Vol. 3 Part II: Annexures to the Draft Environmental and Social Impact Assessment of Reliance Meghnaghat 750 Combined Cycle Power Plant

Project Number: 50253-001
March 2017

BAN: Reliance Bangladesh LNG and Power Limited

Prepared by Adroit Environment Consultants

Annexure-8

Air Quality Monitoring Report

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

[illegible] : 574

Subject : [illegible]

Sample Location : [illegible]

Description of Sample : [illegible]

Sample Location Name : SL-1 – [illegible]

SL-2 – [illegible]

SL-3 – [illegible]

SL-4 – [illegible]

SL-5 – [illegible]

SL-6 – [illegible]

Sample collection : [illegible]

Sampling date : [illegible] September, 2016 [illegible]

Result of analysis

[illegible]	Experiment Date	Sample Location ID	Concentration of different parameters (µg/m³)					
			[illegible]	[illegible]	SPM	[illegible]	[illegible]	[illegible]
	[illegible]	SL-1	21	41	[illegible]	[illegible]	1	[illegible]
	[illegible]	SL-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL-4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	SL-6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unit		µg/m3	[illegible]	µg/m3	[illegible]	[illegible]	µg/m3
	Test Duration (Minutes)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Method of analysis		[illegible]	[illegible]	[illegible]	[illegible]	Acid and Hot Method	[illegible]
	Bangladesh (DoE) Standard for [illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible] Standard		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DoE- Department of Environment, [illegible]

Note: [illegible]

[illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

Nigar Sultana
Sr. Chemist

Syed Hosnea Jahan
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

[illegible] Road, [illegible] Mohammadpur, Dhaka-1207, Tel : [illegible], Mob : [illegible]
Fax : [illegible], Email : [illegible]@gmail.com, [illegible]@gmail.com, Web: www.[illegible]

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : [illegible]

Sample Location : [illegible], Sonargaon, Narayanganj

Description of Sample : [illegible]

Sample Location Name : SL1 - [illegible], Sonargaon, Narayanganj [illegible]

SL2 - [illegible]

SL3 - [illegible]

SL4 - [illegible]

SL5 - [illegible]

SL6 - [illegible]

Sample Collector : [illegible]

Sampling date : [illegible] November 2015 to [illegible] December 2015

Description of Analysis

Month	Parameters/Date	Sample Location ID	Concentration present of different parameter [illegible]					
			SPM	PM10	PM2.5	NOx	SO2	CO
	[illegible]	SL1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	SL6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Units		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Test Duration (Minutes)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	[illegible]	Jacob and Hochheiser	CO Meter
	Bangladesh (ECR) Standard for Ambient Air		[illegible]	150	200	[illegible]	[illegible]	10,000
	WHO Standard		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

ECR - [illegible]

Note: [illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

Nigar Sultana
Sr. Chemist

Syed Hassan [illegible]
Sr. Environmental Engineer (Lab)

Md. [illegible] Rahman
Chief Operating Officer

[illegible], Humayun Road (3rd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel: [illegible] Mob: [illegible]
Fax: [illegible], E-mail: [illegible] Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Serial No. (AECL): 574

Subject: [illegible]

Sample Location: [illegible]

Description of sample: Ambient air quality analysis from different locations.

Sample Location Name: SL-1 – [illegible]

SL-2 – [illegible]

SL-3 – [illegible]

SL-4 – [illegible]

SL-5 – [illegible]

SL-6 – [illegible]

Sample collector: Adroit Environment Consultants Ltd. Sampling Team

Sampling date: [illegible]

Description of analysis

Matrix	Experiment Date	Station Location ID	PM$_{2.5}$	PM$_{10}$	SPM	SO$_2$	NO$_x$	CO
	[illegible]	SL-1	12.1	35.8	50.1	4.4	6.5	110
	[illegible]	SL-2	11.5	41.9	60.2	4.8	5.1	110
	[illegible]	SL-3	27.2	56.1	[illegible]	[illegible]	5.8	[illegible]
	[illegible]	SL-4	11.2	35.1	45.3	[illegible]	4.4	[illegible]
	[illegible]	SL-5	14.5	41.3	[illegible]	4.1	3.7	[illegible]
Air	[illegible]	SL-6	[illegible]	[illegible]	44.7	[illegible]	3.3	[illegible]
	Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	[illegible]
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	[illegible]	[illegible]	CO Meter
	Bangladesh Daily Standard for ambient Air		[illegible]	150	[illegible]	365	[illegible]	10,000
	[illegible] Standard		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Note: [illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

Nigar Sultana
[illegible]

Sayed Mounce Jahan
Sr. Environmental Engineer (AECL)

Md. Zahedur Rahman
Chief Operating Officer

[illegible]
Fax: +88-02-[illegible]; E-mail: [illegible]; Web: [illegible]

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Serial No. : 574

Subject : [illegible]

Sample Location : [illegible]

Description of sample : [illegible]

Sample Location Name : SL.1 – [illegible]

SL.2 – [illegible]

SL.3 – [illegible]

SL.4 – [illegible]

SL.5 – [illegible]

SL.6 – [illegible]

Sampling conducted by : Adroit Environment Consultants Ltd. Monitoring Team

Sampling date : [illegible]

Description of analysis

SL No	Laboratory ID	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			PM2.5	PM10	SPM	SO_2	NO_x	CO
01	[illegible]	SL.1	4.8	[illegible]	[illegible]	[illegible]	5.3	[illegible]
	[illegible]	SL.2	4.4	[illegible]	24.6	[illegible]	7.4	[illegible]
	[illegible]	SL.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Total Duration (Minutes)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	[illegible]	[illegible]
	Bangladesh Daily Standard for ambient Air		[illegible]	[illegible]	200	[illegible]	100	[illegible]
	[illegible] Standard		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

1. [illegible] Particulate Matter ($PM_{2.5}$)
2. [illegible] (PM_{10})
3. Suspended Particulate Matter (SPM)
4. Oxides of Nitrogen (NO_x)
5. Sulphur Di-Oxide (SO_2)
6. Carbon Mono-Oxide (CO)

Nigar Sultana
Sr. Chemist

Syed Hasnan Ishaab
Sr. Environmental Engineer(Lab)

Md. Zubaer Rahman
Chief Operating Officer

2/12, Humayun Road (3rd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel : +88 02-9118712-13, Mob : 01733376808-10
Fax : +88-02-9118714, E-mail: aecl.dhaka@gmail.com, [illegible]@gmail.com, Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Report # AECL: 574

Subject : [illegible]

Project Location : [illegible]

Description of sample : [illegible]

Sample Location Name : SL-1 [illegible]

SL-2 [illegible]

SL-3 [illegible]

SL-4 [illegible]

SL-5 [illegible]

SL-6 [illegible]

Sample collector : [illegible]

Monitoring date : [illegible]

Description of analysis

Sl. No.	Monitoring Date	Sample Location ID	Concentration present of different parameter [illegible]					
			[illegible]	[illegible]	SPM	[illegible]	[illegible]	CO
01	[illegible]	SL-1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL-4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL-6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Units		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Test Duration (Minutes)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Method of Analysis		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Bangladesh Standard for Ambient Air		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible] Standard		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Instruments: 1. [illegible]

2. [illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

Nigar Sultana
Sr. Chemist

Syed Hosnee Jahab
Sr. Environmental Engineer (Lab)

Md. [illegible]
Chief Operating Officer

[illegible] Dhaka-1207 Tel: [illegible]
Fax: [illegible] E-mail: [illegible] Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL: 571

Subject: [illegible]

Site Location: [illegible]

Description of sample: [illegible]

Sample Location Name: SL1 – [illegible]
SL2 – [illegible]
SL3 – [illegible]
SL4 – [illegible]
SL5 – [illegible]
SL6 – [illegible]

Sample collected: Adroit Environment Consultants Ltd. [illegible]

Sampling date: [illegible] October, 2015

Description of analysis:

Month	Experiment Date	Sample Location ID	Concentration of different parameters in ambient air [illegible]					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_X	CO
	[illegible]	SL1	15.2	33.5	34.9	4.8	3.8	112
	[illegible]	SL2	15.7	41.7	[illegible]	3.7	[illegible]	120
	[illegible]	SL3	19.2	31.4	[illegible]	4.2	5.4	118
	[illegible]	SL4	11.8	33.9	[illegible]	8.5	5.1	128
	[illegible]	SL5	20.1	40.8	[illegible]	4	5.1	144
[illegible]	[illegible]	SL6	15.0	34.1	[illegible]	3.8	4.3	144
Units			µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
Test Duration (Minutes)			1440	1440	1440	1440	1440	480
Method of Analysis			Gravimetric	Gravimetric	Gravimetric	West-Gaeke	[illegible]	CO Meter
Bangladesh (DoE) Standard for ambient Air			65	150	200	365	[illegible]	10,000
USEPA Standard			35	150	NF	365	[illegible]	NF

DoE- Department of Environment, NF – Not found

Instruments: 1. [illegible]
2. [illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

Nigar Sultana
Sr. Chemist

Syed Hossain [illegible]
Sr. Environmental Engineer(Lab)

Md. Zohedul [illegible]
Chief Operating Officer

[illegible] Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel: [illegible] Mob: [illegible]
Fax: [illegible], E-mail: [illegible]@gmail.com, [illegible]@gmail.com, Web: [illegible]

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Reference : [illegible]

Subject : [illegible]

Sample Location : [illegible]

Description of sample : [illegible]

Sample Location Name : [illegible]

[illegible]

Sample collection : Adroit Environment Consultants Ltd. Monitoring Team

Sampling date : [illegible]

Description of sample [illegible]

Sl. No.	Experiment Date	Sample Location ID	$PM_{2.5}$	PM_{10}	SPM	NO_x	SO_2	CO
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unit		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Test Duration (Minutes)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West Gaeke	[illegible]	[illegible]
	Bangladesh (DoE) Standard for ambient Air		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible] Standard		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DoE - Department of Environment; [illegible]

Instruments : [illegible]

[illegible]

1. Fine Particulate Matter ($PM_{2.5}$)
2. Respirable Dust Content (PM_{10})
3. Suspended Particulate Matter (SPM)
4. Oxides of Nitrogen (NO_x)
5. Sulfur Di-Oxide (SO_2)
6. Carbon Mono-Oxide (CO)

Nigar Sultana
Sr. Chemist

Syed Hossain Jahab
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

2/10, Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207, Tel: [illegible], Mob: [illegible]
Fax: [illegible], E-mail: aecldhaka@gmail.com, [illegible], Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Ref: [illegible] : 174

Subject : [illegible]

Sample Location : [illegible]

Description of sample : [illegible]

Sample Location Name : [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Name of Institute : [illegible]

Sampling date : [illegible] October, 2016 [illegible] October 2016

Description of analysis

Result	Experiment Date	Sample Location ID	$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
	[illegible]	[illegible]	[illegible]	11.8	[illegible]	4.3	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.8	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.5	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.5	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.4	[illegible]
	Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	[illegible]
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	[illegible]	[illegible]	10,000
	WHO Standard		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DoE: Department of Environment; [illegible]

Instruments: 1. [illegible]
2. Fine Particulate Sampler [illegible]

1. Fine Particulate Matter ($PM_{2.5}$)
2. Respirable Dust Concentration (PM_{10})
3. Suspended Particulate Matter (SPM)
4. [illegible]
5. [illegible]
6. Carbon Monoxide (CO)

Nigar Sultana
Sr. Chemist

Syed [illegible] Jahan
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

2/12, Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel: +88 02-9118712-13, Mob: [illegible]
Fax: +88-02-9110714, E-mail: aecldhaka@gmail.com, [illegible]@gmail.com, Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

ADCL LABORATORY AND ENVIRONMENTAL Management Solutions

AMBIENT AIR QUALITY TEST REPORT

571

Subject : Ambient air quality analysis report at the proposed site of [illegible] Bangladesh [illegible] Power [illegible]

Sample Location : [illegible], [illegible], [illegible]

Description of sample : Ambient air quality [illegible]

Sample Location Name : SL-1 - [illegible], [illegible] (GPS Coordinate: N-23°[illegible]; E-90°[illegible])

SL-2 - [illegible] (GPS Coordinate: N-23°[illegible]; E-90°[illegible])

SL-3 - [illegible] (GPS Coordinate: N-23°[illegible]; E-90°[illegible])

SL-4 - [illegible] (GPS Coordinate: N-23°[illegible]; E-90°[illegible])

SL-5 - [illegible] (GPS Coordinate: N-23°[illegible]; E-90°[illegible])

SL-6 - [illegible] (GPS Coordinate: N-23°[illegible]; E-90°[illegible])

Sample collector : Adroit Environment Consultants Ltd. Monitoring Team

Sampling date : [illegible] October, 2016 to [illegible] October, 2016

Description of analysis

Result	Reporting Date	Sample Location ID	Concentration of different parameters [illegible]					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
	[illegible]	SL-1	12.8	23.3	41.5	4.4	4.5	158
	[illegible]	SL-2	11.2	23.9	42.5	4.4	5.1	177
	[illegible]	SL-3	16.3	25.7	40.5	4.5	4.8	177
	[illegible]	SL-4	8.5	19.8	32.1	5.4	4.7	172
	[illegible]	SL-5	16.8	22.5	40.7	4.5	5.3	158
ND	[illegible]	SL-6	16.1	24.5	40.5	5.5	4.7	172
	Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	[illegible]
	Method of Analysis		Standard [illegible]	Standard [illegible]	Standard [illegible]	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for [illegible]		65	150	200	365	100	10000
	IFC/WB Standard		75	150	[illegible]	125	200	[illegible]

ND: [illegible], NF: [illegible]

Instruments: 1. [illegible]
2. [illegible]

1. Fine Particulate Matter ($PM_{2.5}$)
2. Respirable Dust Content (PM_{10})
3. Suspended Particulate Matter (SPM)
4. Oxides of Nitrogen (NO_x)
5. Sulfur Dioxide (SO_2)
6. Carbon Mono Oxide (CO)

11.02.16
Nigar Sultana
Sr. Chemist

2/11/16
Syed Hossain [illegible]
Sr. Environmental Engineer [illegible]

2/11/16
Md. Zahedur Rahman
Chief Operating Officer

3/5 Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel: +88 02-9118712-13, Mob: [illegible]
Fax: +88 02 9116714, E-mail: [illegible]@gmail.com, [illegible]@gmail.com Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Report No.: 574

Subject: [illegible]

Sample Location: [illegible]

Description of sample: [illegible]

Sample Location Name: SL1 - [illegible]

SL2 - [illegible]

SL3 - [illegible]

SL4 - [illegible]

SL5 - [illegible]

SL6 - [illegible]

Sample collector: Adroit Environment Consultants Ltd. [illegible]

Sampling date: [illegible]

Description of analysis

[illegible]	[illegible]	Sample Location ID	Concentration present of different parameters [illegible]					
			[illegible]	[illegible]	SPM	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.5	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.2	[illegible]	[illegible]
	Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	[illegible]	CO Meter
	Bangladesh [illegible] Standard [illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible] Standard		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Test Methods: 1. [illegible]

2. [illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

[illegible]
Nigar Sultana
Sr. Chemist

[illegible]
Syed [illegible]
Sr. Environmental Engineer (Lab)

[illegible]
Md. Zahedur Rahman
Chief Operating Officer

[illegible] Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207. Tel: +88 02 [illegible], Mob: [illegible]
Fax: +88 02 [illegible], E-mail: [illegible], Web: [illegible]

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Reference No: [illegible]

Subject: [illegible]

Sample Location: [illegible]

Description of sample: [illegible]

Sample Location Name: [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Sample collected by: [illegible]

Sampling date: [illegible]

Description of Analysis:

Period	Experiment Date	Sample Location ID	Concentration present of different parameters in ambient air					
			[illegible]	[illegible]	SPM	SO_2	NO_x	CO
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unit		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Test Duration (Minutes)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Method of Analysis		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Instruments: [illegible]

[illegible]

[illegible]

Md. Zahedur Rahman
Chief Operating Officer

[illegible]

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : [illegible]

Sample Location : [illegible]

Description of sample : [illegible]

Sample Location Name : SL-1 – [illegible]

SL-2 – [illegible]

SL-3 – [illegible]

SL-4 – [illegible]

SL-5 – [illegible]

SL-6 – [illegible]

Sample collector : Adroit Environment Consultants Ltd. Monitoring Team

Monitoring date : [illegible]

Description of sample

Month	Monitoring Date	Sample Location ID	Concentration of Ambient Air Quality Parameters ($\mu g/m^3$)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_2	CO
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Units		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Time Duration (hours)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Method of Analysis		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Bangladesh (DoE) Standard for ambient Air		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible] Standard		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DoE: Department of Environment – [illegible]

Instruments: [illegible]

[illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

[signature] [illegible]

[signature]

[signature]

212, Hemayet Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 [illegible]

Tel: [illegible], E-mail: [illegible], Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo No.: 574

Subject: [illegible]

Sample location: [illegible]

Description of sample: [illegible]

Sample Location Name: SL1 - [illegible]

SL2 - [illegible]

SL3 - [illegible]

SL4 - [illegible]

SL5 - [illegible]

SL6 - [illegible]

Sample collection: [illegible]

Sampling period: [illegible] October 2016 to [illegible] October 2016

[illegible]

Week	Experiment Date	Sample Location ID	PM2.5	PM10	SPM	SO_2	NO_x	CO
	[illegible]	SL1	15.8	33.8	67.9	7.9	8.1	154
	[illegible]	SL2	25.9	57.8	91.2	10.6	[illegible]	160
	[illegible]	SL3	32.4	53.4	[illegible]	6.8	[illegible]	160
	[illegible]	SL4	21.9	61.8	90.7	7.5	[illegible]	154
	[illegible]	SL5	31.2	[illegible]	[illegible]	8.9	10.5	160
[illegible]	[illegible]	SL6	[illegible]	[illegible]	[illegible]	11.4	12.4	[illegible]
	Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$
	Test Duration (Minutes)		1440	1440	1440	1440	[illegible]	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		[illegible]	150	200	[illegible]	[illegible]	10000
	IFC/WB Standard		[illegible]	150	NF	125	200	NF

DoE: Department of Environment, NF = Not found

Instruments: 1. [illegible]
2. [illegible]

1. Fine Particulate Matter (PM2.5)
2. [illegible]
3. Suspended Particulate Matter (SPM)
4. Oxides of Nitrogen (NO_x)
5. Sulphur Dioxide (SO_2)
6. Carbon Monoxide (CO)

Nigar Sultana
Sr. Chemist

Syed [illegible]
Sr. Environmental Engineer (Lab)

Md. Zahadur Rahman
Chief Operating Officer

[illegible], Humayun Road (2nd Floor), Block B, Mohammadpur, Dhaka 1207 Tel: +88 02-9116712-13, Mob: [illegible]
Fax: +88-02-9116714, E-mail: [illegible]@gmail.com, [illegible]@gmail.com, Web: www.[illegible]

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Memo # AECL: 574

Subject: Ambient air quality analysis report at the proposed project of [illegible]

Sample Location: [illegible]

Description of sample: Ambient air quality analysis report at different location.

Sample Location Name: SL-1 – [illegible] (GPS Coordinate: [illegible])

SL-2 – [illegible] (GPS Coordinate: [illegible])

SL-3 – [illegible] (GPS Coordinate: [illegible])

SL-4 – [illegible] (GPS Coordinate: [illegible])

SL-5 – [illegible] (GPS Coordinate: [illegible])

SL-6 – [illegible] (GPS Coordinate: [illegible])

Sample collector: Adroit Environment Consultants Ltd. Monitoring Team.

Sampling date: 24th October 2016 to 27th October 2016

Description of analysis

Week	Sampling Date	Sample Location ID	$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_2	CO
			Concentration present of different parameters [illegible]					
	24-25/10/16	SL-1	22.9	14.9	91.2	5.9	5.5	152
	24-25/10/16	SL-2	11.2	27.5	104.7	9.1	5.5	119
	26-27/10/16	SL-3	23.1	12.8	152.6	12.3	13.2	[illegible]
	26-27/10/16	SL-4	13.5	12.1	103.8	13.1	19.2	375
	25-27/10/2016	SL-5	12.8	21.4	117.6	5.2	8.9	107
01	25-27/10/2016	SL-6	12.7	21.8	107.4	9.8	9.5	154
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		65	150	200	365	100	10,000
	[illegible] Standard		75	150	NF	125	200	NF

[illegible]

Instruments: 1. [illegible] Dust Sampler [illegible]
2. Fine Particulate Sampler Model Envirotech APM 550

1. [illegible] ($PM_{2.5}$)
2. Respirable Dust Content (PM_{10})
3. Suspended Particulate Matter (SPM)
4. [illegible] (NO_x)
5. Sulphur Dioxide (SO_2)
6. Carbon Monoxide (CO)

Nigar Sultana
Sr. Chemist
19.12.16

Syed Hashee Jahab
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

2/12, Humayun Road (2nd Floor), Block B, Mohammadpur, Dhaka 1207 Tel: +88-02-9116712-13, Mob: [illegible]
Fax: +88-02-9116714, E-mail: aecldhaka@gmail.com, [illegible]@gmail.com, Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo #AECL: 974

Subject: [illegible]

Sample Location: [illegible]

Description of sample: [illegible]

Sample Location Name: SL1 – [illegible]

SL2 – [illegible]

SL3 – [illegible]

SL4 – [illegible]

SL5 – [illegible]

SL6 – [illegible]

Sample collection: Adroit Environment Consultants Ltd. [illegible]

Sampling period: [illegible]

Description of sample(s)

Week	Monitored Date	Sample Location ID	PM2.5	PM10	SPM	SO2	NOx	CO
			Concentration present of different parameter in ambient air					
	[illegible]	SL1	[illegible]	102.8	[illegible]	8.2	8.0	[illegible]
	[illegible]	SL2	34.9	100.1	170.2	12.2	12.7	[illegible]
	[illegible]	SL3	35.2	75.5	119.7	10.9	[illegible]	[illegible]
	[illegible]	SL4	10.9	41.7	61.9	7.9	6.5	[illegible]
	[illegible]	SL5	21.8	[illegible]	[illegible]	6.5	7.4	[illegible]
[illegible]	[illegible]	SL6	[illegible]	[illegible]	[illegible]	7.7	7.4	141
	Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	[illegible]	[illegible]	CO Meter
	Bangladesh (DoE) Standard for ambient air		65	150	200	365	100	10,000
	WHO Standard		25	[illegible]	[illegible]	[illegible]	200	[illegible]

[illegible]

Instruments: 1. [illegible]
2. [illegible]

1. [illegible]
2. [illegible]
3. Suspended Particulate Matter (SPM)
4. [illegible]
5. [illegible]
6. [illegible]

Nigar Sultana
Sr. Chemist

Syed Hosneo [illegible]
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574

Subject : [illegible]

Sample Location : [illegible]

Description of sample : [illegible]

Sample Location Name : SL1 - [illegible]

SL2 - [illegible]

SL3 - [illegible]

SL4 - [illegible]

SL5 - [illegible]

SL6 - [illegible]

Sample collection : [illegible]

Recording date : [illegible] October 2016 to [illegible] November 2016

[illegible]

Week	Experiment Date	Sample Location ID	$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
	[illegible]	SL1	55.8	101.8	112.8	10.1	16.1	151
	[illegible]	SL2	33.2	105.3	315.4	6.4	13.5	231
	[illegible]	SL3	31.3	95.5	200.4	9.7	11.1	161
	[illegible]	SL4	31.3	87.8	226	8.5	11.5	165
	[illegible]	SL5	31.8	81.3	185.4	7.1	8.5	201
[illegible]	[illegible]	SL6	32.3	53.8	104.8	7.2	8.4	171
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient air		65	150	200	365	100	10,000
	WHO Standard		25	150	NA	125	200	[illegible]

DoE - Department of Environment, NA - Not Available

Instruments: 1. [illegible]
2. [illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

[illegible signature] 29.12.16
Nigar Sultana
Sr. Chemist

[illegible signature] [illegible]-12-16
Syed Hossain Jahab
Sr. Environmental Engineer (Lab)

[illegible signature]
Md. Zahedur Rahman
Chief Operating Officer

212, Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka 1207 Tel.: +88 02-9116712-13, Mob.: [illegible]
Fax: +88-02-9116714, E-mail: [illegible]@gmail.com, [illegible]@gmail.com, Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 5774

Subject : [illegible]

Sample Location : [illegible]

Description of sample : [illegible]

Sample Location Name : SL1 - [illegible]

SL2 - [illegible]

SL3 - [illegible]

SL4 - [illegible]

SL5 - [illegible]

SL6 - [illegible]

Sample collected by : Adroit Environment Consultants Ltd. Monitoring Team

Sampling date : [illegible]

Description of analysis:

Week	Experiment date	Sample location ID	Concentration of different parameters in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
[illegible]	[illegible]	SL1	14.2	43.1	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL2	[illegible]	[illegible]	170.5	8.7	[illegible]	[illegible]
	[illegible]	SL3	25.1	[illegible]	158.2	[illegible]	[illegible]	[illegible]
	[illegible]	SL4	[illegible]	[illegible]	[illegible]	[illegible]	11.8	[illegible]
	[illegible]	SL5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL6	[illegible]	55.2	[illegible]	[illegible]	[illegible]	[illegible]
	Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	[illegible]
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient air		65	150	200	[illegible]	[illegible]	[illegible]
	IFC/WB Standard		[illegible]	[illegible]	NF	[illegible]	200	[illegible]

DoE- Department of Environment, NF- Not found

Instruments: 1. Portable Dust Sampler [illegible]

2. [illegible]

1. [illegible]
2. [illegible]
3. Suspended Particulate Matter [illegible]
4. [illegible]
5. [illegible]
6. Carbon Mono Oxide [illegible]

19.12.16
Nigar Sultana
Sr. Chemist

19.12.16
Syed Hosnae Jahab
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Memo # AECL: 5774

Subject: [illegible]

Sample Location: Meghnaghat, Sonargaon, Narayanganj

Description of sample: [illegible]

Sample Location Name: SL1 – [illegible]

SL2 – [illegible]

SL3 – [illegible]

SL4 – [illegible]

SL5 – [illegible]

SL6 – [illegible]

Sample collector: [illegible]

Sampling date: [illegible] November 2016 to [illegible] November 2016

[illegible]

Week	Experiment Date	Sample Location ID	Concentration of different parameters in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
	[illegible]	SL1	25.8	117	183.7	8.8	8.1	185
	[illegible]	SL2	33.3	132.8	151.5	6.8	7.3	183
	[illegible]	SL3	26.7	109.8	[illegible]	9.3	3.5	184
	[illegible]	SL4	33.3	115.4	175.5	7.5	5.1	187
	[illegible]	SL5	[illegible]	128	141.5	3.0	4.8	151
18	[illegible]	SL6	79.5	148	178.5	5.2	2.8	47
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Total Duration (Minutes)		1440	1440	1440	1440	1440	[illegible]
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for Ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE- Department of Environment, NF = Not Found

Instruments: 1. [illegible]
2. [illegible]

1. Fine Particulate Matter ($PM_{2.5}$)
2. Respirable Particulate Matter (PM_{10})
3. Suspended Particulate Matter (SPM)
4. Oxides of Nitrogen (NO_x)
5. Sulphur Di-Oxide (SO_2)
6. Carbon Mono-Oxide (CO)

15.11.16
Meher Sultana
Sr. Chemist

Syed Hosnee Jahab
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

3/12, Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel: +88-02-9116712-13, Mob: [illegible]
Fax: +88-02-9116714, E-mail: [illegible]@gmail.com, [illegible]@gmail.com, Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

[illegible] : 5774

Subject : Ambient air quality analysis report of the proposed project of [illegible] Bangladesh LNG & Power Ltd. [illegible] MW CCPP

Sample location : [illegible]

Description of sample : [illegible]

Sample Location Name : SL1 - [illegible] (GPS Coordinate: [illegible])

SL2 - [illegible] (GPS Coordinate: [illegible])

SL3 - [illegible] (GPS Coordinate: [illegible])

SL4 - [illegible] (GPS Coordinate: [illegible])

SL5 - [illegible] (GPS Coordinate: [illegible])

SL6 - [illegible] (GPS Coordinate: [illegible])

Sample collected by : Adroit Environment Consultants Ltd. (Monitoring Team)

Sampling date : [illegible] November, 2015 to [illegible] November, 2015

Description of data plate:

Week	Reporting Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
18	[illegible]	SL1	81.8	151.8	201.8	8.1	7.4	[illegible]
	[illegible]	SL2	29.9	[illegible]	127	8.16	[illegible]	[illegible]
	11-11-2015	SL3	33.3	114	188	7.2	12.7	[illegible]
	11-11-2015	SL4	45.5	145.8	151.7	7.5	8.2	[illegible]
	12-11-2015	SL5	31.5	[illegible]	151.5	[illegible]	5.5	171
	12-11-2015	SL6	34.5	81.2	[illegible]	5.0	5.4	[illegible]
	Unit		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	[illegible]
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for ambient Air		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	IFC/WB Standard		75	150	[illegible]	125	200	[illegible]

[illegible]

Instruments: 1. Respirable Dust Sampler [illegible]
2. Fine Particulate Sampler [illegible]

1. [illegible] ($PM_{2.5}$)
2. Respirable [illegible] (PM_{10})
3. Suspended Particulate Matter (SPM)
4. [illegible]
5. [illegible]
6. Carbon Monoxide (CO)

19.11.15

Nigar Sultana
Sr. Chemist

19-11-15

Syed Hosnee Jahab
Sr. Environmental Engineer (Lab)

Md. Zahidur Rahman
Chief Operating Officer

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Ref. No. AECL : 574

Subject : [illegible]

Sample Location : [illegible]

Description of sample : Ambient air quality analysis [illegible]

Sample Location Name : SL1 – [illegible] (GPS Coordinate: [illegible])
SL2 – [illegible] (GPS Coordinate: [illegible])
SL3 – [illegible] (GPS Coordinate: [illegible])
SL4 – [illegible] (GPS Coordinate: [illegible])
SL5 – [illegible] (GPS Coordinate: [illegible])
SL6 – [illegible] (GPS Coordinate: [illegible])

Sample collected by : Adroit Environment Consultants Ltd. [illegible]

Sampling date : 14th November 2016 to 17th November 2016

Description of analysis :

Areas	Experiment Date	Sample Location ID	Concentration present in the sample ($\mu g/m^3$)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
	[illegible]	SL1	35.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL2	[illegible]	[illegible]	[illegible]	6.5	[illegible]	[illegible]
	[illegible]	SL3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	SL4	[illegible]	[illegible]	[illegible]	6.2	[illegible]	[illegible]
	[illegible]	SL5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	SL6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unit		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	[illegible]	[illegible]	CO Meter
	Bangladesh (DoE) Standard for ambient Air		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible] Standard		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DoE: Department of Environment; [illegible]

Instruments : 1. [illegible]
2. [illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

19.12.16
Nigar Sultana
Sr. Chemist

19.12.16
Syed Hosnee Jahab
Sr. Environmental Engineer(Lab)

Md. Zahedur Rahman
Chief Operating Officer

212, Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel : [illegible]
Fax : +88-02-9116714, E-mail: aecldhaka@gmail.com, [illegible]@gmail.com, Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : [illegible]

Subject : [illegible] proposed project of [illegible] LNG & Power Ltd [illegible]

Sample Location : [illegible]

Identification of sample : Ambient Air quality [illegible] different locations

Sample Location Name : SL1 – [illegible] (GPS Coordinate: [illegible])

SL2 – [illegible] (GPS Coordinate: [illegible])

SL3 – [illegible] (GPS Coordinate: [illegible])

SL4 – [illegible] (GPS Coordinate: [illegible])

SL5 – [illegible] (GPS Coordinate: [illegible])

SL6 – [illegible] (GPS Coordinate: [illegible])

Sample collection : Adroit Environment Consultants Ltd. [illegible] Team

Sampling date : 17th November 2018 to 20th November 2018

Description of analysis:

Area	Sampling Date	Sample Location ID	Concentration present of different parameters (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
01	[illegible]	SL1	31.9	[illegible]	130.8	1.7	3.6	400
	[illegible]	SL2	33.9	115.8	165.7	1.2	7.1	[illegible]
	[illegible]	SL3	33.7	[illegible]	154.5	4.6	[illegible]	[illegible]
	[illegible]	SL4	38.4	124.7	155.1	1.8	7.5	[illegible]
	[illegible]	SL5	34.1	[illegible]	102.7	3.7	6.1	[illegible]
	[illegible]	SL6	[illegible]	[illegible]	146.2	1.2	6.1	[illegible]
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for Ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

[illegible]

Instruments: 1. [illegible]
2. [illegible]

1. [illegible] (PM_{10})
2. Respirable Dust [illegible] ($PM_{2.5}$)
3. Suspended Particulate Matter (SPM)
4. Oxides of Nitrogen (NO_x)
5. Sulphur Di-Oxide (SO_2)
6. Carbon Mono-Oxide (CO)

Nigar Sultana
Sr. Chemist

Syed Hosnee Jahab
Sr. Environmental Engineer [illegible]

Md. Zahedur Rahman
Chief Operating Officer

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo number: [illegible]

Subject: Ambient air quality analysis report of the proposed project [illegible]

Sample Location: [illegible]

Description of sample: Ambient air quality analysis report at different location

Sample Location Name: S.1 – [illegible]

S.2 – [illegible]

S.3 – [illegible]

S.4 – [illegible]

S.5 – [illegible]

S.6 – [illegible]

Sample collector: Adroit Environment Consultants Ltd. Monitoring Team

Sampling date: [illegible] November 2015 [illegible] November 2015

Description of analysis

Month	Experiment Date	Sample Location ID	Concentration present of different parameter in ambient air (µg/m³)					
			PM2.5	PM10	SPM	SOx	NOx	CO
	[illegible]	S.1	[illegible]	[illegible]	[illegible]	[illegible]	7.8	179
	[illegible]	S.2	38.1	[illegible]	174.2	5.8	[illegible]	155
	[illegible]	S.3	40.2	102.5	140.1	3.2	4.5	158
	[illegible]	S.4	38.5	[illegible]	140.1	3.7	5.5	164
	[illegible]	S.5	[illegible]	[illegible]	[illegible]	4.4	7.4	[illegible]
12	[illegible]	S.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh DoE Standard for ambient Air		65	150	200	365	100	10000
	IFC/WB Standard		75	150	NF	125	200	NF

[illegible]

Instruments: 1. Respirable Dust Sampler [illegible]

2. Fine Particulate Sampler [illegible]

1. [illegible] (PM2.5)
2. [illegible] (PM10)
3. Suspended Particulate Matter (SPM)
4. [illegible] (SOx)
5. [illegible] (NOx)
6. [illegible] (CO)

Niger Sultana
Sr. Chemist

Syed Hosnee Jahab
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

2/12, Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel: +88-02-9116712-13, Mob: [illegible]
Fax: +88-02-9116714, E-mail: [illegible], Web: [illegible]

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT

AMBIENT AIR QUALITY TEST REPORT

Memo # AECL: 4-74

Subject: [illegible]

Sample Location: [illegible]

Description of sample: [illegible]

Sample Location Name: SL1 - [illegible]

SL2 - [illegible]

SL3 - [illegible]

SL4 - [illegible]

SL5 - [illegible]

SL6 - [illegible]

Sample collector: [illegible]

Sampling date: [illegible] November, 2016 to [illegible] November, 2016

Date of analysis: [illegible]

Week	Duration of Date	Sample Location ID	Concentration of the parameters (µg/m³)					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
1st	25-26/11/2016	SL1	34.3	140	213.8	4.1	8.2	117
	25-26/11/2016	SL2	31.8	82.2	184.1	6.2	5.3	104
	26-27/11/2016	SL3	41.7	180.5	192.7	3.6	6.1	142
	26-27/11/2016	SL4	46.3	179.1	190.1	4.1	7.8	150
	27-28/11/2016	SL5	36.2	59.1	158.1	5.0	6.8	127
	27-28/11/2016	SL6	48.6	124.4	314.1	7.5	5.5	119
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	480
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for Ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE - Department of Environment, NF - Not Found

Reference: 1. [illegible]
2. [illegible]

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]

Nigar Sultana
Sr. Chemist

Syed Hosnee Jahab
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
AMBIENT AIR QUALITY TEST REPORT

Memo # AECL : 574
Subject : [illegible]
Sample Location : [illegible]

Description of Sample : [illegible]
Sample Location Name : SL1 - [illegible]
SL2 - [illegible]
SL3 - [illegible]
SL4 - [illegible]
SL5 - [illegible]
SL6 - [illegible]
Sample collected by : Adroit Environment Consultants Ltd. Monitoring Team
Sampling date : [illegible]

Parameters of analysis

Week	Measurement Date	Sample Location ID	Concentration of different parameters					
			$PM_{2.5}$	PM_{10}	SPM	SO_2	NO_x	CO
	[illegible]	SL1	42.8	102	164.6	4.9	5.0	115
	[illegible]	SL2	41.3	100.4	184.2	3.8	[illegible]	125
	[illegible]	SL3	49.6	116.7	142.6	7.8	8.1	149
	[illegible]	SL4	37.2	105.4	175.8	4.9	9.4	121
	[illegible]	SL5	39.4	125.6	165.2	[illegible]	9.8	129
15	[illegible]	SL6	51.7	123.4	283.2	7.1	5.2	[illegible]
	Units		µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
	Test Duration (Minutes)		1440	1440	1440	1440	1440	[illegible]
	Method of Analysis		Gravimetric	Gravimetric	Gravimetric	West-Gaeke	Jacob and Hochheiser	CO Meter
	Bangladesh (DoE) Standard for Ambient Air		65	150	200	365	100	10,000
	IFC/WB Standard		75	150	NF	125	200	NF

DoE - Department of Environment, NF - Not Found

Instruments: 1. Respirable Dust Sampler Model Envirotech (APM 460BL) and
2. Fine Particulate Sampler (Model Envirotech, India, APM 550)

1. Fine Particulate Matter ($PM_{2.5}$)
2. Respirable Dust Particle (PM_{10})
3. Suspended Particulate Matter (SPM)
4. Oxides of Nitrogen (NO_x)
5. Sulfur Dioxide (SO_2)
6. Carbon Monoxide (CO)

Nigar Sultana
Sr. Chemist

Syed Hasnat Jahan
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

2/12, Humayun Road (2nd Floor), Block B, Mohammadpur, Dhaka-1207, Tel : +88-02-9116712-13, Mob : [illegible]
Fax : +88-02-9116714, E-mail: [illegible], [illegible]@gmail.com, Web: www.aecl-bd.org

Annexure-9

BPDB Consent letter

Secretariat
Bangladesh Power Development Board
WAPDA Building (1st Floor)
Motijheel C/A, Dhaka-1000

বাংলাদেশ বিদ্যুৎ উন্নয়ন বোর্ড

Bangladesh Power Development Board

Memo No. -1466/BPDB/Sectt./Dev.- ২০৩/২০১১ Dated: 17-05-2016

Sameer Kumar Gupta
Vice President and Business Head, Gas Projects
Reliance Power Limited
Reliance Centre, 19, Walchand Hirachand Marg,
Ballard Estate, Mumbai, Maharashtra, India 400001
Fax: +91 22 3032 7669

Subject: **Request for consent for carrying out the site related studies for the proposed <u>Phase I of 750 MW power plant at Meghnaghat.</u>**

Reference: Your letter: (i) RPL/BD/BDT/2016-17/001 dated: 06.04.2016
(ii) RPL/BD/BDT/2016-17/006 dated: 03.05.2016

Dear Sir,

Please refer to the above mentioned subject under reference. In response to your proposal for setting up 750 MW LNG based CCPP at Meghnaghat, Narayanganj, Bangladesh; BPDB has agreed to allow your access in the BPDB's land at Meghnaghat site for conducting the followings:

- Topographic Survey
- Geotechnical Investigations
- Area Drainage Study & Determination of Safe Grade Elevation
- Construction Material Sourcing Study
- Site Specific Seismic Studies
- Construction Material Sourcing Study
- Water related studies
- Environmental Studies
- Test piling
- Geotechnical studies

Please note that, BPDB shall have no obligation for conducting above mentioned studies and works.

By order,

(Mazharul Haque)
Secretary (Addl. charge)
Bangladesh Power Development Board

Goutam Kundu
Director
IPP Cell-1, BPDB, Dhaka

Memo No. -1467/BPDB/Sectt./Dev.- ২০৩/২০১১ Dated: 17-05-2016

Copy for kind information:

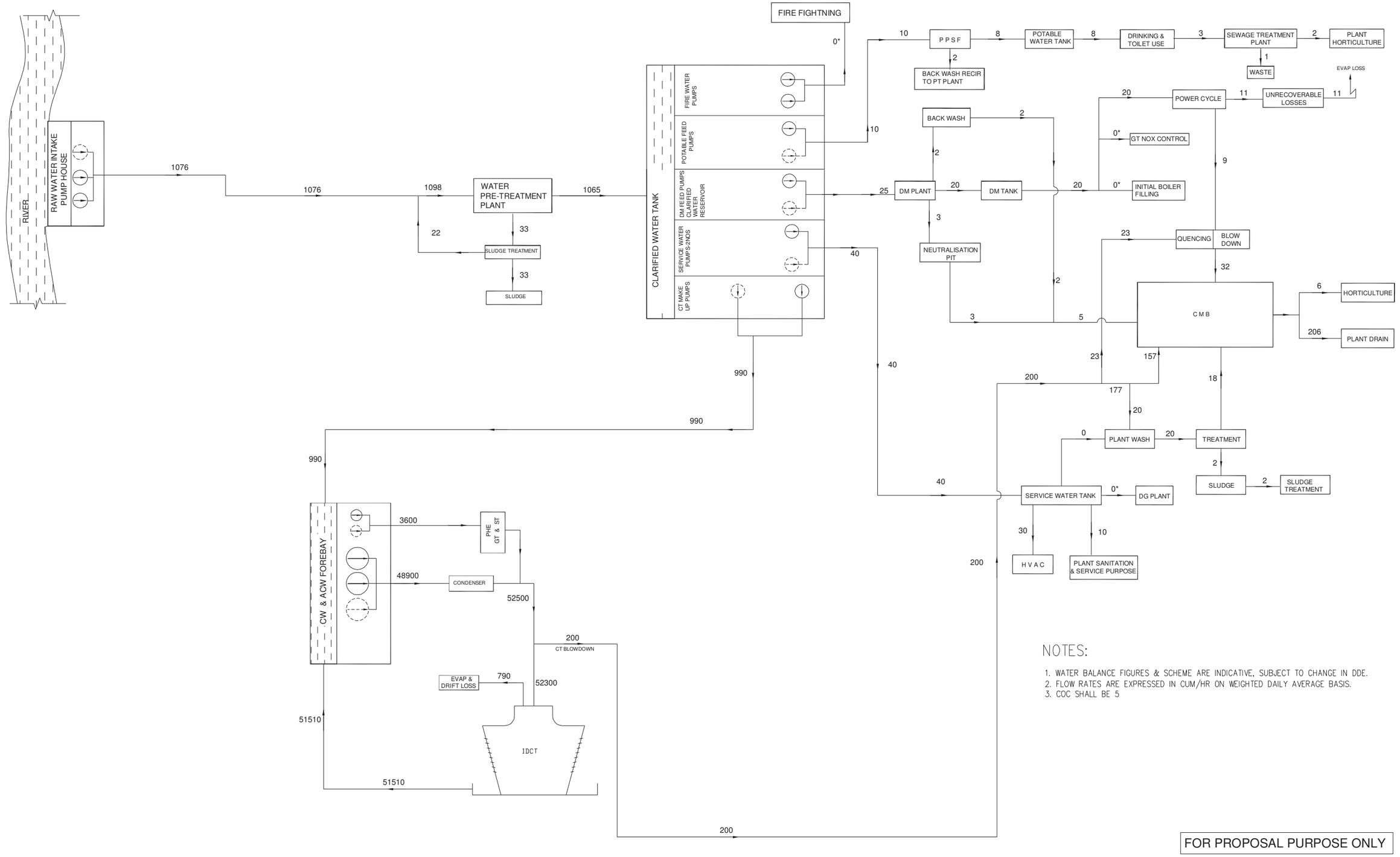
1. Member, Company Affairs/Generation, BPDB, Dhaka
2. Chief Engineer, Private Generation, BPDB, Dhaka.
3. Director, IPP Cell-1, BPDB, Dhaka.
4. Director, State and Transport, BPDB, Dhaka.
5. C.S.O to Chairman, BPDB, Dhaka.
6. PS to Secretary, Power Division, MPEMR, Dhaka.

(Pranob Kumar Ghosh)
Assistant Secretary (Dev.)
Central Secretariat, BPDB, Dhaka

[illegible]

Annexure-10

Water Balance Diagram



NOTES:

1. WATER BALANCE FIGURES & SCHEME ARE INDICATIVE, SUBJECT TO CHANGE IN DDE.
2. FLOW RATES ARE EXPRESSED IN CUM/HR ON WEIGHTED DAILY AVERAGE BASIS.
3. COC SHALL BE 5

FOR PROPOSAL PURPOSE ONLY

NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE
FIRST ISSUE	VRP	BB	A	25.04.16

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY		
FOR CONSTRUCTION		

REVIEWED: ARCHITECTURAL, CIVIL & STRUCTURAL, ELECTRICAL, INSTRUMENTATION, MECHANICAL, ENGG. MANAGER

APPROV | MECH. | INST. | ELEC. | CIVIL | ARCH. — REVIEWED

WATER BALANCE DIAGRAM (WBD)-750 MW CCPP

750 MW COMBINED CYCLE POWER PROJECT, BANGLADESH

RELIANCE POWER LIMITED
Dhirubhai Ambani Knowledge City, I-Block,
Thane Belapur Road, Koparkhairane,
Navi Mumbai-400710 (India)

DRAWN : BB	CHECKED : VRP	SCALE : NTS	METHOD OF PROJECTION
REVIEWED : KH		DATE : 25.04.16	
APPROVED : VM/PP			

JOB NO. | DRAWING NO. REL-BDCCP-MEM-EPC-A-51002 | SHEET 01 OF 01 | REV. A

REVDATE | FILENAME

Annexure-11

Traffic Volume Survey

Table: Average Vehicle Movement on the Dhaka-Chittagong Highway Between (24hrs)

Place: Mograpara Bus Stop

Data Collection Date: 1-12-2016

Hours	Truck /Lorries	Truck PCU (3)	Bus Minibus	Bus PCU (3)	Car / Jeep /Microbus	Car PCU (1)	Motor-cycles /Auto rickshaw	Motorcycle/Auto PCU (.5)	Truck PCU
06:00PM	108	324	245	735	70	70	15	7.5	1136.5
07:00PM	105	315	40	120	40	40	15	7.5	482.5
08:00PM	151	453	46	138	48	48	63	31.5	670.5
09:00PM	99	297	28	84	38	38	14	7	426
10:00PM	113	339	40	120	49	49	15	7.5	515.5
11:00PM	190	570	26	78	43	43	11	5.5	696.5
12:00AM	157	471	37	111	40	40	8	4	626
01:00AM	104	312	75	225	50	50	4	2	589
02:00AM	85	255	35	105	50	50	2	1	411
03:00AM	99	297	60	180	40	40	3	1.5	518.5
04:00AM	65	195	66	198	65	65	4	2	460
05:00AM	105	315	70	210	50	50	9	4.5	579.5
06:00AM	80	240	78	234	50	50	12	6	530
07:00AM	76	228	68	204	95	95	19	9.5	536.5
08:00AM	96	288	45	135	110	110	19	9.5	542.5
09:00AM	87	261	53	159	77	77	22	11	508
10:00AM	96	288	32	96	48	48	22	11	443
11:00AM	115	345	72	216	53	53	42	21	635
12:00PM	131	393	128	384	95	95	38	19	891
01:00PM	134	402	97	291	68	68	38	19	780
02:00PM	131	393	80	240	93	93	26	13	739
03:00P	108	324	97	291	66	66	16	8	689

M									
04:00PM	101	303	62	186	71	71	15	7.5	567.5
05:00PM	123	369	100	300	70	70	15	7.5	746.5
Total	**2659**	**7977**	**1480**	**5040**	**1479**	**1479**	**447**	**223.5**	**14719.5**

(Note: The Traffic Volume have been counted at 10 minutes in each 24 hours and multiply to 6 obtained 1 hour traffic volume)

The Traffic volume have counted by: Adroit Environment Consultants Ltd. (Monitoring Team)

River Traffic Survey for Reliance Meghnaghat 750 MW CCPP

Place: Char Balaki

Date: 3/12/2016

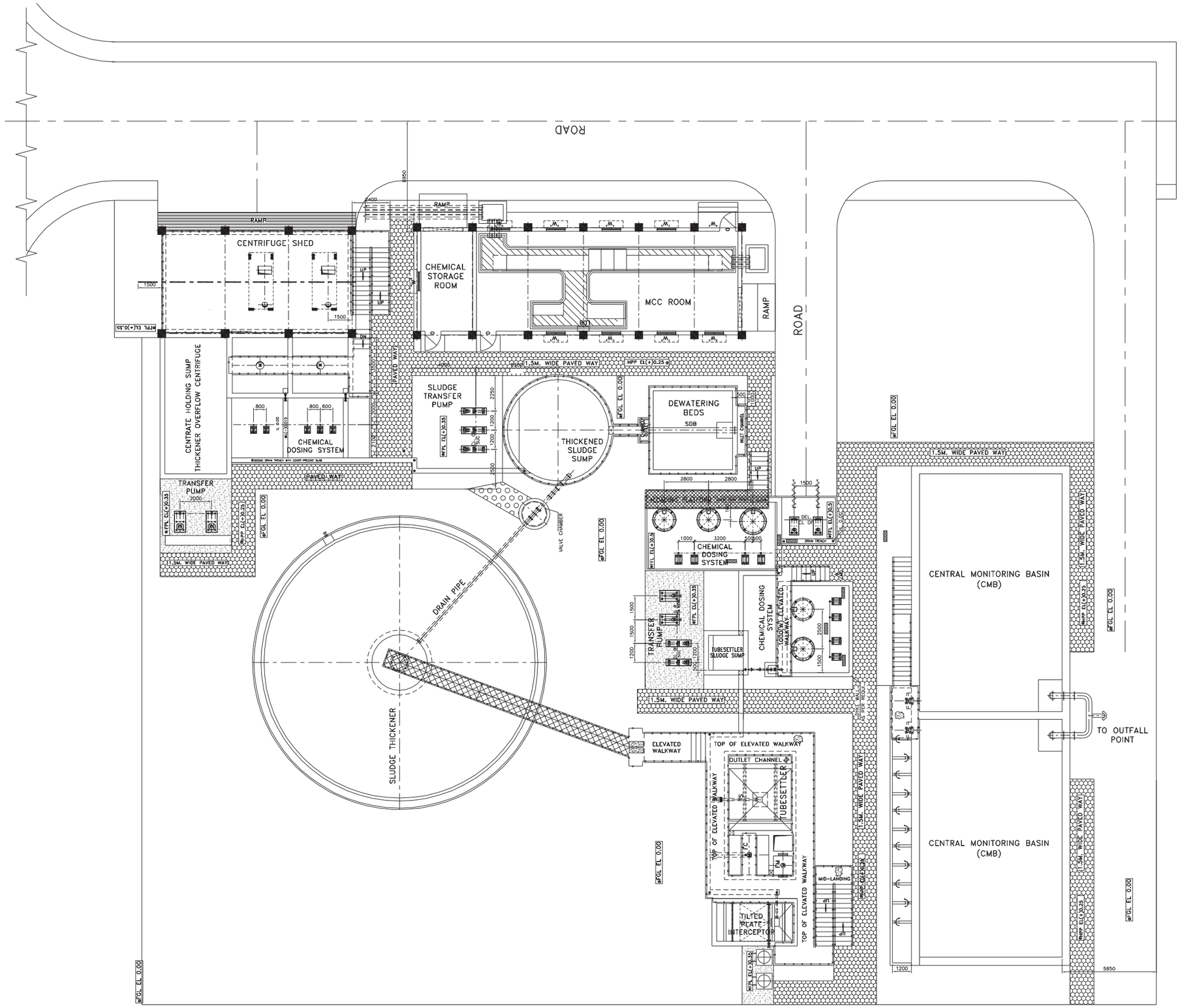
Hour	Direction	Oil Tanker	Goods Ship	Speed boat	Engine Boat	Fishing Boat	Others
01:00PM	Up		1		1	5	
	Down		1		1	3	
02:00PM	Up		4		2	5	
	Down		3		1	8	
03:00PM	Up	1	4				
	Down		2				
04:00PM	Up		2			5	
	Down		5		1	2	
05:00PM	Up		3			4	
	Down		2			3	
06:00PM	Up		2		3	2	
	Down		4			4	
07:00PM	Up		2		1	3	
	Down		1		1	2	
08:00PM	Up		1				
	Down		3				
09:00PM	Up						
	Down						
10:00PM	Up						
	Down						
11:00PM	Up						
	Down						
12:00AM	Up						
	Down						
01:00AM	Up						
	Down						
02:00AM	Up						
	Down						
03:00AM	Up						
	Down						
04:00AM	Up						

	Down					1	
05:00AM	Up	1	1		5	4	
	Down				2	3	
06:00AM	Up				4	3	
	Down				2	3	
07:00AM	Up				3	2	
	Down				1	1	
08:00AM	Up				3	2	
	Down				1	1	
09:00AM	Up		3		3	5	
	Down		5		1	4	
10:00AM	Up		1		4	3	
	Down		1		6	4	
11:00AM	Up		3		1	1	
	Down		1			1	
12:00PM	Up		2			3	
	Down		1			1	
Total		**2**	**61**		**45**	**89**	

Annexure-12

Layout of Effluent Treatment Plant (ETP)

DWG. NO. REL-BDCCP-MEM-EFC-A-51002 REV.A



NOTES:

1) ALL DIMENSIONS ARE IN mm & ELEVATIONS ARE IN METERS.

2) ALL EQIUPMENT & ARRANGEMENT SHOWN ARE TANTATIVE THE SAME SHALL REVISED DURING DETAIL ENGINEERING AS PER THE REQUIREMENT,

GENERAL ARRNGEMENT LAYOUT-EFFLUENT TREATMENT PLANT

750 MW COMBINED CYCLE POWER PROJECT BANGLADESH

RELIANCE POWER LIMITED
Dhirubhai Ambani Knowledge City, I-Block,
Thane Belapur Road, Koparkhairane,
Navi Mumbai-400710 (India)

							GENERAL LAYOUT EFFICIENT TREATMENT PLANT	VM	ML	A	28.11.16
APPROV.	MECH.	INST.	ELEC.	CIVIL	ARCH.	REVIEWED	NATURE OF REVISION & DESCRIPTION	CHECKED	DRAWN	REV.	DATE

RELEASE STATUS	DATE	SIGNATURE
PRELIMINARY		
FOR TENDER ONLY		
FOR CONSTRUCTION		
ARCHITECTURAL		
CIVIL & STRUCTURAL		
ELECTRICAL		
INSTRUMENTATION		
MECHANICAL		
ENGG. MANAGER		

REVIEWED

DRAWN : ML	CHECKED : VM	SCALE : NTS	METHOD OF PROJECTION
REVIEWED : KH/VM		DATE : 28.11.16	
APPROVED : VM/MP			

JOB NO. | DRAWING NO. REL-BDCCP-MEM-130-A-59000 | SHEET 01 OF 01 | REV. 0A

Annexure-13

Noise Monitoring Report

AECL LABORATORY ANALYSIS REPORT

AMBIENT NOISE QUALITY TEST REPORT

Memo # AECL :
Enterprise : Reliance Bangladesh LNG & Power limited.
Project address : Meghnaghat, Sonargaon, Narayanganj.

Description of Sample : Ambient Noise quality analysis report
Sample Location : Vati Bolaki, Hosseindi, Gozaria, Munshiganj
Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Sampling date : 29 November, 2016 to 30 November, 2016 .
Reporting date : 10 December, 2016.

Description of analysis

Concentration present **(LA_{eq}) dBA.**					
Location Coordinated : N 23°34' 50.23" E 90° 34' 0.39"					
SN	**Time**	**Minimum**	**Maximum**	**Average**	**Remark**
01	06.00 AM	47.2	52.2	51.8	Noise source from normal activities.
02	07.00 AM	52.1	56.7	54.1	Noise source from normal activities.
03	08.00 AM	57.3	60.4	59.0	Noise source from normal activities.
04	09.00 AM	50.0	54.5	52.6	Noise source from normal activities.
05	10.00 AM	48.5	55.6	52.1	Noise source from normal activities.
06	11.00 AM	49.2	58.1	51.7	Noise source from normal activities.
07	12.00 PM	47.9	50.2	48.7	Noise source from normal activities.
08	01.00 PM	54.7	58.8	56.7	Noise source from normal activities.
09	02.00 PM	48.7	50.9	49.3	Noise source from normal activities.
10	03.00 PM	55.2	58.7	56.9	Noise source from normal activities.
11	04.00 PM	60.3	63.9	61.8	Noise source from normal activities.
12	05.00 PM	54.2	56.7	55.0	Noise source from normal activities.
13	06.00 PM	50.8	52.3	51.3	Noise source from normal activities.
14	07.00 PM	53.9	56.8	55.5	Noise source from normal activities.
15	08.00 PM	46.7	48.8	47.5	Noise source from normal activities.
16	09.00 PM	44.9	49.9	47.4	Noise source from normal activities.
17	10.00 PM	43.1	46.0	44.1	Noise source from normal activities.
18	11.00 PM	42.8	45.9	45.1	Noise source from normal activities.
19	12.00 AM	39.9	46.4	43.8	Noise source from normal activities.
20	01.00 AM	40.6	43.4	42.5	Noise source from normal activities.
21	02.00 AM	37.5	41.1	39.2	Noise source from normal activities.
22	03.00 AM	39.7	42.8	37.5	Noise source from normal activities.
23	04.00 AM	38.8	41.6	39.9	Noise source from normal activities.
24	05.00 AM	38.6	42.7	40.5	Noise source from normal activities.

Bangladesh (DoE) Standard		
Industrial area	**75**	**70**
Commercial Area	**70**	**60**
Mixed Area	**60**	**50**
Residential Area	**55**	**45**
World Bank/IFC Standard		
Industrial	**70**	**70**
Residential; Intuitional; Educational	**55**	**45**

All units are in (LA_{eq}) dBA.

Note: This noise data was usually accomplished by – Lutron Sound Level Meter (Model – 4010)

Syed Hosney Zahab
Senior Environment Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

AECL LABORATORY ANALYSIS REPORT

AMBIENT NOISE QUALITY TEST REPORT

Memo # AECL :
Enterprise : Reliance Bangladesh LNG & Power limited.
Project address : Meghnaghat, Sonargaon, Narayanganj.

Description of Sample : Ambient Noise quality analysis report
Sample Location : Pachani, Sonargaon, Narayangonj.
Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Sampling date : 22 November, 2016 to 23 November, 2016 .
Reporting date : 10 December, 2016.

Description of analysis

Concentration present **(LA_{eq}) dBA.**					
Location Coordinated : N 23° 36' 29.66" E 90° 34' 35.30"					
SN	**Time**	**Minimum**	**Maximum**	**Average**	**Remark**
01	06.00 AM	52.3	57.4	54.6	Noise source from normal activities.
02	07.00 AM	51.5	56.1	54.6	Noise source from normal activities.
03	08.00 AM	48.2	50.6	49.0	Noise source from normal activities.
04	09.00 AM	52.8	58.7	54.6	Noise source from normal activities.
05	10.00 AM	46.6	57.2	50.9	Noise source from normal activities.
06	11.00 AM	50.5	54.7	52.1	Noise source from normal activities.
07	12.00 PM	54.2	59.4	56.2	Noise source from normal activities.
08	01.00 PM	47.0	56.4	49.6	Noise source from normal activities.
09	02.00 PM	46.9	55.4	50.2	Noise source from normal activities.
10	03.00 PM	46.6	51.9	48.8	Noise source from normal activities.
11	04.00 PM	44.3	47.8	45.8	Noise source from normal activities.
12	05.00 PM	47.1	53.5	49.5	Noise source from normal activities.
13	06.00 PM	49.1	52.7	50.1	Noise source from normal activities.
14	07.00 PM	45.6	49.3	47.3	Noise source from normal activities.
15	08.00 PM	46.5	48.2	47.4	Noise source from normal activities.
16	09.00 PM	45.6	46.5	46.1	Noise source from normal activities.
17	10.00 PM	44.8	46.9	45.7	Noise source from normal activities.
18	11.00 PM	45.5	48.1	46.8	Noise source from normal activities.
19	12.00 AM	41.0	44.0	42.8	Noise source from normal activities.
20	01.00 AM	41.3	43.6	42.5	Noise source from normal activities.
21	02.00 AM	40.5	46.8	43.1	Noise source from normal activities.
22	03.00 AM	38.6	43.2	40.5	Noise source from normal activities.
23	04.00 AM	39.9	42.4	41.7	Noise source from normal activities.
24	05.00 AM	40.3	42.5	41.1	Noise source from normal activities.
Bangladesh (DoE) Standard					
Industrial area				**75**	**70**
Commercial Area				**70**	**60**
Mixed Area				**60**	**50**
Residential Area				**55**	**45**
World Bank/IFC Standard					
Industrial				**70**	**70**
Residential; Intuitional; Educational				**55**	**45**

All units are in (LA_{eq}) dBA.

Note: This noise data was usually accomplished by – Lutron Sound Level Meter (Model – 4010)

Syed Hosney Zahab
Senior Environment Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

AECL LABORATORY ANALYSIS REPORT

AMBIENT NOISE QUALITY TEST REPORT

Memo # AECL :
Enterprise : Reliance Bangladesh LNG & Power limited.
Project address : Meghnaghat, Sonargaon, Narayanganj.

Description of Sample : Ambient Noise quality analysis report
Sample Location : Gowal Gao, Gazaria, Munshiganj.
Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Sampling date : 20 November, 2016 to 21 November, 2016 .
Reporting date : 10 December, 2016.

Description of analysis

Concentration present **(LA_{eq}) dBA.**					
Location Coordinated : N 23º 34 21.64 E 90º 35 22.22					
SN	**Time**	**Minimum**	**Maximum**	**Average**	**Remark**
01	06.00 AM	51.4	57.7	55.8	Noise source from normal activities.
02	07.00 AM	48.0	55.4	52.2	Noise source from normal activities.
03	08.00 AM	47.8	49.2	48.7	Noise source from normal activities.
04	09.00 AM	48.1	55.4	53.3	Noise source from normal activities.
05	10.00 AM	46.8	57.1	54.4	Noise source from normal activities.
06	11.00 AM	43.6	51.0	48.5	Noise source from normal activities.
07	12.00 PM	47.1	52.1	50.2	Noise source from normal activities.
08	01.00 PM	50.0	58.0	53.3	Noise source from normal activities.
09	02.00 PM	47.8	55.0	51.3	Noise source from normal activities.
10	03.00 PM	45.6	51.4	46.9	Noise source from normal activities.
11	04.00 PM	48.7	50.4	49.6	Noise source from normal activities.
12	05.00 PM	47.7	53.7	49.2	Noise source from normal activities.
13	06.00 PM	44.9	48.3	46.9	Noise source from normal activities.
14	07.00 PM	46.4	50.8	46.2	Noise source from normal activities.
15	08.00 PM	46.7	49.3	47.1	Noise source from normal activities.
16	09.00 PM	46.8	49.1	47.5	Noise source from normal activities.
17	10.00 PM	41.7	44.6	43.4	Noise source from normal activities.
18	11.00 PM	40.9	46.0	42.9	Noise source from normal activities.
19	12.00 AM	39.5	43.7	42.8	Noise source from normal activities.
20	01.00 AM	40.5	44.8	42.7	Noise source from normal activities.
21	02.00 AM	41.1	43.6	42.2	Noise source from normal activities.
22	03.00 AM	39.2	44.5	41.4	Noise source from normal activities.
23	04.00 AM	40.0	43.9	41.6	Noise source from normal activities.
24	05.00 AM	40.6	45.8	42.7	Noise source from normal activities.

Bangladesh (DoE) Standard		
Industrial area	**75**	**70**
Commercial Area	**70**	**60**
Mixed Area	**60**	**50**
Residential Area	**55**	**45**
World Bank/IFC Standard		
Industrial	**70**	**70**
Residential; Intuitional; Educational	**55**	**45**

All units are in (LA_{eq}) dBA.

Note: This noise data was usually accomplished by – Lutron Sound Level Meter (Model – 4010)

Syed Hosney Zahab
Senior Environment Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

AECL LABORATORY ANALYSIS REPORT

AMBIENT NOISE QUALITY TEST REPORT

Memo # AECL :
Enterprise : Reliance Bangladesh LNG & Power limited.
Project address : Meghnaghat, Sonargaon, Narayanganj.

Description of Sample : Ambient Noise quality analysis report
Sample Location : Mograpara, Sonargaon, Narayangonj.
Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Sampling date : 01 December, 2016 to 2 December, 2016 .
Reporting date : 10 December, 2016.

Description of analysis

Concentration present **(LA_{eq}) dBA.**					
Location Coordinated : N 23° 38' 8.93" E 90° 35' 41.36"					
SN	**Time**	**Minimum**	**Maximum**	**Average**	**Remark**
01	06.00 AM	59.0	84.8	70.1	Noise source from normal activities.
02	07.00 AM	65.7	76.9	72.3	Noise source from normal activities.
03	08.00 AM	66.7	81.6	69.2	Noise source from normal activities.
04	09.00 AM	64.2	84.8	68.6	Noise source from normal activities.
05	10.00 AM	65.5	83.3	67.8	Noise source from normal activities.
06	11.00 AM	66.1	81.9	65.3	Noise source from normal activities.
07	12.00 PM	63.8	82.5	66.1	Noise source from normal activities.
08	01.00 PM	62.2	71.2	66.4	Noise source from normal activities.
09	02.00 PM	62.4	73.3	65.1	Noise source from normal activities.
10	03.00 PM	64.7	80.2	67.2	Noise source from normal activities.
11	04.00 PM	68.8	79.4	74.8	Noise source from normal activities.
12	05.00 PM	68.6	77.0	69.1	Noise source from normal activities.
13	06.00 PM	68.5	84.4	79.5	Noise source from normal activities.
14	07.00 PM	66.7	77.8	69.1	Noise source from normal activities.
15	08.00 PM	65.8	82.9	68.7	Noise source from normal activities.
16	09.00 PM	64.6	81.5	70.6	Noise source from normal activities.
17	10.00 PM	64.1	79.0	65.9	Noise source from normal activities.
18	11.00 PM	66.4	75.0	69.2	Noise source from normal activities.
19	12.00 AM	57.7	88.4	72.2	Noise source from normal activities.
20	01.00 AM	58.0	77.4	67.2	Noise source from normal activities.
21	02.00 AM	56.9	70.5	64.9	Noise source from normal activities.
22	03.00 AM	58.0	70.2	65.1	Noise source from normal activities.
23	04.00 AM	62.2	73.2	65.8	Noise source from normal activities.
24	05.00 AM	56.1	71.2	61.2	Noise source from normal activities.

Bangladesh (DoE) Standard		
Industrial area	**75**	**70**
Commercial Area	**70**	**60**
Mixed Area	**60**	**50**
Residential Area	**55**	**45**
World Bank/IFC Standard		
Industrial	**70**	**70**
Residential; Intuitional; Educational	**55**	**45**

All units are in (LA_{eq}) dBA.

Note: This noise data was usually accomplished by – Lutron Sound Level Meter (Model – 4010)

Syed Hosney Zahab
Senior Environment Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

AECL LABORATORY ANALYSIS REPORT

AMBIENT NOISE QUALITY TEST REPORT

Memo # AECL :
Enterprise : Reliance Bangladesh LNG & Power limited.
Project address : Meghnaghat, Sonargaon, Narayanganj.

Description of Sample : Ambient Noise quality analysis report
Sample Location : Jamaldi, Gazaria, Munshiganj.
Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Sampling date : 01 December, 2016 to 2 December, 2016 .
Reporting date : 10 December, 2016.

Description of analysis

Concentration present **(LA_{eq}) dBA.**					
Location Coordinated : N 23° 38' 8.93" E 90° 35' 41.36"					
SN	**Time**	**Minimum**	**Maximum**	**Average**	**Remark**
01	06.00 AM	48.7	60.1	54.1	Noise source from normal activities.
02	07.00 AM	49.4	63..2	57.1	Noise source from normal activities.
03	08.00 AM	48.9	66.5	61.7	Noise source from normal activities.
04	09.00 AM	56.3	69.3	63.1	Noise source from normal activities.
05	10.00 AM	57.4	69.2	63.9	Noise source from normal activities.
06	11.00 AM	57.3	72.5	65.8	Noise source from normal activities.
07	12.00 PM	63.8	82.5	66.1	Noise source from normal activities.
08	01.00 PM	51.2	75.1	65.8	Noise source from normal activities.
09	02.00 PM	52.2	75.1	63.4	Noise source from normal activities.
10	03.00 PM	53.0	70.5	61.6	Noise source from normal activities.
11	04.00 PM	51.3	68.3	62.7	Noise source from normal activities.
12	05.00 PM	51.2	67.8	59.8	Noise source from normal activities.
13	06.00 PM	51.2	68.2	58.3	Noise source from normal activities.
14	07.00 PM	53.7	54.9	58.8	Noise source from normal activities.
15	08.00 PM	51.7	65.0	69.7	Noise source from normal activities.
16	09.00 PM	51.7	66.7	60.1	Noise source from normal activities.
17	10.00 PM	52.2	64.3	60.6	Noise source from normal activities.
18	11.00 PM	47.7	62.2	53.8	Noise source from normal activities.
19	12.00 AM	43.2	55.36	47.6	Noise source from normal activities.
20	01.00 AM	42.1	50.6	45.6	Noise source from normal activities.
21	02.00 AM	43.2	48.2	46.8	Noise source from normal activities.
22	03.00 AM	42.4	51.7	45.3	Noise source from normal activities.
23	04.00 AM	42.7	49.4	44.7	Noise source from normal activities.
24	05.00 AM	47.4	55.7	49.2	Noise source from normal activities.

Bangladesh (DoE) Standard		
Industrial area	**75**	**70**
Commercial Area	**70**	**60**
Mixed Area	**60**	**50**
Residential Area	**55**	**45**
World Bank/IFC Standard		
Industrial	**70**	**70**
Residential; Intuitional; Educational	**55**	**45**

All units are in (LA_{eq}) dBA.

Note: This noise data was usually accomplished by – Lutron Sound Level Meter (Model – 4010)

Syed Hosney Zahab
Senior Environment Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

AECL LABORATORY ANALYSIS REPORT

AMBIENT NOISE QUALITY TEST REPORT

Memo # AECL :
Enterprise : Reliance Bangladesh LNG & Power limited.
Project address : Meghnaghat, Sonargaon, Narayanganj.

Description of Sample : Ambient Noise quality analysis report
Sample Location : Boiddarbazar, Sonargaon, Narayangonj.
Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Sampling date : 01 December, 2016 to 2 December, 2016 .
Reporting date : 10 December, 2016.

Description of analysis

Concentration present **(LA_{eq}) dBA.**					
Location Coordinated : N 23° 38' 8.93" E 90° 35' 41.36"					
SN	**Time**	**Minimum**	**Maximum**	**Average**	**Remark**
01	06.00 AM	43.7	53.7	48.5	Noise source from normal activities.
02	07.00 AM	46.3	55.2	50.1	Noise source from normal activities.
03	08.00 AM	59.5	61.8	56.1	Noise source from normal activities.
04	09.00 AM	53.7	70.0	61.8	Noise source from normal activities.
05	10.00 AM	52.2	74.6	65.2	Noise source from normal activities.
06	11.00 AM	57.2	75.1	67.1	Noise source from normal activities.
07	12.00 PM	56.0	69.7	62.6	Noise source from normal activities.
08	01.00 PM	55.8	68.3	62.5	Noise source from normal activities.
09	02.00 PM	55.9	72.7	65.7	Noise source from normal activities.
10	03.00 PM	52.7	64.9	57.8	Noise source from normal activities.
11	04.00 PM	51.8	63.1	57.8	Noise source from normal activities.
12	05.00 PM	52.4	66.8	58.0	Noise source from normal activities.
13	06.00 PM	51.8	71.2	60.9	Noise source from normal activities.
14	07.00 PM	53.7	66.1	59.8	Noise source from normal activities.
15	08.00 PM	53.9	67.7	60.0	Noise source from normal activities.
16	09.00 PM	52.3	64.2	57.7	Noise source from normal activities.
17	10.00 PM	52.2	65.3	57.4	Noise source from normal activities.
18	11.00 PM	47.9	58.3	50.5	Noise source from normal activities.
19	12.00 AM	46.8	56.1	51.2	Noise source from normal activities.
20	01.00 AM	39.2	47.8	42.3	Noise source from normal activities.
21	02.00 AM	38.6	45.1	41.5	Noise source from normal activities.
22	03.00 AM	39.7	45.3	40.6	Noise source from normal activities.
23	04.00 AM	41.8	47.2	43.4	Noise source from normal activities.
24	05.00 AM	46.1	53.6	49.7	Noise source from normal activities.

Bangladesh (DoE) Standard		
Industrial area	**75**	**70**
Commercial Area	**70**	**60**
Mixed Area	**60**	**50**
Residential Area	**55**	**45**
World Bank/IFC Standard		
Industrial	**70**	**70**
Residential; Intuitional; Educational	**55**	**45**

All units are in (LA_{eq}) dBA.

Note: This noise data was usually accomplished by – Lutron Sound Level Meter (Model – 4010)

Syed Hosney Zahab
Senior Environment Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

Annexure- 14
Water Quality Monitoring Report

GROUND WATER

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
GROUND WATER QUALITY TEST REPORT

Memo # AECL : 5[illegible]
Project Name : **Reliance Meghnaghat 750 MW CCPP**
Project Location : **Meghnaghat, Sonargaon, Narayanganj.**

Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Description of Sample : Ground Water Quality Analysis report.
Sample Location : [illegible]
Sampling date : 21st November, 2016.
Reporting date : 20th December, 2016.

Description of analysis

SL. No.	Name of Parameters	Concentration Present	DoE (Bangladesh) Standard *	WHO Standard	Unit	Method of analysis
1.	pH	7.05	6.5-8.5	6.5-8.5		pH Meter
2.	DO	5.01	6	NF	mg/L	DO meter
3.	TDS	353	≤1000 mg/L	NF	mg/L	TDS meter
4.	Conductivity	378.2	NF	250	µS/cm	Conductivity Meter
5.	Alkalinity	240	NF	NF	mg/L	Standard Titrimetric method
6.	Iron	0.06	0.3-1.0	NF	mg/L	Colorimetric
7.	Chloride	372	150-600	250	mg/L	Mercuric nitrate titration
8.	Hardness	240	200-500	NF	mg/L	EDTA titrimetric method
9.	Temperature	25.0	(20-30)°C	NF	°C	Mercury filled thermometer
10.	Arsenic	0.047	0.05	0.01	mg/L	AAS
11.	TSS	8	10	NF	mg/L	Dried at 103-105
12.	Turbidity	5.9	10	NF	NTU	Nephelometric
13.	Salinity	400	NF	NF	mg/L	AAS
14.	Manganese	0.2	0.1	0.5	mg/L	AAS
15.	Cadmium	<0.001	0.005	0.003	mg/L	AAS
16.	Calcium	85.3	75	NF	mg/L	AAS
17.	Chromium	<0.02	NF	0.05	mg/L	AAS
18.	Zinc	<0.005	5	NF	mg/L	AAS
19.	Copper	0.01	1	2	mg/L	AAS
20.	Lead	<0.05	0.05	0.01	mg/L	AAS
21.	Magnesium	56.3	30-35	NF	mg/L	AAS
22.	Fluoride	<1	1	NF	mg/L	Potentiometry
23.	Nitrate	14.3	10	50	mg/L	Potentiometry

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

24.	Sulphate	25.1	400	NF	mg/L	[illegible]
25.	Phosphate	0.28	6	NF	mg/L	Photometric
26.	COD	5.2	-	NF	mg/L	Open Reflux
27.	BOD_5 at 20°C	2.3	0.2	NF	mg/L	5-Day BOD test
28.	TC	14	0	0	N/100 mL	Membrane Filter Technique
29.	FC	0	0	0	N/100 mL	Membrane Filter Technique

* BDS drinking water quality standard, NF=not found

Nigar Sultana
Sr. Chemist

Syed Husnea Janab
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer

2/12, Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel : +88-02-9116712-13, Mob : 01733378808-10
Fax : +88-02-9116714, E-mail: aecdhaka@gmail.com, [illegible]@gmail.com, Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
GROUND WATER QUALITY TEST REPORT

Memo # AECL : 541
Project Name : **Reliance Meghnaghat 750 MW CCPP**
Project Location : **Meghnaghat, Sonargaon, Narayanganj.**

Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Description of Sample : Ground Water Quality Analysis report
Sample Location : Meghnaghat
Sampling date : 21st November, 2010.
Reporting date : 20th December, 2010.

Description of analysis

Sl. No.	Name of Parameters	Concentration Present	DoE (Bangladesh) Standard *	Who Standard	Unit	Method of analysis
1.	pH	7.02	6.5-8.5	6.5-8.5	-	pH Meter
2.	DO	5.05	6	Nil	mg/L	DO meter
3.	TDS	388	1000	Nil	mg/l	TDS meter
4.	Conductivity	593	Nil	250	µS/cm	Conductivity Meter
5.	Alkalinity	180	Nil	Nil	mg/l	Standard Titrimetric method
6.	Iron	0	0.3-1.0	Nil	mg/L	Colorimetric
7.	Chloride	140	150-600	250	mg/L	Mercuric nitrate titration
8.	Hardness	138	200-500	Nil	mg/L	EDTA titrimetric method
9.	Temperature	25.6	[20-30]°C	Nil	°C	Mercury Bulb Thermometer
10.	Arsenic	0.006	0.05	0.01	mg/L	AAS
11.	TSS	6.5	50		mg/L	Dried at 103-105
12.	Turbidity	4.0	10	Nil	NTU	Nephelometric
13.	Salinity	402	Nil		mg/L	AAS
14.	Manganese	0.1	0.1	Nil	mg/L	AAS
15.	Cadmium	<0.002	0.005	Nil	mg/L	AAS
16.	Calcium	87.5	75	Nil	mg/L	AAS
17.	Chromium	<0.05	Nil	0.05	mg/l	AAS
18.	Zinc	<0.005	5	Nil	mg/L	AAS
19.	Copper	<0.01	1	1	mg/L	AAS
20.	Lead	<0.05	0.05	0.01	mg/L	AAS
21.	Magnesium	10.42	30-35	0.5	mg/L	AAS
22.	Nickel	<1	1	0.002	mg/L	Potentiometric
23.	Nitrate	3.5	10	50	mg/L	Potentiometric
24.	Sulphate	9.6	400	Nil	mg/l	Nephelometric

312, Nawabpur Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel: +88 02-8116712-13, Mob: 01733370909-10
Fax: +88-02-9116714, E-mail: aecldhaka@gmail.com, nukhan06@gmail.com, Web: www.aecl-bd.org

25	Phosphorus	<0.01	[illegible]	NF	mg/L	Photometric
26	COD	5.8	10*	NF	mg/L	Open Reflux
27	BOD_5 at 20°C	1.7	0.2	NF	mg/L	5-Day BOD test
28	TC	4	0	2	n/100mL	Membrane Filter Technique
29	FC	0	0	2	n/100mL	Membrane Filter Technique

* DoE drinking water quality standard, NF=not found.

Sultana 28.12.16
Nigar Sultana
Sr. Chemist

[signature] 28/12/16
Syed Hosnee Jahed
Sr. Environmental Engineer(Lab)

[signature] For
Md. Zahedur Rahman
Chief Operating Officer

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
GROUND WATER QUALITY TEST REPORT

Memo # AECL : 594
Project Name : **Reliance Meghnaghat 750 MW CCPP**
Project Location : **Meghnaghat, Sonargaon, Narayanganj.**

Sample Collector : Adroit Environment Consultants Ltd (Monitoring team)
Description of Sample : Ground Water Quality Analysis report
Sample Location : Jamaldi.
Sampling date : 21st November, 2016.
Reporting date : 20th December, 2016.

Description of analysis

SL No.	Name of Parameters	Concentration Present	DoE (Bangladesh) Standard *	WHO Standard	Unit	Method of analysis
1.	pH	7.28	6.5-8.5	6.5-8.5	-	pH Meter
2.	DO	5.93	6	NF	mg/L	DO meter
3.	TDS	504	≤1000	NF	mg/L	TDS meter
4.	Conductivity	1512	NF	250	µS/cm	Conductivity Meter
5.	Alkalinity	385	NF	NF	mg/L	Standard Titrimetric method
6.	Iron	0.02	0.3-1.0	NF	mg/L	Colorimetric
7.	Chloride	125	150-600	250	mg/L	Mercuric nitrate titration
8.	Hardness	320	200-500	NF	mg/L	EDTA titrimetric method
9.	Temperature	25.8	(20-30)°C	NF	°C	Mercury filled thermometer
10.	Arsenic	0.017	0.05	0.01	mg/L	AAS
11.	TSS	5.5	10	NF	mg/L	Dried at 103-105
12.	Turbidity	1.3	10	NF	NTU	Nephelometric
13.	Salinity	300	NF	NF	mg/L	AAS
14.	Manganese	<0.1	0.1	0.5	mg/L	AAS
15.	Cadmium	<0.005	0.005	0.003	mg/L	AAS
16.	Calcium	78	75	NF	mg/L	AAS
17.	Chromium	<0.02	NF	0.05	mg/L	AAS
18.	Zinc	<0.005	5	NF	mg/L	AAS
19.	Copper	<0.01	1	2	mg/L	AAS
20.	Lead	<0.05	0.05	0.01	mg/L	AAS
21.	Magnesium	58.3	30-35	NF	mg/L	AAS
22.	Fluoride	<1	1	NF	mg/L	Potentiometry
23.	Nitrate	2.2	10	50	mg/L	Potentiometry

212, Humayun Road (2nd Floor), Block B, Mohammadpur, Dhaka 1207 Tel : +88 02-9116712-13, Mob : 01738876609-10
Fax : +88-02-9116714, E-mail: aecldhaka@gmail.com, mukhan05@gmail.com; Web: www.aecl-bd.org

24.	Sulphate	5.4	400	NF	mg/L	Nephelometric
25.	Phosphate	<0.07	[illegible]	NF	mg/L	Photometric
26.	COD	[illegible]	[illegible]	NF	mg/L	Open Reflux
27.	BOD5 at 20°C	3.7	[illegible]	NF	mg/L	5 Day BOD test
28.	Total Coli.	14	0	0	N/100 mL	Membrane Filter Technique
29.	Fecal Coli.	3	0	0	N/100 mL	Membrane Filter Technique

* DoE drinking water quality standard, NF-not found.

Nigar Sultana
Sr. Chemist

Syed Hossen Iqbal
Sr. Environmental Engineer(Lab)

Md. Zahedur Rahman
Chief Operating Officer

SURFACE WATER

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
SURFACE WATER QUALITY TEST REPORT

Memo # AECL : 574
Project Name : Reliance Meghnaghat 750 MW CCPP
Project Location : Meghnaghat, Sonargaon, Narayanganj.

Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Description of Sample : Surface water quality analysis report.
Sample Location : Upstream
Sampling date : 25th November, 2015.
Reporting date : 20th December, 2015.

Description of analysis

SL No.	Name of Parameters	Concentration Present	DoE (Bangladesh) Standard *	WHO Standard	Unit	Method of analysis
1.	pH	7.78	6-9	6-9	-	pH Meter
2.	DO	6	4.5-8	NF	mg/L	DO meter
3.	TDS	98	2100	NF	mg/L	TDS meter
4.	Conductivity	195 µS/cm	NF	NF	µS/cm	Conductivity Meter
5.	Alkalinity	60	NF	NF	mg/L	Standard titrimetric method
6.	Iron	0.04	2	3.3	mg/L	Colorimetric
7.	Chloride	170	600	NF	mg/L	Mercuric nitrate titration
8.	Hardness	144	200-500	NF	mg/L	EDTA titrimetric method
9.	Temperature	27.3	40	NF	°C	Mercury filled thermometer
10.	Arsenic	<0.003	0.02	NF	mg/L	AAS
11.	TSS	15.3	150	50	mg/L	Dried at 103-105
12.	Turbidity	20.2	NF	NF	NTU	Nephelometric
13.	Salinity	<0.01	NF	NF	mg/L	Potentiometry
14.	Manganese	<0.5	5	NF	mg/L	AAS
15.	Cadmium	<0.002	0.50	0.1	mg/L	AAS
16.	Calcium	3.8	NF	NF	mg/L	AAS
17.	Chromium	0.02	0.5	0.5	mg/L	AAS

18.	Zinc	<0.005	5	5	mg/L	AAS
19.	Copper	0.2	0.5	0.5	mg/L	AAS
20.	Lead	<0.05	0.1	0.5	mg/L	AAS
21.	Magnesium	15.6	NF	NF	mg/L	AAS
22.	Fluoride	0.4	2	NF	mg/L	Potentiometry
23.	Boron	11	10	NF	mg/L	Potentiometry
24.	Sulphate	14.5	NF	NF	mg/L	Turbidimetric
25.	Phosphate	<0.03	NF	NF	mg/L	Photometric
26.	COD	56.5	200	200	mg/L	Open Reflux
27.	BOD5 at 20°C	17.3	50	50	mg/l	5-Day BOD test
28.	TC	>160	0	0	N/100 mL	Membrane Filter Technique
29.	FC	34	0	0	N/100 mL	Membrane Filter Technique

* DoE Inland Surface Water quality standard, NF: not found.

20.12.16
Nigar Sultana
Sr. Chemist

20/12/16
Syed Hasnee Ishab
Sr. Environmental Engineer(Lab)

Md. Zahedur Rahman
Chief Operating Officer

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
SURFACE WATER QUALITY TEST REPORT

Memo # AECL : 579
Project Name : Reliance Meghnaghat 750 MW CCPP
Project Location : Meghnaghat, Sonargaon, Narayanganj.

Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Description of Sample : Surface water quality analysis report
Sample Location : Near Project Site.
Sampling date : 21st November, 2016
Reporting date : 20th December, 2016.

Description of analysis

Sl. No.	Name of Parameters	Concentration Present	DoE (Bangladesh) Standard *	WHO Standard	Unit	Method of analysis
1.	pH	7.18	6-9	6-9	-	pH Meter
2.	DO	8	4.5-8	NF	mg/L	DO meter
3.	TDS	38	2100	NF	mg/L	TDS meter
4.	Conductivity	15µS/cm	NF	NF	µS/cm	Conductivity Meter
5.	Alkalinity	60	NF	NF	mg/L	Standard titrimetric method
6.	Iron	0.038	1	3.5	mg/L	Colorimetric
7.	Chloride	165	600	NF	mg/L	Mercuric nitrate titration
8.	Hardness	117	200-500	NF	mg/L	EDTA titrimetric method
9.	Temperature	27.3	40	NF	°C	Mercury filled thermometer
10.	Arsenic	<0.004	0.05	NF	mg/L	AAS
11.	TSS	15.5	150	50	mg/L	Dried at 103-105
12.	Turbidity	38.7	NF	NF	NTU	Nephelometric
13.	Salinity	<100	NF	NF	mg/L	Potentiometry
14.	Manganese	<0.1	5	NF	mg/L	AAS
15.	Cadmium	<0.002	0.50	0.1	mg/L	AAS
16.	Calcium	30.2	NF	NF	mg/L	AAS
17.	Chromium	<0.02	0.5	0.5	mg/L	AAS
18.	Zinc	<0.005	5	1	mg/L	AAS

19.	Copper	0.06	0.5	0.5	mg/l	AAS
20.	Lead	<0.05	0.1	0.5	mg/l	AAS
21.	Magnesium	46.5	NF	NF	mg/l	AAS
22.	Fluoride	0.5	1	NF	mg/l	Potentiometry
23.	Nitrate	5.5	10	NF	mg/l	Potentiometry
24.	Sulphate	13.5	NF	NF	mg/l	Nephelometric
25.	Phosphate	<0.07	NF	NF	mg/l	Photometric
26.	COD	21.8	200	250	mg/l	Open Reflux
27.	BOD5 at 20°C	7.4	50	50	mg/l	5-Day BOD test
28.	TC	>100	0	NF	N/100 ml	Membrane Filter Technique
29.	FC	52	0	NF	N/100 ml	Membrane Filter Technique

* BnF Inland Surface water quality standard, NF=not found.

Sultana
20.12.16
Nipa Sultana
Sr. Chemist

20/12/16
Syed Hasnat Jahab
Sr. Environmental Engineer(Lab)

For
Md. Zahedur Rahman
Chief Operating Officer

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
SURFACE WATER QUALITY TEST REPORT

Memo # AECL : 974
Project Name : **Reliance Meghnaghat 750 MW CCPP**
Project Location : **Meghnaghat, Sonargaon, Narayanganj.**

Sample Collector : Adroit Environment Consultants Ltd (Monitoring team)
Description of Sample : Surface water quality analysis report.
Sample Location : Downstream.
Sampling date : 21st November, 2016.
Reporting date : 20th December, 2016.

Description of analysis

SL No.	Name of Parameters	Concentration Present	DoE (Bangladesh) Standard *	WHO Standard	Unit	Method of analysis
1.	pH	7.26	6-9	6-9	-	pH Meter
2.	DO	5	4.5-8	NF	mg/L	DO meter
3.	TDS	37	2100	NF	mg/L	TDS meter
4.	Conductivity	18.3µS/cm	NF	NF	µS/cm	Conductivity Meter
5.	Alkalinity	88	NF	NF	mg/L	Standard Titrimetric method
6.	Iron	0.01	2	0.3	mg/L	Colorimetric
7.	Chloride	140	600	NF	mg/L	Mercuric nitrate titration
8.	Hardness	125	200-500	NF	mg/L	EDTA titrimetric method
9.	Temperature	27.5	20	NF	°C	Mercury filled thermometer
10.	Arsenic	<0.005	0.05	NF	mg/L	AAS
11.	TSS	11.2	150	50	mg/L	Dried at 103-105
12.	Turbidity	9.6	NF	NF	NTU	Nephelometry
13.	Salinity	<100	NF	NF	mg/L	Potentiometry
14.	Manganese	<0.1	5	NF	mg/L	AAS
15.	Cadmium	<0.002	0.50	0.1	mg/L	AAS
16.	Calcium	35.5	NF	NF	mg/L	AAS
17.	Chromium	<0.01	0.5	0.5	mg/L	AAS
18.	Zinc	<0.005	5	3	mg/L	AAS
19.	Copper	0.9	0.5	0.5	mg/L	AAS

2/12, Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel : +88-02-9116712-13, Mob : 01730076608-10
Fax : +88-02-9116714, E-mail: aecdhaka@gmail.com, mushan05@gmail.com, Web: www.aecl-bd.org

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

20.	Lead	<0.03	0.1	0.1	mg/l	AAS
21.	Magnesium	23.7	NF	NF	mg/l	AAS
22.	Fluoride	0.9	2	NF	mg/l	Potentiometry
23.	Nitrate	5.7	10	NF	mg/l	Potentiometry
24.	Sulphate	8.2	NF	NF	mg/l	Nephelometric
25.	Phosphate	0.03	NF	NF	mg/L	Photometric
26.	COD	33.2	200	250	mg/L	Open Reflux
27.	BOD_5 at 20°C	17.6	50	30	mg/L	5-Day BOD_5 test
28.	TC	>100	0	NF	N/100 mL	Membrane Filter Technique
29.	FC	82	0	NF	N/100 mL	Membrane Filter Technique

* DoE Inland Surface water quality standard, NF-not found.

Nigar Sultana
Sr. Chemist

Syed Homee Jahab
Sr. Environmental Engineer (Lab)

Md. Zahedur Rahman
Chief Operating Officer.

Annexure- 15
Soil Test Report

Adroit Environment Consultants Ltd.

A House of Complete Environmental Management Solutions

AECL LABORATORY ANALYSIS REPORT
SOIL TEST REPORT

Memo # AECL : 574
Project Name : **Reliance Meghnaghat 750 MW CCPP**
Project Location : **Meghnaghat, Sonargaon, Narayanganj.**

Sample Collector : Adroit Environment Consultants Ltd (Monitoring team).
Description of Sample : Soil Test Analysis report.
GPS Coordinate : Mugrapara (23°37'59.10"N, 90°35'5.96"E).
Jamaldi 23°35'49.82"N, 90°37'0.69"E).
Project Site (23°36'27.70"N, 90°35'40.50"E).
Char Balaki (23°36'17.30"N, 90°34'38.60"E).
Sampling date : 21st November, 2016.
Reporting date : 26th December, 2016.

Description of analysis

SL.	Parameters		Analytical Results				Analytical Methods
			Project Area	Char Baleki	Mograpara	Jamaldi	
	Physical Parameters						
1	Particle Size Distribution	Sand (%)	84	89	43	47	Hydrometer Method
		Silt (%)	4	8	36	38	
		Clay (%)	2	4	17	15	
2	Texture		Sand	Loamy Sand	Loam	Loam	Marshel's Textural Triangle Method
3	Permeability (cm/hr)		5.1	6.3	2.5	1.6	Constant Head Method
4	Porosity (%)		53	52	49	48	Core Method
5	pH		7.22	7.33	7.33	6.56	pH Meter 1:2.5
6	Electrical Conductivity (µS/cm)		16.2	12.3	225.2	74.5	EC Meter 1:5
	Chemical Parameters						
7	Nitrates (mg/kg)		2.11	3.20	11.20	12.45	KCl extraction and Ion chromatography
8	Phosphates (as PO_4^{3-}) (mg/kg)		43.21	46.23	112.85	147.37	Olsen extraction and Ion chromatography
9	Iron (Fe) (%)		0.083	0.013	1.55	1.58	Acid digestion and AAS
10	Lead(Pb) (mg/kg)		2.80	*BDL	11.3	10.50	Acid digestion and AAS
11	Manganese (Mn) (mg/kg)		147.5	8.55	375.5	330.4	Acid digestion and AAS
12	Nickel (Ni) (mg/kg)		7.70	1.30	18.30	22.55	Acid digestion and AAS
13	Barium (Ba) (mg/kg)		1225	1145	1730	1975	Acid digestion and AAS
14	Zinc (Zn) (mg/kg)		25.74	5.97	108.72	95.05	Acid digestion and AAS
15	Copper (Cu) (mg/kg)		2.20	0.050	13.55	14.80	Acid digestion and AAS
16	Cadmium (Cd) (mg/kg)		BDL	BDL	BDL	BDL	Acid digestion and AAS
17	Chromium (Cr) (mg/kg)		11.85	2.60	28.15	29.60	Acid digestion and AAS
18	Arsenic (As) (mg/kg)		1.62	0.22	2.66	1.70	Acid digestion and AAS
19	Cation Exchange Capacity (cmol/kg)		0.62	1.55	11.0	10.12	NH_4OAc method

Nigar Sultana 26.12.16
Nigar Sultana
Sr. Chemist

26/12/16
Syed Hosnee Jahab
Sr. Environmental Engineer(Lab)

26/12/16
Md. Zahedur Rahman
Chief Operating Officer.

2/12, Humayun Road (2nd Floor), Block-B, Mohammadpur, Dhaka-1207 Tel : +88 02-9116712-13, Mob : 01733376609-10
Fax : +88-02-9116714, E-mail: aecldhaka@gmail.com, nukhan05@gmail.com, Web: www.aecl-bd.org

Annexure- 16

Ecological Survey (Fauna)

AN ECOLOGICAL SURVEY OF THE FAUNA AND FLORA OF PROPOSED SITE FOR RELIANCE MEGHNAGHAT 750 MW COMBINED CYCLE POWER PLANT AT MEGHNAGHAT, NARAYANGANJ, BANGLADESH

[BASELINE SURVEY FOR DATA GENERATION ON ECOLOGY IN AND AROUND THE PROPOSED PROJECT AREA AT MEGHNAGHAT, SONARGAON, NARAYANGANJ]

PART-I: THE FAUNA

Submitted by

Dr. Abdul Jabber Howlader
Professor
Department of Zoology
Jahangirnagar University
Savar, Dhaka, Bangladesh

Dr. AFM Aslam
Professor
Department of Zoology
Jahangirnagar University
Savar, Dhaka, Bangladesh

Dr. Md. Baki Billah
Associate Professor
Department of Zoology
Jahangirnagar University
Savar, Dhaka, Bangladesh

An Ecological Survey of the Fauna of Proposed Site for Reliance Meghnaghat 750 MW Combined Cycle Power Plant

The variety of life on Earth, its biological diversity is commonly referred to as biodiversity. The number of species of plants and animals, the enormous diversity of genes in these species, the different ecosystems on the planet is all part of a biologically diverse Earth. It represents the wealth of biological resources available to us. Humans cannot breathe unless both flora and fauna survive and thrive on the earth. Fauna is a significant part of the ecosystem. All the animals are connected in one way or another, mainly through food chains. As the usage of the land is getting more and more intensive throughout the country, there is a threat for natural habitat to vanish, also many populations of different species has declined. Some of the animal populations that have been abundant earlier now are vanishing or are almost disappeared. For the reasons, conservation of global biodiversity has become the issue of prime importance in recent decades (Turner *et al*., 1990; Ehrlich and Wilson, 1991). Conservationists around the globe are battling with conservation challenges under the ever accelerating threats of anthropogenic disturbances to biodiversity. Bangladesh has realm number of biological diversity for its geographical location and favorable climatic condition for life. Biodiversity is facing unprecedented levels of threat due to unwise industrialization. For the reasons, It has become imperative to assay diversity prior to any big set up.

Understanding biological diversity in terms of the processes by which ecosystems and their components function, be it at community, species, population or genetic levels, is critical to informing its sustainable use and safeguarding it for the benefit of future generations. Sustainable ecosystem and sustainable development is intensely interrelated (Fig. 1).

Identifying and monitoring biological diversity is a huge and potentially infinite task given its variability in time and space and its spectrum of levels. Biodiversity estimation applying short span studies are becoming ever popular and in this regard preparation of checklists of birds on a wider scale has been given much importance (Roy *et al*., 2011). The reliance Group of Bangladesh is planning to construct a 750 MW Conbined Cycle Powe Plant. at Meghnaghat, Sonargaon, Narayangonj. The GPS position of the site is $23^0$36’25.56’N, $90^0$35’32.16”E. A rapid faunal diversity assessment was carried out at different locations of the proposed site to get idea about the biodiversity of the area. Though the present short study

does not reflect complete biodiversity of that area. Detail investigation is necessary to have a complete list.

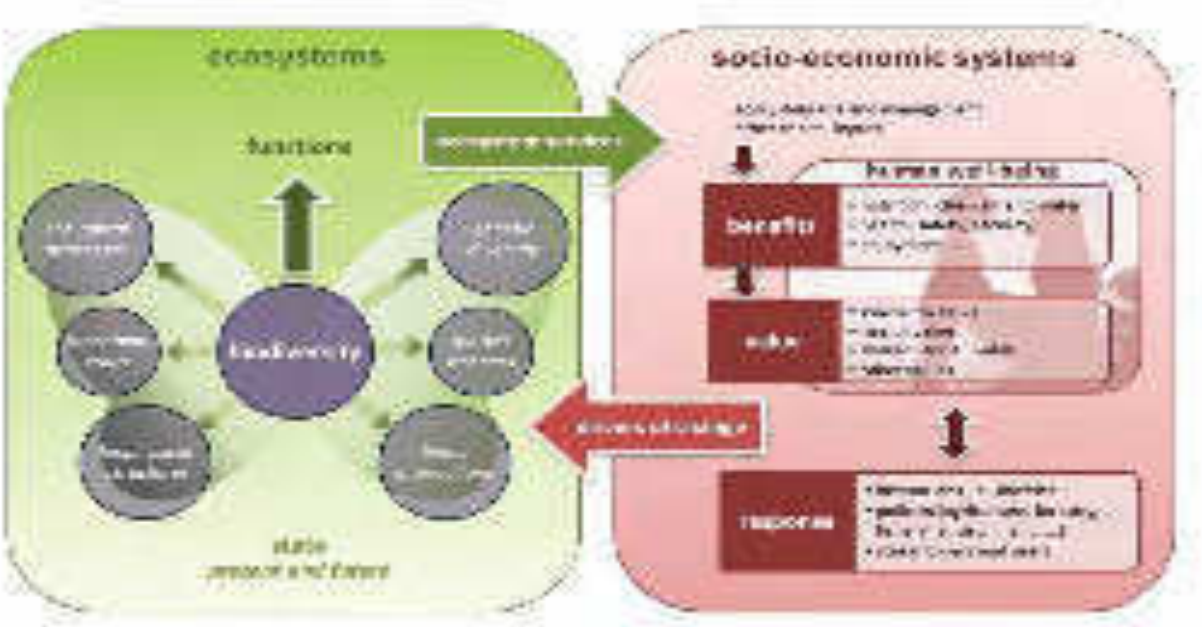


Fig. 1: Conceptual framework for ecosystem assessment

Indicator species assessment of different biotypes and habitats has been used as tools to assess the biological health of habitats. They are also considered model organisms to assess the effects of global climate change. We made a quick survey on some bio indicator species viz, Odonate, Butterfly, Mollusc, Plankton, Fish and Avifauna. Diversity of these indicator species will give an idea about the health of that specific area.

INDUSTRIALIZATION IN THE STUDY AREA

We cannot avoid demand of industrialization for the better development of the country. But careful decision should be taken prior to any new set up. If any such set up create threat to the biodiversity, country development would not be sustainable. Fisherman of the river near study area informed that they hardly can catch any fish from the river nowadays. There are some industries already existed near the study are. Such industries should be very careful for their effluent and byproduct.

Plate 1: Industry near study area

Plate 2: Industry near study area

Plate 3: Dust coming out from an industry made shade over the industry building, may also be harmful for all biodiversity

Plate 4: Making carrier ship near the bank of river

Plate 5: Water coming out from an industry

Plate 6: Carrier vessel in the river

Plate 7: Carrier vessel in the river

Methods of sample collection

A comprehensive survey was conducted at the vicinity of proposed Reliance Meghnaghat 750 MW CCPP on December 2, 2016 to get an idea about the status of the diversity of animals in that area. Water samples of the river were collected from different locations around the proposed power plant. Different physical parameters of the water samples were checked and recorded. Phytoplankton and Zooplankton nets were used to collect different types of planktons available in each type of water sample. Different types of fishes, macro and micro-invertebrates were collected from each of the location. Several types of fishing nets were utilized for this purpose. To get an idea about the biodiversity of each location, water samples were collected around 40 meter radius of each sampling location. The collected specimens were identified instantly or brought to the laboratory for further confirmation. Proper keys, Journals, books and encyclopedia were consulted for identification of the collected specimens. Fishermen were interviewed to get an idea about the present status and past records of the availability and abundance of fish population of the river. Fish sellers of the local fish market were also interviewed to collect their opinion about the present and past status of the abundance of fishes in the area.

For phytoplankton and Zooplankton survey 10 lit of water (two liters each time) was collected from each sampling location and was sieved by plankton net. 45 ml of sieved water was collected in a 50 ml Falcon tube. Then 5 ml of alcohol was added in each Falcon tube as preservative so that the microorganisms are not damaged before identification, In this way 5 samples were collected from each sampling location 1 ml of water from each 50 ml sample was studied in a “rafter cell counter” under microscope.

Observations

Huge number of floating water hyacinth was trapped by the local people. They use bamboo poles for trapping. They use this place to attract different kinds of fishes as shelter place. Fishermen encircle this area after every 15-20 days with nets and capture fish. During

interview with the local people, they informed that during each fishing huge quantity of different kinds of fishes are captured. Water quality includes various physical and biological parameters which has direct influence on the aquatic organisms and vegetations. Abundance of fishes and their growth are dependent on the quality of water and availability of food. Few physical parameters of water samples of each sampling location examined and presented in Table 1:

Plate:8

Plate:9

Plate:10

Plate:11

Plate:12

Plate:13

Plate: Showing different sampling locations and collection of samples

CHAPTER – I

INSECT FAUNA

Insects are one of the most important groups in the natural world. Approximately 80% of animal species on earth are insects. They affect the life and welfare of humans in many different ways. **Insects play** crucial **roles** in **ecosystem** functioning. As pollinators, they contribute to the reproduction of most flowering plants. About 80% of the flowering plants on Earth are pollinated by insects. According to some estimates, over ⅓ of the human diet can be traced directly or indirectly to bee pollination. **Insects** are often the first decomposers of dead plants and animals, and introduce microorganisms that continue this process and release nutrients for new plant growth. Nevertheless they are extremely important as essential components of both natural and modified ecosystems. In this survey we targeted few bio-indicator species.

ODONATA FAUNA

Odonata is an order of carnivorous insects, encompassing the dragonflies (Anisoptera) and the damselflies (Zygoptera). Odonates are aquatic or semi-aquatic as juveniles. Thus, adults are most often seen near bodies of water and are frequently described as aquatic insects. However, many species range far from water. Adult Odonates are terrestrial and are found near water, whereas the immature stages are aquatic and inhabit all typesof freshwater habitats ranging from permanent running waters and lakes to small temporary rain pools (Silsby 2001, Harp 1996, Corbet 1999). Many species are limited to some particular habitats, both during larval and adult life

stages especially the stenotopic species. However, their specificity to aquatic habitats makes them an ideal model for monitoring the health of freshwater ecosystems (Subramanian 2009, Orr 2003, Watanabe et al., 2004).The adults are harmless and their beautiful colorpattern raised strong aesthetic sense to human being. People in some countries also take the adult dragonflies as a minor food item (Chowdhury, 1989; Chovanec 1994; Legner 1995; Clarke 1996; Nikula *et al*., 2007).

They are carnivorous throughout their life, mostly feeding on smaller insects.Dragonflies and damselflies play key roles in both terrestrial and aquatic habitats. They are predators as both

nymphs and adults, feeding on a variety of prey including nuisance species such as mosquitoes and biting flies. Nymphs can be top predators in fishless wetlands and help structure the wetland community. Dragonfly and damselfly nymphs in turn are an essential food resource for fish and amphibians, and adults are eaten by upland predators such as birds, bats, lizards, and spiders.

Odonates can act as **bioindicators** of water quality in rivers because they rely on high quality water for proper development in early life. Odonate nymphs are important components ofmost fresh water habitats, intermediate links in aquatic food webs, functioning as both prey andpredators. Nymphs are food for birds, fish, bugs. Since their diet consists entirely of insects, odonate density is directly proportional to the population of prey, and their abundance indicates the abundance of prey in the examined ecosystem (Golfieri *et al*., 2016). Species richness of vascular plants has also been positively correlated with the species richness of dragonflies in a given habitat. This means that in a location such as a lake, if one finds a wide variety of odonates, then a similarly wide variety of plants should also be present. This correlation is not common to all bioindicators, as some may act as indicators for a different environmental factor, such as the pool frog acting as a bioindicator of water quality due to its high quantity of time spent in and around water (Sahlén *et al.* 2000).

They can be indicators of different biotypes and habitats, and have been used as tools to assess the biological health of aquatic habitats and to detect levels of heavy metals such as mercury. They are also considered model organisms to assess the effects of global climate change. For the reasons, a survey of this group was prime important.

Survey and identification

Adult Odonates were observed were recorded and some were collected by using standard hand nets and anesthetized in the field. Back in the laboratory they were identification with thehelp of taxonomic key provided by Fraser (1933, 1934, 1936, Lahiri (1987), Mitra (1983),Srivastava and Sinha (1993), Needham and Westfall (1954), Walker and Corbet (1975),Westfall (1996) and available photographs. As the survey time was only one day, it was not possible to survey all species. We also consulted previous information to enlist the survey species.

FINDINGS

Odonates found during the survey are recorded in the following tables:

Table: List of dragonfly species recorded from the study area

Family: Libellulidae

Sl. No.	**Common Name**	**Scientific name**
1.	Coral Tailed Cloud Wing	*Tholymis tillarga*
2.	Skimmer	*Rhodothemis rufa*
3.	Wandering Glider	*Pantala flavescens*
4.	Green Marsh Hawk	*Orthetrum sabina*
5.	Fulvous Forest Skimmer	*Neurothemis fulvia*
6.	Ruddy Marsh Skimmer	*Crocothemis servilia*
7.	Ditch Jewel	*Brachythemis contaminata*

Family: Gomphidae

Sl. No.	**Common Name**	**Scientific name**
8.	Common Clubtail	*Ictinogomphus rapax*

Table: Damselfly species recorded from the study area

Family: Coenagrionidae

Sl. No.	**Common Name**	**Scientific name**
1.	Saffron-faced Blue Dart	*Pseudagrion rubriceps*
2.	Coromandel Marsh Dart	*Ceriagrion coromandelianum*
3.	Pigmy Darlet	*Agriocnemis pygmaea*
4.	Orange-tailed Marsh Dart	*Ceriagrion cerinorubellum*
5.	Narrow-winged damselfly	*Agriocnemis femina*
6.	Little Blue	*Enallagma parvam*

Family: Platycnemididae

Sl. No.	**Common Name**	**Scientific name**
7.	Common Bush Dart	*Copera ciliata*

Plate 1: Dominant Anisopteran Odonate of the survey area: Ruddy Marsh Skimmer (*Crocothemis servilia*) (Male)

Plate 2: Ruddy Marsh Skimmer (*Crocothemis servilia*) (Male): Dorsal view

Plate 3: Resting of Ruddy Marsh Skimmer (*Crocothemis servilia*) (Male): Lateral view

Plate 4: Coromandel Marsh Dart *Ceriagrion coromandelianum*

Plate 5: Zygopteran Odonate Little Blue (*Enallagma parvam*) (Male) feeding

Plate 6: Mating ofLittle Blue (*Enallagma parvam*) (Male): Stage-i

Plate 7: Mating ofLittle Blue (*Enallagma parvam*) (Male): Stage-ii

Plate 8: Mating ofLittle Blue (*Enallagma parvam*) (Male): Stage-iii

Plate 9: Mating ofLittle Blue (*Enallagma parvam*) (Male): Stage-iv

In our study, out of 15 species recorded, 8 species weredragonflies belonging to two families: Libellulidae, and Gomphidae; 7 species were damselflies under two families:

Coenagrionidae, and Platycnemididae.

Collection of data for phylogenetic analysis:

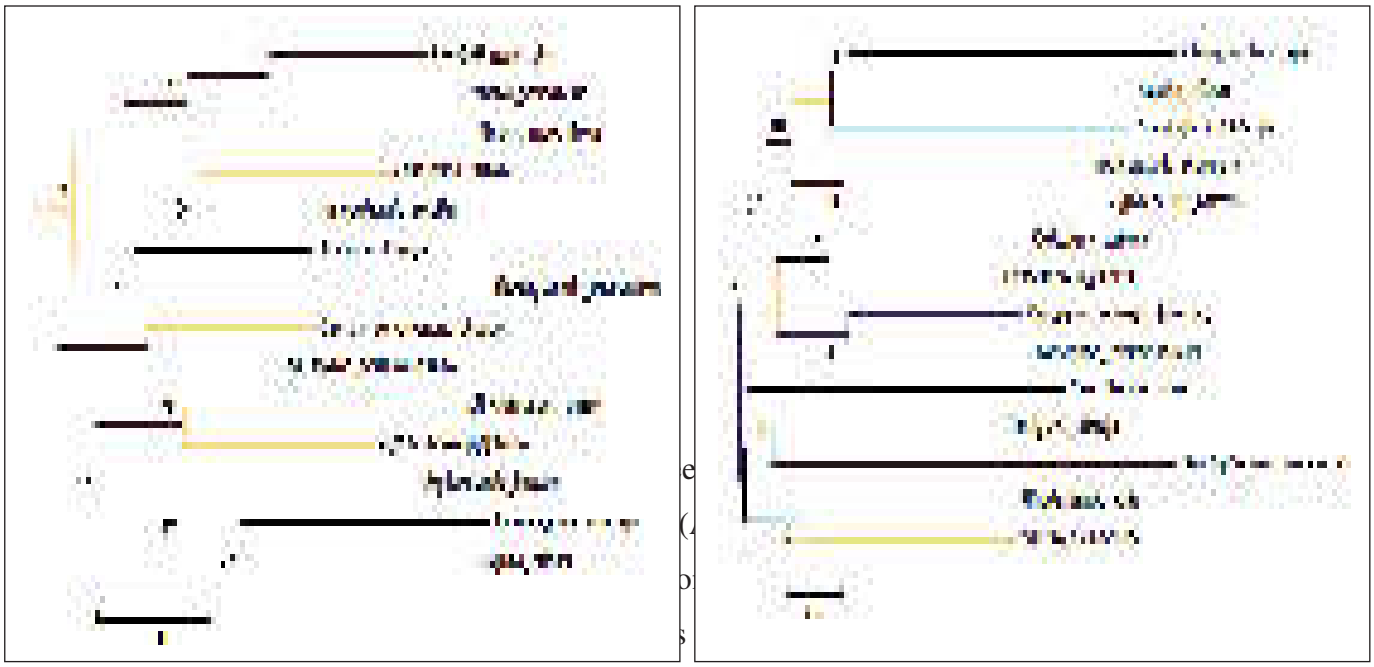
COI gene sequence of fourteen (14) Odonata species was collected from National Center for Biotechnology Information (NCBI) (http://ncbi.nlm.nih.gov) for their molecular and phylogenetic analysis.

Name of species	**GenBank Accession Number (COI gene)**
Tholymis tillarga	AB709198.1
Rhodothemis rufa	KX281843.1
Pantala flavescens	KR080133.1
Orthetrum sabina	KU496904.1
Neurothemis fulvia	JN817427.1
Crocothemis servilia	KR149807.1

Brachythemis contaminata	KC287157.1
Ictinogomphus rapax	KX891024.1
Pseudagrion rubriceps	KX263704.1
Ceriagrion coromandelianum	KU220871.1
Agriocnemis pygmaea	KU871002.1
Ceriagrion cerinorubellum	KU220868.1
Agriocnemis femina	KF369283.1
Copera ciliata	KF369527.1

Phylogenetic analysis:

The evolutionary history was inferred using both the Neighbor-Joining (NJ) and maximum likelihood (ML) tree method based on MEGA 6 (Saitou and Nei, 1987; Felsenstein, 1885; Tamura et al., 1985).In both phylogenetic trees (Maximum Likelihood and Neighbour-joining), grouped Fourteen (14) Odonata species into two clusters. In maximum likelihood tree, *Rhodothemis rufa, Pantala flavescens, Neurothemis fulvia, Orthetrum sabina, Crocothemis servilia, Tholymis tillarga, Brachythemis contaminata* gropued within same clusters. *Ictinogomphus rapax, Pseudagrion rubriceps, Ceriagrion coromandelianum, Agriocnemis pygmaea, Ceriagrion cerinorubellum, Agriocnemis femina* and *Copera ciliate* clustered into another group. All species are closely related and highest bootstrap value (75) was shown in the sub cluster of *Ceriagrion coromandelianum* and *Ceriagrion cerinorubellum.* Same results were observed in neighbor joining tree construction. In context of branch length, *Brachythemis contaminate* was genetically most distance from the common ancestors in both trees (Fig. 2).



evolutionaryhistory was inferred using the Neighbor-Joining method. The optimal tree with the sum of branch length = 0.57177990 is shown. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) is shown next to the branches. The bar at the bottom is a scale for genetic change.

Genetic Distance:

Kimura's two parameter (K2P) genetic distances was carried out using MEGA 6(Tamura et al., 2013). Interspecific genetic divergence range of Odonata species was 0.13-0.32.*Ictinogomphusrapax* showed highest (0.32) pairwise distance than rest. *Ceriagrion cerinorubellum* showed lowest (0.13) pairwise distance among studied Odonates.

Table: Interspecific K2P sequence divergence at the COI barcode region among the Odonates

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.*Tholymistillarga*														
2. *Rhodothemisrufa*	0.20													
3. *Pantalaflavescens*	0.21	0.16												
4.*Orthetrumsabina*	0.21	0.20	0.17											
5. *Neurothemisfulvia*	0.21	0.22	0.22	0.23										
6. *Crocothemisservilia*	0.17	0.21	0.19	0.14	0.21									
7.*Brachythemisconta minata*	0.23	0.25	0.24	0.27	0.26	0.28								
8.*Ictinogomphus rapax*	0.25	0.27	0.26	0.26	0.26	0.25	0.32							
9.*Pseudagrion rubriceps*	0.24	0.23	0.23	0.22	0.24	0.22	0.30	0.24						
10.*Ceriagrion coromandelianum*	0.21	0.21	0.21	0.19	0.20	0.16	0.27	0.25	0.23					
11.*Agriocnemis pygmaea*	0.22	0.26	0.21	0.21	0.23	0.21	0.28	0.21	0.29	0.21				
12.*Ceriagrion cerinorubellum*	0.20	0.18	0.21	0.19	0.24	0.17	0.27	0.28	0.23	0.13	0.18			
13.*Agriocnemis femina*	0.25	0.21	0.27	0.23	0.25	0.24	0.31	0.24	0.22	0.21	0.19	0.20		

14.*Copera ciliate*	0.23	0.26	0.25	0.22	0.26	0.20	0.32	0.22	0.21	0.22	0.23	0.26	0.22	

References

Bulankova E. 1997. Dragonflies (Odonata) as bioindicators of environment quality. Biologia Bratislava. 52:177-180.

Chovanec A. 1994. Libellulidians are Bioindicator. Ecology. 56 (2):302-307.

Chowdhury SH, Mia MI. 1989. Notes on some Damselflies (Odonata, Zygoptera) Chittagong Univ. Campus. Chittagong Univ. Studies, Part II. 13(1): 65-70.

Clarke TE, Samways MJ. 1996. Dragonflies (Odonata) as indicators of biotope quality in the Krueger National Park, South Africa. Journal of Applied Ecology. 33:1001-1012.

Corbet PS. 1999. Dragonflies: Behaviour and Ecology of Odonata. Cornell University Press, Ithaca N.Y. 829. 4(8):127-130

Felsenstein J. 1985. Confidence limits on phylogenies: An approach using the bootstrap. *Evolution.* 39: 783-791.

Fraser FC. 1933, 1934 and 1936. *Fauna of British India, including Ceylon and Burmah*. Odonata.Vols. I, II & III. pp.423, pp.398 and pp.461. Today and Tomorrow's Publishers, New Delhi.

Fraser FC. 1933. The Fauna of British India Including Ceylon andBurma.Odonata.Vol. 1. London: Taylor & Francis. 433 pp.

Fraser FC. 1934. The Fauna of British India Including Ceylon and Burma.Odonata. Vol. II. London: Taylor & Francis. 398pp.

Fraser FC. 1936. The Fauna of British India Including Ceylon and Burma.Odonata. Vol. III. London: Taylor & Francis. 461pp.

Golfieri B, Hardersen S, Maiolini B, & Surian N. 2016. Odonates as indicators of the ecological integrity of the river corridor: Development and application of the Odonate River Index (ORI) in northern Italy. Ecological Indicators, 61, 234-247.

Harp GL, Harp PA. 1996. Previously unpublished Odonata records for Arkansas, Kentucky and Texas. NotulOdonatol; 4(8):127-130.

Kimura M. 1980. A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences. *Journal of Molecular Evolution* **16**:111-120

Lahiri AR. 1987. Studies on the Odonate Fauna of Meghalaya.Misc. Publications.Occasional Paper no. 99, *Zool. Surv. India*. 395pp.

Legner EF. Biological control of Diptera of medical and veterinary importance.J VectEcol 1995; 20:59-120.

Massachusetts Division of Fisheries and Wildlife.National Heritage and Endangered Species Program, 2007, 109.

Mitra TR. 1983. A list of Odonata of Calcutta.Ent. Monthly Mag. 119 : 29 -31.

Needham JG, Westfall MJ. 1954. A Manual of the Dragonflies of North America (Anisoptera), including the Greater Antilles and the Provinces of the Mexican Border. University of California Press, Berkeley. 615pp.

Nikula B, Ryan JL, Burne MR. A Field Guide to the Dragonflies and Damselflies of Massachusetts. 2nd Edition.

Orr AG. 2003. A Guide to the Dragonfly of Borneo: Their Identification & Biology. Natural History Publications (Borneo) Sdn. Bhd., Malaysia. 195pp

Prasad M. and Varshney RK. 1988. The Odonata of Bihar, India. Misc. Publications.Occ. Paper no. 110. *Zool. Surv. India*. 44pp.

Sahlén, Göran; Ekestubbe, Katarina. 2000. "Identification of dragonflies (Odonata) as indicators of general species richness in boreal forest lakes". Biodiversity and Conservation. **10** (5): 673–690.

Saitou N. and Nei M. 1987. The neighbor-joining method: A new method for constructing phylogenetic trees. Molecular Biology and Evolution. 4: 406-425.

Silsby J. 2001. Dragonflies of the world.Smithsonian InstitutionPress, USA. Washington DC. 216.

Subramanian KA. 2009. A checklist of Odonata (Insecta) of India.Zoological survey of India. 1-36.

Subramanian KA. 2005. Dragonflies and Damselflies of Peninsular India-A field guide. Indian Academy of Sciences, Bangalore, India. 118.

Tamura K., Stecher G., Peterson D., Filipski A., and Kumar S. 2013. MEGA6: Molecular Evolutionary Genetics Analysis version 6.0. *Molecular Biology and Evolution.* 30: 2725-27295.

Walker EM. 1953. The Odonata of Canada and Alaska.Vol. 1.University of Toronto Press. 292.

Walker EM. 1958. The Odonata of Canada and Alaska.Vol. 2.University of Toronto Press. 318.

Walker EM, Corbet PS. 1975. The Odonata of Canada and Alaska.vol. 3.University of Toronto Press. 307.

Watanabe M, Matsuoka R, Taguchi M. 2004. Habitat selection and population parameters of *Sympetrum infuscatum* (Selys) duringsexual mature stages in a cool temperate zone of Japan (Anisoptera: Libellulidae). Odonatologica. 33:169–179.

Westfall MJ, May ML. Damselflies of North America. Scientific Publishers.1996, 649.

LEPIDOPTERA (BUTTERFLY) FAUNA

Lepidoptera (butterfly) is widely accepted as a good indicator of ecosystem health. Butterfly is a primarily day-flying insect belonging to order Lepidoptera. Several characters of the butterflies like their wide distribution, species diversity, specific to vegetation type, rapid response to perturbation, taxonomic tractability, statistically significant abundance and ease of sampling made them successful and useful organism to check changes in environmental parameters. Butterflies are diverse animals and sensitive to changes in microclimate and habitat (Bobo *et al.* 2006, Akite 2008 and Bonebrake *et al.* 2009) which influences their distribution and abundance. Butterflies have been found to be a specific useful indicator group in grasslands and in other open habitats . They also react to pressures such as climate change (Corezzola, 2011). For the reasons mentioned above and well visibility, butterfly fauna was studied in the 2 km radius of the spot area.

Butterfly collection and identification (Methodology):

Field survey and butterflies collections were carried using line transect method described by (Kunte, 1997). All transects were walked between 9.30 am and 4.30 pm, which was a peak time for butterfly activities under sunny weather condition. The study area was covered with cultivated land, wetland and homestead vegetation include trees, herbs, shrubs, grasses and climbers which support butterflies species for their larval food, nectar feeding and resting.

Butterfly species were primarily identified directly in the field or, in difficult cases, following capture using a sweep net and that were immobilized and brought back in the laboratory. Specimens were identified using taxonomic key mentioned in the reference. Previous works of the area was also consulted to prepare the list.

Table: List of butterflies of the survey area

Family: Danaidae

1.	Plain Tiger	*Danaus chrysippus* (Linnaeus, 1758)
2.	Common Crow	*Euploea core* (Cramer, 1780)
3.	Striped Tiger	*Danaus genutia* (Cramer 1779)

Family: Papilionidae

4.	Common Rose	*Pachliopta aristolochiae* (Fabricius, 1775)

5.	Lime Butterfly	*Papilio demoleus* (Linné, 1758)
6.	Common Mormon	*Papilio polytes* (Cramer, 1775)

Family: Pieridae

7.	Common Emigrant	*Catopsilia pomona* (Fabricius, 1775)
8.	Common Grass Yellow	*Eurema hecabe* (Linné, 1758)
9.	Common Jezebel	*Delias eucharis* (Drury, 1773)
10.	Mottled Emigrant	*Catopsilia pyranthe* (Linné, 1758)

Family: Nymphalidae

11.	Grey Pansy	*Junonia atlites* (Linné, 1763)
12.	Lemon Pansy	*Junonia lemonias* (Linné, 1758)
13.	Chocolate Pansy	*Junonia iphita* (Cramer, 1779)
14.	Peacock Pansy	*Junonia almana* (Linnaeus, 1758)
15.	Common Duffer	*Discophora sondaica* (Stichel, 1902)

Family: Lycaenidae

16.	Striped Pierrot	*Tarucus nara* (Kollar, 1848)
17.	Pale Grass Blue	*Pseudozizeeria maha* (Kollar, 1848)
18.	Slate Flash	*Rapala manea* (Moore, 1879)
19.	Common Lineblue	*Prosotas nora* (Moore, 1875)
20.	Common Ciliate Blue	*Anthene emolus* (Godart, 1823)

Family: Hesperidae

21.	Straight Swift	*Parnara guttatus* (Moore, 1865)
22.	Conjoined Swift	*Pelopidas conjuncta* (Herrich-Schäffer, 1869)
23.	Brown Awl	Badamia exclamationis (Fabricius, 1775)

Family: Satyridae

24.	Common Evening Brown	*Melanitis leda* (Linné, 1758)

A total of 24 species of butterflies were recorded during the survey. The existing checklist of butterfly is not complete so further studies are needed to update the checklist. This inventory work will be helpful for decision makers to implant any industry keeping the diversity intact.

Collection of data for phylogenetic analysis

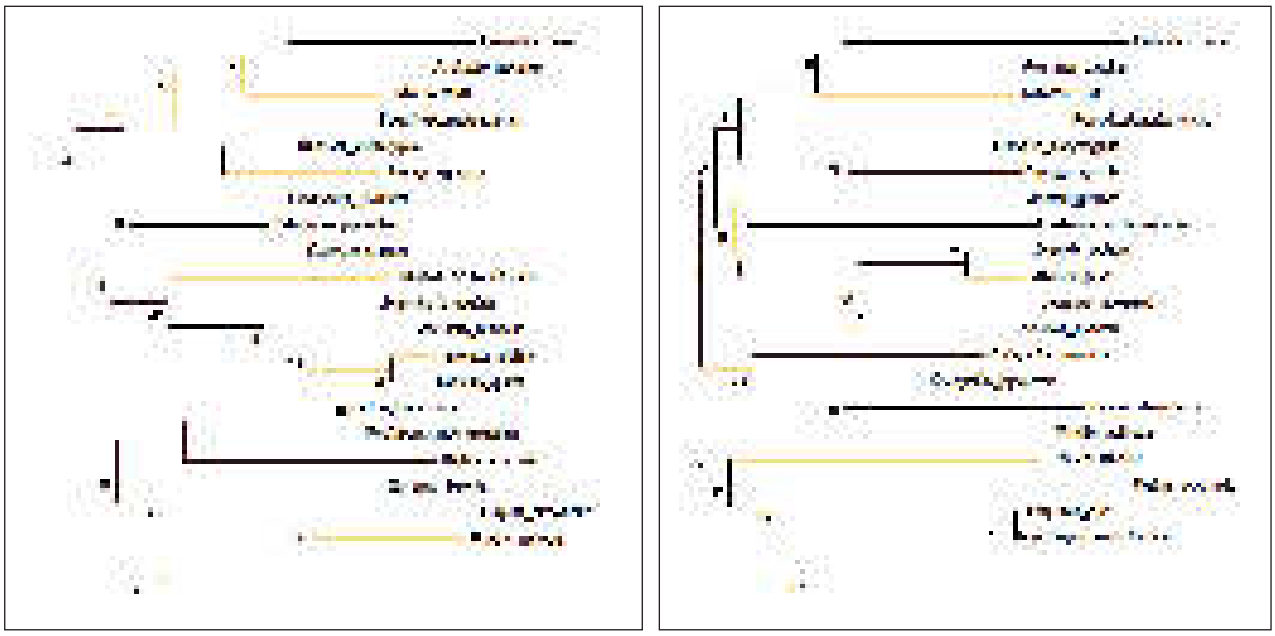
COI gene sequence of Twenty (20) butterfly species was collected from National Center for Biotechnology Information (NCBI) for their molecular and phylogenetic analysis.

Name of Species	GenBank Accession Number
Danaus chrysippus	HQ990426.1
Euploea core	JX261942.1
Danaus genutia	KC755857.1
Pachliopta aristolochiae	AB851904.1
Papilio demoleus	KP759524.1
Papilio polytes	HQ962338.1
Catopsilia pomona	HQ962273.1
Eurema hecabe	KC755861.1
Delias eucharis	KX008047.1
Catopsilia pyranthe	KC755841.1
Junonia atlites	HQ962256.1
Junonia lemonias	HQ962241.1
Junonia iphita	HQ962225.1
Junonia almana	KC755867.1
Tarucus nara	KJ402193.1
Pseudozizeeriamaha	KF492057.1
Prosotas nora	HQ962284.1
Anthene emolus	KJ508004.1
Parnara guttatus	HQ990729.1
Badamia exclamationis	KF391242.1

Phylogenetic analysis

The evolutionary history was inferred using both the Neighbor-Joining (NJ) and maximum likelihood (ML) tree method based on MEGA 6 (Saitou and Nei, 1987; Felsenstein, 1885; Tamura *et al*., 1985). All twenty species of butterfly were grouped into two clusters in both

maximum-likelihood and Neighbour-joining tree construction. In maximum-likelihood tree, *Euploea core* and *Pachliopta aristolochiae* showed highest bootstrap value (100). Sub cluster *Euploea core* and *Pachliopta aristolochiae, Junonia atlites and Junonia almana* showed highest bootstrap value 100 in neighbor Joining tree. In both phylogenetic analyses, all species showed very close relationship.



A. Maximum-likelihood tree **B. Neighbor-Joining Tree**

Fig 3. Evolutionary relationships among twenty butterfly species were constructed using MEGA 6 software. In maximum likelihood tree (A), the evolutionary history was inferred by using the Maximum Likelihood method based on the Kimura 2-parameter model. The tree with the highest log likelihood (-3863.6675) is shown. In neighbor- joining tree (B), the evolutionary history was inferred using the Neighbor-Joining method. The optimal tree with the sum of branch length = 1.05302345 is shown. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) is shown next to the branches. The bar (0.02) at the bottom is a scale for genetic change.

Genetic Distance:

Kimura's two parameter (K2P) genetic distances was carried out using MEGA 6 (Tamura *et al*., 2013).Interspecific genetic divergence range of butterfly species was 0.00-0.20. *Prosotas nora* showed highest (0.20) pairwise distance than rest. *Pachliopta aristolochiae* showed lowest (0.00) pairwise distance among studied butterflies.

Table : Interspecific K2P sequence divergence at the COI barcode region among butterflies

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Danaus chrysippus																				
Euploea core	0.15																			
Danaus genutia	0.07	0.14																		
Pachliopta aristolochiae	0.14	0.00	0.14																	
Papilio demoleus	0.17	0.12	0.17	0.13																
Papilio polytes	0.16	0.14	0.16	0.13	0.10															
Catopsilia pomona	0.12	0.13	0.14	0.13	0.13	0.15														
Eurema hecabe	0.14	0.13	0.14	0.13	0.15	0.14	0.14													
Delias eucharis	0.14	0.13	0.15	0.13	0.19	0.18	0.17	0.15												
Catopsilia pyranthe	0.10	0.12	0.12	0.12	0.13	0.13	0.09	0.13	0.15											
Junonia atlites	0.13	0.15	0.11	0.14	0.15	0.15	0.13	0.15	0.16	0.11										
Junonia lemonias	0.14	0.15	0.14	0.15	0.17	0.15	0.14	0.16	0.18	0.14	0.08									
Junonia iphita	0.13	0.14	0.11	0.14	0.15	0.14	0.13	0.15	0.16	0.12	0.03	0.07								
Junonia almana	0.13	0.14	0.14	0.13	0.14	0.13	0.14	0.13	0.17	0.13	0.07	0.07	0.07							
Tarucus nara	0.12	0.15	0.14	0.15	0.18	0.16	0.14	0.16	0.17	0.12	0.13	0.10	0.13	0.11						
Pseudozizeeria maha	0.12	0.17	0.13	0.17	0.17	0.15	0.14	0.16	0.17	0.12	0.16	0.15	0.16	0.17	0.10					

Prosotas nora	0.12	0.19	0.14	0.18	0.18	0.19	0.16	0.16	0.20	0.15	0.16	0.17	0.16	0.16	0.11	0.13				
Anthene emolus	0.12	0.16	0.13	0.15	0.15	0.14	0.13	0.15	0.17	0.11	0.13	0.12	0.12	0.13	0.0	0.13	0.10			
Parnara guttatus	0.13	0.14	0.13	0.14	0.15	0.14	0.13	0.16	0.17	0.13	0.13	0.13	0.13	0.12	0.12	0.15	0.15	0.13		
Badamia exclamationis	0.13	0.15	0.14	0.15	0.17	0.16	0.13	0.15	0.17	0.12	0.13	0.11	0.13	0.12	0.13	0.15	0.17	0.14	0.13	

Plate 10: Two dominant butter fly species of study area Grey pansy(left) and Common Duffer (right)

References

Akite P. 2008. Effects of anthropogenic disturbances on the diversity and composition of the butterfly fauna of sites in the Sango Bay and Iriiri areas, Uganda: implications for conservation. African J Ecol; 46:3-13.

Bashar MA. 2013a."Forests of Bangladesh and butterfly biodiversity", Environmental Biology and Biodiversity Laboratory (EBBL), Dhaka University.

Bashar M A. 2013b. Dictionary of Biodiversity, Mohammad Publications, Dhaka, Bangladesh; 57.

Bingham CT. 1905. Butterflies.Vol. II and Vol. II.Fauna of British India.text illustrations and 10 color plates, London; 480.

Bobo KS, Waltert M, Fermon H, Njokagbor J, Muhlenberg M. 2006. From forest to farmland: butterfly diversity and habitat associations along a gradient of forest conservation in Southwestern Cameroon. J InsConserv; 10:29-42.

Bonebrake TC, Sorto R. 2009. Butterfly (Papilionidae and Hesperiidae) rapid assessment of a costal countryside in El Salvador.Tropical Conservation Science; 2:34- 51.

Chowdhury SH, Hossain M. 2013.Butterflies of Bangladesh-A Pictorial Handbook (Revised and enlarged version I). Skylark Printers. Dhaka, Bangladesh; 260.

Corezzola S. 2011. "Investigating butterfly communities for biodiversity Monitoring", National Forest Service-CNBFVR, Italy.

Evans WH.1932. The Identification of Indian Butterflies.The Bombay natural History Society; 130-198, 199-273.

Evans WH. 1932. The Identification of Indian Butterflies, Bombay Natural History Society, Bombay.Edn 2, Reprinted by Today and Tomorrow's Printers and Publishers, New Delhi; 454.

Felsenstein J. 1985. Confidence limits on phylogenies: An approach using the bootstrap. *Evolution* 39:783-791.

Islam ATMF, Islam MH, Saifullah ASM, Endo K, Akira Yamanaka. 2011. New records of butterflies and their species diversity in four different areas of Savar, Dhaka, Bangladesh. Univ J ZoolRajshahiUniv; 30: 09-15.

Kehimkar I. 2008.The Book of Indian Butterflies.Bombay Natural History Society; 497.

Kimura M. 1980. A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences. *Journal of Molecular Evolution* 16:111-120.

Kunte KJ.1997. Seasonal patterns in butterfly abundance and species diversity in four tropical habitats in Northern Western Ghats. J Bio Sci; 22(5):593-603.

Kunte K. 2000. Butterflies of Peninsular India.Universities Press Ltd., India; 254.

Kunte K. 2000. Butterflies of Peninsular India.. Universities Press (Hyderabad) and Indian Academy of Sciences, Bengaluru; 270.

Larsen TB.2005.Butterflies of West Africa.Apollo Books, Stenstrup.

Marshall GFL, de Niceville L. 1883. Butterflies of India, Burmah and Ceylon.Vol 1.A.J Reprints Agency, New Delhi; 338.

Neogi AK, Baki MA, Sadat MN, Selim SR, Bhouiyan NA. 2014. Five New Record of Butterfly Species from Dhaka, Pirojpur and Cox's Bazar Districts of Bangladesh. J EntomolZool Stud; (2):197-200.

Pinratana BA, Eliot JN. 1996. Bosco Offset, Bangkok; 3:140.

Saitou N. and Nei M. 1987. The neighbor-joining method: A new method for reconstructing phylogenetic trees. *Molecular Biology and Evolution* 4:406-425.

Shahjahan RM, Razzak MA, Islam ATMF, Saifullah ASM, Akira Yamanaka, Inoue M et al. 2008a.Preliminary study of seasonal fluctuations of the numbers of butterflies in a forest of Dhaka, Bangladesh. Bang J Zool; 36(2):245-252.

Tamura K., Stecher G., Peterson D., Filipski A., and Kumar S. 2013. MEGA6: Molecular Evolutionary Genetics Analysis version 6.0. *Molecular Biology and Evolution*30: 2725-2729.

Wynter-Blyth MA. 1957. Butterflies of Indian Region, Bombay Natural History Society, Bombay; 523.

OTHER COMMON INSECT FAUNA OBSERVED IN THE STUDY AREA

Plate 10: Oleander aphids(Aphis nerii) and ant association on a Akond (*Calotropis*) tree growing in study area. Aphids sucking latex.

Plate 11: Green spotted beetle

Plate 12: Huge number of Ground Beetle was observed in the bank of river near study area

Plate 13: Considerable number of Cattle poisoning sawfly was observed near cattle grazing in the study area

Plate 14: Flies on Akond leaf

Plate 15: Green Bottle Fly – *Lucilia sp.*

CHAPTER - II

MOLLUSCA FAUNA

Numerous molluscs live in freshwater and terrestrial habitats, both lotic (flowing water) such as rivers, streams, canals, springs, and underground cave streams (stygobite species) and lentic (still water) such as lakes, ponds. The two major classes of molluscs have representatives in freshwater: the gastropods (snails) and the bivalves (freshwater mussels and clams).Freshwater mollusca populations have been declining for decades and are among the most seriously impacted aquatic animal's worldwide (Bogan 1993, Williams *et al*.1993). However, in 2004 the IUCN Red List of Threatened Species included nearly 2,000 endangered non marine molluscs.

Human interaction: For millennia, molluscs have been a source of food for humans, as well as important luxury goods, notably pearls, mother of pearl, Tyrian purple dye, sea silk, and chemical compounds. Their shells have also been used as a form of currency in some preindustrial societies. Snails and slugs can also be serious agricultural pests.

Bioindicators: Most freshwater mollusca prefer well oxygenated water and a constant flow of shallow water (COSWIC 2003, Strayer2004). Biological monitoring of rivers using benthic macro invertebrates is accepted as a useful tool for the assessment of water quality (Hellawell 1986, Rosenberg and Resh 1993).Bivalve molluscs are used as bioindicators to monitor the health of aquatic environments in both fresh water and the marine environments. Their population status or structure, physiology, behavior or the level of contamination with elements or compounds can indicate the state of contamination status of the ecosystem.

Collection and Identification

Specimens were collected by hand picking from the dry areas of river bank and from fisherman. Species were identified based upon morphological characteristics of the shell, photographs and other taxonomic keys. The shell characters such as shape, spire length and shape, mouth opening, opercular shape, umbilicus shape and size, color and ornamentation of the shell are used mainly for the identification apart from the internal characters of which the important one is radula.

FINDINGS

Molluscs found during the survey are as follows:

Table: List of Molluscs found in survey areas

i. Class: Gastropoda

Sl No.	Family	Common name	Scientific name
1.	Pilidae	Common Apple snail	*Pila globosa*
2.	Pilidae	Apple-snail	*Pila virens*
3.	Viviparidae	River Snail	*Bellamya begalensis*
4.	Thiaridae	Screw Snail	*Melanoides tuberculata*
5.	Thiaridae	Brotia Snail	*Brotia costula*
6.	Lymnaeidae	Lymneid Snail	*Lymnaea luteola*

ii. Class: Bivalvia

Sl No.	Family	Common name	Scientific name
1.	Unionidae	Fresh water Mussel	*Lamellidens corrianus*
2.	Unionidae	Fresh water Mussel	*Lamellidens marginalis*
3.	Unionidae	Fresh water Mussel	*Lamellidens jenkinsianus*
4.	Unionidae	Fresh water Mussel	*Parreysia corrugata*
5.	Sphaeriidae	Striated Fingernail	*Sphaerium striatinum*

Six Gastropod species and 5 Bivalves were found during survey. Ofcourse, this area contains more mollusc fauna that could not found during this short time survey. Future research needs to continue to make a complete list and look at the habitatlocations of the different species of freshwater mollusca of this area.

Plate 16: Dead Mollusc shells in the survey area

Plate 17: River snail (*Bellamya begalensis*)

Plate 18: Apple snail (*Pila globusa*)

Plate 19: Screw Snail (*Melanoides* sp)

Plate 20: Fresh water Mussel: *Parreysia corrugata* (External view of shell)

Plate 21: Fresh water Mussel: *Parreysia corrugata* (Internal view of shell)

Plate 22: Fresh water Mussel (*Lamellidens jenkinsianus*)

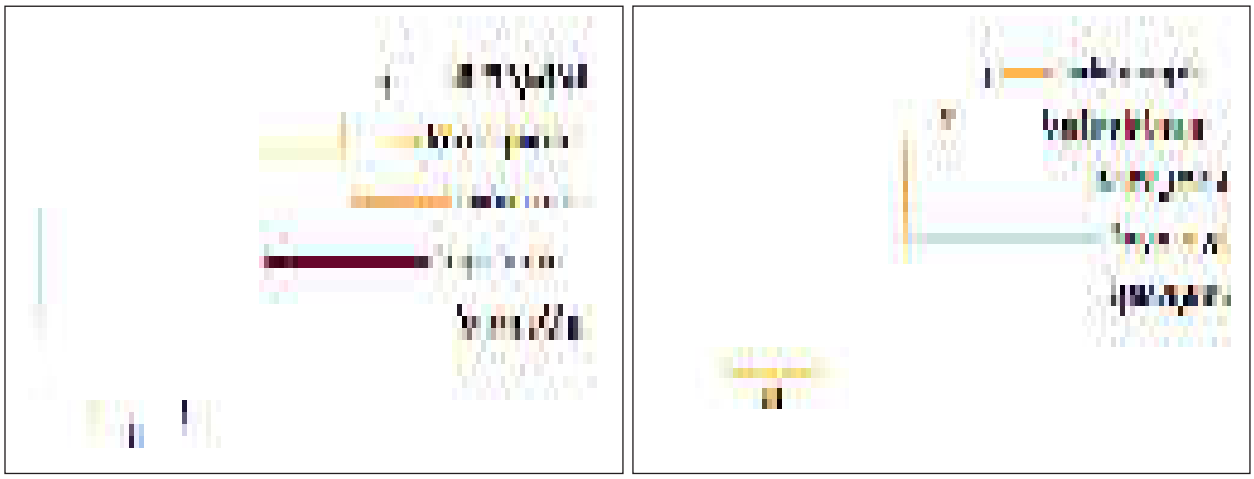
Collection of data for phylogenetic analysis

COI gene sequence of five (5) mollusk species was collected from National Center for Biotechnology Information (NCBI) (http://ncbi.nlm.nih.gov) for their molecular and phylogenetic analysis.

Name of species	GenBank Accession number (COI gene)
Lamellidens corrianus	JQ861225.1
Lamellidens marginalis	KP268834.1
Lamellidens jenkinsianus	KP268836.1
Parreysia corrugate	KJ872816.1
Sphaerium striatinum	AF120667.1

Phylogenetic analysis of Mollusca

The evolutionary history was inferred using both the Neighbor-Joining (NJ) and maximum likelihood (ML) tree method based on MEGA 6 (Saitou and Nei, 1987; Felsenstein, 1885;Tamura et al., 1985). In both phylogenetic trees (Maximum Likelihood and Neighbour-joining), grouped Five (5) mollusc species into two clusters. In maximum likelihood tree, *Lamellidens corrianus, Lamellidens marginalis, Lamellidens jenkinsianus, Parreysia corrugate* were grouped within same cluster. Same results were shown in neighboou-joining tree analysis. In maximum likelihood trees, highest bootstrap value (98) were observed in *Lamellidens corrianus ,Lamellidens marginalis, Lamellidens jenkinsianus*sub clusters. In neighbor-joining tree, highest bootstrap value (99) was observed in *Lamellidens marginalis* and *Lamellidens jenkinsianus*sub cluster. The bar at the bottom 0.05 is a scale for the genetic change (Fig 1).



A. Maximum likelihood tree **B. Neighbour Joining tree**

Fig 4. Evolutionary relationships among five mollusc species were constructed using MEGA 6 software. In maximum likelihood tree (A), the evolutionary history was inferred by using the Maximum Likelihood method based on the Kimura 2-parameter model. The tree with the highest log likelihood (-2220.1663) is shown. In neighbor- joining tree (B), the evolutionary history was inferred using the Neighbor-Joining method. The optimal tree with the sum of branch length = 1.42922426 is shown. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) is shown next to the branches.

Genetic Distance

Kimura's two parameter (K2P) genetic distances was carried out using MEGA 6(Tamura et al., 2013). Interspecific genetic divergence range of mollusc species was 0.04-0.48.*Sphaeriumstriatinum* showed highest (0.41) pairwise distance than rest. *Lamellidens jenkinsianus* showed lowest (0.04) pairwise distance among studied Mollusc.

Table : Interspecific K2P sequence divergence at the COI barcode region among molluscs

	1	2	3	4	5
1.*Lamellidens corrianus*					
2.*Lamellidens marginalis*	0.10				
3.*Lamellidens jenkinsianus*	0.10	0.04			
4.*Parreysia corrugate*	0.18	0.17	0.16		
5.*Sphaerium striatinum*	0.41	0.40	0.39	0.42	

References

Bogan AE. 1993. Freshwater bivalve extinctions (Mollusca: Unionoida): a search for causes. American Zoologist. 33(6):599-609.

COSWIC. 2003. COSWIC assessment and status report on the Rocky mountain ridged mussel *Gonidea angulata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Vi + 29 pp.

Felsenstein J. 1985. Confidence limits on phylogenies: An approach using the bootstrap. *Evolution* 39:783-791.

Hancock, Rebecca. 2008. *"Recognising research on molluscs".* Australian Museum.

Haszprunar G. 2001. "Mollusca (Molluscs)". *Encyclopedia of Life Sciences*. John Wiley & Sons, Ltd.

Hellawell JM. 1986. Biological Indicators of Freshwater Pollution and Environmental Management. London: Elsevier Applied Science Publishers.

Kimura M. 1980. A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences. *Journal of Molecular Evolution* 16:111-120.

Little L, Fowler HW, Coulson J, Onions CT. eds. 1964. "Malacology". *Shorter Oxford English Dictionary*. Oxford University press.

Lydeard C R, Cowie R, Ponder WF, *et al*. 2004. "The global decline of nonmarine mollusks" (PDF). *BioScience*. **54** (4): 321–330.

Nicol, David. 1969. "The Number of Living Species of Molluscs". *Systematic Zoology*. **18** (2): 251–254.

Ponder, Winston F. & Lindberg, David R. 2004. "Phylogeny of the Molluscs". World Congress of Malacology.

Rosenberg DM, Resh VH. 1993. Freshwater Bio monitoring and Benthic Macroinvertebrates. New York: Chapman & Hall.

Saitou N. and Nei M. 1987. The neighbor-joining method: A new method for reconstructing phylogenetic trees. *Molecular Biology and Evolution* **4**:406-425.

Schneider, JA. 2001. "Bivalve systematics during the 20th century". *Journal of Paleontology*. **75** (6):1119–1127.

Strayer DL, Hattala K, Kahnle A. 2004. Effects of an invasive bivalve (Dreissenapolymorpha) on fish populations in the Hudson River estuary. Can J Fish AquatSci; 61:924– 941.

Tamura K, Stecher G, Peterson D, Filipski A, and Kumar S. 2013. MEGA6: Molecular Evolutionary Genetics Analysis version 6.0. *Molecular Biology and Evolution*30: 2725-27295.

Williams JD, Warren Jr. ML, Cummings KS, Harris JL, Neves RJ. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries. 18(9): 6-22.

CHAPTER - III

FISH FAUNA

Meghna river estuary is the largest estuarine ecosystem of Bangladesh and support diverse fisheries communities compared to others. Present study was carried out to assess the fish diversity status with relation to major hydrological parameters in both spatio-temporal scales. Fish samples were collected together with water quality parameters from different sampling stations of the Meghna river estuary.

Several types of small fishes were captured and have been presented in Table 1. We were not able to capture any single big fish. Names of fishes available at other seasons of the year are presented in Table 2. According to fisherman, the rivers becomes devoid of fishes in the dry season. However, in the rainy season, few types of fishes become available. It was learnt from interviews with the fisherman and fish sellers that in the recent past the river had abundant fishes. Several types of big fishes like Rui, Catla, Ayre, Mrigel, Boal along with different types of small fishes were very common. But at present number of all types of fishes has declined greatly. The physical parameters are shown in table 3.

Table 1. List of small fishes captured during survey period by using different types of fishing nets from the river Meghna near the proposed Reliance Meghnaghat 750 MW CCPP

Local Name	Scientific Name	Sampling Locations			
		Location 1	Location 2	Location 3	Location 4
Golsha	*Mystus cavasius*	-	-	-	+
Bele	*Glossogobius giuris*	-	-	-	-
Tengra	*Mystus vittatus*	+	-	-	
Puti	*Puntius conchonius*	+	+	+	+
Fali	*Notopterus notopterus*	-	+	-	-
Kachki	*Coricasu borna*	++	++	++	++
Mola	*Amblypharyngodon mola*	+	-	-	+
Kakila	*Xenentodon cancila*	-	-	-	-
Chapila	*Gudusia chapra*	-	+	-	+
Kholisha	*Colisha fasciatus*	-	-	-	+

Chingri	*Macrobrachium eqidense*	-	+	-	+
Shol	*Channa striatas*	-	-	-	-
Taki	*Channa punctatus*	-	-	-	-
Shing	*Heteropneustes fossilis*	-	-	-	-
Koi	*Anabas testudineus*	-	-	-	-
Pabda	*Ompok pabda*	-	-	-	+

Status: ++Common, +Few, - Absent

Table 2. List of fish fauna recorded during the survey as mentioned by the local people and fishermen

Common English name	Local Name	Scientific Name	Abundance
Rohu	Rui	*Labeo rohita*	+
Catla	Katla	*Catla catla*	+
Black Rohu	Kalibaush	*Labeo calbasu*	+
Freshwater Shark	Boal	*Wallago attu*	+
Long-whiskered Catfish	Ayre	*Sperata aor*	+
Tire-track Spiny Eel	Bain	*Mastacembelus armatus*	+
Humped Featherback	Chital	*Chitala chitala*	+
Dwarf Chamelonfish	Meni	*Badis badis*	+
Dwarf Catfish	Batashi	*Batasio tengana*	+
Pama Croaker	Poa	*Otolithoides pama*	+
River Shad	Ilish	*Tenulosa ilisha*	+
Gangetic Hairfin	Fasha	*Setipinna phasa*	+
Silondia Vacha	Shilong	*Silonia silondia*	+
Batchwa Vacha	Bacha	*Eutropiichthys Vacha*	+
Gangetic Lotia	Kala Bata	*Crossocheilus latius*	+
Ghora-chela	Ghora Chela	*Securicula gora*	+
Giant Snakehead	Gagarr	*Channa marulius*	+
Walking Catfish	Magur	*Clarius batrachus*	+
Spotted Snakehead	Taki	*Channa punctatus*	+

Spotted Snakehead	Shol	*Channa punctatus*	+
Walking Snakehead	Ranga Cheng	*Channa orientalis*	+
Victory Loach	Dari	*Scistura scaturigina*	+
Choukkani	Kanpona	*Aplocheilus panchanx*)	+
Stinging Catfish	Shing	*Heterpeneustes fossilis*	+

Status: +Few

Phylogenetic analysis:

The evolutionary history was depicted using MEGA 6 (Tamura *et al*., 1985) based on maximum likelihood tree method.

The Maximum Likelihood method grouped 13 fish species into two clusters. One cluster includes *Labeo rohita, Labeo bata, Labeo gonius, Punctius ticto, Channa striata, Channa marulius, Mystus vitatus, Mystus cavasius and Ambyypharyngodon mola* while other cluster includes *Punctius sarana, Labeo calbasu, Channa punctatus and Mystus tengra*. All species are closely related and highest bootstrap value (82) was shown in the sub cluster of *Channa striata* and *Channa marulius.*

Fig. Evolutionary relationship among 13 fish species were constructed using MEGA-6 software based on Kimura 2- best fitted model.

Table 3. Water quality parameters of the river Meghna near Reliance Meghnaghat 750 MW CCPP

Parameters	Location 1	Location 2	Location 3	Location 4
Temperature (^{0}C ±SE)	22.6 ± 1.2	22.4 ± 1.01	21.6 ± 1.05	22.8 ± 1.02
Secchi depth (Cm±SE)	114 ± 10.2	88.6 ± 9.1	79 ± 14.1	105 ± 15.01

Macrobrachium rosenbergii

Glossogobius giuris

Macrobrachium ohione

Metapenaeus joyneri and *Acetes japonicas*

Giant fresh water prawn, Acetes japonicas and *Anguilla bengalensis*

Parambassis ranga

Fig. Some representative of the freshwater fishes collected from different locations of the River Meghna.

Chitala chitala and Labeo bata

Amblypharyngodon mola

Ambassis nalua

Notopterus notopterus, labeo bata and *puntius sarana*

Ailia coila

Apocryptes bato

CHAPTER - IV

Plankton diversity

Phytoplanktons are the producer of the river ecosystem and thus their status are of prime importance. List of Phytoplanktons and Zooplankton found in the water samples of different sampling locations are presented respectively in Table 1 and 2.

Table 1.List of zooplanktons recorded from the water samples of the different sampling locations of the river Meghna near the proposed Reliance Meghnaghat 750 MW CCPP

Name of the species	Number of the species at different sampling locations			
	Location 1	Location 2	Location 3	Location 4
Escarpia	9	5	11	8
Keratella	2	1	5	8
Brachiomus	4	8	9	13
Lepadella	-	5	9	-
Cyclops	6	9	12	9
Diatomus	7	5	4	13
Bosmina	5	9	3	8
Daphnia	7	3	8	7
Euglena sp	3	9	4	4
Phacus	2	5	2	8
Trichocera	-	1	1	-
Monostyta	1	1	3	1
Nebalia	5	2	8	11
Hexarthra	-	5	11	12
Heterocypris	2	8	12	14

Data from each sampling locations represents total of 5 samples, 1 ml each time

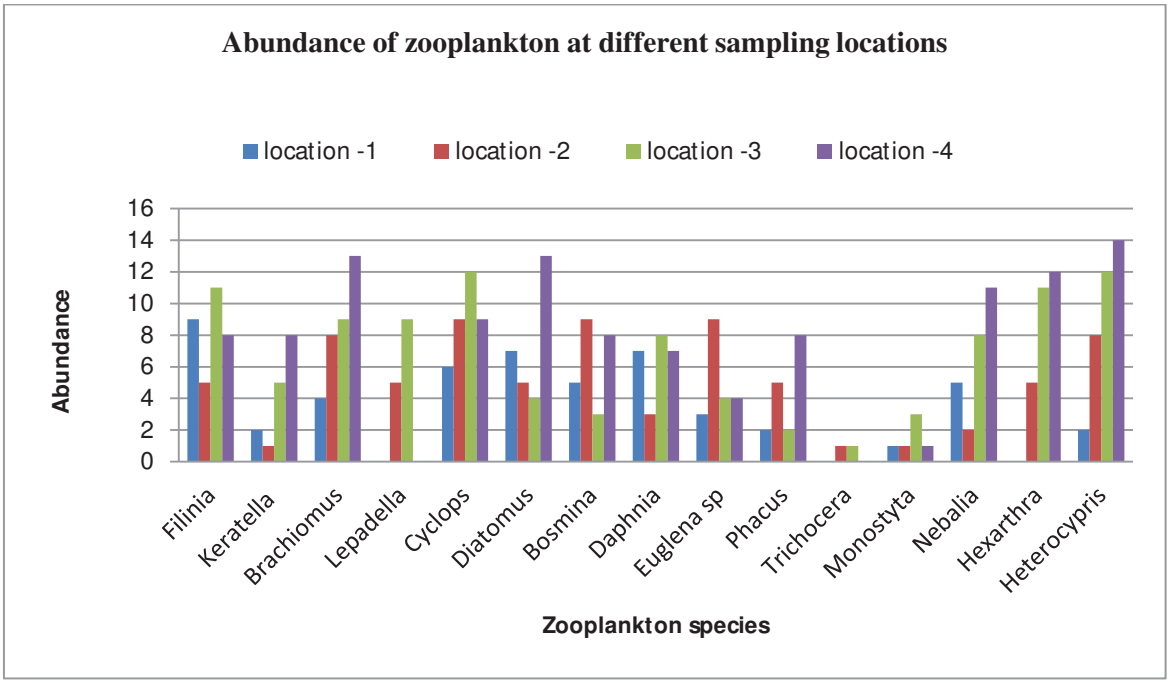


Table 2. List of phytoplanktons recorded from the water samples of the river Meghna near the proposed Reliance Meghnaghat 750 MW CCPP

Name of the species	Number of the species at different sampling locations			
	Location 1	Location 2	Location 3	Location 4
Chlorella	8	3	6	11
Nostoc sp.	3	5	4	8
Chlamydomonas	8	11	-	9
Oedogonium sp.	8	4	7	2
Cosmarium	5	9	11	9
Pithophora sp.	2	11	10	1
Pinnularia	1	3	-	2
Volvox sp.	1	11	2	11
Oscillatoria sp.	4	-	2	-
Chlamydomonas sp.	-	3	2	2
Nitzschia	2	11	2	3

Synedra	3	7	8	1
Navicula sp.	8	-	1	2
Melosira,	2	5	1	-
Cymbella	1	3	2	1
Anabaena	3	2	3	7
Nitzschia sp.	-	1	2	3
Microcystis,	-	2	1	10
Euglena	4	11	8	9

Data from each sampling locations represents total of 5 samples, 1 ml each time

CHAPTER - IV

WILDLIVE FAUNA (AVI FAUNA)

WILDLIFE DIVERSITY

Biodiversity boosts ecosystem productivity where each **species**, no matter how small, all have an **important** role to play. Greater **species diversity** ensures natural sustainability for all life forms. Besides basic survival and global health, wildlife plays an important role in other facets of life like economics and recreation. One of the most important of wild lives are birds. Birds are among the best monitors of environmental changes. Changes in their population, behavior patterns, and reproductive ability have most often been used to examine the long-term effects of habitat fragmentation (Harisha and Hosetti, 2009). Ecologically, birds are of tremendous importance because of their key roles as pollinators and agents of seed dispersal (Bibi and Ali, 2013). Therefore, understanding the diversity and structure of bird communities is essential to delineate the importance of regional or local landscapes for avian conservation (Kattan and Franco, 2004). The preservation of global species diversity has emerged as one of the most important issues today (Hu *et al*., 2011). Birds are very sensitive to environmental changes and are used as a "**bioindicator**."

Birds occupy almost all habitat types and diversity of birds often serves as a good indication of overall diversity of a given area (Furness and Greenwood, 1993). Birds are also known to be responsive to any kind of changes to their ambient conditions hence can be used as bioindicator (Padoa–Schioppa *et al*., 2006).

Study of avifaunal diversity is an essential ecological tool which acts as an important indicator to evaluate different habitats both qualitatively and quantitatively (Bilgrami, 1995). Unfortunately global diversity of birds is decreasing incessantly primarily due to anthropogenic disturbances (Rapoport, 1993) and climate change (Chen *et al*., 2011; Sekercioglu *et al*., 2012). No surprise that IUCN Red List of endangered birds has already recognized 1226 bird species as threatened globally (Bird Life International 2010).

We noted **common bird species** that we observed during our one day survey. Certainly this is not a complete list of avifaunal diversity. To make a complete list more intensive and season wise study is necessary.

COMMON BIRDS OBSERVED DURING THE STUDY

Plate 23: Jungle Myna searching for food in a field

Common name: Jungle Myna
Scientific name: *Acridotheres fuscus*
Family: Sturnidae

Behavior

This bird is a common resident breeder in tropical southern Asia including Bangladesh. This common passerine is typically found in forest and cultivation. The jungle myna builds a nest in hole. During the study this species was abundantly observed near cattle grazing field.

The jungle myna is fairly omnivorous, eating fruit, grain and insects. Insect food comprises grasshoppers, mole-crickets and crickets (Orthoptera), termites.

Plate 24: Pied Myna searching for food in a field(left), a yet to be adult resting (right)

Common name **:** Pied Myna or Asian Pied Starling
Scientific Name **:** *Gracupica contra*
Family **:** Sturnidae

Behavior

This myna is strikingly marked in black and white and has a yellowish bill with a reddish bill base. They are found mainly in areas with access to open water.

Its habitat is lowland open areas with scattered trees near water, often near human habitation. This species is often seen at sewage farms and refuse tips. During the study this species was abundantly observed near cattle grazing field.

These starlings are usual found in small groups, foraging mainly on the ground but perching on trees and buildings. Their diet mostly consists of insects, worms, spiders, etc. and various fruits.

Plate 25: Brahminy kite flying and searching for food over the river

Common Name: Brahminy kite
Scientific Name: *Haliastur indus*
Family: Acciptridae

Behavior

The **brahminy kite** (*Haliastur indus*), is a medium-sized bird of prey in the family Accipitridae. They are found mainly on the coast and in inland wetlands where they feed on dead fish and other prey. Adults have a reddish-brown plumage and a contrasting white head and breast which makes them easy to distinguish from other birds of prey.

During the study few such birds were found flying and searching for food and perching.

It is primarily a scavenger, feeding mainly on dead fish and crabs, especially in wetlands and marshland but occasionally hunts live prey such as hares and bats.

Plate 26: Pariah kite flying and searching for food (left) and preying (right)

Common Name **:** Pariah kite
Scientific Name **:** *Milvusmigrans*
Family **:**Acciptridae

Behavior

The **black kite** (*Milvus migrans*) is a medium-sized bird of prey in the family Accipitridae. Unlike others of the group, black kites are opportunistic hunters and are more likely to scavenge. They spend a lot of time soaring and gliding in thermals in search of food. Their angled wing and distinctive forked tail make them easy to identify.

Black kites are most often seen gliding and soaring on thermals as they search for food.

During the study a good number of such birds were observed flying and preying.

Plate 27: Black headed sea gull (First winter plumage)

Common Name **:** Black headed sea gull
Scientific Name **:** Chroicocephalus *ridibundus*
Family **:** Laridae

Behavior

Like most gulls, it is highly gregarious in winter, both when feeding or in evening roosts. During the study, a considerable such birds were found swimming and searching their food on the river. The black-headed gull is Omnivorous in nature and opportunistic feeder. It eats insects, fish, seeds, worms, some seeds and berries, scraps, and carrion in towns, or invertebrates in ploughed fields with equal relish. It is a noisy species, especially in colonies.

Plate 28: Fork tailed drongo/Black drongo (*Dicrurus adsimilis*)

Common Name **:** Fork tailed drongo

Scientific Name **:** *Dicrurus adsimilis*

Family **:**Dicuridae

Behavior

The **fork-tailed drongo**, also called the **common drongo**, black droongo (*Dicrurus adsimilis*), is a species of drongo in the family Dicruridae, which are medium-sized passerine birds .

The fork-tailed drongo is a common and widespread resident breeder. They also utilize disturbance caused by animals, and may perch on their backs. At times they catch ectoparasites on mammals, plunge-dive to catch fish, or kleptoparasitise mammals or birds. During our study we observed a considerable such birds in resting, perching and preying condition.

These insect-eating birds are usually found in open forests or bush, and are tolerant of arid climates. They are almost exclusively carnivorous, but may take nectar when available. They flycatch or take prey from the ground, and are attracted to bush fires.

Plate 29: Little cormorant resting (up) and searching food (down) in the study area of river Meghna

Common Name	**:** Little cormorant
Scientific Name	**:** *Microcarbo niger*
Family	**:** Phalacrocoracidae

Behavior

The **little cormorant** (*Microcarbo niger*) is a member of the cormorant family. It forages singly or sometimes in loose groups in lowland freshwater bodies, including small ponds, large lakes, streams and sometimes coastal estuaries. These birds are seen in both inland and coastal water bodies. They are found in village ponds, estuaries, lagoons, creeks, tidal flats, marshes, swamps, fish ponds, lakes and streams. Little cormorants tend to forage mainly in small loose groups and are often seen foraging alone.

The little cormorant mostly feed on fish and sometimes also crustaceans and amphibians. They drive to catch they prey and surface to swallow it.

Plate 30: Cattle egret searching for its food.

Common Name **:**Cattle egret
Scientific Name **:***Bubulcus ibis*
Family **:** Ardeidae

Behavior

It is a white bird adorned with buff plumes in the breeding season. It nests in colonies, usually near bodies of water and often with other wading birds.

Their feeding habitats include seasonally inundated grasslands, pastures, farmlands, wetlands and rice paddies. They often accompany cattle or other large mammals, catching insect and small vertebrate prey disturbed by these animals.

The cattle egret feeds on a wide range of prey, particularly insects, especially grasshoppers, crickets, flies(adults and maggot, and moths, as well as spiders, frogs, and earthworms.

Plate 30: Common tern flying

Common Name **:** Common Tern

Scientific Name **:** *Sterna hirundo*

Family **:** Sternidae

Feeding behavior:

The common tern feeds by plunge-diving for fish, from a height of 1–6 m (3.3–19.7 ft), either in the sea or in freshwater lakes and large rivers. The bird may submerge for a second or so, but to no more than 50 cm (20 in) below the surface. When seeking fish, this tern flies head-down and with its bill held vertically. Few tern was observed during the study time

GARDEN LIZARD

The oriental garden lizard, eastern garden lizard or changeable lizard (*Calotes versicolor*) is an agamid lizard found widely distributed in Asia. Garden lizard was observed during the survey period.

Changeable Lizards eat mainly insects and small vertebrates, including rodents and other lizards. Although they have teeth, these are designed for gripping prey and not tearing it up. So prey is swallowed whole, after it is stunned by shaking it about. Sometimes, young inexperienced Changeable Lizards may choke on prey which are too large. Occasionally changeable lizards also consume vegetable matter. During the breeding season, the male's head and shoulders turns bright orange to crimson and his throat black. Males also turn red-headed after a successful battle with rivals. Both males and females have a crest from the head to nearly the tail, hence their other common name "Crested Tree Lizard".

Plate 32: Oriental Garden Lizard *Calotes versicolor*

References:

Bibi F, Ali Z. 2013. Measurement of diversity indices of avian communities at Taunsa Barrage Wildlife Sanctuary, Pakistan. Journal of Animal and Plant Sciences 23: 469-474.

Bilgrami KS. 1995. Concept and Conservation of Biodiversity. CBS Publishers and distributors, Delhi.

Bird Life International. 2010. IUCN Red List for birds. http://www.birdlife.org/

Chen IC, Hill JK, Ohlemüller R, Roy DB. and Thomas CD. 2011. Rapid range shifts of species associated with high levels of climate warming. Science 333: 1024–1026.

Furness RW. and Greenwood JJD. 1993. Birds as a Monitor of Environmental Change. Chapman and Hall, London.

Harisha MN, Hosetti BB. 2009. Diversity and distribution of avifauna of Lakkavalli range forest, Bhadra Wildlife Sanctuary, Western Ghat, India. Ecoprint 16:21-27.

Hu J, Jiang Z, Zhang C, et al. 2011. Bird diversity and the conservation value of a new Ramsar site: Guandong Haifeng Wetlands, China. Integrative Zoology 6:266-278.

Kattan GH, Franco P. 2004. Bird diversity along elevation gradients in the Andes of Colombia: area and mass effects. Global Ecology and Biogeography 13:451-458.

Padoa–Schioppa E, Baietto M, Massa R. and Bottoni L. 2006. Bird communities as bioindicators: The focal species concept in agricultural landscapes. Ecological Indicators 6 (1): 83–93.

Rapoport EH. 1993. The process of plant colonization in small settlements and large cities. In: Mac Donell, M.J. and Pickett, S. (Eds), Humans as components of ecosystems. Springer–Verlag, New York, 190–207.

Sekercioglu CH., Primack RB. and Wormworth J. 2012. The effects of climate change on tropical birds. Biological Conservation 148: 1–18.

Annexure- 17

Ecological Survey (Flora)

AN ECOLOGICAL SURVEY OF THE FAUNA AND FLORA OF PROPOSED SITE FOR RELIANCE MEGHNAGHAT 750 MW COMBINED CYCLE POWER PLANT AT MEGHNAGHAT, NARAYANGANJ, BANGLADESH

[BASELINE SURVEY FOR DATA GENERATION ON ECOLOGY IN AND AROUND THE PROPOSED PROJECT AREA AT MEGHNAGHAT, SONARGAON, NARAYANGANJ]

PART-II: THE FLORA

Submitted by

Dr. Gazi Mosharof Hossain
Professor
Department of Botany
Jahangirnagar University
Savar, Dhaka, Bangladesh

Dr. Fakhruddin Ali Ahmed
Professor
Department of Botany
Jahangirnagar University
Savar, Dhaka, Bangladesh

INTRODUCTION

Sustainable power supply is a major prerequisite for the socio-economic development of a nation. Bangladesh is a dense populated country in the world and at present about 53% of the total population of Bangladesh has access to electricity. In our country per capita electricity generation is only 272 KWh but reliable and quality supply of power is still a faraway. In this situation, to achieve the Millennium Development Goal (MDG) the country need to generate more power. Honorable Prime Minister Sheikh Hasina has reiterated her determination to reach electricity to every household of the country by 2021 calling upon the people to maintain austerity in using power and gas at their houses and workplaces to achieve the goal. The prime ministers said the electricity and gas are country's national resources which accelerate the country's economic activities. "So we will have to protect this valuable resources," she said, also urging all to maintain austerity in use of water. She said her government has been implementing a masterplan to generate 24,000 MW electricity by 2021; 40,000 MW by 2030 and 60,000 MW by 2041 under a long term plan.

Reliance Power has received in-principle approval from the Bangladesh government for the first phase of a 3,000 megawatt gas-based power plant, paving the way for the largest Foreign Direct Investment in the neighboring country. The project is part of a memorandum of understanding signed between Reliance Power and the BPDB. The MoU spoke of developing in phases a 3,000MW LNG-based combined cycle power project in Bangladesh at an estimated investment of about $3 billion (Nikkei Asian Review, 5 May 2016).

A combined cycle power plant is highly efficient as it uses both gas and steam turbines to produce electricity. The gas turbine produces electricity using natural gas, while the steam one generates additional power with the waste heat from the gas turbine.

A baseline ecological survey was conducted in and around the proposed Reliance Meghnaghat 750 MW CCPP area during December 2016. The specific objective of the baseline ecological survey was to collect existing floras of both aquatic and terrestrial ecosystems as well as to identify the plant species under threatened categories (i.e., Critically Endangered, Endangered and Vulnerable) as per Red Data Book.

Flora relates to all aquatic and terrestrial based plants. Plants are vital for ecosystem function and are used as resources for human food, shelter, clothing and other products. Developments often have the potential to impact flora. These potential impacts may be felt at several different levels including individuals, communities, populations, species, ecosystems or habitats.

Potential impacts to flora could include a reduction in diversity, change in species composition, and the destruction of individuals, species or communities or, changes to species population distributions or health. This section identifies the potential impacts to flora that may occur as a result of the Project.

Bangladesh Govt. always give emphasize to control human impact and interaction with the environment in order to preserve natural resources. It is a process that industries, companies, and individuals undertake to regulate and protect the health of the natural world. Thus in view of the above point a floral study was carried out at the proposed LNG based power plant site of Meghna river bank.

Description of the studied area:

The first phase, a 750 MW power plant, will be set up on 35 Acres of land at Meghnaghat (Sonargaon, Narayanganj district), around 40 km south east (GPS coordinate 23º36′25.56″N, 90º35′32.16″) of Dhaka, along with the FSRU (floating storage and re-gasification unit) terminal at Maheshkhali Island in Cox's Bazar district of Bangladesh. The water requirement will be 1076 m^3/hr and quantity of discharged water will be about 206 m^3/hr. Both procurement source and discharge site will be the Meghna river.

Methodology

The present baseline ecological survey was conducted during December 2016. The basic methodological approaches which were followed for the present baseline work are-

- Field survey,
- Site selection for sampling,
- Plant samples collection,
- Identification of plant samples,
- Data analysis and interpretation.

Field survey

A comprehensive field survey was conducted almost throughout the designated sites of the proposed power plant areas at Reliance Meghnaghat 750 MW CCPP area during December 2016.

Site selection for sampling

All types of ecological habitats like aquatic/wetland, cultivated land, fallow land, homestead area, road side, forest area and salt/shrimp culture area etc. of the designated sites/locations within 2 km radius of the project area were selected for sampling of both qualitative and quantitative data collection.

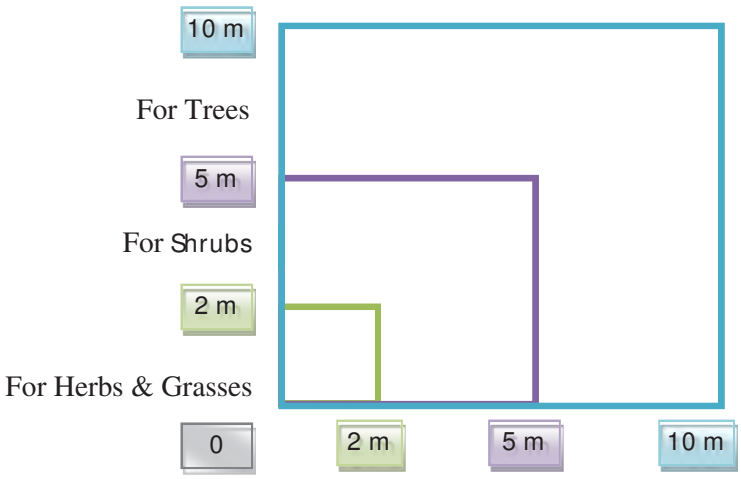


Figure 1. Quadrat size applied for quantitative analysis of different categories of plants.

Plant samples collection

Plant samples of different species, observed in the visited sites were collected following standard quadrat method (Braun-Blanquet, 1932; Raunkiaer, 1934). The quadrat size- 2m×2m for herbs and grasses, 5m×5m for shrubs and 10m×10m for trees were standardized on the basis of species-area-curve method (Cain, 1938).

Identification of plant samples

All the collected plant specimens found in the selected sites of Proposed Power Plant area was identified by taxonomic expertise and through cross-checking with herbarium specimens preserved at BNH/JUH and also matching the taxonomic description, keys or the photographs/illustrations in the relevant literatures, especially the recent Floras and Manuals of Hooker, 1872-1897; Prain, 1903; Khan, 1972-1987; Khan amd Halim, 1987; Siddiqui, 2007a, b; Ahmed, 2008a,b, c, d; 2009a,b etc.

In each selected sites/location, ten quadrats were randomly applied in diversified habitats. Collected plant samples were processing and preparation of herbarium sheets following standard herbarium techniques (Jain and Rao, 1977).

Data analysis and interpretation

Abundance and Frequency of the recorded species was determined by using formulae described as Shukla and Chandal (1993), and Verma and Agarwal (1986).

Abundance: No. of individuals per quadrat of occurrence.

$$A = \frac{\text{Total no. of individuals of a species in all the quadrats}}{\text{Total no. of quadrats in which the species occurred}}$$

Frequency: This is described as the % of quadrats occupied by a given species.

$$F\,(\%) = \frac{\text{Total no. of quadrats in which the species occurred}}{\text{Total no. of quadrats studied}} \times 100$$

According to the values of abundance as well as frequency, the recorded plant species were recognized and categorized as their existing status following DAFOR scale (described as Shukla and Chandal, 1993; and Kent and Coker, 1992).

The categorization of threatened plant species in this project has followed the IUCN Red List categories, where the species are classified in nine groups based on the criteria such as rate of decline, population size, area of geographic distribution, and degree of population and distribution fragmentation. Each of these groups has been defined according to the followings:

1. **Extinct** (EX): No individuals remaining.
2. **Extinct in the Wild** (EW): Known only to survive in captivity, or as a naturalized population outside its historic range.
3. **Critically Endangered** (CR): Extremely high risk of extinction in the wild.
4. **Endangered** (EN): Very high risk of extinction in the wild.
5. **Vulnerable** (VU): High risk of extinction in the wild.
6. **Near Threatened** (NT): Likely to become endangered in the near future.

7. **Least Concern** (LC): Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
8. **Data Deficient** (DD): Not enough data to make an assessment of its risk of extinction.
9. **Not Evaluated** (NE): Has not yet been evaluated against the criteria.

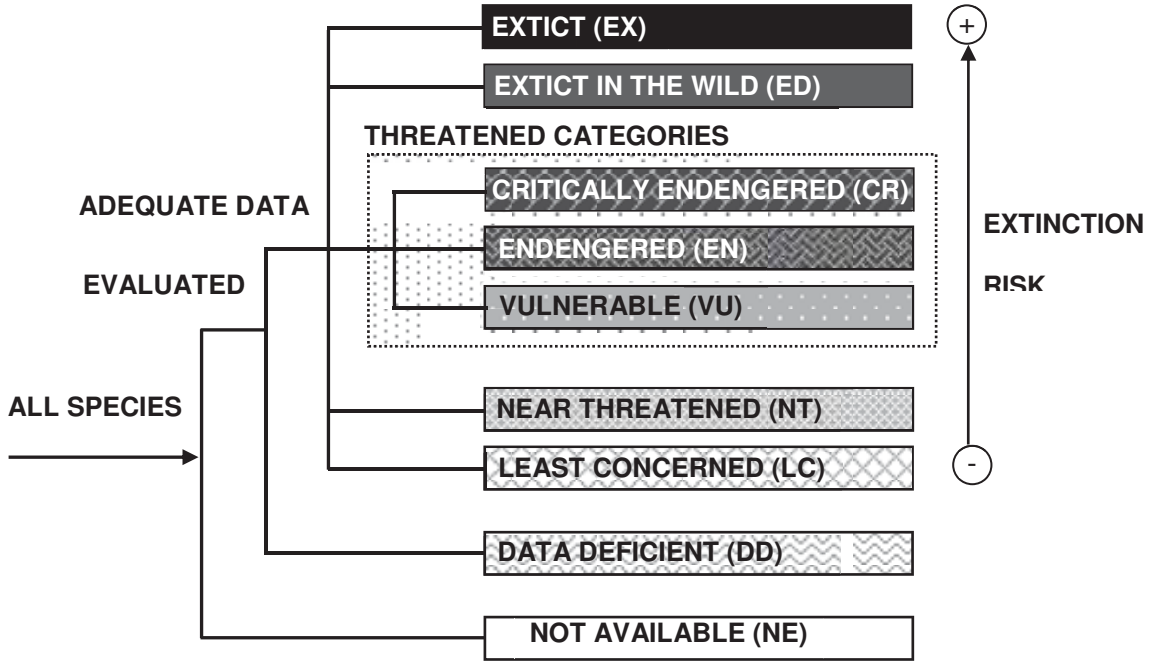


Figure 2. Correlation of IUCN Red List categories based on the extent of extinction risk.

Observations

A total of 192 vascular plant species belonging to 161genera under 78 families have been recorded from the proposed LNG-based power plant area (Table 1 and Figure 3) where the maximum 153 (80%) plant species belonged to the dicotyledonous group, followed by 32 (17%) and 7 (3%) plant species belonged to the monocotyledonous and pteridophytes (ferns) groups, respectively (Figure 4).

Among the habit categories, the highest number of species 105 (54.69%) were herbs, followed by 42 (21.88%), 16 (8.33%) and 15 (7.81%) species were trees, shrubs and climbers, respectively whereas the lowest number of plant species 11 (5.73%) were recorded as creeper (Figure 5).

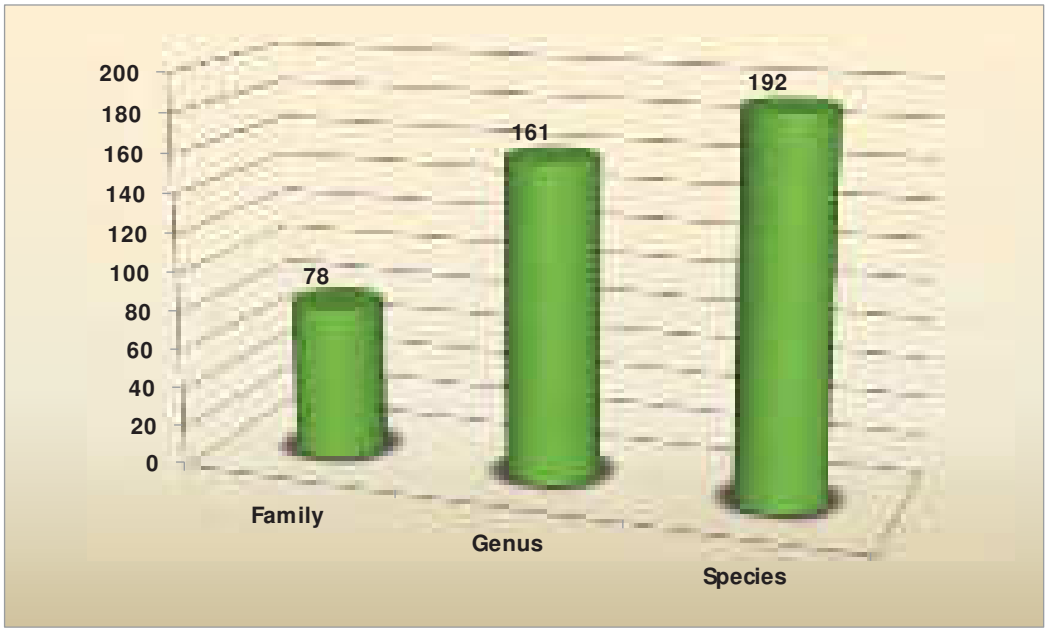


Figure 3. Species composition of the in the proposed LNG-based power plant area area.

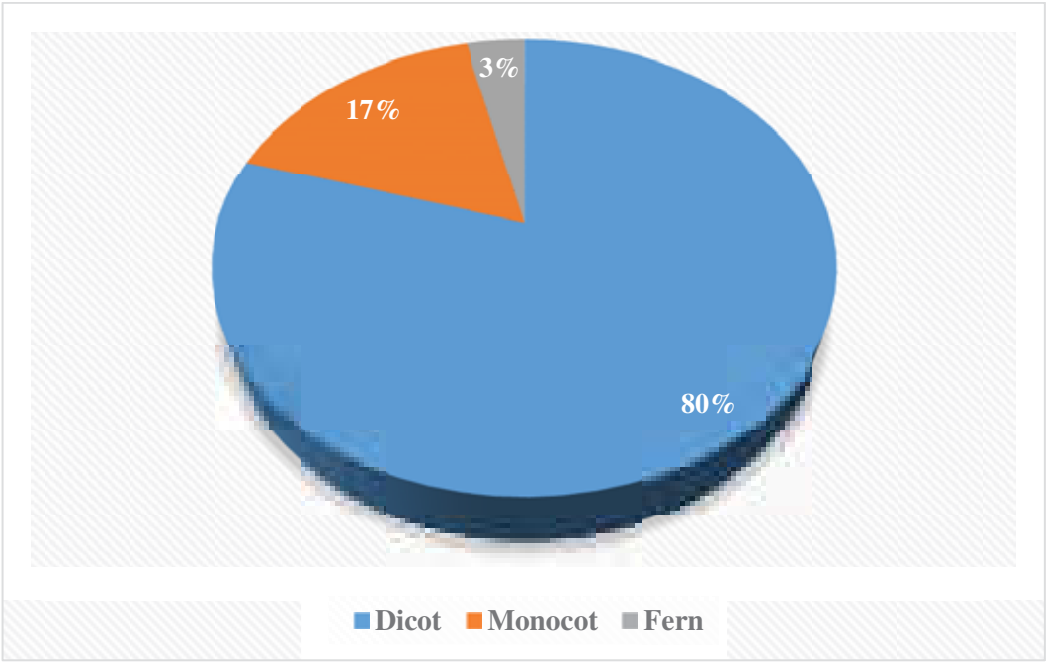


Figure 4. Cotyledonary status of the recorded plant species in the proposed LNG-based power plant area area.

Figure 5. Habit categories of the recorded plant species of the present LNG-based power power plant sites.

From the present study, out of 192 recoeded plant species, terrestrial habitats represent 153 (79.69%) species whereas the aquatic /or wetland habitats harbored 39 (20.31%) species in the present power plant project sites (Figure 6).

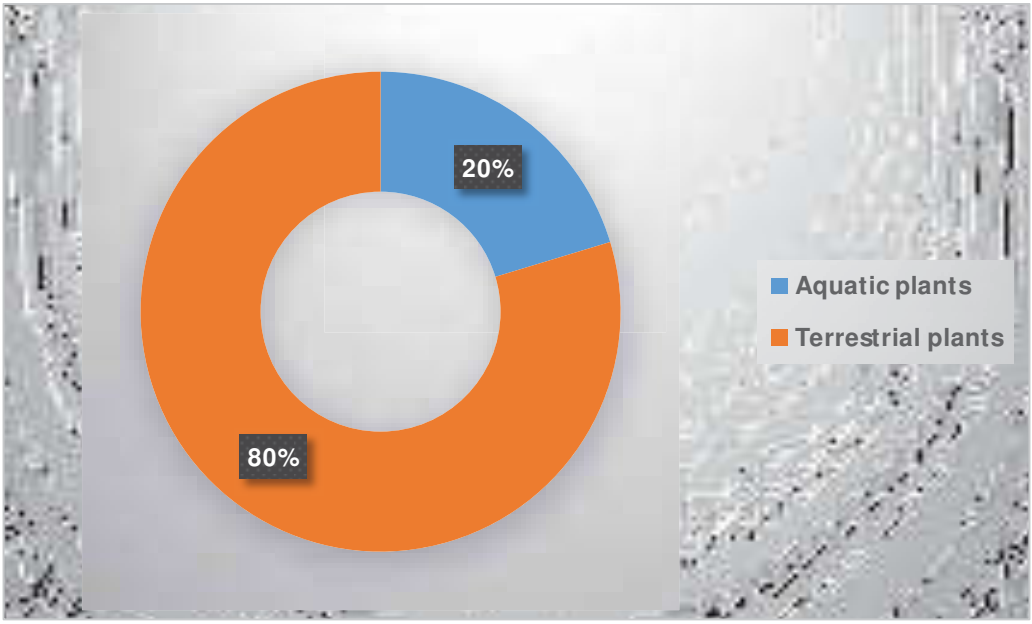


Figure 6. Habitat categories of the recorded plant species of the present power plant sites.

Table 1. Comprehensive checklist of the identified plant recorded from the selected sites of the proposed power plant project area at Meghnaghat, Bangladesh during December 2016.

A. Aquatic/wetland flora					
Sl.no.	**Scientific name**	**Family name**	**Local name**	**Habit**	**Plant group**
1.	*Adenosma indianum* (Lour.) Merr.	Scrophulariaceae	Baghjama	Herb	Dicot
2.	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	Henchi	Creeper	Dicot
3.	*Aponogeton appendiculatus* Bruggen	Aponogetonaceae	Jalkachu	Herb	Monocot
4.	*Azolla pinnata*	Azollaceae	Azola	Herb	Fern
5.	*Barringtonia acutangula* (L.) Gaertn.	Lecythidaceae	Hijal	Tree	Dicot
6.	*Colocasia esculenta* (L.) Schott	Araceae	Kachu	Herb	Mocot
7.	*Crateva magna* (Lour.) DC.	Capparaceae	Borun	Tree	Dicot
8.	*Cryptocoryne spiralis* (Retz.) Fischer *ex* Wydler	Araceae	Gangkochu	Herb	Monocot
9.	*Cyperus rotundus* L.	Cyperaceae	Muthaghas	Herb	Monocot
10.	*Cyperus* sp	Cyperaceae	Bhadighas	Herb	Monocot
11.	*Eichhornia crassipes* (Mart.) Solms	Pontederiaceae	Kachuripana	Herb	Mocot
12.	*Enhydra fluctuans* Lour.	Asteraceae	Helencha	Creeper	Dicot
13.	*Ficus heterophylla* L. f.	Moraceae	Latadumur	Climber	Dicot
14.	*Floscopia* sp.	Commelinaceae	Kanshira	Herb	Monocot
15.	*Hygrophila polysperma* (Roxb.) T. Anders.	Acanthaceae	Makhna	Herb	Dicot
16.	*Hygroryza aristata* (Retz.) Nees	Poaceae	Jalghas	Creeper	Monocot
17.	*Ipomoea aquatica* Forssk.	Convolvulaceae	Kolmi shak	Creeper	Dicot
18.	*Ipomoea fistulosa* Mart. *ex* Choisy	Convolvulaceae	Dholkalmi	Herb	Dicot
19.	*Leersia hexandra* Sw.	Poaceae	Aralighas	Herb	Mocot
20.	*Lemna perpusilla* Torrey	Lemnaceae	Khudipana	Herb	Mocot
21.	*Limnophila sessiliflora* (Vahl) Blume	Scrophulariaceae	Limnophila	Herb	Dicot
22.	*Ludwigia adscendens* (L.) Hara	Onagraceae	Keshordom	Creeper	Dicot
23.	*Ludwigia hyssopifolia* (G. Don) Exell apud A. & R. Fernandas	Onagraceae	Bonmorich	Herb	Dicot
24.	*Marsilea minuta* L.	Masileaceae	Susni sak	Creeper	Fern
25.	*Najas minor* L.	Najadaceae	Najas	Herb	Dicot
26.	*Nymphoides indicum* (L.) O. Kuntze	Menynthaceae	Chandmala	Herb	Dicot
27.	*Persicaria assamica* (Meissn.) Sojak	Polygonaceae	Bishkathali	Herb	Dicot
28.	*Persicaria barbata* (L.) Hara	Polygonaceae	Bishkathali	Herb	Dicot
29.	*Persicaria hydropiper* (L.) Spach	Polygonaceae	Bishkathali	Herb	Dicot
30.	*Persicaria orientalis* (L.) Spach	Polygonaceae	Bishkathali	Herb	Dicot
31.	*Pistia stratiotes* L.	Araceae	Topapana	Herb	Mocot
32.	*Polygonum plebeium* R. Br.	Polygonaceae	Bishkathali	Herb	Dicot
33.	*Rotala indica* (Willd.) Koehne	Lythraceae	Deshi ghurni	Herb	Dicot
34.	*Salvinia cucullata*	Salviniaceae	Indurkanipana	Herb	Fern
35.	*Salvinia molesta*	Salviniaceae	Boropatapana	Herb	Fern
36.	*Salvinia natans*	Salviniaceae	Basanpatapana	Herb	Fern
37.	*Schoenoplectus articulatus* (L.) Palla	Cyperaceae	Chechri	Herb	Mocot
38.	*Trewia nudiflora* L.	Euphorbiaceae	Petali	Tree	Dicot
39.	*Vallisneria spiralis* L.	Hydrocharitaceae	Patajahangi	Herb	Mocot

Table continued….

B. Terrestrial flora					
Sl no	**Scientific name**	**Family name**	**Local name**	**Habit**	**Plant group**
40.	*Acacia auriculiformis* A. Cunn. *ex* Benth. & Hook.	Mimosaceae	Akashmoni	Tree	Dicot
41.	*Aegle marmelos* (L.) Corr.	Rutaceae	Bel	Tree	Dicot
42.	*Ageratum conyzoides* L.	Asteraceae	Phulkuri	Herb	Dicot
43.	*Albizia chinensis* (Osb.) Merr.	Mimosaceae	Kkoroi	Tree	Dicot
44.	*Albizia lebbeck* (L.) Benth. & Hook.	Mimosaceae	Kalokoroi	Tree	Dicot
45.	*Albizia procera* (Roxb.) Benth.	Mimosaceae	Silkoroi	Tree	Dicot
46.	*Alternanthera sessilis* (L.) R. Br. ex Roem. & Schult.	Amaranthaceae	Chhoto chanchi	Creeper	Dicot
47.	*Amaranthus gangeticus* L.	Amaranthaceae	Notey shak	Herb	Dicot
48.	*Amaranthus spinosus* L.	Amarantaceae	Katanotey	Tree	Dicot
49.	*Amaranthus tricolor* L.	Amaranthaceae	Lalshak	Herb	Dicot
50.	*Amaranthus viridis* L.	Amaranthaceae	Notey	Herb	Dicot
51.	*Ammannia baccifera* L.	Lythraceae	Acidpata	Herb	Dicot
52.	*Ampelopteris prolifera* (Retz.) Copel	Thelypteridaceae	Dekia	Herb	Fern
53.	*Anisomeles indica* (L.) O. Kuntze	Lamiaceae	Bontulshi	Herb	Dicot
54.	*Annona reticulate* L.	Annonaceae	Ata, Nona Ata	Tree	Dicot
55.	*Annona squamosa* L.	Annonaceae	Shorifa	Shrub	Dicot
56.	*Aphanamixis polystachya* (Wall.) R. Parker	Meliaceae	Pitraj	Tree	Dicot
57.	*Artocarpus chama* Buch.-Ham. *ex* Wall.	Moraceae	Chapalish	Tree	Dicot
58.	*Artocarpus heterophyllus* Lamk.	Moraceae	Kathal	Tree	Dicot
59.	*Arundo donax* L.	Poaceae	Gangabena	Tree	Mocot
60.	*Atylosia scarabaeoides* (L.) Baker	Fabaceae	Kukshim	Climber	Dicot
61.	*Averrhoa carambola* L.	Oxalidaceae	Kamranga	Tree	Dicot
62.	*Axonopus compressus* (Sw.) P. Beauv.	Poaceae	Chapraghas	Herb	Mocot
63.	*Azadirachta indica* A. Juss.	Meliaceae	Neem	Tree	Dicot
64.	*Brassica nigra* (L.) Koch	Brassicaceae	Shorisha	Herb	Dicot
65.	*Cajanus cajan* (L.) Millsp.	Fabbaceae	Arhor	Shrub	Dicot
66.	*Calotropis gigantea* (L.) R. Br.	Asclepiadaceae	Akond	Shrub	Dicot
67.	*Cardiospermum halicacabum* L.	Sapindaceae	Phutkilata	Climber	Dicot
68.	*Carica papaya* L.	Caricaceae	Papaya	Herb	Dicot
69.	*Centella asiatica* (L.) Urban	Apiaceae	Thankuni	Creeper	Dicot
70.	*Chenopodium album* L.	Chenopodiaceae	Botua shak	Herb	Dicot
71.	*Chromolaena odorata* (L.) King & Robinson	Asteraceae	German lata	Herb	Dicot
72.	*Chloris barbata* Sw.	Poaceae	Ghash	Herb	Monocot
73.	*Christella dentate*	Thelypteridaceae	Dekia	Herb	Fern
74.	*Cissampelos pareira* L. var. hirsuta (Buch.-Ham. *ex* DC.) Forman	Menispermaceae	Lotagach	Climber	Dicot
75.	*Citrus grandis* (L.) Osbeck.	Rutaceae	Jambura	Tree	Dicot
76.	*Cleome rutidosperma* DC.	Capparaceae	Hurhurey	Herb	Dicot
77.	*Cleome viscosa* L.	Capparaceae	Holudhurhurey	Herb	Dicot
78.	*Clerodendrum viscosum* Vent.	Verbenaceae	Vat	Shrub	Dicot
79.	*Coccinia cordifolia* Cogn.	Cucurbitaceae	Telakucha	Herb	Dicot
80.	*Cocos nucifera* L.	Arecaceae	Narical	Tree	Mocot
81.	*Commelina benghalensis* L.	Commelinaceae	Kanchira	Herb	Mocot
82.	*Commelina longifolia* Lamk.	Commelinaceae	Kanai, Kanchira	Herb	Mocot
83.	*Corchorus olitorius* L.	Tiliaceae	Bonpat/Titpat	Herb	Dicot
84.	*Cotula hemispherica* (Roxb.) Wall, ex C. B.	Asteraceae	Babuni	Herb	Dicot
85.	*Crotalaria pallida* Ait.	Fabaceae	Jhonjhoni	Herb	Dicot
86.	*Croton bonplandianus* Baill.	Euphorbiaceae	Banmarich	Herb	Dicot
87.	*Cucurbita maxima* Duch. ex Lamk.	Cucurbitaceae	Mistikumra	Climber	Dicot
88.	*Cyathula prostrata* (L.) Blume	Amaranthaceae	Chhoto Apang	Herb	Dicot
89.	*Cynodon dactylon* (L.) Pers.	Poaceae	Durba	Herb	Mocot
90.	*Cuscuta reflexa* Roxb.	Cuscutaceae	Sharnalata	Climber	Dicot

Table continued….

91.	*Cyanotis cristata* (L.) D. Don	Commelinaceae	unknown	Herb	Dicot
92.	*Dactyloctenium aegyptium* (L.) P. Beauv.	Poaceae	Ghash	Herb	Monocot
93.	*Dentella repens* (L.) J. R. & G. Forst.	Rubiaceae	Sharpil bhuipata	Herb	Dicot
94.	*Desmodium heterophyllum* (Willd.) DC.	Fabaceae	Bonmotosuti	Herb	Dicot
95.	*Desmodium triflorum* (L.) DC.	Fabaceae	Tripatri shak	Herb	Dicot
96.	*Dillenia indica* L.	Dilleniaceae	Chalta	Tree	Dicot
97.	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceae	Chuprialu	Climber	Monocot
98.	*Diospyros peregrina* Guerke	Ebenaceae	Deshigab	Tree	Dicot
99.	*Eclipta alba* (L.) Hassk.	Asteraceae	Kalokeshi	Shrub	Dicot
100.	*Eleusine indica* (L.) Gaertn.	Poaceae	Kechla	Herb	Mocot
101.	*Eragrostis tenella* (L.) P. Beauv. *ex* Roem. & Schult.	Poaceae	Unknown	Herb	Mocot
102.	*Eragrostis unioloides* (Retz.) Nees *ex* Steud.	Poaceae	Mulakoni	Herb	Mocot
103.	*Eucalyptus camaldulensis* Dehnhardt	Myrtaceae	Eucalyptus	Tree	Dicot
104.	*Euphorbia hirta* L.	Euphorbiaceae	Dudhia	Herb	Dicot
105.	*Evolvulus nummularius* (L.) L.	Convolvulaceae	Khetpapra	Creeper	Dicot
106.	*Ficus benghalensis* L.	Moraceae	Bat	Tree	Dicot
107.	*Ficus hispida* L. f.	Moraceae	Kagdumur	Tree	Dicot
108.	*Ficus religiosa* L.	Moraceae	Ashwath	Tree	Dicot
109.	*Fimbristylis acuminata* Vahl	Cyperaceae	Acumifimbry	Herb	Mocot
110.	*Glinus oppositifolius* (L.) A. DC.	Molluginaceae	Gimashak	Herb	Dicot
111.	*Gmelina arborea* Roxb.	Verbenaceae	Gamar	Tree	Dicot
112.	*Gnaphalium luteo-album* L.	Asteraceae	Sadalomi	Herb	Dicot
113.	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Nemuti	Herb	Dicot
114.	*Heliotropium indicum* L.	Asteraceae	Hatisur	Herb	Dicot
115.	*Hedyotis corymbosa* (L.) Lamk.	Rubiaceae	Khetpapra	Herb	Dicot
116.	*Hibiscus rosa-sinensis* L.	Malvaceae	Jaba	Shrub	Dicot
117.	*Hibiscus sabdariffa* L.	Malvaceae	Stholpadda	Shrub	Dicot
118.	*Ipomoea batatas* (L.) Poir.	Convolvulaceae	Misti alu	Creeper	Dicot
119.	*Jasminum sambac* (L.) Ait.	Oleaceae	Jui	Shrub	Dicot
120.	*Kyllinga microcephala* Steud.	Cyperaceae	Muthaghas	Herb	Monocot
121.	*Lablab purpureus* (L.) Sweet	Fabaceae	Shim	Climber	Dicot
122.	*Lagenaria siceraria* (Molina) Standl.	Cucrbitaceae	Lau	Climber	Dicot
123.	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Jiga	Tree	Dicot
124.	*Launaea aspleniifolia* DC.	Asteraceae	Lonia	Herb	Dicot
125.	*Lawsonia inermis* L.	Lythraceae	Mehedi	Tree	Dicot
126.	*Leucaena leucocephala* (Lamk.) de Wit.	Mimosaceae	Ipil-Ipil	Tree	Dicot
127.	*Leucas aspera* (Willd.) Link	Lamiaceae	Swetdrawn	Herb	Dicot
128.	*Lindernia rotundifolia* (L.) Alston	Scrophulariaceae	Chotohelencha	Herb	Dicot
129.	*Lippia alba* (Mill.) Briton *et* Wilson	Verbenaceae	Lipia	Herb	Dicot
130.	*Litchi chinensis* Sonn.	Sapindaceae	Litchu	Tree	Dicot
131.	*Luffa cylindrica* (L.) M. Roem.	Cucurbitaceae	Jhinga	Climber	Dicot
132.	*Madhuca longifolia* (Koenig) MacBride	Sapotaceae	Mohua	Tree	Dicot
133.	*Mangifera indica* L.	Anacardiaceae	Am	Tree	Dicot
134.	*Melia azedarach* L.	Meliaceae	Gora Neem	Tree	Dicot
135.	*Melochia corchorifolia* L.	Sterculiaceae	Unknown	Shrub	Dicot
136.	*Merremia hederacea* (Burm. f.) Hallier f.	Convolvulaceea	Unknown	Climber	Dicot
137.	*Mikania cordata* (Burm. f.) Robinson	Asteraceae	Assam lata	Climber	Dicot
138.	*Mimosa pudica* L.	Mimosaceae	Lazzabati	Herb	Dicot
139.	*Mirabilis jalapa* L.	Nyctaginaceae	Shayndhamaloti	Herb	Dicot
140.	*Moringa oleifera* Lamk.	Moringaceae	Shojna	Tree	Dicot
141.	*Momordica charantia* L.	Cucurbitaceae	Korolla	Climber	Dicot
142.	*Musa paradisiaca* L.	Mussaceae	Kathalikola	Herb	Mocot
143.	*Neolamarckia cadamba* (Roxb.) Bosser	Rubiaceae	Kadom	Tree	Dicot
144.	*Ocimum sanctum* L.	Lamiaceae	Babuitulshi	Herb	Dicot
145.	*Oldenlandia corymbosa* L.	Rubiaceae	Khetpapra	Herb	Dicot
146.	*Oxalis corniculata* L.	Oxalidaceae	Amrul	Herb	Dicot
147.	*Panicum* sp.	Poaceae	Bashpatighas	Herb	Mocot

Table continued….

148.	*Paspalum flavidum* (Retz.) A. Camus	Poaceae	Moissaghas	Herb	Mocot
149.	*Passiflora foetida* L.	Passifloraceae	Jhumkalata	Climber	Dicot
150.	*Pedilanthus tithymaloides* Poit.	Euphorbiaceae	Bera Chita	Herb	Dicot
151.	*Phyla nodiflora* (L.) Greene	Verbenaceae	Bakan	Herb	Dicot
152.	*Phyllanthus acidus* (L.) Skeels	Euphorbiaceae	Arboroi	Tree	Dicot
153.	*Phyllanthus niruri* L.	Euphorbiaceae	Bhuiamla	Herb	Dicot
154.	*Phyllanthus reticulatus* Poir.	Euphorbiaceae	Sitka	Shrub	Dicot
155.	*Phyllanthus urinaria* L.	Euphorbiaceae	Sitka	Shrub	Dicot
156.	*Physalis minima* L.	Solanaceae	Phutka	Herb	Dicot
157.	*Pogostemon crassicaulis* (Benth.) J. R. Press	Lamiaceae	Aripachuli	Herb	Dicot
158.	*Pouzolzia zeylanica* (L.) Benn.	Urticaceae	Bilati luchipata	Herb	Dicot
159.	*Psidium guajava* L.	Myrtaceae	Peyara	Tree	Dicot
160.	*Punica granatum* L.	Punicaceae	Dalim	Shrub	Dicot
161.	*Richardia scabra* L.	Rubiaceae	Khetpapra	Herb	Dicot
162.	*Ricinus communis* L.	Euphorbiaceae	Rerhi/Vrenda	Shrub	Dicot
163.	*Rorippa indica* (L.) Hiern	Brassicaceae	Bonshorisha	Herb	Dicot
164.	*Sacciolepis interrupta* (Willd.) Stapf	Poaceae	Ghash	Herb	Monocot
165.	*Saccharum spontaneum* L.	Poaceae	Kash	Herb	Mocot
166.	*Samanea saman* (Jacq.) Merr.	Mimosaceae	Raintree	Tree	Dicot
167.	*Scoparia dulcis* L.	Scrophulariaceae	Bandhoney	Herb	Dicot
168.	*Senna alata* (L.) Roxb.	Caesalpiniaceae	Datmardan	Shrub	Dicot
169.	*Senna occidentalis* Roxb.	Caesalpiniaceae	Kolkashunda	Shrub	Dicot
170.	*Senna tora* (L.) Roxb.	Caesalpiniaceae	Kolkashunda	Herb	Dicot
171.	*Sida acuta* Burm. f.	Malvaceae	Berela	Herb	Dicot
172.	*Sida rhombifolia* L.	Malvaceae	Pitberela	Herb	Dicot
173.	*Solanum lycopersicum* Dunal	Solanaceae	Tomato	Herb	Dicot
174.	*Solanum melongena* L.	Solanaceae	Begun	Herb	Dicot
175.	*Solanum nigrum* L.	Solanaceae	Kakmachi	Herb	Dicot
176.	*Solanum sisymbrifolium* Lamk.	Solanaceae	Kataegun	Herb	Dicot
177.	*Sphaeranthus indicus* L.	Asteraceae	Mundi	Herb	Dicot
178.	*Spondias pinnata* (L. f.) Kurz	Anacardiaceae	Amra	Tree	Dicot
179.	*Stephania japonica* (Thunb.) Miers	Menispermiaceae	Ghaupata	Climber	Dicot
180.	*Swietenia mahagoni* Jacq.	Meliaceae	Mehagoni	Tree	Dicot
181.	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	Nakphul	Herb	Dicot
182.	*Syzygium cumini* (L.) Skeels	Myrtaceae	Jam	Tree	Dicot
183.	*Tamarindus indica* L.	Caesalpiniaceae	Tetul	Tree	Dicot
184.	*Terminalia catappa* L.	Combretaceae	Kathbadam	Tree	Dicot
185.	*Thevetia peruviana* (Pers.) K. Schum.	Apocynaceae	Holud korobi	Tree	Dicot
186.	*Tinospora cordifolia* (Willd.) Hook. f. & Thoms.	Menispermaceae	Gulancha	Climber	Dicot
187.	*Trema orientalis* (L.) Blume	Ulmaceae	Jibon	Tree	Dicot
188.	*Tridax procumbens* L.	Asteraceae	Tridhara	Herb	Dicot
189.	*Urena lobata* L.	Malvaceae	Banokra	Shrub	Dicot
190.	*Vernonia cinerea* (L.) Less.	Asteraceae	Kukurshunga	Herb	Dicot
191.	*Xanthium indicum* Koen. ex Roxb.	Asteraceae	Ghagra	Herb	Dicot
192.	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Kul, Boroi	Tree	Dicot

According the DAFOR status, the existing flora of the visited site represents 17, 39, 74, 50 and 12 species as rare, occasional, frequent, abundant and dominant respectively (Figure 7). Plant species belonging to Azollaceae, Ebenaceae, Euphorbiaceae, Lamiaceae, Lecythidaceae, Lythraceae, Malvaceae, Meliaceae, Menispermaceae, Nyctaginaceae, Oleaceae, Passifloraceae, Poaceae, Sapotaceae, Scrophulariaceae, Thelypteridaceae families were found to be rare according to DAFOR categories (Table 2).

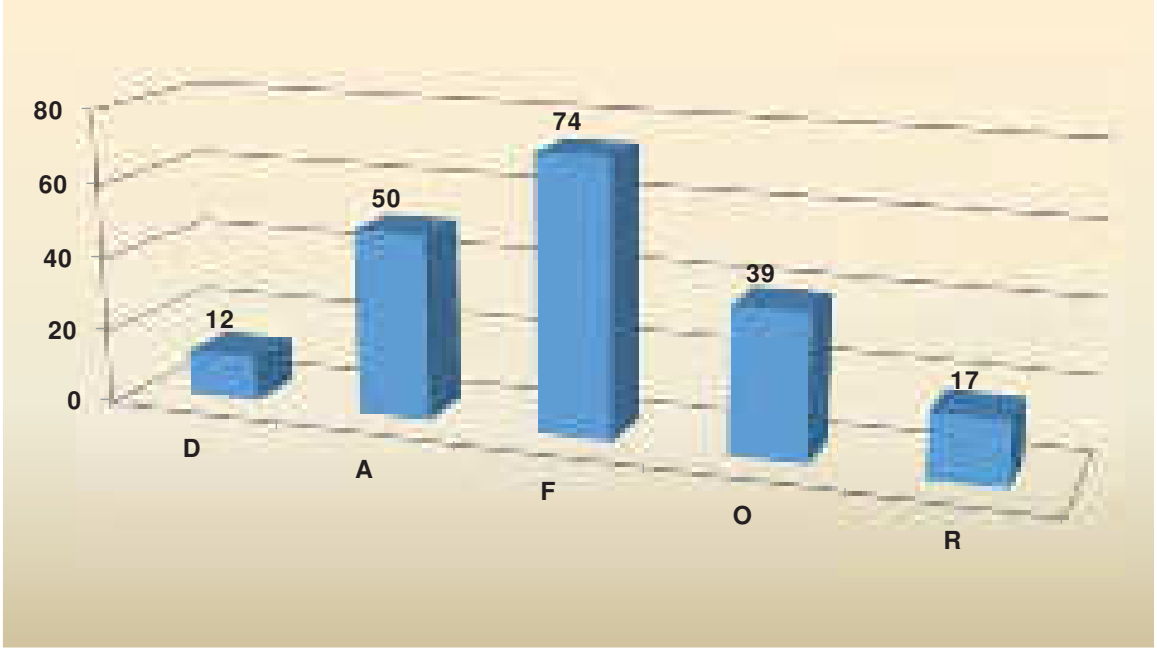
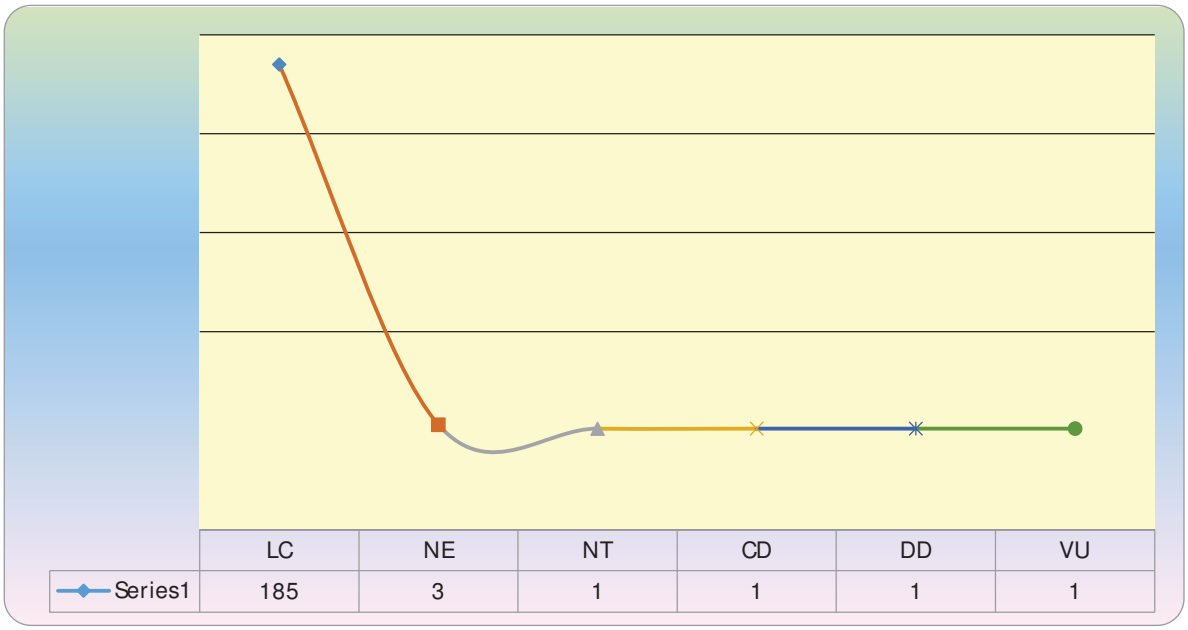


Figure 7. Existing DAFOR status of recorded plants from the present project area.

According to the Red List categories, out of 192 recorded plants, 185 species were included in Least Concern (Lc) category, 3 species were recognized as Not Evaluated (NE), 1 species were Near Threatened (NT), 1 species were Coservation Dependent (CD), 1 species was recognized for each the Data Dificit (DD) and 1 species was recognized as Vulnerable (VU) categories (Table 2, Figure 8).



	LC	NE	NT	CD	DD	VU
Series1	185	3	1	1	1	1

Figure 8. Red list categories of the flora recorded from the present power plant project area.

Table 2. Redlist categories and existing DAFOR status of the recorded vegetation in the proposed LNG-based power plant area area.

Sl.no.	Scientific name	Family name	Red list status	DAFOR status
1.	*Acacia auriculiformis* A. Cunn. *ex* Benth. & Hook.	Mimosaceae	Lc	O
2.	*Adenosma indianum* (Lour.) Merr.	Scrophulariaceae	Lc	R
3.	*Aegle marmelos* (L.) Corr.	Rutaceae	Lc	O
4.	*Ageratum conyzoides* L.	Asteraceae	Lc	F
5.	*Albizia chinensis* (Osb.) Merr.	Mimosaceae	Lc	O
6.	*Albizia lebbeck* (L.) Benth. & Hook.	Mimosaceae	Lc	F
7.	*Albizia procera* (Roxb.) Benth.	Mimosaceae	Lc	A
8.	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	Lc	A
9.	*Alternanthera sessilis* (L.) R. Br. ex Roem. & Schult.	Amaranthaceae	Lc	D
10.	*Amaranthus gangeticus* L.	Amaranthaceae	Lc	F
11.	*Amaranthus spinosus* L.	Amarantaceae	Lc	A
12.	*Amaranthus tricolor* L.	Amaranthaceae	Lc	F
13.	*Amaranthus viridis* L.	Amaranthaceae	Lc	F
14.	*Ammannia baccifera* L.	Lythraceae	Lc	O
15.	*Ampelopteris prolifera* (Retz.) Copel	Thelypteridaceae	Lc	F
16.	*Anisomeles indica* (L.) O. Kuntze	Lamiaceae	Lc	R
17.	*Annona reticulate* L.	Annonaceae	Lc	O
18.	*Annona squamosa* L.	Annonaceae	Lc	O
19.	*Aphanamixis polystachya* (Wall.) R. Parker	Meliaceae	Lc	R
20.	*Aponogeton appendiculatus* Bruggen	Aponogetonaceae	CD	F
21.	*Artocarpus chama* Buch.-Ham. *ex* Wall.	Moraceae	Lc	O
22.	*Artocarpus heterophyllus* Lamk.	Moraceae	Lc	O
23.	*Arundo donax* L.	Poaceae	Lc	F
24.	*Atylosia scarabaeoides* (L.) Baker	Fabaceae	Lc	O
25.	*Averrhoa carambola* L.	Oxalidaceae	Lc	O
26.	*Axonopus compressus* (Sw.) P. Beauv.	Poaceae	Lc	A
27.	*Azadirachta indica* A. Juss.	Meliaceae	Lc	F
28.	*Azolla pinnata*	Azollaceae	Lc	R
29.	*Barringtonia acutangula* (L.) Gaertn.	Lecythidaceae	Lc	R
30.	*Brassica nigra* (L.) Koch	Brassicaceae	Lc	A
31.	*Cajanus cajan* (L.) Millsp.	Fabbaceae	Lc	F
32.	*Calotropis gigantea* (L.) R. Br.	Asclepiadaceae	Lc	F
33.	*Cardiospermum halicacabum* L.	Sapindaceae	Lc	O
34.	*Carica papaya* L.	Caricaceae	Lc	F
35.	*Centella asiatica* (L.) Urban	Apiaceae	Lc	A
36.	*Chenopodium album* L.	Chenopodiaceae	Lc	A
37.	*Chloris barbata* Sw.	Poaceae	NE	R
38.	*Christella dentata*	Thelypteridaceae	NT	R
39.	*Chromolaena odorata* (L.) King & Robinson	Asteraceae	VU	A
40.	*Cissampelos pareira* L. var. hirsuta	Menispermaceae	Lc	R
41.	*Citrus grandis* (L.) Osbeck.	Rutaceae	Lc	F
42.	*Cleome rutidosperma* DC.	Capparaceae	Lc	A
43.	*Cleome viscosa* L.	Capparaceae	Lc	F
44.	*Clerodendrum viscosum* Vent.	Verbenaceae	Lc	F
45.	*Coccinia cordifolia* Cogn.	Cucurbitaceae	Lc	A
46.	*Cocos nucifera* L.	Arecaceae	Lc	F
47.	*Colocasia esculenta* (L.) Schott	Araceae	Lc	D
48.	*Commelina benghalensis* L.	Commelinaceae	Lc	A
49.	*Commelina longifolia* Lamk.	Commelinaceae	Lc	F
50.	*Corchorus olitorius* L.	Tiliaceae	Lc	O
51.	*Cotula hemispherica* (Roxb.) Wall, ex C. B.	Asteraceae	Lc	F
52.	*Crateva magna* (Lour.) DC.	Capparaceae	Lc	A

Table continued…

53.	*Crotalaria pallida* Ait.	Fabaceae	Lc	F
54.	*Croton bonplandianus* Baill.	Euphorbiaceae	Lc	D
55.	*Cryptocoryne spiralis* (Retz.) Fischer *ex* Wydler	Araceae	Lc	F
56.	*Cucurbita maxima* Duch. ex Lamk.	Cucurbitaceae	Lc	F
57.	*Cuscuta reflexa* Roxb.	Cuscutaceae	Lc	A
58.	*Cyanotis cristata* (L.) D. Don	Commelinaceae	Lc	F
59.	*Cyathula prostrata* (L.) Blume	Amaranthaceae	NE	F
60.	*Cynodon dactylon* (L.) Pers.	Poaceae	Lc	A
61.	*Cyperus rotundus* L.	Cyperaceae	Lc	F
62.	*Cyperus* sp	Cyperaceae	Lc	O
63.	*Dactyloctenium aegyptium* (L.) P. Beauv.	Poaceae	Lc	F
64.	*Dentella repens* (L.) J. R. & G. Forst.	Rubiaceae	Lc	F
65.	*Desmodium heterophyllum* (Willd.) DC.	Fabaceae	Lc	O
66.	*Desmodium triflorum* (L.) DC.	Fabaceae	Lc	A
67.	*Dillenia indica* L.	Dilleniaceae	Lc	O
68.	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceae	Lc	O
69.	*Diospyros peregrina* Guerke	Ebenaceae	Lc	R
70.	*Eclipta alba* (L.) Hassk.	Asteraceae	Lc	A
71.	*Eichhornia crassipes* (Mart.) Solms	Pontedariaceae	Lc	D
72.	*Eleusine indica* (L.) Gaertn.	Poaceae	Lc	A
73.	*Enhydra fluctuans* Lour.	Asteraceae	Lc	A
74.	*Eragrostis tenella* (L.) P. Beauv. *ex* Roem. & Schult.	Poaceae	Lc	A
75.	*Eragrostis unioloides* (Retz.) Nees *ex* Steud.	Poaceae	Lc	F
76.	*Eucalyptus camaldulensis* Dehnhardt	Myrtaceae	NE	F
77.	*Euphorbia hirta* L.	Euphorbiaceae	Lc	F
78.	*Evolvulus nummularius* (L.) L.	Convolvulaceae	Lc	F
79.	*Ficus benghalensis* L.	Moraceae	Lc	O
80.	*Ficus heterophylla* L. f.	Moraceae	Lc	F
81.	*Ficus hispida* L. f.	Moraceae	Lc	O
82.	*Ficus religiosa* L.	Moraceae	Lc	O
83.	*Fimbristylis acuminata* Vahl	Cyperaceae	Lc	F
84.	*Floscopia* sp.	Commelinaceae	Lc	A
85.	*Glinus oppositifolius* (L.) A. DC.	Molluginaceae	Lc	F
86.	*Gmelina arborea* Roxb.	Verbenaceae	Lc	O
87.	*Gnaphalium luteo-album* L.	Asteraceae	Lc	A
88.	*Grangea maderaspatana* (L.) Poir.	Asteraceae	Lc	A
89.	*Hedyotis corymbosa* (L.) Lamk.	Rubiaceae	Lc	F
90.	*Heliotropium indicum* L.	Asteraceae	Lc	D
91.	*Hibiscus rosa-sinensis* L.	Malvaceae	Lc	O
92.	*Hibiscus sabdariffa* L.	Malvaceae	Lc	R
93.	*Hygrophila polysperma* (Roxb.) T. Anders.	Acanthaceae	Lc	O
94.	*Hygroryza aristata* (Retz.) Nees	Poaceae	Lc	A
95.	*Ipomoea aquatica* Forssk.	Convolvulaceae	Lc	D
96.	*Ipomoea batatas* (L.) Poir.	Convolvulaceae	Lc	F
97.	*Ipomoea fistulosa* Mart. *ex* Choisy	Convolvulaceae	Lc	A
98.	*Jasminum sambac* (L.) Ait.	Oleaceae	Lc	R
99.	*Kyllinga microcephala* Steud.	Cyperaceae	Lc	D
100.	*Lablab purpureus* (L.) Sweet	Fabaceae	Lc	F
101.	*Lagenaria siceraria* (Molina) Standl.	Cucrbitaceae	Lc	F
102.	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Lc	F
103.	*Launaea aspleniifolia* DC.	Asteraceae	Lc	A
104.	*Lawsonia inermis* L.	Lythraceae	Lc	O
105.	*Leersia hexandra* Sw.	Poaceae	Lc	A
106.	*Lemna perpusilla* Torrey	Lemnaceae	Lc	A
107.	*Leucaena leucocephala* (Lamk.) de Wit.	Mimosaceae	Lc	F
108.	*Leucas aspera* (Willd.) Link	Lamiaceae	Lc	A
109.	*Limnophila sessiliflora* (Vahl) Blume	Scrophulariaceae	Lc	A
110.	*Lindernia rotundifolia* (L.) Alston	Scrophulariaceae	Lc	A

Table continued…

111.	*Lippia alba* (Mill.) Briton *et* Wilson	Verbenaceae	Lc	F
112.	*Litchi chinensis* Sonn.	Sapindaceae	Lc	O
113.	*Ludwigia adscendens* (L.) Hara	Onagraceae	Lc	A
114.	*Ludwigia hyssopifolia*	Onagraceae	Lc	D
115.	*Luffa cylindrica* (L.) M. Roem.	Cucurbitaceae	Lc	F
116.	*Madhuca longifolia* (Koenig) MacBride	Sapotaceae	Lc	R
117.	*Mangifera indica* L.	Anacardiaceae	Lc	F
118.	*Marsilea minuta* L.	Masileaceae	Lc	A
119.	*Melia azedarach* L.	Meliaceae	Lc	F
120.	*Melochia corchorifolia* L.	Sterculiaceae	Lc	O
121.	*Merremia hederacea* (Burm. f.) Hallier f.	Convolvulaceea	Lc	F
122.	*Mikania cordata* (Burm. f.) Robinson	Asteraceae	Lc	F
123.	*Mimosa pudica* L.	Mimosaceae	Lc	F
124.	*Mirabilis jalapa* L.	Nyctaginaceae	Lc	R
125.	*Momordica charantia* L.	Cucurbitaceae	Lc	A
126.	*Moringa oleifera* Lamk.	Moringaceae	Lc	O
127.	*Musa paradisiaca* L.	Mussaceae	Lc	F
128.	*Najas minor* L.	Najadaceae	Lc	F
129.	*Neolamarckia cadamba* (Roxb.) Bosser	Rubiaceae	Lc	O
130.	*Nymphoides indicum* (L.) O. Kuntze	Menynthaceae	Lc	F
131.	*Ocimum sanctum* L.	Lamiaceae	Lc	F
132.	*Oldenlandia diffusa* (Willd.) Roxb.	Rubiaceae	DD	F
133.	*Oxalis corniculata* L.	Oxalidaceae	Lc	A
134.	*Panicum* sp.	Poaceae	Lc	F
135.	*Paspalum flavidum* (Retz.) A. Camus	Poaceae	Lc	F
136.	*Passiflora foetida* L.	Passifloraceae	Lc	R
137.	*Pedilanthus tithymaloides* Poit.	Euphorbiaceae	Lc	O
138.	*Persicaria assamica* (Meissn.) Sojak	Polygonaceae	Lc	F
139.	*Persicaria barbata* (L.) Hara	Polygonaceae	Lc	F
140.	*Persicaria hydropiper* (L.) Spach	Polygonaceae	Lc	A
141.	*Persicaria orientalis* (L.) Spach	Polygonaceae	Lc	D
142.	*Phyla nodiflora* (L.) Greene	Verbenaceae	Lc	F
143.	*Phyllanthus acidus* (L.) Skeels	Euphorbiaceae	Lc	R
144.	*Phyllanthus niruri* L.	Euphorbiaceae	Lc	A
145.	*Phyllanthus reticulatus* Poir.	Euphorbiaceae	Lc	D
146.	*Phyllanthus urinaria* L.	Euphorbiaceae	Lc	F
147.	*Physalis minima* L.	Solanaceae	Lc	F
148.	*Pistia stratiotes* L.	Araceae	Lc	A
149.	*Pogostemon crassicaulis* (Benth.) J. R. Press	Lamiaceae	Lc	A
150.	*Polygonum plebeium* R. Br.	Polygonaceae	Lc	F
151.	*Pouzolzia zeylanica* (L.) Benn.	Urticaceae	Lc	F
152.	*Psidium guajava* L.	Myrtaceae	Lc	F
153.	*Punica granatum* L.	Punicaceae	Lc	O
154.	*Richardia scabra* L.	Rubiaceae	Lc	A
155.	*Ricinus communis* L.	Euphorbiaceae	Lc	O
156.	*Rorippa indica* (L.) Hiern	Brassicaceae	Lc	A
157.	*Rotala indica* (Willd.) Koehne	Lythraceae	Lc	R
158.	*Saccharum spontaneum* L.	Poaceae	Lc	A
159.	*Sacciolepis interrupta* (Willd.) Stapf	Poaceae	Lc	F
160.	*Salvinia cucullata*	Salviniaceae	Lc	A
161.	*Salvinia molesta*	Salviniaceae	Lc	F
162.	*Salvinia natans*	Salviniaceae	Lc	D
163.	*Samanea saman* (Jacq.) Merr.	Mimosaceae	Lc	A
164.	*Schoenoplectus articulatus* (L.) Palla	Cyperaceae	Lc	A
165.	*Scoparia dulcis* L.	Scrophulariaceae	Lc	F
166.	*Senna alata* (L.) Roxb.	Caesalpiniaceae	Lc	A
167.	*Senna occidentalis* Roxb.	Caesalpiniaceae	Lc	F

168.	*Senna tora* (L.) Roxb.	Caesalpiniaceae	Lc	F

Table continued…

169.	*Sida acuta* Burm. f.	Malvaceae	Lc	F
170.	*Sida rhombifolia* L.	Malvaceae	Lc	O
171.	*Solanum lycopersicum* Dunal	Solanaceae	Lc	A
172.	*Solanum melongena* L.	Solanaceae	Lc	A
173.	*Solanum nigrum* L.	Solanaceae	Lc	F
174.	*Solanum sisymbrifolium* Lamk.	Solanaceae	Lc	D
175.	*Sphaeranthus indicus* L.	Asteraceae	Lc	F
176.	*Spondias pinnata* (L. f.) Kurz	Anacardiaceae	Lc	O
177.	*Stephania japonica* (Thunb.) Miers	Menispermiaceae	Lc	O
178.	*Swietenia mahagoni* Jacq.	Meliaceae	Lc	F
179.	*Synedrella nodiflora* (L.) Gaertn.	Asteraceae	Lc	F
180.	*Syzygium cumini* (L.) Skeels	Myrtaceae	Lc	O
181.	*Tamarindus indica* L.	Caesalpiniaceae	Lc	F
182.	*Terminalia catappa* L.	Combretaceae	Lc	O
183.	*Thevetia peruviana* (Pers.) K. Schum.	Apocynaceae	Lc	O
184.	*Tinospora cordifolia* (Willd.) Hook. f. & Thoms.	Menispermaceae	Lc	R
185.	*Trema orientalis* (L.) Blume	Ulmaceae	Lc	O
186.	*Trewia nudiflora* L.	Euphorbiaceae	Lc	A
187.	*Tridax procumbens* L.	Asteraceae	Lc	F
188.	*Urena lobata* L.	Malvaceae	Lc	O
189.	*Vallisneria spiralis* L.	Hydrocharitaceae	Lc	A
190.	*Vernonia cinerea* (L.) Less.	Asteraceae	Lc	O
191.	*Xanthium indicum* Koen. ex Roxb.	Asteraceae	Lc	A
192.	*Ziziphus mauritiana* Lamk.	Rhamnaceae	Lc	F

Note: LC= Least Concern, NE= Not Evaluated, NT= Near Threatened, CD= Coservation Dependent, DD= Data Deficient, VU= Vulnerable. D= Dominant, A= Abundant, F= Frequent, O= Occasional, R= Rare.

Oldenlandia diffusa of the family Rubiaceae was found data deficit, *Aponogeton appendiculatus* of the family Aponogetonaceae was found conservation dependent, *Christella dentate* of the family Thelypteridaceae was found near threatened and *Chromolaena odorata* of the family Asteraceae was found vulnerable categories. Besides, *Cyathula prostrata* of the family Amaranthaceae, *Eucalyptus camaldulensis* of the family Myrtaceae, *Chloris barbata* of the family Poaceae were found in not evaluated category.

Threats to the Project Sites and Biodiversity

The major threats to habitats of the project area as well as on the biodiversity which were recognized from the present baseline survey as well as from consult with the local people are-

- Dusting and generation of waste during the course of construction work,
- Water pollution as a result of possible leakage of fuels and lubricants and chemical substances in the course of the construction work,
- Aquatic freshwater plant species may become affected due to increase of water temperature,

- Regular natural calamities

The overall floristic composition and their existing status of the present project sites is quite good facing under different threats due to multifarious anthropogenic activities as well as the natural calamities.

Suggestions

Suggestions should be implemented for proper management and conservation of the poject area:

- Further disturbance to the natural habitats and its diversity should be stoped,
- Regular monitoring of ecosystem health by specialists,
- Proper management plan should be implemented to maintain ecological integrity,

References

Ahmed, Z.U. (ed.) 2008a. Encyclopedia of Flora and Fauna of Bangladesh. **Vol. 6**: Angiosperms: Dicotyledons (Acanthaceae-Asteraceae). Asiatic Society of Bangladesh, Dhaka. 408 pp.

Ahmed, Z.U. (ed.) 2008b. Encyclopedia of Flora and Fauna of Bangladesh. **Vol. 7**: Angiosperms: Dicotyledons (Balsaminaceae-Euphorbiaceae). Asiatic Society of Bangladesh, Dhaka. 546 pp.

Ahmed, Z.U. (ed.) 2008c. Encyclopedia of Flora and Fauna of Bangladesh. **Vol. 8**: Angiosperms: Dicotyledons (Fabaceae-Lythraceae). Asiatic Society of Bangladesh, Dhaka. 478 pp.

Ahmed, Z.U. (ed.) 2008d. Encyclopedia of Flora and Fauna of Bangladesh. **Vol. 12**: Angiosperms: Monocotyledons (Orchidaceae-Zingiberaceae). Asiatic Society of Bangladesh, Dhaka. 552 pp.

Ahmed, Z.U. (ed.) 2009a. Encyclopedia of Flora and Fauna of Bangladesh. **Vol. 9**: Angiosperms: Dicotyledons (Magoliaceae-Punicaceae). Asiatic Society of Bangladesh, Dhaka. 488 pp.

Ahmed, Z.U. (ed.) 2009b. Encyclopedia of Flora and Fauna of Bangladesh. **Vol. 10**: Angiosperms: Dicotyledons (Ranunculaceae-Zygophyllaceae). Asiatic Society of Bangladesh, Dhaka. 580 pp.

Braun-Blanquet, J. 1932. Plant sociology: The study of plant communities. McGeaw-Hill Book Co. Inc., New York, USA.

Cain, S.A. 1938. The species-area curve. *American Midland Naturalist*. 19: 573-581.

Hooker, J.D. 1872-1897. The Flora of British India. Vol. 1-7. London. Indian Reprint (1973). Bishen Singh Mahendra Pal Singh, New Connaughat Place, Dehra Dun, India, 5568 pp.

Huq, A.M. 1986. Plant names of Bangladesh, Bangladesh National Herbarium, BARC, Farmgate, Dhaka, Bangladesh. 289 pp.

Jain, S.K. and Raw, R.R. 1977. A handbook of field and herbarium methods/ **xvi**, 157 p.

Kent, M. and Coker, P. 1992. Vegetation description and analysis: A practical approach. The CRC Press, Inc. Belhaven Press, Landon. 363 pp.

Khan, M.S. (ed.). 1972-1987. Flora of Bangladesh, Vol. 2-43. Bangladesh National Herbarium (DACB), Dhaka, Bangladesh.

Khan, M.S. and Halim, M. 1987. Aquatic angiosperm of Bangladesh. Bangladesh National Herbarium, BARC, Dhaka.

Prain, D. 1903. Bengal Plants, Vol. 1 and 2. Reprint Edition 1963. Calcutta. 1-1319 pp.

Shukla, R.S. and Chandal, P.S. 1993. Plant Ecology. S. Chandal and Company Ltd. New Delhi, India. 197 pp.

Siddiqui, K.U. (ed.). 2007a. Encyclopedia of Flora and Fauna of Bangladesh. **Vol. 5**: Bryophytes, Pteridophytes and Gymnosperms. Asiatic Society of Bangladesh, Dhaka. 390 pp.

Siddiqui, K.U. (ed.). 2007b. Encyclopedia of Flora and Fauna of Bangladesh. **Vol. 11**: Angiosperms: Monocotyledons (Agavaceae-Najadaceae). Asiatic Society of Bangladesh, Dhaka. 399 pp.

Verma, P.S. and Agarwal, V.K. 1986. Princoples of ecology. S.Chandal and Co. (Pvt.) Ltd., New Delhi, India. 591 pp.

List of some important photographs taken from the Proposed Power Plant Area.

Acacia auriculiformis

Adenosma indianum

Achyranthus aspera

Acmella culva

Ageratum conyzoides

Albizia procera

	
Amaranthus blitum	*Amaranthus spinosus*
	
Alternanthera sessilis	*Ammannia baccifera*
	
Ampelopteris prolifera	*Anisomeles indica*

Aponogeton appendiculatus

Atylosia scarabaeoides

Azadirachta indica

Azolla pinnata

Centella asiatica

Barringtonia acutangula

	
Colocasia esculenta	*Colocasia esculenta*
	
Calotropis procera	*Calotropis gigantia*
	
Cardiospermum helicacabum	*Cardiospermum helicacabum* (Fruit)

	
Carica papaya	*Christella dentata*
	
Clerodendrum viscosum	*Cocos nucifera*
	
Cissampelos pareira L. var. hirsuta	*Coccinia cordifolia*

	
Cotula hemispherica	*Crotalaria pallida*
	
Commelina longifolia	*Commelina benghalensis*
	
Crateva magna	*Croton banplandianum*

Cryptocoryne spiralis

Cuscuta reflexa

Desmodium triflorum

Dioscoria alata

Eleusine indica

Enhydra fluctuans

	
Eclipta prostrata	*Eichhornia crassipes*
	
Eucalyptus camaldulensis	*Ficus heterophylla*
	
Evolvulus nummularius	*Fimbristylis acuminata*

Fimbristylis squarrosa

Glinus oppositifolius

Gmelina arborea

Grangea maderaspatana

Heliotropium indicum

Floscopia

Gnaphalium luteo-album

Hygroryza aristata

Ipomoea aquatica

Ipomoea fistulosa

Ipomoea batatas

Kyllinga microcephala

Kyllinga brevifolia

Lagenaria siceraria

Lablab purpureus

Launaea aspleniifolia

Leucas aspera

Lemna perpusilla

Leucaena leucocephala

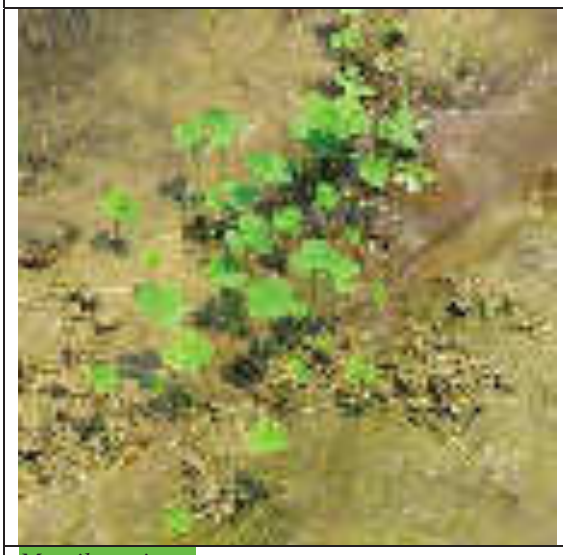
Lindernia rotundifolia

Limnophila sessiliflora

Ludwigia adscendens

Lippia alba

Ludwigia hyssopifolia

	
Luffa cylindrica	*Merremia hederacea*
	
Marsilea minuta	*Mikania cordata*
	
Mimosa pudica	*Mirabilis jalapa*

	
Momordica charantia	*Musa paradisiaca*
	
Najas minor	*Oldenlandia corymbosa*
	
Oryza sativa	*Oxalis corniculata*

	
Passiflora foetida	*Persicaria assamica*
	
Persicaria hydropiper	*Persicaria orientalis*
	
Phyla nodiflora	*Phyllanthus reticulatus*

	
Pistia stratiotes	*Pogostemon crassicaulis*
	
Richardia scabra	*Rorippa indica*
	
Saccharum spontaneum	*Ricinus communis*

	
Rotala rotundifolia	*Salvinia cucullata*
	
Salvinia molesta	*Salvinia natans*
	
Samanea saman	*Schoenoplectus articulatus*

	
Senna alata	*Senna alata* (Fruit)
	
Senna occidentalis	*Senna tora*
	
Sida acuta	*Solanum nigrum*

	
Solanum sisymbrifolium	*Solanum sisymbrifolium* (Fruit)
	
Sphaeranthus indicus	*Stephania japonica*
	
Thevetia peruviana	*Tinospora cordifolia*

	
Trewia nudiflora	*Vallisneria spiralis*
	
Tridax procumbens	*Xanthium indicum*

Annexure- 18

Questionnaire for Conducting Social Survey

Questionnaire for FGD and Local Dwellers

রিলায়েন্স মেঘনাঘাট ৭৫০ মেগাওয়াট বিদ্যুৎকেন্দ্রের জন্য সামাজিক ও পরিবেশ সম্পর্কিত বিস্তারিত মতামত

সামাজিক সম্পৃক্তি

১) সাধারন তথ্যাবলিঃ

গ্রামের নামঃ	ইউনিয়নঃ	জেলাঃ	বিভাগঃ

২) বাসিন্দার বিবরণীঃ

উত্তরদাতার নামঃ			পারিবারিক প্রধানের নামঃ	
উত্তরদাতার সাথে প্রধানের সম্পর্কঃ			ধর্মঃ	জাতিগত গোষ্ঠী:
পরিবারের ধরনঃ (√/x)	একক পরিবারঃ	যৌথ পরিবারঃ	বর্ধিত পরিবারঃ	
পরিবারের সদস্য সংখ্যাঃ				
প্রাপ্তবয়স্ক পুরুষঃ	প্রাপ্তবয়স্ক নারীঃ	ছেলে শিশুঃ	মেয়ে শিশুঃ	
নারী পারিবারিক প্রধান (যদি প্রযোজ্য হয়):	নামঃ		বয়সঃ	

৩) পরিবারের বিবরণীঃ

নং	পারিবারিক সদসস্যের নাম	লিঙ্গ (পু/ম)	উত্তরদাতার সাথে সম্পর্ক[১]	বয়স	বৈবাহিক অবস্থা[২]	শিক্ষাগত যোগ্যতা[৩]	সাধারন কর্মকাণ্ড[৪]

নং	পারিবারিক সদসস্যের নাম	লিঙ্গ (পু/ম)	উত্তরদাতার সাথে সম্পর্ক[১]	বয়স	বৈবাহিক অবস্থা[২]	শিক্ষাগত যোগ্যতা[৩]	সাধারন কর্মকাণ্ড[৪]

[১) ক)বাড়ীর প্রধান, খ)স্ত্রী, গ)স্বামী, ঘ)পুত্র, ঙ)কন্যা, চ)জামাতা, ছ)পুত্রবধূ, জ)ভাই, ঝ)বোন, ঞ)বাবা, ট)মা, ঠ)নাতি, ড)নাতনি, ঢ)দাদা/নানা, ণ)দাদি/নানি, ত)খালা/ফুফু/চাচি/মামি, থ)চাচা/মামা/খালু/ফুপা, দ)ভাগিনা/ভাতিজা, ধ)ভাগিনি/ভাতিজি, ন)অন্যান্য

২) ক)বিবাহিত, খ)অবিবাহিত, গ)তালাকপ্রাপ্ত, ঘ)বিচ্ছিন্ন, ঙ)বিপত্নিক/বিধবা

৩) ক)অশিক্ষিত, খ)সশিক্ষিত, গ)প্রাইমারি পাশ (১ম-৫ম শ্রেণী), ঘ)নিম্ন মাধ্যমিক পাশ (৬ঠ-৮ম শ্রেনী), ঙ) মাধ্যমিক (৯ম-১০ম শ্রেণী), চ)উচ্চ মাধ্যমিক (১১ম-১২ম শ্রেণী), ছ)স্নাতক, জ)স্নাতকোত্তর, ঝ)কারিগরি, ঞ)অন্যান্য

৪) ক)চাকরিজীবী, খ)শ্রমিক, গ)জেলে, ঘ)ব্যবসা, ঙ)সাংসারিক কাজ, চ)ছাত্র, ছ)বৃদ্ধ/অবসরপ্রাপ্ত, জ)স্কুলগামী বয়সের কমবয়সী, ঝ)প্রতিবন্ধী, ঞ)অন্যান্য]

৪) স্থাপনার বিবরণীঃ

১)স্থাপনার ধরনঃ[১]	২)কক্ষের সংখ্যাঃ	৩)ছাদের ধরনঃ[২]
৪)দেয়ালের ধরনঃ[৩]	৫)মেঝের ধরনঃ[৪]	৬)গোয়াল ঘরঃ

[১)ক)পাকা, খ)আধাপাকা, গ)কাচা, ঘ)টিন;

২)ক)দালান, খ)টিন, গ)কাঠ ও পাথর, ঘ)ইটের ঘর, ঙ)কাঠ, চ)অন্যান্য;

৩)ক)পাথর, খ)টিন, গ)কাদামাটি, ঘ)ইট, ঙ)কাঠ, চ)অন্যান্য;

৪)ক)সিমেন্ট, খ)কাদামাটি, গ)পাথর, ঘ)অন্যান্য]

৫) সম্পদের বিবরণীঃ

গবাদি পশু (সংখ্যা)-	গরু:	ষাঁড়:	মহিষ:	ছাগল:	ভেড়াঃ	হাস/মুরগিঃ	উল্লেখ্য অন্যান্যঃ

স্যানিটেশন সুবিধাঃ (হ্যাঁ/না)	বিদ্যুৎ সুবিধাঃ (হ্যাঁ/না)	খাবার পানির উৎসঃ (হ্যাঁ/না)	পানির মানঃ

টেলিভিশনঃ (হ্যাঁ/না)	মোবাইলঃ (হ্যাঁ/না)	কেরোসিন চুলাঃ (হ্যাঁ/না)	গ্যাসের চুলাঃ (হ্যাঁ/না)	ফ্যানঃ (হ্যাঁ/না)

ট্রাক্টরঃ (হ্যাঁ/না)	গাড়িঃ (হ্যাঁ/না)	মোটরসাইকেলঃ (হ্যাঁ/না)	বাইসাইকেলঃ (হ্যাঁ/না)	রেফ্রিজারেটরঃ (হ্যাঁ/না)

উল্লেখযোগ্য অন্যান্যঃ	

৬) পেশা এবং আয়ের বিবরণীঃ

পেশার শ্রেণী:	কৃষিকাজ	পশুপালন	ব্যাবসা	জেলে	চাকরি (সরকারি/বেসরকারি)	গৃহস্থালির কাজ	আত্ম নির্ভরশীল	পণ্য উৎপাদন	অন্যান্য

পেশার ধরনঃ	কৃষি শ্রমিক	স্বনির্ভর খামারি	স্বনির্ভর কিন্তু খামারি নয়	বেতনপ্রাপ্ত

মাসিক আয় (টাকা)	৫০০০/- এর নিচে	৫০০০-১০০০০/-	১০,০০০-২০,০০০/-	২০,০০০/- এর উপর

পরিবেশের সম্পৃক্তি

৭) প্রকল্প সম্পর্কে ধারণাঃ

প্রকল্প সম্পর্কে ধারনা?	
কোন ঐতিহাসিক স্থাপনা আশেপাশে আছে কি?	
মাছ ধরার ক্ষেত্রে কি ধরনের সমস্যা হতে পারে?	
পরিবেশগত কি ধরনের সমস্যা হতে পারে?	
গো-চারণের কোন অসুবিধা হবে কিনা?	
প্রকল্প থেকে কি আশা করা যায়?	

৮) চিহ্নিতকরণ (১ থেকে ৫ এর মধ্যে)

অত্যন্ত গুরুত্বপুরন-৫, বেশ গুরুত্বপূর্ণ-৪, নিরপেক্ষ-৩, খুব গুরুত্বপূর্ণ নয়-২, একদমই গুরুত্বপূর্ণ নয়-১

শিক্ষা প্রতিষ্ঠান			স্বাস্থ্যকেন্দ্র	
গুরুত্বপূর্ণ স্থাপনা (রাস্তা, বিদ্যুৎ ইত্যাদি)			কাজে নিয়োগ	
পানি সরবরাহ			পরিবহন ব্যবস্থা	
দক্ষতার উন্নয়ন			নারীর ক্ষমতায়ন (প্রশিক্ষণ, চাকরি, স্বাস্থ্য সুবিধা, শিক্ষা ইত্যাদি)	
কৃষির উন্নয়ন			বিনোদন সুবিধা	
অন্যান্য (উল্লেখ করুন):		মন্তব্যঃ		

Questionnaire for Local Government Representatives and NGOs

I. GENERAL PROFILE OF AREA

1.	Village and Upazila			
	Union			
	District			
2.	Total Population in area			
	Male (%)			
	Female (%)			
3.	Ethnic Group (% of families in area)			
4.	Religion (% as followed by population of the area)			
5.	Literacy Level (% of literate, male& female & illiterate)			
6.	Main Occupation (primary, secondary, tertiary)in area	Primary:	Secondary:	Tertiary:
7.	Livestock Details (average % of livestocks owned & variety)			
8.	Monthly Family Income (average income as per occupation wise)			
9.	Government Schemes (available in the area)			
10.	NGOs working in the area & type of work undertaken			
11.	Number of Fishermen in the area			

II. INFORMATION RELATING TO AMENITIES PRESENT

TYPES OF FACILITIES	Y/N	NO. OF FACILITIES
EDUCATION: a. Schools • Primary • Middle • Secondary • Senior Secondary b. College c. Technical Institutes d. Vocation Training Centres e. Medical Schools f. University		
Teacher- Student Ratio: **Others:**		

TYPES OF FACILITIES	Y/N	NO. OF FACILITIES
HEALTH CENTRES: a. Hospital b. Primary Health Centres c. Pharmacies d. Private Nursing Homes e. Maternity Hospitals f. Veterinary Hospitals		
Common Diseases in the Area:		
OTHER AMENITIES: a. Drinking Water b. Sanitation Facilities c. Electricity Supply d. Irrigation Facilities e. Transport Facilities (rail connectivity, bus services) f. Road Condition g. Post Office h. Telecommunication i. Banks		

III. GENDER PROFILE IN THE AREA

S. No.	QUESTIONS	REMARKS
1.	What provisions are present specific to women? Specific to Govt. Schemes	
2.	What pattern of employment is prevalent among women?	
3.	Do the men go out of the area for employment purpose?	
4.	Medical problems are prevalent among women	
5.	Are there vocational centers catering to women?	

IV. INFORMATION RELATING TO THE PROJECT

S. No.	QUESTIONS	REMARKS
1.	Are you aware of the project in the area?	
3.	Are there any cultural heritage/ archaeological sites near the project area?	
4.	Are there any other development projects in the adjoining area? Nature of the project.	

5.	Has the land prices gone up in the area?	
5.	Do you anticipate any risks associated with the project's operation?	
7.	Benefit/Expectation from the Project	
8.	Any other remarks/observations	

V. NEEDS ASSESSMENT (Prioritize the areas that need improvement, on a scale from 1 to 10; 1 being the lowest) FOR FUTURE DEVELOPMENT

S.N	Areas	Scale (1-10)	Remarks
1	Education		
2	Healthcare		
3	Infrastructure • Roads • Sanitation		
4	Skill Development		
5	Women Empowerment		
6	Water Supply		
7	Power Availability		
8	Agricultural Development		
9	Any Other		

DATE:

NOTES:

Annexure- 19

Details of Workforce

Construction Phase (EPC Contractor)

Engineers & Managers

Function	Requirement	Site	HQ
Chief Project Director	1	1	-
Project Management & Control	5	3	2
Project Engineering	24	14	10
CPG (At site)	4	4	-
Construction Group			
Power Block			
Mech	5	5	-
Elect & C&I	5	5	-
Civil	6	6	-
BOP Systems			-
Mech	4	4	-
Elect & C&I	4	4	-
Civil	3	3	-
Material Management			-
Stores & Material Mgmt	3	3	-
Logistics/ Custom Clearance	1	1	-
Support Services – HR, admin, Legal, Security	12	12	-
Field Safety	1	1	-
Site Contracts & Commercial	4	4	-
TOTAL	**82**	**70**	**12**

Skilled /Unskilled

Function	Requirement	Site	HQ
Mechanical Erection-GT/ST	200	200	-
Mechanical Erection-HRSG	350	350	-
Civil	900	900	-
GIS	20	20	-
BOP Electrical	175	175	-
400 KV cabling	15	15	-
Canteen	10	10	-
Drivers	5	5	-
Gardning	5	5	-
House keeping	6	6	-
Security	25	25	-
Construction Power	6	6	-
Construction Water	4	4	-
Medical	2	2	-
Total	**1,723**	**1,723**	

Total	**1,805**	**1,793**	**12**

Operation Phase

#	Department	SMC (A7-A8)	MMC (A4-A6)	JMC (A1-A3)	Skilled	Non Skilled	Total
1	Business	1	1	1	-	-	**3**
2	Legal	-	1	1	-	-	**2**
3	HR & Admin	-	1	2	-	-	**3**
4	CEO Cell	-	1	1	-	-	**2**
5	Finance & Accounts	-	1	5	-	-	**6**
6	Operations	1	5	10	-	-	**16**
7	Chemistry	-	-	5	5	-	**10**
8	Control & Instrumentation	1	2	6	10	2	**21**
9	Electrical	1	2	5	15	2	**25**
10	Mechanical	1	2	8	20	2	**33**
11	Technical Services	1	1	2	-	-	**4**
12	House Keeping	-	-	-	-	10	**10**
13	Green Belt	-	-	-	-	10	**10**
14	Material Handling	-	-	-	1	4	**5**
15	Office Assistant	-	-	-	-	5	**5**
16	Drivers	-	-	-	3	-	**3**
17	**Total**	**6**	**17**	**46**	**54**	**35**	**158**

#	Category	Total
1	Contracted - Non Technical	35
2	Contracted – Technical	54
3	Junior Management (JM)	46
4	Middle Management (MM)	17
5	Senior Management (SM)	6
6	Top Management (TM)	2
7	**Grand Total**	**160**

Annexure- 20

Interlink between ADB SPS guideline and ESIA report

Appendix No.	Under the Heading of ADB SPS 2009		Page No. of ADB Policy Document	Submitted ESIA		
				Chapter No.	Name of the Chapter	Page No.
1	Introduction		30	1	Introduction	1-1
	Objective		30			1-4
	Scope of Application		30			1-5
	Requirements	Environmental Assessment	30	4	Description of The Environment (Baseline Data)	4-1
		Monitoring and Reporting	34			4-4
		Information Disclosure	33	10	Information Disclosure, Consultation, and Participation	10-2
		Consultation and Participation	33			10-3
		Grievance Redress Mechanism	33	11	Grievance Redress Mechanism	11-1
		Environmental Planning and Management	31	7	Environmental Management Plan	7-1
		Unanticipated Environmental Impacts	34	6	Anticipated Environmental Impacts and Mitigation Measures	6-1
		Biodiversity Conservation and Sustainable Natural Resource Management	34	4	Description of The Environment (Baseline Data)	4-42
		Pollution Prevention and Abatement	35	7	Environmental Management Plan	7-2
		Health and Safety	38	6	Anticipated Environmental Impacts and Mitigation Measures	6-11
		Physical Cultural Resources	39	4	Description of The Environment (Baseline Data)	4-53
	ESIA Report Structure	Executive Summary	41	-	Executive Summary	xvii
		Policy, Legal, and Administrative Framework		3	Policy, Legal, and Administrative Framework	3-1
		Description of the Project		2	Description of The Project	2-1
		Description of the Environment (Baseline Data)		4	Description of The Environment (Baseline Data)	4-1
		Anticipated Environmental Impacts and Mitigation Measures		6	Anticipated Environmental Impacts and Mitigation Measures	6-1
		Analysis of Alternatives		9	Environmental	9-1

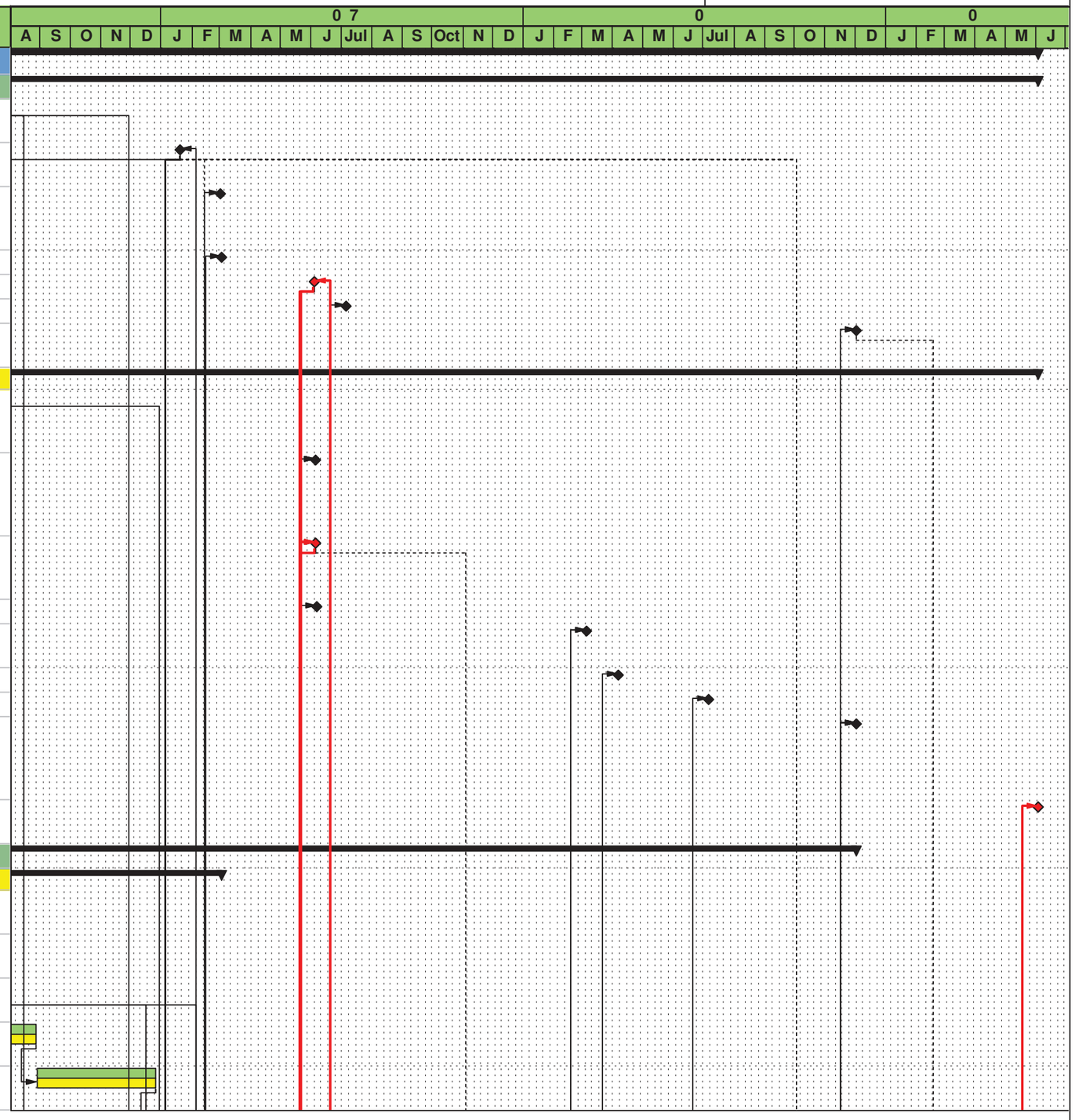
Annexure- 21

Project Schedule (Phase I)

Schedule of Activities for Bangladesh Phase I Development

(With Samalkot Equipment)

Activity ID	Activity Name	Duration Days	Start	Finish	Predecessors
Mechanical Phase- 750 MW		1434	01-Mar-15 A	03-Jun-19	
Milestones		1129	27-Mar-16 A	03-Jun-19	
MS00100	In Principle approval from GoB	0		27-Mar-16 A	BD00014
MS00105	Signing of definitive agreements	0		20-Jan-17	BD00065
MS00115	Award of FSRU/ FSU and Related Infra EPC contract	0		01-Mar-17	A1004620
MS00116	Award of LNG contract	0		03-Mar-17	FS004000
MS00125	Financial Closure	0		04-Jun-17	BD00690
MS00126	Start of construction	0	06-Jul-17		C110165
MS00145	FSRU Ready -Gas at site	0		02-Dec-18	FS004020, FS003080
EPC Milestones		1039	17-May-16 A	03-Jun-19	
MS00102	NTP for Studies (after In principle approval from GoB)	0	17-May-16 A		MS00100
MS00110	NTP to start of EWP Work	0	05-Jun-17		BD01510, BD00065, BD00800, MS00125
MS00130	NTP to start of Main Plant Work (After Financial Closure)	0	05-Jun-17		BD00870, BD00690, MS00125
MS00135	Award of Civil work	0	06-Jun-17		C110090
MS00160	Start of GTG erection	0	05-Mar-18		C110190, C100440
MS00180	Start of HRSG erection	0	06-Apr-18		C110210
MS00200	Start of STG erection	0	06-Jul-18		C110230
MS00220	Open Cycle Commissioning	0		02-Dec-18	C101080, BD01410, BD01430, BD01450
MS00240	Combined Cycle commissioning	0		03-Jun-19	C101100
Business Activities		1251	31-Mar-15 A	02-Dec-18	
Project Arrival		611	31-Mar-15 A	02-Mar-17	
BD00010	Technical commitee report to MOP	215	31-Mar-15 A	16-Mar-16 A	
BD00012	MOP recomendation to Cabinet	60	16-Mar-16 A	24-Mar-16 A	BD00010
BD00014	In Principal approval from Cabinet	15	25-Mar-16 A	28-Mar-16 A	BD00012
BD00034	Submission of CCPP Agreements	30	30-Jul-16	28-Aug-16	
BD00054	Discussion of CCPP Agreements	120	29-Aug-16	26-Dec-16	BD00034

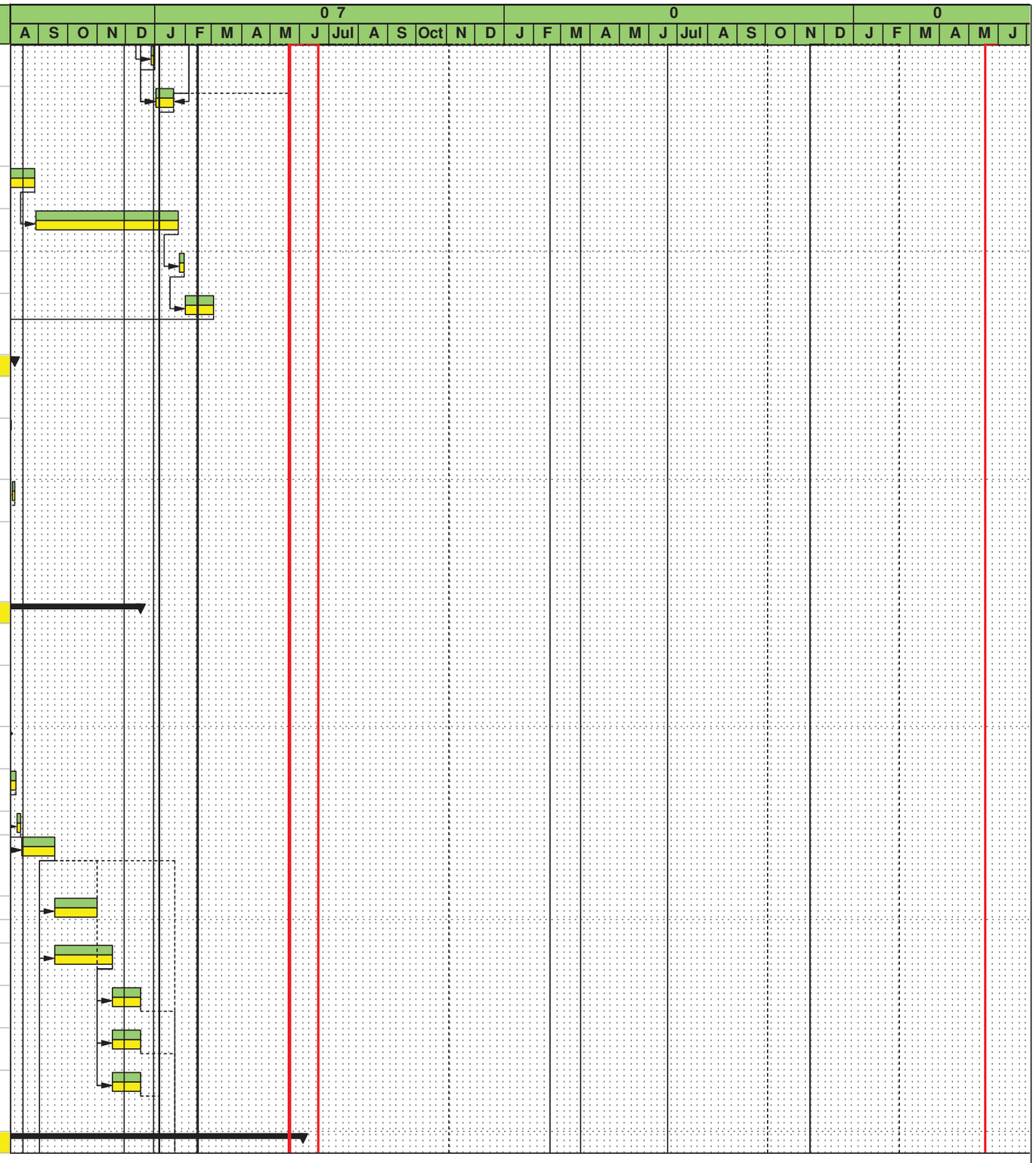


Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

Activity ID	Activity Name	Duration Days	Start	Finish	Predecessors
BD00055	Power Tariff Negotiations	5	27-Dec-16	31-Dec-16	BD00054
BD00065	Signing of Project Agreements with BPDB and other stake holders	20	01-Jan-17	20-Jan-17	BD00014, BD00014, BD00054, BD00055
BD00073	Submission of LNG Terminal Agreements	30	30-Jul-16	28-Aug-16	
BD00074	Discussion of LNG Terminal Agreements	150	29-Aug-16	25-Jan-17	BD00073
BD00094	Re-gas Tariff Negotiations	6	26-Jan-17	31-Jan-17	BD00074
BD00134	Signing of Project Agreements – LNG Terminal	30	01-Feb-17	02-Mar-17	BD00094
Company Incorporation at Dubai		404	01-Feb-16 A	07-Aug-16	
BD00130	Appointment of Consultant	12	01-Feb-16 A	16-Apr-16 A	
BD00150	Document Preparation(Including MoA, AoA, Forms etc.)	14	16-Apr-16 A	03-Aug-16	BD00130
BD00170	Registration of Company In Dubai	4	04-Aug-16	07-Aug-16	BD00150
BD00190	Opening of Bank Account in Dubai and Issue of share certificates	0	30-Jun-16 A		
Company Incorporation at Bangladesh		535	01-Feb-16 A	16-Dec-16	
BD00050	Appointment of Consultant	12	01-Feb-16 A	15-Apr-16 A	
BD00070	Document Preparation (Including MoA, AoA, Forms etc.)	5	01-Feb-16 A	21-Mar-16 A	
BD00075	Opening of Temp. Bank Account in Bangladesh	0		30-Jul-16	
BD00080	Transfer of Equity from Reliance UAE	10	30-Jul-16	08-Aug-16	BD00075, BD00190
BD00085	Statutory fee Payment	5	09-Aug-16	13-Aug-16	BD00080
BD00090	Registration of Company in Bangladesh	35	14-Aug-16	17-Sep-16	BD00070, BD00170, BD00085
BD00100	Trade License	45	18-Sep-16	01-Nov-16	BD00090
BD00120	TIN Registration	1	30-Jul-16	30-Jul-16	
BD00121	Permanent Account Opening	60	18-Sep-16	16-Nov-16	BD00090
BD00210	VAT Certification	30	17-Nov-16	16-Dec-16	BD00090, BD00121
BD00230	Service Tax Certification	30	17-Nov-16	16-Dec-16	BD00090, BD00121
BD00235	Investment License from Board of Investment	30	17-Nov-16	16-Dec-16	BD00090, BD00121
Financial closure		705	01-Jan-16 A	04-Jun-17	

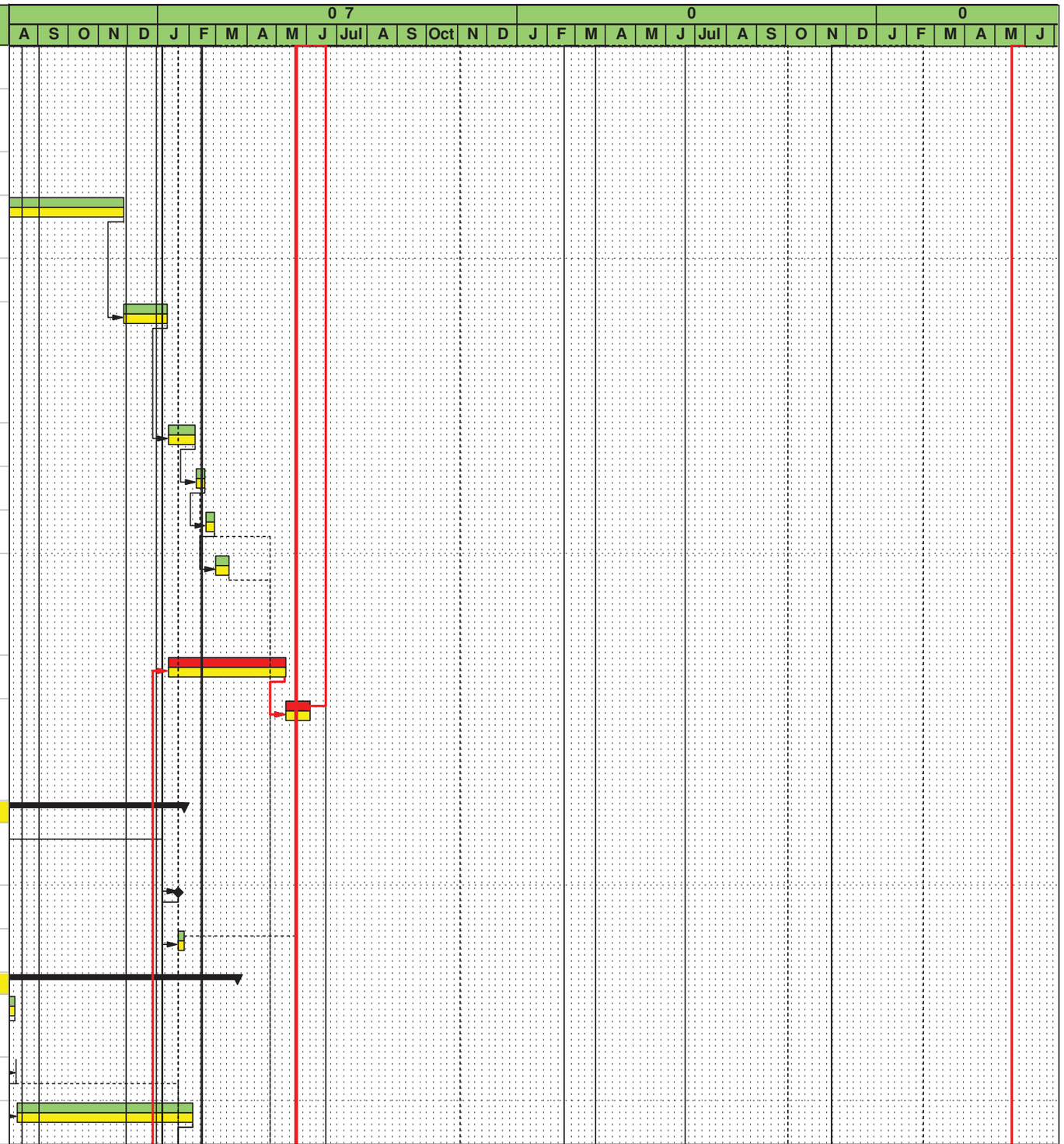


Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

Activity ID	Activity Name	Duration Days	Start	Finish	Predecessors
BD00470	Preparation of Cost Economics	46	01-Jan-16 A	31-Mar-16 A	
BD00490	Preparation of Information Memorandum	60	01-Jan-16 A	31-Mar-16 A	
BD00510	Initial approach to Lenders	31	01-Apr-16 A	30-Jul-16 A	BD00470, BD00490
BD00550	Negotiation with Lenders on Financing terms	120	30-Jul-16	26-Nov-16	BD00510
BD00570	Initial due deligence by lenders	1	30-Jul-16	30-Jul-16	
BD00590	Short listing & Finalization of consultants by Lender (Engineering, Financial, Insurance, Environmental)	45	27-Nov-16	10-Jan-17	BD00550
BD00610	Initial investigation by consultants	28	11-Jan-17	07-Feb-17	BD00590
BD00630	Preparation of reports by consultants	10	08-Feb-17	17-Feb-17	BD00610
BD00650	Review of reports by lender	10	18-Feb-17	27-Feb-17	BD00630
BD00655	Creation of security interests in favour of the Lenders in the Project Company's bank accounts	14	28-Feb-17	13-Mar-17	BD00630, BD00650
BD00660	EIA Disclosure Period	120	11-Jan-17	10-May-17	BD00807, A1004720
BD00690	Documentation- Financial Closure achieved	25	11-May-17	04-Jun-17	BD00650, FS004000, BD00655, FS003060, BD00660
Land Acquisition		256	17-May-16 A	27-Jan-17	
BD01470	Consent from BPDB for conduction of Studies & investigation	0	17-May-16 A		MS00102
BD01490	Signing of Land lease Agrrement	0	21-Jan-17		BD00065, BD01470
BD01510	Physical possesion of Land	7	21-Jan-17	27-Jan-17	BD01490
Re-export related activities		236	30-Jul-16	22-Mar-17	
BD00705	Preparation of all applications (SC/RBI/Customs)	10	30-Jul-16	08-Aug-16	
BD00710	Application to Supreme Court for Re-Export	1	09-Aug-16	09-Aug-16	BD00705, MS00100
BD00715	Clearance from Supreme court	180	10-Aug-16	05-Feb-17	BD00710

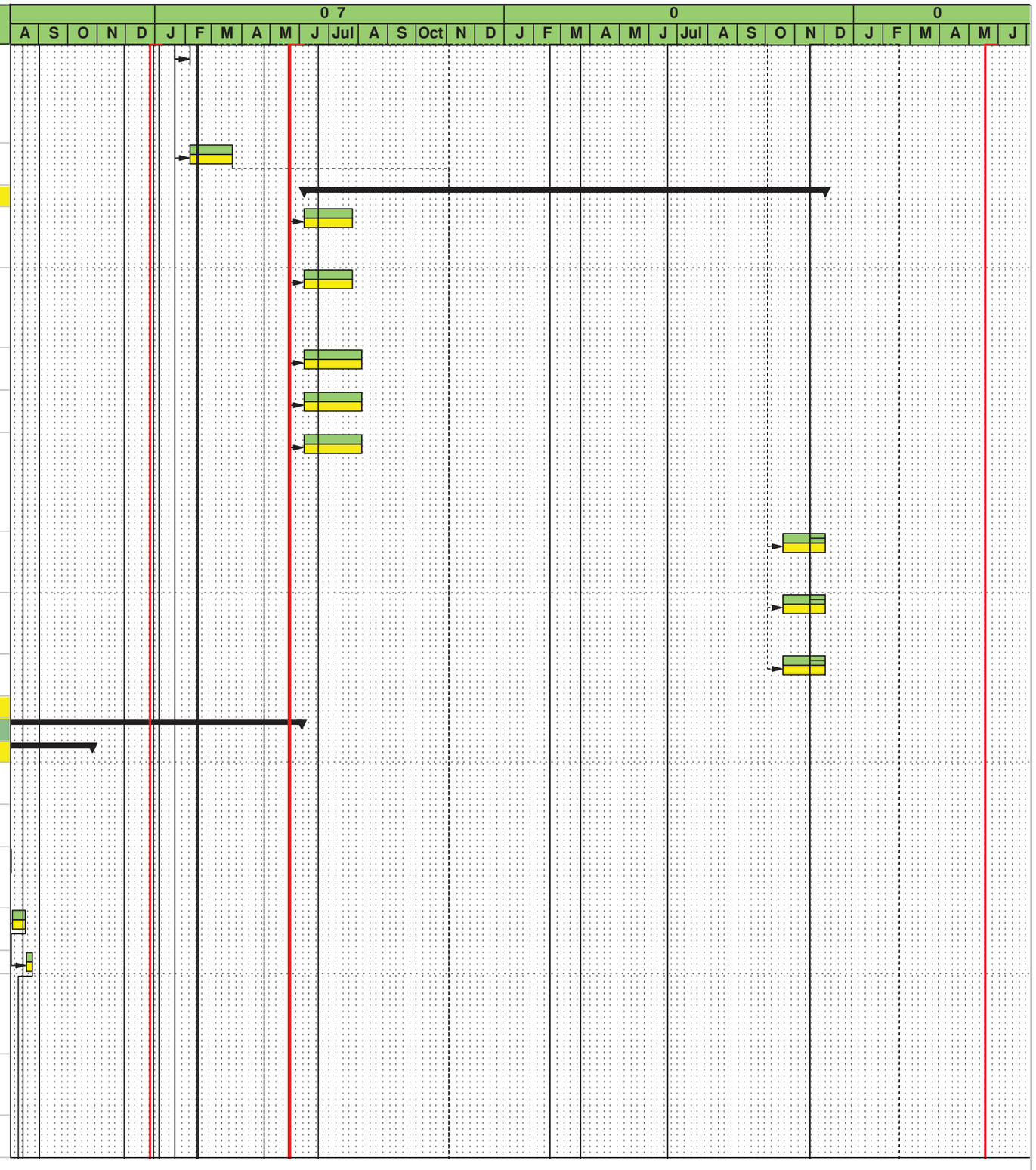


Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

Activity ID	Activity Name	Duration Days	Start	Finish	Predecessors
BD00730	Application to RBI & customs for Re-Export	1	06-Feb-17	06-Feb-17	BD00710, BD00090, BD00210, BD00230, BD00715
BD00770	Approval from Customs & RBI	45	06-Feb-17	22-Mar-17	BD00715
Alarsa ter FC -Other arals		546	05-Jun-17	02-Dec-18	
BD01310	Approval of installations for boilers at the Facility	51	05-Jun-17	25-Jul-17	MS00125
BD01330	"Certificate of Registration" of Facility under Factories Act, 1965	51	05-Jun-17	25-Jul-17	MS00125
BD01350	License for storage of petroleum products	61	05-Jun-17	04-Aug-17	MS00125
BD01370	Arms License – Security	61	05-Jun-17	04-Aug-17	MS00125
BD01390	Permission for transporting chemicals, toxic wastes and hazardous materials on land and water routes	61	05-Jun-17	04-Aug-17	MS00125
BD01410	Commission start-up and operate the Facility in compliance with EIA	45	19-Oct-18	02-Dec-18	MS00105
BD01430	Approval as satisfying fire safety and protection standards	45	19-Oct-18	02-Dec-18	MS00105
BD01450	Permission for storage of sulphuric acid at Site	45	19-Oct-18	02-Dec-18	MS00105
Gas Pipeline From Mehsana att Kutumbur		0			
Award EPC Contract		562	11-Apr-16 A	02-Jun-17	
Turnkey EPC for CCPP		343	11-Apr-16 A	27-Oct-16	
TE00010	Pre qualification notice	0	11-Apr-16 A		
TE00030	Receipt of EOI application	0	30-Jul-16*	30-Jul-16	TE00010
TE00050	Evaluation of EOI application & issue of RFP	5	30-Jul-16	03-Aug-16	TE00030
TE00070	Receipt of query on RFP	15	04-Aug-16	18-Aug-16	TE00050
TE00090	Pre-bid conference	7	19-Aug-16	25-Aug-16	TE00070
TE00095	Replies to bidders' queries and Issuance of Final Amendments to RFP	1	30-Jul-16	30-Jul-16	
TE00100	Receipt of Techno-Commercial and Price Bids	1	30-Jul-16	30-Jul-16	
TE00110	Technical Discussion with bidders	1	30-Jul-16	30-Jul-16	

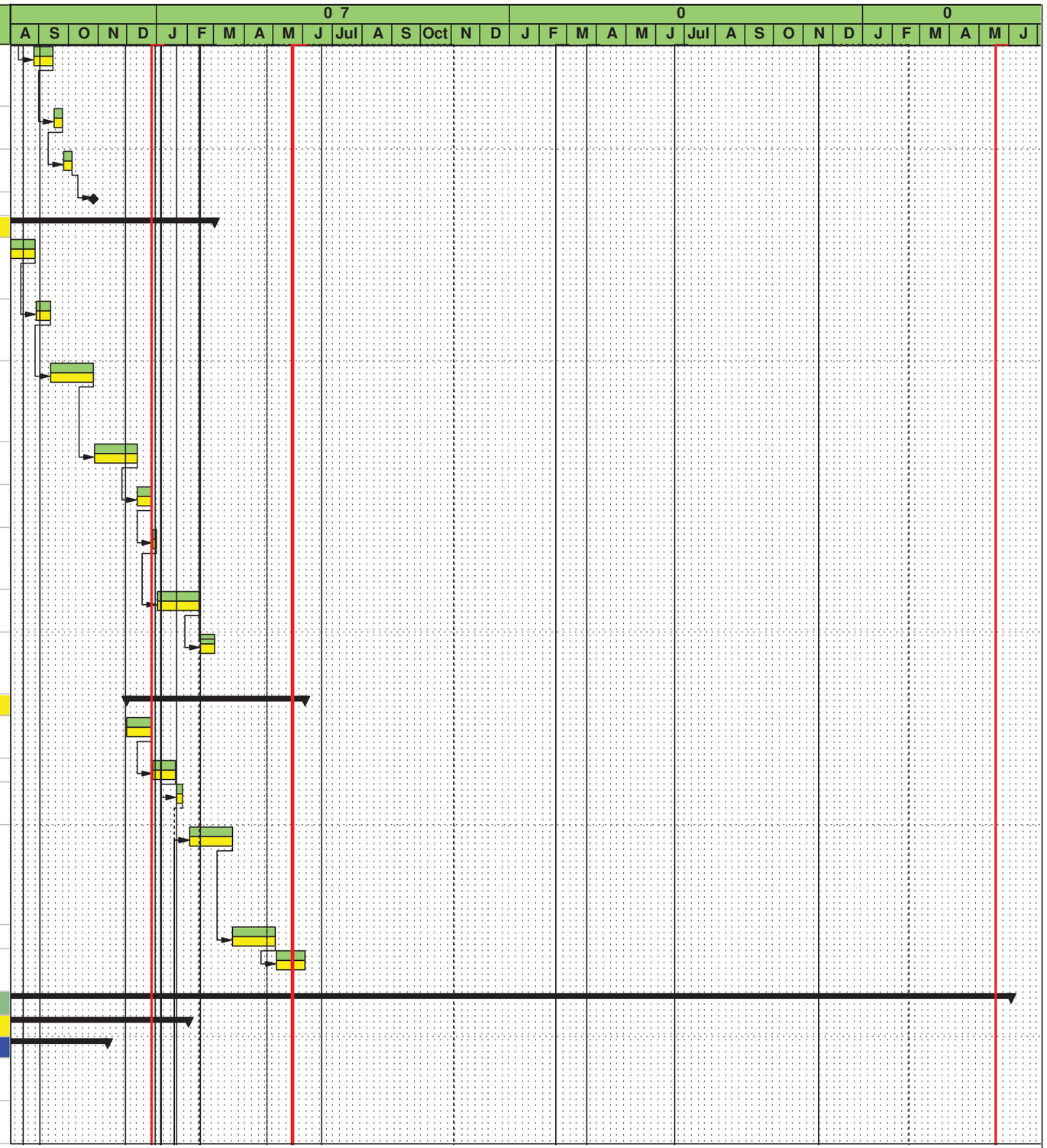


Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

Acti it ID	Acti it Name	Durati n Da s	Start	Finis	Predecess rs
TE00120	Issue of final amendment & receipt of bid	21	26-Aug-16	15-Sep-16	TE00090
TE00130	Clearance from Finance & Buisness	10	16-Sep-16	25-Sep-16	TE00120
TE00150	Clearance from management	10	26-Sep-16	05-Oct-16	TE00130
TE00170	Award of Work	0	27-Oct-16*		TE00150
FSU C arter A reement		215	30-Jul-16	01-Mar-17	
A1004480	Floating of EOI & Indicative offer submission	30	30-Jul-16	28-Aug-16	
A1004500	Short listing of Bidders & Pre-Bid Meeting at Delhi	15	29-Aug-16	12-Sep-16	A1004480
A1004520	Tender Package preparation and Floating of RFP for Firm Offer	45	13-Sep-16	27-Oct-16	A1004500
A1004540	Techno-Commercial & Price Bid Submission	45	28-Oct-16	11-Dec-16	A1004520
A1004560	Firm Offer Negotiation and Contract Award	15	12-Dec-16	26-Dec-16	A1004540
A1004580	Tender Package preparation for FSU and re-floating of RFP	5	27-Dec-16	31-Dec-16	A1004560
A1004600	Techno-Commercial & Price Bid Submission	45	01-Jan-17	14-Feb-17	A1004580
A1004620	Firm Offer Negotiation and Contract Award for FSU	15	15-Feb-17	01-Mar-17	A1004600
P C A ard	**r LNG Terminal In rastructure**	184	01-Dec-16	02-Jun-17	
A1004750	RFP preparation & Floating	26	01-Dec-16*	26-Dec-16	
A1004755	Bid Submission	25	27-Dec-16	20-Jan-17	A1004750
A1004765	Bid Evaluation & Award of Contract	7	21-Jan-17	27-Jan-17	A1004755
A1004780	RFP preparation & Floating (including detailed design by PMC)	45	03-Feb-17	19-Mar-17	A1004765, A1004900, A1004920, A1004940, A1004960
A1004800	Bid Submission	45	20-Mar-17	03-May-17	A1004780
A1004820	Bid Evaluation & Award of Contract	30	04-May-17	02-Jun-17	A1004800
EPC Acti ities		1434	01-Jul-15 A	03-Jun-19	
Tec nical Studies		583	01-Jul-15 A	02-Feb-17	
CCPP Related Studies		516	01-Jul-15 A	10-Nov-16	
A100402	Ordering of studies	90	01-Jul-15 A	28-Sep-15 A	
A100404	Revalidation of Orders	0	21-May-16 A		A100402

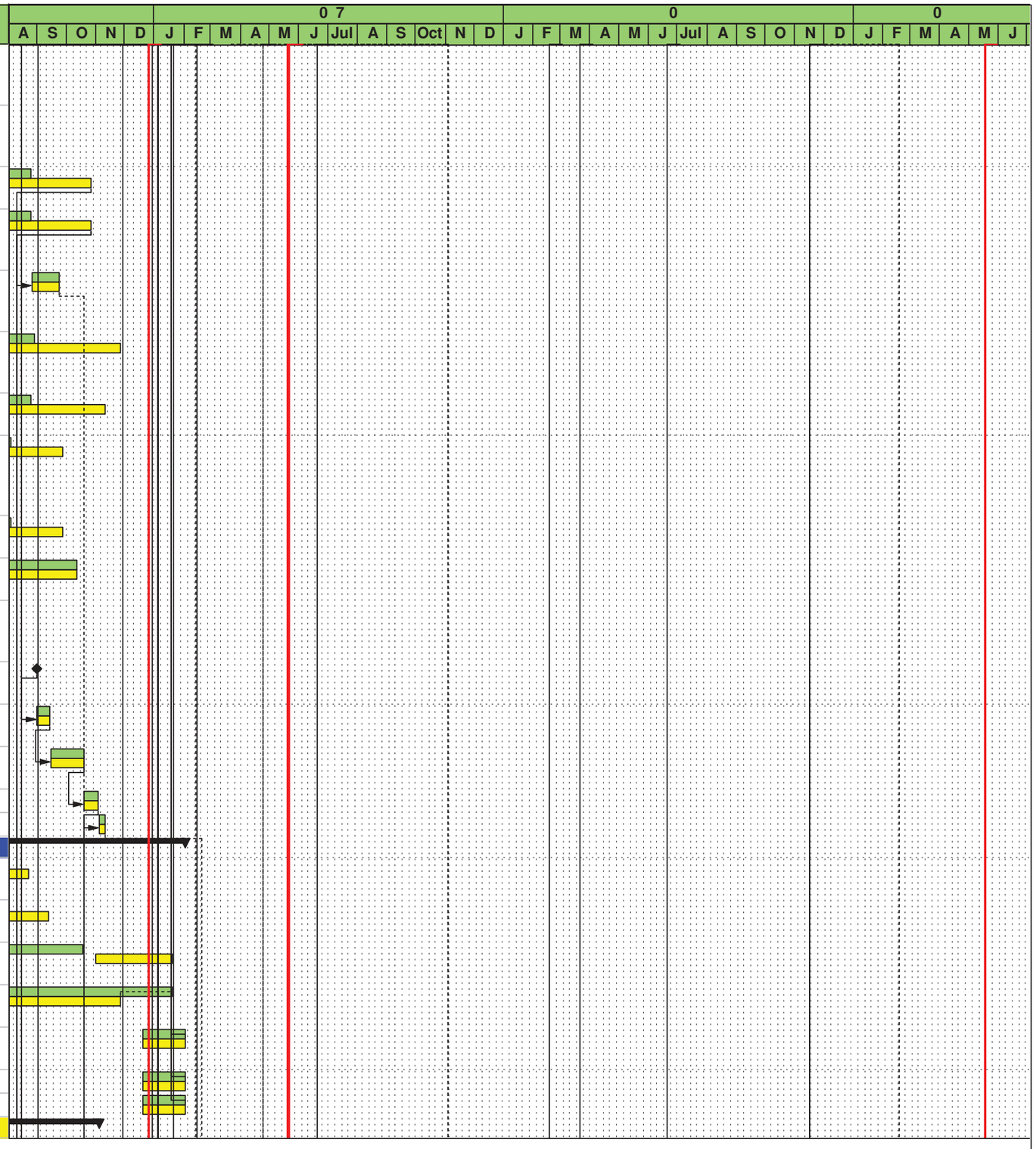


Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

Acti it ID	Acti it Name	Durati n Da s	Start	Finis	Predecess rs
A100405	Ordering of Environnemental Studies CCPP	0	25-May-16 A		
A100409	NTP For Studies and Investigation	0	17-May-16 A		MS00102, A100404, A100405
A101400	Topographic Survey	90	17-May-16 A	25-Aug-16	MS00102
A101500	Geotechnical Investigations - Draft Report	90	21-May-16 A	25-Aug-16	MS00102
A101505	Geotechnical Investigations - Final Report	30	26-Aug-16	24-Sep-16	A101500
A101600	Area Drainage & Safe Grade Elevation Study	121	17-May-16 A	29-Aug-16	MS00102
A101700	Site Specific Seismic Studies	105	17-May-16 A	25-Aug-16	MS00102
A101800	Sweet Water Availability, Intake outfall location study & Source sustainability.	60	17-May-16 A	04-Aug-16	MS00102
A101900	Construction Material Sourcing study	60	17-May-16 A	04-Aug-16	MS00102
A102000	Concrete Mix design study	75	30-Jul-16	12-Oct-16	MS00102
A102040	Logistic Study for equipment transportation	60	15-Nov-15 A	30-Dec-15 A	A100402
B101520	Ordering of Testing of Piles	0	31-Aug-16*		
C110100	Mobilisation with Piling rigs	15	31-Aug-16	14-Sep-16	B101520
C110120	Piling of Test Piles + strengthning	35	15-Sep-16	19-Oct-16	C110100
C110150	Testing of Piles	15	20-Oct-16	03-Nov-16	C110120
C110160	Final BOQ	7	04-Nov-16	10-Nov-16	C110150
LNG Terminal Related Studies		188	01-Dec-15 A	02-Feb-17	
A1004840	Metocean Desktop study	25	14-Jan-16 A	19-Feb-16 A	
A1004860	Detailed Feasibility Study - Part A	45	01-Dec-15 A	15-Jan-16 A	
A1004880	Detailed Feasibility Study - Part B	81	01-Nov-16 A	18-Oct-16	
A1004900	Metocean Study	120	01-Sep-16 A	20-Jan-17	
A1004920	Geo technical and Geo Physical Studies	45	20-Dec-16*	02-Feb-17	
A1004940	Bathymetry Study	45	20-Dec-16*	02-Feb-17	
A1004960	Pipeline Route survey	45	20-Dec-16*	02-Feb-17	
C nsultanc		492	01-Jul-15 A	04-Nov-16	

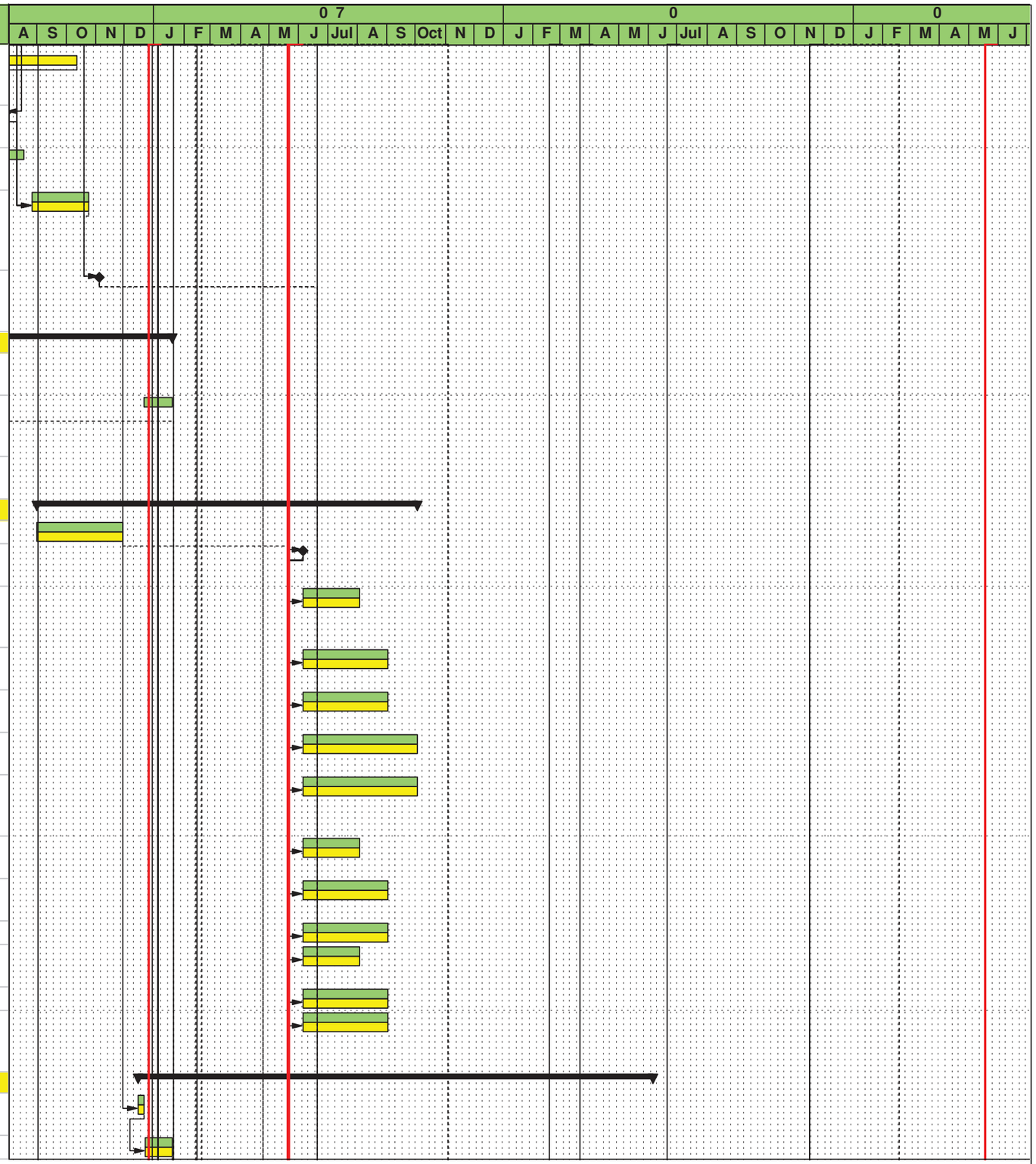


Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

Activity ID	Activity Name	Duration Days	Start	Finish	Predecessors
A1004402	Civil Consultancy Services-Ordering up to E-Aucton	180	01-Jul-15 A	27-Dec-15 A	
A1004407	Ordering of Civil Consultancy Services	0	30-Jul-16 A		A1004402, MS00100
A1004408	Consultancy services for Power block - Mech	270	01-Jul-15 A	18-Aug-16	MS00100
A102720	Civil Order - Validation of Design, based on Geotechnical Studies and finalise BOQ	60	26-Aug-16	24-Oct-16	A101400, A101500, A1004407
A102722	Start of release of Civil drawing	0	04-Nov-16		A101505, A102720, C110150
OEM Inspection		326	01-Jul-15 A	20-Jan-17	
A1004428	CMI Inspection ordering	150	01-Jul-15 A	27-Nov-15 A	
A1004448	Ordering for Inspection & repair of ST Component at Works	215	01-Jul-15 A	20-Jan-17	MS00105
A1004468	Inspection of HRSG equipment	21	04-Feb-16 A	24-Feb-16 A	MS00102, A1004428
Site Enablin Works		397	01-Sep-16	02-Oct-17	
A100800	Ordering of EWP works	90	01-Sep-16*	29-Nov-16	
A103300	Mobilisation	0	05-Jun-17		A100800, MS00125
B100300	Site enabling internal Roads , Peripheri Roads	60	05-Jun-17	03-Aug-17	A103300
B100500	Approach Road from Jetty to site	90	05-Jun-17	02-Sep-17	A103300
B100600	Fencing / Boundary Wall	90	05-Jun-17	02-Sep-17	A103300
B100700	Site Construction office / Porta Cabins	120	05-Jun-17	02-Oct-17	A103300
B100800	Construction stores & Storage yard preparation.	120	05-Jun-17	02-Oct-17	A103300
B100900	Construction Power & Const Water	60	05-Jun-17	03-Aug-17	A103300
B101100	Strengthening of Existing roads	90	05-Jun-17	02-Sep-17	A103300
B101200	Weighbridge	90	05-Jun-17	02-Sep-17	A103300
B101300	Helipad & interlinking road	60	05-Jun-17	03-Aug-17	A103300
B101400	Fire-tender	90	05-Jun-17	02-Sep-17	A103300
B101500	Labour Colony Infrastructure Development	90	05-Jun-17	02-Sep-17	A103300
Ordering Civil Contract		538	15-Dec-16	05-Jun-18	
C110000	Floating of Tender with Draft BOQ	7	15-Dec-16*	21-Dec-16	MS00100
C110020	Receive bids	30	22-Dec-16*	20-Jan-17	C110000

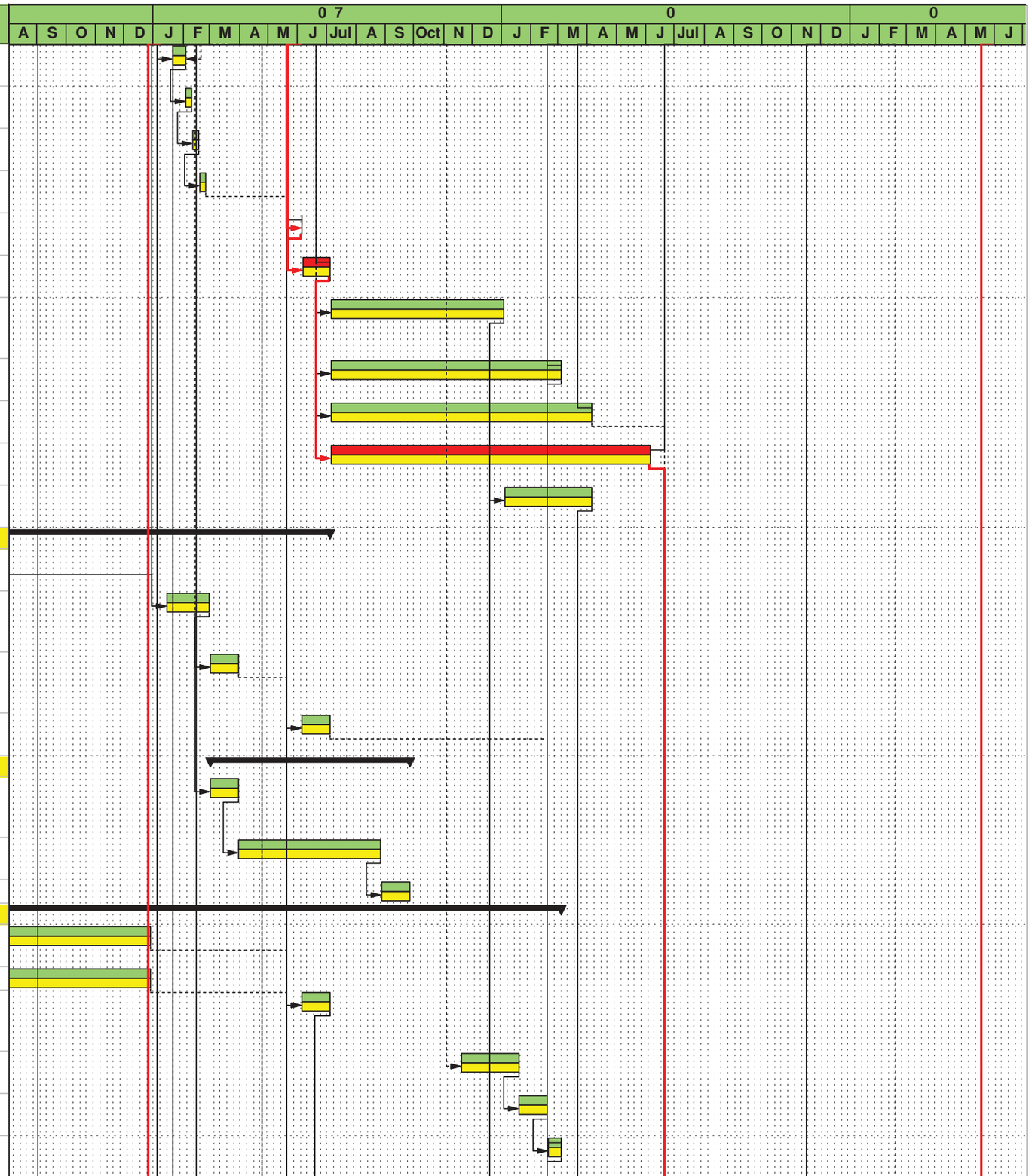


Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

Acti it ID	Acti it Name	Durati n Da s	Start	Finis	Predecess rs
C110040	TER with Final BOQ	14	21-Jan-17	03-Feb-17	C110020, C110160
C110060	Submission of Final bid after final BoQ	7	04-Feb-17	10-Feb-17	C110040
C110070	E- Auction & Negotiation with Vendor	7	11-Feb-17	17-Feb-17	C110060
C110080	Clearance from Finance & Buisness	7	18-Feb-17	24-Feb-17	C110070
C110090	Award of Civil work	1	05-Jun-17	05-Jun-17	MS00130, C110080
C110165	Mobilisation	30	06-Jun-17	05-Jul-17	C110090, MS00125
C110170	Civil works & release of PHB structure Foundation	182	06-Jul-17	03-Jan-18	A102722, C110165
C110190	Civil works & Release of GTG foundation 1&2	242	06-Jul-17	04-Mar-18	A102722, C110165
C110210	Release of HRSG foundation 1&2	274	06-Jul-17	05-Apr-18	A102722, C110165
C110230	Release of STG Deck-1	335	06-Jul-17	05-Jun-18	A102722, C110165
C110250	Erection of PHB structure	92	04-Jan-18	05-Apr-18	C110170
Restructurin C ntracts		735	01-Jul-15 A	04-Jul-17	
C100810	Finalise the contracts to be restructured	90	01-Jul-15 A	28-Sep-15 A	
C100830	Negotiation with Vendors for restructuring	45	15-Jan-17*	28-Feb-17	MS00102, C100810
C100840	Finalisation of Contracts with Existing contractors	30	01-Mar-17	30-Mar-17	C100830, MS00105
C101020	Mobilisation	30	05-Jun-17	04-Jul-17	MS00130, C100840
Orderin Ne C ntract it Clubbin		210	01-Mar-17	26-Sep-17	
C100940	Purchase requisition for Packages for New contracts	30	01-Mar-17	30-Mar-17	C100830
C100980	Ordering of New Contracts	150	31-Mar-17	27-Aug-17	C100940
C101000	Mobilisation	30	28-Aug-17	26-Sep-17	C100980
S i tin e ui ments r m Samal t		581	01-Aug-16	04-Mar-18	
C100200	Ordering for dismantling & Packaging	150	01-Aug-16*	28-Dec-16	MS00102
C100220	Ordering for Logistics	150	01-Aug-16*	28-Dec-16	MS00102
C100300	Mobilisation	30	05-Jun-17	04-Jul-17	MS00130, C100220, C100200
C100410	Packaging & Loading of GTG 1&2	60	20-Nov-17	18-Jan-18	BD00770, MS00130
C100420	Transportation to Bangladesh	30	19-Jan-18	17-Feb-18	C100410
C100440	Custom clearance & shifting to Site	15	18-Feb-18	04-Mar-18	C100420

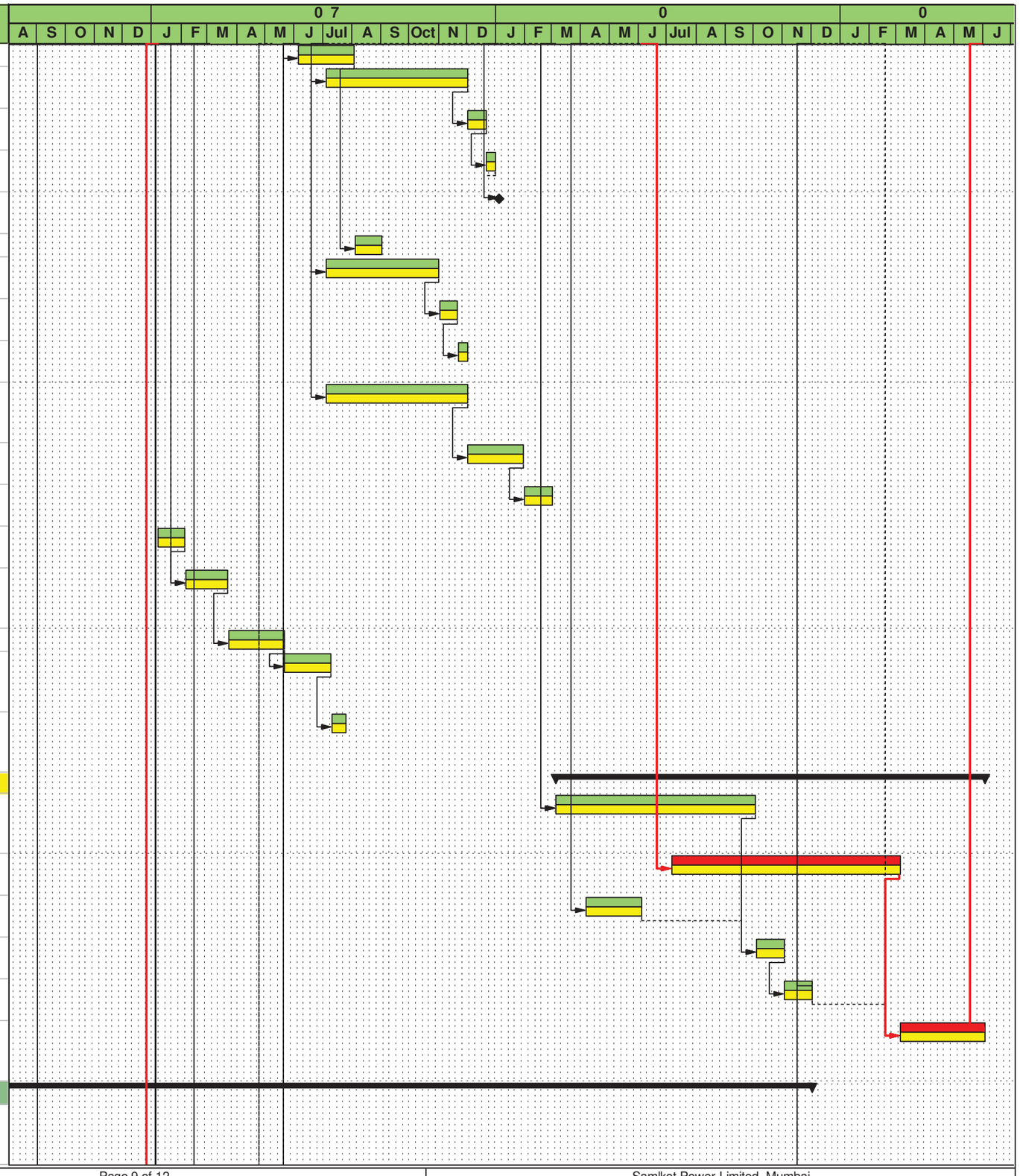


Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

Acti it ID	Acti it Name	Durati n Da s	Start	Finis	Predecess rs
C100460	Packaging & Loading	60	05-Jun-17	03-Aug-17	MS00130
C100500	Dismentaling of PHB Structures	150	05-Jul-17	01-Dec-17	C100300
C100520	Transportation to Bangladesh-1st Lot	20	02-Dec-17	21-Dec-17	C100500
C100540	Custom clearance & shifting to Site - 1st Lot	10	22-Dec-17	31-Dec-17	C100520
C100560	Start of PHB structure Erection	0	04-Jan-18		C100540, C110170
C100580	Transpotation of Port	30	04-Aug-17	02-Sep-17	C100460
C100600	Dismentaling of BOP equipments	120	05-Jul-17	01-Nov-17	C100300
C100620	Transportation to Bangladesh - 1st Lot	20	02-Nov-17	21-Nov-17	C100600
C100640	Custom clearance & shifting to Site-- 1st Lot	10	22-Nov-17	01-Dec-17	C100620
C100720	Dismentaling of Eleatrical & other equipments	150	05-Jul-17	01-Dec-17	C100300
C100740	Transportation to Bangladesh	60	02-Dec-17	30-Jan-18	C100720
C100760	Custom clearance & shifting to Site	30	31-Jan-18	01-Mar-18	C100740
C100855	Ordering for Logistics till GE works	30	07-Jan-17	05-Feb-17	
C100860	Transpotation of equipments required Inspection to GE works	45	06-Feb-17	22-Mar-17	C100855, BD00715, A1004448
C100880	Inspection & rectification	60	23-Mar-17	21-May-17	C100860
C100900	Transpotation of equipments back to Balgladesh port	50	22-May-17	10-Jul-17	C100880
C100920	Transpotation of equipment to site to Site (1st Lot)	15	11-Jul-17	25-Jul-17	C100900
Mec anical Erecti n		456	05-Mar-18	03-Jun-19	
C100960	Erection of GTG & Aux	213	05-Mar-18	03-Oct-18	C110190, C100440, C101020
C101040	Erection of STG , HRSG	243	06-Jul-18	05-Mar-19	C110210, C110230
C101060	Erection of Air Inlet plenem	60	06-Apr-18	04-Jun-18	C110250
C101070	Commisioning of Open Cycle - GTG-1	30	04-Oct-18	02-Nov-18	C100960, C101060
C101080	Commisioning of Open Cycle - GTG-2	30	03-Nov-18	02-Dec-18	C101070
C101100	Commissioning in Combined Cycle	90	06-Mar-19	03-Jun-19	C101040, C101080, MS00145
FSRU		1031	11-Nov-15 A	02-Dec-18	
FS000000	Metocean Desktop study (site screening, Data collection and Report)	120	24-Nov-15 A	29-Feb-16 A	

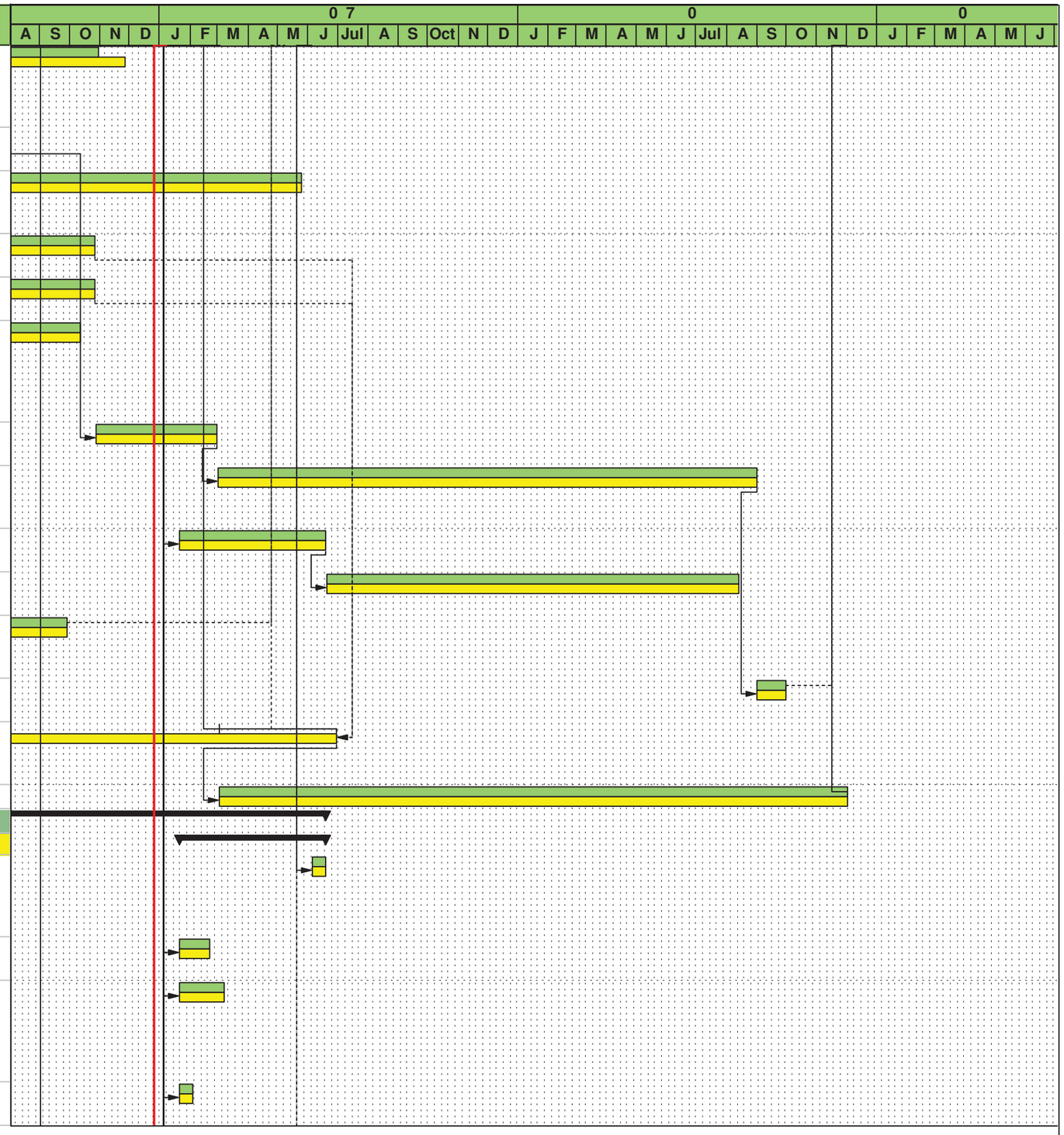


Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

Acti it ID	Acti it Name	Durati n Da s	Start	Finis	Predecess rs
FS000010	Site Specific Studies (Metocean Studies,Geo technical,Geo Physical,Bathymetry,Topography	120	25-Jul-16 A	31-Oct-16	FS000000
FS000020	Detailed Fesability study	120	30-Jan-16 A	30-Jul-16	MS00100
FS000060	RAPID EIA/EIA contracting, Report making and approval	300	30-Jul-16	25-May-17	FS000000
FS001000	Legal consultant/Firm hiring	90	30-Jul-16	27-Oct-16	MS00100
FS001020	Taxation consultant/Firm hiring	90	30-Jul-16	27-Oct-16	MS00100
FS002000	Other advanced Studies (Riser & Mooring analysis,Navigation simulation,HAZID & HAZOP study)	75	30-Jul-16	12-Oct-16	FS000020
FS002020	Feed study for Jetty/ Topside etc	124	28-Oct-16	28-Feb-17	FS000020
FS002040	Marine Facilities Development (order Placement & Execution)	549	01-Mar-17	31-Aug-18	FS002020
FS003020	Gas Pipeline work contract award	150	21-Jan-17	19-Jun-17	MS00105
FS003040	Execution work Gas Pipeline	420	20-Jun-17	13-Aug-18	FS003020
FS003060	Gas Transmission agreement (with GTCL/Petrobangla)	61	30-Jul-16	28-Sep-16	MS00100
FS003080	FSRU Deployment and Commisioning	30	01-Sep-18	30-Sep-18	FS002040
FS004000	LNG Sourcing contract signing	365	11-Nov-15 A	03-Mar-17	FS001000, FS001020, BD00134
FS004020	LNG Supply at Site	640	03-Mar-17	02-Dec-18	FS004000
Statut r Clearances		325	30-Jul-16	19-Jun-17	
Ot er Clearance		150	21-Jan-17	19-Jun-17	
BD00890	Government Authorization for execution of Financing Documents	15	05-Jun-17	19-Jun-17	MS00125
BD00910	Generation License	31	21-Jan-17	20-Feb-17	BD00235, MS00105
BD00930	Govt. Authorization for installation, construction and operation of deep tube well at Site	46	21-Jan-17	07-Mar-17	BD00235, MS00105
BD00950	Approval for Import duty exemption	14	21-Jan-17	03-Feb-17	MS00105



Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

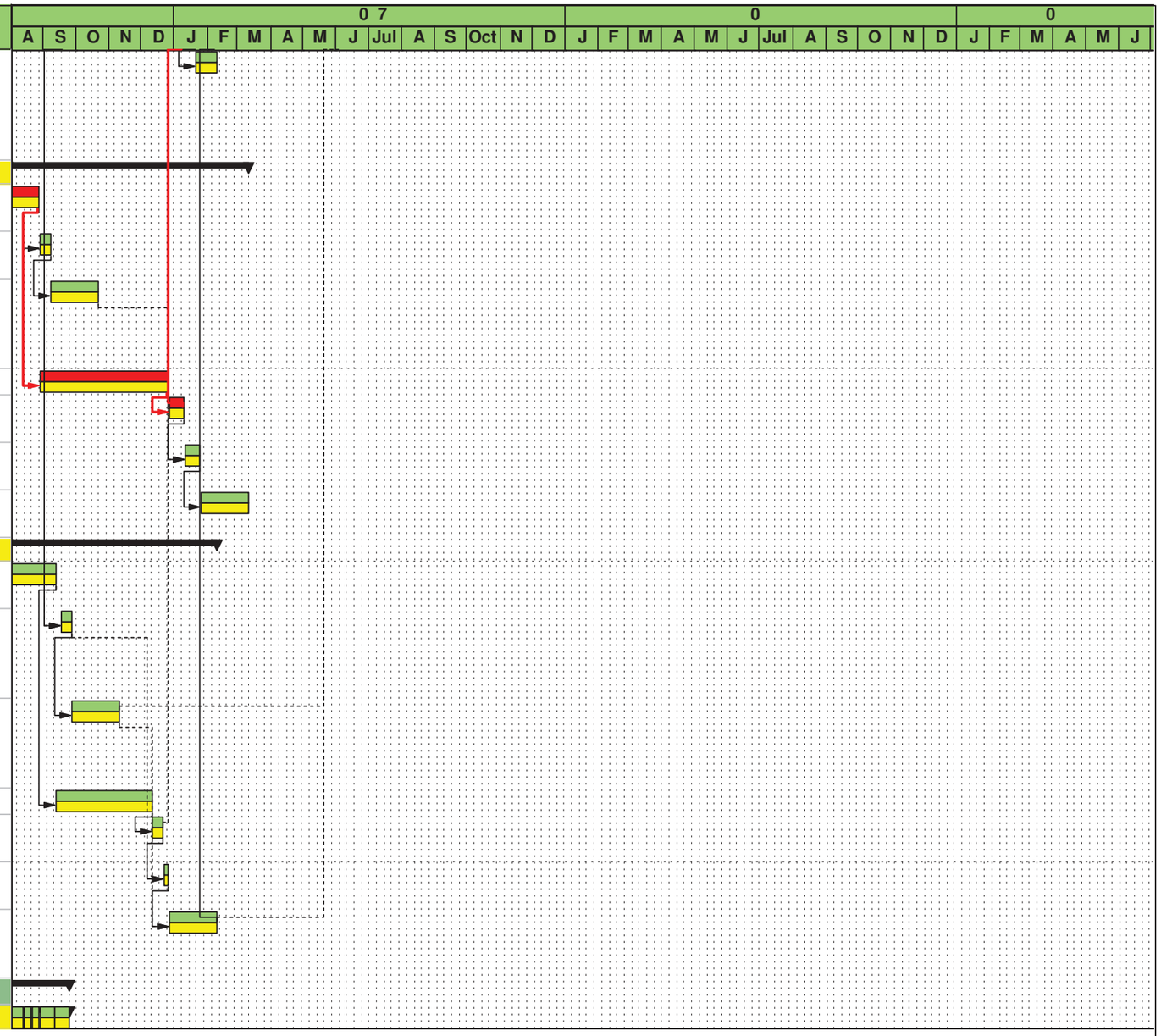
Activity ID	Activity Name	Duration Days	Start	Finish	Predecessors
BD00970	Import permits, licenses, consents, etc. for project plant and equipment, supplies, etc.	10	21-Jan-17	30-Jan-17	MS00105
BD00990	NOC for re-export of temporary equipment	14	21-Jan-17	03-Feb-17	MS00105
BD01010	Registration of agreements for royalties, technical know-how fees and technical assistance fees paid by Company	20	21-Jan-17	09-Feb-17	MS00105
BD01030	Permission for installation of septic tank and soak pit at Site	20	21-Jan-17	09-Feb-17	MS00105, BD01490
BD01050	Approval for construction of shoreline work, jetty, intake and outfall structures,use of River water	50	10-Feb-17	31-Mar-17	BD00870
BD01070	Exemption from Insurance Act 1938 to permit obtaining insurance for project from foreign companies	14	21-Jan-17	03-Feb-17	MS00105
BD01090	Permit for company to use electricity within Facility for auxiliaries	14	21-Jan-17	03-Feb-17	MS00105
BD01110	Permit for company for connection of the Facility to earth (Approval from OEACEI)	20	21-Jan-17	09-Feb-17	MS00105
BD01130	No Objection Certificate to build exhaust stacks and bypass stacks from Civil Aviation Authority	30	21-Jan-17	19-Feb-17	MS00105
BD01150	Payment to foreign companies, under Foreign Exchange Regulations Act 1947	20	21-Jan-17	09-Feb-17	MS00105
BD01170	Permission for foreign currency lending	20	21-Jan-17	09-Feb-17	MS00105
BD01190	Opening and operating on-shore Dollar and off-shore Foreign Currency bank accounts	20	21-Jan-17	09-Feb-17	MS00105
BD01210	Purchase of dollars in Bangladesh and transfer of dollars outside Bangladesh	20	21-Jan-17	09-Feb-17	MS00105

Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		

Activity ID	Activity Name	Duration Days	Start	Finish	Predecessors
BD01250	Make or remit payments in Dollars from bank accounts in Bangladesh or outside Bangladesh	20	21-Jan-17	09-Feb-17	MS00105
EC r LNG Terminal		225	30-Jul-16	11-Mar-17	
A1004640	Preparation of IEE by Consultant	30	30-Jul-16	28-Aug-16	
A1004660	Application to DOE for Site Clearance	10	29-Aug-16	07-Sep-16	A1004640
A1004680	Site Clearance (SC) Certificate and Approved ToR from DOE	45	08-Sep-16	22-Oct-16	A1004660
A1004700	Data collection for EIA	120	29-Aug-16	26-Dec-16	A1004640
A1004720	Finalization of EIA report	15	27-Dec-16	10-Jan-17	A1004700
A1004740	Submission of Report to DOE	15	11-Jan-17	25-Jan-17	A1004720, A1004680
A1004760	Issue of EIA approval & EC from DOE	45	26-Jan-17	11-Mar-17	A1004740
EC r CCPP		195	30-Jul-16	09-Feb-17	
BD00780	Preparation of IEEE by Consultant	45	30-Jul-16	12-Sep-16	A100409, A100405
BD00790	Application to Department of Environment (DOE) for site Clearance	10	18-Sep-16	27-Sep-16	BD00780, BD00090
BD00800	Location Clearance (LC) Certificate and Issue of TOR for ESIA by DOE	45	28-Sep-16	11-Nov-16	BD00790
BD00805	Data collection for EIA	90	13-Sep-16	11-Dec-16	BD00780
BD00807	Finalisation of EIA report	10	12-Dec-16	21-Dec-16	BD00805
BD00810	Submission of Report to DOE	5	22-Dec-16	26-Dec-16	BD00790, BD00807
BD00870	Issue of EIA approval & construction Clearance from DOE	45	27-Dec-16	09-Feb-17	BD00800, BD00810
Activity For Citation		453	01-Mar-15 A	25-Sep-16	
Land Acquisition at Citation		453	01-Mar-15 A	25-Sep-16	



Primary Baseline | Remaining Work | Milestone | S..
Actual Work | Critical Remaining Work | Milestone

Samlkot Power Limited, Mumbai

Revision	Checked	Approved
Schedul for Bidd...		