

## 添付資料 3

### 質問票と回答

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## QUESTIONNAIRE FOR GROUND WATER USE PLANNING

### 1. Confirmation of the Contents of the Requested Project

#### 1-1 National Plans Related to Water Supply for Irrigation

- (1) Please show the national programs related to the irrigation plan and ground water development plan for irrigation such as national plan, national policy, government's 10<sup>th</sup> Plan, poverty reduction strategy, national water policy and so on.  
(収集資料 A-1、A-2)
- (2) Please show the relationship between national plans and the requested project.  
(明確な回答無し)
- (3) Please show the objective of the requested Project (for example, economic development through agricultural promotion or poverty reduction through agricultural promotion).  
(第2章「4-3 井戸掘削計画の妥当性」参照)
- (4) Please show the main beneficiaries of the Project (for example, land owners or domestic farmers with small holdings).  
(第2章「4-3 井戸掘削計画の妥当性」参照)
- (5) It is reported that the State of Punjab is relatively rich state in India. So, please show the reason why the State of Punjab was selected for Japanese Grant Aid Project.  
(第2章「3-3 対象地域の社会・経済状況 (4)貧困問題」参照)

#### 1-2 Present Conditions of Water Use for Irrigation and Future Ground Water Development Plans for Irrigation in Punjab and Project area (Kandi area)

- (1) Please show the general conditions of ground water use for the irrigation in Punjab.  
(明確な回答無し)
- (2) Please show the detail of the on-going and planned ground water development scheme for irrigation in Punjab including following schemes:
  - 400 no. proposed tube wells under World Bank
  - 100 no. proposed tube wells under NABARD
  - 110 no. proposed tube wells under State Plan
  - 75 no. proposed alternate tube wells under State Plan
  - 75 no. proposed new tube wells under State Plan
  - Others(収集資料 C-1、C-2、C-3、C-4、C-5、C-6)
- (3) Please show the relationship between the requested project and the projects mentioned above in detail.  
(第2章「3-5 実施機関 (7) PSTC の井戸掘削に係る予算」参照)
- (4) Please show the present conditions and future schemes of the irrigation in the Project area (irrigation areas, cropping pattern, harvest yield, irrigation water supply system in Kandi area).

(灌漑局からは将来計画は特に無いとの回答)

- (5) Please show the budget used for ground water development for irrigation in Punjab.  
(収集資料 A-3)
- (6) Please show the census data and social conditions of the project area (Kandi area)  
(収集資料 A-4)
- (7) Please show the detail of the prospective well drilling project which will be implemented using the requested drilling rigs such as areas/sites, number of wells, abstraction amount, irrigation water supply system, expansion of irrigable area, main crops, anticipated benefit (increase of income), number of beneficiaries, staged drilling plan, cash planning of the project and others.  
(現地調査で PSTC が明確な計画を持っていないことが判明)
- (8) Please show the procedures and flows of the construction of irrigation water supply system (for example, request to State government from farmer's associations → examination of the request by the State government → well drilling by PSTC → handing over of the well to the farmer's associations → Installation of submergible pump and construction of water supply system by farmer's associations → operation and maintenance of the system by farmer's associations).  
(第 2 章「3-4 カンディ地区の灌漑の現況と灌漑計画 図 2.3.12 灌漑給水施設建設の流れ」参照)
- (9) Please show the scope of the service of the governmental agencies and the contribution of the beneficiaries in the Project (for example, -government: well drilling, -beneficiaries (farmers): pump installation, construction of water supply system, operation and maintenance of the system).  
(第 2 章「3-4 カンディ地区の灌漑の現況と灌漑計画」参照)

## 2. Present Groundwater Abstraction in Kandi Area

2-1 Please show the data concerning the present groundwater abstraction including followings (well inventory data if any):

- (1) Well name, Location (coordinate), Owner
- (2) Completion year
- (3) Use
- (4) Annual abstraction amount and working month
- (5) Ground water level
- (6) Total discharge amount of ground water in these ten years in Kandi area
- (7) Others  
(収集資料 D-2)

2-2 Please show the data concerning the groundwater level including followings:

- (1) Name, location and depth of the observation wells
- (2) Hydrographs of the ground water level in the observation wells
- (3) Are there tendency of decline of ground water level in the area? If any, please show these locations and anticipated causes of ground water level decline.

(収集資料 D-3)

### 3. Operation and Maintenance of the Ground Water Supply System for Irrigation

3-1 Please show the annual water consumption amount per hectare of main crops in Punjab:

Main Crop	Water Consumption (m <sup>3</sup> /hectare/year)	Growing Seasons (month)	Weight of Crop (kg/hectare)	Market Price (Rs/kg)

(第 2 章「3-3 対象地域の社会・経済状況 表 2.3.10 パンジャブ州における主要農作物の単位あたり収量と市場価格」参照)

3-2 Please show the tariff of abstracted ground water supplied for irrigation and its collection system.

(第 2 章「3-6 地下水開発に関連する法規制と水料金体制」参照)

3-3 Please show the average electricity cost for ground water abstraction used for irrigation (Rs/m<sup>3</sup>).

(第 2 章「3-6 地下水開発に関連する法規制と水料金体制」参照)

3-3 Are there committees for operation and maintenance of the water supply system for irrigation in Punjab? If any, please show the representative organization system of the committees.

(第 2 章「3-4 カンディ地区の灌漑の現況と灌漑計画 (3)カンディ地区における地下水による灌漑 1) 現況」参照)

3-4 Please show the average income of the farmers in the project area (Kandi area).

(現地での農民への聞き取り調査によると Rs24,000/年程度とのこと)

### 4. Rural Water Supply

Please show the rural water supply conditions of the project area (Kandi area) such as coverage ratio, number of the population to be supplied, present water sources, water borne disease, water demand per capita, future plans of rural water supply, estimated population to be served by the Project (prospective drilling project using the requested rigs), activities of donors and NGOs for rural water supply and so on.

(第 2 章「3-7 村落給水」参照)

### 5. Organizations and Budget

Please show the up-dated organization, number of staff members and budget of last three years of Ministry of Water Resources, Central Ground Water Board and Punjab State Tubewell Corporation (PSTC). Especially for PSTC, income and expenditure of these five years are requested.

(第2章「3-5 実施機関」参照)

#### **6. Activities of other Donors, NGOs**

Are there donors and NGOs acting for irrigation water supply other than World Bank? If any, please show their activities in detail.

(第2章「3-9 他ドナーやNGOの援助動向」参照)

#### **7. Local Contractors**

Are the local consultants available that are able to conduct the socio-economic survey including water use survey on the farmers? Please show the list of capable consultants and show the unit cost of the survey.

(PSTCからは、このようなコンサルタントはパンジャブ州には無いとの回答があった)

Are there ground water development activities for irrigation that are implemented by private sectors in the project area (Kandi area)? In any, please show their activities and governmental participation to them such as permission, registration, tax payment, licensing, fund furnishing and so on. In addition, please show the demarcation (work shearing) between Punjab State Tubewell Corporation and private drilling companies. Are there any possibilities of privatization of PSTC in future?

(第2章「3-8 民間井戸掘削会社」参照)

## Questionnaire/Hydrogeology

### 1. Maps

If you have following maps in the target and surrounding areas, please provide us these.

*Min. of Defence  
Min. of Information  
Survey of India*

Maps	Exist/Nothing	Holder
Topographic map <input type="checkbox"/> 1/25,000 or <input type="checkbox"/> 1/50,000	Exist/Nothing	Available with the Corpn. But cannot be provided as some of the are restricted.
Geological map	Exist/Nothing	Enclosed with the report as <b>Annex. B</b>
Hydrogeological map	Exist/Nothing	Enclosed with the report as <b>Annex. B</b>
Soil map	Exist/Nothing	
Land use map	Exist/Nothing	
Administrative map	Exist/Nothing	Enclosed with the report as <b>Annex. A</b>
Location map of hydrological observation station & Location map of existing wells	Exist/Nothing	Enclosed with the report as <b>Annex. D and D1</b>
Location map of existing irrigation canal	Exist/Nothing	Enclosed with the report as <b>Annex. E</b>
Planning map of irrigation canal	Exist/Nothing	N.A.
Planning map of well facility construction	Exist/Nothing	Please refer Kandi Area Map <b>Ann C.</b> where $t/w$ wells are proposed. Prospective plan is given on page 15 of the report

### 2. Hydrological Data

#### 2-1. Meteorological Data

Please provide us meteorological data in Punjab, such as temperature, precipitation, etc. which were observed at hydrological observation stations.-

**The rain fall data of Ropar and Hoshiarpur Distt of Punjab is available and is given in Annex-F attached with the report**

[Empty box]

2-2. River Data

Please provide us data of river in Punjab, such as river water level, river flow rate, river water quality at hydrological observation stations.-

**Please refer page 6 and 7 of the Hydrogeological report.**

3. Well Data

中央平原の地形地質図 → 3/4 27-16巻

3-1. Well Drilling Data

Please provide us existing well drilling data and location map for existing wells in Punjab.

**The brief information about the blocks of the Kandi area is given in Ann. J of the project report. Lithological logs and assembly designs of different tubewells of PSTC in kandi area are enclosed as Ann. J1 to J20**

3-2. Groundwater Level Data by Observation

If the groundwater level is observed in Punjab, please provide us these.

**Water level Data received from the Directorate of Water Resources & Environment is enclosed as Ann. G and maps are as Ann. H & I**

3-3. Groundwater Quality Analysis Data

If the groundwater quality is analyzed in Punjab, please provide us these.

**Water samples from the existing tubewells of PSTC in the Kandi area are analyzed in the laboratory of the Hydrogeological wing of PSTC and the report is attached as Ann. K**

3-4. Pump Operation Record

If the pump operation record is logged at existing well in Punjab, please provide us these.

[Empty box]



#### 4. Document and Investigative Report

If the document and investigative report for hydrogeology and groundwater in Punjab are available, please provide us these.

Document and Report	Exist/Nothing	Holder
Report for geological investigation	Exist/Nothing	Data of different blocks given in the report
Report for hydrogeological investigation	Exist/Nothing	Given in the report
Master plan for irrigation	Exist/Nothing	As per project report
Master plan for water supply	Exist/Nothing	Not Available
Groundwater law	Exist/Nothing	Available with CGWB → 請在中
Water quality standard for irrigation water	Exist/Nothing	Fit for irrigation purposes
Water quality standard for potable water	Exist/Nothing	Water potable in kandi area
Report for study on land subsidence	Exist/Nothing	Not available
Report for study on groundwater contamination	Exist/Nothing	Not available with PSTC may be available with pollution control dept.

#### 5. Master Plan for Groundwater Development in Punjab

##### 5-1. Hydrogeology

Please explain us about the summary of hydrogeology in Punjab.

**Brief Hydrogeology of Punjab given in the project report P. No. 3,4,5 and the Hydrogeological Map enclosed as Ann. V**

##### 5-2. Groundwater Hazard

Please explain us about the groundwater hazard in Punjab such as land subsidence, groundwater contamination, etc., the measure such as control by law and the plan in future.

### 5-3. Water Quality Standard

Please explain us about the water quality standard in Punjab for potable water, irrigation water and industrial water.

Item of Analysis	Potable Water	Irrigation Water	Industrial Water
<b>Please see the page no. 28 of the report. It is the standard of the potable and irrigation water of Punjab</b>			

### 5-4. Master Plan for Groundwater Development

If the master plan for groundwater development in Punjab is available, please explain us it.

<b>Different projects for the installation of deep tubewells in the state of Punjab have been submitted to different agencies. The information is on P.No. 16 of the report</b>
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## 6. Request of Additional Information

### 6-1. Report for the Hydrogeological Study in Punjab

Please provide us the report for the hydrogeological study in Punjab. It might be included the hydrogeological cross section between Kandi area and central alluvium plain, explanation of groundwater flow in all area of Punjab, explanation of groundwater recharge area, explanation of amount of groundwater recharge, etc., and this study might have been carried out more than 1 hydraulic circle.

<b>The brief report on the Hydrogeology of Punjab and the kandi area is given in the project report. P.No.3-5</b>
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### 6-2. Interview to the member of the hydrogeological study in Punjab

Please make appointment with the member of hydrogeological study team, which carried out above study in chapter 6-1.

### 6-3. Method of calculation of Amount of Groundwater Recharge

Please explain us how to calculate the amount of groundwater recharge in the major hydrogeological study in Punjab. The explanation shall be included following information.

**The methodology and the procedure as adopted by the Water Balance Committee of the Punjab is given in report P.No. 9-12 and the location map of the observatory stations is given as Ann. D and the Number of T/wells of PSTC are as in Ann.D1**

- (1) Hydrogeological parameter which were used for the hydrogeological modeling (simulation) in Punjab such as coefficient of permeability, coefficient of transmissibility, specific yield, meteorological data, etc.

**Please see annexure Q of the report**

## Questionnaire/Equipment

### 1. Punjab State Tubewell Corporation.PSTC.

#### 1-1. Position of PSTC

Please explain us about the relation and position of PSTC in the central government and the government of Punjab and the Law of PSTC if available.

PSTC was incorporated in 1970, under the Companies Act, 1956, for exploitation of groundwater potential in the State by Punjab Govt. The Corporation is fully owned by Punjab Government. Central Government has also provided funds under CADWM Project (Memorandum of Articles of PSTC attached.).

#### 1-2. Outline of PSTC

Please explain us about the outline of PSTC.

Work contents	Well drilling Hydrogeological investigation PSTC is drilling deep T/wells in the area where no other irrigation facilities exist. Besides, PSTC is lining watercourses of canal command.
Capital	Rs 125,00,00,000/-
Equity participant	Fully owned by the Government of Punjab
Nos. of staff	2,750 (Office worker: 900)
Engineer	Engineer : 78
	Driller : 13
	Hydrogeologist/Geophysist : 4
	Sub driller : 10
	Mechanic : 23
	Driver : 23
	Site coordinator (Junior Engineer) : 216
	S.E. for Monitoring Quality Control & Planning in Head: 1
	D. E. in Office: 4 for T/wells, Lining, Planning & Vigilance
S. D. E.: 7	
Branch office	Detail in Organization Chart
Workshop	At Rampur Doraha, Ludhiana and at Mahilipur, Hoshiarpur
Comment by PSTC	PSTC has sufficient trained drilling crew/ Engineer conversant with drilling & development of Tubewells & other allied works.

### 1-3. Technology Assessment of Engineer in PSTC

Please explain us about technical capabilities of Engineer in PSTC.

Description	Assessment Item	Equip ment	Staff	Assess ment	Comment by PSTC
Hydrogeological investigation	Interpretation of topographical map	A	A	5	Can do
	Interpretation of aerial photograph	C	C	1	Cannot do
	Electrical sounding	B	B	5	
	Electro magnetic sounding	C	C	1	
	Interpretation of drilling cuttings	A	B	4	
Drilling work (for formation)	Clay and/or silt	A	A	5	
	Sand	A	A	5	
	Gravel	A	A	5	
	Cobble	A	A	5	
	Boulder	A	A	5	
Drilling work for depth.	until 150 m depth	A	A	5	
	until 200 m depth	A	A	5	
	until 300 m depth	B	B	4	
	until 400 m depth	C	C	3	
Drilling work for others.	Plumb drilling	A	A	5	
	Discharge cuttings	A	A	5	
Borehole logging	Site works	A	A	5	
	Analysis works	A	A	5	
	Planning casing program	A	A	5	
Casing works	Welding casing pipes	A	A	5	
	Plumb installation	A	A	5	
Gravel packing	Selecting packing gravel	A	A	5	
	Installation of packing gravel	A	A	5	
Pumping test	Planning of pumping rate	A	A	5	
	Measurement of pumping rate	A	A	5	
	Measurement of water level	A	A	5	
	Analysis of pumping test result	A	A	5	
	Selecting the permanent pump	A	A	5	

Equipment, Staff : A (Enough) B (Nearly enough) C (Defect)

Assessment : (Good. 5 4 3 2 1 (Low capacity.

#### 1-4. Existing Equipment in PSTC

Please explain us about the equipment in PSTC, their present situation, the donated equipment by other donor and the route of procurement of spare parts.

Name of equipment	Model	No.	Year	Donor	Frequency of usage	Situation of maintenance	Route of procurement of spare part
Direct rotary rig		5	1971, 1973 -1974		B	B	Local Market
Percussion rig	Sankyo	2	2000 -2001	Japan	B	A	
Air compressor	250 PSI	6	1984 -1988		B	B	Local Market
	650 PSI	1	2000		B	B	
	750 PSI	1	2001		B	B	
TATA truck	PAT-5052	1	1985		B	B	Local Market
	PNH-9891	1	1975		B	B	Local Market
	PNH-8795	1	1974		B	B	Local Market
	PB-12C-9633	1	1998		B	B	Local Market
	PB-12C-1463	1	1987		B	B	Local Market
	PB-10AS-9631	1	1996		B	B	Local Market
Leyland truck	PB-10W-1996	1	1996		B	B	Local Market
	PB-10U-9631	1	1996		B	B	Local Market
Tata Water Tanker	Pur-3492	1	1973		B	B	Local Market
Crane truck	PB-7626	1	2000	Japan	B	B	
	PB-7281	1	2001	Japan	B	B	

Frequency of usage. A High B Medium C Low

Situation of maintenance. A Good B Some problem C Not activity

## 1-5. Standard Materials

Please explain us about the specification and the suppliers of drilling materials which are usually used by PSTC.

Materials	Specification	Suppliers (please fill up more than 3 companies)	Tel, E-mail
Drilling bits	TCR bit/Drag bit	L. M. P, O. N. G C	
Drilling wire			
Bailer		L. M. P, open market	
Temporary casing pipes		Open market	
Bentonite and/or clay		Open market/Rajasthan	
Polymer		Not used	
PVC casing pipes		Not used	
PVC screen pipes		Not used	
Steel casing pipes			
Steel screen pipes		Owfstill Sachdeva Sales, Alfa	
Stainless casing pipes		Trading, Jalandhar	
Stainless screen pipes			
Centralizer			
Packing gravel		Open market	
Cement		ACC, Vikram, open market	
Submersible motor pump			
Engine turbine pump		Calama, Amrit, Ahmedabad	
Water meter and valves		Open market	
Diesel generator			
Air compressor		K. G. Khosla, L. G	

## 2. Well Drilling Works by PTSC

### 2-1. Experience of Well Drilling Works

Please explain us about the experience of well drilling works and problems in each drilling rigs.

Equip ment	Model	Drilling method	Operation year	Nos. of well drilling	Total drilling length (m)	Problems
D.R.R (5)		Direct Rotary	25	200	4000 m	Nothing
P.R. (2)	Sankyo	Open hole	7	15	8500 m	Nothing

## 2-2. Well Structure

Please explain us about the standard well structure in PTSC if available.

Normally 585/650 mm dia borehole drilled up to depth of 250-300 m. After successful drilling, lowering of Tubewells assembly having housing pipe 125 m, 300 mm dia reducer 300 mm x 200 mm, bind pipe & stainless steel strainer 200 mm dia (6.3 mm thick) lowered. Length of strainer & blind pipe depend upon the availability of strata encountered. After lowering of T/well assembly open area of well is filled with gravel pack.

## 2-3. Construction Periods of Well Drilling Works

Please explain us about the construction periods of well drilling works against the following formation in each drilling method.

Drilling depth	Formation	Cased hole	Open hole	Mud rotary
0 to 5 m	Top soil	5 days	3 days	5 days
5 to 20 m	Gravel			
20 to 25 m	Clay	2 days	2 days	1 days
25 to 50 m	Sand	10 days	8 days	9 days
50 to 70 m	Gravel	18 days	7 days	10 days
70 to 100 m	Cobble & Pebble	20 days	10 days	10 days
100 to 150 m	Boulder	35 days	15 days	25 days
Construction periods		90 days	45 days	60 days
Total Cost		12 Lacs	9 Lacs	5.5 Lacs



#### 2-4. Construction Cost of Well Drilling Works

Please explain us about the construction cost of well drilling works under the condition of standard well structure which is explained above 2-2 and formation which is shown in above 2-3.

Description	Specification	Q'ty	Unit price	Amount
Mobilization and rig set up		1 lot	L.S	50,000/-
Surface drilling	Top soil	5 m	2000	10,000/-
Drilling works	Clay	15 m	2000	30,000/-
	Sand	30 m	2000	60,000/-
	Gravel	20 m	5500	1,10,000/-
	Clay	30 m	2000	60,000/-
	Gravel	20 m	5500	1,10,000/-
	Boulder	30 m	8000	2,40,000/-
Borehole logging		1 lot	10000	10,000/-
Casing works	30 m screen length	150 m	12000	3,60,000/-
Gravel packing		50 m	5500	1,65,000/-
Well development		1 lot	100000	1,00,000/-
Pumping test	Step drawdown, continuous, recovery	1 lot	150000	1,50,000
Demobilization		1 lot	75000	75,000

#### 2-5. Problem in Well Drilling Works

Please explain us about the problems and lessons in well drilling works in each drilling method as following.

Cased hole method by cable percussion rig	In case of Cased Hole method, it takes much time to lower & extract the casing pipes.
Open hole method by cable percussion rig	In case of Open Hole method, it takes less time to complete.
Direct mud circulation method by rotary rig	In case of Direct Mud Circulation method, the rig cannot work in heavy boulder.

### 3. Maintenance and Control of Equipment in PSTC

#### 3-1. Workshop

Please explain us about the equipment for the maintenance of drilling equipment in PSTC.

Name	Model	Nos.	Year	Donor	Frequency of usage	Situation of maintenance	Route of procurement of spare parts
Lathe	1974	4	1974	-	B	A	Open Market
Cutter	1974	3	1974	-	B	A	Open Market
Shakur	1978	2	1978	-	B	A	Open Market
Welding set	1972	5	1972	-	B	A	Open Market
Generator	1972	2	1972	-	B	A	Open Market

Frequency of usage. A High B Medium C Low

Situation of maintenance. A Good B Some problem C Not activity

#### 3-2. Spare Parts of Well Drilling Equipment

Please explain us what measure you take in case the spare parts is not able to be procured in local market.

The spare parts are arranged from Local Market & in case of non-availability the necessary parts are being got manufactured as per samples of damage part.

### 3-2. Mechanic in PSTC

Please explain us about the technical capabilities of Mechanic in PSTC.

Description	Assessment Item	Equipment	Staff	Assessment	Comment by PSTC
General maintenance	Oil change and grease up	A	B	5	Being done in local market
	Filter change	A	B	5	
	Tire puncture mending	C	C	1	
	Spare parts change	A	B	5	
	Overhaul of engine	C	C	1	
Measurement of materials	Measurement by slide caliper and micrometer	B	B	5	
Cutting of materials	Cutting by band saw and hacksaw	B	B	5	
	Cutting by gas	B	B	5	
Process of materials	Process by lathe	B	B	5	
	Process by milling machine	B	B	5	
Welding	Electric welding	A	B	5	
	Gas welding	A	B	5	
	Solder	A	B	5	
Threading of pipe	Threading by threading machine	A	B	5	

Equipment, Staff : A (Enough) B (Nearly enough) C (Defect)

Assessment : (Good. 5 4 3 2 1 (Low capacity.

### 4. Manufacture of Well Drilling Equipment and Well Drilling Contractor

#### 4-1. Manufacture of Well Drilling Equipment

Please provide us about manufactures of well drilling equipment and their contact address, and in case the recommendable rig is available, please provide us about model, capacity and repute.

Manufacture Name	Tel, E-mail	Model	Drilling method	Capacity	Repute, comment
LMP Rigs Ltd, Billi Mora, Gujrat			Direct rotary	5	Reputed
Super Engineers, Ambala, Haryana			Percussion	2	Reputed

Capacity : (High capacity) 5 4 3 2 1 (Low capacity)

#### 4-2. Well Drilling Contractor

Please provide us about well drilling contractors, their contact address and their capacity.

Contractor Name	Tel, E-mail	Drilling method	Capacity	Repute, comment
Gurnam Singh & Co., 29/1, Ind area, Ph-II, Chandigarh	0172-2652550	Case/open hole drilling	3	They have only DR & PR Rigs.
H. N. Singh & Co., Bharatgarh road, Nalagarh	094180-36116	Case/open hole drilling	2	
B.S. Enterprises, Mohali <i>D-117, Industrial Area</i>	0172-5093081	Case/open hole drilling	2	
Sharma Deep T/well Boring, 241, Ind area, Ph-I, Chandigarh	094170-17360	Open hole mud drilling	2	
Super Engineers, Baldev Nagar, Ambala	0171-2540798	Case hole open drilling	3	
Agro King Deep T/well Co., Naraingarh road, Ambala	094160-25022	Case hole open drilling	1	
Papular Pipes, Phagwara road, Hoshiarpur	098151-96622	Case hole open drilling	1	
United Engineer, Hoshiarpur	098140-00795	Open hole mud drilling	2	
Jasbir Deep Tubewell Co., Chandigarh Road, Rajpura	098551-40486	Case Hole Open drilling	2	
Dhillon Const Co., Punjab Bagh, Pafiala	098140-03913	Open Hole Mud drilling	1	

Capacity : (High capacity) 5 4 3 2 1 (Low capacity)

## 5. Procurement of Equipment and Materials

### 5-1. Procurement Route

Please inform us about several procurement routes form foreign market and which route is the most economical route.

Route 1	Calcutta, Patna, Lucknow, Delhi, Chandigarh
Route 2	Bombay, Surat, Ratlam, Mathura, Delhi, Chandigarh
Route 3	

5-2. Condition of Import of Equipment and Materials

Please inform us about licenses and procedures to import the equipment and materials.

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5-3. Tax

Please inform us about the method of tax exemption and necessary periods.

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5-4. Periods of Transportation

Please inform us about the periods of transportation between the landing port and the final destination.

Works	Periods (days)
Landing at port including the waiting days in the ship at port	
Custom clearance including the waiting days at the bonded storage	
Railroad transport including the loading works between the port and the rarest station	
Tracking including landing works between the nearest station and the final destination	
Tracking including landing works between the port and the final destination	

## QUESTIONNAIRE FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

SPCB の Nodal 事務所長 Mr. S. P. Garg より以下の回答を得た。

1. The project of ground water development is not included in Schedule-I of Environment Impact Assessment Notification,1994 and not even in the amendment dated 27<sup>th</sup> October, 2003. Is it not necessary to carry out EIA study for ground water development projects?  
(必要ない。)
2. We would like to know all amendments for Acts, Rules and Notifications regarding Environment which have been conducted since 8<sup>th</sup> June 2004, because “Legislations on Environment, Forests, and Wildlife” in home page of MOEF are updated on 8/06/2004.  
(住宅に関する法令の改定はあるが、環境に関しては特にない。)
3. Which is responsible for environmental clearance of ground water development project implemented in Punjab State, CPCB or SPCB?  
(地下水開発についてはないが、一般の開発プロジェクトに関しては、原則的には両者に責任があるといえる。しかし、公聴会等の EIA に係る具体的な手続きについては SPCB が主体になって実施する。たとえば、公聴会における事業説明などは、事業者ではなく SPCB が行う。)
4. How can we make a contact with relevant professors in Punjab Agriculture University?  
(SPCB ではなく、PSTC の紹介で、NHK のテレビ番組に出演した教授に会って、本件プロジェクトに係る見解を確認することができた。)
5. Could you introduce relevant NGOs which are interested in ground water development in Punjab State?  
(パンジャブ州で、地下水開発に関心を有する NGO は活動していない。)

添 付 資 料 4

**Mid Term Report**

**PRELIMINARY STUDY  
ON  
THE EXPLOITATION OF GROUND WATER  
IN  
THE STATE OF PUNJAB  
OF  
THE REPUBLIC OF INDIA**

**MID TERM REPORT**

**March 2006**

**Prepared by  
PRELIMINARY STUDY TEAM**



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## **1. Introduction**

The Government of Republic of India (hereinafter referred to as “GOI”) requested implementation of the Exploitation of Ground Water in the State of Punjab (hereinafter referred to as “the Project”) in August 1997 for grant aid to the Government of Japan.

In response to the request from the GOI, the Government of Japan (hereinafter referred to as “GOJ”) entrusted the study to examine the viability of the Project to the Japan International Cooperation Agency (hereinafter referred to as “JICA”), the official agency implementing Japanese Government’s technical assistance and expediting proper execution of the Japan’s Grant Aid. Hence, JICA decided to conduct a Preliminary Study and send the study team, headed by Mr. Hiroyuki KINOMOTO, Team Leader, Water Resources Development Management Team, Project Management Group III, Grant Aid Management Department, JICA.

The Study Team shall carry out the following studies:

- (1) Confirmation of the contents of the requested Project.
- (2) Investigation of the present situation and problems in the related sectors.
- (3) Confirmation of capability and capacity of the implementation agencies.
- (4) Confirmation of operation and maintenance system and its capability of the implementation agencies in the national and local levels.
- (5) Verification of fiscal capabilities of the organization concerned.
- (6) Assistance and activities from other donors and NGO in the related sectors.
- (7) Collection and analysis of data, information and materials related to the Project.

This Mid Term report has been prepared to show the interim results of the survey up to 14<sup>th</sup> of March, 2006 through the discussion with Punjab State Tube Well Corporation which is the counterpart agency of the Study Team.

## 2. Survey Itinerary

The Study Team has started survey in India from 2<sup>nd</sup> March. The activities of the Study Team until 14<sup>th</sup> March are shown in next table:

Table 2.1 Survey Itinerary of the Study Team

Date	Day	Schedule	Activities
Mar 2	Thu		Meeting with JICA Office, Japan Embassy, Ministry of Finance, Ministry of Water Resources
Mar 3	Fri		Meeting with Central Ground Water Board, Collection of Information
Mar 4	Sat	Delhi ⇒ Chandigarh	
Mar 5	Sun		Internal Meeting
Mar 6	Mon		Meeting with Panjab State Tubewell Corporation Limited (PSTC)
Mar 7	Tue		8:00 Visit drilling site and typical site in Rupnagar (or Kandi)
Mar 8	Wed	Chandigarh ⇒ Ludhiana	8:00 Move to Ludhiana
			Visit typical site in central plain
			Hearing from local people in central plain (Mr. KAWADA)
			15:30 Meeting with PAU
		Ludhiana ⇒ Hoshiarpur	Visit typical site in central plain
Mar 9	Thu		Visit drilling site and typical site in Hoshiarpur
			Hearing from local people in Hoshiarpur (Mr. KAWADA)
Mar 10	Fri	Hoshiarpur ⇒ Chandigarh	Move to Chandigarh
			Confirmation of date collecting
Mar 11	Sat		Ocasional day for site survey
Mar 12	Sun		Ocasional day for site survey
Mar 13	Mon		Visit workshop and drilling companies
			Visit SPCB in Patiala (Mr. KAWADA)
			Collectiong data from PSTC, DoI, DWR, CGWB/RD and DoA
Mar 14	Tue		Visit workshop and drilling companies
			Meeting with NGO (Mr. KAWADA)

### 3. Findings of the Survey

Main findings of the survey conducted from 2<sup>nd</sup> of March to 14<sup>th</sup> of March are shown in this Chapter.

#### 3.1 Findings Related to Ground Water Use Planning

##### (1) Revised Project Components

Original project of “The Exploration of Ground Water in the State of Punjab”, which was submitted to Japanese Government in 1997, has been up-dated and revised through the series of discussions held between Punjab State Tube Well Corporation (PSTC) which is the agency in charge of execution of the Project and the Preliminary Study Team based on “The Revised Project Report for the Procurement of 2no. Open Hole Percussion Rigs under the Japanese Grant-in-Aid Programme” which described the present conditions of the Study Area. The main components and objectives of the revised project are as follows:

##### a. Objectives and beneficiaries

As far as state of Punjab is concerned, there are certain areas where the people are very poor and their land holdings are very small (less than one hector). Such very poor areas in State of Punjab are also regarded as one of the poorest areas in India.

Kandi area is classified into such very poor areas in State of Punjab. They depend on agriculture but they are devoid of irrigation facilities. The objective of the Project is to raise the standard of the living in Kandi area by increasing the agricultural productivity which will be achieved by implementation of ground water exploitation project. The objective of the Project is also conformed to National Plan and State Plan for poverty reduction. It is estimated that around 43,000ha will be newly irrigated by the Project and beneficial farmers might be more than 45,000 families.

##### b. Project duration: fifteen (15) years from 2007 to 2022

##### c. Revised project is formulated integrating following four projects

- 80 No. Tubewells Project (100 No Tubewells Project under NABARD, 20 wells have been completed)
- 400 No Tubewells Project
- 110 No Tubewells Project
- 75 No Tubewells Project
- 75 No Alternate Tubewells Project (Rehabilitation Project)

##### d. Total number of wells to be drilled in the revised project is 740 wells among which 100 wells are scheduled to be drilled with the requested rigs.

##### e. The schedule of the revised project is as follows;

Total No of Wells	Qty of Rigs	Type of Rigs	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022
100	2	PR* granted by Japanese Gov.	10	10	10	10	10	10	10	10	10						
<b>100</b>	<b>2</b>	<b>PR* requested to Japanese Gov.</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>						
463	5	Other rigs owned by PSTC	30	30	30	30	30	30	30	30	30	30	30	30	32	32	39
77	-	Sublet to local contractor	8	8	8	8	9	9	9	9	9						
740	-	-	58	58	58	58	59	59	59	59	59	50	30	30	32	32	39

\*: Percussion drilling rigs donated or to be donated by Japanese Government which will be used only for hard bouldery formations

f. Project area is Kandi area in State of Punjab.

g. The revised project shall be financed by “Minor Irrigation Scheme” of State of Punjab. The budget for drilling in Kandi area in fiscal year of 2006-2007 has been already secured and its amount is Rs337,000,000.

h. Item and quantity of equipment to be requested to Japanese Government are shown in “3.2 (4) Requirement of the Equipment”.

## (2) Ground Water Balance

Up-dated ground water balance is described in the revised Project Report mentioned above. According to this report, 15 blocks are categorized as “Safe”, 4 blocks are categorized as “Semi-critical and 2 block is categorized as “Critical” in Kandi area. It is Judged that 80% of the blocks in the Kandi area is safe for ground water exploitation. However, the ground water exploitation in four blocks which are categorized “Critical” or “Semi-critical” should be examined cautiously.

## (3) Interview to Dr. Gurdev S. Hira

The interview to Dr. Gurdev S. Hira, Professor Punjab Agricultural University, was held on 7<sup>th</sup> March. Dr. Hira expressed his opinion that the Kandi area is very safe for ground water exploitation and such project is very useful from the standing point of soil conservation.

## (4) Subsidization and Water Tariff

PSTC constructs well and irrigation water supply pipelines for the farmers based on the request of the farmers. The beneficially farmers do not contribute for the construction of the water supply facilities. The operation and maintenance of the irrigation water supply system are also undertaken by PSTC. Beneficially farmers only pay 80% of electricity cost and Punjab government subsidies remaining recurrent cost such as payroll of administrators of the system, repairing cost of the system and other necessary cost.

The water tariff laid on beneficial farmers is approximately Rs0.3/m<sup>3</sup>, on the contrary, actual cost of water is Rs1.65/m<sup>3</sup>. This means that the Punjab government subsidies Rs 1.35/m<sup>3</sup> which occupies more than 80% of actual water cost.

## (5) Activities of other Donors and NGOs

PSTC stated that there are no activities of NGOs in Kandi area. As for the 400 No. tube wells project financed by World Bank, it has started from 1992 and terminated by 1999. Number of drilled wells in this project is actually 320. At present, there are neither activities of other donors and NGOs nor future plan of such activities in Kandi area.

### 3.2 Findings Related to Hydrogeology and Drilling Machinery Planning

#### (1) Geology and Hydrogeology

Geology and Hydrogeology are described in the report. According to the report, quaternary alluvium deposited on Tertiary sediment or on Precambrian basement in the most of Punjab State. However, the Siwalik System which consists of Neogene and Tertiary deposits are spread in the north east area of the state where borders on other states and Kandi area is located in this System.

Series		Geology	Thickness
Quaternary	Alluvium Deposits	Clay, silt, sand and gravel	1,000 m
Neogene	Siwalik System	Sand, gravel, cobble, pebble and boulder with silt and clay	-
Tertiary			
Precambrian	Basement	Matamorphic and igneous rocks	-

From the view point of the hydrogeology, the following zones have been delineated in the state.

Districts	Area (km <sup>2</sup> )	Aquifer		Yield (L/min)	Static Water Level
		Formation	Depth		
i Muktsar, Faridkot, Moga, Bathinda, Mansa and southern part of Sangrur and Ferozepur	12,350	Sand and gravel	150 m	<833	5-10 m
ii From South of Fazilka to north of Moga, north eastern of Gurdaspur, Hoshiarpur, Nawanshahar, Patiala, Ropar and Anandpur Sahib valley of Ropar	6,900	Sand, gravel, pebble, cobble and boulder	300 m	833-2,500	10-90 m
iii Amritsar, Kapurthala, Fatehgarh Sahib, Ludhiana, Patiala, and parts of Sangrur, Gurdaspur, Ferozepur, Nawanshahar, Jalandhar and Ropar	29,260	Sand and gravel	300 m	2,500	20-60 m
iv Part of Ropar, Gurdaspur, Hoshiarpur and Nawanshahar	1,850	Sand, gravel, pebble, cobble and boulder	-	<833	30-100 m
v Gurdaspur, Mukerian block of Hoshiarpur, Anandpur Sahib block of Ropar	-	Sand, gravel, pebble, cobble and boulder	40 m	16-1,200	20-100 m

Kandi area is classified as above ii and iv.

### (2) Working Conditions of the Two Rigs Donated by Japanese Government

Japanese Government donated two sets of the cable tools percussion drilling rig in 2000 and 2001, which enable to drill by the open hole drilling method.

The first procured drilling rig in 2000 has been operated about 3,257 hours and the second procured drilling rig in 2001 has been operated about 2,055 hours. The drilling site is normally operated about 8 hours in a day and it is necessary to calculate the works of mobilization & demobilization, drilling rig set up, site clearance, etc. Therefore the first procured drilling rig and the second procured drilling rig would be operated about 660 and 340 days in each after the procurement. According to the result of this study, PSTC was not budgeted for the drilling works in Kandi area until the fiscal year 2004-2005, therefore the drilling rigs from Japan hadn't been operated so much. However, after the fiscal year 2005-2006, the frequency of operation of rigs has been increased because PSTC enabled to be budget for their activities in Kandi area.

The conditions of drilling machines are quite good but some of consumption items such as bit, work casing pipes, etc. have been exhausted. The drilling result by the two rig donated by Japanese Government shall be shown as following table.

Percussion Rig Donated in 2000		Percussion Rig Donated in 2001	
2000	Ragwal III in Talwara Block, 152m,		
	Bhamotar II in Talwara Block, 152m		
	Bhatpur Rajputan in Mahilpur Block, 169m		
	Malhewal in Muhilpur Block, 131m		
		2001	Haler Well in Talwara Block, 151m
			Dhagroll Path in Talwara Block, 148m
2005-2006	Sariana IV in Mukerian Block, 115m	2005-2006	Bhavnal in Mukerian Block, 119m
	Hamowal III in Mukerian Block, 114m		Morichak in Mukerian Block, 120m
	Raili I in Mukerian Block, 140m (under drilling)		Ralli II in Mukerian Block, 140m (under drilling)
	Total 7 wells		Total 5 wells

### (3) Technical Level of Drilling Works by PSTC

The technical level of drilling works by PSTC is also quite good however they doubt whether they can drill more than 200 m by using the open hole drilling method and their own technique or not. Therefore, they have desired to be transferred the technique of deep drilling method from the Japanese Drilling Engineers.

#### (4) Requirement of the Equipment

The preliminary study team confirmed the demand of PSTC on this request. According to their explanation, the original equipment list had been prepared in 1997 and the surrounding situation of PSCT has changed. Therefore, PSTC has requested the following equipment.

<u>Item</u>	<u>Quantity</u>
1. Truck mounted Cable Tool Percussion type drilling rig of 400m in capacity	2 No.
2. Truck with 4 ton Cab-back Crane	2 No.
3. 5 m <sup>3</sup> Water Tank Truck	2 No.
4. Truck mounted High Pressure Air Compressor	1 No.
5. Pumping Test Equipment	2 No.
6. Borehole Electrical Logging Equipment of 400m in capacity	1 No.
7. Electrical Geophysical Survey Equipment	1 No.
8. Spare Parts for the New and Previous Procured Equipment	L.S.
9. Consultancy Services	L.S.

The original requested drilling rig had the 300 m drilling in capacity. However the elevation in Kandi area sometimes reaches more than 600 m. In this situation, the aquifer shall be expected below 300 m from the ground level according to the existing drilling data. Therefore, PTSC requests to procure the drilling rig of 400 m in capacity.

'2. Drive pipes of different sizes' and '3. Drill Stem Tester' in the original equipment are not necessary, because 'Drive pipes of different sizes' shall be used for the cased hole percussion drilling method and 'Drill Stem Tester' shall be used for the hydrogeological survey and it is not satisfied with the purpose of this request.

On the other hand, PSTC has listed 'Truck with 4 ton Cab-back Crane', '5 m<sup>3</sup> Water Tank Truck', 'Truck mounted High Pressure Air Compressor', 'Pumping Test Equipment', 'Borehole Electrical Logging Equipment of 400m in capacity' and 'Electrical Geophysical Survey Equipment' as an additional request. These are necessary for this request to achieve the project purpose.

'Truck with 4 ton Cab-back Crane' shall be used to transport the drilling equipment and materials to the site.

'5 m<sup>3</sup> Water Tank Truck' shall be used to transport the construction water. The geology of Kandi area consists of boulder, cobble, pebble, etc. In this situation, in case the drilling depth is required deeper, it possible to be such an accident during the drilling works as the drilling mud is lost from the borehole and the drilling bit is stuck in the borehole. To avoid such an accident, the construction water shall be transported immediately and must be kept in the drilling site at any time.

'Truck mounted High Pressure Air Compressor' shall be used to develop the well. Actually, PSTC has several units of air compressor however they are towed by heavy duty truck. It will bring the dangerous situation during the transportation because the route to most of the project site in Kandi area has to be passed through



the steep road. Thus, this is necessary to carry out the project in safety.

‘Pumping Test Equipment’ shall be used to measure the capacity of aquifer, and the permanent pump equipment shall be decided based on the result of pumping test.

‘Borehole Electrical Logging Equipment of 400m in capacity’ shall be used to measure SP and geological resistivity, and the casing program shall be decided based on these data.

‘Electrical Geophysical Survey Equipment’ shall be used to measure the geological resistivity, and the drilling program shall be decided based on this data.

### **3.3 Findings related to Environmental and Social Considerations**

#### (1) Environmental Clearance in India

In India the procedure of EIA (Environmental Impact Assessment) is called one of “Environmental Clearance”, and expansion and modernization of any activities or new projects are restricted and prohibited unless Environmental Clearance has been accorded.

#### 1) Legislation

The Environment (Protection) Act, 1986 came into force in 1986 to implement the decisions taken at the United Nation Conference on the Human Environment held at Stockholm in 1972 in so far as they related to the protection and improvement of environment and prevention of hazards to human beings, other living creatures, plants and property.

The relevant laws and rules related to Environment are as follows;

- The Water (Prevention and Control of Pollution) Cess Act, 1977, Rules(3) & Notifications(11)
- The Air (Prevention and Control of Pollution) Act, 1981, Rules(2) & Notifications(10)
- Public Liability Insurance Act, 1991, Rule(1) & Notifications(5)
- National Environment Appellate Authority Act, 1997
- National Environment Tribunal Act, 1995
- The Prevention of Cruelty to Animals Act, 1960, Rules(16) and Notification(1)
- The Wild Life (Protection) Amendment Act, 2002, Rules(9), Notifications(9) & Guideline(1)
- Forest (Conservation) Act, 1980, Rules(2) & Guideline(1)
- The biological Diversity Act, 2002 & Rule(1)
- Notifications for Environment (Protection) Act
  - /Coastal Regulation Zone
  - / Eco-sensitive Zone
  - / Environmental Labs
  - /Noise Pollution
  - / Hazardous Substances Management

Besides Acts, many kinds of Rules and Notifications are stipulated, and the management of environmental

protection seems to have been successful.

## 2) Status of Project Appraisal for EIA

New projects of 434 were submitted to get permission of EIA appraisal and 286 projects attained the environmental clearance in 2004. Status of project appraisal in 2004 is as shown in Table 3.1.

Table 3.1 Status of project appraisal from January to December, 2004

No	Nature of the project	Projects pending at the beginning of the year	Projects received during the year	Projects cleared during the year	Projects closed/rejected/exempted/returned during the year	Projects pending at the end of the year
1.	Industry	105	198	165	15	123
2.	Thermal Power	18	19	27	7	3
3.	River Valley and Hydroelectric	12	10	8	7	7
4.	Mining	69	140	62	28	119
5.	Infrastructure & Miscellaneous	42	65	23	7	77
6.	Nuclear Power	0	0	0	0	0
7.	New Construction Projects & Industrial Estates	0	2	1	0	1
total		246	434	286	64	330

## 3) Procedure of EIA

The procedure of EIA was prescribed in Environment Impact Assessment Notification, 1994. Any person who desires to undertake any new project in any part of India or the expansion or modernization of any existing industry or project listed in the Schedule-I of EIA Notification, 1994 shall submit an application to the Secretary, Ministry of Environment and Forests, New Delhi. The application shall be accompanied by a project report which shall include an EIA Report, an Environment Management Plan and **details of public hearing.**

## 4) Public Hearing

Any person who apply for environmental clearance of projects shall submit to the SPCB (State Pollution Control Board) 20 sets of documents including project content and mitigation measures for water pollution, air pollution and waste management. SPCB shall cause a notice for environmental public hearing published in at least 2 newspapers.

## (2) Scoping

### 1) Activities subject to EIA in the Schedule-I of EIA Notification, 1994

Development activities subject to EIA are shown in the Schedule-I of EIA Notification, 1994 as follows;

Although a major irrigation project is included in No.2 "River valley project", exploitation of groundwater is not included in the list.

Table 3.2 List of Projects requiring Environmental Clearance

No	Project	No	Project	No	Project
1	Nuclear power	12	Hydrocyanic acid	23	Distillery
2	River valley project	13	Metallurgical	24	Raw kin and Hide
3	Port/Harbour/Airport	14	Chlor alkali	25	Pulp and paper
4	Petroleum refinery	15	Paint complex	26	Dye
5	Chemical fertilizer	16	Viscose	27	Cement
6	Pesticide	17	Battery	28	Foundry
7	Petrochemical	18	Tourism project	29	Electro-plating
8	Bulk drug	19	Thermal power	30	Meta amino phenol
9	Oil and gas	20	Mining		
10	Synthetic rubber	21	Highway		
11	Asbestos	22	Tarred road		

## 2) Scoping

The result of scoping is as shown in Table 3.3.

## (3) IEE

### 1) Result of IEE

The result of IEE is as shown in Table 3.4.

### 2) Opinion of Stakeholders

#### **Local people;**

All of villagers who came to the meeting said that everything would be better than now if they got water for irrigation. The chief of Village Rajwal which has one tube-well provided by WB Fund says that the villagers want three wells more and carry out a green revolution.

#### **Authority**

Dr. Gurdev S. Hira, Professor of Punjab Agriculture University says;

Local people in Kandi area are poor and want to get irrigation water. Water quality is good and groundwater can be recharged so easily. Development of agriculture and green will facilitate reservation of surface soil in Kandi area.

#### **Project proponent**

They say;

They want to secure budget and drill wells for poor farmers in Kandi area. The environment would be better than now because it is barren land at present.

#### **SPCB**

Exploitation project of groundwater is not subject to EIA.

In Central Plain Area over-using of pesticide has been serious problem because of possibility of health sufferings. Central and local governments are promoting reduction of pesticide use at agricultural land.

Although it may be safer in Kandi area and exploitation of groundwater is necessary for local people, same promotion would be inevitable in future.

#### **NGO**

There are few NGOs in the State of Punjab except ones interested in human health.

**Table 3.3 Results of Scoping Work for The Project for Exploitation of Groundwater  
in the State of Punjab in India**

No.	Impacts	Construction phase		Operation phase	
		Rating	Brief Description	Rating	Brief Description
<b>Environmental Impacts</b>					
1	Air pollution				Power source is electricity.
2	Water pollution		Muddy water is circulated and finally dried on the site.		Pesticide may be used in the agricultural land but not discharged outside.
3	Soil pollution			B	Pesticide may be accumulated in the agricultural land.
4	Waste				
5	Noise and vibration				
6	Ground subsidence				Layer is sandy and gravelled.
7	Offensive odors				
8	Geographical features				
9	Bottom sediment				
10	Biota and ecosystem				
11	Water usage			B	Impact on water usage in downstream area may be expected.
12	Accidents				
13	Global warming				
<b>Social Impacts</b>					
1	Involuntary Resettlement				
2	Local economy such as employment and livelihood, etc.				Food or income increases securely.
3	Land use and utilization of local resources				Agricultural land is utilized effectively.
4	Social institutions such as social infrastructure and local decision-making institutions				
5	Existing social infrastructure and services				Water resources for drinking water increase.
6	The poor, indigenous and ethnic people				Poor farmers can reap a better harvest.
7	Maldistribution of benefit and damage				All villagers are equally supplied with water for irrigation.
8	Local conflict of interests			B	Private drilling companies will be influenced.
9	Gender				Some husband may not go out as a laborer and cooperate with his wife.
10	Children's rights				
11	Cultural heritage				
12	Infectious diseases such as HIV/AIDS, etc.				

A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown

No Mark: No impact is expected.

Table 3.4 IEE (Initial Environmental Examination) of The Project for Exploitation of Groundwater in the State of Punjab in India

Items		Impact and Mitigation Measures
Construction Phase		
None		
Operation Phase		
1	Soil Pollution	After provision of irrigation water, farmers will use fertilizer and pesticide in the agricultural land to develop crops and to protect them from noxious insects respectively. In case of irrigation owing to groundwater, since water does not flow out of the land into the river, fertilizer and pesticide may be accumulated on the land. Therefore, they need to control utilization of fertilizer and pesticide to prevent soil pollution.
2	Water Usage	Whenever groundwater is exploited upstream, there might be impact on water level downstream. However, implementation of this project would not give a significant impact on water level in Central Plain Area in the State of Punjab because of followings; <ul style="list-style-type: none"> <li>• Recharging of groundwater is very easy in Kandi area because the area is located at the foot of mountains.</li> <li>• There are a lot of “No Critical” area for groundwater exploitation in Kandi area</li> <li>• The Central Plain Area is far from Kandi area.</li> <li>• From topographical and geophysical point of view there might be possibly no impact on Central Plain Area.</li> </ul>
3	Local Conflict of Interests	In the State of Punjab there are two major well drilling companies and a lot of minor companies. As the latter cannot dig deep tube-wells, PSTC will never give any impact on them because it concentrates on drilling deep tube-wells. As regard the former, since PSTC aims poor farmers in Kandi area and besides digging wells they have to install electric facility, water pump and distribution pipes under ground, i.e. public works without any profit. Moreover PSTC operates and maintains the whole facility, and collects small amount of money from poor beneficiaries. Therefore, it is difficult for private companies to get profit from those public works.



Villagers we had meetings with