DRAFT Environmental and Social Impact Assessment Report

Project Number: 50182-001
November 2018

INO: Riau Natural Gas Power Project
ESIA Vol.5_Technical Appendices Part E

Prepared by ESC for the Asian Development Bank

APPENDIX F

Result of Soil Mechanic Lab.

SUMMARY OF SOIL MECHANIC LABORATORY TEST
SOIL INVESTIGATION, SOIL IMPROVEMENT AND TOPOGRAPHY STUDY OF RIAU GFPP 275 MW

No.	Bore Hole	Depth (m)	USCS	Gs	Determination Unit weight of dry density & moisture content			Atterberg limits			Particle Size Distribution Analisis (ASTM D 422)				Consolidation		Triaxial UU Total Stress		% Finer Soil pass No. 200 Sieve
					Wn %	γm Mg / m^3	γd Mg / m^3	wL %	wP %	IP %	Gravel %	Sand %	Silt %	Clay %	Cv cm/sec	Cc	C kg/cm^2	ϕ deg	
1	BH-01	1.40 - 1.60	CH	2.5624	25.37	1.968	1.570	84.76	24.85	59.91	0.00	22.45	51.61	25.94	-	-	-	-	77.55
2	BH-01	6.45 - 6.60	CH	2.5460	29.73	1.831	1.411	73.33	28.86	44.47	0.00	25.23	52.15	22.62	-	-	-	-	74.77
3	BH-01	11.30 - 11.48	CH	2.5346	21.83	1.883	1.546	69.26	21.12	48.14	0.00	20.66	54.89	24.45	-	-	-	-	79.34
4	BH-01	19.30 - 19.50	CH	2.5554	18.68	1.876	1.581	73.66	17.52	56.14	0.00	23.79	53.66	22.55	-	-	-	-	76.21
5	BH-01	23.00 - 23.18	CH	2.5342	19.80	1.897	1.583	61.82	18.02	43.80	0.00	26.64	49.25	24.11	-	-	-	-	73.36
6	BH-01	29.00 - 29.30	CH	2.5526	22.25	1.711	1.400	63.81	21.96	41.85	0.00	24.51	51.05	24.44	-	-	-	-	75.49
7	BH-02	1.95 - 2.45	MH	2.5748	40.36	1.895	1.350	55.87	39.46	16.41	0.00	23.77	51.60	24.63	2.179E-04	0.2750	0.122	1.921	76.23
8	BH-02	2.70 - 2.90	CH	2.5574	21.64	1.900	1.562	64.17	21.07	43.10	0.00	24.58	50.42	25.00	-	-	-	-	73.13
9	BH-02	8.50 - 8.80	CL	2.5338	22.89	1.925	1.566	44.00	21.55	22.45	0.00	17.46	56.75	25.79	-	-	-	-	86.36
10	BH-02	9.70 - 10.00	CL	2.5476	25.04	1.834	1.467	49.50	24.27	25.23	0.00	28.56	50.41	21.03	-	-	-	-	
11	BH-02	14.80 - 15.00	CH	2.5655	21.87	1.982	1.626	62.27	20.55	41.72	0.00	22.60	53.95	23.45	-	-	-	-	
12	BH-02	18.45 - 18.65	CH	2.5365	24.62	1.926	1.545	79.20	24.22	54.98	0.00	20.89	53.39	25.72	-	-	-	-	
13	BH-02	28.20 - 28.45	CH	2.5518	29.41	1.918	1.482	84.79	27.75	57.04	0.00	15.68	56.05	28.27	-	-	-	-	
14	BH-03	2.00 - 2.50	MH	2.5479	37.30	1.833	1.335	59.52	36.10	23.42	0.00	26.87	51.16	21.97	1.975E-04	0.2944	0.191	1.955	73.13
15	BH-03	2.75 - 3.00	CH	2.5468	23.69	1.900	1.536	63.51	22.82	40.69	0.00	14.84	57.45	27.71	-	-	-	-	85.16
16	BH-03	6.45 - 6.95	MH	2.5515	34.93	1.819	1.348	55.96	33.82	22.14	0.00	13.64	60.11	26.25	1.416E-04	0.4984	0.305	1.982	86.36
17	BH-03	8.25 - 8.45	CH	2.5646	23.61	1.771	1.433	55.79	23.08	32.71	0.00	16.47	58.05	25.48	-	-	-	-	83.53
18	BH-03	13.00 - 13.20	CH	2.5563	27.60	1.904	1.492	56.18	26.76	29.42	0.00	21.94	54.92	23.14	-	-	-	-	78.06
19	BH-03	18.75 - 19.00	CH	2.5373	16.89	1.850	1.583	67.83	16.17	51.66	0.00	18.51	56.95	24.54	-	-	-	-	81.49
20	BH-03	20.00 - 20.30	CL	2.5651	16.70	1.914	1.640	47.56	16.32	31.24	0.00	27.75	48.48	23.77	-	-	-	-	72.25
21	BH-03	26.80 - 27.00	CH	2.5455	20.75	1.855	1.536	71.74	19.83	51.91	0.00	19.60	54.83	25.57	-	-	-	-	80.40

COMPACTION TEST

ASTM D 698-78 page 155

PROJECT	:	Soil Investigasi Topography Riau Alt. 2
LOCATION	:	Tenayan, Riau
SAMPLE No.	:	Test Pit - 01 (TP-01)
DEPTH	:	1.50 m
DATE	:	05-Jun-17
TESTED BY	:	Lab. Mektan
PREPARED BY	:	Lab. Mektan
CHECK BY	:	Lab. Mektan
APPROVED BY	:	Lab. Mektan

NATURAL MOISTURE CONTENT = 18.66 %

SPECIFIC GRAVITY = 2.5765

Parameters :

W_{opt} = 29.81 %

$\gamma_{dry\ max}$ = 1.351 t/m^3

$\gamma_{dry\ opt}$ = 1.283 t/m^3

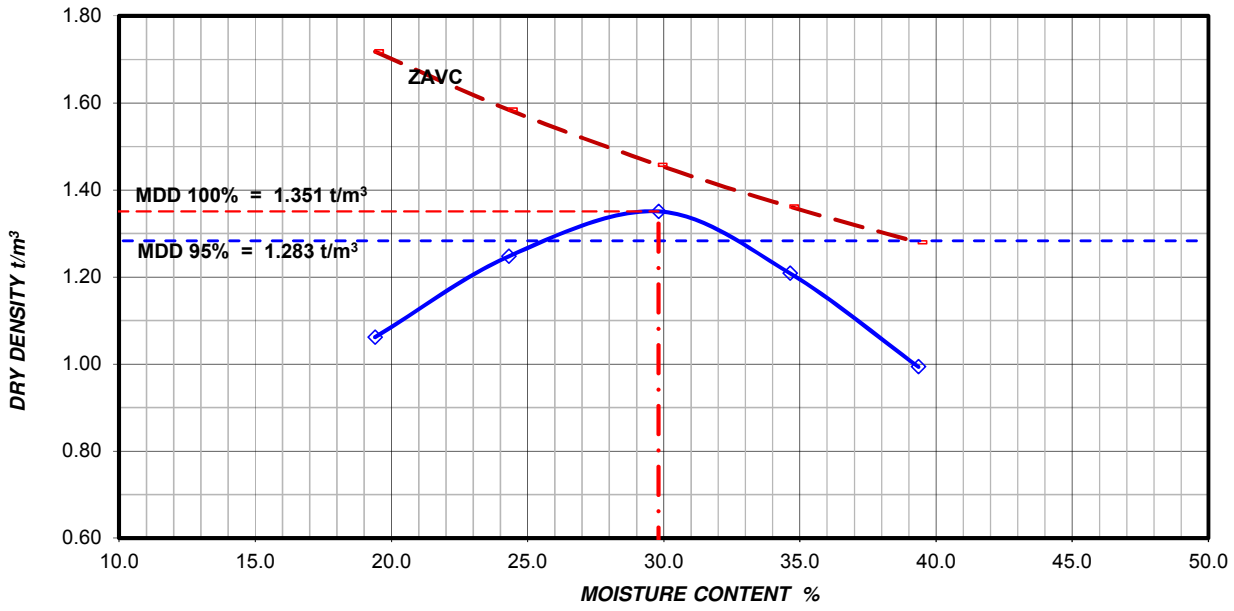
TYPE COMPACTION TEST

(X) STANDARD COMPACTION TEST

( ) MODIFIED COMPACTION TEST

DIAMETER OF MOULD	=	9.92	(cm)	*WEIGHT OF HAMMER* =	2.50 (kg)
HEIGHT OF MOULD	=	11.55	(cm)	*NUMBER OF LAYERS* =	3.00 (-)
CROSS AREA OF MOULD	=	77.29	(cm^2)	*NUMBER OF BLOWS/LAYERS* =	25.00 (-)
VOLUME OF MOULD	=	892.29	(cm^3)	*HEIGHT OF DROP* =	30.50 (cm)
				ENERGY DENSITY =	6.14 (tm/m^3)

TEST NUMBER		1	2	3	4	5
INCREASE OF WATER USED	(%)	19	24	29	34	39
WEIGHT OF MOULD + BASE + WET SOIL	(gr)	2869.0	3121.6	3302.4	3189.5	2973.2
WEIGHT OF MOULD + BASE	(gr)	1738	1738	1738	1738	1738
WEIGHT OF WET SOIL	(gr)	1131	1384	1564	1452	1235.2
VOLUME OF WET SOIL	(cm^3)	892.29	892.29	892.29	892.29	892.29
BULK DENSITY	(t/m^3)	1.268	1.551	1.753	1.627	1.384
MOISTURE CONTENT	(%)	19.40	24.31	29.81	34.64	39.35
DRY DENSITY	(t/m^3)	1.062	1.247	1.351	1.208	0.993
WEIGHT OF DRY SOIL	(gr)	947	1113	1205	1078	886
VOLUME OF DRY SOIL	(cm^3)	368	432	468	418	344
VOLUME OF VOIDS	(cm^3)	525	460	425	474	548
VOID RATIO	(-)	1.427	1.066	0.908	1.133	1.594
POROSITY	(%)	58.798	51.586	47.578	53.108	61.444
Z.A.V.C	(t/m^3)	1.718	1.584	1.457	1.361	1.279



COMPACTION TEST

ASTM D 698-78 page 155

PROJECT	:	Soil Investigasi Topography Riau Alt. 2
LOCATION	:	Tenayan, Riau
SAMPLE No.	:	Test Pit - 02 (TP-02)
DEPTH	:	1.50 m
DATE	:	05-Jun-17
TESTED BY	:	Lab. Mektan
PREPARED BY	:	Lab. Mektan
CHECK BY	:	Lab. Mektan
APPROVED BY	:	Lab. Mektan

NATURAL MOISTURE CONTENT = 23.47 %

SPECIFIC GRAVITY = 2.5462

Parameters :

W_{opt} = 33.24 %

$\gamma_{dry\ max}$ = 1.354 t/m^3

$\gamma_{dry\ opt}$ = 1.287 t/m^3

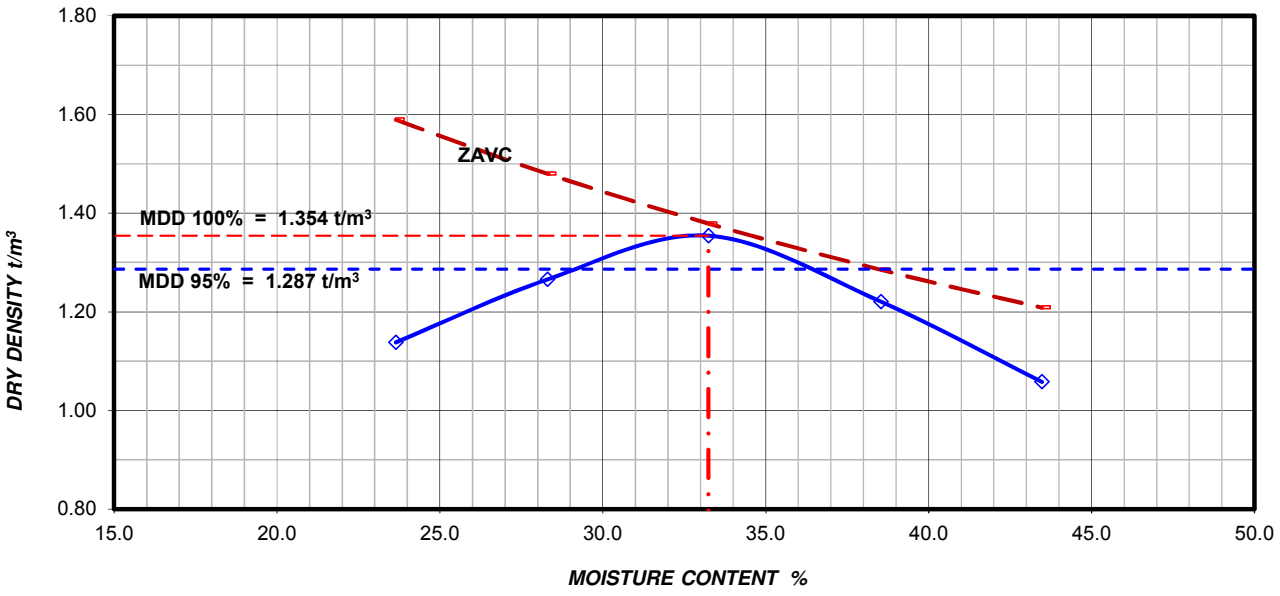
TYPE COMPACTION TEST

(X) STANDARD COMPACTION TEST

( ) MODIFIED COMPACTION TEST

DIAMETER OF MOULD	=	9.92	(cm)	*WEIGHT OF HAMMER* =	2.50 (kg)
HEIGHT OF MOULD	=	11.55	(cm)	*NUMBER OF LAYERS* =	3.00 (-)
CROSS AREA OF MOULD	=	77.29	(cm^2)	*NUMBER OF BLOWS/LAYERS* =	25.00 (-)
VOLUME OF MOULD	=	892.29	(cm^3)	*HEIGHT OF DROP* =	30.50 (cm)
				ENERGY DENSITY =	6.14 (tm/m^3)

TEST NUMBER		1	2	3	4	5
INCREASE OF WATER USED	(%)	23	28	33	38	43
WEIGHT OF MOULD + BASE + WET SOIL	(gr)	2993.6	3187.3	3348.2	3246.8	3092.4
WEIGHT OF MOULD + BASE	(gr)	1738	1738	1738	1738	1738
WEIGHT OF WET SOIL	(gr)	1256	1449	1610	1509	1354.4
VOLUME OF WET SOIL	(cm^3)	892.29	892.29	892.29	892.29	892.29
BULK DENSITY	(t/m^3)	1.407	1.624	1.805	1.691	1.518
MOISTURE CONTENT	(%)	23.65	28.31	33.24	38.54	43.48
DRY DENSITY	(t/m^3)	1.138	1.266	1.354	1.221	1.058
WEIGHT OF DRY SOIL	(gr)	1015	1130	1208	1089	944
VOLUME OF DRY SOIL	(cm^3)	399	444	475	428	371
VOLUME OF VOIDS	(cm^3)	493	449	418	465	522
VOID RATIO	(-)	1.237	1.011	0.880	1.086	1.407
POROSITY	(%)	55.305	50.283	46.809	52.063	58.451
Z.A.V.C	(t/m^3)	1.589	1.480	1.379	1.285	1.208



APPENDIX G

Ground Water and Soil Chemical Properties

CERTIFICATE OF ANALYSIS

NO : GS.COA.06.2017.107

TESTING FACILITY : BANDUNG

COA 5.8
Terbitan : A
Revisi : 00

JOB NO. : **17/107**
CLIENT : **PT. WAHANA GUNA MANDIRI**
DATE RECEIVED : 22 May 2017
SAMPLED BY : Client.
TIME OF ANALYSIS : Commenced 23 May 2017 until 08 June 2017.
TEST METHOD : Waters analyzed in accordance with the procedures published by the American Public Health Association (APHA, 2012), PT. Geoservices Environmental Laboratories WILAB 5.0.

Lab. No : **B 001**
Client ID : **BH – 01 DEPTH 28.5 m**

Parameter	Unit	Result	Method
Acidity (as $CaCO_3$)	mg/L	133	APHA 2310 B - 2012
Total Alkalinity (as $CaCO_3$)	mg/L	95	APHA 2320 B - 2012
Hydrogen Sulphide (H_2S)	mg/L	0.21	APHA 4500 S^{2-} D - 2012
Chloride (Cl)	mg/L	21	APHA 4500 Cl^--C - 2012
Sulfate (SO_4)	mg/L	36	APHA 4500 SO_4 E - 2012
Organic Matter (by $KMnO_4$)	mg/L	366	SNI 06 - 6989.22 - 2004

Bandung, 08 June 2017

Checked
Rika Rachmawati
Analyst

Approved Signatory
Lasmijati Kosasih
Laboratory Manager

CERTIFICATE OF ANALYSIS

NO : GS.COA.06.2017.112

TESTING FACILITY : BANDUNG

COA 5.8
Terbitan : A
Revisi : 00

JOB NO. : **17/112**
CLIENT : **PT. WAHANA GUNA MANDIRI**
DATE RECEIVED : 30 May 2017
SAMPLED BY : Client.
TIME OF ANALYSIS : Commenced 31 May 2017 until 09 June 2017.
TEST METHOD : Waters analyzed in accordance with the procedures published by the American Public Health Association (APHA, 2012), PT. Geoservices Environmental Laboratories WILAB 5.0.

Lab. No : **B 001**
Client ID : **BH – 02 DEPTH 10.20 m**

Parameter	Unit	Result	Method
Acidity (as $CaCO_3$)	mg/L	18	APHA 2310 B - 2012
Total Alkalinity (as $CaCO_3$)	mg/L	328	APHA 2320 B - 2012
Chloride (Cl)	mg/L	31	APHA 4500 Cl^--C - 2012
Sulfate (SO_4)	mg/L	34	APHA 4500 SO_4 E - 2012
Organic Matter (by $KMnO_4$)	mg/L	702	SNI 06 - 6989.22 - 2004

"This Report is to replace Report dated 12 June 2017"

CERTIFICATE OF ANALYSIS

NO : GS.COA.06.2017.112

TESTING FACILITY : BANDUNG

COA 5.8
Terbitan : A
Revisi : 00

JOB NO. : **17/112**
CLIENT : **PT. WAHANA GUNA MANDIRI**
DATE RECEIVED : 30 May 2017
SAMPLED BY : Client.
TIME OF ANALYSIS : Commenced 31 May 2017 until 09 June 2017.
TEST METHOD : Waters analyzed in accordance with the procedures published by the American Public Health Association (APHA, 2012), PT. Geoservices Environmental Laboratories WILAB 5.0.

Lab. No : **B 001**
Client ID : **BH – 02 DEPTH 10.20 m**

Parameter	Unit	Result	Method
Hydrogen Sulphide (H_2S)	mg/L	28	IK 5 Bab 6.50

Bandung, 13 June 2017

Checked
Rika Rachmawati
Analyst

Approved Signatory
Lasmijati Kosasih
Laboratory Manager

"This Report is to replace Report dated 12 June 2017"

CERTIFICATE OF ANALYSIS

NO : GS.COA.06.2017.113

TESTING FACILITY : BANDUNG

COA 5.8
Terbitan : A
Revisi : 00

JOB NO. : **17/113**
CLIENT : **PT. WAHANA GUNA MANDIRI**
DATE RECEIVED : 30 May 2017
SAMPLED BY : Client.
TIME OF ANALYSIS : Commenced 31 May 2017 until 12 June 2017.
TEST METHOD : Waters analyzed in accordance with the procedures published by the American Public Health Association (APHA, 2012), PT. Geoservices Environmental Laboratories WILAB 5.0.

Lab. No : **B 001**
Client ID : **BH – 03 DEPTH 20.00 m**

Parameter	Unit	Result	Method
Acidity (as $CaCO_3$)	mg/L	104	APHA 2310 B - 2012
Total Alkalinity (as $CaCO_3$)	mg/L	132	APHA 2320 B - 2012
Chloride (Cl)	mg/L	94	APHA 4500 Cl^--C - 2012
Sulfate (SO_4)	mg/L	104	APHA 4500 SO_4 E - 2012
Organic Matter (by $KMnO_4$)	mg/L	304	SNI 06 - 6989.22 - 2004

CERTIFICATE OF ANALYSIS

NO : GS.COA.06.2017.113

TESTING FACILITY : BANDUNG

COA 5.8
Terbitan : A
Revisi : 00

JOB NO. : **17/113**
CLIENT : **PT. WAHANA GUNA MANDIRI**
DATE RECEIVED : 30 May 2017
SAMPLED BY : Client.
TIME OF ANALYSIS : Commenced 31 May 2017 until 12 June 2017.
TEST METHOD : Waters analyzed in accordance with the procedures published by the American Public Health Association (APHA, 2012), PT. Geoservices Environmental Laboratories WILAB 5.0.

Lab. No : **B 001**
Client ID : **BH – 03 DEPTH 20.00 m**

Parameter	Unit	Result	Method
Hydrogen Sulphide (H_2S)	mg/L	2	IK 5 Bab 6.50

Bandung, 13 June 2017

Checked
Rika Rachmawati
Analyst

Approved Signatory
Lasmijati Kosasih
Laboratory Manager

METODE UJI (Method) ASTM G 51	FORM (FORMULIR) RESULT OF (HASIL PENGUJIAN) ACIDITY / ALKANITY	Form no. (No. formulir)	1
		Issue/Revision (Terbitan/Revisi)	
		Tanggal Revisi	01 06 2017
		Page 1 of 5 (Halaman 1 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~) / DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

- Dat Date of (Tanggal) :
- Sample accepted (Contoh diterima) : 01 06 2017
- Sample tested (Contoh dites) : 02 06 2017
- Test finished (Contoh selesai dites) : 07 06 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	1 BH 01			
Depth/ Elevation (Kedalaman/ Elevasi)	29.00 - 29.30			
W (weight) mg	5000.00			
Titrarisi P Acidity (TPAc)	0.10			
Titrarisi P Alkalinity (TPA)	0.30			
Titrarisi M Alkalinity (TMA)	0.01			
NaOH	0.1082			
Hcl	61.000			
P Acidity = (60000 / W) x (TPAc x NaOH) (mg/Kg CO3)	64.92			
P Alkalinity = (72,135 / W) x (TPA x Hcl) (mg/Kg HCO3)	264.01			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method)	FORM (FORMULIR) RESULT OF (HASIL PENGUJIAN) SULPHUR TRIOXIDE (S)	Form no. (No. formulir)	2
		Issue/Revision (Terbitan/Revisi)	
		Tanggal Revisi	01 06 2017
		Page 2 of 5 (Halaman 2 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~)/ DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

- Date ، Date of (Tanggal) :
- Sample accepted (Contoh diterima) : 01 06 2017
- Sample tested (Contoh dites) : 02 06 2017
- Test finished (Contoh selesai dites) : 07 06 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	1 BH 01			
Depth/ Elevation (Kedalaman/ Elevasi)	29.00 - 29.30			
W (weight) mg/l	10.0			
Kehilangan berat (Kb) mg/l	0.0007			
Berat sampel dalam 50 ml	13.7100			
N (normality)	13.7400			
Sulfur Trioxide (S) ppm = (Kb / W) x 1000 x N	9.62			
Sulfur Trioxide (S) % = (Kb / W) x 1000 x N (mg/Kg)	0.00962			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method)	FORM (FORMULIR)	Form no. (No. formulir)	3
		Issue/Revision (Terbitan/Revisi)	
ASTM C 114 - 05	RESULT OF (HASIL PENGUJIAN)	Tanggal Revisi	01 06 2017
	SOLUBLE KLORIDA (CL)	Page 3 of 5 (Halaman 3 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~) / DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

Date of (Tanggal)

- Sample accepted (Contoh diterima) : 01 06 2017
- Sample tested (Contoh dites) : 02 06 2017
- Test finished (Contoh selesai dites) : 07 06 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	1 BH 01			
Depth/ Elevation (Kedalaman/ Elevasi) (m)	29.00 - 29.30			
V (volume) ml.	0.200			
N (normality)	0.0480			
W (weight) g.	5.0627			
Soluble Klorida (CL) % = 3,5453 x V x N / W	0.0067			
Soluble Klorida (CL) ppm (mg/kg)	67.32			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method) ASTM	FORM (FORMULIR) RESULT OF (HASIL PENGUJIAN) SOLUBLE SULFAT (SO3)	Form no. (No. formulir)	4
		Issue/Revision (Terbitan/Revisi)	
		Tanggal Revisi	01 06 2017
		Page 4 of 5 (Halaman 4 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~)/ DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

Date of (Tanggal)

- Sample accepted (Contoh diterima) : 01 06 2017
- Sample tested (Contoh dites) : 02 06 2017
- Test finished (Contoh selesai dites) : 07 06 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	1 BH 01			
Depth/ Elevation (Kedalaman/ Elevasi)	29.00 - 29.30			
W (weight) g	10.000			
Kehilangan berat (Kb)	34.3000			
% Kehilangan berat = N x (Kb / W) x 100 %	0.0024			
N (normality)	0.0007			
Soluble Sulfat (SO3) ppm = (Kb / W) x 10.000	24.01			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method)	FORM (FORMULIR)	Form no. (No. formulir)	5
		Issue/Revision (Terbitan/Revisi)	
ASTM D 2974	RESULT OF (HASIL PENGUJIAN)	Tanggal Revisi	01 06 2017
	ORGANIC CONTENT & PH	Page 5 of 5 (Halaman 5 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~) / DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

- Date of (Tanggal) :
- Sample accepted (Contoh diterima) : 01 06 2017
- Sample tested (Contoh dites) : 02 06 2017
- Test finished (Contoh selesai dites) : 07 06 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM ppm (mg / kg) :

No. of sample (No. contoh)	1 BH 01			
Depth/ Elevation (Kedalaman/ Elevasi) (m)	29.00 - 29.30			
W 1 (weight) g.	30.6509			
W 2 (weight) g.	30.5547			
W 3 (weight) g. = W 1 - W 2	0.0962			
W 4 (weight) g.	29.5816			
W 5 (weight) g. = W 1 - W 4	1.0693			
Organic Content % = (W 3 / W 5) x 100%	**9.00**			
PH (Reaksi)	**9.68**			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method) ASTM G 51	FORM (FORMULIR) RESULT OF (HASIL PENGUJIAN) ACIDITY / ALKANITY	Form no. (No. formulir)	1
		Issue/Revision (Terbitan/Revisi)	
		Tanggal Revisi	05 Juni 2017
		Page 1 of 5 (Halaman 1 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~)/ DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

- Date of (Tanggal) :
- Sample accepted (Contoh diterima) : 05 Juni 2017
- Sample tested (Contoh dites) : 06 Juni 2017
- Test finished (Contoh selesai dites) : 12 Juni 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	2 BH 02			
Depth/ Elevation (Kedalaman/ Elevasi)	9.70 - 10.00			
W (weight) mg	5000.00			
Titrarisi P Acidity (TPAc)	0.10			
Titrarisi P Alkalinity (TPA)	0.30			
Titrarisi M Alkalinity (TMA)	0.01			
NaOH	0.1090			
Hcl	61.650			
P Acidity = (60000 / W) x (TPAc x NaOH) (mg/Kg CO3)	66.05			
P Alkalinity = (72,135 / W) x (TPA x Hcl) (mg/Kg HCO3)	266.83			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method)	FORM (FORMULIR) RESULT OF (HASIL PENGUJIAN) SULPHUR TRIOXIDE (S)	Form no. (No. formulir)	2
		Issue/Revision (Terbitan/Revisi)	
		Tanggal Revisi	05 Juni 2017
		Page 2 of 5 (Halaman 2 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~)/ DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

- Date of (Tanggal) :
- Sample accepted (Contoh diterima) : 05 Juni 2017
- Sample tested (Contoh dites) : 06 Juni 2017
- Test finished (Contoh selesai dites) : 12 Juni 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	2 BH 02			
Depth/ Elevation (Kedalaman/ Elevasi)	9.70 - 10.00			
W (weight) mg/l	10.0			
Kehilangan berat (Kb) mg/l	0.0007			
Berat sampel dalam 50 ml	13.7110			
N (normality)	13.7410			
Sulfur Trioxide (S) ppm = (Kb / W) x 1000 x N	9.76			
Sulfur Trioxide (S) % = (Kb / W) x 1000 x N (mg/Kg)	0.00976			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method)	FORM (FORMULIR)	Form no. (No. formulir)	3
		Issue/Revision (Terbitan/Revisi)	
ASTM C 114 - 05	RESULT OF (HASIL PENGUJIAN)	Tanggal Revisi	05 Juni 2017
	SOLUBLE KLORIDA (CL)	Page 3 of 5 (Halaman 3 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~) / DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

Date of (Tanggal)

- Sample accepted (Contoh diterima) : 05 Juni 2017
- Sample tested (Contoh dites) : 06 Juni 2017
- Test finished (Contoh selesai dites) : 12 Juni 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	2 BH 02			
Depth/ Elevation (Kedalaman/ Elevasi) (m)	9.70 - 10.00			
V (volume) ml.	0.200			
N (normality)	0.0480			
W (weight) g.	5.0721			
Soluble Klorida (CL) % = 3,5453 x V x N / W	0.0067			
Soluble Klorida (CL) ppm (mg/kg)	67.19			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method) ASTM	FORM (FORMULIR) RESULT OF (HASIL PENGUJIAN) SOLUBLE SULFAT (SO3)	Form no. (No. formulir)	4
		Issue/Revision (Terbitan/Revisi)	
		Tanggal Revisi	05 Juni 2017
		Page 4 of 5 (Halaman 4 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~)/ DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

Date of (Tanggal)

- Sample accepted (Contoh diterima) : 05 Juni 2017
- Sample tested (Contoh dites) : 06 Juni 2017
- Test finished (Contoh selesai dites) : 12 Juni 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	2 BH 02			
Depth/ Elevation (Kedalaman/ Elevasi)	9.70 - 10.00			
W (weight) g	10.000			
Kehilangan berat (Kb)	34.4200			
% Kehilangan berat = N x (Kb / W) x 100 %	0.0024			
N (normality)	0.0007			
Soluble Sulfat (SO3) ppm = (Kb / W) x 10.000	24.44			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method)	FORM (FORMULIR)	Form no. (No. formulir)	5
		Issue/Revision (Terbitan/Revisi)	
ASTM D 2974	RESULT OF (HASIL PENGUJIAN)	Tanggal Revisi	05 Juni 2017
	ORGANIC CONTENT & PH	Page 5 of 5 (Halaman 5 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah ~~(Asli)~~ / DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

- Date of (Tanggal) :
- Sample accepted (Contoh diterima) : 05 Juni 2017
- Sample tested (Contoh dites) : 06 Juni 2017
- Test finished (Contoh selesai dites) : 12 Juni 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM ppm (mg / kg) :

No. of sample (No. contoh)	2 BH 02			
Depth/ Elevation (Kedalaman/ Elevasi) (m)	9.70 - 10.00			
W 1 (weight) g.	30.6513			
W 2 (weight) g.	30.5539			
W 3 (weight) g. = W 1 - W 2	0.0974			
W 4 (weight) g.	29.5818			
W 5 (weight) g. = W 1 - W 4	1.0695			
Organic Content % = (W 3 / W 5) x 100%	**9.11**			
PH (Reaksi)	**9.62**			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method) ASTM G 51	FORM (FORMULIR) RESULT OF (HASIL PENGUJIAN) ACIDITY / ALKANITY	Form no. (No. formulir)	1
		Issue/Revision (Terbitan/Revisi)	
		Tanggal Revisi	05 Juni 2017
		Page 1 of 5 (Halaman 1 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~)/ DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

- Date of (Tanggal) :
- Sample accepted (Contoh diterima) : 05 Juni 2017
- Sample tested (Contoh dites) : 06 Juni 2017
- Test finished (Contoh selesai dites) : 12 Juni 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	3 BH 03			
Depth/ Elevation (Kedalaman/ Elevasi)	20.00 - 20.30			
W (weight) mg	5000.00			
Titrarisi P Acidity (TPAc)	0.10			
Titrarisi P Alkalinity (TPA)	0.30			
Titrarisi M Alkalinity (TMA)	0.01			
NaOH	0.1081			
Hcl	61.595			
P Acidity = (60000 / W) x (TPAc x NaOH) (mg/Kg CO3)	65.51			
P Alkalinity = (72,135 / W) x (TPA x Hcl) (mg/Kg HCO3)	266.59			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method)	FORM (FORMULIR) RESULT OF (HASIL PENGUJIAN) SULPHUR TRIOXIDE (S)	Form no. (No. formulir)	2
		Issue/Revision (Terbitan/Revisi)	
		Tanggal Revisi	05 Juni 2017
		Page 2 of 5 (Halaman 2 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~)/ DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

- Date of (Tanggal) :
- Sample accepted (Contoh diterima) : 05 Juni 2017
- Sample tested (Contoh dites) : 06 Juni 2017
- Test finished (Contoh selesai dites) : 12 Juni 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	3 BH 03			
Depth/ Elevation (Kedalaman/ Elevasi)	20.00 - 20.30			
W (weight) mg/l	10.0			
Kehilangan berat (Kb) mg/l	0.00069			
Berat sampel dalam 50 ml	13.7130			
N (normality)	13.7410			
Sulfur Trioxide (S) ppm = (Kb / W) x 1000 x N	9.48			
Sulfur Trioxide (S) % = (Kb / W) x 1000 x N (mg/Kg)	0.00948			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method)	FORM (FORMULIR)	Form no. (No. formulir)	3
		Issue/Revision (Terbitan/Revisi)	
ASTM C 114 - 05	RESULT OF (HASIL PENGUJIAN)	Tanggal Revisi	05 Juni 2017
	SOLUBLE KLORIDA (CL)	Page 3 of 5 (Halaman 3 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~) / DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

Date of (Tanggal)

- Sample accepted (Contoh diterima) : 05 Juni 2017
- Sample tested (Contoh dites) : 06 Juni 2017
- Test finished (Contoh selesai dites) : 12 Juni 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	3 BH 03			
Depth/ Elevation (Kedalaman/ Elevasi) (m)	20.00 - 20.30			
V (volume) ml.	0.200			
N (normality)	0.0481			
W (weight) g.	5.0762			
Soluble Klorida (CL) % = 3,5453 x V x N / W	0.0067			
Soluble Klorida (CL) ppm (mg/kg)	67.29			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method) ASTM	FORM (FORMULIR) RESULT OF (HASIL PENGUJIAN) SOLUBLE SULFAT (SO3)	Form no. (No. formulir)	4
		Issue/Revision (Terbitan/Revisi)	
		Tanggal Revisi	05 Juni 2017
		Page 4 of 5 (Halaman 4 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~)/ DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

Date of (Tanggal)

- Sample accepted (Contoh diterima) : 05 Juni 2017
- Sample tested (Contoh dites) : 06 Juni 2017
- Test finished (Contoh selesai dites) : 12 Juni 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM % BERAT :

No. of sample (No. contoh)	3 BH 03			
Depth/ Elevation (Kedalaman/ Elevasi)	20.00 - 20.30			
W (weight) g	10.000			
Kehilangan berat (Kb)	34.4300			
% Kehilangan berat = N x (Kb / W) x 100 %	0.0025			
N (normality)	0.0007			
Soluble Sulfat (SO3) ppm = (Kb / W) x 10.000	24.62			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

METODE UJI (Method)	FORM (FORMULIR)	Form no. (No. formulir)	5
		Issue/Revision (Terbitan/Revisi)	
ASTM D 2974	RESULT OF (HASIL PENGUJIAN)	Tanggal Revisi	05 Juni 2017
	ORGANIC CONTENT & PH	Page 5 of 5 (Halaman 5 dari 5)	

Project (Contoh dari) : Soil Investigation And Topography

Type of sample (Jenis contoh) : Tanah (~~Asli~~) / DS (terganggu)

Location (lokasi) : CCPP Alt.2 Riau

Clent :

- Date of (Tanggal) :
- Sample accepted (Contoh diterima) : 05 Juni 2017
- Sample tested (Contoh dites) : 06 Juni 2017
- Test finished (Contoh selesai dites) : 12 Juni 2017

HASIL ANALISA KIMIA DARI CONTOH KERING (105 ^{O}C) DALAM ppm (mg / kg) :

No. of sample (No. contoh)	3 BH 03			
Depth/ Elevation (Kedalaman/ Elevasi) (m)	20.00 - 20.30			
W 1 (weight) g.	30.6521			
W 2 (weight) g.	30.5539			
W 3 (weight) g. = W 1 - W 2	0.0982			
W 4 (weight) g.	29.5817			
W 5 (weight) g. = W 1 - W 4	1.0704			
Organic Content % = (W 3 / W 5) x 100%	**9.17**			
PH (Reaksi)	**9.66**			

Checked by supervisor (Diperiksa oleh penyelia)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

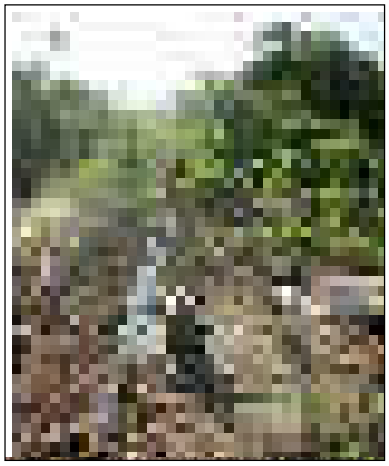
Tested by technician (Disiapkan oleh teknisi)
Date (Tanggal) :
Name and sign (Nama dan tanda tangan) :

APPENDIX H

Photo Documentation

Section of Survey	:	Powerplant	Date	:	May 10 - 25, 2017
Type of Measurement	:	Traverse, Detail, Long Section, Cross Section & Leveling		:	

Documentation	Additional Notes








Scope of Work:

Establishment of BM & CP.

Leveling measurement from reference BM to GFPP site.

Traverse measurement at power plant area.

Detailed survey at power plant area.

Measurement position of Borehole, Geolectrical & Test Pit

BH-ID	:	BH-01	Date	:	May 11-16, 2017
Location	:	-	Coordinates	:	780533.75 E, 59873.54 S
Total Depth	:	30 m	Elevation	:	28.62 m

Documentation	Additional Notes

The field drilling work assignments including:

Preperation:

- site clearing
- equipment moving
- site set-up

drilling work:

- Core sampling
- Geotechnical field testing (SPT, permeability test)
- Geological description of core sample

BH-ID	:	BH-03	Date	:	May 23 - 26, 2017
Location	:	-	Coordinates	:	780566.52 E, 59551.52 S
Total Depth	:	30 m	Elevation	:	31.05 m

Documentation	Additional Notes






The field drilling work assignments including:

Preperation:
- site clearing
- equipment moving
- site set-up

drilling work:
- Core sampling
- Geotechnical field testing (SPT, permeability test)
- Geological description of core sample

BH-ID	: BH-02	Date	:	May 17 - 21, 2017
Location	: -	Coordinates	:	780544.97 E, 59711.44 S
Total Depth	: 30 m	Elevation	:	28.97 m

Documentation	Additional Notes

The field drilling work assignments including:

Preperation:

- site clearing
- equipment moving
- site set-up

drilling work:

- Core sampling
- Geotechnical field testing (SPT, permeability test)
- Geological description of core sample

Geoelectrical	: GL-1, GL-2 & GL-3	Date	:	May 31-June 02, 2017
Location	: -	coordinates	:	Same with Borehole
Penetration	: 100 m	Elevation	:	Same with Borehole

The field survey work assignments including:

Preperation:
- site orientation
- equipment setup

Survey work:
- Spreading cable
- Installation of electrode
- Data recording

Preliminary Labour Mobilisation Schedule

DIRECT LABOR MOBILIZATION SCHEDULE (preliminary)

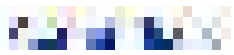
Project Name: Indonesia Riau Project

NO.	DESCRIPTION		PEAK TIME	TOTAL MAN-MTH	CONSTRUCTION PERIOD																														
					2016	2017												2018												2019						
					DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
					-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
C	**LOCAL**		956	**10,374**	**-**	**37**	**38**	**47**	**50**	**55**	**59**	**64**	**111**	**201**	**275**	**348**	**459**	**543**	**654**	**771**	**819**	**923**	**956**	**905**	**864**	**739**	**573**	**393**	**283**	**156**	**39**	**14**	**-**	**-**	**-**	**-**
C	FOREMAN	Civil/Building Foreman	11	171	-	2	3	4	5	5	6	6	9	9	10	10	11	11	10	10	9	9	9	8	7	7	6	3	2	-	-	-	-	-	-	-
C		Steel Structure Foreman	1	6	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C		Mechanical Foreman	17	133	-	-	-	-	-	-	-	-	-	-	-	-	2	3	4	8	12	17	17	17	17	17	12	5	2	-	-	-	-	-	-	-
C		Piping Foreman	8	83	-	-	-	-	-	-	-	-	-	-	-	2	4	5	5	8	8	8	8	8	8	7	5	3	2	2	-	-	-	-	-	-
C		Welding Foreman	8	62	-	-	-	-	-	-	-	-	-	-	-	1	2	3	3	3	6	6	7	8	8	6	3	2	2	2	-	-	-	-	-	-
C		Tank Foreman	2	10	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	2	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
C		Electrical Foreman	6	60	-	-	-	-	-	-	-	-	-	-	-	1	2	2	5	5	6	6	6	6	6	5	5	2	2	1	-	-	-	-	-	-
C		Instrument Foreman	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C		Painting Foreman	3	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	2	3	3	3	3	1	-	-	-	-	-
C		Insulation Foreman	2	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1	1	2	2	2	2	2	2	-	-	-	-
C		HVAC Foreman	11	70	-	-	-	-	-	-	-	-	-	-	-	-	2	4	6	7	10	11	11	10	7	2	-	-	-	-	-	-	-	-	-	-
C	MECHANICAL	Mechanical Fitter	45	417	-	-	-	-	-	-	-	-	-	-	-	-	-	7	14	20	28	35	42	45	45	45	45	42	28	14	7	-	-	-	-	-
C		Iron Worker	42	402	-	-	-	-	-	-	-	-	-	-	-	2	5	12	18	27	32	35	42	41	40	39	37	34	22	11	5	-	-	-	-	-
C		Refractory Layer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C		Castable Worker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C	PIPING	Pipe Fitter(Class A)	45	368	-	-	-	-	-	-	-	-	-	-	-	8	12	16	20	24	32	45	45	45	45	32	18	10	8	8	-	-	-	-	-	-
C		Pipe Fitter(Class B)	26	161	-	-	-	-	-	-	-	-	-	-	-	-	4	9	14	23	25	26	26	19	11	4	-	-	-	-	-	-	-	-	-	-
C		Pipe Welder(Class A)	56	446	-	-	-	-	-	-	-	-	-	-	8	12		16	24	32	40	56	56	56	56	43	18	13	8	8	-	-	-	-	-	-
C		Pipe Welder(Class B)	12	71	-	-	-	-	-	-	-	-	-	-	-	-	3	3	6	7	11	12	12	9	6	2	-	-	-	-	-	-	-	-	-	-
C		Plate Welder(Class A)	5	24	-	-	-	-	-	-	-	-	-	-	-	-	1	2	4	4	5	5	2	1	-	-	-	-	-	-	-	-	-	-	-	-
C		Plate Welder(Class B)	16	160	-	-	-	-	-	-	-	-	-	-	-	2	4	7	9	13	13	15	16	16	16	15	14	8	6	5	1	-	-	-	-	-
C		Steel Fabricator	11	95	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	5	5	8	11	11	11	11	11	7	5	3	1	-	-	-	-	-
C		Rigger	44	398	-	-	-	-	-	-	-	-	-	-	4	9		17	22	31	35	40	44	44	43	36	29	19	13	9	4	-	-	-	-	-
C	INSULATION	Insulator	14	145	-	-	-	-	-	-	-	-	-	-	-	-	2	4	6	7	9	11	13	14	14	12	9	11	11	11	7	4	-	-	-	-
C		Tin Smith	5	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	3	5	5	5	5	5	2	2	-	-	-	-
C	PAINTING	Painter	8	46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	3	3	5	8	8	8	7	2	-	-	-	-	-	-
C		Sign Painter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C		Sand Blaster	5	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	2	3	5	5	5	2	1	-	-	-	-	-	-
C	HVAC	HVAC Duct Worker	16	89	-	-	-	-	-	-	-	-	-	-	-	2		4	6	8	9	16	16	16	8	4	-	-	-	-	-	-	-	-	-	-
C		Plumber	5	31	-	-	-	-	-	-	-	-	-	-	-	1		2	2	3	5	5	5	4	3	1	-	-	-	-	-	-	-	-	-	-
C	ELECTRICAL	Electrician	23	236	-	-	-	-	-	-	-	-	-	-	5	9		10	18	18	23	23	23	23	23	20	18	9	9	5	-	-	-	-	-	-
C	INSTRUMENT	Instrumet Fitter	7	31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4	7	7	7	4	2	-	-	-	-	-
C	BUILDING	Carpenter	12	132	-	-	-	-	-	-	-	-	12	12	12	12	12	12	12	12	12	12	12	-	-	-	-	-	-	-	-	-	-	-	-	-
C		Concrete Worker	4	44	-	-	-	-	-	-	-	-	4	4	4	4	4	4	4	4	4	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-
C		Re-Bar Worker	9	99	-	-	-	-	-	-	-	-	9	9	9	9	9	9	9	9	9	9	9	-	-	-	-	-	-	-	-	-	-	-	-	-
C		Mason	18	126	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	18	18	18	18	18	18	-	-	-	-	-	-	-	-	-	-	-
C		Plaster	18	126	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18	18	18	18	18	18	18	-	-	-	-	-	-	-	-	-	-
C		Tile Layer	5	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5	5	5	-	-	-	-	-	-	-	-	-	-
C		Painter	17	85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	17	17	17	17	-	-	-	-	-	-	-	-	-	-
C	STEEL STRUCTURE	Structural Steel Erector	30	180	-	-	-	-	-	-	-	-	-	-	30	30	30	30	30	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C	CIVIL	Carpenter	60	649	-	-	-	-	-	-	-	-	-	40	50	50	60	60	50	50	45	45	40	40	35	35	24	15	10	-	-	-	-	-	-	-
C		Concrete Worker	30	282	-	-	-	-	-	-	-	-	-	20	20	25	30	30	25	25	20	20	15	15	10	10	8	6	3	-	-	-	-	-	-	-
C		Re-Bar Worker	35	338	-	-	-	-	-	-	-	-	-	20	25	30	35	35	30	30	25	25	20	20	15	10	10	5	3	-	-	-	-	-	-	-
C	COMMON	Scaffolder	33	335	-	-	-	-	-	-	-	-	-	5	5	7	12	16	19	25	31	33	33	33	31	27	21	17	11	7	2	2	-	-	-	-
C		Semi-Skilled Worker	143	1,717	-	15	15	18	20	20	23	23	32	32	45	57	76	84	106	120	132	143	143	139	132	115	94	60	45	24	3	2	-	-	-	-
C		Helper	202	2,432	-	20	20	25	25	30	30	35	45	50	64	80	104	122	149	165	177	202	202	191	194	169	141	93	66	30	3	2	-	-	-	-
C	OTHER	Const. Equip Operator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C		Truck Driver	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CONSTRUCTION EQUIPMENT MOBILIZATION SCHEDULE (preliminary)

Project Name: Indonesia Riau Project

NO.	DESCRIPTION	PEAK TIME	TOTAL SET-MTH	2015	2016												2017												2018						
				DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
				-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	Dozer(Crawler) 19 ton	1	1			1																													
	Dozer(Crawler) 32 ton	2	5			2	1	1	1																										
	Excavator(Crawler) 0.20 m3	0	1															0	0	0	0	0	0	0	0	0	0	0							
	Excavator(Crawler) 0.70 m3	2	6									2	2	2																					
	Excavator(Crawler) 1.00 m3	2	13			1	1	1	1	1	1	2	2	1	1	1	1																		
	Excavator(Tire) 0.60 m3	1	5							1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0							
	Loader(Tire) 1.72 m3	1	2							1	1	1																							
	Macadam Roller 10 ton	1	2																								1	1							
	Tandem Roller 10 ton	1	2																								1	1							
	Vibration Roller 10.0 ton	1	20			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				1	1							
	Portable Vibration Roller 0.75 ton	1	11										1	1	1	1	1	1	1	1	1	1	1												
	Tire Roller 12 ton	1	2																								1	1							
	Plate Compactor 1.5 ton	1	12										1	1	1	1	1	1	1	1	1	1					1	1							
	Motor Grader 3.6 m	1	2																								1	1							
	Asphalt Paver 3 m	1	2																								1	1							
	Asphalt Distributor 3800 ℓ	1	2																								1	1							
	Pile Driver 50 ton	6	18							6	6	6																							
	Crane(Crawler) 30 ton	1	6											1	1	1	1	1	1																
	Crane(Crawler) 50 ton	1	5											1	1				1	1	1	1	1												
	Crane(Crawler) 80 ton	1	16							1	1	1	1	1	1	1	1	1	1	1	1	1	1				1	1							
	Crane(Crawler) 500 ton	1	3													1	1	1																	
	Crane(Tire) 30 ton	3	30												1	1	2	2	2	2	2	2	3	3	3	3	2	1	1						
	Crane(Tire) 50 ton	4	43												1	3	4	4	4	4	4	4	3	3	3	3	2	1							
	Crane(Tire) 150 ton	1	6														1	1	1	1	1	1													
	Hydraulic Lifting Device 400 ton	1	2																	1	1														
	Truck Crane 5 ton	2	27									1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1								
	Truck Crane 10 ton	1	7																1	1	1	1	1	1	1										
	Truck Crane 18 ton	4	49												2	2	3	3	4	4	4	4	4	4	4	4	3	2	2						
	Forklift 5.0 ton	3	31									1	1	2	3	3	3	3	3	2	2	1	1	1	2	2	1	1							
	Forklift 7.0 ton	3	32												2	3	3	3	3	3	3	3	2	2	2	2	1								
	Forklift 10.0 ton	1	7																1	1	1	1	1	1	1										
	Concrete Pump Car 36 m	1	9										1	1	1	1	1	1	1	1	1	1	1				1								
	Concrete Pump Car 41 m	1	10									1	1	1	1	1	1	1	1	1	1														
	Concrete Vibrator 5.5 HP	2	20									2	2	2	2	2	2	2	2	2	2														
	Generator 100 kw	2	21									1	1	2	2	2	2	2	2	1	1	1	1	1	1	1									
	Generator 150 kw	6	18							6	6	6																							
	Welding Machine(AC) 200 Amp	14	105									1	1	3	3	6	8	9	12	14	14	14	9	7	3	1									
	Welding Machine(AC) 400 Amp	1	6																1	1	1	1	1	1											
	Welding Machine(AC) 500 Amp	34	342												5	12	20	26	31	34	34	34	32	26	25	23	23	12	5							
	Welding Machine(DC) 200 Amp	22	202												4	11	14	19	20	21	21	22	20	14	13	11	6	4	2							
	TIG Welding Machine 500 Amp	40	440												5	10	15	25	35	40	40	40	40	40	40	40	40	20	10							
	Dump Truck 8.0 ton	3	8								3	3	2																						
	Dump Truck 15.0 ton	25	160			25	25	25	25	1	1	1	7	7	6	6	5	5	4	4	4	2	2	1	1	1	1	1							
	Cargo Truck 1.0 ton	7	52												1	1	2	3	3	3	3	5	7	6	5	4	3	3	3						
	Cargo Truck 2.5 ton	1	12													1	1	1	1	1	1	1	1	1	1	1	1								
	Tractor & Trailer 30 ton	2	20												1	1	1	1	2	2	2	2	2	1	1	1	1	1	1						
	Test Pump 50 kg/cm2	2	4																				2	2											
	Test Pump 200 kg/cm2	2	18																	1	1	2	2	2	2	2	2	2	2						
	Scissor Lift(Electric) 7.9 m	2	17														1	2	2	2	2	2	2	2	2										
	Air Compressor 318 CFM	1	6											1	1	1	1	1	1																
	Air Compressor 375 CFM	6	49			0	0	0	0	6	6	6	0	0	0	0	0	0	1	2	3	3	2	3	3	3	3	3	3	1	1				
	Sand Blasting M/C 0.5 m3	2	8																	1	2	2	2	1											
	Airless Sprayer 50:1	4	43																	2	4	4	4	4	4	4	4	4	4	3	2				
	Winch 30 HP	4	45												1	2	3	3	4	4	4	4	4	4	4	3	2	2	1						



Preliminary Transportation Plan

Riau GFPP (275MW) IPP Project

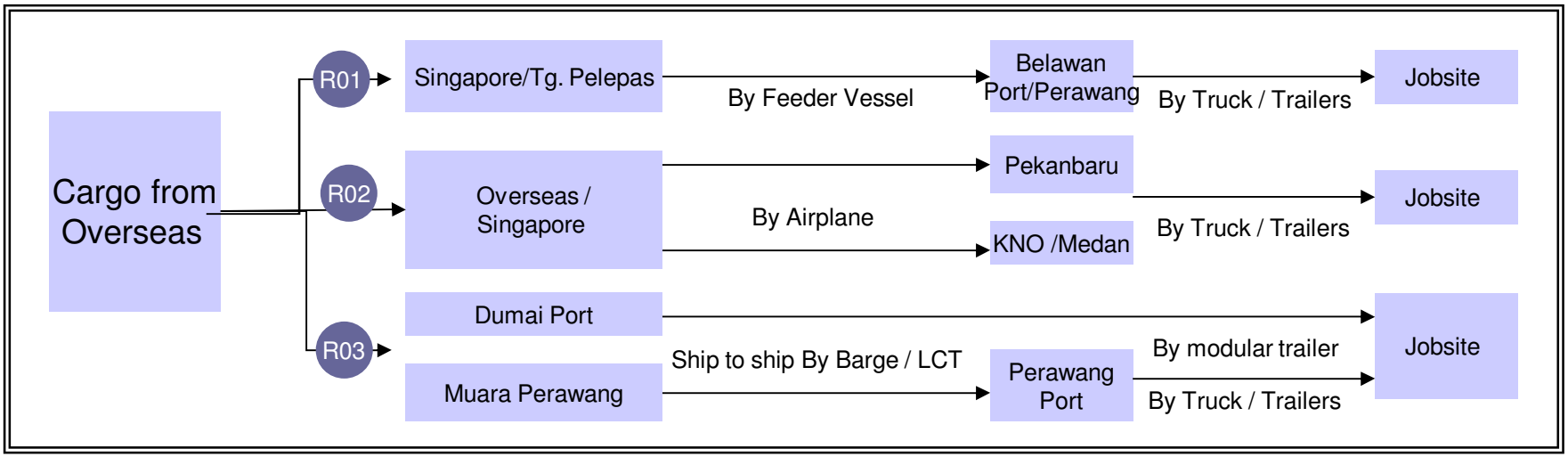
Transportation Plan

as PRELIMINARY

Sep. 2017

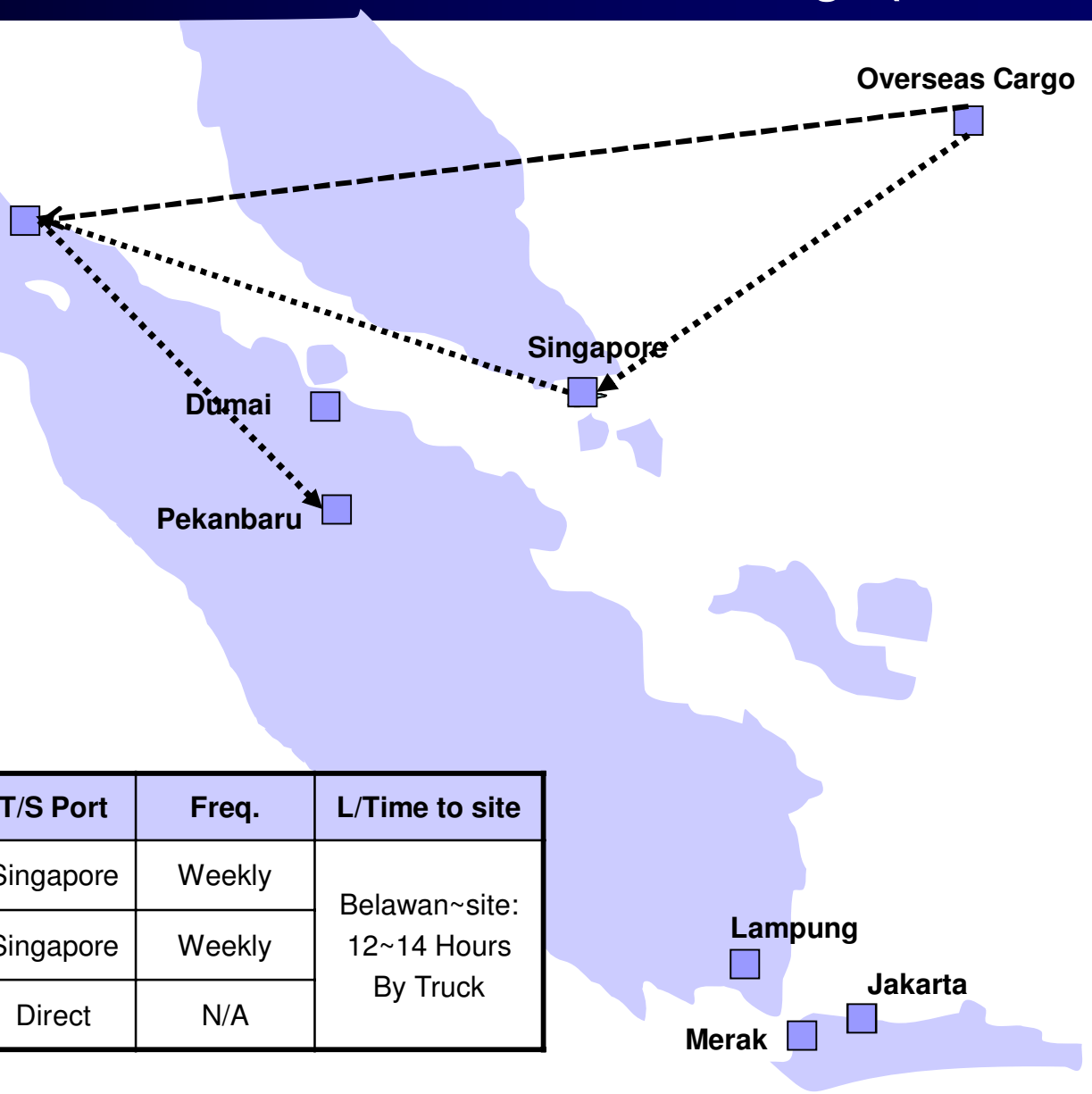
Contents

I. Routing & Transportation Plan



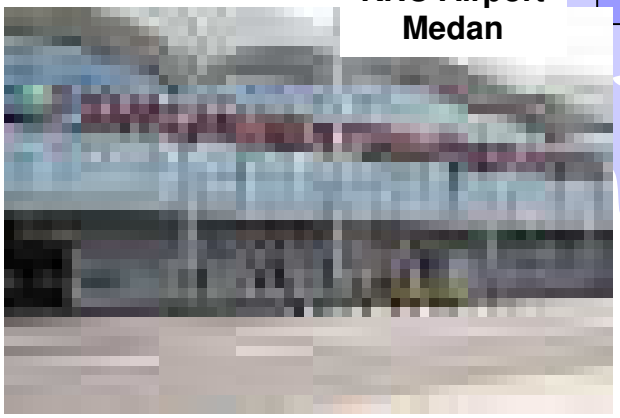
	Cargo by	1st Route	2nd Route
R01	Containerized	• POD : Belawan Port, Medan • Routing : Overseas ~ Singapore ~ Belawan Port • Transit time : 2 Days • Belawan to Pekan Baru Project Site by Inland Transportation – 18 Hours	• POD : Perawang Port, Pekan baru • Routing : Overseas – Tg. Pelepas/Port Kelang – Perawang Port, Pekan Baru (T/Time 2 days) • Perawang Port to Project Site by Inland Transportation - 1 Hours
R02	Airfreight	• POD : Overseas / Singapore – Pekanbaru • Routing : Singapore ~ Pekanbaru ~ Jobsite • Transit time : 2 Days including clearance	• POD : Kualanamu (KNO) Aiirport. Medan • Routing : Ovreseas – KNO ~ Jobsite • Transit Time : 3 Days including clearance
R03	General Bulk, & Heavy Parts	• POD : Dumai Port for Huge vessel / Heavy cargo • Routing : Overseas - Dumai ~ Jobsite • Transit time : 4 Days including clearance • Customs Process in Dumai	• POD : Muara Perawang -> ships to ships by barge to Perawang Port • Routing : Overseas ~ Muara Perawang ~ Perawang Port - Jobsite • Customs process in Perawang Port area

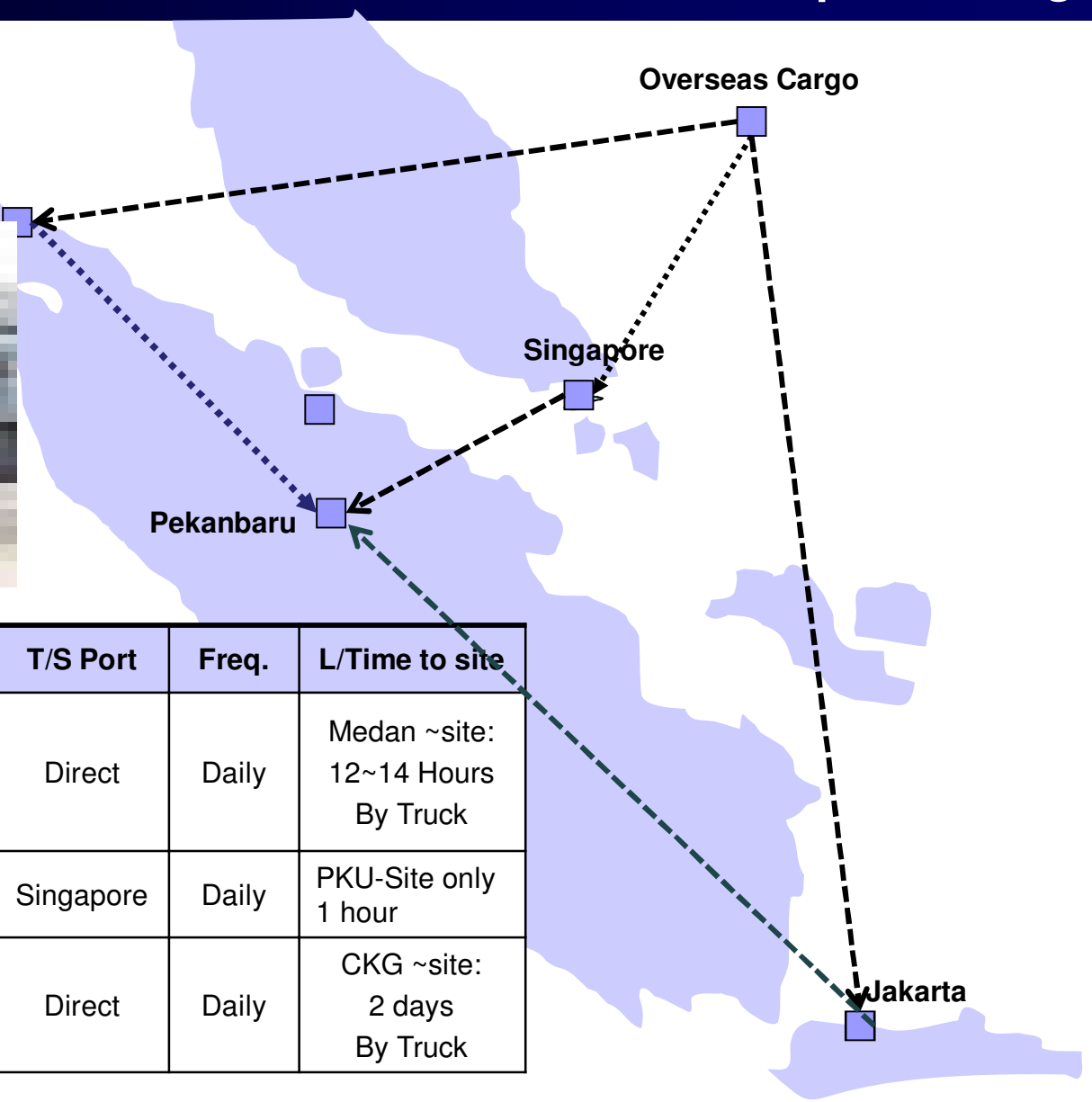
Containerized cargo (FCL/LCL)



Shipment	Discharged	T/S Port	Freq.	L/Time to site
FCL	Belawan	Singapore	Weekly	Belawan~site: 12~14 Hours By Truck
LCL	Belawan	Singapore	Weekly	
B/Bulk	Belawan	Direct	N/A	

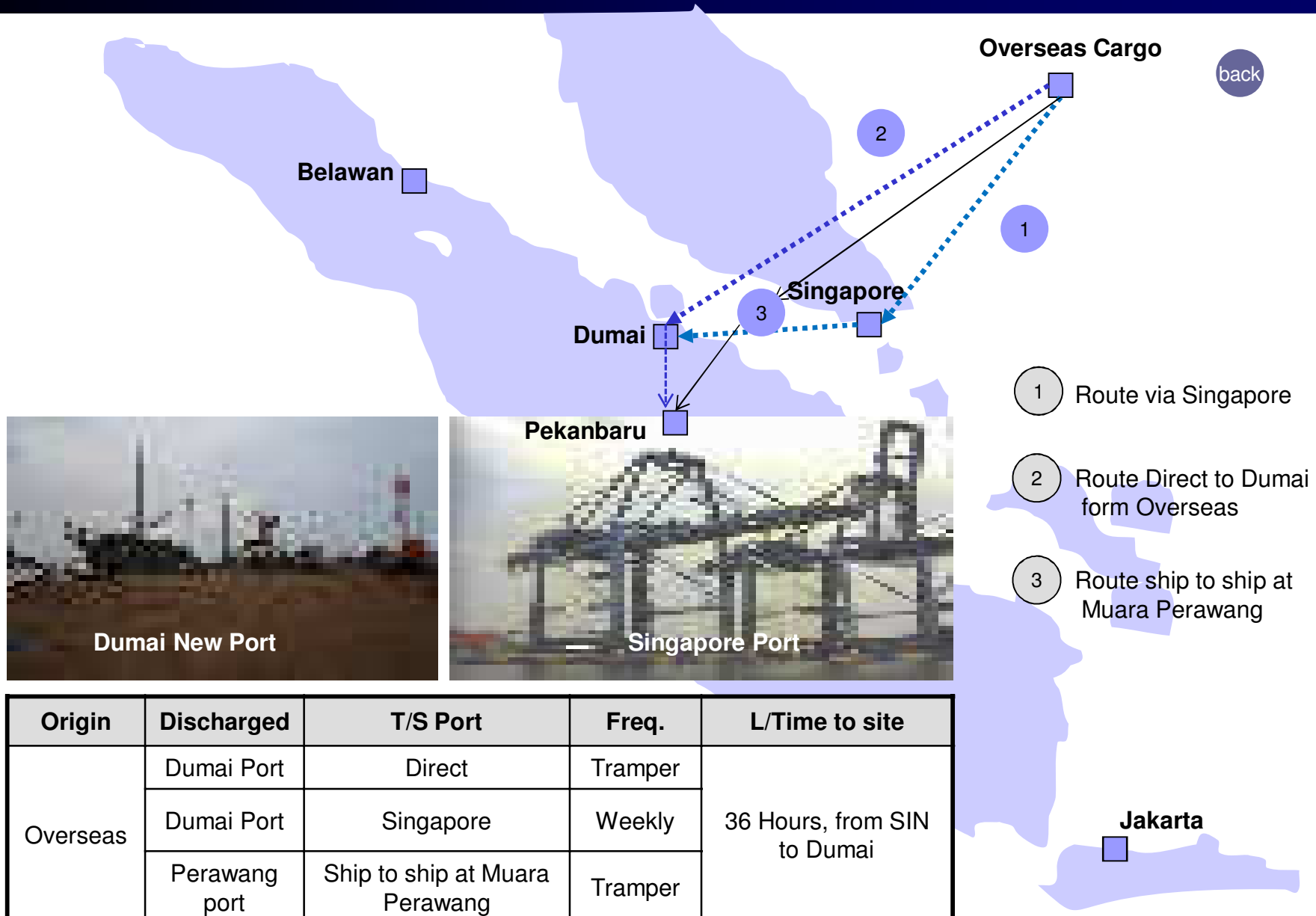
Air shipment cargo





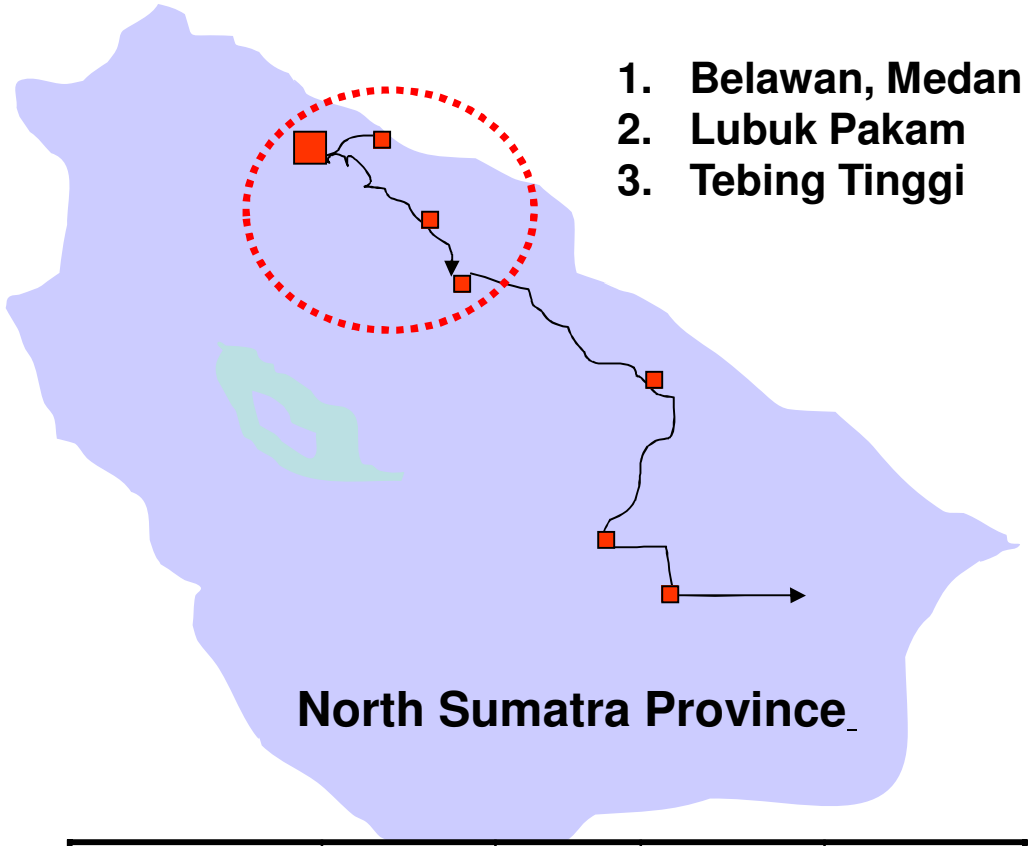
Origin	Discharged	T/S Port	Freq.	L/Time to site
Overseas	Kualanamu/KNO Medan Airport	Direct	Daily	Medan ~site: 12~14 Hours By Truck
Overseas	Pekan baru/PKU airport	Singapore	Daily	PKU-Site only 1 hour
Overseas	Jakarta Airport/CKG	Direct	Daily	CKG ~site: 2 days By Truck

Bulk / Heavy cargo



Origin	Discharged	T/S Port	Freq.	L/Time to site
Overseas	Dumai Port	Direct	Tramper	36 Hours, from SIN to Dumai
	Dumai Port	Singapore	Weekly	
	Perawang port	Ship to ship at Muara Perawang	Tramper	

II. Inland Survey Belawan – Pekan Baru

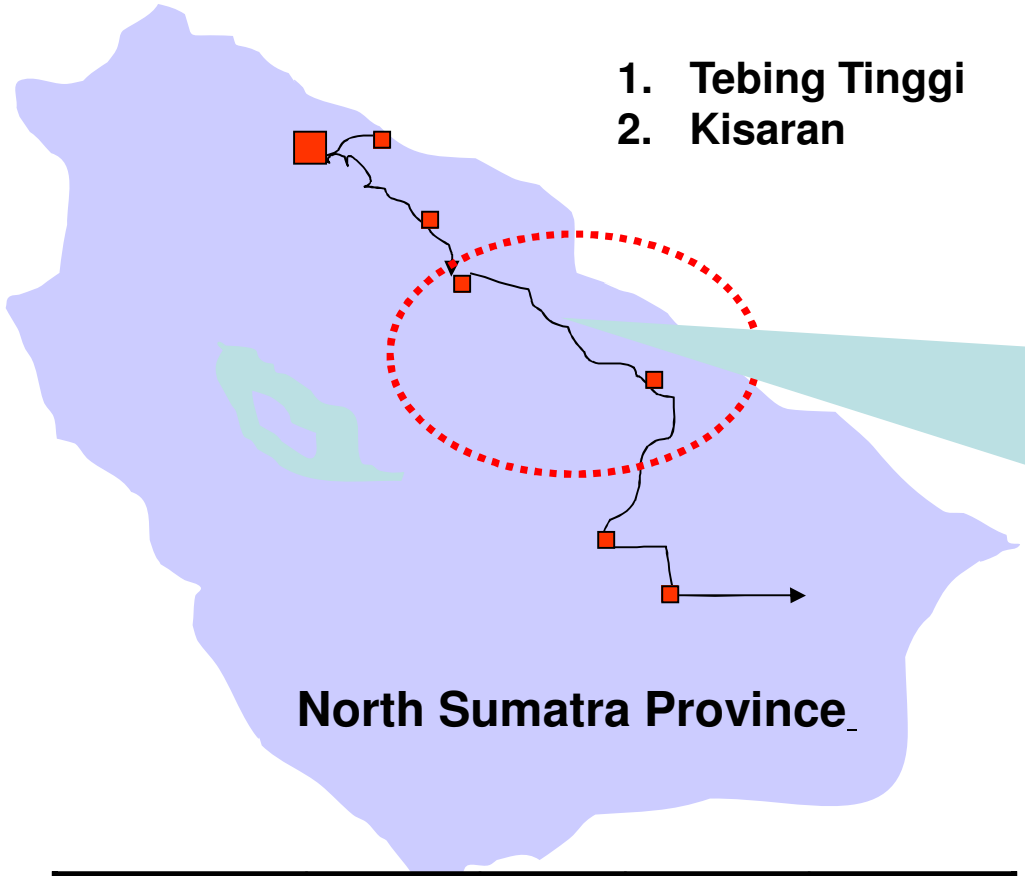


1. **Belawan, Medan**
2. **Lubuk Pakam**
3. **Tebing Tinggi**

Routing	Obstacle	Road	KM	Remarks
Belawan	N	Asphalt	0 KM	Straight
Lubuk Pakam Via Tj. Morawa	N	Asphalt	32 KM	Straight
Tebing Tinggi	N	Asphalt	97 KM	Straight

II. Inland Survey Belawan – Pekan Baru

Road to Pekan Baru

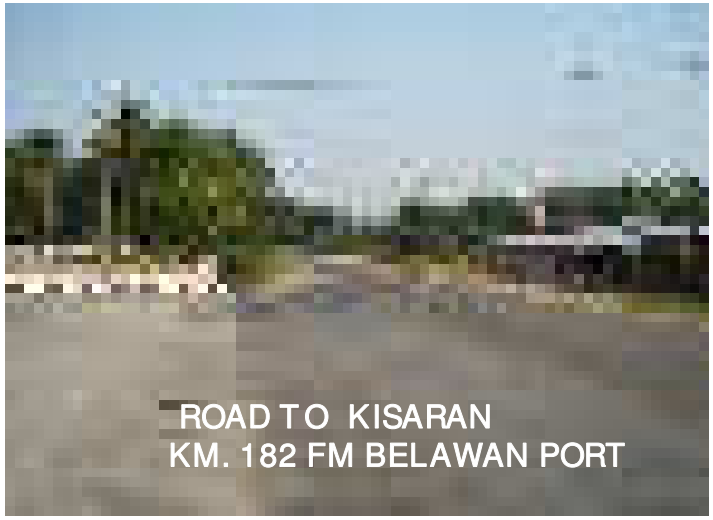


Routing condition :

Good Asphalt surface, winding in several area. Width : 7~8 Meter.

Descending and ascending through Palm Plantation.

Routing	Obstacle	Road	KM	Remarks
Tebing Tinggi	N	Asphalt	97 KM	Straight
Kisaran	N	Asphalt	182 KM	Winding, Ascending, descending



II. Inland Survey Belawan – Pekan Baru

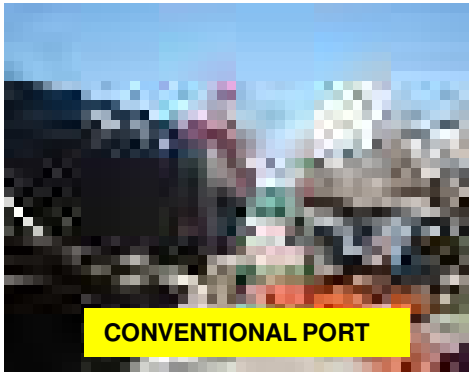
Road to Pekan Baru

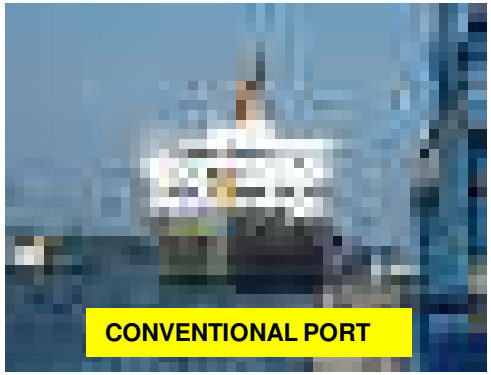
North Sumatra Province

Riau Province

Routing	Obstacle	Road	KM	Remarks
Kota Pinang	N	Asphalt	383 KM	Winding
Bagan Batu	N	Asphalt	504 KM	Hole and bad road condition
Pekan Baru	N	Asphalt	565 KM	Straight, bad road

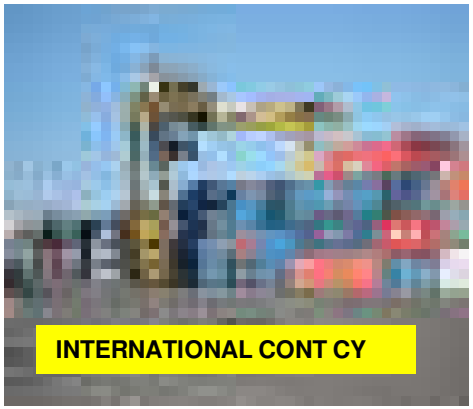
PICTURE SURVEY OF BELAWAN PORT


CONVENTIONAL PORT

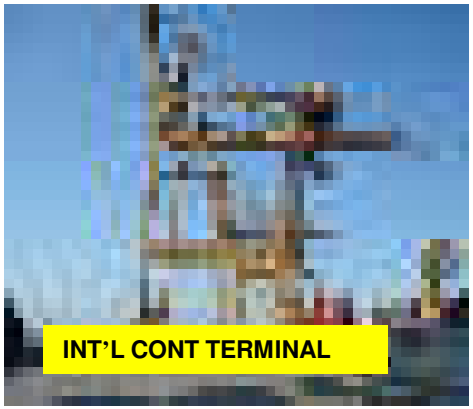

CONVENTIONAL PORT


INTERINSULER PORT


CY CONT FOR INTERINSULER CARGO


INTERNATIONAL CONT CY


INTERNATIONAL CONT CY


INT'L CONT TERMINAL


INTERNATIONAL CONT CY


GATE IN OF BELAWAN PORT


INTERNATIONAL CONT PORT OF BELAWAN SEE FM OLD PORT


INTERNATIONAL BULK PORT


WAREHOUSING IN BELAWAN

PICTURE OF DUMAI PORT


NEW PORT OF DUMAI
DEPTH 9-12 METERS


JETTY OF NEW PORT IN DUMAI


JETTY OF NEW PORT IN DUMAI

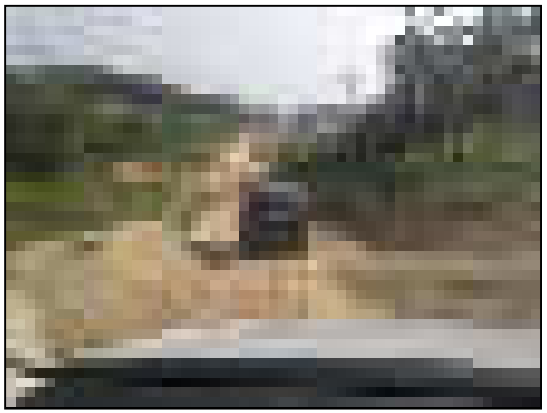

JETTY OF NEW PORT IN DUMAI


JETTY OF NEW PORT IN DUMAI


PUBLIC BEACHING PORT
5 KM FM MAIN ROAD

- Jl.PLTG Tenayan (Offroad by decline road & ascending road with sideways 60˚)





- Jl.PLTG Tenayan (after 7 KM Offroad by decline road & ascending road with sideways 60˚)



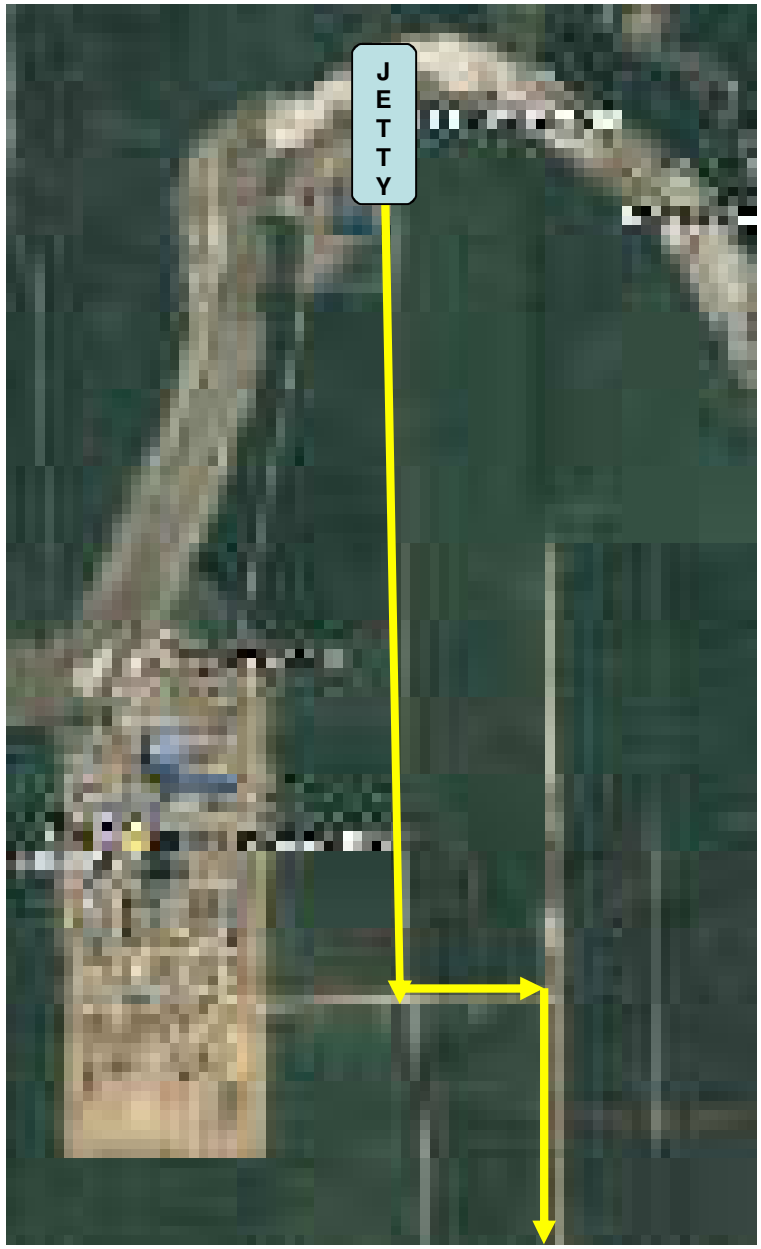


- **Jl.PLTG Tenayan to Site for Jeti Penayang Port (Offroad 5 KM by Off and countryroad, dusty and graven road)**
- **SIAK River by Perawang Port (the Nearest Jetty, with depth > 50m deep)**

III. Temporary Jetty (option 1)

III. Temporary Jetty (option 2)

III. Temporary Jetty to Site Route (unpaving road)



IV. Heavy Equipment Transportation Plan

1. Receiving Heavy Cargo on to Barge at Port

1.Receiving cargo barge loosing at port

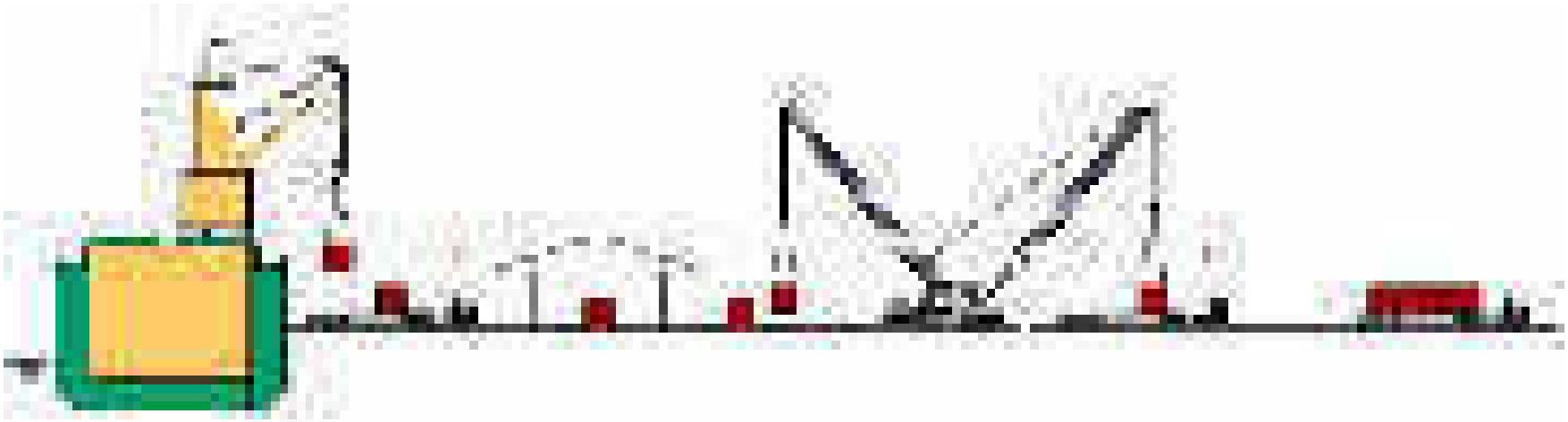
2.Sea transport from anchorage point to site jetty

3. Discharging heavy lift cargo from barge by roll off system

4. Shifting heavy lift to unloading bay at site

IV. Heavy Equipment Transportation Plan

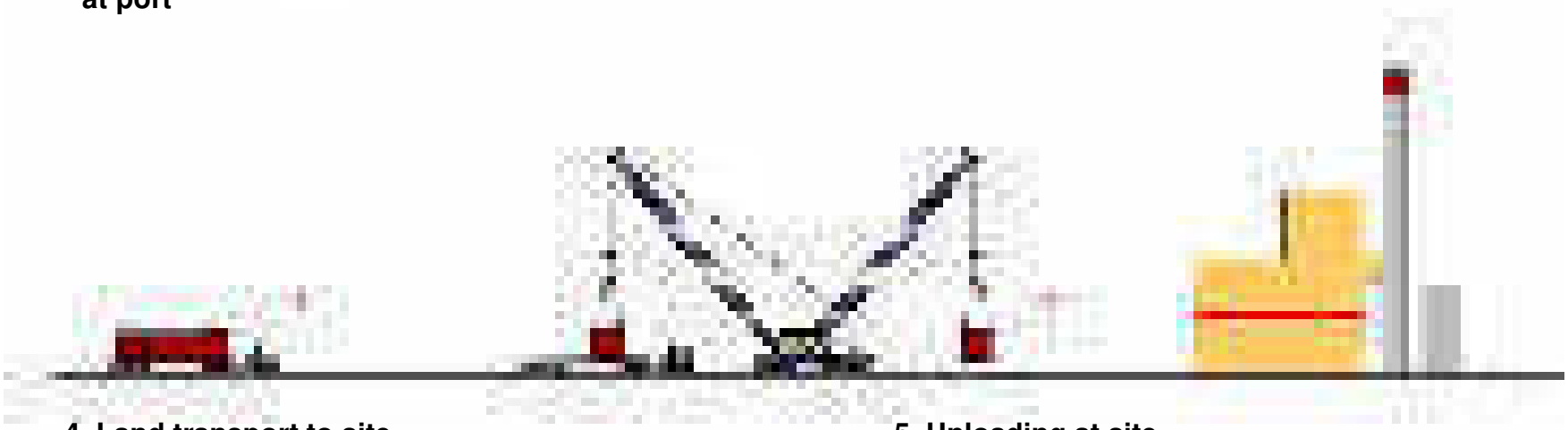
2. Receiving General & Oversized Cargo at Port



1. Discharging cargo at port

2. Storage

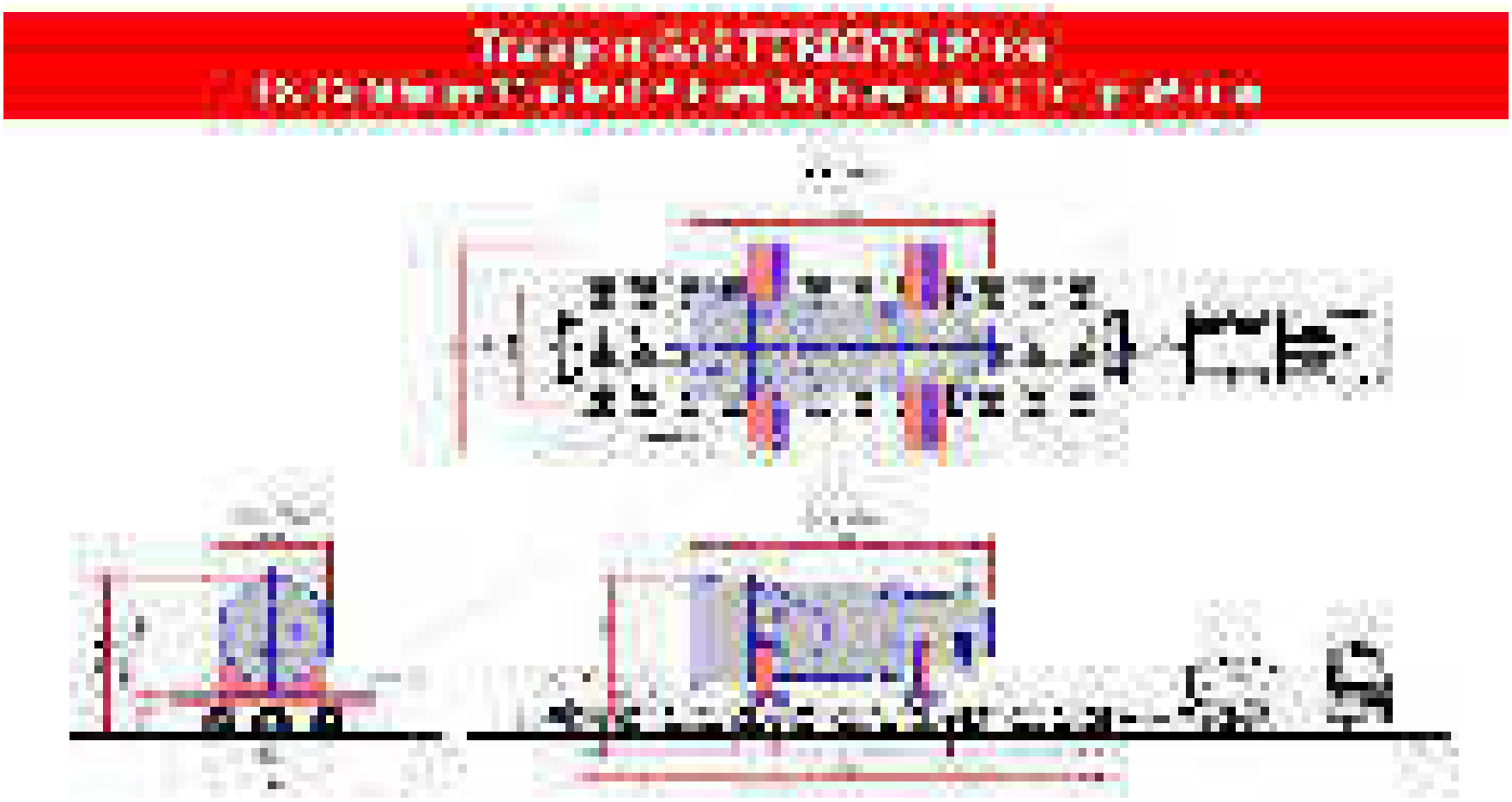
3. Loading to trailer



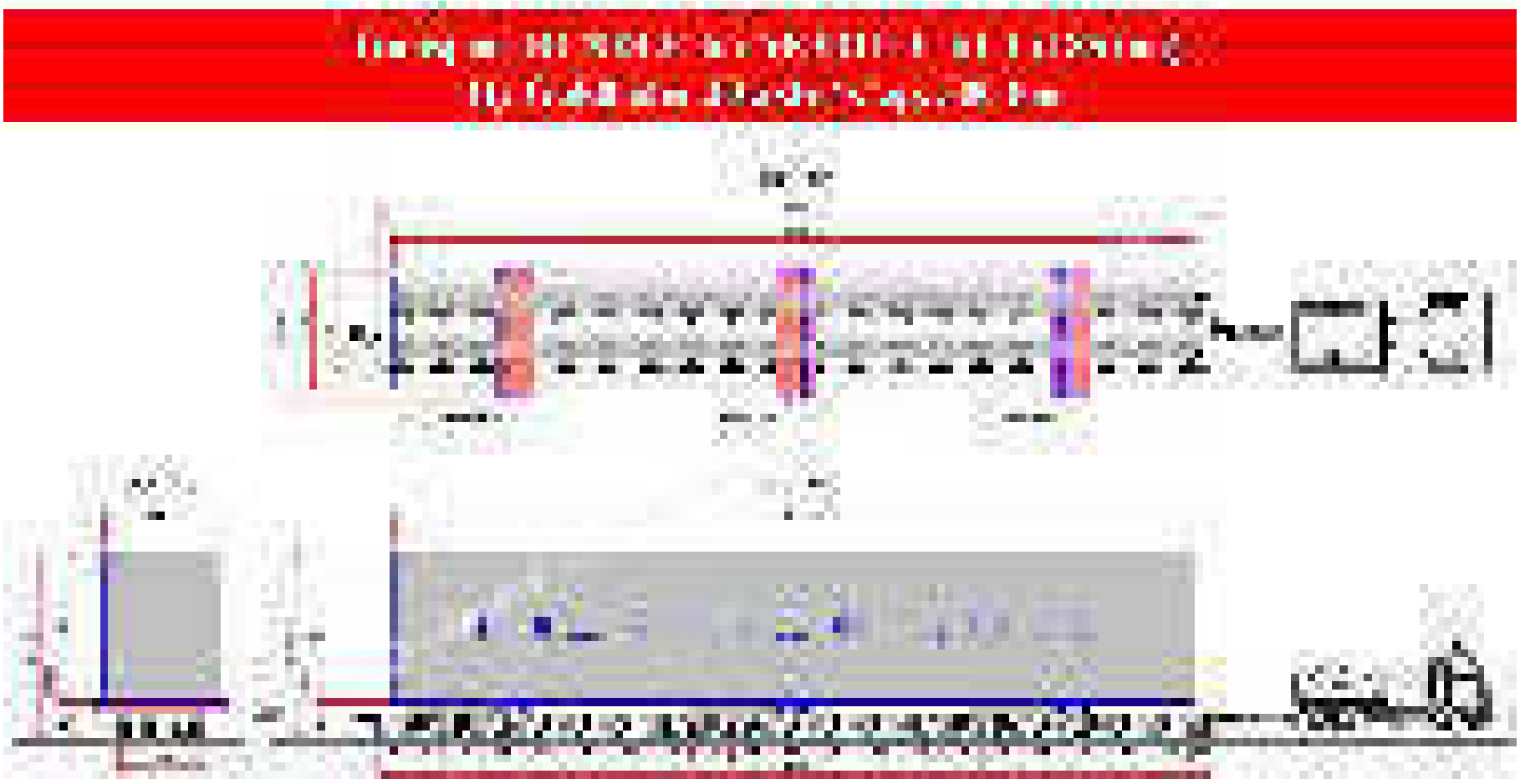
4. Land transport to site

5. Unloading at site

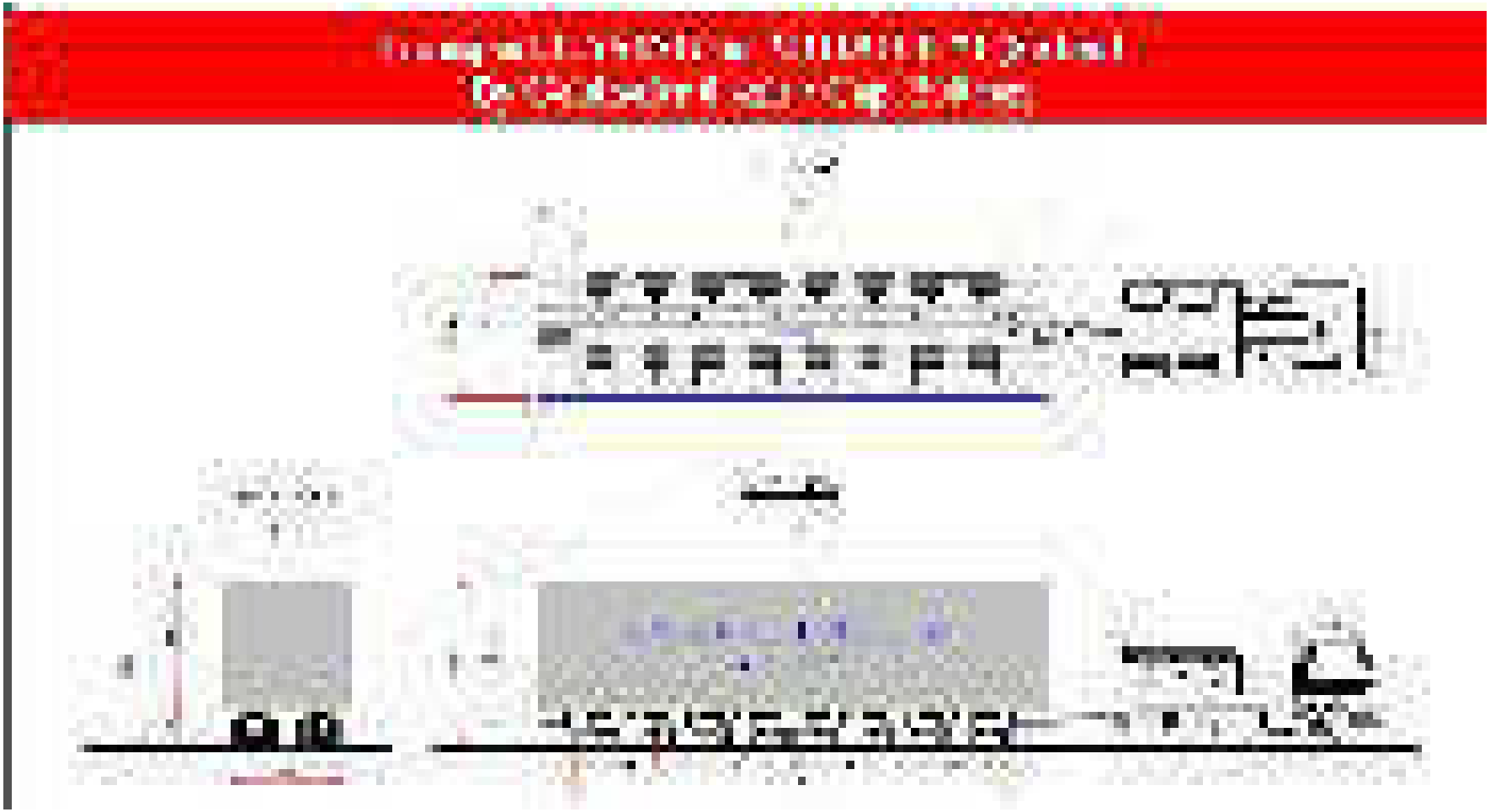
IV. Heavy Equipment Transportation Plan



IV. Heavy Equipment Transportation Plan



IV. Heavy Equipment Transportation Plan



V. Heaviest Loads Cargo List (Preliminary)

#	DESCRIPTION	Q'ty	Dimension (m)			CBM (m³)		G.Weight (Ton)		Transportation		Remarks
			L	W	H	Unit	Total	Unit	Total	Barge	Category	
1	Turbine a Gaz / Gaz Turbine	2	9.9	3.6	4.6	163.9	328	91	182	Barge	Heavy	
2	Alternateur / Generator	2	9.1	3.5	3.5	111.5	223	150	300	Barge	Heavy	
3	GT AIR FILTER	2	10.2	3.2	4.6	150.1	300	17	33	Barge	Heavy	
4	GT AIR FILTER	2	10.2	2.4	4.6	112.6	225	11	22	Barge	Heavy	
5	GT AIR FILTER	2	10.2	2.5	4.7	119.9	240	16	33	Barge	Heavy	
6	DUCT ARRANGEMENT INLET	2	6.1	4.4	4.0	107.4	215	18	36	Barge	Heavy	
7	EXHAUST DIFFUSER	2	4.8	3.9	4.1	76.8	154	6	12	Barge	Heavy	
8	LIQUID/AIR/ WATER INJECTION SK	2	6.4	4.1	4.1	107.6	215	34	67	Barge	Heavy	
	GT Total	16					1,899		686			
9	Stator (Including Air Cooler)	1	8.0	3.6	4.1	118.1	118	141	141	Barge	Heavy	
	ST Total	1					118		141			
10	MODULE 1A	1	27.2	4.2	1.5	171.4	171	85	85	Barge	Super.H	
11	MODULE 2A	1	27.2	4.2	3.0	342.7	343	113	113	Barge	Super.H	
12	MODULE 3A	1	27.2	4.2	3.3	377.0	377	122	122	Barge	Super.H	
13	MODULE 4A	1	27.2	4.2	3.3	377.0	377	122	122	Barge	Super.H	
14	MODULE 5A	1	27.2	4.2	2.8	319.9	320	110	110	Barge	Super.H	
15	SIDE PANEL1	2	24.9	3.9	1.3	126.2	252	38	77	Barge	Super.H	
16	SIDE PANEL2	4	20.0	3.0	0.8	48.0	192	6	24	Barge	Heavy	
17	SIDE PANEL3	2	24.9	4.2	1.3	136.0	272	39	78	Barge	Super.H	
18	SIDE PANEL4	4	20.0	3.3	0.8	52.8	211	7	30	Barge	Heavy	
19	SIDE PANEL5	2	24.9	4.3	1.3	139.2	278	39	79	Barge	Super.H	
20	TOP PANEL3	1	4.9	4.2	1.0	20.6	21	6	6	Barge	Heavy	
21	TOP PANEL5	1	4.9	4.3	1.0	21.1	21	6	6	Barge	Heavy	
22	TOP PANEL6	1	4.9	4.3	1.0	21.1	21	6	6	Barge	Heavy	
23	BOTTOM PANEL3	1	4.9	4.2	1.0	20.6	21	6	6	Barge	Heavy	
24	BOTTOM PANEL5	1	4.9	4.3	1.0	21.1	21	6	6	Barge	Heavy	
25	BOTTOM PANEL6	1	4.9	4.3	1.0	21.1	21	6	6	Barge	Heavy	
26	SHELL PLATE	5	10.0	6.0	4.3	258.0	1,290	15	77	Barge	Super.H	
27	LIFTING JIG	2	23.1	3.5	1.2	97.0	194	14	29	Barge	Super.H	
28	FRAME ASS'Y	1	29.7	1.8	0.9	48.1	48	26	26	Barge	Super.H	
	HRSG Total	33					4,452		1,010			
29	Generator Step-Up Transformer	3	9.0	4.0	8.1	291.6	875	98	295	Barge or other	Super.H	
30	Unit Auxiliary Transfor	2	6.0	4.7	3.6	101.5	203	27	53	Barge or other	Super.H	
	Transformer Total	5					1,078		349			
	GRAND TOTAL	55					7,547		2,186			

VI. Preliminary Transportation Plan

Gas Pipeline Sample Construction Execution Plan and other information

	275MW RIAU GAS-FIRED COMBINED CYCLE POWER PLANT PROJECT MEDCO RATCH POWER RIAU	

DOCUMENT NO.
CPM – CON – CEP – 001

CONSTRUCTION EXECUTION PLAN

Rev	Issue Date	Reason for Issue	Prepared By	Approved By
0	11/01/2017	Issued for Information	PT. CITRA PANJI MANUNGGAL	PT. MEDCO RATCH POWER RIAU
1	19/12/2017	Issued for Information		
Signed By,				

TABLE OF CONTENTS

1 GENERAL

This document to describe the method of the project was made by PT Citra Panji Manunggal (CPM)to explain how the work will be undertaken so that the project can be implemented on schedule and in accordance with the specifications and quality required in the tender documents.

Project Location : Siak to Pekanbaru, Riau - Indonesia
Project Owner/Client : **PT. Medco Ratch Power Riau**

2 SCOPE

The scope of this document is to describe the construction execution strategy for installation of the onshore pipeline for **EPC Gas Pipeline For 275 MW Riau Gas-Fired Combined Cycle Power Plant Project**.

3 OBJECTIVE

The purpose of this document is to describe the plan, methodologies, and strategies for constructing the aforementioned pipeline. This plan establishes the construction organization, discusses administrative processes, identifies pre-construction activities, and summarizes key construction. Related procedures that will be used to execute the project, with the goal of ensuring all safety requirements are met, quality expectations are achieved, and the project is completed on schedule, will be issued separately.

4 REFERENCE

This procedure refers to International Standards and Codes and Local Regulations.

5 ABBREVIATION & DEFINITION

CLIENT	PT. Medco Ratch Power Riau
CPM	PT. CITRA PANJI MANUNGGAL
QA/QC	Quality Assurance / Quality Control
HSE	Health, Safety and Environment
DCC	Document Control Center
EPC	Engineering, Procurement and Construction

6 CONSTRUCTION ORGANIZATION

6.1 Organization Chart

The Construction Organization Chart for this project can be seen in Attachment 1.

6.2 Key Personnel Responsibilities

6.2.1 Project Manager

The Project Manager (PM) will be responsible for the overall project execution and will establish the most effective project task force for the execution of the project. He will communicate with the CLIENT Project Manager and implement the resolution of matters requiring judgment at the highest levels, including decisions related to contractual matters. During construction activities at site he will be back to back with DPM as General Site Manager at construction site.

General Responsibilities

The Project Manager is the representative of CPM which shall be valid from the effective date of the contract up to the date of completion of the contractual obligations and will report to Project Sponsor. Consequently, he shall be the focal point on all matters and actions related to the Project.

The Project Manager is responsible, within the allocated budget, for satisfying all contractual commitments towards Client while looking after the interests of CPM and managing the risks associated with the project.

The Project Manager is mandated to promote, conduct and monitor CPM HSE Policy objectives to enable work to be carried out safely. If necessary, he is responsible for the implementation of remedial action in matters of health, safety and protection of the environment. Project Manager needs to constantly reinforce the message that safety will not be compromised for any reason.

General Duties

1. Initial Execution Stage

- Implementation of administrative and financial actions
- Mobilization of the Project Task Force
- Preparation or approval of Project Procedures
- Internal and external kick-off meeting
- Check list of priority actions / documents
- Dispatch of Project comments to the relevant parties
- Approval of Schedules
- Approval of Project HSE Plan

- Coordinate Engineering, Procurement, Subcontracts, Construction and Pre-commissioning activities.
- Prepare Project Execution Plan in accordance with project plan basis policy.

2. Project Execution Stage

- General Management (Issue of Monthly report to Company and CPM Corporate Management; Coordination with 3rd parties).
- Overall coordination inside the Project Task Force and between Jakarta Project Office and Site Office.
- Selection of vendors and subcontractors
- Follow up of progress monitoring
- Participation in the organization of Construction and Pre-Commissioning from Jakarta Project Office

6.2.2 **Construction Manager**

The Construction Manager (CM) will report directly report to the Project Manager.

Responsibilities and Duties

- Manage a team of construction specialists who perform the actual field construction works in accordance with requirements contained in the approved Construction Plan, Drawings, Specifications and Construction Procedures.
- At the start of field construction work :
  - Review Construction ExecutionPlan and Contract Agreement with Client, to become familiar with the details of the project, to-date progress of the project, significant milestone, and various procedures.
  - Together with Safety Manager / Security Coordinator, reviews the forthcoming construction activities in the view of any Client's safety / security regulation, such as but not to be limited to the work permit system, emergency evacuation procedure, and project HSE Plan.
  - Together with the QC Manager and the Engineering Manager (EM), reviews the forth coming construction activities in the view of Site QA and QC, any design changes, and any non-conformity control procedures to be complied with.
  - Together with Project Control Managers, reviews the forthcoming construction activities in relation with target progress and milestones of project.

- Reviews the Temporary Facility Plan, makes sure that the plan has covered all required construction aids and sufficient to support the safe and productive works.

- Initiates or reviews correspondences related to construction works, outgoing to CLIENT and Subcontractors prior to signature by the General Site Manager.
- Attends regular scheduled meetings with CLIENT's Representatives to formally review the status of construction, the present challenges of the work, and the planned works in the coming week(s) or month(s).
- Overviews the overall day-to-day construction works and ensures that :
  - The Construction work force and Subcontractors crews are working at allocated work places, under adequate supervision and harmonious coordination, having enough manpower, materials, equipments, tools, consumables, drawings, specifications, and correct instructions for the required production.
  - The work is carried out in compliance with QC procedures, and in proper sequence to meet the target progress and milestones in a safe and economic way.
  - The Project HSE Plan is implemented at actual field works and obeyed by all people: managers, superintendents, supervisors, craftsmen and visitors of the subcontractors.
- A lead of weekly staff coordination meetings to review the actual schedule of works being performed, the forthcoming activities and targets, and highlighted 90 day look-ahead schedule.
- Reviews the work schedules prepared by the construction work group or area team and Subcontractors and instruct if a corrective action is required, he shall be prepared to offer solutions to the Site Management Team for further discussion.
- Review and checks requisitions prepared by the construction group for construction tools, temporary materials, additional manpower, material substitutions, prior to submit to the GSM for approval.
- Reviews construction progress reports prepared by project control prior to GSM approval for submittal to the Project Manager and or the Client.
- Participate in the HSE inspections and audits. In case of an accident happened, the CM shall attend the Emergency Response Team meeting conducted by Safety/Security Manager.
- Reviews the constructability of any field design change proposed by Field Engineering.
- Approves time sheets of area/disciplinary superintendents and supervisors.
- Coordinates preparation of Close-Out Report and review the reports, before submit to GSM.

6.2.3 Project HSE Manager

The Project HSE Manager will assist the Project Manager, who has a prime responsibility for the overall HSE management and performance of the project

during the entire project execution period. His major roles and responsibilities are to:

- Establish the HSE Management Plan and incorporate regulatory and CLIENT's HSE policy and requirements specified in the contract documents, and also CPM's HSE policy, objectives and targets.
- Set up the project HSE programs, procedures, training materials, HSE audit programs, etc, including modifying and / or improving CPM's standards, if necessary, to ensure that they meet HSE goals and objectives.
- Fully participates in CPM's HSE Programs and Initiatives such as Hazard identification; Observation and Intervention Programs.
- Promotes an "Approaching Others" no blame culture with each other CPM personnel.
- Coordinate with the Engineering Manager on HSE engineering activities to comply with the HSE engineering program and requirements, such as hazard and effects management, incorporate HSE requirement into engineering, conduct safety reviews including HAZOP (Hazard and Operability) and SIL (Safety Integrity Level) from a HSE point of view, monitor completeness and close-out matters raised during engineering, etc.
- Maintain a record of all documentation on HSE matters relating to Project,
- Communicate and maintain close communication with the Site HSE Manager on HSE requirements and information,
- Coordinate with Company's HSE representatives as and when required.
- Prepare a "Monthly HSE Report" on the progress status of all activities included in the HSE Management Plan; timely report on any HSE issue requiring action by the Project Management: Early report on any conflict with the CLIENT's HSE representative on HSE matters requiring resolution at the Contract Management level.

6.2.4 Project QA/QC Manager

The Project QA/QC Manager will report directly to the GSM. He will be responsible to establish a Project Quality (assurance) system in accordance with CLIENT's Specifications and CPM's Quality Management system as follows:

- Define the measures to be put in place for quality planning, quality surveillance and quality improvement.
- Prepare schedule of Quality Audit and ensure its implementation.
- Manage the execution of the quality surveillance activities.
- Ensure satisfactory interface and communication with CLIENT'sQC Representatives.
- Prepare the Project Quality Plan, based on ISO 9001 : 2000 and CLIENT's Project Requirements
- Conduct External Quality Audit at Vendor and Subcontractor (if any).

6.2.5 Chief of Security

The chief of security will assist the Site HSE Manager and coordinate with the Construction Manager, his major responsibilities are to :

- Prepare and submit to Company the security plan for each location where Contractor plans to perform work.
- Provide adequate staffing required for implementation of the security plan.
- Notify Company of work site security incidents and threats immediately or as directed by Company representative or Company procedures.
- Cooperate and assist as required with Company security personnel to asses and maintain an appropriate level of work site security.
- Provide Company the ability to conduct security program review to test and evaluate Contractor security systems.

6.2.6 **Project Engineer**

The Project Engineer shall collaborate with the Construction Manager on any engineering assistance requirement on Site. The Project Engineer shall ensure that CLIENT-approved documents are used as reference/basis of the construction activities and shall coordinate with the H/O engineering team for any potential deviation or design changes. He is also responsible to prepare Site Queries if required.

6.2.7 **Project Control**

The Project Control will be responsible to prepare the schedule and update with the Project Manager, meeting with CLIENT regarding the progress and schedule, and give awareness to the personnel's to catch up any delay.

6.2.8 **Document Control**

The Document Control will responsible for the implementation of all correspondence and document control systems.

6.2.9 **Area Superintendent**

The Area Superintendent shall report to The Construction Manager and shall be responsible for the execution and implementation of all site activities related to this plan. CPM will assign two area superintendents to implement the plan.

6.2.10 **Discipline Supervisors**

The Discipline Supervisors shall report to the Area Superintendent and shall be responsible for their specific part of the installation work.Discipline Supervisors will be assigned as follows:

- Pipeline Supervisors is responsible for over all pipeline construction activities such as clearing and grading, bending, stringing, welding, trenching, backfilling, open cut crossing,as well as above ground piping (if any).
- Field Joint Coating Supervisor is responsible for field joint coating activities including allocation of resources, materials and equipment, as well as ensuring all field joint coating activities are conducted safely and per job description.

- Civil Supervisors is responsible for civil construction activities such as communication building, steel structures, temporary roads, drainage and reinstatement and restoration.
- Electrical and Instrument Supervisors is responsible for the installation and testing of the electrical and instrumentation part of the work.
- Hydrotest Supervisors is responsible for hydrotesting activities such as cleaning, gauging and hydrotesting. While N2 blanketing is part of system completion manager.
- Crossing Supervisors is responsible for construction activitiessuch as HDD and Auger Boring.

6.2.11 Human Resource Coordinator

The Human Resources Coordinator shall oversee all aspects regarding CPMtemporary site employees. The Personnel supervisor shall handle/conduct performance review of SiteEmployees. He shall ensure that employees understand the duties and responsibilities of their positions.

6.2.12 Logistic Coordinator

The Logistic Coordinator will be based at site office and shall handle the distribution and reception of materials, warehouse, as well as organizing equipmentmobilization and demobilization. The Logistic coordinator shall always maintain stocks in the yard, warehouse and other on-site facilities.

6.2.13 Work Permit Coordinator

The Work Permit Coordinator is responsible to coordinate the work permit system, he/she will be assisted by a permit to work man at every working area for arranging (with Supervisor) the work permits and apply the correct work permits prior to commencement of the work. He will ensure that the working permit has been completed with the JSA for each working activity.

6.2.14 Socio Economic Coordinator

The Socio Economic Coordinator is responsible to inform and socialize the working activities to every village chief and local community along the pipeline ROW. He/She is also responsible to take action to solve any social-economic problems that may occur prior, during, or after construction. The socio economic staff shall continuously socialize about the construction activities with the local communities.

7 MEDICAL TREATMENT AND MEDEVAC SUPPORT

Field medical service including medical treatment and medevac service will be provided by a Hospital with 24 hours a day access to an off-site consultant physician. A clinic, a national doctor, paramedics, and two ambulances will be provided to meet service as follows:

- General medical care, including diagnosis and therapy of common, acute medical condition.

- First aid and minor trauma management.
- In-field stabilization of medical and surgical emergencies.
- Rescue, extrication and medical transportation of ill and injured parties by suitable air, water, or ground transport to designated referral hospital.

Staffing equipment, programs and procedures, and supplies for medical service shall be in accordance with Health Risk Assessment, Upstream service Manual, Company's Health inspection guidelines, and health plan.

8 CONSTRUCTION ADMINISTRATIVE PLAN

8.1 Establishment of Temporary Facilities

1) Prior to the start the pipeline installation, CPM will construct a temporary facility for CPM at Site Project.
2) The Temporary facilities will consist of:
   - Site Office facility
   - Camp facility (Housing rental), the camp will accommodate approx. 12 person / housing
3) The Site Office will be the head quarter of the General Site Manager (Project Manager/Construction Manager, in a day to day basis on site title of the project manager change become the general site manager), who is responsible for the day to day overall site activities such as; control all construction activities, field engineering, site procurement, maintaining progress, site commercial, quality of the work, etc. Other functions of the site office will include, but not be limited to communication center with CPM Head Office (HO), CLIENT's liaison and administration such as, insurance, medical requirements, progress reports, safety, permitting and material control.

8.2 Correspondence and Document Control

Communication and correspondence on project will be as follows:

- Throughout the construction phase, a weekly construction coordination meeting will be held and attended by the Construction Manager, Area Superintendent, Supervisors, Field Engineers, Socio Economic Coordinator, Chief Security, Logistic Officer and lead by the Construction Manager. Coordination meetings are intended to discuss safety tracking report, project progress report and address any issues and obstacles met during the construction activities.
- Project communications include Project Records, such as: correspondence, memos, electronic mail, telephone conversations; and Project Reports, such as: minutes of meeting, reports, procedures, and transmittal of documentation.
- All Project letters (outgoing and incoming) shall be reviewed, approved and signed by the Project Manager (General Site Manager) and/or by a person authorized by the Project Manager (General Site Manager).

- Correspondence is defined as letters written to persons or organizations outside the CPM's Project Team. The appropriate letterhead and numbering shall be used for all correspondence.
- Documents/Drawings will be transmitted by using "Document/Drawing Transmittal Form". Addressee copy of the transmittal form will be sent to the addressee with the instruction to sign and return thereby acknowledging receipt of the documents.
- All subjects and discussions during any meetings between/among parties shall be noted and documented in such a manner that it can be easily traced and retrieved. Copies are normally distributed to all attendees and other certain related parties.

8.3 Construction Design Change

All design changes will be handled by the Project Engineer and assisted by draftsman. Any revision in engineering design shall be aknowledged by CLIENT and subject to approval. The change/revision on site will be proposed as Technical / Site Query and may be used for construction once approved by the CLIENT.

If the design change will cause a deviation in the spec, the issue will be resolved at the Jakarta office, endorsed by Engineering Manager, and approved by the Project manager. The Engineering Manager will send the TQ and information letter to the CLIENT.

8.4 Construction Meetings

1) Meeting between CPM and CLIENT
   - Meetings between CLIENT and CPM will be held weekly.The participantswill include the SM/CM and area superintendents and will take placein a CLIENTor CPM meeting room.
   - Construction Meetings at Site will be held between the CLIENT and CPM to allow close monitoring of all aspects of the Project execution.
   - Ad hoc Meetings that are not part of the regular schedule of meetings may be convened according to the requirements of the parties, but shall be restricted as far as possible to only those necessary to progress the completion of the works.
   - The organizing party shall prepare and distribute an agenda and propose a time for the meeting together with any information necessary to properly conduct the meeting.
   - Progress and coordination meetings shall be held on weekly basis, shorter intervals may be dictated by the rate of progress or the need to resolve matters that might otherwise result in delay to the Works.
   - A standing agenda shall be established at the first of each meeting. Meetings shall be normally be chaired and recorded by CPM, and then approved by CLIENT.
   - The written records of all meetings shall be circulated to all attendees and all relevant supervisors.
2) Internal Staff Meetings
   - Internal staff meetings with all discipline supervisors are held at least once per week to discuss all aspects of the project and to maintain good internal communications and to keep records of the activity/construction progress, the

weather, any event, quality or HSE problems. In addition, ad hoc meetings may be called when necessary.

- Each internal meeting at site shall be recorded and updated by the CPM, and the written records of all internal meetings shall be circulated to all attendees.

3) Safety Meetings
   - Internal safety meetings with all discipline supervisors will be held at least one time per week to discuss all HSE aspects of the project to maintain good internal communications and to keep records of HSE problems. In addition to the above, safety tool box meetings shall be performed prior the start of work each day.
   - Safety meetings will be conducted in stages involving the parties grouped in the tier 1 (Monthly Management), tier 2 (Weekly Site Management) and 3 (Weekly Worker).

8.5 Construction Reports

1) Daily Reports
   CPM shall prepare a daily Construction Progress Report covering all activities of the construction work (Civil, Mainline, Mechanical and Valve Station Works). These reports shall be submitted by the Construction Manager and shall be delivered on a daily basis to the CLIENT Representative at Site not later than 10.00 AM the next day. The report also will be uploaded on the web based pipe-track system.
2) Monthly Progress Report
   CPM shall submit a monthly progress report to CLIENTon a monthly basis.
   Cut Off date shall be on the last day at the end of the day shift of each calendar month. The submission of the report shall be within 7 days following the end of each month.

8.6 Drafts As-built Documents

The As-Built Documents shall comprisethe following:

- Red lined diagrams, will be developed as follows:
  - Before an As-built document is produced, a red line will be provided at site by the Surveyor.
  - For the pipeline and FOC, the surveyor will take coordinates on top of the pipe and/or FOC, and backfill crown witnessed by the CLIENT.
  - For Civil work, the Surveyor will take the coordinates of a building, fencing or valve stations.
  - The results and findings will be marked on the drawing (Red Lining) and signed by both parties (CPM and CLIENT).
  - The Coordinates and elevations data taken (soft and/or hard file) will be reported to the Technical Supporting Department for the as built drawing process.
- The file contents are similar to the DFO (Documents For Operation).
- Drawings of the Permanent Works as installed (including a “family tree” index incorporating all drawings from suppliers and subcontractors), indicating all changes

made to the original Drawings issued for construction will be submitted to CLIENT for review and approval.

- Specification of the Permanent Works as installed, indicating all changes made to the original Specification issued for construction, will be submitted to CLIENT for review and approval.
- A copy of all TQ'S and SQ'S issued by the CPM during the execution of the Works. This applies to CLIENT's instruction of change(s) from the original scope of work.
- A full report on all non-conformities identified and corrective measure taken.
- A copy of all construction records and deliverables developed by the CPM and/or its Sub-Contractor(s), including all test results.
- An original of all Standards and Codes of Practice applicable to the works.
- Operation and maintenance documentation, including all applicable product information required to operate and maintain the system.
- A copy of all project documentation prepared by CPM and its Subcontractor(s) (procurement/sub-contracting documents).
- A copy of environmental reports, records and statistic.
- Installation Procedures for the work.
- Draft of As-Built Documents shall be submitted in paper hard-copy format.
- The original design shall be clearly distinguishable from what has been built. On drawings, this may be achieved by layer separation, line color or line type, or a combination thereof. In the Specifications, this shall be achieved by any changes being identified in red font. Where words have been deleted from the Specifications, the deleted word shall remain in view but be stroked through with a line.
- Each change from the original design shall be referenced to the authorization giving rise to that change.

9 CONSTRUCTION RISK ASSESMENT

The objectives of the construction risk assessments are as follows:

- Identification of all the construction risks including those induced by a change.
- Scenario Development.
- Cause identification.
- Consequence Analysis.
- Probability Analysis.
- Implementation of control measures that lower risk.

Construction risk assessments for selected construction activities should be completed approved, and all action items closed out before commencing the work. Construction risk assessment will be developed at least 1 month prior to commencement of the work.

10 PRE-CONSTRUCTION ACTIVITIES

The objective of the Preconstruction activities is to ensure that the facilities which are required during main construction execution are sufficient and adhering to the following criteria:

- The quantity, size and condition of facilities are sufficient, safe and secure.
- Optimization of the local content.
- All project, government laws and standard practice quality requirements are met.

10.1 Main Camp, Office and Laydown

- The main camp is centralisation of accomodation where major of CPM's staff will be located stayed during the project in Pekanbaru City. In addition to main office, when necessary, CPM will provide site office for personnel on each spread.
- Laydown area will be built in around ROW near Jalan Minas, Riau.
- Temporary Utility Plan are developed as necessary depend on site condition.
- CPM will utilizeinternet for data communication between CPM Jakarta office and CPM Site Office.

10.2 Mobilization

CPM will mobilize material, manpower and equipment based on the latest pre-construction schedule.

10.3 Work Permit

Permits from local governments must be obtained before constructing the facilities.
Below is the list of the requirement permits:

- HO.
- Local Authority
- Permit to works
- Domestic and Construction waste.

Those permits must be obtainedat least 2 weeks before start construction. During an internal meeting the Permit-to-Work Man will inform the permit status. The Permit-to-Work Man will hand over a copy of the permit which has been approved by the government authority to the Construction Manager. At the same time the Permit-to-Work Man will inform all the government requirements to the Construction Manager.

11 WORKER AND MATERIAL TRANSPORTATION

11.1 Worker Responsibilities

11.1.1 Foremen

TheSupervisor will be based on the ROW and will be responsible for supervision of stringing activities along the ROW, and will provide the necessary information and liaise with PTW Man responsible for applying the correct work permits prior to commencement of works. The supervisor will ensure the hauling and stringing activities performance is in accordance with procedure. The Supervisor shall also

be responsible for the overall implementation of the Project HSE Plan and safety regulations that govern.

11.1.2 **Warehouse Supervisor**

The Warehouse Supervisor is responsible for loading/unloading activities at the Site Project laydown areas. He will coordinate with the supervisor to load trailers and send them to the ROW. He is also responsible for overall implementation of HSE requirement at the laydown areas.

11.1.3 **Safety Officer / Safetyman**

The Safety Officer/ Safetyman will be responsible for the implementation of the HSE Plan and compliance with all statutory regulations that govern on all the activity commenced at his assigned spread. The Safety Officer / Safetyman will supervise the HSE aspects of the work at a maximum of 50 workers in one spread and to conduct safety briefings.

11.1.4 **Permit to Work Man**

The Permit-to-Work (PTW) Man is responsible for arranging (with Supervisor) the work permits and apply the correct work permits prior to commencement of work. The PTW Man will ensure the working permit is completed with the JSA of each working activities and ensure the permits are approved before the work is started.

11.1.5 **Certified Crane Operator**

The Certified Crane operator is responsible to operate the crane correctly and safely. The Operator shall have adequate knowledge to load & unload pipe at storage and stock yard. The operator shall always observe the hand signals of the rigger in charge of the lifting operation and watch out for any existing properties that could be harmed by the operation.

11.1.6 **Certified Side Boom Operator**

The certified Side Boom operator is responsible to operate the side boom correctly and safely. The operator shall be have adequate knowledge of the land condition to avoid the side boom getting bogged down on site especially in swampy areas. The operator shall be always accompanied by a rigger who will monitor the side boom movement and look out for the safety of personnel as well as for any existing properties that could be damaged by the operation.

11.1.7 **Pipe Carrier Operator**

The pipe carrier operator is responsible to operate the pipe carrier correctly and safely. The operators shall have adequate knowledge about the land/soil condition to avoid the carrier getting bogged down on site especially in swampy areas.

11.1.8 **Certified Rigger**

The certified Rigger shall be responsible for loading, unloading, moving of material including but not limited to the following:

- Ensure that the lifting equipment is certified,adequately maintained and in a good condition.
- Ensure that lifting gear and storage locations are regularly inspected.

11.1.9 **Material Controller**

The Material controller will be responsible for all consumables & non-permanent material, storage (warehousing), and identifying, record, stock, report and shall serve the site activities where required.

11.1.10 **Flagmen**

The flagmen are responsible to manage the traffic during working activity especially when the equipment movement. Flagmen are also responsible for the implementation of traffic management plan.

11.1.11 **Helpers**

The Helpers are responsible for performing all work ordered by supervisor correctly and safely. Work will consist of unskilled activities such as: preparing the hand tool, perform manual handling, etc.

11.1.12 **Medic**

The Medic shall be standing by on site during the construction activities. Medic is responsible to conduct first aid and medical actions in case of medical emergencies. The Medic shall be part of the Emergency Response Team. The medic will be assisted by the first aider (provided from each trained crew personnel at each working area).

11.1.13 **First Aider**

The first aider is responsible to conduct first aid action in case of any incident during working at work area. The first aider will be the trained personnel from each working crew.

11.1.14 **Truck Drivers**

Truck Drivers are responsible for:

- Taking care of their own health and safety.
- Not being under the influence of drugs and/or alcohol while operating a truck.
- Checking and confirming that their truck is safe to operate.
- Ensuring the suitability of the vehicle for the task to be performed. E.g. load capacity, pipes quantity, lashing strength, wooden dunnage, stopper, etc.
- Reporting any incidents damages or malfunctions to their Supervisors.
- Not making any unauthorized modifications to vehicles.

- Ensuring that they hold the appropriate and original driver's license and truck registration (SIM & STNK).
- Ensuring that seat belts are worn at all times.
- Identify areas of risk e.g.: blind spots, and support countermeasure activities.
- Wear appropriate Personal Protective Equipment (PPE).
- Ensure Truck Loads are secure and safe during transport
- No speeding
- No smoking is allowed on board the truck and while refueling.
- No telephone use while driving.
- Vehicle Tracking Operator.
- To ensure that the vehicle tracking system is fully functional.
- To monitor truck movements and to make report from Site Project Site Office.
- To maintain communication with the pipe transport supervisor during trucks movement, and react in the appropriate way when (emergency/unusual) situations occur.

11.1.15 Dispatcher

The dispatcher will responsible for:

- Ensure that the driver is fully aware of the content of the transportation procedure prior to commencing the journey.
- Coaches the driver to practice safe driving behaviors.
- Ensure all proper approval permits are obtained for any deviations necessary to fulfill the objective of the journey.

11.1.16 Escort

The escort will ride in a separate vehicle and will be assigned to guide each pipe transport truck along their journey. They are responsible for ensuring their journey from the laydown area to the ROW and return is safe.

11.2 Vehicle Condition

11.2.1 General Truck Safety Requirements

Equipment control, maintenance and inspection will be carried out on any truck used. Every truck which will be used, a truck and trailer inspection will be done every day before and after carrying out the work, using a truck inspection form.

11.2.2 Truck Selection

The following standards have been applied when choosing trucks for this project:

a) Trucks should be less than 8 years old.
b) As a minimum, trucks are equipped with the following:
   - First Aid kit.
   - Fire extinguisher.

- Seat Belt.
- Spare tire.
- Tool kit to change the tire
- Lashing equipment (chain and sling belt) suitable for the load of pipes or bends.
- Wheel stopper, wooden dunnage
- 3 pieces wooden support shall be used on the flatbed (size: length 230 cm x 16 cm width x 8 cm height), covered by rubber.
- Stanchions, 80 cm height for 3 points on both sides, shall be covered by rubber.
- Steel head board protection, with the appropriate measurements and strength.
- The rear window panel of the truck cabin shall be protected with appropriate head board that fully covers the rear panel. Head board rack will be inspected and approved prior to use on project.

11.3 HSE Requirement

11.3.1 Training and Drivers Competency

CPM will ensure that the basic types of information and training required by all employees, supervisors are provided prior to the start of work and throughout the duration of the work.

A training program will be used to educate and train people in order to improve health, safety and environmental awareness and performance. A brief overview of the training program is as follows:

The education and training will comprise of 4 (four) basic elements:

- Orientation
- Pre Work Briefing
- Job specific and topic specific training
- Supervisor Training

Pre Work Briefing will be used to reinforce issues addressed at orientation and new issues arising as the project develops i.e. weather / traffic conditions, demonstration, etc.

CPM will train all personnel involved in observing and correcting unsafe acts or unsafe condition through HSE report card.

CPM shall provide all personnel with HSE awareness, induction and training, and where required, specific training applicable to the employee's work task.

CPM will roll-out the observation and intervention program to all personnel, and the program will refer to the CPM Safety Management Plan.

11.3.2 **PPE Requirements**

CPM will ensure that all Personal Protective Equipment (PPE) used on the Project is in conformance with project requirements. All PPE and Safety Equipment shall be checked daily prior to commencement of work.

Minimum PPE:
CPM will provide PPE in accordance with an internationally recognized standard and project requirements. Minimum levels of PPE shall be provided for protection for head (Safety Helmet), feet (Safety Boots), ear (ear plug), eye (safety goggle), hands (Gloves), and high visibility work vests, these are the basic requirements to be used at all times.

11.3.3 **Communication System**

The primary communication system during the transportation activities will be by radio. The radio will be held by the driver assistant of each trailer.

A dispatcher will be assigned to track the trailers from laydown to the ROW, the dispatcher will always communicate with the trailer, transport supervisor, and warehouse supervisor at the laydown, and with mid end supervisor at the transfer laydown or ROW by using the radio mentioned above.

CPM shall provide radio repeaters as necessary to provide coverage for all working areas. Mobile phones will also be provided as secondary communication system on site.

11.3.4 **Socio-Economic**

CPM will inform the local police (Polsek) of transportation plans including timing and routes. This communication will be done by formal letter at least 2 weeks prior to starting. Further, each village chief will be notified of CPM transportation plan as well. Additional socialization will be performed at schools and markets.

Local flagmen will be deployed at busy intersection and high population areas.
Water truck will be used to control the dust that will be generated during transport through village roads.

11.3.5 **Regulation Permit**

Prior to start of the construction activities, the pipe transportation supervisor shall ensure that the site has been permitted to work by the CLIENT, local authorities, village chief and/or local land owner to avoid unnecessary delays due to any problems during the performance of the work, the permits such as:

- Polisi Resort (District Police Department)
- Kepala Satuan Lalu-lintas (Police Traffic department)
- Kepala Polisi Sektor (Sub-District Police Department Chief) at each Sub-Local village chief

- Dinas Perhubungan (DISHUB)
- DLLAJR (Dinas Lalu Lintas Angkutan Jalan Raya)

11.4 Incident Management

11.4.1 Emergency Situation

The driver should calmly and appropriately respond to emergency situations when they occur. He should also guide his helper on what to do and ensure a single command and control structure. He should contact the Pipe Transport Supervisor as soon as it is safe to do so. He should give details of the incident, the location, the time and what has been done so far. If need be, he should also contact the nearby Police to lodge report of incident.

11.4.2 Vehicle Accident

Any accident during transportation, minor or major, shall be immediately reported to the Supervisor and Police. As custodian of the process, the Supervisor shall report to Safety Officer and Area Superintendent. TheSupervisor should collect any evidences, conduct interviews and present formal reports with recommendations.

The CPM's Incident Investigation and Report shall as a minimum contain:

- Incident or work illness that happens to all transportation's personnel.
- Location, date and time of the incident.
- Contacts' detail of third parties (i.e. police officers, witnesses).

11.4.3 Vehicle Breakdown

For the safety of others, vehicle operators must signal that their vehicle has broken down by switching on their hazard lights and by displaying a triangle at the back of their vehicle.

Vehicle operators must report their vehicle breakdown to the Supervisor as soon as emergency signals have been set up. Vehicle shall be parked in a safe place.
The Supervisor shall coordinate with the AreaSuperintendent to find the solutions (e.g. send a mechanic, prepare towing truck, or get a new head trailer).

11.4.4 Rules Violation

Truck drivers that do not comply with the traffic rules outlined in this document will, depending of the seriousness of the offence:

- Receive a verbal warning.
- Receive a written warning (for CPM employees).
- Be temporary suspended from driving on the Project.
- Be permanently suspended from driving on the Project.
- Be temporary suspended from work (for CPM employees).
- Be dismissed from work (for CPM employees).

11.5 Journey Management Procedures

11.5.1 Assignment of Equipment and Personnel

Appropriate equipment and qualified personnel will be assigned. The selection is not only a function of technical specifications for the requested service, but will also take into account any special considerations for the journey (rain, road bad condition, floating, landslide, etc).

11.5.2 Speed Limit and Safe Distance

Drivers will comply with the road authority and company speed limits and safe distance set in the specific operating area/location. These limits below have been set following a local hazard identification assessment.
For the prevailing vehicle speed limits and safe distance are:

- Average speed :
  - 40 – 50 km/hour (on province main roads)
  - Maximum 30 km/hr when passing on the village roads
  - Safe distance between trailer driving convoy is 15–20 m
  - Less than 30 km/hr (on markets or schools areas, etc.)

11.5.3 Transportation Briefing

The pipe Transport Supervisor and the HSE site advisor will conduct a briefing to all drivers to ensure that:

- The route is clearly defined.
- Potential driving hazards, especially dangerous intersections, are identified in advance, taking into consideration the terrain, weather, known dangerous routes, speed limits, holidays (especially those which involve fasting), etc.
- Appropriate vehicles are assigned to the journey.
- Only qualified drivers are assigned and that there certification is current for the type of vehicles to be used.
- Drivers and passengers are fully briefed on the journey: route, hazards, planned stops, etc.
- Vehicles are inspected using an appropriate checklist before the journey begins.
- Gasoline must full before the journey.
- Recommendations are followed regarding scheduling rest stops.

11.5.4 Trucks Safety Equipment

All the trucks shall be equipped with seat belts, a fire extinguisher, a first aid box, wheel stopper, reverse alarm, headrest, handbrake, lashing and a tools box.

11.5.5 Time Limit for Driving

The drivers are only allowed 3 hours per trip (maximum), excluding breaks and lunch. Each trailer will have two trips a day on schedule.

11.5.6 **Parking Condition during Loading/Unloading Activities**

During loading and unloading operation, the driver must:

- Switch off the engine and always apply vehicle's parking brakes.
- The two of wheel stopper must be used correctly.
- Keep away from heavy lifting equipment.
- Start the engine only when directed by the supervisor.
- Responsible for lashing and unlashing of the pipes on his truck and to ensure that the pipes are properly secured.
- In coating yard and laydown area, drivers shall wait in driver's waiting room.
- Sleeping in the truck is not allowed while waiting for loading or unloading.
- Parking is only allowed on the designated area (rest area and laydown).

11.5.7 **Medical Check Up & Drug and Alcohol Test**

All personnel who are involving in the pipes transportation shall take and pass MCU test.

- Using drugs, alcohol or narcotics, is strictly prohibited and will result in immediate termination of employment.
- MCU and D&A test has been done under Contractor facilities
- Random test of alcohol and drugs will be done throughout and random during the transportation.

11.5.8 **Mobile Telephones**

The risk of an accident involving the use of a mobile phone is equal to the risk of an accident involving the abuse of alcohol, i.e. 4 times higher than normal driving risk. The use of a mobile phone or radio, while operating a vehicle, is prohibited. If called, the vehicle operator must first stop and park his vehicle in an appropriate safe location, where he does not disturb traffic, before answering the call.

11.5.9 **Working Time**

Normal working time shall be as follows:

06.45 – 07.00 : Toolbox Meeting
07.00 – 11.45 : Working hours
11.45 – 12.00 : Clean up working area and preparing for break
12.00 – 13.00 : Break time
13.00 – 17.30 : Working hours
17.30 – 17.45 : Closing / Toolbox Meeting

All personnel shall be responsible for cleanliness and tidiness of working area before leaving.

No works are allowed during heavy rain and risky weathers.

11.5.10 **Pipe and Equipment Transport Assessment**

The pipes and equipment will be transported from laydown (LD) to temporary laydown (TLD) prepared at the ROW or near it. From the temporary lay-down, the pipes will be hauling and stringing along the ROW by using side boom and pipe carrier.

11.5.11 **Pipe Laydown and Transfer Laydown**

The pipe will be stored at laydown area in Pekanbaru City.

For HDD pipes will be stocked at laydown Site Project. Fuel tank for the transportation vehicle and other equipment also will be available at each laydown, the fuel will be supplied from local supplier.

The temporary laydown will be prepared at mini stock pile along ROW.

11.6 Traffic Management Plan

11.6.1 **Local Community Awareness**

The local community and the public are often directly impacted by project traffic. Socialization is an important part of minimizing community impact. The socialization will be established and coordinated by CPM. Ongoing coordination between the local community head/chief and CPM will be in effect for the duration of the project to provide timely updates.

The socialization and the required permits for the above activities will be completely done before starting work on each area. All nighttime road closures and extended time delays will require one-week advanced public notification.

11.6.2 **High Population Center**

There are high population centers that will be passed through by a high volume of project vehicles. These include markets, city centers, and other dense areas. Prior to starting a high volume of traffic, the local leaders of these areas will be engaged and informed of our traffic plan and mitigation steps such as installation of traffic lights, signs, or flagmen will be done as necessary.

11.6.3 **Small Village Roads**

There are small village roads that will be passed through by a high volume of project vehicles. These roads will not be used for heavy duty access; only light duty vehicles will pass through these roads. Prior to use, some improvements for the roads will be undertaken.

11.6.4 **Signs, Barricade and Flagmen**

1. Signs will be placed in the following areas:
   - 100 m around the main entry /exit gate of laydown.
   - Open cut crossing.

- T-Junction.
- Transfer laydown area.
- Turning area inside ROW.

The sign board message example such as: “Hati-Hati Keluar Masuk Kendaraan Proyek / Warning in out Vehicle Activity along Project Area” and “Kurangi Kecepatan Sekarang / Please Move Slowly”.

2. Barricades, as well as the sign, will be placed in the following areas:
   - exit/entry point of the temporary and permanent laydown areas and camp.
   - Other areas that can be accessed by vehicles.

3. Flagmen will be assigned to reduce the traffic flow impact during the movement of the vehicle as follow:
   - A minimum of one flagman will be positioned away from construction sites that could impact local traffic.
   - A minimum of one flagman will standby at exit/entry point of the ROW half an hour before the project vehicle/equipment is passing.
   - A minimum of one flagman will assist vehicles/equipment during turning and passing ROW entry/exit points.
   - The Flagmen will setup the signs and/or barricades when project vehicles pass, and take them down after to give access for other road users.
   - A Minimum of one flagman will be on standby at crowded public areas (such as market, school, etc.) to anticipate the traffic impact that may occur.
   - All flagmen will wear high visibility vest, in addition to standard PPE.

11.6.5 Vehicle Identification

After all the inspections have been done and the vehicle complies with requirements, the project vehicles will be tagged with an identity sticker numbering.

11.6.6 Speed Limit and Safe Distance

Drivers will comply with the road authority and company speed limits and safe distance set in the specific operating area/location. These limits below have been set following a local hazard identification assessment.

- For the prevailing vehicle speed limits and safe distance are
  - Maximum speed 40 – 50 km/hour on province main roads for trailer
  - Maximum speed 80/hour for light vehicle
  - Safe distance between trailer driving convoy is 15 - 20 km/hour

11.6.7 **Safety Driving**

1. All cars and drivers will be hired from a reputable agency.
2. Safety driving test will be conducted as part of HSE planning as follow:
   - Defensive Driving Course for all project drivers (excl. equipment operators)
   - Medical check-up, Drug and alcohol test for all drivers and all equipment operators
3. All operators and heavy equipment shall possess a valid certificate.
4. Consider having back up operators for work more than normal working hour.
5. When passing high population areas (market, school, office, etc) the vehicles speed limits will be 10 km/hour.
6. Set the travel/delivery time for pipeline and other material to avoid peak travel times where able.
7. Ensure the drivers are aware of high population areas and critical road crossing points.

11.6.8 **Traffic Route Flow**

1. Freeway / arterial traffic flow routes
   - Utilize all freeways and major arterial roadways wherever feasible for transportation during construction.
   - Identify necessary freeway on ramps / off ramps prior to starting travel.
   - Identify key interchanges/intersections necessary prior to starting travel.
   - Determine freeway/arterial lane assignments for the traffic.
   - Identify/collect data about peak traffic times for specific locations such as school, office areas, market, etc.

2. Local traffic flow routes
   - Determine local streets that connect to freeway entrance/exit ramps and/or arterial intersections.
   - Determine recommended flow routes to/from general and reversed offloading areas.
   - Avoid right turn movements across traffic flow.
   - Focus on ingress and egress operation separately.
   - Identify/collect data about peak traffic times for specific locations such as school, office areas, market, etc.

3. Alternate routes
   - Identify mainline problem locations.
   - Evaluate proposed alternate routes.
   - Achieve participating agency agreement on roles and responsibilities.
   - Identify equipment and personnel resources required to deploy an alternate route plan.

- Identify/collect data about peak traffic times for specific locations such as school, office areas, market, etc.

4. Emergency access routes
   - Evaluate necessary street closures within the site area to connect with some of the following; public safety headquarters, hospitals, ambulance and first-aid stations on site.
   - Evaluate need for emergency access lanes along streets.
   - Prepare (if such as case happen) the emergency access routes may remain closed to all non-emergency vehicles. The traffic control staff and permit to access the side street for emergency.

11.6.9 Site Access and Parking Rules

1. Vehicles access and circulation
   - Left turn circulation pattern to enter or exit the work site.
   - As much as possible, the vehicle or equipment will mobilize with contraflow operation.
   - Use the ROW for vehicle access and circulation.

2. Temporary Parking and Monitoring
   - Reduce the number of vehicles on site as much as possible.
   - Design the offloading areas to avoid conflict with primary traffic ingress/egress route.
   - Use the ROW to park small vehicles and equipment and if not possible use off-street areas with permit/agreement.
   - No vehicle is allowed to park on the road way / traffic lane.
   - Be aware with the soil condition and landscape where the vehicle wants to park.
   - Ensure the parked vehicle is not obscuring another vehicle to pass.
   - Park is not allowed for motorcycle.
   - All project vehicles and equipment only be allowed park on the dedicated parking area.

11.6.10 Pedestrian Access

1. Pedestrian control
   - Identify and establish dedicated pedestrian walkways where necessary.
   - Limit vehicular intersection of pedestrian walkways.

- Disabled accessibility
  - Consider to maintain minimum path width.
  - Consider to include curb cuts and temporary ramps for negotiating grade separation.
  - Conform to local community with disabilities act regulations.

11.6.11 **Driving in ROW**

1. All vehicles and equipment that enter / exit the ROW will be inspected by the Security Force.
2. Non-authorized vehicle is not allowed to enter the ROW. An-authorized vehicle can be identified from identity sticker attached on the vehicle.
3. Vehicle enter to the ROW will be assisted by the flagmen at the ROW area.
4. All vehicles will move slowly along the ROW area, ROW speed limit set a 10 kph.
5. Pipe trailers will offload the pipe in dedicated temporary laydown areas.
6. Safety officer will monitor all vehicles/equipment movement and flagmen will assist to support safe maneuvering.
7. Backing of vehicles and equipment will be minimized as much as possible.
8. All vehicles and equipment on the ROW will turn in dedicated turning points under assistance of the flagman.
9. ROW turning points to be established near each temporary laydown area on the ROW.
10. Only project equipment, trucks, trailers, CLIENT's cars and CPM's cars are allowed to driving on ROW.
11. No motorcycle is allowed to drive on and cross the ROW.

11.6.12 **Night Time Driving**

All activities shall be planned to avoid the need for night driving, including circumstances where an approved activity takes place during the night.

CPM shall therefore reduce the night driving risk to a level that is as low as reasonably practicable (ALARP).

To comply with the 'spirit' of this policy with respect to night driving, a planning effort is expected at all times in order to minimize night driving and achieve ALARP risk levels. Management of night driving is a line responsibility. Night driving for any planned operation will require the prior approval of the CLIENT representative.

11.6.13 **Prevention of Unauthorized Vehicle Use**

All vehicles shall be locked at all times when left unattended to prevent unauthorized persons from attempting to drive or operate the vehicle.

Vehicle operators who fail to lock and secure their vehicles prior to leaving the vehicle shall face disciplinary action.

11.7 Pipe Handling and Loading

Trailers per spread will be utilized to transport the pipe from lay-down to mini stock pile or pipeline route at ROW. The trailer will be rented from a local trailer/truck rental

company. Prior to being used on the project will undergo a thorough inspection by CLIENT.

11.8 Pipe Transportation Route

Pipe transportation route will be start from the nearest Port to laydown at Minas area via public roads. The route will be proposed to the CLIENT and approved prior to start the works.

11.9 Pipe Unloading at Temporary Laydown on ROW

The pipe will be unloaded at the temporary laydown or mini stockpile by side boom utilized for stringing also. The pipe will be directly strung to the ROW at the same day, so that the transfer area will be always ready for the next pipe loading (not any pipe remaining that required width space).

11.10 Warehousing Procedure

The objective of the warehousing procedure is to define the steps and requirement for managing the storage of all materials at lay-down/warehouse areas, starting from receiving to storage, and issuing (including prevention material) until hand-over material to CLIENT after project completion.

12 PIPELINE CONSTRUCTION

In order to complete the project on schedule, CPM will mobilize manpower and equipment as follows:

12.1 Construction Spread Description

CPM will decide to establish the area for construction into 2 (two) spread.

- Spread 1 will start from Siak to KP 24+000
- Spread 2 will start from KP 24+000 to Pekanbaru
- The divided of the area into the spreads will be followed by dividing of manpower, equipment and materials as required for each spread.

12.2 Clearing and Grading Method

12.2.1 Clearing and Grading Works

Clearing and Grading works will be done with 2 (two) team using excavator and bulldozer (optional) by following detailed engineering design that have been approved by CLIENT. Team 1 (one) will be started from the middle of the pipeline route to downstream and team 2 (two) from the middle of the pipeline route to upstream.

- The clearing & grading works will be performed by the following sequence :

1) Mark the ROW boundary at left and right side also the above ground archeological by the surveyor. Marker shall be higher than surround brush or paddies and contrast painted in order to ease looked by workers.
2) Tree felling shall be carried out immediately in front of bulldozer activity.
3) Perform the clearing & grading inside boundaries using excavator or dozer.
4) Grade the ROW from left or right heading to center and the sloped the surface from center to left and right.
5) Install temporary mat if the equipments walking across the underground existing pipelines or utilities.
6) Provide temporary waterway at both side (left & right at ROW) inside the boundary.
7) Excavated soil from waterway will placed at outside.
8) Removed the brush and debris to disposal area by dump truck.
9) Continue until finish.

- Clearing shall be restricted to the limits of the construction ROW. The working area shall be cleared by the removal of trees and vegetation as necessary, including overhanging branches that would be in the way of construction and future maintenance operations.

- The ROW shall be graded and maintained to a standard suitable for construction traffic, and in such a manner as to reduce the requirement for field bending of line pipe.

- Where the pipeline route lies in the vicinity of existing pipelines or other works; grading operations are restricted only to those areas clearly marked as being clear of existing facilities. The instructions of the owner of existing pipeline or other buried facilities shall be respected. Social-economic advisor shall inform the supervisor of the requirements of the owner.

- Transit of vehicles and/or equipment across the axis of existing buried pipeline or utilities shall be avoided as far as possible. Transit shall only take place once the existing pipeline or facility is protected as required by the Owner of the pipeline/facility. Any earth work which may decrease the minimum cover over of existing facilities shall be avoided, unless specifically covered in a procedure.

- Clearing and grading shall be restricted to the approved ROW, and to the extent practical, limited to that necessary for the safe and efficient operation of equipment. Grading activities will be minimized in wetland areas. To the extent possible, the disturbance will be restricted to only that

necessary for the pipe ditch and any access roads adjacent to the ditch, unless safety is an issue.

12.2.2 **Timber/Brush Removal**

Trees, rock, stumps, brush and other debris shall not be pushed off the work area. Trees, brush, stumps and other encumbrances shall be cut flush with the finished grade. Stumps within 4-5 m of the centerline of pipeline alignment shall be removed by grubbing. All trees cleared shall be felled in a way to ensure they fall within the working area.

The above works may be performed by excavator or by using hand tools such as axes or machetes, all felled vegetation will be removed to the temporary disposal area/location.

Trees to be cut shall be recorded and reported to the CLIENT for information.

All timber which is determined to be merchantable by the CLIENT representative shall be stripped of leaves and branches, cut into standards length and stacked in the working area (parallel to the work area) for disposal by the CLIENT. All timber which is not merchantable and the trees tops, brush and inflammable debris shall be burned, on the work area if permitted by the CLIENT.

12.2.3 **Grading and Top Soil Preservation**

- Grading activities will be achieved by excavator or dozer.
- Cut and leveled to maximum 30 cm depth and also sloped transversally to the temporary waterway (small ditch) that prepared at the edge of ROW limits. This waterway shall drain to nearest existing waterway (ditch, irrigation, or creek). Silt fences shall be installed to prevent sediment carried by the sheet flow.
- The top soil will be removed during trench excavation and staked at adequate distance from the edge of trench so that is does not become mixed with excavated sub soil from the trench or with any foreign debris.

12.2.4 **ROW Drainage**

Existing ditches and waterways that are found within the ROW will be marked. A temporary waterway (culvert) may be installed in the waterway backfilled until the same level with ground. Culvert installation shall be performed during clearing or prior to continue the construction process.

12.2.5 **Equipment**

CPM will mobilize the following equipment to perform the clearing and grading activities and put on the list as follow:

No	EQUIPMENT DESCRIPTION	QTY	
		Unit	Remark
1	Excavator	2	each spread
2	Bulldozer	1	optional
3	Total station (survey equipment)	1	each spread
4	Mini bus	1	each spread
5	Hand tools (shovel, hoe, etc)		as required
6	Dump truck		as required

All equipment shall have valid certificates which will be attached to the Permit to Work (PTW).

12.3 Pipe Hauling and Stringing Method

12.3.1 Preparation Works

The areas in which the pipe materials will be placed shall be cleaned, cleared and compacted (if necessary) from existing obstacles.
All pipes shall be stacked at stock yard on earth embankment with sand bags underneath the pipes.

Flatbed trailer will be used for the pipe transportation. It will be equipped with 3 (three) rows of wooden block supports at approx. 4 m distances apart. Three supports will be provided to prevent significant deflection of the pipes during transportation. The trailer used for pipe transportation shall be of sufficient length to eliminate excessive overhang of the pipe. The rear window panel of the truck cabin shall be protected with appropriate head board that fully covers the rear panel. Head board rack will be inspected and approved prior to use on project.

The pipe transportation route shall be as per the Traffic Management Plan and approved by the CLIENT prior to transporting the pipe to each pipe location. Prior to the start of hauling, a survey will be performed to identify clearance restrictions. Corrective measures will be taken as required.

The pipe shall be inspected for dimensions, coating conditions and damages before and after to being brought to the site.

12.3.2 Lifting Works

All lifting equipment and slings shall be subject to testing/certification and regular inspection (daily) prior to use. Adequate color coding/marking of the equipment shall be provided; green for good condition and red for broken. Red tagged equipment/tools will be removed from the job site.

Pipe may be lifted using end hooks or straps:

- If end hooks are used, they shall be made of aluminum or other CLIENT approved material

- If lifting straps are used they shall be made of non-abrasive material such as nylon webbing

Certified spreader bar may be used to maintain the angle between the pipe and the strap/sling/hook to greater than 60 degrees.

All pipes shall be picked up clear of the ground without dragging. Pipes shall not be subjected to impact or jarring. When cranes or side booms are used, tag lines shall be used for guiding the load.

Lifting calculations, arrangements, and drawings shall be prepared by CPM, refer to actual site condition and submitted as attachment on permit to work.

12.3.3 **Pipe Hauling and Stringing Setup**

From the main pipe yard, pipes will be transported to the temporary laydown area. From temporary laydown pipe shall be strung to each spread with required equipment such as Side boom and/or pipe carrier.

To start pipe hauling and stringing activities, following activity shall be conducted:

1. Ensure that PPE is available and worn correctly prior to start of any working activities.
2. Perform Pre-job meeting, attended by all the personnel involved.
3. Supervisor shall ensure that all workers have the appropriate induction and training.
4. The Supervisor shall clearly explain the work permit and JSA to all personnel involved in the work.
5. Workers will participate in updating or modifying the JSA to meet actual work conditions.
6. Check the equipment and tools to be used; any damaged equipments and tools shall be tagged or repaired prior to use or replaced.
7. Set-up (if necessary) barrier, signage, and warning sign at working area.

After all preparations are completed, pipe hauling activities can be started (Pipe Loading & Unloading, Transportation of Pipe, Transferring and Stringing). When finished work time on a day, place all the equipment and tools in a proper and tidy position on site, shut down and secure all equipment/tools correctly.

Supervisor shall submit necessary report or document to QC inspector for further data processing.

Security shall patrol the job site regularly to keep the working area free from non-authorized persons and local community, and to prevent property loss.

12.3.4 **Pipe Loading**

Equipment setup is illustrated on attachment drawing maximum 10 pipes can be loaded on a trailer.

During loading and unloading activities, only the Rigger may give instructions to the crane operator.

Trucks shall be prohibited from backing up.

Lifting of pipes shall use pipe hooks with protective padding to prevent damage on the pipe bevel. Tag lines shall be attached on both ends of the pipe to enable guidance of the pipe during lifting operations. One man shall be assigned to each tag line. Rubber strip shall be installed between the pipes to eliminate direct contact of pipe insulation.

Prior to the trailer leaving from the stock yard, the QC Inspector shall check and record: pipe number, heat number, and length and also to prepare pipe damage report. Damaged pipe will be quarantined.

Loaded pipe onto the trailer shall be lashed with padded lashing material such as lashing belt and the lashing shall be thoroughly inspected and sufficiently tightened prior to any loaded trailer movement. Strap tightening devices shall not come into contact with coated pipe surface.

Flagman shall be deployed to monitor and guide traffic during trailer and heavy equipment operations.

12.3.5 **Transportation of Pipe**

After the QC Inspector has inspected and recorded the pipe loading configuration, and checks on the lashing on trailer have been completed, the trailer is allowed to travel from the pipe yard to destination. Pipe shall not overhang truck bed by more than 1.2 m. From main stock pile, the pipe will be transported to each location and temporary for stringing. CPM shall only use the approved route for pipe transportation. Any other route to be used for pipe transportation shall be proposed to the CLIENT for approval.

On the ROW, proper signage will be installed the traffic flow for pipe trailer flow of this route shall be such that reversing will be not required.
If the transportation trailer or pipe carrier can't access the new pipeline ROW due to the limitation of access road the pipe will be loaded to small pipe carrier to transfer the pipe from nearest access to temporary stock pile at pipeline ROW.

If the ROW condition is can be entered by the pipe trailer especially during dry season, trailer turn over area in the ROW will be prepared at a minimum 500m interval or at the required location by the clearing and grading crew.

12.3.6 **Pipe Unloading**

When the pipe arrived to destination temporary stock area, the pipe shall be unloaded using side boom or crane prepared on that area.
Pipe yards shall have suitable drainage and shall be horizontal to avoid pipe rolling off downhill slopes.

12.3.7 **Stringing**

Except in special circumstance, stringing will be performed prior to trench excavation. In sections where rock breaking will be necessary pipes will be placed with a distance 6 m from centerline rock breaking.

When lifting the pipe off the pipe carrier at far side, pipe carrier operator shall be leave the pipe carrier cabin at the moment since the boom of the side booms are cross over the cabin.

Side boom and/or pipe carrier (on muddy soil condition) may be utilized for unloading and stringing operation. Pipe shall be strung in line ready for set up and welding with pipe ends offset.

A bevel cover shall be installed to avoid bevel damage. No pipe or other material shall be strung along the ROW before all clearing and grading operations have been carried out on the area of pipe to be strung.

Pipe shall be supported by placing earth embankment with a sandbag.

During pipe haul and stringing operations, special attention shall be given to the following:

- Minimize overlap of the pipe; leave required gaps for other access.
- Avoid any damage to pipe coating or insulation.
- Road access is maintained relatively flat.
- The pipe shall be strung in a manner that causes the least interference with the normal land use.
- Gaps shall be left at intervals to permit the passage of farm stock and equipment. The gaps will be closed and temporary access way such as temporary wooden bridge shall be installed when the pipe is welded.
- CONTRACTOR shall make provisions for passage or crossing for animals, machinery as well as normal site traffic. The gaps will be replaced with temporary access way when the pipe is welded
- Stacking of pipe in the working width is not allowed.

Where pipe handling and stringing near a public road, a flagman shall be assigned on the job site with flagmen on each end of the working area. Road markers and barrier tape with contrast color shall be installed near the public road.

12.3.8 Equipment

CPM will mobilize the following equipment to perform the hauling and stringing activities for each team as follow:

No	Description	Hauling	Stringing	
		Siak laydown	Spread 1	Spread 2
1	Sideboom/excavator		2 unit	2 unit
2	Crane 25 Ton	1 unit		
3	Flatbed Trailer	4 unit		
4	Total Station		1 unit	1 unit
5	Pipe Skid		1 unit	1 unit

All equipment valid certificates shall be subject to attached on Permit to Work (PTW).

12.4 Fit-up and Line-up Welding Method

12.4.1 Pre-Construction Works

- Preparation works shall commence in advance of the main activity. Its main purpose is to set up and organize the equipment, materials, tools, and personnel required for fit-up and welding of the pipeline under each particular site condition.
- First, the pipe will be aligned in a string over sand bag supports.
- Same as all other locations, a barricade will be deployed around the working area to restrict access only to personnel directly involved.
- Ensure that there is a minimum 50 cm ground clearance between the pipe and ground. Prepare welding canopy and install during or after fit-up has been completed.
- The QC Inspector (Welding Inspector) shall control and inspect the welding process including preparation works, fit-up, beveling, etc. Any deviation from the WPS shall be rectified before welding commencement.
- All welding equipment shall be inspected and be in a good condition prior to being mobilized to site. Where required, equipment shall be calibrated.

12.4.2 Welding Electrode Treatment

All welding electrodes shall be stored inside a warehouse with controlled room temperature and humidity as per manufacture recommendations.

Electrodes shall be prepared for the welder as per the request from the welding or mid end supervisor. Each type of electrode may have a different kind of baking and holding, depending upon manufacture's recommendations.

The electrode shall be directly put in the quiver delivered to the welder for use. The quiver shall be plugged into a cable socket and temperature is maintained as per the requirements.

Where the electrode is not required to be baked (as per manufacture's recommendation); hence can be directly taken from the packaging. Ensure that the packing is in good condition before use.

12.4.3 Welding Procedure

All welding parameters and repair procedures for the relevant materials and applications are contained in the corresponding approved WPS and PQR. WPS and PQR shall be in accordance with API 1104 Standard and CLIENT specification.

Approved WPS shall be posted at each work location and shall be readily available to each welders.

The welding work shall be protected from adverse weather conditions such as wind and rain. Welding shall not be performed during heavy rain.

The number of welders required to produce a weld shall be sufficient for laying all beads as specified in the WPS. Only welders who are qualified for approved

WPS and PQR shall perform the welding operations.

Precautions shall be taken during welding to ensure that no electrical arc strikes/burns occur over pipeline surface including fitting etc.

At the discretion of the CLIENT, arc strikes/burns may need to be eliminated in accordance with a CPM-developed Arc Strikes/Burn Inspection/Removal procedure.

The procedure shall include:

- Method of determining the wall thickness of the pipe in the area of arc strikes/burns
- Method of grinding/filing the arc strikes/burns from the body of the pipe
- Method of inspecting the area to ensure the arc strikes/burns HAZ has been removed
- NDT method to inspection of the area for evidence of cracks (UT and MPI)

- Method of confirming the remaining wall thickness after grinding/filing (by UT)

In the event that the remaining wall thickness is less than the project-specific minimum wall thickness, the affected pipe shall be cut out as cylinder. Backwelding shall not be performed for pipelines in sour service.

Prior to start fit-up and welding activities, following activity shall be carried-out or conducted:

1) Ensure that PPE is available and worn correctly prior to start any working activities.
2) Perform Pre-job meeting, attended by all the personnel involved.
3) The Supervisor shall clearly explain the work permit and JSA to all personnel involved in the work.
4) Workers will participate in updating or modifying the JSA to meet actual work conditions.
5) Check the equipment and tools to be used; any damaged equipment and/or tools shall be tagged or repaired prior to use or replaced.
6) Set-up barrier, signage, and warning sign at working area. Warning signal shall be erected and maintained.

Fit-up and welding may be performed with following sequence:

1) QC Inspector (Welding Inspector) shall perform the pre-welding inspection for the pipe to be welded (end pipe bevel condition and configuration, pipe cleanness, pipe roundness, etc.) prior to fit-up.
2) Prepare the first length of pipe joint by lifting it up ±50 cm above ground level and put the support (sand bag) underneath the pipe. In order to avoid rolling of pipe by sideways, sand/soil bags shall be placed besides the pipe.
3) Set up an internal clamp with the compressor and insert the internal clamp onto the first pipe
4) Check inside pipe for foreign object/cleanliness.
5) Lift up and fit-up the second length of pipe joint by side boom.
6) Fix the pipe fit-up by internal clamp.
7) Check the weld configuration prior to joining the pipes
8) QC Inspector (Welding Inspector) shall be inspecting the final pipe fit-up prior to start welding.
9) Pre-heat shall be performed using LPG heating torch until the pipe surface achieve required temperature defined on approved WPS. Pre-heat shall be performed evenly on circumferential and shall be in line with approved WPS.
10) Perform pipe welding after pre-heat is finished (root pass, hot pass, filler pass and final pass).
11) During welding, Welding Inspector shall inspect every weld layer to reduce any possible weld defects.
12) Place “Night Cap” at the end of the pipeline.

13) At the end of workday, all equipment and tools shall be organized, shutdown and secured.
14) Supervisor shall submit the progress report or document to QC inspector for further data process. Daily report shall be submitted to the CLIENT after the approval from CLIENT Welding Inspector and third party inspectors.
15) Security patrols will be used to keep the working area free from non-authorized persons and local community and to provide security for equipment and tools.

12.4.4 **Bevel End**

The bevel ends shall be checked prior to fit-up. The bevel, joint type, root face, root gap, etc. configuration and dimensions of the weld preparation shall be in accordance with the approved WPS. Bevels shall be cleaned by power brush before welding, including minimum 25 mm inside and outside of the pipe.

For special conditions, such as line up tie-in, after cutting and re beveling the spool/pipe surface shall be inspected with Magnetic Particle Inspection (MPI) on the bevel surface and Ultrasonic Test Method (UT) shall be performed for a distance of 100 mm from the pipe end to detect lamination or inclusions prior to start welding.

12.4.5 **Fit-Up**

The pipe shall be internally checked prior to fit-up for cleanliness and to ensure that no debris is left inside the pipe. No oil or grease shall be allowed inside the pipe. Any water left inside the pipe shall be cleaned.

Fit-up may be performed by side boom or excavator. Lifting using excavator shall be in accordance with the excavator lifting capacity, here in maximum two lengths (24 m, 2.5 tons) of non-concrete coated pipe allowed to be lifted by excavator. A Lifting belt shall be utilized to avoid damage to the pipe coating or insulation. The use of wire sling shall be prohibited.

If access for heavy equipment is limited, then lifting of pipes for fit-up will utilize series of lifting frames and/or lifting tripods with chain block installed at the center point of lifting as lifting device. CPM shall analyze and calculate the size of tripod or frame to be used for lifting and submit to the CLIENT for review and approval prior to use. Chain block hook will be certified prior to use.

12.4.6 **Welding Performance**

Line-up pipe welding may be performed by 6 welders at each line up spread with the configuration as follow:

- 2 welders for Root and Filler 1 & 2
- 2 welders for filler 3 and 4
- 2 welders for final pass or cap

12.4.7 **Root Pass**

The Root pass shall be executed according to the relevant approved WPS. All starts and stops in the root pass shall be ground to a smooth taper prior to continue the weld.

12.4.8 **Hot Pass**

The Hot pass shall normally be applied as soon as possible after the root has been welded (but no later than the time limit given in the relevant WPS). Each pass of weld metal shall be cleaned before a further pass is applied. Visible defects and other faults shall be removed by wire brush or grindstone.

The degree of completeness of weld prior to removal of line up clamps is specified in the Welding Procedure Specification (WPS).

If the hot pass is delayed due to some reason and exceeded the WPS limitation, weld joint shall be rejected and cut-out as a cylinder.

12.4.9 **Filler and Final Pass**

Prior to laying a filler or cap bead, the previous bead shall be brushed or lightly ground. Each pass shall be completed around the whole circumference before the next pass is started. The number of beads on both weld section shall be same, so that the completed weld have a substantially uniform cross section around the entire circumference of the pipe.

12.4.10 **Welding Numbering System**

A unique identification number shall be assigned to each welding joint in order to accurately identify the welding location and to avoid the duplication of the number. Prior to commencement of welding work, those identification numbers shall be assigned based on the latest alignment sheets reviewed by engineer.

During construction even though a crew skips somewhere discontinuously, the number assigned in the above way shall be applied. Additional numbers and /or adjustment of the number will be necessary according to the site condition.The identification numbers are marked near the weld joint where it is easily visible.

12.4.11 **Inspection & Testing**

All inspection for Pipeline Fit-Up and Line-Up Welding work shall cover the minimum Inspection & Test requirement (Construction Inspection and Test Plan), CLIENT specification, and API 1104 Welding of Pipeline and Related Facilities.

The QC/Welding Inspector shall have enough experience and qualification to perform inspection activities.

12.4.12 **Visual Inspection**

After welding is completed, 100% visual inspection shall be performed prior to NDE (Radiography, UT, etc.). Visual check shall be conducted in each layer of the welding sequence to reduce welding repair possibility. The acceptance criteria of visual inspection shall be in accordance with standard API 1104 and CLIENT specification.

12.4.13 **Welding Repairs**

After the visual inspection or NDE report has been issued by Welding Inspector, the repair team shall prepare the equipment and personnel (welder, grinder, and helper) to repair the weld defect. The NDT crew shall mark the repair position at the weld surface. The weld repair position shall be sketched by the welding inspector and issued to the welders that are qualified to conduct the weld repair.

Weld repair shall be performed according to relevant approved repair WPS and PQR. Defect removal method, groove preparation, NDE performed, welding process and welding consumable shall be strictly followed as per approved repair weld procedure.

No more than two (2) weld repairs to the same location shall be made. If the defect is not repaired in two attempts, then the entire weld shall be cut out as a cylinder and re-welded.

The maximum length of any weld repair shall be 75 mm (3 inch). If the sum total length of the section to be weld repaired exceeds 30% of the length of the weld, then the entire weld shall be cut out as a cylinder and re-welded.
Removal of weld metal or portions of base metal may be accomplished by the following methods, but only one method of excavation permitted (according to approved method):

- Machining
- Grinding
- Chipping

Oxy-fuel gouging shall not be permitted for removal of weld metal or base metal. The defect shall be completely removed and the cavity (in planar defect) shall be inspected using Magnetic Particle Inspection (MPI) to verify complete removal of the defect.

Repairs shall be inspected 100% by NDE (i.e., MPI, Radiography, Ultrasonic test) after completion, using the method prescribed for the original weld.

12.4.14 **Equipment**

CPM will mobilize the following equipment to perform the pipeline fit-up and welding activities as follow:

No	Description	Spread 1		Spread 2	
		Qty	Unit	Qty	Unit
1	External Clamp	2	Set	2	Set
2	Excavator	2	Unit	2	Unit
3	Side Boom	1	Unit	1	Unit
4	Minibus	2	Unit	2	Unit
5	Welding Machine	8	Unit	8	Unit
6	Cutting Machine	1	Set	1	Set
7	Grinding Machine	8	Set	8	Set
8	Lifting tools	As required			
9	Electrode Quiver	1	Unit	1	Unit
10	Equipment Skid	1	Set	1	Set
11	LPG Heating Torch	2	Set	2	Set
12	Lifting Frame	As required			
13	Shelter (welding canopy)	4	Set	4	Set

12.5 Trench

Excavation Method

12.5.1 **Pre-Construction Works**

The Survey Team will survey the alignment along the route of the pipeline. Wooden stakes will be installed at an interval of 12 m to mark the pipeline location. Surveyor shall mark existing pipeline and utilities. The markers shall be maintained during excavation, any damaged marker shall be replaced immediately.

A tool box talk will be held between operator, workers and QC prior start off activity every day to inform the procedure and hazard on site.

Warning devices (i.e. barrier, barricade, signs) shall be placed around all excavations, to provide warning that a hazard exists in the immediate vicinity.

The trench shall have “escape” ramps with slopes less than 45 degrees every 500 m to provide a means of escape to any animals that may fall into the trench.

In addition, to protect personnel from local population from falling into open trenches or excavation, at least :

- Warning tape shall be installed at the edge of ROW in areas where trenches area still open.

- Second barrier of warning tape shall be placed at a distance of no less than 3 m from the open excavation.
- Install netting over the trench in densely populated areas or where water is present in trench.
- Employ locally recruited professional security personnel to regularly patrol the trenches.
- Conduct a familiarization program in the local community center and local schools to alert especially children to the dangers of open trenches and excavations.

Prior to the start of Trench Excavation, the following activities shall be conducted :

1) Ensure that PPE is worn correctly.
2) Pre-job meeting attended by all the personnel involved.
3) The supervisor shall clearly explain the work permit and JSA to all personnel involved.
4) Check the equipment and tools to be used, any damage equipment and/or tools shall be repaired prior to use.
5) Install barrier, signage, and warning sign at the working areas.

12.5.2 Location of Third Party Services and Foreign Pipelines

Prior to any excavation, the owner or operator of any third party services or pipelines expected to be crossed shall be contacted. They will be provided with sufficient notice to permit adequate discussion on the preferred method to cross their utility or pipeline. See third party pipeline crossing agreement for detailed requirements.

When crossing over another pipeline, protection will be provided by earthen ramp, swamp mats or other means acceptable to the pipeline owner/operator. Traffic will be managed so that crossing over existing lines is minimized.

12.5.3 Trench Excavation

Generally excavators will be utilized for the excavation of the pipeline trench. Hand digging may be required where it is impossible for excavators to fully expose, and trench beneath obstructions intersecting the centerline route (such as pipeline and utilities). For rocky areas the excavation will be done by excavators fitted with a hydraulic jack hammer or manual jack hammer. Once the rocks are destroyed, the excavator will remove the rocks to its required depth.

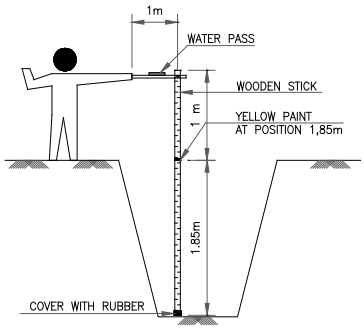
The excavation operation shall be supervised at all times by a person specially designated to monitor the excavation for any existing utilities that could be damaged by the operation.

The trench shall be excavated in accordance with technical specifications, to provide the pipeline with a minimum of 1.2 meter cover from top of pipe (TOP) to natural ground level along the route, 1.5 m minimum for road crossing, 2 meter minimum for waterway crossing and a minimum 60 cm clearance (below third party pipelines). Deeper trenching may be required in areas to avoid unnecessary installation of hot bends and also where the pipe requirespadding (here in minimum 150 mm under the pipe bottom) such as rock trench bottom surface and/or other trench bottom surfaces with hard protrusions capable of damaging pipe coating.

A swamper (helper) will work with each excavator. The swamper will control vehicle and foot traffic around the excavator.

Additional space in the form of sloped bell-holes will be provided at tie-in locations. There will be adequate clearance around the pipe to allow the tie-in welding to be performed safely. The bell-hole will be a minimum of 4.0 m in length.

The “double ditch” method of trenching refers to the practice of separating the topsoil and the subsoil during excavation and replacing it into the trench in the same profile that naturally occurred. The depth of the topsoil shall be determined. Topsoil shall be carefully removed and stacked at adequate distance from the edge of trench so that it does not become mixed with the excavated subsoil from the trench or with any foreign debris. The excavated subsoil that will be used for backfilling material may be put between the edge of trench and topsoil stack or may be disposed to temporary disposal areas by using dump truck. The excavated subsoil that consists of rock, gravel, boulders or like material shall not be backfilled directly onto the trench, but shall be the stacked further from the edge of the trench. Padding material shall be prepared for backfill over the pipe and at the bottom of the pipe (see below drawing and sketch for trench excavation profile sketch).



If required, the excavated soil heap or stack (topsoil and subsoil) shall be retained in such a way that it is not washed away during rain. Hard soil should be put at the bottom edge around excavated soil.

The trench depth shall be continuously checked during the excavation by surveyor. This is to avoid the excess depth of trench from approved drawings and specifications. Measurement stick with attached handle rod or measured rope may be used for trench depth measurement to eliminate the surveyor from entering the trench. Any inappropriate depth shall be re-trenched until the trench achieves the required depth.

If the excavation process find an archaeological site, CPM will ask to CLIENT to discuss for further action.

All roots, buried timber and rock encountered in the ditch line shall be removed such that in no instance they come in contact with the pipe. No chips or parts of stumps or rock shall be left in the trench. Sand shall be thrown into locations where stumps, roots or rock have been cut out of the trench line, in order to pad the pipe and eliminate possible contact with these objects.

The bottom of the trench shall be leveled to provide a continuous uniform bedding (bearing surface) for the pipe all along ROW. The trench shall be free of stones, metal, wood, vegetation, clods or any other debris that may cause damage to the pipeline coating, and will be inspected immediately prior to the placement of the pipe. The width of the trench will be a minimum of 40 cm larger than the O.D. of the insulation pipe.

In order to avoid unstable and sliding trench walls, the inclinations of trench walls shall be defined by the field engineer according to the subsoil material. If required (where personnel are required to enter the trench) the trench walls shall be sloped back or stabilized by special means as a steel plate, a trench box or other appropriate measures.

The length of open trench shall be limited to the minimum length required for construction purposes and CPM shall back fill the trench immediately after pipe lowering. The maximum length of open trench shall not exceed 500 m.

12.5.4 Excavation at Paddy Field Area

If temporary irrigation pipes across the pipeline ROW have been installed during clearing and grading activities, the temporary irrigation shall be removed (with consent of the CLIENT) during trenching and the waterway hole from the two paddy fields shall be blocked by soil dike, along paddy field area. If any water spills onto the trench from the higher elevation paddy field, the water shall be pumped out by pump to the lower paddy field.
If the trench needs to be de-watered due to flooding by rain water, water will be removed using suitable ditch pumps.

12.5.5 **Excavation at Access and Road Crossing**

During the excavation activity across a road, access gate, villager access, etc., CPM shall provide and maintain temporary bridge, temporary walks, passageways, fences, or other structures so as not to interfere with traffic. CPM shall provide signs, barricades, and flagmen to warn and protect traffic while excavation is in progress.

12.5.6 **Excavation Around Existing Buried Pipeline and Service**

The Surveyor shall confirm and mark the exact locations of buried utility cables, pipelines, and/or other pipeline.

If above said facilities need to be exposed, CPM shall give sufficient notice to the utility owners so that they may have a representative present.

When the horizontal and vertical location and the physical size of these facilities has been determined using manual excavation, it is normally allowed to perform mechanical excavation to within 1 m of such facilities, provided existing facilities are visible and adequate protected.

Excavation closer than 1 m shall be carried out manually. Shore protection will be erected as sloping will be conducted when manual excavation is required in a trench.

Manual excavation may be required at any location where in the opinion and sole discretion of the CLIENT representative, it is necessary.

12.5.7 **Trench Excavation at Rocky Area**

A hydraulic rock breaker mounted on the excavator may be used for excavating activities at rocks area which will cut the ditch at least 200 mm wider. Excavation of the rock layer shall be no less than 30 cm below the indicated finished grade.

12.5.8 **Trench in Wetlands**

In wetlands, trenching shall be performed by swamp excavator or tracked excavators working off mats, riprap or similar. The excavated soil will be put on the non-working side, minimum 0.5 m from trench edge. The excavated soil heap shall be pushed (compacted) by excavator bucket to prevent the excavated soil from falling into the trench due to water current.

12.5.9 **Steep Trench**

Sometimes due to a limited amount of available space for trenching, the trench must be dug into a steep and narrow trench. To prevent the high possibility of trench collapse, shoring or shielding protection must be erected in place wherever there is a reason for personnel to enter the trench (i.e. bell-holes for tie-in).

12.5.10 **Preservation of Existing Facilities**

Damage to trees and fences outside the ROW will be avoided. All necessary measures will be taken to ensure the continued functioning of existing canals, irrigation channels, etc.

To protect nearby existing underground pipelines against excavation activities, the following measures will be taken:

- Detect existing pipelines or other utilities by pipe & cable detector, then mark with wooden pegs.
- Excavate small pit by manual digging to identify the pipe.
- Expose the existing pipe or other utility by manual digging.
- A person will be assigned specifically to focus on watching the excavation when working near existing pipeline/utilities. He will give signals to excavator operator to guide the excavation process.
- Wood and thick rubber will be placed on the existing pipe to protect against direct impact of the excavator bucket and other potential hazards. Steel "Dog House" may be installed as alternative protection if required by the third party pipeline operator.
- If pipeline crosses catchment area of any wells, appropriate action will be taken to minimize any negative impact during construction.

12.5.11 **Drainage**

Except where drainage is diverted with consent of the CLIENT, no drain, gutter, channel or pipe will be obstructed. At all times the trench will be kept free of water, except where the water will be utilized as the median for placement of the pipes.

12.5.12 **Inspection**

Inspection will cover as a minimum the following:

- Trench route in compliance with alignment sheets.
- Pipeline depth along the route minimum (1.2 m cover from the top of pipe to natural ground level).
- Pipeline depth for road/river crossing (refer to CLIENT and detail construction drawing).
- Crossing existing facilities and pipelines.
- All information required for "As Built" records.

12.5.13 **Equipment**

CPM will mobilize the following equipment to perform the pipeline trench excavation activities:

No	Description	Qty	Unit	Remarks
1.	Excavator	2	Unit	Each spread
2.	Swamp Excavator	-	-	As Required
3.	Long Arm Excavator	-	-	As Required
4.	Diesel and/or electric Water Pump	1	Unit	Each spread (If Required)
5.	Hydraulic Rock Breaker	-	-	Each spread (If Required)
6.	Total Station	1	Unit	Each spread
7.	Metal Detector Digicat	1	Unit	Each spread
8.	Hand tools	-	-	As Required for manual digging

All equipment valid certificates shall be subject to attached on Permit to Work (PtW).

12.6 Lowering-in

12.6.1 **Pre-Construction Works**

CLIENT shall be notified prior to lowering-in operations. Geometrical characteristic of the trench will be established and submitted to the CLIENT prior to start lowering.

The open trench length for lowered pipe shall have sufficient slack to allow for contraction caused by temperature changes.

The trench bottom shall be inspected to ensure the correct depth and conditions have been met. No rocks, clods, skids, and other debris that have hard protrusions capable of damaging the pipe coating are allowed at the trench bottom.

Where the trench is excavated in rocky areas, make sure that the trench bottom has been filled with padding material (loose soil) at minimum 150 mm prior to lowering-in the pipe.

If required, any water filled in the trench shall be dewatered prior to lowering-in the pipe.

Prior to lowering of pipes, all lifting equipment and cable slings shall be inspected for mechanical soundness, suitability, and wear. Any cradler roller or

lifting belts found defective will be replaced. Only personnel involved in lowering operations shall be permitted to be around the trench during lowering.

Open ends of pipe placed in the trench will be securely covered using rubber, plastic, canvas or other approved caps to prevent the ingress of animal, debris, water, and floating in the event that the trench is filled of water. When two pipes or more are welded together above ground, pipe ends shall be also covered with caps. Welding of metal caps shall be not permitted. The end caps shall be installed prior to the lowering operation to eliminate personnel from working inside the trench.

Prior to starting pipe lowering-in activities, the following activities shall be conducted:

1) Ensure that PPE is worn correctly.
2) Pre-job meeting attended by all the personnel involved.
3) The supervisor shall clearly explain the work permit and JSA to all personnel involved.
4) Check the equipment and tools to be used, any damaged equipment and/or tools shall be repaired prior to use or replaced.
5) Install barriers, signage, and warning signs at the working areas.

12.6.2 General

Pipe shall be picked up without dragging, sliding, or bouncing off the underneath support (soil berm) during lowering-in operations.

Prior to lowering the pipe, a holiday test must have been performed and the result must be accepted, any pipe coating damage shall be repaired immediately. Maximum free span is 35 m (refer to the attached calculation note. Lifting of pipes will be done with cradle roller to minimize damage on the pipe insulation; lifting belt will be used for lowering-in pipe that not possible to use cradle roller such as lowering-in pipe at crossing. No sling belt will be placed at girth weld or pipe joint. Any other selected equipment or lifting tools used to lower the pipe shall be informed and accepted by the CLIENT.

All pipes and bends will be kept at a minimum of 150 mm clearance between pipe and trench wall. Ensure the pipe is lowered without rubbing the top or sides of the trench.

12.6.3 Lowering-In Sequence

Side boom will be set-up for the lowering-in operations:

- Side boom No.4 will be positioned 6 m from the end side of P/L and will lift the pipe to a height of 80 cm from ground elevation.
- Side boom No.3 will be positioned 35 m interval from Side boom No.4 position and will lift the pipe to a height of 60 cm from ground elevation.

- Side boom No.2 will be positioned 35 m interval from Side boom No.3 position and will lift the pipe to a height of 40 cm from ground elevation.
- Side Boom No.1 will be positioned 35 m from Side Boom No.2 and will lift the pipe to a height of 20 cm from ground elevation.
- In this condition, all equipment shall be stationary and the riggers shall check the sling conditions. When all equipments are in safe condition, the supervisor will order to lower the pipe step by step, start from Side boom 4 until side boom 1.
- Side booms 4, 3 and 2 will boom out to move the pipe until the pipe is directly above its trench position, then side booms 4 and 3 will lowering-in the pipe.
- Soon after Side Boom 4 has lowered in the pipe, while Side booms 1, 2 & 3 hold the pipe, Side boom 4 will move toward Side boom-3.
- While Side booms 1, 2 & 4 hold the pipe, side boom-3 will move toward side boom-2.
- While Side booms 1, 3 & 4 hold the pipe, side boom-2 will move toward side boom-1.
- While Side booms 2, 3 & 4 hold the pipe, Side boom-1 will move to the next position. And it is typical until the entire lowering job complete.
- At the end of each pipeline section, A tie-in bell hole will be provided, so the roller cradles can be released at the end of lowering-in without any personnel entering the trench. See Sequence 6 of 6 at the attached drawing).
- After lowering-in operations have been completed for a section, the pipe shall be surveyed to ensure that the pipe is located without unnecessary strain and rests evenly on the bottom of trench with minimum of 1.2 m cover for normal area and 1.5 m cover for highway road crossing, or as dictated by pipeline profile drawings.
- This survey will be perform using the total station (coordinate and elevation data are taken). The prismatic stick and the measurement stick will be held from above ground by the survey helper. The personnel shall avoid from working inside the trench.
- When finished each day, all the equipment and tools shall be placed in a proper and tidy position. The Side booms shall be disconnected from the pipe.
- Shut down all the equipment correctly.
- Secure all equipment and tools.
- The Supervisor shall submit the progress report or document to QC inspector for further data processing.
- Security shall regularly patrol to keep the working area free from non authorized persons and local community and to keep all the equipment and tools secure.

12.6.4 Lowering Inspection

The Inspection will cover the minimum inspection & test requirements as follow:

- Check dimension of Trench bottom (2.0 m depth for normal area or 2.5 m depth minimum for road crossing and 1.0 m width minimum)
- All information required for "Red Lining" and "As-Built" records.
- Soft granular bedding and cover.

12.6.5 **Equipment**

CPM will mobilize the following equipment to perform the lowering-in activities as follow:

No	Description	Qty	Unit	Remarks
1.	Side Boom or excavator	3	Unit	Each Spread
2.	Rigging tools (webbing sling, shackle, etc)			As Required
3.	Water Pump (Electric and/or Diesel)	1	Unit	Each spread (If Required)
4.	Total Station	2	Unit	Each Spread
5.	Webbing belt	5	Ea	Each Spread
6.	Low-Bed trailer	1	Unit	(for equipment mobilization between spreads)
7.	Mini Bus	2	Unit	Each Spread
8.	Excavator	2	Unit	Each Spread (if required)

The excavator will be available in case of any collapse of trench. All equipment shall have valid certificates and be subject to a permit to work.

12.7 Backfilling and Compaction

12.7.1 **Pre-Construction Works**

CPM will calculate the quantity of backfill material, which may consist of sand, soil, and coarse aggregate for road crossing. The type and layer arrangement of backfill material will depend on the type of ground where the pipeline is buried and the requirements of the road authorities.
Prior to backfilling CPM and CLIENT QC inspector shall check the pipeline lowering-in report and other quality control documents which are related to the activities.

12.7.2 **Backfilling**

Backfilling shall be conducted so that the trench is neatly backfilled. The materials shall be stored near the trench whenever possible and have at least 1 m clearance from trench edge.

Once the pipeline position has been surveyed for elevation/position the backfilling operation can be carried out. The pipe will be buried in such a way that it complies with the required cover and is provided with bedding material that is free from extraneous material to allow the pipe to rest firmly, uniformly and continuously and to ensure no damage will occur to the pipe coating.

All backfill shall be compacted with the excavator bucket to minimize settlement. To prevent damage to the pipe insulation, the compaction shall be performed when the backfill reaches 30 cm below the natural grade level.
The Backfilled trench shall have a crown of at least 300 mm to allow for future settlement.

For any pipeline to be tie-in, the backfill shall be limited to at least 95 m from end of lowered to allow pipeline end to move for fit up purposes.

Backfilling and compaction of excavated soil is not allowed during heavy rain. Rocks, gravel, boulders or similar material shall not be backfilled directly onto the lowered pipe inside the trench.

If the backfill material (excavated soil) is not enough for complete backfill, the remaining material will be supplied from other backfill source at Site Project with similar soil type.

Prior to the start of backfilling and compaction activities, the following activities shall be performed:

- Ensure that PPE is available and worn correctly prior to start any working activities.
- Perform Pre-job meeting, attended by all the personnel involved.
- The Supervisor to ensure that all workers have the correct induction and training.
- The Supervisor shall clearly explain the work permit and JSA to all personnel involved in the work.
- Workers will participate in updating or modifying the JSA to meet actual work conditions.
- Check the equipment and tools to be used; any damaged equipment and tools shall be repaired prior to use or replaced.
- Set-up (if necessary) barrier, signage, and warning sign at working area & maintain it.
- Confirm that the socio-economic personnel have informed the local community of the upcoming work.
- Ensure that the work site is clear of non-authorized people.
- Obtain clearance from survey that trench can be backfilled.

Begin backfilling and compaction activities.

When finished with work for the day, place all the equipment and tools in a proper and tidy position on site

Shut down all the equipment correctly.

Secure all equipment and tools.

The supervisor shall submit the progress report or document to the QC inspector for further data processing.

Security shall regularly patrol to keep the working area free from non authorized persons and local community and to keep all the equipment and tools secure.

12.7.3 Normal Trench Area Backfilling

Normal Trench is for stable and relatively dry ground conditions; dry farm land is considered as normal area.

Backfill material shall be selected from soil material previously excavated from the trench (for subsoil and topsoil) free from vegetation roots, stone and rock with a maximum particle size 20 mm.

The compaction shall be performed when the backfill reaches 60 cm below the natural grade level by excavator bucket before installation of pipeline warning tape.

The backfill material shall be free from boulders and free from root debris or any other substances that would harm the pipe.

Pipeline warning tape shall be installed approximately 60 cm below natural grade.

12.7.4 Rock Trench Area Backfilling

Rock trench configuration is applied for hard soil and rocky areas.
First layer (underneath the pipe) of backfill material shall be excavated material with no objects larger than 20 mm and free from root debris or any other substances that would harm the pipe. It is placed around the circumference of the pipe by excavator (minimum 150 mm below the pipe bottom and 150 mm over the top of pipe).

The upper layer of soil material will be selected from soil material previously excavated from the trench (for subsoil and topsoil) or the similar material from outside source; free from vegetation roots, stone and rock with a maximum particle size 20 mm. It will be compacted when the backfill reaches 30 cm below the natural grade level by excavator bucket.

Pipeline warning tape shall be installed approximately 60 cm below natural grade.

If the supply and transportation of a sufficient amount of sand or earth to cushion the pipe is not feasible, CPM will propose to the use of rock shield, which CPM shall install in lieu of earth and sand.

12.7.5 Wet Trench Area Backfilling

A wet trench consists of swampy unstable grounds with clay or loose soil characteristic. The area is predominantly flooded.
The trench will be backfilled using the previously excavated material. Since the wet area is not flow water, the excavated soil will be pushed by excavator bucket to avoid any excavated material became slurry.

Compacting will be done by compacting the backfill material with the excavator bucket.

Trench backfilling will be performed as follows:

- Block the trench by installing 2-3 meter wide earth bund in the trench, byexcavator, 50 m apart.
- Dewater the open trench using water pumps to obtain dry trench before backfill.
- This condition will be applied for wet areas only; for wide expansions and flooded area, the methodology will be detailed in a specific construction procedure, based on the actual conditions.

12.7.6 Wash Prevention and Drainage

Backfilled material shall be protected from washing away by the rain by excavation of a small drain to carry any excess water from rainfall or seepage away from the backfilled trench. When backfilling on hillsides or sloping ground; furrows or terrace shall be provided across the pipeline to direct the water flow into the natural drainage courses and away from the pipeline route ditch.

Care shall be taken to keep all drainage ditches maintained and unobstructed, to prevent water backup against the spoil or backfill crown.

For sloping area, trench erosion breakers (sand and/or cement bag) shall be installed inside the trench prior to backfilling. Trench erosion breaker installation will be performed as following sequence:

- Prepare the sand and cement material near the slope area.
- Fill the sand and cement material into the bag and close tightly.
- Make sure the bag does not exceed 20 kg.
- Place the sand bag into the trench as per construction drawing by excavator.
- Prepare trench protection complete with entry and egress ladder when the personnel are required to entry the trench to tidying the sand bag. Personnel that working inside the trench shall use body harness with attached rope,hold by other worker outside the trench.
- Silt fences shall be installed to prevent silt contamination of surrounding fields.

12.7.7 Equipment

CPM will mobilize the following equipment to perform the backfilling activities as follows:

No	Description	Qty	Unit	Remarks
1.	Excavator	2	Unit	Each Spread
2.	Water Pump	2	Unit	Each spread (If Required)
3.	Total Station	1	Set	Each Spread
4.	Minibus	1	Unit	Each Spread

All equipment certificates shall be subject to attached on Permit To Work (PTW).

12.8 Boring Method

12.8.1 Pre-Boring Works

CPM shall perform the following activities prior to boring execution:

- A pre boring meeting shall be held with Company prior to starting work on each bore.
- Crossing area where auger boring activities is to be carried out shall be surveyed and ensured for suitability.
- All the approach roads shall be surveyed for suitability and access for transportation of equipment and materials to the boring location.
- Boring machine, water pumps, line pipe, pilot/sacrificial pipe and other tools and equipment that are required for the boring operation shall also be arranged in advance and ensured for their availability at site location.
- Location where pipe will be installed will be checked by pipe locator.
- Manual trial digging will be performed to ensure that no underground utilities that exist at boring area; directly backfilling the open trench after finish.

- Necessary lighting arrangement shall be set up at the location when the night shift is performed.
- Install temporary hard stand at the equipment area (at both staring and arrival pit) by stripping the soft native soil and replace with lime stone material then compacted with excavator bucket.

12.8.2 Starting Pit and Arrival Pit Construction

- The Surveyor shall mark the exact boring location on both sides of the road, including any existing underground utilities.
- From the marked up boring centerline, the surveyor shall mark the area for excavation of the Starting and Arrival Pits.
- Install barricade and warning signs around the excavation areas.
- CPM will invite representatives from all affected utilities to observe excavation. CPM to work with utility companies to relocate existing utilities if necessary.
- To assist with the boring process, two pits will be excavated, one for starting and one for arrival. The starting pit will be prepared first and the arrival pit will be prepared before. The bored pipe reaches the exit point. The size of each pit is as follows:

Boring Method	Starting Pit (West Side) (L x W x D) at base	Arrival Pit (East Side) (L x W x D) at base
Auger Boring	20m x 3.5m x 2.5*	14m x 3.5m x 3.8m*

- Make soil stairway with handrail at starting pit area

- Workers in the starting pit and arrival pit will be made safe by the installation of a trench box around the pit wall; the trench box will consist of separate segments.
- Install boring rail in trench box, and install box machine. The bottom of the pit at the Starting Pit shall be levelled to accommodate the rail of the boring machine. Manual levelling may be performed after the trench box mentioned above has been installed.
- At both the starting and arrival pits, bell holes will be prepared.
- The excavated soil will be placed on the side of the trench edge at minimum 2m away from the edge of pit.
- Water seepage in the pits due to a low water table shall be removed by installing a sump pit and a submersible pump.
- No entry allowed in the pit if water is present at a depth of more than 0.5m.

12.8.3 Boring Execution with Auger Boring Method

The auger boring will be performed by the following sequence:

1. Lay the guide rail on the bottom of the starting pit, and then install the anchor (piled anchor) to the ground by excavator bucket.

2. After the rail has been properly set, the auger boring machine will be lowered into the pit.
3. Set-up and level the auger machine. The final positioning will be verified by the surveyor.
4. A 16" diameter sacrificial pipe will be bored first prior to inserting the product pipe (coated pipe) 20" diameter.
5. Lift the auger bit using a side boom or crane. Then, push auger bit inside the 16" diameter sacrificial pipe using an excavator. Once inserted, attach the cutter.
6. Lower the sacrificial pipe with the auger bit into the pit then fit the pipe to the auger machine by connecting the connector pin at the end of the auger bit to the connection point at the Auger machine.
7. The sacrificial pipe will be driven (bored and pushed) by using the auger bit fitted with side cutters in the front of the auger bit to create a bore 25 to 40 mm larger than the sacrificial pipe diameter.
8. The soil inside the first pipe will be removed (driven out) by the auger bit inserted into the pipe. The soil will come out from the auger machine along the side of the rail as the auger machine moves forwards. The extruded soil will be removed manually from the pit.
9. Continue the boring operation until the first 12m sacrificial pipe protrudes 1-1.5m from the start side.
10. Disconnect the auger machine from the auger bit then pull back the machine to the first position.
11. Depending on the length of boring requirement (36m length), insert the next auger bit into the next sacrificial pipe then lower the second sacrificial pipe and auger bit in the pit on the rails.
12. Auger bit to other auger bit clamping will be done, followed by pipe fit up with external clamp.
13. Weld the first and second sacrificial pipe. The welding will not be full thickness weld, but minimum 50% thickness weld will be performed.
14. After all welding has been done, install warning signs and barricades around the arrival pit, and then perform excavation for the arrival pit and install trench box after excavation.

15. Level shall be checked at the both ends of the sacrificial pipe for every insertion to conform that the alignment is as per the drawing.
16. Bore will be constantly monitored when it is passing under the existing pipeline.
17. Boring will continue until the required length has been achieved.
18. Insert the next auger bit into the next sacrificial pipe then lower the third sacrificial pipe and auger bit in the pit on the rails.
19. Auger bit to other auger bit clamping will be done, followed by pipe fit up with external clamp.
20. Weld the second and third sacrificial pipe. The welding will not be full thickness weld, but minimum 50% thickness weld will be performed.
21. Boring will continue until the required length has been achieved.
22. Once the boring operation is completed, the cutter head will be detached.
23. Pull back the auger bit to the starting pit with the auger machine and remove each section of the auger bit, one by one.
24. Weld the product pipe (coated pipe) to the reducer (16” x 12”), and then lower the product pipe into the pit by side boom.
25. Weld the product pipe with reducer to the bored sacrificial pipe end.
26. Connect the end of product pipe to the auger machine then drive (push) it forward. A side boom may be utilized at the arrival pit to pull the sacrificial pipe while driven by the auger machine.
27. Continue the operation until the sacrificial pipe is about 6m out at the arrival pit, cut the sacrificial pipe and remove. Continue until the product pipe end protrudes 1-1.5m from the start side.
28. Disconnect the auger machine from the product pipe then pull back the machine to the first position.
29. Lower the next product pipe (also concrete pipe) into the starting pit.
30. Weld the first and second product pipe in accordance with the approved WPS.
31. Perform visual inspection and all required NDE as soon as possible after welding is completed.

32. After all welding inspections are passed; perform field joint coating (use HDD coating type) by the coating crew then perform the coating inspection and test (holiday test).
33. Level shall be checked at the both ends of the pipe for every insertion to conform that the alignment is as per the drawing.
34. Bore will be constantly monitored when it is passing under the existing pipelines
35. Continue push the product pipe until the product pipe end reach the tie-in point at arrival pit area.
36. Disconnect the auger machine from the product pipe then pull back the machine to the first position.
37. Lower the next product pipe (also concrete pipe) into the starting pit.
38. Weld the second and third product pipe in accordance with the approved WPS.
39. Perform visual inspection and all required NDE as soon as possible after welding is completed.
40. After all welding inspections are passed; perform field joint coating (use HDPE coating type) by the coating crew then perform the coating inspection and test (holiday test).
41. Level shall be checked at the both ends of the pipe for every insertion to conform that the alignment is as per the drawing.
42. Continue push the product pipe until the product pipe end reach the tie-in point at arrival pit area.
43. Once the end of first product pipe reaches the tie-in point at the arrival pit, stop driving operation then cut the reducer and disconnect the auger machine.
44. At both ends of the pipe, perform survey to take the elevations and coordinates as reference data for the as-built drawing process.
45. Remove all the auger equipment from the pit (auger machine, rail, etc.).
46. Install the straight pipe (weld to the bored pipe) and perform NDE and FJC on the starting pit side, then Install pipe support (sand/soil bag) after the weld is finished.

47. Install a cap at the both ends of the pipe and install a vertical stick as the marker of the end pipe position (if required).
48. Remove the trench protection box in starting pit before backfill the pit, in the reverse order from how it was installed.
49. Perform partial backfilling and compaction of the starting pit; at the ends of each pipe, the trench will be left open to provide access for tie-ins.
50. Install hard barricade and warning signs around the open excavations.
51. Repeat the sequence number 46 and 47 for the arrival pit side, but in the arrival pit use vertical bend for weld to the bored pipe.
52. Perform Cathodic Protection cable installation after the tie-in work between boring and mainline pipe in arrival pits, the position will be at near of the tie-in point.
53. Remove the trench protection box in arrival pit before backfill the pit, in the reverse order from now it was installed.
54. Perform partial backfilling and compaction of the arrival pit; at the ends of each pipe, the trench will be left open to provide access for tie-ins.
55. Install hard barricade and warning signs around the open excavations.
56. Install rubber sheet and Cathodic Protection test point cables for the existing pipelines then connect the cables to the test points.
57. During the entire operation, the pits shall be kept free of water for personnel safety and to ensure that the water does not damage the Auger boring machine and/or hinder the operation.
58. Perform backfilling for the open excavations.

12.8.4 Equipment

CPM will mobilize the following equipment to perform the boring activities as follows:

No	Description	Qty
1	*Mobile crane25 tons SWL / Hi-ab Crane/ Side boom (optional)	1 Unit
2	Rigging tools (Shackle, webbing sling, chain block, etc.)	As required
3	Sacrificial pipe dia. complete with reducer	as required

4	Water Pump	2 sets
5	Total Station	1 set
6	Excavator	2 units
7	Dump truck	1 unit
8	Welding machine	2 units
9	Grinding machine	2 set
10	External Clamp	1 set
11	Cutting tools	1 set
12	Night cap	2 sets
13	Mini bus	1 Unit
14	First Aid box	1 Set
15	Tripod / frame with chain block	2 Set
16	Field Joint Coating Equipment	1 Set
17	Holiday detector	1 unit
18	NDT Equipment (Radiography, UT, MPI)	1 Set
19	Shore plate for entry & exit pit	as required
20	Light plants (including lamp, power cable, etc.)	1 set
21	Generator 5 kVA	1 unit
22	Grit blaster	1 Unit
23	Goal posts	As required
24	Pipe Locator	1 set
25	Mud mats (for trench bottom)	As required
26	Auger Boring Equipment	
	– Auger machine unit	1 unit
	– Auger rail	1 set
	– Auger bit complete with connector	1 set
	– Cutter bit	1 set
	– Hammer rail	1 set

12.8.5 **Location of Road Crossing (Boring Method Application)**

Location of road crossing which will need boring method application will be decided after re-survey the actual site condition.

Boring method, will be done in the following areas:

NO	CROSSING	KP	METHOD	REMARKS
1	Road	5+450	Auger boring	
2	Road	8+600	Auger boring	
3	Road	33+800	Auger boring	

12.9 Road Crossing (Open Cut Method)

The road crossing by open cut method shall be used for crossing where the traffic is light, and which do not require crossing by boring method. Open cut method can be done in the areas where existing utilities are presented, but this will require careful digging. The CLIENT shall have final approval of which roads shall be crossed by open cut.

As soon as possible, the pipe shall be laid in the trench and backfilled in order to reduce the time of an open trench across the road.

If necessary, a wooden temporary access road shall be installed to provide temporary access road across the pipe for villager activities.

Backfilling shall be performed in accordance with Backfilling & Compaction Procedure.

At the end of each workday, all equipment and tools shall be organized, shutdown and secured.

The Supervisor shall submit the working progress report or document to the QC inspector for further data processing.

The Security shall regularly patrol to keep the working area free from non authorized persons and local community and to keep all the equipment and tools safe or secure.

12.9.1 **Pipeline Fabrication**

The pipe to be laid across the road may be pre-fabricated (fit-up, welded, coated, etc.) at a prepared fabrication area beside the center of pipeline. All fabrication activities shall be performed in a safe manner and in accordance with approved working procedures.

The pipe section will be fabricated prior to trench excavation of the road crossing, in order to avoid a long time open trench. For fit-up and welding activities, the mobile crane will be used to assemble and/or for line up the pipe.

The fabrication work sequence will be as follows:

1. Ensure that PPE is available and worn correctly prior to start any working activities.
2. Perform Pre-job meeting, attended by all the personnel involved.
3. Supervisor to ensure that all the workers have the correct induction and training required for the work.
4. The Supervisor shall clearly explain the work permit and JSA to all personnel involved in the work.
5. Workers will participate in updating or modifying the JSA to meet actual work conditions.
6. Check the equipment and tools to be used; any damaged equipment and/or tools shall be tagged and repaired prior to use, or replaced.
7. Set-up (if necessary) barrier, signage, and warning sign at working area. Warning signals shall be erected and maintained. Warning signs shall be erected for both day and night shift. The road crossing will be illuminated at night.
8. Confirm that Socio-economic personnel have informed local community of the upcoming work.
9. Ensure that the work site is clear of non-authorized people.
10. Prepare the fabricated area as flat as possible. Compaction shall be done (manual or by excavator bucket) when required.
11. Place the pipe support or bedding at the temporary pipe position and set-up the welding machine with drip pan underneath and install grounding properly.
12. While filling equipment with fuel, a fuel hand pump shall be used. Plastic sheet and drip pan shall be placed under the equipment to manage fuel spill.
13. Fit-up the pipe using external clamp as per drawing and WPS.
14. Check the welding gap and perform other required inspection prior to welding.
15. Perform welding operation as per relevant WPS.
16. Perform all required inspection for welding as per CLIENT specification (Visual inspection, radiography, etc.)
17. Perform field joint coating and holiday test on pipe insulation and field joint coating.
18. Supervisor shall submit the work progress report or document to the QC inspector for further data processing.

12.9.2 **Excavation**

Excavation will be started after received the permit from the concerned authorities. Ensure that all known services and utilities are located, marker and protected prior to start of excavation. Pre-cut the tarmac (if any), with appropriate equipment to provide neat trench width cross section.

Excavation of the road crossing may be performed with three scenarios as follow:

a. Scenario-1: Two Halve Excavation

This scenario may be performed when the road traffic is can be fully blocked for long time.

- First, Flagmen shall install a blockade on one half of the road. Install the warning sign and set up the barricade around the half of the road.
- Start the trench excavation from the road middle to the edge of road.
- Where services or utilities are present, the excavation will be done by manual (if necessary) until such services are made safe. Existing cables shall be marked by distinctive colored tape and moved a side and tied securely to prevent falling into trench.
- The profile of the trench shall comply with details design drawing. Minimum 1.5 m cover from TOP to road surface shall be implemented. This minimum depth of cover shall be implemented across the road right of way and for a minimum distance of 5 m on both sides of the road right of way. Where a drainage ditch runs parallel to the road, the measurement for minimum cover will be taken from bottom of the drainage ditch.
- Install temporary access bridge which designed for the vehicle crossing over the open trench where the half road excavation is completely finished.
- Once the temporary access bridge already completed, re-open the traffic through the first half lane (across the temporary access bridge).
- As soon as possible, perform the required preparation for second half excavation such as warning sign, barricade re-position and set-up, traffic line through temporary access bridge lane clearing, and equipment positioning while the traffic is blocked. Flagmen shall set-up the proper time to temporary block the road traffic for the next half road excavation.
- Perform the second half of road excavation with the same method with the first half excavation as mentioned above.

- Install temporary access bridge over the open trench when the excavation is completely finished
- After the second temporary access bridge has been installed, install all necessary warning signs around the open trench and road side, then open the second half of the road to traffic
- Excavated the sloped bell-holes for tie-in operation at both side of crossing then install the barricade and warning sign around the bell-holes.

b. Scenario-2: Temporary Bypass Lane

A temporary bypass lane will be constructed when the volume of the road traffic is considered too heavy and therefore cannot be blocked.

- Build temporary bypass lane prior to open cut the main road crossing.
- The temporary bypass lane shall have sufficient width so that traffic is not disturbed.
- The distance between the bypass lane and the edge of road to be open cut shall be sufficient to allow a pipeline tie-in (min. 10m space/distance).
- Install warning signs before the bypass lane area and set-up a barricade to block access through the bypass during construction.
- Flagmen shall be assigned to manage the traffic during any activities near the existing road.
- Clear the area where the bypass lane will be built.
- Soil fill and compaction shall be conducted where necessary to provide the bypass lane with a foundation that is adequate to support the traffic that will flow over it.
- Grade the bypass lane using excavator and slope it to the edge of the bypass.
- Prepare a small ditch for drainage to prevent any water entrapment on the surface of the bypass lane.
- When the bypass lane is completed, open the barricade that blocks the access to the bypass lane.
- Block the existing road and guide road traffic through the bypass lane.
- Perform the trench excavation in the existing road.
- The bypass lane and the trench excavation shall be performed sifter the pipe to be laid has been fabricated and all the required inspection has been performed/approved (e.g. NDE and holiday testing) to avoid a long traffic disruption.

c. Scenario-3: Complete Road Block

Complete or fully road block may be performed for the low traffic and no underground service or utilities present near or across the road.

- Ensure that the pipe to be laid in the trench is completed and that all the required inspections have been approved (e.g. NDE and holiday testing) prior to start of road excavation, to reduce the time of road traffic disruption.
- Ensure that the adequate amount of backfilling material is available at site (near the road crossing) prior to blocking the road.
- Socialization to the village chief shall be done at least a month prior to open cut commencement, at least a day before the road blockade, re-inform to the village chief will be done by socio economic team.
- Install all necessary warning signs and set-up the barricades to block the road.
- Flagmen shall stand by at both sides of the road (outside the blockade) to inform and prevent any villager entry the blockade during construction activities.
- Perform the trench excavation until required depth; if necessary, 2 (two) excavators may be used to speed up the excavation process.
- The Surveyor shall check the excavation depth during excavation.
- When the excavation has reached the required depth, ensure that the bottom of the trench is in a dry condition. Pump out the water if any water is found inside the trench.
- For laying of pipe and tie-in welding see section 11.4.
- Road crossing eligible for complete road block will be done by main spread whenever possible.

12.9.3 Laying and Tie-In Welding of Pipe

- When the excavation has been achieved the required depth, ensure the bottom of the trench is in dry condition. Pump out the water if any water is found inside the trench.
- If necessary, install or fill the trench bottom with padding material (loose soil or selected excavated material free from root and stone) prior to laying the fabricated pipe into the trench.
- Set up the crane in position and install the lifting tools such as shackle, webbing sling, and tag ropes to the pipe to be laid.
- Lift-up the fabricated pipe and lower it carefully onto the trench.

- Make sure that the pipe is lowered-in without rubbing the top or side of the trench wall.
- Perform survey to take the as-built data and to make sure that the pipe is laid uniformly on the trench bed.
- Tie-in welding will be performed after the pipe is laid and fit properly.

12.9.4 **Backfilling**

Prior to backfilling operation the pipe shall be surveyed to final check the position of the pipeline. The surveyor will measure the pipeline position using survey equipment and prepare raw data/sketch as built position of the pipes.

The backfilling shall be completed using appropriate backfilling material, filled in sufficient compacted layers not exceeding 30 cm. Warning tape to be installed 60 cm below the surface top layer of backfilling (the final 30 cm below the bottom of the road surface) will be compacted using the excavator bucket.

Compaction of the backfill to within 30 cm below the bottom of the surface of the road shall fulfill the following density requirements with standard CBR tests.

- Min. 85% Relative Density for cohesion less soils
- Min. 95% Proctor Density for cohesive soils

The final 30 cm of the ditch backfill below the bottom of the road surface shall be similar material as the existing road structure material.

12.9.5 **Reinstatement**

The road surfaces will be reinstated in their original condition or better. In case of public roads, the reinstatement shall be made in accordance with the requirements of the relevant road authority.

12.10 Crossing Existing Underground Pipeline (if any)

12.10.1 **Mobilisation**

- Flatbed trucks will be utilized to transport the equipment and material required for the work. The equipment loads shall not exceed the flatbed truck load capacities and/or the width of the flatbed truck.
- During transportation, flagman shall guard particular points along the route from the workshop until the final destination of the transport.

12.10.2 **Survey and Identification**

- CPM shall give a minimum of 3 week notice to Third Party Pipeline Operators so that they may have a representative present during the excavation and installation activities.
- Surveyor shall identify and mark the exact location of existing underground utility cables, pipelines, and other facilities. The survey activities may be performed using a pipe/metal detector but finding must be validated by manual digging.
- Third Party Pipeline Operators will be contacted prior to excavation as per crossing agreement.
- All requirements of the crossing agreements are to be followed.

12.10.3 **Open Cut Activities**

The open cut activities will be performed by the following sequence :

1. Notification to the third party pipeline/ utilities operator.
2. Survey & marking of the existing facilities (includes use of pipe locator/metal detector).
3. Manual excavation and positive identification of the existing facilities (including installation of shoring, if required).
4. Temporary mat will be installed on ground above the existing pipeline or utilities in order to cover the underground existing pipeline and utilities while heavy equipments (excavator and side boom) move over the top. CPM shall strive to keep such equipment crossings to a minimum.
5. Installation of positive protection for the existing facilities (“metal doghouse”).
6. Mechanical excavation to within a maximum of one meter distance to the existing pipeline/ utilities.
7. Install padding in bottom of trench (if required); such as in rocky areas.
8. Install new pipe under the existing pipe/ utilities. In some cases the new pipe may be installed above the existing pipeline/ utilities, depending of depth of burial of the latter.
9. Install personal protection box on the tie-in area (trench box).
10. Perform tie-in welding.
11. Perform NDT.
12. Remove the positive protection of existing pipeline.
13. Perform Field joint coating activities

14. Perform cad welding on the new and existing pipeline if required, the cad welding will be done before field joint coating so that the cad weld can be encased in the same coating as for the field joint coating.
15. Install anode.
16. Remove the personal protection box, ensure that no further inside trench activities are required.
17. Partial backfill& compacting.
18. Install rubber mat between the pipelines.
19. Install pipeline warning tape.
20. Complete backfill and compact in layers.
21. Install cathodic protection test station (if any)

12.10.4 **Excavation**

- Once the existing underground utilities/pipelines have been marked and manually excavated it normally allowed to perform mechanical excavation to within 1 m of such facilities, provided existing facilities are visible and adequately protected.
- Excavation closer than 1 m shall be carried out by manual excavation. Shore protection shall be erected into the trench to protect the workers.
- Manual excavation may be required at any location where in the opinion and sole discretion of the COMPANY representative, makes this necessary.
- Existing pipes or utilities shall be supported with sandbags to prevent sagging.
- Trench protection box including entry & exit access ladders shall be installed prior to personnel entering the trench.
- All personnel working inside the trench shall wear body harness.

12.10.5 **Welding**

- All welding performance shall be in accordance with relevant WPS.
- Workers must be protected from the danger of confined space, i.e. by installing a tie-in box or benched excavation techniques.
- Protection for existing pipe or utility shall consist of the installation of a fire blanket and metal “dog-house”.
- Fire extinguisher shall be stand-by on site at all times.
- All welding activity shall be in accordance with Welding Procedure.

12.10.6 **Crossing Detail**

- A minimum clearance of 60 cm will be kept between the bottom of the existing pipe to the top of the new pipe.
- Additional isolation between the Cathodic Protection systems of the existing pipeline and the new pipe will be achieved by the installation of a rubber mat between the pipes.

12.10.7 **Inspection**

- All inspections for the Pipeline or Utility Crossing work shall comply with the minimum Inspection & Test requirements (Construction Inspection and Test Plan).
- All welding for product pipe shall be subject to NDT.

12.10.8 **Backfilling and Compaction**

- For crossing points, backfill and compaction will be done manually. The area outside of crossing point will be done by excavator.
- All backfilling activity shall be in accordance with Backfilling and Compaction Procedure.

12.10.9 **Equipment Movement**

- Incase the equipment is required to move/walk across the existing pipeline, additional protection (e.g. steel plate, temporary bridge) will be installed on the ground surface above the existing pipeline.
- In such case, CPM will provide a calculation that demonstrates that the existing pipe can be crossed safely.

12.11 Waterway Crossing (Open Cut Method)

Wherever possible CPM will strive to cross waterways when they are in dry condition, when this is not possible the sequence described below:

- Surveyor shall ascertain the water depth by comparing the highest water level that could occur during the installation versus the bottom of the waterway. Waterway bed/bottom is measured from natural ground layer, not mud layer. Above activities is performed in order to define the actual condition for further discussion about the appropriate method or scenario for the waterway crossing. Pontoon will be prepared if necessary to perform the survey on the width and depth waterway crossing.
- Trenching limits shall be marked with bamboo sticks across the river/ditch. Contrast painted color mark on excavator arm depth of trench will be done to measure the trench depth.
- Concrete coated pipe will be installed as stipulated in the design drawings.
- Spill berms will be installed on both sides of the waterway downstream of the crossing.

- The trench shall be maintained and any soil collapse shall be re-trenched until the required trench profile as per construction drawing. The trench will be excavated with sufficient slope concerning the sensitivity of the buffer zone along banks of waterway.
- In case the crane cannot be mobilized to the crossing area, the excavators will be used as pipe laying (lifting) equipment. Ensure that the equipment is complemented with certain certificate to do the activity.
- At the end of each workday, all equipment and tools shall be organized, shutdown and secured.
- The Supervisor shall submit the working progress report or document to the QC inspector for further data processing.

12.11.1 Pipeline Fabrication

The pipe to be laid across the waterway will be pre-fabricated (fit-up, welded, coated, etc.) at a prepared fabrication area on the edge of the waterway. All fabrication activities shall be performed in a safe manner and in accordance with approved working procedures.

For fit-up and welding activities, the crane will be used to assemble and/or for line up the pipe.

The fabrication work sequence is the same with the fabrication work sequence for crossing road by open cut.

Prepare sandbags to reduce the water flow velocity (energy dissipater) as required quantity.

12.11.2 Excavation and Pipe Laying

- Do not start any excavation work without prior authorization of the authorities concerned.
- Install warning signs and barricades before digging.
- Surveyor will monitor the trench depth from the bund to ensure the trench profile is straight and even depth. Excavate in a manner to keep the trench profile stick to design.
- The excavation will be done manually until the access ways (bund) are clearly visible. Existing cables shall be marked by distinctive colored tape and moved a side and tied securely to prevent falling into trench.

- The profile of the trench shall comply with the detailed design drawing. Minimum 2 m cover from top of pipe to the bottom of waterway crossing shall be implemented.
- Spoil shall be moved to a spoil pile away from the waterway and protected against loss from rain.
- Excavate sloped bell-holes for tie-in operation at both sides of the crossing at a minimum of 4m from the edge of waterway or as per construction drawing; then install the barricade and warning sign around the bell-holes.

a. Scenario-1: Temporary Equipment Access

If the excavator cannot reach the midpoint of the waterway, CPM will prepare temporary access for equipment by installing sand bags, across the river / ditch as required.

Construction temporary equipment access will be performed in the following sequence:

1. Prepare sufficient amount of sand/soil bags and flume pipes or concrete culvert as water access when access bund is built.
2. Lay concrete culvert/flume pipe on the bottom of the waterway at the equipment access position (downstream of waterway), start from the near side by excavator until the maximum distance that excavator can reach.
3. Put the sandbags over the flume pipes or concrete culverts
4. Start trench excavation of the waterway from the near side of waterway, and lay the excavated soil over the sand bags heap. Ensure the soil is protected from falling/spill into the waterway.
5. Meanwhile the pipe spools is being prepared in fabrication area, near the crossing
6. Continue the excavation and soil heap until the maximum distance that excavator can reach.
7. Move the excavator on the position at the above equipment access.
8. Repeat the step 2 to step 4 until the excavator reach and can move across to the other side of waterway.
9. Excavate the sloped bell-holes for tie-in operation at both sides of crossing at a minimum of 4m from the edge of waterway or as per construction drawing; then install the barricade and warning sign around the bell-holes.

Pipe laying will be as following sequence:

Width of waterway less than 10 m

1) Surveyor shall check the depth of trench by level stick.
2) Place the sand bag as energy dissipaters at the both of waterway slope trench in accordance with construction drawing by excavator or manual.
3) Removed the flume pipe prior to lowering-in/laying the pipes.
4) Pipe spool is then lowered by side boom or excavator using sling belt.
5) Pipe fitter and surveyor checks the pipe alignment. Any adjustment is done by the side boom or excavator.
6) Backfill the trench with the excavated soil; push the backfill surface on every single heap by excavator bucket.
7) Pump out the water inside the tie-in bell.
8) Fit-up the pipe and clamp. Then weld one end of the tie-in.
9) Upon obtaining NDT clearance (QC acceptance) and FJC acceptance, backfill the trench using the excavated soil then remove the temporary dam.

Width of waterway 10 to 20 m

1) Ditch will be kept free of water using pump (bailing out) to the downstream side of waterway.
2) Surveyor shall check the depth of trench by level stick.
3) Pipe zinker (u-shape spool) will be fabricated at workshop or at site (near the crossing). The spool shall be fabricated to achieve cover as shown on alignment sheet and/or crossing detail drawings.
4) Surveyor will check depth of trench by level stick.
5) Place the sand bag as energy dissipaters at the both of waterway slope trench in accordance with construction drawing by excavator or manual.
6) 2 Side booms or excavators will lift the fabricated pipes zinker on a two lifting point, two lifting point arrangement and move through the temporary equipment access across the waterway.
7) Lowered-in the pipe gently to center of water crossing. Tag lines will guide orientation of the spool from both ends of the crossing.
8) Surveyor will check top of pipe elevation and the pipe alignment using auto level.
9) Backfill the trench with the excavated soil; push the backfill surface on every single heap by excavator bucket.

10) Install temporary pig launcher by welding it onto one end of the pipe spool. Also install temporary pig receiver by welding it onto the other end of the spool.

11) Run a poly-pig using air compressor. Repeat the operation until pipe is clean (mud free).

12) Pump out the water inside the tie-in bell.

13) Fit-up the pipe spool and clamp to a straight pipe. Then weld one end of the tie-in.

14) Complete reinstatement of the river/ditch embankment.

Width of waterway more than 20 m

For pipeline installation across this waterway will be detailed on separate procedure if such case occurs.

b. Scenario-3: Bypass Waterway

A bypass waterway will be constructed where the waterway is too wide or has a large water flow rate.

1. Excavate the bypass waterway with similar depth and width as the original waterway.
2. The bypass shall not be opened before it has been completed leave 1 m unexcavated on each side to block the water flow.
3. Meanwhile the pipe spools is being prepared in fabrication area, near the crossing.
4. When the bypass excavation is finished, open the block by excavating the remaining 1m space so that the water can flow both through the bypass and main waterway.
5. Provide temporary equipment access across the waterway at the downstream side of waterway by the same method with temporary equipment access scenario-1.
6. Start trench excavation from the near edge of waterway or may be perform by 2 excavators at both side.
7. Place the excavated soil at the upstream side of waterway to blockade the water flow.

8. When water flow has been fully blocked, pump out the water inside the trench through the downstream side of waterway or the bypass if necessary.
9. Next sequence is Pipe laying that will be as explained in Scenario-1.

12.11.3 **Backfilling**

The pipe shall be surveyed to prepare the as built position of pipeline. The backfill shall be compacted per layer with use of excavator bucket. The slurry (wet backfill) will not be compacted.

12.11.4 **Reinstatement**

The ditch/river condition or embankment will be reinstated as near to the original condition as possible. In case of river/ditch embankment the reinstatement shall be made in accordance with the requirements of the relevant authority.

12.12 General Tie-in

Tie-in welds are those which defined as being closure welds, connecting sections of pipeline at areas such as river and road crossing, sectional valves, and any break in the mainline left un-welded for construction handle-ability purpose.

12.12.1 **Preparation Works**

- The areas in which the pipe and materials will be placed shall be clean, compacted and cleared from existing obstacles.
- Where tie-in is required, bell holes will provide sufficient space for tie-in activities such as welding, radiography test and field joint coating.
- The bell hole shall be kept completely safe by sloping/stepping the excavation.
- The slope of the bell hole wall shall not be steeper than 60° in hard soil, 450 in normal soil, 300 in soft soil from horizontal axis; when the slope is steeper, trench box for tie-in shall be fabricated and installed. This will also depend on soil conditions.
- The bottom of the bell hole may be sloped to drain ground water away, and a water collection pit (sump) will be installed. This sump pit will collect the water before being pumped out.
- The entry and egress to bell holes shall be properly prepared. Proper positive ladder shall be arranged for the entry or egress of the work force. The ladder shall be arranged in such a way that the ladder won't fall while in use.

- All welding equipment shall be inspected and in a good condition prior to the commencement of the welding activity. Any calibration of welding equipment shall be done prior to the commencement of welding activity.

12.12.2 Tie-In Works

Tie-in works will be performed in the following order:

- Prior to start tie-in activities, following activity shall be conducted:
  1. Ensure that PPE is available and worn correctly prior to start any working activities.
  2. Perform Pre-job meeting, attended by all the personnel involved.
  3. The Supervisor to ensure that all workers have the correct induction and training.
  4. The Supervisor shall clearly explain the work permit and JSA to all personnel involved in the work.
  5. Workers will participate in updating or modifying the JSA to meet actual work conditions.
  6. Check the equipment and tools to be used; any damaged equipment and tools shall be tagged or repaired prior to use.
  7. Install trench box for tie-in when the slope of tie-in pit or bell is steeper than allowable and install ladder for personnel entry and egress, fix it to ground or other proper structure above ground to eliminated ladder fall.
  8. During Tie-in, normally PUF (poly urethane foam) will be exposed to atmosphere. Plastic sheet will be installed to avoid water ingress into the PUF.
  9. Set-up barriers, signage, and warning signs at working area & shall be maintained.

- Perform Fit-up and welding as per following sequence:
  1. QC Inspector (Welding Inspector) shall perform the pre-welding inspection for the pipe to be welded (end pipe bevel condition and configuration, pipe cleanness, pipe roundness, etc.) prior to fit-up.
  2. Prepare the first pipe section on fix position; it may have been fixed since the pipeline section has been backfilled. For the pipe flexibility, the pipe will leave minimum of 4 lengths of pipe shall be free to have flexibility for tie-in wastewithout backfill.

3. A minimum 50 cm distance will be maintained between bottom of pipe and the bottom of the trench.
4. The second pipeline section end will overlap with the first pipeline section. Measure and mark on the second pipeline section the actual overlap length.
5. Cut the overlap second pipeline section using cutting torch.
6. Re-bevel the pipe end and smooth using grinding machine after cutting as per bevel configuration define on approved WPS. Re-beveled pipe end shall be ground and bevel configuration shall be in compliance with approved WPS.
7. Perform all required NDT on the after cutting pipe end bevel surface (MPI or PT and UT). Lamination check shall be conducted to a length of 100 mm from pipe end.
8. Fit-up the second pipeline to first pipeline section using side boom after NDT result accepted.
9. Fix both pipeline sections in place using external clamp.
10. QC Inspector (Welding Inspector) shall be inspecting the final pipe fit-up prior to start welding.
11. Pre-heat shall be performed using LPG heating torch until the pipe surface achieve required temperature defined on approved WPS. Pre-heat shall be performed evenly on circumferential and shall be in line with approved WPS.
12. Perform pipe welding after pre-heat finished (root pass, hot pass, filler pass and final pass).
13. During welding, Welding Inspector shall inspect every weld layer to reduce any possible weld defects.
14. Completed weld joint shall be NDT tested.
15. Radiography shall be performed and reviewed by CPM and CLIENT welding inspectors.
16. Welding Inspector shall inform to the tie-in Supervisor for the result of NDT (accepted or not accepted) for further construction process such as welding repair (if any weld defect), field joint coating, backfilling, etc.

- At the end of the shift, place all the equipment and tools on proper and tidy position on site.
- At the end of workday, all equipment and tools shall be organized, shutdown and secured.

- Supervisor shall submit the progress report or document to QC inspector for further data process. Daily report shall be submitted to CLIENT after the approval from CLIENT Welding Inspector and third party inspectors.
- Security patrols will be used to keep the working area free from non-authorized persons and local community and to provide security for equipment and tools.

12.12.3 **Tie-In Welding**

- **Root pass**

  The Root pass shall be executed according to the relevant approved WPS. All starts and stops in the root pass shall be ground to a smooth taper prior to the continuation of welding.
- **Hot pass**

  The Hot pass shall normally be applied as soon as possible after the root has been welded (but no later than the time limit given in the relevant WPS). Each pass of weld metal shall be cleaned before a further pass is applied. Visible defects shall be removed by wire brush or grinding.

  The degree of completeness of a weld prior to removal of line up clamps is specified in the Welding Procedure Specification (WPS).

- **Filler and final pass**

  Prior to laying a filler or cap bead, the previous bead shall be brushed or lightly ground. Each pass shall be completed around the whole circumference before the next pass is started. The number of beads on both weld section shall be same, so that the completed weld have a substantially uniform cross section around the entire circumference of the pipe.

12.12.4 **Inspection and Testing**

All inspection and test for tie-in shall be comply with the inspection and test requirement defined on Construction Inspection and Test Plan.

Welding inspection will be performed during all the welding activity including welding preparation activity. Qualified welding inspector shall be engaged to carry-out the welding inspection.

12.13 Cold Bending

Direction changes to comply with the pipeline alignment shall be accomplished using bends formed using the cold bend method. Cold Field Bends shall be conducted by CPM and shall comply with the requirements of ASME B31.4. CPM will perform cold bend at Lay down area and use 1 bending machine.

A bending survey shall be conducted as soon as practical after grading is completed. The following items shall be marked during the survey: pipe center, starts point of bending, and welding seam.

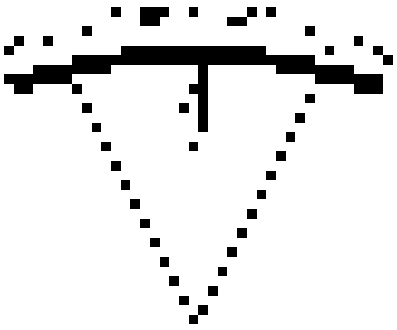
During construction, pipe may be flexed for installation purposes to a radius of curvature at their natural bend angle.
CPM shall submit bending qualification/bending procedure and calculation of maximum bending angle for CLIENT approval.

Prior to site field bending, a "Bend Qualification Test (BQT)" shall be conducted on pipe that is to be utilized in the installation of the works. A minimum of 2.0 meter of straight pipe shall be left at ends of pipe joints. The BQT will be performed at temporary lay-down area prior to start the bend production.

12.13.1 Bending Qualification Test (BQT)

The BQT shall be performed for one line pipe joint to the maximum bend degree (up to 18°). The BQT shall be performed to qualify the procedure prior to start of full cold bend production.A CLIENT representative will witness the BQT and testing activity.

The minimum radius of a cold bend shall be 40D radius of arc and/or maximum bend angle 18° for 16 inch diameter in 8 m cold bending arc length (subtracted 2m of both straight pipe-ends from a 12m pipe (see figure on next page). The maximum degree is also subject to the capacity of the bending machine. The shop drawings will be provided before activities start at site.



The following essential variables shall be applied and listed in the Bending Qualification Test (BQT):

Material	Material standard and Grade
Type of Pipe	Spiral Welded pipe

Bend Radius	One radius qualifies all larger radii
Diameter (D)	Any change in diameter
Wall thickness (t)	Any change in wall thickness
Type of Equipment	Details of Equipment and any change In equipment

During the BQT, QC inspector shall check and record the following factors:

- Pipe No.
- Diameter of pipe
- Wall thickness (shall be greater than CLIENT specification minimum line pipe wall thickness) – After and before Bending every 50 cm
- Thickness of External Coating and insulation.
- Pipe Length.
- Type of Bending Machine.
- Bending Data.
- Bend Increment (degree).
- Pull Measurement (Bend mark or segment length, in mm).
- Insulation condition (visual check)
- Bend Increment (Degree) under bending force and after relaxation of bending force; and

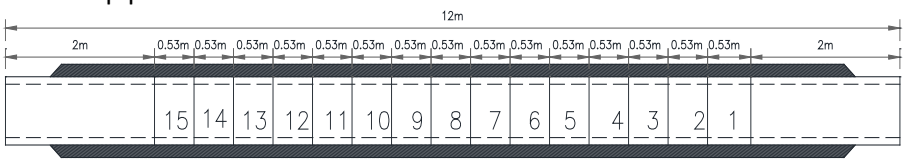
After BQT, the insulation shall be inspected visually and by mechanical test (see section 16.4). The visual check shall reveal no defect, crack or wrinkle on the pipe. The insulation will be removed to show that no wrinkle and no ovality, and no deformation exist that is more than 2.5% at the pipe bend.

Pipes which have wrinkles or buckles after bending will be rejected. No attempt shall be made by the Contractor to repair such damage by any method. Visible signs such as “DON’T USE” shall be marked clearly on the damaged bends. The rejected bends shall be quarantined.

The gauging plate of 97.5% inside diameter shall be fabricated in order to inspect the roundness of pipe. Ovality of bend pipe shall not exceed 2.5%.

12.13.2 Sequence of Bending Qualification Test

1. Mark the pipe as below sketch.



2. Lift the pipe by crane or side boom (see lifting sketch on attchament-2) and position on the bending machine and insert the internal mandrel onto the pipe.
3. Use hydraulically driven winch to move the pipe through the machine. The pipe will move easily on the contoured rollers. Insert the pipe to mark number 1.
4. Check the pipe position prior to start bending operation (including the pipe level check).
5. Start bending operation. First, on the mark number 1, bending machine will inject 1 deg.
6. Check visual HDPE coating, if there are no damage then continue to the mark number 2.
7. Inject the pipe 1 deg and check visual HDPE coating, if there are no damage then continue to the next mark number until all mark injected (full 15 degrees bend) then skip to Sequence number 12. Perform visual HDPE coating inspection on every bend increment (injection).
8. In case of the HDPE coating damage is occurs during bend injection (ex. at the mark number 1 or first injection), the bend will be continued until the mark number 4 or 5 injection to ensure that the damaged is still occurs or not while perform 1 deg bend injection per mark number.
9. If the HDPE coating damage is still occurs while perform 1 deg bend injection, for the next mark (number 6 to10) will be reduced to 0.75 deg per injection.
10. If there are no wrinkles or buckles, then we take conclusion that the maximum cold bend permitted is 0.75 deg per injection. But if the HDPE coating damage is still occurs, for the next mark injection (number 11 to 15) will be reduced to 0.5 deg per injection.
11. In case of the HDPE coating damage is still occurs while the bending is performed on 0.5 deg per injection, CPM will ask CLIENT to discuss and find solution.
12. Visually inspect entire HDPE surface of final bend (full bend) and record any damage.
13. Following no HDPE coating damage occurs during bend injection, perform the pipe roundness inspection with the gauging plate (97.5% inside diameter of pipe and the length is equal with inside pipe diameter, by pulling the attached rod manually in order to find the wrinkle or buckle during bending.
14. Cut away HDPE only to allow inspection of PUF.
15. Inspect PUF for cracking or damage and record.
16. Cut away and remove PUF from pipe, do not damage FBE or pipe.
17. Record any apparent disbonding between PUF and FBE.
18. Visually inspect FBE and verify FBE coating with holiday detector test set at voltage of 2.6 V over the FBE.
19. Inspect pipe for wrinkling, ovality, deformation exist.
20. Conduct tests NDE and Mechanical test for NDE and mechanical testing.

12.13.3 **Acceptance Criteria for BQT**

1) No extreme bulges that can cause crack on HDPE and PUF are identified.
2) No PU extrusion from the HDPE layer and /or at the end of pipe is allowed.
3) Any damage to the HDPE during bending the operation will be repaired by melt stick or patching. The material for stick or patching is HDPE.
4) Cracking of the PUF is allowed either longitudinally or circumferentially up to a crack opening width of 3 mm.
5) No pipe ovallity more than 2.5% internal diameter of pipe.
6) Pass test for NDE, mechanical testing and water stop test as described on below paragraph.

12.13.4 **Non-Destructive Examination (NDE)**

The qualification bend shall be subjected to 100% visual examination and 100% Magnetic Particle Inspection (MPI) or Dye Penetrate Tested (PT) and UT (ultrasonic test) wall thickness checks at minimum 5 locations along the outer radius and 5 locations along inner radius of the bend all test after bending and 100% RT weld area (helical weld or longitudinal weld). This will necessitate the removal of insulation, which must be achieved without damaging the parent pipe. NDE method and acceptance criteria shall be as for the parent pipe. Above NDE method will be applied for BQT only.

The wall thickness of the qualification test shall be measured after bending has been completed by ultrasonic at a minimum of five locations along both the inner and outer radii of the bend (between and including the start and stop points of the bend arc angle).

The out-of-roundness and any other specified relevant dimensional requirement shall be checked after bending by manual diameter measurement. The requirement of the design code and relevant project specification shall be met.

12.13.5 **Mechanical Testing**

Specimens for destructive testing shall be collected from the area exposed to the most severe deformation. All tests specified for the parent pipe shall be performed, except transverse weld tensile testing. The testing will be performed at a test laboratory; the QC Inspector and a CLIENT representative will witness the testing activity. The mechanical testing will be performed on BQT only.

Acceptance criteria shall be as for the parent pipe with the following exceptions:

- Elongation shall not exceed 5%.
- Hardness values shall be maximum 20 HRC.

12.13.6 **Water Stop Test**

At the end of the bend pipe insulation, this shall be performed in the same method with water stop testing for straight-line pipe insulation while it fabrication. Pressure test will be performed with 7 psi using bottle oxygen and check with bubble test on the surface coating. This test only performed during BQT test.

The hole for blowing nipple will be bored by manual, and then the nipple pipe will be inserted. If necessary, the nipple will be sealant joined to the HDPE surface. Flexible hose will be installed at the above mentioned nipple and connected to the nitrogen bottle regulator. Check the connection prior to open the nitrogen bottle for water testing.

12.13.7 **Bend Survey**

The bending engineer will determine the degree of the bends based on the construction survey. Prior to bending the line pipe, the field engineers will clearly mark the requested degree, pipe center, start point of bending (2m from pipe-ends), segment or mark, degree per segment or mark, and bending positions, together with its type such as Over Bend (OB), Sag Bend (SB), Side Bend Right (SBR) and Side Bend Left (SBL) and orientation.

The desired maximum degree of bending along one total joint shall be no more than 15 degree or the degree qualified as a result of BQT, unless the CLIENT representative allows it as per actual site condition but the bend radius is not less than 40D, CPM will issue a Site Query in such case and another BQT shall be conducted.

After the bending engineers determine the required degree for the bends, the “Pipe Bending List” shall be submitted to CLIENT for review.

12.13.8 **Bending Operation**

- All cold bends will be made at the bending area in the laydown area or workshop.
- All contact surfaces of the bending machine shall be padded to prevent damage to the pipe, coating or insulation. Prior to bending, the contact surface of the bending machine shall be cleaned.
- CPM will use a bending machine with modified bending set (consist of Stiff Back Liner, Pin-Up Liner, Pin-Up Clamp Liner) and bending dies in order to be suitable for pipe plus insulation. The bending machine shall be assembled with a full circle bending shoe and internal mandrels

- A calibrated stiff back indicator rod allows the operator to make consistently uniform bends, and the pin-up clamp automatically grips the pipe to prevent distortion.
- The bevel guard shall be re-installed after bending and inspection.
- Following bending, the bends shall be placed horizontally on wooden skids, sand bags or other proper supports to elevate them from the ground surface.
- The bends shall be stored in a special area until the bends are required to be installed at site.

Cold bend production will be performed by following sequence:

1. Mark on the pipe surface, the bend increment position (at a minimum every 533 mm) and tangent limits as per drawing or bend request from field engineer.
2. Lift the pipe by crane or side boom and positioned on the bending machine and insert the internal mandrel into the pipe.
3. Insert the pipe into the bending machine from the pin-up liner side.
4. Use hydraulically driven winch to move the pipe through the machine. The pipe will move easily on the contoured rollers.
5. Check the pipe position prior to start bending operation (including the pipe level check).
6. Perform bending operation (hydraulic injection).
7. Check the bend degree on every bending (hydraulic injection) sequence using degree measurement.
8. Check the final bend degree when all bending (injection) sequences are finished.
9. Following bending, horizontally placing the bend on a wooden skids, sand bags or other proper supports to elevate them from the ground surface.
10. Remove the internal mandrel from inside and perform all required test and inspection including pipe roundness inspection with the gauging plate (97.5% inside diameter of pipe and the length is equal with inside pipe diameter, by pulling the attached rod manually).
11. The bevel guard shall be re-installed after bending and inspection.
12. Prepare the bending report and submit to CLIENT for review and approval.

12.13.9 Acceptance Criteria for Cold Bending

1. No extreme bulges that can cause crack on HDPE and PUF are identified.
2. No PU extrusion from the HDPE layer and /or at the end of pipe is allowed.
3. Any damage to the HDPE during bending the operation will be repaired by melt stick or patching. The material for stick or patching is HDPE.

4. Cracking of the PUF is allowed either longitudinally or circumferentially up to a crack opening width of 3 mm. Any voids or damaged PUF areas greater than 3 mm in diameter but less than 250 mm diameter can be repaired manually. If PUF damaged area is greater than 250 mm diameter, then Contractor shall make an opening in the HDPE, remove the damaged PUF, inject new PUF and reseal with HDPE patch using welding method.
5. No pipe ovallity more than 2.5% internal diameter of pipe.

CPM will perform all cold bending at the laydown area and the equipment are listed below:

No	Description	Qty
1	Sideboom	1 unit
2	Crane	1 unit
3	Bending machine (with fully circle bend shoe and internal mandrel)	1 set
4	Gauging plate	1 set
5	Protractor	1 set
6	Lifting tools (shackle, webbing sling, end hook	as required

12.14 Worker Housing and Transportation

All workers from supervisor below will stay at a private house or their own house, CPM will manage the transportation from a gathering point to the work location. They will use a bus or a light vehicle. Since our recruitment plan for local manpower will use local workers in the neighborhood of the working location, then some of them will go directly to the working location by themselves. Workers will not be allowed to work without proper training.

12.15 Construction Completion Procedure

The CLIENT and CPM shall carry out a joint inspection to verify that the constructions are completely done, which will initiate the construction completion certificate by the CLIENT. Any punch list items identified during the inspection will be cleared by the CPM and shall be subject to CLIENT's separate written acceptance. All other associated documentation, certification, verification, check lists, inspection and test records will be compiled and presented to the CLIENT together with the Construction Completion Certificate.

After review of the documents required the construction completion, CPM and CLIENT representatives will perform walk down in every discipline. The walk down result will be record on Construction Completion Check Record (CCR). Any outstanding work will be listed on a Punch list.

12.16 Inspection & Test Plan Procedures

The ITP has been established to define the required activities related to the inspection of material, site inspection execution, inspection delegation and inspection and test status. The ITP describes the inspection activities to be performed to ensure that anypurchased or constructed item complies with the CLIENT specifications, international codes and standards and Government Regulations and to ensure that inspection activities are substantially and effectively contributing to the quality.
Measures will be taken to hold the construction until all required inspections and tests have been completed and any non-conforming product has been identified. Test records will be kept when inspection and/or tests acceptance criteria have been passed.

12.17 Hydrostatic Testing Procedure

Hydrostatic pressure testing will be performed by CPM after pipeline cleaning and gauging has been completed and accepted. Test package documents shall be completed and approved prior water filling.

Before filling water, pigs will be installed in the test header and will insert 5 m3 of water as lubrication. When CPM starts filling water in to the pipeline, the filling pump will pump the water to push the pigs.This is to minimize the air trapped during the water filling process.

All concerned parties will verify and inspect the hydrostatic equipment to be sure that the equipment meets the requirements.

The valves will be hydrotested separately at the work shop and will be installed after the mainline hydrotest finished as “Golden Weld”. The trench at the valve station will be left open only at the valve positions so there is no obstruct to the other construction activities at the valve station areas.

12.18 Reinstatement Procedure

The ROW and any temporary access road, lay-down area, and camp shall be reinstated back to their original conditions. Any existing utilities or facilities dismantled during construction shall be put back to its place or reinstated as soon as the pipeline has been laid and backfilled.

13 ONSITE PROCUREMENT AND MATERIAL CONTROL

13.1 On-Site Procurement Plan

On site procurement can be carried out for items that cost less than 100 million rupiah provided that the material to be purchasedis not permanent or construction material. Such material is to be purchased near the site and delivered directly to the site. If the material is not available around the site, the purchase will be done by the head office procurement team.

The requisition for the procurement will be also carried out from site office, and will be routed to the head office procurement team.

13.2 Material Control

The specifications of materialsto be used for construction and which need to purchased, shall be in accordance with the specifications.

Material inspection and quantity tracking will be done at site by the site procurement team and QA/QC Teams.

14 CONSTRUCTION QA/QC PLAN

14.1 Quality Manual

CPM Quality Manual covers a Quality Management System to perform pipeline installation work (which are described in the Quality Manual documents, Quality Procedures, Work Instruction, Forms and supported by other documents relevant to a Quality System ISO 9000 Series.

The Quality Manual consists of descriptions of organization, responsibilities, and activities to fulfill quality elements stipulated in ISO-9001:2000.

14.2 Quality Plan

CPM will develop a Project Quality Plan to demonstrate how the CPM will fulfill the Contract requirements in respect of quality-related matters and activities.

15 ENVIRONMENT

A wide range of waste material will be generated from CPM office, campsite, pipeline construction, camp, temporary site facility, and hydrostatic testing. Waste from the project materials, scrap steel, old electrodes, wood, liquid waste (such as waste oil and chemicals), and general waste such as litter and rubbish.

The waste will be collected, stored, treated and disposed of in accordance with the Waste Management Plan (WMP) and thus adhere to requirements of the relevant local authorities.

CPM shall report to the CLIENT all waste quantities generated on the CLIENT-provided Work Sites and shall supply data for quantities of waste generated on a weekly/monthly basis. CPM data must include all Subcontractors employed by CPM.

16 WORK LICENSE AND WORKER FITNESS CERTIFICATION

CPM will select employees for the project based on requirement of each department. Basic hiring will be made in accordance with CPM policies, as well as rules and regulations.

Basically, CPM will maximize hiring local labor especially for non-skilled labor, however where there is a shortage of skilled labor. The hiring will be done from other locations.

To ensure that every worker is in a good condition and fit for duty, CPM will arrange a medical checkup which will be conducted by a Medical Provider.

The MCU will consist of a full clinic examination, urinalysis, chest X ray and others depending on their job position. Drug and alcohol test will be mandatory for safety sensitive positions. For category I every site worker should pass the MCU.

The result of the occupational health examinations will be documented and kept by CPM for a minimum of three years.

17 CONSTRUCTION SAFETY, HEALTH, ENVIRONMENT AND SECURITY PLAN

Safety, health, environmental and security will lead by the HSE Manager, CPM will assign dedicated person to arrange, manage and conduct the training.

Most personnel that directly involve on each work discipline, will be safety trained by Safety Officer at the stockyard area and/or at work site. Basically, the training will cover the basic PPE requirement, introduction of Emergency Response Plan, Muster Point, etc.

HSE Concern as below:

- Excavation at Town and High Population area
- Hauling material at detour road and ROW

- Installation of pipe at swampy area
- HDD and Thrust bore operation work
- Cleaning Work
- Hydro testing Work
- Etc.

CPM will develop a working procedure for each activity and perform a risk assessment meeting to assess the risk included in a certain activity.

17.1 Safety Plan

Site Safety Plan is to act as a guideline to the project team for various measures that need to be implemented during the project execution to manage safety so that the objective "An injury and Incident Free Work Place" and safety shall not be compromised to achieve any other business objective:

- Safety, Health and Environment are not affected and work crew performs their work in accordance with well accepted safe working practices.
- Equipment deployed for construction activities is certified, secured and safe.
- Adequate safety levels are maintained and environmental impacts are minimized and monitored during the entire performance of the work.

Meet the CLIENTHSE requirements / Indonesian legal regulations and other safety related requirements pertaining to the project.

The HSE team will assign a safety officer to each work location to manage the safety aspects on that location. All members of the project team are considered to be part of the safety organization and will therefore be responsible to work in a safe manner.

The HSE department will conduct safety and enhancement programs in order to pass safety knowledge and motivation to all project members, such as: distribute safety booklets, perform safety inductions, safety training, safety tool box meeting, and reward program.

All CPM and Subcontractor members within this project have the same commitment to Safety.

The Safety Plan consists of several procedures such as:

- Project Safety Management Plans
- Strategic Emergency Preparedness Plan
- Emergency Response Plan
- Project Management Safety Steering Team Charter
- Incident Management Procedure
- Work Site Emergency Preparedness Plan
- Emergency Response Procedures

- Site Specific Safety Procedures
- Site Specific Safety Management Plans
- Safety Coordination Procedure
- Safety Training Documentation Procedure
- Permit To Work / Loto Procedures
- Confined Space Entry Procedures
- Energy Isolation Procedure
- Scaffolding Erection And Disassembly Program

Site Safety Plan scope is applicable during the engineering, procurement, transportation, construction, systems completions and start-up support of the pipeline by CPM including, without limitation, providing all project management, supervision, engineering services, procurement services, construction services, consultations, equipment, materials, labors, construction tools, construction equipment, construction utilities, construction supplies, systems completion materials and resources, temporary structures and facilities, and transportation including, without limitation, hauling, unloading, and handling to, at, and from WORKSITE for this Project.
CPM strongly believes that the employees are our most valuable resources and no phase of business is more important than contractor personal safety. CPM believes that all accidents can be prevented and that safety is an integral part of everyone's job. CLIENT, CPM Management and employees are responsible for demonstrating safety leadership, providing a safe work environment and promoting safety as a value.

CPM core safety beliefs include:

- All accidents are preventable
- All injuries are preventable
- Working safely is a condition of employment
- All operating exposures can be safeguarded
- Trained employees to work safely is essential
- Recognizing safe behaviors fosters better understanding of our policies, philosophy and practices

To contribute to safety improvement across the operation, CPM share best practices and lessons learned among industries / organizations and CLIENT. In addition, CPM have a dedicated staff of safety professionals, and construction team to support our philosophy.

17.2 Health Plan

Prevention is the key element used to minimize the severity of occupational injuries and illnesses. However, unpredictable events do occur, and it is important that an emergency medical facility is defined so that prompt and competent medical treatment is provided to an injured or ill employee.

The provision of health services will be done by Hospital.

Site Health plan shall be refer to Site Specific Health Plan.

Health Plan is covered by several procedures such as:

- Dengue Control procedures
- Occupational Health Reporting Procedures
- Health Auditing Procedures
- Site Specific Health Plans
- Clinic Practice Guidelines
- Medical Equipment Maintenance Procedures
- Medical Evacuation Procedures
- Sanitary Health Procedures
- Dust control procedure
- Radiation equipment emergency and operating procedures
- Occupational Health Staffing Plan

17.3 Environmental Management

CPM confirms its commitment in performing the contractual works with the least possible impacts on the environment and in absolute compliance with all Indonesian Regulations, Local Regulations and CLIENT requirements.

CPMwill respect the environment by acting to minimize any impact which may arise from construction operations; this includes assessing the types of materials and substances that are currently in use and substituting them with more environmental friendly ones.

CPM shall take note of all environmental issues and comply with all laws, rules and regulations related to the environment. This shall include but not be limited to avoiding unnecessary felling or damaging of trees, proper discharge of effluent, dust control, emission of noise, vibrations, fumes, waste, socioeconomic surrounding the construction operation area, etc.

CPM shall implement the Environmental Management Plan (EMP) in accordance with the conditions stipulated in the Environmental Impact Assessment (AMDAL).

The environmental management issues that have been specifically considered within this document include: land use, land clearing and grading, removed vegetation management, borrow pits, water consumption, watercourse crossing & wetlands, land reclamation, hydro testing, dust control, noise control, open trenches/excavations, storage of fuels, lubricants, solvents, chemicals and other dangerous/toxic materials, waste disposal and oil spill.

The environment management will refer to Environment Management Plan.

Environment is secured by several procedures such as:

- Regulatory Compliance Plan

- Socioeconomic Action Plan
- Waste Management Plan
- Environmental Management Plan
- Socioeconomic Compliance And Management Plan
- Spill Prevention And Response Plan

17.4 Security Plan

CPM will construct secure facilities at the work locations such as the camp, office, material storage, site work shop and lay-down areas.

The Jakarta office will follow existing CPM security systemswhich will be improved to meet with the CLIENT requirements as stated in the Contract.

Site facilities will be designed as per site conditions and Contractual requirements.

Security Expectation vs CPM Strategy and Plan:

NO	Frame Work	Result (Target)	CPM's Strategy and Program
1	Workforce Control	Unauthorized person cannot enter to project facilities	All project persons shall have a background check; Entering the office, working area or camp will require a security check. Flow chart Access Control in doc Inventory Manifesting Procedure
2	Controlled Asset	No asset lost	All working areas including camp will be controlled by security guard, and all out going materials from storage, office, camp will be control with permit -Please see site specific security procedure (Appendix Access Control)
3	Emergency Response	Security incident is no impact to continuity of the business work	-Refer to the evacuation procedure
4	Local Security	Get local people who has a licensed security from Local Police	

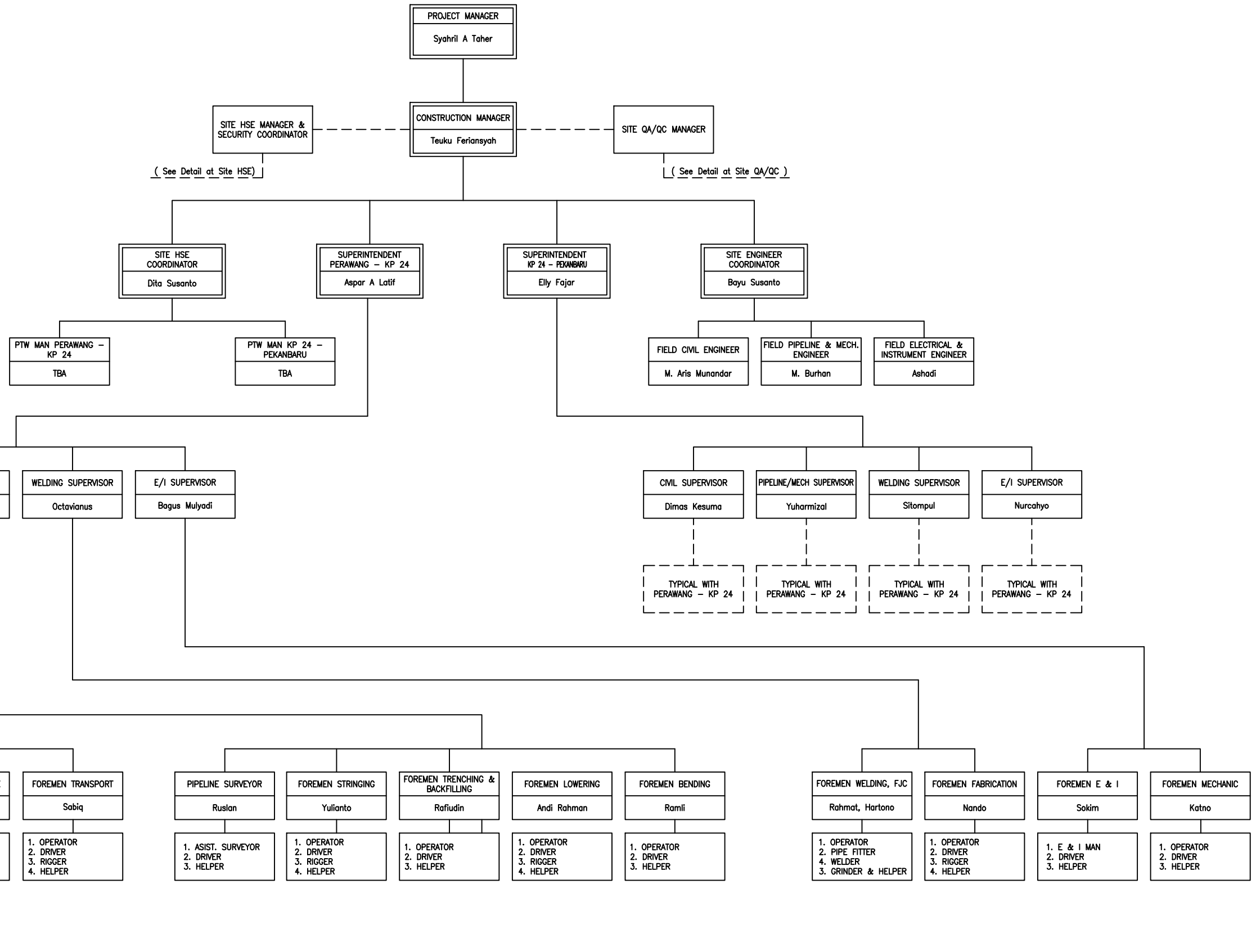
18 ATTACHMENT

- Attachment 1 : Construction Organization Chart
- Attachment 2 : Flow Chart Interfaces between Purchasing and other Department
- Attachment 3 : Lay-down layout
- Attachment 4 : Drawing Auger Boring Method
- Attachment 5 : Typical Trench Excavation & Lowering Operation

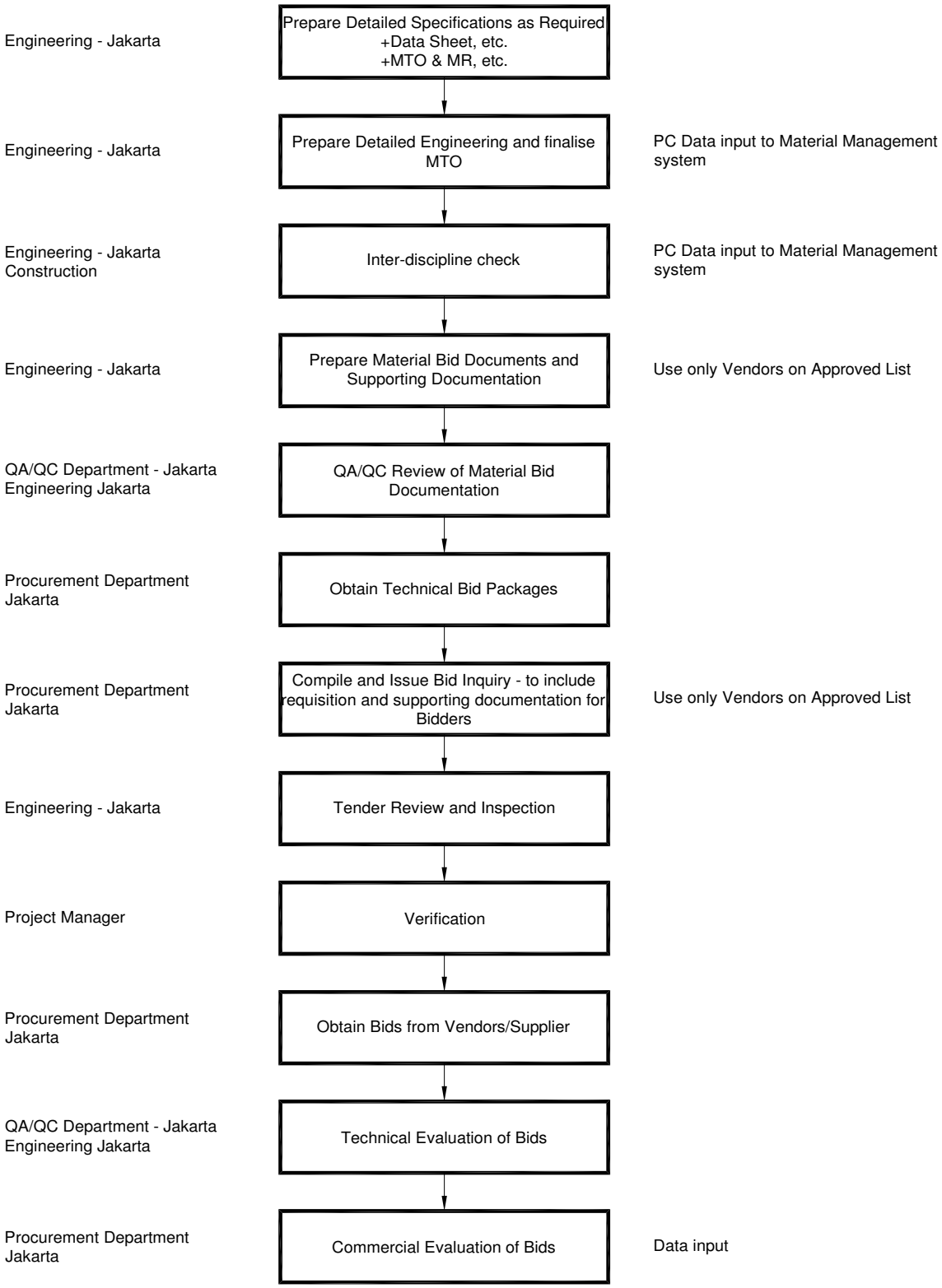
Attachment – 1: Construction Organization Chart

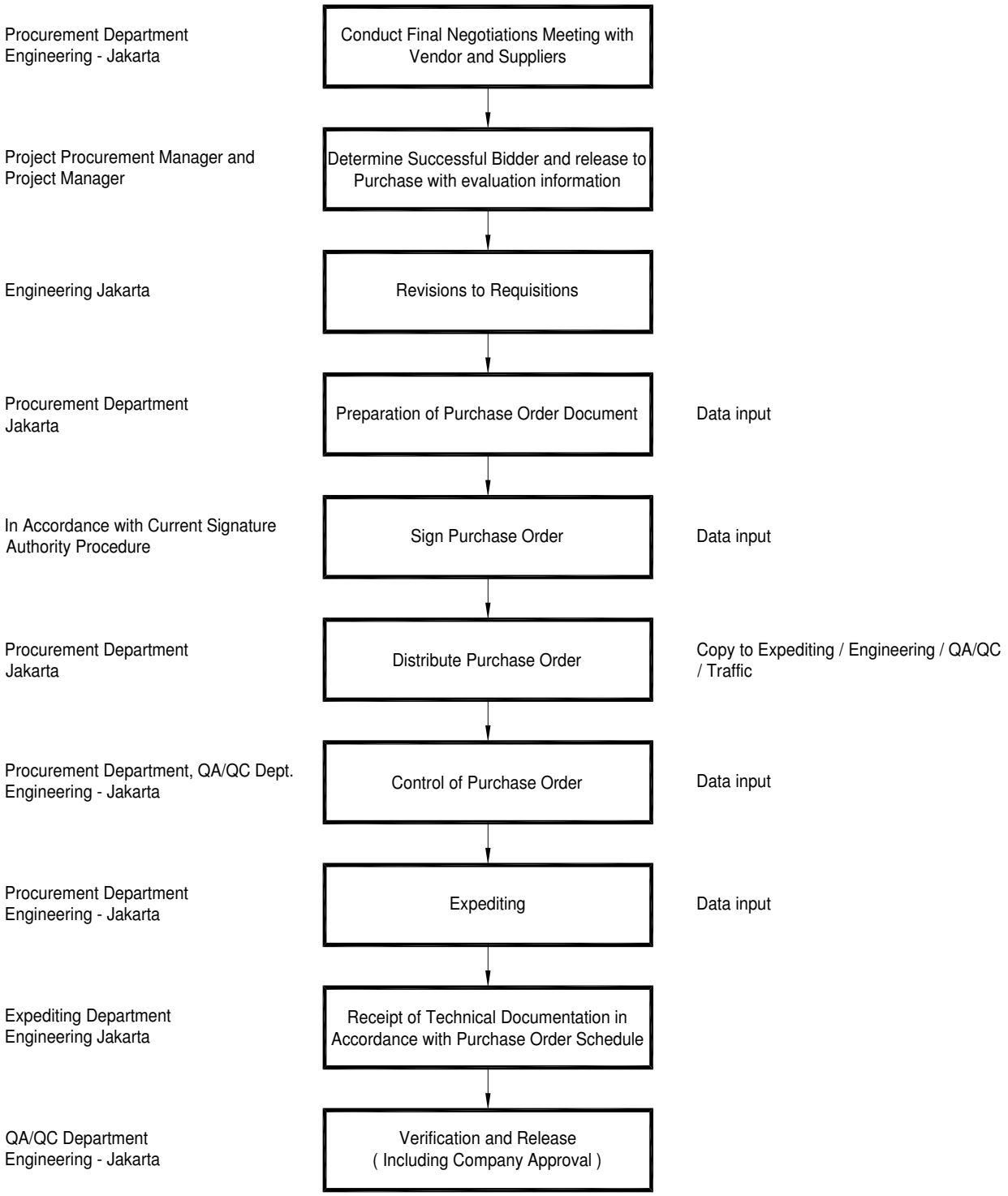
CONSTRUCTION ORGANIZATION CHART
ECP GAS PIPELINE FOR RIAU 250 MW GFPP IPP PROJECT
PT. CITRA PANJI MANUNGGAL

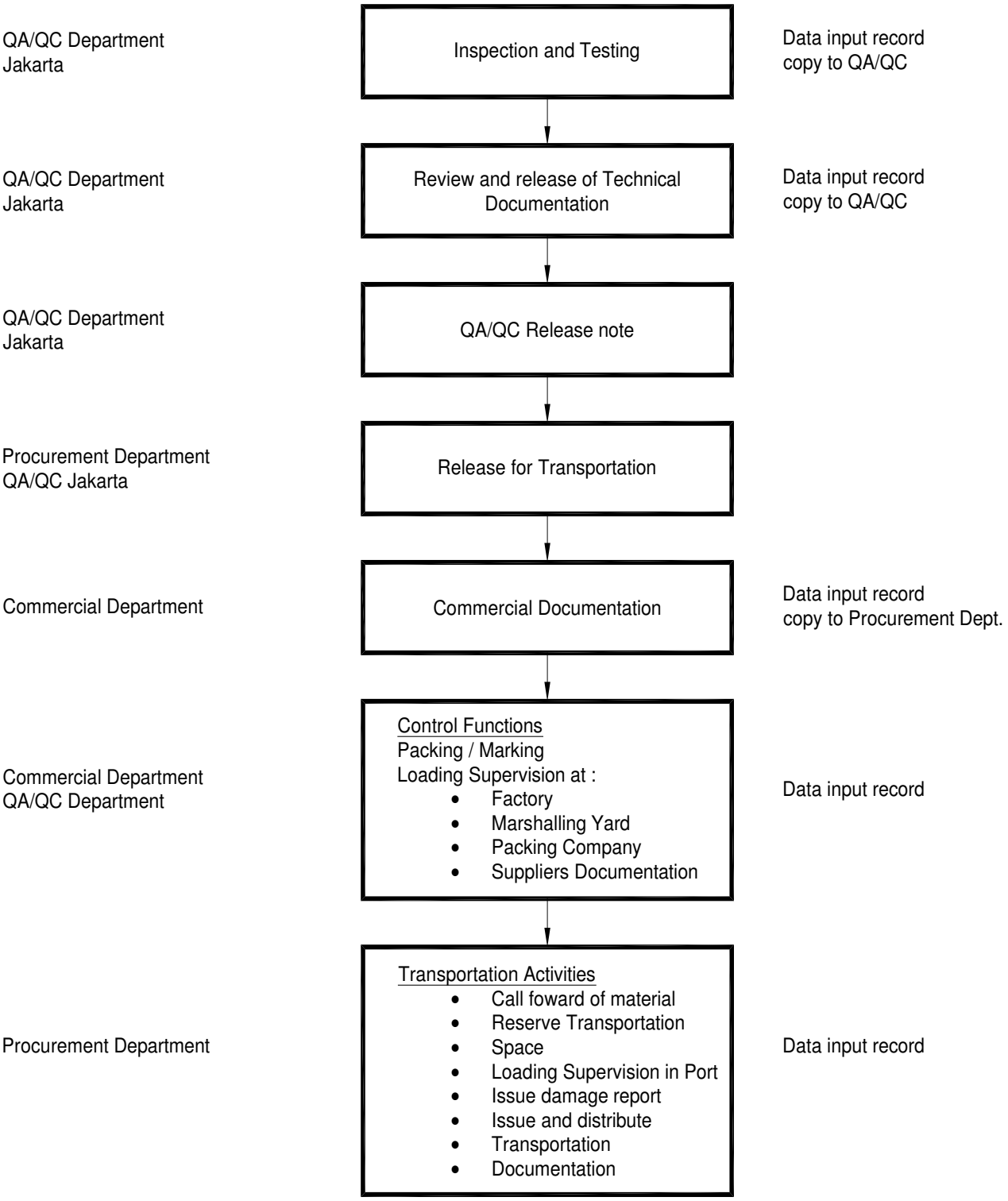
2. CONSTRUCTION ORGANIZATION CHART

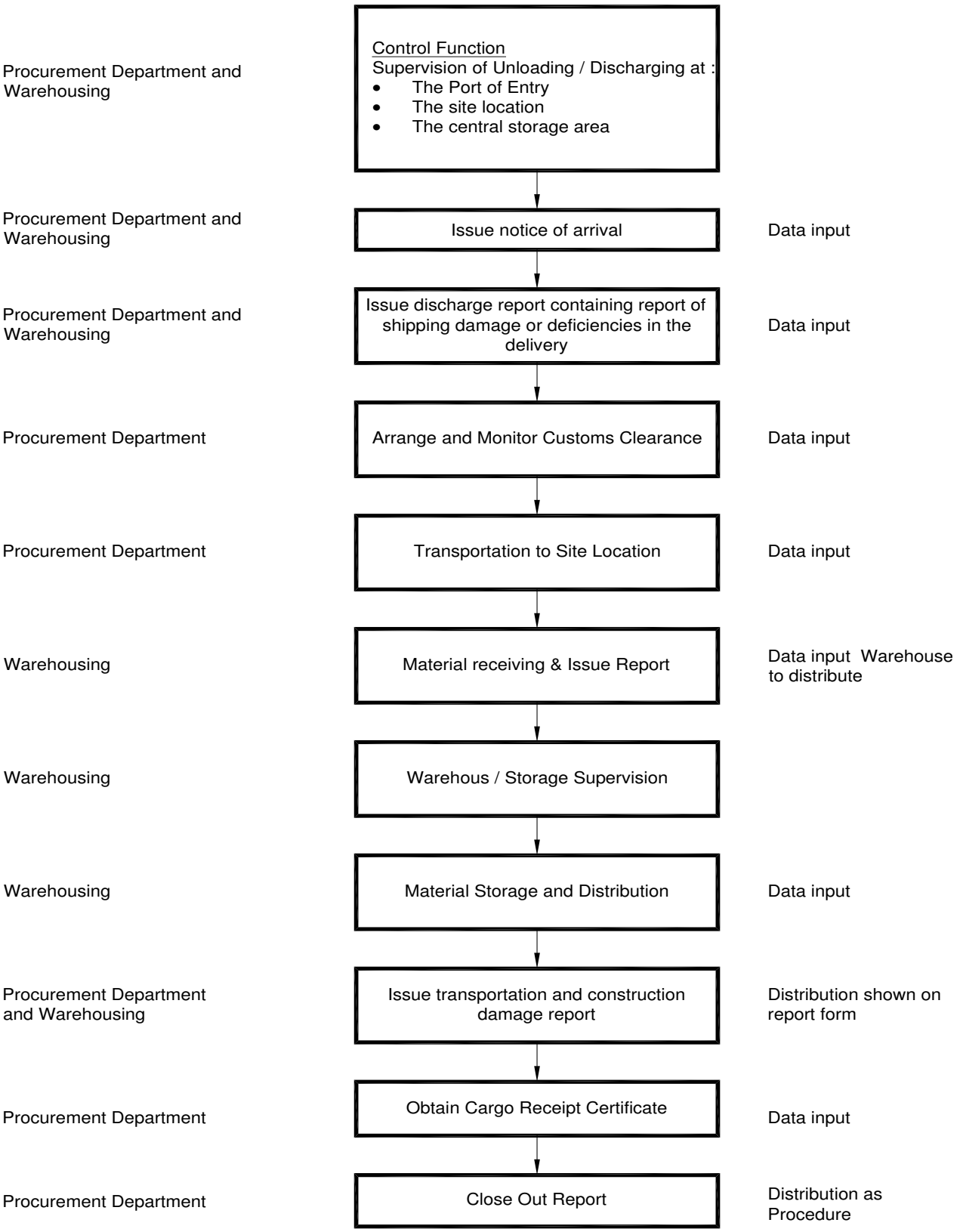


Attachment – 2: Flow Chart Interfaces between Purchasing and other Department



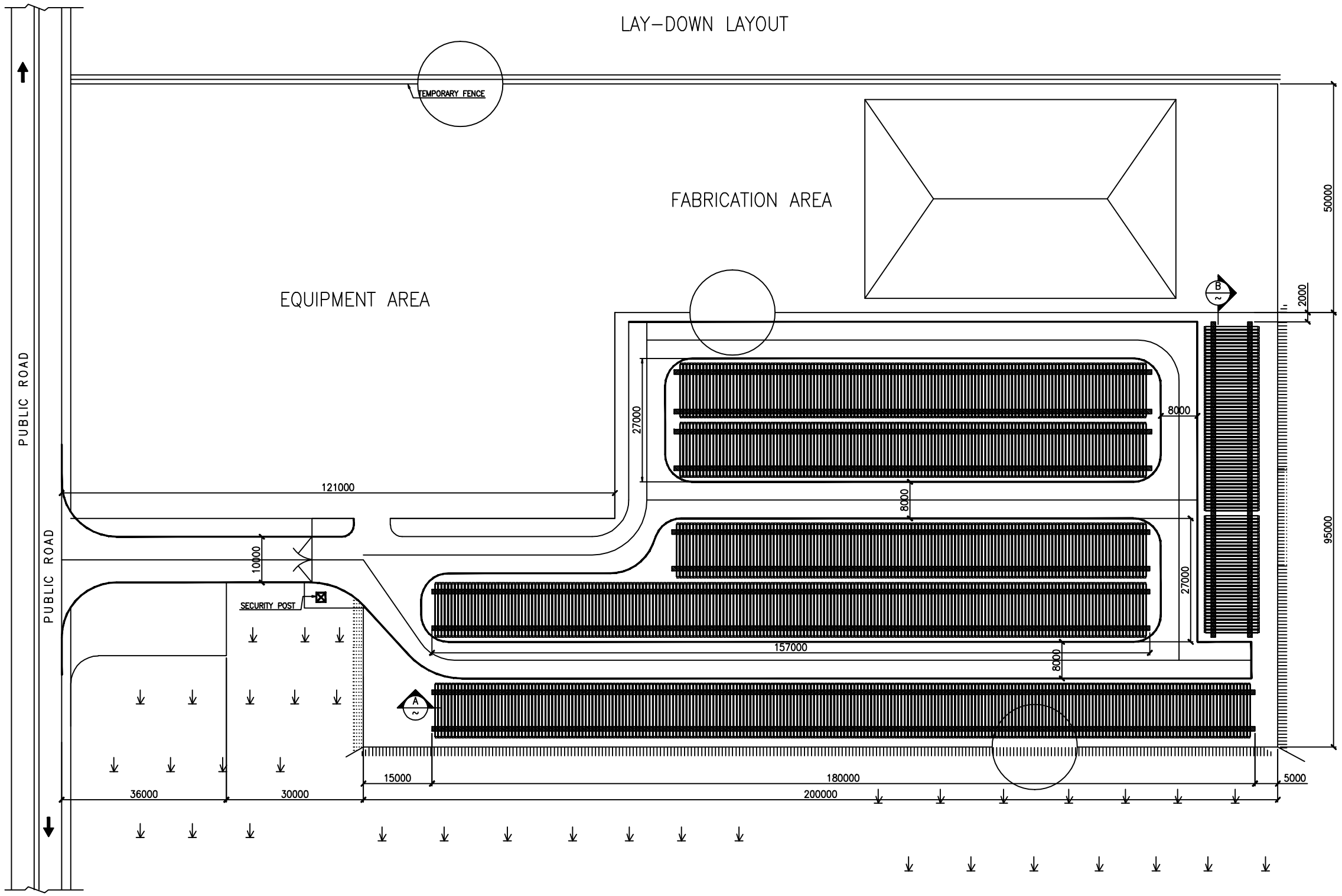

Procurement Department Engineering - Jakarta
Conduct Final Negotiations Meeting with Vendor and Suppliers
Project Procurement Manager and Project Manager
Determine Successful Bidder and release to Purchase with evaluation information
Engineering Jakarta
Revisions to Requisitions
Procurement Department Jakarta
Preparation of Purchase Order Document
Data input
In Accordance with Current Signature Authority Procedure
Sign Purchase Order
Data input
Procurement Department Jakarta
Distribute Purchase Order
Copy to Expediting / Engineering / QA/QC / Traffic
Procurement Department, QA/QC Dept. Engineering - Jakarta
Control of Purchase Order
Data input
Procurement Department Engineering - Jakarta
Expediting
Data input
Expediting Department Engineering Jakarta
Receipt of Technical Documentation in Accordance with Purchase Order Schedule
QA/QC Department Engineering - Jakarta
Verification and Release (Including Company Approval)

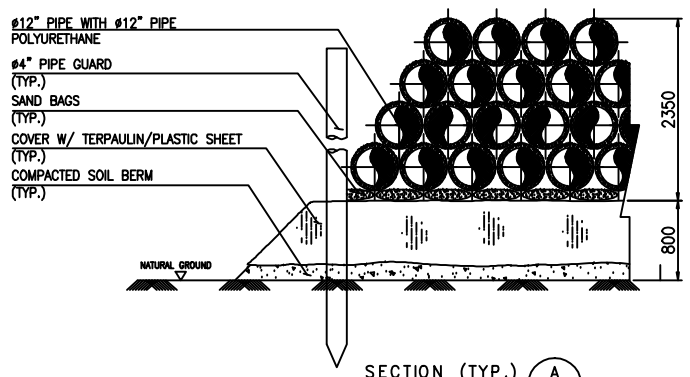

QA/QC Department Jakarta
Inspection and Testing
Data input record copy to QA/QC
QA/QC Department Jakarta
Review and release of Technical Documentation
Data input record copy to QA/QC
QA/QC Department Jakarta
QA/QC Release note
Procurement Department QA/QC Jakarta
Release for Transportation
Commercial Department
Commercial Documentation
Data input record copy to Procurement Dept.
Commercial Department QA/QC Department
Control Functions
Packing / Marking
Loading Supervision at :
Factory
Marshalling Yard
Packing Company
Suppliers Documentation
Data input record
Procurement Department
Transportation Activities
Call foward of material
Reserve Transportation
Space
Loading Supervision in Port
Issue damage report
Issue and distribute
Transportation
Documentation
Data input record


Procurement Department and Warehousing
Control Function
Supervision of Unloading / Discharging at :
• The Port of Entry
• The site location
• The central storage area
Procurement Department and Warehousing
Issue notice of arrival
Data input
Procurement Department and Warehousing
Issue discharge report containing report of shipping damage or deficiencies in the delivery
Data input
Procurement Department
Arrange and Monitor Customs Clearance
Data input
Procurement Department
Transportation to Site Location
Data input
Warehousing
Material receiving & Issue Report
Data input Warehouse to distribute
Warehousing
Warehous / Storage Supervision
Warehousing
Material Storage and Distribution
Data input
Procurement Department and Warehousing
Issue transportation and construction damage report
Distribution shown on report form
Procurement Department
Obtain Cargo Receipt Certificate
Data input
Procurement Department
Close Out Report
Distribution as Procedure

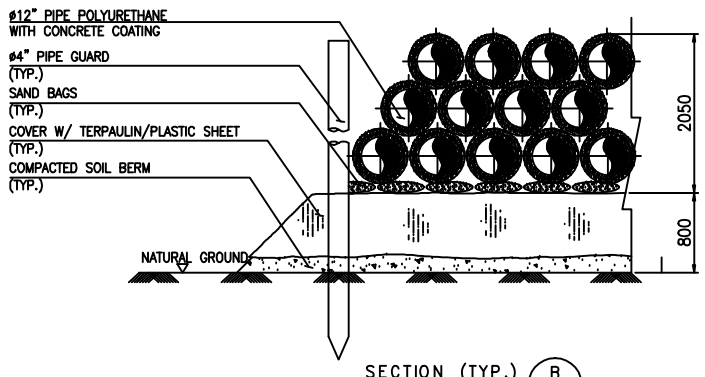
Attachment – 3: Propose Laydown Layout

LAY–DOWN LAYOUT

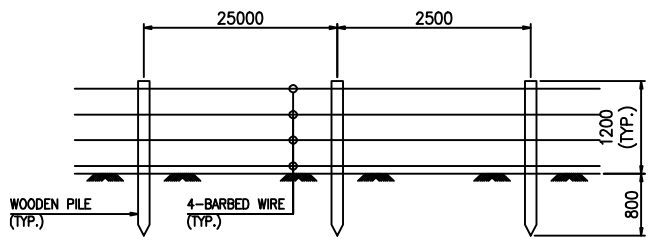




SECTION (TYP.) A
SCALE 1:100



SECTION (TYP.) B
SCALE 1:100

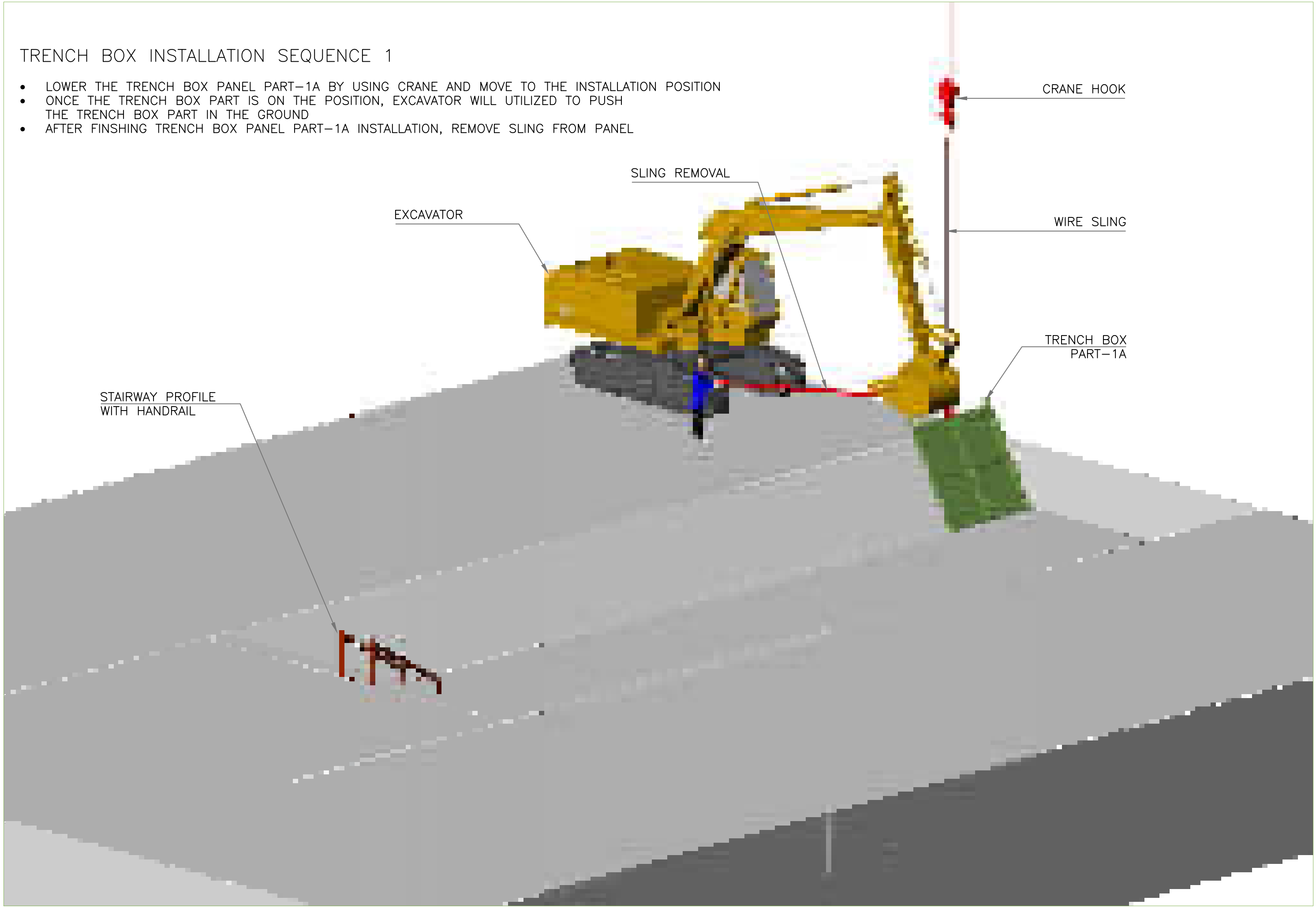


TYPICAL TEMPORARY FENCE
SCALE 1:100

Attachment – 4: Auger Boring Layout

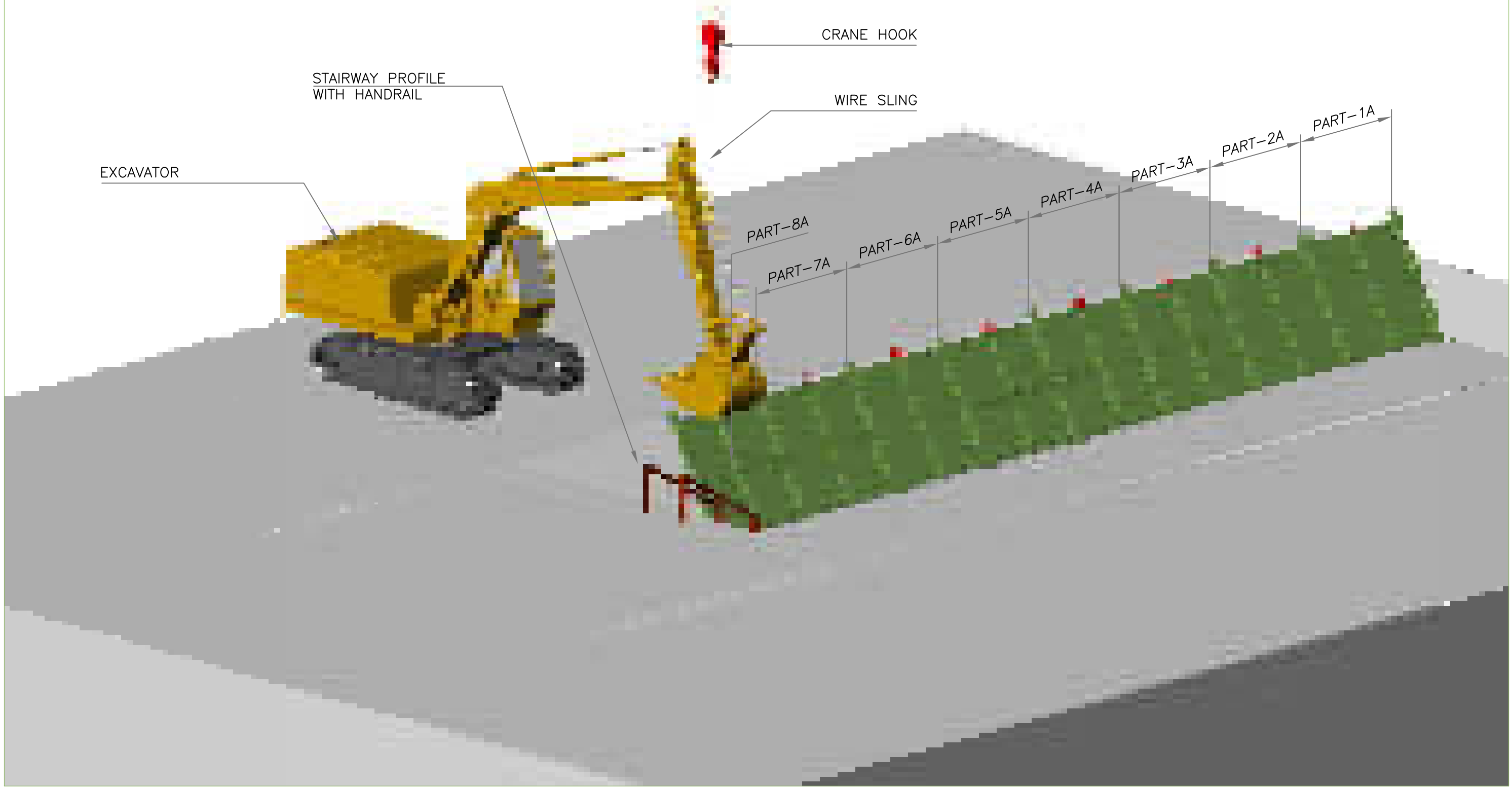
TRENCH BOX INSTALLATION SEQUENCE 1

- LOWER THE TRENCH BOX PANEL PART–1A BY USING CRANE AND MOVE TO THE INSTALLATION POSITION
- ONCE THE TRENCH BOX PART IS ON THE POSITION, EXCAVATOR WILL UTILIZED TO PUSH THE TRENCH BOX PART IN THE GROUND
- AFTER FINSHING TRENCH BOX PANEL PART–1A INSTALLATION, REMOVE SLING FROM PANEL



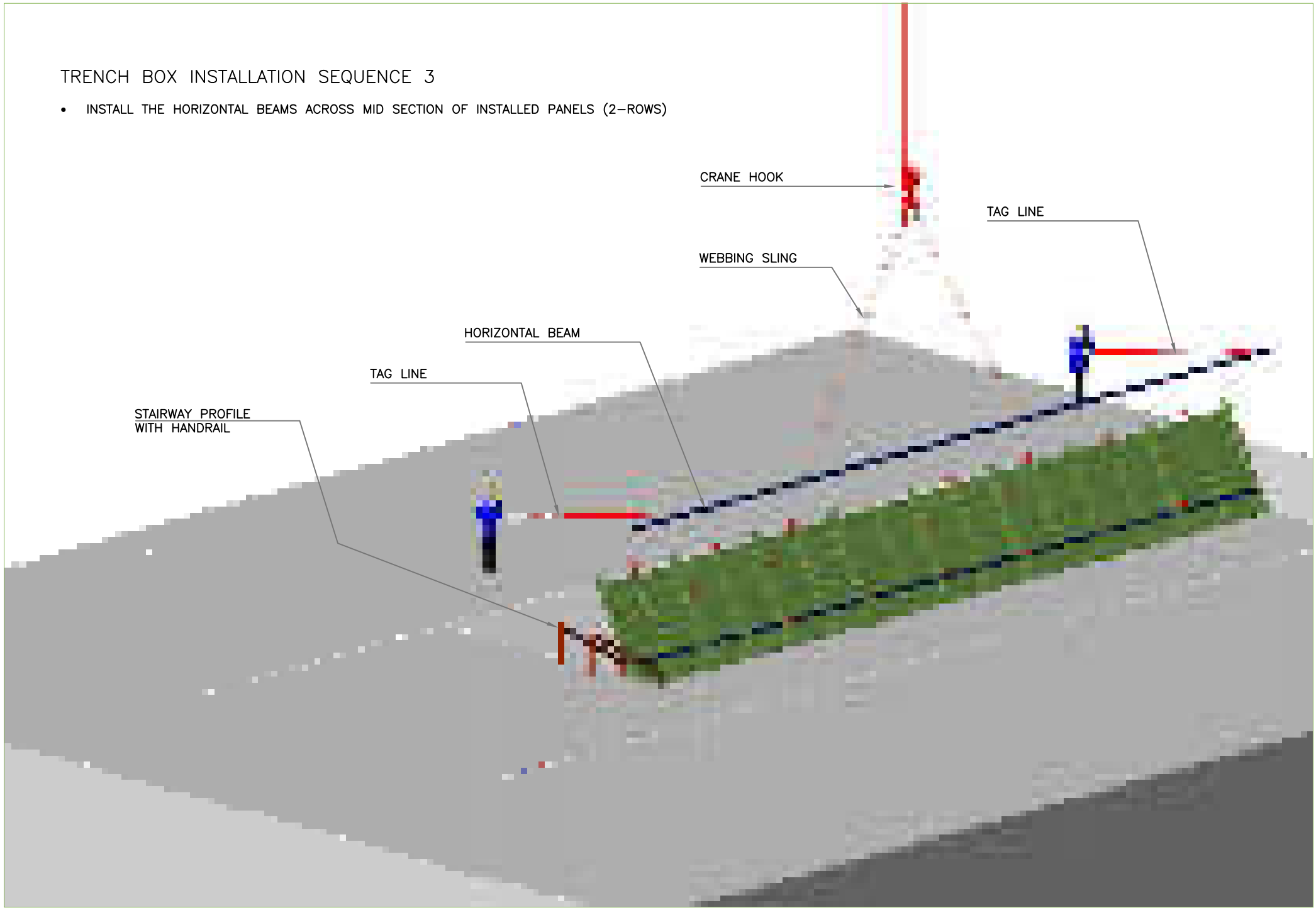
TRENCH BOX INSTALLATION SEQUENCE 2

- CONTINUE INSTALL THE OTHER PANEL UNTIL PART–8A



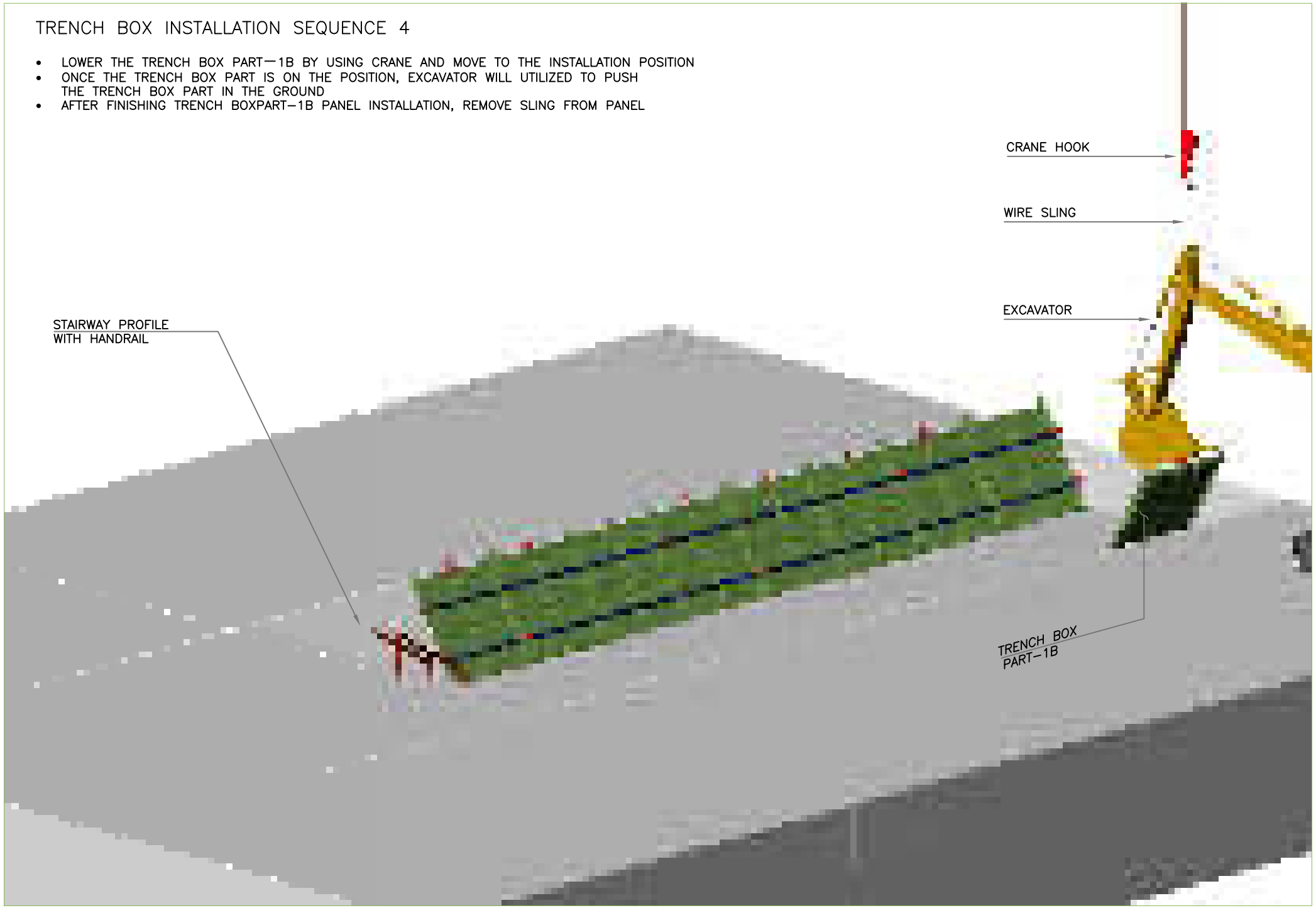
TRENCH BOX INSTALLATION SEQUENCE 3

- INSTALL THE HORIZONTAL BEAMS ACROSS MID SECTION OF INSTALLED PANELS (2–ROWS)



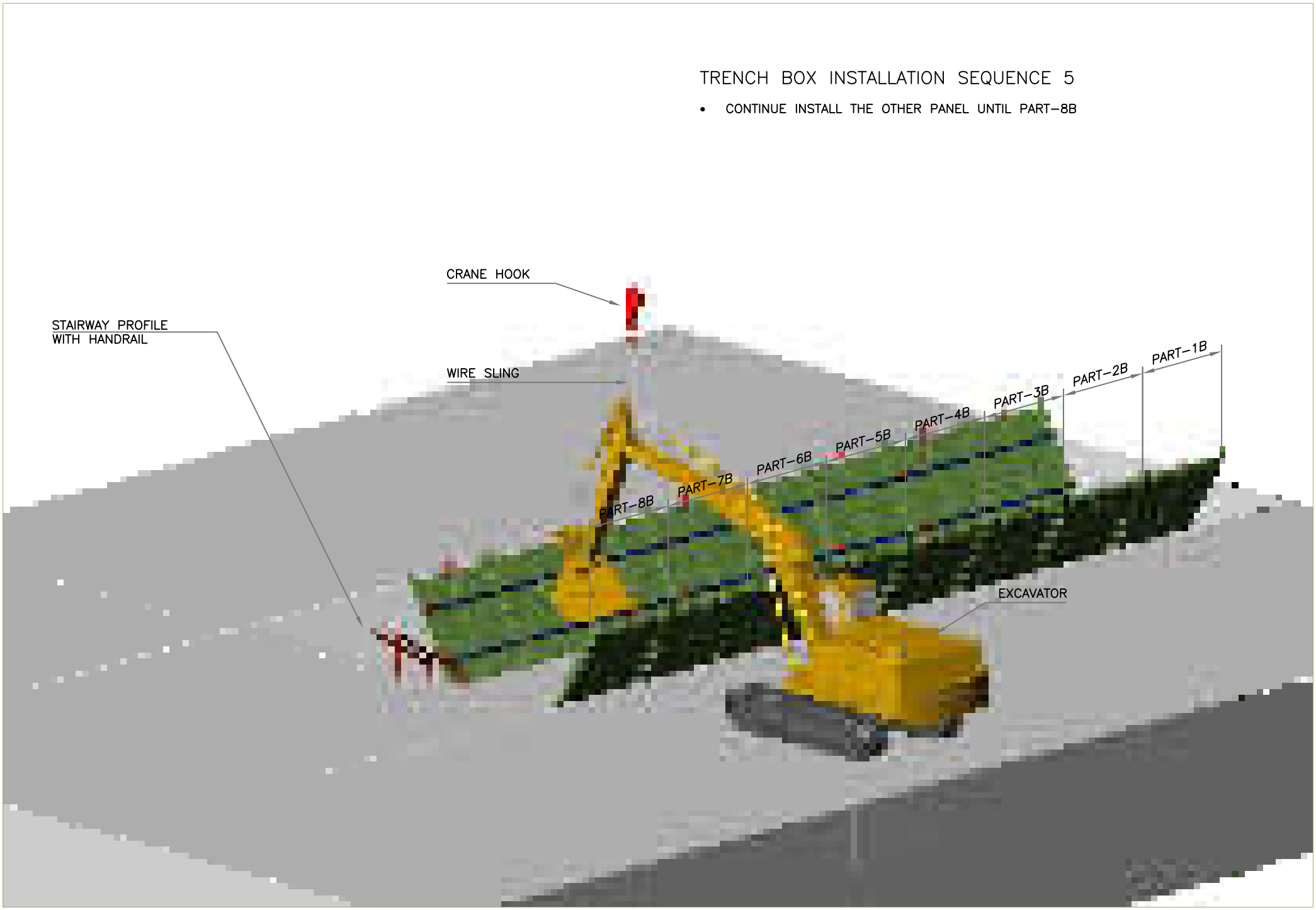
TRENCH BOX INSTALLATION SEQUENCE 4

- LOWER THE TRENCH BOX PART—1B BY USING CRANE AND MOVE TO THE INSTALLATION POSITION
- ONCE THE TRENCH BOX PART IS ON THE POSITION, EXCAVATOR WILL UTILIZED TO PUSH THE TRENCH BOX PART IN THE GROUND
- AFTER FINISHING TRENCH BOXPART—1B PANEL INSTALLATION, REMOVE SLING FROM PANEL



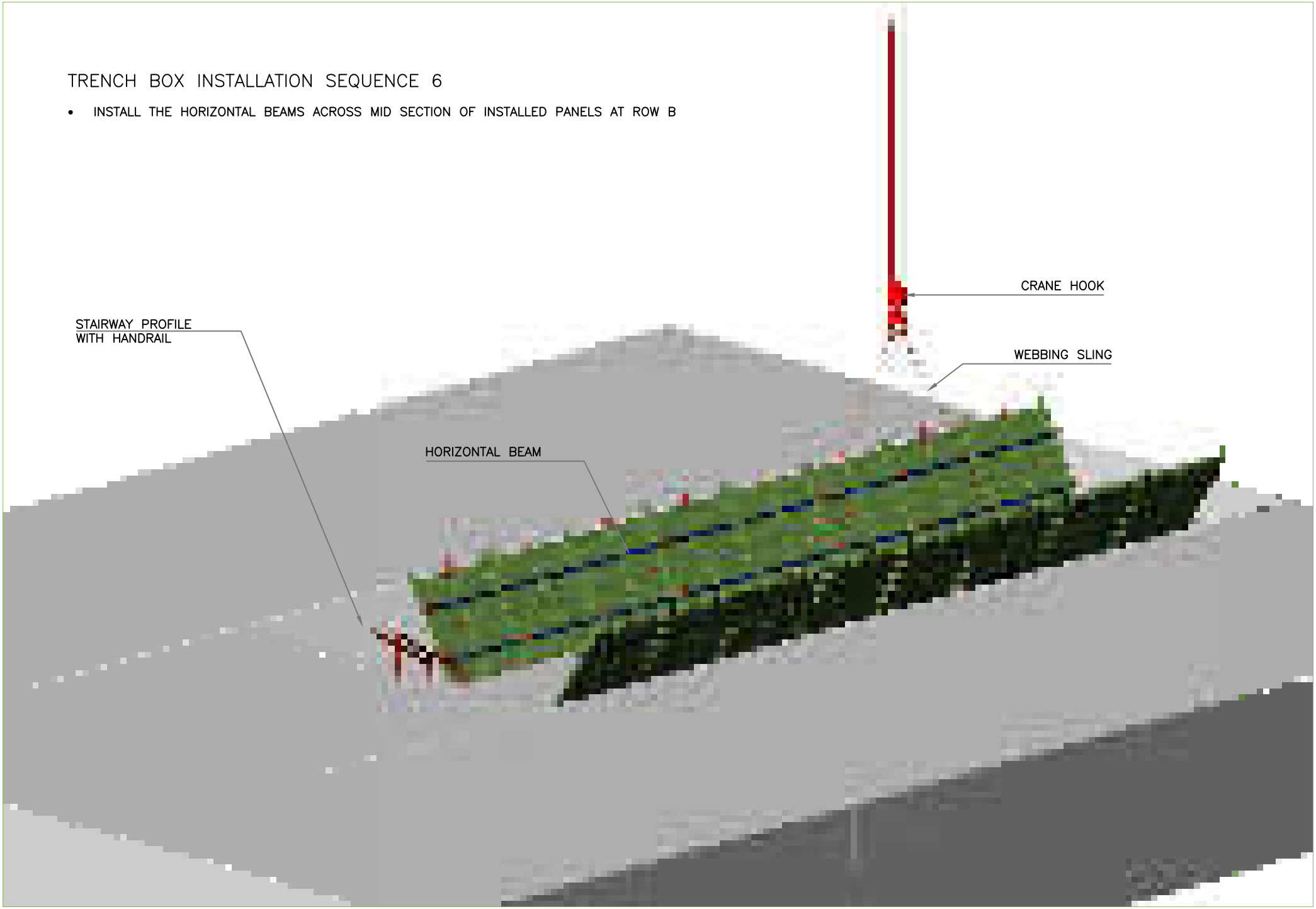
TRENCH BOX INSTALLATION SEQUENCE 5

- CONTINUE INSTALL THE OTHER PANEL UNTIL PART-8B



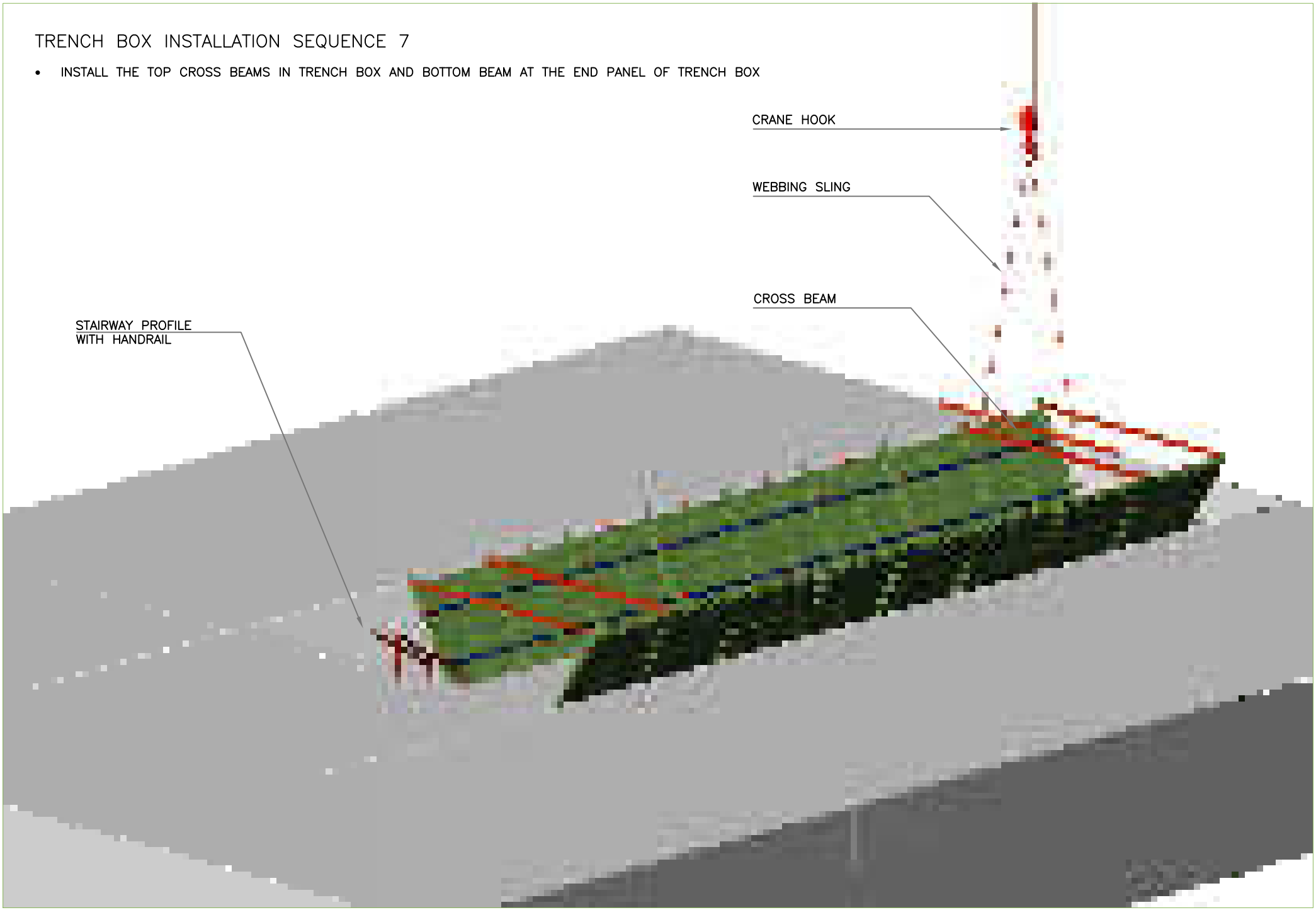
TRENCH BOX INSTALLATION SEQUENCE 6

- INSTALL THE HORIZONTAL BEAMS ACROSS MID SECTION OF INSTALLED PANELS AT ROW B



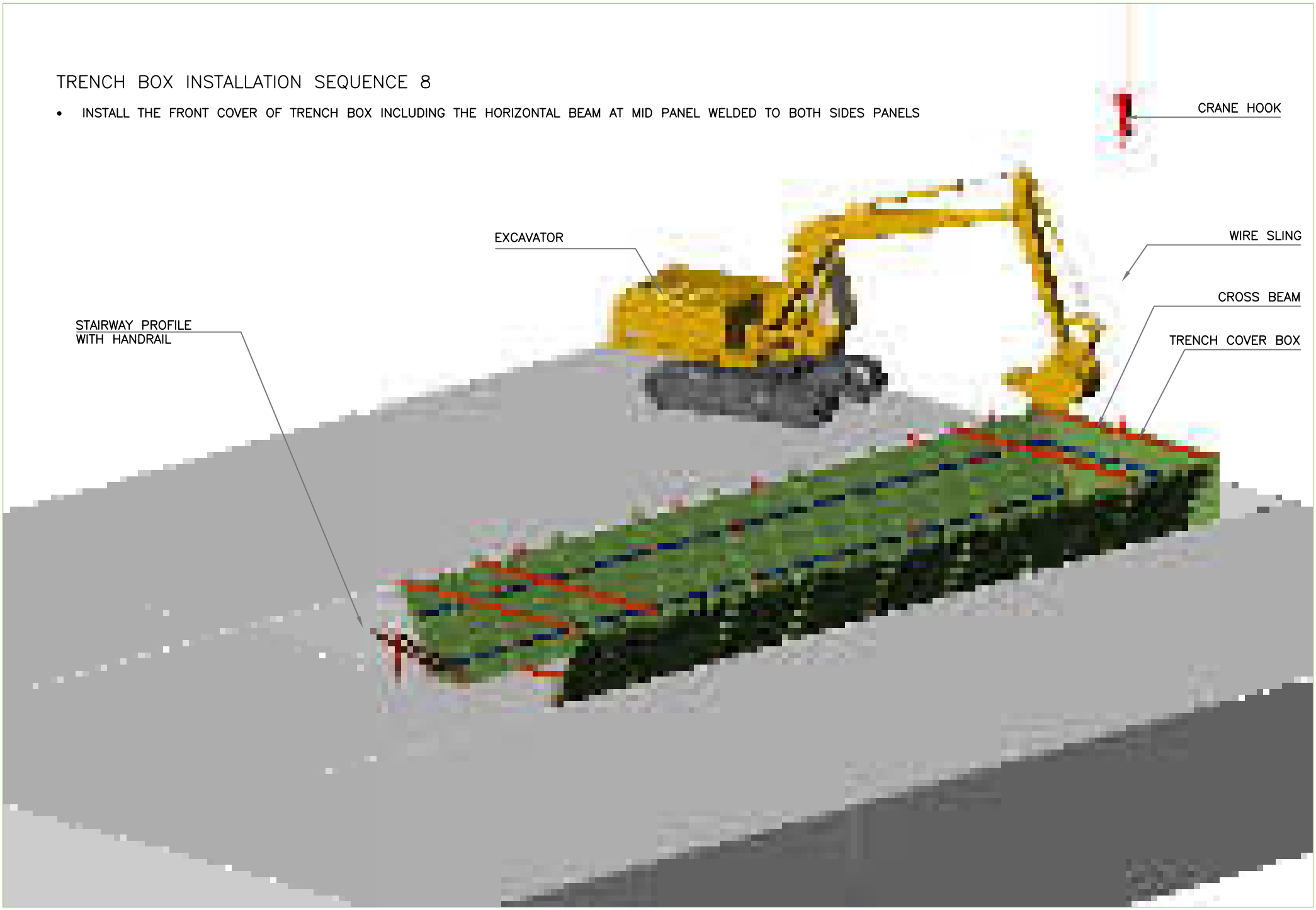
TRENCH BOX INSTALLATION SEQUENCE 7

- INSTALL THE TOP CROSS BEAMS IN TRENCH BOX AND BOTTOM BEAM AT THE END PANEL OF TRENCH BOX

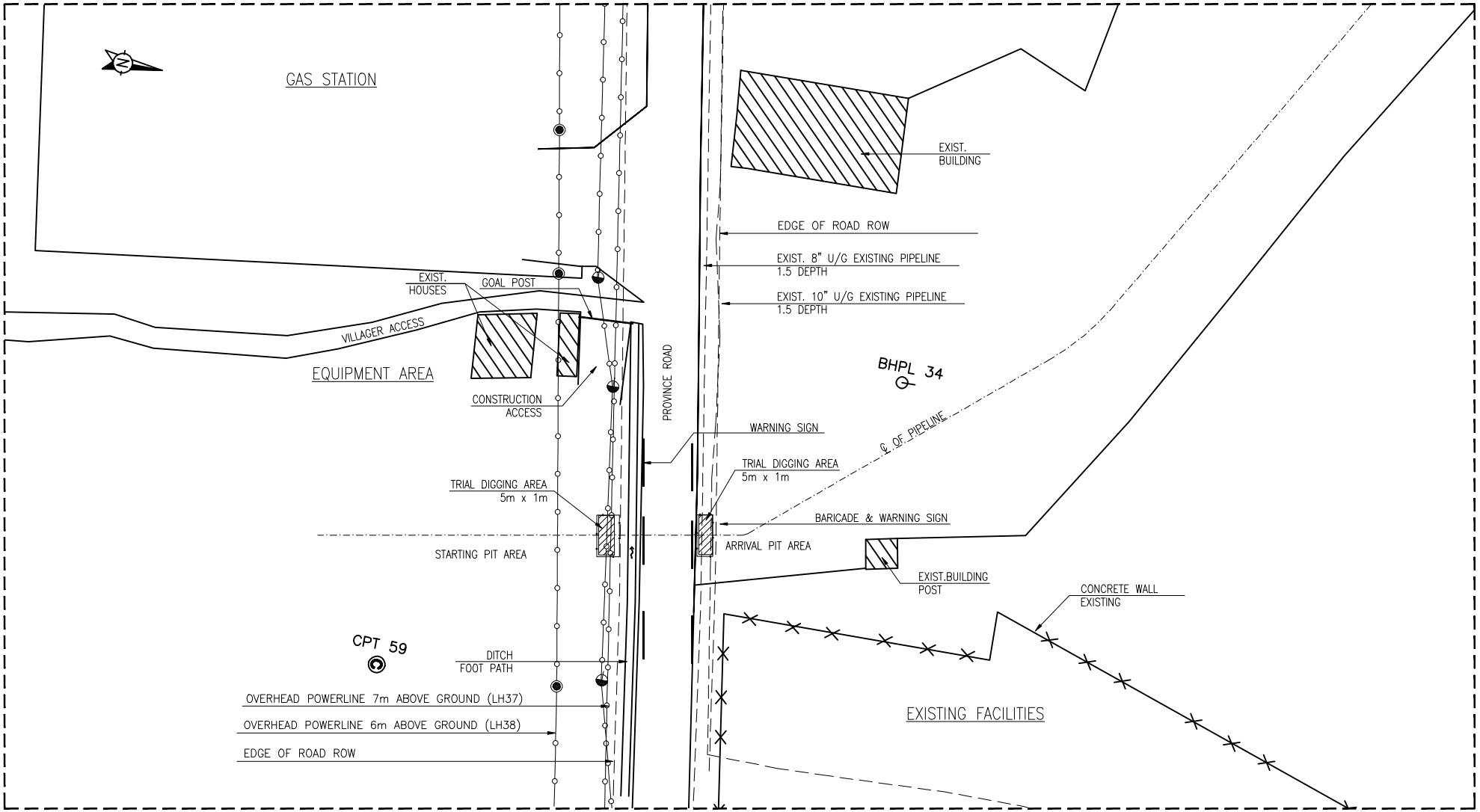


TRENCH BOX INSTALLATION SEQUENCE 8

- INSTALL THE FRONT COVER OF TRENCH BOX INCLUDING THE HORIZONTAL BEAM AT MID PANEL WELDED TO BOTH SIDES PANELS

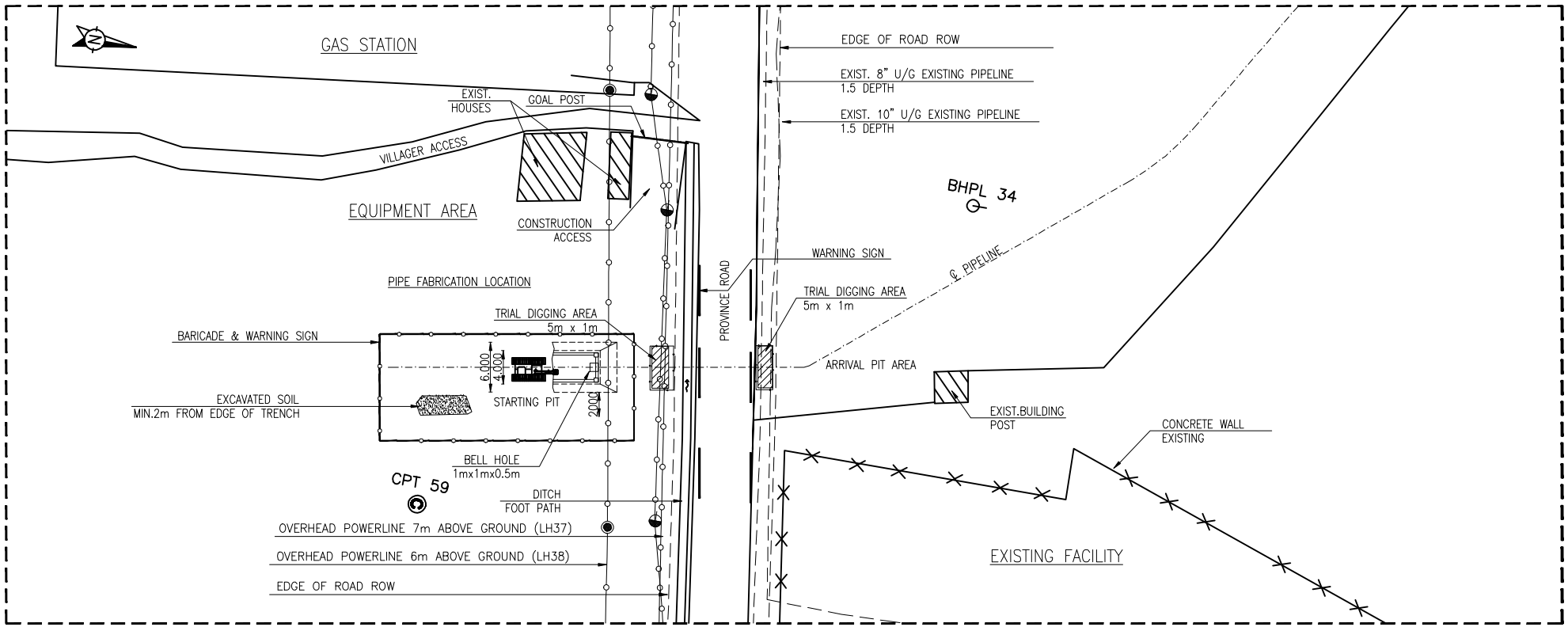


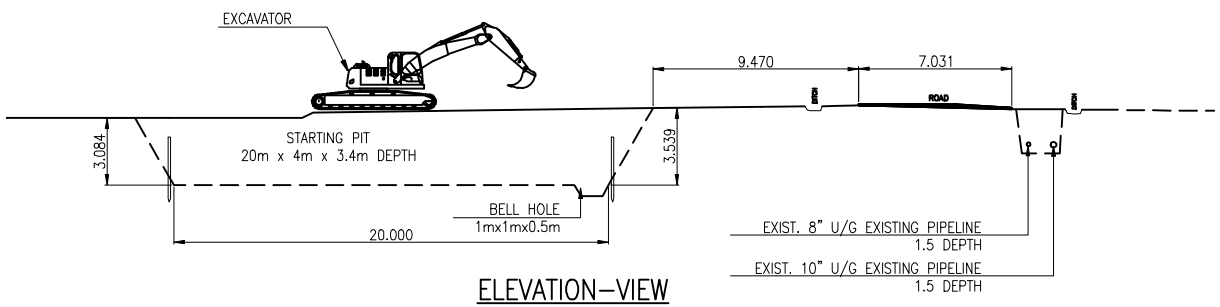
AUGER BORING SEQUENCE 1 OF 21



- Pre Boring meeting shall held with the CLIENT prior to starting work on each bore.
- All the underground pipeline and utilities will be mapped and noted prior to start boring operation. Pipe identification using Pipe/Metal Detector and manual digging shall be performed to ensure the position and depth of the underground pipeline and utilities.
- The Surveyor shall mark the exact boring location on both sides of the road, including any existing underground utilities.

AUGER BORING SEQUENCE 2 OF 21

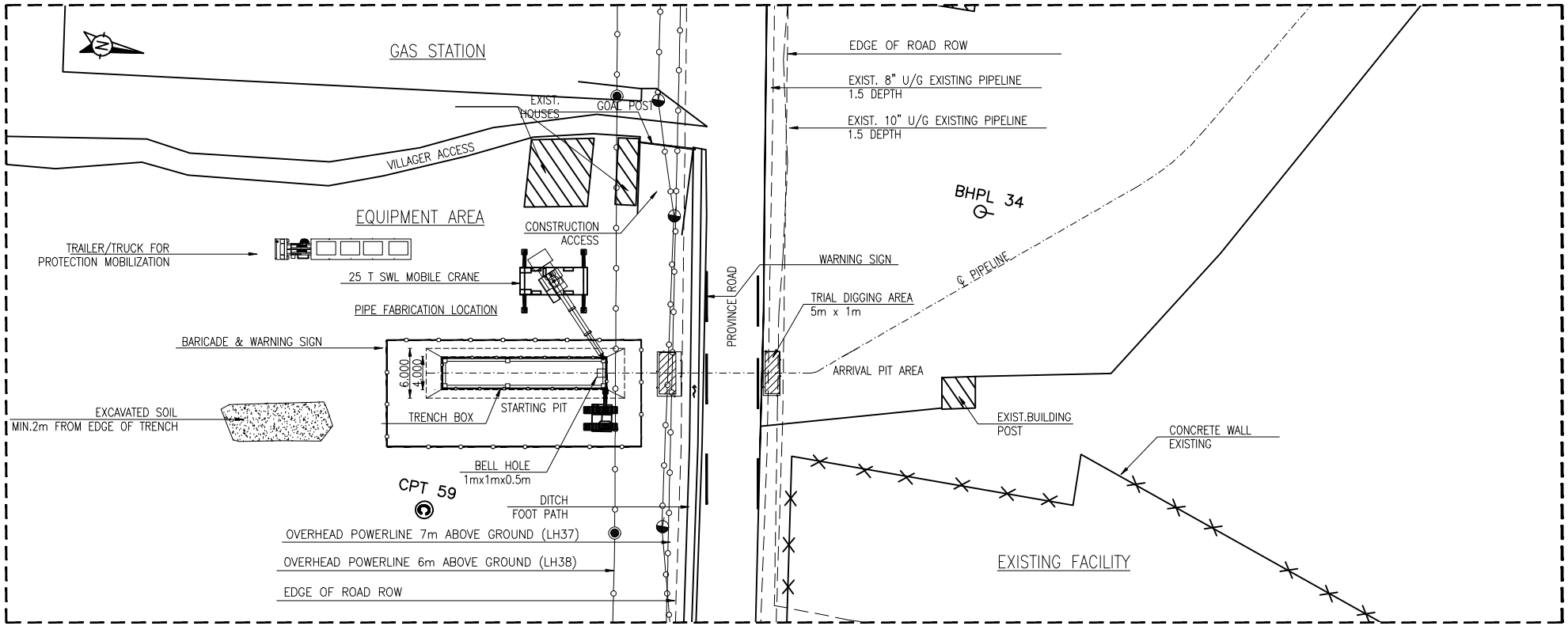


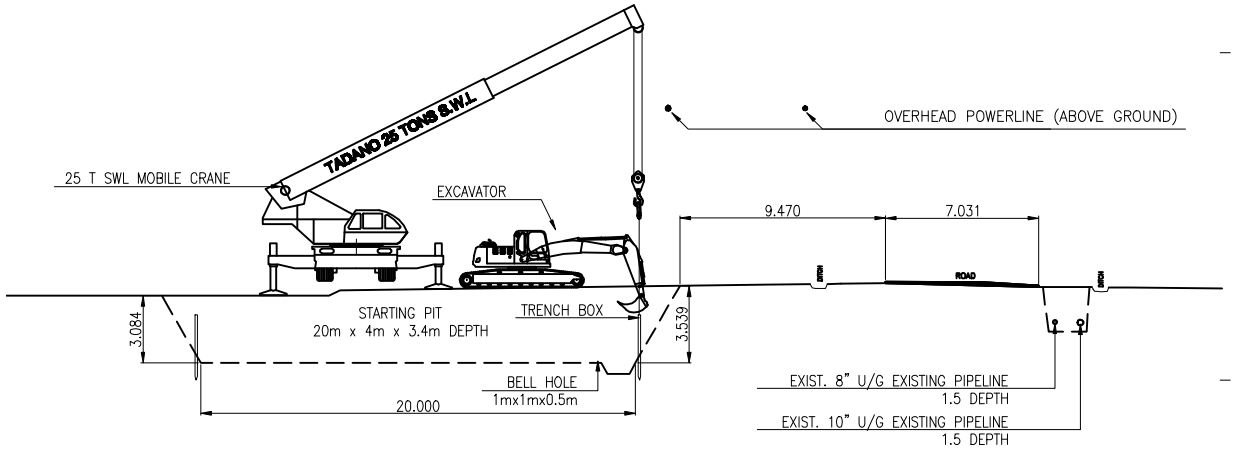


ELEVATION–VIEW

- Install barricade and warning signs around the excavation area.
- Contractor to invite representatives from all affected utilities to observe excavation. Contractor to work with utility companies to relocate existing utilities if necessary.
- To assist with the boring process, two pits will be excavated, one for starting pit and one for arrival pit. The starting pit will be prepared first and the arrival pit will be prepared before the bored pipes reach the exit point

AUGER BORING SEQUENCE 3 OF 21

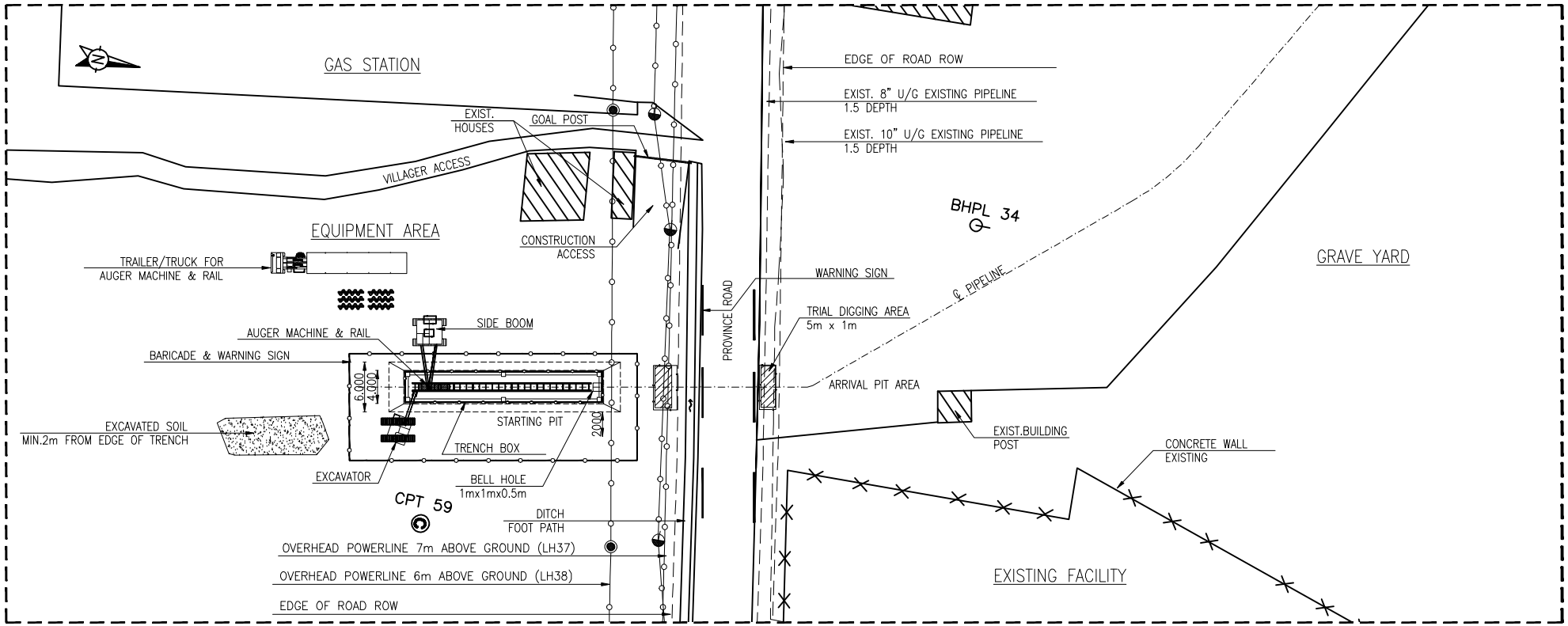


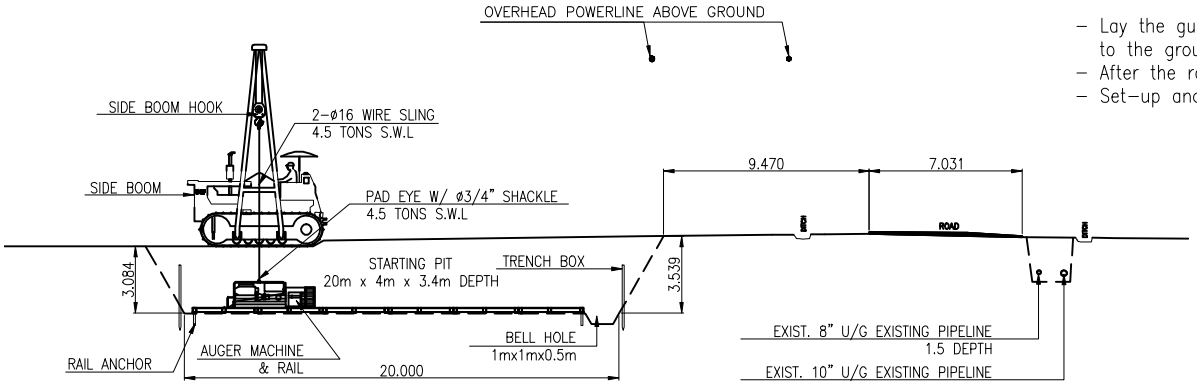


ELEVATION–VIEW

- Workers in the starting pit and arrival pit will be made safe by the installation of trench box, the trench box will be installed as the following sequence:
  1. Lift the trench box one by one in the north side by using crane, and move to the installation position. Once the trench box part is on the position, excavator will utilized to push the trench box into the ground.
  2. Repeat until all of trench box in the west side are installed.
  3. Install the horizontal beam in trench box row–west side.
  4. Lift the trench box one by one in the east side by using crane, and move to the installation position. Once the trench box part is on the position, excavator will utilized to push the trench box into the ground.
  5. Repeat until all of trench box in the east side are installed.
  6. Install the horizontal beam in trench box row–east side.
  7. Install the bottom cross beam in trench box.
  8. Install the front cover box in trench box
- During lifting of the trench box by crane, the crane movements will be closely monitored by the banksman and he's the only one that may direct the crane.

AUGER BORING SEQUENCE 4 OF 21





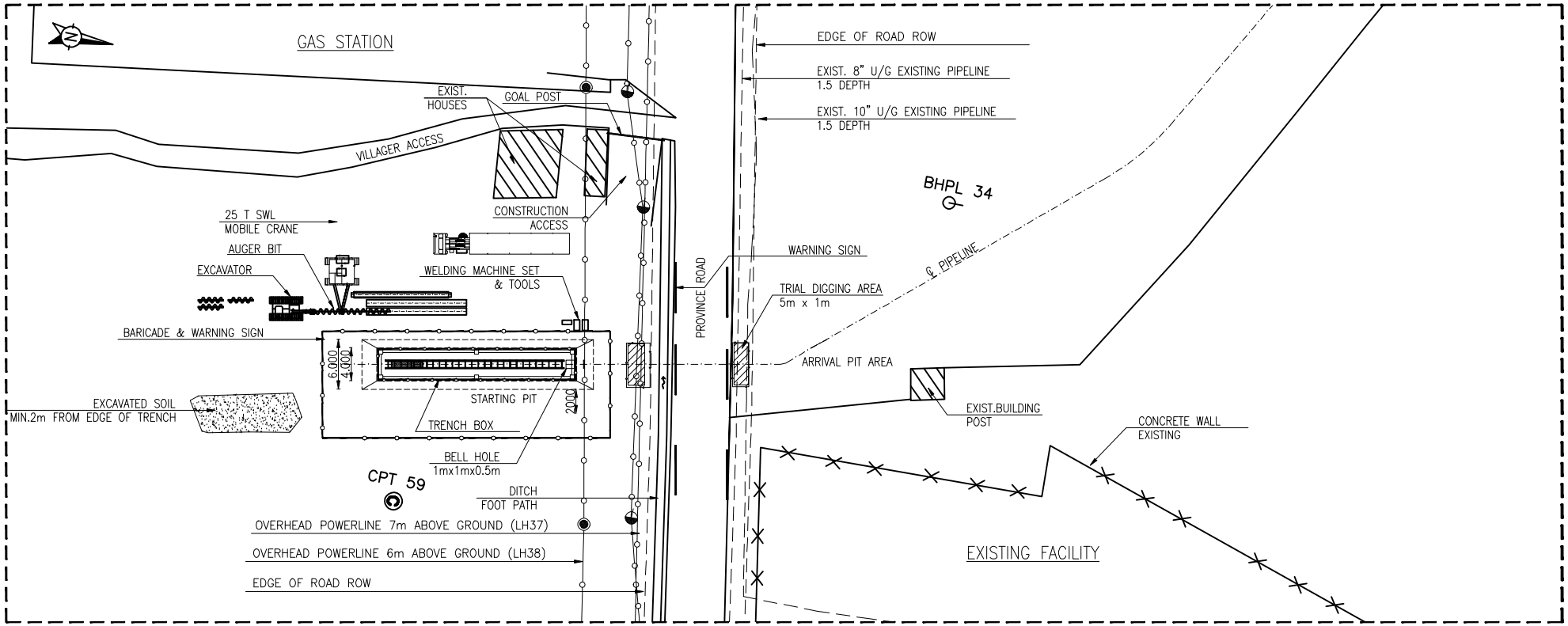
ELEVATION–VIEW

- Lay the guide rail on the bottom of starting pit then install the anchor (piled anchor) to the ground by excavator bucket.
- After the rail has been properly set, the auger boring machine will be lowered into the pit.
- Set–up and level the auger machine. The final positioning will be verified by the surveyor

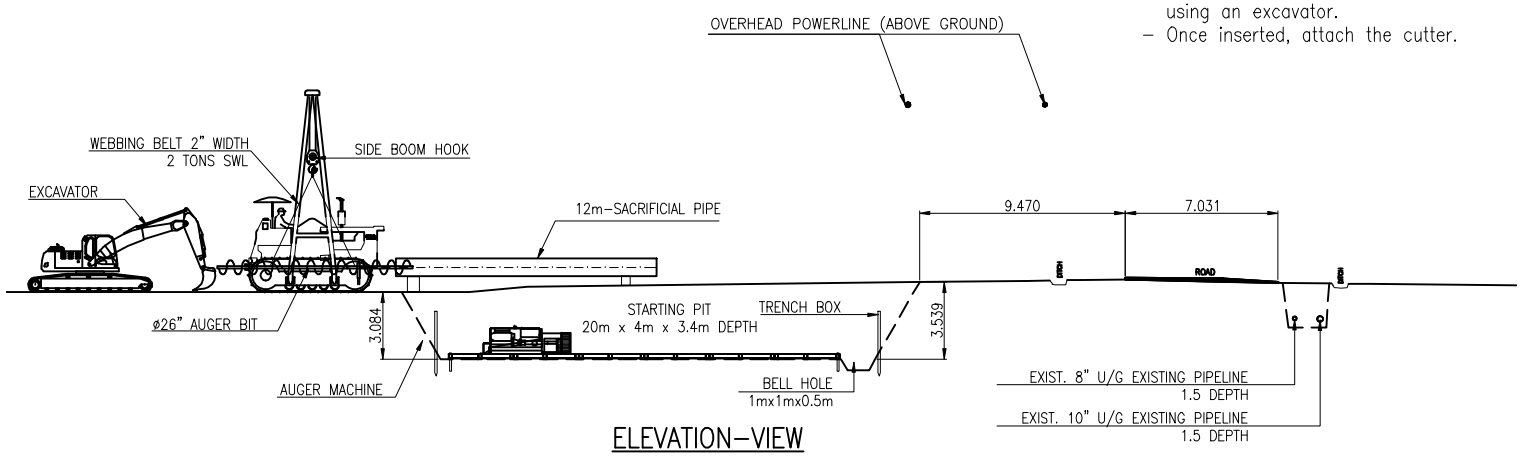
LIFTING CALCULATION

AUGER MACHINE	= 2.5 TONS
CONTINGENCY LOAD	= 0.5 TONS
TOTAL LOAD	= 3 TONS
LIFTING RADIUS	= 6m
SIDE BOOM CAPACITY	= 7 TONS
SAFETY FACTOR	= 2.33

AUGER BORING SEQUENCE 5 OF 21



- Llift the auger bit using a side boom. Then, push inside the sacrificial pipe using an excavator.
- Once inserted, attach the cutter.

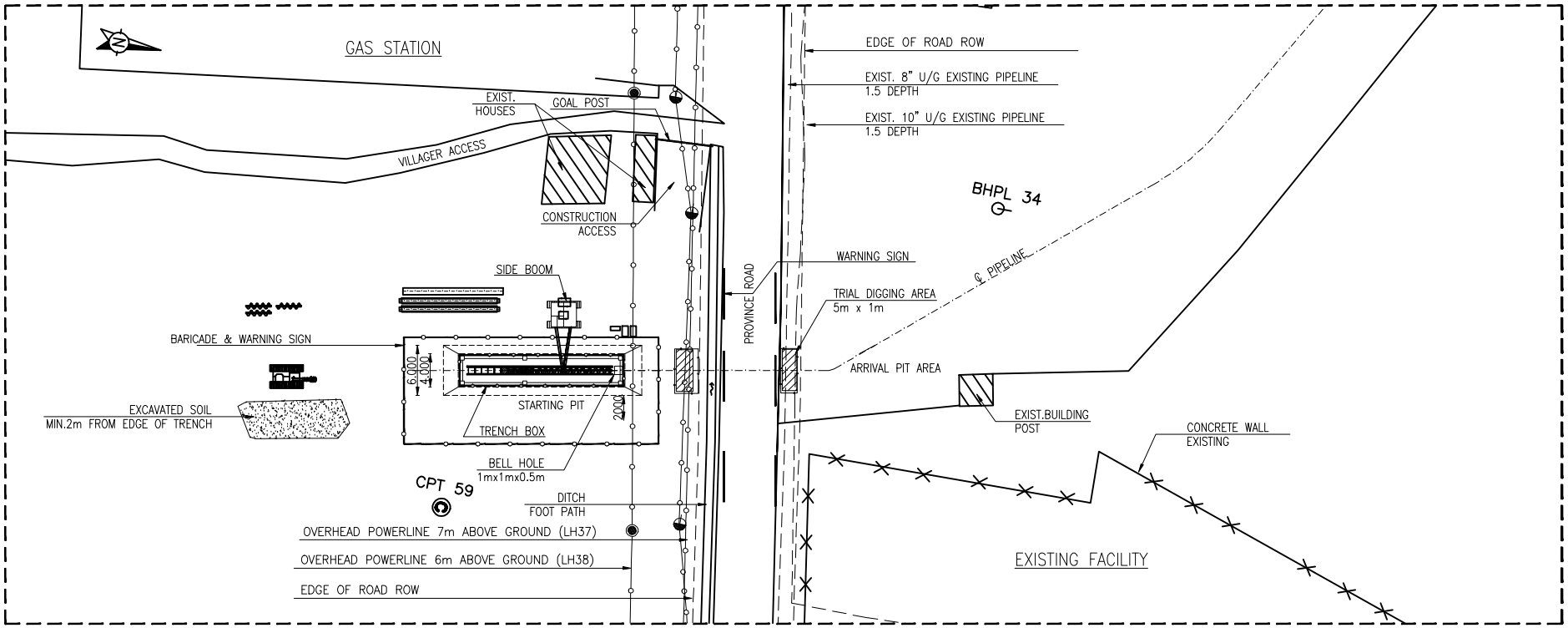


ELEVATION-VIEW

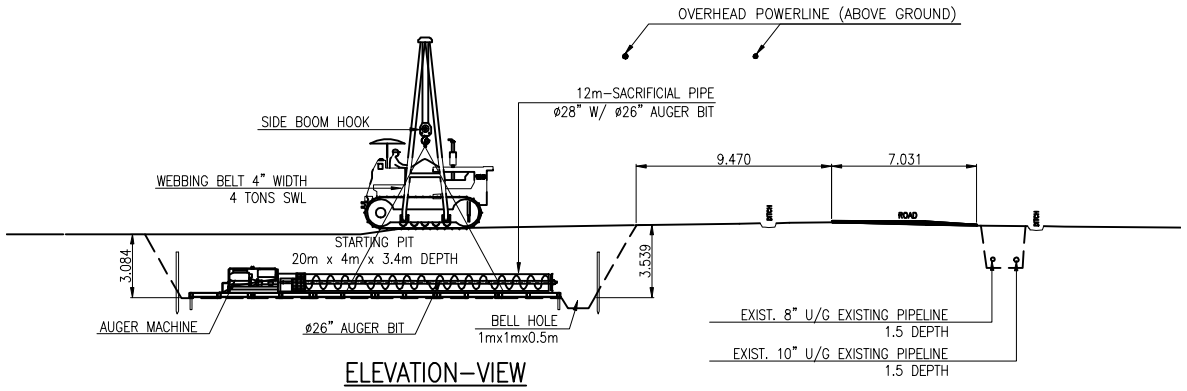
LIFTING CALCULATION

AUGER BIT	= 2 TONS
CONTINGENCY LOAD	= 0.2 TONS
TOTAL LOAD	= 2.2 TONS
LIFTING RADIUS	= 4m
SIDE BOOM CAPACITY	= 10 TONS
SAFETY FACTOR	= 4.55

AUGER BORING SEQUENCE 6 OF 21



– Lower the sacrificial pipe with auger bit into the pit then fit the pipe to the auger machine by connecting the pin connector at the end of the auger bit to the connection point at the Auger machine

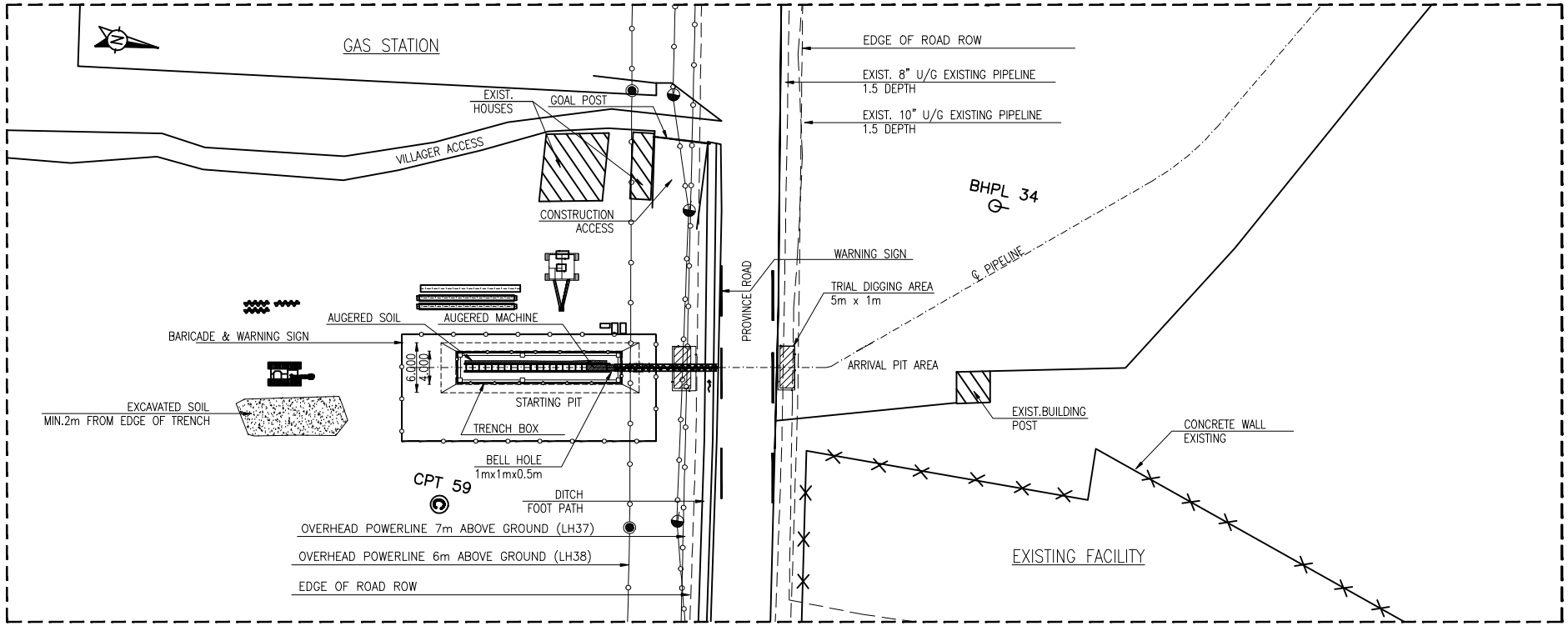


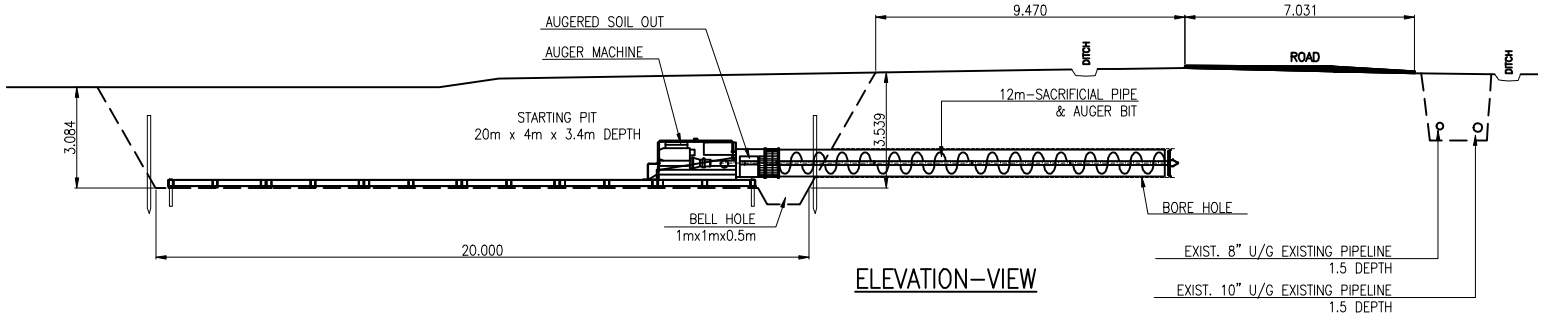
ELEVATION–VIEW

LIFTING CALCULATION

PIPE & BIT LOAD	= 4 TONS
CONTINGENCY LOAD	= 0.5 TONS
TOTAL LOAD	= 4.5 TONS
LIFTING RADIUS	= 6m
SIDE BOOM CAPACITY	= 7 TONS
SAFETY FACTOR	= 1.55

AUGER BORING SEQUENCE 7 OF 21

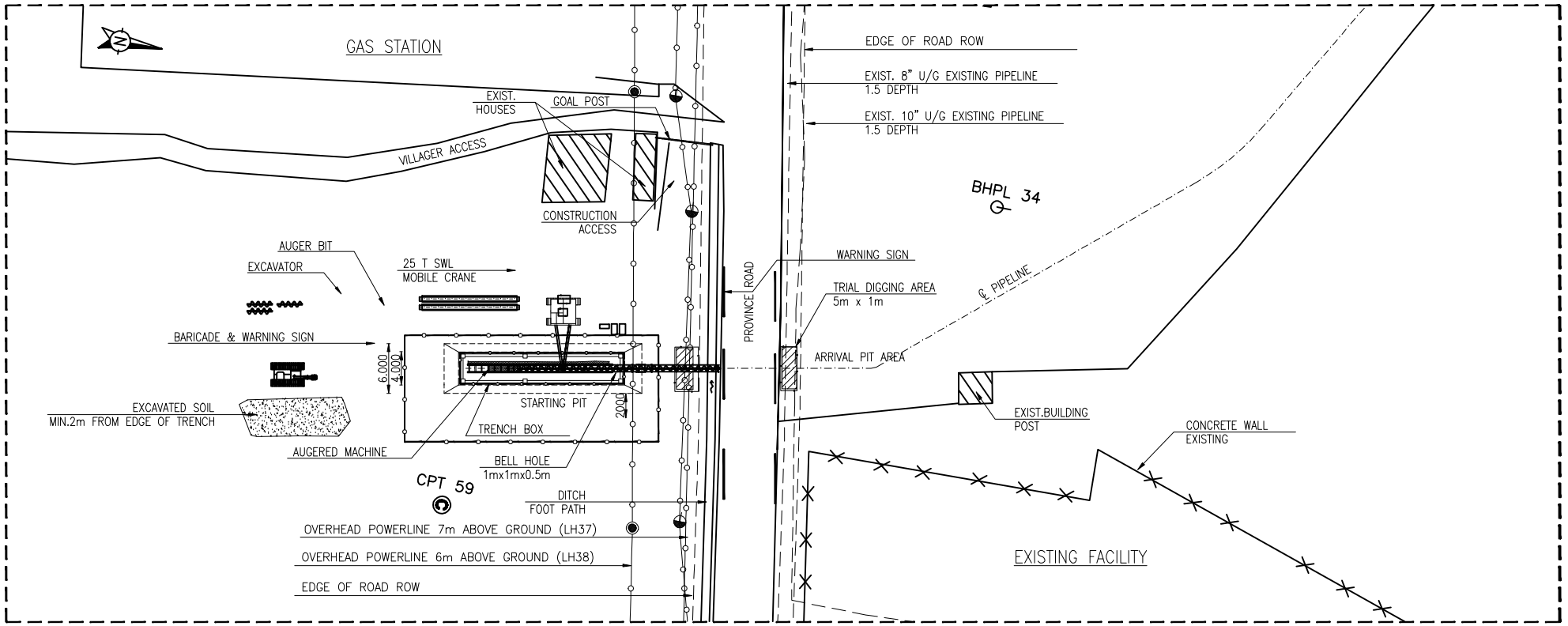


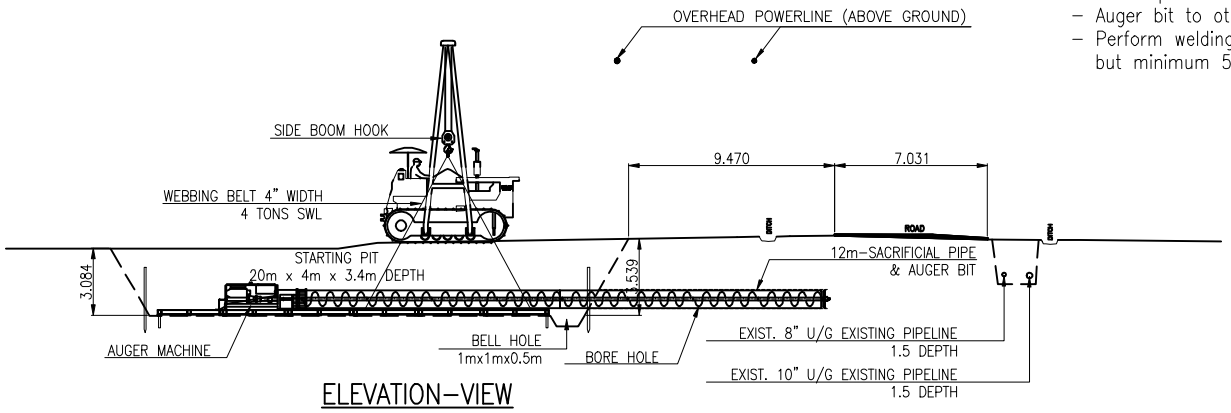


ELEVATION–VIEW

- The sacrificial will be driven (bore and pushed) by using the auger bit fitted with side cutters in the front of the auger bit to create a bore 25 to 40 mm larger than the sacrificial pipe diameter.
- The soil inside the first pipe will removed (drive out) by the auger bit inserted into the pipe. The soil will come out from the auger machine along the side of the rail as the auger machine moves forwards. The extruded soil will be manually removed from the pit.
- Continue the boring operation until the first 12m sacrificial pipe protrudes 1–1.5m from the start side

AUGER BORING SEQUENCE 8 OF 21





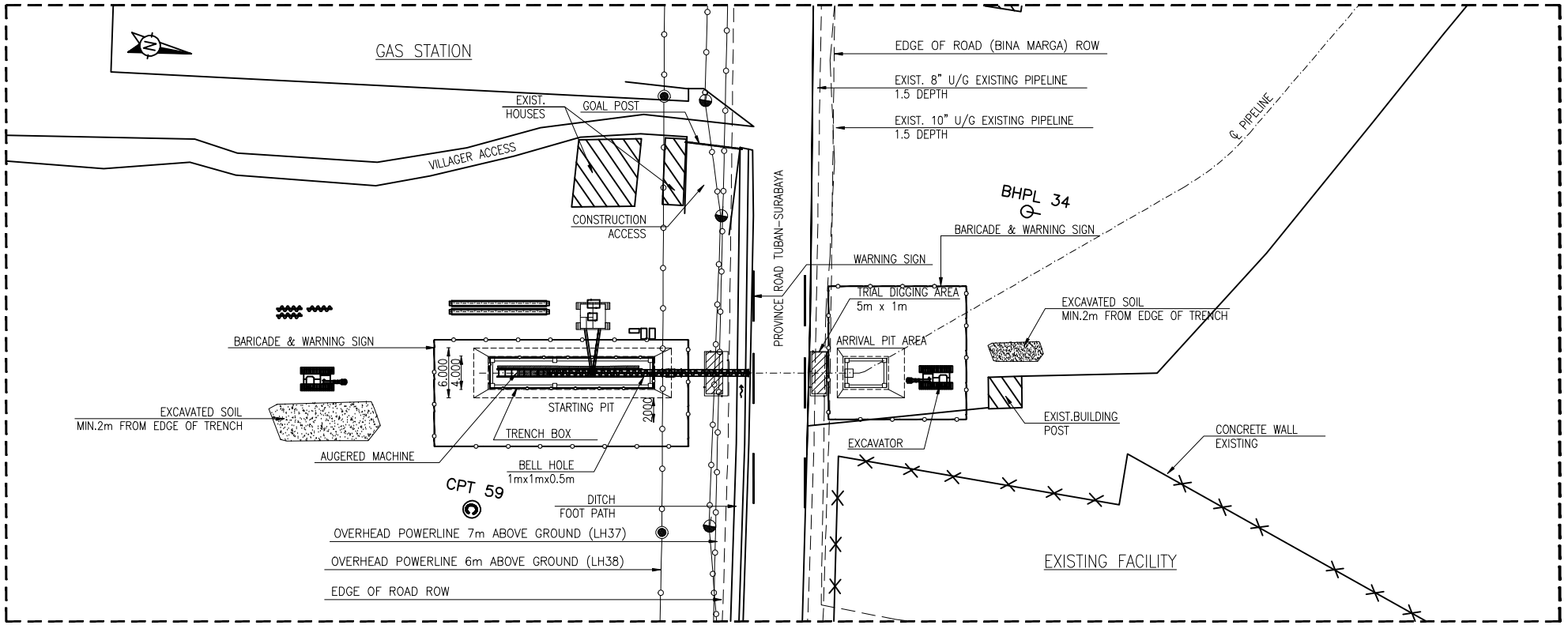
ELEVATION-VIEW

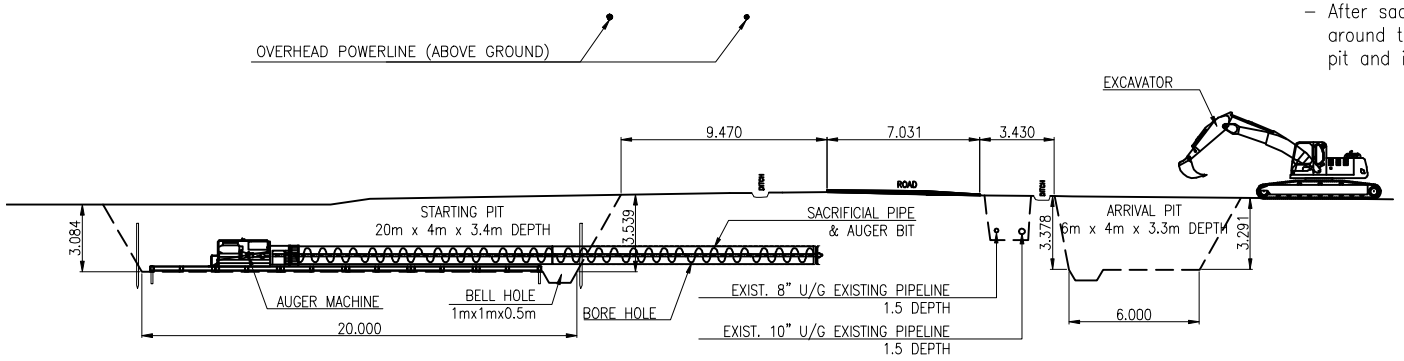
- Depending on the length of boring requirement (24m length), insert the next auger bit Into the next sacrificial pipe then lower the second sacrificial pipe and auger bit in the pit on the rails.
- Auger bit to other auger bit clamping will be done, followed by pipe fit up with external clamp.
- Perform welding the first and second sacrificial pipe. The welding will not be full thickness weld, but minimum 50% thickness weld will be performed

LIFTING CALCULATION

PIPE & BIT LOAD	= 4 TONS
CONTINGENCY LOAD	= 0.5 TONS
TOTAL LOAD	= 4.5 TONS
LIFTING RADIUS	= 6m
SIDE BOOM CAPACITY	= 7 TONS
SAFETY FACTOR	= 1.55

AUGER BORING SEQUENCE 09 OF 21

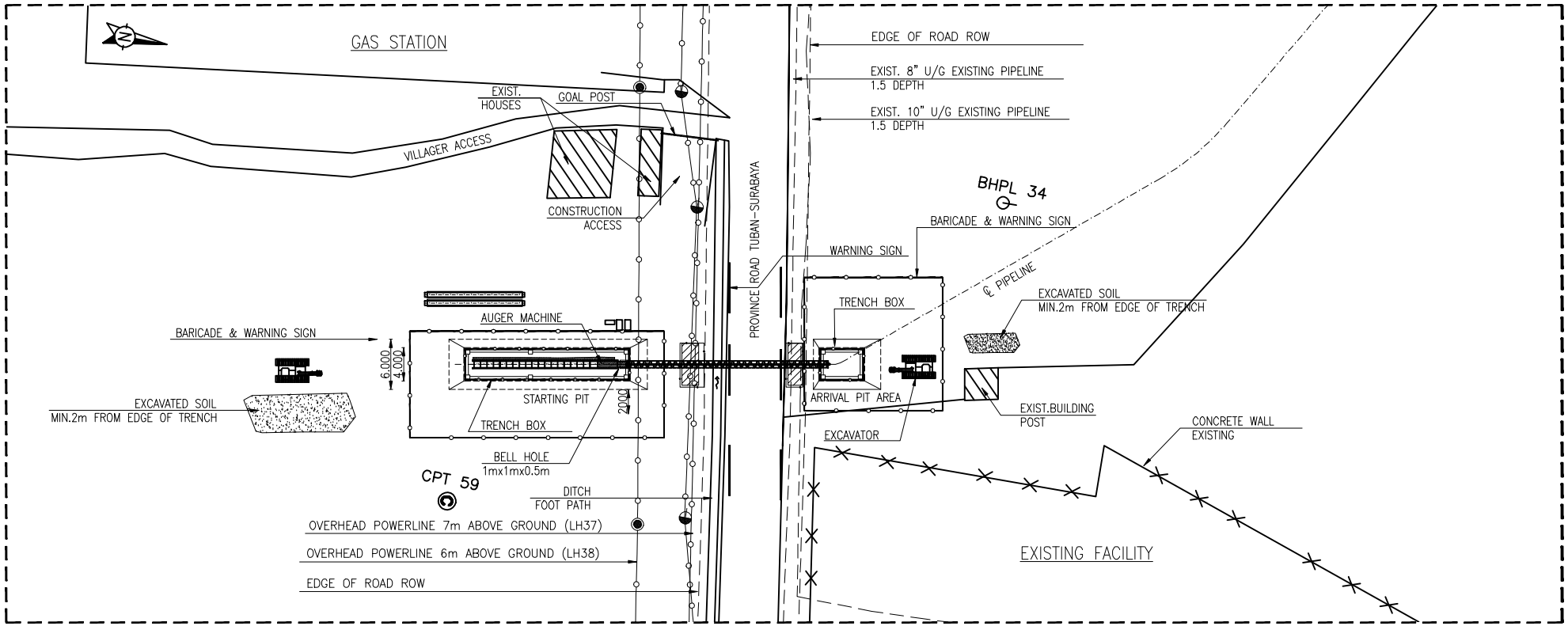




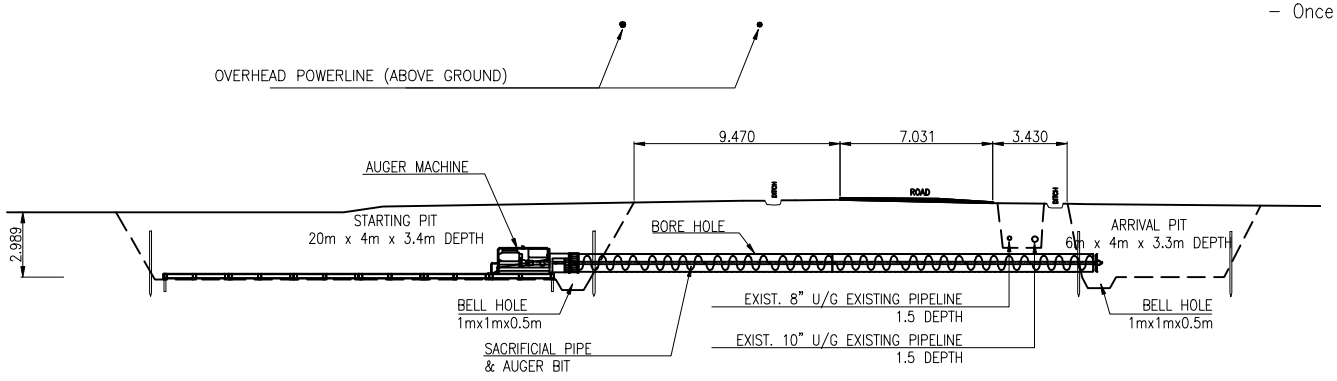
ELEVATION–VIEW

– After sacrificial pipe welding, then install warning signs and barricades around the arrival pit, and then perform excavation for the arrival pit and install trench box after excavation

AUGER BORING SEQUENCE 10 OF 21

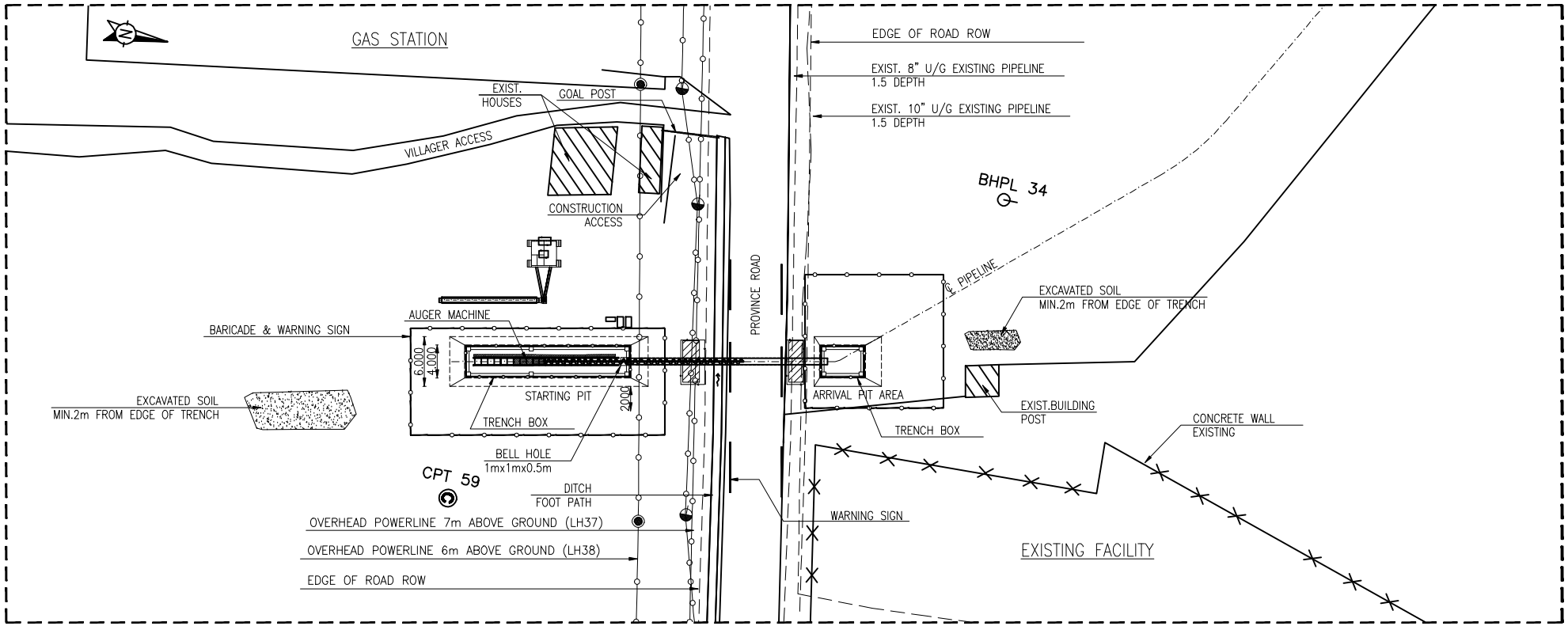


- Boring will continue until the required length has been achieved
- Once the boring operation is completed, the cutter head will be detached

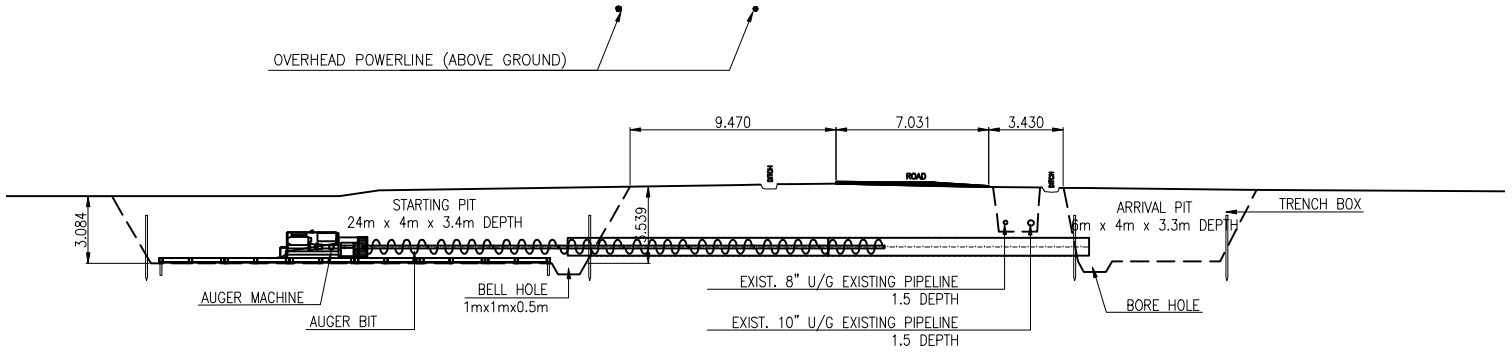


ELEVATION–VIEW

AUGER BORING SEQUENCE 11 OF 21

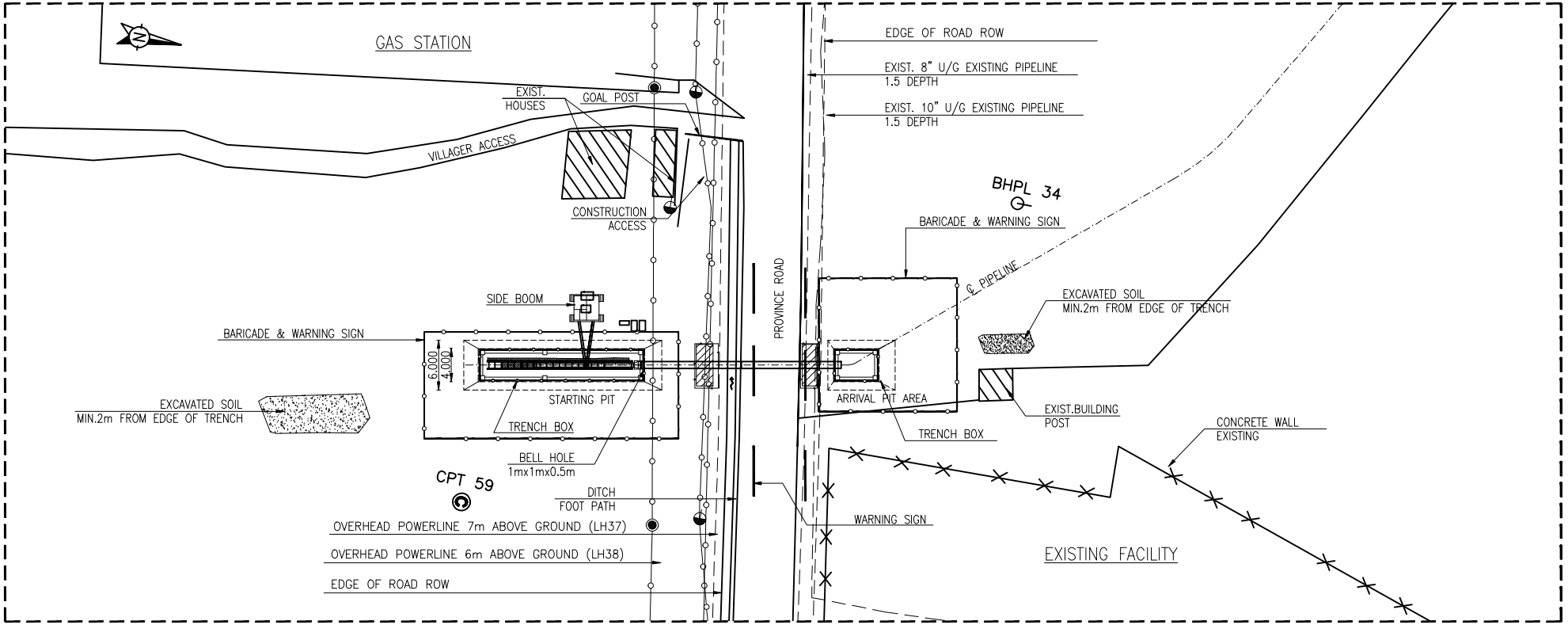


- Pull back the auger bit to the starting pit with the auger machine and remove each section of the auger bit, one by one
- While pull back operation, weld the product pipe (concrete pipe) to the reducer(28" x 20").

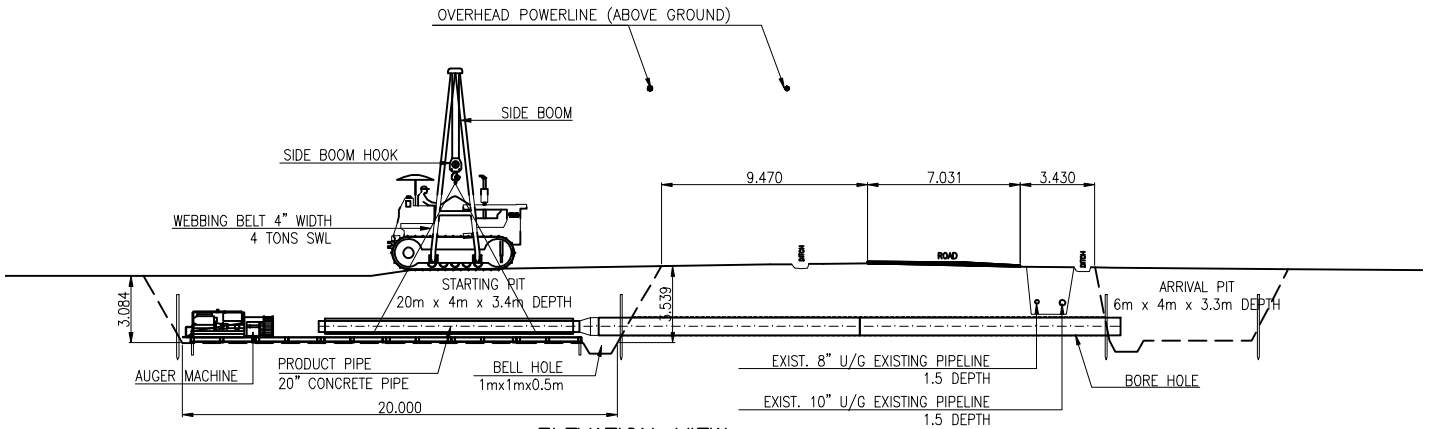


ELEVATION-VIEW

AUGER BORING SEQUENCE 12 OF 21



- Lower the product pipe with end reducer into the trench
- Weld the end of reducer to the bored sacrificial pipe end.

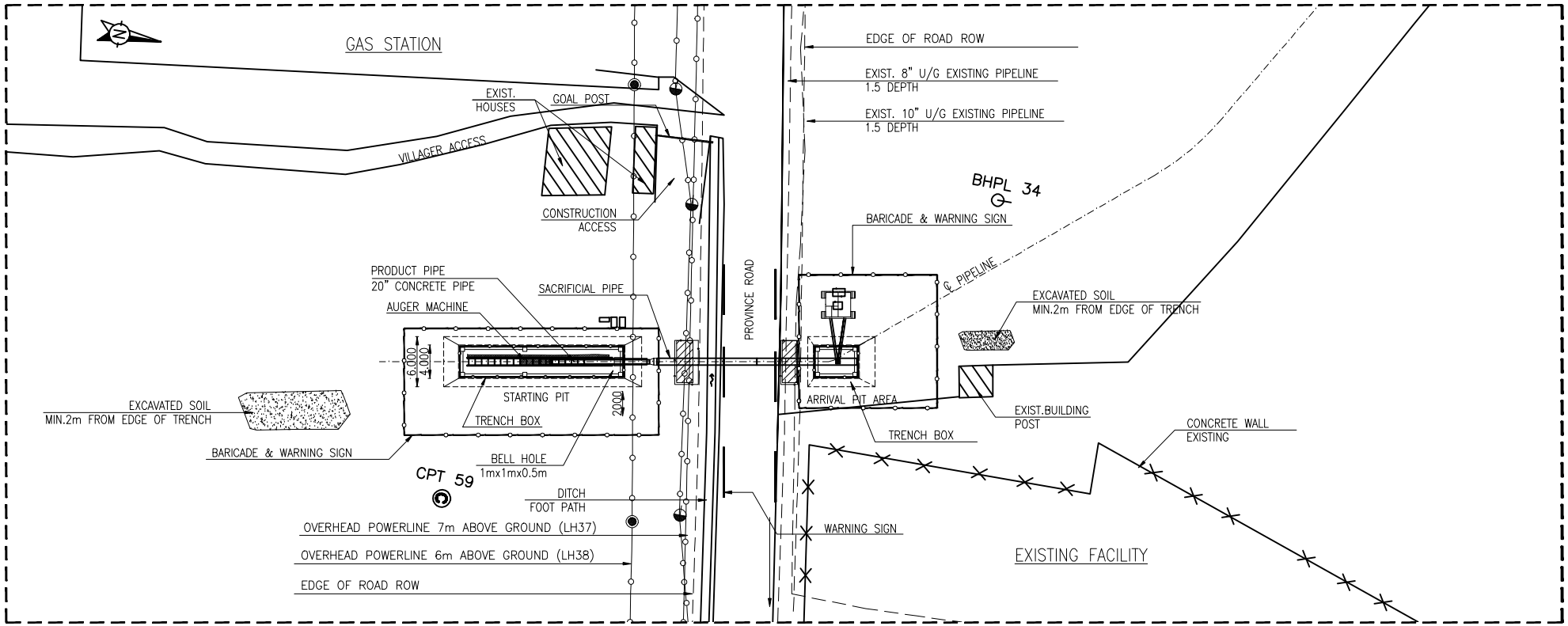


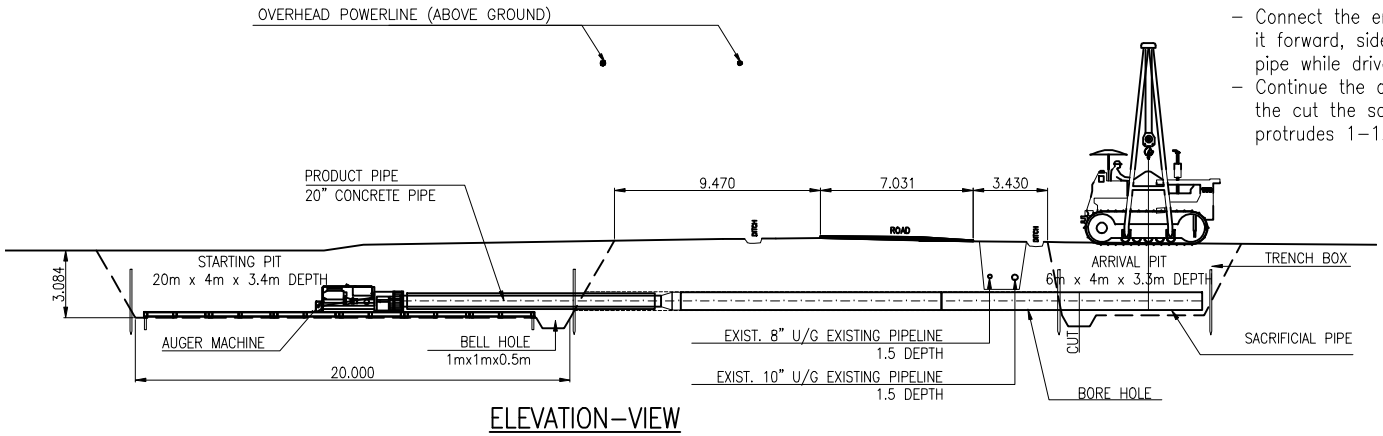
ELEVATION–VIEW

LIFTING CALCULATION

PIPE LOAD	= 5.5 TONS
CONTINGENCY LOAD	= 0.2 TONS
TOTAL LOAD	= 5.7 TONS
LIFTING RADIUS	= 6m
SIDE BOOM CAPACITY	= 7 TONS
SAFETY FACTOR	= 1.23

AUGER BORING SEQUENCE 13 OF 21

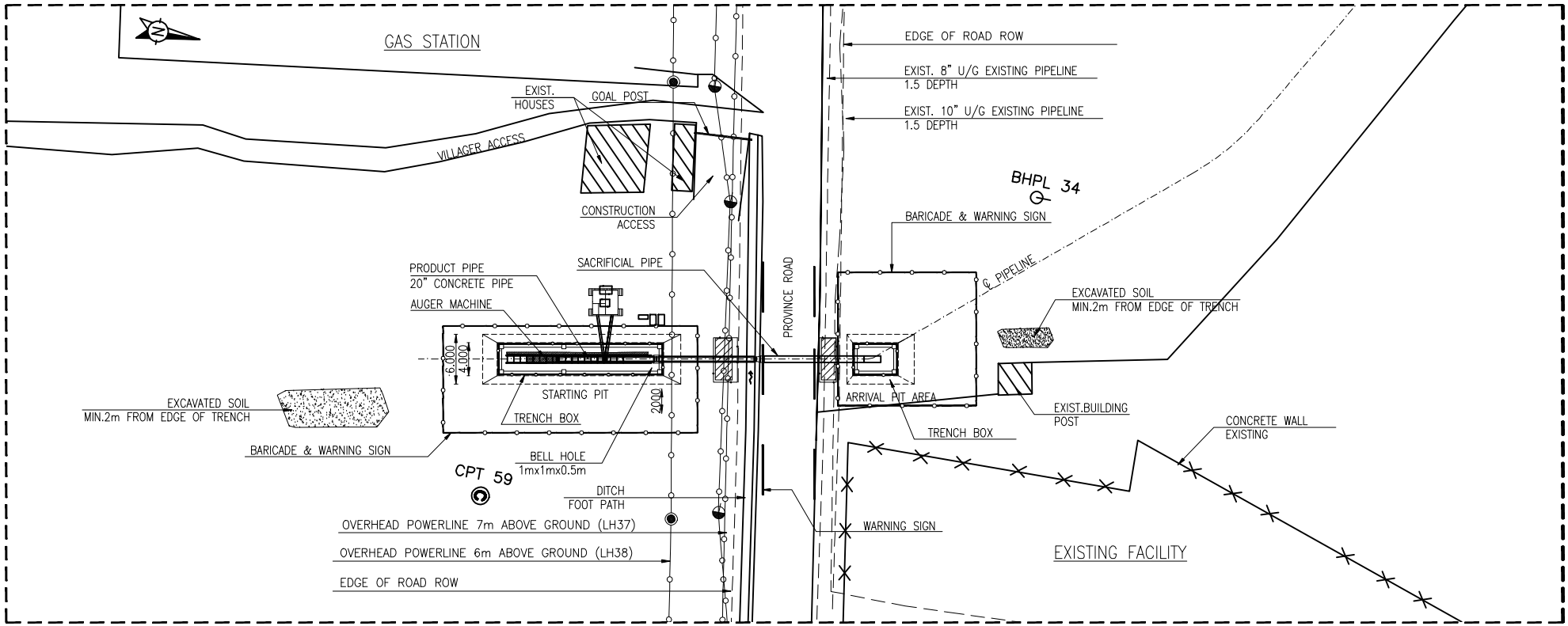


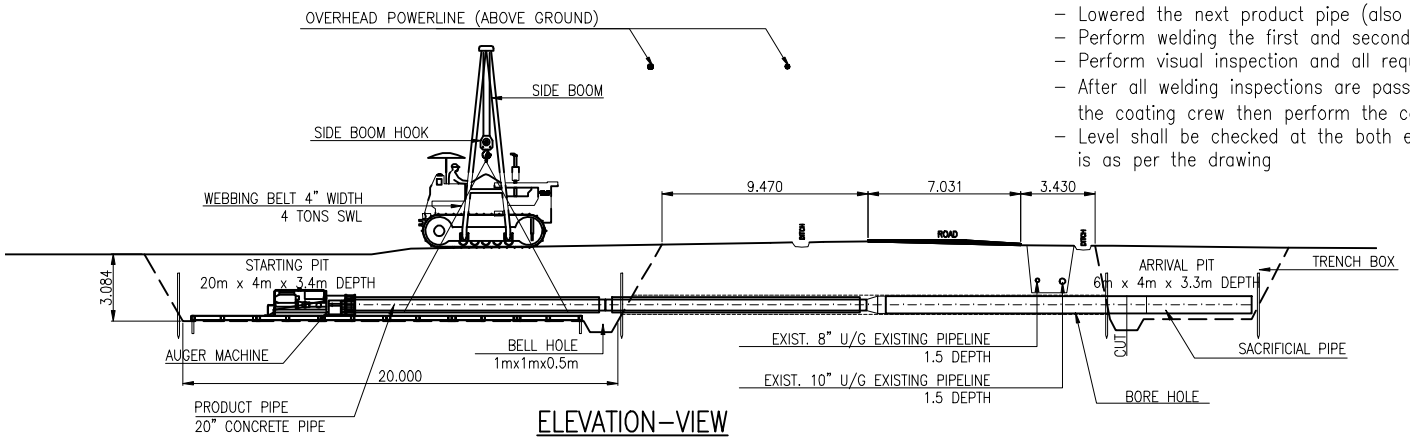


ELEVATION–VIEW

- Connect the end of product pipe to the auger machine then drive (push) it forward, side boom at the arrival pit may be utilized to pull the sacrificial pipe while driven by auger machine.
- Continue the operation until the sacrificial pipe is about 6m out at the arrival pit, the cut the sacrificial pipe and remove. Continue until the product pipe end protrudes 1–1.5m from the start side

AUGER BORING SEQUENCE 14 OF 21





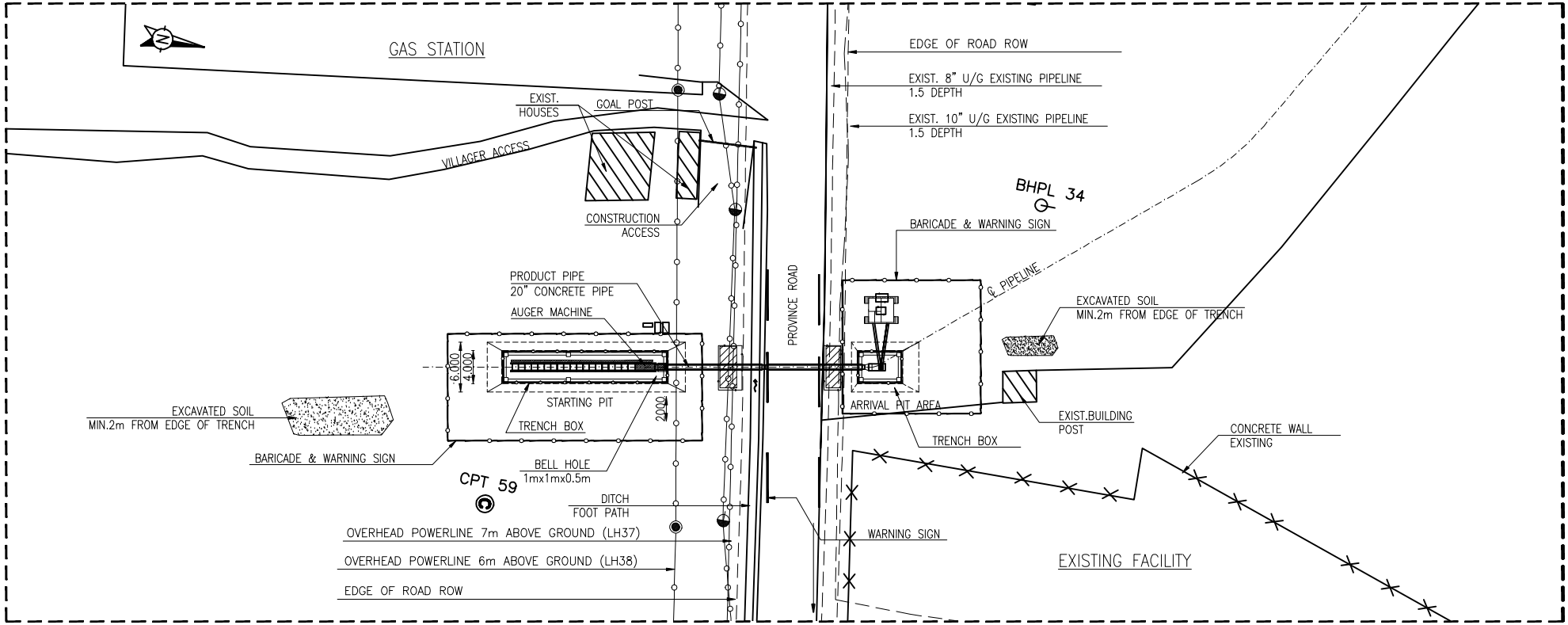
ELEVATION–VIEW

- Disconnect the auger machine from the product pipe then pull back the machine to the first position.
- Lowered the next product pipe (also concrete pipe) into the starting pit.
- Perform welding the first and second product pipe in accordance with the approved WPS.
- Perform visual inspection and all required NDE as soon as possible after welding is completed.
- After all welding inspections are passed; perform field joint coating (use HDD coating type) by the coating crew then perform the coating inspection and test (holiday test).
- Level shall be checked at the both ends of the pipe for every insertion to conform that the alignment is as per the drawing

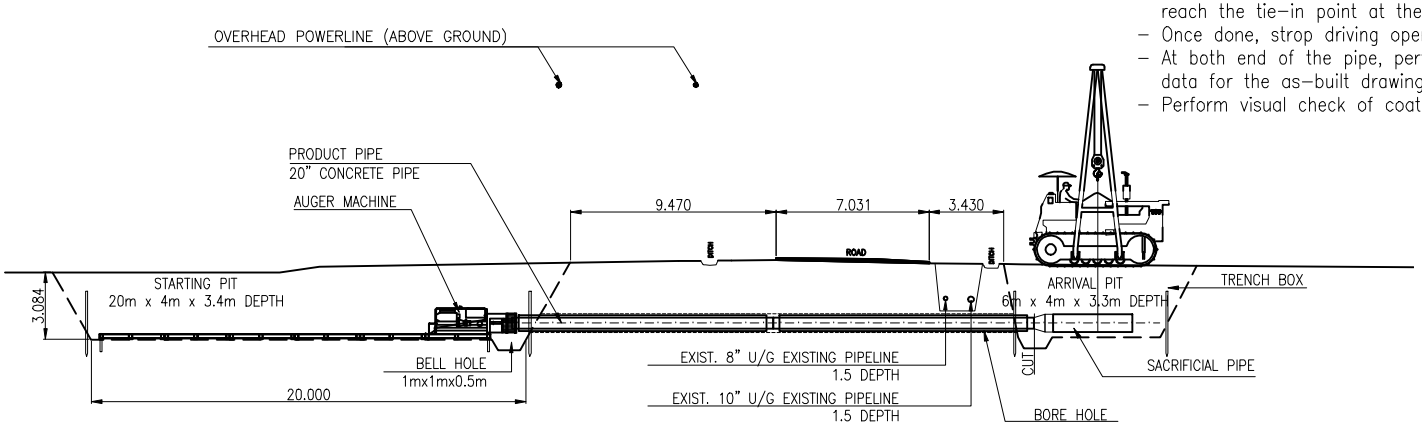
LIFTING CALCULATION

PIPE LOAD	= 5.5 TONS
CONTINGENCY LOAD	= 0.2 TONS
TOTAL LOAD	= 5.7 TONS
LIFTING RADIUS	= 6m
SIDE BOOM CAPACITY	= 7 TONS
SAFETY FACTOR	= 1.23

AUGER BORING SEQUENCE 15 OF 21

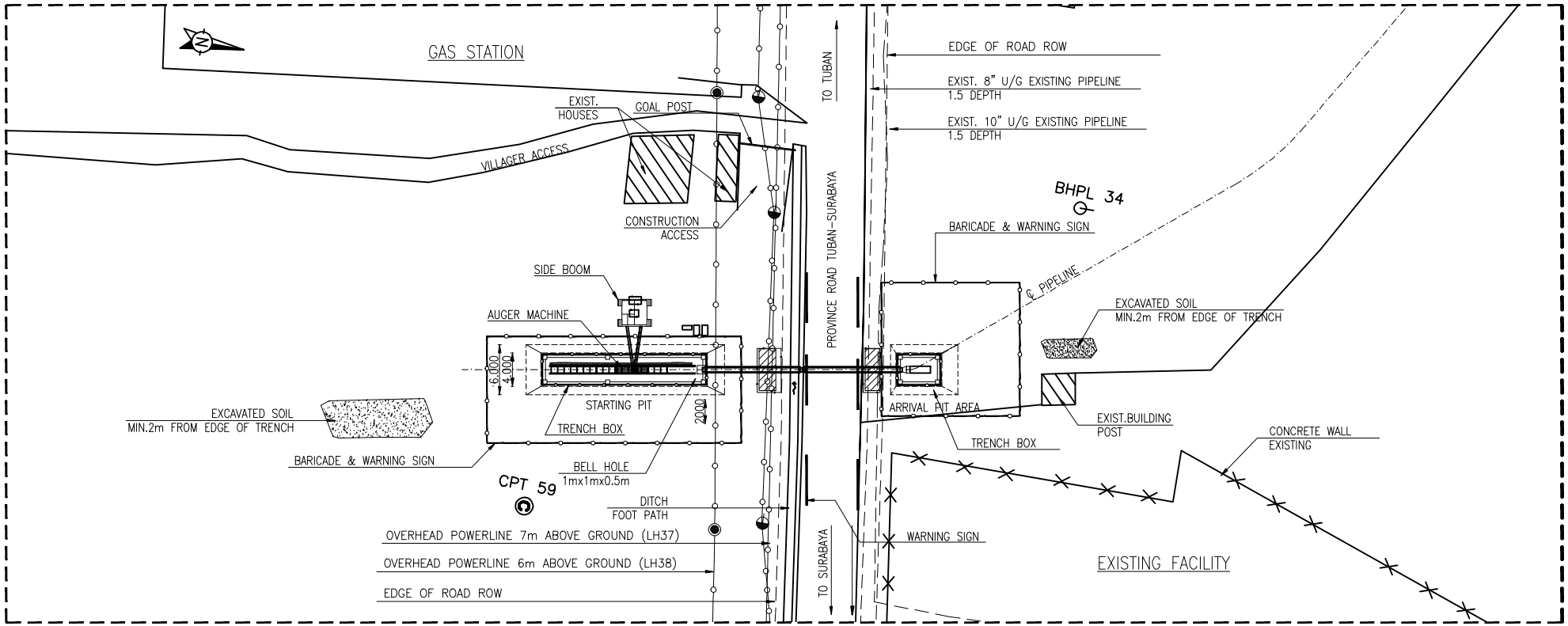


- Continue push the product pipe (as mentioned on sequence 13) until the product pipe end reach the tie-in point at the arrival pit
- Once done, strop driving operation then cut the reducer and disconnect the auger machine
- At both end of the pipe, perform survey to take the elevation and coordinates as reference data for the as-built drawing process.
- Perform visual check of coating, at exit point, for any signs of damage.

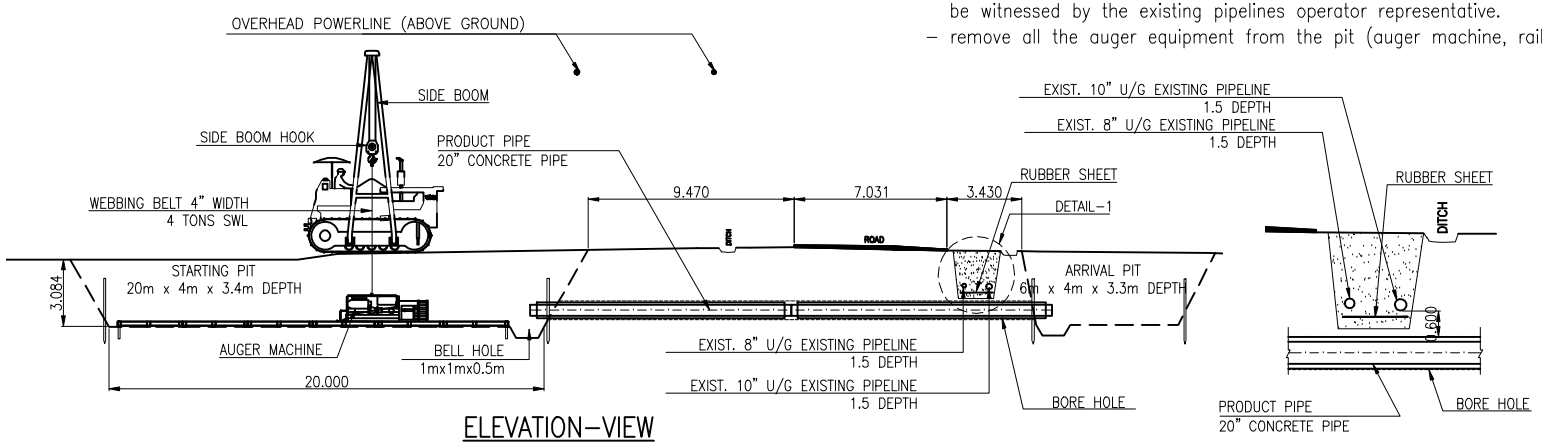


ELEVATION-VIEW

AUGER BORING SEQUENCE 16 OF 21



- Install rubber sheet under the existing pipeline then perform backfilling for the open trench at the existing pipeline. The installation of the rubber sheet under the existing pipelines shall be witnessed by the existing pipelines operator representative.
- remove all the auger equipment from the pit (auger machine, rail, etc.)

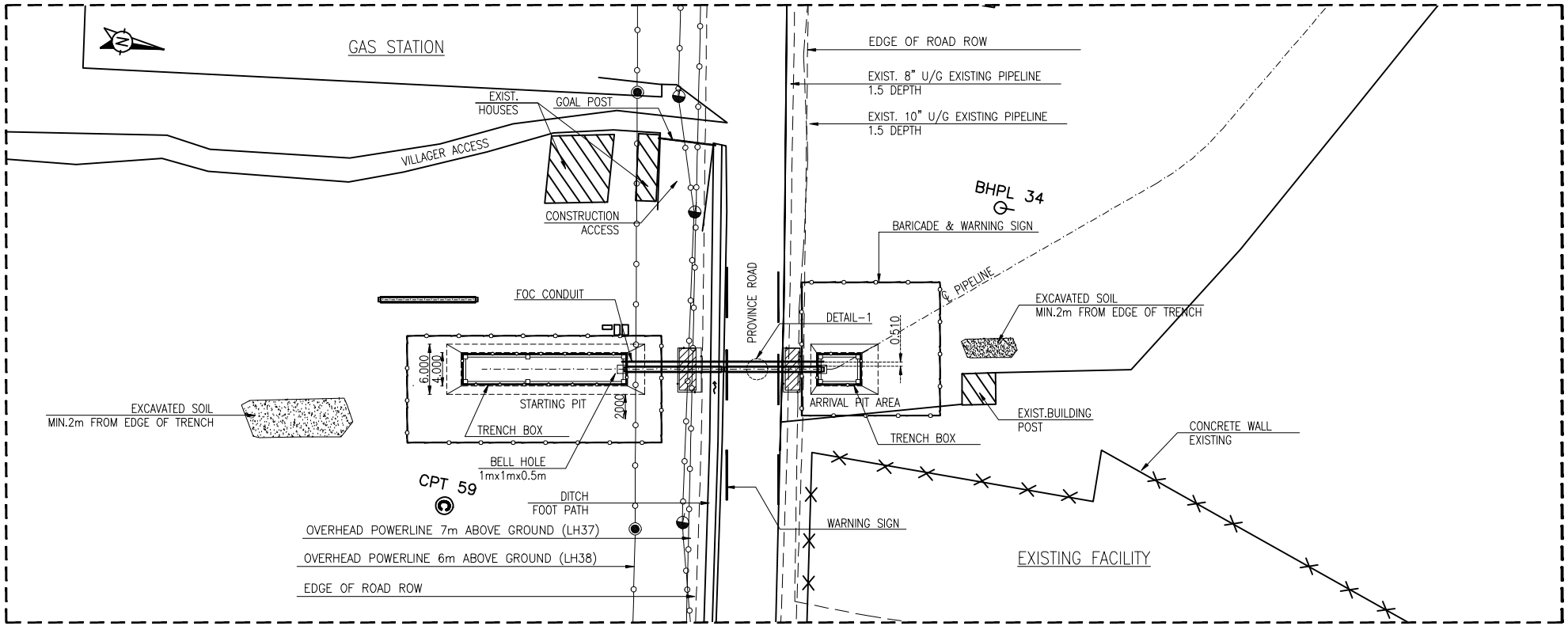


ELEVATION-VIEW

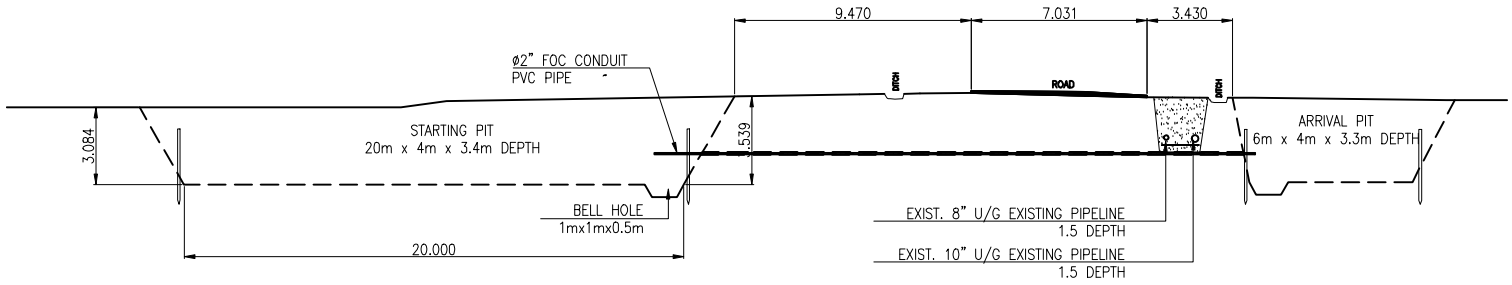
LIFTING CALCULATION

AUGER MACHINE	= 2.5 TONS
CONTINGENCY LOAD	= 0.5 TONS
TOTAL LOAD	= 3 TONS
LIFTING RADIUS	= 6m
SIDE BOOM CAPACITY	= 7 TONS
SAFETY FACTOR	= 2.33

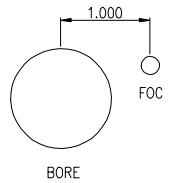
AUGER BORING SEQUENCE 17 OF 21



- Prepare the manual boring equipment inside the starting pit for FOC conduit installation at this crossing.
- Perform manual boring for FOC conduit; refer to document no. IDBE-IK-KPZZZ-ENXXX Boring Procedure for FOC Conduit Installation

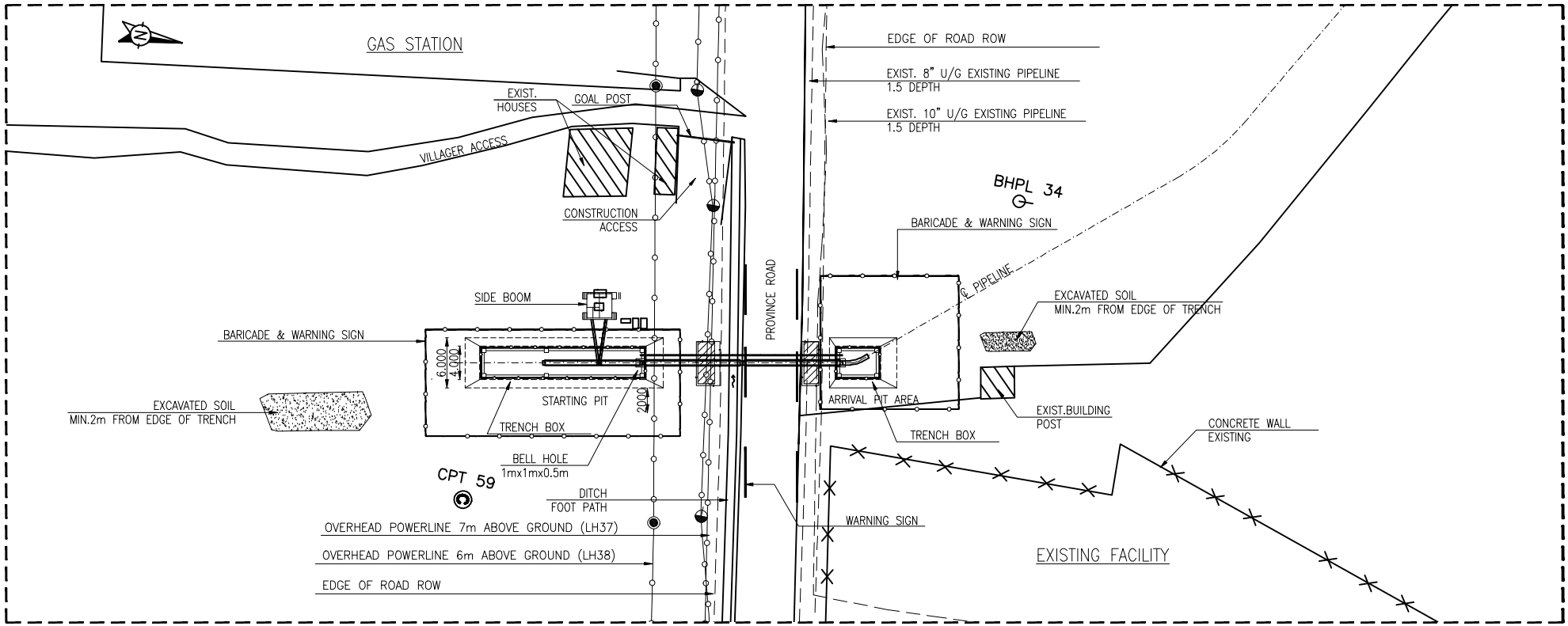


ELEVATION-VIEW

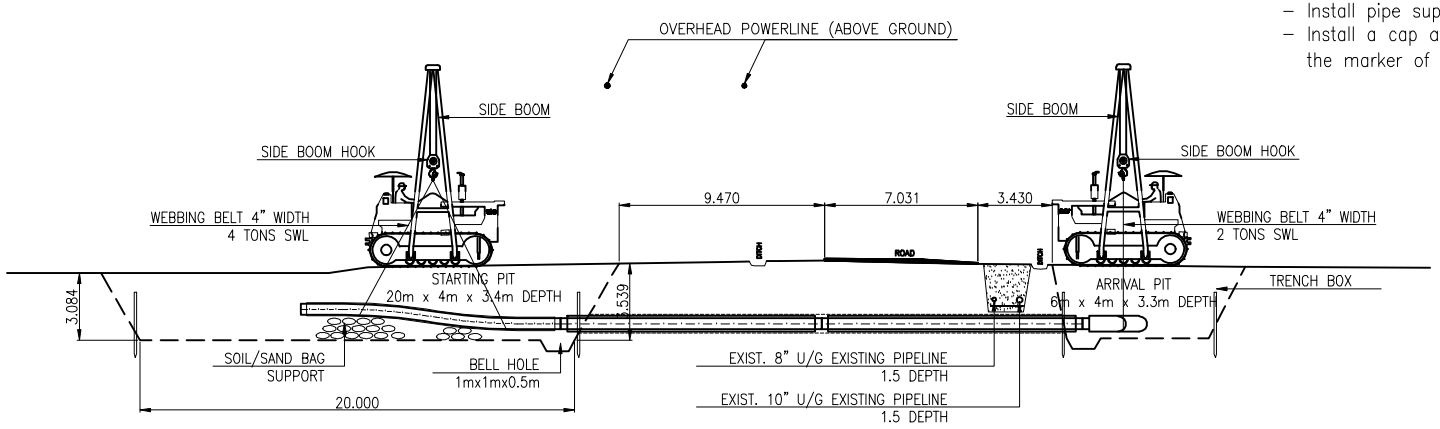


DETAIL-1

AUGER BORING SEQUENCE 18 OF 21



- Install the vertical bend (weld to the bored pipe) and perform NDE and FJC on both sides of the crossing (bore start and arrival sides).
- Install pipe support (soil/sand bag) after the weld is finished
- Install a cap at the both ends of the pipe and install a vertical stick as the marker of the end pipe position (if required).

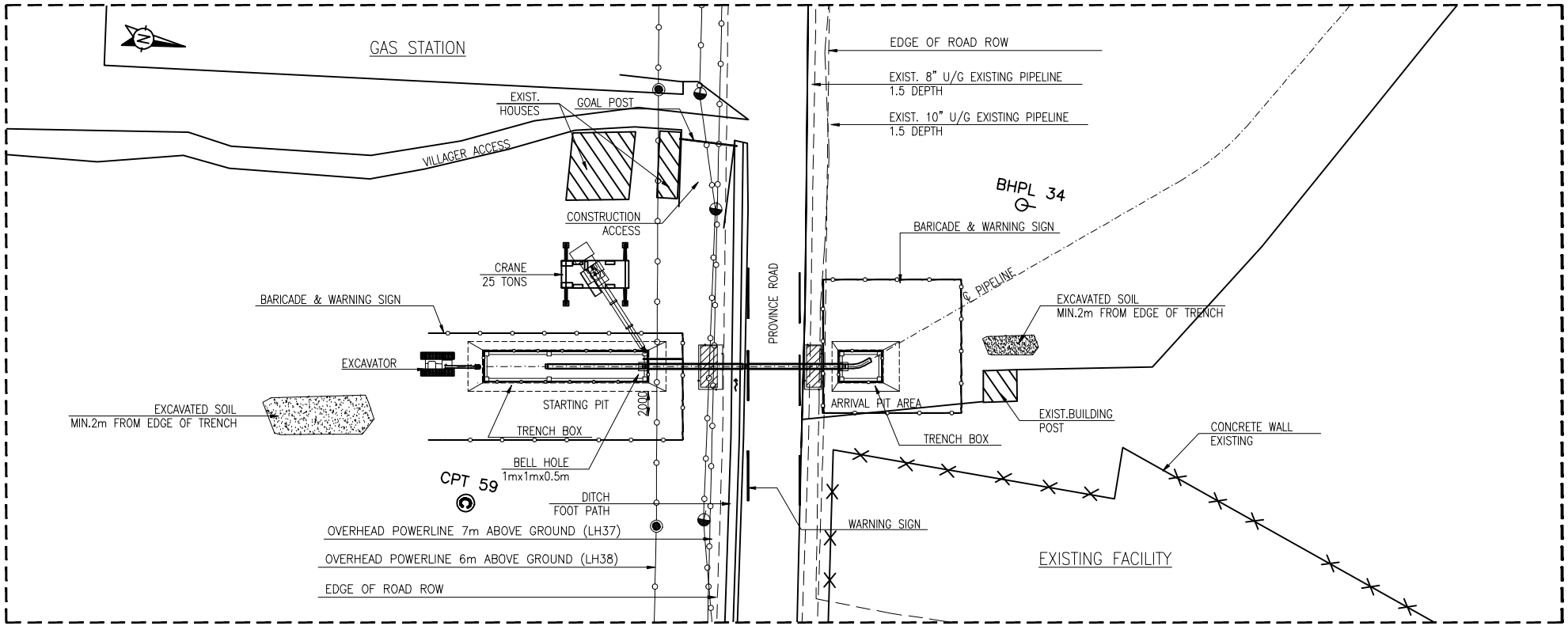


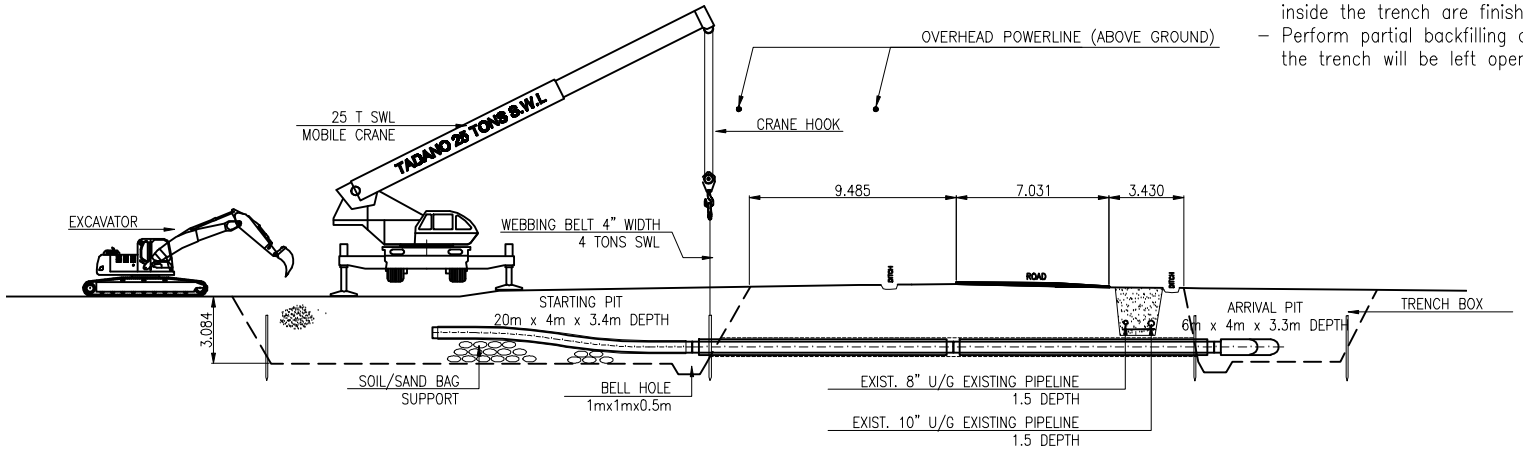
ELEVATION–VIEW

LIFTING CALCULATION

BEND PIPE LOAD	= 2.0 TONS
CONTINGENCY LOAD	= 0.2 TONS
TOTAL LOAD	= 2.2 TONS
LIFTING RADIUS	= 6m
SIDE BOOM CAPACITY	= 7 TONS
SAFETY FACTOR	= 3.18

AUGER BORING SEQUENCE 19 OF 21





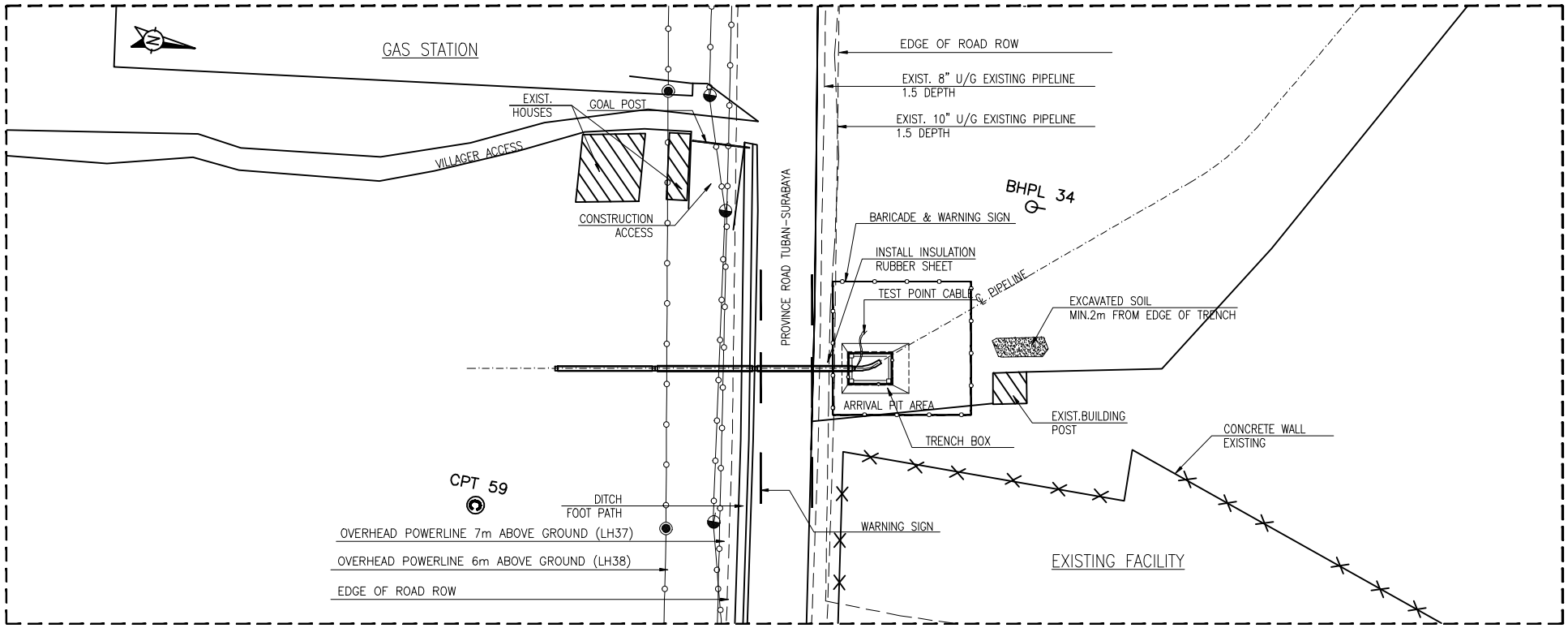
ELEVATION–VIEW

- Remove the shore protection box from starting pit after all activities inside the trench are finished by using crane (sling–up)
- Perform partial backfilling and compaction of the pit; at the ends of each pipe, the trench will be left open to provide access for tie–ins

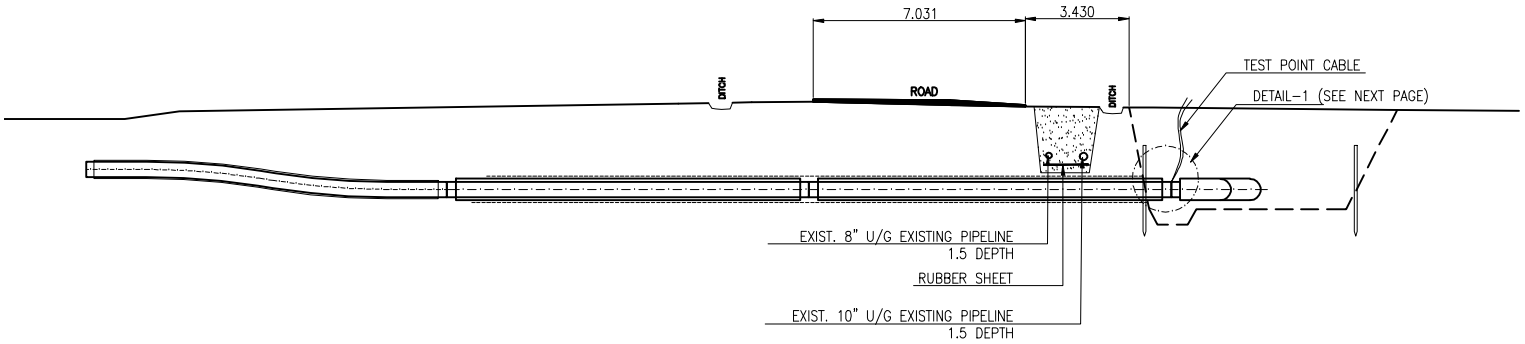
LIFTING CALCULATION

PROTECTION PULL LOAD	= 2 TONS
CONTINGENCY LOAD	= 0.5 TONS
TOTAL LOAD	= 2.5 TONS
LIFTING RADIUS	= 15m
CRANE CAPACITY	= 3.2 TONS
SAFETY FACTOR	= 1.28

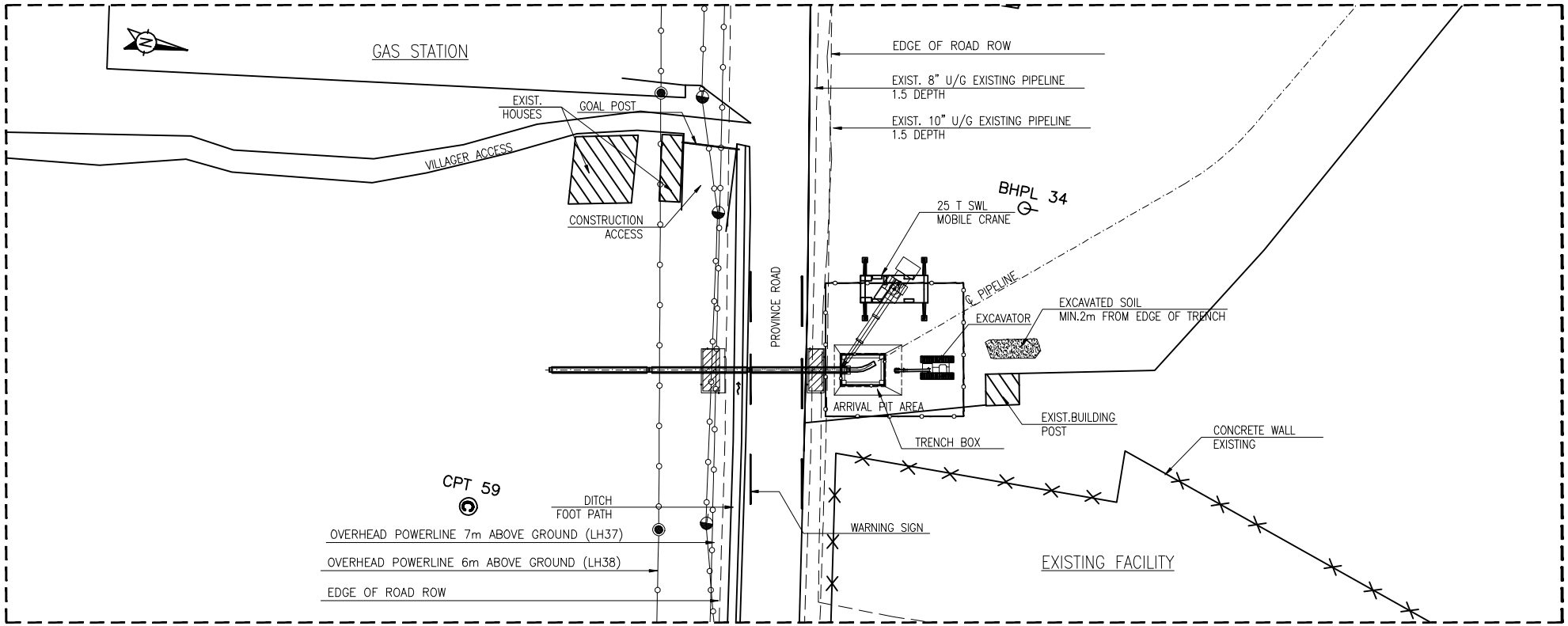
AUGER BORING SEQUENCE 20 OF 21



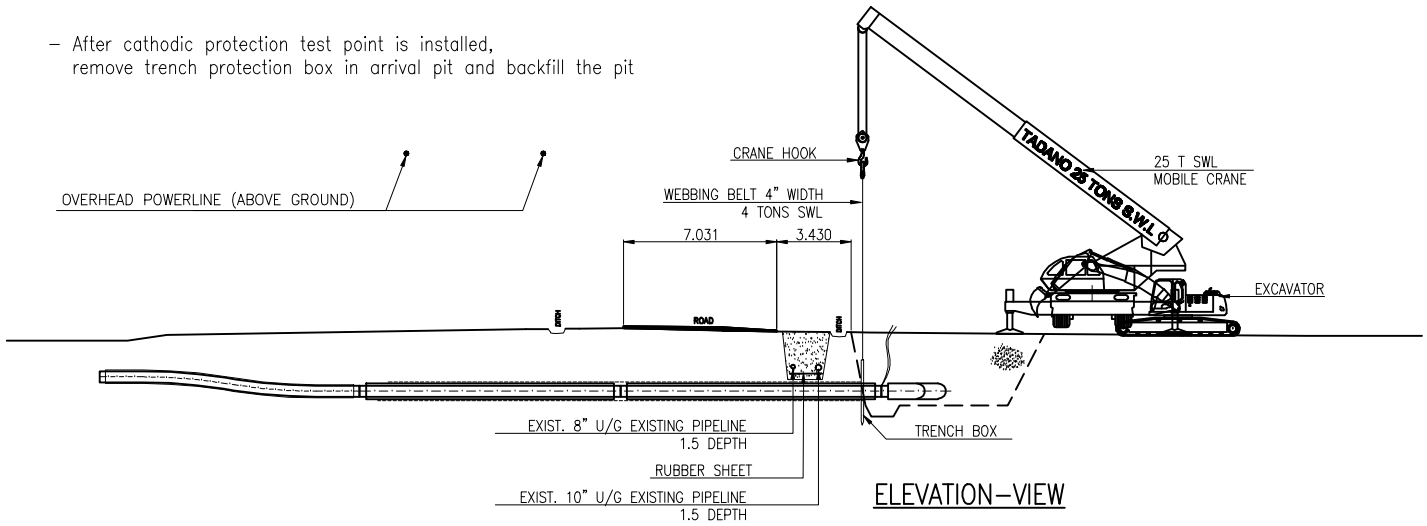
– Cathodic Protection test point will be installed after the tie–in work between boring and mainline pipe in arrival pit, the position will be at near of the tie–in poin



AUGER BORING SEQUENCE 21 OF 21



– After cathodic protection test point is installed, remove trench protection box in arrival pit and backfill the pit



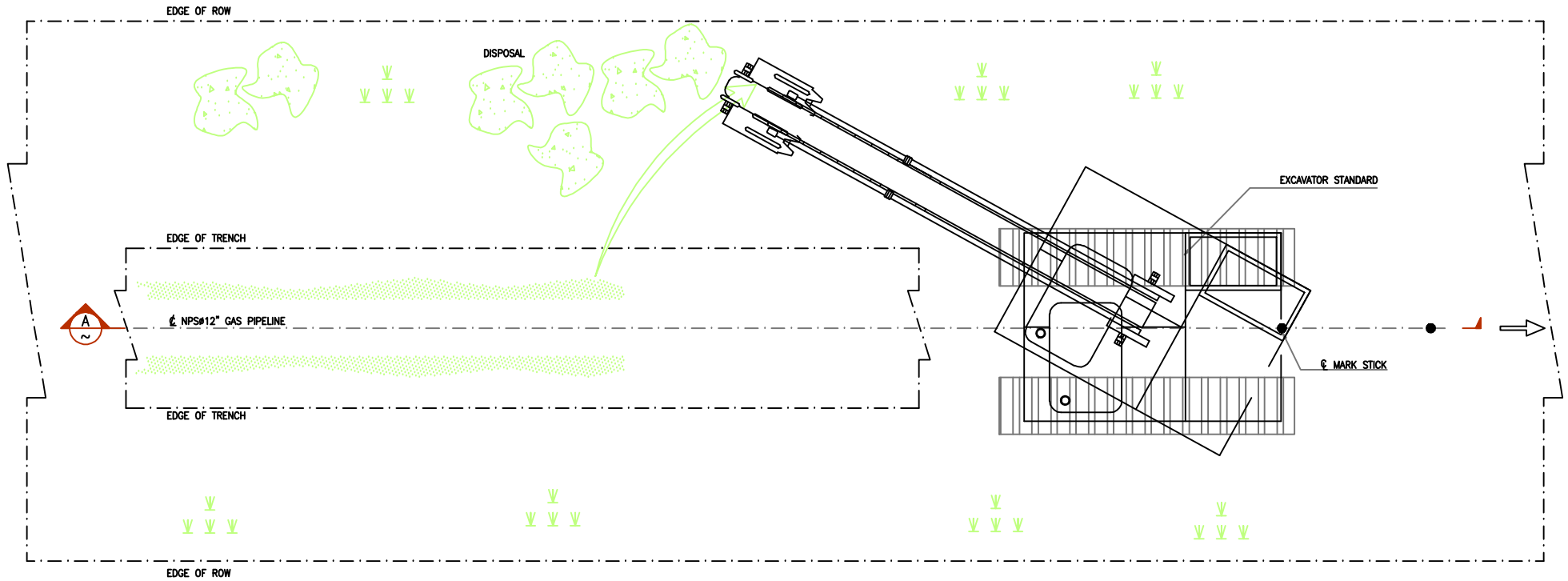
ELEVATION–VIEW

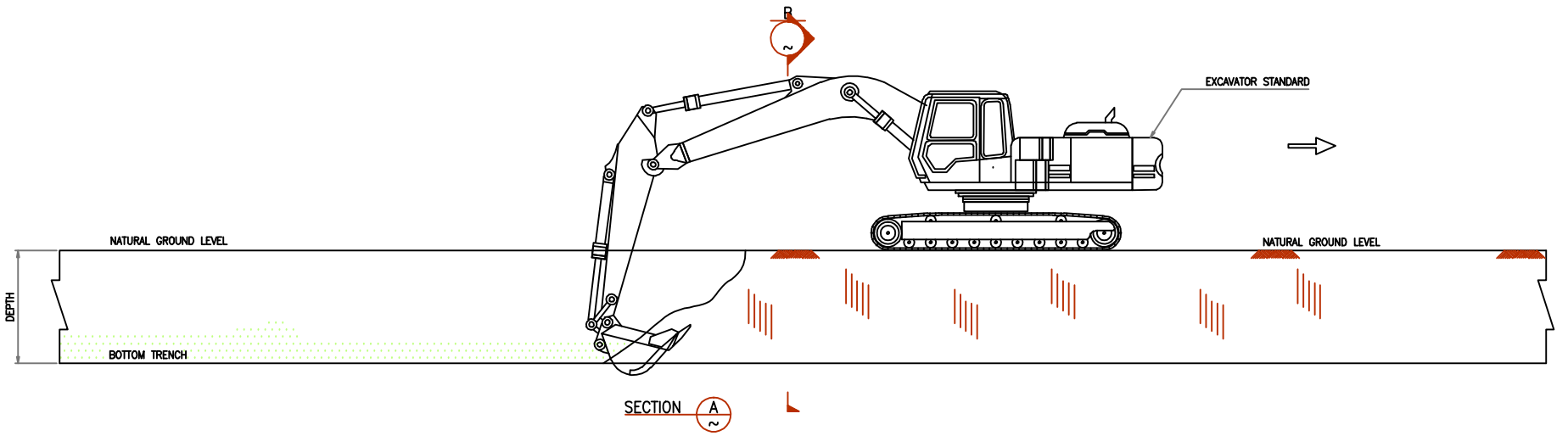
LIFTING CALCULATION

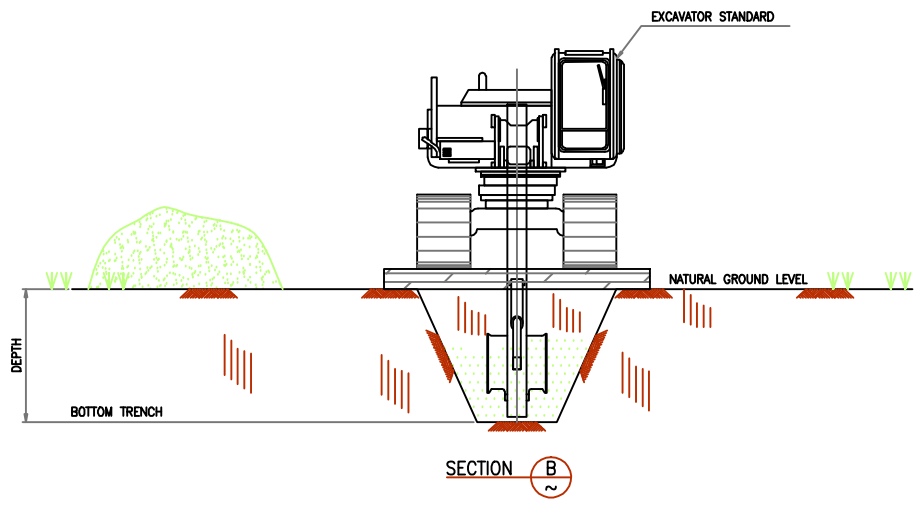
PROTECTION PULL LOAD	= 2 TONS
CONTINGENCY LOAD	= 0.5 TONS
TOTAL LOAD	= 2.5 TONS
LIFTING RADIUS	= 15m
CRANE CAPACITY	= 3.2 TONS
SAFETY FACTOR	= 1.28

Attachment – 5: Typical Trench Excavation & Lowering Operation

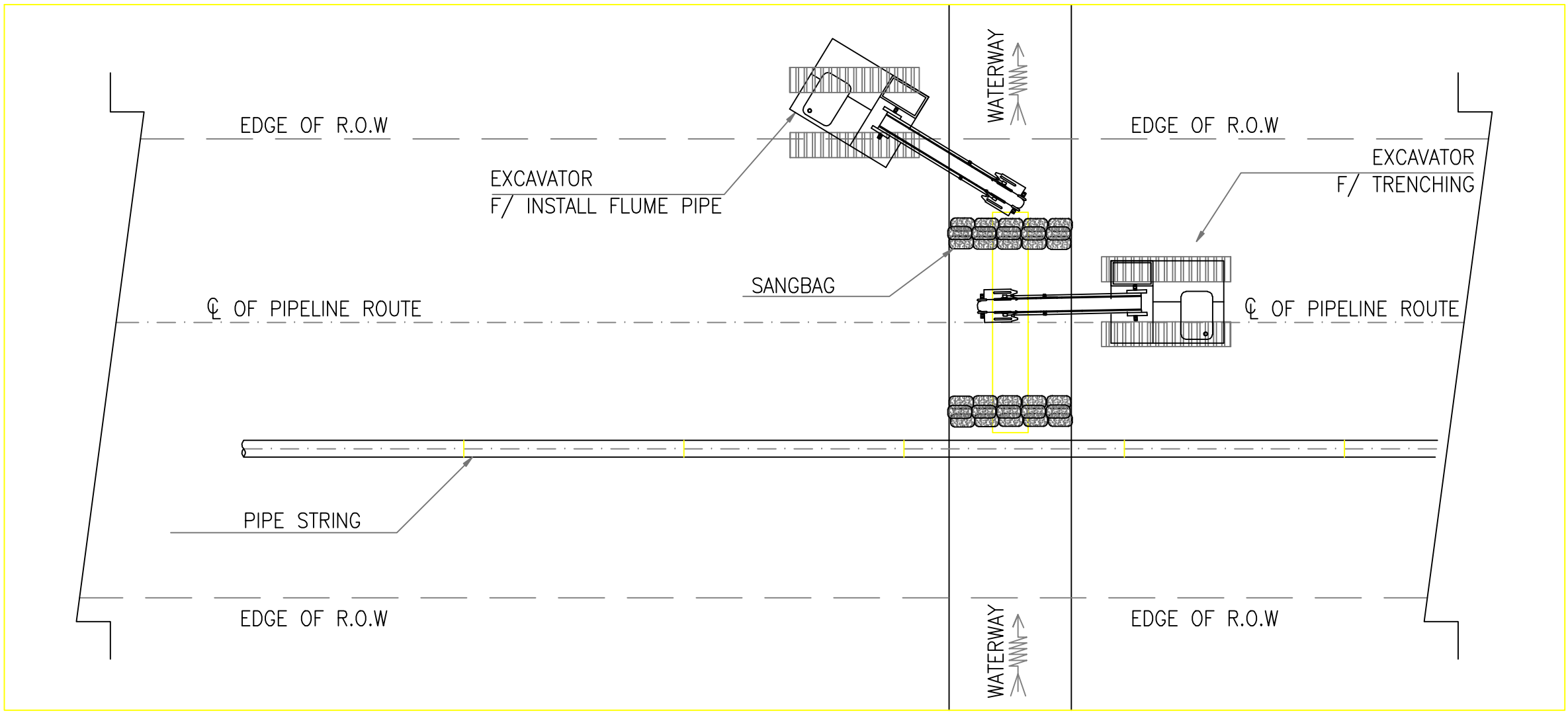
TYPICAL TRENCHING FOR NORMAL AREA







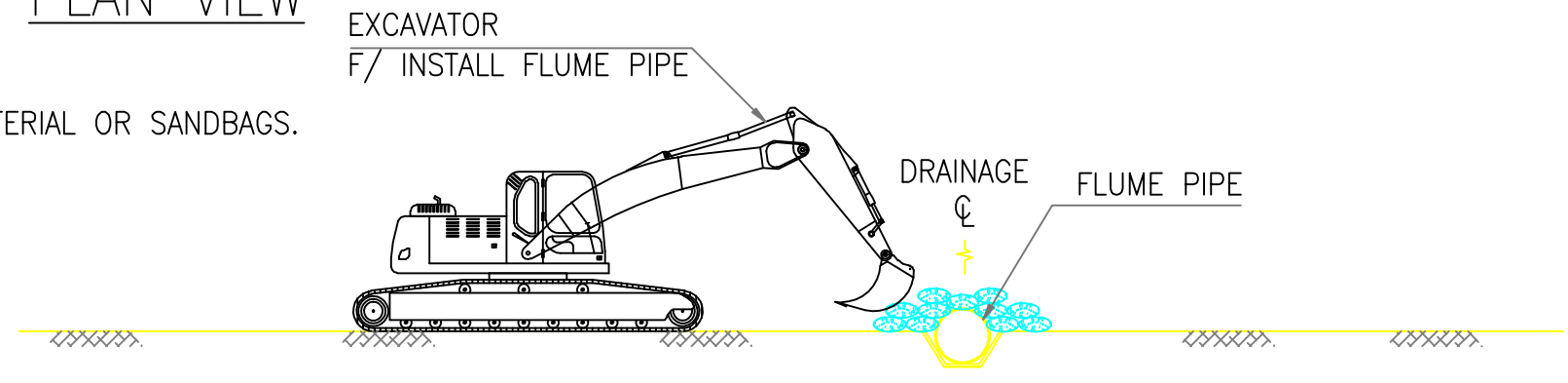
TYPICAL TRENCH EXCAVATION AT WATERWAY CROSSING



PLAN VIEW

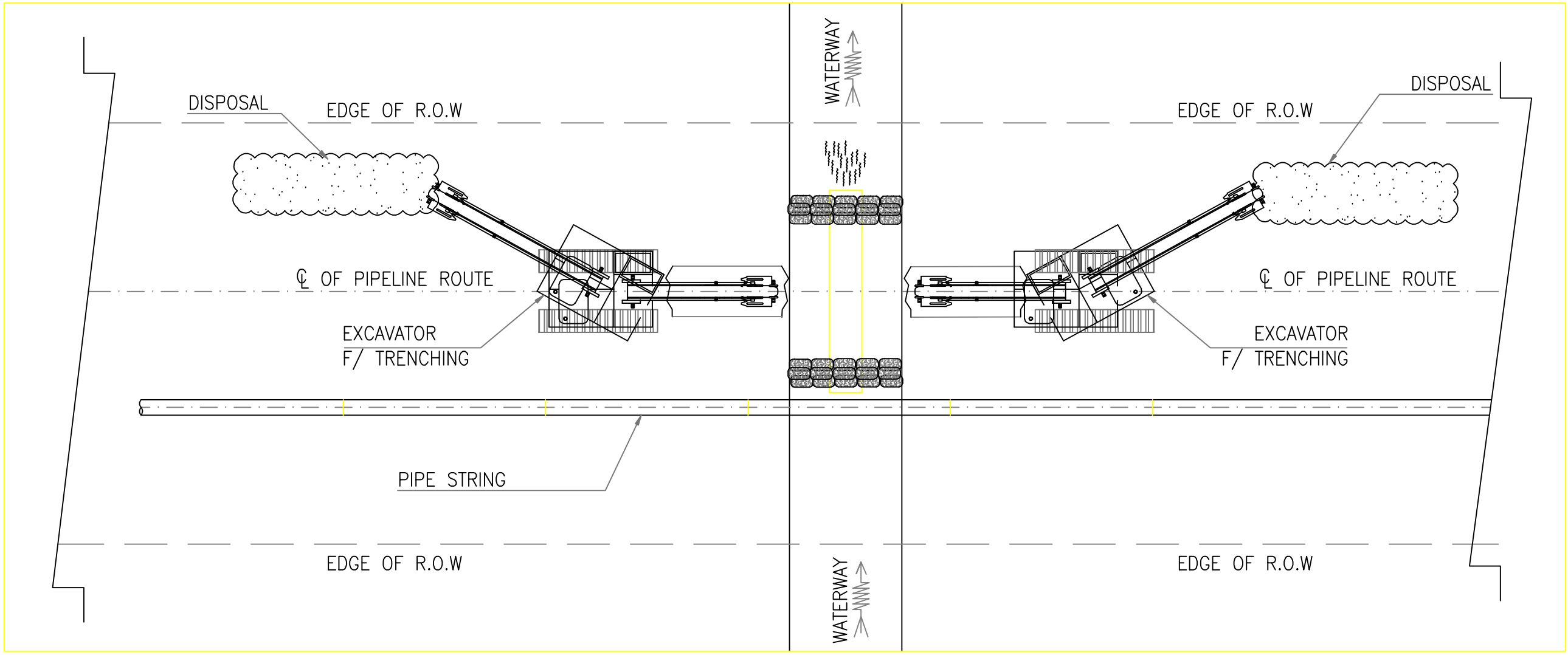
SEQUENCE–1:

- INSTALL THE FLUME PIPE AND BACKFILL ON TOP THE FLUME PIPE WITH SUITABLE MATERIAL OR SANDBAGS.
- MAKESURE THE WATER COMPLETELY FLOWS ONLY THROUGH THE PIPES;
  MEANS THE WORK AREA DOWNSTREAM OF THE BLOCKAGE BECOMES DRY.



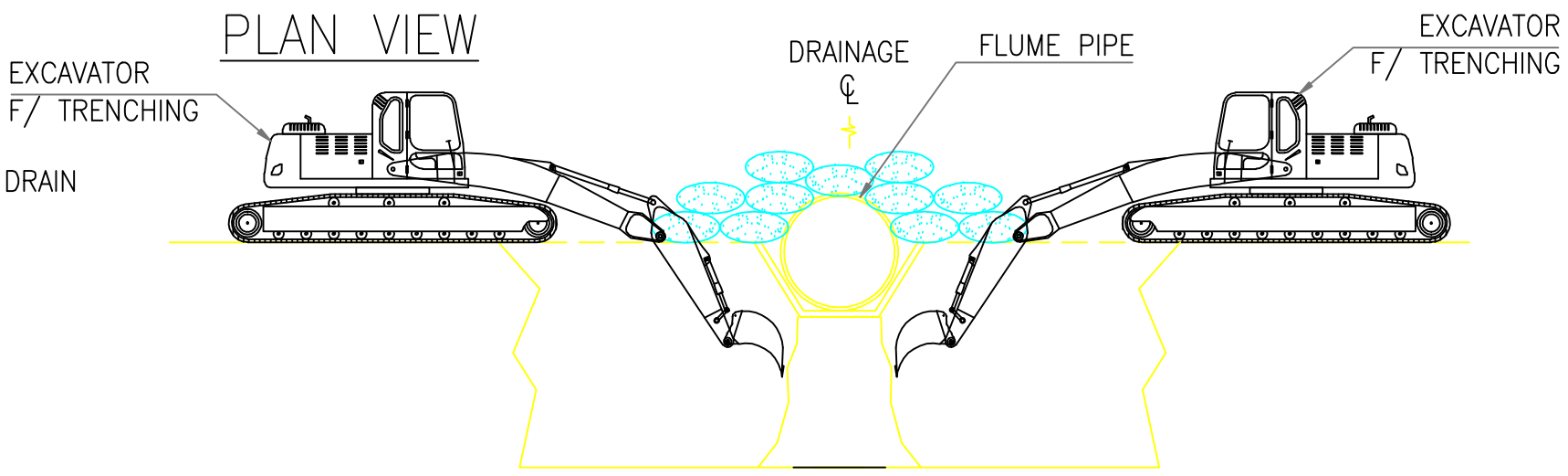
ELEVATION VIEW

TYPICAL TRENCH EXCAVATION AT WATERWAY CROSSING

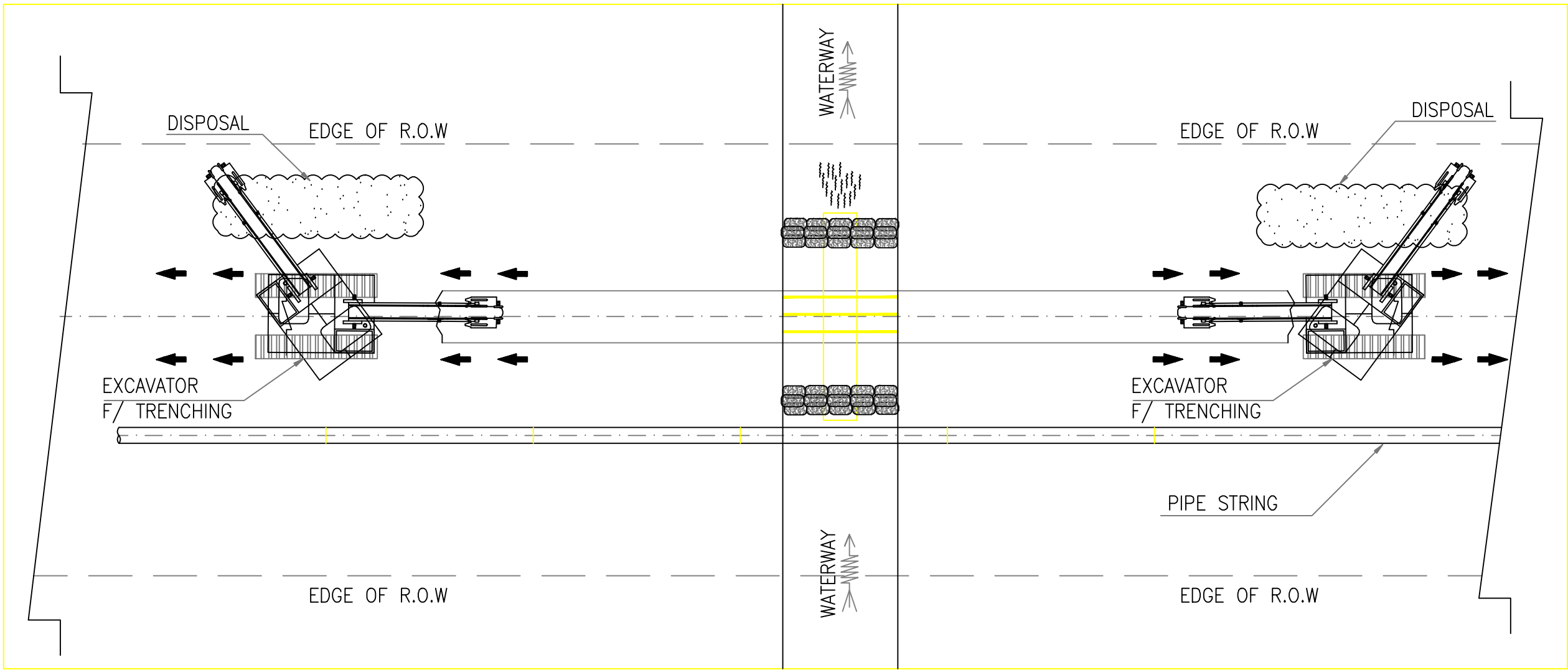


SEQUENCE–2:

- START EXCAVATION THE OPEN TRENCH IN THE RIGHT AND LEFT SIDES OF THE DRAIN FOLLOW THE CENTERLINE WITH SIMILAR DEPTH AS THE DESIGN DRAWING.
- LAY THE EXCAVATED SOIL ON THE DEDICATED DISPOSAL AREA.



TYPICAL TRENCH EXCAVATION AT WATERWAY CROSSING

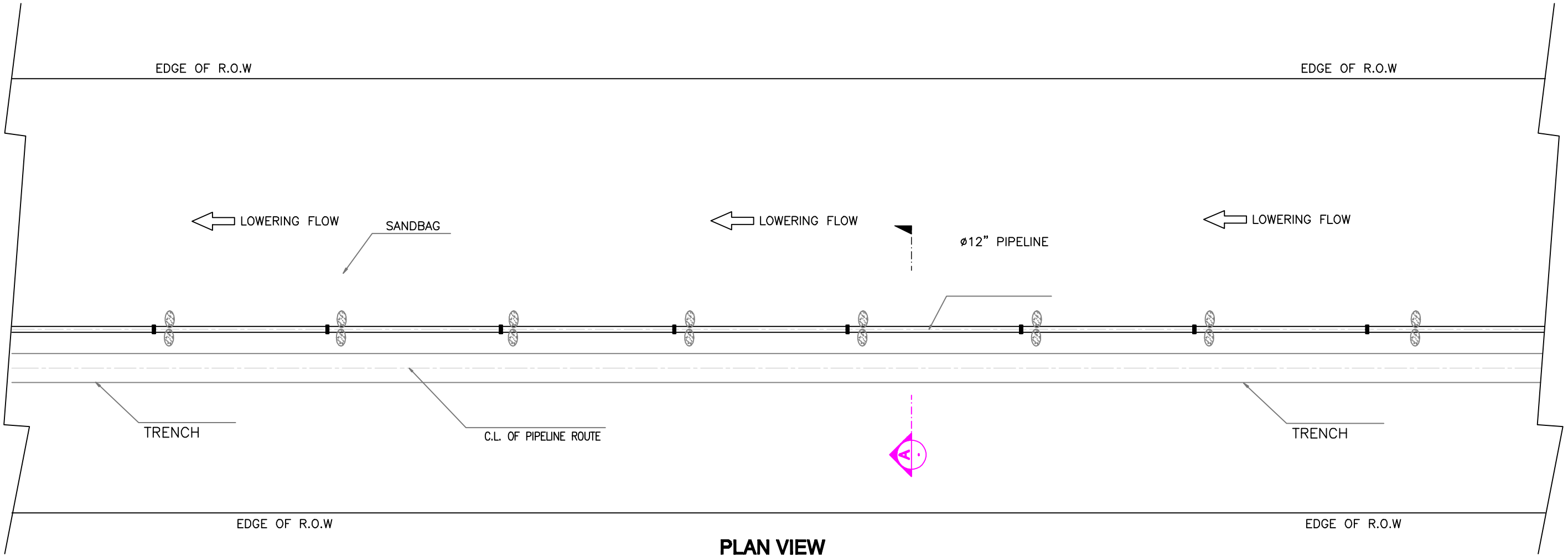


PLAN VIEW

SEQUENCE–3:

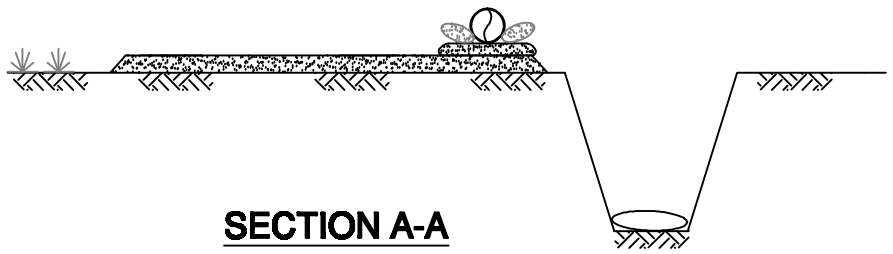
– EXCAVATOR WILL CONTINUE EXCAVATION FOLLOW THE CENTERLINE WITH SIMILAR DEPTH AS THE DESIGN DRAWING.
– THE SURVEYOR WILL MAKESURE THE DEPTH OF THE TRENCH USING LEVEL STICK.
– ENSURE THE SURVEYOR POSITION IS SAFE FROM EXCAVATOR MANEUVER.

LOWERING SEQUENCE 1 OF 8



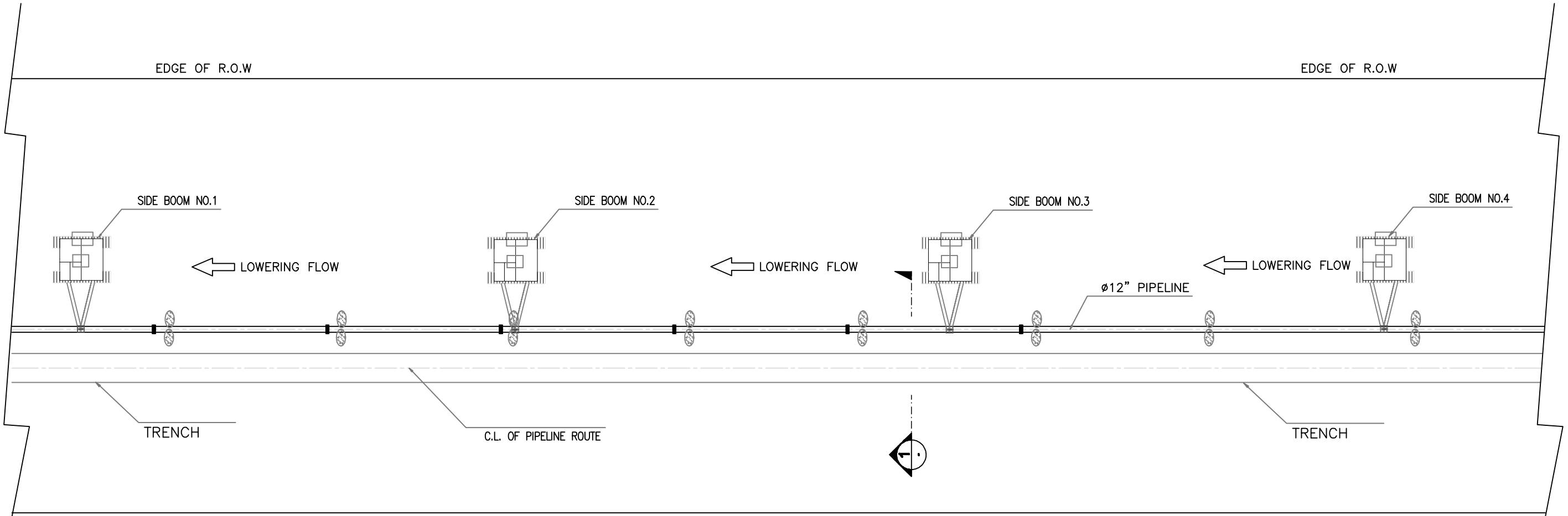
PLAN VIEW

PIPE READY FOR LOWERING

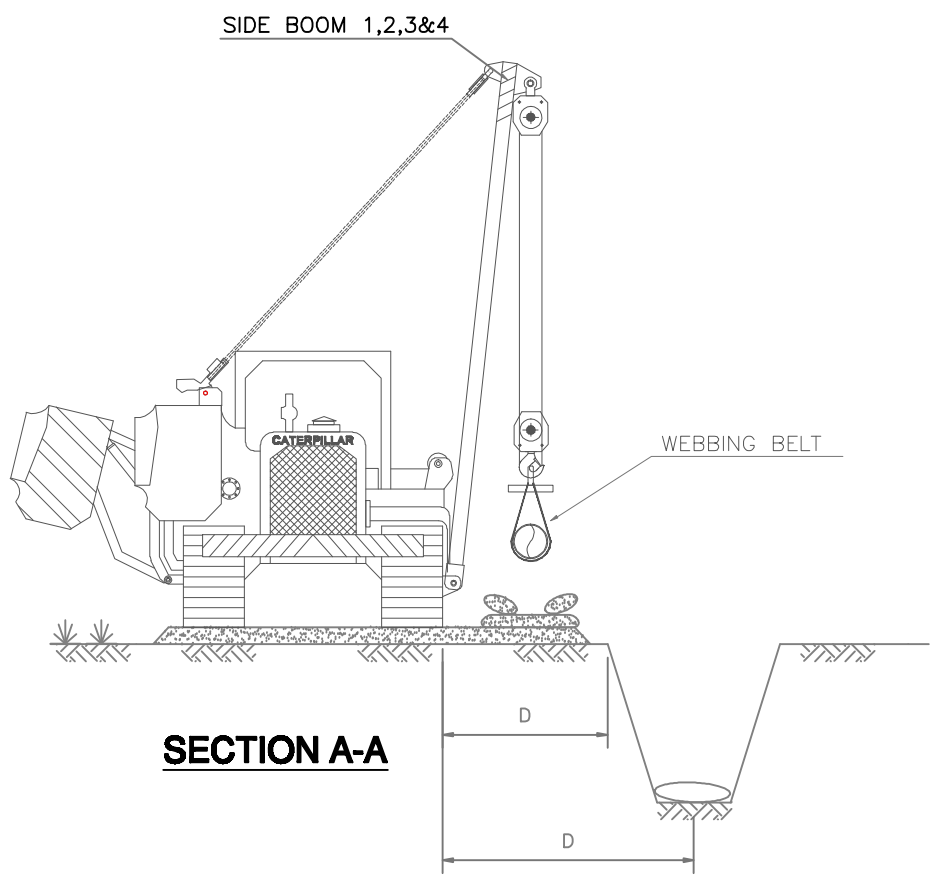


SECTION A-A

LOWERING SEQUENCE 2 OF 8



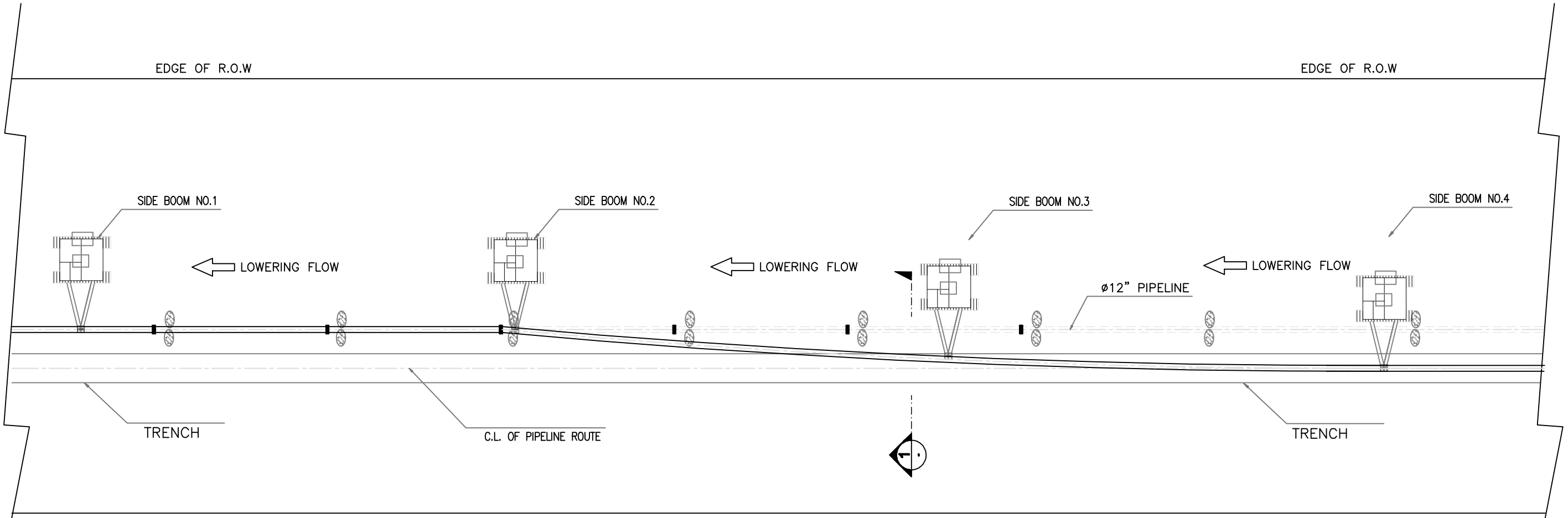
PLAN VIEW



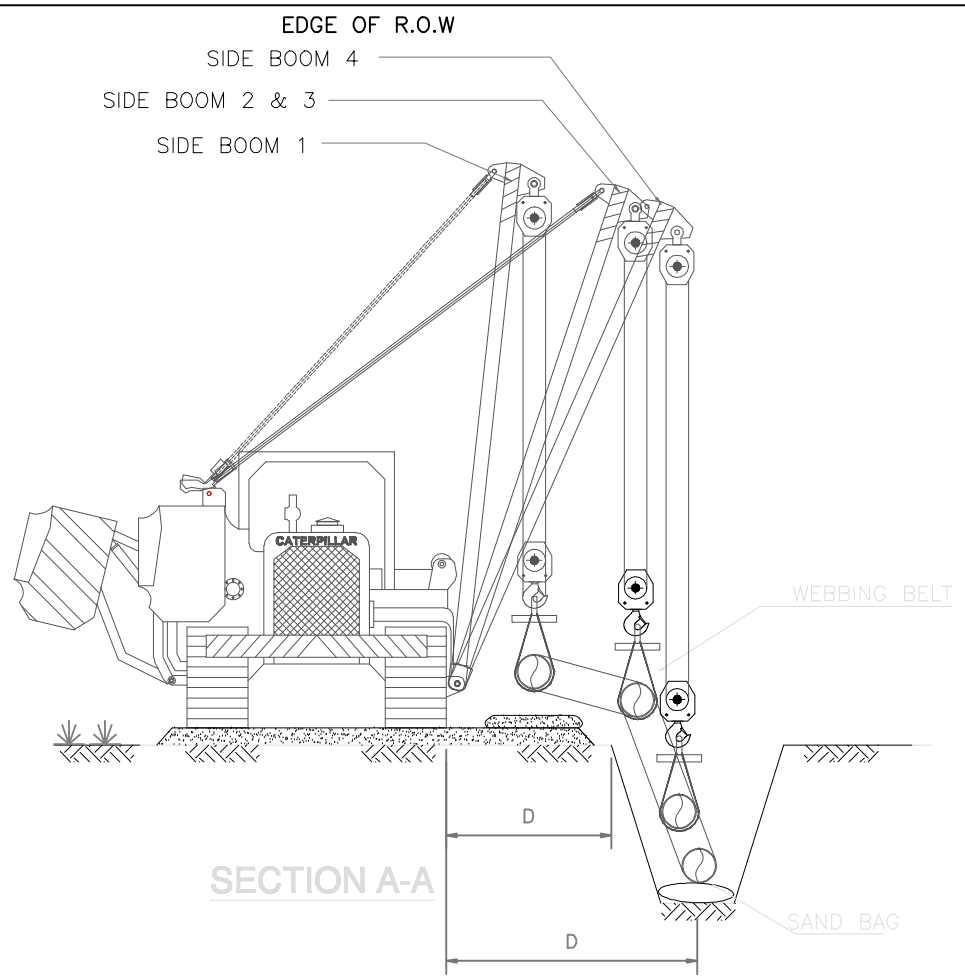
SECTION A-A

SIDE BOOM READY AT EACH POSITION

LOWERING SEQUENCE 3 OF 8



PLAN VIEW

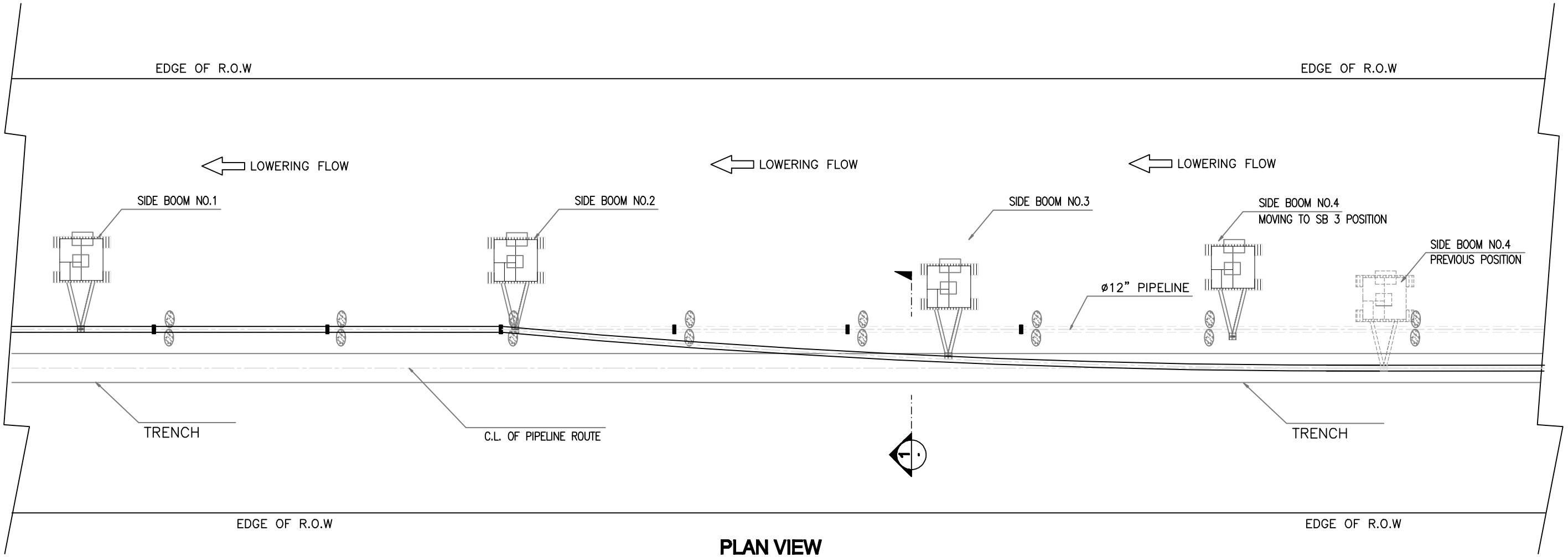


SIDE BOOM AT EACH POSITION

SEQUENCE:

STEP 1 : SIDE BOOM 1, 2 & 3 SLIGHTLY LIFT PIPE ABOVE SUPPORT
STEP 2 : SIDE BOOM 2, 3 & 4 WILL BOOM OUT TO MOVE THE PIPE UNTIL THE PIPE IS DIRECTLY ABOVE ITS TRENCH POSITION, THEN SIDE BOOMS 4 & 3 WILL LOWERING-IN THE PIPE.

LOWERING SEQUENCE 4 OF 8

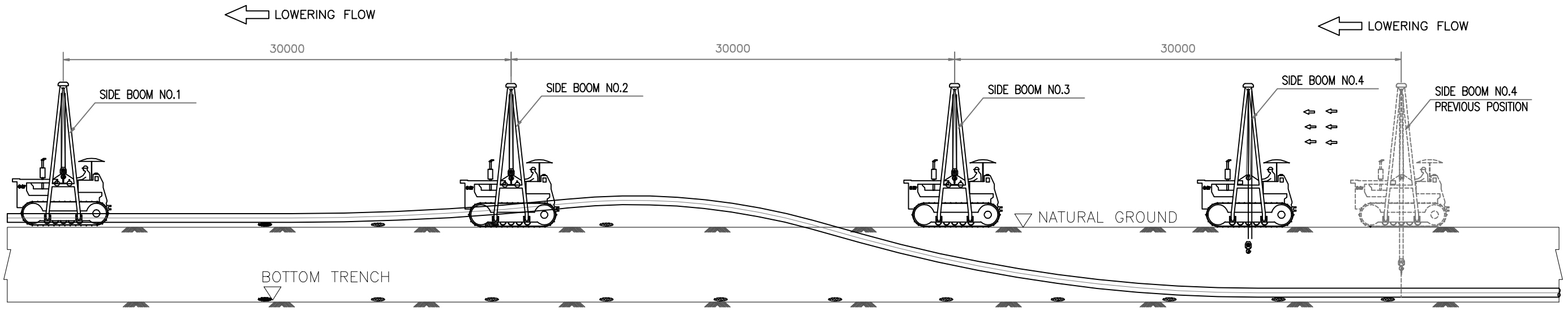


PLAN VIEW

SIDE BOOM AT NEXT POSITION

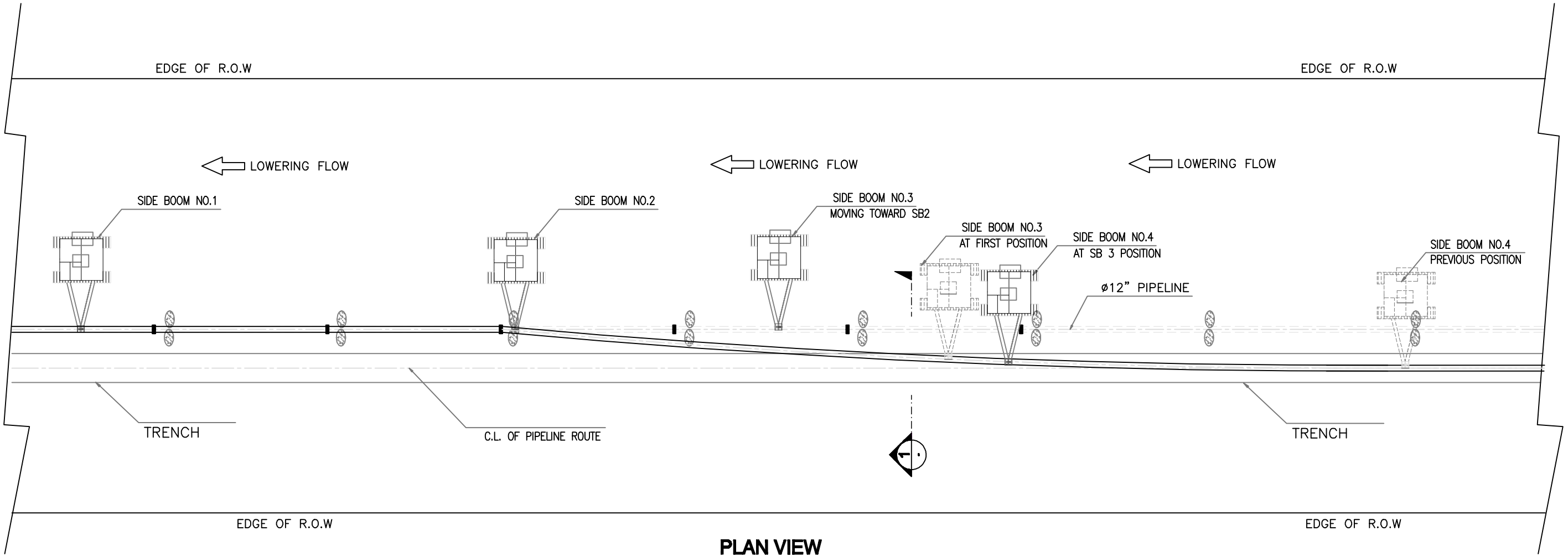
SEQUENCE:

STEP 1 : AFTER SIDE BOOM 4 HAS LOWERED IN THE PIPE, SIDE BOOM 1, 2, & 3 WILL HOLD THE PIPE.
STEP 2 : SIDE BOOM 4 WILL MOVE TOWARD SIDE BOOM 3 POSITION.



ELEVATION VIEW

LOWERING SEQUENCE 5 OF 8

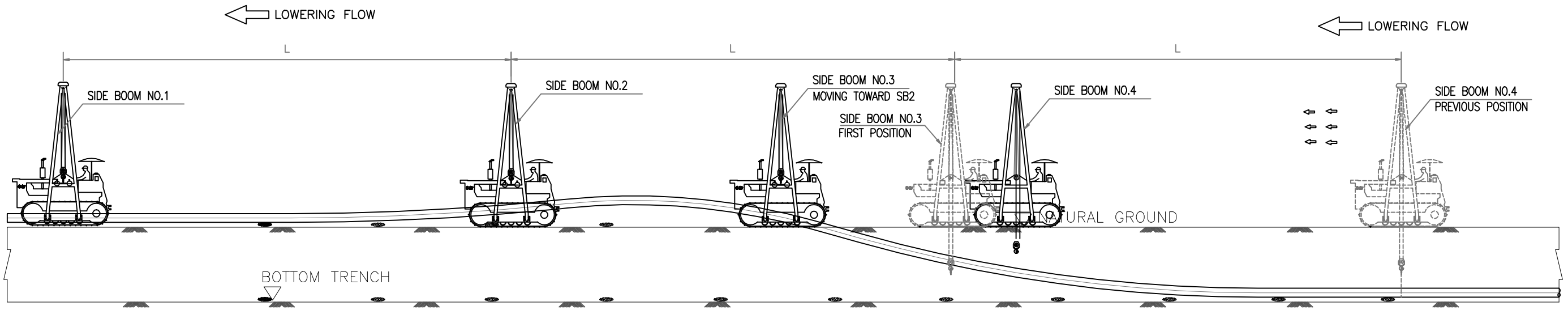


PLAN VIEW

SIDE BOOM AT NEXT POSITION

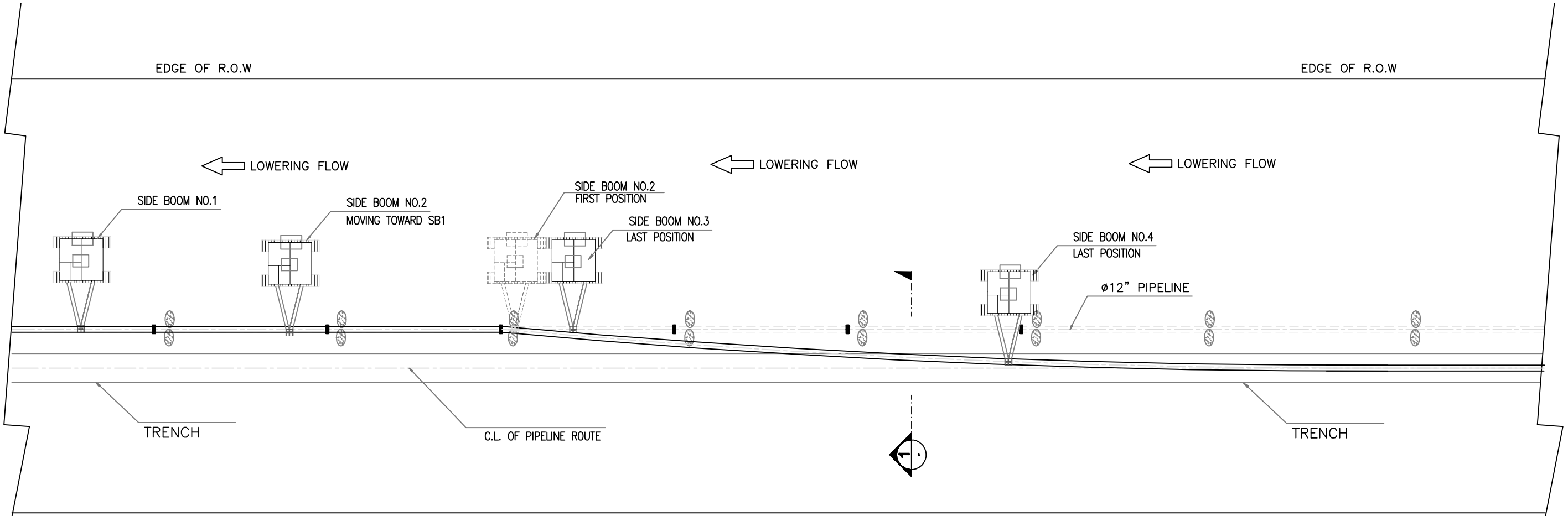
SEQUENCE:

STEP 1 : AFTER SIDE BOOM 4 HASMOVED TOWARD SIDE BOOM 3 POSITION, SIDE BOOM 1, 2 & 4 WILL HOLD THE PIPE.
STEP 2 : SIDE BOOM 3 WILL MOVE TOWARD SIDE BOOM 2 POSITION.



ELEVATION VIEW

LOWERING SEQUENCE 6 OF 8

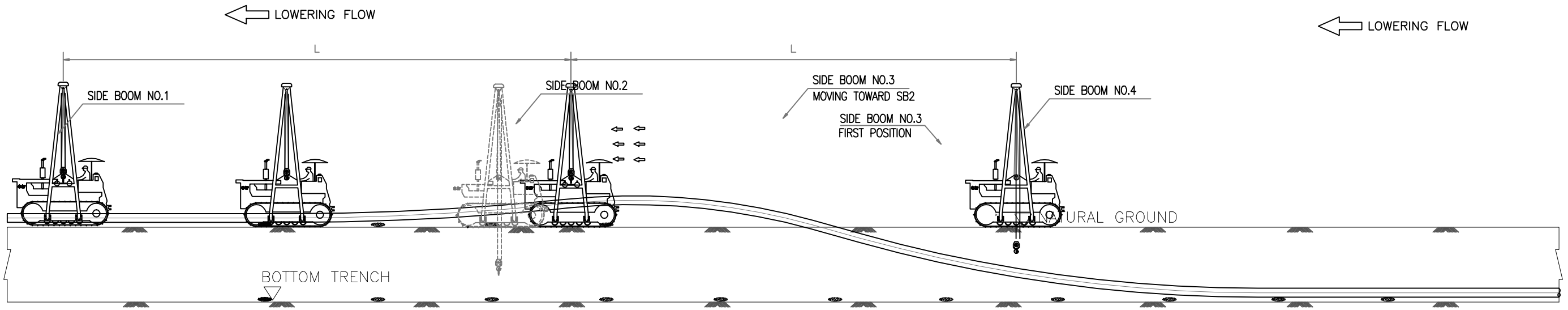


PLAN VIEW

SIDE BOOM AT NEXT POSITION

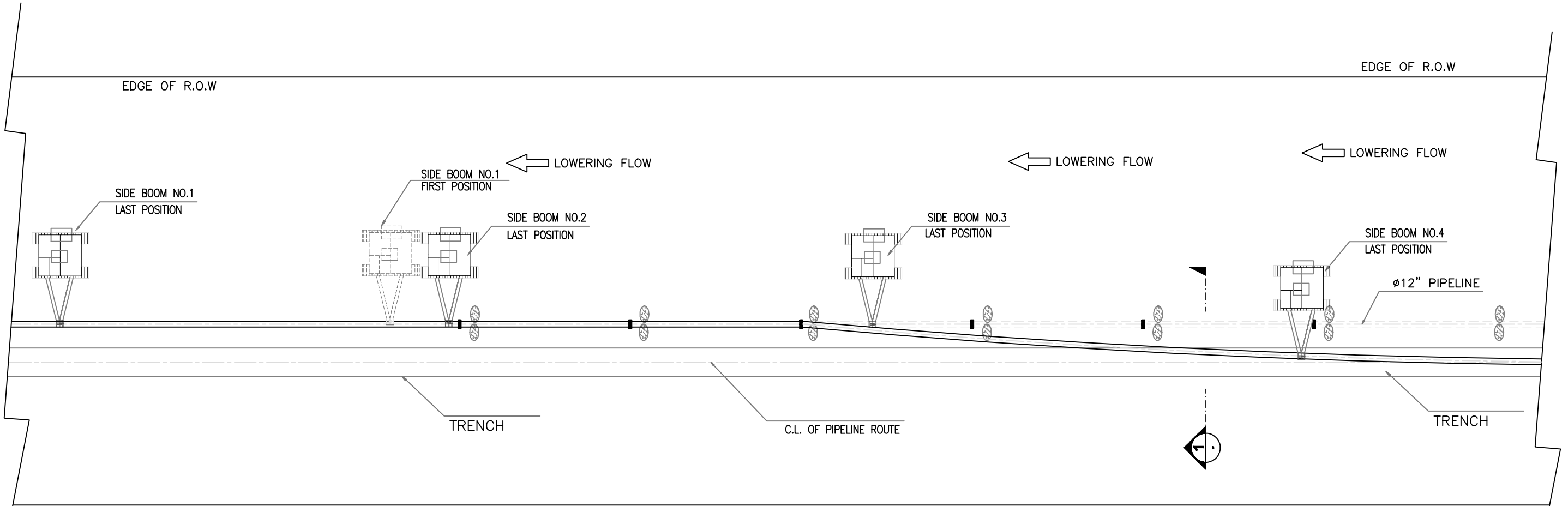
SEQUENCE:

STEP 1 : AFTER SIDE BOOM 3 HAS MOVED TOWARD SIDE BOOM 2 POSITION, SIDE BOOM 1, 3 & 4 WILL HOLD THE PIPE.
STEP 2 : SIDE BOOM 2 WILL MOVE TOWARD SIDE BOOM 1 POSITION.



ELEVATION VIEW

LOWERING SEQUENCE 7 OF 8

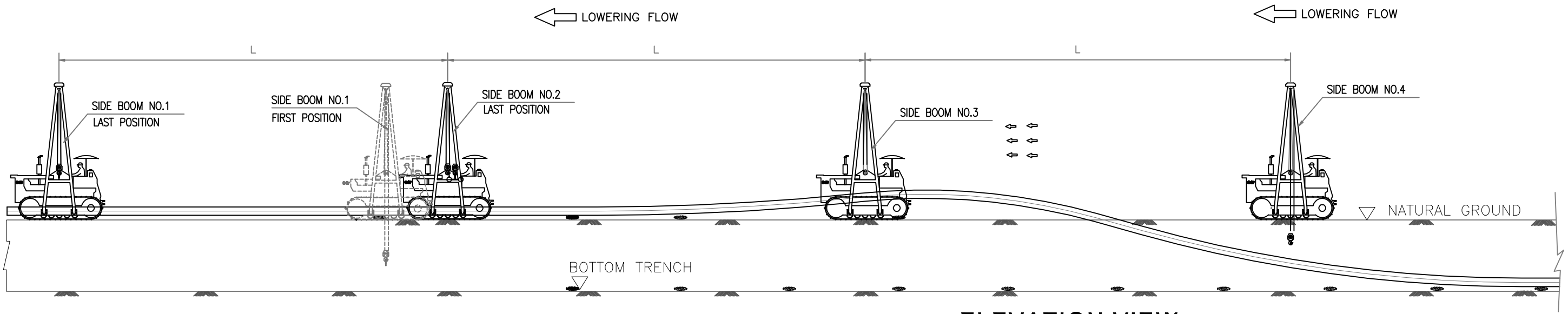


PLAN VIEW

SIDE BOOM AT NEXT POSITION

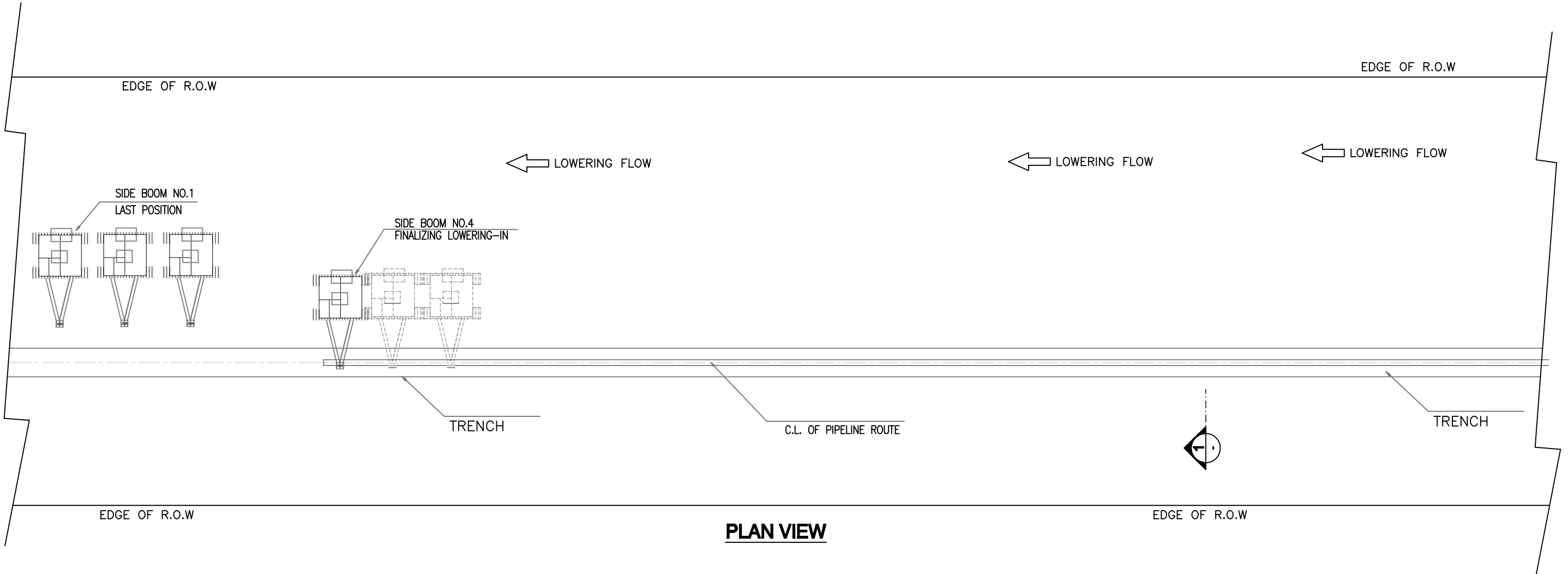
SEQUENCE:

STEP 1 : AFTER SIDE BOOM 2, 3 & 4 HAVE MOVED TO THE LAST POSITION, SIDE BOOM 2, 3 & 4 WILL HOLD THE PIPE.
STEP 2 : SIDE BOOM 1 WILL MOVE TO THE NEXT POSITION WITH INTERVAL 30m FROM SIDE BOOM 2.



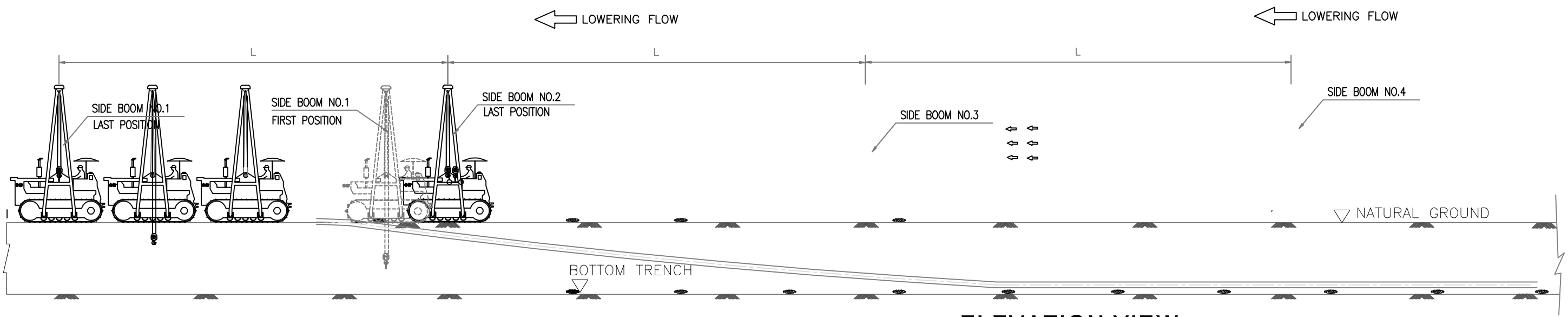
ELEVATION VIEW

LOWERING SEQUENCE 8 OF 8



PLAN VIEW

TYPICAL LOWERING-IN PROFILE AT END OF PIPE



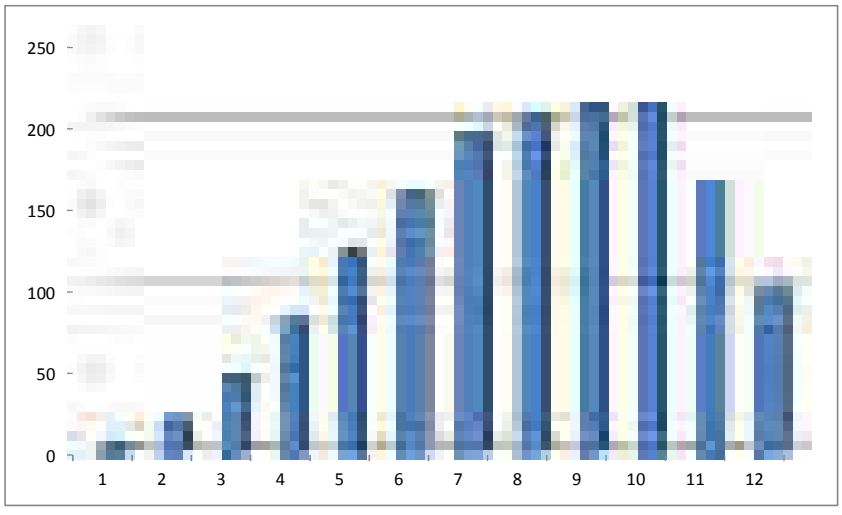
ELEVATION VIEW

RIAU GFPP 250 MW PIPELINE PROJECT
MANPOWER LOADING
PIPELINE 48 KM # 12"

No.	Manpower Description	Bulan												Remarks
		M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8	M-9	M-10	M-11	M-12	
A	**INDIRECT LABOR**	**23**	**48**	**51**	**57**	**62**	**78**	**80**	**80**	**78**	**70**	**65**	**56**	
I	**PROJECT MANAGEMENT**													
1	Project Manager	1	1	1	1	1	1	1	1	1	1	1	1	
2	Construction Manager	1	1	1	1	1	1	1	1	1	1	1	1	
3	Deputy Construction Manager	1	1	1	1	1	1	1	1	1	1	1	1	
4	HDR & Public Affair Manager	1	1	1	1	1	1	1	1	1	1	1	1	
5	Project Control / Planning Manager	1	1	1	1	1	1	1	1	1	1	1	1	
6	Quantity Surveyor	1	1	1	1	1	1	1	1	1	1	1	1	
7	Field Scheduler	1	1	1	1	1	1	1	1	1	1	1	1	
8	QA/QC Coordinator		1	1	1	1	1	1	1	1	1	1	1	
9	QA/QC Inspector					4	6	8	8	8	6	6	4	
10	Engineering Manager	1	1	1	1	1	1	1	1	1	1	1	1	
11	Disiplin Engineer	4	6	6	6	6	8	8	8	6	6	4	4	
12	CAD Operator	2	4	4	4	4	6	6	6	6	5	4	4	
13	Chief Surveyor	2	3	3	3	3	3	3	3	3	3	3	2	
14	Document Control	2	2	2	2	2	2	2	2	2	2	2	2	
15	Procurement Manager	1	1	1	1	1	1	1	1	1	1	1	1	
16	Expeditor		1	2	2	2	2	2	2	2	2	2	2	
17	Buyer		1	2	2	3	3	3	3	3	3	3	2	
18	Logistik		1	2	4	4	4	4	4	4	3	3	2	
19	HSE Manager		1	1	1	1	1	1	1	1	1	1	1	
20	HSE Coodinator		1	1	1	1	1	1	1	1	1	1	1	
21	Project Finance / Accounting	2	2	2	4	4	6	6	6	6	6	6	4	
22	Office Staff		4	4	6	6	8	8	8	8	6	6	6	
23	Driver	2	4	4	4	4	8	8	8	8	8	6	4	
24	Clerks / Secretary		4	4	4	4	6	6	6	6	4	4	4	
25	Office Eqp Operator		2	2	2	2	2	2	2	2	2	2	2	
26	Janitor		2	2	2	2	2	2	2	2	2	2	2	
B	**DIRECT LABOR**	**23**	**41**	**65**	**125**	**172**	**244**	**284**	**289**	**299**	**299**	**267**	**155**	
1	Surveyor	2	4	4	6	6	6	6	6	6	6	6	4	
2	Spread Boss (Superintendent)			2	2	2	2	2	2	2	2	2	2	
3	QA/QC Welding Engineer		2	2	2	2	2	2	2	2	2	2	2	
4	Field Engineers			2	2	3	3	3	3	3	3	3	2	
5	Cummunity Dev & HRD Supervisor	1	1	1	2	4	4	4	4	4	4	4	2	
6	Pipeline Foreman				4	6	8	8	8	10	10	8	6	
7	Civil Work Foreman					2	3	3	3	3	3	3	3	
8	Pipeline Welder (Cs)	0	0	4	15	15	30	30	30	30	30	20	10	
9	Structure Welder		2	2	2	2	2	2	2	4	4	4	2	
10	Pipe Fitters & Grinderman				10	20	20	40	45	45	45	30	10	
11	Mechanics		4	4	6	6	6	6	6	6	6	6	4	
12	Riger			4	4	4	4	4	4	4	4	4	2	
13	HE Operator			10	15	20	20	30	30	30	20	20	10	
14	Driver	10	10	10	17	26	30	30	30	30	30	30	26	
15	Material man		2	4	2	4	10	10	10	10	10	8	4	
16	Iron Woker						3	3	3	3	3	3	2	
17	Carpenter						6	6	6	6	6	6	2	
18	Mason						6	6	6	6	6	6	2	
19	Painter / Coater						4	4	4	4	4	4	2	
20	Skilled Labor / Helper		6	6	6	10	15	15	15	15	15	12	6	
21	Common Labor	10	10	10	30	40	60	70	70	70	70	70	40	
22	Pigging & Hydrotest										6	6	6	
23	Drying Specialist										4	4	4	
24	Operators									2	2	2	2	
25	HDD Team									4	4	4		
TOTAL INDIRECT LABOR		**23**	**48**	**51**	**57**	**62**	**78**	**80**	**80**	**78**	**70**	**65**	**56**	
TOTAL DIRECT LABOR		**23**	**41**	**65**	**125**	**172**	**244**	**284**	**289**	**299**	**299**	**267**	**155**	
TOTAL MANPOWER		**46**	**89**	**116**	**182**	**234**	**322**	**364**	**369**	**377**	**369**	**332**	**211**	

RIAU GFPP 250 MW PIPELINE PROJECT
EQUIPMENT LOADING
PIPELINE 48 KM # 12"

No.	Description	AMOUNT	MONTH												AMOUNT UNIT PER MONTH
			M-1	M-2	M-3	M-4	M-5	M-6	M-7	M-8	M-9	M-10	M-11	M-12	
1	Side Boom / Pipe Layer	5				2	5	5	5	5	5	5	5	4	4,6
2	Swamp Backhoe	2					2	2	2	2	2	2	2	2	2,0
3	Mobile Crane 40T	1					1	1	1	1	1	1	1	1	1,0
4	Dozer	2			1	1	1	1	2	2	2	2	1	1	1,4
5	Grader	2			1	1	1	1	2	2	2	2	1	1	1,4
6	Long Arm Excavator	1							1	1	1	1	1	1	1,0
7	Normal Excavator	15			2	4	8	10	15	15	15	15	10	8	10,2
8	Separate Ponton & Boot	0				0	0	0	0	0	0	0	0	0	-
9	Bending Machine 8 - 22 Inch	1				1	1	1	1	1	1	1	1	1	1,0
10	Welding Machine 500 A - 600 A	40	0	0	4	15	15	40	40	40	40	40	20	10	22,0
11	Truck Crane 5 T	3		1	2	2	3	3	3	3	3	3	2	2	2,5
12	High Bed Trailer + Prime Mover	6		2	2	2	6	6	6	6	6	4	2	2	4,0
13	Low Bed Trailer + Prime Mover	2		2	2	2	2	2	2	2	2	2	2	2	2,0
14	Dump Truck	2						2	2	2	2	2	2	1	1,9
15	Light Truct	6						4	4	4	6	6	6	4	4,9
16	Auger Boring	2									2	2	2	2	2,0
17	Thrust Boring	1									1	1	1	1	1,0
18	Compressor 1100 CFM	1										1	1	1	1,0
19	Compressor 750 CFM	2				2	2	2	2	2	2	2	2	2	2,0
20	Compressor 350 / 375 CFM	1					1	1	1	1	1	1	1	1	1,0
21	Generator Set 50 KVA	2		2	2	2	2	2	2	2	2	2	2	2	2,0
22	Generator Set 30 KVA	4		4	4	4	4	4	4	4	4	4	4	4	4,0
23	Fuel Truck	2		1	1	2	2	2	2	2	2	2	2	2	1,8
24	MPV Vehicle	15	3	3	10	10	15	15	15	15	15	15	15	5	11,3
25	SUV Vehicle	15	3	3	10	10	15	15	15	15	15	15	15	5	11,3
26	Crew Bus / Manhoul	6					4	4	4	6	6	6	4	2	4,5
27	Pick up Vehicle	2			2	2	2	2	2	2	2	2	2	2	2,0
28	Ambulance Vehicle	1		1	1	1	1	1	1	1	1	1	1	1	1,0
29	Concrete Mixcer 350 Ltr	4							4	4	4	4	4	2	3,7
30	Concret Vibrator	4							4	4	4	4	4	2	3,7
31	NDT Equipment Set	2					2	2	2	2	2	2	2	2	2,0
32	HDD Equipment Set	1										1	1	1	1,0
33	Hydrotest & Drying Equipment Set	1										1	1	1	1,0
34	Survey Equipment Set	2		2	2	2	2	2	2	2	2	2	2	2	2,0
35	Painting Tools Set	2				2	2	2	2	2	2	2	2	2	2,0
36	Fitter Tools Set	45				10	20	20	40	45	45	45	30	10	29,4
37	Civil Works Tools Set	3						3	3	3	3	3	3	1	2,7
38	Electrical Tools Set	2								2	2	2	2	2	2,0
39	Instrument Tools Set	2								2	2	2	2	2	2,0
40	HP Pumps Set	1											1	1	1,0
41	Water Filling Pump's	1											1	1	1,0
42	Internal Clamp's	4				4	4	4	4	4	4	4	4	4	4,0
TOTAL			**6**	**21**	**46**	**81**	**123**	**159**	**195**	**206**	**211**	**212**	**167**	**103**	



Station Staffing and Organisation Chart

Appendix C. ESIA Baseline Survey Terms of Reference (Dry)

Memorandum

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Adelaide SA 5000 Australia
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www.jacobs.com

Subject	Baseline Environmental Data Collection Terms of Reference (TOR)	**Project Name**	Riau 275 MW GFPP Project (Medco Ratch Power Riau)
Attention	NBC, Medco Ratch Power Riau	**Project No.**	AM039100
From	PT Jacobs Indonesia		
Date	05.07.17		

1. Introduction

This Baseline Environmental Data Collection Terms of Reference (TOR) has been developed by PT Jacobs Group Indonesia (PT JGI) to collect sufficient baseline data to quantify the receiving environmental and social baseline status for both the power plant site (including 700m of transmission line) and gas supply pipeline route for the Riau 250 MW CCGT Power Plant Project for the ESIA, and is in addition to the baseline sampling required under Indonesian legislation for the power plant AMDAL and the UKL/UPLs for the gas pipeline and transmission line . The project consists of a 275 MW combined cycle power plant and ancillary facilities, a 40 km long 12-inch gas pipeline, and a switchyard and 150 kV transmission line (750m) - collectively referred to hereafter as the 'Project'.

This TOR should be read in conjunction with the Riau Environmental and Social Impact Assessment (ESIA) – Scoping Report (to be completed), which provides details on the known existing environmental and social site conditions and explains the approach taken to ESIA.

2. Summary Project Description

The Project will be located approximately 10 km due east of Pekanbaru City, approximately 5 km south of the Siak River. The power plant and switchyard will be comfortably accommodated inside the 9 ha of land being procured by the Sponsors. The power plant is a 2 x 1 combined cycle plant, designed to deliver up to 275MW over the 20 year term of the PPA. It will burn gas fuel only. Key components of the project will comprise the following:

- Power generated by 2 x 1 combined cycle plant, delivering up to 275 MW;
- River water intake and outlet;
- Air emissions will be released to the atmosphere via 2 x 45 m tall, 3.8 m diameter chimneys;
- Wet mechanical draft cooling tower;
- Earthworks to level and raise the power plant platform to approximately 28m above mean sea level;
- Gas will be supplied from TGI Gas Station 40 km from the power plant via a 12 inch diameter pipeline; and
- a 150kV switchyard at the plant, with a 750 m double-phi connection to intercept the Tenayan – Pasir Putih 150 kV transmission line (TL).

2.1 Power Plant and Transmission Line

The power plant site is located to the east of Pekanbaru City, in Sail Sub District. The site bounded by palm oil plantation to the west, south and east and Road 45 on the North. The Project Sponsors proposes to construct a 750m long 150kV transmission line to tie in to Tenayan – Pasir Putih 150kV existing transmission line. Four transmission towers will be erected between the power plant and the existing transmission line. The proposed power plant and transmission line sites are shown in Appendix A.

2.2 Gas Pipeline Route

The gas supply line is approximately 46 km long from the PGN Gas Terminal Port at Perawang (Future Line of KP 457 – SV 1401.1 of the Grissik Duri Pipeline – coordinate: 47N 791885 E81526 (UTM Format)) to the gas receiving facility located within the Riau CCGT Power Plant at Tenayan district, Pekanbaru City, Riau Province. The proposed pipeline route is shown in Appendix C.

3. Baseline Sampling

3.1 Introduction

This TOR sets out the baseline survey environmental data that is required to be collected by NBC (hereafter referred to as 'the subconsultant'). It describes:

- The type of data to be collected by the baseline sampling surveys;
- The sampling locations, number of samples, sampling methodology to be followed and frequency of sampling;
- Analysis methods for ecological samples collected;
- Parameters that samples should be analysed for (water, sediment, soil and groundwater samples); and
- Reporting formats for the data collected.

3.2 Requirements of the Subconsultant

The baseline sampling as set out in this ToR will be conducted for the Environmental and Social Impact Assessment (ESIA) for the overall Project adhering to international Asian Development Bank (ADB) International Safeguards and is in additon to the baseline sampling conducted in accordance with Indonesian environmental regulations for the the power plant AMDAL and UKL/UPLs for the transmission line and gas pipeline. The ESIA baseline sampling will be conducted prior to the sampling required for the AMDAL and UKL/UPL.

The subconsultant is required to report on the progress of the baseline data collection surveys to PT JGI. The subconsultant shall provide informal fortnightly progress reporting (email) to PT JGI and monthly face to face meetings with PT JGI's Project Manager during the baseline data collection phase. The progress meetings between the subconsultant and PT JGI during this phase will confirm progress in the data collection, discuss outcomes of consultation undertaken and identify any issues in the collection of the baseline data, thus avoiding schedule/scope creep. For all surveys the raw data that underpins the statistical analysis undertaken as part of the survey should be provided.

Any issues encountered by the subconsultant that prevent the subconsultant undertaking the baseline survey by the method specified in this TOR or where data is not available or cannot be obtained must be advised to PT JGI as soon as the issue comes to the notice of the

subconsultant. PT JGI will then in discussions with the subconsultant and the Project Sponsors determine whether the data is required or an alternative survey method or modification to the proposed survey can be used.

The subconsultant will provide PT JGI with sampling and monitoring methodologies prior to undertaking the baseline data collection for review to ensure JGI's data requirements for the ESIA will be met.

A maximum of three months has been allowed in the ESIA preparation schedule for the undertaking of baseline studies, as the baseline surveys need to be completed before end of September 2017. At this stage we have only aloowed for dry season sampling and based on the findings limited wet season sampling may be required. The TOR may be changed based on environmental and social data currently being collected by the Project Sponsors, which will be made available to PT JGI for this Project.

4. Freshwater Aquatic Survey, including Water Quality

The subconsultant shall conduct a baseline survey to characterise regional freshwater communities and ecology of the Siak River and other water courses in the vicinity of the Project power plant, TL and gas pipeline route that includes:

- Fish;
- Macroinvertebrates;
- Algae and macrophytes;
- Aquatic habitats; and
- Water quality.

Water quality, and ecological (macroinvertebrate and net fishing) sampling of the above water courses is required at locations shown in Appendix B and Appendix D.

4.1 Water Quality Samples

4.1.1 Methodology

Water samples should be collected from the Siak River, an unnamed creek to the south of the proposed power plant site and from four watercourses along the gas pipeline route. Samples will be collected under dry season flow conditions at minimum two sampling locations (one upstream and one downstream). The proposed water quality sample locations are shown in Appendix B (power plant / TL) and Appendix D (gas pipeline route).

Samples will be collected and stored in accordance with the requirements specified in Government Regulation No. 82 Year 2001 regarding Water Quality Management and Pollution Control Class II (as minimum, unless otherwise regulated by local government regulation) and ISO 5667.6:2004 Water quality – Sampling Part: 6 Guidance on sampling of rivers and streams or its equivalent. The sampling will be conducted to determine the physical, chemical and biological parameters of the rivers prior to the power plant development. The parameters that the samples are to be analysed for are set in Table 4.1 below.

For metals the samples jars will be acid preserved. One set of metal samples will be for total metal and the water sample will be placed in the sample container without filtration. Another sample will be collected for soluble metals and the sample will be filtered to remove suspended solids in the field prior to it being placed in the container containing acid preservative. Laboratory analysis of water samples should be carried out in accordance with APHA method.

Organic parameters must be collected in glass jars and that only the first set of samples from each sampling location needs to be analysed for the organic parameters being organochlorine pesticides, Dioxins, Furans, other toxics such as PAH (Polycyclic Aromatic Hydrocarbons), and Polychlorinated Biphenyls (PCB). This would be for the first set of samples collected.

Table 4.1: Analysis Parameters for Water Samples

Parameter		Siak River	Unnamed Creek Connecting power Plant to Siak River	Spot sampling on watercourses crossed by proposed gas pipeline
pH		✓	✓	✓
Total Suspended Solids		✓	✓	✓
BOD		✓	✓	✓
COD		✓	✓	✓
Oil and Grease		✓	✓	✓
Arsenic		✓	✓	✓
Boron		✓	✓	✓
Cadmium		✓	✓	✓
Chromium	Hexavalent	✓	✓	✓
	Total	✓	✓	✓
Copper		✓	✓	✓
Iron		✓	✓	✓
Lead		✓	✓	✓
Mercury		✓	✓	✓
Manganese		✓	✓	✓
Nickel		✓	✓	✓
Zinc		✓	✓	✓
Soluble Heavy Metals (filtered) as per bulleted list above		✓	✓	✓
Ammonia		✓	✓	✓
Fluoride		✓	✓	✓
Total nitrogen		✓	✓	✓
Nitrate		✓	✓	✓
Nitrite		✓	✓	✓
Phosphorus		✓	✓	✓

Parameter	Siak River	Unnamed Creek Connecting power Plant to Siak River	Spot sampling on watercourses crossed by proposed gas pipeline
Total Coliform Bacteria	✓	✓	✓
Organochlorine pesticides	✓	×	×
Dioxins, Furans, other toxics such as PAH (Polyaromatic Hydrocarbons)	✓	×	×
Polychlorinated Biphenyls (PCB)	✓	×	×
Temperature	✓	✓	✓
Conductivity	✓	✓	✓
Turbidity (NTU)	✓	✓	✓

4.1.2 Sampling Frequency and Field Data

As a minimum, water samples should be collected from the identified sampling locations on at least two occasions during the dry season and on one occasion during the wet season (to be confirmed at the end of dry season sampling). Measurements of pH, temperature, dissolved oxygen and conductivity should be recorded in the field at the time the samples are collected. The date and time that the samples were collected and the weather conditions at the time of sampling and for the previous 24 hours should also be noted.

The flow rate of the river at each of the sampling point should be estimated at each sample location. At each sampling point the cross section of the river should be determined along with the velocity of the river at that point. Velocity can be determined by use of flow measuring device or by timing a device floating in the main current of the river between two points marked on the opposite bank. Cross sectional areas will need to be determined, depth and width of the river at the sampling points. Cross sections may be available from the survey of the rivers, which is to be conducted either as part of the baseline data collection by the subconsultant or by the power plant designers. If not they will need to be measured as part of the water sampling programme.

4.2 Freshwater Ecological Sampling

4.2.1 Macro-invertebrate Sampling

Macro-invertebrate sampling will be conducted at one location (unnamed creek near the power plant) and at one location on Siak River, as identified in Section 4.1 and shown in Appendix B. Sediment samples will collected at this location by grab or box corer methods. A total of three samples will collected at this point following a transect across the rivers. The sediment samples will be composited and a sample taken and sent to the laboratory to determine the chemical contaminants present in the sediments.

The benthic fauna will be treated in a standard manner - sieved through 1 mm mesh size, identified to species level and enumerated, weighed and subjected to ABC analyses. Abundance, species diversity and distribution frequency will be determined for each sampling location. The sampling should not be carried out within two weeks of a storm event as this has the potential to flush organisms out of their ecosystems and thereby potentially reducing the number of organisms present.

The sampling should be conducted by a recognised laboratory or university with the facilities to store and count the species. Sampling should be conducted following the guidance provided in the ANZECC Water Quality Guidelines for Fresh and Marine Waters, 2000.

A report will be provided setting out the sampling methodology followed, sample locations, raw data and the analysis of abundance and diversity.

4.2.2 Net Fishing

If appropriate, net fishing will be conducted at the upstream and downstream sampling locations identified for both the Siak River and other watercourses to determine the abundance and diversity of fish species in the rivers prior to the power plant development. Any protected species identified in the survey will need to be clearly identified so that the impact of effluent discharged to rivers from the power plant development can be assessed. The sampling should be conducted by a recognised laboratory or university with experience in conducting similar surveys.

4.3 Reporting

Reports on the baseline data collected by these studies will be prepared by the subconsultant and submitted to PT JGI within one month of the data collection being undertaken.

5. Terrestrial Ecology

The baseline survey will assist in determining the baseline for terrestrial ecosystems and the representative flora and fauna in each of the habitats at the power plant/TL site and the gas pipeline route. As a minimum, flora and fauna samples should be collected from a number of identified sampling locations along the gas pipeline route on at least one occasion during the dry season only. Due to the area being predominantly palm oil plantation and therefore low in biodiversity, it is considered that dry season sampling is only required for terrestrial ecology. Date and time that the samples were collected and the weather conditions at the time of sampling and for the previous 24 hours should be noted.

5.1.1 Site Survey Preparation – All Sites

The task includes review of background information on the locality, field work to survey habitats and species, and reporting of methodologies, results and conclusions. A literature review shall be conducted before carrying out field surveys. This will also include screening of international databases to identify international recognised key biodiversity risks such as designated or protected areas and threatened species. Specific tasks include:

1) Describing and mapping the various terrestrial habitats on the sites. This is to include the fish ponds if any.

2) Within each habitat, use internationally accepted, standard sampling techniques to identify:
   - Habitat type (wetland / agriculture / forest; intact / degraded / modified; man-made; significance of biodiversity – local, national, international). Include information on hydrology, soils or other habitat characteristics that are relevant.
   - Species - including introduced, indigenous, noxious pest or weed, economic value, significance – local, national, international. The significance of species shall be noted in the report.
   - Note the ecological uses of the site for significant faunal species (i.e. feeding, nesting, migrating)

3) Sampling techniques shall be adequate to provide a detailed list of species, abundance, and habitats condition using primarily visual and aural methods. Trapping, handling, specimen collection of species is not expected as part of this study (except for the fish survey, as discussed above).

4) Type of survey will include:
   a) Vegetation / flora;
   b) Avifauna (birds);
   c) Herpetofauna (amphibians and reptiles);
   d) Mammals

5.1.2 Survey methodologies

Vegetation / flora

A preliminary land-use/habitat classification of the study area shall be prepared in GIS by interpretation of satellite imaginary and/or aerial photography. This information shall be used to stratify the vegetation and habitat types for further detailed survey. Stratification is necessary to ensure that the full range of potential habitats and vegetation types are systematically sampled. Stratification shall consider land-use, elevation and vegetation type (shrub, cleared agriculture / plantation / off-stream wetlands).

Power Plant / TL

Habitat classification maps will be ground-truthed through a combination of walked transects through habitat-types to provide further detailed information on vegetation boundaries, floristic diversity and the possible presence of rare and threatened plants.

Walked transect surveys shall aim to record all plant species within the vicinity of the Project. There will be 3-4 transects for the power plant / TL site. Particular attention shall be paid to the dominant, rare, endemic, threatened, protected, invasive species, and the species that are of importance to local communities. Locations of rare or threatened plant species shall be identified using a GPS and data on the size and distribution of the population shall be recorded.

The following general data shall be along each route:

- location using handheld GPS to record coordinates;
- photographs showing habitat structure and any notable plant species;
- habitat types and structure.

Additional habitat conditions data shall be recorded per transect, including the level of modification or disturbance of habitat found per transect and this shall be assessed according to the following grading:

- relatively stable or undisturbed communities (e.g. old growth, unlogged forest);
- late successional or lightly disturbance communities (e.g. old growth mangrove swamp that was selectively logged in recent years);
- mid-successional or moderately to heavily disturbed communities (e.g. young to mature secondary forest); and
- early successional or severely disturbed communities.

Gas Pipeline Route

The gas pipeline route will be driven with all habitats recorded in detail on route. In areas of notable floristic diversity, the site will be assessed in more detail with 100m transects running perpendicular to the road. Notable species will be recorded as above for the power plant / TL site.

Avifauna

Power Plant / TL

The survey shall focus on sampling bird species' richness and abundance located within the range of different habitat strata present. Line transects surveys will be used with a point count method. There will be 3-4 for the power plant / TL site.

Transect surveys and point count surveys involving a 20 minute time-based survey and each transect/point to record all birds seen or heard within a 50 m radius of the census point. Bird surveys shall be conducted within four hours of sunrise to sample peak activity time and surveys shall avoid adverse weather (e.g. high wind or rain). Geographic coordinates shall be recorded at each survey point

Observations on birds shall be done primarily through visual observation and call identification. Nests and important food source/trees for any protected and rare species shall be recorded and captured with GPS. Where possible, surveys will also cover the foreshore area for seabirds.

Gas Pipeline Route

The gas pipeline route will be driven with all habitats recorded in detail on route. In areas of notable potential for avifauna, the site will be assessed in more detail with 100m transects running perpendicular to the road, on the same side as that the pipeline will run. Notable species will be recorded as above for the power plant / TL site.

Herpetofauna

Power Plant / TL

The type and number of reptile and amphibian species shall be recorded during the walked transect surveys. Areas of high concentrations of individuals shall be captured with GPS. Study area and observations of significance shall be photographed.

Gas Pipeline Route

The gas pipeline route will be driven with all habitats recorded in detail on route. In areas of notable potential for herpetofauna, the site will be assessed in more detail with 100m transects running perpendicular to the road, on the same side as that the pipeline will run. Notable species will be recorded as above for the power plant / TL site.

Mammals

Power Plant / TL

The type and number of mammal species shall be recorded during the walked transect surveys. Visual identification of animals, refuges, scat or other signs is expected. It is not deemed necessary to use camera traps in this study.

Gas Pipeline Route

The gas pipeline route will be driven with all habitats recorded in detail on route. In areas of notable potential for mammals, the site will be assessed in more detail with 100m transects running perpendicular to the road, on the same side as that the pipeline will run. Notable species will be recorded as above for the power plant / TL site.

5.1.3 Reporting

Reports delivered by subconsultants shall include the follows:

- Background context, from desk top study.
- Sampling methodology including limitations to methodology (weather, season, timeframe, sampling biases, etc.). Cite references for standard sampling methodologies.
- Results, including species lists and abundance (including indigenous and introduced), observations of refuges / nests etc., significant habitats or species (rare, threatened, noxious etc.), ecosystem uses for key species (nesting, migrating, foraging etc.).
- Conclusions on the significant issues or factors that should be addressed in the environmental impact assessment study, including recommendations for further study work if required.

6. Groundwater Resources (Power Plant Only)

6.1 Collect and Review Background Information

Background information needs to be obtained by the subconsultant on the existing groundwater use and hydrogeological characteristics of the power plant site. Data required to be obtained as part of this assessment includes:

- Determine the location, depth and groundwater levels (both static and pumping levels if available) of existing groundwater /bores and wells within two kilometres of the site.
- Obtain available geological and construction information for bores/wells within two kilometres of the power plant site. Bore construction data may include information on bore casing, well screens, and pump installation, such as depth, diameter, material types, screen slot sizes, and pump specifications.
- Determine the locations of existing groundwater users in nearby villages.
- Advise PT JGI what data is available and whether it is sufficient to prepare hydrogeological maps.
- Prepare hydrogeological maps if there is sufficient data available that show the locations of existing boreholes in relation to the proposed power station and ash disposal site. These maps should clearly identify existing groundwater supply bores, surface geology, groundwater catchment boundary, and hydrogeological features (e.g. springs).
- Determine seasonal fluctuation of the groundwater levels from either existing monitoring data, or undertake regular water level monitoring of accessible bores.
- Arrange and undertake a water sampling programme of three bores/wells within one kilometre of the proposed site to determine baseline water quality of the groundwater system surrounding the project site. Selection of appropriate sampling sites will be undertaken in discussions with PT JGI based on the results of the above review and will target wells which have information on geology, bore construction and yield. It will likely include a borehole drilled on the project site, assuming that this has accessible piezometer installation. A total of three water samples are to be collected once the well volume has

sufficiently purged such that field parameters (pH, total dissolved solids, temperature) have stabilised. The samples are to be analysed for the same parameters as set out in Table 4.1, excluding dioxins**.**

6.2 Reporting

The subconsultant shall provide the base datasets identified above to PT JGI in appropriate electronic format to enable data manipulation and integration. These data will be used by PT JGI to develop a preliminary conceptual understanding of the hydrogeology of the area surrounding the site. The results of this work will be used to refine the scope and specific requirements for additional investigations and ongoing base data collection to be undertaken.

7. Contaminated Land (Power Plant Only)

Surface soil samples to a depth of 300m are to be collect at the power plant area and analysed for pesticides being organochlorine, organophosphorous and organo nitrous. A total of 10 soil samples on a grid based system shall be collected and analysed.

8. Air Quality

8.1 Ambient Air Quality

The construction activities for both the power plant/TL and the have the potential to adversely impact on the ambient air quality therefore baseline monitoring should be undertaken by the subconsultant at a selection of potentially sensitive sites that could be affected by the construction activities.

The monitoring sites must be located in suitable areas that comply with the guidelines set out in Australian Standard AS 2922 Ambient Air – Guide for the Siting of Sampling Units 1987. The purpose of AS 2922 is to ensure that the location of the sampling site is such that the collected data is representative of that location. The standard has a number of guidelines to facilitate the site location conformity. The guidelines also outline sites to avoid including those that:

- Restrict airflows in the vicinity of the sampling inlet.
- May alter pollutant concentrations by adsorption or absorption.
- Chemical interference with the pollutant being measured may occur.
- Physical interference may produce atypical results.

Consideration is also given to vandalism, adequate access, services and local activities when selecting a site. In addition, for the data to be applicable to human health the sampling inlet should be located near the breathing zone, i.e. around 1 to 2 m above ground level.

Figure 7.1 of AS 2922 documentation and shows the generalised layout and guidelines for a typical sampling site. It is noted that security is an issue in respect to the sampling equipment and local schools, mosques or other relatively secure sites should be used. Discussions should be entered with village chiefs to fine secure sites.

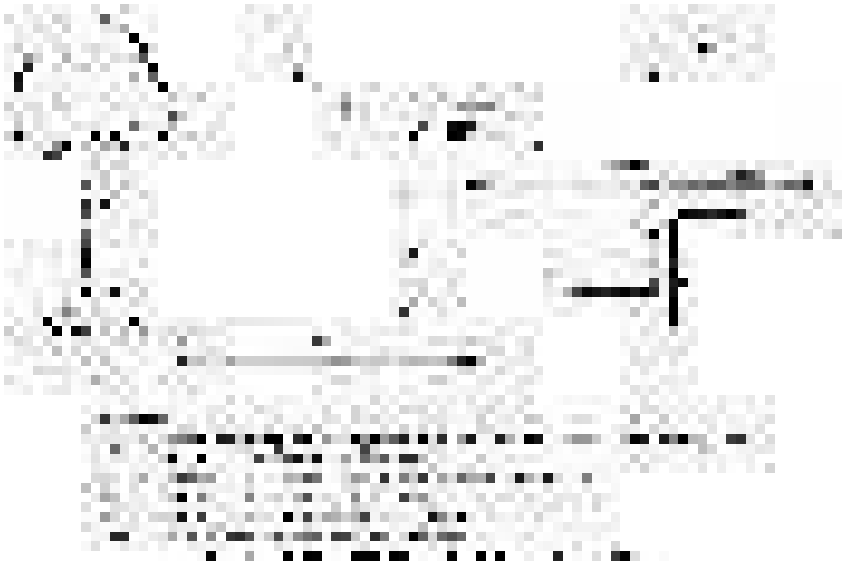


Figure 7.1: Generalised Ground Level Sampling Site

At this initial stage it is proposed that the following monitoring is conducted at the two sites:

- PM10/Total suspended particulate using high volume sampler or low volume method.
- Nitrogen dioxide by either active sampling or by passive diffusion tubes

8.1.1 PM_{10}/PM2.5Total Suspended Particulate

PM10 and PM2.5 will be collected at each of the monitoring sites following Method IO-2.1 Sampling of Ambient Air for PM10 and PM2.5 Using High Volume (HV) Sampler. Ambient air is drawn at a known flow rate through a prepared filter via a PM10 and a PM2.5 inlet, which effectively acts as a hood to prevent precipitation and debris from falling onto the filter. . The sample volume is calculated from the average flow rate and sample duration. The material collected on the filter is determined gravimetrically. Sampling duration is for a 24-hour period.

Sampling would be carried out twice a month for a minimum of three months at each of the monitoring sites.

Subconsultant is to advise which method will be followed and when sampling can commence.

8.1.2 Passive Sampling

Table 7-1 lists the gaseous pollutants to be measured using integrated passive samplers. It also lists a brief description of the reaction occurring in each passive sampler, the analytical method used to measure the reacted product, the sensitivity required, and references for the method discussed. Weather shields have been installed at all sites to protect the passive sampler units.

Table 7.1: Passive Sampling Methods

Pollutant	Reaction & Analysis	Detection Limit
NO_2	Nitrogen (NO_2) is chemiadsorbed onto TEA as nitrite. Nitrite is quantified by visible spectrophotometry. Sampling is selective for gaseous molecules. Any airborne nitrite will not cross the diffusive membrane.	± 2 ppb for 14 day mean

The radiello passive samplers will be exposed for 14 day periods for the three months prior to site works commencing at each of the four monitoring sites. For AMDAL requirements the monitoring will be for one 24 hour period per month.

9. Noise

9.1 Methodology

Construction and operational activities have the potential to adversely impact on the noise environment therefore baseline monitoring should be undertaken by the subconsultant at a selection of noise sensitive sites affected by the activities. These locations must be situated away from existing noise sources such as roads or industry and be representative of the ambient noise environment. Samples will be collected in accordance with the requirements specified in the WBG EHS General ..

Long-term measured background noise levels over a minimum period of 48 hours of good weather should be undertaken to provide information on the background noise environment in the absence of industrial or extraneous noise sources. The subconsultant in their Baseline Noise Report should comment on any current activities near the pipeline sites that may cause a background level of noise and ground vibration (e.g. other industry, railway, major roads, etc.).

The daily variation of background noise levels recorded every 15 minutes at nearby noise sensitive sites should be recorded and reported as mean daily noise levels in the Baseline Noise Report with particular regard to the different periods of the day and night. The survey conditions, meteorology, location and results for each location for the baseline monitoring should also be recorded and included in the Baseline Noise Report. Noise measurements were performed by integrating sound level meter which have facilities L_{TMS}, namely L_{eq} recorded every 5 seconds for 60 minutes measurement. Measurements were taken during the 24-hour activity (L_{SM}). Each measurement should be able to represent a certain time interval with a set of at least four time measurements during the day and three at night time measurements, such as the following example:

- L_1 measured at 07:00 to 08:00 to represent at 06:00 to 9:00
- L2 measured at 10:00 to 11:00 to represent at 09:00 to 11:00
- L3 measured at 15:00 to 16:00 to represent at 14:00 to 17:00
- L4 measured at 20:00 to 21:00 to represent at 17:00. to 22:00
- L5 measured from 23.00 to 24.00 for representing 22.00 to 24.00
- L6 measured at 1:00 to 2:00 for representing 24.00 - 3:00
- L7 measured at 4:00 to 5:00 to represent at 03:00 to 6:00

Where possible, sufficient noise data should be collected to account for variations in seasonal and meteorological conditions. This will provide a baseline for comparison of predicted noise levels as well as information to be used in later studies.

9.2 Sampling locations – Power Plant

The noise sample locations should represent all potentially affected receivers. This will typically be residential properties and excludes unoccupied buildings and should be continuous over at least four days. It should also cover seasonal variations (however as the location is equatorial, this may not be relevant). The sites for noise monitoring are as following (also shown in Appendix B):

1) Rural property to the north (affected by existing PS noise)

2) Rural property to the south (unaffected by existing PS noise)

3) Outskirts of Penkanbaru to the west

4) Outskirts of Penkanbaru to the south

9.3 Sampling locations – Gas Pipeline Route

Noise monitoring along the gas pipeline should be representative of the main noise environments along the route. This monitoring can be a single 15 minute period at each location, however if night works are proposed, monitoring should also be done at night. The sites for noise monitoring are as following (also shown in Appendix D):

1) Outskirts of Penkanbaru close to the proposed pipeline route

2) Rural environment

3) River crossing

4) Outskirts of Jln Koperasi

5) Close to main road (Ji Raya Minas Perawang)

9.4 Reporting

A short Baseline Noise Report will be prepared setting out the above data and provided to PT JGI along with the raw noise monitoring data to enable a noise impact assessment to be prepared. The subconsultant will provide technical details (specification) of the proposed sound level meter to be used, so that PT. JGI can check that it will produce the data required.

10. Social and Economic

10.1 General

The subconsultant will collect data on the current farming activities in the vicinity of the power plant site, TL and gas pipeline route. This includes:

- A breakdown of the crops being grown, number of hectares covered and the annual tonnages harvested and the number of local people who farm or are supported by these fields.
- Demographic data on the number of people involved in the farming activities, where they reside, and age profile.

The subconsultant is required to collect information on:

- Historical settlement of the area and traditional activities;
- Known archaeological sites within two kilometre radius of the gas supply pipeline;
- Traditional and present-day social and tribal structures in the proposed sites;
- Identify and describe of sites of cultural and heritage importance within two kilometre radius of the power plant site, TL and gas pipeline route;
- Determine the values(importance) placed on these sites in terms of local, regional and national significance;
- Identify and record existing activities of cultural and heritage value within two kilometre radius of the power plant site, TL and gas pipeline route;
- Identify potential effects of the proposed power plant site, TL and gas pipeline route on the cultural and heritage sites and values;

- The views of the key local, regional and national groups, as relevant on the heritage and cultural sites near the site; and
- Provide a report that sets out the methodology used to collect the baseline data and the data collect in respect to cultural activities and heritage sites in the surrounding area.

10.2 Public Health

The subconsultant is required to collect information on:

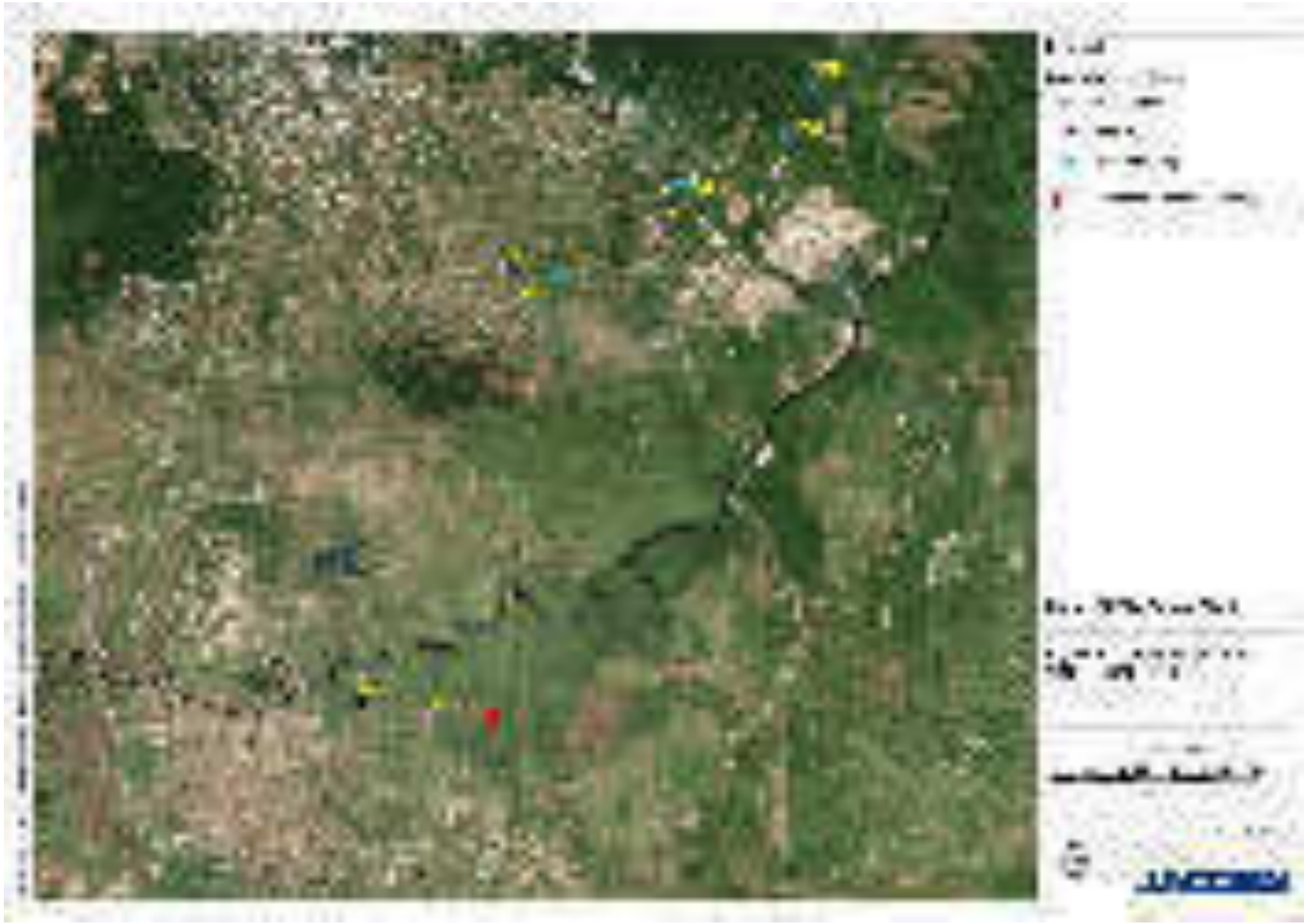
- Historical information of public health in the vicinity of the power plant site, TL and gas pipeline route, to include:
  - Identify and describe of type of public disease on the area;
  - Determine the values (dominance) of the disease on the area;
  - Identify public health facilities to include availability of health worker on the area;
  - Identify potential effects of the proposed transmission line on community public health; and
  - Provide a report that sets out the methodology used to collect the baseline data and the data collect in respect to public health in the surrounding area.

Appendix 1 Proposed Location of Power Plant and Transmission Line

Appendix 2 Proposed Sampling Locations – Power Plant

Appendix 3 Proposed Location of Gas Pipeline Route

Appendix 4 Proposed Sampling Locations – Gas Pipeline



Appendix D. ESIA Baseline Survey Terms of Reference (Wet)

Memorandum

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Subject	Baseline Environmental Data Collection Terms of Reference (ToR) – Wet Season and Gas Pipeline	**Project Name**	Riau 275 MW GFPP Project (Medco Ratch Power Riau)
Attention	NBC, Medco Ratch Power Riau	**Project No.**	IZ095300
From	Jacobs		
Date	22.12.17		

1. Introduction

Dry season sampling for the power plant site has been completed and there is now a new gas pipeline route. This Baseline Environmental Data Collection Terms of Reference (ToR) has been developed by Jacobs New Zealand (Jacobs) to collect further baseline data to quantify the receiving environmental and social baseline status over the wet season for both the power plant site (including 750 m of transmission line) and the new gas pipeline route. This sampling is required for the ESIA, and is in addition to the baseline sampling required under Indonesian legislation for the power plant AMDAL and the UKL/UPLs for the gas pipeline and transmission line.

The project consists of a 275 MW combined cycle power plant and ancillary facilities, a 40 km long 12-inch gas pipeline, and a switchyard and 150 kV transmission line (750 m) - collectively referred to hereafter as the 'Project'.

This ToR should be read in conjunction with the Riau Environmental and Social Impact Assessment (ESIA) – Scoping Report, which provides details on the known existing environmental and social site conditions and explains the approach taken to ESIA.

2. Baseline Sampling

2.1 Introduction

This ToR sets out the baseline survey environmental data that is required to be collected by NBC (hereafter referred to as 'the subconsultant'). It describes:

- The type of data to be collected by the baseline sampling surveys;
- The sampling locations, number of samples, sampling methodology to be followed and frequency of sampling;
- Analysis methods for ecological samples collected;
- Parameters that samples should be analysed for (water, sediment, soil and groundwater samples); and
- Reporting formats for the data collected.

2.2 Requirements of the Subconsultant

The subconsultant is required to report on the progress of the baseline data collection surveys to Jacobs. The subconsultant shall provide informal weekly progress reporting (email) to Jacobs and monthly face to face meetings with Jacobs Project Manager during the baseline data collection phase. For all surveys the raw data that underpins the statistical analysis

undertaken as part of the survey should be provided. To align with the ESIA schedule, the baseline surveys need to commence in mid-January 2018 and be conducted over a maximum four-week period with all results and analysis provided to Jacobs by end of February 2018.

Any issues encountered by the subconsultant that prevent the subconsultant undertaking the baseline survey by the method specified in this ToR or where data is not available or cannot be obtained must be advised to Jacobs as soon as the issue comes to the notice of the subconsultant. Jacobs will then in discussions with the subconsultant and the Project Sponsors determine whether the data is required or an alternative survey method or modification to the proposed survey can be used.

It is assumed that the sampling and monitoring methodologies to be followed by the subconsultant is the same as the previously agreed for the dry season sampling. Any change in methodology should be agreed with Jacobs before sampling commences.

3. Freshwater Ecology and Water Quality

The subconsultant shall conduct a baseline survey to characterise regional freshwater communities and ecology of the Siak River and three other watercourses the gas pipeline route will cross.

The survey will include:

- Fish;
- Macroinvertebrates;
- Algae and macrophytes;
- Freshwater habitats; and
- Water quality.

3.1 Water Quality Samples

3.1.1 Methodology

Water quality sampling will be undertaken at the following locations (also shown in Appendix 1 and Appendix 2):

- WQ2 (Siak River);
- WQ3 (Siak River);
- WQ5 – Proposed jetty location (Siak River – new location);
- RW1 (gas pipeline route);
- RW2 (gas pipeline route); and
- RW3 (gas pipeline route).

Samples will be collected and stored in accordance with the requirements specified in Government Regulation No. 82 Year 2001 regarding Water Quality Management and Pollution Control Class II (as minimum, unless otherwise regulated by local government regulation) and ISO 5667.6:2004 Water quality – Sampling Part: 6 Guidance on sampling of rivers and streams or its equivalent. The sampling will be conducted to determine the physical, chemical and biological parameters of the rivers prior to the power plant development. The parameters that the samples are to be analysed for are set in Table 3.1 below.

For metals the samples jars will be acid preserved. One set of metal samples will be for total metal and the water sample will be placed in the sample container without filtration. Another set of samples collected will be for soluble metals at the same sampling location and the sample will be filtered to remove suspended solids in the field prior to it being placed in the container containing acid preservative. Laboratory analysis of water samples should be carried out in accordance with APHA method.

Organic parameters must be collected in glass jars and that only the first set of samples from each sampling location needs to be analysed for the organic parameters being organochlorine pesticides, Dioxins, Furans, other toxics such as PAH (Polycyclic Aromatic Hydrocarbons), and Polychlorinated Biphenyls (PCB). This would be for the first set of samples collected.

Table 3.1: Analysis Parameters for Water Samples

Parameter		Siak River	Spot sampling on watercourses crossed by proposed gas pipeline
pH		✓	✓
Total Suspended Solids		✓	✓
BOD		✓	✓
COD		✓	✓
Oil and Grease		✓	✓
Arsenic		✓	✓
Boron		✓	✓
Cadmium		✓	✓
Chromium	Hexavalent	✓	✓
	Total	✓	✓
Copper		✓	✓
Iron		✓	✓
Lead		✓	✓
Mercury		✓	✓
Manganese		✓	✓
Nickel		✓	✓
Zinc		✓	✓
Soluble Heavy Metals (filtered) as per bulleted list above		✓	✓
Ammonia		✓	✓
Fluoride		✓	✓

Total nitrogen	✓	✓
Nitrate	✓	✓
Nitrite	✓	✓
Phosphorus	✓	✓
Total Coliform Bacteria	✓	✓
Organochlorine pesticides	✓	×
Polychlorinated Biphenyls (PCB)	✓	×
Temperature	✓	✓
Conductivity	✓	✓
Turbidity (NTU)	✓	✓

3.1.2

Sampling Frequency and Field Data

Measurements of pH, temperature, dissolved oxygen and conductivity should be recorded in the field at the time the samples are collected. The date and time that the samples were collected and the weather conditions at the time of sampling and for the previous 24 hours should also be noted.

3.2 Freshwater Ecological Sampling

Freshwater ecological sampling will be undertaken at the following locations (also shown in Appendix 1 and Appendix 2):

- WQ2 (Siak River);
- WQ3 (Siak River);
- WQ5 – Proposed jetty location (Siak River – new location);
- RW1 (gas pipeline route);
- RW2 (gas pipeline route); and
- RW3 (gas pipeline route).

3.2.1 Macro-invertebrate Sampling

Macro-invertebrate samples will be collected by grab or box corer methods. A total of three samples will collected following a transect across the watercourses.

The benthic fauna will be treated in a standard manner - sieved through 1 mm mesh size, identified to species level and enumerated, weighed and subjected to ABC analyses. Abundance, species diversity and distribution frequency will be determined for each sampling location. The sampling should not be carried out within two weeks of a storm event as this has the potential to flush organisms out of their ecosystems and thereby potentially reducing the number of organisms present.

The sampling should be conducted by a recognised laboratory or university with the facilities to store and count the species. Sampling should be conducted following the guidance provided in the ANZECC Water Quality Guidelines for Fresh and Marine Waters, 2000.

3.2.2 Sediment Sampling

Sediment samples will be taken using a grab or box corer method at the following locations:

- WQ5 – proposed jetty location;
- RW1; and
- RW2.

The samples will be sent to the laboratory to determine the chemical contaminants present in the sediments based on parameters identified in Table 3.1.

3.2.3 Net Fishing

If appropriate, net fishing will be conducted at the upstream and downstream sampling locations identified for both the Siak River and other watercourses to determine the abundance and diversity of fish species in the rivers prior to the power plant development. Any protected species identified in the survey will need to be clearly identified so that the impact of effluent discharged to rivers from the power plant development can be assessed. The sampling should be conducted by a recognised laboratory or university with experience in conducting similar surveys.

3.3 Reporting

Reports on the baseline data collected by these studies will be prepared by the subconsultant and submitted to Jacobs within one month of the data collection being undertaken.

4. Terrestrial Ecology

The baseline survey will assist in determining the baseline for terrestrial ecosystems and the representative flora and fauna in each of the habitats at the power plant/TL site (to include the proposed jetty, the water intake and water pipeline areas) and the gas pipeline route. Sampling of the power plant during the wet season should be collected from the same locations at the power plant site that were conducted during the dry season but should include the new transmission route. Sampling of the gas pipeline should be along the new route as show in Appendix 1. Date and time that the samples were collected and the weather conditions at the time of sampling and for the previous 24 hours should be noted.

4.1.1 Site Survey Preparation – All Sites

The task includes review of background information on the locality, field work to survey habitats and species, and reporting of methodologies, results and conclusions. Specific tasks include:

1) Describing and mapping the various terrestrial habitats on the sites. This is to include the fish ponds if any.

2) Within each habitat, use internationally accepted, standard sampling techniques to identify:
    - Habitat type (wetland / agriculture / forest; intact / degraded / modified; man-made; significance of biodiversity – local, national, international). Include information on hydrology, soils or other habitat characteristics that are relevant;
    - Species - including introduced, indigenous, noxious pest or weed, economic value, significance – local, national, international. The significance of species shall be noted in the report; and

- Note the ecological uses of the site for significant faunal species (i.e. feeding, nesting, migrating).

3) Sampling techniques shall be adequate to provide a detailed list of species, abundance, and habitats condition using primarily visual and aural methods. Trapping, handling, specimen collection of species is not expected as part of this study (except for the fish survey, as discussed above).

4) Type of survey will include:
   a) Vegetation / flora;
   b) Avifauna (birds);
   c) Herpetofauna (amphibians and reptiles);
   d) Mammals

4.1.2 Survey methodologies for Power Plant and Transmission Line

Vegetation / flora

The surveys will comprise walked transects through habitat-types to provide detailed information on vegetation boundaries, floristic diversity and the possible presence of rare and threatened plants.

Walked transect surveys shall aim to record all plant species within the vicinity of the Project. Particular attention shall be paid to the dominant, rare, endemic, threatened, protected, invasive species, and the species that are of importance to local communities. Locations of rare or threatened plant species shall be identified using a GPS and data on the size and distribution of the population shall be recorded.

The following general data shall be along each route:

- location using handheld GPS to record coordinates;
- photographs showing habitat structure and any notable plant species; and
- habitat types and structure.

Additional habitat conditions data shall be recorded per transect, including the level of modification or disturbance of habitat found per transect and this shall be assessed according to the following grading:

- relatively stable or undisturbed communities (e.g. old growth, unlogged forest);
- late successional or lightly disturbance communities (e.g. old growth mangrove swamp that was selectively logged in recent years);
- mid-successional or moderately to heavily disturbed communities (e.g. young to mature secondary forest); and
- early successional or severely disturbed communities.

Avifauna

The survey shall focus on sampling bird species' richness and abundance located within the range of different habitat strata present. Line transects surveys will be used with a point count method.

Transect surveys and point count surveys involving a 20 minute time-based survey and each transect/point to record all birds seen or heard within a 50 m radius of the census point. Bird surveys shall be conducted within four hours of sunrise to sample peak activity time and surveys shall avoid adverse weather (e.g. high wind or rain). Geographic coordinates shall be recorded at each survey point

Observations on birds shall be done primarily through visual observation and call identification. Nests and important food source/trees for any protected and rare species shall be recorded and captured with GPS.

Herpetofauna

The type and number of reptile and amphibian species shall be recorded during the walked transect surveys. Areas of high concentrations of individuals shall be captured with GPS. Study area and observations of significance shall be photographed.

Mammals

The type and number of mammal species shall be recorded during the walked transect surveys. Visual identification of animals, refuges, scat or other signs is expected. It is not deemed necessary to use camera traps in this study.

4.1.3 Survey Methodology for Gas Pipeline Route

An ecological specialist from Jacobs and the subconsultant will conduct an initial screening survey of the gas pipeline route. The screening survey will identify habitats and areas of vegetation along the route that the subconsultant will focus further detailed terrestrial ecology surveys in accordance with the methodologies outlined in Section 4.1.2 above. These areas may include scrub and fringes of regrow and secondary forest, where observational sampling is required which covers dawn and dusk periods. This should be repeated every five km on paved road and every one km on plantation roads. Where the pipeline goes through palm oil plantations transects/quadrats will be run perpendicular to the pipeline.

4.1.4 Reporting

Reports delivered by subconsultants shall include the follows:

- Sampling methodology including limitations to methodology (weather, season, timeframe, sampling biases, etc.). Cite references for standard sampling methodologies;
- Results, including species lists and abundance (including indigenous and introduced), observations of refuges / nests etc., significant habitats or species (rare, threatened, noxious etc.), ecosystem uses for key species (nesting, migrating, foraging etc.); and
- Conclusions on the significant issues or factors that should be addressed in the environmental impact assessment study, including recommendations for further study work if required.

5. Soils

The subconsultant will undertake soil sampling at four locations along the gas pipeline route, to be identified by the subconsultant and agreed with Jacobs. The locations samples should be adjacent to the road and not within plantation areas. The soil sampling will comprise the following:

- Using a hand auger, a soil sample will be taken and tested for parameters outlined in Table 5.1 below.

Table 5.1: Analysis Parameters for Soil Samples

Parameter
Arsenic
Boron
Cadmium
Chromium
Copper
Iron
Lead
Mercury
Manganese
Nickel
Zinc
Organochlorine pesticides
PAH
PCB

6. Groundwater Resources

6.1 Power Plant

6.1.1 Collect and Review Background Information

Use background information obtained by the subconsultant from dry season sampling on the existing groundwater use and hydrogeological characteristics of the power plant site. Data required to be obtained as part of this assessment includes:

- Undertake a water sampling programme of the bores/wells previously sampled from dry season sampling to determine baseline water quality of the groundwater system surrounding the project site during the wet season. A total of three water samples are to be collected once the well volume has sufficiently purged such that field parameters (pH, total dissolved solids, temperature) have stabilised. The samples are to be analysed for the same parameters as set out in Table 3.1, excluding dioxins.

6.1.2 Reporting

The subconsultant shall provide the base datasets identified above to Jacobs in appropriate electronic format to enable data manipulation and integration. These data will be used by Jacobs to develop a preliminary conceptual understanding of the hydrogeology of the area surrounding the site. The results of this work will be used to refine the scope and specific requirements for additional investigations and ongoing base data collection to be undertaken.

6.2 Gas Pipeline

6.2.1 Collect and Review Background Information

Background information needs to be obtained by the subconsultant on the existing groundwater use and hydrogeological characteristics of the gas pipeline route. Data required to be obtained as part of this assessment includes:

- Determine the locations of existing groundwater users in nearby villages that the pipeline route runs through or is 50 – 100 m distance from.
- Determine the location, depth and groundwater levels (both static and pumping levels if available) of existing groundwater /bores and wells within 50 – 100 m of the pipeline route.
- Obtain available geological and construction information for bores/wells within 50 – 100 m of the pipeline route. Bore construction data may include information on bore casing, well screens, and pump installation, such as depth, diameter, material types, screen slot sizes, and pump specifications.
- Arrange and undertake a water sampling programme of bores/wells identified as being within 50 – 100 m of the pipeline route to determine baseline water quality of the groundwater system along the pipeline route. Selection of appropriate sampling sites will be undertaken in discussions with Jacobs based on the results of the above review and will target wells which have information on geology, bore construction and yield. A total of three water samples are to be collected once the well volume has sufficiently purged such that field parameters (pH, total dissolved solids, temperature) have stabilised. The samples are to be analysed for the same parameters as set out in Table 3.1, excluding dioxins**.**

6.2.2 Reporting

The subconsultant shall provide the base datasets identified above to Jacobs in appropriate electronic format to enable data manipulation and integration.

7. Air Quality

7.1 Ambient Air Quality

Air quality monitoring will be undertaken as follows:

- The monitoring sites at the power plant will be the same as those undertaken during the dry season monitoring (as outlined in Appendix 1) including:
  - AQ1 – AQ4: NO_2; and
  - AQ5 and AQ6: PM10 and PM2.5.
- Sampling will be conducted at 3 locations along the pipeline route (AQ1, AQ2 and AQ3) as outlined in Appendix 2.
- The locations must be located in suitable areas that comply with the guidelines set out in Australian Standard AS 2922 Ambient Air – Guide for the Siting of Sampling Units 1987.

7.1.1 PM_{10}/PM2.5Total Suspended Particulate

- PM10 and PM2.5 will be collected at each of the monitoring sites:
  - AQ 5 and 6 – Power Plant and Transmission Line; and
  - AQ1 – AQ3 – Gas pipeline.
- Method IO-2.1 Sampling of Ambient Air for PM10 and PM2.5 Using High Volume (HV) Sampler will be used;
- Sampling will be carried out twice a month for one month at each of the power plant monitoring sites; and
- Sampling will be conducted twice at each of the gas pipeline locations over a two-week period.

7.1.2 Passive Sampling

Table 7.1 lists the gaseous pollutants to be measured using integrated passive samplers. It also lists a brief description of the reaction occurring in each passive sampler, the analytical method used to measure the reacted product, the sensitivity required, and references for the method discussed. Weather shields have been installed at all sites to protect the passive sampler units.

Table 7.1: Passive Sampling Methods

Pollutant	Reaction & Analysis	Detection Limit
NO_2	Nitrogen (NO_2) is chemiadsorbed onto TEA as nitrite. Nitrite is quantified by visible spectrophotometry. Sampling is selective for gaseous molecules. Any airborne nitrite will not cross the diffusive membrane.	± 2 ppb for 14 day mean

The radiello passive samplers will be exposed for 14 day periods at the power plant sampling locations (AQ1 – AQ4).

8. Noise

8.1 Sampling locations – Gas Pipeline Route

Noise monitoring is required along the new gas pipeline route only and will follow the sample methodology as the Dry Season sampling. Noise monitoring along the gas pipeline should be representative of the main noise environments along the route. This monitoring can be a single 15 minute period at each location. Nine noise monitoring sites have been proposed (N01 – N09) as shown in Appendix 2.

8.2 Reporting

A short Baseline Noise Report will be prepared setting out the above data and provided to Jacobs along with the raw noise monitoring data to enable a noise impact assessment to be prepared. The subconsultant will provide technical details (specification) of the proposed sound level meter to be used, so that Jacobs can check that it will produce the data required.

9. Traffic

9.1 Road Traffic Survey

The subconsultant will undertake a road traffic survey along roads in and adjacent to the power plant and along the gas pipeline route. The survey will comprise the following:

- note the existing road infrastructure;
- traffic counts over two days, particularly focus will be given to main road marked as TS in Appendix 1 and 2; and
- photographs to document the current road conditions.

9.2 River Traffic Survey

The subconsultant will undertake a river traffic survey at the proposed temporary jetty location. The river traffic survey will comprise the following:

- An initial desktop study of any existing river traffic data from the river authorities with focus on the stretch of river adjacent to the power plant site; and
- A river traffic count over two days at the proposed jetty location. The survey should note river traffic associated with the existing Tanayan Power Plant, fishing vessels, recreational users and any others identified.

10. Social and Economic

10.1 General

The subconsultant will collect social baseline data at the water intake area on the Siak River and along the gas pipeline route. Social surveys along the gas pipeline route should be door to door and include residents, food stalls, squatters and any other users of the area identified.

The social survey should collect information on the current farming activities in the vicinity of the gas pipeline route. This includes:

- A breakdown of the crops being grown, number of hectares covered and the annual tonnages harvested and the number of local people who farm or are supported by these fields.
- Demographic data on the number of people involved in the farming activities, where they reside, and age profile.

Similar data should be provided for any other non-farming activities identified.

The subconsultant is required to collect information on:

- Potential areas where land acquisition may be required;
- Identify and determine village boundaries;
- Historical settlement of the area and traditional activities;
- Known archaeological sites within two kilometre radius of the gas supply pipeline;
- Traditional and present-day social and tribal structures in the proposed sites;
- Identify and describe of sites of cultural and heritage importance within two km radius of the gas pipeline route;
- Determine the values(importance) placed on these sites in terms of local, regional and national significance;
- Identify and record existing activities of cultural and heritage value within two km radius of the gas pipeline route;
- Identify potential effects of the proposed gas pipeline route on the cultural and heritage sites and values;
- The views of the key local, regional and national groups, as relevant on the heritage and cultural sites near the site; and
- Provide a report that sets out the methodology used to collect the baseline data and the data collect in respect to cultural activities and heritage sites in the surrounding area.

Before the finalisation of the survey forms and the commencement of the survey campaign, the subsconsultant shall meet with Jacobs and MRPR to clarify all details and procedures.

10.2 Public Health

The subconsultant is required to collect information on:

- Historical information of public health in the vicinity of the gas pipeline route, to include:
  - Identify and describe of type of public disease on the area;
  - Determine the values (dominance) of the disease on the area;
  - Identify public health facilities to include availability of health worker on the area;
  - Identify potential effects of the proposed transmission line on community public health; and
  - Provide a report that sets out the methodology used to collect the baseline data and the data collect in respect to public health in the surrounding area.

11. Summary of Baseline Surveys

A summary of the baseline surveys required for the wet season sampling is detailed in Table 11.1 below.

Figure 11.1 : Summary of Baseline Surveys

Survey Type		Power Plant / Transmission Line Survey	Gas Pipeline Survey
Water Quality		WQ2, WQ3, WQ5 (proposed jetty location)	RW1, RW2, RW3
Freshwater Ecology		WQ2, WQ3, WQ5 (proposed jetty location)	RW1, RW2, RW3
Sediment Sampling		WQ5	RW1, RW2
Terrestrial Ecology		Same as Dry Season Sampling	To be confirmed from initial screening walkover
Soils		N/A	4 locations to be identified by subconsultant and agreed with Jacobs
Groundwater Resources		Same as Dry Season Sampling	To be identified by subconsultant and agreed with Jacobs
Air Quality	PM10 and PM2.5	AQ4, AQ5	AQ1, AQ2, AQ3
	NO_2	AQ1, AQ2, AQ3, AQ4	N/A
Noise		N/A	N01, N02, N03, N04, N05, N06, N07, N08 and N09
Traffic	Road	Along main road noted in Appendix 1	Along main roads noted in Appendix 2
	River	At proposed jetty location	N/A
Social Economic		At water intake location	Along gas pipeline route

Appendix 1 Proposed Sampling Locations – Power Plant

Appendix 2 Proposed Sampling Locations – Gas Pipeline