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STEP-1 DUE DILIGENCE REPORT

REHABILITATE AND UPGRADE
WARSAK HYDROELECTRIC POWER STATION

July 2011

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WARSAK HYDROELECTRIC POWER STATION

Submission Date: July 14, 2011

Contract No: AID-EPP-I-00-03-00004
Task Order #: EPP-1-08-03-00004

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WARSAK HYDROELECTRIC POWER STATION
Step 1 Due Diligence, Phase III

1. INTRODUCTION

The goal of the USAID energy program in Pakistan, focusing on the power sector, is to support the Government of Pakistan (GOP) in adding power generating capacity available to the National Grid, decrease losses in delivery of electric power to customers and increase cost recovery from them. This will be achieved through investment in infrastructure, support to institutional reform through technical assistance and promotion of new technology.

The program is being implemented in three phases. Phase I supports power plant repairs and efficiency improvements, replacement of existing tube well pump motors with more efficient power saving models, and technical assistance to help reform the power distribution companies. Phase II funds two multipurpose dam projects to generate electricity, store water and control flooding.

Phase III aims to support GOP in its longer term national development plans by making available funds to provide and promote investments in high-priority, high visibility major energy projects. It will also look at new technology initiatives in a way that encourages IFI, other donors and private sector funding and engages all relevant USG agencies (e.g., OPIC, EXIM). Technical Assistance will also be provided to develop institutional capacity and support energy sector reforms that will encourage public and private investment in the sector.

Energy projects under Phase III will be chosen based upon:

1) **Technical feasibility -**
a) Will the proposed intervention actually contribute significantly to meeting Pakistan's energy and other vital development needs, while improving the country's energy security?
b) Does the project use domestic or imported resources?
c) Does the project result in energy diversification?

2) **Cost -**
a) Is the cost reasonable?
b) Can the project's full financing be arranged in a timely fashion?

3) **Overall effect -**
a) Is the project high visibility?
b) Is it a high priority for Pakistan?
c) Will the power generated and other benefits be worth the time and money?

All projects identified for USG support undergo a two-step Due Diligence process. In Step 1 existing documents and other information is reviewed for adequacy to apply selection criteria and make a recommendation to USG. Step 2 is an in-depth analysis of any additional information required for a USG decision on the project.

As part of the assistance to be provided by USAID under Phase III, GOP has requested funds for WAPDA, the implementing agency for the project, to rehabilitate and upgrade the multipurpose Warsak Power Station.

USAID tasked AEAI to conduct the Step 1 Due Diligence and confirm facts from WAPDA, evaluate whether the project meets the USAID criteria described above, highlight any particular risk or concern that needs to be mitigated or addressed and to make a recommendation.

2. SUMMARY

The 243 MW hydroelectric power station at the multipurpose Warsak Dam was commissioned in the 1960s. Structures have deteriorated and equipment at the power station is old. The civil works, machinery, equipment, cabling, control system, everything has eventually aged with use and repairs over the past half century. It is no longer realistic to expect that routine and annual maintenance will keep the plant running reliably. Complete refurbishing or replacing is required. The generating capacity has reduced by 30MW and the water reservoir has lost its live storage capacity due to accumulation of silt. The 50 year old station is in need of a major overhaul. It is a credit to WAPDA engineers and technicians that the station is still functioning.

WAPDA is hiring consultants to do a study that will cost $4 million and take a year to complete, followed by rehabilitation works that could span 4 years and are currently estimated to cost over $300 million. To keep the station running till such time that the actual rehabilitation work gets underway, the 50 years old units 1 to 4, particularly Unit 3, need some immediate repair and replacement of parts. WAPDA requests that $3 million be available to cover such costs.

3. RECOMMENDATION

USAID approve $7 million for WAPDA to hire consultants and to undertake essential repairs required at the station during the period that the rehabilitation plans are being finalized.

The consultants will require a year to complete their study and to develop their report on the works needed to rehabilitate and upgrade the Hydroelectric Power Station. USAID may consider support for implementing results of the study as the study progresses, the quantum and nature of work is better defined and the cost estimates are better known.

If USAID chooses to support WAPDA in Warsak, USAID will need to stay involved and monitor progress of Consultant's work and be in position to make reliable determination on the scope and cost of work that could be eligible for USAID funding. USAID must therefore also approve Step 2 Due Diligence:

1) To continue Due Diligence of the proposed project.
2) To monitor activities at WAPDA and the site and report progress to USAID.

This Step 1 Due Diligence Report and recommendation is based on findings of a site visit and information provided by members of the WAPDA-USAID Task Force for the project.

4. BACKGROUND

The Warsak Hydroelectric Power station is located in the Federally Administered Tribal Area (FATA), on the River Kabul about 30 KM (by road) Northwest of Peshawar. The Khyber Agency is to the South (right bank) and Mohmand Agency to the North (left bank) of the river. Geographic location is 34-09-50 North; 71-21-32 East – a 'google' image is at **Annex 1**.

The yellow line in the image, towards the left, shows the border between Afghanistan and Pakistan and the light blue line going North to South, East of the mountain range, separating the mountains from the plains, is the border for FATA. Peshawar is capital of Khyber Pukhtunkhwa Province in North West Pakistan.

This multipurpose project – with a hydro power plant and an irrigation canal, that takes off to the south downstream of the dam and irrigates areas East and North of Peshawar - was completed in two phases between 1951 and 1981, under the Colombo plan, jointly by the Governments of Pakistan and Canada. The first phase, comprising of construction of the Dam and Power house with four generating unit of around 40 MW each and a 132kV power transmission line, started in 1951 and was completed in1962. In the second phase, from 1975 to 1981, two additional units of around 40 MW each were added. The total installed capacity of the 6 units at the station is 243MW and they have been generating on average about 1,000 GWh a year.

In the mid-1960 small cracks had already started to appear in the concrete structure of the Power House and on conclusion of phase 2 in 1981, described above, the Government of Pakistan formally requested Canadian assistance for remedial measures. The study conducted with help of Canadian International Development Agency (CIDA) identified considerable structural movement of concrete due to Alkali-Aggregate Reaction (AAR). Owing to structural uncertainties at the station and other electrical-mechanical problems with the units, power generating capacity had reduced to 150MW. Additionally, silt accumulated in the reservoir had made operation of the intake (feeding water to turbines) and draft tube gates (water exiting the plant) almost impossible.

Emergency repair were carried out by WAPDA in 1991/1992 and in 1993, CIDA provided C$27 million for rehabilitation of the Power station. SNC-Shawinigan Inc., a subsidiary of SNC-Lavalin, with the National Engineering Services of Pakistan (NESPAK) as associates, was appointed project consultant and after investigations and study, the rehabilitation work was carried out. This effort successfully stabilized the Power House structure but not much could be done about the silt. As an engineer at Warsak put it, "If the repair and rehabilitation had not been done, this place would have been a museum by now."

Owing to the considerable repair and rehabilitation work done at the station since 1996, the maintenance staff at the station is fully trained and the plant is operating at 213 MW. The station workshop has the equipment and tools to carry out routine and regular maintenance procedures. One machine out of six is fully overhauled each year during the low flow season, and put back in operation by mid of May next year. Over six years each machine goes through an overhaul. The runner (rotating element) of the turbine is the part most affected due to abrasive action of silt in the water passing under pressure and requires regular and extensive repair. Each runner is normally repaired twice before it needs to be replaced. An option to be considered during this proposed rehabilitation study is to replace the steel runners with tungsten carbide or ceramic coated runners to reduce the frequency of overhauling, however, initial and replacement costs will be major considerations.

The machine workshop at Warsak also caters to the maintenance and repair needs of other smaller hydropower stations, such as the ones at Dargai, Chitral and Kuram Garhi. Outside assistance, primarily from the Heavy Mechanical Complex (HMC) at Wah, is required for work to be done by a Shaper and a Miller. The Vertical Lathe installed in the work shop at Warsak is one of the largest (6 meter) such machines in Pakistan.

5. JUSTIFICATION

Warsak Dam has lost more than 80% of its initial storage capacity and the Power Station is practically operating as 'run-of-river' plant for quite some years now. Sedimentation Management Studies were a part of the CIDA funded rehabilitation work in the mid 1990s and Model Studies on at least 6 possible solutions were carried out but there was no successful outcome. It is quite possible that there may be no viable solution and the station will continue to operate on run-of-the-river, however, with new technologies and improved capabilities for simulation study, the problem should be studied as a solution may still be found.

The 'Objective' of the work, described in the SNC- Shawinigan completion report was:
" . . to completely rehabilitate the Warsak Hydroelectric Power Station and to develop the capacity to carry out ongoing maintenance, thus increasing the serviceable life of plant and prolong its ability to provide power to the national grid for the next 25 years"

It has been some years since the rehabilitation works were carried out. Since then many more problems have cropped up due to further aging of the many electro-mechanical parts and equipment at the power station and the aging and weathering of the various civil structures.

The maximum load that Warsak Power Station can now sustain is 213 MW against the total installed capacity of 243 MW. But the entire station is at risk. Rehabilitation and upgrading the plant will not only salvage the situation but also regain the 30 MW of lost hydropower capacity.

The operation and control systems at the Warsak Power Station are technology of the Fifties (50s). These are now considered inefficient and obsolete, spares and parts are not available and everything is vulnerable to defects and breakdowns. Up-gradation and modernization is due and has been determined as the only, the most prudent and most viable option.

6. THE PROJECT

WAPDA wants to undertake a second effort to rehabilitate, upgrade and modernize the station. The objective is that the six generating units of Warsak Power Station, having spent life of 50 years (Unit 1 to 4) and 30 years (Unit 5 & 6) are made capable to operate efficiently and reliably at the initial installed capacity of 243 MW for another 30 years.

The following works have been identified to be included in the proposed Warsak Rehabilitation and Upgrading Project.

<u>Electro-Mechanical Works</u>

Change the rated Power Factor of Generators 1 to 4 from 1.0 to 0.85.

This will enhance their capacity from the present 40 MW/40 MVA to 40MW/47 MVA each, and enable Warsak to share more reactive power at the northwest end of the National Grid without losing capacity.

Replace generator windings of Unit 1-4 and raise their insulation rating from Class-B to Class-F.

This will improve efficiency and increase their useful life.

Identify and implement measures to ensure reliable operation of unit 5 and 6 at the rated output of 40 MW.

Replace 13.33 MVA, single phase Power Transformers of unit 1 to 4 with 48 MVA, 3-phase Power Transformers.

This will increase open space in the switchyard, reduce maintenance time and costs and improve efficiency.

Replace rotary excitation system with static excitation system and mechanical governors with digital governors on unit 1 to 4.

This will increase reliability, reduce maintenance and eliminate the need to scour the market for obsolete parts.

Replace electro-mechanical relays with digital metering, recording and protection systems for all generating units and transmission lines.

Replace plant operating and control system.

Replace and upgrade instrumentation throughout the project area.

Install a CO2 Fire Protection system for all Generators and in Switchyard.

None exist at the moment.

Replace the Single Bus Bar for the Station Service supply and auxiliaries with a Double Bus Bar system.

Procure a spare Station Service Transformer with spare windings and a spare tap changer.

Design and install a new Trash Rack Cleaning Mechanism (TRCM) for efficient clearing of debris during high water season to allow unrestricted water flow to turbines.

With the plant operating on 'run-of-river', the existing obsolete TRCM is not capable to clean the trash racks and mobile cranes have to be mobilized to keep the water flowing.

Replace obsolete sprocket and chain system operating the spillways gates of the dam with improved design mechanism.

Replace the two 40 tons overhead mobile cranes.

<u>Civil Works</u>

Identify and implement remedial measures for the Intake Structures that are in need of major repair.

Cracks (3 to 4 inches wide) have appeared in the intake structure of the trash rack bays for machines 7 and 8. These cracks appear to extend inside the piers between the consecutive bays. The guide channels in bay No. 8 are broken, probably due to movement of the structure.

Repair and strengthen the Spillway Chute.

The top surface of the entire spillway chute is badly brazed and reinforcing steel bars are partially exposed.

Repair the Stilling Basin.

The concrete is damaged and pitted - at locations the pits are more than three inches (3") deep and clearly visible. Repair is essential to avoid failure of the floor of the basin and uncontrolled erosion.

Repair leaking roof of the Power House.

Study and repair the following structures *in which significant cracks have developed and are visible*:
The 'Baily Bridge' abutment
The Wave Wall
The Inspection Gallery
The deck of the Spillway
The Retaining Wall of the Stilling Basin (near the power house)

There is also the matter of Sedimentation Management. The reservoir has lost more than 80% capacity. Many studies have been done to salvage the situation but none have been found feasible. However, technology is evolving and new solutions are possible. The Consultants will review all previous studies and try to come up with a practical solution.

7. COST

A Feasibility Study is to be conducted. This study will consider and analyze various options and evaluate each one for cost against benefit to arrive at an optimal solution. An accurate cost estimate is therefore not possible at this stage since investigations, studies, design and model studies to be done will determine the cost of the project. The work could be to repair or rehabilitate or replace works and parts depending on whichever is found most feasible. The currently estimated amounts and expected schedule of payment is:

(**Million US$**)

Description	Year						**TOTAL**
	2011	2012	2013	2014	2015	2016	
Feasibility Study, Design, Tender Documents and PC-I	2	2	-	-	-	-	**4**
Immediately needed and essential spares and repairs	1	2	-	-	-	-	**3**
E & M Equipment	-	-	35	60	90	80	**265**
Civil Works	-	-	5	7	8	5	**25**
Engineering & Management (Construction Supervision)	-	-	2	4	4	5	**15**
Total	**3**	**4**	**42**	**71**	**102**	**90**	**312**

The cost of the Feasibility Study Consultancy Services is $4 Million and the Consultancy for Final Design and Construction Supervision will be in the range of $15 Million. The Electrical, Mechanical and Civil Works could cost $290 Million. The estimate for total cost is $312 Million which includes $3 million foreseen as costs that could be incurred in the next two years to keep the station running while plans and designs for the rehabilitation work are being finalized.

WAPDA has developed these preliminary cost estimates and also provided some detail (see **Annex 2)** however these may be taken as 'ball park' figures and variation – up or possibly down in many cases – is certain. Break up between local and foreign exchange costs is at **Annex 3**. Accurate estimates will be available after completion of Feasibility Study and will become even more precise after preparation of detailed design and agreement on tender specifications. Till such time and for purpose of this Step 1 Due Diligence, the estimated figures are acceptable.

8. ENVIRONMENT & RESETTLEMENT

The rehabilitation of a power plant will generally have little environmental and no resettlement issue. The Warsak rehabilitation project will be carried out inside the power house building with negligible environment impact. The matter of disposal of old transformer oil and any Asbestos material will be handled per internationally accepted principals, standards and requirements. The nature of civil works envisioned also does not warrant concern of any significant environment issues as it will be limited to repair of existing structures. Disposal of debris could be the only issue to watch and ensure it is kept benign.

In effect the project should be viewed as a major mitigating effort to ensure environmental protection and avoid resettlement of population. The project will prevent a potentially major environmental and resettlement risk as the effort is to prevent possible failure of structures and equipments. The alternate to not repairing is loss - loss of a major development infrastructure, related revenues, jobs and livelihoods.

And since no land acquisition is involved, there is no resettlement issue.

9. BENEFITS

The primary benefit that is expected to accrue from the proposed project to repair, rehabilitate, replace and upgrade the Warsak Hydropower Station is that this renewable resource producing 1 billion units of electric power each year will not disintegrate and die. The Warsak Power Station will get a new lease on life and continue to provide 1,000 GWh power to Pakistan each year for at least the next 30 years – replacing a potential annual bill of $200 Million from a thermal IPP (assumed @ $0.20 a unit).

The increase of 30 MW in the existing generation capacity and capability to run the power station at its total installed capacity of 243 MW, will provide additional 120 GWh of clean renewable electric power each year to the National Grid

The repair works and new equipment will save 30 GWh of energy lost due to forced shut-down of power house when heavy trash accumulates at the intake of the power house during high water season.

This increase of about 150 GWh from Warsak power station will replace the thermal power that is currently being purchased at the marginal cost of 20 cents a unit, or $30 million a year.

In addition to these benefits the project could claim Carbon Credits. The CDM benefits for 150 GWh of electricity at 15 Euro per ton of CO_2 saved can be estimated at $1.5 million a year.

10. STATUS

WAPDA is in process to engage RSWI (Canada) - DCE (Pakistan) as consultant to carry out a feasibility study. The objective of the study is to determine the most viable options, technical as well as financial, to rehabilitate and upgrade and modernize the facility at Warsak. They will study the aging electrical and mechanical equipment and civil structures and then prepare detail design and cost estimates to lead to a PC-I for implementation of the project. They will also develop Tender Documents for the work to be done.

The scope of work requires the consultancy services to accomplish the following four tasks:

1 - Conduct a Feasibility Study and prepare Detail Design and Tender Documents for rehabilitation, up gradation and modernization of the Warsak Hydroelectric Power Station.

2 - Carry out a study to determine the causes of defects in different civil structures at Warsak and prepare Detail Design and Tender Documents for implementing the required remedial works.

3 - Review previous Sedimentation Management Studies, carry out further studies and suggest the most practicable and cost effective solution. Prepare Detail Design and Tender Documents for implementation of the proposed remedial measures.

4 - Assist in preparation of PC-I for complete Rehabilitation Works recommended based on task 1, 2 and 3 above.

This study will cost $4 million and is expected to be completed in 12 month. The rehabilitation project, including supervisory consultants, is estimated to cost $305 million over 4 years.

11. IMMEDIATE PLAN

WAPDA's immediate plan is to sign an agreement with the consultants selected for the assignment - the Joint Venture of M/s RSWI (Canada) and DCE (Pakistan) – of doing a feasibility study and prepare detailed design, tender documents and assist with the PC-I. This is expected to be ready in one year after start of the consultancy services.

A tentatively proposed implementation plan for the project starting from June 2011 to December 2016 is attached as **Annex 4**.

12. RISKS & ISSUES

Loss of Capacity

The project is expected to take 4 years to complete. During this period there will be times when the plant will not be able to generate power to capacity – and the National Power Control and Dispatch will possibly have to take power from plants burning expensive imported oil to make up that loss. Assuming 25% loss of capacity at the plant over the 4-year period of repair, and that thermal power replaces the units lost, one could add about $200 Million[1] to cost of project.

The construction plans will consider this matter when scheduling works and will try to minimize loss of capacity at the plant.

Selection of Equipment

The turbines and generators at Warsak need to be replaced and procurement option may be limited to the supplier who provided the existing plant and machinery. This will limit the negotiating power of WAPDA. The alternative of seeking open competition may involve higher costs as foundations, embedded parts, ancillary equipment, related machinery, tools and spares will also need to be replaced.

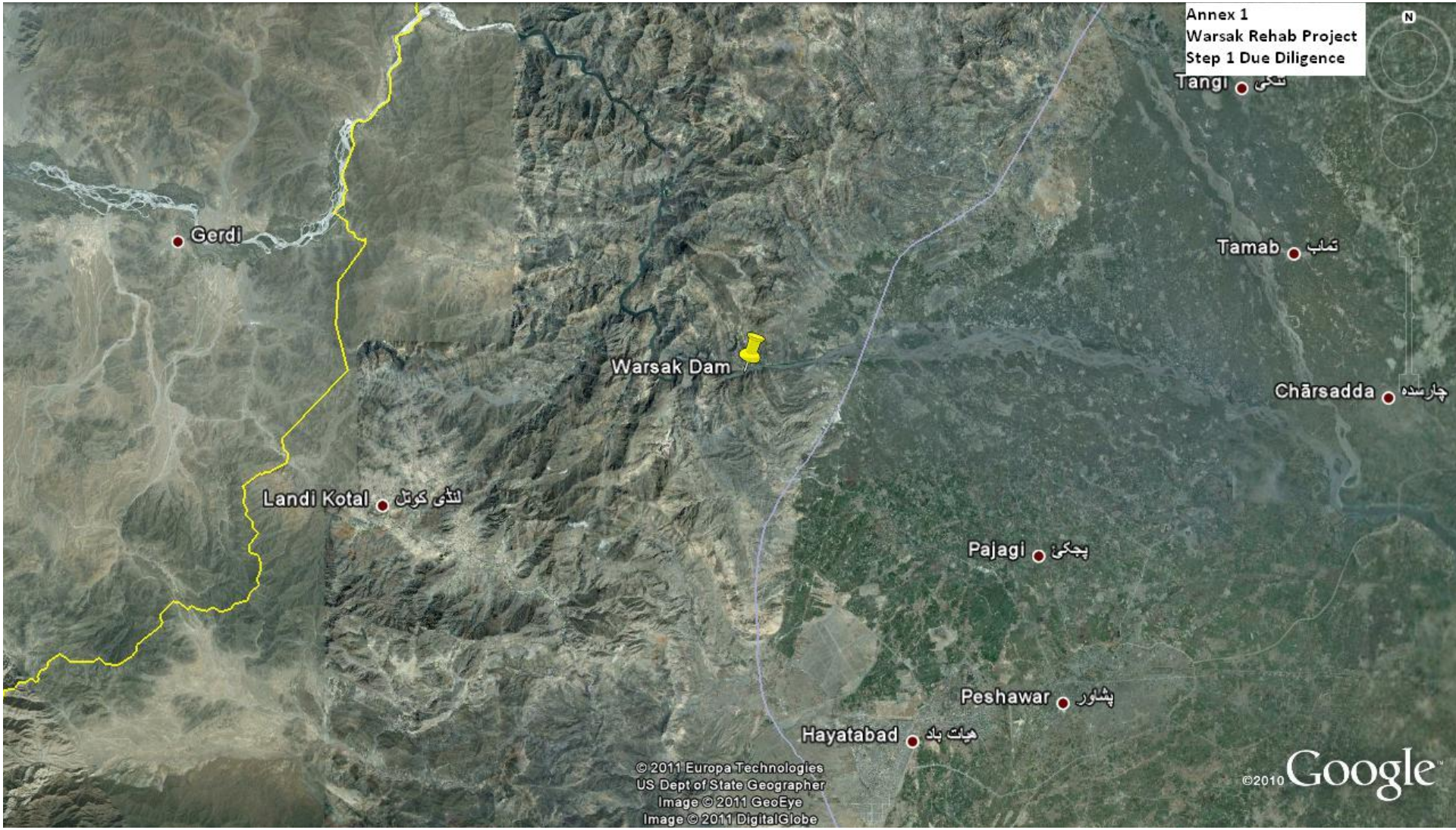
Structures and Foundation

All civil structures, foundations and embedded parts are in place for more than 50 years. The upcoming study will attempt to get a better idea of the state of these civil works and structures and embedded parts. Till such time the uncertainty and risk of possibly incurring higher costs for civil work will remain.

[1] - 25% x 1000GWh x 4 yrs x $0.20/unit

The benefit expected from the project is pretty much known but the overriding risk in the project is the uncertainty of the cost of achieving such benefit. The study to be done will evaluate possible and reasonable options and quantify related risks to answer the question – what is the most prudent option to gain maximum benefit from Warsak at minimal cost?

USAID review of this Step 1 Due Diligence Report will determine Step 2


Annex 1
Warsak Rehab Project
Step 1 Due Diligence
Tangi
Gerdi
Tamab
Warsak Dam
Chārsadda
Landi Kotal
Pajagi
Peshawar
Hayatabad
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ESTIMATED COST FOR REHABILITATION

($ 1.00 = Pak Rs 85)

A. ELECTRICAL WORKS

	Description	$ Millions
1	Change Unit 1 – 4 (0.85 pf)	66
	i. Replacement of Stator Winding.	20
	ii. Replacement of Stator Core.	15
	iii. Replacement of Rotary Exciter, Field winding & breaker	10
	iv. Replacement of Power Transformers	20
	v. Replacement of PMG.	1
2	11KV Circuit Breakers between Generator and Transformer with Protection Scheme.	2
3.	Upgrade/Re-habilitate 132 KV Switch Yard	14.8
	i. Replacement of 4 x 132KV Minimum Oil Circuit Breakers with new technology Circuit Breaker	8
	ii. Spare parts, testing equipment for new 132 KV breakers	3
	iii. 132KV Bus Sectionalizer	3.3
	iv. Replacement of insulators	0.5
5	Replace 400V Bus Bar and 250/400V Distribution Panels	0.8
6	Upgrade/Replace Station Service Transformer	0.3
7	Replace Air conditioning plant and systems	0.3
8	1MVA Diesel Genset with accessories, controls & spares	30
9	Fire protection system	15
10	CCTV system on spillway and machine room	10
11	Computerization of Control Room	5
12	Replace protection systems on 132 KV lines	5
13	Replace protection, instrumentation, control and recording system for entire plant and Dam	20
14	SCADA/DCS system for power station	20
	Total Electrical Works **(A)**	**190**

B. MECHANICAL WORKS

	Item Description	Qty	**$ millions**
1	Turbine Runner, Francis Reaction Type, 57000HP, Net Head 144 ft, Centerline 1121ft SPD, with Tungsten Carbide coating.	6	27
2	Head Cover for Unit 1-4	4	8
3	Head Cover for Unit 5-6	2	4
4	Wicket Gates for unit 1-4	4	4
5	Wicket Gates for unit 5-6	2	2
6	Governor Oil Pumps Unit 1-4	4	0.4
7	Governor Oil Pumps Unit 5-6	2	0.1
8	Inlet Valve Oil pump Unit 1-4	4	0.15
9	Inlet Valve Oil Pump Unit 5-6	2	0.06
10	Joint for Penstock Butterfly valve unit 1-4	4	0.3
11	Joint for Penstock Butterfly valve unit 5-6	2	0.15
12	Seal and Scraper for Butterfly Valve	6	0.2
13	Inlet Valve Servomotors	6	2
14	Replace chain system with rope hoist system	9	2
15	60 Ton mobile Crane	2	2
16	Trash rack cleaning machine (telescopic type)	1	5
17	Spare parts for shaft sealing system Unit 1-6	6	2
18	Replace cooling water systems	L/S	1
19	Replace generator cooling systems	L/S	2
20	Dewatering submersible pumps	8	0.35
21	Milling machine, table surface 1250x4000	1	1
22	Horizontal lathe machines	4	2
23	Workshop tools and equipment	L/S	2
24	Replace mechanical governors, Unit 1-6	6	5.09
25	100 PSI compressor	4	1
26	600 PSI Compressor	8	1.2
	Total Mechanical Works **(B)**		**75**

C. CIVIL WORKS

Name of Work	Remarks	$ Million
Coffer Dam and Stilling Basin	Need repair to hold pressure of sediment laden water	5.0
Generator floor support, Unit 2-4	25% work done in Phase-I, remaining work in Phase-II	0.5
Spillway Chutes	Badly eroded and need repair	1.0
Power House roof	Water leaks during rainy season	0.5
Rock face near power intake gates	A safety hazard that needs to be short-created/surfaced	2.0
Instrumentation	Instruments in the Dam and power house need to be replaced	2.0
Cracks in intake and main dam structure	Underwater cracks due to AAR need to be repaired.	1.0
Seismic station and scale model studies	Seismic measuring and recording station is required	0.5
Flood measuring and warning station	A measuring and recording station upstream of the Dam is needed	1.0
Sedimentation studies and works	To restore some reservoir capacity	5.0
Model Studies	Finite element model study	0.5
Other civil works including installation of new equpments		10.5
	Total Civil Works **(C)**	**25.000**
	Total Project Construction Cost (A+B+C)	**290 Million**
Consultancy Services Cost for Feasibility Study		**$4 Million**
Cost of essential spares and repairs		**$3 Million**
Consultancy Services Cost for Construction Supervision		**$15 Million**
Total Estimated Cost for Rehabilitation Project		**$312 Million**

Annex 3
Warsak rehab Project
Step 1 Due Diligence

Yearly Financial Requirement

(Million US$)

(L – Local Costs F – Foreign Exchange Cost T – Total)

Description	Year 2011			Year 2012			Year 2013			Year 2014			Year 2015			Year 2016			TOTAL		
	L	F	T	L	F	T	L	F	T	L	F	T	L	F	T	L	F	T	L	F	T
Feasibility Study, Design, Tender Documents, PC-I	0.3	1.7	2.0	0.3	1.7	2.0	-	-	-	-	-	-	-	-	-	-	-	-	**0.6**	**3.4**	**4**
Immediate Repairs and Spares Required	0.3	0.7	1.0	0.7	1.3	2.0													**1.0**	**2.0**	**3**
Hydro-Mechanical Equipment	-	-	-	-	-	-	5.0	30.0	35.0	5.0	55.0	60.0	5.0	85.0	90.0	5.0	75.0	80.0	**20.0**	**245.0**	**265**
Civil Works	-	-	-	-	-	-	5.0	-	5.0	7.0	-	7.0	8.0	-	8.0	5.0	-	5.0	**25.0**	**-**	**25**
Engineering, Project Management / Construction Supervision	-	-	-	-	-	-	0.4	1.6	2.0	0.8	3.2	4.0	0.8	3.2	4.0	1.0	4.0	5.0	**3.0**	**12.0**	**15**
Sub Total	**0.6**	**2.4**	**3.0**	**1.0**	**3.0**	**4.0**	**10.4**	**31.6**	**42.0**	**12.8**	**58.2**	**71.0**	**13.8**	**88.2**	**102.0**	**11.0**	**79.0**	**90.0**	**49.6**	**262.4**	**312**

Annex 4

Warsak rehab Project

Step 1 Due Diligence

PROPOSED IMPLEMENTATION PLAN

Components	Start	End	Time	2011				2012				2013				2014				2015				2016			
				Qt1 &2		Qt3	Qt4	Qt1	Qt2	Qt3	Qt4	Qt1	Qt2	Qt3	Qt4	Qt1	Qt2	Qt3	Qt4	Qt1	Qt2	Qt3	Qt4	Qt1	Qt2	Qt 3	Q t 4
Feasibility Study Detail Design, Preparation of Tender Documents and PC-I	**8/11**	**5/12**	**12 M**																								
WAPDA Review	**6/12**	**6/12**	**1 M**																								
Hiring of Consultants for Award of Contract & Construction Supervision	**7/12**	**12/12**	**6 M**																								
Approval of PC-I	**7/12**	**9/12**	**3 M**																								
Pre Qualification of Contractors & Issuance of Tender	**1/13**	**6/13**	**6 M**																								
Bidding & Award of Contract	**7/13**	**12/13**	**6 M**																								
Poject Construction	**1/14**	**12/16**	**36 M**																								

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