
- Operation Org.: Da Nhim – Ham Thuan – Da Mi Hydro Power Joint Stock Company

#### *Diagram of management and operation organization of the Project*



The owner established a specialized group with 2-3 people (bachelor and upper) in environment sector

Table 1.10: Overview of the project

Stage of the Project	Action	Schedule	How to do	Araising possibility of environmental factors
<b>Preparation</b>	Compensation, supporting - resettlement	This will be conducted after the provincial People's Committee issued a decision on land acquisition	Measurement, detailed inventory will be performed by the Board of Compensation – site clearance	
	Clearing vegetation, site clearance	0,5 month	Manual and vehicles	- Solid waste: plant, covered vegetation, material
<b>Civil</b>	Digging and casting the foundation of station, drain cable	5,5 month	Manual and vehicles	- Air environment: <i>(Dust, emissions, noise caused by construction activities)</i> - Water environment: + wastewater of construction workers + wastewater of construction - Soil environment: + Solid waste daily + Solid waste from construction activities - Other impacts: + infrastructure + Security + Labour accident +...
	fabrication and installation for device		Manual and vehicles	
	Embankment building for foundation protection		Manual and vehicles	
	Installation of PV module array, inverter station, floating bridge		Manual and vehicles	
	Completion, acceptance, handover			

<b>Stage of the Project</b>	<b>Action</b>	<b>Schedule</b>	<b>How to do</b>	<b>Araising possibility of environmental factors</b>
<b>Operation</b>	Electricity Produce		Under people's monitor	The reason is mainly from construction workers 's daily activities

## **Chapter 2**

### **NATURAL ENVIRONMENT CONDITIONS AND SOCIO-ECONOMIC OF THE PROJECT AREA**

#### **2.1. NATURAL ENVIRONMENT CONDITIONS**

##### **2.1.1. Geographical and geological conditions**

Solar plant in Da Mi hydro power reservoir in Binh Thuan province was aimed at the addition of a clean energy for National electricity system, meet to demand for electricity network in general and Binh Thuan Province in particular

Other goal of the Project shall be one of the first solar projects in Viet Nam, contribute to develop clean energy from solar. This complies already with the development trend of the government, MOIT and EVN.

According to the report on the construction survey results in the stage of preparing the feasibility study report relating to geological condition of the project area as the follows:

##### ***a) Geology general of the area***

For geology of the area is expected to build a solar power plant in Da Mi hydro power reservoir in Binh Thuan province, according to the results of the field survey combined with reference geological maps mineral 1:200,000 sheets Gia Ray - Ba Ria was led by Nguyen Duc Thang indicated that geological features of the study area include rocks of the following complexes:

##### **Magma penetration, complex consciousness phase 2 ( $\gamma\delta J_3dq_2$ ) :**

*Complex consciousness phase 2* appear on all blocks with the area of tens km<sup>2</sup>. The constructed soil consists of granite, biotite-hornblende granodiorite Phân bố toàn bộ khu vực nghiên cứu của dự án.

The results of the field survey show that the soil layers in the study area are mainly weathered products of granite. With a depth of up to 9m, it is possible to divide the geological layers from the top down of the whole plant, station and 110kV line route with the following geological layers:

##### ***\* The layer soil, grounding soil tQ***

- Layer 1: The grounding soil consists of clayey and macadam, light yellow color with semi-hard. This is distributed in HK5 hole of factory area with 3.2m thick

- Layer 1a: The top layer soil consists of macadam and gravel, gray-brown, blue-gray, tight. This is distributed in 3 bore holes of the 22/110kV station and the motorway leading to the plant from km 0 + 00 to km 0 + 306.84 with 0.5m thick

##### ***\* Formations of aluvi quaternary accumulation***

- Layer 2: Mud clods and humus in dark gray, moisture soil in the status of plasticity to paste. This is locally distributed in HK5 and along the shore of Da Mi reservoir from the

rising water level down to the lake of the plant area, this layer is located under the 1st layer with the thickness of 1.3m

\* Formations of aluvi, deluvi, strong weathering on the granite floor of the complex consciousness phase 2 ( $\gamma\delta J_3 d q_2$ )

- Layer 3: Clay, clay mixed macadam, yellowish-brown, reddish-brown, moisture soil, semi-rigid, with 20-30% of rocky, in which the rocky is accounted for 3-20%,  $\square$  rocky = 0.4-1.2m. Distribution of plant is at HK4, HK6, HK7, 110kV line is at HK8, HK9. The thickness is from 0.6-3.5m.

- Layer 3a: clay, clay mixed macadam, yellow-brown color, yellow-grey color, less moisture soil, hard, macadam proportion of 20-30%, 40-55% rocky,  $\square$  rocky = 0.3 -1.5m. Distribution of motorway from the 0 + 331.75 km to the 0 + 441.25 km; with 1.3-1.5m thick

- Layer 4: granite is strongly weathered to clay, clay mixed macadam with gray-brown, grayish gray, grayish gray color, less moisture soil, semi-rigid with a macadam proportion of 20-35%. This distributed in most of plant areas, station and lines. With 1,1-7,1m thick

- Layer 5: Strong weathered zone IA2: granite rock is strongly weathered into macadam mixed yellow-brown and yellow-grey clay, less moisture soil, hard status, macadam proportion of 40-60%. The depth of hole in station area at HK2 and HK3 is up to 8m that has no sign of the end of this layer.

### ***b) Geography, topography, geomorphology***

Theo đặc điểm hình thái cấu trúc, địa mạo khu vực Nhà máy điện mặt trời nổi tại hồ thủy điện Đa Mi, tỉnh Bình Thuận thuộc 2 kiểu địa hình chính như sau: According to the morphological structure, the geomorphology of the floating solar power plant in Da Mi Hydroelectric Reservoir, Binh Thuan Province, is divided into 2 main types of terrain as follows

#### *Denudation cavitation topographic*

This is almost of the research area of the plant, the whole area of 22/110kV transformer station and the 110kV connection line, the components of this layer is the ruins of the formation, ruins, weathered products of granite including clay, clay mixed macadam ... Formation of long hills and mountain in the shape of saddles, surface topography is relatively relaxed, the slope from 10 to 15. Most of vegetation are bush, tree and pepper, coffee of local people

#### *Accumulation Topographic*

This topographic is just distributed a little in the plant area, along the shore of Da Mi reservoir, chink in streams and chink in path. They develop mainly in the form of mudflats along streams, under horizontal slope from a few meters to more than ten meters, stretching several meters along the river and stream. The surface of the mudflats is flat or rippled, with no slope, slightly inclined toward the lake. The composition of this type consists of sandy mud ... Most of vegetation are bush and tree

### ***c) Physical properties of soil***

The physical and mechanical properties of the soils were determined by sampling

in the exploratory drilling process and transferred to laboratory to analyse. This includes not only the result of survey process but also the geological references of nearby areas with similar geological conditions of the study area

Recommended physical and mechanical indicators of the soil layer are shown in the following table:

The physical properties of the soil layers shown in Table 2.1

Table 2.1: Recommended physical and mechanical indicators of the soil, rock

Catergogies		Layer 1	Layer 2*	Layer 3	Layer 3a	Layer 4
Natural Moisture	W %	18,6	38	18,8	10,4	21
Natural Density	$\rho_w$ (g/cm <sup>3</sup> )	1,91	1,65	1,85	1,62	1,76
Saturated Density	$\rho_{bh}$ (g/cm <sup>3</sup> )	1,94	1,71	1,91	1,84	1,84
Proportion	$\rho$ (g/cm <sup>3</sup> )	2,61	2,60	2,67	2,75	2,67
Natural emptying factor	$\rho_0$ (%)	0,62	1.12	0,72	0,87	0,84
Thick level	B	-0,01	0,93	-0,28	-0,29	-0,08
Coefficient of natural compressed subsidence	$a_{tn}$ (cm <sup>2</sup> /kg)	0,026	0,103	0,030	0,026	0,033
Coefficient of saturated compressed subsidence	$a_{bh}$ (cm <sup>2</sup> /kg)	0,028	0.104	0,035	0,036	0,037
Natural cohesive force	$C_{tn}$ (kg/cm <sup>2</sup> )	0,244	0,081	0,298	0,212	0,270
Saturated cohesive force	$C_{bh}$ (kg/cm <sup>2</sup> )	0,174	0,079	0,199	0,118	0,174
Natural inside friction angle	$\rho_{tn}^0$ (degree)	21	9	20	21	21
Saturated inside friction	$\rho_{bh}^0$ (degree)	19	7	18	17	19
Natural convention of load capacity	$R_0$ (kg/cm <sup>2</sup> )	1,6	0,4	1,73	1,5	1,68
Saturated convention of load capacity	$R_0$ (kg/cm <sup>2</sup> )	1,2	0,3	1,28	1,1	1,16
Natural deformation	$E_{tn}$ (kg/cm <sup>2</sup> )	180	21	148	135	104
Saturated deformation	$E_{bh}$ (kg/cm <sup>2</sup> )	167	19	116	100	96

(Resource: Explanning on the survey report of the Project published by PECC4 in March/2017)

#### d) Hydrogeological conditions

Based on the geological structure, characteristics, storage capacity, soil water movement and surface water relationship with underground water in the study area of solar power plant in Da Mi hydro power reservoir belonged to Binh Thuan province can be divided into main aquifers as follows:

- The aquifer in alluvial formations belonged to quaternary sediments
- The aquifer of granite belonged to complex consciousness phase 2 ( $\gamma\delta J_3 d q_2$ )

##### a) Aluvi formations (aQ):

In the study area, aluvi formations were developed mainly in the factory area, along the shore of the Da Mi reservoir and the tributaries flowing into the reservoir in the form

of high mudflats and coastal with the composition of clay mud, clay ... appeared locally at the plant and met at HK5 of the plant. The results of the drill survey at HK5 show that the underground water is present at a depth of 2.0m. Underground water contains and moves in the holes of the soil, relates closely to the water of lakes and streams. The fluctuation of the undergroundwater shall change in the seasons

*b) The aquifer of granite in complex consciousness phase 2 ( $\gamma\delta J_3 d\dot{q}_2$ ) :*

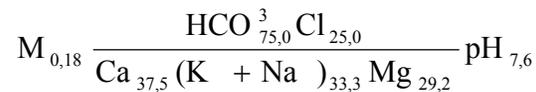
Distribution in the ruins of the formation edQ, strongly weathering zone IA1, strongly weathering zone IA2 of rocks in complex consciousness phase 2, the movement aquifer in holes of soil and cracks of rocks are shown as the following:

The main source of supplying is rainwater, the drainage area is the river system. The fluctuation of the underground water shall change in the seasons

Underground water exists and circulates in cracking assist, mechanical weathering of rocks. Results of drilling survey at holes of HK4, HK5, HK6, HK7 of the plant area; station at HK1, HK2, HK3 area of 22/ 110kV station; HK8, HK9 of the 110kV line show that underground water at depths of 2.0-7.6m

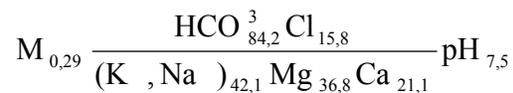
The analysis results of 5 water samples in bore holes of HK5, HK7 of the plant area; HK1, HK2 of 22/110kV station area; HK8 of the 110kV line show that the chemical composition of the underground water is shown in the following formula:

Underground water sample at HK1:



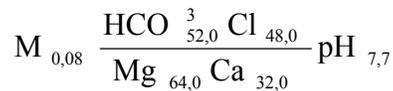
Water type of bicarbonate calcium chloride potassium sodium magnesium, colorless water, odorless water, super-light, weakness invasive (assessed according to the standard of 3994-1985).

Well water sample at HK2:



Water type of bicarbonate Water Potassium Sodium Magnesium Calcium, colorless water, odorless water, pale, weakness invasive (assessed according to the standard of 3994-1985).

Underground water sample at HK5



Water type of Bicarbonate Chloride Calcium Magnesium, colorless, odorless, super-light water, weakness invasive for concrete (assessed according to the standard of 3994-1985)

Water sample at HK7

$$M_{0,10} \frac{HCO_{51,7}^3 Cl_{48,3}}{(K, Na)_{58,6} Mg_{20,7} Ca_{20,7}} pH_{7,5}$$

Water type of Bicarbonate Potassium Chloride Potassium Magnesium Calcium Calcium, colorless, odorless, super-light, weakness invasive (assessed according to TCVN 3994-1985).

Sample water at HK8:

$$M_{0,34} \frac{HCO_{83,0}^3 Cl_{17,0}}{Mg_{51,1} Ca_{25,5} (K, Na)_{23,4}} pH_{7,3}$$

Water type of Bicarbonate Water Magnesium Calcium Potassium Sodium, colorless, odorless, pale, weakness invasive (assessed according to TCVN 3994-1985)

### ***e) Earthquake***

- Based on the assessment of neo-tectonic activity in the area, the scope of research was influenced by the vertical movement process, particularly the subsidence process, subsidence amplitude of 2 mm/year, but this is considered as the potential for disaster

According to the construction standard TCVN 9386: 2012 of earthquake resistant construction, the project located in Ham Thuan South district has an earthquake background with the acceleration peak of basement  $a = 0.0220g$  corresponding to the earthquake background of level V based on the MSK-64 scale

## **2.1.2. Weather conditions, meteorology**

### ***2.1.2.1. General characteristics***

The project area is in the tropical monsoon climate with hot and humid conditions as the following characteristics:

- Rain season starts from May to October, dry season starts from November to April. This is the mountainous climate in the north of the province, which is contiguous to the Lam Dong highland with the heavy rainfall of Bao Loc - Dai Quang (3700 - 4000 mm / year), so it has very high rainfall and humidity and less than sub-valley of La Nga River. The average annual rainfall of this region is 1600-2000mm.

- The air temperature is relatively low and relatively stable. The annual average temperature ranges from 21.5 to 22.50C, at some mountain peaks with temperature above 1000m can be below 21oC. Average annual heat is 7500 - 83000C, the difference between the hottest month and the coldest month is only 2 - 3oC. Average temperature of the coldest month is over 20oC.

- Average humidity is 70-85%, little cloudy and a lot of sunny. Sunny hours per year are up to 2300 hours and more.

- Activities of storm are infrequent in this area. About 4-5 years, there is a storm occurring from October to December.

+ From November - April (winter monsoon): NE (North East)

- Average wind speed:

Due to the influence of terrain, the ground wind speed in Binh Thuan is different in different areas. The northeastern area of the province (Tuy Phong district, Bac Binh district) has the highest wind speed ( $> 3 \text{ m/s}$ ), then the wind speed decreases from east to west. The west area of the province which is contiguous with Bao Loc Highland has the smallest average wind speed.

Table 2.2: Average monthly and annual wind speed recorded in Bao Loc meteorological station for reference

Features	Monthly and annual average wind speed (m/s)												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Vtb	1,6	1,6	1,5	1,3	1,3	1,6	1,9	2,2	1,4	1,3	1,6	1,9	1,6

Source: Hydrological and meteorological station in South Middle Vietnam from 1978-2016.

- Wind pressure:

Table 2.3: Standard wind pressure with repeating cycle of wind once in 10 years and once in 20 years

Regional line	Pressure range	$W_0$ (kN/m <sup>2</sup> ) 3 seconds, 10 years	$W_0$ (kN/m <sup>2</sup> ) 3 seconds, 20 years
Entire line (DD - DC)	IA	0,52	0,60

Source: Hydrological and meteorological station in South Middle Vietnam from 1978-2016.

**b) Air temperature**

Due to the high mountainous terrain, the temperature in this area is quite low. The annual average temperature varies from 21.5 to 22.5<sup>0</sup>C. In some mountain peaks above 1000m height, it may fall below 21<sup>0</sup>C. Absolute average, highest, lowest temperature during observation period according to documents of Bao Loc meteorological station are as follows:

Table 2.4: Air temperature features at Bao Loc meteorological station for reference

Features	Months, years												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Ttb °C	20,2	21,1	22,2	23,1	23,3	22,7	22,2	22,0	22,2	21,9	21,2	20,2	21,9
Tmax °C	31,8	33,8	33,6	32,2	32,3	33,4	30,8	30,9	31,3	31,0	31,0	30,6	33,8
Tmin °C	8,8	8,8	11,2	15,2	15,9	16,2	16,8	16,8	16,6	13,5	10,8	9,8	8,8

Source: Hydrological and meteorological station in South Middle Vietnam from 1978-2016

**c) Rainfall (mm)**

There are two seasons of rain: rainy season coincides with the summer monsoon. Rainfall in the year is mainly concentrated in this season (80-90%). The number of rainy days in the rainy season is 20-25 days, and 160 - 180 days in the whole year. Dry season coincides with the winter monsoon. Rainfall is not significant. There are even months without rain. The project area in the North West of the province has the highest rainfall, from 2300 to 2600mm.

Table 2.5: Monthly and annual rainfall in years in La Ngau and Bao Loc Station (mm)

Month													
Months Stations	1	2	3	4	5	6	7	8	9	10	11	12	Year
	La Ngau	8	5	28	75	237	307	420	483	382	243	95	23
Bao Loc	64	53	115	192	241	297	397	475	402	333	171	81	2832

Source: Hydrological and meteorological station in South Middle Vietnam from 1978-2016

Maximum rainfall per day: 235.7 mm.

**2.1.2.3. Basic climate features**

**a. Thunderstorms**

This is an area with many thunderstorms in Binh Thuan province, with an average of 100-120 days with thunderstorms. Beginning in April, there are seasonal storms. June, July, and August are the peak months of the thunderstorm. Thunderstorms are not long, but they come with the intensity of rainfall. Sometimes thunderstorms are intense, which cause turnados and thunders.

Table 2.6: Average number of thunderstorm days (days)

Months District	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
	North Thuan Ham	0,1	0,5	1,1	8,4	18,1	13,9	15,5	14,2	15,1	14,6	4,3	2,2

Source: Hydrological and meteorological station in South Middle Vietnam from 1978-2016

**b. Storm**

Based on the data of the meteorological stations in Binh Thuan province and the storm statistics in 39 years (from 1977 - 2015), there are 10 storms, the tropical depression

landing directly into Binh Thuan province (from 10.5°N - 12°N), equivalent to one storm landing in every 4 years.

The number of storms and tropical depression affecting the province is 19 with average frequency of 0.53, equivalent to one storm affecting Binh Thuan province in every 2 years. However, in the period from 1997 to 2000, every year there are storms, tropical depression affecting. Especially there were two typhoons landing directly as in 1993 (KIM, MANNY). In 2000 and 2010, there were 2 tropical depressions affecting the province.

Stormy season in Binh Thuan province starts from October to December. The frequency of storms and tropical depressions that affect Binh Thuan province is highest in November (17%), in October (15.7%), in December (11.4%). There are also storms, tropical depression appearing early (ill-timed), but not as much as in March /1982, January/2010.

The 10th storm named TESS, which formed in the Pacific and moved mainly south-west, after moving through Palawan Island (The Philippines), changed its direction between West and West-Northwest. In November 1988, it landed directly in Binh Thuan. The direct impact of the storm circulation, combined with the increasing cold air caused winds strong storm level 10, level 12, level 13 on Phu Quy island; level 7, level 9 in Phan Thiet City. Binh Thuan province had heavy to extremely heavy rain.

### **c. Drought**

From the beginning of January to April, since the rainy season ends early, continuous heat expands throughout the province, causes water shortage and drought in some local areas, which leads to water shortage and damages to some areas of agricultural and fruit-growing lands, including Ham Thuan Bac and Tanh Linh districts. In some years, local dry heat also occurs in the months from April to July, causing drought in some areas.

#### **2.1.3. Hydrological conditions**

The transmission line and transformer stations are located on sloping hillside. According to survey results, transformer station and transmission line are not affected by flooding.

The floating solar power plant at Da Mi hydroelectric reservoir consists of panels located on the float system on the Da Mi hydroelectric reservoir. The flood season of Da Mi reservoir on La Nga river begins in July and ends in November. According to the flood monitoring data of La Nga River recorded by Dai Nga and Ta Pao Hydrological Stations, most of the major floods occur in August, September and October, when West - South monsoon and storms in East Sea are most active. The hydrological conditions of the plant area were evaluated based on the hydrological parameters of Da Mi reservoir with a normal water level of 325m, dead water level of 323m, extending water level with the frequency of 0.1% is 327.5m.

#### **2.1.4. Quality and conditions of soil, water and air**

To assess the current state of the physical environment of the project area, the Investor coordinates with the subcontractor –Environmental and Technology Center to collect

samples and analyze them in the laboratory. The results of the survey and sample analysis are described below:

### 2.1.4.1. Quality of air environment

#### a) Description of the air environment sampling

On April 5, 2017, Power Engineering Consulting Joint Stock Company coordinated with Phuong Nam Environmental Analysis and Measurement Center and the Investor to conduct environmental survey and take samples of the project area.

Carry out air quality survey at 03 surveying locations, in detail:

- Sample KK1: The proposed area for building transformer station, located on the bank of Da Mi hydroelectric reservoir, about 150m away from the water surface of the reservoir.

Geographic coordinates: X = 1243537; Y = 428528.

- Sample KK2: The area between the 110kV transmission line and national highway No. 55.

Geographic coordinates: X = 1243861; Y = 429622.

- Sample KK3: The end of the 110kV transmission line, the connecting shaft to connect with the existing Ham Thuan - Duc Linh 110kV transmission line.

Geographic coordinates: X = 1243759; Y = 431624.

Description of the weather, surrounding environment at sampling and determine GPS sampling location: sunny, not cloudy, windless.

#### b) Analysis results of surrounding air quality and noise in the project area

Table 2.7: Results of analysis of air quality

No.	Parameters	Units	Test Methods	Results			QCVN 05:2013/BTNMT 26:2010/BTNMT
				KK1	KK2	KK3	
1	Noise	dBA	TCVN 7878-2:2010	50,5	56,3	51,7	70**
2	Suspending Dust (TSP)	mg/m <sup>3</sup>	TCVN 5067:1995	0,02	0,08	0,04	0,3
3	Sulfur dioxide (SO <sub>2</sub> )	mg/m <sup>3</sup>	TCVN 5971:1995	0,02	0,01	0,03	0,35
4	NO <sub>x</sub>	mg/m <sup>3</sup>	HD77-PPDN-NO <sub>x</sub>	0,05	0,03	0,03	0,2
5	Carbon monoxide (CO)	mg/m <sup>3</sup>	HD24-LM-CO	KPH	KPH	KPH	30
6	Lead (Pb)	mg/m <sup>3</sup>	TCVN 5067:1995	KPH	KPH	KPH	-

(Source: Southern Center for Environmental Analysis and Measurement in April 2017)

#### Notes:

- KK1: Location at coordinates: X = 1243537; Y = 428528;

- KK2: Location at coordinate: X = 1243861; Y = 429622;

- KK3: Location at coordinate: X = 1243759; Y = 431624;

- KPH: Not detected;

- "-" : No specified;
- This result is valid only on the specimen;
- QCVN 05: 2013 / BTNMT: QCKTQG on ambient air quality;
- (\*\*) QCVN 26: 2010 / BTNMT: QCKTQG on noise.

\* **Comments:** Based on the analysis of air quality in the project area, at the time of taking samples, all analyzes were much lower than the National Technical Regulation for ambient air (QCVN 05: 2013 / BTNMT). All noise quality assessment results are compliant with QCVN 26: 2010 / BTNMT noise standards.

#### 2.1.4.2. Water quality (surface water)

##### a. Sampling sites

- Sample NM1: Samples of surface water were taken at the installation location of solar cell system on Dam Mi hydroelectric reservoir. Geographical coordinate of the location is: X = 1243613; Y = 428504.
- Sample NM2: Samples of surface water were taken at the location between the solar system and the sturgeon farm of the Investor. Geographical coordinate of the location is: X = 1243382; Y = 428188.
- Sample NM3: Samples of surface water were taken at the location of the Investor's sturgeon farm. Geographic coordinate of the location is: X = 1243048; Y = 427226.

##### b) Analysis results of water quality

Table 2.8: Results of surface water quality analysis in the project area

No.	Parameters	Units	Test methods	Results			QCVN 08-MT:2015/BTNMT
				MN1	MN2	MN3	
1	pH	-	TCVN 6492:2011	7,2	7,1	7,1	5,5-9
2	DO	mg/l	TCVN 7325:2004	5,2	5,6	5,1	4
3	TSS	mg/l	TCVN6625:2000	12,4	14,2	18,5	50
4	COD	mg/l	SMEWW 5220C:2012	14,3	11,9	17,2	30
5	BOD <sub>5</sub>	mg/l	TCVN 6001-1:2008	6,7	7,2	11,4	15
6	Coliform	MNP/100ml	TCVN 6187-2:2009	740	670	680	7500
7	Nitrat	mg/l	SMEWW 4500-NO <sub>3</sub> -E:2012	1,6	1,8	1,9	10
8	Nitrit	mg/l	TCVN 6178:1996	KPH	KPH	KPH	0,05
9	Ammonium	mg/l	EPA Method 350.2	KPH	KPH	KPH	0,9
10	Copper	mg/l	SMEWW 3111.B:2012	<0,03	<0,03	<0,03	0,5
11	Iron	mg/l	SMEWW 3111B:2012	<0,08	<0,08	<0,08	0,4
12	Niken	mg/l	SMEWW 3111.B:2012	KPH	KPH	KPH	0,1
13	Zinc	mg/l	SMEWW 2012-3500-Zn.B	0,08	0,06	0,09	1,5
14	Lead	mg/l	SMEWW	KPH	KPH	KPH	0,05

No.	Parameters	Units	Test methods	Results			QCVN 08-MT:2015/BTNMT
				MN1	MN2	MN3	
			3111B:2012				
15	Chromium	mg/l	SMEWW 3500-Cr.B:2012	KPH	KPH	KPH	<b>0,5</b>
16	Phosphate	mg/l	TCVN 6202:2008	KPH	KPH	KPH	<b>0,3</b>

(Source: Southern Center for Environmental Analysis and Measurement in April 2017)

**Notes:**

- MN1: Location at coordinate: X = 1243613; Y = 428504;

- MN2: Location at coordinate: X = 1243382; Y = 428188;

- MN3: Location at coordinate: X = 1243048; Y = 427226;

- KPH: Not detected;

- This result is valid only on the specimen;

- QCVN 08-MT: 2015 / BTNMT: National technical regulation on surface water quality.

\* **Comments:** At the time of sampling, based on the results of the analysis, the surface water quality at the surveying sites was quite good. Most of the analyzes were compliant with standards in Column A2- QCVN 08 -MT: 2015 / BTNMT except two indicators of DO beyond standards in Column A2-QCVN 08-MT: 2015 / BTNMT.

**2.1.4.3. Quality of soil environment**

*a. Sampling sites*

- Sample MD1: Sample is taken at the construction site of the 110kV transformer substation. Geographical coordinate of the location is: X = 1243310; Y = 428164.

- Sample MD2: Sample is taken at the location of the G1 tie line of the 110kV connection line. Geographical coordinate of the location is: X = 1244173; Y = 430272.

- Sample MD3: Samples are taken at the end of 110kV connection line, connection point between 110kV transmission line and Ham Thuan - Duc Linh 110kV transmission line. Geographical coordinate of the location is: X = 1244120 The Y = 431587.

*b) Results of analysis of soil environment quality*

Table 2.9: Analysis results of soil samples in the project area

No.	Parameters	Units	Test methods	Results			QCVN 03-MT : 2015/BTNMT
				MD1	MD2	MD3	
1	Arsen (As)	mg/kg	EPA Method 3050B SMEWW 3114B:2012	3,05	1,18	1,83	<b>25</b>
2	Cadimium(Cd)	mg/kg	EPA Method 3050B SMEWW 3111B:2012	0,85	0,12	0,51	<b>10</b>
3	Copper (Cu)	mg/kg	EPA Method 3050B SMEWW 3111B:2012	45,3	58,2	76,9	<b>300</b>
4	Lead (Pb)	mg/kg	EPA Method 3050B SMEWW 3111B:2012	16,6	9,2	11,3	<b>200</b>
5	Zinc (Zn)	mg/kg	EPA Method 3050B SMEWW	104,4	90,6	59,3	<b>300</b>

			3111B:2012			
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(Source: Southern Center for Environmental Analysis and Measurement in April 2017)

\* **Comments:** At the time of sampling, based on the analysis results, the soil quality at the surveying sites was quite good and most of the analyzes were compliant with QCVN 03-MT: 2015 / BTNMT standard.

#### 2.1.4.4. Electric field intensity

##### a. Sampling sites

Sample: The sample is taken at the end of the 110kV connection line, the connection point between the 110kV transmission line and the existing 110kV Ham Thuan - Duc Linh transmission line. Geographical coordinate of the location is: X = 1244079; Y = 431532.

##### b. Measurement results

Table 2.10: Surveying results of electric field intensity

No.	Parameters	Units	Methods	Results	Decree No. 14/2014/ND-CP
				DT	
1	Industrial frequency electric field intensity	kV/m	Rapid tester HI3604	1,164	≤ 5
2	High-frequency electric field intensity	kV/m	Rapid tester HI3604	0,877	

(Source: Southern Center for Environmental Analysis and Measurement in April 2017)

\* **Comments:** At the time of sampling, based on the analyzing result of the electric field intensity at the sampling sites shows, all results are compliant with Decree No. 14/2014 / ND-CP.

#### 2.1.5. Status of biological resources

##### a) Vegetation

The vegetation in the area is poor due to human impact. Natural vegetation has almost been replaced by human - affected vegetation. Current vegetation in the project area mostly includes rubbers, cashews, bananas, eucalyptus, etc.

##### a) Fauna

Since the vegetation in the area, in the electric safety corridor is human-affected vegetation (orchards, production forest lands, etc.) which is heavily affected by the human, fauna in the project area mostly includes households' cattles like buffalos, cows, goats, poultry, etc, wild animals are almost unrecognized.

Fauna of the reservoir area mainly includes natural aquatic species. In addition, about 500m away from the project location, there is the sturgeon farm of Tam Long - Da Mi Joint Stock Company.

## 2.2. SOCIAL AND ECONOMIC CONDITIONS

### 2.2.1. Economic conditions

#### 2.2.1.1. La Ngau Commune

##### Crops:

- Food and foodstuff crops: In 2016, there are 738 hectares of land to be planted , divided into 3 crops, of which: 610 hectares of hybrid corn, 83 hectares of rice, 04 hectares of various kinds of beans, 01 hectares of vegetables and 40 hectares of cassava. The total

output was 4,835 tons / 5,576 tons, reaching 86.71% of the target set by the district. Average food per capita is 1,680 kg / person / year.

- Industrial trees: There are 04 main types of industrial trees in the commune.

+ Cashew: The cashew area is 165 ha. In particular, the area for harvesting is 165 hectares. Average yield is 5 quintals per hectare. Harvest yield is 82.5 tons.

+ Pepper: The pepper area is 2.2 hectares. Area for harvesting is 2 hectares. Productivity is 10 quintals per hectare. Harvest yield is 2 tons. For Da Mi village, in 2016 planting area increased an additional 0.2 ha.

+ Coffee: There are 13 hectares, of which the area for harvesting is 12 hectares. Average yield is 1.2 tons/ha. Harvest yield is 14.4 tons. In 2016, due to low purchasing price and high fertilizer price, farmers do not grow more coffee.

+ Fruits: Total area is 13 hectares, including 07 hectares of banana, 04 hectares of mango, 02 hectares of durian.

### **Breed:**

- Total number of cattle: 1,793 ones, with an addition of 145 ones in comparison with the same period of last year. Of which there are 153 buffaloes, 974 cows, 225 goats and 441 pigs. Through the agriculture, rural and fishery survey, there was a significant increase in cow herds. The reason is that households receive compensation to buy more cows. At the same time, since time of growth has come, number of cows should increase rapidly.

- Total number of poultry in the whole commune is 3,477, of which: 3,189 chickens and 288 ducks. The total number decrease by 118 ones in comparison with the same period last year, mainly chickens.

### **2.2.1.2. Da Mi Commune**

#### **Crops**

- Irrigation, intensive farming, pest control are assured in the dry season. Specifically, 1,480 hectares of coffee, 506 hectares of durian grows well.

- In 2016, the yield of some crops in the commune increased in comparison with 2015. The high price of agricultural products contributes to stabilize the life of people. Specifically, there were 1,145 hectares of coffee harvested with estimated productivity of 3,5 – 4 tons per hectare, at the price of VND40 - 44,000 / kg. The price increased by VND10 - 14,000 / kg; 203 hectares of cashew harvested with estimated productivity of 1,2 - 1,5 tons per hectare, at the price of 35,000 - 38,000 VND / kg, 554 hectares of durian harvested with estimated productivity of 2 - 2.5 tons per hectare, at the price of 25,000 to 35,000 VND / kg. Mango productivity was 2.5 tons per hectare. Tangerine productivity was 0.7 tons per hectare, at a quite stable price from 25,000 to 30,000 VND / kg.

- In 2016, the Commune People's Committee mobilized the people to renovate 12 hectares of grafted cashew trees for high productivity intercropped with 103 hectares of durian, 80 hectares of avocado, 02 hectares of coffee and grow short-term crops such as corn, cassava, black beans.

#### **Breed**

- Breeding in the whole commune in 2016 was quite stable. Beside cows, goats, sheep, fresh water fish, some households started to raise black pigs, hybrid pigs and poultry to increase income. Disease prevention in the herd of cattle and poultry was attached great importance. Therefore, disease did not occur in the commune.

### **2.2.1.3. La Da commune**

#### **Crops**

In 2016, agricultural production was stable. Total annual cultivated area is estimated at 2277.9 hectares (90.39%) with high productivity. Of which, rice reached 81.54%; hybrid corn reached 63, 75%, etc. Total output of grain in the whole year is estimated at 2,222.52 tons, reaching 100.1% of the proposed resolution.

In addition, in 2016, some crops had high economic value. Rubber, cashew had high output. Specifically, 80 hectares of rubber were harvested with the output of 3853 tons of latex; 690 hectares of cashew with the output of 552 tons.

#### **Breed**

Livestock situation in 2016 continued to stabilize. The commune veterinary clinic has vaccinated cattle and poultry. Total number of cattle and poultry in the commune is about 5465, mainly including cattle, goats, pigs and 2690 poultry. In particular, in 2016, the World Vision provided support to the villagers with 12 households raising goats and 08 households raising pigs.

### **2.2.2. Social conditions**

#### **2.2.2.1. La Ngau Commune**

##### **a. Population**

- La Ngau is the least populated commune in Tanh Linh district with 2126 people (pure ethnic minorities). Over the past few years, population planning has been emphasized. La Ngau is a land with many ethnic groups. Beside the Kinh majority living in the delta, there are 18 ethnic minorities living in the district (K'Ho, Cham, Gia rai , Nung, Raglai, Nung, Raglai, Ban, Ede, Tay, Thai, Dao, etc).

- Total number of poor households in early 2017 is 247 households / 1,057 people, accounting for 39.52%, of which, 208 poor households from ethnic minorities / 916 people, accounting for 47.27%, 95 nearly poor households / 424 persons, accounting for 15.20%, of which nearly 81 poor households from ethnic minorities/ 358 people, accounting for 18.4%.

##### **b. Education**

- In 2016 - 2017, the task of mobilizing students of all ages to go to school reached high efficiency. The policies of children in ethnic minority is implemented in accordance with Decree No. 49/2010 / ND-CP of the Government and Decision No. 93 of the People's Committee of Binh Thuan province to support students who are in ethnic minorities at the age of secondary schools, primary schools and kindergartens.

##### **c. Medical**

- Commune's health station has 06 staff members, in which: 01 doctor, 03 nurses, 01 pharmacist, 01 midwife. The village's health worker consists of 08 collaborators, of which 06 of them have been professionally trained and operated effectively.
- Medical examination and treatment: Total number of examination and medicine distribution under health insurance is 2,720 turns, of which 595 turns of children under 6 years-old, accounting for 158.6%. Number of turns with the combination method between traditional medicine and modern medicine is 951, accounting for 34.9%. Elderly people are periodically taken care and examined.
- Propaganda: Monitor and propagandize to the community about prevention of mother-to-child HIV transmission (in the commune there is one HIV patient under medical control).
- Focus on the implementation of health programs on disease prevention such as malaria control with the total number of tests of 850 times, reaching 100%, parasites (+) 03, BNSR 03; the prevention program of tuberculosis- leprosy with the number of cases detected of 30 cases, reaching 136.3%. 03 leprosy patients and 03 tuberculosis BK (+) are under medical control.

#### **2.2.2.2. Da Mi Commune**

##### **a. Population**

Da Mi is a mountainous commune in Ham Thuan Bac district with an average population of 4,239 people, population density of 29 persons/km<sup>2</sup>. Males account for 51% of the total population, with 2,157 ones. Females account for 49% of the total population with 2,082 ones. Natural population increase is 5.83%. There are 103 poor households and 111 nearly poor households in the whole commune according to poverty standard of the new period. (Source: Statistical yearbook of 2016, Ham Thuan Bac district)

##### **b. Education**

In general, the educational situation in the 2016 - 2017 school year in the district is stable with a total of 888 pupils (of which: 210 kindergartens, 223 pupils at Da Mi 1 primary school, 245 pupils at Da Mi 2 primary school, 210 students at secondary school).

Da Mi kindergarten: 100% of children are taken care of, monitored by growth charts and absolutely safe. At the end of the year, 3 of 95 children have malnutrition, accounting for 3.15%. 100% of children attend school, 100% of children go to the last grade (95/95 pupils) and reach the standards of preschool education universalization at the proper age as regulated.

Da Mi 1 primary school: In the school year 2015-2016, 247/248 pupils completed their study, accounting for 99.6%. At the end of the year, 111 students achieved good results in their studies and training.

Da Mi 2 primary school: In the school year 2015-2016, 247/247 students completed their studying with capacity and quality reaching 100%.

Da Mi secondary school: Total number of students in the school is 198 students. Of which, the number of excellent students is 22 students, accounting for 11.11%, 67 good students accounting for 33.84%, 96 average students accounting for 48.48%, 13 weak students accounting for 6.57%.

### **c. Medical**

The health care of the commune is quite good in disease prevention and control, regular propaganda for people, keeping food safety and hygiene. The commune health station cooperated with the medical center to regularly spray insecticides against dengue fever in Group 4 of Đaguri village and propagate among the people about the prevention and control of dengue fever. They also organize broadly vaccination programs with vaccines against diseases like BCG, HIP, polio, measles.

#### **2.2.2.3. La Da village**

##### **a. Population**

La Da is a mountainous commune with the majority of K'Ho ethnic group. The commune has an average population of 3,334 people with density of 30 persons/km<sup>2</sup>. Of these, 49% are male with 1,666 people. 51% are female with 1,668 people. Natural population increase is 5.83%.

Table 2.11: Statistics on households, people in ethnic groups in La Da commune

No. of households / Total No. of Kinh Tay Muong Kh me Hoa Dao Cham Co Ho

No.TT	Households/ people	Total	Kinh	Tay	Muong	Khome	Hoa	Dao	Cham	K' Ho
1	Households	749	202	31	5	2	1	1	6	507
2	People	3.334	742	120	18	8	4	2	21	2.413

*Source: Ham Thuan Bac Statistical Yearbook of 2016*

##### **b. Education**

In 2016, the quality of education in the commune was stable and continued to maintain the universalization of primary and secondary education. The rate of 5-year-old children entering kindergarten and 6-year-old children entering Grade 01 is 100%. Schools carried out policies for ethnic minority students very well in accordance with Resolution No. 49 of the Government and Decision No. 93 of the People's Committee of the province. Due to the feature that ethnic minority households account for 73% of the total number of households in the commune, the implementation of the policy of ethnic minority children is strictly implemented in accordance with Decree No. 49/2010/ND-CP of the Government and Decision No. 93 of Binh Thuan People's Committee on support for ethnic minority pupils in secondary, primary and kindergarten schools.

##### **c. Medical**

The medical examination and treatment in 2016 maintained regularly. There were 5580 patients examined and treated. Increased reproductive health care and family planning services have enabled people to access reproductive health services. In addition, the rate of third birth in the commune is still high with 28/91 cases (accounting for 30.76%).

### Chapter 3

## EVALUATING, PROSPECTING THE ENVIRONMENTAL IMPACT OF THE PROJECT

### 3.1. EVALUATING, PROSPECTING THE IMPACT

#### 3.1.1. Assess and forecast impacts during the project preparation phase

Activities in this phase include:

- Survey and design work for feasibility study.
- Compensation, support and resettlement activities.

##### 3.1.1.1. *The source of the impact which is related to waste*

Activities in the preparation stage do not generate waste.

##### 3.1.1.2. *Non-polluting sources*

Implementation of compensation, support and resettlement for clearance in the preparation phase of construction can cause the following effects:

- Use of land to build stations and connectors: property, crops, trees on the land within the area occupied permanently.
- The quantity surveyed at the time of the preliminary survey (March 2017), will be accurate during the measurement and inspection period after the demarcation and measurement of cadastral maps.

#### 1. *Impacts due to compensation, support and resettlement*

Compensation, support and resettlement for project clearance reduce the land fund, cause damages to the assets on land, affect the economy, income, etc of the affected people. The project was built in La Ngau Commune, Tanh Linh District and Da Mai Commune, La Da District, Ham Thuan Bac District - Binh Thuan Province. The level of damage is as follows:

##### a) *Impact on land*

Table 3.1: Estimated land area acquired for project construction

No.	Status	Area (hectare)
1	Land for perennial crops	5,88

*Source: Survey report of the project in March 2017*

The land which is expected to be acquired permanently and the land within the line safety corridor are agricultural land (perennial land). Currently there are: cashew, mango, banana, pepper, jackfruit grown on them. The number of households affected by the project is about 17, which will be detailed during the detailed inventory period.

**a) Effects of trees, crops**

Table 3.2: Trees, crops expected to be affected

No.	Contents	Units	Quantity	
			Tanh Linh	North Ham Thuan
<b>1</b>	<b>Transformer station and power plant area</b>			
	Melaleuca tree (2 years)	Trees	400	
	Small Banana tree	Trees	90	
<b>2</b>	<b>Inverter station, 22 kV transmission line and access road area</b>			
	Cashew tree Grade A (10 – 20 years)	Trees	70	
	Newly-grown pepper tree	Trees	650	
	Pepper tree Grade A (3 - 20 years)	Trees	100	
	Dragon fruit tree	Pillars	15	
	Mango tree Grade A (for harvesting)	Trees	310	
	Mango tree about to be harvested	Trees	100	
	Coffee tree Grade A (for harvesting)	Trees	250	
	Jackfruit tree Grade A (for harvesting)	Trees	280	
	Rambutan tree Grade A (for harvesting)	Trees	10	
	Banana tree (for harvesting)	Trees	100	
	Banana tree about to be harvested	Trees	40	
	Small banana tree	Trees	30	
<b>3</b>	<b>110kV transmission line</b>			
	Banana tree (for harvesting)	Trees	1000	
	Banana tree about to be harvested	Trees	200	
	Small banana tree	Trees	100	
	Coffee tree Grade A (for harvesting)	Trees	450	700
	Cashew tree Grade A (10 – 20 years)	Trees	150	900
	Cashew tree (4 – 10 years)			60
	Wood for harvesting (Grade A)	Trees	4	
	Rambutan tree Grade A (for harvesting)	Trees	10	
	Mango tree Grade A (for harvesting)	Trees	20	110
	Mango tree about to be harvested	Trees	15	
	Small avocado tree	Trees	5	20
	Durian tree Grade A (for harvesting)	Trees	6	8
	Small durian tree	Trees	5	6
	Agarwood (5-8 năm)	Trees		20
	Simmer tree (10 years)	Trees		5
	Lily (1 year)	Trees		15
	Rubber tree (5 - 8 years)	Trees		25
	Mangrove tree	Trees		20
	Dragon fruit tree	Pillars		25

*Source: Survey report of the project in March 2017*

***b / Influence on houses, auxiliary works***

The project does not affect the houses and architectural works of the households in the project area, except for some other architectural objects such as ponds, fences, sewers.

***2. Mines and explosive remnants of war***

UXO/Landmine will be handled in the line corridor prior to construction in order to ensure safety during the construction process.

When preparing the ground for the project, the Investor will hire organizations that have the function of conducting clearance work in areas of construction including permanent occupied land for transformer stations, inverter station; temporarily occupying land during the construction of foundation, temporarily occupying land as material gathering yard; temporarily occupying land for building pillars; temporary land to make strips; line clearance section, warehouses. The total area of UXO/landmine clearance is 6.65 hectares on land.

**3.1.2. Evaluate and forecast impacts during the construction phase of the project**

The construction phase includes the following main activities:

- Mobilizing construction workers;
- Mobilizing vehicles, machines, construction equipment;
- Site preparation: clearing and unloading of ground cover, ground leveling, construction of camps, warehouses; transportation of materials and construction materials; electricity, water.
- Execution: solar power plant, inverter station, transformer station, internal road construction, foundation excavation (control center foundation, equipment foundation, accident-oil containing foundation, fire-fighting water-tank foundation, etc; installation of float system, PV panels; concrete work; plastering work; erecting pillars; installation of insulators, accessories, machines, equipment for the station.
- Construction of transmission line: construction of foundation piles (foundation work, installation of moulds, reinforcement of foundation, foundation concreting, installation of geodesic); erecting pillars; Insulators, accessories; line installation (pulling the lines and taking the sag).
- Road outside the station.

***3.1.2.1. The source of the impact related to waste***

***1/. Impact on the air environment***

During the construction process, the ambient air surrounding the project is affected by the construction of excavation; transportation, loading and unloading of raw materials. Specifically:

(i) Arising from the process of transporting excavated earth from outside to level the substation ground.

(ii) Mainly arising from excavation works for the construction of transformer substations and connection lines.

(iii) arising from the transportation, loading and unloading of materials and equipment: transportation and unloading construction materials (cement, sand, macadam, etc.), loading and unloading process and transportation of equipment.

The main pollutants are dust; smoke contains CO, SO<sub>x</sub>, NO<sub>x</sub>, hydrocarbons.

**a) Dust, exhaust gas**

➤ **Dust arising from the excavation, embankment works for construction**

The extent of dust diffusion depends largely on the amount of excavated soil and embanked soil. Diffusing dust is calculated based on the pollution coefficient and soil-filled volume. Based on the World Bank's Environmental Assessment Sourcebook (Volume II, sectoral guidelines, environment, World Bank, Washington DC, August 1991), the pollution coefficient is determined by the mode:

$$E = k \times 0,0016 \times \frac{\left(\frac{U}{2,2}\right)^{1,4}}{\left(\frac{M}{2}\right)^{1,3}}$$

Of which:

E: Pollution Coefficient (kg/ton)

k: The grain structure has an average value of 0.35

U: wind speed (1.6 m / s)

M: The average moisture content of the material is 18.6%

Using the above formula, we can calculate the pollution coefficient E = 0.00786kg / ton of soil. The average specific gravity of the soil is 1.56 tons / m<sup>3</sup>, E = 0.00786 kg / ton = 0.01226 kg / m<sup>3</sup> = 12.26 g / m<sup>3</sup>. According to World Health Organization (WHO) guidelines, 1993 edition, the dust emission factor was about 1-100g / m<sup>3</sup>, the result above is appropriate.

Based on the volume of excavation and embankment of the project, the amount of dust generated in the air environment from the excavation and embankment activities of the project is calculated as follows.

Table 3.3. Volume of excavation during construction of transformer station

No.	Tasks	Volume (m <sup>3</sup> )
1	Excavation	728
2	Embankment	397

Source: Investor's Survey, March 2017

Table 3.3: The amount of dust generated during excavation and construction of transformer station

No.	Tasks	Volume		Amount of dust generated (kg)	Dust load (mg/s)
		m <sup>3</sup>	tons		
a	Excavation	728	1.135,7	8,9	2,2

b	Embankment	397	619,3	4,9	1,2
<b>Total</b>		<b>1.125</b>	<b>1.755</b>	<b>13,8</b>	<b>3,3</b>

Notes:

- Average density of soil is 1.56 tons/m<sup>3</sup>.
- The time for construction of excavation and embankment is 5 months, 8 hours/working day.

The Gaussian Diffusion Spectrometer (DAP) model was used to predict dust diffusion in the air (According to Mr. Pham Ngoc Dang, Air Environment, 1997 edition).

$$C_x = \frac{E}{\pi\sigma_y\sigma_z u} \exp\left[-\left(\frac{H^2}{2\sigma_y^2}\right)\right]$$

C: Concentration of pollutants in air (mg / m<sup>3</sup>).

E: Emission Waste (mg / s).

H: Points height (m), H = 1 m

$\sigma_z$ : The vertical diffusion coefficient of the atmosphere (m) is the function of the distance x toward the wind direction.

$\sigma_y$ : Horizontal diffusion coefficient (m); .

$\bar{u}$  :Average wind speed (m / s), = 1.6 m/s.

With  $\bar{u} = 1.6$  m/s, with average sun, stable level of the atmosphere is B. Then we have the coefficients a = 156; c = 106.6; d = 1.149; f = 3.3 (in case x ≤ 1km).

Table 3.4: Dust diffusion forecast results from excavation works of transformer stations

No.	Source of emission	Range of emission	Volume E (mg/s)	Distance to source (m)	Calculated concentration (mg/m <sup>3</sup> )	QCVN 05:2013/BTNMT (mg/m <sup>3</sup> )
1	Dust from excavation construction	Project area	Dust: 3,3	10	0,07	<b>0,3</b>
				20	0,03	
				30	0,02	
				40	0,01	
				50	0,01	

At a distance of 10m from the project site, the dust diffusivity is calculated as 0.07 mg / m<sup>3</sup> (70 □g / m<sup>3</sup>) in comparison with the accepted standard of ambient environment, which is under the standard No. QCVN 05: 2013 / BTNMT (300 □g / m<sup>3</sup>). Consequently, such dust diffusivity can not affect the environment.

- Emissions from construction equipment, transportation

The operation of the construction equipment generates emission from the combustion of the engines. The major emissions are NO<sub>x</sub>, SO<sub>2</sub>, CO, CO<sub>2</sub>, VOC (*volatile organic matter*).

Estimation of machines and construction equipment of the project and the amount of fuel used for the construction machines and equipment are as follows:

Table 3.5: Quantity of fuel (DO diesel) used by machines and equipment

No.	Equipments	Specifications	Quantity	Limit (liter/day) (*)	DO amount (liter/day)
1	Bulldozer D4C-11(4S)	1,89m <sup>3</sup>	02	54,6	109,2
2	Excavator E0-2621a	0,25m <sup>3</sup>	03	54,6	163,8
3	Crane	H=25m, Q=5T	01	60,5	60,5
4	Truck	15m <sup>3</sup>	03	38	114,0
5	Concrete mixer	> 0,25m <sup>3</sup>	02	36	72,0
6	Shock vibrator	1,5	03	4,5	13,5
7	Sheepfoot roller	2,5	01	4,5	4,5
8	Vibrating paving roller DY-48A	12T	01	40,32	40,3
9	Pump	2HP	02	7,65	15,3
10	Uwelding machine		02	(-)	0,0
<b>Total</b>					<b>593,1</b>

Source: (\*) Circular No. 06/2010 / TT-BXD dated 26/5/2010 of the Ministry of Construction

The amount of gas produced when completely burning 1 kg of diesel oil is about 22-25 m<sup>3</sup>. The density of DO oil is 0.87 g / cm<sup>3</sup>. Estimatedly, each day the machines operate an average of 8 hours / day. Emissions from burning DO oil while operating all machinery at the site are:

$$\frac{593,1 \times 25 \times 0,87}{8} = 1.612,5 \text{ m}^3 / \text{h} = 0,448 \text{ m}^3 / \text{s}$$

Based on the pollutant coefficient of pollutants from DO diesel combustion recorded by WHO (in 1993), we can calculate the pollutant amount and concentration of these pollutants as follows:

Table 3.6: Pollution coefficient of pollutants in DO diesel combustion

No.	Pollutants	Pollution coefficient (kg/ton of fuel)	Amount		Pollution concentratu (mg/m <sup>3</sup> )	Pollution concentratu (mg/Nm <sup>3</sup> )	QCVN 19:2009/ BTNMT column B (mg/Nm <sup>3</sup> )
			kg/day	mg/s			
1	Dust	0,90	0,37	12,72	28,4	47,1	200
2	SO <sub>2</sub>	1,00	0,52	17,92	40,0	66,4	500
3	NO <sub>x</sub>	9,62	4,96	172,36	384,8	638,5	850
4	CO	2,19	1,13	39,24	87,6	145,4	1000
5	VOC	0,79	0,41	14,17	31,6	52,5	-

(Source: Assessment of Sources of Air, Water and Land Pollution, WHO 1993).

\* Notes:

- QCVN 19: 2009 / BTNMT: National technical regulation on industrial emission of dust and inorganic substances (column B, Kv = 1, Kp = 1).
- S: percentage of sulfur in diesel fuel: S = 0.05%

Comment:

According to the assessment, the concentration of pollutants caused by the operation of the machines at the siter meet allowed standard. This indicates that the operation of the construction machinery during this period do not seriously affect the quality of the air environment in the project area.

**b) Noise**

- When transporting raw materials from warehouses and yards to the construction sites and vice versa, the noise of vehicles may affect people along the road and people joining in the traffic.
- Equipment for transformer station construction such as concrete mixers, compactors, excavators, hammers, etc. can cause noise to the surrounding environment.

Noise from some common equipment used in construction is shown in the table below.

Table 3.7: Noise levels generated by some construction machines

No.	Equipment	Noise level 1,5m away from source (dBA)	
		Documentation (1)	Documentation (2)
1	Bulldozer	93	-
2	Compaction machine		72-74
3	Bucket excavator		72-84
4	5-15 tons truck	93	82-94
5	Monitoring vehicle	70-82	-

*Notes:*

- Documentations (1): Nguyen Dinh Tuan and partners
- Documentation (2): Mackernize L.Da, 1985.

From the above table we can forecast the noise level from source and calculate the noise level at the recipients according to the formula:

$$L_{\Sigma} = 10 \lg \sum_i^n 10^{0,1.L_i}$$

- LΣ is the total noise level;
- Li is the source noise level I;
- n is the total number of noise sources.

Calculation results and estimate of quantity of source noise level:

The noise level at the distance of  $r_2 > r_1$  will be lower than the noise level at the distance of  $r_1$  with an amount  $\Delta L$  (dBA) according to the U.S. department of transportation formula, 1972:

$$\Delta L = 20 \text{ (dBA)}$$

Of which:  $a$  is the coefficient of influence of ground topography to the ability of absorbing and reflecting to noise, with:

- $a = -0.1$  with asphalt and concrete;
- $a = 0$  with bare ground without trees;
- $a = 0.1$  with grass land.

The result of the noise reduction based on the distance from the source of the noise, in case the ground around has plant (shrubs, grass) on it is as follows:

Table 3.8: Calculation of reduction of noise level from construction activities by distance

No.	Description	Source noise level (dBA) from the source	Noise level reducing by distance (dBA)				
			15m	30m	50m	100m	200m
1	Total noise level at location $L_{\Sigma} = 10 \lg \sum_i^n 10^{0.1 L_i}$						
	Excavation and embankment	94-97	72-74	71-71	70-70	70-70	70-70
2	Permissible noise levels in the workplace (According to Decision No. 3733/2002 / BYT)	85 dBA					
3	QCVN: 26/2010 / BTNMT - Maximum allowable noise limits for public and residential areas	75 dBA					

Calculated at a distance of 15m, noise generated by construction equipment complies with the standards allowed.

The boundaries of project area is away from residential areas and these facilities only works during the day, so the impact is considered to be small, short and manageable.

## **2/. Impact on water environment**

### ***a) Impact of domestic wastewater:***

According to Construction standard No. TCXDVN 33-2006 of the Ministry of Construction, the average amount of water used for the daily life of a worker is 120 liters/

person/day. With the number of workers at the maximum of 40 people, the total average water used for living is about 4.8 m<sup>3</sup>/day.

According to Decree No.80/2014/ND-CP dated 06 August 2014, the amount of domestic wastewater discharged into the environment is 100% of the water used; As such, the amount of domestic waste water is 4.8 m<sup>3</sup>/day.

Composition of domestic wastewater contains residues, suspended solids (SS), organic compounds (BOD/COD), nutrient compounds (N, P) and microorganisms.

Table 3.9: Concentration of pollutants in domestic wastewater

Parameters	Units	Concentration of pollutants		QCVN 14:2008/BTNMT (Column B)
		Untreated	Treated through septic tank	
PH	mg/l	6-7,5	5-7	5-9
BOD <sub>5</sub>	mg/l	200-250	120-140	50
SS	mg/l	180-210	50-100	100
Nitrat (NO <sub>3</sub> <sup>-</sup> )	mg/l	50-70	<1	50
Total coliform	mg/l	10 <sup>6</sup> -10 <sup>7</sup>	10 <sup>3</sup> - 10 <sup>6</sup>	5.000

*Source: Domestic wastewater treatment, Tran Duc Ha, 2006.*

Construction workers gather at the camp, so:

+ Domestic wastewater of workers in the working time is collected into septic tank mobile.

Thus, the impact of domestic wastewater is minimized and manageable.

***b) Construction waste water***

Construction waste water is discharged in the process of building foundation pits of transformer stations and discharging water in the concrete mixing process. Construction waste water will only be discharged in only 6 months and the daily flow is rather low and does not contain any components that adversely affect the water environment. So it does not cause negative impacts on the environment.

Lubricating oil and motor vehicle cleaning fluid:

- Waste oil, water from repair and maintenance of motorcycles and construction vehicles are also filled with suspended solids and grease, which, if not treated, will pollute the surface water. However, the car is maintained in the garages which are available in the local area. So the impact on environment should be low.

***c) Rainwater overflows during construction***

With regard to construction activities, it is possible for rainwater to spill over the land to and for sand and soil to be washed to the drainage system. If there is no good drainage method, it will cause water stagnation and bad effect on the environment.

Maximum flow of runoff is calculated as follows:  $Q = 0.278$  K.I.A (*Trinh Xuan Lai, Drainage, Science and Technology Publishing House, Hanoi, 2000*)

*Of which:*

*Q: maximum flow (m3)*

*K: The overflow factor which depends on the surface characteristics*

*I: highest daily rainfall intensity (mm/day)*

*A: Area (m2)*

*The project area is bare land, with grass on it; The overflow factor is  $K = 0,1$ .*

*The highest rainfall in La Ngau and Bao Loc meteorological stations:  $I = 235.7$  mm.*

*The area of the project area is  $A = 2,816$  m<sup>2</sup>*

The estimated maximum precipitation in the project area will be:

$$Q = 0.278 \times 0.1 \times 215 \times 10^{-3} \times 2.816 = 16.83 \text{ m}^3/\text{day}$$

In general, the impact of rainwater overflow during the construction phase is small. The rain water is quite clean, mostly turbid by rock and some construction materials dropped during construction and can be controlled by the drainage system. In addition, the activities of removing the mulch, leveling the ground, excavation and embankment are done during the dry season. Time of construction is short (about 6 months). Waste, dropped or removed material, are also collected and transported to a suitable site for treatment as required, so that rainwater will not wash away many pollutants from the project to the surrounding water. There shall be no substantial effect.

### **3. Impact on soil environment:**

#### **a) The impact of domestic solid waste**

With the number of workers expected in the peak month at 40 people, the daily solid waste volume of each worker is estimated at about 0.3-0.4kg/person. Based on the current daily solid waste status of each worker at the construction site, the amount of solid waste of the workers is about 12-16kg/day. The composition of daily domestic solid waste shall be as follows:

Table 3.10: Composition and density of solid waste of workers:

No.	Compositions	Weight ratio (%)	Quantity (kg)
1	Paper, packaging, etc	30	3,6 - 4,8
2	Rotting substance (animal and plant)	25	3 - 4
3	Glass	12	1,44 - 1,92
4	Plastic	10	1,2 - 1,4
5	Metals	6	0,72 - 0,96
6	Fiber	2	0,24 - 0,32
7	Other inorganic substances	15	1,8 - 2,4

The majority of domestic waste is biodegradable. Solid waste is collected daily at the waste disposal site of the building for rent for workers. However, during working hours at the construction site, workers will generate a certain amount of waste. This amount of waste will be collected in the waste bin and will be transported to the sanitation facility by the local waste collector.

#### **b) Impact of construction solid waste**

- Excessive excavated/embanked soil, stones, etc will be reused for leveling; Iron, steel, building materials, etc will be collected and returned to the place of production, reused or sold as scrap.

- Mud layer, vegetation cover of a small amount of surface will be used for excavation and embankment balance, leveling house for construction site and supporting area, so it does not affect the surrounding environment.

### ***c) Hazardous waste***

As with other construction works, hazardous waste generated includes waste oil and oil from cleaning mops used for maintenance activities, machinery maintenance, construction vehicles. According to the Ministry of Natural Resources and Environment's Circular No. 36/2015/TT-BTNMT dated June 30, 2015 on the management of hazardous waste, waste oil and grease shall be classified as HW (code 17 02 03), oil from cleaning mops shall be classified as HW (code 18 02 01). Lubricating oil and oil from cleaning mop from maintenance, repair of vehicles and transportation are unavoidable. This amount of HW generated during the construction process of the project depends on the number of means of construction machines and transportation, amount of lubricant discharged from the motor vehicle; lubrication and maintenance cycle of machinery.

The research results of the study on recycling of fuel oil into liquid fuel by the Center for Science and Technology - Ministry of Defense in 2002 showed that the average amount of lubricant discharged from the vehicle transportation and machinery for construction is 7 liters/time of change; cycle of oil-change and maintenance of the machine is from 3 ÷ 6 months depending on the working intensity of the vehicle.

The number of vehicles and mechanical equipment used for the construction of the project is about 10 vehicles. The amount of waste oil generated from the construction activities of the project is estimated at 70 liters/time, about 11.67 - 23.33 liters/month.

#### ***3.1.2.2. Non-polluting sources***

##### **1/. Impact on the ecosystem and landscape of the area**

The project is in line with local planning, so the land use for the project does not affect the local land fund as well as the general landscape.

The ecosystems of the project area and surrounding areas are all human - planting species, mainly coffee, rubber, cashew, banana, etc., which are planted by the local people. When constructing the project, landscape in land acquired for the project will be affected by aggregation of materials, excavation and embankment and so on. However, this effect is only temporary in the construction period of about 6 months. After the construction works, the area will be replaced by a 110kV transformer station and a 110kV transmission line, which will add a clean energy source to the national electricity system to meet the electricity demand in general and Binh Thuan province in particular.

Aquatic ecosystems are mainly natural aquatic species and sturgeon farming at the distance about 500m away from the project site. However, the installation of solar cells will reduce water evaporation, reduce solar energy absorption, decrease water temperature, increase the dissolved oxygen concentration in water, and have a good effect on the activity of aquaculture in the lake.

##### **2/. Influence on infrastructure**

**a) Impact on road traffic**

**\* The process of transporting materials and equipment**

Asphalt road directly connected to the project area is very good. Traffic density is quite sparse which is very convenient for transporting materials and equipment. Transportation of materials and equipment will be done on these roads.

Transportation of construction materials, transportation of waste from removal of vegetation cover to local waste disposal sites (with local authorities’ approval), transportation of equipment for project execution will increase the density of vehicles joining traffic. There will be risk of obstructing traffic, traffic accidents for local people on the route used.

The above effects can be overcome by reasonable transportation time, avoiding peak hours. In case of land subsidence, damage caused by the transportation of construction materials, the Investor shall compensate and/or remedy the damage and return the original situation. As a result, the impact on road traffic is considered to be negligible, controllable.

Construction of transformer stations and roads in the station has no effect on road traffic.

**\* The process of stretching the wires of intersections with roads**

- According to the survey results, the line of traffic intersection of the project area is as follows:

Table 3.11: Features of cross-sectional road of the project

No.	Roads	Width	Road status	Road material	Road status	Traffic dens
1	Inter-communal road	4	Good	Asphalt	Good	sparse
2	Inter-village road	3	Good	Soil	Good	sparse
3	Inter-village road	3	Good	Soil	Good	sparse
4	National Highway No. 55	12	Good	Asphalt	Good	average

Source: Construction survey report prepared by PECCA in March 2017

In the process of laying the wires, there is only an intersection with the road. Contractor will make the scaffolding system, install construction site signs, arrange traffic guide when the wires are pulled through the intersection, so the impact is negligible.

**Impact on waterway traffic**

According to the survey, the reservoir area does not have water navigation activities and shall not be affected by the transportation of solar panels, floats.

**3. Affect to the workers’ health and safety in the project area during the construction process**

**a) The risk of infection from workers to local people and vice versa**

- In process of construction, the labor force will rent houses, camps, warehouses and yards for material gathering. Due to the living conditions, sanitation, workers will be at risk of diseases such as diarrhea, dengue fever, malaria, etc. Contact between workers and local people may cause risk of infection to the community.

However, for local diseases, there are clinics and medical staff. On the other hand, workers receive periodic health checks and have a preventive medicine cabinet, so this effect is negligible.

***b) Affect to social security***

Workers concentrating on the construction site are mainly males in the short time of 06 months. The packages are implemented in turn, so the number of people on the site is not big, around 40 people. The construction area is separated from the residential area. In the process of construction, the Contractors will build temporary houses with barriers to isolate the construction area, housing with residential area, so there shall be no affect to the social security in the area.

***c) Impact on occupational safety during land-based construction***

During the construction process, the contractors shall set up the construction safety management system. The process of quality control and construction safety will be approved by the investor. The contractors perform the field work under the supervision of the consultant agency in accordance with the safety regulations in compliant with current regulations. Therefore, in the process of construction on land, the risk of unsafeness is minimized.

***d) Impact on occupational safety in construction on water surface***

During the construction process, the contractor shall set up the construction safety management system, the process of quality control and construction safety will be approved by the investor. The contractor performs the field work under the supervision of the consultant unit in accordance with the safety regulations in compliant with current regulations.

During the installation of the float system, the panel system on the reservoir, the workers absolutely comply with the regulations on safety on the water (such as using life jackets, safety straps, being trained for rescue work and asphyxiation, etc)

Therefore, the risk of unsafety is minimized during the construction process.

**3.1.3. Evaluate and forecast impacts during the operation / operation phase of the project**

Operation stage includes the following activities:

- Mobilizing the operating workers.
- Transmission activity of transformer station and connection line.
- Maintenance of power plants, inverter stations, transformer stations and connection lines.

***3.1.3.1. The source of the impact related to the waste in the operating phase***

In operation, the solar power plant at Da Mi hydropower reservoir in Binh Thuan province only performs electricity transmission without the need for raw materials and does not produce any products. Therefore, there are no activities of transporting raw materials and products, not creating any kind of emissions, dust.

The wastes in the operation stage mainly includes:

+ Waste arising from the maintenance and repair process such as: luminous branches, porcelains, wire, grease wipers, transformer oil, etc.

### **1/. Impact on water environment**

#### ***Domestic waste water of workers***

The station is designed to operate on a regular manning basis (5 operators/day). According to standard No. TCXDVN 33-2006 of the Ministry of Construction, the daily water consumption of each worker is 120 liters/person. Thus, the total daily water of 5 workers: 0.6m<sup>3</sup>/day. The waste water discharged into the septic tank is under the toilet, so the impact is negligible.

#### ***Wastewater generated by fire prevention***

In the event of a fire, the fire extinguishers will produce an amount of waste water. This is an infrequent source, rarely occurring.

The water supply for the fire department in the station was designed to include 01 tank with tank capacity  $V = 36\text{m}^3$ .

The amount of wastewater generated by fire fighting (if any) depends on the duration of the fire and the extent of the fire.

The oil sump system of the transformer station is larger than the oil contained in the transformer. In the event of a transformer incident, the water discharged from fire fight will flow to the oil trap which may contain spilled oil but will not catch fire, and will be collected in the tank for treatment. Therefore, fire fighting will not affect the environment.

### **2/. Impact on soil environment**

#### ***Domestic waste of workers***

The station is designed according to the mode of regular operators. The waste water is collected into the septic tank,

### **3. Impact on the environment due to hazardous waste:**

#### **➤ *Transformer Oil (Transformer Insulating Oil)***

- The requirements for transformer cooling and insulation oil ensure some are as follows or equivalent:

Insulating oils will be Shell, Diala, Nynas, Caltex or equivalent.

+ Characteristics: Transformer Insulating Oil is new, in accordance with IEC 60296 - grade II. Kinematic viscosity does not exceed 9.0 mm<sup>2</sup>/s at 40 ° C, dielectric dissipation factors at 100 ° C do not exceed 0.01%. The insulating oil used for all transformers in the substation is of the same oil manufacturer.

+Transformer oil is a non-PCB oil.

- The weight of transformer oil is 27,4 tons for each transformer; density is 890kg/m<sup>3</sup>.

- According to operation regulation, when checking result shows that the quality of transformer oil does not meet specifications, it shall be refined and supplemented; If the quality of transformer oil after filtering still does not meet specifications, it shall be replace

with new oil. When replacing with new transformer oil or having transformer accident (leakage, risk of fire or explosion), all of the engine oil is withdrawn to the oil tank.

- With transformer oil packaging (which has weight less than 600kg), there will be contract with the functional agencies to collect and treat the packaging according to regulations.

- Battery system: After use, the battery will be collected and contracted with the agency responsible for treating the hazardous waste for treatment as regulated.

➤ ***Oiled, greased wiper, paint strips, other waste with oil, grease in periodic maintenance***

The periodic maintenance and repair of the transformer station will generate cleaning wiper with oil and grease. Volume depends on the quantity of machinery, equipment to clean, maintenance. Normally, amount of waste is about 4kg/month (for the quantity of less than 600kg) and will be contracted with the unit has the function of collection and treatment according to regulations. Also there are other waste arising in the process of maintenance and repair such as broken porcelain, wire, etc.

➤ Replaced panels in the periodic maintenance process

Solar cells have a very large battery life, about 25 years. Normal operation does not cause pollution. However, during the battery life cycle, some batteries may be damaged and replaced. Investors will contract with units that have the function of collecting and processing according to regulations.

### ***3.1.3.2. Sources do not involve waste in the operation phase***

#### **Impact of electric field on operators and local people**

Electromagnetic field is a special form of matter, characterized by a combination of electrical and magnetic properties. The basic parameters, which represent the characteristics of the electromagnetic field are: frequency, wave length and propagation speed.

As it is known that around the conductor, a device with an electric current flowing, there are an electric field and a magnetic field existing at the same time. For DC currents, these fields are not interdependent, and for AC current they are closely related and form a uniting electromagnetic field.

Around the device carrying the current arise a concentric magnetic field. The amplitude of the magnetic field is proportional to the current amplitude and inversely proportional to the distance from the current bearing object.

The negative impact of electromagnetic field of the industrial frequency currents is shown only at the magnetic field strength of  $150 \div 200$  A/m, so the risk assessment of the electromagnetic field of high power is done mainly by electric field strength.

Thus, around the 110kV transformer station will form an electric field. Based on the Japanese CRIMAG model, the electric field strength of the unprotected 110kV carrier measured at the distance of 7 m is 1 kV/m. Therefore, the electric field of the 110kV transformer station in the area outside the radius of 7 m around the transformer has a strength of  $\leq 1$  kV/m. Accordingly, the electric and magnetic field strength values calculated at the locations in the 110kV transformer are as follows:

Table 3.12: Electric field strength at positions in the transformer and connection line

No.	110kV transformer station	Maximum field voltage (kV/m)	Allowed limit (kV/m)		Decision No. 3733/2002/QD BYT
			Decree No. 14/2014/NĐ-CP		
			Indoor	Outdoor	
1	Station yard	4,31	1	5	25
2	Under 110kV transmission line	0,57	1	5	25
3	Inside control room	0,68	1	5	25

As required by Decree No. 14/2014 / ND-CP, the electric field strength  $\leq 5$  kV/m at any point outdoor, one meter above the ground and  $\leq 1$  kV/m at any point indoor, one meter above the ground, and according to the Standard of Low Frequency Electromagnetic Field Strength, issued together with the Ministry of Health's Decision No. 3733/2002/QD-BYT, the maximum allowable electric field strength at work is 25k/m. Thus, in addition to the radius of 7m from the transformer, the electric field strength meets the requirements of Decree No. 14/2014/ND-CP in the indoor area. At the positions inside the station, the electric field strength is much lower than the maximum allowed by the Ministry of Health under Decision No. 3733/2002/QD-BYT.

### 3.1.4. Evaluating, forecasting the impact caused by the risks and incidents of the project

#### 3.1.4.1. Risks in the construction phase

##### a) Occupational accidents

Protection from occupational accidents is an important task during the construction of new items. As with any large-scale construction work, occupational safety is a matter that is particularly concerned by contractors, investors and workers who work directly on site . Possible occupational accidents may include:

Environmental pollution which is likely to have adverse affect to the health of workers on the site. Some pollution depends on the time and level of impact and are likely to cause serious injury, dizziness, fatigue, even fainting which require prompt medical attention (usually for female workers or people with weak health);

The construction equipment does not meet the safety conditions. The equipment is not subject to labor safety inspection under the guidance of Circular No. 32/2011/TT-BLDTBXH;

The construction site will have many transportation vehicles that can lead to traffic accidents caused by these vehicles;

Failure to comply with labor safety regulations when working with cranes, construction equipment, construction materials, high heaps fall, etc.

Occupational accidents from access to electricity such as construction work with electrical appliances;

On rainy days, the likelihood of causing occupational accidents can be high: slippery soil leads to slippage for workers and piles of construction materials. Electrical

incidents are likely to occur. The soils that are soft and easy to sink will cause incidents for people and construction machinery, etc and accidents when working on the water surface.

The probability of occurrence of the incident depends on the sense of observing the safety regulations for equipment as well as the construction procedures of the contractor and the sense of observing of the rules and regulations of labor safety in specific cases.

#### **b) Explosion and fire**

Fire and explosion can occur in the case of transport and storage of fuel for construction equipment. Explosion and fire can cause a lot of damage to people and property during construction. Specific causes can be identified as follows:

Temporary fuel storage for construction, machinery, technical equipment (paint, gas, oil, etc.) is potential source of fire. When the incident occurs, there might be serious human, economical or environmental damages;

The use of heating equipment in construction (cutting, welding metal, etc) can cause fire, burns or occupational accidents if there are no preventive measures;

The process of construction with electrical appliances can cause short circuit and lead to fire.

As these cases can occur at any time, the contractor will ensure the application of effective preventive measures to minimize these negative effects.

#### **c) Accidents of traffic accidents**

Traffic accident can occur at any time during construction, causing damage to property and life. The cause may be due to the lack of technical specifications or the driver's attention or the drivers do not follow the traffic rules. This incident can be completely prevented by checking the technical condition of the vehicles to ensure traffic safety, propaganda to improve the sense of obeying traffic rules for drivers.

#### **\* Incidents caused by vehicles for equipment and materials transportation**

The process of transporting equipment and materials for construction can cause collisions between vehicles participating in the project with other vehicles on the roads, which will lead to accidents and risks to human life.

#### **\* Incidents during construction**

During construction, if construction workers fail to comply with regulations on safety or are careless in construction, accidents may occur and can be fatal to workers.

#### **3.1.4.2. Risks in operation phase**

##### **a) Fire, electric shock**

This incident occurs during the operation phase, at the transformer station and the transmission line. The main reason is that workers do not comply with regulations or people are not aware of the problem of safety of high voltage grid, etc.

+ Electric shock: When the operator does not strictly comply with the safety rules in operating and using electrical equipment, electric shock may occur. The magnitude of this incident is limited to the spot, directly to the worker causing the incident. When there is a problem, the protective relay will shut the current.

+ Fire Explosion: A fire or explosion may occur during short-circuiting or overload, lightning strike or breakage, especially at cross-site with other power lines. Fire or explosion by electricity occur only at spot and in short time, because when the protective relay located at the circuit breaker will automatically shut the current, the automatic fire protection system will be activated automatically. However, fire and explosion can cause fire, if there is no timely fire extinguishing, it can lead to the risk of fire spread.

These events are rare due to the fact that the design process has been carried out in accordance with the standard and the operators have been trained on safety measures.

***b) Explosion, Oil Spill at transformer station***

Some of the major causes that may lead to fire hazards during the operation of the transformers are identified and listed as follows:

Fire due to short circuit, electric shock;

Fire due to poor wiring (loose, open);

Fire caused by electrical lightning such as lightning strike or wire break;

Transformer incidents by the internal and external causes of the transformer. The probability of transformer fire is very low;

The transformer explosion causes large amounts of oil leaking into the environment. If there are no collection measures, the transformer oil spills into the environment will pollute the environmental components, especially the soil and water environment, negatively affect the habitat of species, the ecosystem, the living of people in the project area. However, the transformer station has been designed with the oil collecting system into the oil trap to minimize the effect.

***c) Lightning strike***

Extremely strong current of lightning may cause breakage, damage to the transmission line and possibly cause explosion of the transformer. However, to ensure the safety of the grid, the transformer station is equipped with lightning protection system. There is direct lightning protection in the transformer station with lightning rods (3 meters long) mounted on a single centrifugal concrete pole and designed to hang two lightning conductors across the transmission line.

The work was designed with lightning protection according to TCVN standard so it is not likely to occur lightning strike. On the other hand, it is possible that the equipment is damaged by time or by weather conditions, that is when problems can occur. Therefore, it is necessary to pay attention to the regular inspection and inspection after flood or heavy rain.

***d) Storm, flood***

The float system is positioned by the anchor system, so storm and flood do not affect the panel system.

**3.2. COMMENTS ON THE DETAILS, RELIABILITY OF EVALUATION RESULTS AND PREDICTION**

\* Comment on the details and reliability of assessments on environmental impacts during project implementation:

To assess the impact of the project "Solar power plant in Da Mi hydropower reservoir, Binh Thuan province" on the environment, quick assessment method of World Health Organization (WHO), consultation method public opinion, method of listing, method of comparison and expert method are the main methods used in this report.

Assessment methods are highly reliable since they are used with basic and advanced scientific research methods and methods are widely used in EIA for development projects around the world as well as in our country. In this report, methods have been used by experts with extensive experience in the field of environmental assessment. Listing methods, comparative methods, expert methods and quick assessment methods are commonly used, which don not require too much data on the environment, ecology, clearly demonstrates the impact of different project activities on environmental and socio-economic factors. In addition to the site surveys, field surveys, monitoring and evaluation in the project area, consultation with the local authorities and social organizations, the assessment is reliable.

Table 3.13: Assessment of reliability of methods used in EIA

No.	Contents	Assessment methods	Comments on details and reliability of the assessment
<b>I</b>			
<b>Preparation stage of the project</b>			
1	Assessment of impact of land acquisition, compensation and assistance	- Method of field survey. - Mapping method. - Method of public consultation	* Comment: The impact data is based on the results of the preliminary survey in March, 2017 during the period of Feasibility study in the absence of a specific landmark of the project in the field (site demarcation and measurement, detailed inventory in the field in the later period of the project) * Reliability: Medium
2	Assessment of impact on ecological environment and production functions	- Professional solution - Method of field survey. - Mapping method	* Comment: - The preliminary ecological investigation and rapid assessment in one period (in April, 2017) at some specific sites, without concrete boundary of the project in the field. - The level of reliability depends on the subjective point of view of the evaluator. * Reliability: Medium
3	Evaluation of mines and explosives left over from the war	List method	* Comments: only semi-quantitative evaluation. * Reliability: Medium
<b>II</b>			
<b>Construction stage</b>			
1	Evaluating and forecasting impacts on the air environment	Experimental calculation	* Comments: The data and calculation coefficients are selected based on design parameters, construction workload and natural conditions of the project area. The calculations are

No.	Contents	Assessment methods	Comments on details and reliability of the assessment
			science - based, recognized and widely used. * Reliability: High
2	Evaluating, forecasting impacts on water environment	Rapid assessment method	* Comments: Based on the results of calculations using the pollution coefficient set by the World Health Organization, it is not suitable for the conditions in the project area. * Reliability: Medium
3	Evaluating and forecasting impacts on the land environment	- Rapid assessment method - Statistical methods and enumeration	* Comments: The assessment has not really been appropriate to the conditions in the project area; The statistic listing tables are only semi-quantitative. * Reliability: Medium
4	Evaluating, forecasting the impact of noise	Experimental calculation method	* Comments: The data and calculation coefficients are selected based on design parameters, construction workload and natural conditions of the project area. The calculations are science - based, recognized and widely used. * Reliability: High
5	Evaluating and forecasting impact on the landscape	- Professional solution method - Method of field survey. - Mapping method	* Comment: - Impact data is based on the results of the preliminary survey in March 2017 during the period of Feasibility study in the absence of specific landmark of the project in the field. - The level of trust depends on the subjective point of view of the evaluator. * Reliability: Medium
6	Evaluating and forecasting impacts on the ecological environment	Similar to (5) above	Similar to (5) above
7	Evaluating, forecasting impact on infrastructure	- Method of field survey. - Statistical method.	* Comments: The survey on the impact of the project on infrastructure is conducted in detail, specific to each section as the basis for project design. * Reliability: High
8	Evaluating and forecasting the effectson health of workers, local people and social security in the project area.	List method	* Comment: Qualitative assessment only. * Reliability: Medium
<b>III</b>	<b>Operation stage</b>		

No.	Contents	Assessment methods	Comments on details and reliability of the assessment
1	Evaluating and forecasting the impact of wastewater discharged by workers	Rapid assessment method	* Comments: Based on the results of calculations using the pollution coefficient set by the World Health Organization, which is not completely suitable for the conditions in the project area. * Reliability: Medium
2	Evaluating and forecasting impact of solid waste	- Rapid assessment method - Statistical methods and enumeration	* Comments: The assessment has not really been appropriate to the conditions in the project area; The statistic listing tables are only semi-quantitative. * Reliability: Medium
3	Evaluating and forecasting impacts on the ecological environment	List method	* Comment: Qualitative assessment only. * Reliability: Medium
4	Evaluating, forecasting the impact of electric field on operators and local people	- Experimental calculation method. - Comparative method	* Comment: The selected data is based on the design parameters and natural conditions of the project area. Evaluation based on computational results is compared with current regulations. Calculations are done by scientific methods which are recognized and has been widely used in Vietnam. * Reliability: High
5	Impact of electromagnetic fields on communication lines	- Method of field survey. - Statistical methods.	* Comments: The survey on the impact of the project on infrastructure is conducted in detail, specific to each section as the basis for project design. * Reliability: High
IV	<b>Estimation of impact caused by project risks and incidents</b>	- Professional method - List method	* Comment: Qualitative assessment only. The reliability of the assessment depends on the subjective point of view of the evaluator. * Reliability: Medium.

## Chapter 4

### MEASURES FOR PREVENTING AND REDUCTION OF NEGATIVE IMPACTS AND PREVENTING, PROTECTING RISKS AND INCIDENTS

#### 4.1. MEASURES FOR PREVENTING AND REDUCING NEGATIVE IMPACTS OF THE PROJECT

##### 4.1.1. Measures to prevent, minimize negative impacts of the project in the preparation phase

###### *Measures to minimize impacts caused by the compensation and support works*

###### *a) Mitigation measures*

Investors have researched and chosen the optimal project location to minimize damage to trees, houses, land, buildings, infrastructure, and so on. At the same time, the Investor also follow local socio-economic development plan in order to arrange the project in accordance with local planning.

In order to minimize the effects of land acquisition and property damage to local people and organizations, the Investor shall compensate for damage caused to local people and organizations in accordance with current regulations on compensation and support and resettlement of the Government and the regulations of Binh Thuan People's Committee when implementing the project.

- The Investor commits to carry out procedures for land recovery and conversion of land use purposes according to regulations.
- The Investor shall carry out compensation, support and resettlement in accordance with Land Law No. 45/2013/QH13, Decree No. 43/2014/ND-CP, Decree No. 44/2014/ND-CP, Decree No. 14/2013/ND-CP, Decision No. 08/2015/QD-UBND of Binh Thuan province, Decision No. 05/2015/QD-UBND of Binh Thuan province and relevant decrees, circulars and guidelines.
- Total budget for compensation and support is 5.6 billion VND.
- Carry out compensation, support for organizations, households affected fairly, publicly, transparently before the land acquisition for construction of the project.
- Work with the Board of compensation, site clearance when there are complaints, claims of people.
- The project owner shall ensure the budget for compensation, support and land clearance for the project.
- Quickly and definitively execute each item to reduce land acquisition time.
- Create more jobs for local laborers (for jobs requiring common labor).

For land in the safety corridor, due to limited land use, high trees shall not be planted to avoid affecting electricity safety. The operating unit will coordinate with the People's Committee of La Ngau Commune, Tanh Linh District and Da Mi Commune, La Da Ham Thuan Bac district - Binh Thuan province to publicize, announce to the people and work together to solve the problem.

###### *b) Minimized - affect area*

- Land acquisition area for the project.

***c) Reduction results***

- Damages are compensated and supported in accordance with current regulations of the Government and People's Committee of Binh Thuan province.

***d) Advantages and disadvantages***

- Compensation for damage caused by the project is mandatory for the investor, which will be included in the commitment to implement environmental protection measures.
- Compensation must be democratic, open and transparent. Basically, the compensation policy of the project has been elaborated according to the contents stipulated in Land Law No. 45/2013/QH13, Decree No. 43/2014/ND-CP, Decree No. 44/2014/ND. Decree No. 47/2014/ND-CP, Decree No. 14/2013/ND-CP and Decisions of Binh Thuan People's Committee.

**4.1.2. Measures to prevent and mitigate negative impacts of the project in the construction stage**

***4.1.2.1. Measures to prevent, mitigate negative impacts of the project related to waste***

***1. Measures to minimize the impact to air environment***

***\* The impact of dust and emissions***

***a) Mitigation measures***

- Surveying and selecting roads, sources of construction materials for the project.
- Using vehicles still in valid period to use for the construction of the project. The vehicles, machinery and equipment put into use must have operation license valid and registered with Vietnam Registry Department).
- Executing units and contractors shall implement the regime of periodical maintenance of vehicles, machinery and construction equipment.
- Watering in the excavation, embankment, leveling items generating dust.
- The expense for water spraying is included in the cost of the construction work package paid by the contractor.
- Requiring trucks to load properly as designed, without any tank extension.
- Warehouses with open materials must be protected against eddies. Storage must located to ensure that no dust can effect areas such as residential areas, living areas of people.
- Covering the carriage of building materials during transportation. This measure will reduce the amount of dust released to the environment by 90-95% compared to unprotected transport.

***b) Minimized area***

- Construction area
- Material gathering yard, transportation route for raw materials and equipment.

***c) Reduction results***

- Reducing dust, emissions like CO, SO<sub>2</sub>, NO<sub>2</sub>, etc into the air as regulations in current standards and regulations QCVN 05: 2013/BTNMT; QCVN 06: 2009/BTNMT; QCVN 04: 2009/BGTVT, QCVN 05: 2009/BGTVT.

**d) Advantages and disadvantages**

- These measures are highly feasible, but they require coordination and supervision of the Investor and the contractors.

- Implementing the mitigation measures in transportation of materials and equipment, and construction machines of the project as above will meet the requirements of environmental protection.

**\* Minimize noise pollution**

**a) Mitigation measures**

According to current noise measurement data at the project site (without construction), the noise level is below the standard of Vietnam for residential areas (QCVN 26: 2010/BTNMT). However, the construction of the project will certainly increase the noise in the area.

The use of noisy construction equipment (bulldozers, compactors, compressors, concrete mixers, etc) will cause unavoidable noise. However, the project will also have some measures to minimize noise effect generating from the construction area of the project to surrounding people. The best mitigation measures are:

- The vehicles, machinery and equipment used must have the operation license of the Vietnam Registry Department in which there are regulations on emissions, noise.

- Motor vehicles, heavy trucks and construction equipment used by the construction units must be inspected for noise, vibration and emission to ensure they meet the Vietnamese standards on technical and environmental safety.

- All loud construction works are carried out during the day.

**b) Minimized area**

- Construction area

**c) Advantages and disadvantages**

- The measures are highly feasible, but they require coordination and supervision of the Investor and the contractors.

- Implementing the mitigation measures in transportation of materials and equipment, and construction machines of the project as above will meet the requirements of environmental protection.

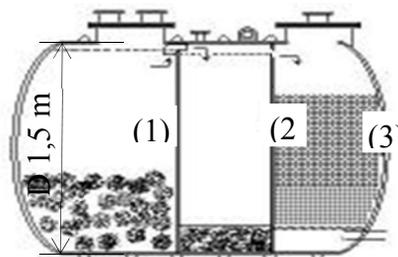
**2. Measures to mitigate impacts on water environment**

**a) Mitigation measures**

**\* For domestic wastewater:**

- For temporary workers concentrating on vacant land next to the project location, the investor shall take measures to compel the contractors to perform: hiring of mobile toilets (used for construction sites) with waste water tanks to collect and treat domestic

wastewater of workers according to the regulations with 03 toilets to ensure sufficient living of workers.



<u>Tank dimensions</u>	<u>Length (m)</u>	<u>Volume (m<sup>3</sup>)</u>
(1) Containing cabinet	1,2	2,1
(2) Deposition cabinet (Anearobic cabinet)	0,8	1,4
(3) Filtering cabinet	0,4	0,7
<b>Total</b>	<b>2,4</b>	<b>4,2</b>

Image No. 4: Mobile toilets

\* For construction wastewater:

- Wastewater from the washing of aggregate, water leakage from the process of mixing concrete with small mass has the main components including suspended substances containing no toxic components, so it should be deposited to mud and flow out.

- For waste oil and motor vehicle washing fluid: maintenance work is done at the garage to best manage the waste source. Garages have sewage, grease and waste collection systems that are treated according to regulations.

\* For storm water runoff during transformer station construction:

- When compiling soil and rock, it is necessary to compact it with the average thickness of 0.25m. Compaction shall be carried out in layers in accordance with design documents until the required compaction factor achieves the required standard to reduce the degree of dislocation, reduce the possibility of being washed away by rainwater.

- Do not concentrate raw materials near canals, drainage ditches.

- Regularly checking, not to let building waste enter the canal, drainage ditches.

- The construction activities must be neat and careful, not to let concrete, cement and sand dropped around the construction area to reduce the possibility of being washed away by rainwater.

- Construction in the form of rolling and cleaning the site immediately upon completion.

- After the construction of soil and rock, excess or removal construction materials, scattering shall be cleaned up to return the ground for people to continue production to avoid empty land.

- The construction site is designed to have a drainage system to ensure that no water is left on the road surface and that no rainwater or sewage is left in the process of construction in surrounding constructions.

- Building rainwater drainage ditches for transformer station area to prevent rainwater from depositing on the surface.

***b) Minimized area***

- Construction site area.

- Camp area, auxiliary works (warehouse, concrete mixing area, garage).

***c) Reduction results***

- Ensure the pollutant parameters of wastes according to standard No. QCVN 14: 2008/ BTNMT before being discharged into the environment.

***d) Advantages and disadvantages***

- Measures are highly feasible, but they require coordination and supervision of the Investor and the contractors.

**3. Measures to minimize impacts on the soil environment**

***a) Mitigation measures***

**\* Mitigation measures for domestic solid waste:**

Construction of the project will generate solid waste, mainly domestic solid waste as being analyzed in detail in Chapter 3. The amount of domestic waste for construction workers is about 12-16kg/day. Control measures are as follows:

- Asking workers not to litter.

- Arranging the containers of waste at the site of construction. The Investor/contractors shall contract with the functional unit in the locality for collection and treatment in accordance with regulations.

**\* Mitigation measures for solid waste generated:**

- Excessive soil, rock, etc will be reused for leveling; Iron, steel, construction materials, etc shall be collected and returned to the place of production, reused or sale of scrap.

- Mud layer, vegetation cover cleared, in small quantity will be used for soil balance, ground leveling for construction work and auxiliary areas, so it does not affect the surrounding environment.

***b) Minimized area***

- Construction site area.

- Camp area, auxiliary works (material storehouse, concrete mixer location).

***c) Reduction results***

- Preventing the discharge of waste and hazardous waste into the environment.

- Ensuring the collection, transportation and treatment of waste according to the Government's Decree No. 38/2015/ND-CP dated April 24, 2015 on solid waste management.

- Ensuring the collection, transportation and treatment of hazardous waste according to Circular No. 36/2015/TT-BTNMT dated 30 June 2015 on regulations on management of hazardous waste.

***d) Advantages and disadvantages***

- With the above solutions, the efficiency of solid waste treatment in this period is optimal and effective.

- Measures are highly feasible, but they require coordination and supervision of the Investor and the contractors.

**4. Measures to reduce pollution caused by hazardous waste**

Hazardous waste (HW) of the project is mainly identified as waste oil, oil-based wiper from maintenance activities, machinery maintenance, construction equipment. To control waste oil and grease wiper, the Investor shall coordinate with the Construction Contractor to take the following measures:

Minimize the repair of vehicles, construction machines in the project area. The maintenance of mechanical equipment and facilities must be carried out at functional facilities around the area; waste oil and grease wiper will be collected by these facilities;

Particularly for minor incidents, minor repairs that must be carried out in the project area, waste oil and grease wiper must be thoroughly collected and stored in suitable containers. in the project area;

The construction phase will be equipped with a 100-liter oil waste tank and a 60 liter grease wiper tank;

Due to the very low volume generated, the HW generated will be stored in suitable containers in a safe location in the material storage area of the project site. At the end of construction, the contractor will contract with the functional unit to collect and treat all HWs at the project containing houses. The collection and storage of HW transportation shall be carried out by competent organizations which are licensed by competent state agencies to carry out the hazardous waste management. At the same time, the investor shall make register of the hazardous waste source and submit it to the Department of Natural Resources and Environment for consideration.

***4.1.2.2. Measures to prevent and mitigate negative impacts of the project which are not related to wastes during the construction phase***

**1/. Mitigation measures affect the landscape**

***a) Mitigation measures***

- Executing the rational and definite construction work for each item in order to reduce the time for temporary occupation of land.

- Utilizing the volume of excavated soil to fill the transformer station platform, compacting, leveling and smoothing without obstructing traffic.

- Equipment, materials (sand, cement, rock, iron, steel, etc) are concentrated at warehouses and yards to ensure the safety and aesthetics of the landscape.

- After construction, the construction unit is responsible for clearing and disposing of construction materials and materials.

b) **Mitigation Area**: site construction area.

c) **Mitigation results**

- Ensure the regulations on construction and urban.

d) **Advantages, disadvantages**: Methods are feasible and effective.

## ***2/. Mitigation methods affect the infrastructure***

a) **Mitigation Methods**

*\* Mitigation methods for public transport*

- Construction vehicles are not overloaded. For oversized or overload machinery must have the dedicated transport to avoid damage to the road surface subsidence.

- In the construction process, the existing roads are used to transport materials and equipments . In case of damage or downgrading of roads caused by the project, the Employer or the construction contractor shall have to repair and restore the current state of the road.

- Contact the route management agency to have a coordinated plan to ensure safe construction and uninterrupted traffic.

b) **Mitigation Area**

- Along the roads transported the materials and equipment

c) **Mitigation results**

- To ensure the provisions on Decree No. 11/2010 / ND-CP dated February 24, 2010 of the Government about management and protection of land road traffic infrastructures.

d) **Advantages, disadvantages**

- These methods have an important role in mitigation the impacts of construction work on the traffic activities of the project area.

- Ensure circulation of the routes.

- Ensure the safety for workers and people.

- It is high feasible and effective

## **3/. Mitigation methods that affect the health and safety of workers in the project area during construction**

a) **Mitigation methods**

*\* Mitigate the risk of infection from workers to local people and vice versa*

- The construction unit performs the periodical health check and arranges medicine cabinets at the campsite to prevent common diseases for workers: cold medicine, fever, cotton bandage.

- Arrange the clean and hygienic resting place for to prevent illness.

- Arrange and equip the essential items for workers: curtains, mats, ...

- Propagate for workers to raise awareness of health and environmental hygiene.

- Implement the specific regulations on food hygiene for construction workers.

*\* Affect to the security and the order*

- The construction unit registers temporary residence and provides exactly information on the quantity and duration of stay of construction workers groups/ teams to the People's Committee of La Ngau and Da Mi communes during the construction period. Establish the relationship between the construction unit and the local government to discuss and make the necessary management decisions.

- Require the construction workers not to participate or cause social evils; The offender is strictly punished in accordance with the law.

- Require the workers respect the culture, customs, management, beliefs, historical and cultural relics, temples of the local, not to encroach on these areas.

- Make good relationships with local authorities, coordinate with local authorities in managing workers.

*\* Methods to ensure labor safety for construction workers in the process of construction and in the project area*

During the construction process comply with the regulations on safety techniques in construction of power projects specified in QCVN QTĐ-7: 2008/BCT - Volume 7: Construction of power projects; and other safety regulations issued by the State. Specifically:

- On organization of construction site:

+ Make fences and signboards around the site to prevent unauthorized persons from entering the site.

+ Have drainage system to ensure clean and dry construction ground. Do not put water on the road or let water flow into ground works.

+ Wells, cellars, pits on the work ground are covered to ensure the safety of passers or fences are sure. Trench lines, pits near the traffic road with a fence 1m high, having signal lights at night.

- *Comply with the regulations and work order:* Construction of pile foundation with high quality, suitable with geological structure of each location. To closely supervise the construction of pile foundation, ensure the correct type, volume of materials and technical construction.

- *Transportation of tools, materials and equipments:* performed by specialized trucks and rudimentary vehicles. The vehicle is tested a load before being used, secured firmly and in compliance with safety regulations for transport.

- *When digging the pit*

+ Strictly implement the safety methods during excavation.

+ All employees working under the foundation pit must have adequate labor protection equipment.

+ There are methods to strengthen the foundation pit at dangerous locations during construction;

+ The labor safety board assigns people directly supervises safety throughout the construction process.

- *Safety methods during installation of transformer and machinery, installation of beams, wiring, wire tension, sagging and other accessories.*

+ The positions to pull the rope to overcome obstacles must be scaffolding, signboards and bars, must have a red light signal at night.

+ Be careful during the time of pulling over the waterway; other power lines

+ Workers participating in the above work to ensure labor discipline, safety rules and regulations on labor equipment (wearing hats, gloves, ...).

+ Examine the ligaments, hook the cables before crane loads.

- *When working on high*

+ All workers are checked for health, enough standards of health to work on high, equipped with labor protection equipment.

+ The person who climbs to the pole must have a safety level of three or more and be able to work on high. Standard safety belts using the latest inspection shall not exceed 6 months. Moving, working on high workers must wear safety belts and safety belts should be firmly attached to the pole.

+ The equipments and tools are carefully checked for quality and quantity before using. Carefully inspect the braking cable before climbing up the pole.

+ Do not work on high when it is dark, foggy, when wind level V up.

In addition to site management, when it is necessary to appoint a specialist to perform safety and environmental monitoring tasks (to inspect production equipment, labor protection equipment and to regularly guide workers on safety and environmental protection during construction).

- *Installation of electrical equipment and power network*

+ Must strictly comply with the rules on safety installation of electrical equipment and related regulations.

+ Workers carrying electrical equipment must understand the rules of safety transportation and installation of electrical equipment.

+ Moving and installation of electrical equipments must use specialized tools to anchor. Do not use steel wires, cables, chains to tie the insulating parts, the contact points of the base holes.

+ During installation the transformer must short circuit the output of the machine and grounded protection of the wires.

+ Lamps to check the simultaneous switching of the contact points as well as for shine inside of the barrel must use voltage not exceeding 12V.

+ Before closing electricity to test the grid and electrical equipment must stop all related work, and the person in the distribution room must exit the danger area.

+ Fuses of the electrical network connected to the equipment must be removed during the construction time. Only put the fuse in the electrical network to adjust the device after everyone has been in a safe place.

+ All equipments, steel structures must have a grounding system and be connected to the general grounding system of the whole station.

- *Emergency work in case of accident*

The principle of work accident prevention is the main principle, but in the case of occupational accidents, construction contractors must also take emergency methods in time. In the event of an accident, the first-aid organization at site, then victims shall be promptly taken to the hospital for treatment and must keep the nearest hospital phone number for the ambulance. In addition, medical cabinets should be provided for first aid.

### ***b) Mitigation Area***

- The whole area of the construction site.

- Support area and construction worker camp.

### ***c) Mitigation results***

- Ensure that the provisions of the Labor Code No. 10/2012 / QH13 dated 18 June 2012 come into effect from 01/05/2013; Decree No. 45/2013 / ND-CP of the Government guiding the Labor Code on working time, rest time and labor safety and hygiene.

- Prevent and control epidemics, social evils and ensure order and safety in the localities according to the Law on Drug Prevention dated December 9, 2000; Ordinance on Handling of Administrative Violations dated July 2, 2002; Ordinance on Prostitution Prevention and Control dated March 17, 2003.

d) *Advantages, disadvantages*: Methods are feasible and effective

## **4.1.3. Methods to prevent, mitigate negative impacts of the project during the operation period**

### ***4.1.3.1. Methods to prevent, mitigate negative impacts related to waste***

#### **1/. Mitigation methods of affecting the water environment**

##### ***a) Mitigation methods***

##### **Domestic wastewater:**

The amount of domestic wastewater of operators is small, however, this wastewater containing high levels of SS and BOD<sub>5</sub> will be a significant source of water pollution. Therefore, this wastewater will be collected and treated by three compartments septic tank in the form of self-seepage.

Septic tanks are two simultaneous functions: sediment and decompose the dregs. Sediment is retained in the tank from 3 to 6 months, under the influence of anaerobic microorganisms, organic matter decomposes, partially forming gases and partially forming dissolved inorganic matter.

Wastewater after treatment through septic tanks, the concentration of pollutants is reduced by 40-60%, but still higher than domestic wastewater standards, the pollution criteria exceed 2-3 times compared to the standard. Therefore, it is necessary to add the item of wastewater treatment works after the septic tank.

With low load, investing in waste water treatment systems after septic tanks will not be economically feasible and difficult to operate in a small flow treatment system. Therefore, the proposed solution is to add anaerobic biological filter to the septic tank to increase waste water retention time and to utilize anaerobic digestion by adhering microorganisms to remove the amount of organic residue. Waste water after the anaerobic biological filter will be released in the form of self-infiltration. Diagram of septic tank structure combined with anaerobic biological filter for domestic wastewater treatment as follows:

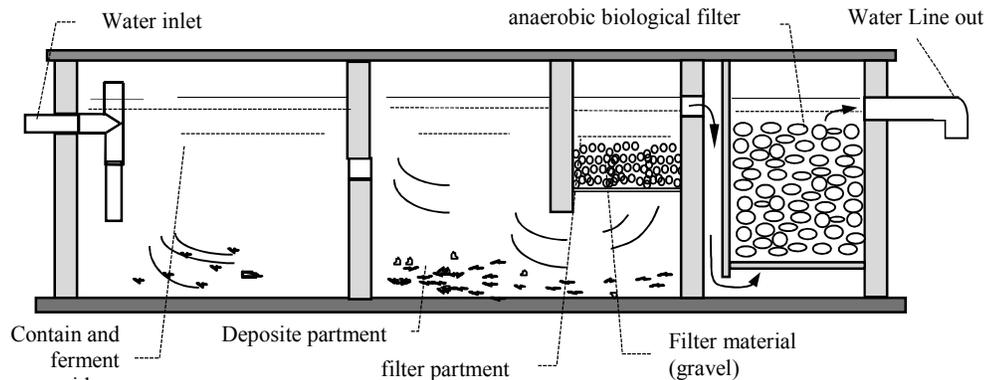


Figure 5: Structure of septic tanks combined anaerobic biological filter compartment

Wastewater from toilets is directed into the tank. Here, most of the suspended solids in the effluent are kept in the tank for 3 to 6 months, under the influence of anaerobic microorganisms, decomposing organic matter, partially forming substances gas and partly inorganic form. Wastewater from the reservoir is fed into the settling tank. Here, suspended organic matter is deposited by gravity. After settling, the water flows through the sand filter compartment. The water flows back from the bottom up through the filter material to separate the suspended organic matter. Water from the filter is passed through anaerobic biological filter. Thanks to the upstream bulkheads, the wastewater moves in a downward direction, contacting the anaerobic microorganisms adhering to the surface of the particles of the filter material so that the organic matter remains in the wastewater. The solution is dissolved, the water emerges through the filter material to the outside in the form of self-infiltration. Filter material depends on the construction contractor, some suggested materials are as follows: Multipurpose filter material ODM - 2F; spherical micro; MQ7 ...

b) **Mitigation Area:** Transformer station area

c) **Advantages, disadvantages:** Methods are high feasible and effective

## **2/. Mitigation Methods of affecting the land environment *Biện pháp giảm thiểu tác động đến môi trường đất:***

a) **Mitigation Methods:**

*Domestic waste of the operation worker*

Arranging the trash bins in the Transformer Station area. Solid waste of the operation worker was collected in the trash bin next to camp, Construction site with the

size of the 100liter waste container is arranged 2 barrels. Urban environmental sanitation will collect daily.

*The duster cloth with oil, grease in periodic maintenance process*

*Clean equipment with oil, grease during maintenance transformer station is collected and contracted with specialized units of waste treatment.*

**b) Mitigation Area:** Transformer Station area

**c) Mitigation results:** To ensure the collection, transportation and treatment of waste according to Decree No. 38/2015 / ND-CP of the Government dated April 24, 2015 on solid waste management.

**d) Advantages, disadvantages:** Methods are feasible and effective.

### **3/. Mitigation Methods of hazardous waste**

**a) Mitigation Methods:**

- The employer is Da Nhim - Ham Thuan - Da Mi Hydropower Joint Stock Company (the operating unit) shall file a dossier for registration of the hazardous waste source generator, requesting Binh Thuan Natural Resource and Environment Department to issue a dossier "Floating Solar power plant in Da Mi hydropower reservoir, Binh Thuan province" as regulated.

- According to the assessment of annual waste/hazardous waste of the Plant is under 600kg, so It will be signed with the unit responsible for collecting and treating waste. Storage will use the available hazardous waste storage of the owner.

#### **➤ Oil transformer waste:**

- The operation unit commits not to use the transformer containing PCB Đơn vị vận hành cam kết không sử dụng MBA có chứa chất PCB.

- When the transformer has a leak or explosion risk, or when replacing oil for the transformer, transformer oil is collected and stored in the oil tank (capacity 36m<sup>3</sup>); then the Employer will sign the contract with the unit responsible for treating hazardous wastes according to regulations.

- Oil collection process: to drain the oil from the transformer when having the problem, there is the general oil tank in the station. The oil tank with the capacity 36 m<sup>3</sup>, the size 4mx5m (It is enough to contain all the oil in a transformer and a part of the fire water) was made of reinforced concrete label B15(M200), with lid covered. At the bottom of the tank there is an oil pit, there is arranged the oil pipe in the tank. The tank was built underground, surrounded by macadam, the walls were arranged with steel steps. After the oil is collected into the oil pit, the employer will contract with the unit responsible for treating hazardous waste to be disposed of in accordance with the treatment of hazardous waste.

**b) Mitigation Area:** Plant area, Transformer station, Inverter, connection line. **Khu vực giảm thiểu:** khu vực Nhà máy, Trạm biến áp, inverter, tuyến đường dây đầu nối.

**c) Mitigation results:** To ensure the collection, transportation and treatment of waste according to Circulars No. 36/2015/TT-BTNMT dated June 30, 2015 of the Ministry of Natural Resources and Environment on the Regulation on hazardous waste management.

**d) Advantages, disadvantages:** Methods are high feasible and effective.

#### ***4.1.3.2. Methods to prevent, mitigation negative impacts not related to waste in the operation phase***

##### **Methods to mitigate the impact of electric field strength on the environment to human health**

###### ***a) Mitigation methods***

###### ***Mitigate the electric field strength***

As Chapter 3 states that the electric field strength values need to be met and that in Chapter 2, electric field strength values are measured at a number of locations in the area and values below the allowable limits Decree No 14/2014 / ND-CP on the outside electric field strength values and lower than the regulations of the electric strength standards issued in accordance with Decision 3733/2002 / QD-BYT. However, to ensure electromagnetic field safety, several management and control methods need to be taken during the operation of the transformer as follows:

###### **a) Prevent the affecting of electromagnetic fields for operators**

To ensure absolute safety, operators must comply with the operating procedures to ensure safety requirements;

Equipped with anti-magnetic clothing when employees work in high electromagnetic fields. In addition, when working in areas with high electromagnetic field effects, it is required to comply with the branch standards on the permissible level of electric field frequencies and to determine the working conditions;

To be fully equipped with labor protection devices, complying with the regulations on working time in areas with high electromagnetic strength to ensure safety;

Implementation of the regime to work in shifts to ensure that the contact time with the electric field strength within the specified limits.

###### **b) Prevent the impact of electric fields on the environment**

Grounding of metal structures of houses and works is stipulated in Circular No. 31/2014/ TT-BCT dated October 2, 2014 of the Ministry of Industry and Trade on detailing some contents of electric safety.

It is forbidden to carry out all work in the power grid safety corridor if using equipment, tools is possible to break the safe distance of discharge according to the voltage level. In

special cases, due to urgent requirements of the national defense and security work, there must be agreement with the power grid managing units on the necessary safety methods;

The employer will be responsible for organizing the environmental monitoring, electrical safety during the operation, and the cost of avoiding the electric field of the project is included in the operating costs of the project.

**b) Mitigation Area:** in power plant area, inverter station, connection line.

**c) Mitigation results:**

To ensure the provisions on Decree No. 14/2014 / ND-CP dated February 26, 2014 of the Government on detailing the implementation of the Electricity Law about electricity safety.

**d) Advantages, disadvantages:** Methods are high feasible and, but must have the coordination and supervision of the Employer, consulting unit, construction contractor and operation unit.

## **4.2. METHODS FOR MANAGEMENT, PREVENTION AND RESPOND TO RISKS AND INCIDENTS OF THE PROJECT**

### **4.2.1. Methods to manage, prevent and respond to risks and incidents of the project in the preparation stage**

In the process of clearing the ground for the project, in order to limit the encroachment into the areas outside the planned site, the following methods shall be taken:

It is not allowed to use defoliant, herbicides to clear trees in the project area;

In case of discovering the cultural relic in the project area, the work will be stopped immediately and the location will be adjusted. Upon detecting that the heritage, monuments, relics will stop the construction activities and report them to competent functional agencies.

### **4.2.2. Methods to manage, prevent and respond to risks and incidents of the project in the construction phase**

#### **4.2.2.1. Methods to protect labor safety**

*a) Basic rules and organization of labor safety inspection on site*

Work safety will be the employer and construction unit concerned from the beginning. The construction units will set up labor safety board before the work started. The safety board will organize training for employees on labor safety and checking the health to arrange workers in accordance with the nature of work on the site. In the course of construction such as excavation, erection, etc., it is very easy to get accidents so everyone on the site must strictly comply with the working procedures as well as regulations on labor safety.

The propaganda and education of all regulations on the site, especially the rules of labor safety for workers such as the rules on the use of safety belts when working on the high, the regulations on the use of electricity, use of machinery ... must be disseminated to each worker working on the site. The labor safety board of the construction site regularly inspects and supervises the methods to protect labor safety at the site, periodically reconsider, the good points are multiplied, the shortcomings are reminded, proposed remedies.

Hazardous areas must be marked with signs, safety signs and safety bars, and there must be a red light signaling at night. Be on guard for the duration of pulling the cable.

Must check regularly maintenance machinery, equipment, specialized cables, etc. before using.

*b) Labor safety methods under foundation pit*

All staff working under the foundation pit must have adequate labor protection equipment; There are methods to reinforce the roof of the pit at dangerous locations during construction;

The Labor Safety Board arranges the person directly supervises the safety throughout the construction process.

*c) Safety methods for lifting equipment*

Check the technical parameters of the lifting equipment, until the technical parameters are passed for the operation, if any points are not technically guaranteed, resolutely suspended operation.

Before lifting, inspect the work of hook, tie, ligaments. When operation, there must be guard and command forces. Do not stand directly down or work straight down the crane when lifting.

*d) Safety work on using electricity*

All electrical connection points must be sealed without opening; All devices do not use overload regulation; When disassembling, it is necessary to cut off the power or use an insulator.

*e) Accident and rescue work*

The principle of work accident prevention is the main principle, but in the case of work accidents, construction contractors must also take emergency methods in time. In the event of an accident, the first-aid organization shall be promptly taken to the hospital for treatment and must keep the nearest hospital phone number for the ambulance. In addition, medical cabinets should be provided for first aid.

*f) Methods to protect the health of workers*

In order to protect workers' health at the construction site, a number of methods should be taken:

Providing daily clean water for workers;

Having medicine cabinets and medical staff for workers when needed;

Training workers to develop methods for labor safety and regular disease prevention;

Provide necessary labor protection equipment at each construction stage, carefully check the labor tools to be brought before construction, tools must be lightweight, easy to operate;

Organizing periodical health checks, vaccination and medicine for disease prevention for construction workers. Should monitor the sources of disease to take methods to quarantine in time.

**4.2.2.2. Fire protection methods**

Fully apply fire protection requirements in the construction process. There are rules, fire signs prohibit fire in places where no fire, or near flammable. Prohibition of arc welding,

gas welding in areas with petrol, explosive substances. Banning electricity for cooking is not regulated.

The construction contractor must develop regulations on fire protection and equipment necessary for fire protection at the request of police.

To set up barriers to isolate hazardous areas such as explosive materials (fuel depots, petrol stations ...) and areas for welding and cutting steel.

Disseminating, educating and mobilizing people to strictly comply with the fire protection regulations of the State.

#### ***4.2.2.3. Traffic Safety***

In the construction process, many means of transportation transport materials and equipments into and out of the project area. In order to ensure traffic safety in the area, the following methods need to be taken:

Transport vehicles must meet all technical safety requirements and vehicles must have certificates of inspection by functional agencies before they can be put to use. When operation, drivers must comply with traffic regulations; when entering the project area, the drivers must follow the direction of the operator, the location of the stop, the loading, and so on;

Restricted transportation during peak hours with high passenger density;

The employer and construction contractors must allocate time, distribute and properly route the transportation of materials and equipments in service of construction in order to avoid traffic congestion in the area;

On roads leading into the project area, there must be signposts for the means to go along the prescribed routes;

At roads leading into the project area, there must be signs with motorized means of regular entry and exit, signs in the corners and in dangerous sections.

### **4.2.3. Methods to manage, prevent and respond to risks and incidents of the project in the operation phase**

#### ***4.2.3.1. Mitigation electric shock***

During the design process, the safety issue is considered very carefully so the risk of failure is very low if the safety regulations are complied with. When the problem occurs, the protection relay automatically switches off to protect the person from electric shock. In addition, The transformer is also protected grounded to ensure safety.

All metal structures in the station are connected to the grounding system of the station, bonded by C-clamp, bonded at the lightning welded positions by thermal welding.

The grounding system is arranged and calculated to ensure safety for people and equipment in all working modes. The grounding resistance of the system ensures that  $R_{nd}$  is  $<0.5\Omega$  at any time of the year.

#### ***4.2.3.2. Prevention and response to fire incidents***

a) Fire prevention and fighting system:

General requirements:

The station is equipped with automatic fire alarm system in the control room and distributor, fire alarm by the system, flashing lights;

Fire-fighting systems for electrical appliances using carbon dioxide (CO<sub>2</sub>);

Oil fire fighting system using chemical flasks, dry sand ...;

The transformer 110kV fire alarm system includes four explosion-proof heat detectors mounted above the transformer grille, controlled by two separate zones;

The transformers have equipped with fire protection system inside the machine at the beginning of the small fire appear, then the oil pressure in the machine increased, the fire signs arise;

Oil pressure and oil pressure monitoring systems in the transformers will isolate the risk of fire and fire alarm signals.

Plan of arrangement of fire alarm equipment:

Apply the Standards TCVN 5738-2000 - Fire alarm system - Technical requirements and appendices attached to the plan to arrange equipment fire alarm system for each area as follows:

Table 4.1: Installation of fire alarms

No	Name of the work item	Producti on rank	Refract ory level	Fire alarm
1	Operator and distributor 22kV	E	I	Fire alarm button; fire alarm; heat detectors and smoke; heat detector; Fire fighters center
2	Transformer 110kV - 63MVA	D	II	Explosion-proof thermostat

Plan of installation of fire fighting equipment:

Requirements for installation and use, stipulating the equipment and management of fire fighting equipment for each area as follows:

Table 4.2: Installation of fire fighting equipment in areas

SNo	Name of the work item	Producti on rank	Refract ory level	Fire alarm
1	110kV transformer area	D	II	Sandbanks, shovels Handle air bottle CO <sub>2</sub> 5kg / bottle Trolley air tank CO <sub>2</sub> 30kg / car Trolley powdered Asul T35 35kg / car.
2	Operator area and 22kV distribution	E	I	Installation of central fire control system. Handle air bottle CO <sub>2</sub> 5kg / bottle Trolley air tank CO <sub>2</sub> 30kg / car Trolley powdered Asul T35 35kg / car.

b) Management methods

Set up rescue teams to respond to fire or electric shock at connected sites; members are transformer station operators;

Make a fire prevention plan and regularly rehearse with the guidance of the police about fire prevention and fighting ;

Regular inspection and maintenance of fire protection equipment to ensures that they are always in good conditions;

Regularly check and maintain the transformer and other ancillary equipment so that they are always in the best condition;

Raise awareness of staff and workers in transformer station on fire prevention and fighting.

#### **4.2.3.3. Prevention and correction of oil leakage**

Oil leakage prevention:

During the operation of the transformer, some oil leakage and remedies are described as follows:

Table 4.3: Oil leakage phenomena and remedies

<b>No</b>	<b>Phenomen</b>	<b>Cause</b>	<b>Remedies</b>
1	Oil level in transformer is high	Ambient temperature is too high; The transformer is overloaded.	In this case, the oil level will be higher than the above line; Reduce load on transformer, avoid overloaded transformer operation.
2	Oil levels in the transformer is low.	The ambient temperature is too low; Possible oil leakage.	In this case, the oil level will be lower than the lower line; Check oil leak point. Stop running the transformer and repair the transformer at the oily place.
3	There is a flow of oil on the porcelain transformer.	Leakage at the transformer	Replace the transformer bushing; If the oil flows from the rubber joint, it is necessary to replace the rubber joints.

Collecting oil in case of transformer breakdown:

For transformer station, power transformers are oil immersion type, in normal operation, there is no oil leakage from the transformers. The probability of a transformer breakdown is very low. However, in the event of a transformer incident, the oil can spill over and spread to the surrounding environment.

To collect oil from the transformer in the event of an accident, prevent oil leaks affecting to the environment and the ecosystem. In the design of transformer construction, the oil tank must be located. Oil tank with oil volume of 36m<sup>3</sup>, size 4mx5m made of reinforced concrete label B15 (M200) with lid. At the bottom of the tank, there are the oil pipelines. The tank was built underground, surrounded by macadam slabs, and the walls were arranged with steel steps. The oil is collected in the tank and then pumped into the

container. This amount of oil will be considered if remaining usable will be recirculated after transformer troubleshooting, if the oil is considered non-reusable and the waste oil must be treated. The unit has the function of collecting and treating such as hazardous waste.

#### **4.2.3.4. Protection against lightning**

The station is designed to protect against lightning with the equipment in the station can withstand voltage as follows:

System voltage: 110kV / 22kV

Lightning impulse withstand voltage: 550kV / 125kV

Industrial frequency voltage: 230kV / 50kV

Lightning protection for the transformer by lightning valves near the input of the transformer.

Lightning protection shall be directed to the station by lightning strikes mounted on the gate posts and lightning collecting needles mounted on the lightning rods in the station.

Lightning conductor is connected to ground station with bare copper wires, with twisted strand of 120mm<sup>2</sup>.

To protect against lightning strikes directly on the wire, the connection line is designed to be hung with two lightning strands. The protection between the lightning conductor and the power cable at the top of the pole shall be less than 200, ensuring the requirements of the norm 11 TCN-19-2006 (Article II.5.63).

#### **4.2.3.5. Safe operation of the transformer**

a) Record and check

For the safe operation of the transformer, the operator must record the transformer parameters and check for hours as follows:

- Record the parameters at the transformer:

+ Transformer Oil;

+ Oil temperature;

+ Coil temperature.

- Check:

+ External status of transformer, oil leakage ....

+ Color of desiccant:

Green: Normal.

+ Pink: Desiccant is out of ability, must request a new replacement.

+ Verify the operation of four transformer cooling fans in the AUTO mode.

+ If the oil temperature is too high for the fan to run but the fan is not running, the fan must run the manual mode and announce to the shift key;

+ Listen in the transformer: the voice must be quiet and smooth;

+ Check electrical control cabinet: must be clean and normal;

+ Check status: porcelain, conductor, oil, cable, casing grounding must be normal.

b) Cases in need of a transformer emergency stop

The sound is loud, uneven and shaky inside;

Transformer oil spills out;

The heat ups of the transformer increased abnormally;

The color of the oil changes abruptly;

Ceramic insulator is broken, discharge the ceramic insulator surface;

Accident or fire in the transformer scope.

When the transformer is cut by the relay, it must quickly identify which relay is affecting, causing the impact:

If the offset relays, safety valves do not get the transformer to work again. Have to isolate the transformer from the system, organize the test to determine the cause. It is only permitted to operate the transformer when it has been approved by the Director or Deputy Director of the Plant and the Grid Operator;

If the other relay does not work, when the failure of the transformer itself is determined, it is possible to re-energize it once, but with the consent of the grid operator;

All cases of the transformer cutoff relay must promptly notify the grid operator, time and name of the relay to act in conjunction with the processor and report the station leader.

#### ***4.2.3.6. Safety in management, operation and maintenance***

The management of the operation and repair of power grids within the project scope includes: regular repair and maintenance, timely repair and overhaul of transformer and line incidents directly managed by the Managing Authority.

In order to mitigate the negative impacts, to limit incidents in the grid, to ensure a safe operation of the power grid and to limit work accidents, in the process of managing and operating, the operation and maintenance workers must fully and seriously observe the regulations on safety when performing the management, operation and repair work. Carry out the form of working cards, operation cards and procedures to work in accordance with regulations. To comply with the "Technical safety procedures in management, operation, repair and construction of power transmission lines and stations", issued together with the Decision No. 1559 / EVN / KTAT dated October 21, 1999 of General Director of The Electricity of Vietnam, the Circular No. 31/2014 / TT-BCT dated October 2, 2014 of Ministry of Industry and Trade on detailing some safety electricity problems.

### **4.3. IMPLEMENTATED ORGANIZATION OF PROJECTS AND ENVIRONMENTAL PROTECTION METHODS**

#### **4.3.1. Funding for environmental protection activities**

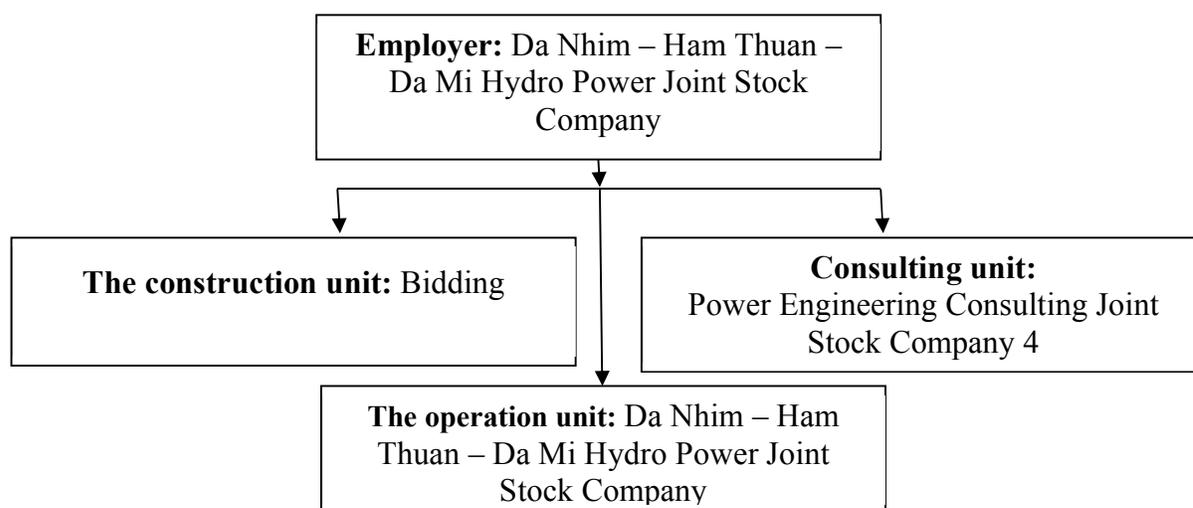
Expenditures for environmental protection activities of the project:

No	Article	Total amount
<b>I</b>	<b>ENVIRONMENTAL MONITORING AND WASTE MONITORING</b>	
<i>1</i>	<i>Construction phase</i>	

No	Article	Total amount
a	Cost for measuring the quality of the air environment (02 samples x 2 times = 04 samples)	Estimated <b>20,000,000 VND</b> (Included in the project's provisional sums)
<b>II</b>	<b>OTHER MONITORING</b>	
<b>1</b>	<b>Construction phase</b>	
A	Supervise the collection and disposal of waste at the site: 02 times x 2,500,000 VND/time = 5,000,000 VND (estimated)	Estimated <b>5,000,000 VND</b> (Calculated in construction costs: in the provisional sums of the project's untold costs)
B	Supervising the workplace health and safety protection for workers at the site: 02 times x 2,500,000 VND/time = 5,000,000 VND (estimated)	Estimated <b>5,000,000 VND</b> (Calculated in construction costs: in the provisional sums of the project's untold costs)
<b>2</b>	<b>Operation Phase</b>	
A	Cost of monitoring electromagnetic field (50,000 VND / point x 3 points) / 06 months and performed during the operation period.	300,000/year (Calculated in operating costs)

#### 4.3.2. Organization of project management and operation

*Block diagram of the organization managing and operating the project:*



## Chapter 5

### ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAM

#### 5.1. ENVIRONMENTAL MANAGEMENT PROGRAM

- The employer shall responsibility for supervising the implementation of environmental management programs in the course of work construction such as surrounding environment management programs, waste management and prevention of environmental incidents.

- The employer organizes and manages the supervision of the implementation of environmental management programs during the construction process: The employer may organize if the company has enough specialized departments or rent the competent authorities are responsible for monitoring the implementation of environmental management programs. Receiving feedback on the environmental issues of the construction units, local people, local authorities, environmental management agencies in the project area, etc. in the course of project implementation in time. Time to adjust environmental management programs.

- Monitoring results are reported periodically to the Department of Natural Resources and Environment of Binh Thuan province. Frequency of reporting is 06 months or one year depending on the monitoring program and the specific period.

##### 5.1.1. Organizational structure

The organizational structure of the environmental management program is shown in Table 5.1

Table 5.1: Implementation of environmental management

Role	Responsibility	Implemented Organization
<b>I</b>	<b>Construction phase</b>	
The Employer	Main responsibility for managing the whole project, including environmental management.	Da Nhim – Ham Thuan – Da Mi Hydro Power Joint Stock Company
the entire project management organization	Responsible for coordinating and managing the implementation of the entire project, including guiding and monitoring the implementation of the environmental management program.	Da Nhim – Ham Thuan – Da Mi Hydro Power Joint Stock Company
Environmental Officer	Responsible for environmental project management, who is the exchange of environmental issues.	Da Nhim – Ham Thuan – Da Mi Hydro Power Joint Stock Company
Project implementation organization	Responsible for day-to-day project management, including: Planning and implementing environmental management activities during construction.	Da Nhim – Ham Thuan – Da Mi Hydro Power Joint Stock Company

<b>Role</b>	<b>Responsibility</b>	<b>Implemented Organization</b>
	<p>Coordination with other member units on environmental management activities</p> <p>Carry out internal monitoring and independent monitoring.</p> <p>Monitor and provide funding for monitoring activities.</p> <p>Reporting environmental information to stakeholders.</p>	
Technical supervision of the contractor	Responsible for supervising construction contractors, including the implementation of environmental management activities.	Da Nhim – Ham Thuan – Da Mi Hydro Power Joint Stock Company
Construction contractors	<p>Responsible for the development and monitoring of major environmental management activities undertaken by the contractor. Include:</p> <ul style="list-style-type: none"> <li>- Apply mitigation methods during the construction phase.</li> <li>- Ensure occupational safety for workers and local people during the construction process.</li> </ul>	Da Nhim – Ham Thuan – Da Mi Hydro Power Joint Stock Company.
<b>II</b>	<b>Operation phase</b>	
Project Operations	Responsible for operation of the project, including environmental management and monitoring activities during the operational phase	Da Nhim – Ham Thuan – Da Mi Hydro Power Joint Stock Company

### 5.1.2 Environmental Management Program

Table 5.2: Environmental management program in the project phases

No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
I	CONSTRUCTION PREPARATION PHASE	Compensation and assistance	Changes in the purpose of land use in long-term occupied areas, reduction of land funds for other uses.	<ul style="list-style-type: none"> <li>- The employer commits to carry out procedures for land recovery and conversion of land use purposes according to regulations.</li> <li>- Compensation, assistance and resettlement in accordance with the regulations of the State and Binh Thuan People's Committee.</li> <li>- The employer ensures budget for compensation, assistance and site clearance.</li> </ul>	Site clearance compensation cost is estimated at 5.6 billion VND.	Before implementing the project	Compensation clearance Board.	<ul style="list-style-type: none"> <li>- Da Nhim – Ham Thuan – Da Mi Hydro power Joint Stock Company</li> <li>- Department of Natural Resources and Environment of Binh Thuan province</li> <li>- People's Committee of Tanh Linh, Ham Thuan Bac district</li> <li>- People's Committee of</li> </ul>

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No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
								La Ngau, Da Mi Commune.
II	CONSTRUCTION PHASE	<ul style="list-style-type: none"> <li>- Level the ground, construct the camp, warehouse.</li> <li>- Construction of foundation excavation MBA, foundation.</li> </ul>	Impact on the air environment: dust, exhaust gas, noise from construction activities and transportation of materials and equipment, causing negative	- Inspection of means of transportation, machinery and equipment which require the operation license of the Vietnam Register in which the emission standards and noise	Calculate the cost of construction	From construction to completion	<ul style="list-style-type: none"> <li>- Da Nhim – Ham Thuan – Da Mi Hydro power Joint Stock Company;</li> <li>- Construction contractor.</li> </ul>	<ul style="list-style-type: none"> <li>- Department of Natural Resources and Environment of Binh Thuan province</li> <li>- People's Committee of Tanh Linh,</li> </ul>

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No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
		<ul style="list-style-type: none"> <li>- Construction of roads inside and outside the station</li> <li>- Transportation, loading and unloading of construction materials and equipment.</li> </ul>	impact on the air environment.	<ul style="list-style-type: none"> <li>levels are determined.</li> <li>- Watering during excavation, leveling and compaction.</li> <li>- Covering the crates carrying construction materials.</li> <li>- Construction equipment is always technically tested and will operate in good condition to meet noise and vibration standards.</li> <li>- All loudspeaker construction articles are carried out during the day.</li> </ul>				Ham Thuan Bac district
			Impact on water environment due to:	* Domestic wastewater:	Calculate the cost of construction	From construction to completion	- Da Nhim – Ham Thuan – Da Mi Hydro	- Department of Natural Resources and

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No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
			<ul style="list-style-type: none"> <li>- Domestic wastewater of construction workers.</li> <li>- Construction wastewater arising during the construction of pit and water leakage during concrete mixing.</li> <li>- Waste oil and motor vehicle washing.</li> </ul>	<ul style="list-style-type: none"> <li>- For temporary construction workers, the employer recommends contractors that: Renting portable toilets (used for construction sites) contain waste water tanks for collecting and treating domestic wastewater of workers according to regulations.</li> <li>* Construction waste water:               <ul style="list-style-type: none"> <li>- Construction sites are designed with guaranteed drainage system. Do not put water on the road</li> </ul> </li> </ul>			<ul style="list-style-type: none"> <li>power Joint Stock Company;</li> <li>- Construction contractor.</li> </ul>	<ul style="list-style-type: none"> <li>Environment of Binh Thuan province</li> <li>- People's Committee of Tanh Linh, Ham Thuan Bac district</li> </ul>

No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
				<p>surface and do not let run rain water, wastewater during construction into surrounding works.</p> <ul style="list-style-type: none"> <li>- Arrange the water hole to settle the sand before going out.</li> </ul> <p><i>* Oil waste and construction wash water car, machine:</i></p> <ul style="list-style-type: none"> <li>- The repairs are carried out at the existing garage in the locality. Garages have oil, grease and waste collection systems that are treated according to regulations.</li> </ul>				

No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
			Impacts on soil environment due to: - Solid waste of construction workers. - Solid waste during construction (cement bag, surplus material, wooden crates containing equipment ...)	* <i>Domestic waste:</i> - Asking workers not to litter. - Construction worker waste is collected and concentrated in garbage containers. Construction contractors will contract with functional units to collect and process. * <i>Construction solid wastes include:</i> - Soil, stones, ... will be reused for leveling the ground; Iron, steel, construction materials ... collected to return the place of	Calculate the cost of construction	From construction to completion	- Da Nhim – Ham Thuan – Da Mi Hydro power Joint Stock Company; - Construction contractor.	- Department of Natural Resources and Environment of Binh Thuan province - People's Committee of Tanh Linh, Ham Thuan Bac district

No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
				production, reuse or sale of scrap. - For mud layer, the vegetation cover of the transformer station surface should be poured in the right place of the district where the locality approves.				
			Impact on the landscape of the area due to: - Construct the project items	- Implement reasonable construction, finish of each item to reduce the time of land temporarily occupied. - Utilize the volume of excavated soil to fill the transformer station platform, compacting, leveling	Calculate the cost of construction	From construction to completion	- Da Nhim – Ham Thuan – Da Mi Hydro power Joint Stock Company; - Construction contractor.	- Department of Natural Resources and Environment of Binh Thuan province - People's Committee of Tanh Linh, Ham Thuan Bac district

No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
				<p>and smoothing without obstructing traffic.</p> <ul style="list-style-type: none"> <li>- Equipment, materials (sand, cement, stone, iron, steel ...) are concentrated in the warehouse by contractor, construction unit to ensure the safety and aesthetics of the landscape.</li> <li>- After construction, the construction unit is responsible for clearing construction materials and the material returned to the site is smooth and safe.</li> </ul>				

No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
			Impact on infrastructure: - Impact on road traffic	<ul style="list-style-type: none"> <li>- Construction vehicles are not overloaded. For oversized, overload machinery, must have specialized transport to avoid damage to the road surface subsidence.</li> <li>- Regulate and arrange the reasonable work to avoid obstructing traffic.</li> <li>- In the course of construction, the existing roads are used to transport materials and equipment. In case of damage, downgrading of</li> </ul>	Calculate the cost of construction	From construction to completion	<ul style="list-style-type: none"> <li>- Da Nhim – Ham Thuan – Da Mi Hydro power Joint Stock Company;</li> <li>- Construction contractor.</li> </ul>	<ul style="list-style-type: none"> <li>- Department of Natural Resources and Environment of Binh Thuan province</li> <li>- People's Committee of Tanh Linh, Ham Thuan Bac district</li> </ul>

No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
				roads caused by the project, the employer shall have to repair and restore the original state.				
		Concentrated the construction workers	<ul style="list-style-type: none"> <li>- Affecting the health and labor safety of the project area during the construction process.</li> <li>- The risk of infection from workers to local people and vice versa.</li> <li>- Affecting security, order and labor safety in the project area during the</li> </ul>	Mitigation methods are specified in Chapter 4, Section 4.1.2.2.	Calculate the cost of construction		- Construction contractor.	- Department of Natural Resources and Environment of Binh Thuan province - People's Committee of Tanh Linh, Ham Thuan Bac district

No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
			construction process					
III	OPERATION PHASE	Operation of power plants, inverter stations, transformer stations and connection lines.	Impact on water environment: - Domestic wastewater of workers for maintenance	- The toilets with septic tank (built during construction phase): Collecting wastewater from transformer station operators to the underground septic tank.	Calculated in the construction cost of the project	Construction of latrines at the construction stage, and wastewater collection during the operation.	- Da Nhim – Ham Thuan – Da Mi Hydro power Joint Stock Company	- Department of Natural Resources and Environment of Binh Thuan province - People's Committee of Tanh Linh, Ham Thuan Bac district
			Domestic waste of maintenance workers affects the soil environment	Arrange garbage cans in the factory area, transformer station. Solid waste of the operator is collected in the garbage. District environmental	Calculated in operating costs	During the operation of the project.	- Da Nhim – Ham Thuan – Da Mi Hydro power Joint Stock Company	- Department of Natural Resources and Environment of Binh Thuan province - People's Committee of

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No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
				sanitation will transport domestic waste to hygienic treatment.				Tanh Linh, Ham Thuan Bac district
			The duster cloth with oil and grease in periodically maintenance process can disperse and pollute the environment	- Oil and grease duster clothes in the process of plant maintenance and transformer stations shall be collected and contracted with units having the function of treating hazardous wastes to be disposed of according to regulations.	Calculated in operating costs	During the operation of the project.	- Da Nhim – Ham Thuan – Da Mi Hydro power Joint Stock Company	- Department of Natural Resources and Environment of Binh Thuan province - People's Committee of Tanh Linh, Ham Thuan Bac district
			Impact of electromagnetic fields on operators and people.	Mitigation methods are provided in Chapter 4, Section 4.1.3.2.	Calculated in operating costs	During the operation of the project.	- Da Nhim – Ham Thuan – Da Mi Hydro power Joint Stock Company	- Department of Natural Resources and Environment of Binh Thuan province;

No	Phase of the project	Project activities	Environmental impacts	Works, methods to protect the environment	Funds for implementation of environmental protection works and methods	Time to complete and complete	Responsibility for implementation	Supervision responsibility
								- Department of Industry and Trade of Binh Thuan province.
			<ul style="list-style-type: none"> <li>- Fire, electric shock incidents.</li> <li>- Incident of oil spill in transformer</li> <li>- Water incident arising from fire</li> </ul>	Mitigation methods are mentioned in chapter 4, item 4.2.3.	<ul style="list-style-type: none"> <li>- Installed works and equipment have been built and installed during the construction phase.</li> <li>- Maintenance and maintenance costs included in project operating costs.</li> </ul>	During the operation of the project	<ul style="list-style-type: none"> <li>- Da Nhim – Ham Thuan – Da Mi Hydro Power Joint Stock Company</li> </ul>	<ul style="list-style-type: none"> <li>- Department of Natural Resources and Environment of Binh Thuan province;</li> <li>- Department of Industry and Trade of Binh Thuan province.</li> </ul>

## **5.2. ENVIRONMENTAL MONITORING PROGRAM**

During the construction phase, the requirements for the implementation of environmental impact mitigation methods entered into contracts with construction contractors. The environmental unit of the employer performs the work related to the environment and supervises activities of the implementation of environmental protection activities of the construction contractor. Activities during the operation phase are self-organized by the employer.

### **5.2.1. Waste monitoring program and surrounding environment**

Table 5.3: Monitoring program for the surrounding environment

<b>STT</b>	<b>Surveying norms</b>	<b>Sample</b>	<b>Surveying position</b>	<b>Frequency</b>	<b>Note</b>
<b>A</b>	<b>CONSTRUCTION PHASE</b>				
1	To supervise the collection and treatment of garbage (solid waste, hazardous waste)		At site	Every 3 months	
2	Supervision of erosion, drowning by excavation.		At site	Every 3 months	
3	Supervise labor safety for workers		At site	Every 3 months	
<b>B</b>	<b>OPERATION PHASE</b>				
1	Electromagnetic monitoring	3 samples	- Station bar - Fence wall system - Installed equipment for operation	Every six months and upon request of the state management agencies	Employer

## Chapter 6

### COMMUNITY CONSULTATION

#### 6.1. SUMMARY ON THE PROCESS OF ORGANIZING COMMUNITY CONSULTATION

##### 6.1.1 Summary of the consultation process Commune People's Committees, organizations directly affected by the project

In item 28, Appendix 2 of Decree No. 18/2015 / ND-CP dated 14/02/2015 of the Government of the project "**Floating Solar power plant on Da Mi hydro reservoir, Binh Thuan province**" belongs to the group of projects on energy and radioactivity (part of the project on construction of power transmission lines of 110 kV or higher). The project must set up an Environmental Impact Assessment report to submit to the Department of Natural Resources and Environment, Binh Thuan Provincial People's Committee for consideration, appraisal and approval. Da Nhim - Ham Thuan - Da Mi Hydropower Joint Stock Company has sent Official Letter No. 13 / ND-CP to People's Committees of communes asking for community consultation on EIA report contents of the project.

Da Nhim - Ham Thuan - Da Mi Hydropower Joint Stock Company has received the written response of the People's Committee of the commune to "*Consultation on the content of the EIA report of the project*", the content of Official Letter is attached to the appendix of the report

Table 6.1: Statistics of respondents' comments on the EIA of the project

No	Answer consultation unit	No. Document	Time
<b>I</b>	<b>Tanh Linh District</b>		
1	La Ngau commune	08/CV-UBND	26/4/2017
<b>II</b>	<b>Ham Thuan Bac District</b>		
1	La Da commune	07/CV-UBND	24/4/2017
2	Da Mi commune	19/CV-UBND	25/4/2017

##### 6.1.2. A summary of the process of organizing a community-based consultation meeting directly affected by the project

Da Nhim - Ham Thuan - Da Mi Hydropower Joint Stock Company, in cooperation with the consultancy unit, has coordinated with the local community to conduct community consultation directly affected by the project. The compositions and opinions of the participants in the meeting are shown in the community meeting minutes.

Table 6.2: Statistical records of community consultation meetings

No	Residential community	Meeting time
<b>I</b>	<b>Tanh Linh District</b>	
1	La Ngau commune	26/4/2017
<b>II</b>	<b>Ham Thuan Bac District</b>	
1	La Da commune	24/4/2017
2	Da Mi commune	25/4/2017

## **6.2. COMMUNITY CONSULTANCY RESULTS**

### **6.2.1. Opinion of Ward People's Committee**

#### **Summarize the opinions of People's Committees of communes:**

1. On the negative impacts of the project on the natural environment, social-economic and public health: agree on the corresponding contents as presented in the enclosed documents.
2. On the methods to mitigate the negative impacts of the project on the natural environment, social-economic and public health: agree on the corresponding contents as presented in the enclosed documents.
3. Proposals for the Employer:
  - Conduct the conversion of land use purpose in accordance with the law before construction.
  - During the construction process, the collection and gathering of domestic wastes and solid wastes at the prescribed places to avoid polluting the surrounding environment.
  - Proposing the employer to fully implement the compensation of land, crops and assets on land satisfactorily for the affected people before performing the project.
  - Periodically inspect the electric safety corridors according to the provisions of law.
  - The construction unit strictly supervises the construction workers and must not leave the construction workers causing security and order in the locality.
  - During the operation period, the employer must regularly check and maintain the line in order to identify problems in a timely manner, avoiding negative impacts on households living near the line.
  - To comply with the Law on Environmental Protection and the provisions of the law on environmental impact assessment.

(The reply official letters of the wards is attached in the appendix)

### **6.2.2. Opinions of community representatives directly affected by the project**

- Proposing the employer to strictly comply with the law on environmental protection and the provisions of the law on environmental impact assessment.
- In the course of construction, the domestic wastes and solid waste must be collected and packed at the prescribed places to avoid polluting the surrounding environment.
- Proposing the employer to complete the compensation of land, crops and assets of the people in the project area.
- Proposing the employer to fully implement the compensation of land, crops and assets on land satisfactorily for the affected people before performing the project.

### **6.2.3. Opinions and commitments of the employer on the proposals, petitions and requests of concerned agencies, organizations and communities**

- The employer would like to receive comments from the People's Committees of communes and communities directly affected by the project and commit to implement methods to protect the environment in accordance with the law, corrective methods in time

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of environmental problems as stated in Chapter 4 of the report on environmental impact assessment.

- In the course of project implementation, if the complaint arises, the employer commits to settle it according to the provisions of law.

## **CONCLUSIONS, RECOMMENDATIONS AND COMMITMENTS**

### **1. Conclusions.**

Based on the analysis of current situation and forecasting possible impacts on the environment when carrying out the project of "**Floating Solar power plant in Da Mi Hydropower reservoir, Binh Thuan province**", there are some comments such as:

- The project "**Floating Solar power plant in Da Mi Hydropower reservoir, Binh Thuan province**" invested by Da Nhim - Ham Thuan - Da Mi hydropower joint stock company to achieve the target:

+ The solar power plant at Da Mi hydropower reservoir, Binh Thuan province was built with the objective of adding a clean energy source to the national electricity system to meet the electricity demand of the power system in general and the Binh Thuan province in particular.

+ The project is also a big target when it is one of the first solar power projects in Vietnam, contributing to create the premise for the development of clean energy from the sun. Consistent with the power development orientation of the Government, the Ministry of Industry and Trade and the Electricity Vietnam.

- The major environmental impacts during the construction phase are dust, exhaust gases, wastewater and construction; Land occupancy of 5.25 hectares located in La Ngau commune, Tanh Linh district and Da Mi commune, Ham Thuan Bac district. However, these negative impacts are mainly temporary (construction period of about 06 months). The impact is negligible, when the end of the construction phase, the impact is terminated.

In order to minimize negative impacts on the environment, the employer will select qualified contractors and modern construction equipment, has a team of professional construction workers with high discipline. There are also binding provisions on environmental protection in construction contracts.

- The environmental impacts of the project are small and insignificant compared to the effects of the project; Methods to mitigate negative impacts have been identified and applied during the construction phase to minimize the negative environmental impacts of the project.

### **2. Recommendations**

The employer proposes Binh Thuan Provincial People's Committee to consider appraising and approving the EIA report of the project so that the employer can soon take the next steps.

### **3. Commitments**

To mitigate the negative impacts on the environment and protect the environment, the employer commits:

- Comply with environmental management programs and environmental monitoring programs as stated in chapter 5;

- Comply with the general regulations on environmental protection related to the phases of the project, including:

1. Commitment on environmental protection methods and methods to be implemented and completed in the preparation and construction stage before the project goes into official operation.

- Good implementation of technical and technological solutions; safety methods; To have a program on prevention and response to environmental risks and incidents in the course of construction.

- Implement methods to reduce air pollution as stated in chapter 4 and closely monitor the emission of gases and dust generated by the project construction activities to minimize the impacts to ensure the standards of environmental quality:

- QCVN 08-MT: 2015 / BTNMT - National technical Standards on surface water quality;

- QCVN 09-MT: 2015 / BTNMT - National technical Standards on groundwater quality;

- QCVN 14: 2008 / BTNMT - National technical Standards on domestic wastewater;

- QCVN 05: 2013 / BTNMT - National technical regulation on around air quality;

- QCVN 07: 2009 / BTNMT - National technical standards on hazardous waste thresholds;

- QCVN 26: 2010 / BTNMT - National Technical standard on noise.

- Collection and treatment of waste oil during construction: Circular No. 36/2015 / TT-BTNMT dated June 30, 2015 of the Ministry of Natural Resources and Environment on management of hazardous waste

- Implement methods to collect and treat wastewater (domestic, construction), protect water quality.

- Carrying out solutions to collect and treat domestic and construction solid waste.

- Decree No. 38/2015/ND-CP dated April 24, 2015 of the Government on the management of waste and scrap;

- Implement methods to prevent erosion and protect the soil environment as stated in the EIA report.

- Implement traffic safety solutions in the process of transporting materials, construction machinery and equipment for the construction of works.

- Implement safety methods for construction workers and people in the construction process.

- Implement methods to limit the impact on the social-economic environment in the communes in the project area during the construction period.

- Commitment to implement legal procedures in using groundwater for the project.

2. Commitment on solutions and methods to protect the environment will be implemented in the period from the implementation of the project throughout the life of the project.

- Good implementation of mitigation methods, safety methods during the operation of the works and repair, maintenance of equipment, prevention of environmental incidents.

- Implement methods to limit the impact on the social-economic environment and ensure security and order in the communes of the project area during the construction and operation phase of the project.

- Implement methods to minimize the impact of electric fields on people's health.

- To compile dossiers certifying the implementation of environmental protection methods before putting the projects into operation.

3. Commitments to overcome environmental pollution in case of environmental incidents and risks caused by the implementation of the project.

4. Commitment to environmental restoration in accordance with the law on environmental protection after the project ends its operation.

5. The employer commits to work closely with local authorities during the implementation of the project, ensuring security and order in the communes of the project area.

The employer commits to fully implement the contents stated in the commitment and take responsibility before law if they violate the Vietnamese standards in construction investment and let incidents happen causing environmental pollution.

## **DOCUMENTS, DATA REFERENCES**

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## **APPENDIX**

- Appendix 1** : Diagrams
- Appendix 1a** : Diagram of the total area
- Appendix 1b** : Diagram of environmental background sampling
- Appendix 2** : Legal documents related to the project
- Appendix 3** : Results of analysis of environmental components
- Appendix 4** : Documents related to community consultation
- Appendix 5** : Some pictures of the project area

**Appendix 1:** Diagrams

**Appendix 1a:** Diagram of the total area

**Appendix 1b:** Diagram of environmental background sampling

## **Appendix 2: Legal Documents Related to the Project**

1. Decision No. 974 / QD-BCT dated March 22, 2007 of the Ministry of Industry and Trade approving the adjustment and supplement of the power development plan of Binh Thuan province in 2011-2015 with vision to 2020.
2. Official Letter No. 4223 / UBND-KT dated 10/11/2016 of the People's Committee of Binh Thuan province approving the policy of supplementing the planning of the solar power plant in Da Mi lake, La Ngau commue, Tanh Linh district.
3. Minutes of working on 09/12/2016 between Da Nhim - Ham Thuan - Da Mi Hydropower Joint Stock Company and related units on investing in the project of floating solar power of Da Nhim - Ham Thuan - Da Mi Hydropower Joint Stock Company.
4. Minutes of meeting held on March 31, 1974 between Da Nhim - Ham Thuan - Da Mi Hydropower Joint Stock Company and Tanh Linh District People's Committee on supplementing the project of floating solar power plant in Da Mi lake La Ngau revised land use planning to 2020 and land use planning 2017.

**Appendix 3: Results of analysis of environmental components**

1. Test results of ambient air quality (03 samples)
2. Test results of Water quality (03 samples)
3. Test results of Land quality (03 samples)
4. Test results of Electric field strength (01 sample)

**Appendix 4: Documents related to community consultation**

1. Official letter replying on consultations of Da Nhim - Ham Thuan - Da Mi Hydropower Joint Stock Company on the content of the report of project of 03 communes:

+ Thanh Linh district: La Ngau commune

+ Ham Thuan Bac district: La Da commune, Da Mi commune.

2. Minutes of community consultation meeting on content of report on EIA of 3 communes:

+ Thanh Linh district: La Ngau commune

+ Ham Thuan Bac district: La Da commune, Da Mi commune.

**Appendix 5: Some pictures of the project area**



*Floating Solar Power Plant in Da Mi Hydropower Reservoir, Binh Thuan province*



*Floating Solar Power Plant in Da Mi Hydropower Reservoir, Binh Thuan province*

