



Department of Alternative  
Energy Development and Efficiency  
**MINISTRY OF ENERGY**

# **LAM PHRA PHLOENG HYDROPOWER PROJECT**

## **AMPHOE PAK THONG CHAI CHANGWAT NAKORN RATCHASIMA**

### **CIVIL WORKS**

### **VOLUME 4**

### **DRAWINGS**

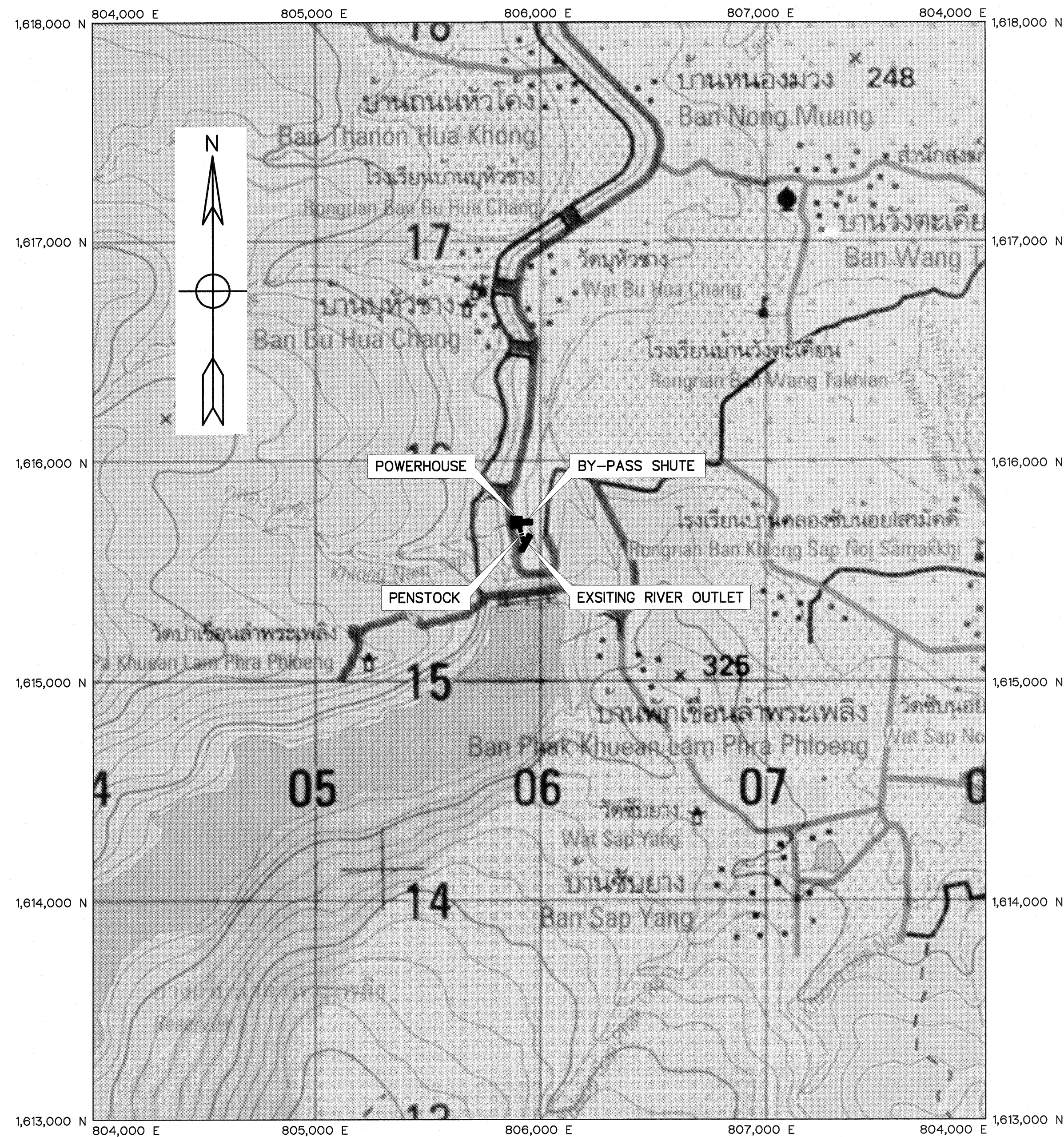


**FRONTIER ENGINEERING CONSULTANTS CO.,LTD.**

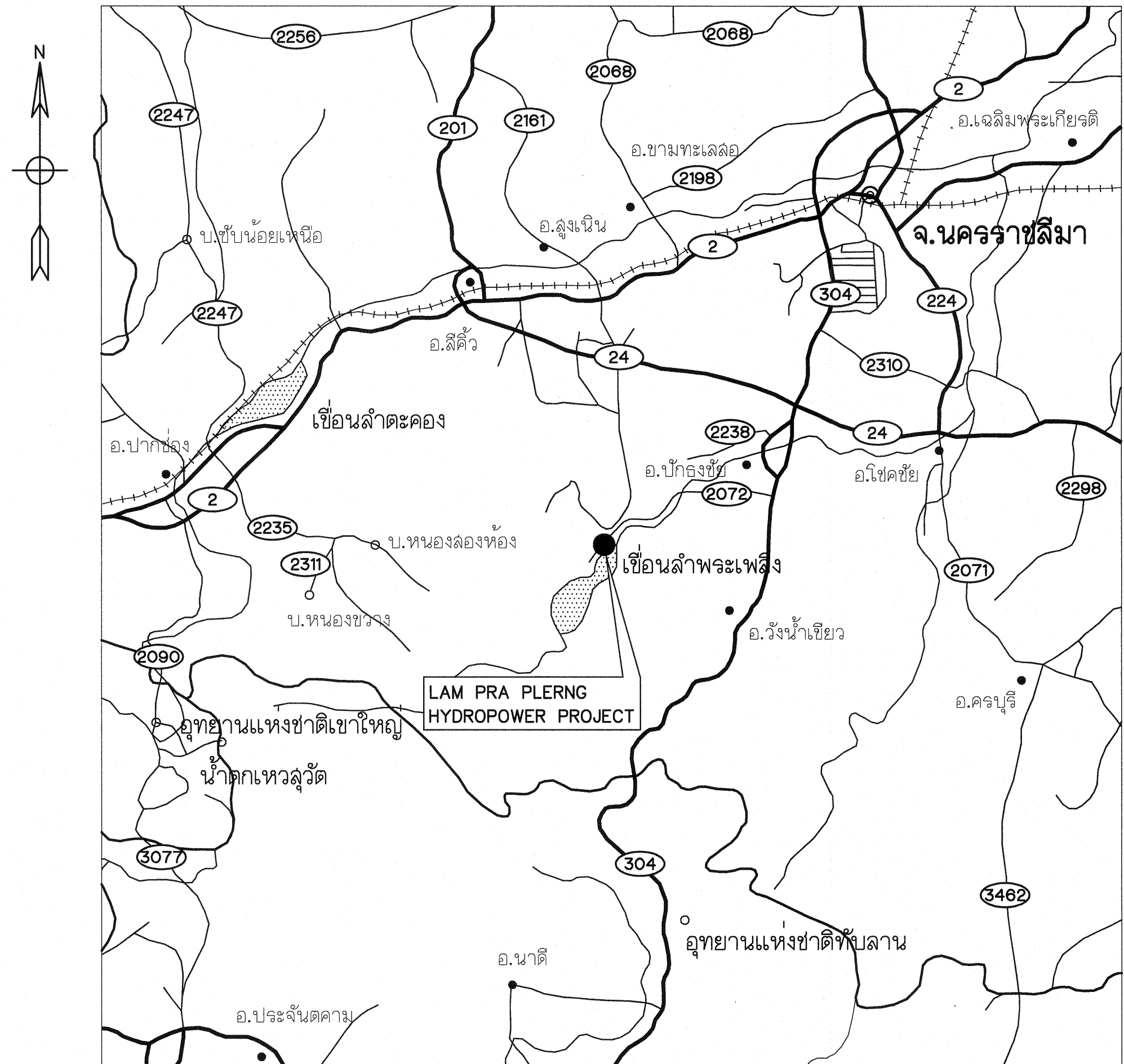
LAM PHRA PHLOENG HYDROPOWER PROJECT  
CONTRACT C1 : LIST OF DRAWINGS

| SHEET NO.   | DRAWING NO. | DRAWING DETAILS                                        |
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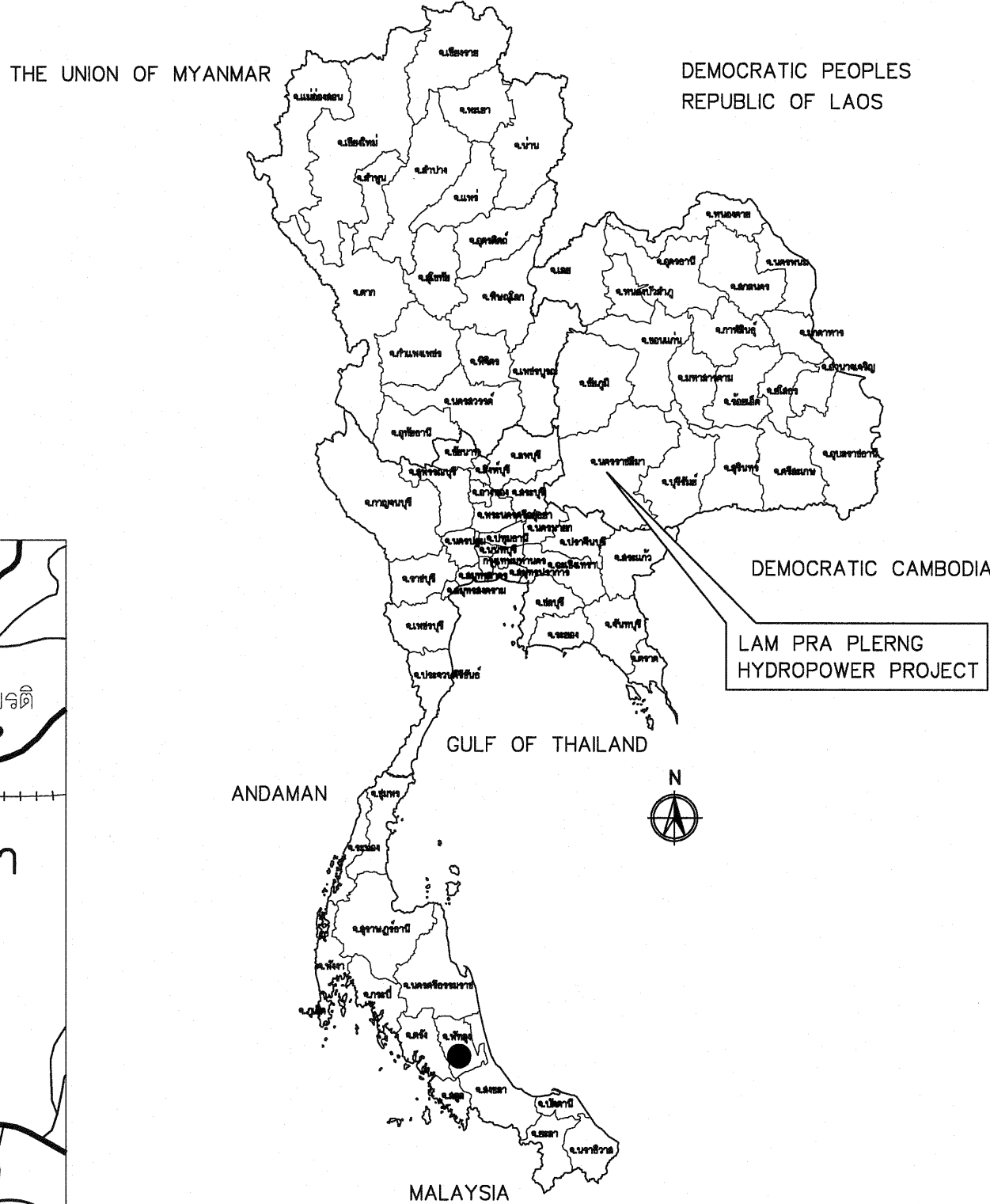
| SHEET NO.     | DRAWING NO. | DRAWING DETAILS                       |
|---------------|-------------|---------------------------------------|
| TAILRACE      |             |                                       |
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|               |             |                                       |



PROJECT AREA MAP  
SCALE 1:15,000



LOCATION MAP  
NOT TO SCALE

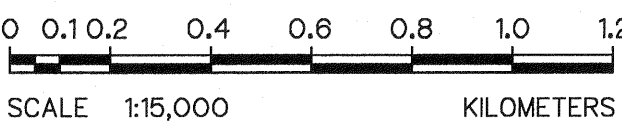


LOCATION MAP  
NOT TO SCALE

LEGENDS :

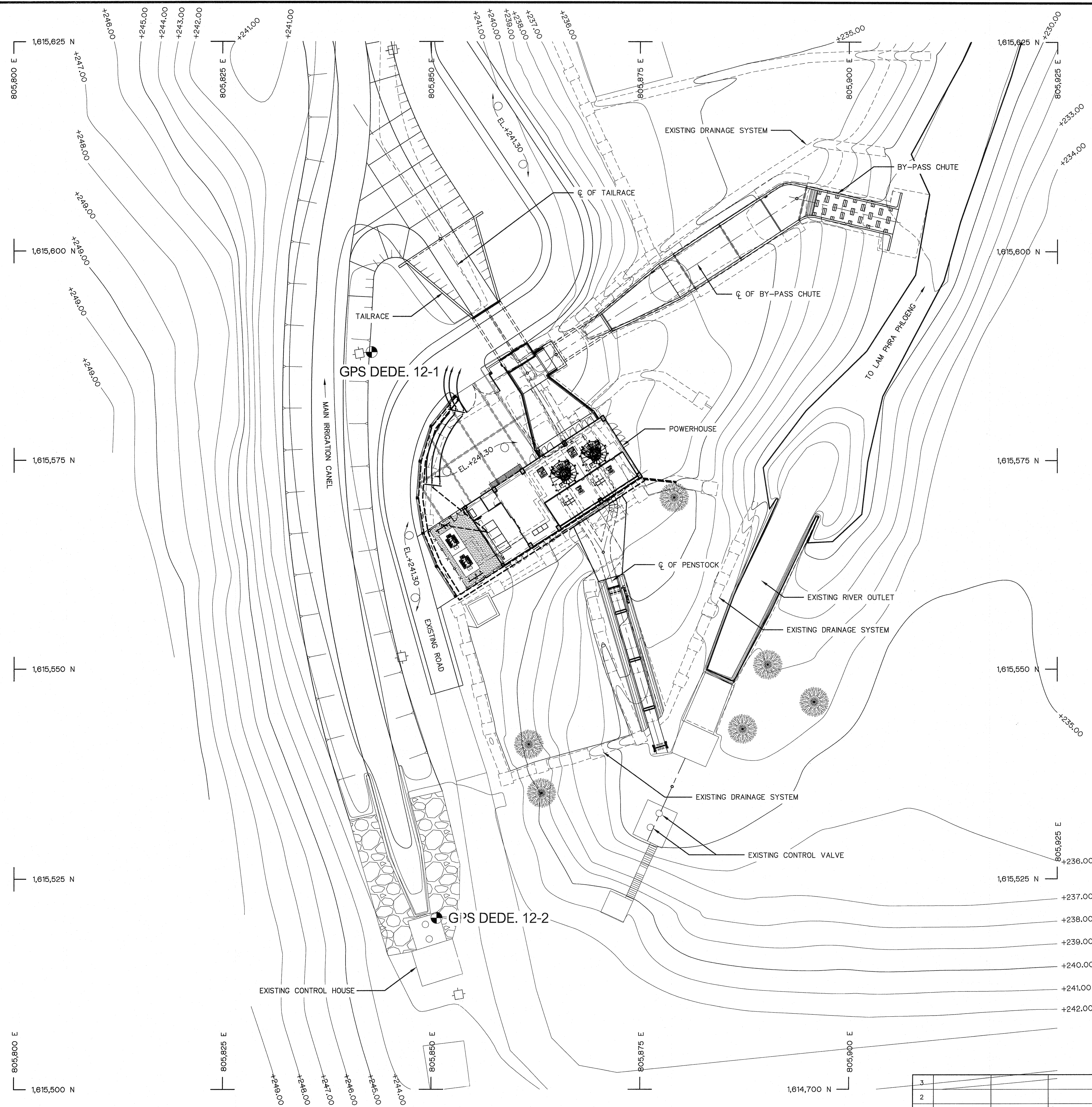
- STREAM
- WEIR
- HEADRACE
- SURGE TANK
- PENSTOCK
- POWERHOUSE

- NOTES :
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN
  2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03



|     |      |             |         |          |
|-----|------|-------------|---------|----------|
| 3   |      |             |         |          |
| 2   |      |             |         |          |
| 1   |      |             |         |          |
| NO. | DATE | REVISIONS   | CHECKED | APPROVED |
|     |      | CONSULTANTS | DEDE    |          |

|                                                                                                             |         |                    |                       |
|-------------------------------------------------------------------------------------------------------------|---------|--------------------|-----------------------|
| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |         |                    |                       |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                         |         |                    |                       |
| CIVIL WORKS<br>GENERAL<br>LOCATION MAP AND PROJECT AREA MAP                                                 |         |                    |                       |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.                                                                   |         | REVIEWED & KITCHAI |                       |
| DESIGNED                                                                                                    | 25.6651 | SUBMITTED          |                       |
| DRAWN                                                                                                       |         | RECOMMENDED        |                       |
| CHECKED                                                                                                     | 25.7324 | APPROVED           |                       |
| PROJECT MANAGER                                                                                             |         | DATE               | DRAWING NO. SHEET NO. |
|                                                                                                             |         | 14/01/62           | LPP-GN-01 1 OF 44     |



LAYOUT PLAN

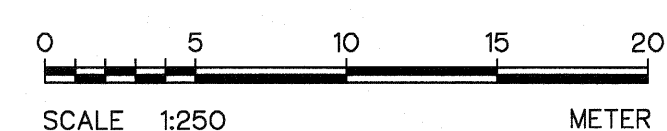
SCALE 1:250

BM. DESCRIPTIONS

| BM NO.         | COORDINATE    |             | ELEVATION<br>M. (MSL.) |
|----------------|---------------|-------------|------------------------|
|                | N             | E           |                        |
| GPS DEDE. 12-1 | 1,615,587.879 | 805,842.863 | 241.873                |
| GPS DEDE. 12-2 | 1,615,520.362 | 805,850.623 | 242.716                |

NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS. UNLESS OTHERWISE SHOWN.
2. SYMBOLE, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03



|                                                                                                             |  |                                                                                      |  |
|-------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------|--|
| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |  |                                                                                      |  |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                         |  |                                                                                      |  |
| CIVIL WORKS<br>GENERAL<br>PROJECT MAP                                                                       |  |                                                                                      |  |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.                                                                   |  | Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |  |
| DESIGNED <i>[Signature]</i> 281.6651                                                                        |  | REVIEWED <i>[Signature]</i> 281.6651                                                 |  |
| DRAWN <i>[Signature]</i>                                                                                    |  | SUBMITTED <i>[Signature]</i>                                                         |  |
| CHECKED <i>[Signature]</i> 281.7324                                                                         |  | RECOMMENDED <i>[Signature]</i>                                                       |  |
| APPROVED <i>[Signature]</i> 14/01/62                                                                        |  | APPROVED <i>[Signature]</i>                                                          |  |
| PROJECT MANAGER                                                                                             |  | DRAWING NO.<br>LPP-GN-02                                                             |  |
| DATE                                                                                                        |  | SHEET NO.<br>2 OF 44                                                                 |  |

## ABBREVIATIONS :

|                                  |                                  |            |                                   |
|----------------------------------|----------------------------------|------------|-----------------------------------|
| A                                | CROSS-SECTION AREA OF FLOW       | MAX.       | MAXIMUM                           |
| AC.                              | ASBESTOS CEMENT PIPE             | M.S.L.     | MEAN SEA LEVEL                    |
| AGG.                             | AGGREGATE                        | MSC.       | MISCELLANEOUS                     |
| ALT.                             | ALTERNATIVE                      | N.         | NORTH                             |
| APPROX.                          | APPROXIMATE                      | n.         | MANNING'S ROUGHNESS COEFFICIENT   |
| AZ.                              | AZIMUTH                          | N.F.       | NEAR FACE                         |
| B.                               | BEGINNING OF SURVEY              | NGL.       | NATURAL GROUND LEVEL              |
| BC.                              | BEGINNING OF CURVE               | NO. OR #   | NUMBER                            |
| BEG.                             | BEGINNING                        | N.W.L.     | NORMAL WATER LEVEL                |
| BF.                              | BOTTOM FACE                      | OD.        | OUTSIDE DIAMETER                  |
| B                                | BEAM                             | O.F.       | OUTSIDE FACE                      |
| B.M.                             | BENCH MARK                       | O&M        | OPERATION & MAINTENANCE           |
| BOTT.                            | BOTTOM                           | PC.        | POINT OF HORIZONTAL CURVATURE     |
| BRG.                             | BEARING                          | PI.        | POINT OF HORIZONTAL INTERSECTION  |
| C.B.R.                           | CALIFORNIA BEARING RATIO         | PL.        | PLATE                             |
| C/C                              | CENTER TO CENTER                 | P.O.C.     | POINT ON CURVE                    |
| CL                               | CENTER LINE                      | P.O.T.     | POINT ON TANGENT                  |
| CL.                              | CLEARANCE                        | P.O.S.T.   | POINT ON SUB-TANGENT              |
| CM. OR cm.                       | CENTIMETER                       | PRC.       | POINT OF HORIZONTAL REVERSE CURVE |
| CM./S OR cm./s                   | CENTIMETER PER SECOND            | PT.        | POINT OF TANGENT                  |
| COL.                             | COLUMN                           | PVC.       | POLYVINYL CHLORIDE                |
| CONC.                            | CONCRETE                         | PVC.       | POINT OF VERTICAL CURVATURE       |
| D                                | DEGREE OF CURVE                  | PVI.       | POINT OF VERTICAL INTERSECTION    |
| DB.                              | DEFORM BAR                       | PVRC.      | POINT OF VERTICAL REVERSE CURVE   |
| d.                               | DEPTH OF WATER                   | PVT.       | POINT OF VERTICAL TANGENT         |
| DIA. OR Ø                        | DIAMETER                         | Q.         | DISCHARGE                         |
| DOH.                             | DEPARTMENT OF HIGHWAY            | QTY. QUAN. | QUANTITY                          |
| DWG.                             | DRAWING                          | R          | RADIUS OF CURVATURE               |
| DEDE.                            | DEPARTMENT OF ALTERNATIVE ENERGY | r          | HYDRAULIC RADIUS                  |
|                                  | DEVELOPMENT AND EFFICIENCY       | RØ , Ø     | ROUND BAR                         |
| E                                | EAST                             | RC.        | REINFORCED CONCRETE               |
| E                                | END OF SURVEY                    | RD.        | ROAD                              |
| EA.                              | EACH                             | REF.       | REFERENCE                         |
| E.C.                             | END OF CURVE                     | REINF.     | REINFORCEMENT                     |
| E.F.                             | END OF FACE                      | REQ'D      | REQUIRED                          |
| EL. OR ELEV.                     | ELEVATION                        | RID.       | ROYAL IRRIGATION DEPARTMENT       |
| EXIST.                           | EXISTING                         | SCH.       | SCHEDULE                          |
| EXP.                             | EXPANSION                        | SE.        | SUPERELEVATION                    |
| EXT.                             | EXTERIOR                         | SETC.      | SECTION                           |
| EX.                              | EXTERNAL DISTANCE OF CURVE       | S.P.C.T.   | STANDARD PROCTOR COMPACTION TEST  |
| f                                | FREE BOARD , FINISH              | S.S.       | SIDE SLOPE                        |
| F.F.                             | FAR FACE                         | STIR.      | STIRRUP                           |
| F.S.L.                           | FULL SUPPLY LEVEL                | STA.       | STATION                           |
| FTG.                             | FOOTING                          | STD.       | STANDARD                          |
| HD.                              | HEAD                             | STR.       | STRUCTURE                         |
| HEX.                             | HEXAGONAL                        | SYMM.      | SYMMETRICAL                       |
| HOR.                             | HORIZONTAL                       | T.         | TANGENT LENGTH , THICKNESS        |
| I.D.                             | INSIDE DIAMETER                  | T          | TON                               |
| I.F.                             | INSIDE FACE                      | THK.       | THICKNESS                         |
| IN. OR "                         | INCH                             | T.F.       | TOP FACE                          |
| INT.                             | INTERIOR                         | T.I.S.     | THAI INDUSTRIAL STANDARD          |
| INV.                             | INVERT                           | Ts.        | SUPERELEVATION TRANSITION LENGTH  |
| Kg.                              | KILOGRAM                         | TYP.       | TYPICAL                           |
| Km.                              | KILOMETER                        | V.         | VELOCITY OF FLOW                  |
| KPH.                             | KILOMETER PER HOUR               | V.C.       | VERTICAL CURVE                    |
| KSC.                             | KILOGRAM PER SQUARE CENTIMETER   | Vc.        | LENGTH OF VERTICAL CURVE          |
| L                                | LENGTH OF CURVE                  | VER.       | VERTICAL                          |
| LC.                              | LENGTH OF HORIZONTAL CURVE       | VOL.       | VOLUME                            |
| LONG.                            | LONGITUDINAL                     | W/         | WITH                              |
| LT.                              | LEFT                             | W.C.       | WATER CLOSET                      |
| L.W.L.                           | LOW WATER LEVEL                  | ⊙          | ANGLE                             |
| M. OR m.                         | METER                            | △          | DEFLECTION ANGLE                  |
| M <sup>2</sup> OR m <sup>2</sup> | SQUARE METER                     |            |                                   |
| M <sup>3</sup> OR m <sup>3</sup> | CUBIC METER                      |            |                                   |
| MM. OR mm.                       | MILLIMETER                       |            |                                   |
| M./S OR m./s                     | METER PER SECOND                 |            |                                   |
| MIN.                             | MINIMUM                          |            |                                   |

## SYMBOLS :

|  |                                            |
|--|--------------------------------------------|
|  | TYPICAL NORTH ARROW                        |
|  | CENTER LINE                                |
|  | PAVED ROAD                                 |
|  | DIRT ROAD, LATEITE ROAD OR TRACK           |
|  | VILLAGE                                    |
|  | CITY OR DISTRICT                           |
|  | POND OR SWAMP                              |
|  | CULVERT UNDER ROAD                         |
|  | BRIDGE                                     |
|  | POLE                                       |
|  | TEST PIT                                   |
|  | EXISTING HAND AUGER                        |
|  | EXISTING DRILL HOLES                       |
|  | DRILL HOLES                                |
|  | DEGREE, MINUTE, SECOND                     |
|  | AT EQUAL DISTANCE BETWEEN CENTER TO CENTER |
|  | B.M.                                       |
|  | STATION                                    |
|  | BC., EC., PC., PI., PT., PCV., PVT.        |
|  | WATER LEVEL                                |
|  | PLAN OF RIPRAP                             |
|  | PLAN OF SLOPE RIPRAP                       |
|  | SECTION OF DUMPED RIPRAP                   |
|  | SECTION OF HAND PLACED RIPRAP              |
|  | SECTION OF SAND                            |
|  | SECTION OF GRAVEL OR COARSE AGGREGATE      |
|  | SECTION OF ROCK                            |
|  | SECTION OF EARTH                           |
|  | SECTION OF BACKFILL                        |
|  | SECTION OF CONCRETE                        |
|  | STEEL SECTION                              |
|  | ELEVATION OR PLAN OF EARTH CUT OR FILL     |
|  | ELEVATION OR PLAN OF ROCK CUT              |
|  | ELEVATION OR PLAN OF SLOPE                 |
|  | NATURAL GROUND LEVEL                       |
|  | CONTOUR LINE                               |
|  | RIVER, STREAM OR NATURAL DRAIN             |
|  | FLOW DIRECTION                             |
|  | SLOPE DIRECTION                            |
|  | SLOPE RATIO                                |

## GENERAL NOTES :

- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS UNLESS OTHERWISE SHOWN.
- DURING THE CONTRUCTION PERIOD, IT IS THE CONTRACTOR'S DUTY TO CHECK THE CORRECTION OF ALL RELEVANT LOCATIONS, DIMENSIONS, ELEVATIONS AND OTHER DATA AS PROVIDED BY THE DRAWING AND TECHNICAL SPECIFICATIONS BEFORE THE IMPLEMENTATION OF THE WORKS.
- IN CASE OF ANY DETAILS BEING NOT MENTIONED OR NOT SHOWN IN THE DRAWING OR TECHNICAL SPECIFICATIONS, OR IN CASE OF ANY DISCREPANCY, DEFECTIVE DESCRIPTION, ERROR, DIMENSION OR AMBIGUITY BETWEEN OR IN ANY OF THE DRAWINGS, IT IS THE CONTRACTOR'S RESPONSIBILITY TO CORRECT AND/OR ADJUST THE RELEVENT DRAWINGS TO OBTAIN FIELD ENGINEER APPROVAL
- ADDITIONAL SYMBOLS, IF REQUIRED, ARE DEFINED IN THE RESPECTIVE DRAWINGS.
- THE SPECIFICATIONS AND THE QUANTITIES OF MATERIALS ARE SPECIFIED IN THE TECHNICAL SPECIFICATIONS.
- ALL PLAIN CONCRETE CORNERS ARE TO BE CHEMFERED 2 cm. UNLESS OTHERWISE SHOWN.
- SLOPE IN CUT AND FILL SECTIONS, UNLESS OTHERWISE SHOWN, SHALL BE CONFORMED TO THE FOLLOWING TABLE OR AS DIRECTED BY FIELD ENGINEER.

| EXISTING GROUND SLOPE<br>1:S | EARTH                    |               | HARD ROCK |               |
|------------------------------|--------------------------|---------------|-----------|---------------|
|                              | CUT 1:S                  | FILL 1:S      | CUT 1:S   | FILL 1:S      |
| OVER 1:1                     | OVER 1:0.5 $\frac{2}{1}$ | $\frac{1}{1}$ | 1:0       | $\frac{1}{1}$ |
| 1:1 - 1:1.5                  | 1:0.5                    | 1             | 1:0       | $\frac{1}{1}$ |
| 1:1.5 - 1:2                  | 1:1                      | 1:1           | 1:0       | 1:1           |
| 1:2 - 1:3                    | 1:1                      | 1:1.5         | 1:0       | 1:1.5         |
| LOWER 1:3                    | 1:1                      | 1:2           | 1:0       | 1:2           |

$\frac{2}{1}$  = FILL SHOULD BE AVOIDED

$\frac{1}{1}$  = FOR DOUBTFUL CASES CONSULT FIELD ENGINEER

## STRUCTURAL DESIGN NOTES :

- THE ULTIMATE COMPRESSIVE STRENGTH OF CONCRETE OF STANDARD CYLINDER (Ø0.15x0.30 m.) TEST AT AGE 28 DAYS SHALL BE AS THE FOLLOWING, UNLESS OTHERWISE SHOWN.

| fc' (ksc) | DESCRIPTION                   |
|-----------|-------------------------------|
| 350       | PRESTRESS CONCRETE            |
| 210       | 1. POWERHOUSE                 |
|           | 2. TAILRACE                   |
|           | 3. BY-PASS CHUTE              |
|           | 4. ANCHOR BLOCK, PIPE SUPPORT |
|           | 5. BOX CULVERT                |
| 140       | LEAN CONCRETE                 |
|           |                               |

- UNLESS OTHERWISE SHOWN, THE FOLLOWING CLEAR COVER OF CONCRETE OVER OF THE REINFORCEMENT SHALL BE USED :
  - FACE EXPOSED TO SCOUR 5.0 cm.
  - FACE EXPOSED TO EARTH OR WEATHER 5.0 cm.
  - FACE UNEXPOSED TO EARTH OR WEATHER 3.0 cm.
- THE REINFORCEMENT LAP SPLICES SHALL NOT BE LESS THAN 50 DIAMETERS OF BIGGER THAN BAR WITH HOOKS, UNLESS OTHERWISE SHOWN.
- EMBEDDED METALWORK SHALL BE SECURELY FASTENED IN POSITION BEFORE PLACING CONCRETE.
- ALL CONSTRUCTION JOINT SHOULD BE TREATED AS DIRECTED IN ORDER TO ASSURE THE BEST BOND.
- A 5 cm. (MIN.) LAYER OF LEAN CONCRETE (1:3:5 BY VOLUME) SHOULD BE PLACED BELOW CONCRETE STRUCTURES.
- THE STRUCTURES SHOULD BE PLACED ON UNDISTURBED SOILS OR COMPACTED FILL AND BACKFILL AROUND THE STRUCTURES SHOULD BE COMPACTED.
- THE FOUNDATION ELEVATIONS ARE SUBJECT TO CHANGE AS DIRECTED ACCORDING TO THE SOIL CONDITIONS.
- ALL SIZES OF REINFORCING BARS AND STRUCTURAL STEELS ARE IN MILLIMETERS.
- ALL STRUCTURAL STEELS ARE THOSE OF T.I.S. DESIGNATION Fe24.
- REINFORCED STEEL BARS SHALL BE CONFORM TO T.I.S. AS FOLLOW :

- DEFORMED BARS (SD30) - T.I.S. 24-2559
- ROUND BARS (SR24) - T.I.S. 20-2559

- ALLOWABLE BEARING CAPACITY OF FOUNDATION

SHALL NOT BE LESS THAN AS FOLLOW :

- POWERHOUSE  $Q_0 = 20 \text{ T/M}^2$
- PENSTOCK  $Q_0 = 20 \text{ T/M}^2$

|             |      |           |         |          |
|-------------|------|-----------|---------|----------|
| 3           |      |           |         |          |
| 2           |      |           |         |          |
| 1           |      |           |         |          |
| NO.         | DATE | REVISIONS | CHECKED | APPROVED |
| CONSULTANTS |      | DEDE      |         |          |

|                                                                                                                 |                                            |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| <br>KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |                                            |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                             |                                            |
| CIVIL WORKS<br>GENERAL<br>SYMBOLS, ABBREVIATIONS, AND GENERAL NOTES                                             |                                            |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.                                                                       | REVIEWED S. KITICHAI                       |
| DESIGNED S. Kitichai อนุมัติ.6651                                                                               | SUBMITTED                                  |
| DRAWN S. Kitichai                                                                                               | RECOMMENDED S. Kitichai                    |
| CHECKED S. Kitichai อนุมัติ.7324                                                                                | APPROVED                                   |
| S. Kitichai 14/01/62<br>PROJECT MANAGER DATE                                                                    | DRAWING NO. LPP-GN-03<br>SHEET NO. 3 OF 44 |

TABLE 1 CLIMATOLOGICAL DATA FOR THE PERIOD 1980–2009

|                        |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
|------------------------|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------------|--------|--------|
| Station                | KASETHOKCHAI    |        |        |        |        |        |        |        |        |        |        |        | Elevation of station above M.S.L. | 190.34 | Meters |
| Index station          | 48434           |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Latitude               | 14° 43' 8.0" N  |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Longitude              | 102° 10' 7.0" E |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
|                        | JAN             | FEB    | MAR    | APR    | MAY    | JUN    | JUL    | AUG    | SEP    | OCT    | NOV    | DEC    | ANNUAL                            |        |        |
| Pressure (Hectopascal) |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Mean                   | 1013.3          | 1011.7 | 1009.9 | 1008.3 | 1007.1 | 1006.2 | 1006.1 | 1006.4 | 1007.8 | 1010.5 | 1012.3 | 1013.9 | 1009.5                            |        |        |
| Ext. max.              | 1025.9          | 1024.6 | 1027.7 | 1019.9 | 1015.5 | 1015.5 | 1013.0 | 1012.6 | 1016.4 | 1020.5 | 1022.6 | 1025.4 | 1027.7                            |        |        |
| Ext. min.              | 1003.5          | 1002.3 | 999.7  | 999.6  | 998.6  | 998.3  | 998.7  | 998.5  | 998.9  | 999.6  | 1002.1 | 1002.2 | 998.3                             |        |        |
| Mean daily range       | 5.9             | 6.1    | 5.9    | 5.4    | 4.6    | 4.2    | 4.1    | 4.2    | 4.6    | 4.8    | 5.1    | 5.6    | 5.0                               |        |        |
| Temperature (Celsius)  |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Mean                   | 24.4            | 26.5   | 28.6   | 29.7   | 29.0   | 28.8   | 28.3   | 28.0   | 27.4   | 26.7   | 25.5   | 23.8   | 27.2                              |        |        |
| Mean max.              | 31.3            | 33.5   | 35.3   | 36.2   | 34.8   | 34.2   | 33.4   | 33.0   | 32.2   | 31.2   | 30.7   | 29.9   | 33.0                              |        |        |
| Mean min.              | 18.1            | 20.2   | 23.0   | 24.6   | 25.0   | 25.0   | 24.6   | 24.5   | 24.0   | 23.1   | 20.7   | 18.1   | 22.6                              |        |        |
| Ext. max.              | 37.1            | 39.0   | 41.2   | 42.5   | 40.7   | 39.0   | 37.9   | 37.0   | 36.2   | 35.7   | 36.1   | 35.9   | 42.5                              |        |        |
| Ext. min.              | 8.7             | 11.3   | 14.0   | 18.6   | 21.0   | 21.6   | 21.5   | 21.1   | 20.2   | 16.1   | 13.5   | 6.5    | 6.5                               |        |        |
| Dew Point (Celsius)    |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Mean                   | 17.4            | 18.6   | 20.7   | 22.5   | 23.7   | 23.5   | 23.3   | 23.4   | 23.8   | 22.9   | 20.2   | 17.4   | 21.5                              |        |        |
| Relative Humidity (%)  |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Mean                   | 68              | 65     | 65     | 68     | 75     | 75     | 76     | 77     | 82     | 81     | 75     | 70     | 73                                |        |        |
| Mean max.              | 89              | 86     | 86     | 86     | 90     | 89     | 90     | 91     | 94     | 94     | 91     | 89     | 90                                |        |        |
| Mean min.              | 43              | 41     | 42     | 46     | 54     | 55     | 57     | 58     | 63     | 62     | 54     | 47     | 52                                |        |        |
| Ext. min.              | 22              | 18     | 18     | 21     | 31     | 28     | 33     | 40     | 43     | 37     | 29     | 28     | 18                                |        |        |
| Visibility (km.)       |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| 07.00 LST              | 3.5             | 3.3    | 4.8    | 7.0    | 9.4    | 10.1   | 10.1   | 10.0   | 9.2    | 6.7    | 5.9    | 5.1    | 7.1                               |        |        |
| Cloudiness (0–10)      |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Mean                   | 3.4             | 3.3    | 4.3    | 4.8    | 6.3    | 7.0    | 7.5    | 7.9    | 7.4    | 5.8    | 4.1    | 3.4    | 5.4                               |        |        |
| Wind (knots)           |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Mean wind speed        | 1.4             | 1.5    | 1.7    | 1.7    | 1.5    | 2.1    | 2.2    | 2.0    | 1.2    | 1.4    | 1.8    | 1.8    | 1.7                               |        |        |
| Max. wind speed        | 25              | 35     | 33     | 44     | 40     | 33     | 34     | 34     | 32     | 35     | 25     | 25     | 44                                |        |        |
| Evaporation (mm.)      |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Mean–pan               | 124.1           | 132.4  | 167.0  | 169.5  | 158.3  | 147.9  | 144.3  | 137.2  | 118.1  | 118.3  | 117.2  | 122.0  | 1656.3                            |        |        |
| Rainfall (mm.)         |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Mean                   | 9.3             | 14.1   | 41.6   | 72.7   | 153.5  | 113.9  | 120.7  | 150.2  | 204.3  | 164.2  | 25.3   | 3.8    | 1073.6                            |        |        |
| Mean rainy day         | 2               | 3      | 6      | 8      | 15     | 14     | 16     | 17     | 19     | 14     | 4      | 1      | 119                               |        |        |
| Daily maximum          | 47.0            | 35.6   | 100.3  | 98.4   | 147.5  | 107.9  | 78.0   | 86.5   | 112.8  | 112.3  | 74.4   | 31.8   | 147.5                             |        |        |
| Number of days with    |                 |        |        |        |        |        |        |        |        |        |        |        |                                   |        |        |
| Haze                   | 3               | 3      | 1      | 0      | 0      | 0      | 0      | 0      | 1      | 2      | 2      | 1      | 11                                |        |        |
| Fog                    | 29              | 27     | 27     | 18     | 2      | 0      | 0      | 0      | 1      | 10     | 15     | 22     | 150                               |        |        |
| Hail                   | 0               | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0                                 |        |        |
| Thunderstorm           | 0               | 2      | 5      | 8      | 11     | 7      | 6      | 8      | 10     | 5      | 1      | 0      | 63                                |        |        |
| Squall                 | 0               | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 0      | 1                                 |        |        |

TABLE 2 FLOOD PEAK DISCHARGE FOR VARIOUS RETURN PERIODS

| RETURN PERIOD<br>(YEAR) | FLOOD PEAK DISCHARGE (M. <sup>3</sup> /SEC.) |                 |
|-------------------------|----------------------------------------------|-----------------|
|                         | REGIONAL FLOOD<br>FREQUENCY ANALYSIS         | UNIT HYDROGRAPH |
| 10                      | 446.7                                        | 414.5           |
| 25                      | 578.7                                        | 598.0           |
| 50                      | 676.6                                        | 683.6           |
| 100                     | 773.8                                        | 773.5           |
| 200                     | 870.6                                        | 899.4           |
| 500                     | 998.3                                        | 1,000.0         |
| 1,000                   | 1,094.9                                      | 1,367.7         |

FIGURE 1 FLOW DURATION CURVE AT LAM PHRA PHLOENG DAM

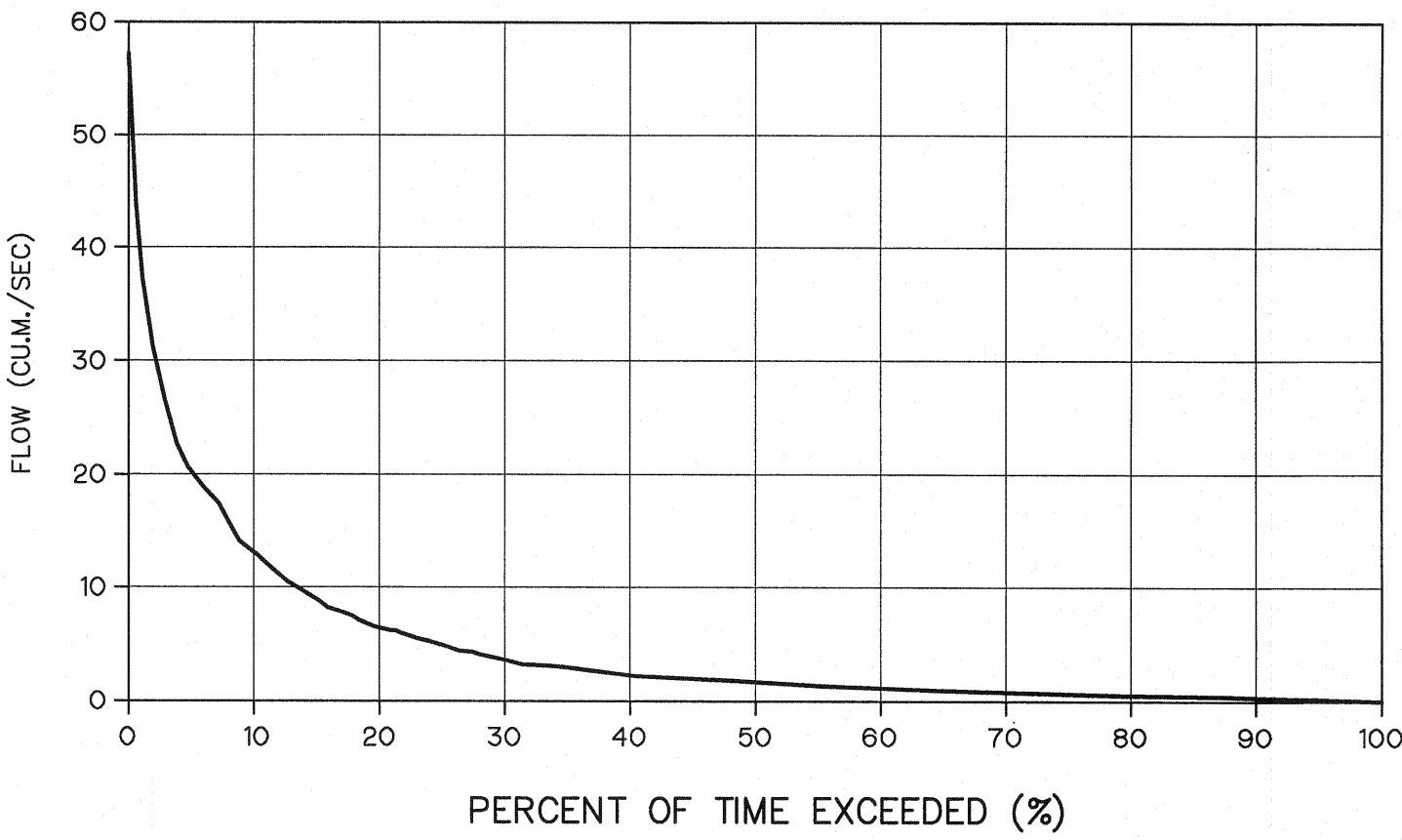


FIGURE 2 FLOW DURATION CURVE AT IRRIGATION OUTLET & RIVER OUTLET OF LAM PHRA PHLOENG DAM

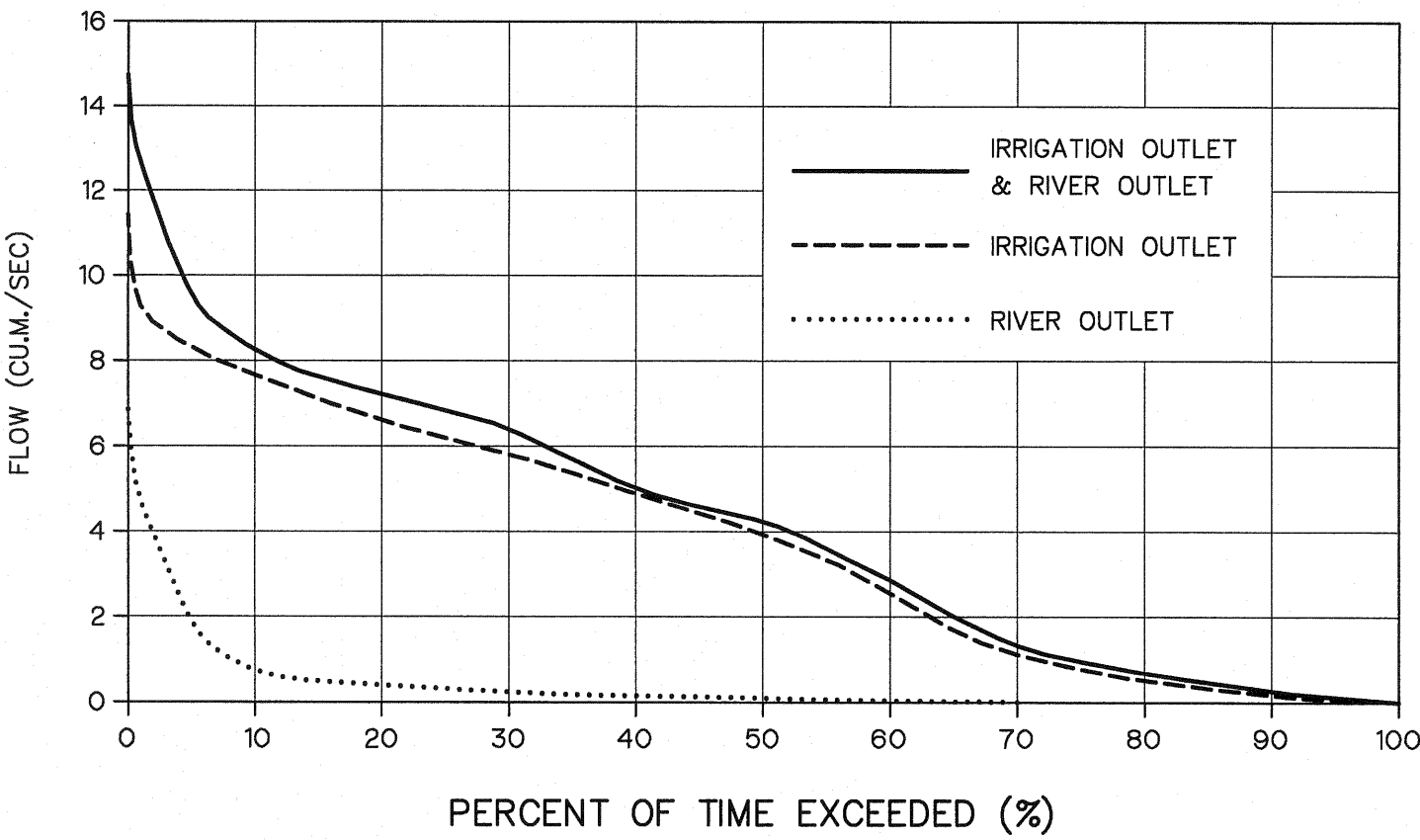
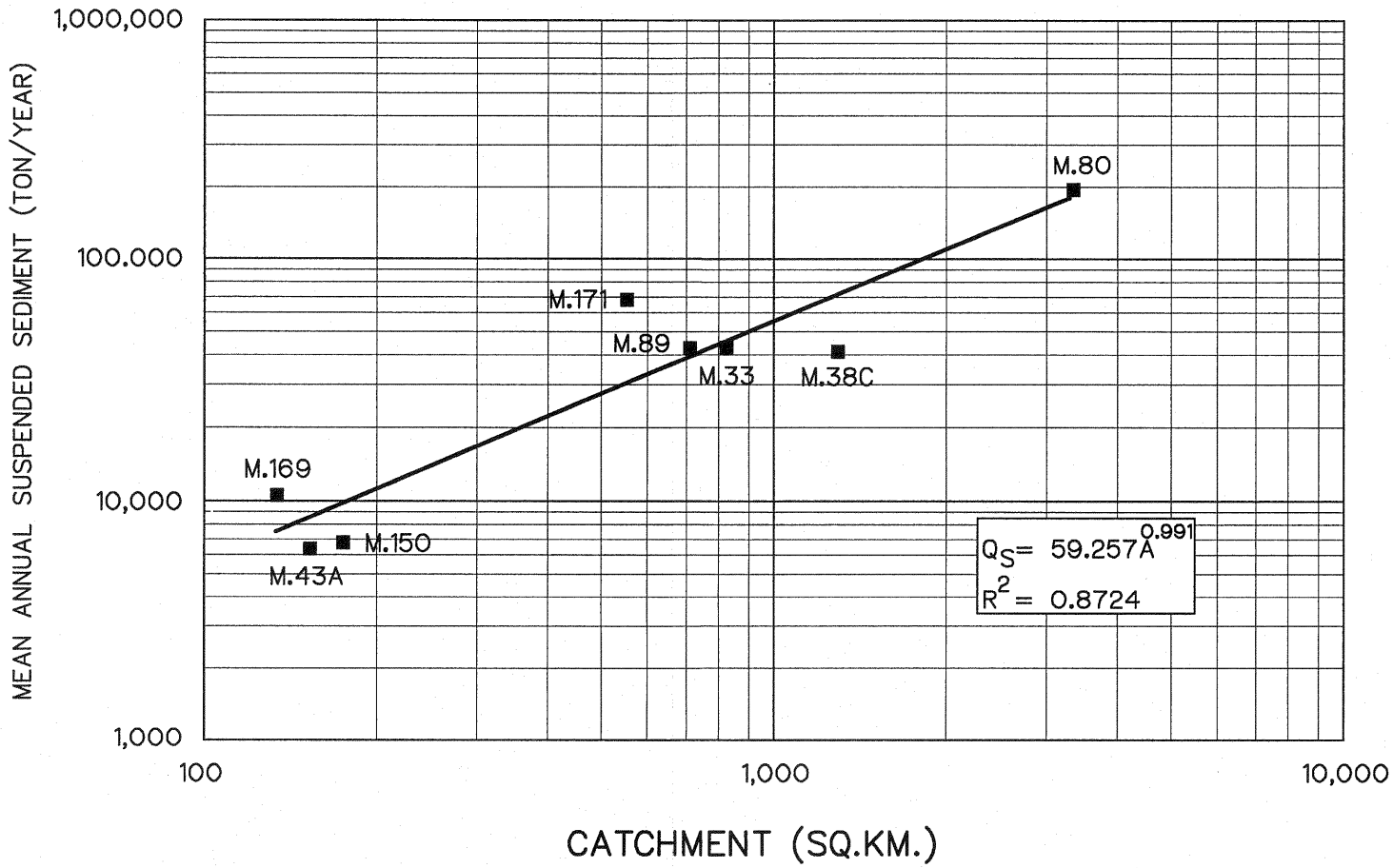


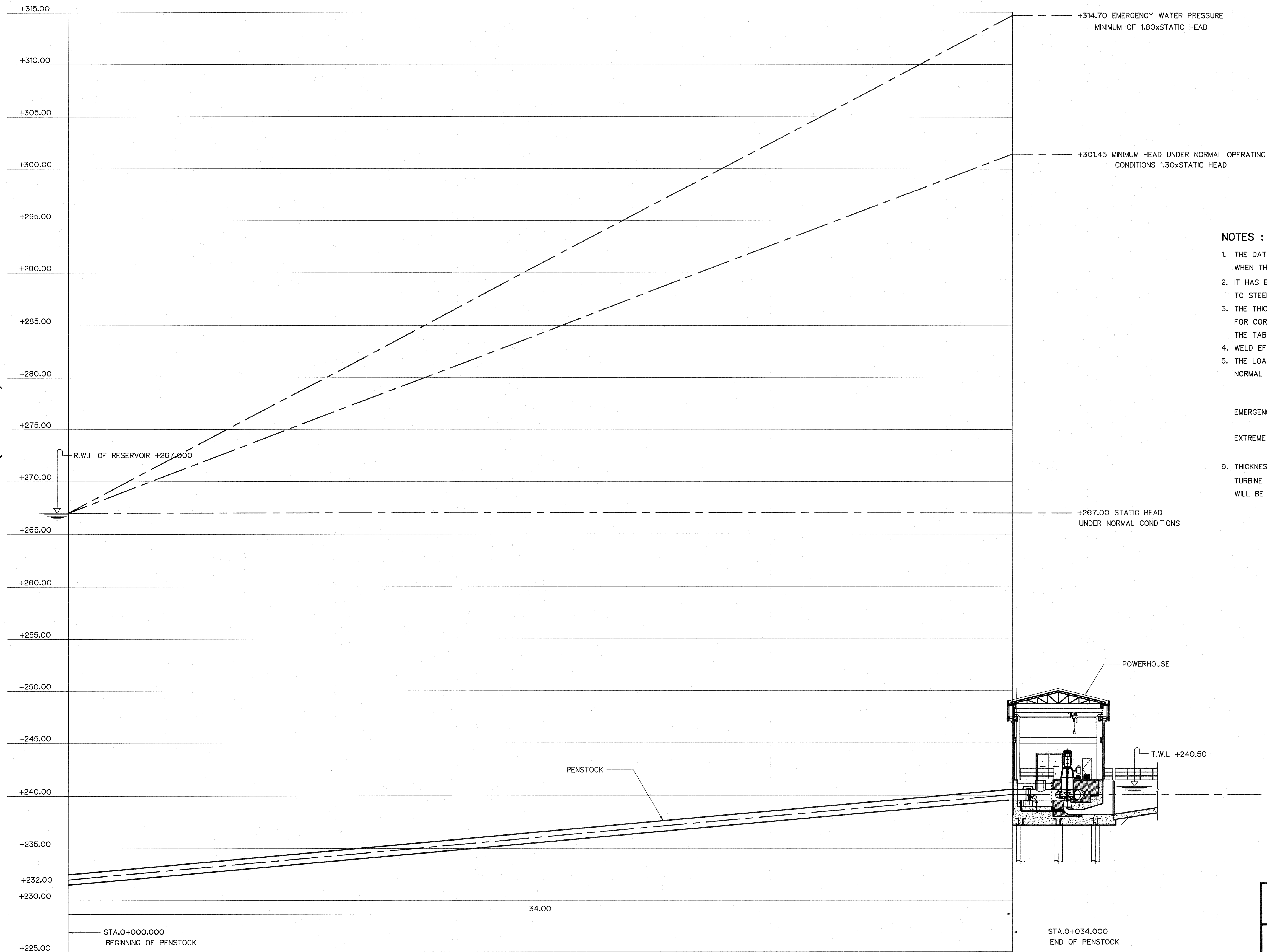
FIGURE 3 RELATIONSHIP BETWEEN ELEVATION AND CATCHMENT AREA



|                                                                                                             |                         |
|-------------------------------------------------------------------------------------------------------------|-------------------------|
| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |                         |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                         |                         |
| CIVIL WORKS<br>GENERAL<br>HYDROLOGY DATA                                                                    |                         |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.                                                                   |                         |
| REVIEWED S. KITICHAN                                                                                        |                         |
| DESIGNED S. Kitichan 06/01/62                                                                               | SUBMITTED               |
| DRAWN S. Kitichan                                                                                           | RECOMMENDED S. Kitichan |
| CHECKED S. Kitichan 06/01/62                                                                                | APPROVED                |
| PROJECT MANAGER 14/01/62                                                                                    | DRAWING NO. LPP-GN-04   |
|                                                                                                             | SHEET NO. 4 OF 44       |

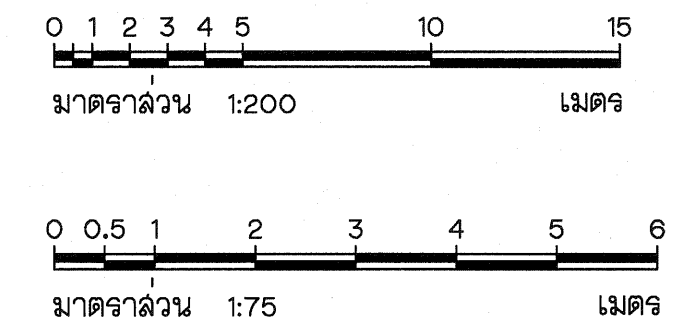
|     |      |             |         |          |
|-----|------|-------------|---------|----------|
| 3   |      |             |         |          |
| 2   |      |             |         |          |
| 1   |      |             |         |          |
| NO. | DATE | REVISIONS   | CHECKED | APPROVED |
|     |      | CONSULTANTS | DEDE    |          |

ELEVATION (M.MSL.)



NOTES :

1. THE DATA SHOWN ON THIS DRAWING IS PROVISIONAL AND WILL BE REVIEWED WHEN THE ACTUAL TURBINE CHARACTERISTICS ARE KNOWN.
2. IT HAS BEEN ASSUMED THAT STEEL FOR THE PRESSURE PIPELINE CONFORMS TO STEEL TYPE SS41 OF THE JAPANESE INDUSTRIAL STANDARD JIS G 3101.
3. THE THICKNESS OF THE PIPE SHELL SHALL INCLUDE A TOLERANCE OF 2 MM. FOR CORROSION AND SHALL BE DESIGNED FOR THE LOAD CASES SHOWN IN THE TABLE BELOW.
4. WELD EFFICIENCY ON THE PRESSURE PIPELINE SHALL BE AT LEAST 90%.
5. THE LOADING CASES MAY BE MORE FULLY DEFINED AS BELOW  
NORMAL - INCLUDES NORMAL WATER PRESSURE AND NORMAL LONGITUDINAL LOADS SUCH AS WEIGHT OF PIPELINE, ANCHOR BLOCK, EXTERNAL SOIL AND WATER PRESSURE  
EMERGENCY - INCLUDES LOSS OF A SUPPORT OR LOADING DUE TO TEST PRESSURE OR IMPOSITION OF DESIGN EARTHQUAKE ON NORMAL CASE  
EXTREME - INCLUDES EXTREME WATER PRESSURES IN PIPELINE OR INCIDENCE OF MAXIMUM CREDIBLE EARTHQUAKE PLUS NORMAL WATER PRESSURE
6. THICKNESS OF PENSTOCK DESIGNED BASE ON PRESSURE RISE HEAD (WATER HAMMER) TURBINE PERFORMANCE, CLOSING TIME (6 SECONDS APPROXIMATELY) WILL BE SPECIFIED IN THE BIDDING DOCUMENTS.



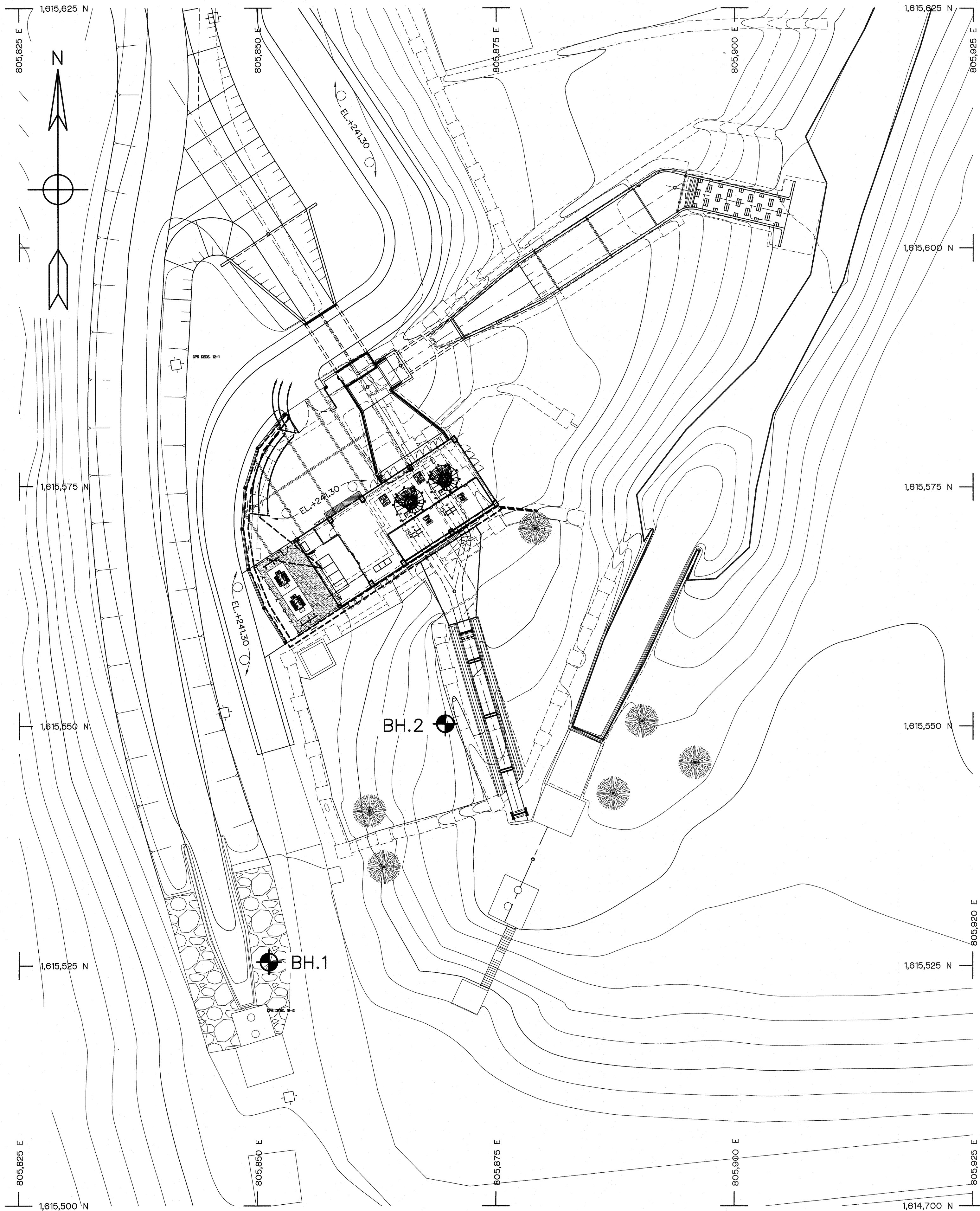
| LOAD CASES                                                               | ALLOWABLE TENSILE STRESS    |
|--------------------------------------------------------------------------|-----------------------------|
| EXTREME WATER PRESSURE RESULTING FROM SLOWDEN CLOSURE OF THE TABLE VALVE | 1.00 x MINIMUM YIELD STRESS |
| EMERGENCY WATER PRESSURE AND ALL OTHER NORMAL LONGITUDINAL LOADS         | 0.75 x MINIMUM YIELD STRESS |
| NORMAL WATER PRESSURE AND ALL OTHER NORMAL LONGITUDINAL LOADS            | 0.60 x MINIMUM YIELD STRESS |

PROFILE ALONG PENSTOCK

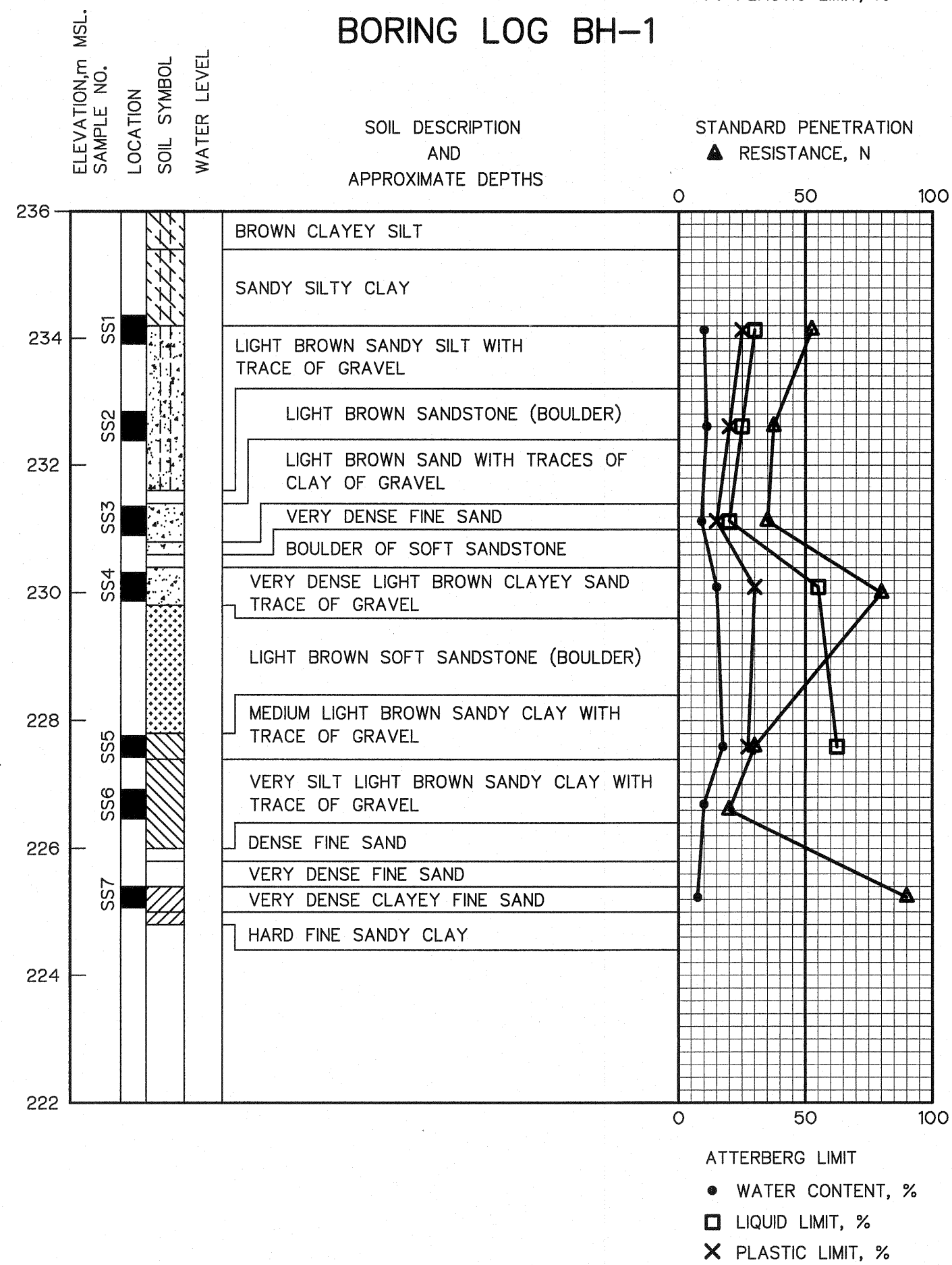
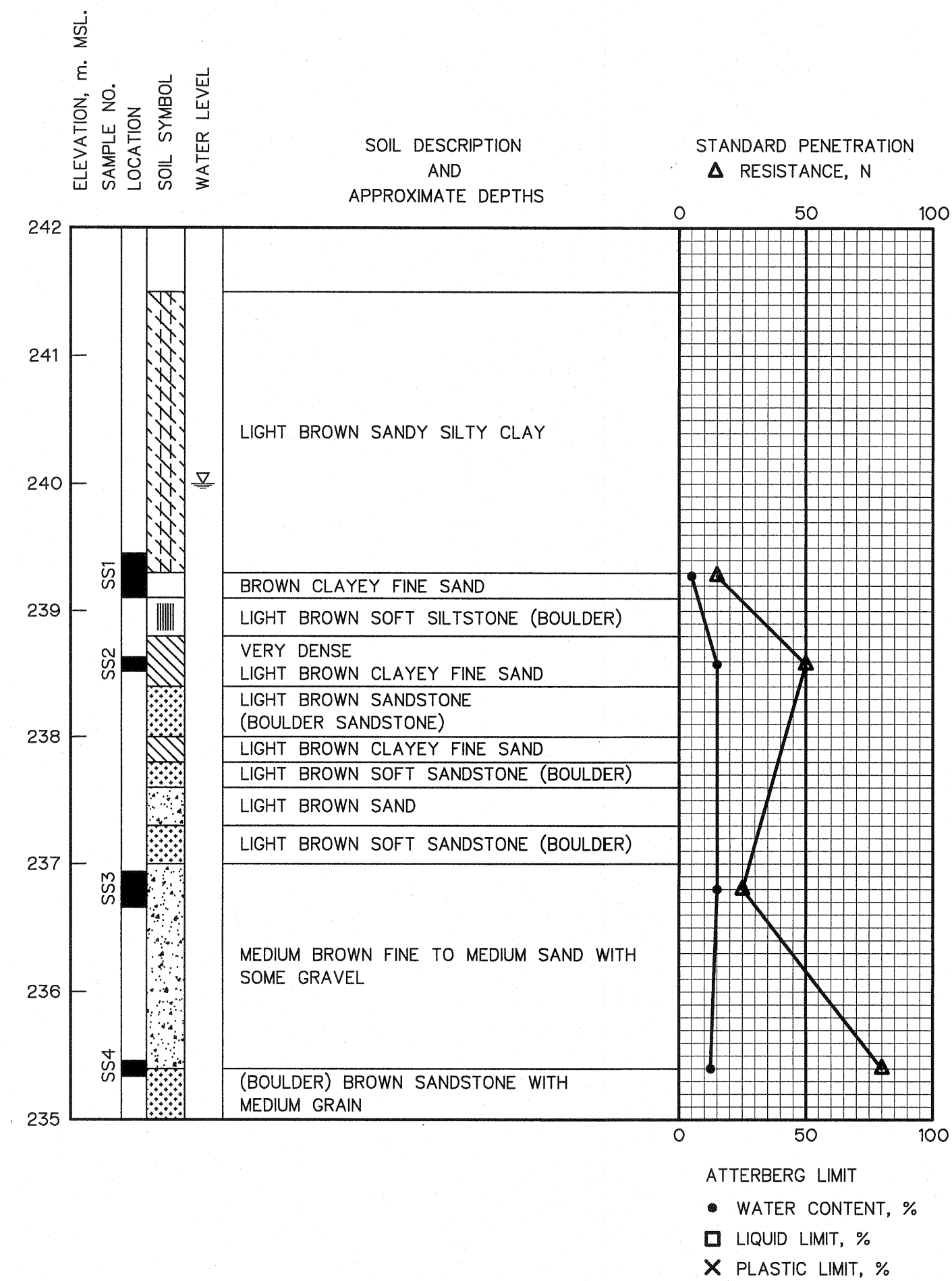
SCALE { VERTICAL 1 : 200  
HORIZONTAL 1 : 75

|     |      |           |         |          |
|-----|------|-----------|---------|----------|
| 3   |      |           |         |          |
| 2   |      |           |         |          |
| 1   |      |           |         |          |
| NO. | DATE | REVISIONS | CHECKED | APPROVED |
|     |      |           |         |          |

|                                                                                                             |  |                                                                                      |                          |
|-------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------|--------------------------|
| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |  |                                                                                      |                          |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                         |  |                                                                                      |                          |
| CIVIL WORKS<br>GENERAL<br>HYDRAULIC GRADE LINE                                                              |  |                                                                                      |                          |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.                                                                   |  | Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |                          |
| DESIGNED                                                                                                    |  | REVIEWED S. KITTEHAI                                                                 |                          |
| DRAWN                                                                                                       |  | SUBMITTED                                                                            |                          |
| CHECKED                                                                                                     |  | RECOMMENDED                                                                          |                          |
| APPROVED                                                                                                    |  | APPROVED                                                                             |                          |
| PROJECT MANAGER                                                                                             |  | 14/01/62<br>DATE                                                                     | DRAWING NO.<br>LPP-GN-05 |
|                                                                                                             |  |                                                                                      | SHEET NO.<br>5 OF 44     |



BORING LOG PLAN  
SCALE 1:250

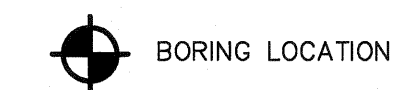


BORING LOG BH-2

#### DESCRIPTIONS

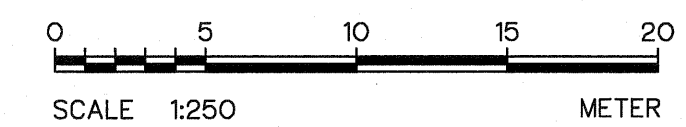
| NO.  | COORDINATE  |               |
|------|-------------|---------------|
|      | E           | N             |
| BH.1 | 805,851.159 | 1,615,525.383 |
| BH.2 | 805,872.928 | 1,615,550.237 |

#### SYMBOL

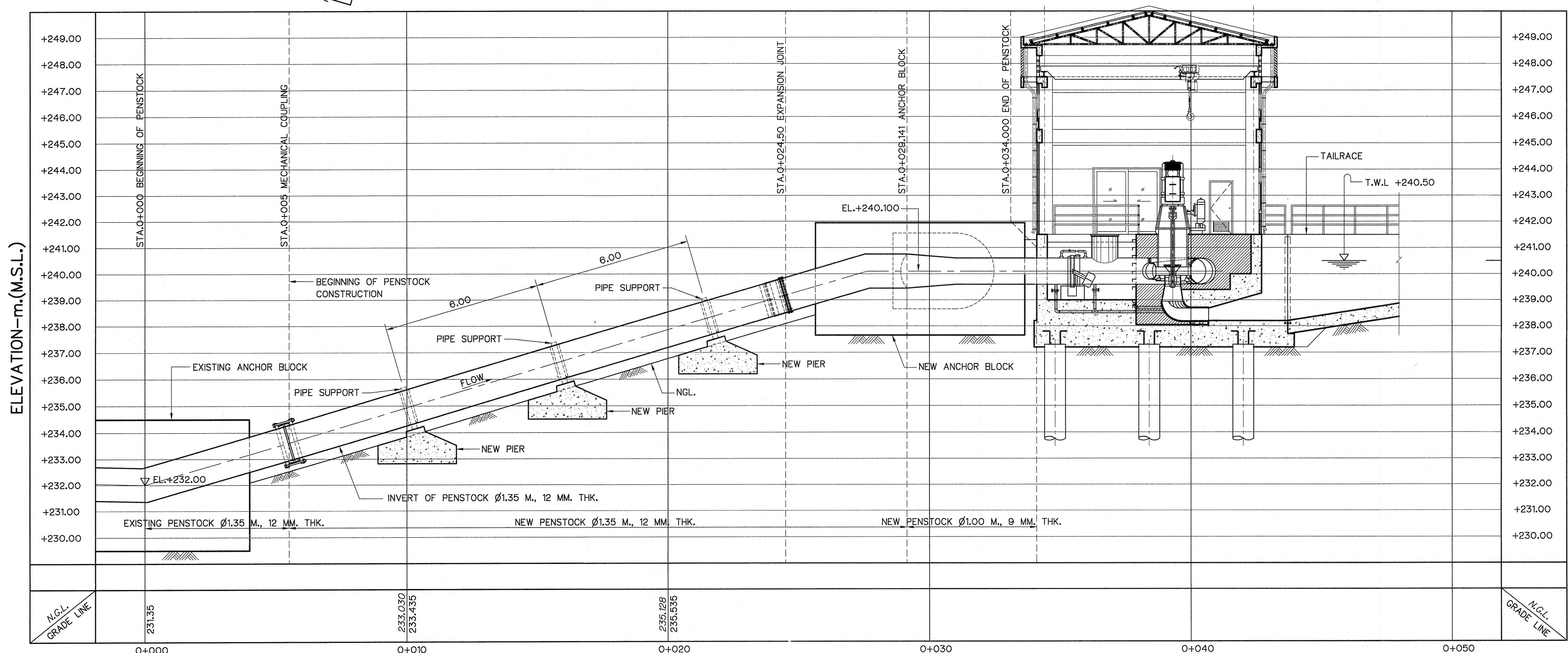
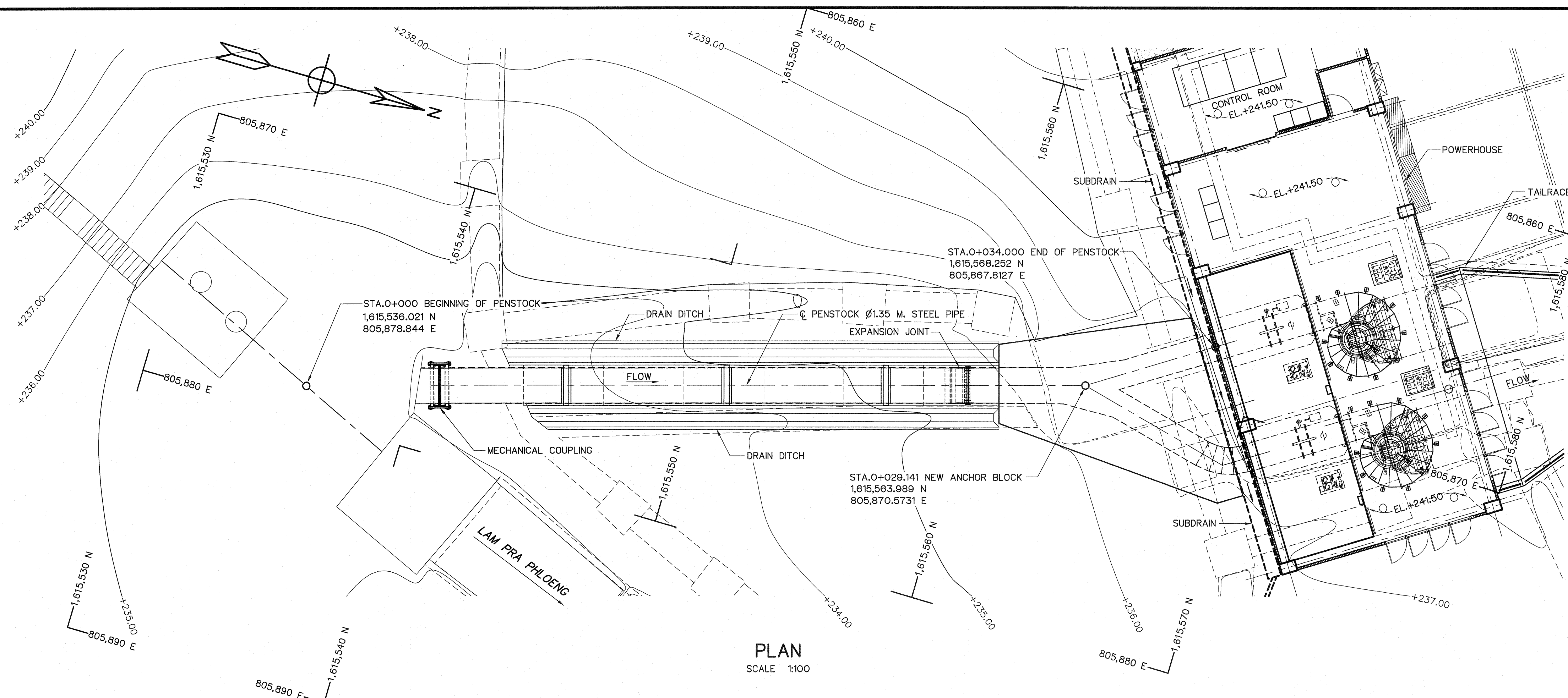


#### NOTES :

- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.



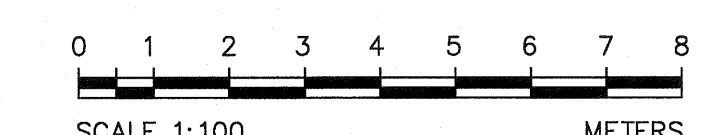
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|-------------------------------------------------------------------------------------------------------------|--|--------------------------------|-----------------------|
| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |  |                                |                       |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                         |  |                                |                       |
| CIVIL WORKS<br>GENERAL<br>GEOLOGICAL DATA                                                                   |  |                                |                       |
| DESIGNED <i>[Signature]</i> 802.6651                                                                        |  | REVIEWED <i>S. KITICHAH</i>    |                       |
| DRAWN <i>[Signature]</i>                                                                                    |  | SUBMITTED <i>[Signature]</i>   |                       |
| CHECKED <i>[Signature]</i> 802.7324                                                                         |  | RECOMMENDED <i>[Signature]</i> |                       |
| APPROVED <i>[Signature]</i>                                                                                 |  | APPROVED <i>[Signature]</i>    |                       |
| PROJECT MANAGER                                                                                             |  | DATE 14/01/62                  | DRAWING NO. LPP-GN-06 |
| CONSULTANTS                                                                                                 |  | DEDE                           | SHEET NO. 6 OF 44     |



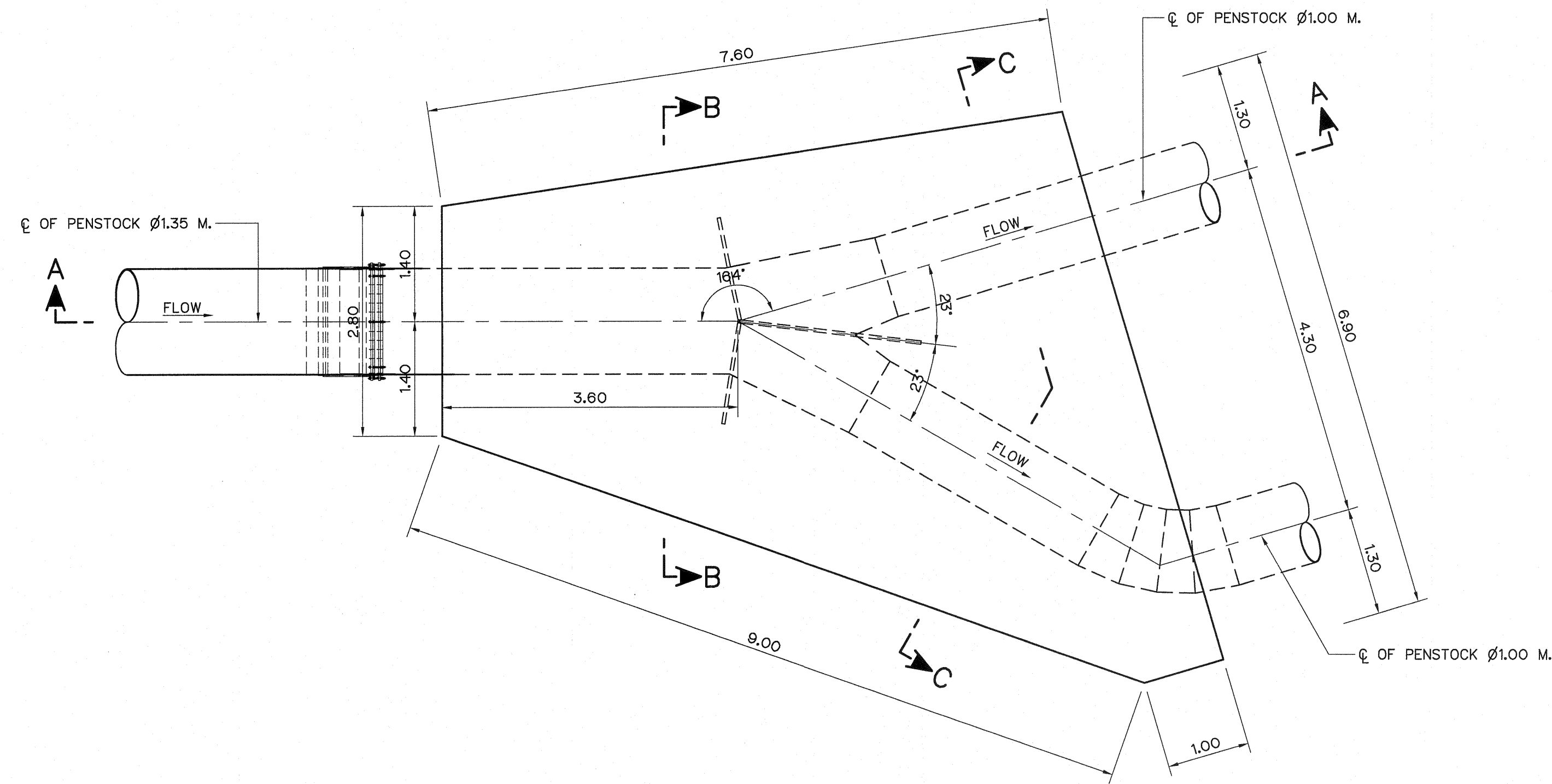
- NOTES :
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS. UNLESS OTHERWISE SHOWN.
  2. SYMBOLE, ABBREVIATIONS AND CENERAL NOTES SEE DWG. NO. LPP-GN-03.
  3. THE ALIGNMENT OF THE PENSTOCK AND RELATED STRUCTURES SHALL BE CHECK AND CORRECTED BY THE CONTRACTOR TO SUIT THE FIELD CONDITIONS AND SHALL BE SUBMITTED TO DEDE'S FIELD ENGINEER FOR APPROVAL.

REFERENCE DRAWINGS :

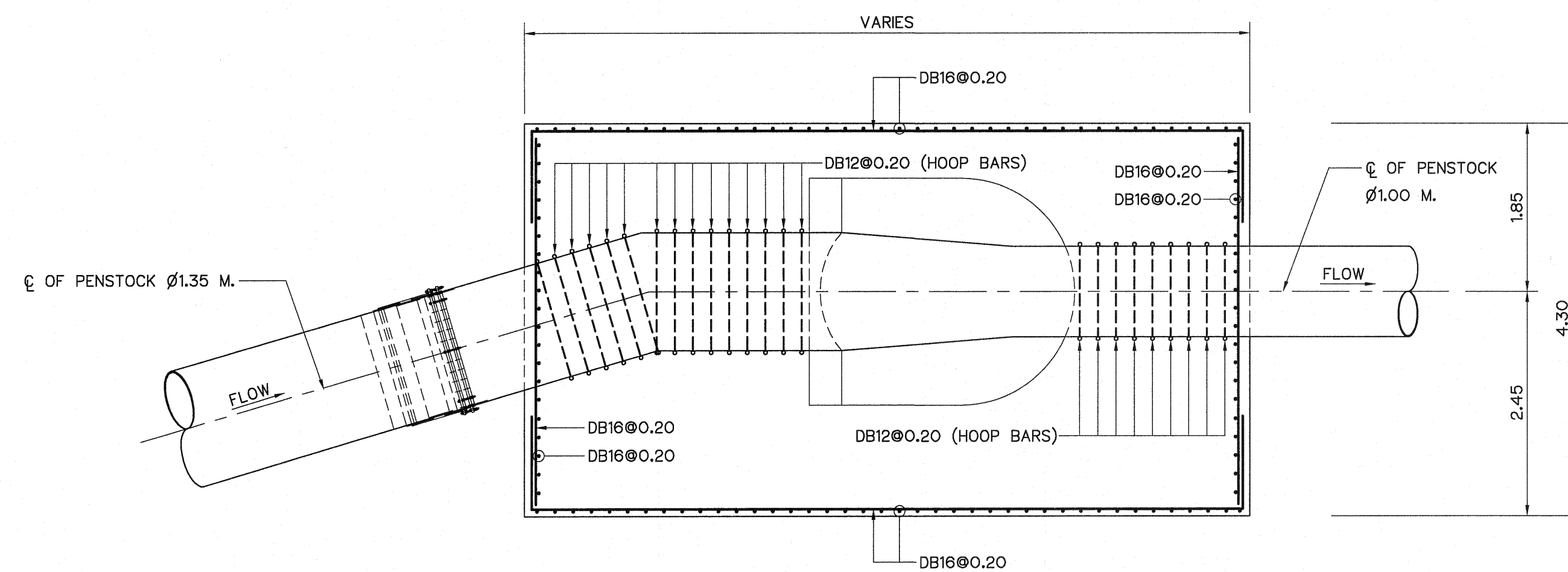
1. PENSTOCK, PIER DETAILS LPP-PS-06



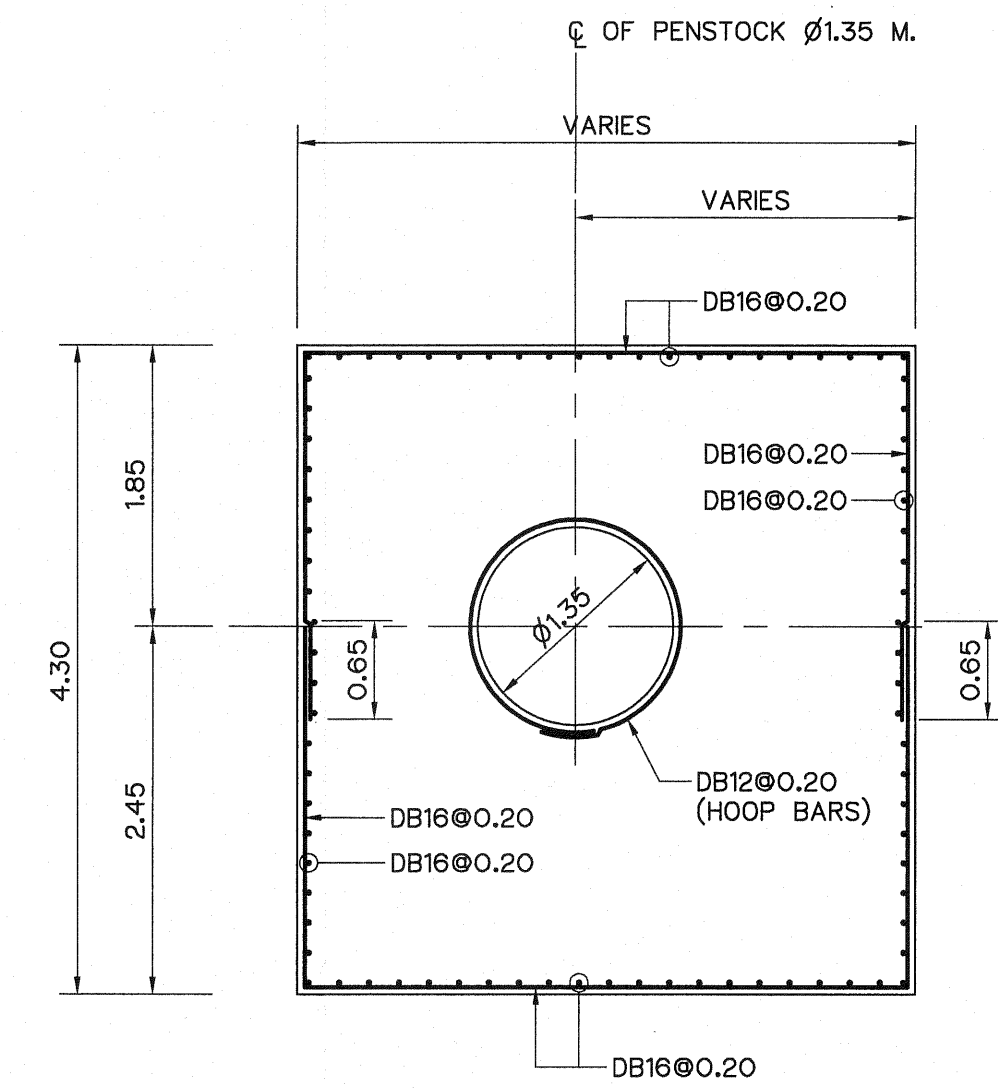
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| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |                                      |  |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |  |                                      |  |
| <p>CIVIL WORKS<br/>PENSTOCK<br/>PLAN AND PROFILE, STA. 0+000 TO STA. 0+034.000</p>                                    |  |                                      |  |
| <p>FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                      |  | <p>REVIEWED <b>S. KITTHAI</b></p>    |  |
| <p>DESIGNED <b>S. KITTHAI</b> @EL.6651</p>                                                                            |  | <p>SUBMITTED <b>S. KITTHAI</b></p>   |  |
| <p>DRAWN <b>S. KITTHAI</b> @EL.7324</p>                                                                               |  | <p>RECOMMENDED <b>S. KITTHAI</b></p> |  |
| <p>CHECKED <b>S. KITTHAI</b> 14/01/62</p>                                                                             |  | <p>APPROVED <b>S. KITTHAI</b></p>    |  |
| <p>PROJECT MANAGER</p>                                                                                                |  | <p>DRAWING NO. LPP-PS-01</p>         |  |
| <p>DATE</p>                                                                                                           |  | <p>SHEET NO. 7 OF 44</p>             |  |



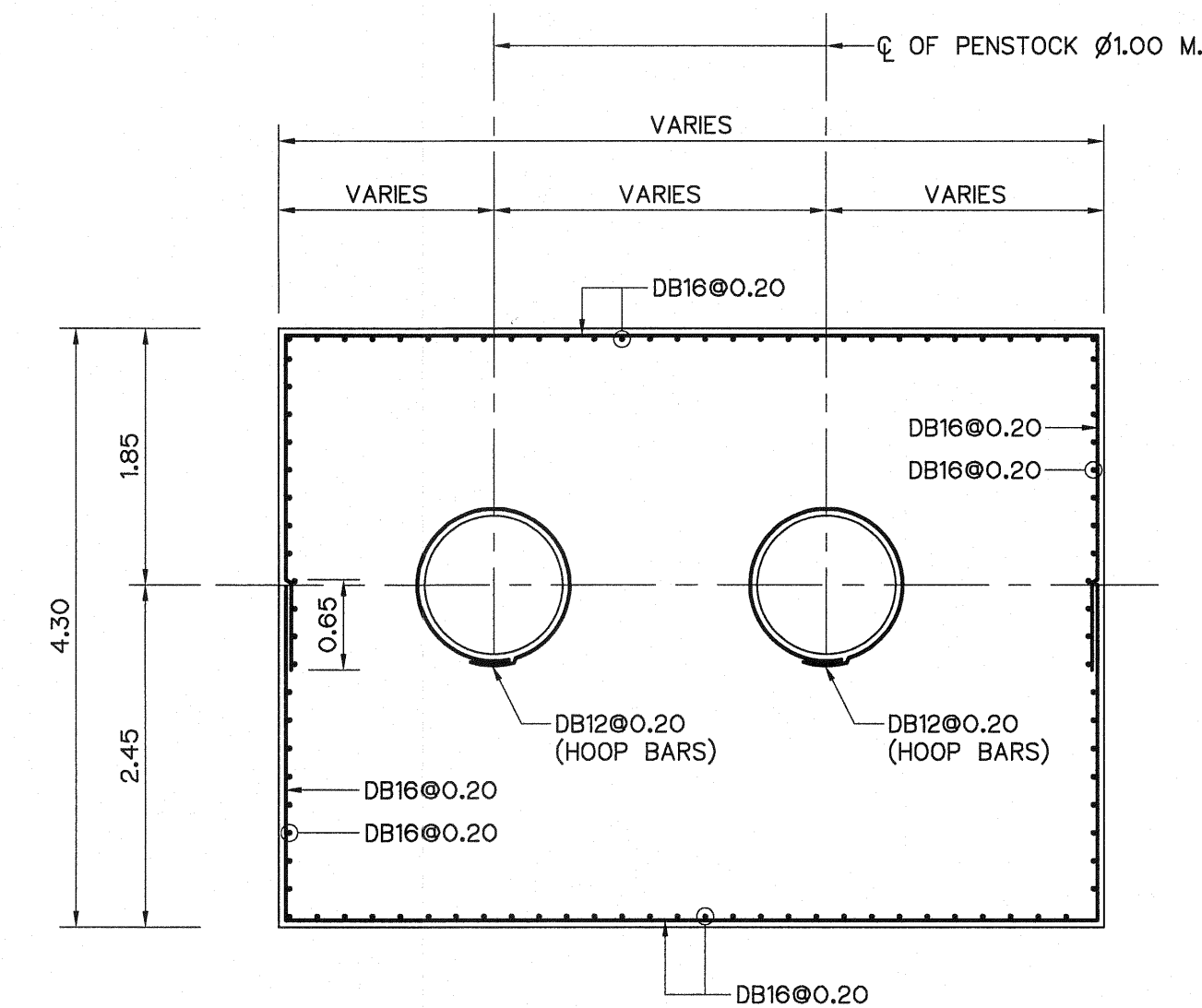
ANCHOR BLOCK PLAN  
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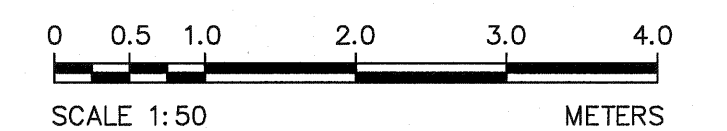
SECTION A-A  
SCALE 1:50



SECTION B-B  
SCALE 1:50



SECTION C-C  
SCALE 1:50



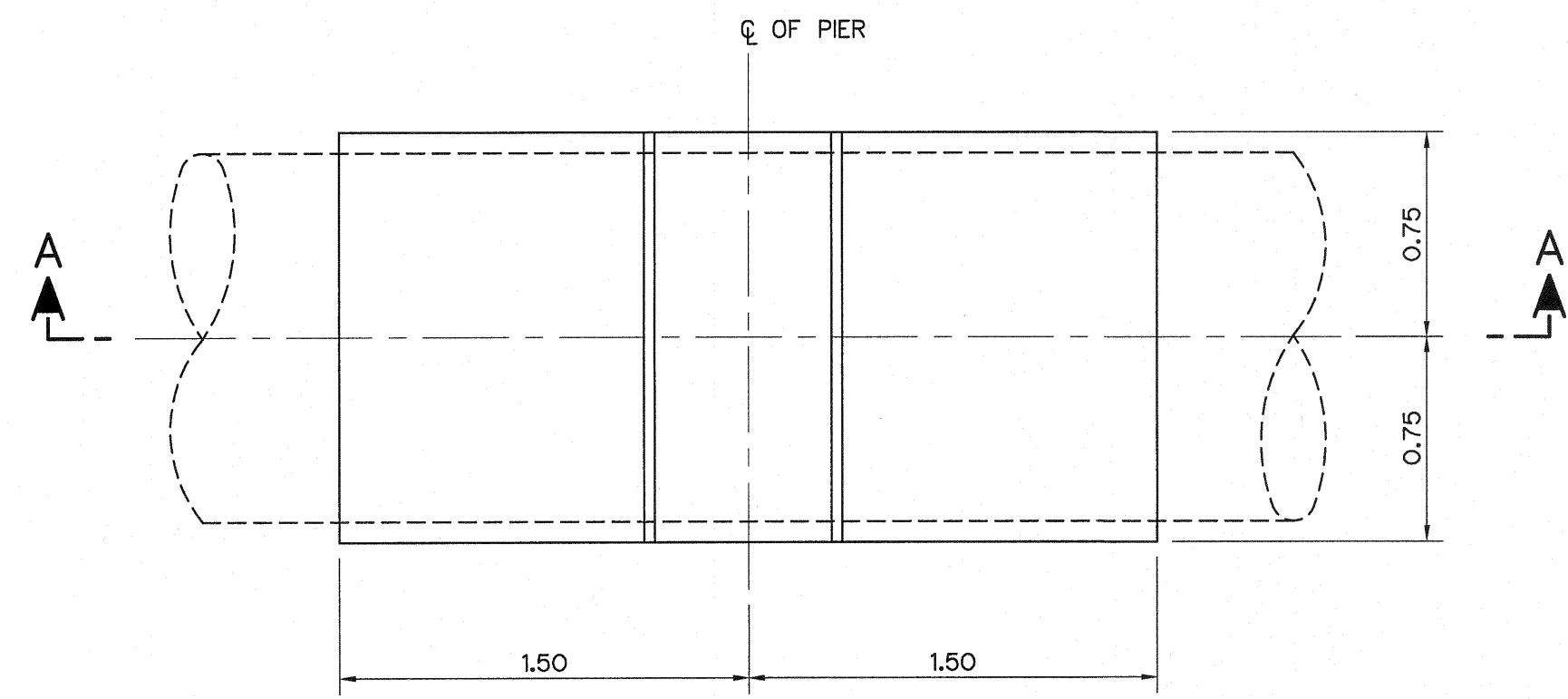
NOTES :

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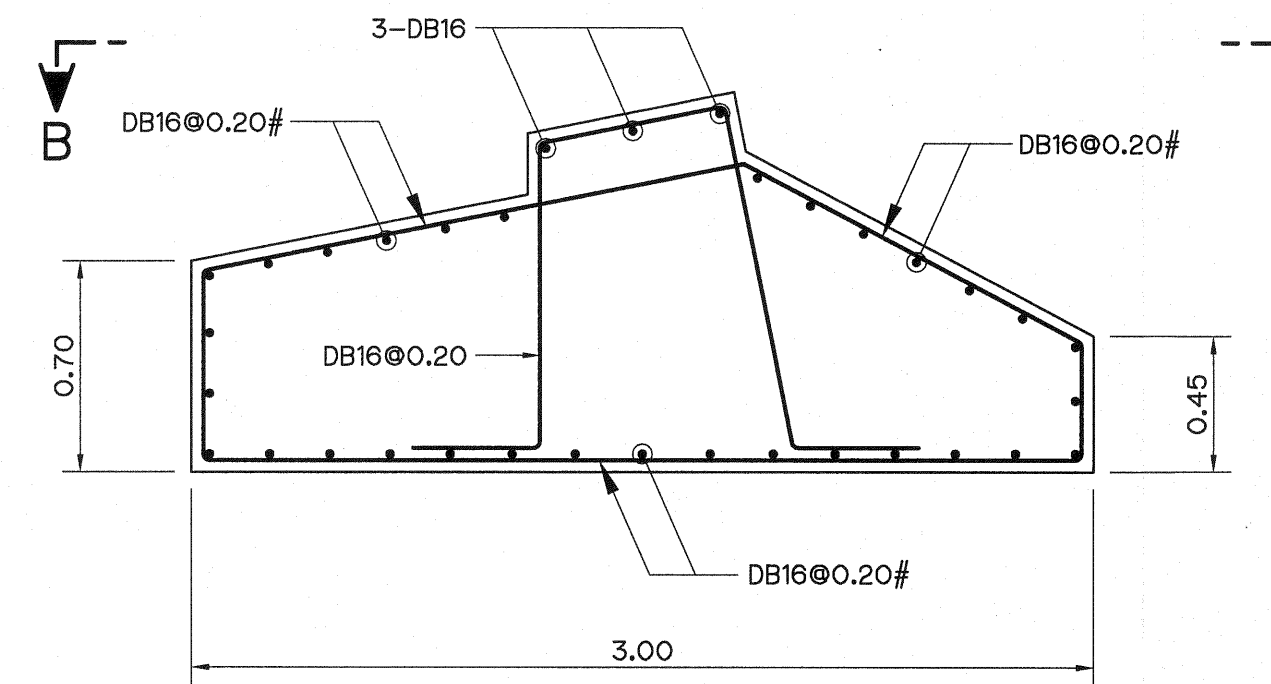
REFERENCE DRAWINGS :

- PENSTOCK PLAN AND PROFILE, STA. 0+000 TO STA. 0+034.000 LPP-PS-01

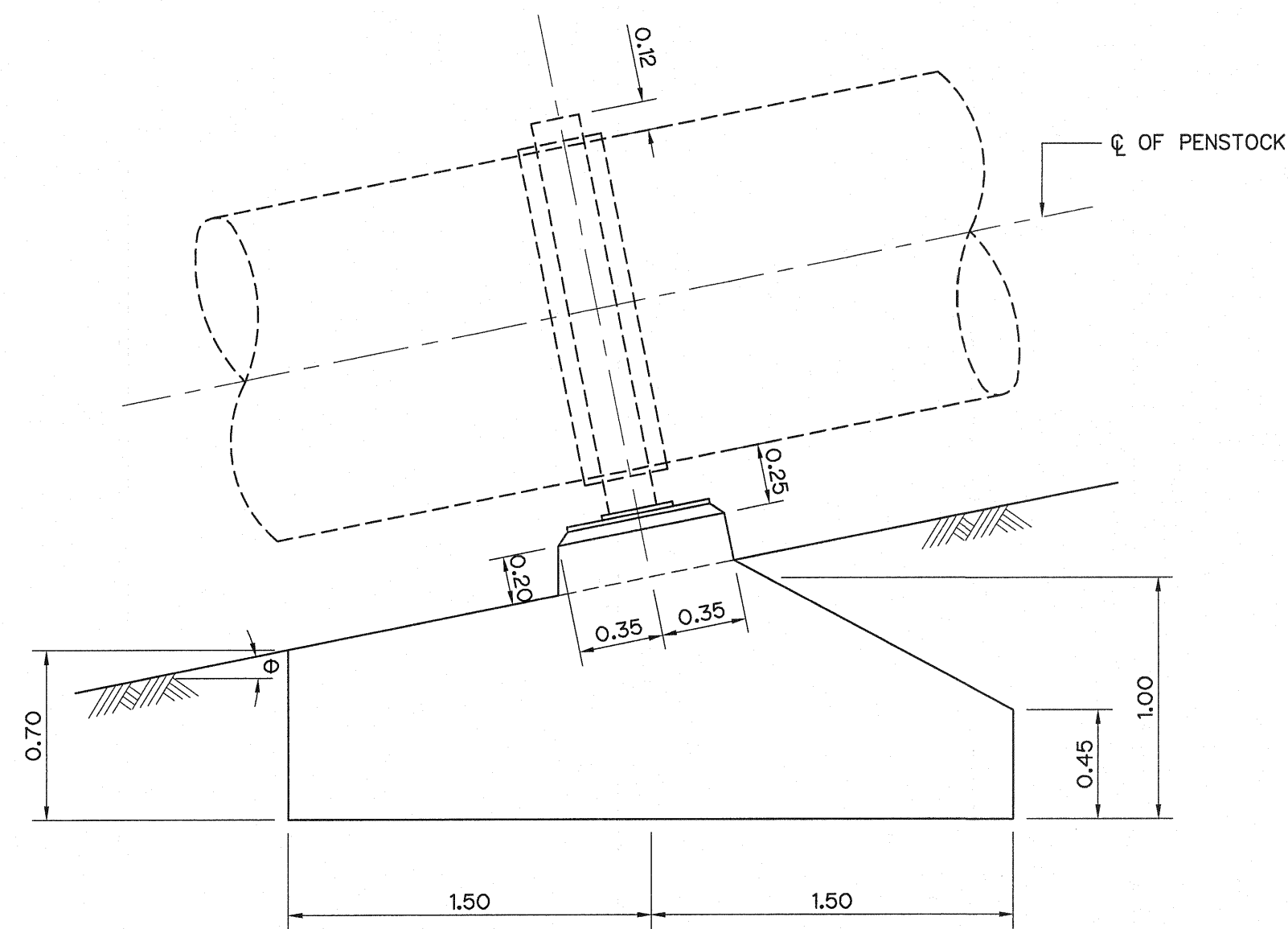
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|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |                                       |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |                                       |
| <p>CIVIL WORKS<br/>PENSTOCK<br/>ANCHOR BLOCK<br/>PLAN ,SECTIONS, AND REINFORCEMENT DETAILS</p>                        |                                       |
| <p>FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                      | <p>REVIEWED <b>S. KITICHAJ</b></p>    |
| <p>DESIGNED <b>S. KITICHAJ</b> 22.6651</p>                                                                            | <p>SUBMITTED <b>S. KITICHAJ</b></p>   |
| <p>DRAWN <b>S. KITICHAJ</b></p>                                                                                       | <p>RECOMMENDED <b>S. KITICHAJ</b></p> |
| <p>CHECKED <b>S. KITICHAJ</b> 22.7324</p>                                                                             | <p>APPROVED <b>S. KITICHAJ</b></p>    |
| <p>CONSULTANTS</p>                                                                                                    | <p>DEDE</p>                           |
| <p>PROJECT MANAGER</p>                                                                                                | <p>DATE 14/01/62</p>                  |
| <p>DRAWING NO.<br/>LPP-PS-02</p>                                                                                      | <p>SHEET NO.<br/>8 OF 44</p>          |



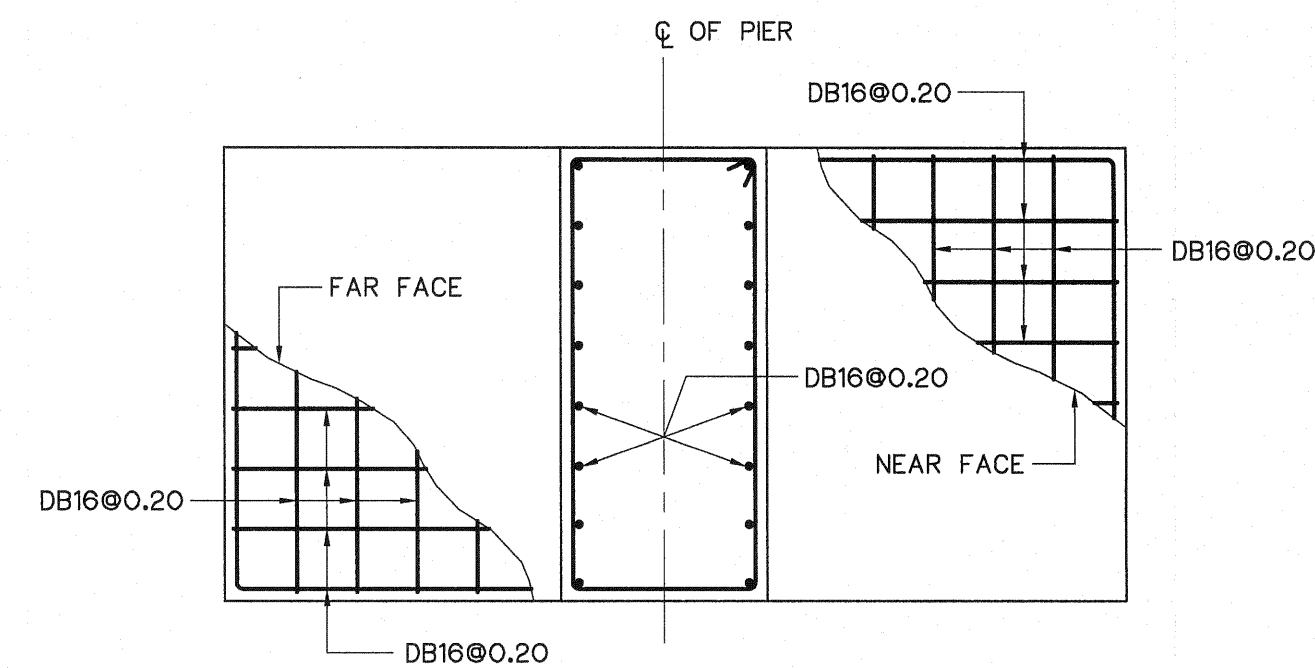
PLAN  
SCALE 1:25



SECTION A - A  
SCALE 1:25



ELEVATION  
SCALE 1:25



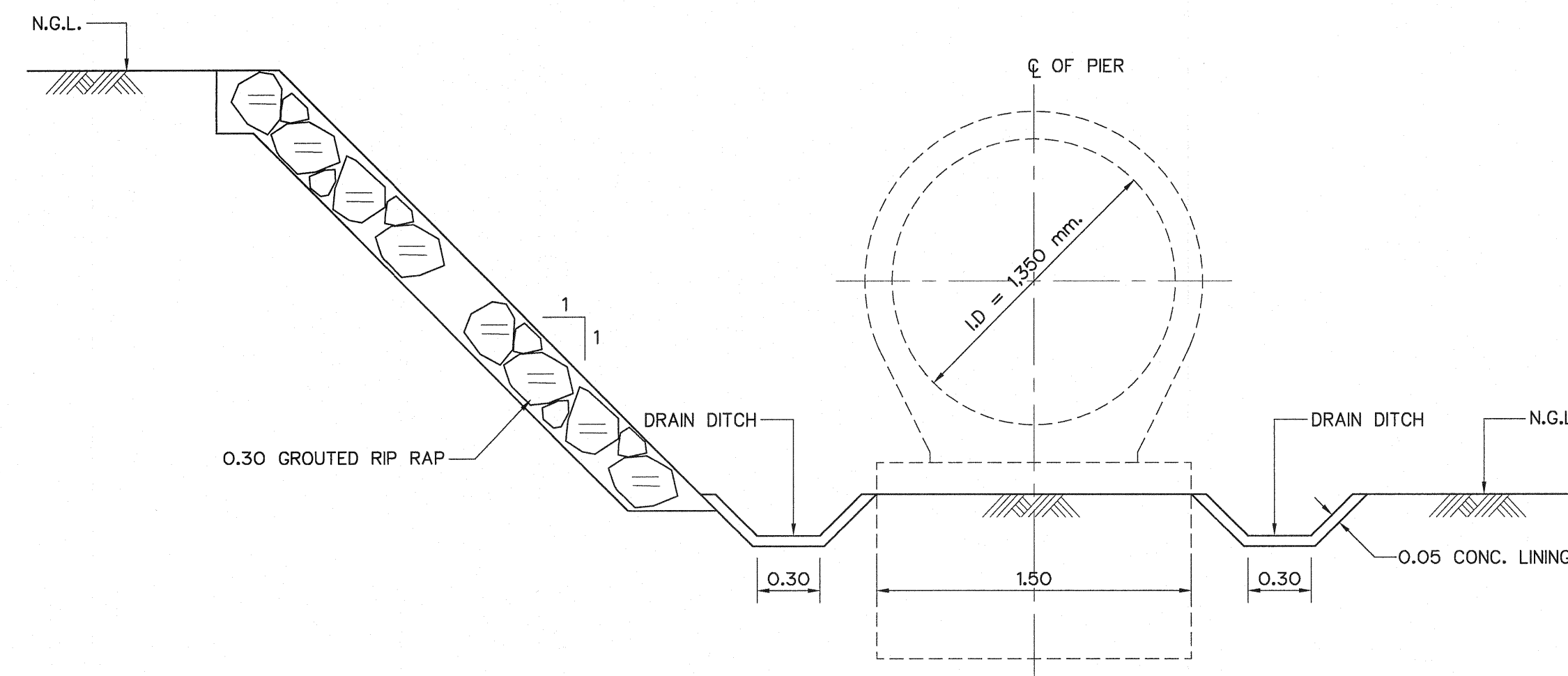
SECTION B - B  
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NOTES :

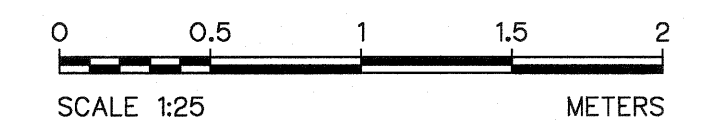
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLE, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
3. THE ALIGNMENT OF THE PENSTOCK AND RELATED STRUCTURES SHALL BE CHECK AND CORRECTED BY THE CONTRACTOR TO SUIT THE FIELD CONDITIONS AND SHALL BE SUBMITTED TO DEDE'S FIELD ENGINEER FOR APPROVAL.

REFERENCE DRAWINGS :

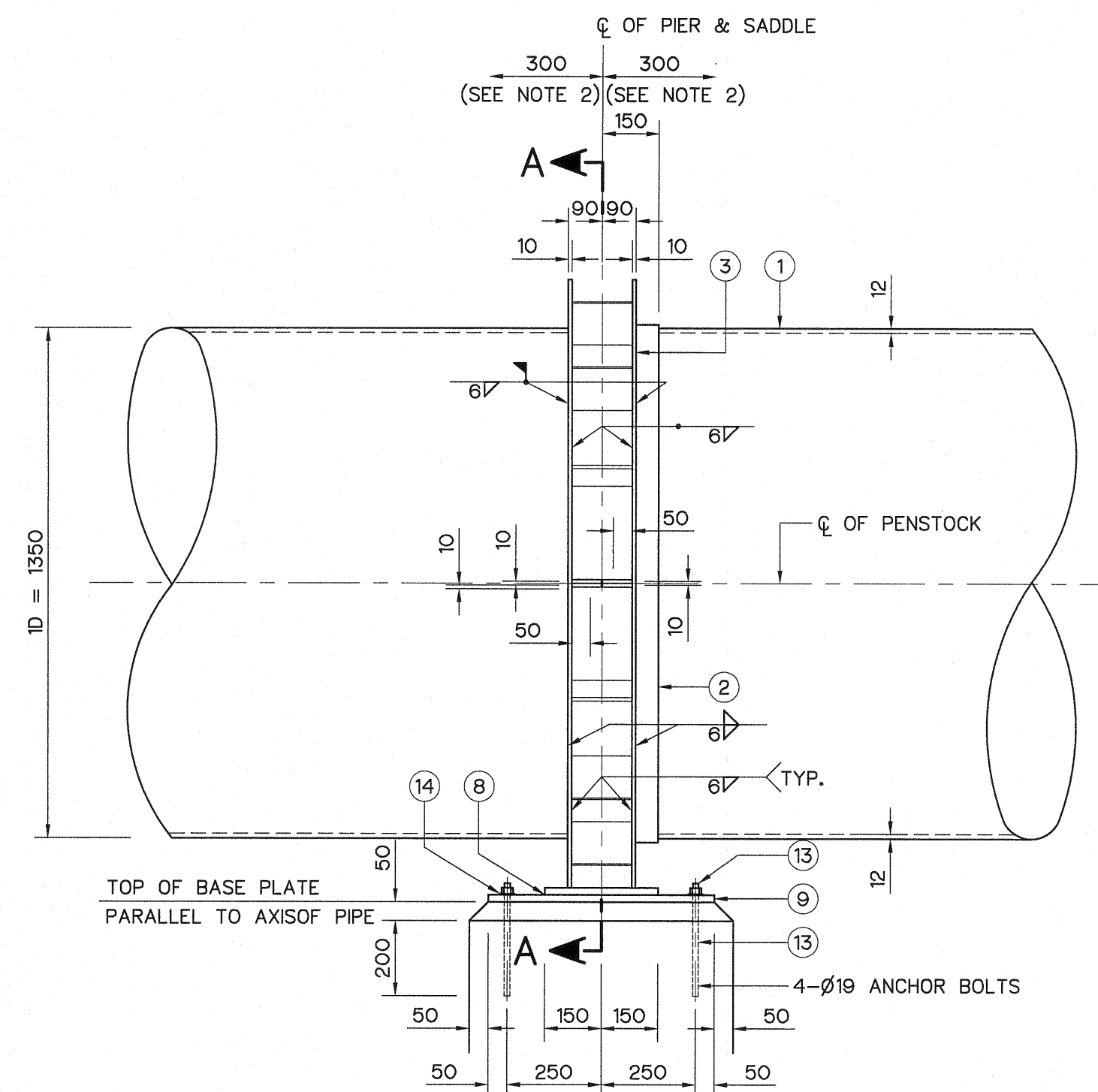
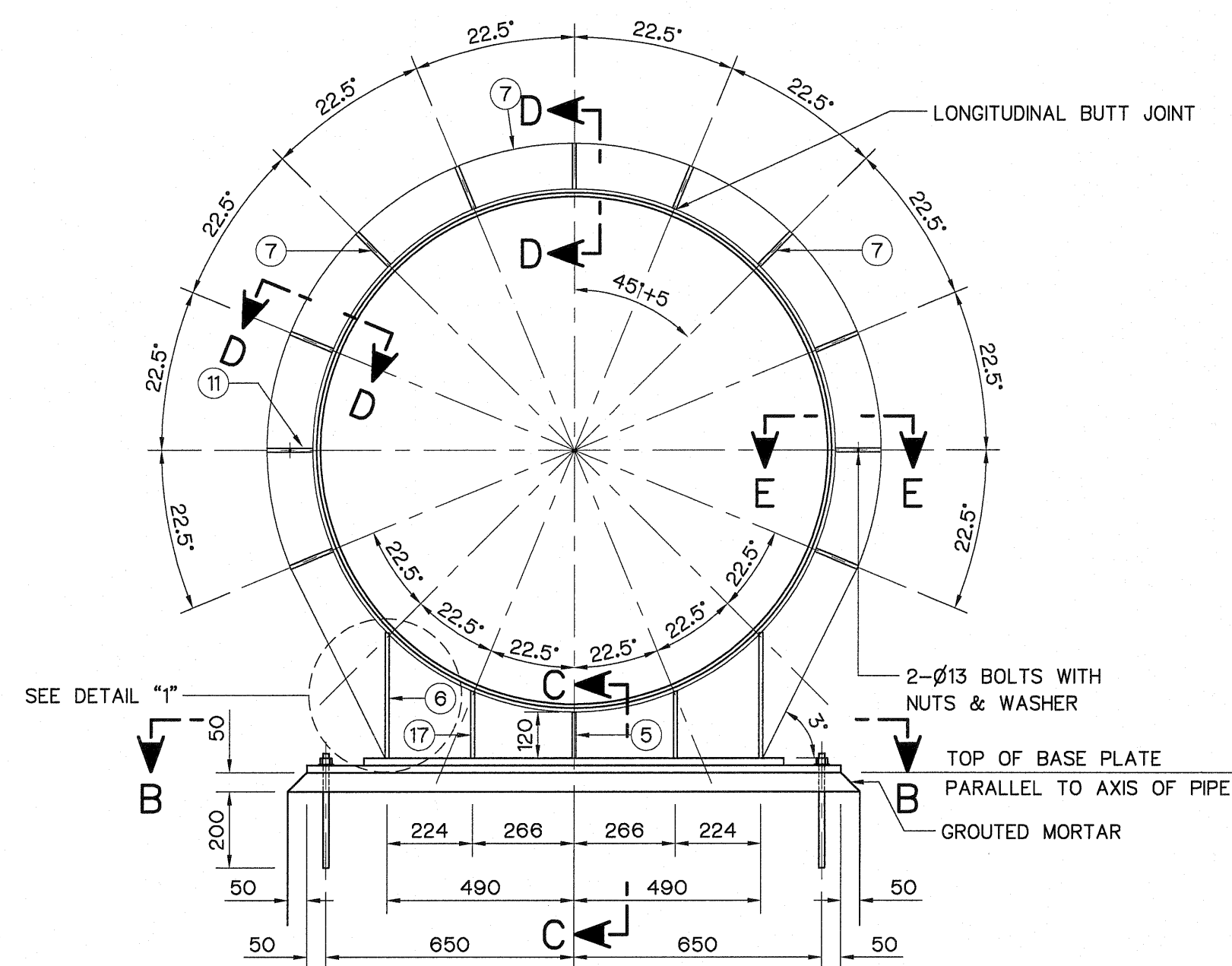
1. PENSTOCK PLAN AND PROFILE, STA. 0+000 TO STA. 0+034.000 LPP-PS-01



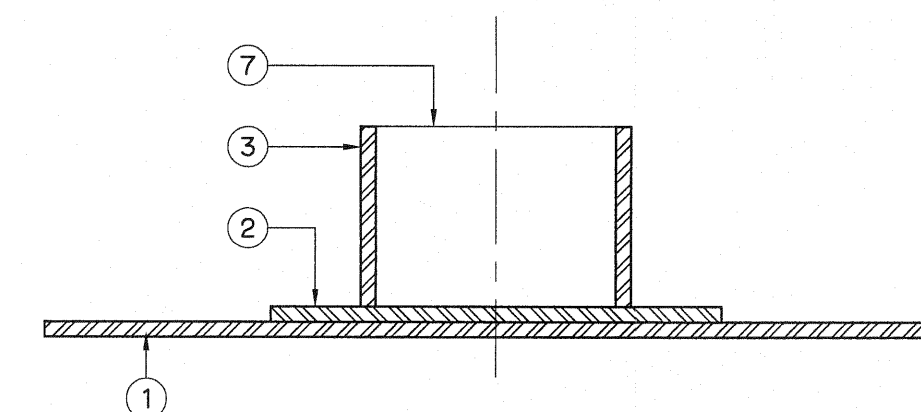
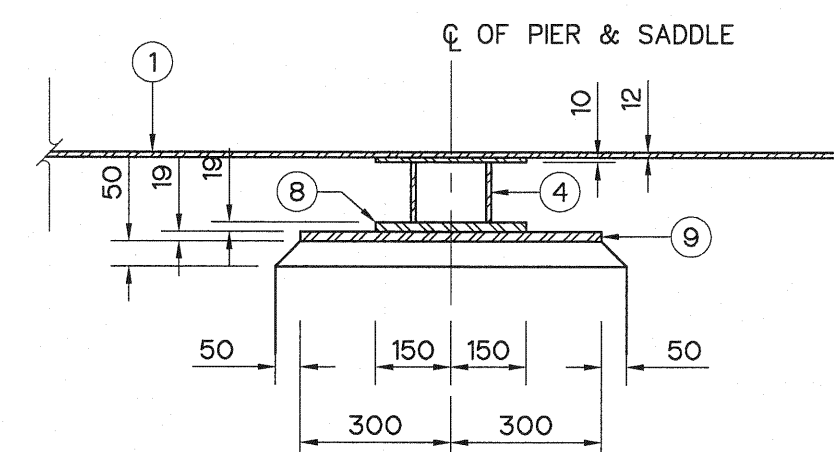
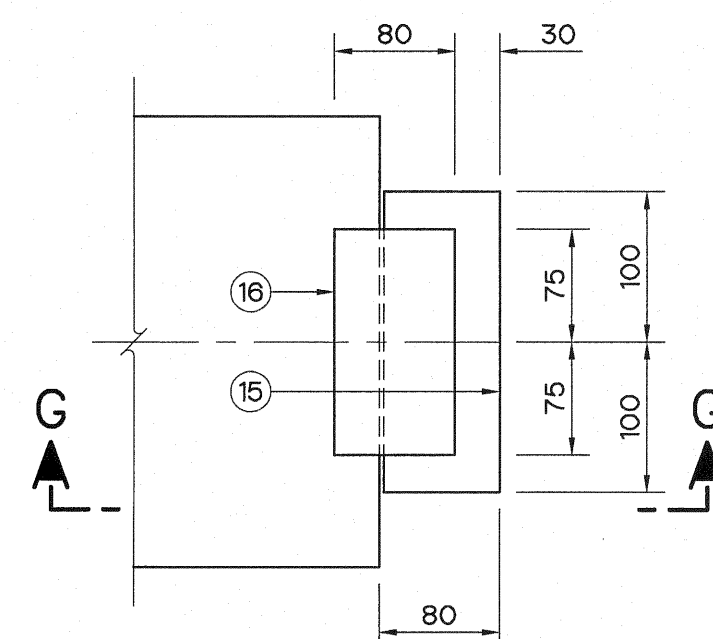
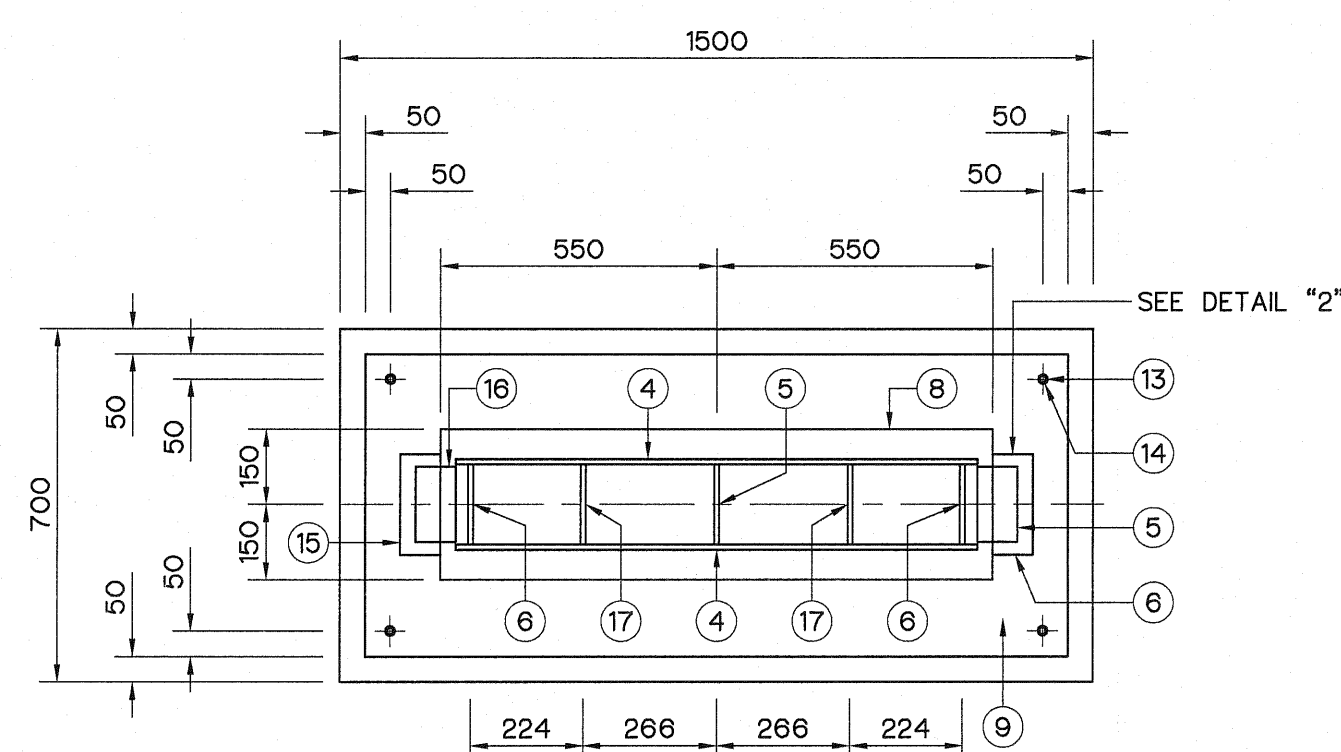
TYPICAL SECTION OF PENSTOCK TRENCH  
SCALE 1:25



|                                                                                                                       |  |                                                                                               |  |
|-----------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------|--|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |                                                                                               |  |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |  |                                                                                               |  |
| <p>CIVIL WORKS<br/>PENSTOCK<br/>PIER &amp; BEND<br/>PLAN, SECTIONS AND REINFORCEMENT DETAILS</p>                      |  |                                                                                               |  |
| <p>FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                      |  | <p>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |
| <p>DESIGNED <i>[Signature]</i> 28.6651</p>                                                                            |  | <p>REVIEWED <i>[Signature]</i> 28.6651</p>                                                    |  |
| <p>DRAWN <i>[Signature]</i> 28.7324</p>                                                                               |  | <p>RECOMMENDED <i>[Signature]</i> 28.7324</p>                                                 |  |
| <p>CHECKED <i>[Signature]</i> 14/01/62</p>                                                                            |  | <p>APPROVED <i>[Signature]</i> 14/01/62</p>                                                   |  |
| <p>CONSULTANTS</p>                                                                                                    |  | <p>DEDE</p>                                                                                   |  |
| <p>PROJECT MANAGER</p>                                                                                                |  | <p>DRAWING NO. LPP-PS-03</p>                                                                  |  |
| <p>DATE</p>                                                                                                           |  | <p>SHEET NO. 9 OF 44</p>                                                                      |  |

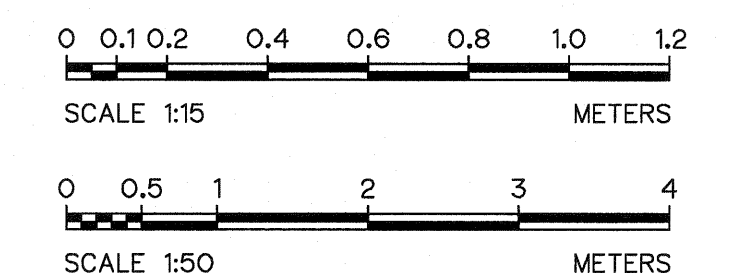
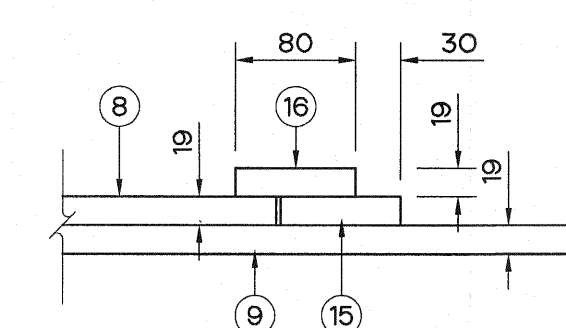
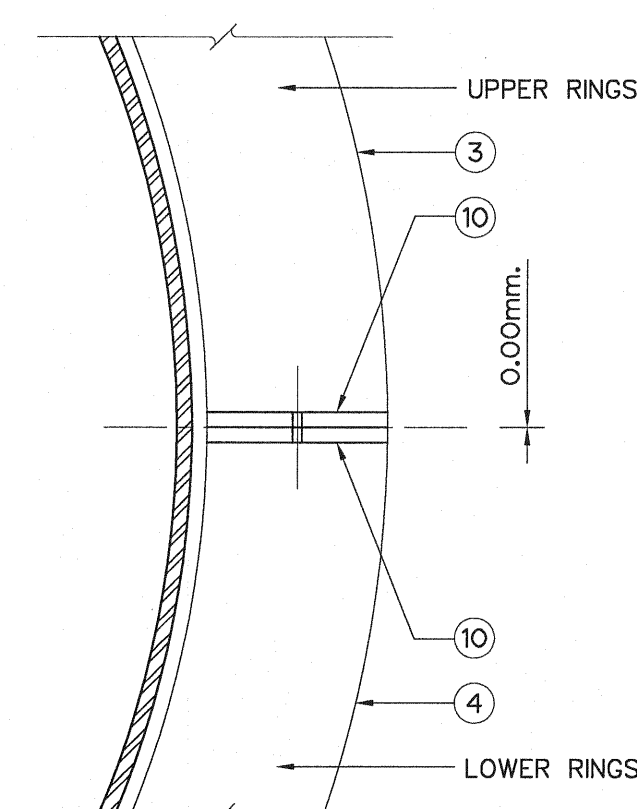
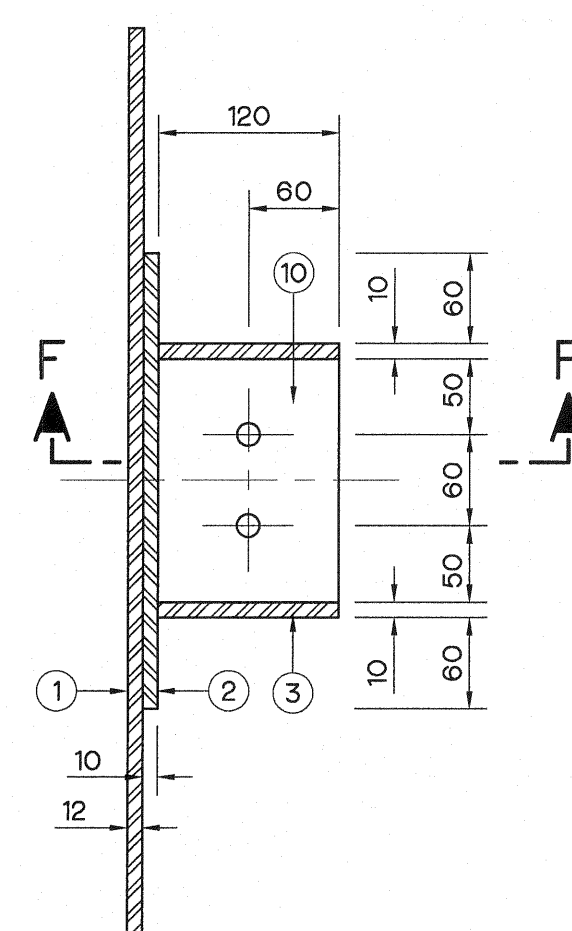
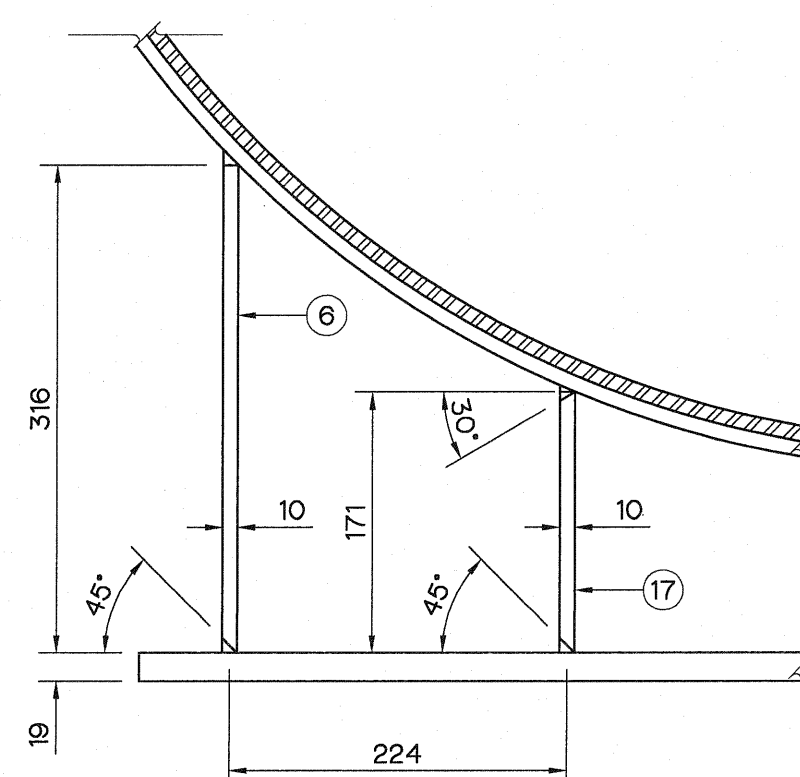


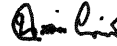
| BILL OF MATERIALS        |                             |                     |      |            |
|--------------------------|-----------------------------|---------------------|------|------------|
| (PER ONE SET OF SUPPORT) |                             |                     |      |            |
| ITEM                     | DESCRIPTION                 | MATERIAL            | QUAN | REMARKS    |
| 1                        | PENSTOCK STEEL PIPE         | ASTM--A283, GUIDE D | —    |            |
| 2                        | REINFORCING PADS            | ASTM--A283, GUIDE D | 2    |            |
| 3                        | UPPER RINGS                 | ASTM--A283, GUIDE D | 2    |            |
| 4                        | LOWER RINGS                 | ASTM--A283, GUIDE D | 2    |            |
| 5                        | STIFFENER PLATES 10x120x160 | ASTM--A283, GUIDE D | 1    |            |
| 6                        | STIFFENER PLATES 10x160x318 | ASTM--A283, GUIDE D | 2    |            |
| 7                        | STIFFENER PLATES 10x120x160 | ASTM--A283, GUIDE D | 9    |            |
| 8                        | SADDLE PLATE 19x300x1100    | ASTM--A36           | 1    | SEE NOTE 3 |
| 9                        | BASE PLATE 16x600x1400      | ASTM--A36           | 1    | GALVANIZED |
| 10                       | BOLTING PLATE 10x120x160    | ASTM--A283, GUIDE D | 4    |            |
| 11                       | BOLT Ø13x40W/NUTS & WASHERS | ASTM--A325          | 4    | GALVANIZED |
| 12                       | ANCHOR BOLTS Ø19x350        | ASTM--A283, GUIDE B | 4    | SEE NOTE 4 |
| 13                       | NUTS Ø19                    | ASTM--A283, GUIDE B | 12   | GALVANIZED |
| 14                       | WASHER Ø19                  | ASTM--A283, GUIDE B | 4    | GALVANIZED |
| 15                       | GUIDE PLATE 20x80x200       | ASTM--A36           | 2    |            |
| 16                       | UPLEFT PLATE 19x80x150      | ASTM--A36           | 2    |            |
| 17                       | STIFFENER PLATES 10x160x171 | ASTM--A283, GUIDE D | 2    |            |

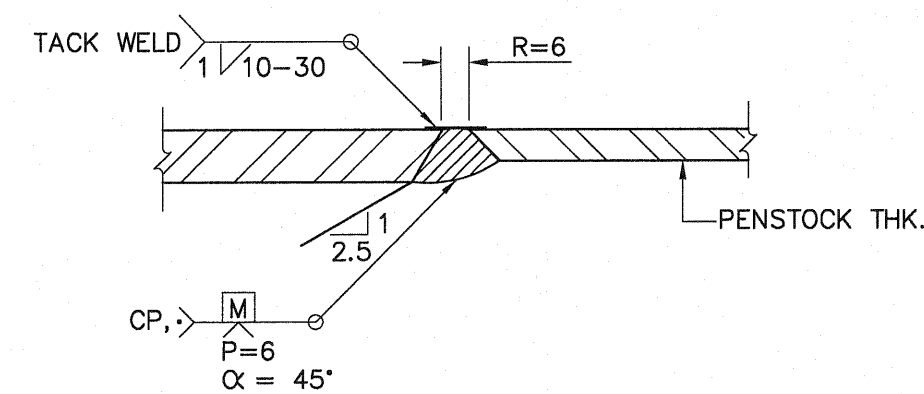


NOTES :

1. ALL DIMENSIONS AND ELEVATION ARE IN METER, UNLESS OTHERWISE SHOWN.
2. JOINT OF PIPE CONNECTION IS NOT ALLOWED IN THIS REGEION.
3. GALVANIZED ON BOTTOM OF PLATE.
4. GALVANICE ONLY PORTION EXPOSED TO WEATHER.
5. THIS DRAWING IS DESIGNED FOR GUIDE LINE ONLY,  
SHOP DRAWING SHALL BE DESIGNED BY CONTRACTOR  
UNDER APPROVAL OF FIELD ENGINEER.



|                                                                                                                                                                                                                    |                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/><b>MINISTRY OF ENERGY</b></p> |                                                                                                                                                                                                           |
| <p align="center"><b>LAM PHRA PHLOENG HYDROPOWER PROJECT</b></p>                                                                                                                                                   |                                                                                                                                                                                                           |
| <p align="center"><b>CIVIL WORKS<br/>PENSTOCK<br/>STEEL PIPE SUPPORT<br/>ELEVATIONS, SECTION &amp; DETAILS</b></p>                                                                                                 |                                                                                                                                                                                                           |
|  FRONTIER ENGINEERING CONSULTANTS CO., LTD.                                                                                   |  <p align="center">Department of Alternative<br/>Energy Development and Efficiency<br/><b>MINISTRY OF ENERGY</b></p> |
| DESIGNED  ๑๒๑.6๕51                                                                                                            | REVIEWED <b>S. KITTHAI</b>                                                                                                                                                                                |
| DRAWN                                                                                                                         | SUBMITTED                                                                                                            |
| CHECKED  ๑๒๑.7324                                                                                                             | RECOMMENDED                                                                                                          |
|                                                                                                                               | APPROVED                                                                                                             |
| PROJECT MANAGER<br>DATE 14/01/62                                                                                                                                                                                   | DRAWING NO. <b>LPP-PS-04</b><br>SHEET NO. 10 OF 44                                                                                                                                                        |



Technical drawing of a circular penstock cross-section. The drawing includes the following features and dimensions:

- Centerline:** A vertical dashed line passing through the center, labeled "C OF PENSTOCK" at the top.
- Inner Diameter:** A diagonal dimension line across the center, labeled  $\phi 1350$ .
- Outer Diameter:** A horizontal dimension line at the top, labeled  $12'$  (twice), indicating a total width of 24 feet.
- Holes:** 30 holes, each with a diameter of  $\phi 3/4"$ , are distributed around the circumference. They are represented by small circles with a cross inside.
- Labels:**
  - 3: Points to the outermost layer of the penstock.
  - 4: Points to the innermost layer of the penstock.
  - 5: Points to a hole.
  - 6: Points to a hole.
  - 8: Points to a hole.

350

100 50 50 50 100

200 50

650

NICKEL CLADDING OUTER SURFACE

530

130 40 40 50

CL OF PENSTOCK

6 RINGS 16 mm. SQUARE ASBESTOS GRAPHITE PACKING

300

FLOW

15 mm. INNER SLEEVE (INCLUDING 0.50 mm. THK. NICKEL CLADDING)

PENSTOCK 12MM. THK.

1

2

PENSTOCK 12MM. THK.

12

19

9

9

7

8

6 mm. CHAMFER

16

20

13

20 45

0.50

6 STUFFING BOX 15 mm. PLATE

1

SEE DETAIL "1"

5

4

12

11

10

30-5/8" BOLTS. EQUALLY SPACED

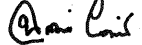
25 80 25

175

SECTION A-A

NOT TO SCALE

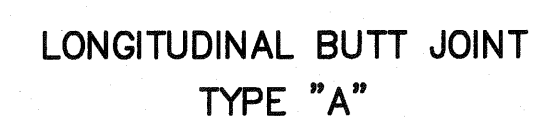
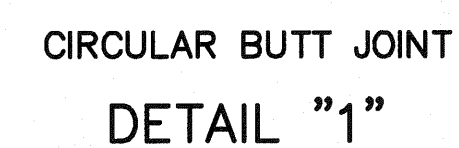
|     |      |      |
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|                                                                                                                                                                                                                                                                            |  |                                                                                                                                                                                                                                            |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  <p style="text-align: center;"> <b>KINGDOM OF THAILAND</b><br/>         Department of Alternative<br/>         Energy Development and Efficiency<br/> <b>MINISTRY OF ENERGY</b> </p> |  |                                                                                                                                                                                                                                            |  |
| <h1 style="margin: 0;">LAM PHRA PHLOENG HYDROPOWER PROJECT</h1>                                                                                                                                                                                                            |  |                                                                                                                                                                                                                                            |  |
| <h2 style="margin: 0;">CIVIL WORKS</h2>                                                                                                                                                                                                                                    |  |                                                                                                                                                                                                                                            |  |
| <h3 style="margin: 0;">PENSTOCK</h3>                                                                                                                                                                                                                                       |  |                                                                                                                                                                                                                                            |  |
| <h4 style="margin: 0;">EXPANSION JOINT, PLAN, SECTIONS AND DETAILS</h4>                                                                                                                                                                                                    |  |                                                                                                                                                                                                                                            |  |
|  <b>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</b>                                                                                                                                    |  |  <p style="text-align: center;">         Department of Alternative<br/>         Energy Development and Efficiency<br/> <b>MINISTRY OF ENERGY</b> </p> |  |
| DESIGNED  ๑๕1.6551                                                                                                                                                                    |  | REVIEWED <b>S. KITTHAI</b>                                                                                                                                                                                                                 |  |
| DRAWN                                                                                                                                                                                 |  | SUBMITTED                                                                                                                                             |  |
| CHECKED  ๑๕1.7324                                                                                                                                                                     |  | RECOMMENDED                                                                                                                                           |  |
|                                                                                                                                                                                       |  | APPROVED                                                                                                                                              |  |
| PROJECT MANAGER                                                                                                                                                                                                                                                            |  | DRAWING NO.                                                                                                                                                                                                                                |  |
| DATE                                                                                                                                                                                                                                                                       |  | LPP-PS-05                                                                                                                                                                                                                                  |  |
|                                                                                                                                                                                                                                                                            |  | SHEET NO.                                                                                                                                                                                                                                  |  |
|                                                                                                                                                                                                                                                                            |  | 11 OF 44                                                                                                                                                                                                                                   |  |



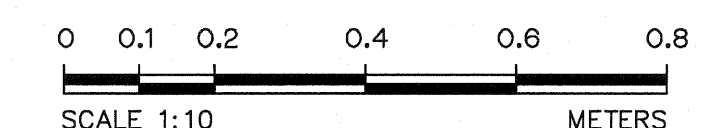
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|--------------------|-------------|----------------------|-----|--------------------|--------------|--------------|--------------|------------------|
|                    |             | T1                   | T3  | ROOT OPENING       | GROOVE ANGLE | ROOT OPENING | GROOVE ANGLE |                  |
| GMAW<br>FCAW       | B-L1a-GF    | 9                    | 1.0 | R = T1             | —            | +1.5, -0     | —            | SINGLE-PASS WELD |
| GMAW<br>FCAW       | B-L1a-GF    | 12                   | 1.0 | R = T1             | —            | +1.5, -0     | —            | SINGLE-PASS WELD |

SMAW = SHIELD METAL ARC WELDING  
GMAW = GAS METAL ARC WELDING  
FCAW = FLUX CORED ARC WELDING



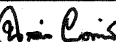
| TYPE | WELDING PROCESS | DESIGNATION | BASE METAL THICKNESS |     | GROOVE PREPARATION |              |           | TOLERANCES |           |         | REMARKS          |
|------|-----------------|-------------|----------------------|-----|--------------------|--------------|-----------|------------|-----------|---------|------------------|
|      |                 |             | T1                   | T3  | ROOT OPENING       | GROOVE ANGLE | ROOT FACE | R          | A         | F       |                  |
| A    | SMAW            | B-U2        | 9                    | —   | R = 2.0            | A = 60°      | F = 2.0   | +15, -0    | +10', -0' | +15, -0 | SINGLE-PASS WELD |
|      | SMAW            | B-U2        | 12                   | —   | R = 2.0            | A = 60°      | F = 2.0   | +15, -0    | +10', -0' | +15, -0 | SINGLE-PASS WELD |
| B    | SMAW            | B-L1a-GF    | 9                    | 1.0 | R = 9.0            | —            | —         | +15, -0    | —         | —       | SINGLE-PASS WELD |
|      | GMAW<br>FCAW    | B-L1a-GF    | 12                   | 1.0 | R = 12.0           | —            | —         | +15, -0    | —         | —       | SINGLE-PASS WELD |

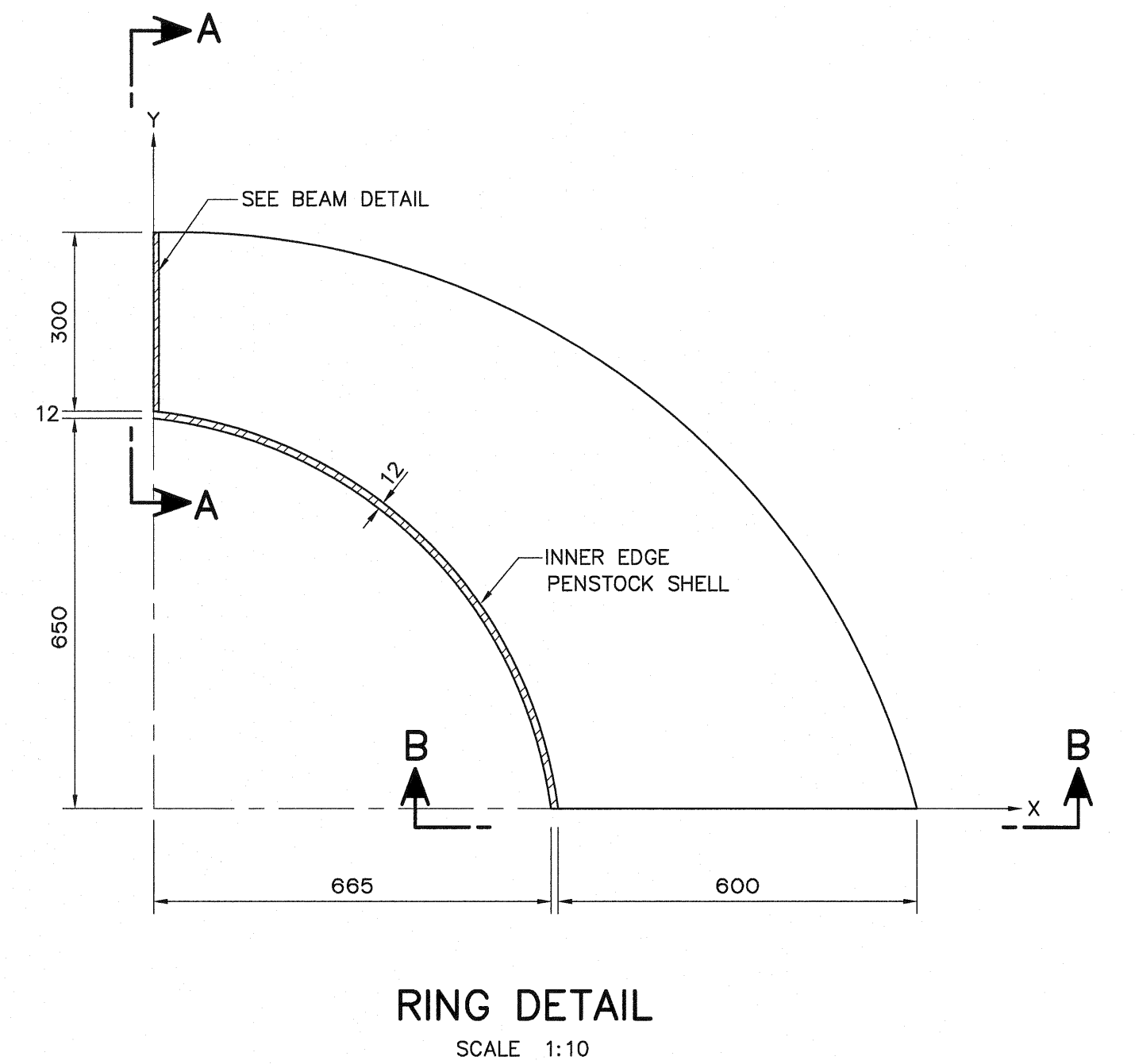
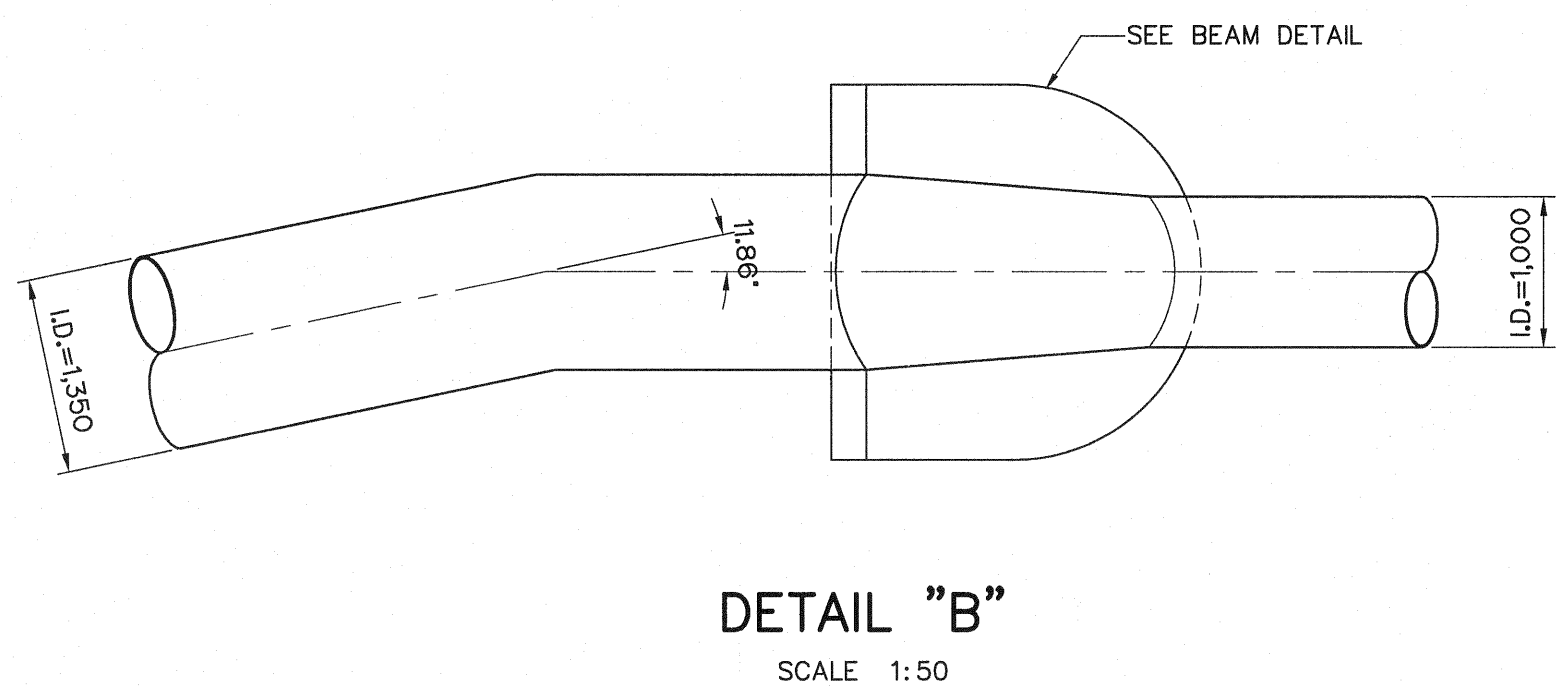
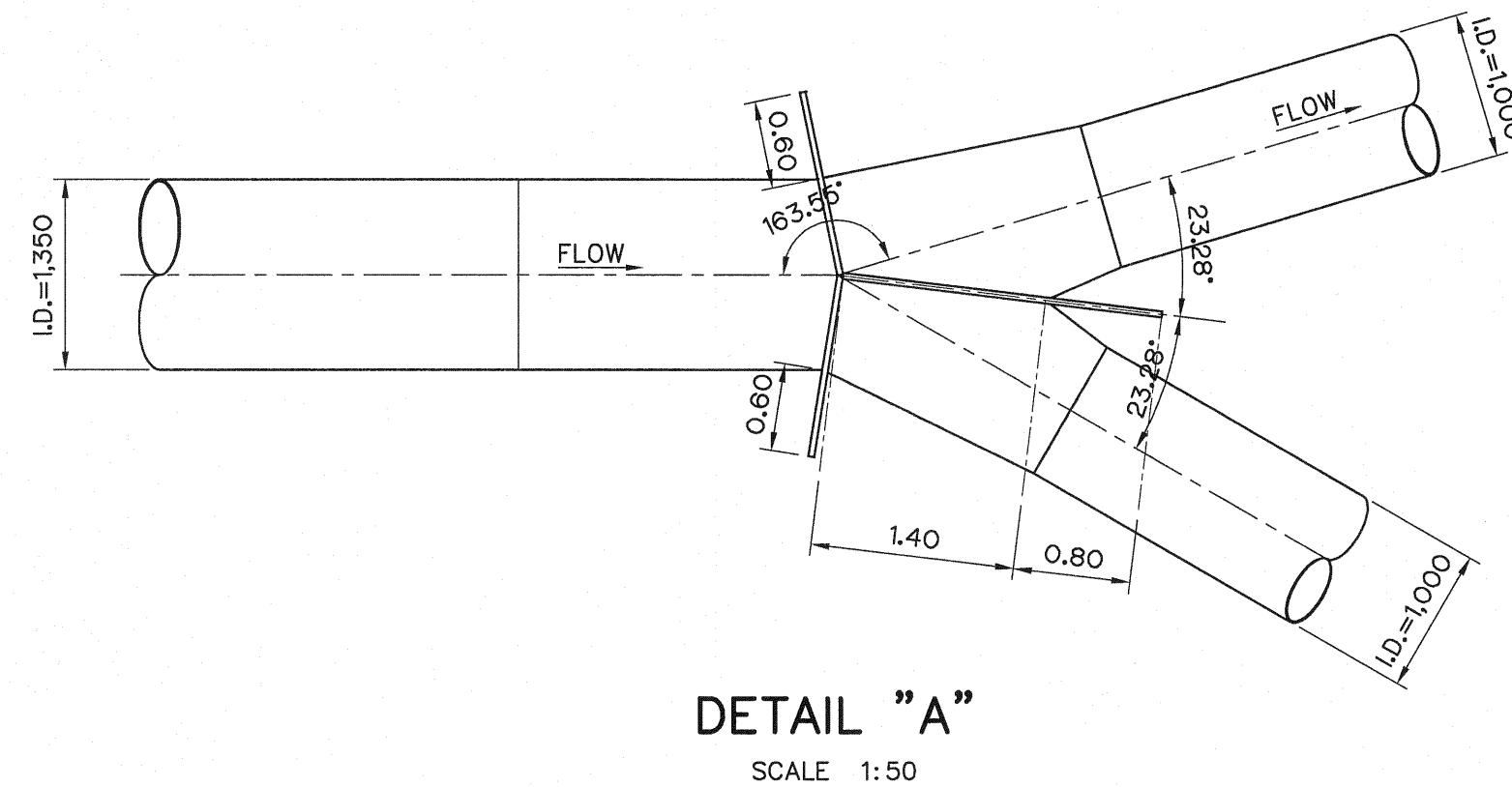
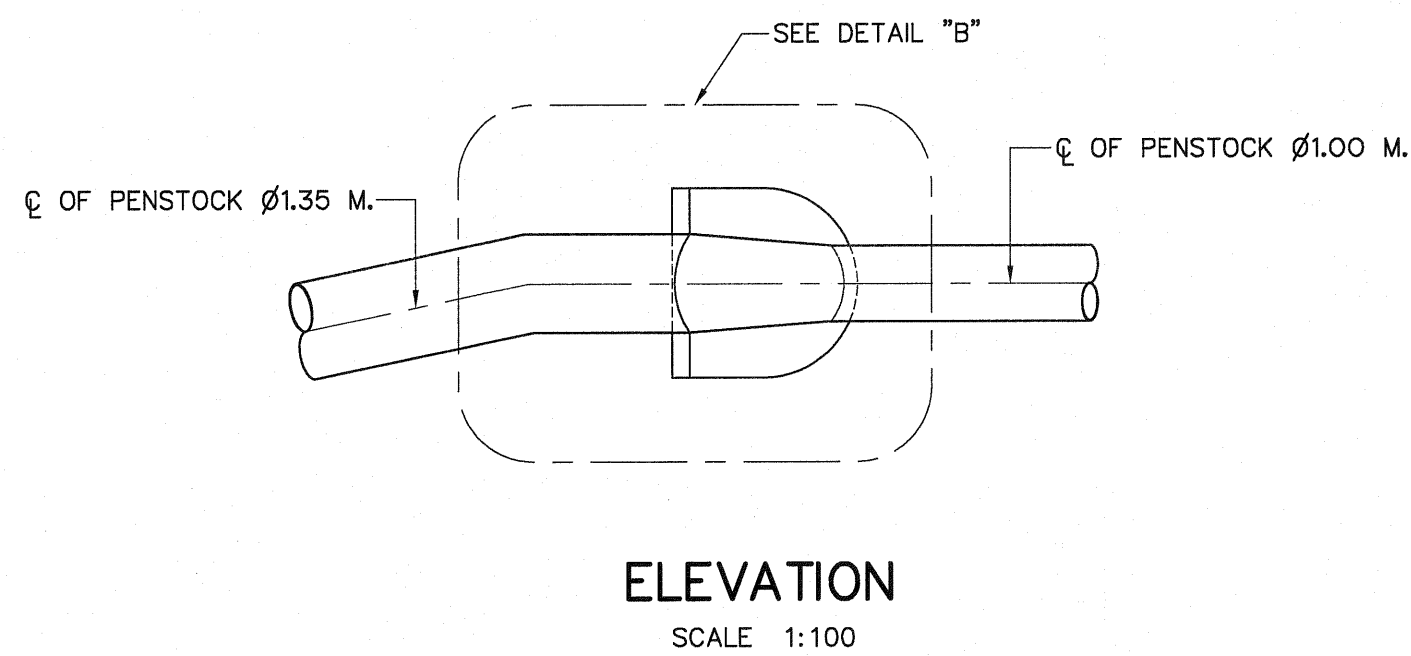
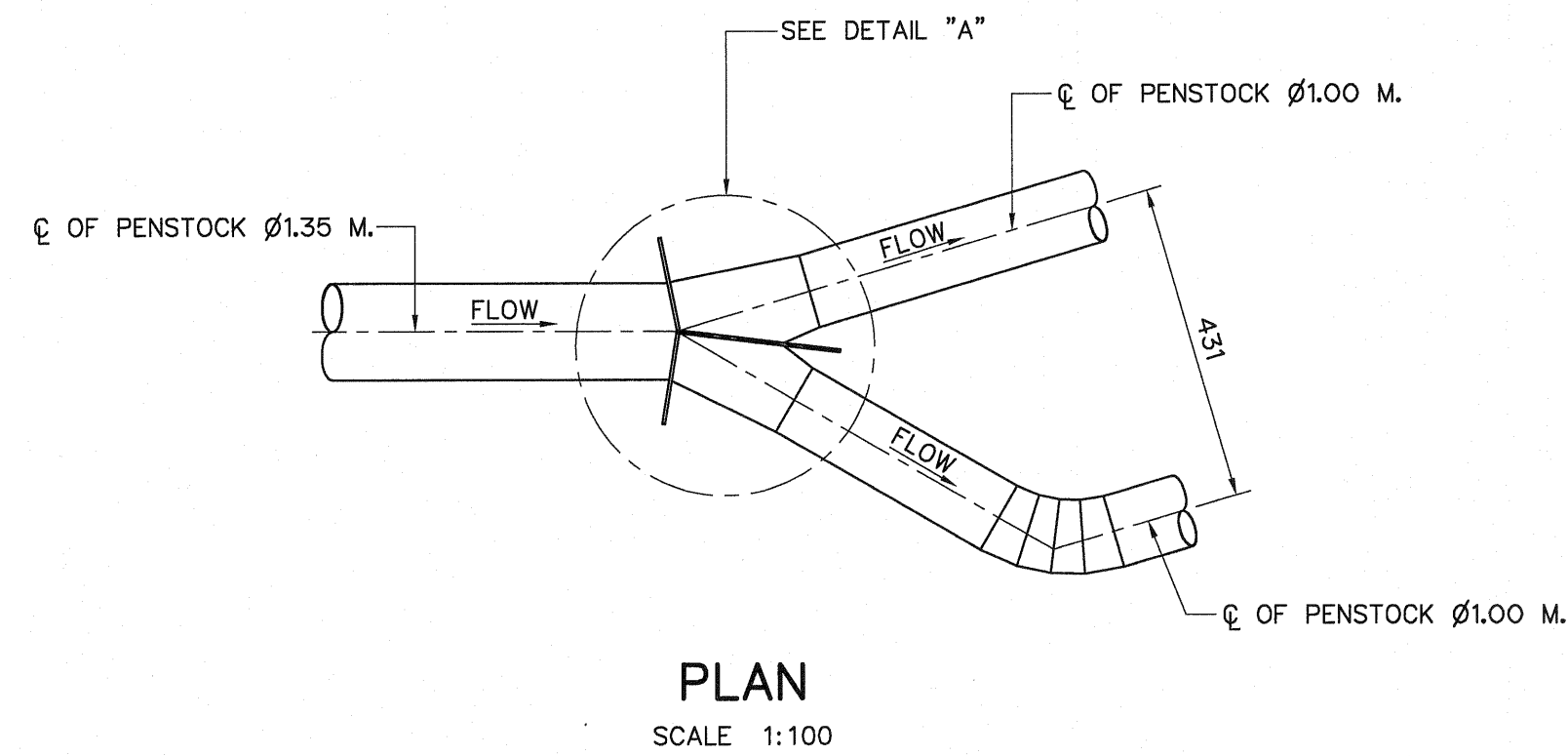
1. ALL DIMENSION ARE IN MILLIMETER, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
3. GROOVE WELD MADE AFTER WELDING OTHER SIDE.
4. USE WELDING ELECTRODE TYPE "E" 70XX.
5. MATERIAL OF BACKING IS THE SAME AS OF PIPE.



|                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                         |                                                                                       |                                                                                       |                                                                                       |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |  |  |  |    |  |  |  |  |
| FIELD WELD SYMBOL                                                                   | WELD - ALL - AROUND SYMBOL                                                          | SQUARE GROOVE WELDING SYMBOL<br>R=ROOT OPENING                                      | V-GROOVE WELDING SYMBOL<br>R=ROOT OPENING<br>A=GROOVE ANGLE<br>F=ROOT FACE          | BACKING SYMBOL (MATERIAL OF BACKING THE SAME AS OF PIPE)                             | COMPLETE JOINT PENETRATION WELD                                                       | FILLET WELD<br>S=WELDING SIZE<br>L=LENGTH OF WELD<br>P=PITCH (CENTER TO CENTER OF WELD) | BACK OR BACKING WELD SYMBOL                                                           | COMBINED WELDS. BACKING WELD ON FAR SIDE AND V-GROOVE WELD ON NEAR SIDE               | BEVEL GROOVE WELDING SYMBOL                                                           | FLARE-BEVEL GROOVE WELDING SYMBOL                                                     |

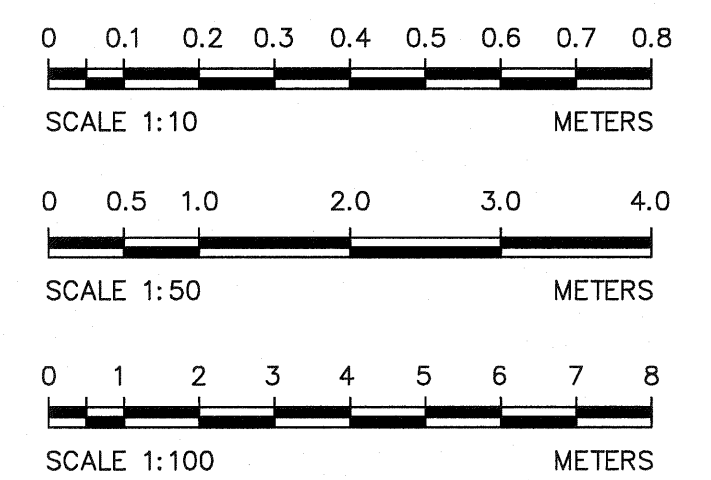
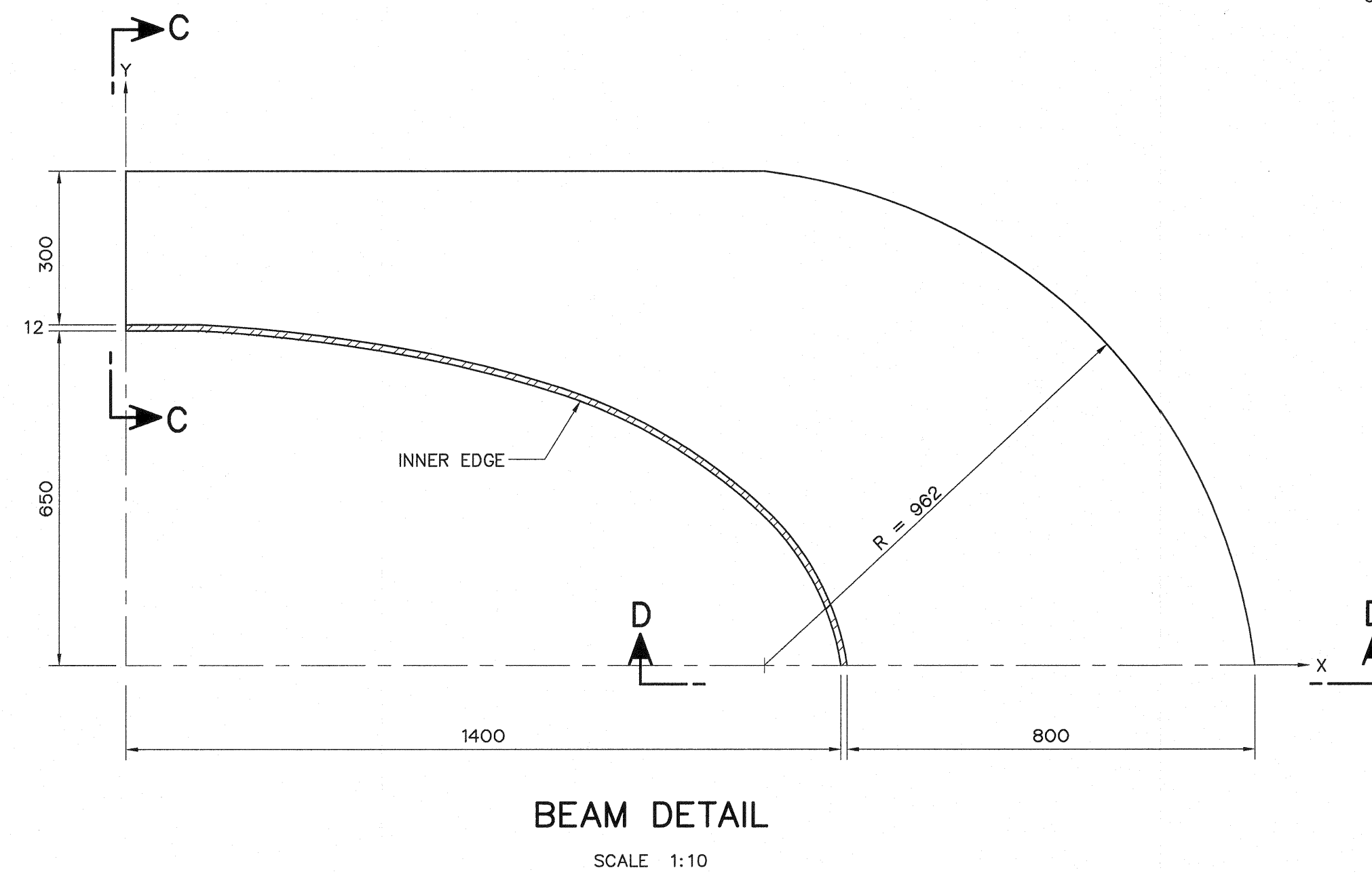
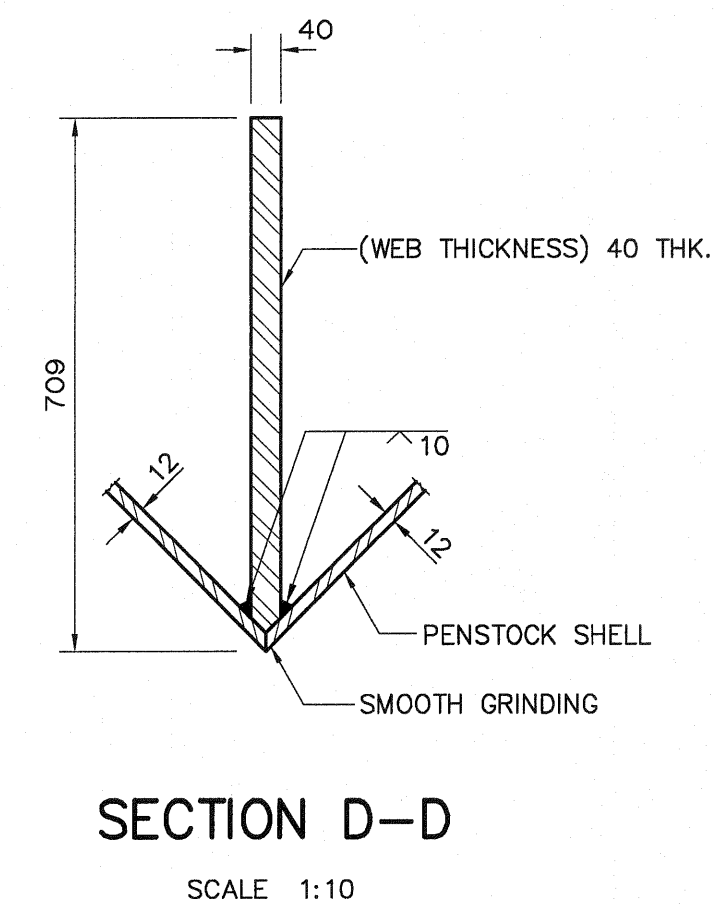
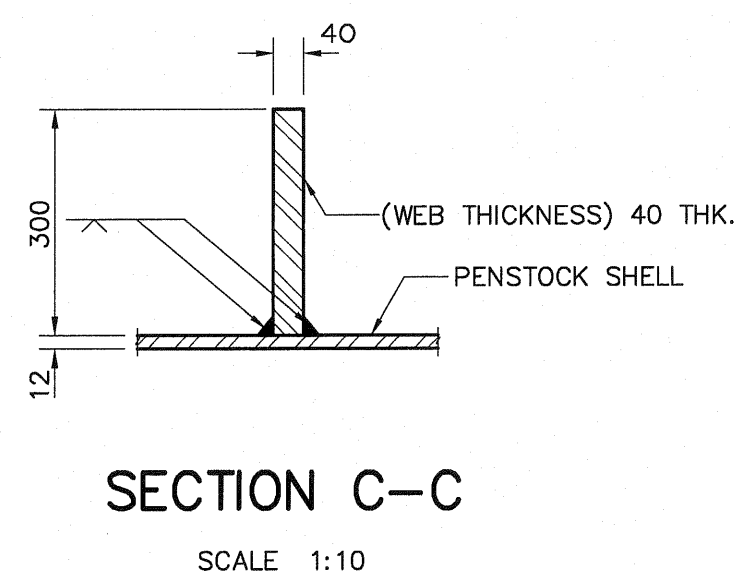
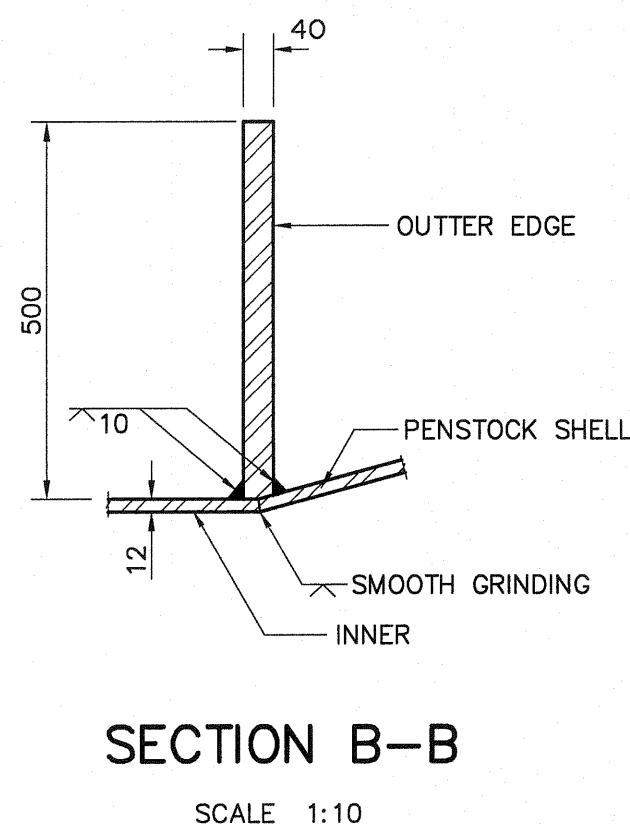
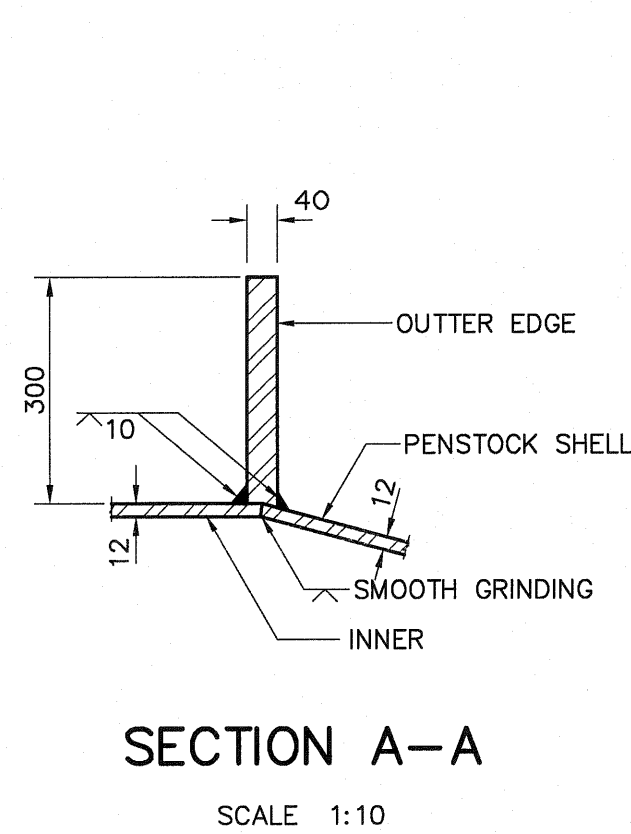
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| 2   |             |           |         |          |
| 1   |             |           |         |          |
| NO. | DATE        | REVISIONS | CHECKED | APPROVED |
|     | CONSULTANTS |           | DEDE    |          |

|                                                                                                                                                                                                                    |                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/><b>MINISTRY OF ENERGY</b></p> |                                                                                                                                                                                                                           |
| <p align="center"><b>LAM PHRA PHLOENG HYDROPOWER PROJECT</b></p>                                                                                                                                                   |                                                                                                                                                                                                                           |
| <p align="center"><b>CIVIL WORKS</b></p>                                                                                                                                                                           |                                                                                                                                                                                                                           |
| <p align="center"><b>PENSTOCK</b></p>                                                                                                                                                                              |                                                                                                                                                                                                                           |
| <p align="center"><b>WELDING DETAILS</b></p>                                                                                                                                                                       |                                                                                                                                                                                                                           |
| <p><b>FEBC</b> FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                                                                                                       | <p align="center"> <br/>         Department of Alternative<br/>Energy Development and Efficiency<br/> <b>MINISTRY OF ENERGY</b> </p> |
| <p>DESIGNED  ๕๕.6651</p>                                                                                                      | <p>REVIEWED <b>S. KITICHAI</b></p>                                                                                                                                                                                        |
| <p>DRAWN </p>                                                                                                                 | <p>SUBMITTED </p>                                                                                                                    |
| <p>CHECKED  ๕๕.7324</p>                                                                                                       | <p>RECOMMENDED </p>                                                                                                                  |
| <p> 14/01/62</p>                                                                                                              | <p>APPROVED </p>                                                                                                                     |
| <p>PROJECT MANAGER _____ DATE _____</p>                                                                                                                                                                            | <p>DRAWING NO. <b>IPP-PS-06</b> SHEET NO. 12 OF 44</p>                                                                                                                                                                    |

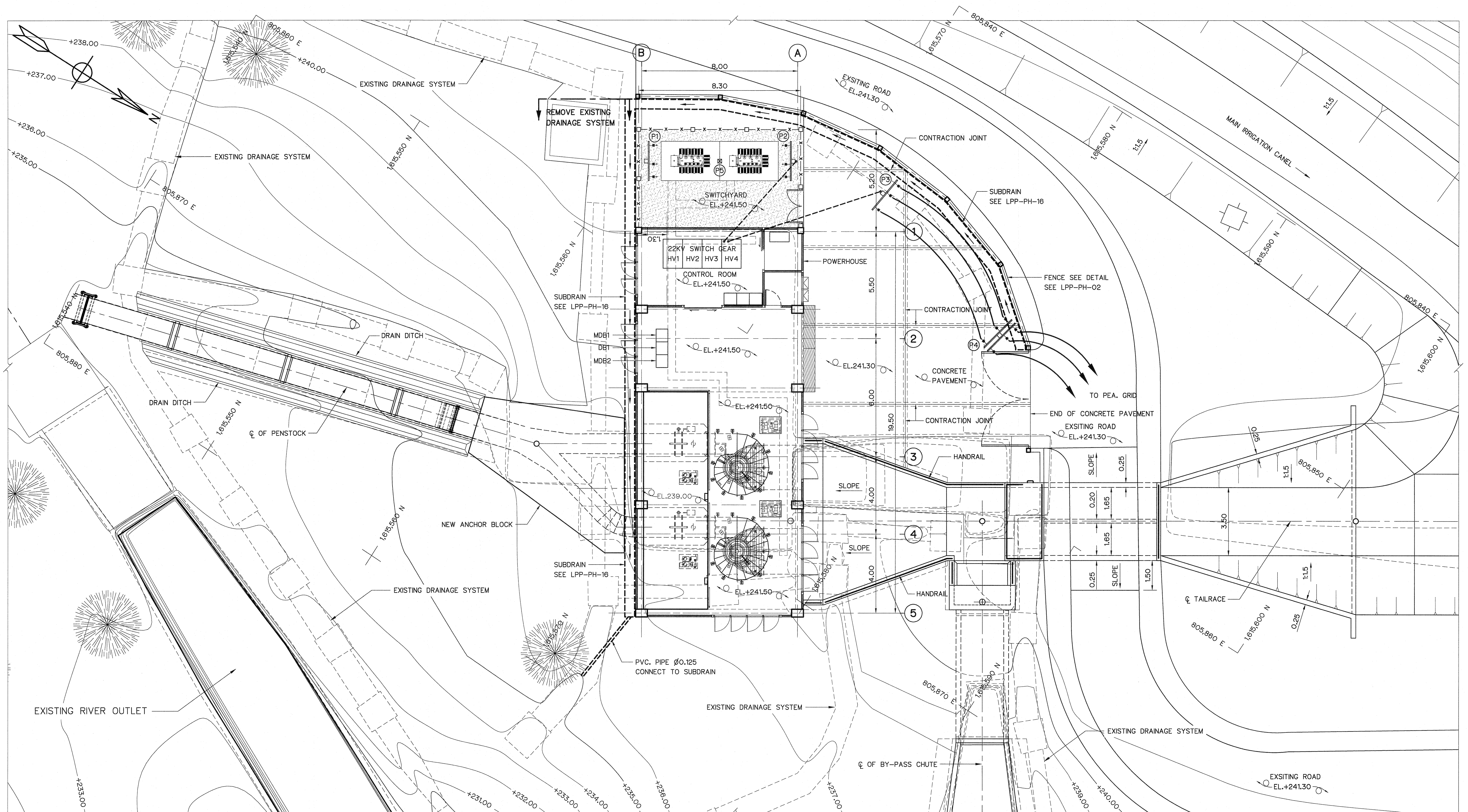


#### NOTES :

- ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SHOWN.
  - SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
  - THIS DRAWING IS DESIGNED FOR GUIDE LINE ONLY.
- SHOP DRAWING SHALL BE DESIGNED BY CONTRACTOR  
UNDER APPROVAL OF FIELD ENGINEER.



|                                                                                                                       |  |                                                                                               |  |
|-----------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------|--|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |                                                                                               |  |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |  |                                                                                               |  |
| <p>CIVIL WORKS<br/>PENSTOCK<br/>WYE, PLAN, SECTIONS AND DETAILS</p>                                                   |  |                                                                                               |  |
| <p>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</p>                                                                     |  | <p>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |
| <p>DESIGNED <i>[Signature]</i> 22.6651</p>                                                                            |  | <p>REVIEWED <i>S. KITCHAN</i></p>                                                             |  |
| <p>DRAWN <i>[Signature]</i></p>                                                                                       |  | <p>SUBMITTED <i>[Signature]</i></p>                                                           |  |
| <p>CHECKED <i>[Signature]</i> 22.7324</p>                                                                             |  | <p>RECOMMENDED <i>[Signature]</i></p>                                                         |  |
| <p>APPROVED <i>[Signature]</i></p>                                                                                    |  | <p>APPROVED <i>[Signature]</i></p>                                                            |  |
| <p>PROJECT MANAGER</p>                                                                                                |  | <p>DATE 14/01/62</p>                                                                          |  |
| <p>CONSULTANTS</p>                                                                                                    |  | <p>DEDE</p>                                                                                   |  |
| <p>DRAWING NO.<br/>LPP-PS-07</p>                                                                                      |  | <p>SHEET NO.<br/>13 OF 44</p>                                                                 |  |



#### NOTES :

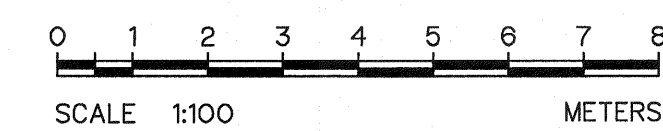
- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
- THE CONTRACTOR SHALL CHECK THE STABILITY OF THE EXCAVATION LINE. IF IT IS NOT SUFFICIENTLY STABLE, THE CONTRACTOR SHALL SUBMIT A REPORT TO THE PROJECT ENGINEER FOR CONSIDERING THE WAY TO IMPROVE ITS STABILITY.

#### REFERENCE DRAWINGS :

- |                                                          |           |
|----------------------------------------------------------|-----------|
| 1. POWERHOUSE, GROUND FLOOR PLANS & ROOF PLAN            | LPP-PH-02 |
| 2. POWERHOUSE, ELEVATIONS                                | LPP-PH-03 |
| 3. POWERHOUSE, SECTION A-A                               | LPP-PH-04 |
| 4. POWERHOUSE, SECTION B-B , C-C                         | LPP-PH-05 |
| 5. POWERHOUSE, PIT VALVE, FIELD TAB AND SUBDRAIN DETAILS | LPP-PH-16 |
| 6. POWERHOUSE, CONCRETE PAVEMENT DETAILS                 | LPP-PH-17 |

#### GENERAL LAY-OUT

SCALE 1:100

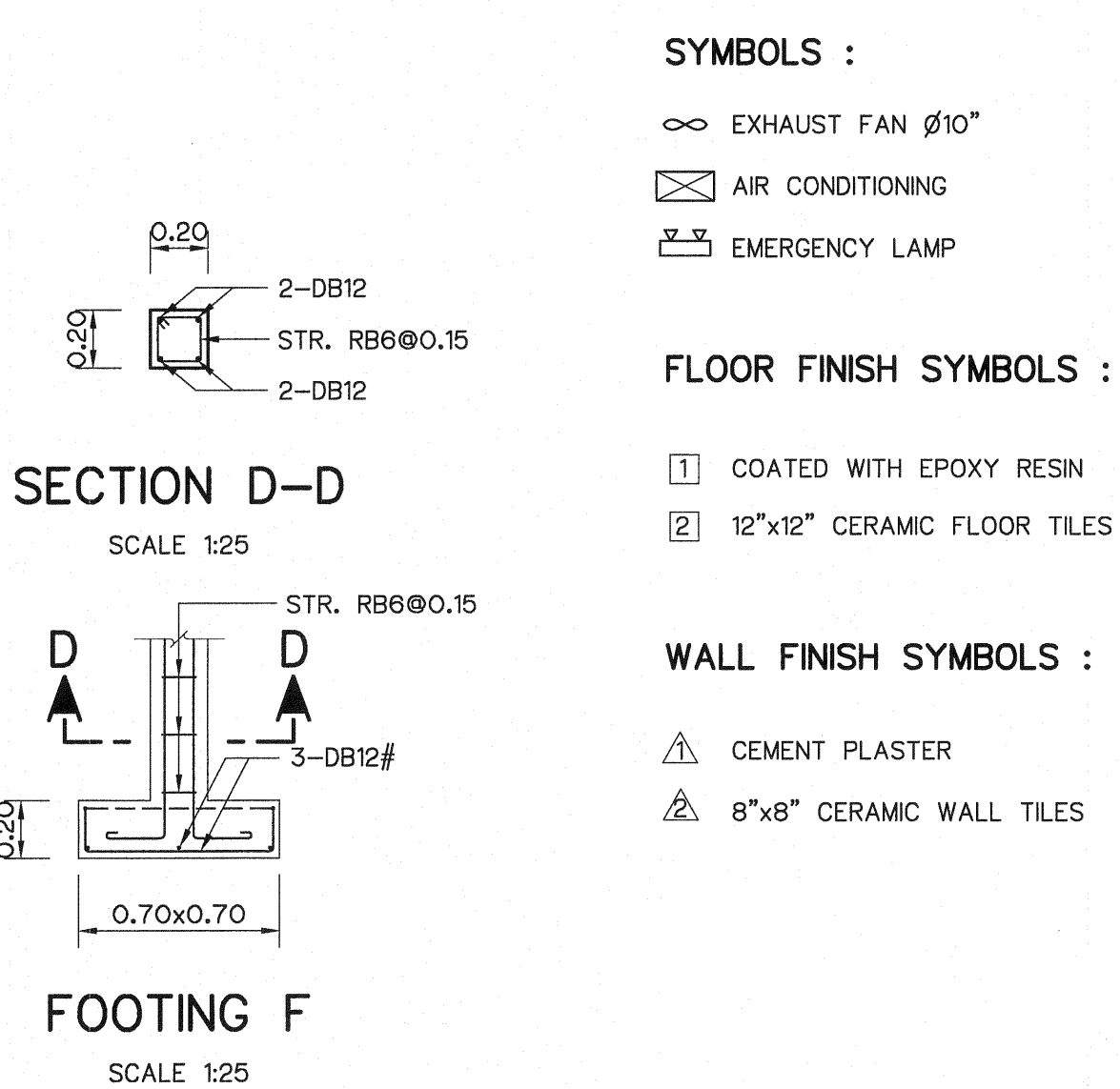
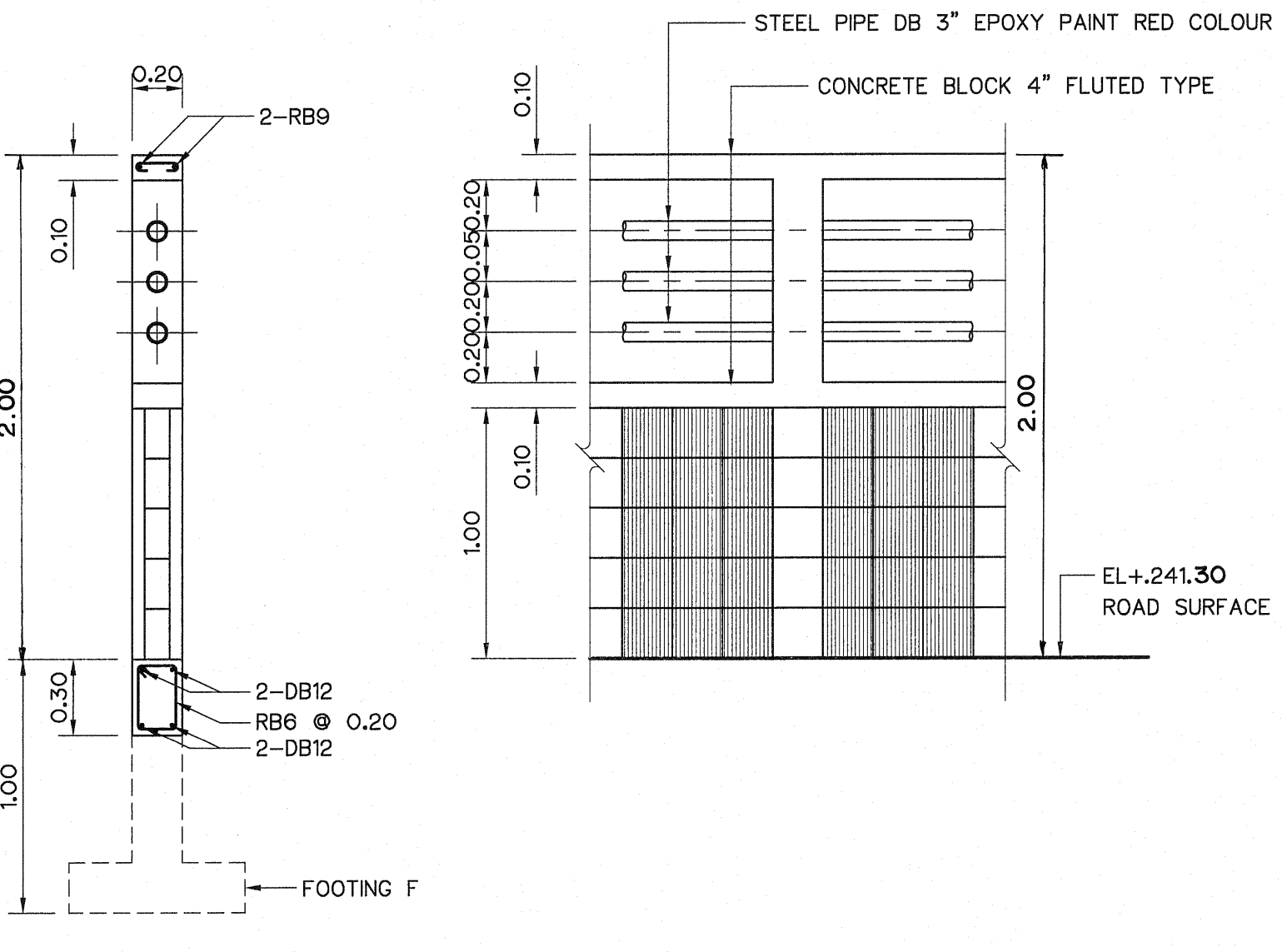
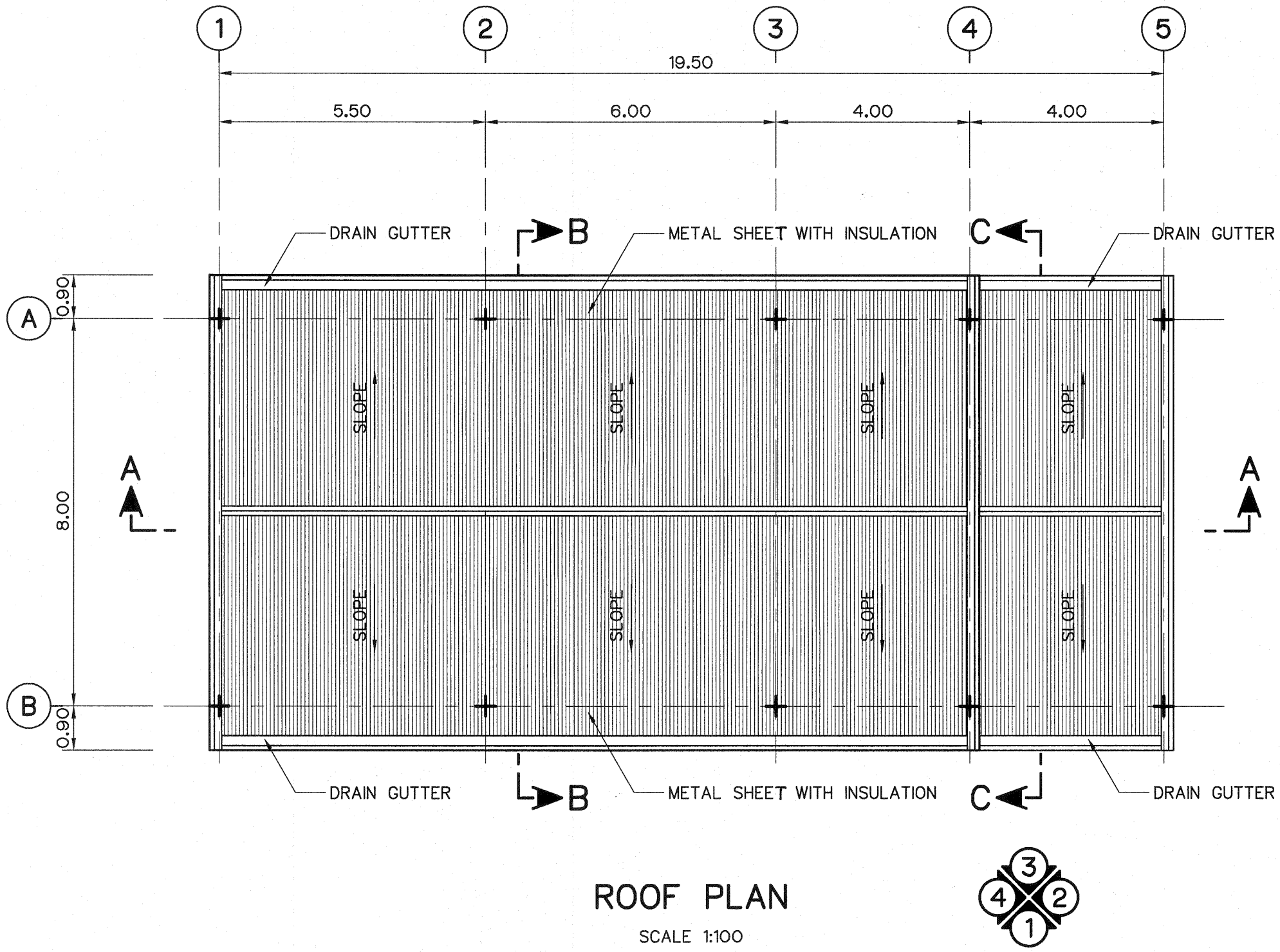
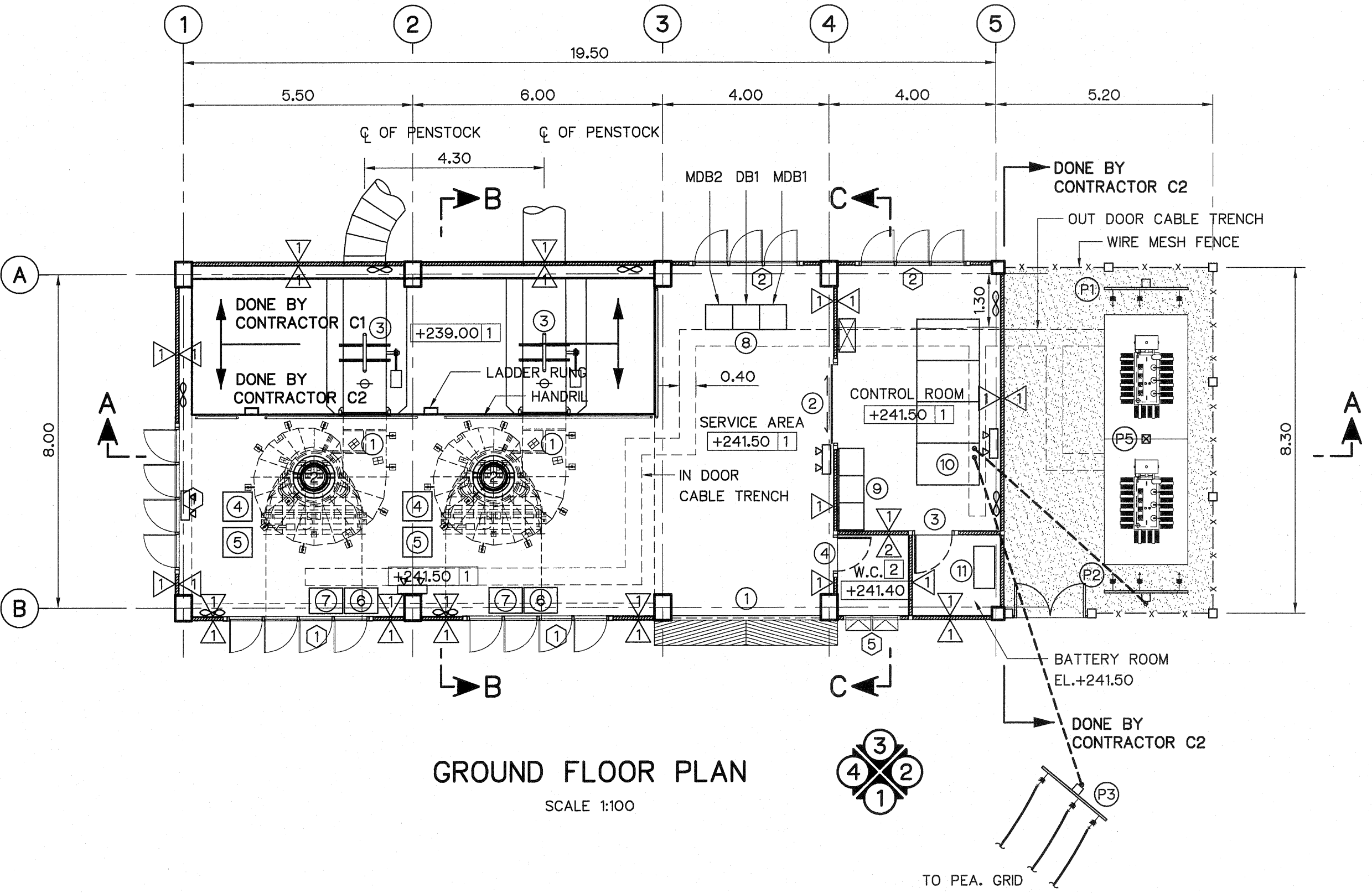


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| NO.         | DATE | REVISIONS | CHECKED | APPROVED |
|             |      |           |         |          |
| CONSULTANTS |      |           | DEDE    |          |

|                                                                                                                       |  |                                                                                               |  |
|-----------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------|--|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |                                                                                               |  |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |  |                                                                                               |  |
| <p>CIVIL WORKS<br/>POWERHOUSE<br/>GENERAL LAY-OUT</p>                                                                 |  |                                                                                               |  |
| <p>FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                      |  | <p>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |
| <p>DESIGNED <i>[Signature]</i> 22.6651</p>                                                                            |  | <p>REVIEWED <b>S. KITICHAI</b></p>                                                            |  |
| <p>DRAWN <i>[Signature]</i></p>                                                                                       |  | <p>SUBMITTED <i>[Signature]</i></p>                                                           |  |
| <p>CHECKED <i>[Signature]</i> 22.7324</p>                                                                             |  | <p>RECOMMENDED <i>[Signature]</i></p>                                                         |  |
| <p>APPROVED <i>[Signature]</i> 14/01/62</p>                                                                           |  | <p>APPROVED <i>[Signature]</i></p>                                                            |  |
| <p>PROJECT MANAGER</p>                                                                                                |  | <p>DRAWING NO. LPP-PH-01</p>                                                                  |  |
| <p>DATE</p>                                                                                                           |  | <p>SHEET NO. 14 OF 44</p>                                                                     |  |

DESCRIPTION :

- ① KAPLAN TURBINE  
② SYNCHROUSE GENERATOR  
③ INLET VALVE AND BYPASS VALVE  
④ FILTRATION AGREGATE  
⑤ HYDRAULIC GOVERNOR OF TURBINE REGULATION  
⑥ SWITCHGEAR CUBICLE  
⑦ GOVERNOR AND TURBINE CONTROL PANEL  
⑧ MAIN CONTROL SWITCHBOARD  
⑨ AC & DC SWITCHBOARD AND BATTERY CHARGER CUBICLE  
⑩ HIGH VOLTAGE SWITCHGEAR 22 KV.  
⑪ BATTERY RACK



SYMBOLS :

- ∞ EXHAUST FAN Ø10"  
⊠ AIR CONDITIONING  
⊠ EMERGENCY LAMP

FLOOR FINISH SYMBOLS :

- ① COATED WITH EPOXY RESIN  
② 12"x12" CERAMIC FLOOR TILES

WALL FINISH SYMBOLS :

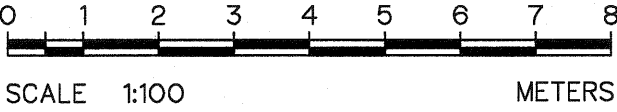
- ⊠ CEMENT PLASTER  
⊠ 8"x8" CERAMIC WALL TILES

NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.  
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.  
3. CONTRACT C1 INCLUDE PENSTOCK BEYOND INLET VALVE (INCLUDE FLANGE).  
4. ALL OF OUT DOOR CABLE TRENCH (INCLUDE INSIDE SWITCHYARD FENCE) SHALL BE DONE BY CONTRACT C2.

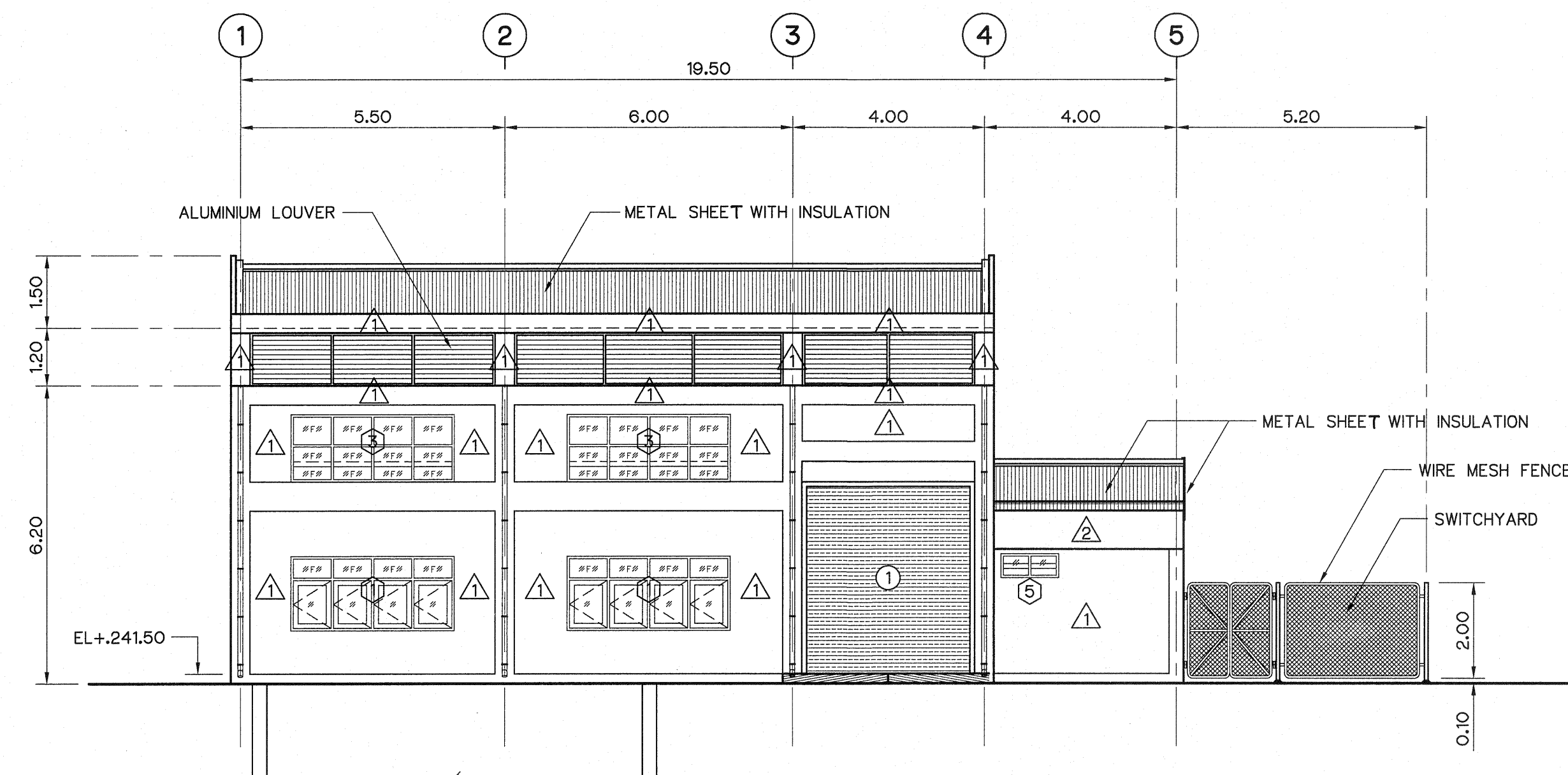
REFERENCE DRAWINGS :

1. POWERHOUSE, GENERAL LAY-OUT LPP-PH-01  
2. POWERHOUSE, ELEVATIONS LPP-PH-03  
3. POWERHOUSE, SECTION A-A LPP-PH-04  
4. POWERHOUSE, SECTION B-B , C-C LPP-PH-05  
5. POWERHOUSE, DETAIL OF DOORS, WINDOWS AND NAME PLATE LPP-PH-06  
6. POWERHOUSE, DETAILS OF TOILET, SEPTIC AND SEEPAGE TANK LPP-PH-07

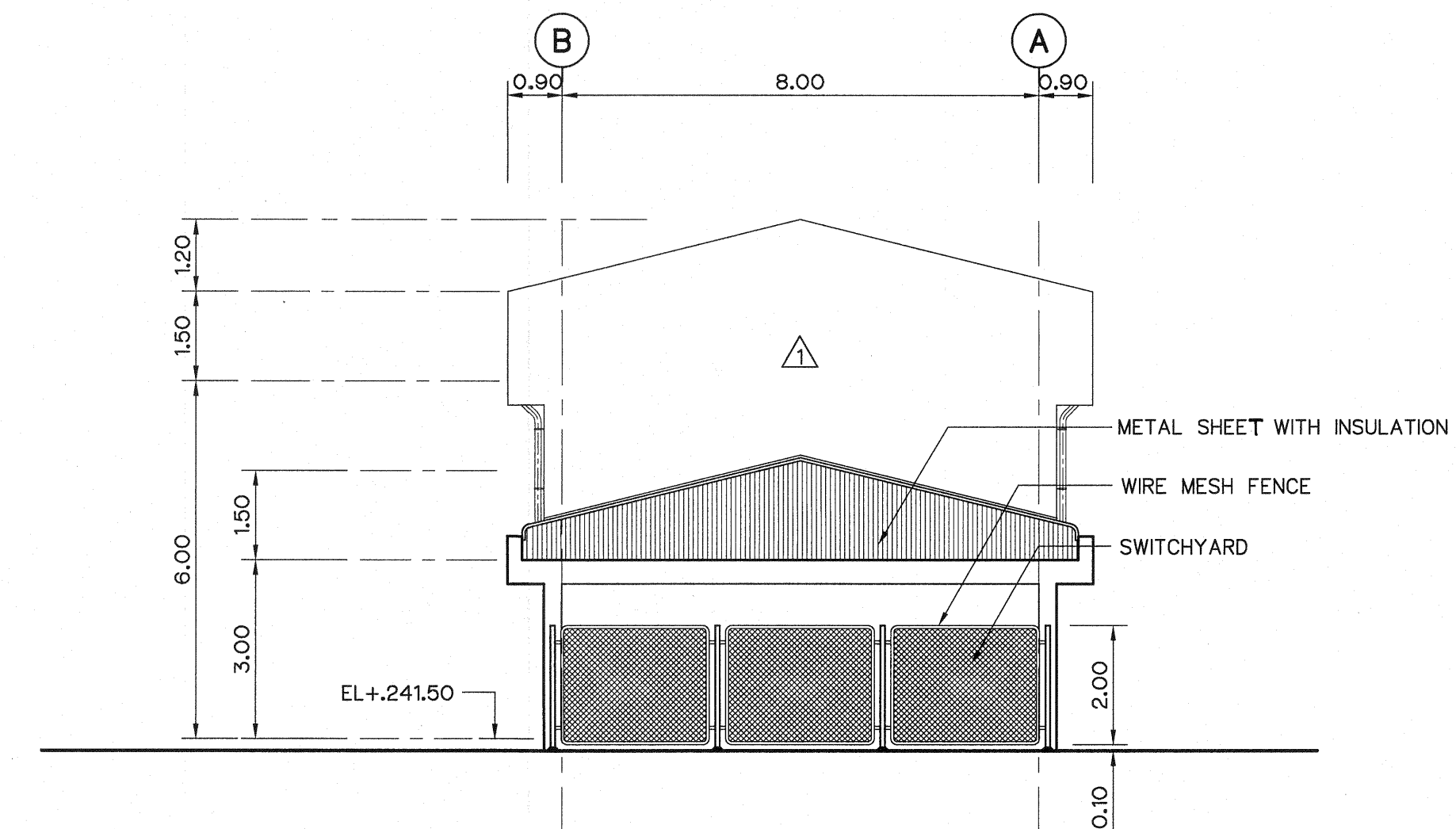


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|-------------------------------------------------------------------------------------------------------------|-----------------------|
| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |                       |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                         |                       |
| CIVIL WORKS<br>POWERHOUSE<br>GROUND FLOOR PLAN & ROOF PLAN                                                  |                       |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.                                                                   | REVIEWED S. KITICHAI  |
| DESIGNED                                                                                                    | SUBMITTED             |
| DRAWN                                                                                                       | RECOMMENDED           |
| CHECKED                                                                                                     | APPROVED              |
| PROJECT MANAGER                                                                                             | DATE                  |
| DRAWING NO.<br>LPP-PH-02                                                                                    | SHEET NO.<br>15 OF 44 |

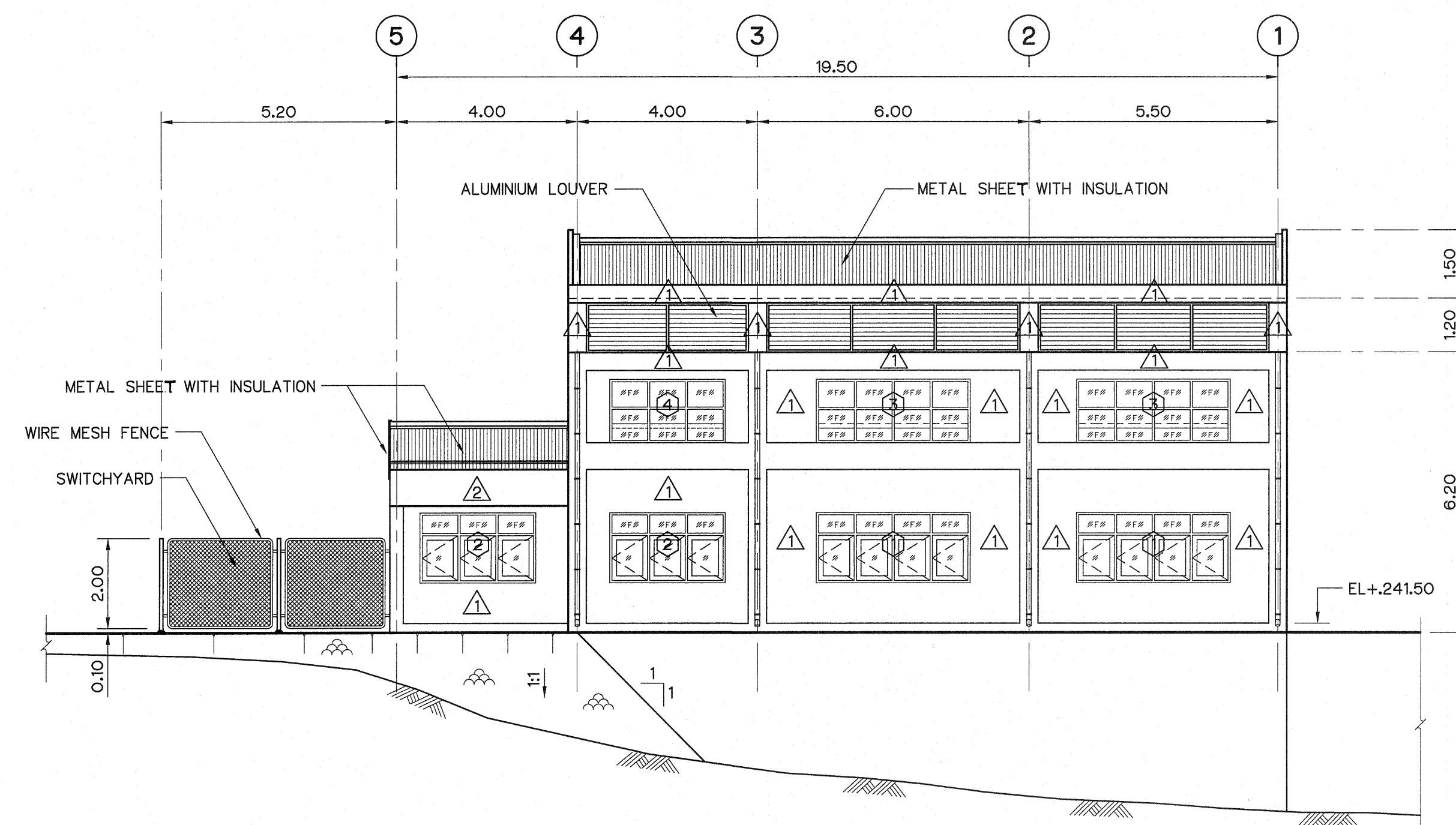
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| CONSULTANTS |      | DEDE      |         |          |



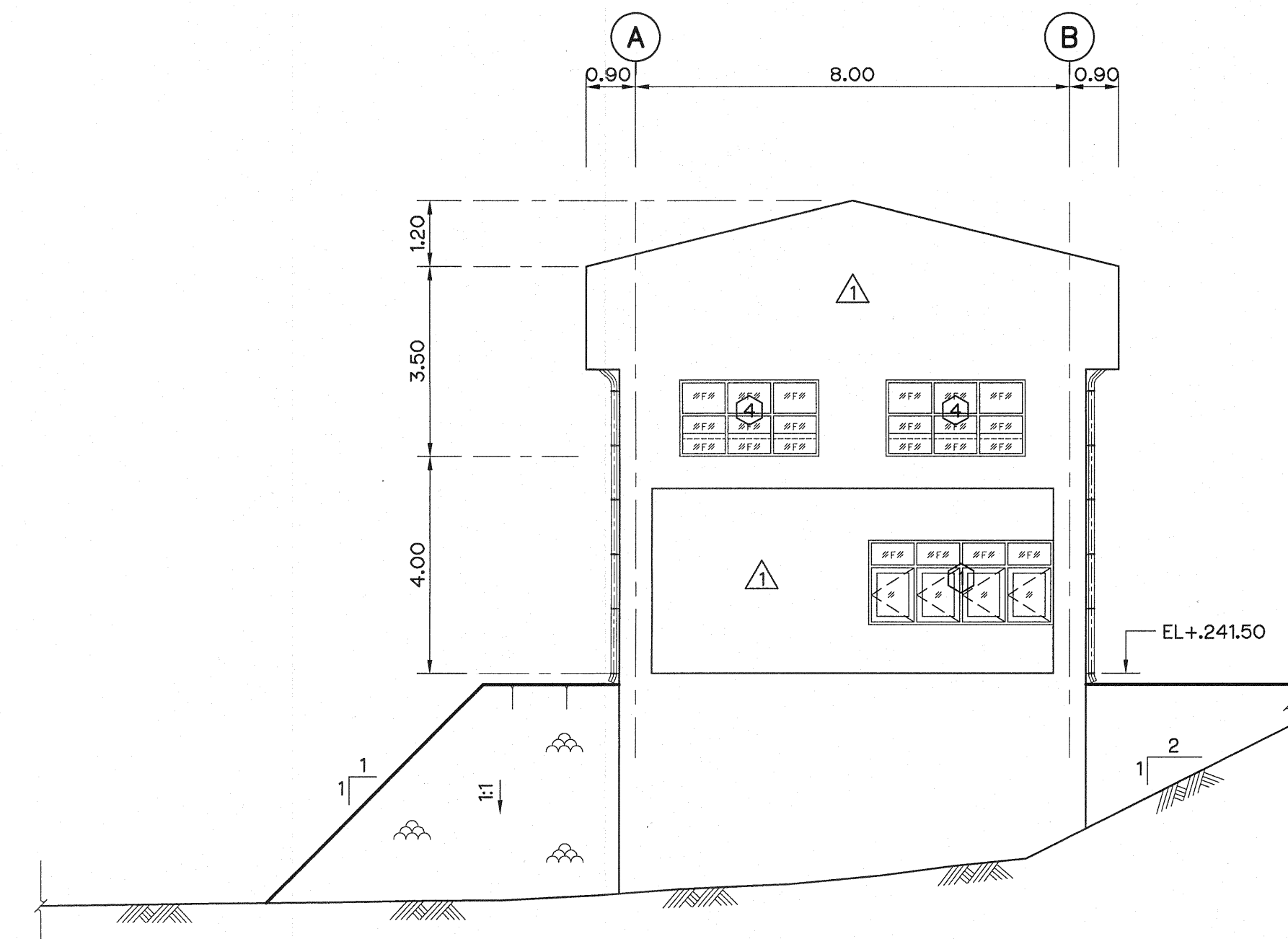
ELEVATION 1  
SCALE 1:100



ELEVATION 2  
SCALE 1:100



ELEVATION 3  
SCALE 1:100



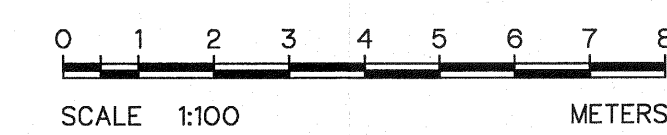
ELEVATION 4  
SCALE 1:100

NOTES :

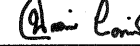
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS,  
UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.

REFERENCE DRAWINGS :

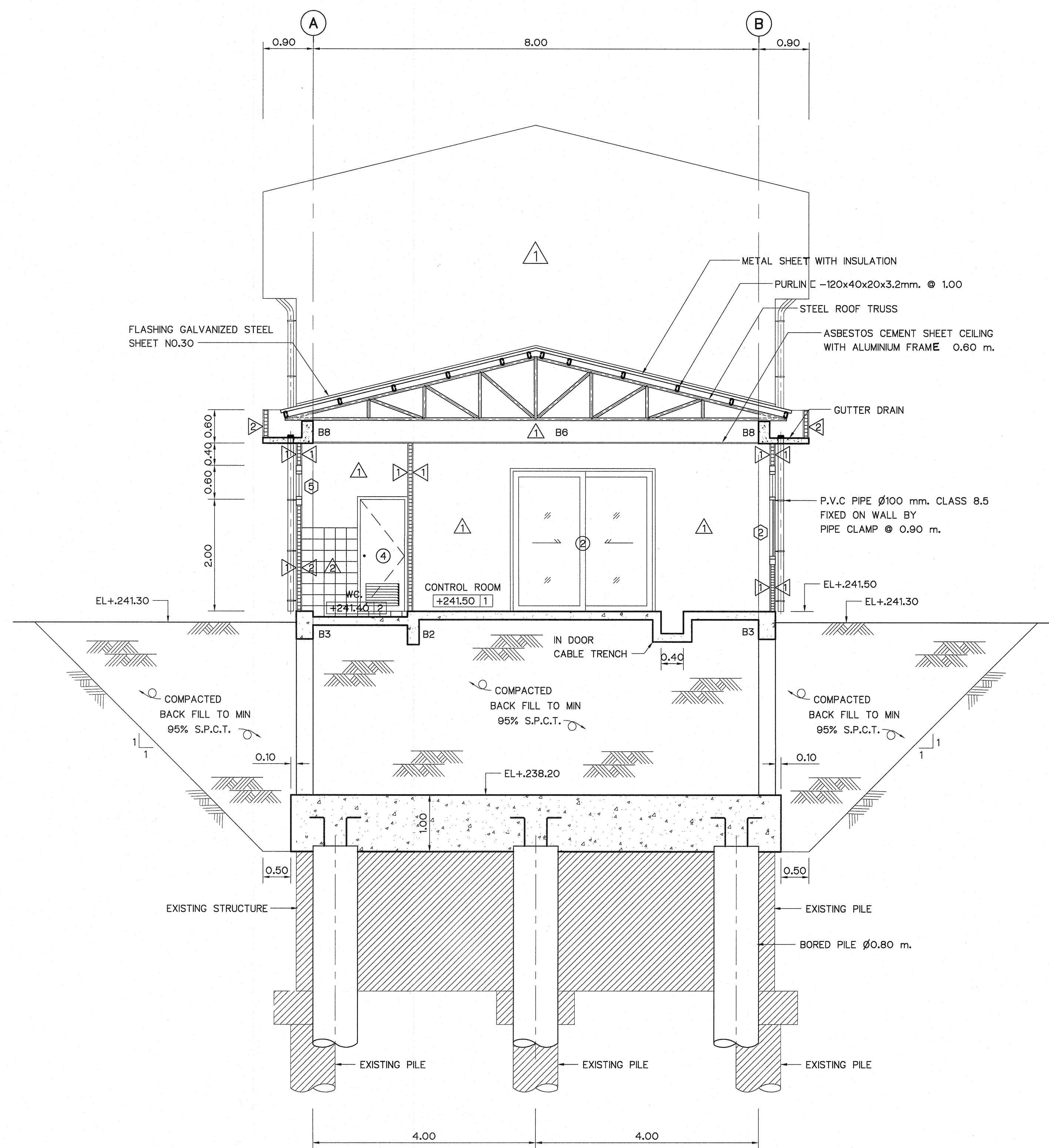
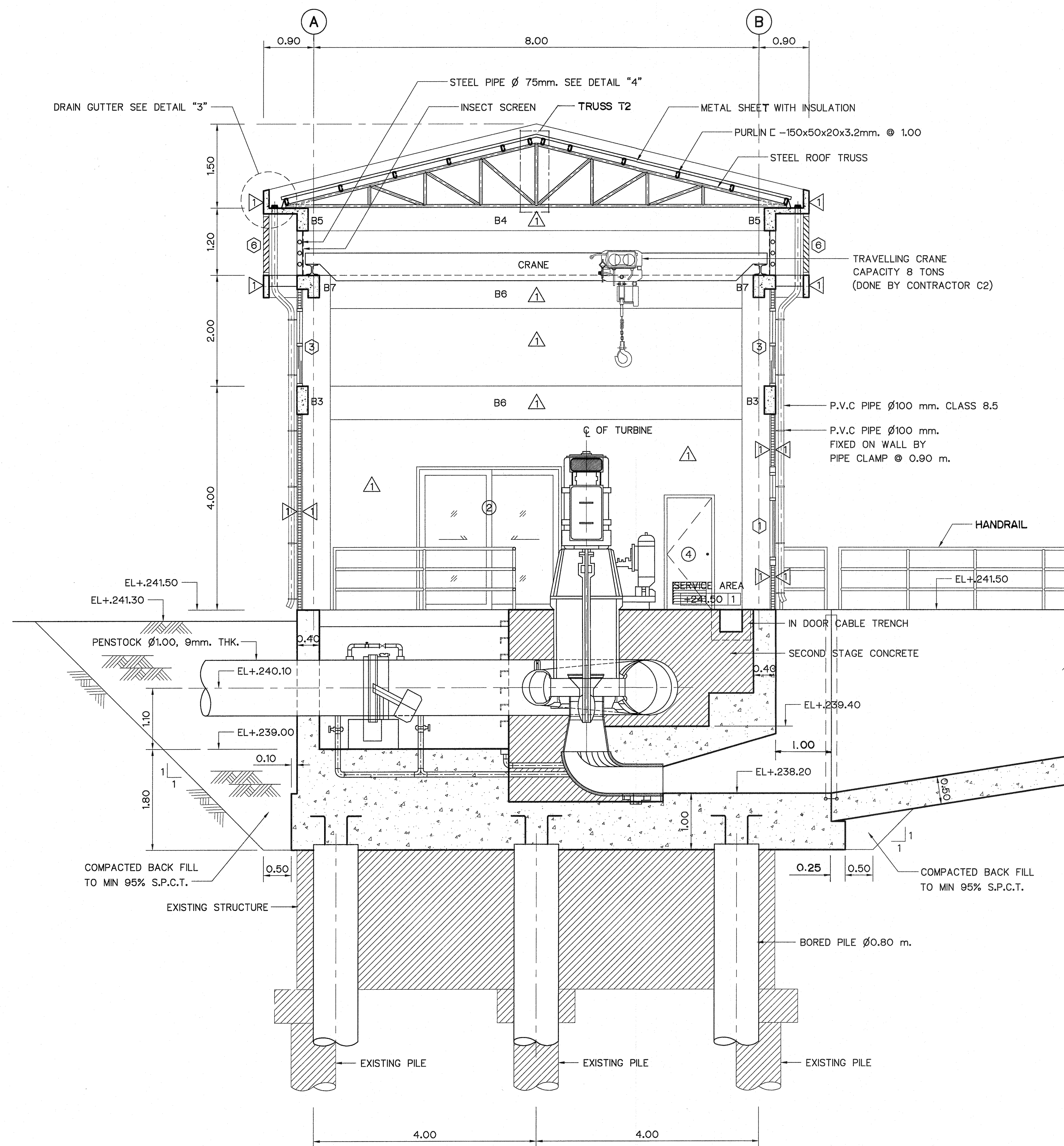
- |                                              |           |
|----------------------------------------------|-----------|
| 1. POWERHOUSE, GROUND FLOOR PLAN & ROOF PLAN | LPP-PH-02 |
| 2. POWERHOUSE, SECTION A-A                   | LPP-PH-04 |
| 3. POWERHOUSE, SECTION B-B , C-C             | LPP-PH-05 |



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|     | CONSULTANTS |           | DEDE    |          |

|                                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                        |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  <div style="text-align: center;">             KINGDOM OF THAILAND<br/>             Department of Alternative<br/>             Energy Development and Efficiency<br/> <b>MINISTRY OF ENERGY</b> </div> |  |                                                                                                                                                                                                                                                        |  |
| <b>LAM PHRA PHLOENG HYDROPOWER PROJECT</b>                                                                                                                                                                                                                                                  |  |                                                                                                                                                                                                                                                        |  |
| <b>CIVIL WORKS</b><br><br><b>POWERHOUSE</b><br><br><b>ELEVATIONS</b>                                                                                                                                                                                                                        |  |                                                                                                                                                                                                                                                        |  |
|  <b>FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</b>                                                                                                                                                      |  |  <div style="text-align: center;">             Department of Alternative<br/>             Energy Development and Efficiency<br/> <b>MINISTRY OF ENERGY</b> </div> |  |
| DESIGNED                                                                                                                                                                                               |  | REVIEWED <b>S. KITICHA</b>                                                                                                                                                                                                                             |  |
| DRAWN                                                                                                                                                                                                  |  | SUBMITTED                                                                                                                                                         |  |
| CHECKED                                                                                                                                                                                                |  | RECOMMENDED                                                                                                                                                       |  |
| <br>PROJECT MANAGER                                                                                                                                                                                    |  | APPROVED <br><br>LPP-PH-03                                                                                                                                        |  |
| 14/01/62                                                                                                                                                                                                                                                                                    |  | SHEET NO.                                                                                                                                                                                                                                              |  |
| DATE                                                                                                                                                                                                                                                                                        |  | 16 OF 44                                                                                                                                                                                                                                               |  |



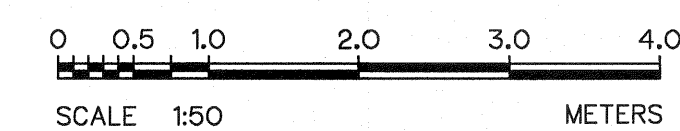


#### NOTES :

- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
- ALLOWABLE LOAD OF BORED PILE Ø0.80 M. SHALL NOT BE LESS THAN 180 TONS.
- BORED PILE TIP SHALL BE PLACED ON FIRM ROCK LAYER OR DENSE SAND APPROX. PILE LENGTH 25 M.

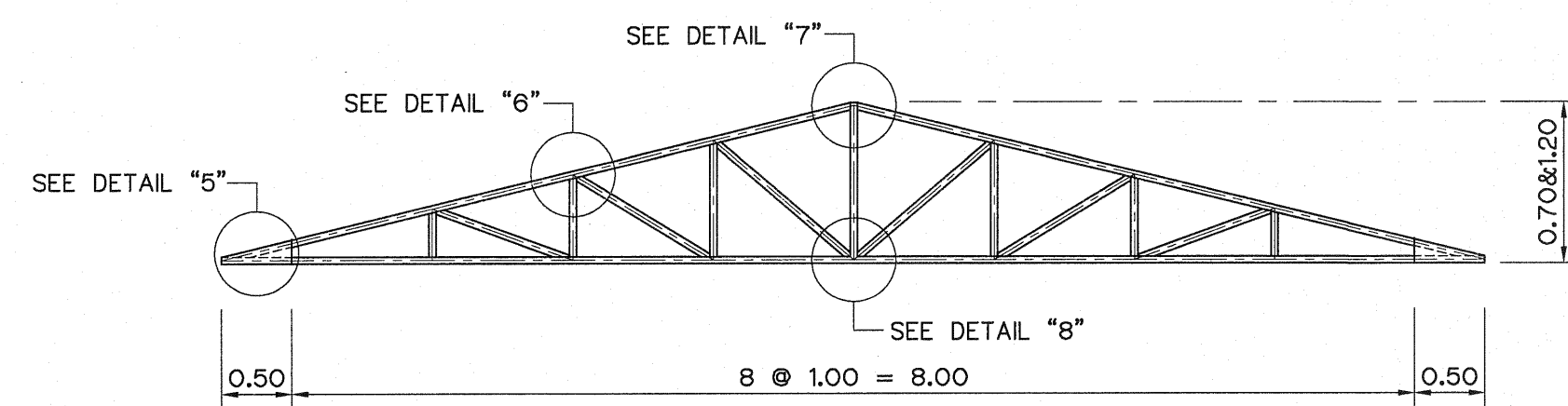
#### REFERENCE DRAWINGS :

- |                                                     |           |
|-----------------------------------------------------|-----------|
| 1. POWERHOUSE, GROUND FLOOR PLAN & ROOF PLAN        | LPP-PH-02 |
| 2. POWERHOUSE, ELEVATIONS                           | LPP-PH-03 |
| 3. POWERHOUSE, ROOF TRUSS AND MISCELLANEOUS DETAILS | LPP-PH-06 |

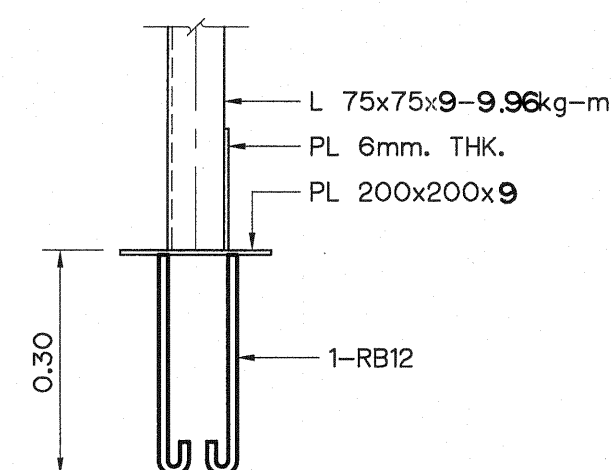


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|     |      |           | CONSULTANTS | DEDE     |

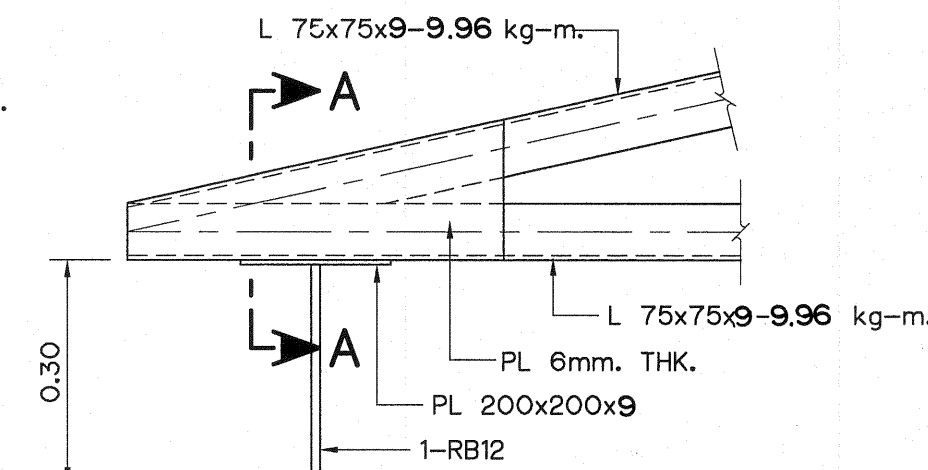
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| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br><b>MINISTRY OF ENERGY</b>                                       |                                                                                                                                                                                                                                                     |
| <b>LAM PHRA PHLOENG HYDROPOWER PROJECT</b>                                                                                                               |                                                                                                                                                                                                                                                     |
| <b>CIVIL WORKS</b><br><b>POWERHOUSE</b><br><b>SECTION B-B , C-C</b>                                                                                      |                                                                                                                                                                                                                                                     |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.<br>DESIGNED: <i>[Signature]</i><br>DRAWN: <i>[Signature]</i><br>CHECKED: <i>[Signature]</i><br>PROJECT MANAGER | Department of Alternative<br>Energy Development and Efficiency<br><b>MINISTRY OF ENERGY</b><br>REVIEWED: <b>S. KITICHAI</b><br>SUBMITTED: <i>[Signature]</i><br>RECOMMENDED: <i>[Signature]</i><br>APPROVED: <i>[Signature]</i><br>14/01/62<br>DATE |
| DRAWING NO.<br><b>LPP-PH-05</b>                                                                                                                          | SHEET NO.<br>18 OF 44                                                                                                                                                                                                                               |



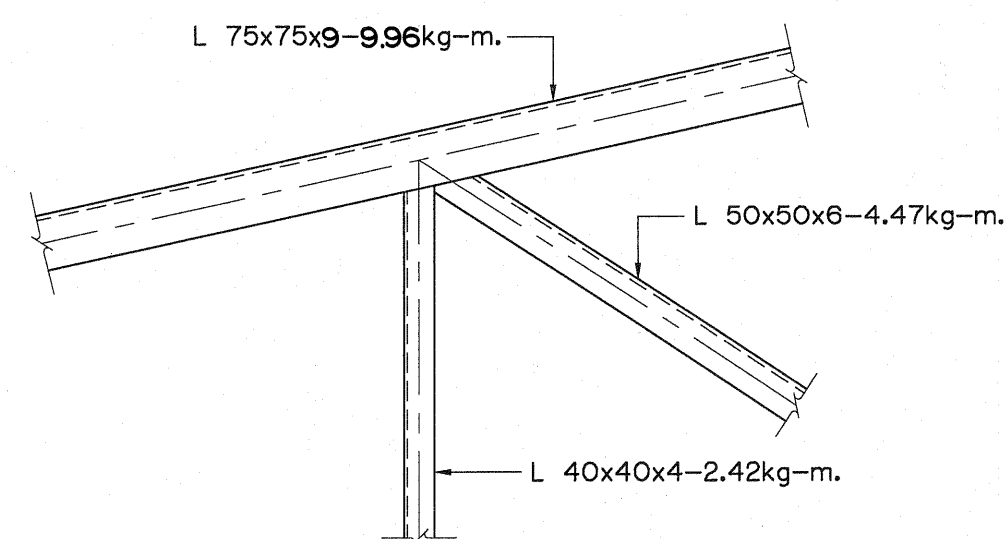
DETAIL STEEL ROOF TRUSS  
SCALE 1:50



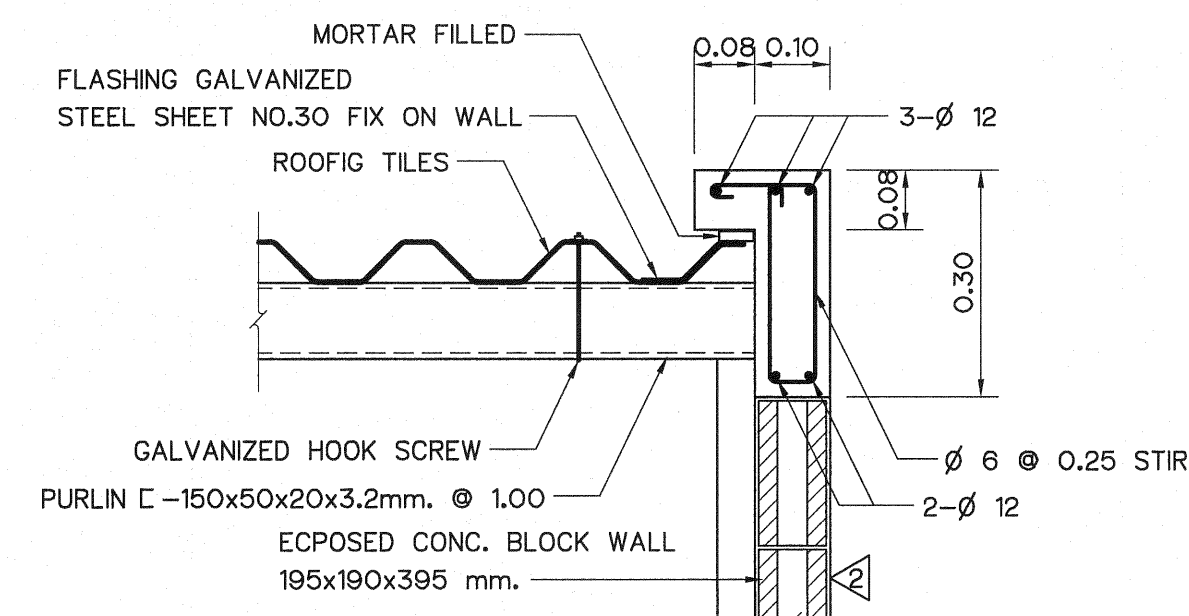
SECTION A-A  
SCALE 1:20



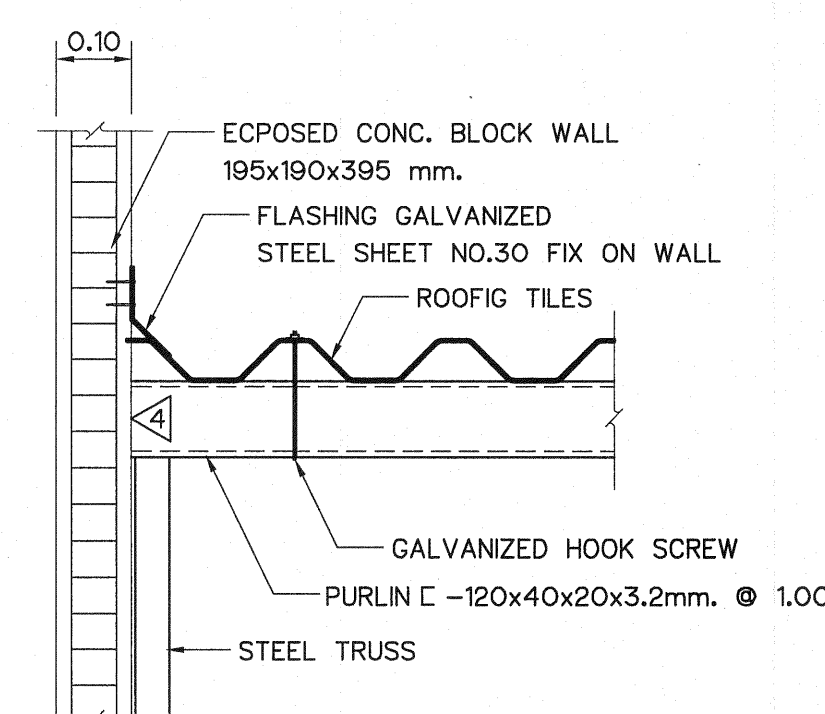
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SCALE 1:20



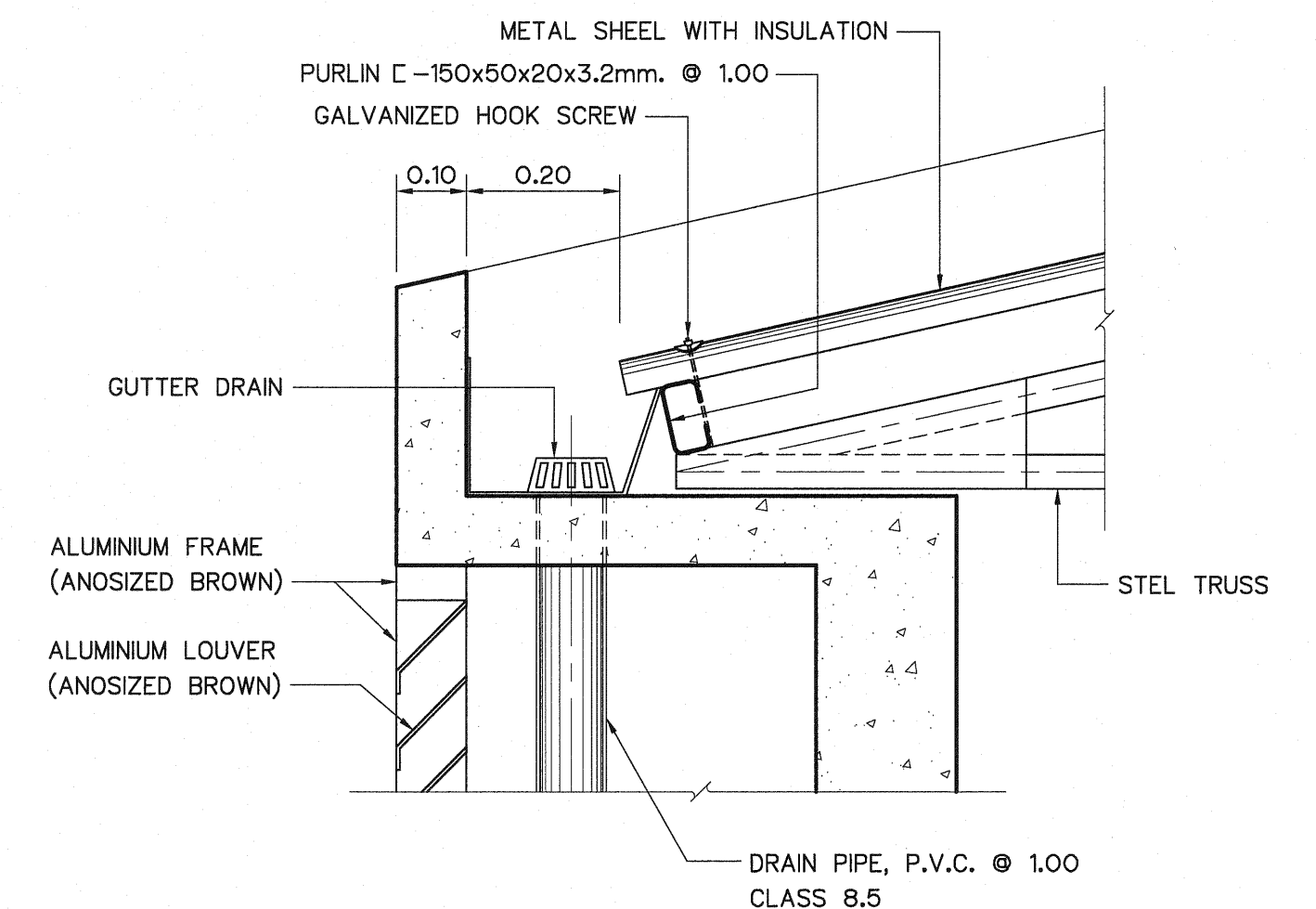
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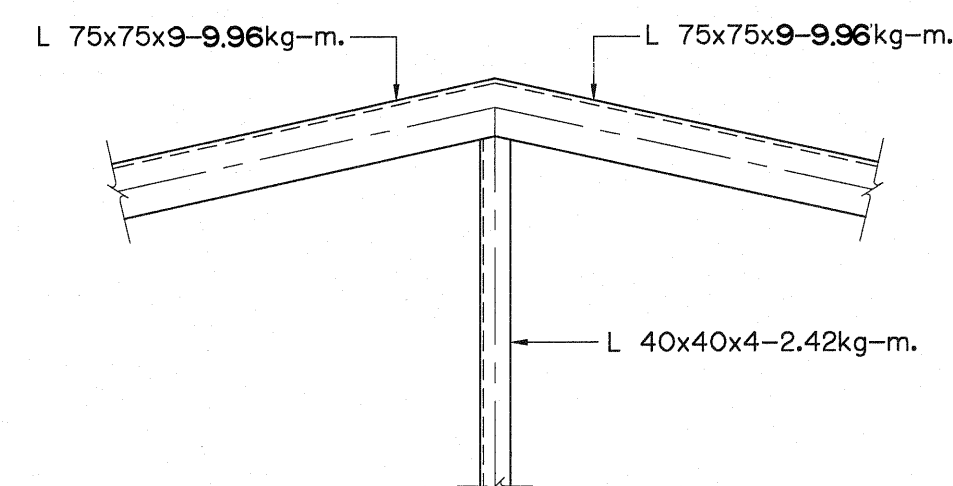
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SCALE 1:20



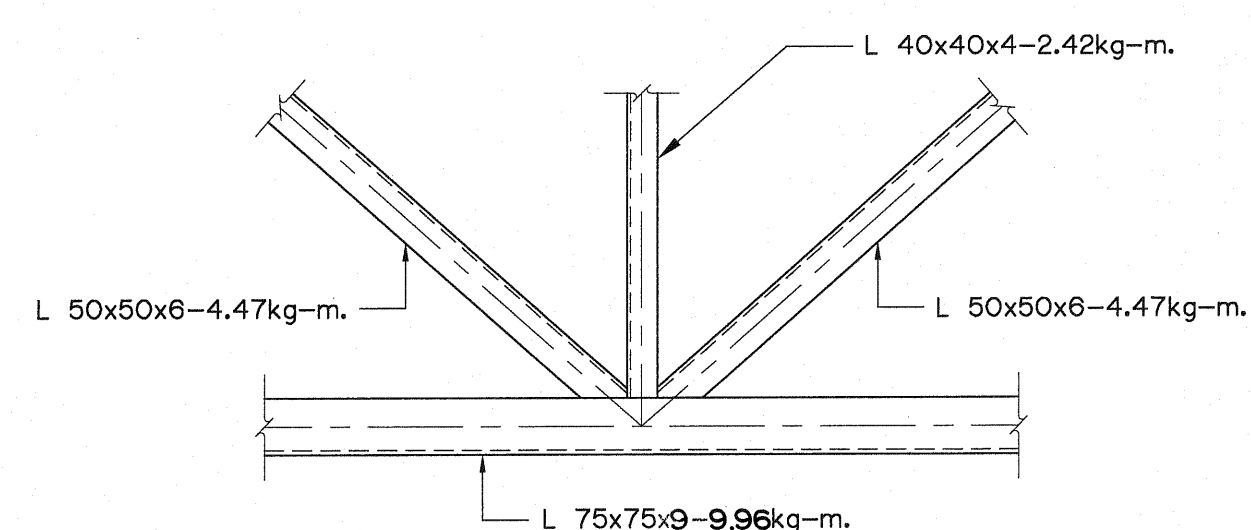
DETAIL "2"  
SCALE 1:20



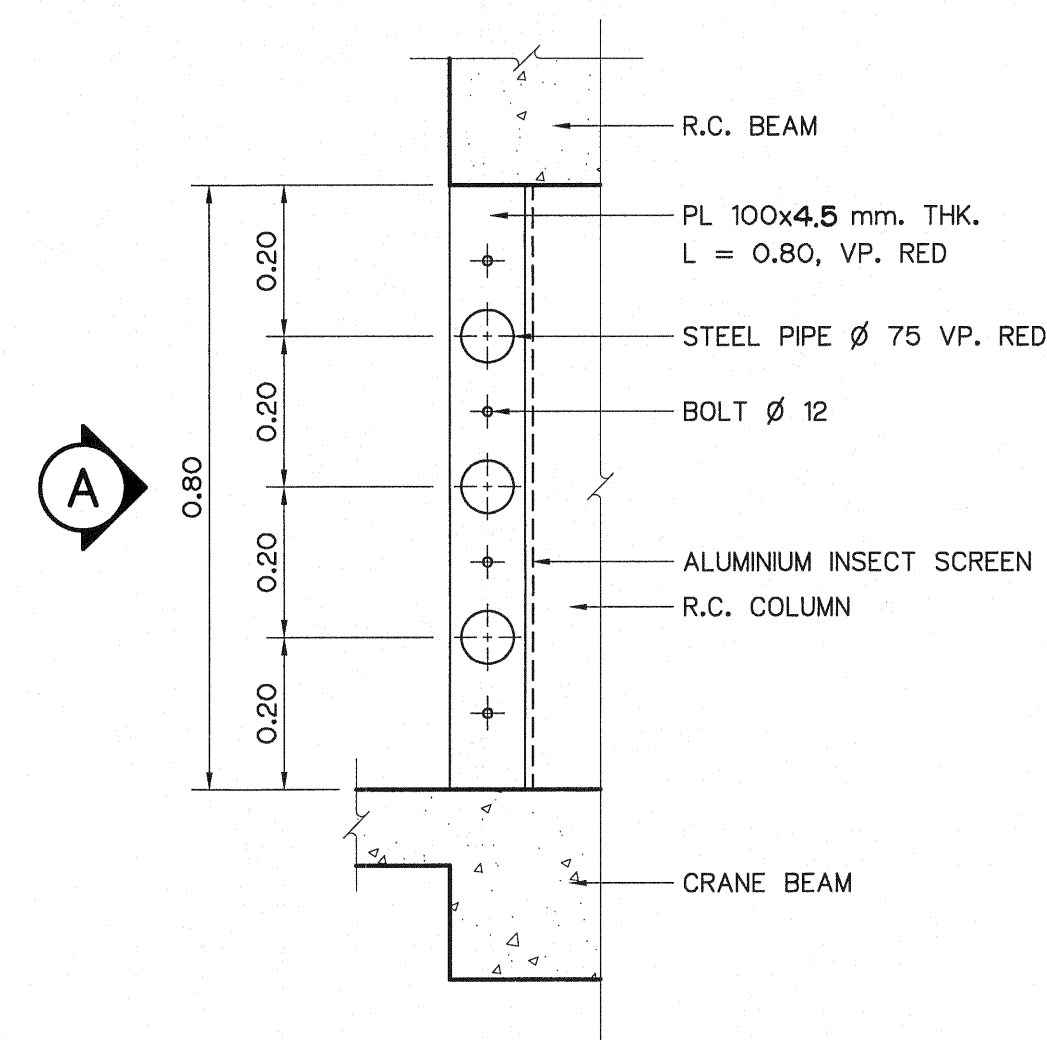
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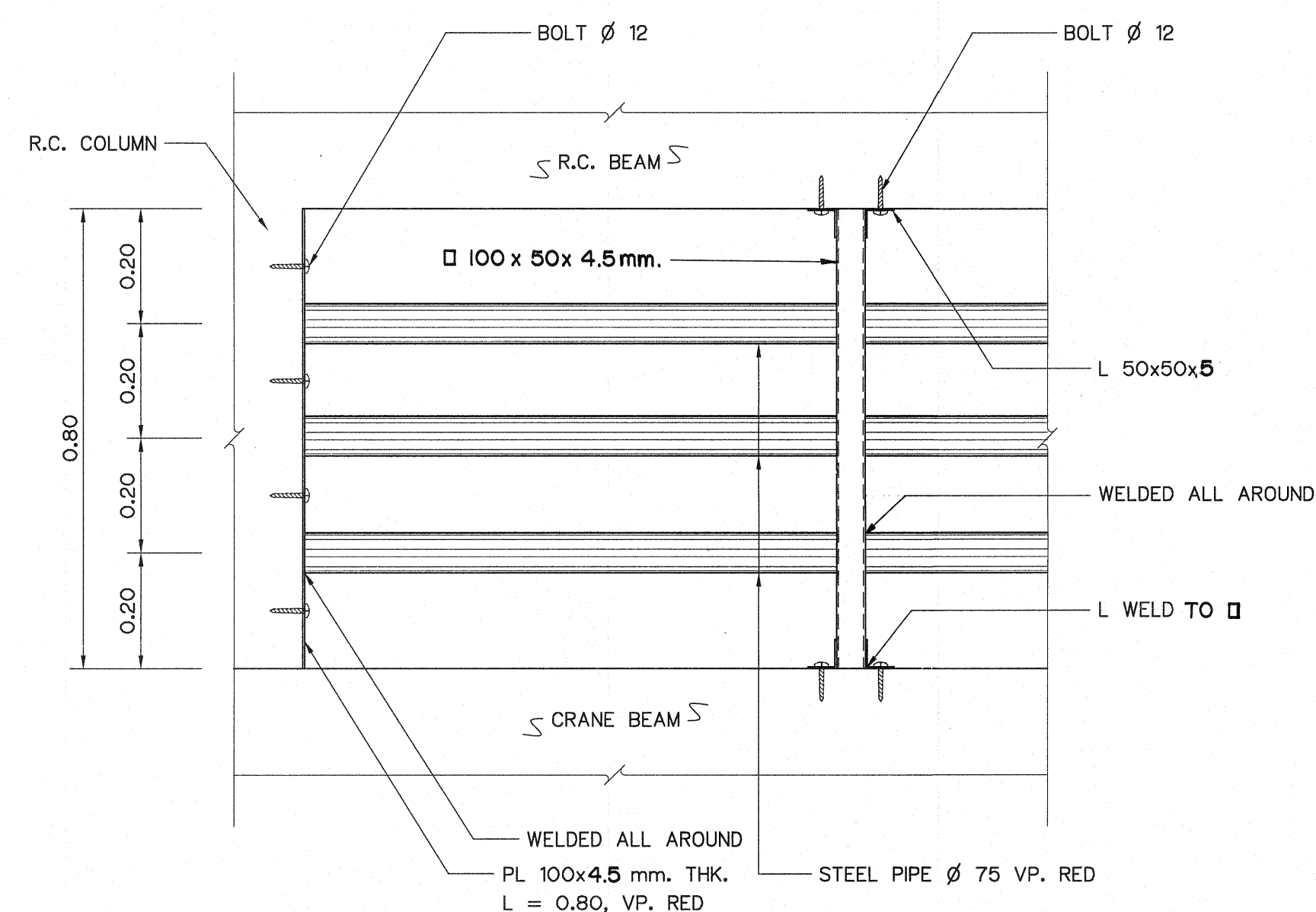
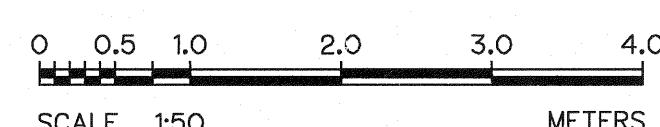
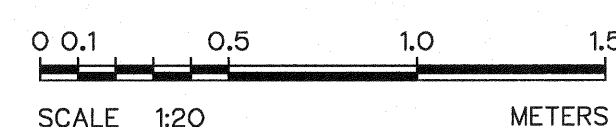
DETAIL "7"  
SCALE 1:20



DETAIL "8"  
SCALE 1:20



DETAIL "4"  
SCALE 1:20



ELEVATION A  
SCALE 1:20

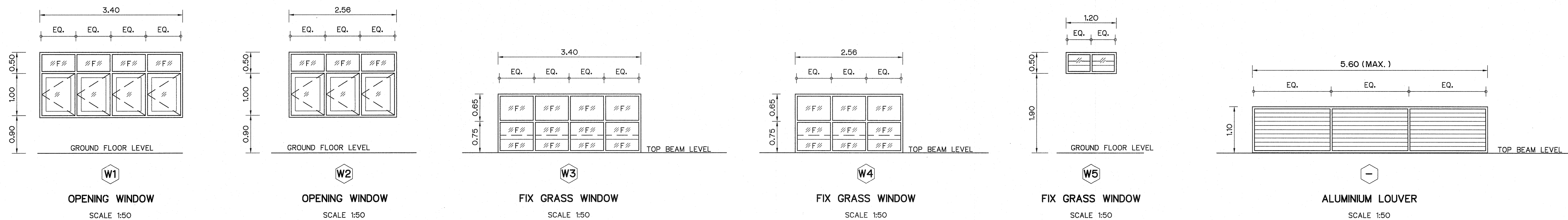
- NOTES :**
- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
  - SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.

- REFERENCE DRAWINGS :**
- POWERHOUSE, GROUND FLOOR PLAN & ROOF PLAN LPP-PH-02
  - POWERHOUSE, ELEVATIONS LPP-PH-03
  - POWERHOUSE, SECTION A-A LPP-PH-04
  - POWERHOUSE, SECTION B-B, C-C LPP-PH-05

|                                                                                                                       |                                |
|-----------------------------------------------------------------------------------------------------------------------|--------------------------------|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |                                |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |                                |
| <p>CIVIL WORKS<br/>POWERHOUSE<br/>ROOF TRUSS AND MISCELLANEOUS DETAILS</p>                                            |                                |
| <p>FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                      | <p>REVIEWED S. KITICHAI</p>    |
| <p>DESIGNED S. KITICHAI</p>                                                                                           | <p>SUBMITTED S. KITICHAI</p>   |
| <p>DRAWN S. KITICHAI</p>                                                                                              | <p>RECOMMENDED S. KITICHAI</p> |
| <p>CHECKED S. KITICHAI</p>                                                                                            | <p>APPROVED S. KITICHAI</p>    |
| <p>PROJECT MANAGER</p>                                                                                                | <p>DRAWING NO. LPP-PH-06</p>   |
| <p>DATE 14/01/62</p>                                                                                                  | <p>SHEET NO. 19 OF 44</p>      |



| SYMBOL | DESCRIPTIONS                               | SIZE  |        | FRAME                | PANEL                          | HINGE                        | LOCKSET      | HANDLE | REMARKS                                   |
|--------|--------------------------------------------|-------|--------|----------------------|--------------------------------|------------------------------|--------------|--------|-------------------------------------------|
|        |                                            | WIDTH | HEIGHT |                      |                                |                              |              |        |                                           |
| D1     | ROLLING DOOR<br>(STEEL NO.18,1.2 mm. Thk.) | 3.60  | 4.00   | GALVANIZED STEEL     | —                              | —                            | NORMAL KEY   | —      | MOTOR OPERATING                           |
| D2     | SLIDE DOOR                                 | 2.50  | 2.50   | ALUMINIUM(NA) 2"x 4" | GLASS 5 mm.thk.                | —                            | CYINDER LOCK | —      |                                           |
| D3     | OPENING DOOR                               | 0.90  | 2.00   | HARDWOOD 2"x 4"      | TEAK PLYWOOD & GLASS 5 mm.thk. | STAINLESS STEEL 4"x3"x2.5mm. | CYINDER LOCK | —      |                                           |
| D4     | OPENING DOOR                               | 0.80  | 2.00   | P.V.C. 2"x 4"        | P.V.C.                         | STAINLESS STEEL 4"x3"x2.5mm. | CYINDER LOCK | —      |                                           |
| W1     | OPENING WINDOW                             | 3.40  | 1.50   | ALUMINIUM(NA) 2"x 4" | GLASS 5 mm.thk.                | ●                            | ●            | ●      | FULL SET OF ACCESSORIES FROM MANUFACTURER |
| W2     | OPENING WINDOW                             | 2.56  | 1.50   | ALUMINIUM(NA) 2"x 4" | GLASS 5 mm.thk.                | ●                            | ●            | ●      | FULL SET OF ACCESSORIES FROM MANUFACTURER |
| W3     | FIXED GLASS WINDOW                         | 3.40  | 1.50   | ALUMINIUM(NA) 2"x 4" | GLASS 5 mm.thk.                | —                            | —            | —      |                                           |
| W4     | FIXED GLASS WINDOW                         | 2.56  | 1.50   | ALUMINIUM(NA) 2"x 4" | GLASS 5 mm.thk.                | —                            | —            | —      |                                           |
| W5     | FIXED GLASS WINDOW                         | 1.20  | 0.50   | ALUMINIUM(NA) 2"x 4" | GLASS 5 mm.thk.                | —                            | —            | —      |                                           |
| ●      | SHALL BE USED SPECIFIED ACCESSORIES        |       |        |                      |                                |                              |              |        |                                           |



#### NOTES :

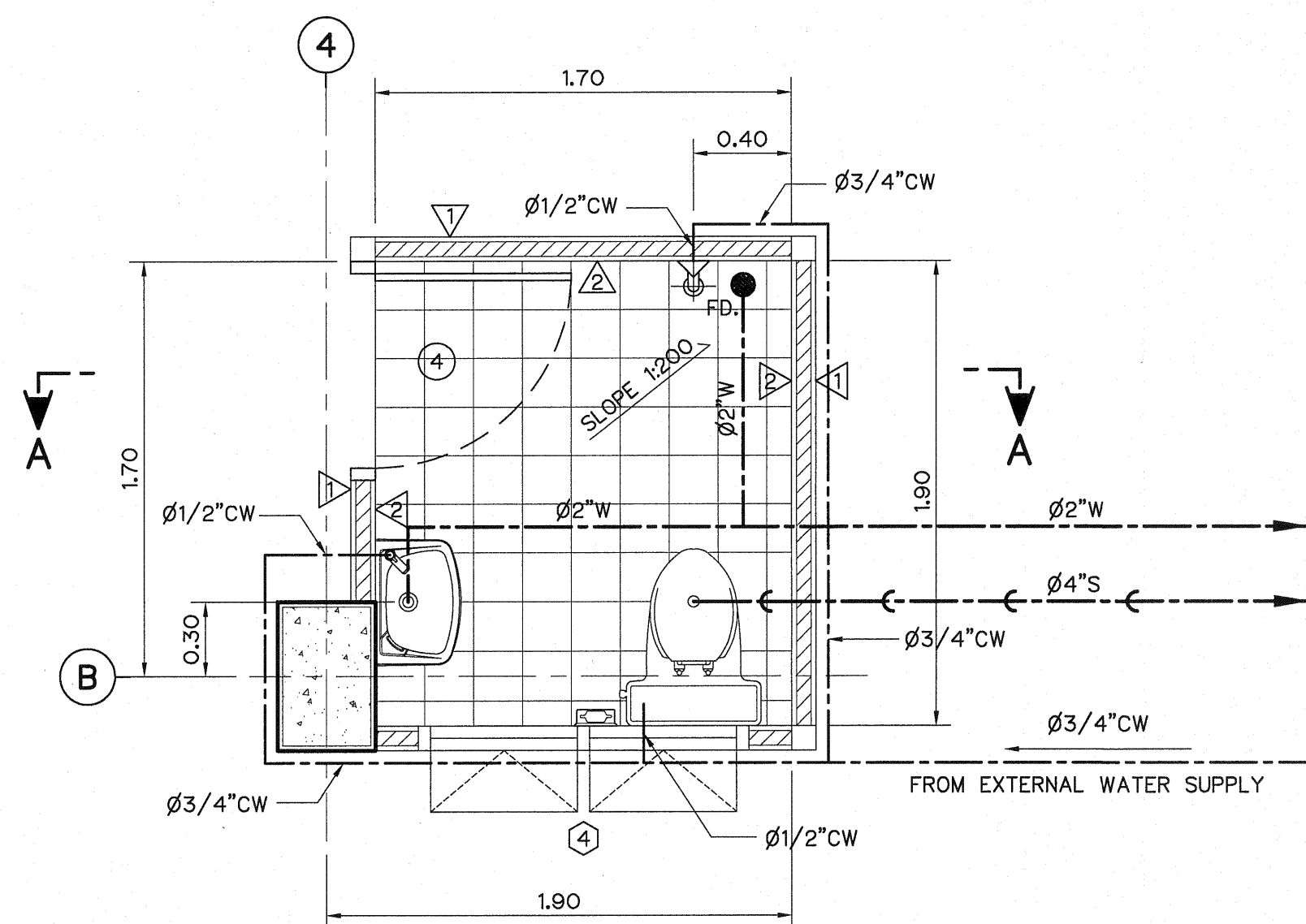
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
3. FOR PAINTING WORKS SEE TECHNICAL SPECIFICATION.

#### REFERENCE DRAWINGS :

- |                                              |           |
|----------------------------------------------|-----------|
| 1. POWERHOUSE, GROUND FLOOR PLAN & ROOF PLAN | LPP-PH-02 |
| 2. POWERHOUSE, ELEVATIONS                    | LPP-PH-03 |
| 3. POWERHOUSE, SECTION A-A                   | LPP-PH-04 |
| 4. POWERHOUSE, SECTION B-B , C-C             | LPP-PH-05 |

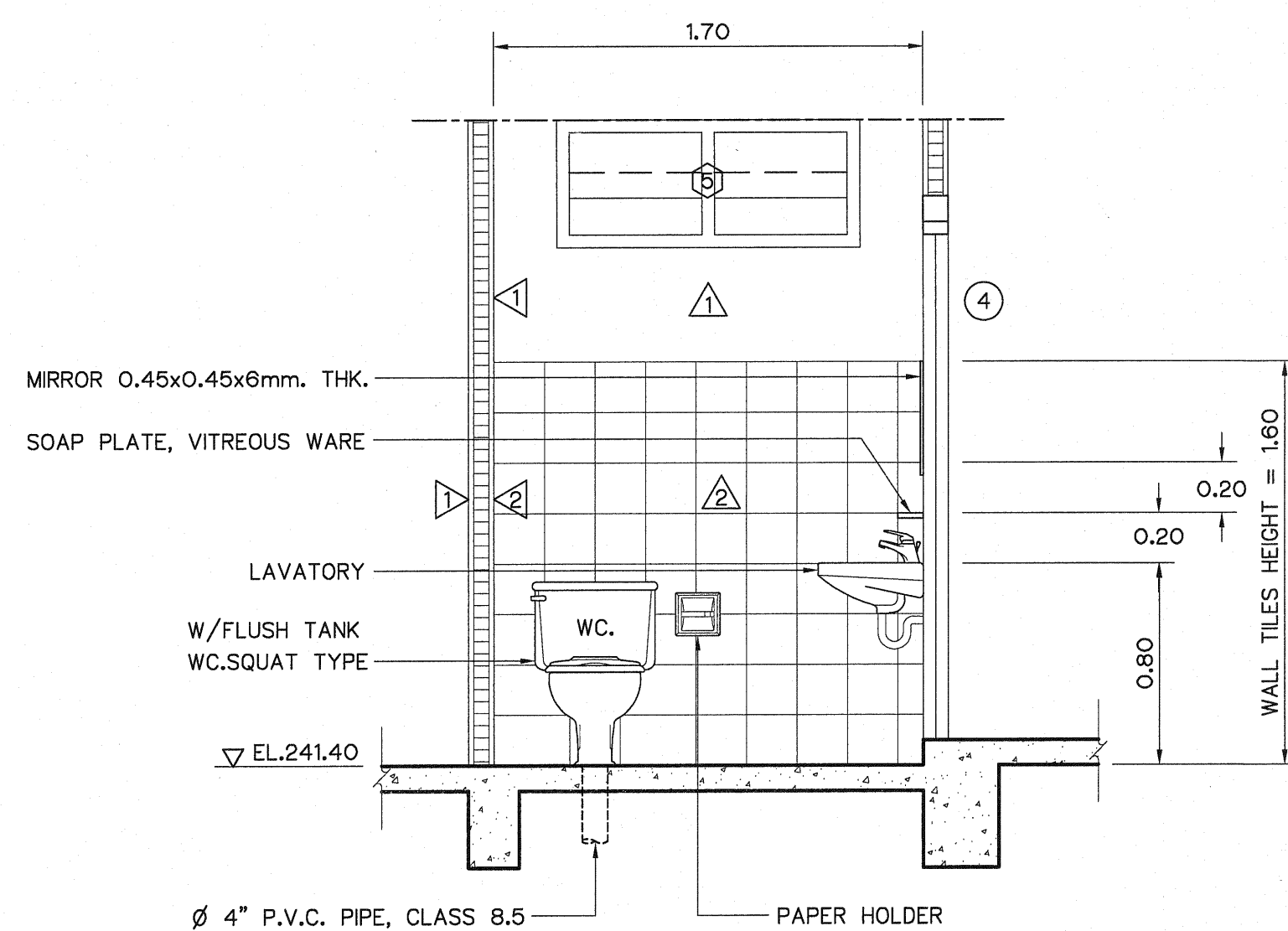
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| NO. | DATE | REVISIONS   | CHECKED | APPROVED |
|     |      | CONSULTANTS |         | DEDE     |

|                                                                                                          |                         |
|----------------------------------------------------------------------------------------------------------|-------------------------|
| KINGDOM OF THAILAND<br>Department of Alternative Energy Development and Efficiency<br>MINISTRY OF ENERGY |                         |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                      |                         |
| CIVIL WORKS                                                                                              |                         |
| POWERHOUSE                                                                                               |                         |
| DETAILS OF DOORS, WINDOWS AND NAMEPLATE                                                                  |                         |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.                                                                | REVIEWED S. KITICHAI    |
| DESIGNED S. Kitichai                                                                                     | SUBMITTED S. Kitichai   |
| DRAWN S. Kitichai                                                                                        | RECOMMENDED S. Kitichai |
| CHECKED S. Kitichai                                                                                      | APPROVED S. Kitichai    |
| PROJECT MANAGER                                                                                          | DRAWING NO. LPP-PH-07   |
| DATE 14/01/62                                                                                            | SHEET NO. 20 OF 44      |



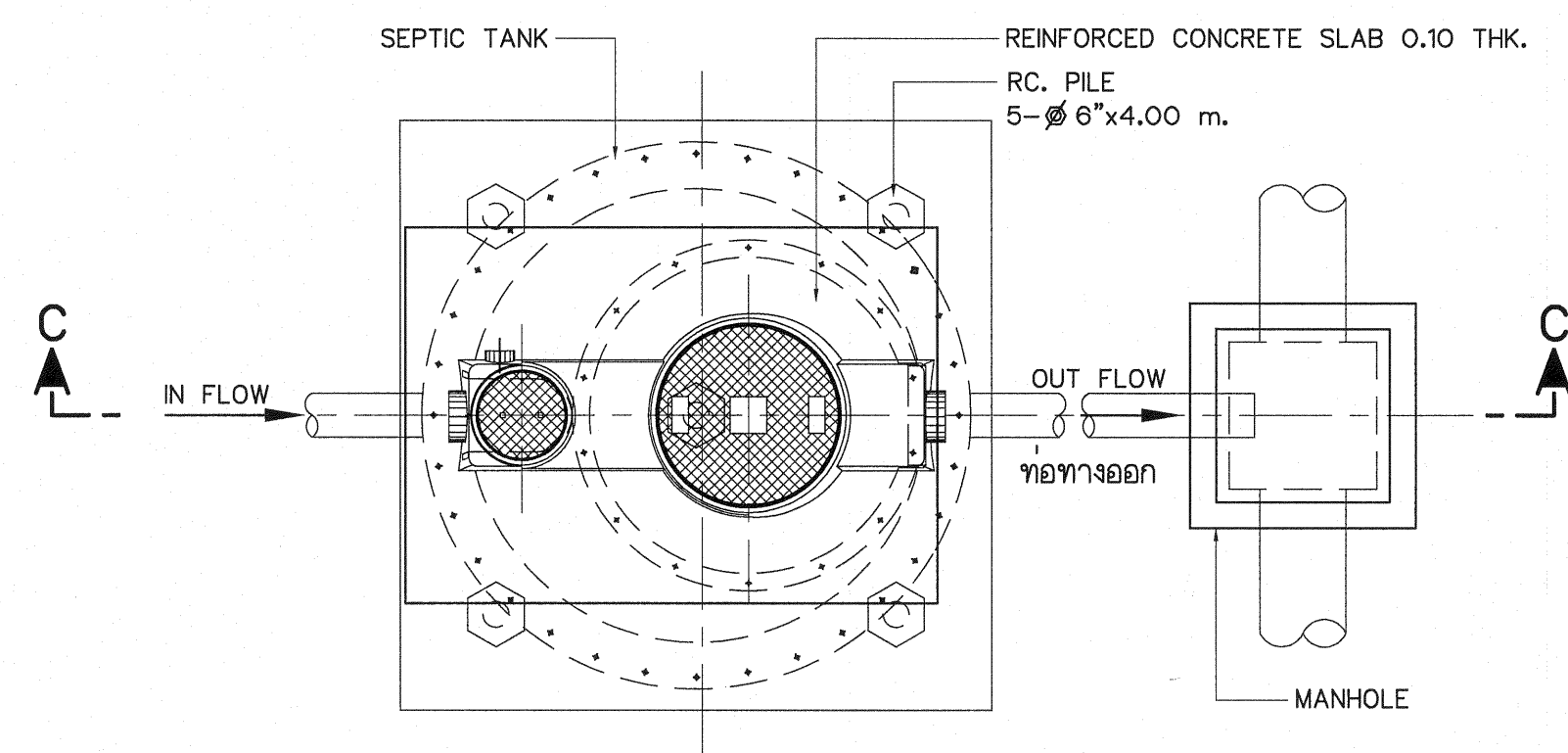
W.C. PLAN

SCALE 1:25



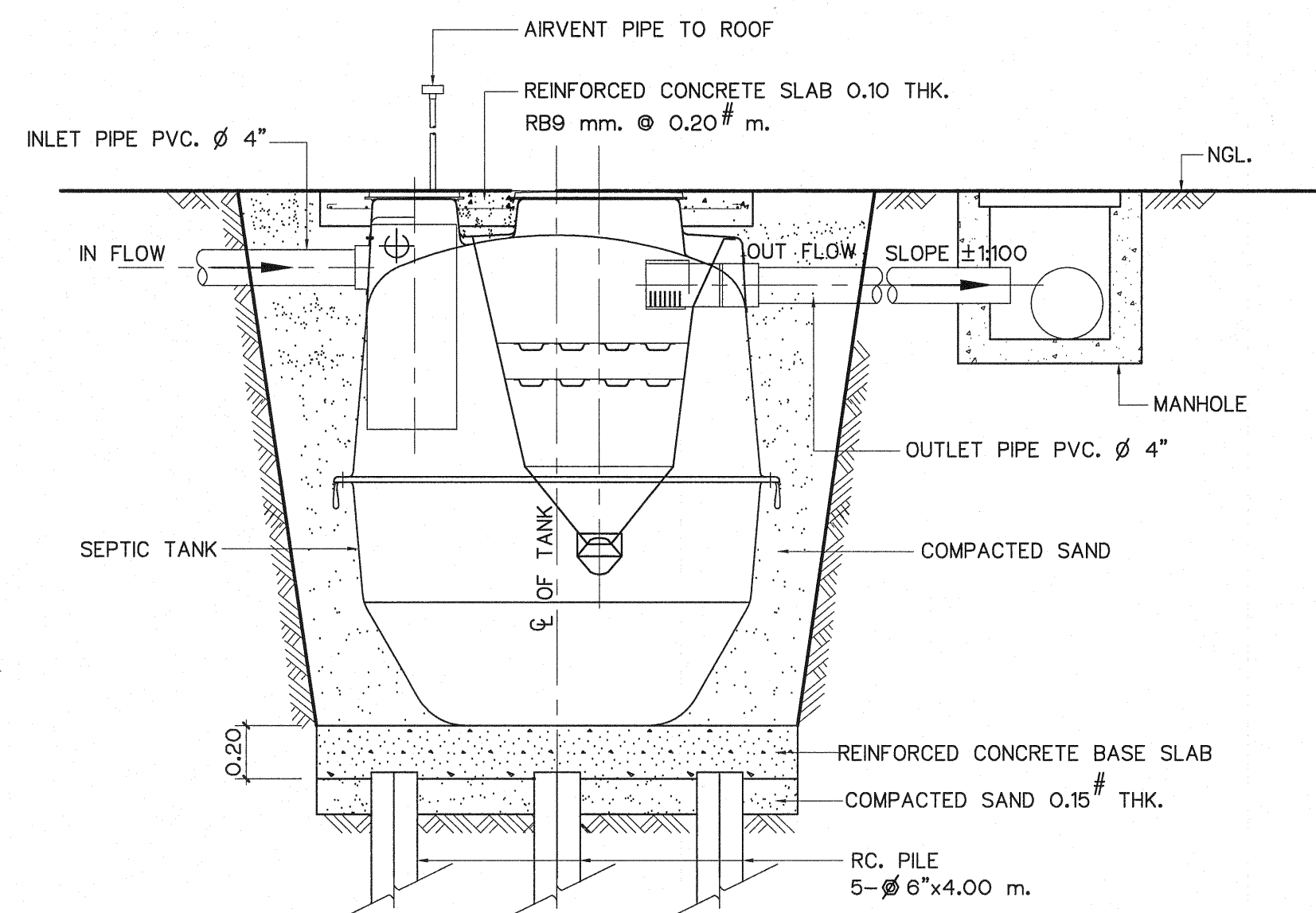
SECTION A - A

SCALE 1:25



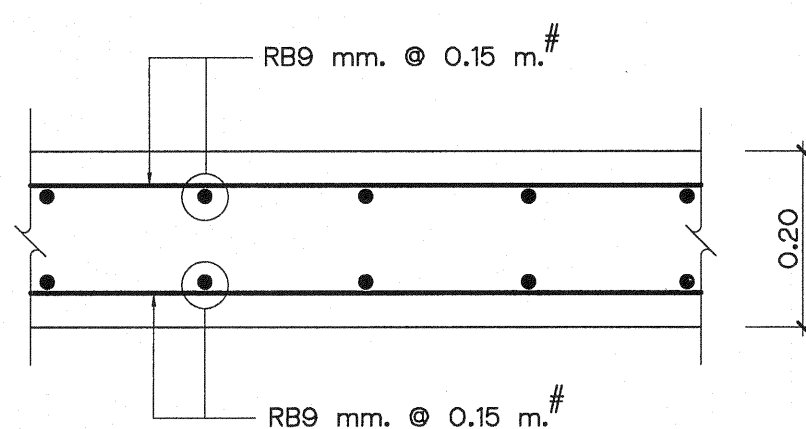
PLAN OF SEPTIC TANK

NOT TO SCALE



SECTION C-C

NOT TO SCALE



REINFORCEMENT OF BASE SLAB

NOT TO SCALE

SYMBOLS :

- ← - - - ← SOIL PIPE
- — — — — WASTE PIPE
- — — — — COLD WATER PIPE
- - - - - VENT PIPE

NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.

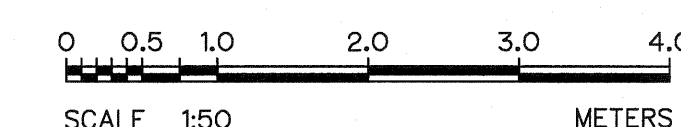
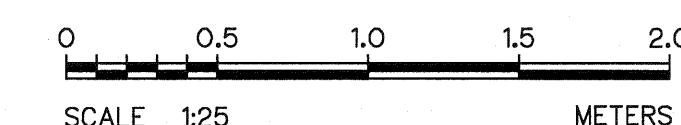
REFERENCE DRAWING :

1. POWERHOUSE, GROUND FLOOR PLAN & ROOF PLAN LPP-PH-02

| APPLICATION AND DIMENSION OF SEPTIC TANK |                         |                                           |           |         |         |
|------------------------------------------|-------------------------|-------------------------------------------|-----------|---------|---------|
| NO. OF USER                              | VOLUMN                  |                                           | CONDITION |         |         |
|                                          | RESIDENTIAL             | SOIL ONLY 60 LPCD<br>TOTAL WASTE 200 LPCD | 16<br>5   | 20<br>6 | 23<br>7 |
| DIMENSION                                | DIAMETER (MM.)          |                                           | 1430      | 1390    | 1460    |
|                                          | HIGHT (MM.)             |                                           | 1490      | 1570    | 1670    |
|                                          | INLET,OUTLET PIPE (MM.) |                                           | 100       | 100     | 100     |
|                                          | VENT (MM.)              |                                           | 50        | 50      | 50      |
| VOLUMS                                   | TOTAL VOLUMN (LITER)    |                                           | 1600      | 1800    | 2230    |
|                                          | SEPTIC ZONE (LITER)     |                                           | 1060      | 1200    | 1530    |
|                                          | FILTER ZONE (LITER)     |                                           | 540       | 600     | 700     |
| REMARK:LPCD = LITER PER CAPITAL PER DAY  |                         |                                           |           |         |         |

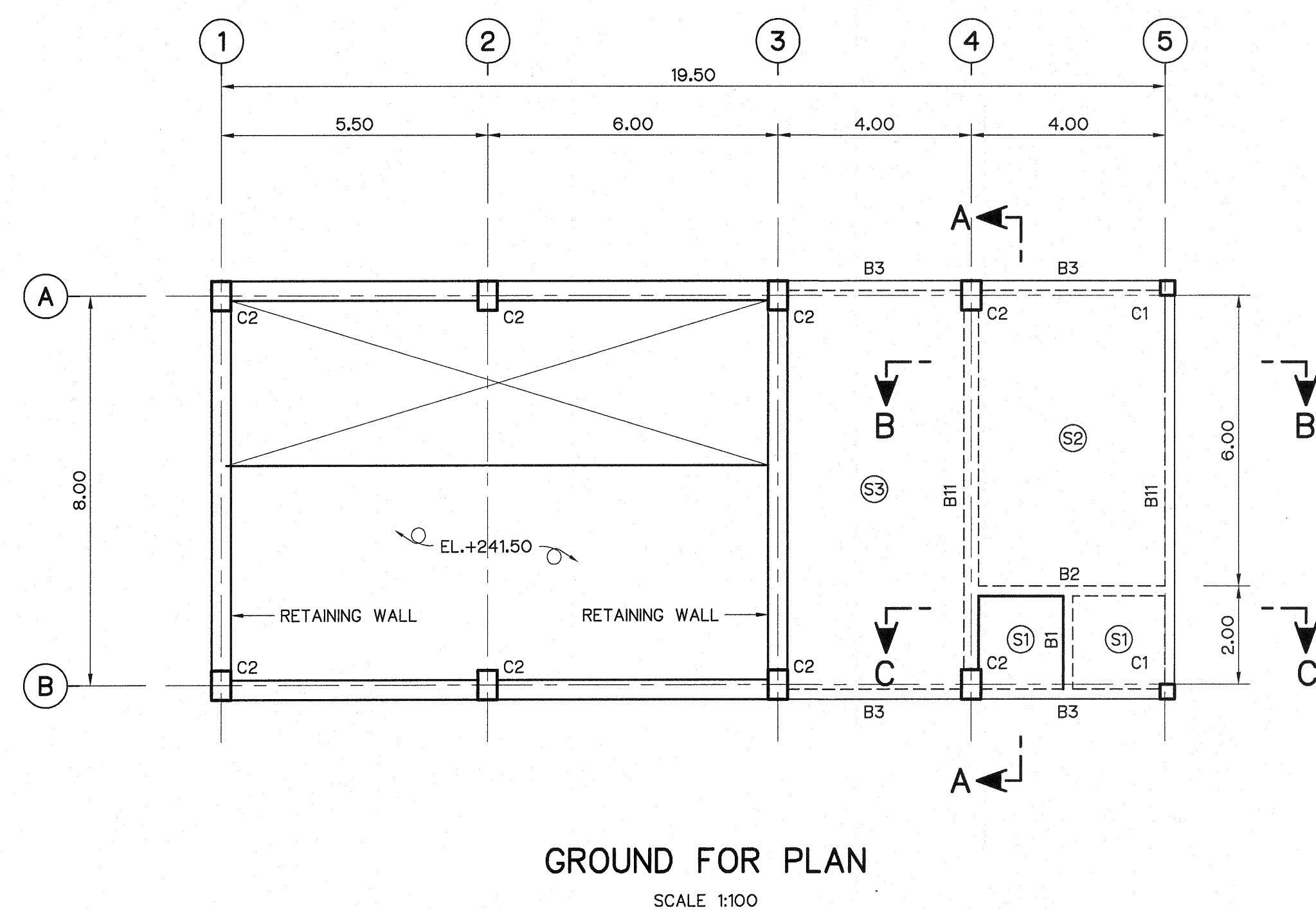
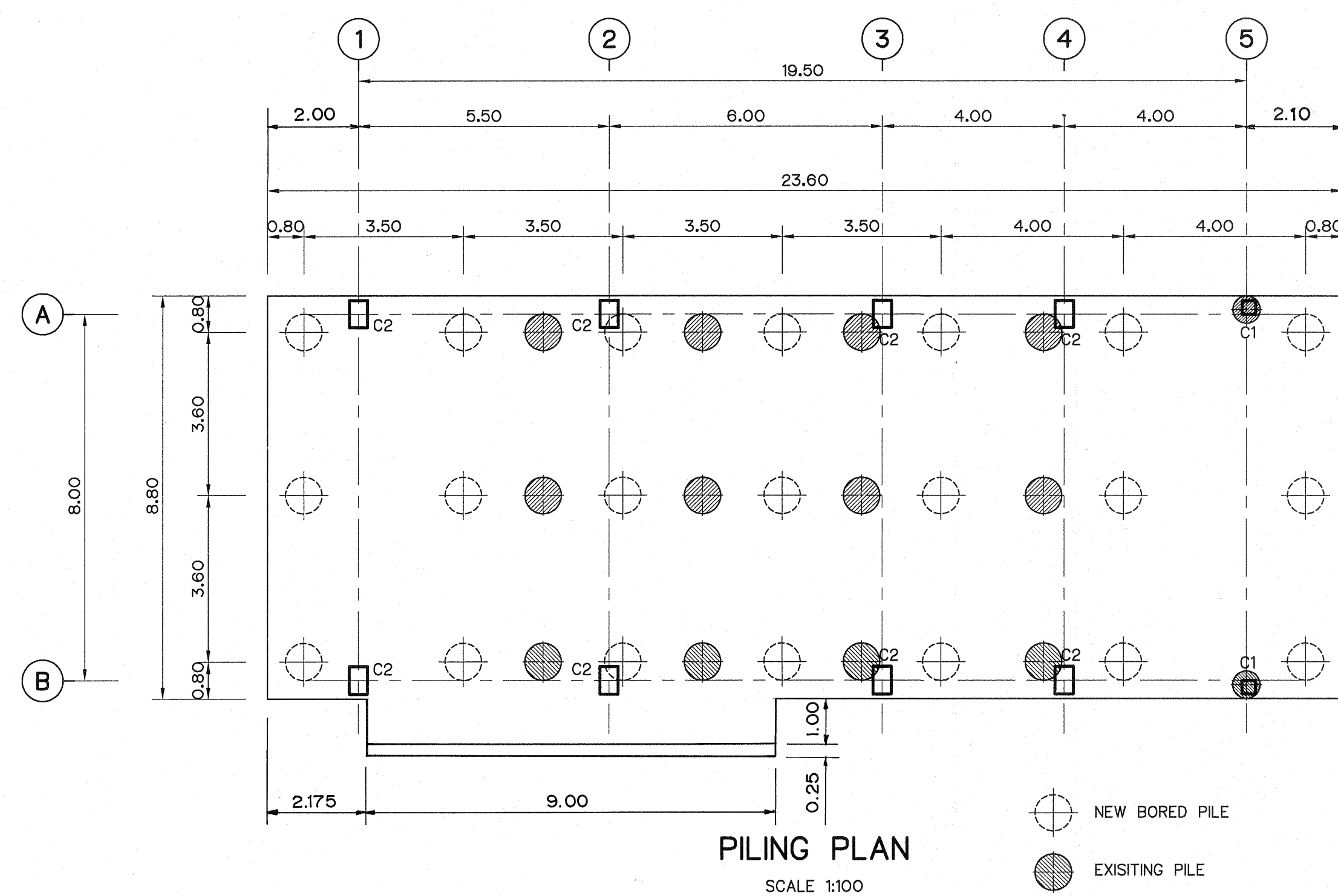
SELECTED CONDITION

| MATERIAL AND APPLICATION OF SEPTIC TANK |                                                  |
|-----------------------------------------|--------------------------------------------------|
| COMPONENTS                              | MATERIAL                                         |
| 1. TANK BODY                            | LLDEL (LINER LOW TYPE MEDIUM DENSITY)            |
| 2. MANHOLE COVER                        | ABS (ACRYLONITRILE-BUTADIENE-STYRENE), IRON CAST |
| 3. INLET, OUTLET PIPES                  | POLYETHYLENE                                     |
| 4. FLEX                                 | FLEXIBLE FITTING ABS ø 100 MM.                   |
| 5. MEDIA                                | HDPE                                             |



|                                                                                                             |                       |
|-------------------------------------------------------------------------------------------------------------|-----------------------|
| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |                       |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                         |                       |
| CIVIL WORKS<br>POWERHOUSE<br>DETAILS OF TOILET AND SEPTIC TANK                                              |                       |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.                                                                   | REVIEWED S.KITICHAN   |
| DESIGNED S.KITICHAN 22.6651                                                                                 | SUBMITTED             |
| DRAWN S.KITICHAN 22.6651                                                                                    | RECOMMENDED           |
| CHECKED S.KITICHAN 22.6651                                                                                  | APPROVED              |
| PROJECT MANAGER 14/01/62                                                                                    | DRAWING NO. LPP-PH-08 |
| DATE                                                                                                        | SHEET NO. 21 OF 44    |

| NO.         | DATE | REVISIONS | CHECKED | APPROVED |
|-------------|------|-----------|---------|----------|
| 3           |      |           |         |          |
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| CONSULTANTS |      | DEDE      |         |          |

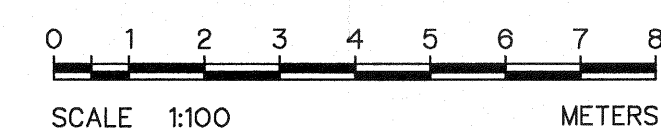
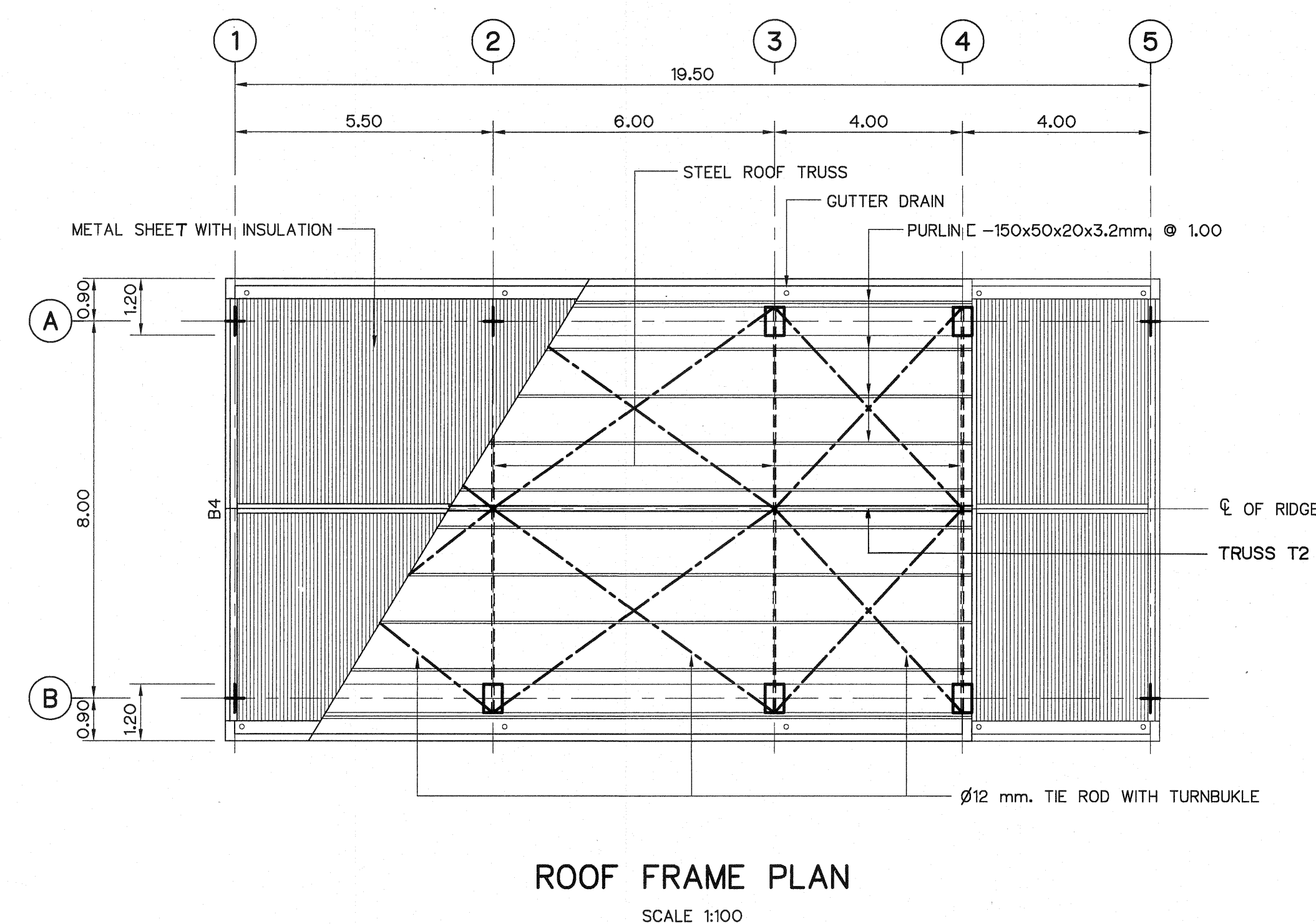
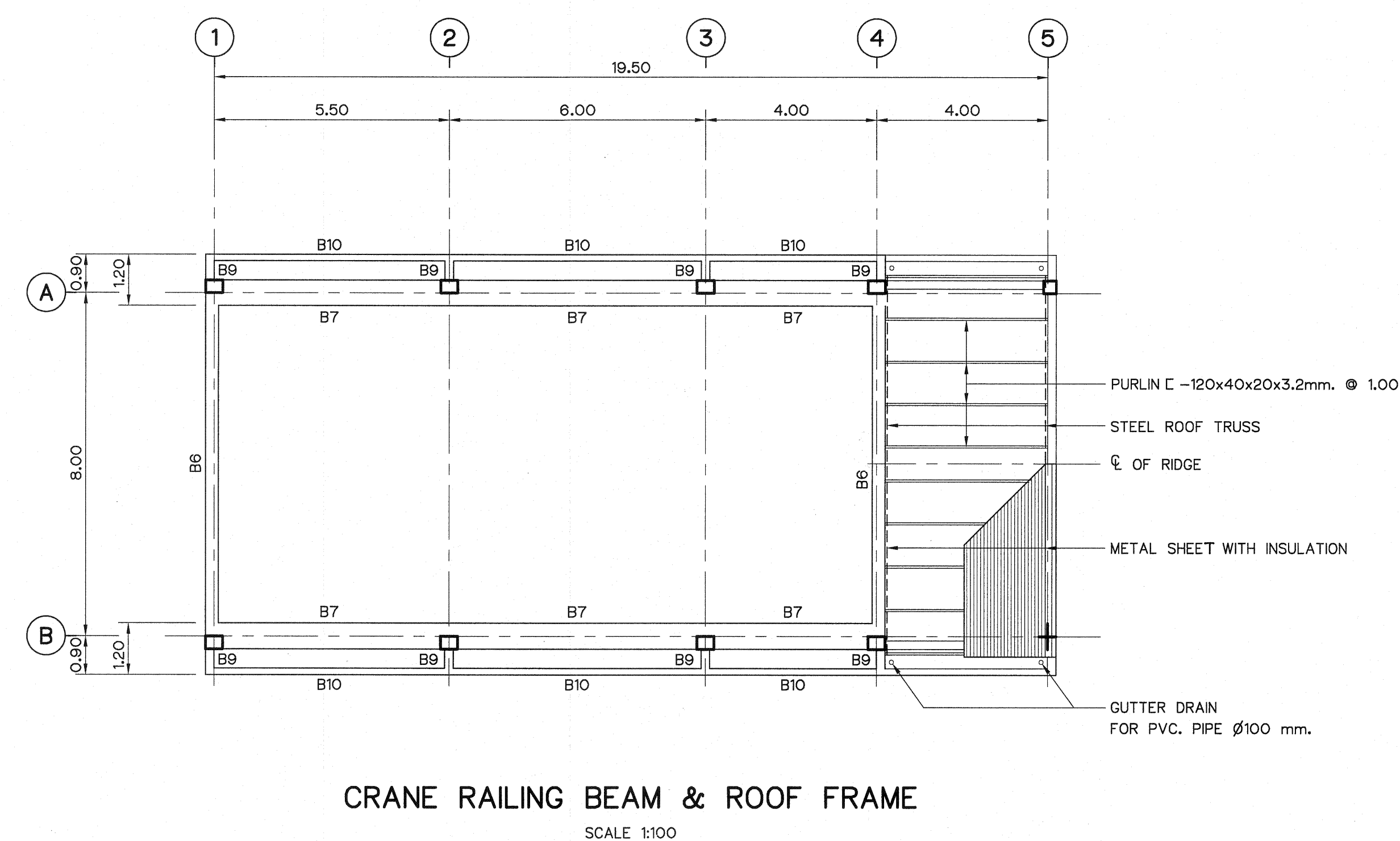


NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
3. LOCATIONS OF LAP SPLICES SHALL BE DETERMINED IN FIELD UNDER THE APPROVAL OF NEA'S FIELD ENGINEER.
4. ALLOWABLE LOAD OF BORED PILE Ø0.80 M. SHALL NOT BE LESS THAN 180 TONS.
5. BORED PILE TIP SHALL BE PLACED ON FIRM ROCK LAYER OR DENSE SAND APPROX. PILE LENGTH 25 M.

REFERENCE DRAWINGS :

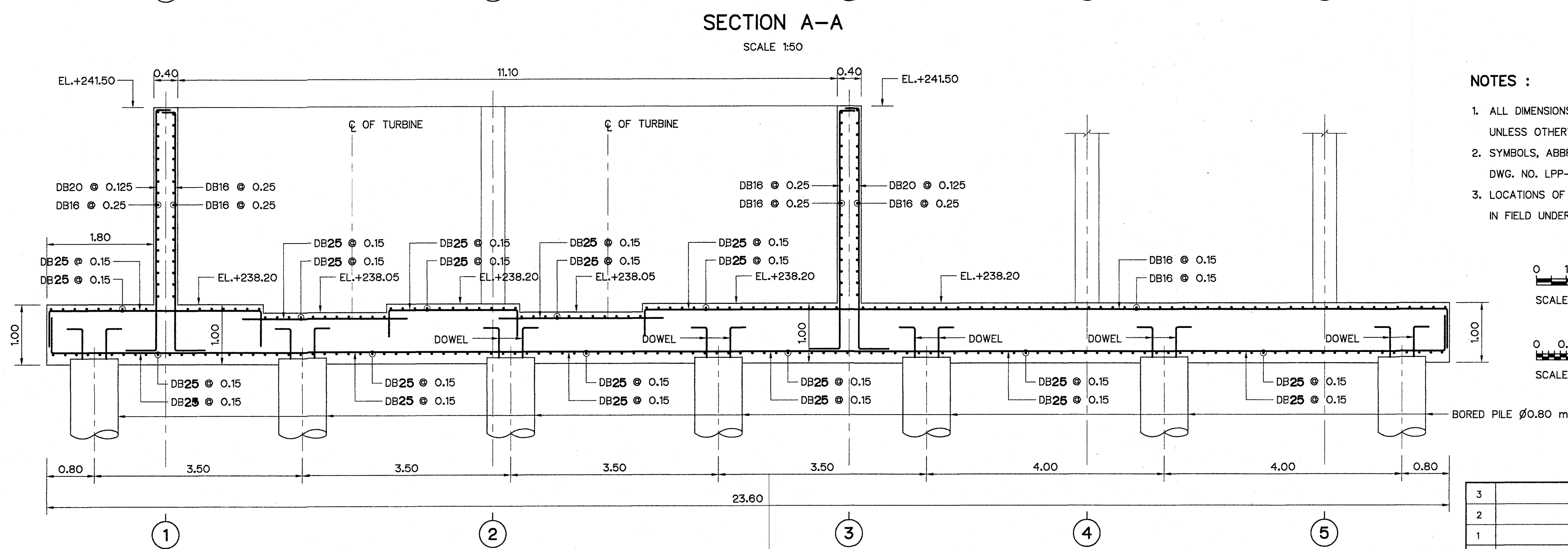
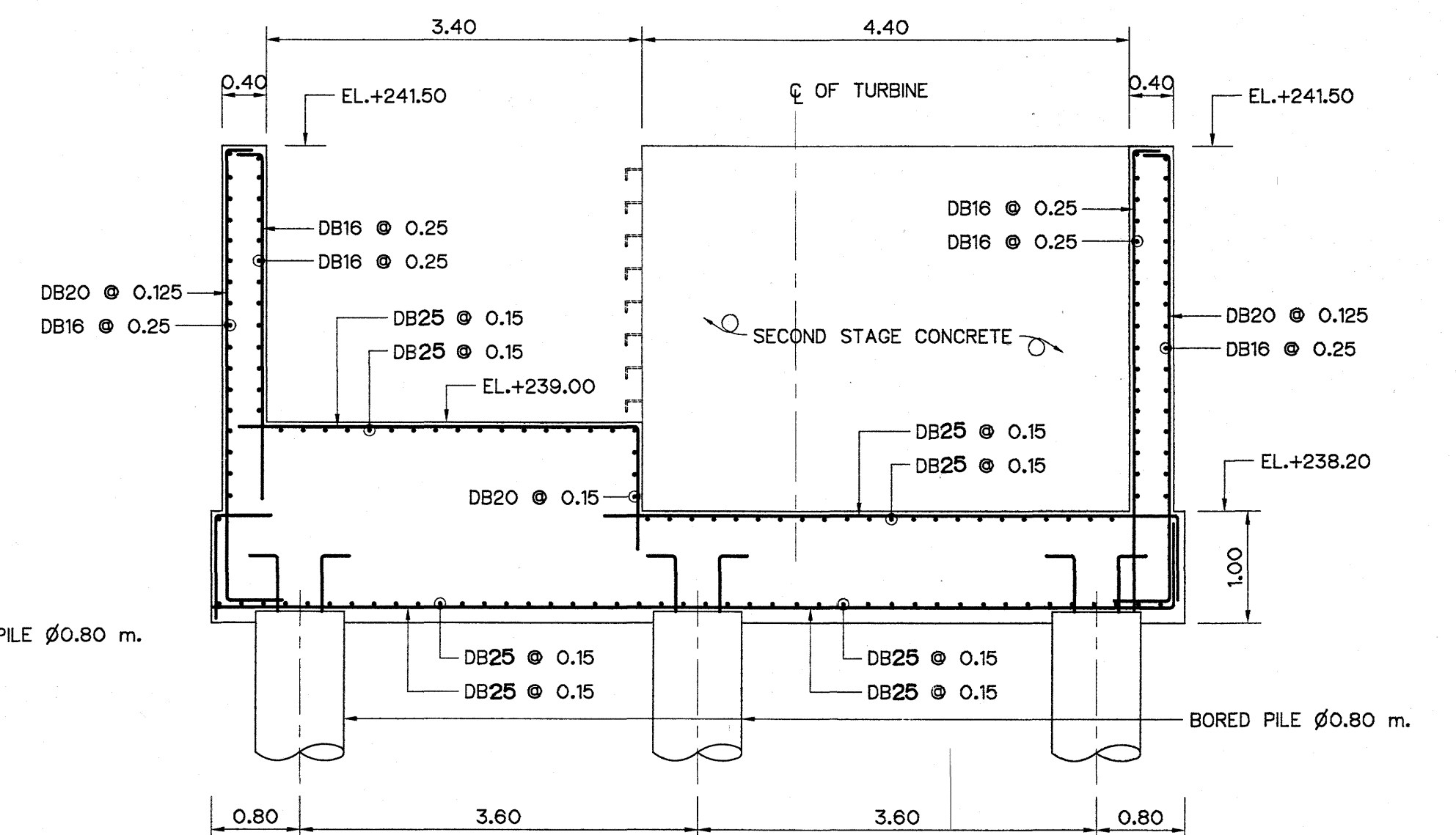
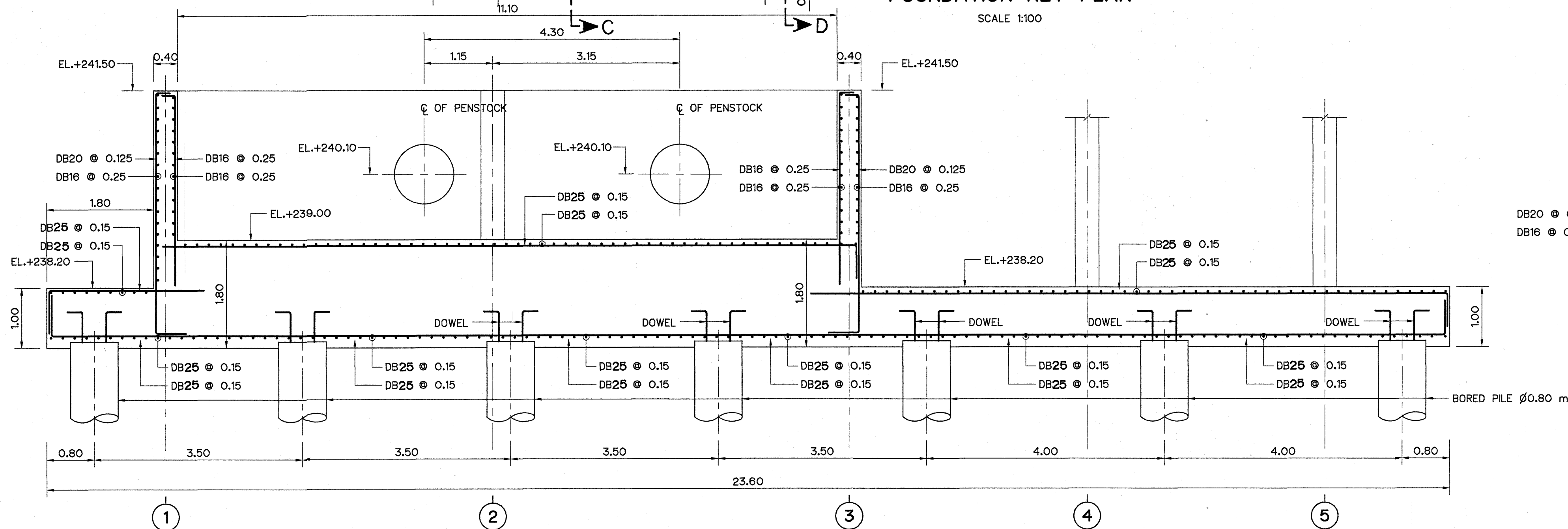
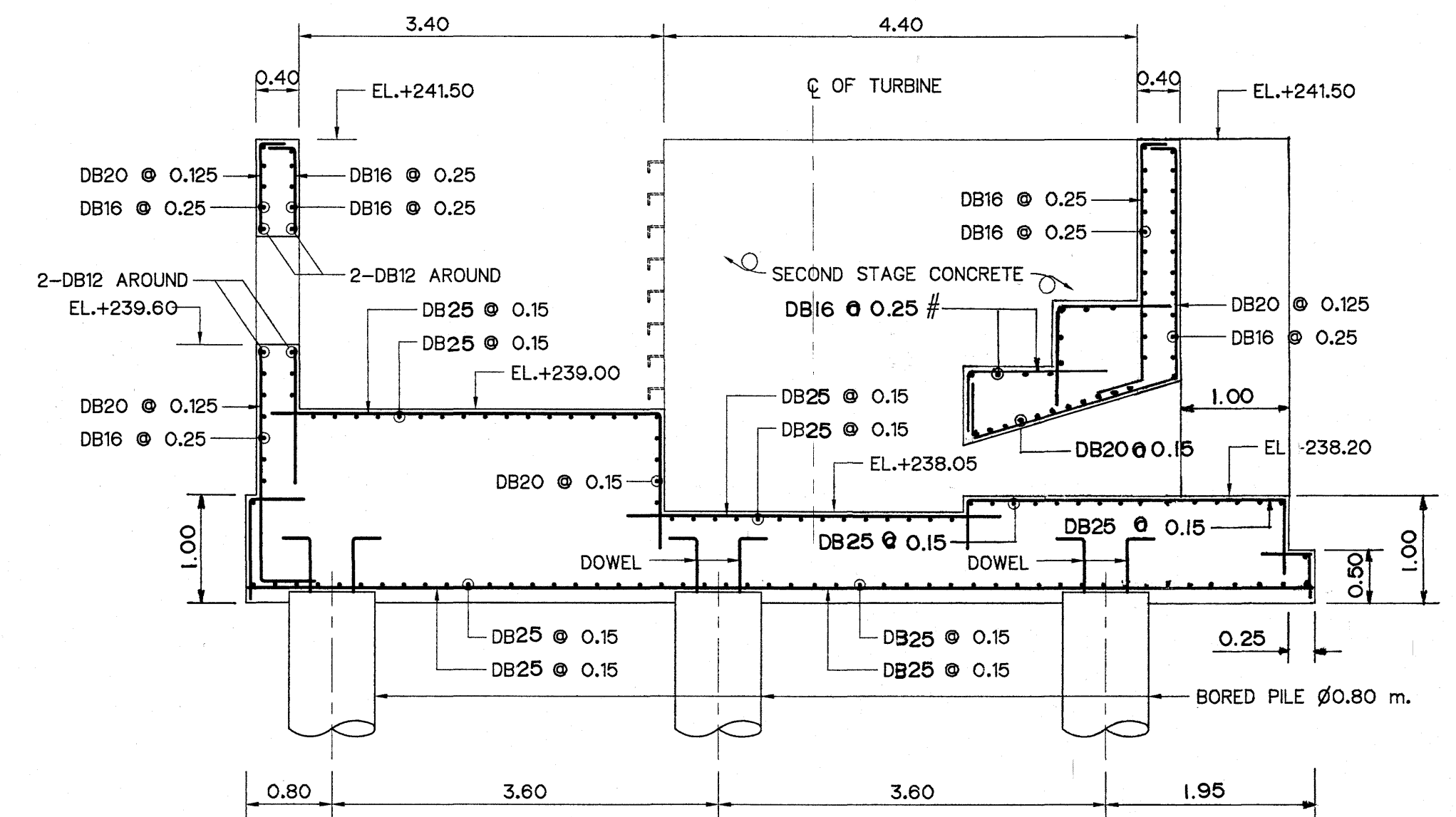
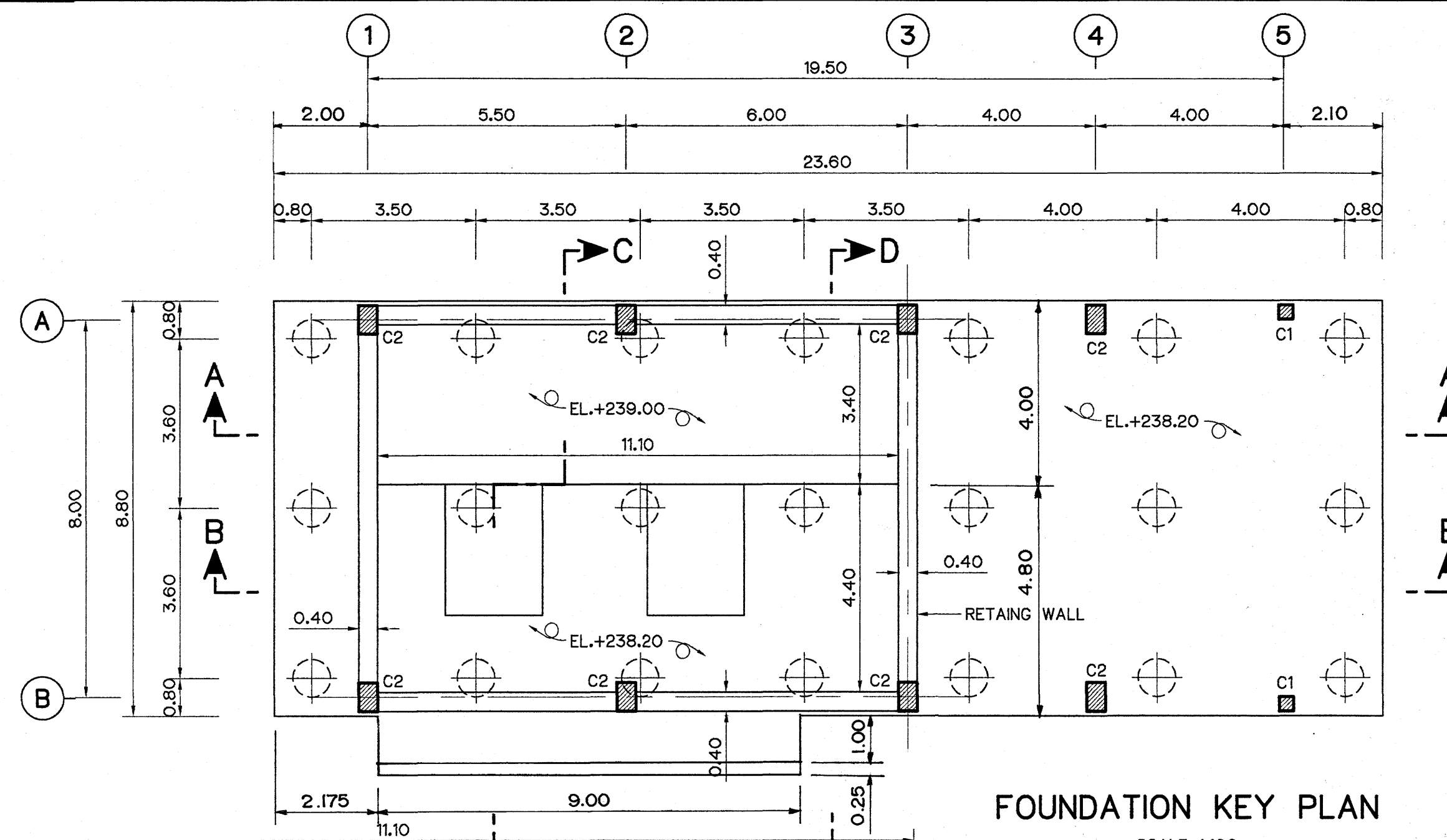
- |                                                 |           |
|-------------------------------------------------|-----------|
| 1. POWERHOUSE, GROUND FLOOR PLANS & ROOF PLAN   | LPP-PH-02 |
| 2. POWERHOUSE, REINFORCEMENT DETAILS            | LPP-PH-10 |
| 3. POWERHOUSE, FOUNDATION REINFORCEMENT DETAILS | LPP-PH-11 |
| 4. POWERHOUSE, CABLE TRENCH DETAILS             | LPP-PH-12 |



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|     | CONSULTANTS |           | DEDE    |          |

|                                                                                                                                                                                                                    |                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/><b>MINISTRY OF ENERGY</b></p> |                                                                                                                                                                                            |
| <p align="center"><b>LAM PHRA PHLOENG HYDROPOWER PROJECT</b></p>                                                                                                                                                   |                                                                                                                                                                                            |
| <p align="center"><b>CIVIL WORKS</b></p>                                                                                                                                                                           |                                                                                                                                                                                            |
| <p align="center"><b>POWERHOUSE</b></p>                                                                                                                                                                            |                                                                                                                                                                                            |
| <p align="center"><b>STRUCTURAL PLAN</b></p>                                                                                                                                                                       |                                                                                                                                                                                            |
| <p><b>FTS</b> FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                                                                                                        |  <p>Department of Alternative<br/>Energy Development and Efficiency<br/><b>MINISTRY OF ENERGY</b></p> |
| <p>DESIGNED  ๑๒.6851</p>                                                                                                      | <p>REVIEWED <b>S. KITICHAJ</b></p>                                                                                                                                                         |
| <p>DRAWN </p>                                                                                                                 | <p>SUBMITTED </p>                                                                                     |
| <p>CHECKED  ๑๒.7324</p>                                                                                                       | <p>RECOMMENDED </p>                                                                                   |
| <p> 14/01/62</p>                                                                                                              | <p>APPROVED </p>                                                                                      |
| <p>PROJECT MANAGER</p>                                                                                                                                                                                             | <p>DRAWING NO. <b>LPP-PH-09</b></p>                                                                                                                                                        |
| <p>DATE</p>                                                                                                                                                                                                        | <p>SHEET NO. 22 OF 44</p>                                                                                                                                                                  |



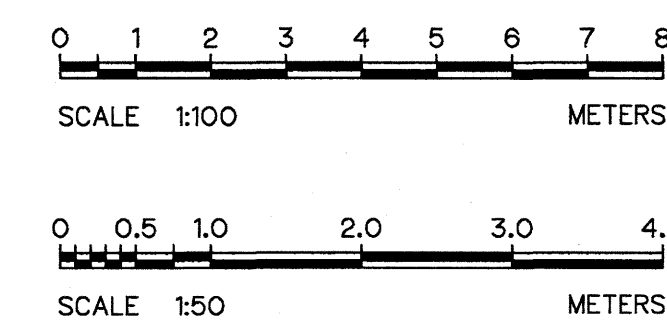


#### NOTES :

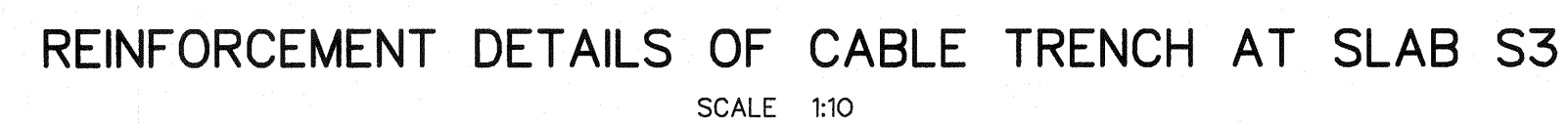
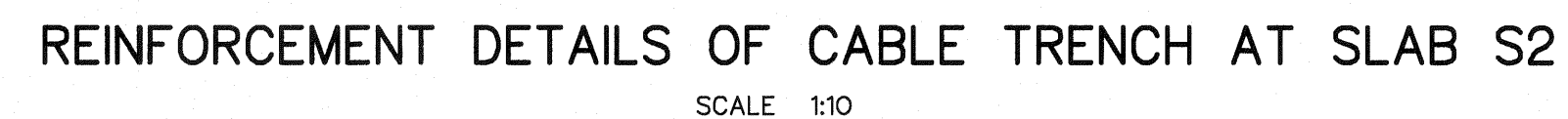
- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
- LOCATIONS OF LAP SPLICES SHALL BE DETERMINED IN FIELD UNDER THE APPROVAL OF FIELD ENGINEER.

#### REFERENCE DRAWINGS :

- POWERHOUSE, STRUCTURAL PLAN LPP-PH-09
- POWERHOUSE, REINFORCEMENT DETAILS LPP-PH-10
- POWERHOUSE, CABLE TRENCH DETAILS LPP-PH-12

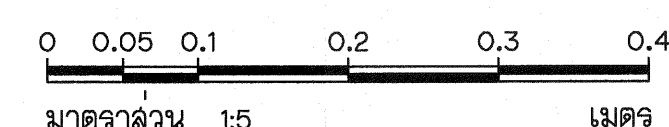


|                                                                                                                       |  |                                                                                               |  |
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| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |                                                                                               |  |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |  |                                                                                               |  |
| <p>CIVIL WORKS<br/>POWER HOUSE<br/>FOUNDATION REINFORCEMENT DETAILS</p>                                               |  |                                                                                               |  |
| <p>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</p>                                                                     |  | <p>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |
| <p>DESIGNED <i>[Signature]</i> 261.6651</p>                                                                           |  | <p>REVIEWED <i>[Signature]</i> 261.6651</p>                                                   |  |
| <p>DRAWN <i>[Signature]</i></p>                                                                                       |  | <p>RECOMMENDED <i>[Signature]</i></p>                                                         |  |
| <p>CHECKED <i>[Signature]</i> 261.7324</p>                                                                            |  | <p>APPROVED <i>[Signature]</i></p>                                                            |  |
| <p>DATE 14/01/62</p>                                                                                                  |  | <p>DRAWING NO. LPP-PH-11</p>                                                                  |  |
| <p>PROJECT MANAGER</p>                                                                                                |  | <p>SHEET NO. 24 OF 44</p>                                                                     |  |



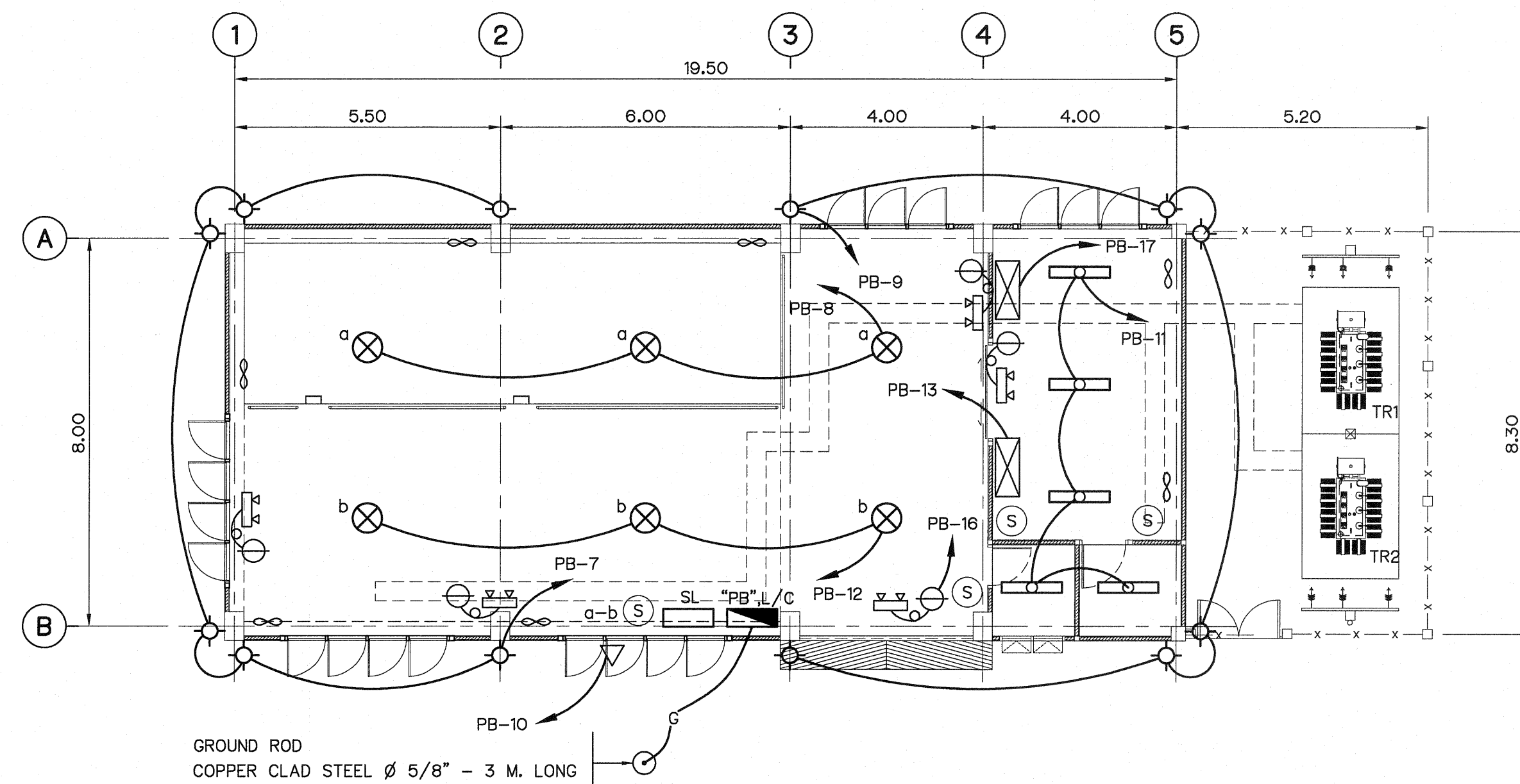
1. ALL DIMENSIONS ARE IN METERS, UNLESS OTHERWISE SHOWN
2. SYMBOLS, ABBREVIATION AND GENERAL NOTES SEE DWG. No. LPP-GN-03.
3. STEEL COVER FOR IN DOOR TRENCH SHALL BE COATED WITH NON BLEEDING TYPE COAL TAR EPOXY.

1. POWERHOUSE, GROUND FLOOR PLANS & ROOF PLAN LPP-PH-02

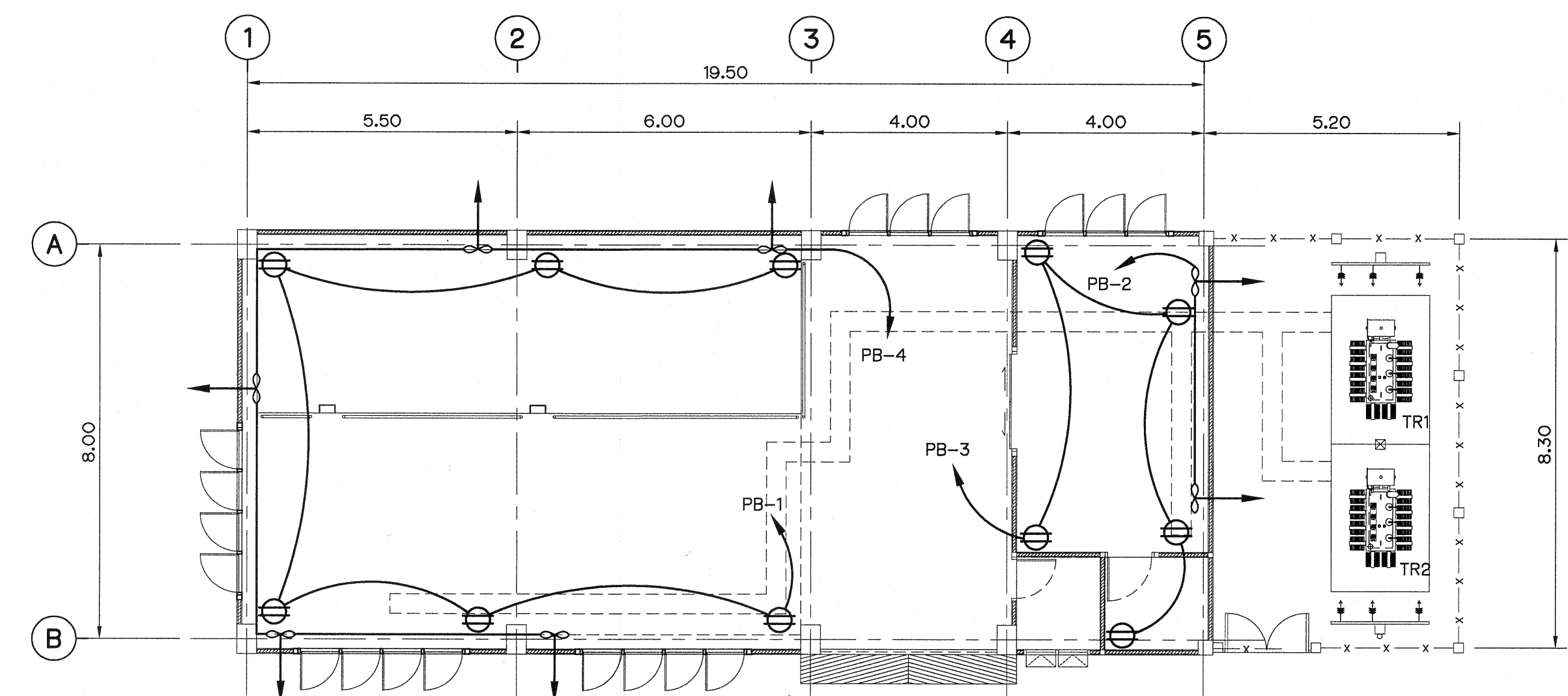


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| NO. | DATE        | REVISIONS | CHECKED | APPROVED |
|     | CONSULTANTS |           | DEDE    |          |

|                                                                                                                                                                                                                                       |                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p style="margin: 0;">KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/><b>MINISTRY OF ENERGY</b></p> |                                                                                                                                                                                   |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                                                                                                                                                   |                                                                                                                                                                                   |
| CIVIL WORKS                                                                                                                                                                                                                           |                                                                                                                                                                                   |
| POWERHOUSE                                                                                                                                                                                                                            |                                                                                                                                                                                   |
| CABLE TRENCH DETAILS                                                                                                                                                                                                                  |                                                                                                                                                                                   |
|  <b>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</b>                                                                                               |  Department of Alternative<br>Energy Development and Efficiency<br><b>MINISTRY OF ENERGY</b> |
| DESIGNED  28J.6651                                                                                                                               | REVIEWED <b>S. KITICHAJ</b>                                                                                                                                                       |
| DRAWN  28J.6651                                                                                                                                  | SUBMITTED                                                                                    |
| CHECKED  28J.7324                                                                                                                                | RECOMMENDED                                                                                  |
| <br>PROJECT MANAGER                                                                                                                              | APPROVED <br>DRAWING NO. <b>LPP-PH-12</b>                                                    |
| 14/01/62                                                                                                                                                                                                                              | SHEET NO. 25 OF 44                                                                                                                                                                |



**LIGHTING PLAN**  
SCALE 1:100



**EXHAUST AND OUTLET PLAN**  
SCALE 1:100

**DIAGRAM**

| LOCATION : MACHINE HALL |                      |           |       |       | "PB" LOAD CENTER 3Ø 4W WITH MCCB. 3P 50AT 100AF<br>(24 CKTS,BRANCH MCB 5 KAIC) |    |                       |                     | IC > 10 KA AT 380 VOLT |   |   |                        |
|-------------------------|----------------------|-----------|-------|-------|--------------------------------------------------------------------------------|----|-----------------------|---------------------|------------------------|---|---|------------------------|
| CKT NO                  | DESCRIPTION          | LOAD (VA) |       |       | MCB                                                                            |    | CONDUCTOR             |                     | A                      | B | C | FROM MDB<br>50AT,100AF |
|                         |                      | A         | B     | C     | POLE                                                                           | AT | SIZE(MM) <sup>2</sup> | TYPE                |                        |   |   |                        |
| 1                       | RECEPTACLES          | 1,080     |       |       | 1                                                                              | 15 | 2.5/1.5               | THW<br>1/2" PVC.    |                        |   |   |                        |
| 3                       | RECEPTACLES          |           | 900   |       | 1                                                                              | 15 | 2.5/1.5               | THW<br>1/2" PVC.    |                        |   |   |                        |
| 5                       | SPARE                |           |       |       | 1                                                                              | 15 | —                     | —                   |                        |   |   |                        |
| 7                       | LIGHTING             | 360       |       |       | 1                                                                              | 10 | 2.5                   | THW<br>1/2" PVC.    |                        |   |   |                        |
| 9                       | LIGHTING             |           | 360   |       | 1                                                                              | 10 | 2.5                   | THW<br>1/2" PVC.    |                        |   |   |                        |
| 11                      | LIGHTING             |           |       | 800   | 1                                                                              | 10 | 2.5                   | THW<br>1/2" PVC.    |                        |   |   |                        |
| 13                      | A/C<br>12,000 BTU/Hr | 1,500     |       |       | 1                                                                              | 20 | 4/4                   | THW<br>3/4" PVC.    |                        |   |   |                        |
| 15                      | SPARE                |           |       |       | 1                                                                              | 20 | —                     | —                   |                        |   |   |                        |
| 17                      | A/C<br>12,000 BTU/Hr |           |       | 1,500 | 1                                                                              | 20 | 4/4                   | THW<br>3/4" PVC.    |                        |   |   |                        |
| 2                       | EXHAUST<br>FAN       | 240       |       |       | 1                                                                              | 10 | 2.5                   | THW 1C<br>1/2" PVC. |                        |   |   |                        |
| 4                       | EXHAUST<br>FAN       |           | 600   |       | 1                                                                              | 10 | 2.5                   | THW 1C<br>1/2" PVC. |                        |   |   |                        |
| 6                       | SPARE                |           |       |       | 1                                                                              | 10 | —                     | —                   |                        |   |   |                        |
| 8                       | LIGHTING             | 420       |       |       | 1                                                                              | 10 | 2.5                   | THW 1C<br>1/2" PVC. |                        |   |   |                        |
| 10                      | LIGHTING             |           | 350   |       | 1                                                                              | 10 | 2.5                   | THW 1C<br>1/2" PVC. |                        |   |   |                        |
| 12                      | LIGHTING             |           |       | 420   | 1                                                                              | 10 | 2.5                   | THW 1C<br>1/2" PVC. |                        |   |   |                        |
| 14                      | SPARE                |           |       |       | 1                                                                              | 10 | —                     | —                   |                        |   |   |                        |
| 16                      | EMERGENCY LIGHT      |           | 250   |       | 1                                                                              | 10 | 2.5                   | THW 1C<br>1/2" PVC. |                        |   |   |                        |
| 18                      | SPARE                |           |       |       | 1                                                                              | 20 | —                     | —                   |                        |   |   |                        |
|                         |                      | 3,600     | 2,460 | 2,720 |                                                                                |    |                       |                     |                        |   |   |                        |

TOTAL CONNECTED LOAD 8,780 VA  
DEMAND FACTOR 75%  
CALCULATED LOAD 6,585 VA

**LEGENDS :**

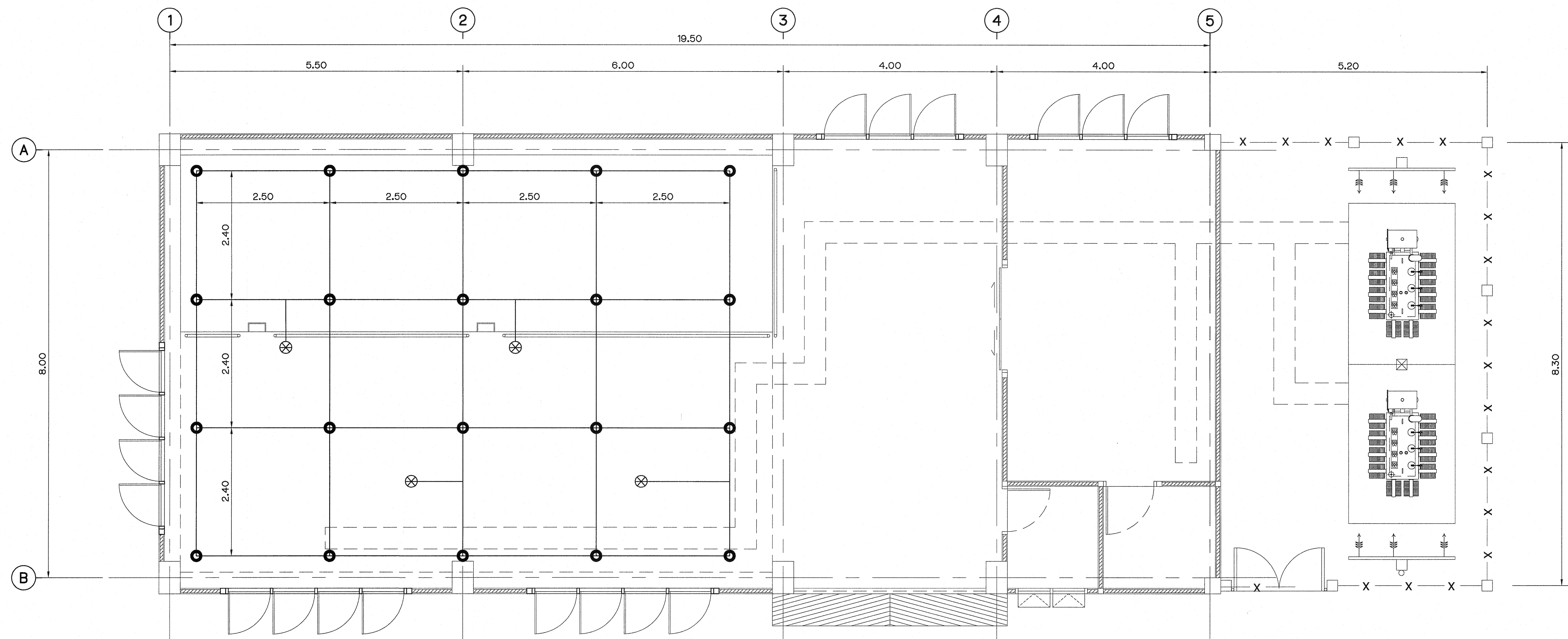
- 1 x 125 W MERCURY VAPOUR LAMP
- 2 x 36 W FLUORESCENT WITH ALUMINIUM ANODIZED REFLECTOR
- 1 x 36 W FLUORESCENT LUMINAIRE
- 1 x 18 W FLUORESCENT LUMINAIRE
- 250 W HIGH PRESSURE SODIUM FLOOD LIGHT
- EXHAUST FAN  $\phi$  10 inch.
- 2 x 25 W EMERGENCY LIGHT WITH BATTERY OPERATE RECEPTACLE
- AIR CONDITION, CEILING TYPE
- LOAD CENTER PANEL
- PB
- DUPLEX RECEPTACLE
- SIMPLEX RECEPTACLE
- POWER RECEPTACLE, 3 $\phi$
- ONE WAY SWITCH, 15A, 1 $\phi$ , 250V
- 1 x 60 W INCANDESCENT, OUTDOOR LUMINAIRE

**NOTE :**

1. ALL DIMENSIONS ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. THE CONTRACTOR HAS TO SUBMIT THE SHOP DRAWING OF GROUNDING SYSTEM FOR APPROVAL.

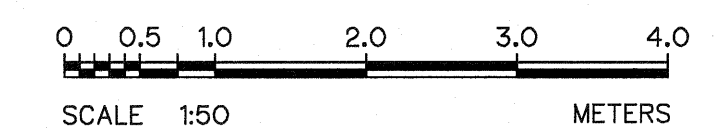
0 1 2 3 4 5 6 7 8  
SCALE 1:100 METERS

|                                                                                                                   |                                                                                           |
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| <p>KINGDOM OF THAILAND<br/>Department of Alternative Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |                                                                                           |
| <p><b>LAM PHRA PHLOENG HYDROPOWER PROJECT</b></p>                                                                 |                                                                                           |
| <p><b>CIVIL WORKS</b><br/><b>POWERHOUSE</b><br/><b>ELECTRICAL LIGHTING, EXHAUST AND OUTLET PLAN</b></p>           |                                                                                           |
| <p>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</p>                                                                 | <p>Department of Alternative Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |
| DESIGNED                                                                                                          | REVIEWED                                                                                  |
| DRAWN                                                                                                             | SUBMITTED                                                                                 |
| CHECKED                                                                                                           | RECOMMENDED                                                                               |
| NO. DATE REVISIONS CHECKED APPROVED                                                                               | APPROVED                                                                                  |
| <p>CONSULTANTS DEDE</p>                                                                                           |                                                                                           |
| <p>PROJECT MANAGER DATE 14/01/62</p>                                                                              |                                                                                           |
| <p>DRAWING NO. LPP-PH-13 SHEET NO. 26 OF 44</p>                                                                   |                                                                                           |



GROUNDING SYSTEM PLAN

SCALE 1:50



LEGENDS :

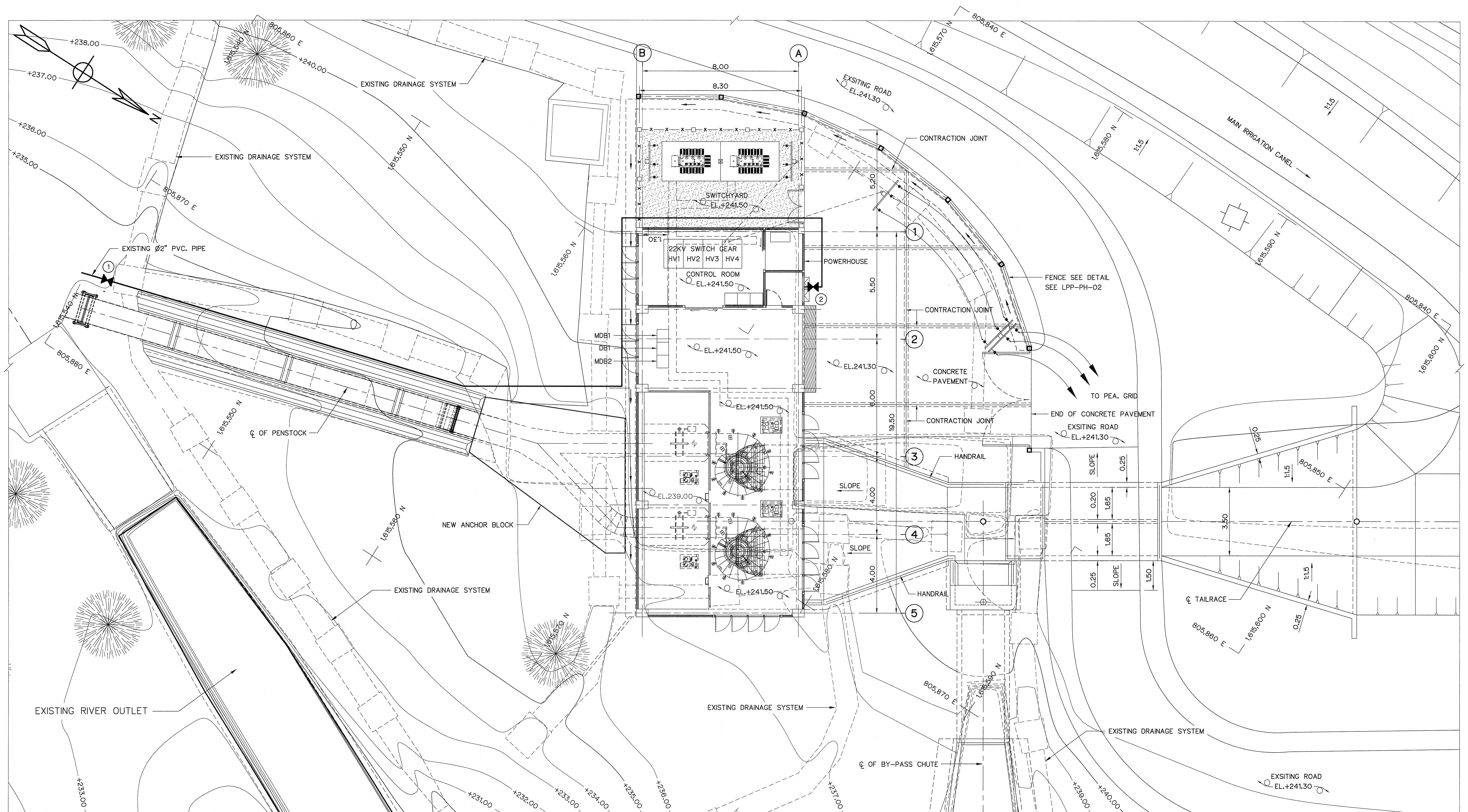
- GROUND ROD
- ⊗ GROUND POINT FOR POWER PLANT EQUIPMENT GROUNDING
- BARE COPPER CONDUCTOR

NOTES :

1. GROUNDING CONDUCTOR, TAP AND RISER FROM GROUNDING NETWORK TO POWER EQUIPMENT SHALL BE FORMED BY BARE COPPER CONDUCTOR NOT LESS THAN 95 SQ.MM.
2. GROUNDING SYSTEM RESISTANCE WILL NOT EXCEED 5 OHM.
3. CONNECTOR TO WITH IN & BETWEEN THE GROUNDING NETWORK TO POWER PLANT EQUIPMENT WILL BE MADE BY THERMAL CADWELD.
4. GROUND ROD WILL BE COPPER COVER STEEL DIAMETER 15.87 MM. 2,400 MM. LONG
5. THIS DRAWING USE FOR GUIDE ONLY.

|                                                                                                                                          |  |
|------------------------------------------------------------------------------------------------------------------------------------------|--|
| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br><b>MINISTRY OF ENERGY</b>                       |  |
| <b>LAM PHRA PHLOENG HYDROPOWER PROJECT</b>                                                                                               |  |
| <b>CIVIL WORKS</b><br><b>POWERHOUSE</b><br><b>GROUNDING SYSTEM</b>                                                                       |  |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.<br>DEPARTMENT OF ALTERNATIVE<br>ENERGY DEVELOPMENT AND EFFICIENCY<br><b>MINISTRY OF ENERGY</b> |  |
| REVIEWED <b>S.KITICHA</b>                                                                                                                |  |
| DESIGNED <i>[Signature]</i> 24/11/1029 SUBMITTED <i>[Signature]</i>                                                                      |  |
| DRAWN <i>[Signature]</i> 24/11/1029 RECOMMENDED <i>[Signature]</i>                                                                       |  |
| CHECKED <i>[Signature]</i> 24/11/1029 APPROVED <i>[Signature]</i>                                                                        |  |
| PROJECT-MANAGER DATE 14/01/62 DRAWING NO. SHEET NO.<br>LPP-PH-14 27 OF 44                                                                |  |

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# GENERAL LAY-OUT

SCALE 1:100

## NOTES :

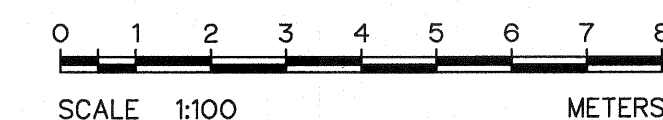
- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.

## REFERENCE DRAWINGS :

- POWERHOUSE, PIT VALVE, FIELD TAP AND SUBDRAIN DETAILS LPP-PH-16

## LEGENDS :

- GATE VALVE  $\varnothing 2''$
- GATE VALVE  $\varnothing 3/4''$



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CONSULTANTS

DEDE

KINGDOM OF THAILAND  
Department of Alternative  
Energy Development and Efficiency  
MINISTRY OF ENERGY

## LAM PHRA PHLOENG HYDROPOWER PROJECT

### CIVIL WORKS POWERHOUSE WATER SUPPLY PIPELINE SYSTEM LAY-OUT

FRONTIER ENGINEERING CONSULTANTS CO.,LTD.

Department of Alternative  
Energy Development and Efficiency  
MINISTRY OF ENERGY

REVIEWED S.KITICHAI

DESIGNED 22.6651

DRAWN 22.7324

CHECKED 14/01/62

PROJECT MANAGER DATE

SUBMITTED

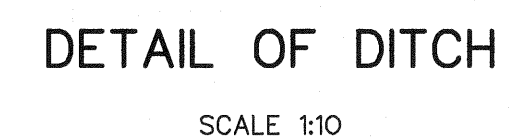
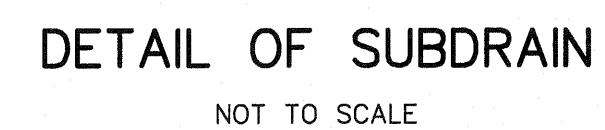
RECOMMENDED

APPROVED

DRAWING NO. LPP-PH-15 SHEET NO. 28 OF 44

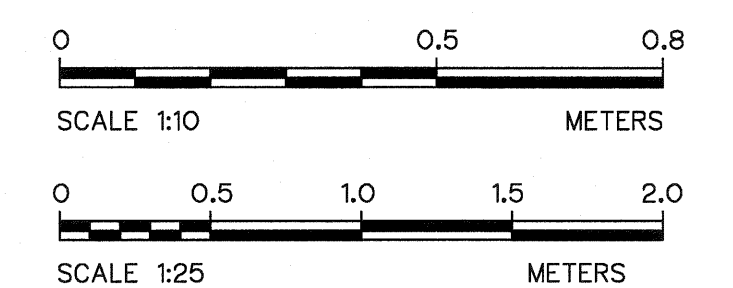


| SIZE OF WATER<br>SUPPLY PIPE<br>(MM.) | SIZE OF SLEEVE PIPE<br>(MM.) | THICKNESS<br>(MM.) |
|---------------------------------------|------------------------------|--------------------|
| 20 (3/4")                             | 100                          | 2.65               |
| 25 (1")                               | 100                          | 2.65               |
| 35 (1 1/4")                           | 100                          | 2.65               |
| 40 (1 1/2")                           | 100                          | 2.65               |
| 55 (2")                               | 100                          | 2.65               |
| 60 (2 1/2")                           | 150                          | 3.45               |
| 80 (3")                               | 150                          | 3.45               |

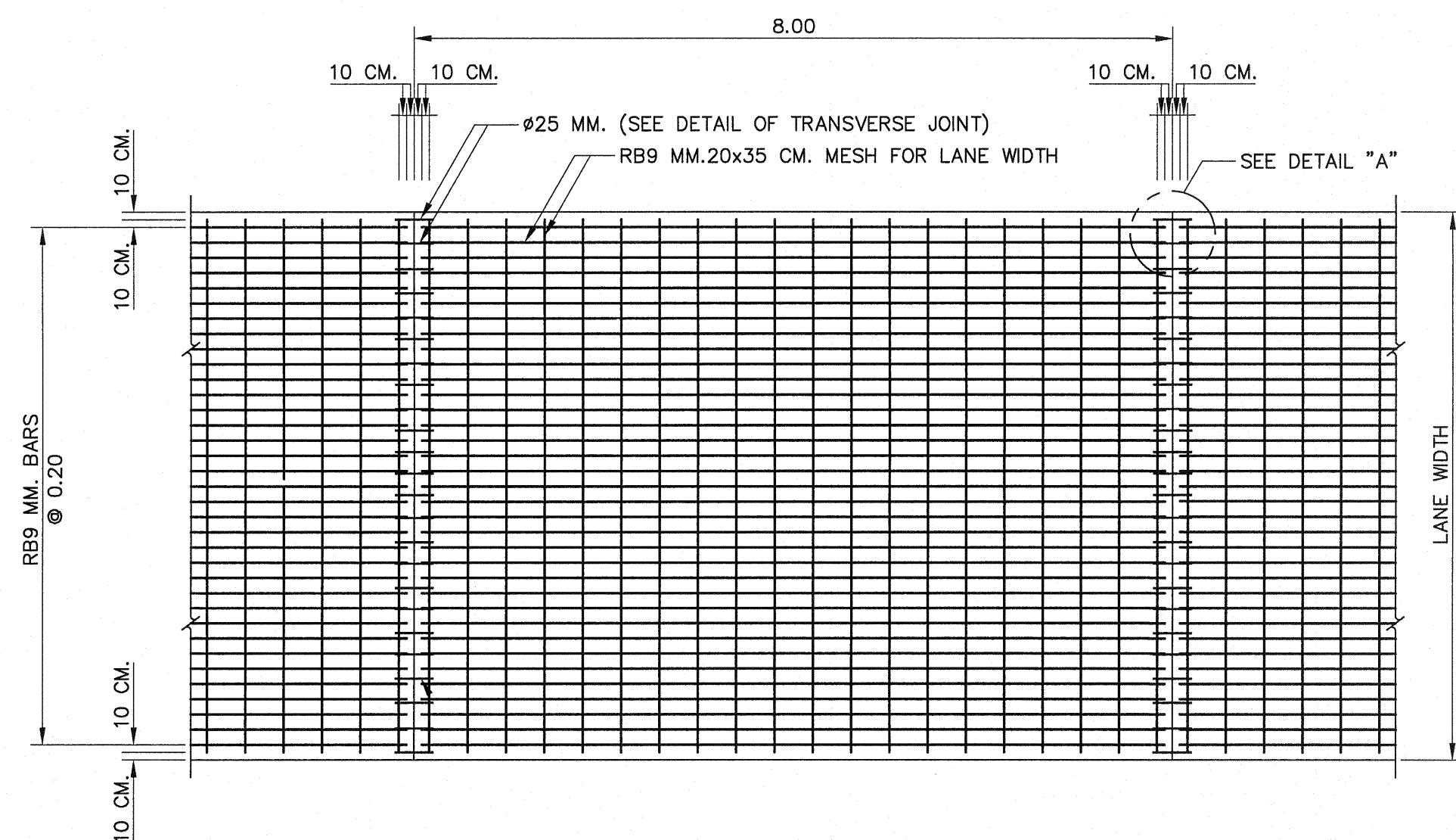


1. ALL DIMENSIONS ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. REINFORCING BARS ARE IN MILLIMETERS.
3. CONCRETE SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 175 KSC. FOR STANDARD CYLINDER AT 28 DAYS.

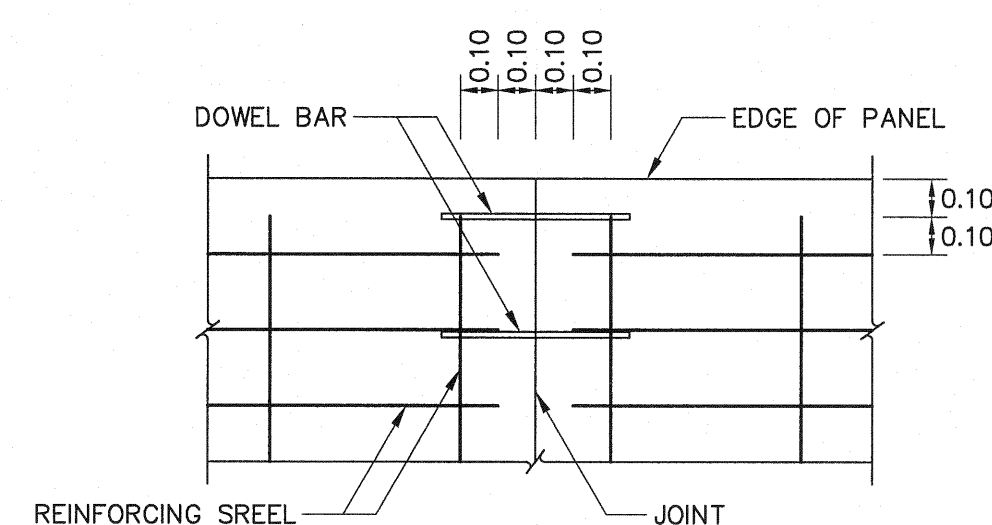
1. POWERHOUSE, WATER SUPPLY PIPELINE SYSTEM LAY-OUT LPP-PH-15



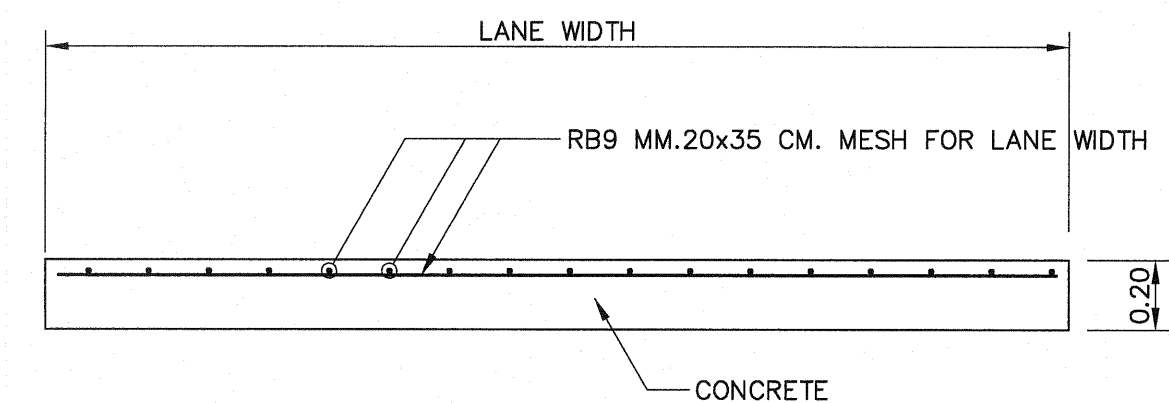
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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/><b>MINISTRY OF ENERGY</b></p> |  |                                                                                                                                                                                            |  |
| <p align="center"><b>LAM PHRA PHLOENG HYDROPOWER PROJECT</b></p>                                                                                                                                                   |  |                                                                                                                                                                                            |  |
| <p align="center"><b>CIVIL WORKS<br/>POWERHOUSE<br/>PIT VALVE, FIELD PAT,<br/>AND SUBDRAIN DETAILS</b></p>                                                                                                         |  |                                                                                                                                                                                            |  |
|  <p><b>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</b></p>                                                                     |  |  <p>Department of Alternative<br/>Energy Development and Efficiency<br/><b>MINISTRY OF ENERGY</b></p> |  |
| <p>DESIGNED  281.6651</p>                                                                                                     |  | <p>REVIEWED <b>S. KITCHAN</b></p>                                                                                                                                                          |  |
| <p>DRAWN </p>                                                                                                                 |  | <p>SUBMITTED </p>                                                                                     |  |
| <p>CHECKED  281.7324</p>                                                                                                      |  | <p>APPROVED </p>                                                                                      |  |
| <p align="center"></p>                                                                                                        |  | <p align="center">14/01/82</p>                                                                                                                                                             |  |
| <p align="center">PROJECT MANAGER</p>                                                                                                                                                                              |  | <p align="center">DATE</p>                                                                                                                                                                 |  |
|                                                                                                                                                                                                                    |  | <p align="center">DRAWING NO.</p>                                                                                                                                                          |  |
|                                                                                                                                                                                                                    |  | <p align="center"><b>LPP-PH-16</b></p>                                                                                                                                                     |  |
|                                                                                                                                                                                                                    |  | <p align="center">SHEET NO.</p>                                                                                                                                                            |  |
|                                                                                                                                                                                                                    |  | <p align="center">29 OF 44</p>                                                                                                                                                             |  |



PLAN OF REINFORCED CONCRETE PAVEMENT  
SCALE 1 : 75



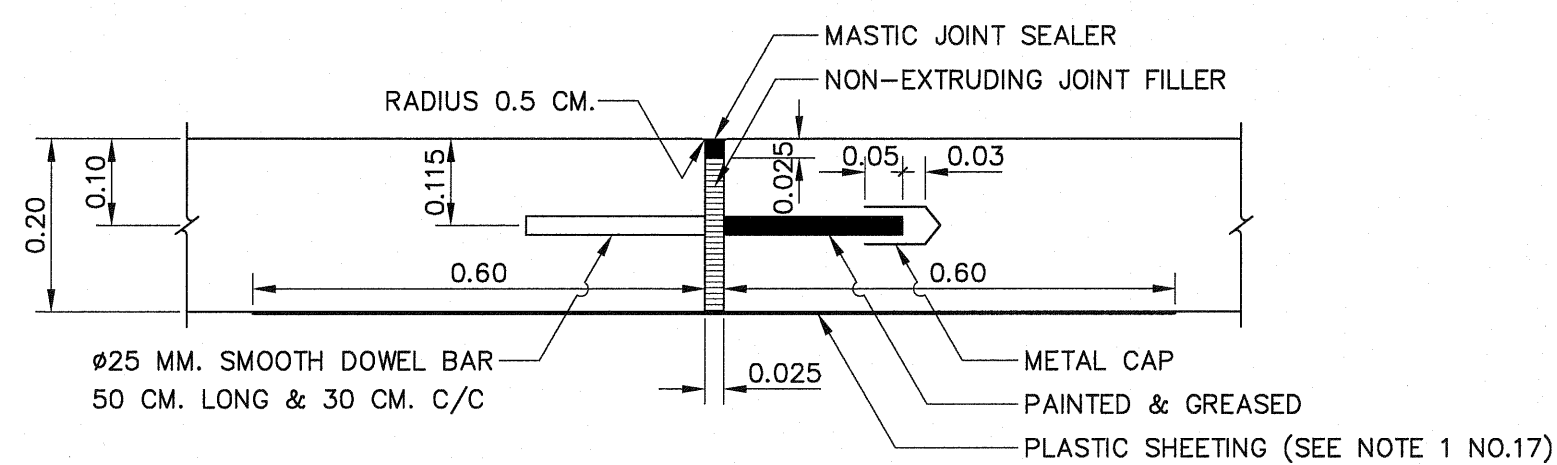
DETAIL "1"  
SCALE 1 : 20



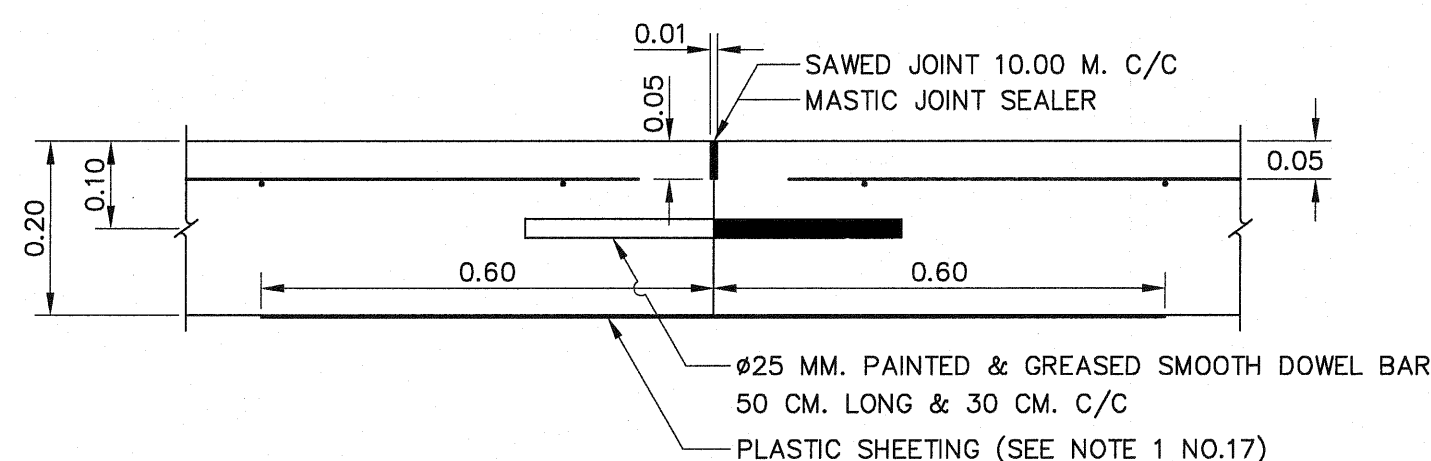
REINFORCEMENT DETAIL OF CONCRETE PAVEMENT CROSS-SECTION  
SCALE 1 : 25

#### NOTES 1 :

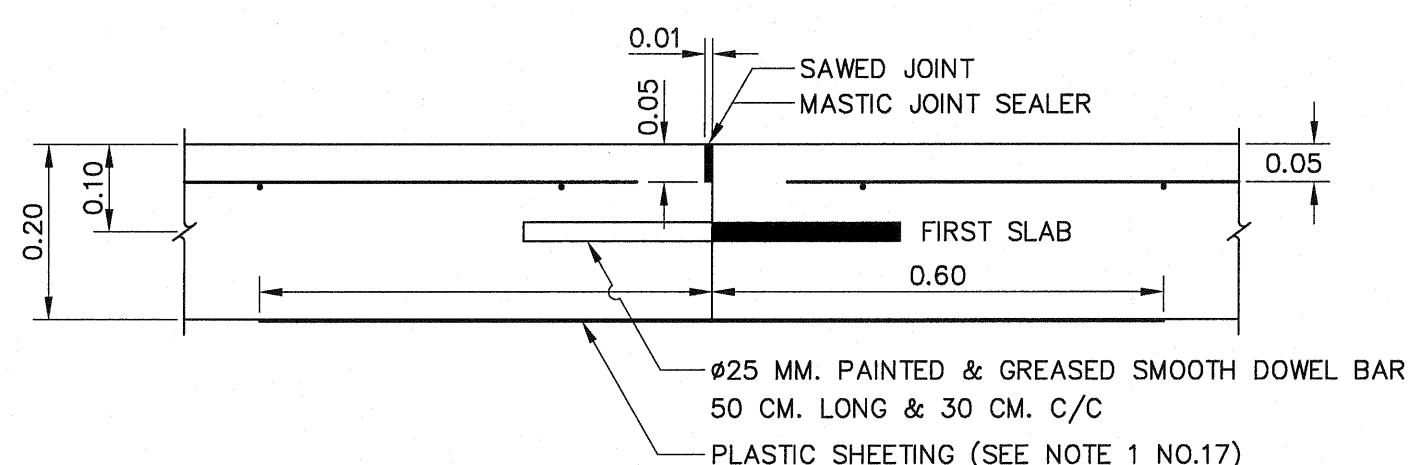
- ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE INDICATED.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
- EXPANSION JOINT SHALL BE CONSTRUCTED AT THE INTERVAL OF 350 METERS. IF THE LAST INTERVAL IS LESS THAN 350 METERS , THE INTERVALS SHALL BE AVERAGED BUT BETWEEN 300 AND 350 METERS.
- EXPANSION JOINT SHALL BE PROVIDED AT THE OUTER EDGE OF BOTH SIDES OF THE BOX CULVERT CROSSING.
- MASTIC JOINT SEALER SHALL BE OF THE HOT POURED ELASTIC TYPE CONFORMING TO TIS.479
- JOINT FILLER SHALL CONFORM TO THE AASHTO M.213-74 OR ASTM. D1751-73 SPECIFICATION.
- CONCRETE SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 210 KSC. FOR STANDARD CYLINDER (Ø0.15x0.50 m.) AT 28 DAYS.
- WELDED WIRE CAN BE USED IN PLACE OF BAR MESH.
- ALL JOINTS EXCEPT EXPANSION JOINT SHALL BE MADE BY SLOT CUTTING MACHINE ONLY. FOAM SHEET, PLYWOOD, TIMBER OR MATERIAL OF THE SAME TYPE SHALL NOT BE ALLOWED.
- PLASTIC SHEET USED IN CONSTRUCTION SHALL HAVE THE FOLLOWING REQUIREMENTS :
  - THICKNESS OF 0.07 MM. WITH A TOLERANCE OF NOT MORE THAN 7% SHALL BE REQUIRED.
  - WIDTH SHALL NOT BE LESS THAN 1.20 M.
  - IT SHALL BE COLOURLESS , TRANSPARENT AND WATERPROOF , FREE FROM POROUS AREA , TURN AREA AND BLISTERING AREA WHICH ARE VISIBLE BY NAKED EYE. EDGE SHALL BE STRAIGHT.
  - CONTINUOUS LENGTH SHALL BE REQUIREMENT TO THE WIDTH OF TRAFFIC LANES. CONNECTION ALLOWED AT LONGITUDINAL JOINTS WITH NOT LESS THAN 20 CM. OVERLAPPING SHALL BE REQUIRED.



DETAIL OF EXPANSION JOINT

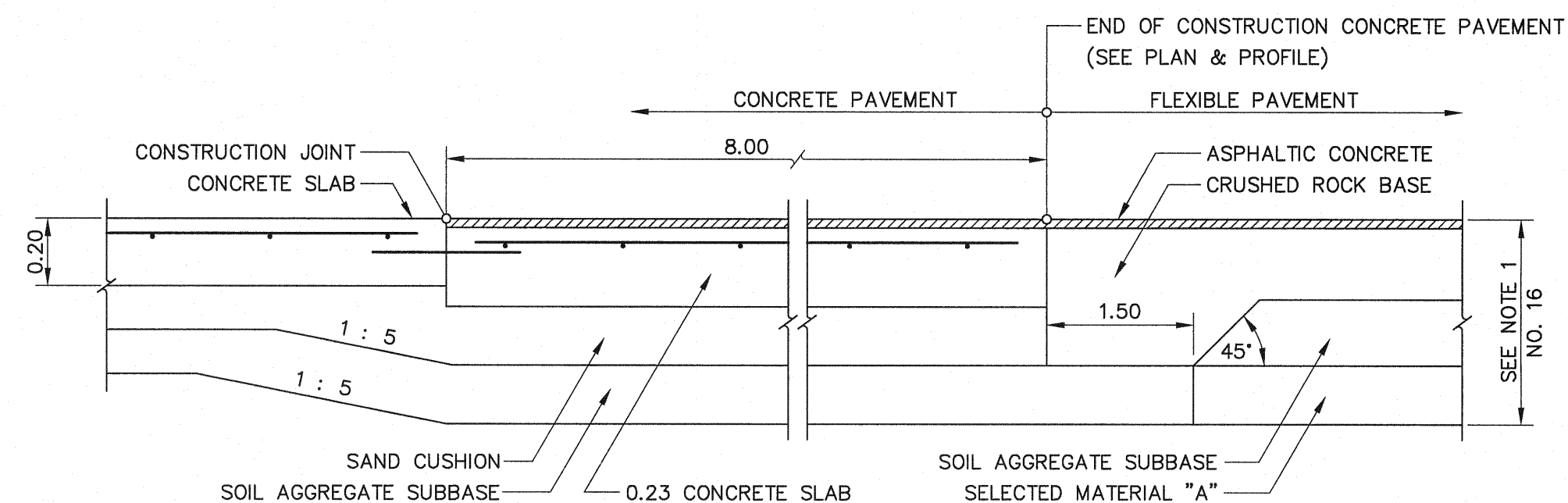


DETAIL OF CONTRACTION JOINT

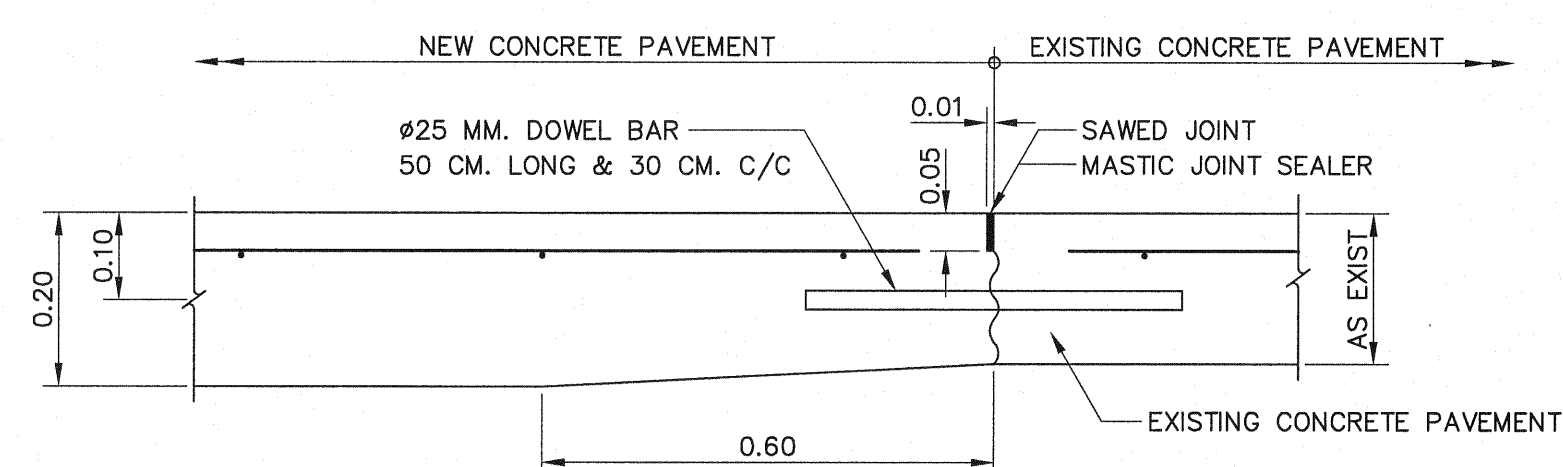


DETAIL OF CONSTRUCTION JOINT

DETAIL OF TRANSVERSE JOINT  
SCALE 1 : 10



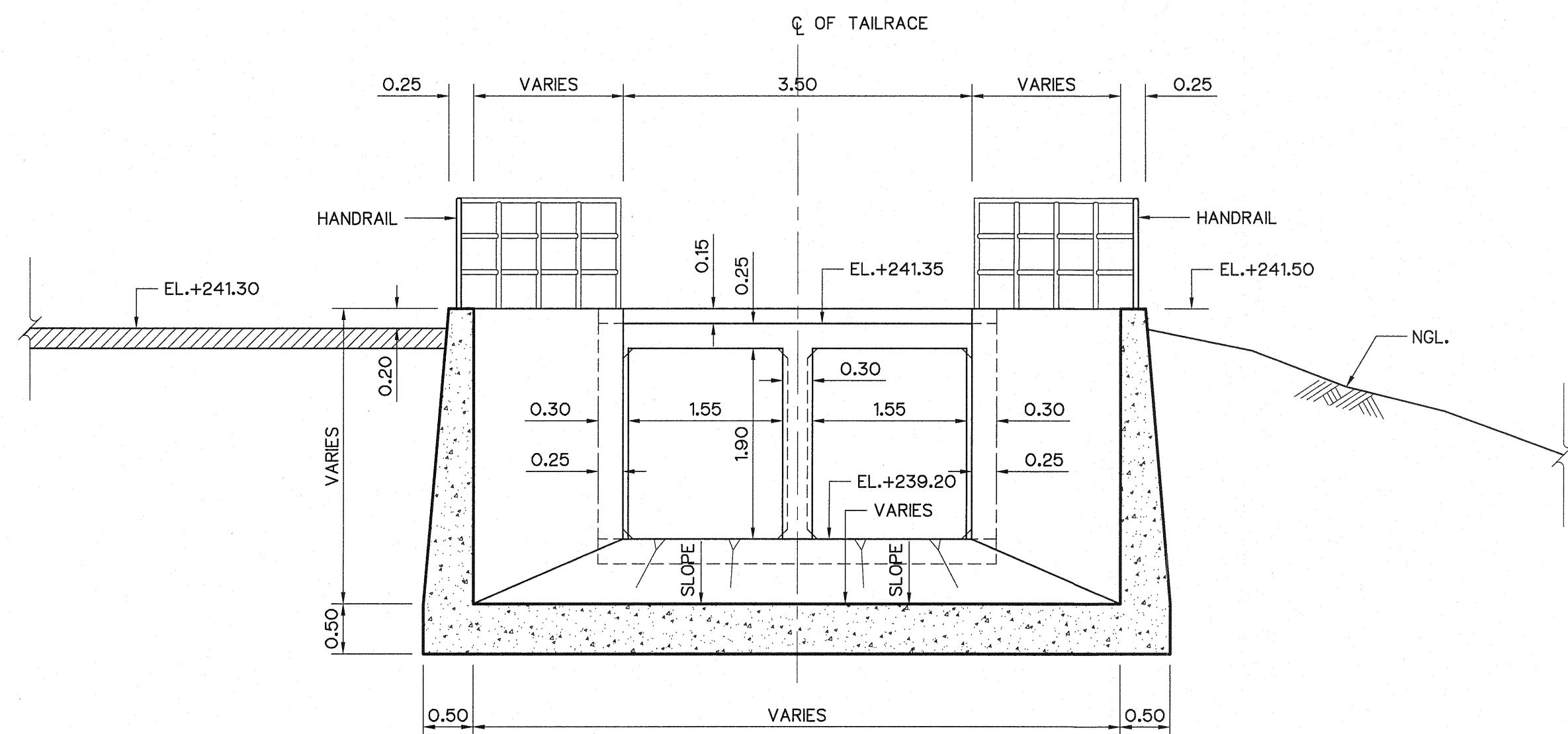
DETAIL OF JOINT BETWEEN CONCRETE PAVEMENT AND FLEXIBLE PAVEMENT  
SCALE 1 : 10



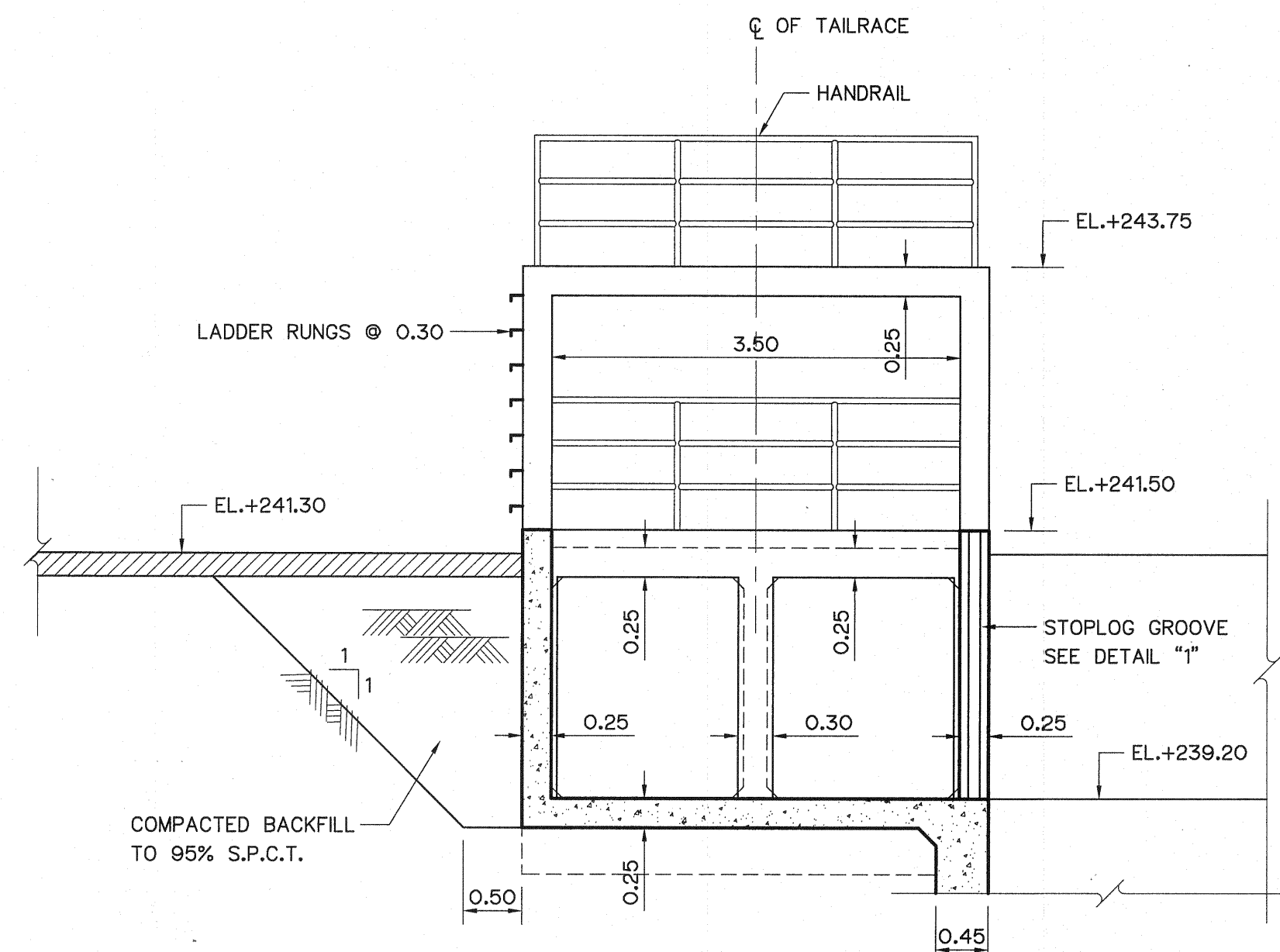
DETAIL OF TRANSVERSE JOINT BETWEEN  
NEW AND EXISTING CONCRETE PAVEMENT  
SCALE 1 : 10

|                                                                                                                       |  |                                                                                               |  |
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| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |                                                                                               |  |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |  |                                                                                               |  |
| <p>CIVIL WORKS<br/>POWERHOUSE<br/>CONCRETE PAVEMENT DETAILS</p>                                                       |  |                                                                                               |  |
| <p>FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                      |  | <p>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |
| <p>3</p>                                                                                                              |  | <p>REVIEWED S. KITCHAI</p>                                                                    |  |
| <p>2</p>                                                                                                              |  | <p>DESIGNED 22.6651</p>                                                                       |  |
| <p>1</p>                                                                                                              |  | <p>DRAWN 22.6651</p>                                                                          |  |
| <p>CHECKED 22.6651</p>                                                                                                |  | <p>RECOMMENDED 22.6651</p>                                                                    |  |
| <p>NO. DATE REVISIONS CHECKED APPROVED</p>                                                                            |  | <p>APPROVED 22.6651</p>                                                                       |  |
| <p>CONSULTANTS</p>                                                                                                    |  | <p>DEDE</p>                                                                                   |  |
| <p>PROJECT MANAGER</p>                                                                                                |  | <p>14/01/82 DATE</p>                                                                          |  |
| <p>LPP-PH-17</p>                                                                                                      |  | <p>DRAWING NO. SHEET NO. 30 OF 44</p>                                                         |  |

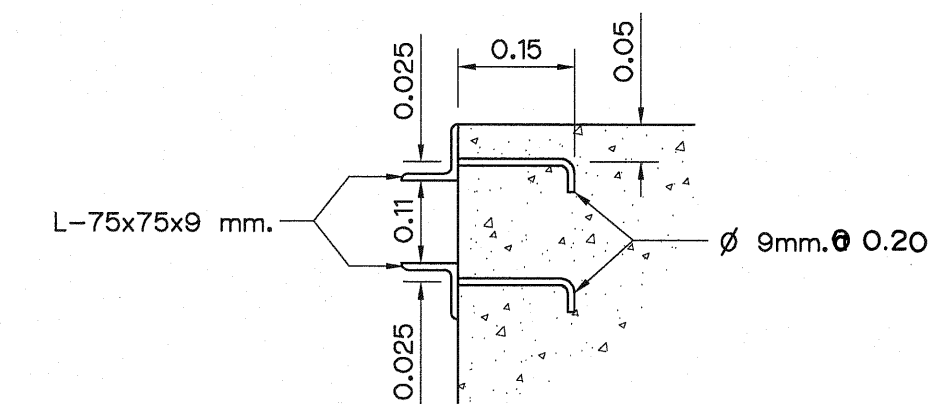




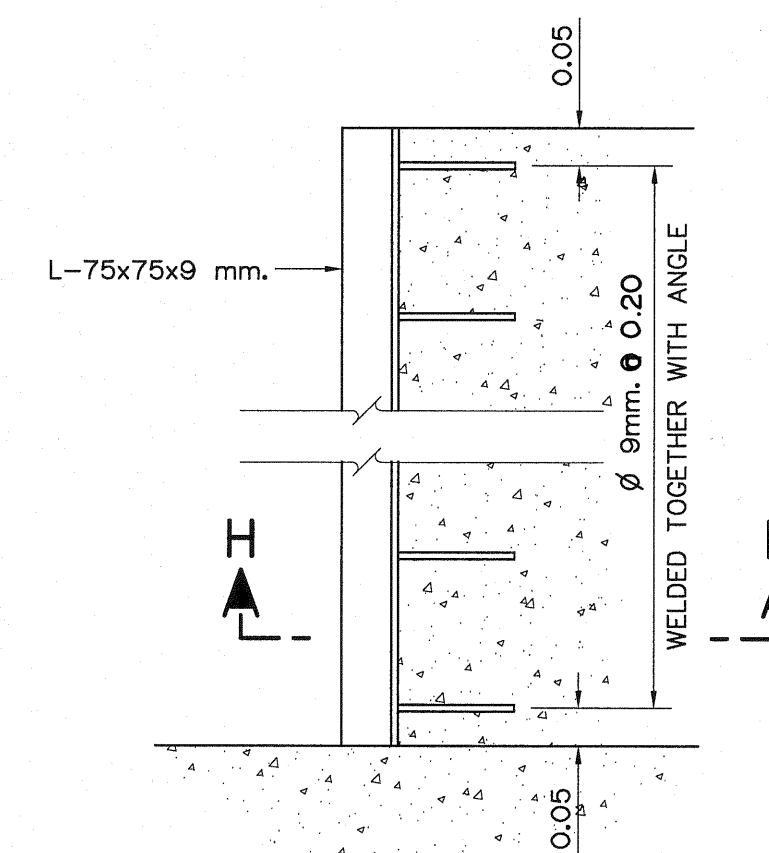
SECTION C-C  
SCALE 1:50



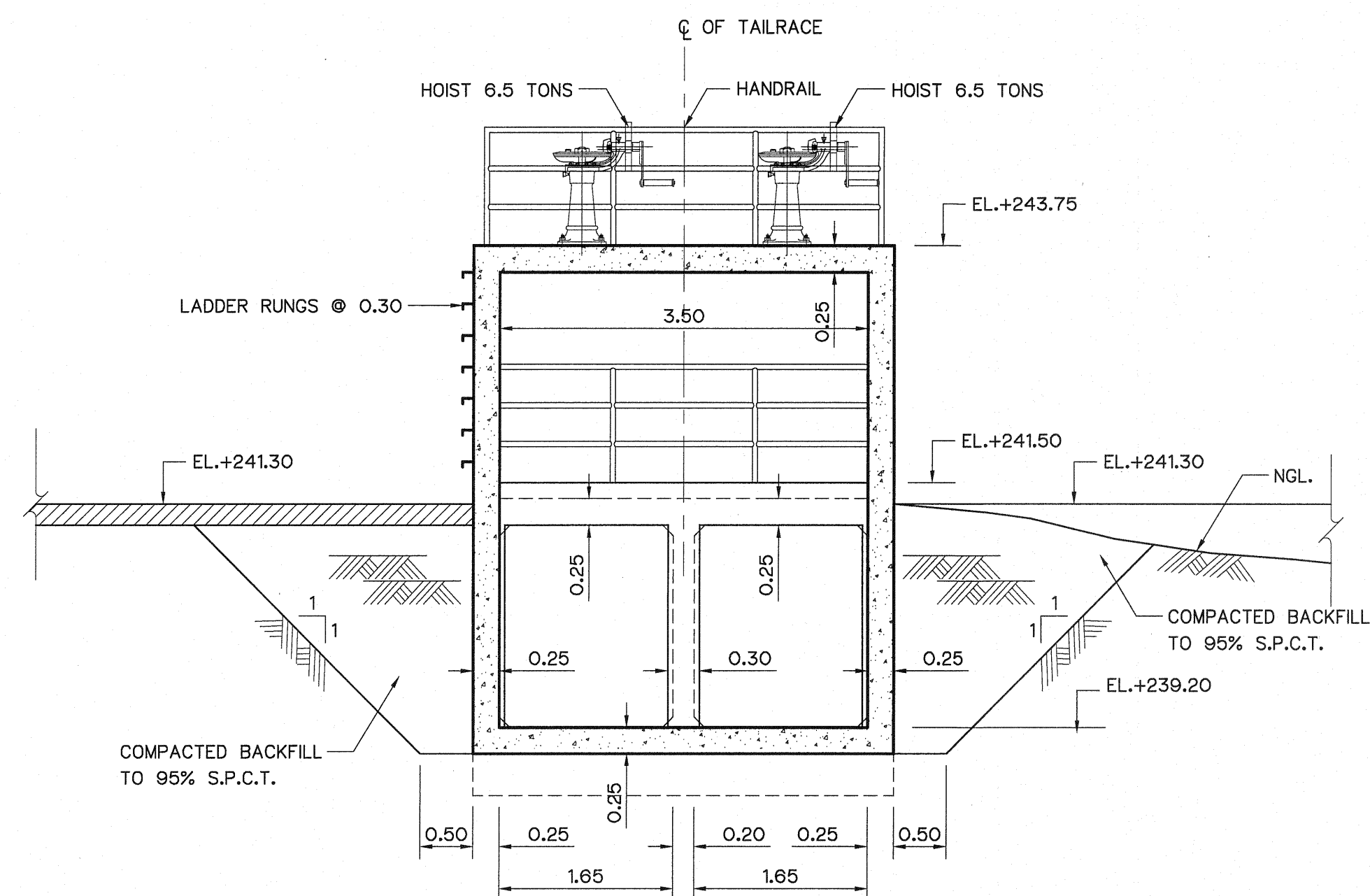
SECTION D-D  
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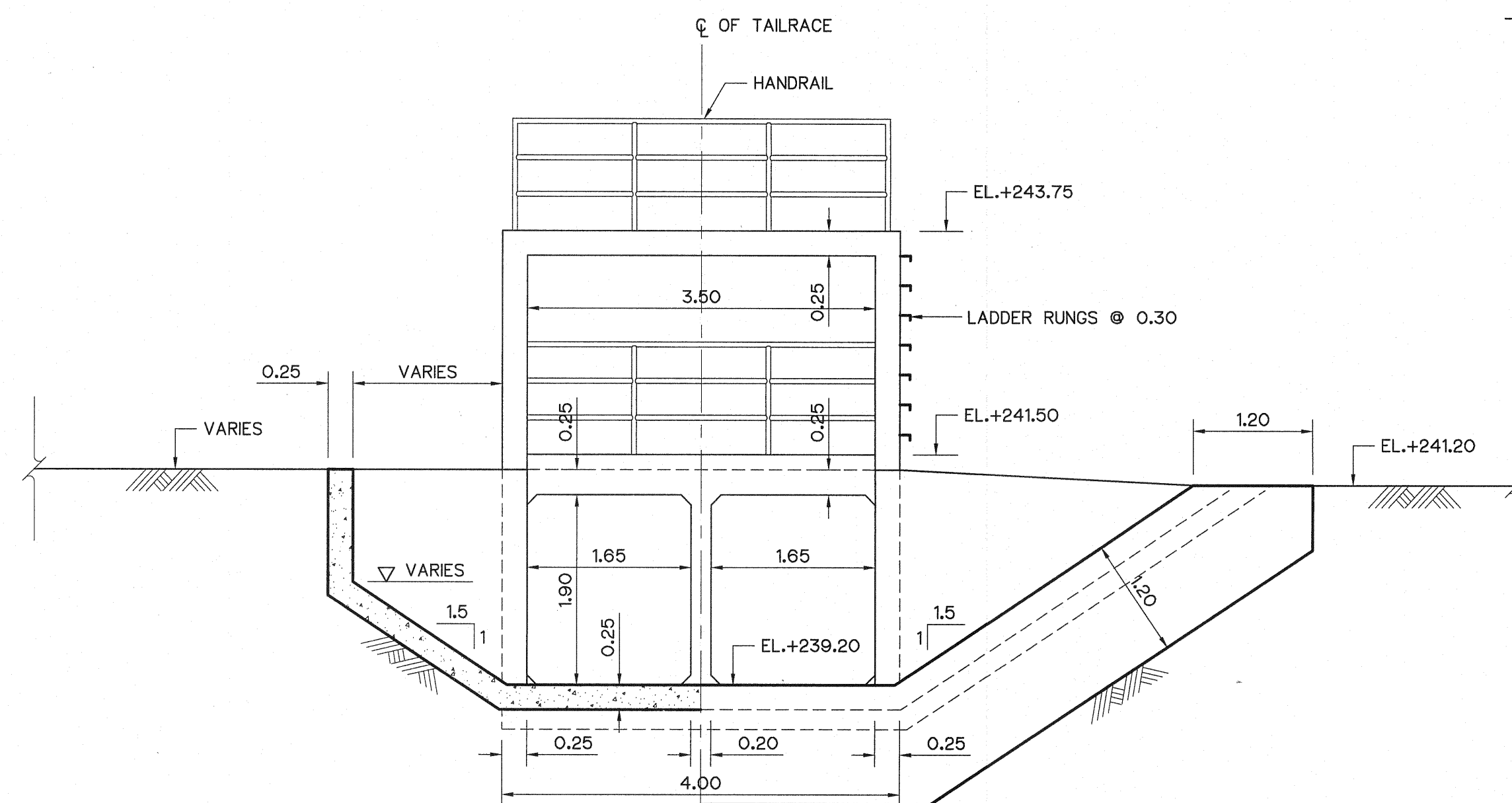
SECTION H-H  
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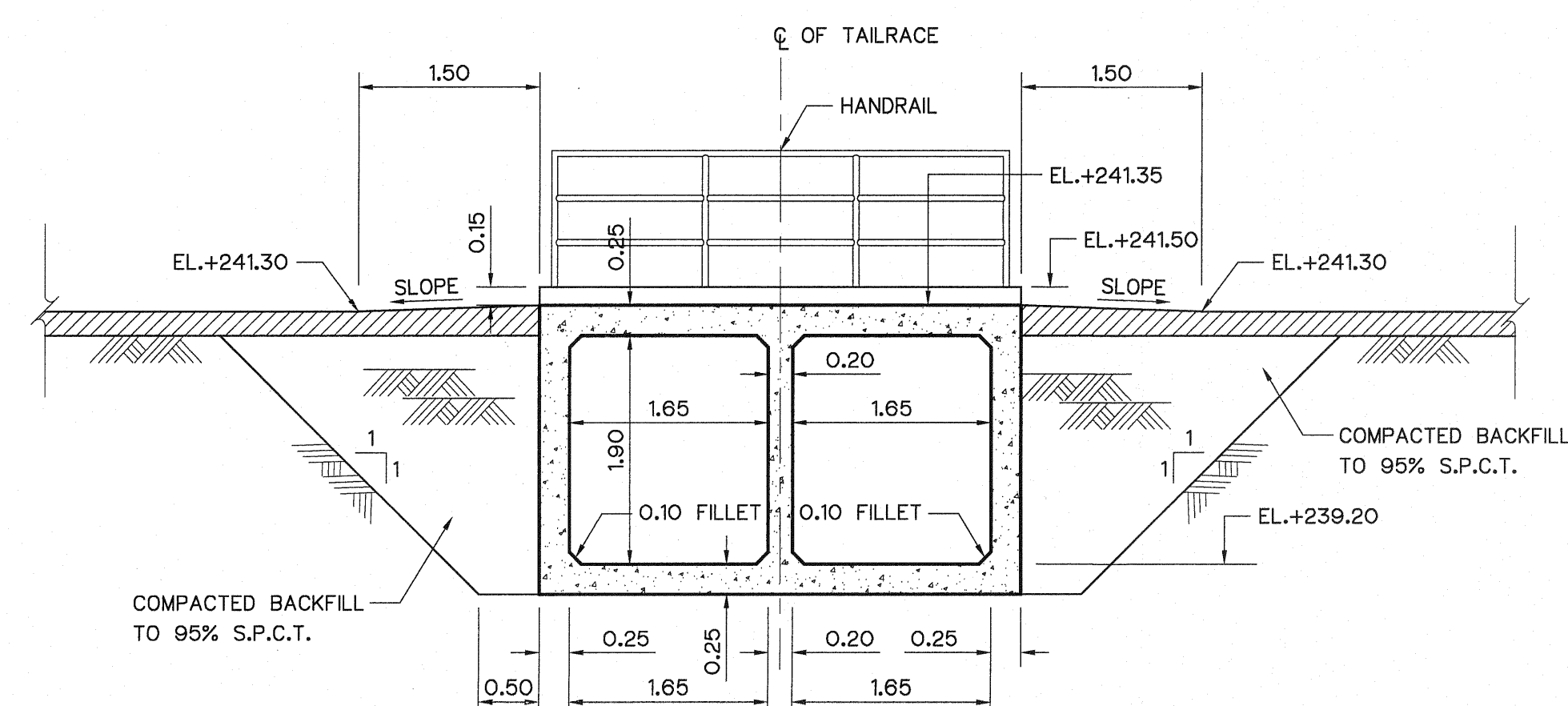
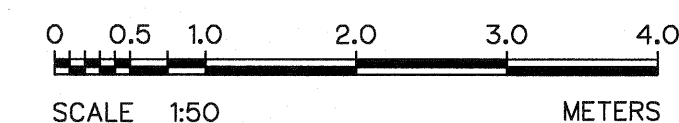
DETAIL "1"  
SCALE 1:10



SECTION E-E  
SCALE 1:50



SECTION F-F  
SCALE 1:50



SECTION G-G  
SCALE 1:50

NOTES :

- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.

REFERENCE DRAWINGS :

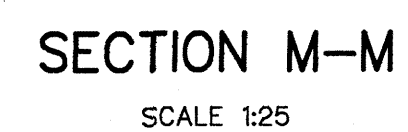
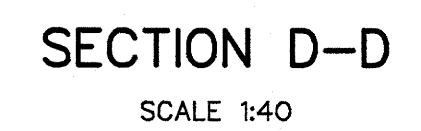
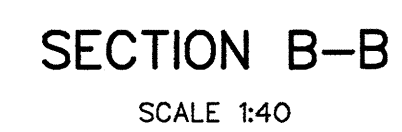
- TAILRACE, GENERAL PLAN, SECTION & DETAILS LPP-TR-01
- TAILRACE, CHUTE PEDESTAL SCREW LIFT CAPACITY 6.5 TONS LPP-TR-08
- BY-PASS, CHUTE HANDRIL AND LUDDER RUNG DETAILS LPP-BC-03
- BY-PASS, CHUTE WATERSTOP DETAILS LPP-BC-04

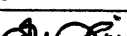
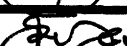
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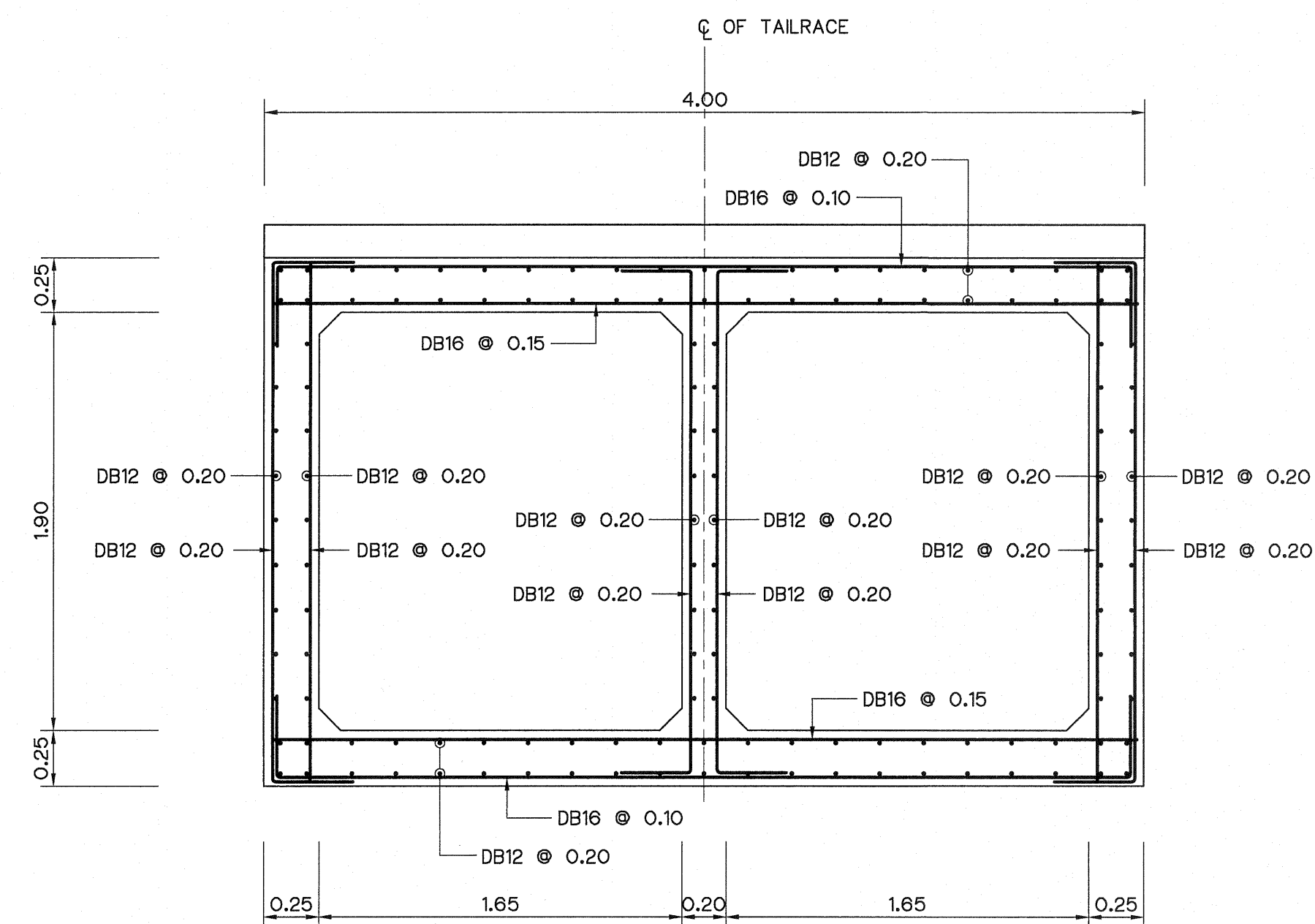
CONSULTANTS

DEDE

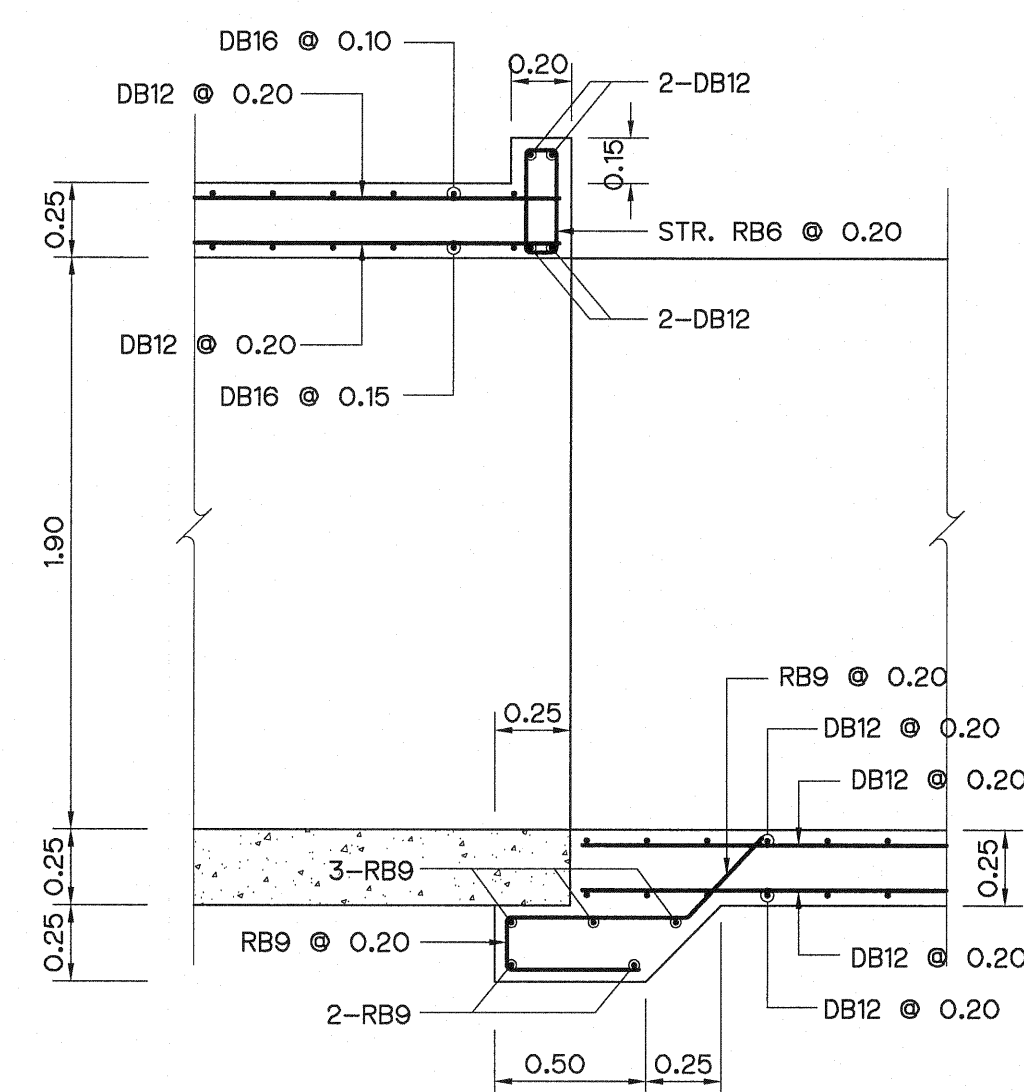
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| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |  |                       |  |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                         |  |                       |  |
| CIVIL WORKS                                                                                                 |  |                       |  |
| TAILRACE<br>SECTIONS                                                                                        |  |                       |  |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.                                                                   |  | REVIEWED S.KITIGAI    |  |
| DESIGNED S.KITIGAI                                                                                          |  | SUBMITTED S.KITIGAI   |  |
| DRAWN S.KITIGAI                                                                                             |  | RECOMMENDED S.KITIGAI |  |
| CHECKED S.KITIGAI                                                                                           |  | APPROVED S.KITIGAI    |  |
| PROJECT MANAGER                                                                                             |  | DRAWING NO. LPP-TR-02 |  |
| DATE 14/01/62                                                                                               |  | SHEET NO. 32 OF 44    |  |



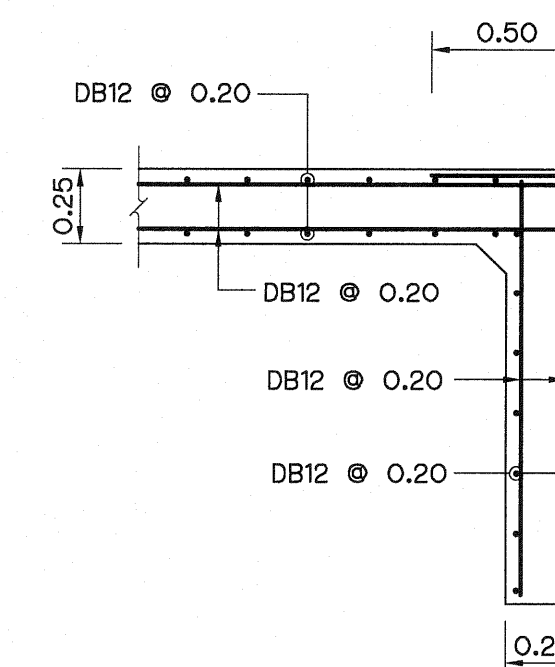
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|  <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/><b>MINISTRY OF ENERGY</b></p> |  |                                                                                                                                                                                            |  |
| <p align="center"><b>LAM PHRA PHLOENG HYDROPOWER PROJECT</b></p>                                                                                                                                                   |  |                                                                                                                                                                                            |  |
| <p align="center"><b>CIVIL WORKS</b></p>                                                                                                                                                                           |  |                                                                                                                                                                                            |  |
| <p align="center"><b>TAILRACE</b></p>                                                                                                                                                                              |  |                                                                                                                                                                                            |  |
| <p align="center"><b>REINFORCEMENT DETAILS 1/2</b></p>                                                                                                                                                             |  |                                                                                                                                                                                            |  |
|  <b>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</b>                                                                            |  |  <p>Department of Alternative<br/>Energy Development and Efficiency<br/><b>MINISTRY OF ENERGY</b></p> |  |
| DESIGNED                                                                                                                      |  | REVIEWED <b>S. KITICHAI</b>                                                                                                                                                                |  |
| DRAWN                                                                                                                         |  | SUBMITTED                                                                                             |  |
| CHECKED                                                                                                                       |  | RECOMMENDED                                                                                           |  |
| PROJECT MANAGER                                                                                                               |  | APPROVED                                                                                              |  |
| 14/01/82                                                                                                                                                                                                           |  | DRAWING NO.                                                                                                                                                                                |  |
| DATE                                                                                                                                                                                                               |  | LPP-TR-03                                                                                                                                                                                  |  |
|                                                                                                                                                                                                                    |  | SHEET NO.                                                                                                                                                                                  |  |
|                                                                                                                                                                                                                    |  | 33 OF 44                                                                                                                                                                                   |  |



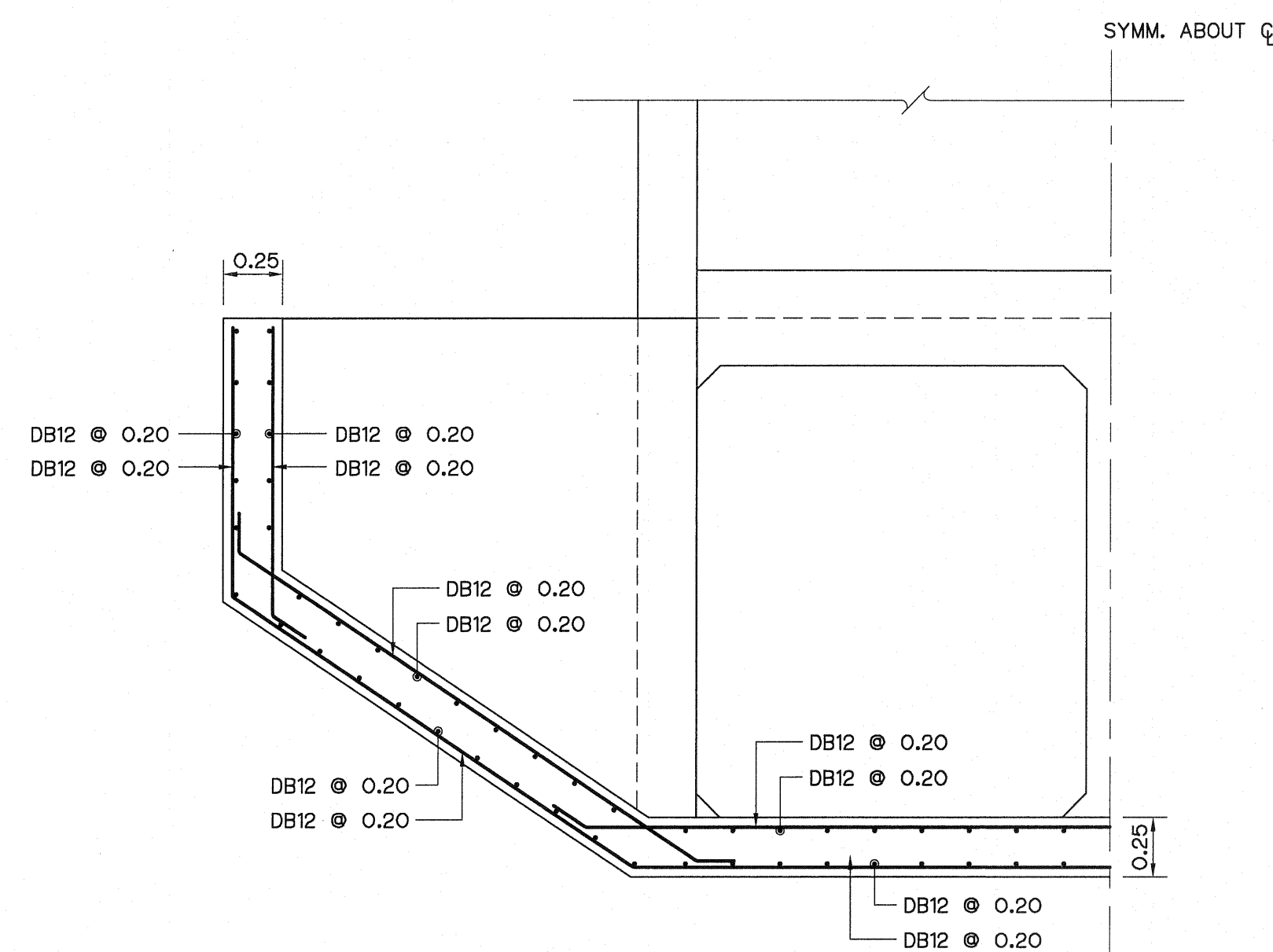
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SCALE 1:25



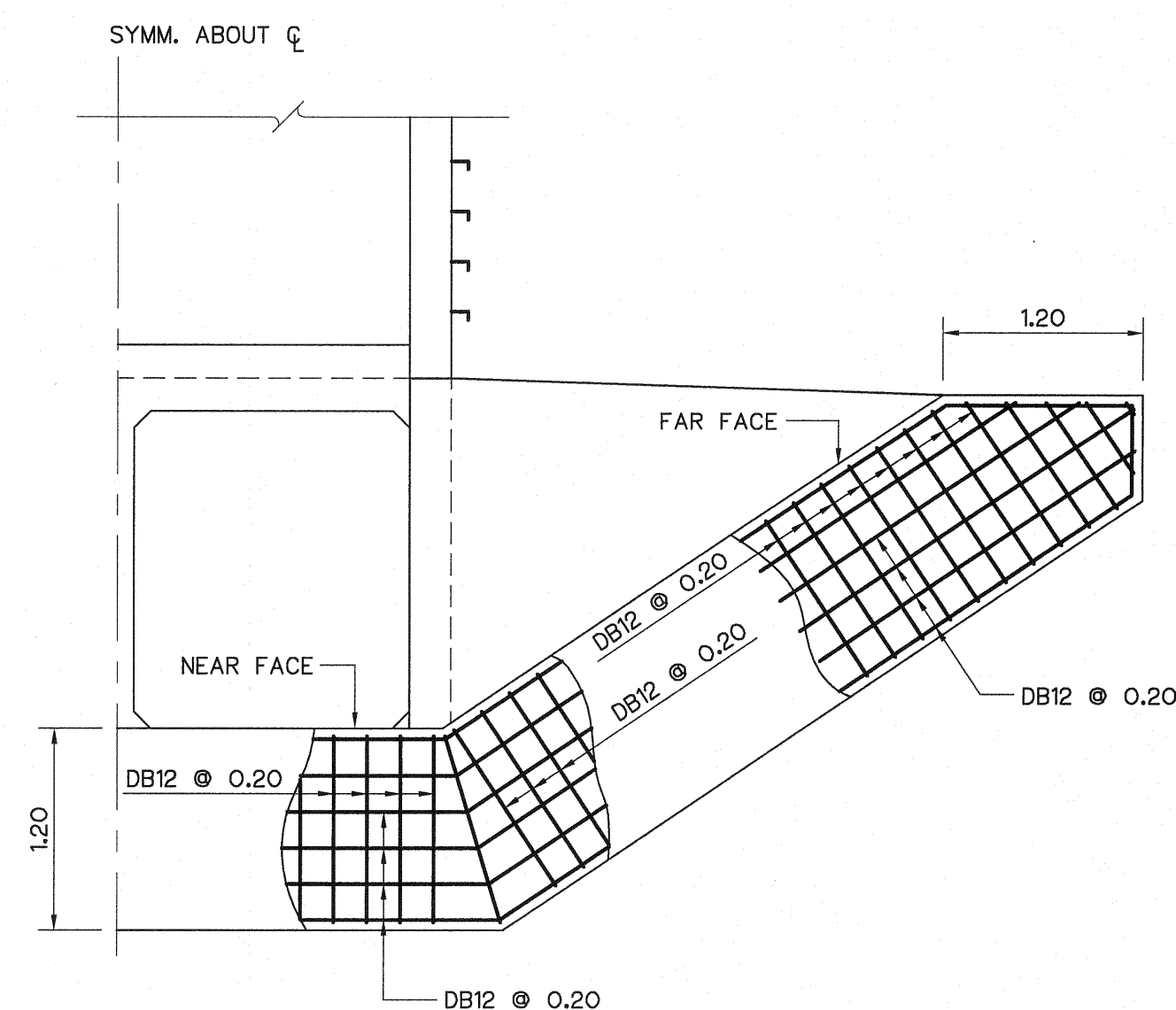
SECTION F-F  
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SECTION I-I  
SCALE 1:25



SECTION G-G  
SCALE 1:25



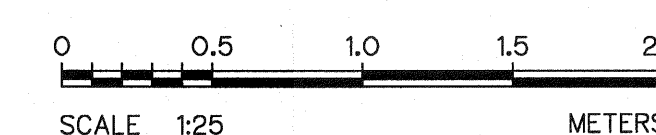
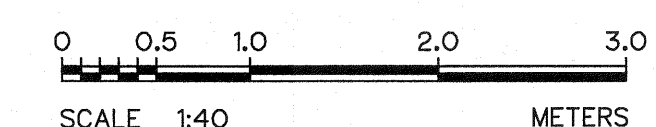
SECTION H-H  
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#### NOTES :

- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
- LOCATIONS OF LAP SPLICES SHALL BE DETERMINED IN FIELD UNDER THE APPROVAL OF FIELD ENGINEER.

#### REFERENCE DRAWINGS :

- TAILRACE, REINFORCEMENT DETAILS 1/2 LPP-TR-03

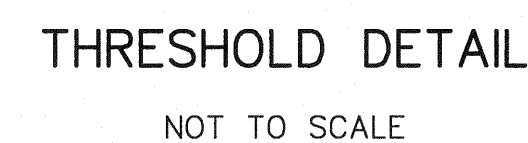
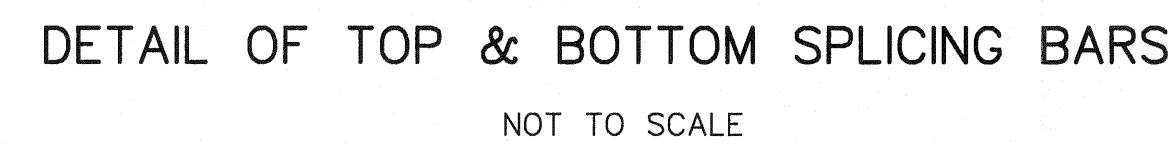
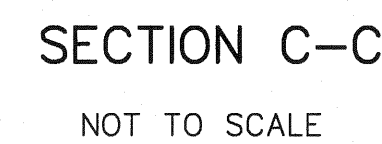
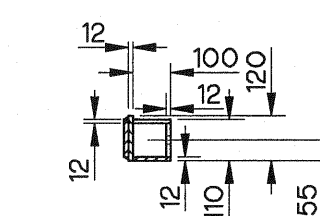
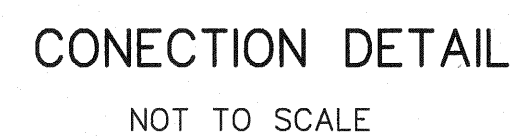
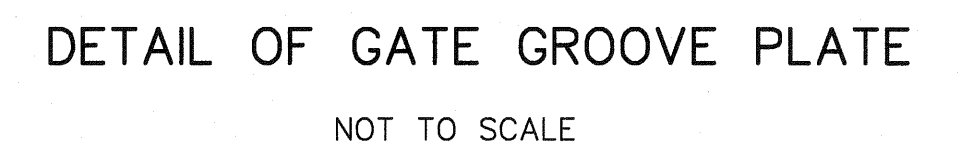
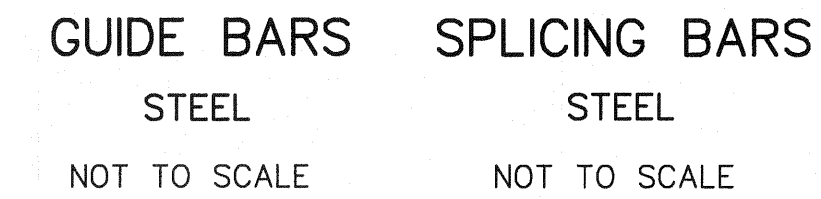
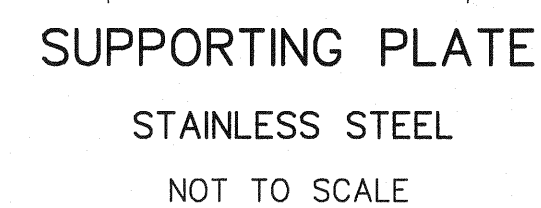
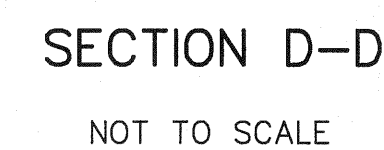
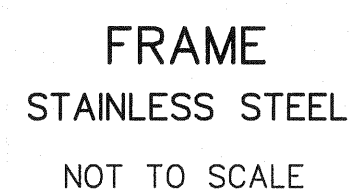
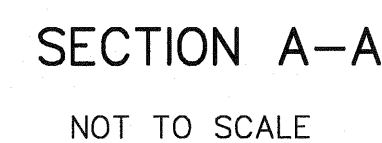
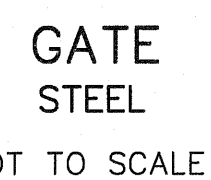
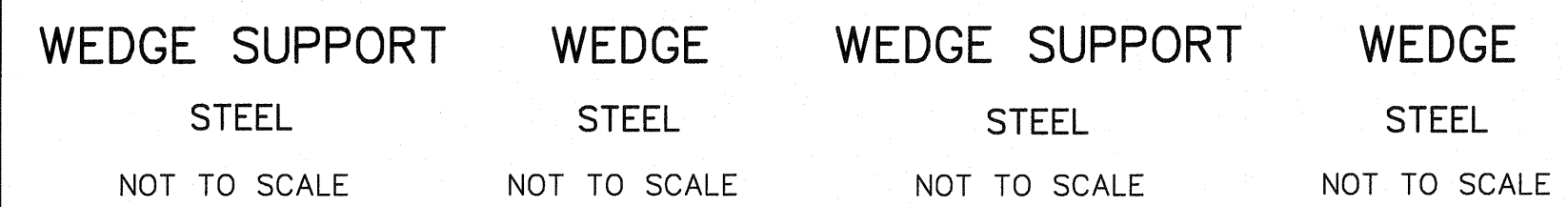


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CONSULTANTS

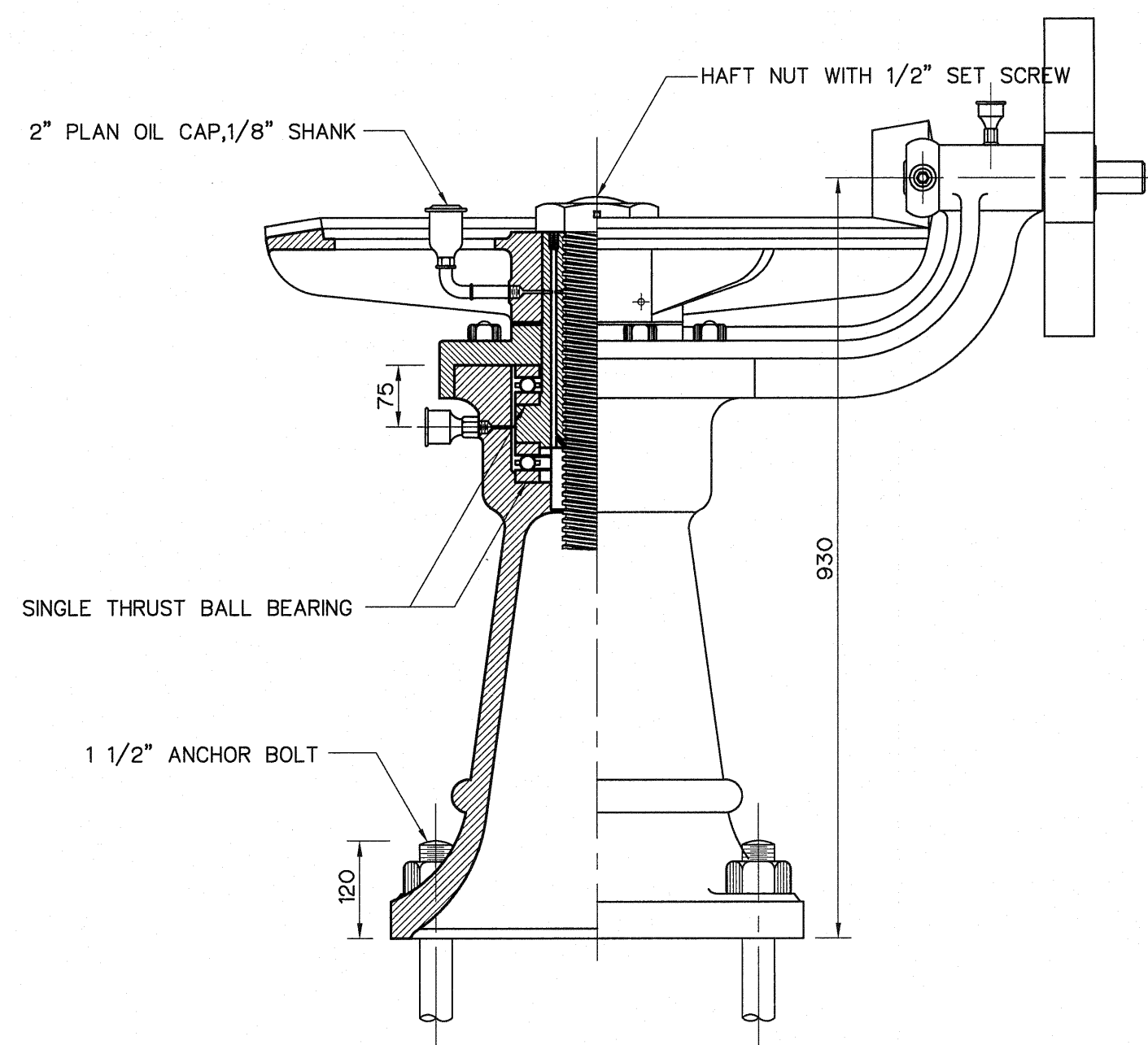
DEDE

|                                                                                                                       |                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |                                                                                               |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |                                                                                               |
| <p>CIVIL WORKS<br/>TAILRACE<br/>REINFORCEMENT DETAILS 1/2</p>                                                         |                                                                                               |
| <p>FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                      | <p>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |
| <p>DESIGNED <i>[Signature]</i> 01.6651</p>                                                                            | <p>REVIEWED <i>S. KITICHAJ</i></p>                                                            |
| <p>DRAWN <i>[Signature]</i></p>                                                                                       | <p>SUBMITTED <i>[Signature]</i></p>                                                           |
| <p>CHECKED <i>[Signature]</i> 01.7324</p>                                                                             | <p>RECOMMENDED <i>[Signature]</i></p>                                                         |
| <p>PROJECT MANAGER</p>                                                                                                | <p>APPROVED <i>[Signature]</i></p>                                                            |
| <p>DATE 14/01/62</p>                                                                                                  | <p>DRAWING NO. LPP-TR-04</p>                                                                  |
| <p>SHEET NO. 34 OF 44</p>                                                                                             | <p></p>                                                                                       |

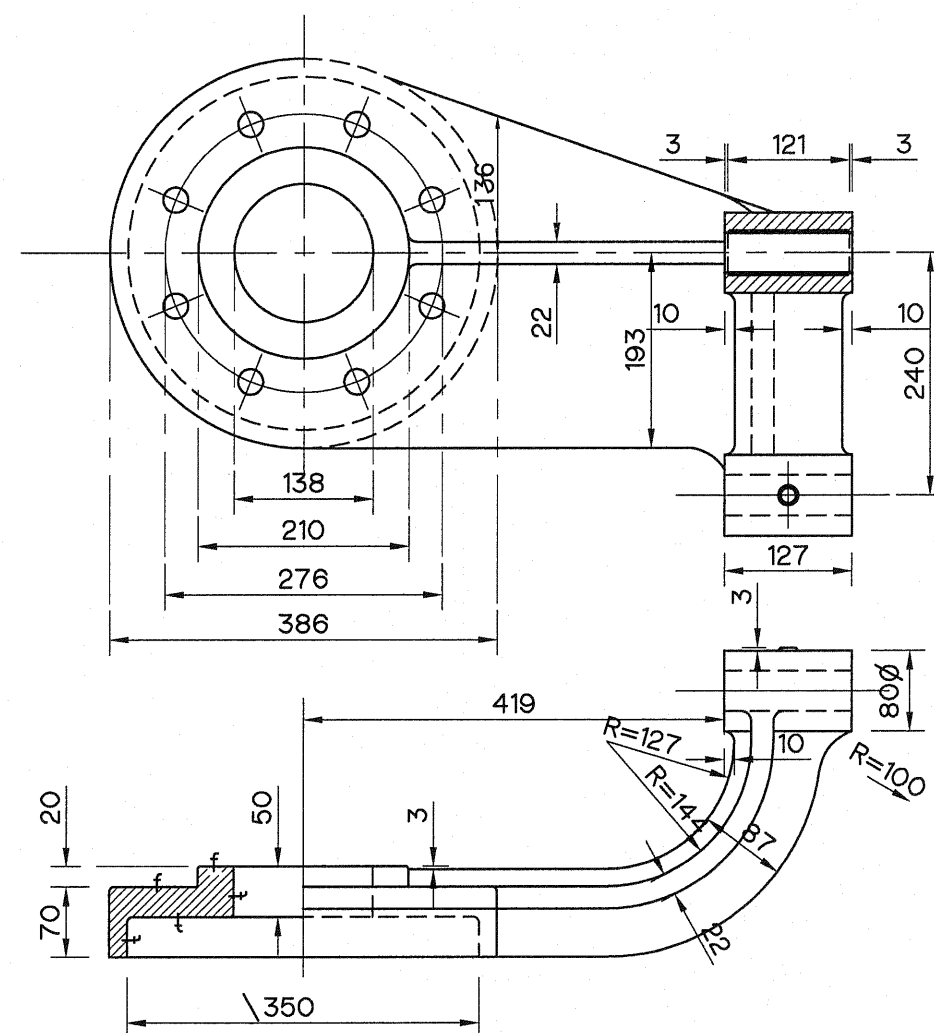


1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SHOWN.
2. ALL WELDING WILL BE 6 MILLIMETER, UNLESS OTHERWISE SHOWN.
3. ALL BOLTS AND NUTS USE ASTM. A325.
4. ALL STRUCTURAL STEELS ARE JIS G3101 SS400.
5. ALL STAINLESS STEEL PLATES ARE JIS G4304 SUS304.
6. THIS DRAWING IS DESIGNED FOR GUIDE LINE ONLY, THE CONTRACTOR HAS TO SUBMITTED SHOP DRAWING TO FIELD ENGINEER FOR APPROVAL.

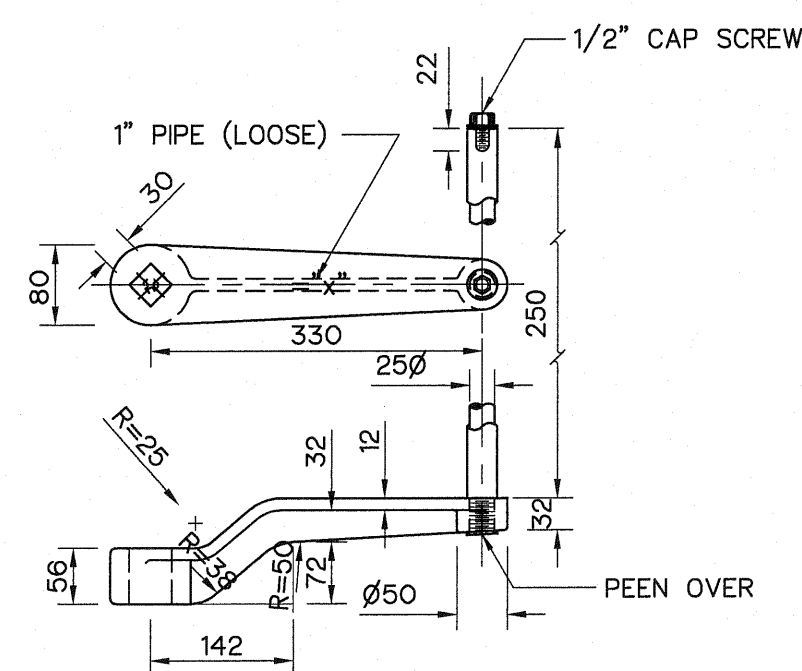
|             |      |           |         |          |                 |                                                                                       |          |             |                                                                                       |           |
|-------------|------|-----------|---------|----------|-----------------|---------------------------------------------------------------------------------------|----------|-------------|---------------------------------------------------------------------------------------|-----------|
| 3           |      |           |         |          | DESIGNED        |  | 22.6.651 | REVIEWED    | S. KITCHANA                                                                           |           |
| 2           |      |           |         |          | DRAWN           |  |          | SUBMITTED   |  |           |
| 1           |      |           |         |          | CHECKED         |  | 22.7.324 | RECOMMENDED |  |           |
| NO.         | DATE | REVISIONS | CHECKED | APPROVED |                 |                                                                                       |          | APPROVED    |  |           |
| CONSULTANTS |      |           |         |          | DEDE            |                                                                                       | 14/01/62 | DRAWING NO. | LPP-TR-05                                                                             | SHEET NO. |
|             |      |           |         |          | PROJECT MANAGER |                                                                                       | DATE     | 35 OF 44    |                                                                                       |           |



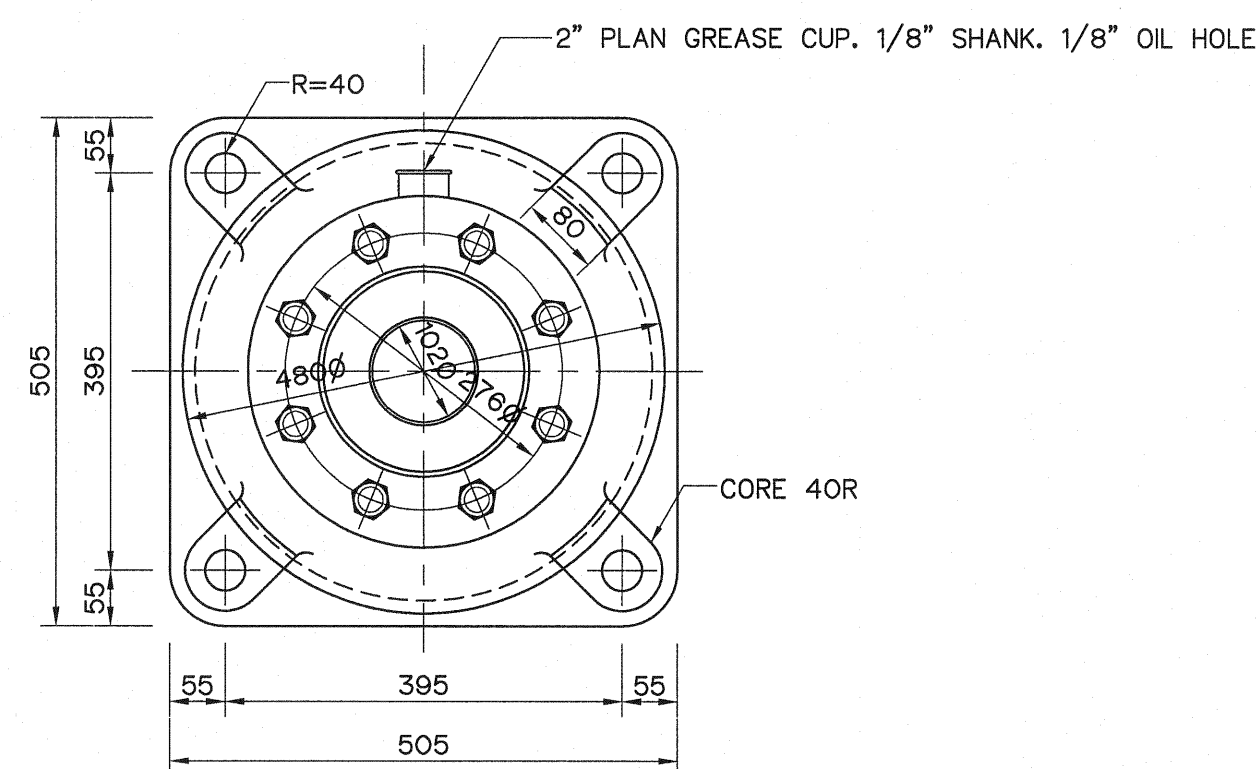
**ASSEMBLY**  
SCALE 1 : 7.5



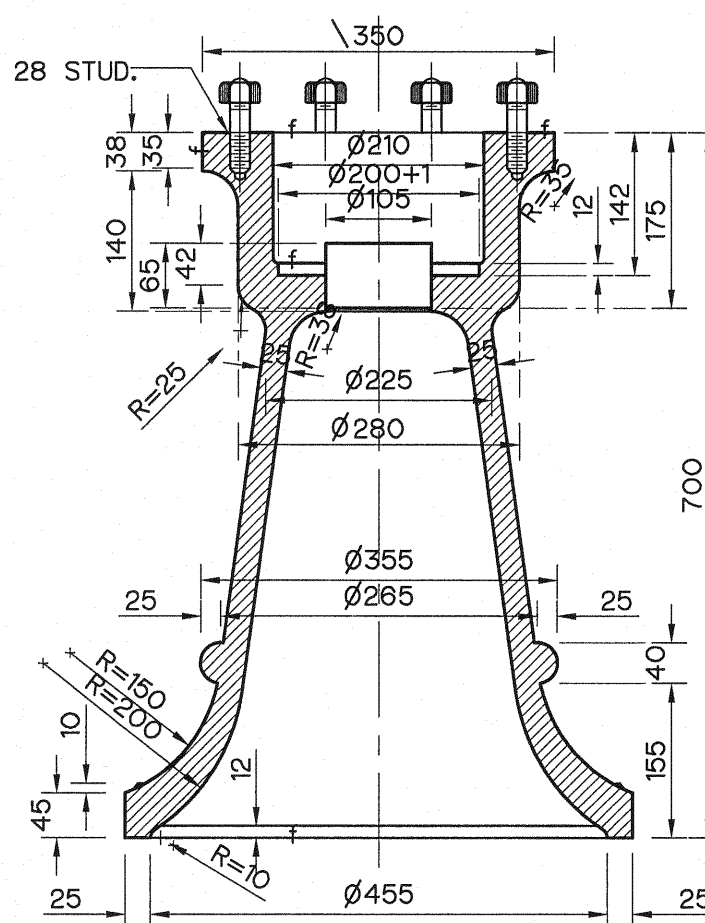
**GAP AND BEARING**  
CAST IRON  
SCALE 1:7.5



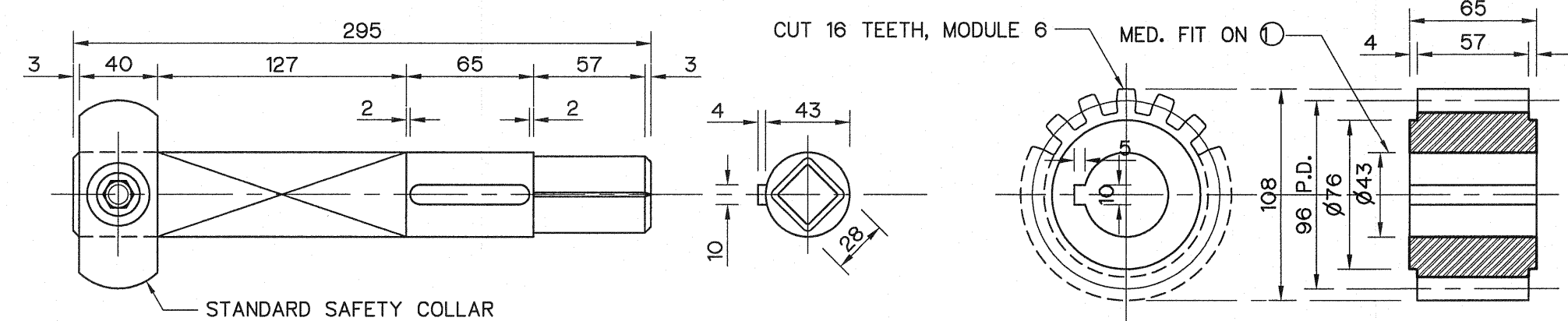
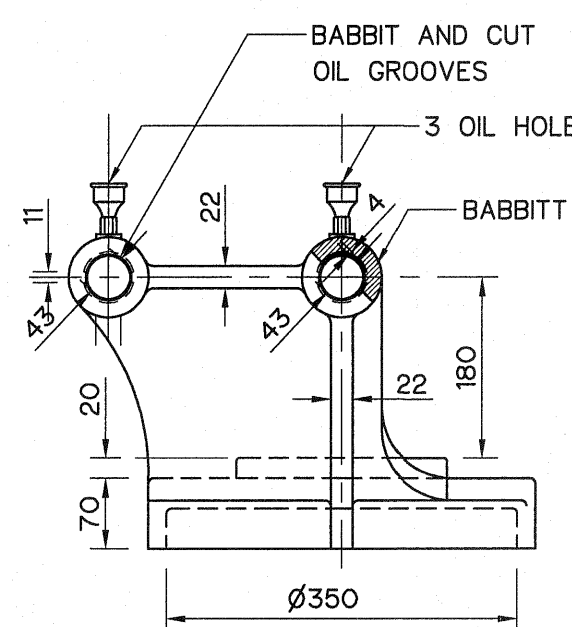
**CRANK ARM**  
CAST IRON  
SCALE 1 : 7.5



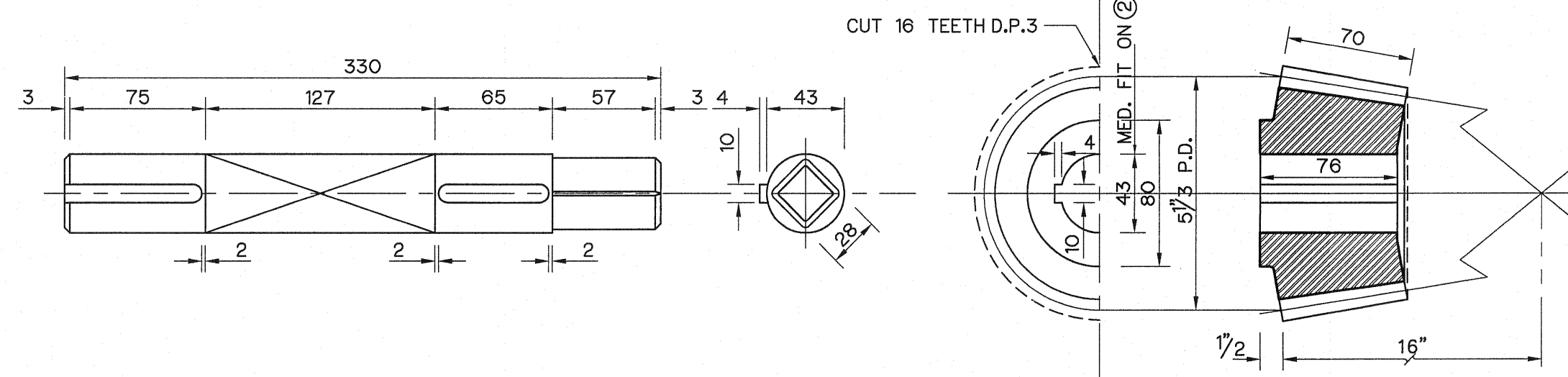
DRILL AND TAP FOR 22 x 28 STUD.



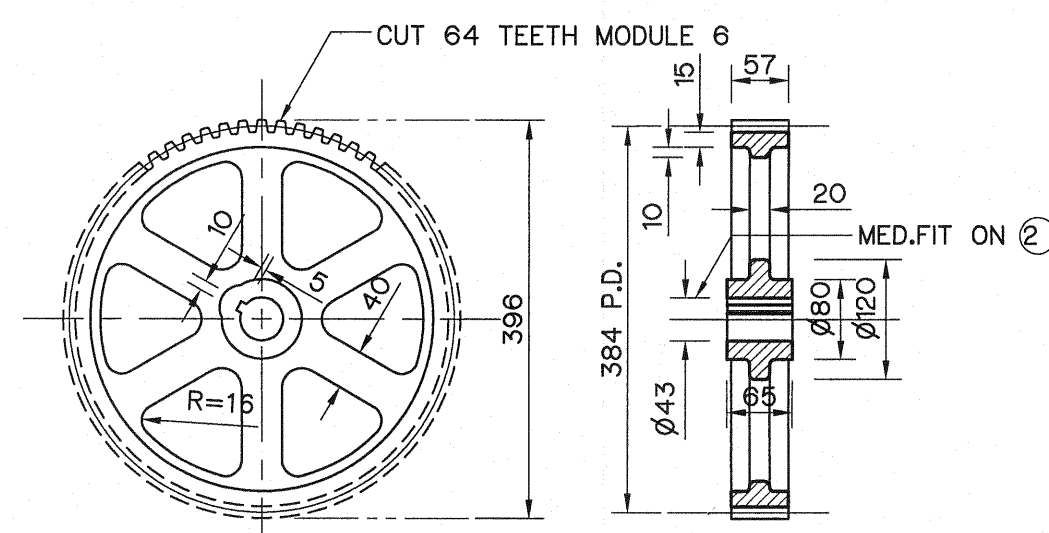
**PEDESTAL**  
CAST IRON  
SCALE 1 : 7.5



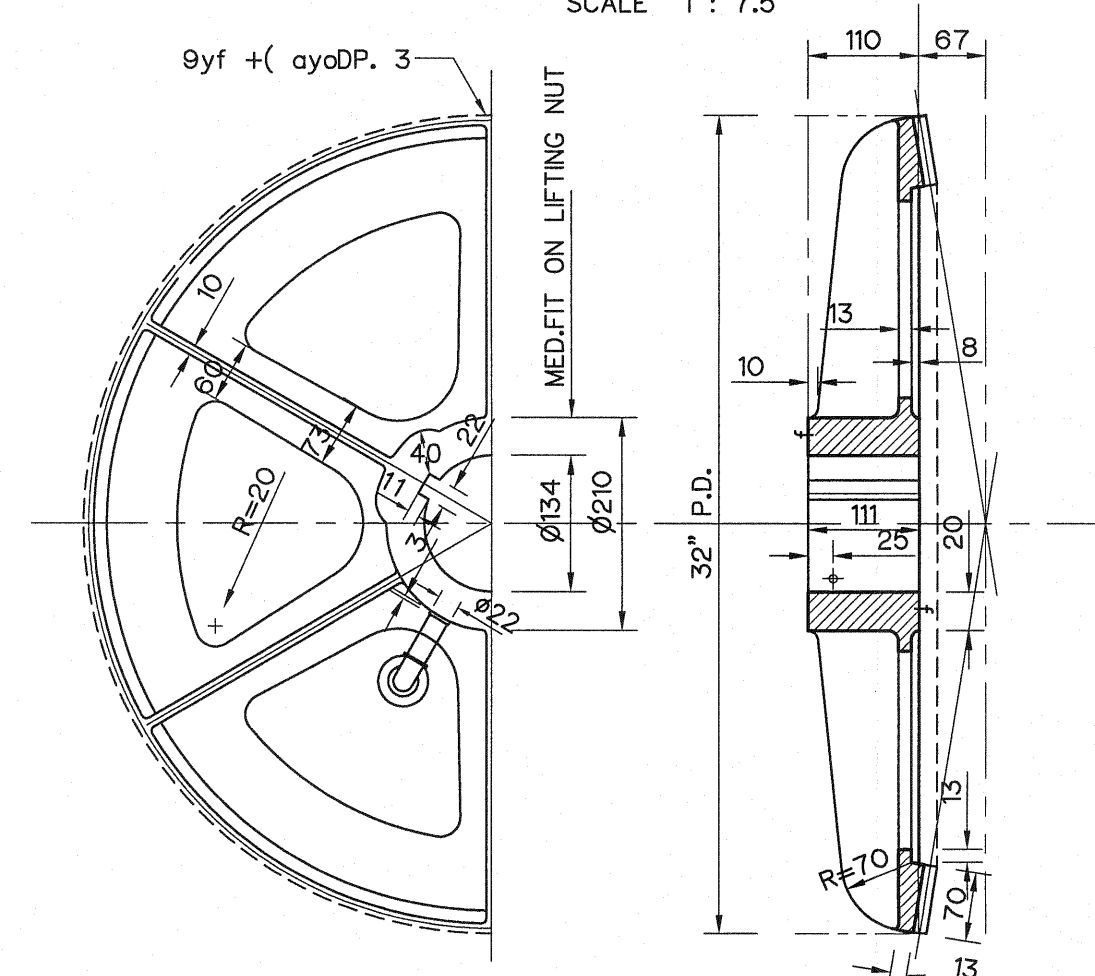
**BEVEL PINION SHAFT**  
COLD ROLLED STEEL  
SCALE 1 : 3



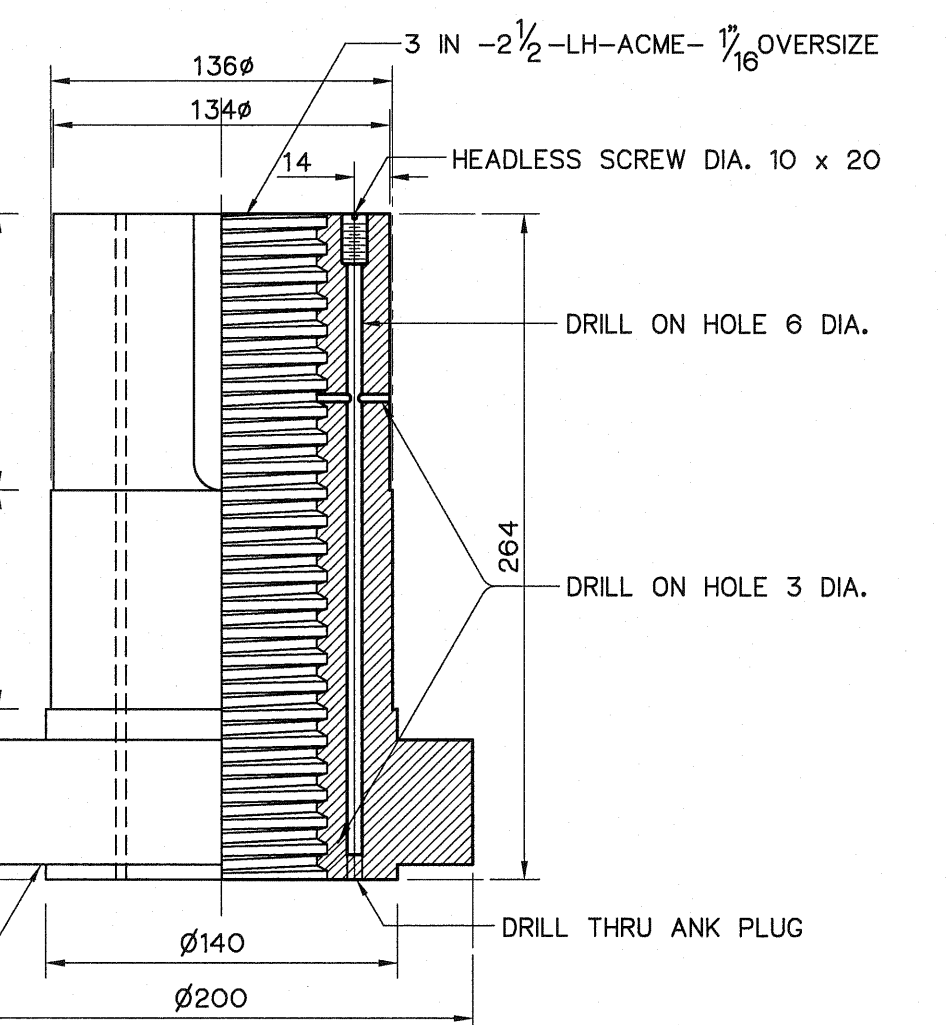
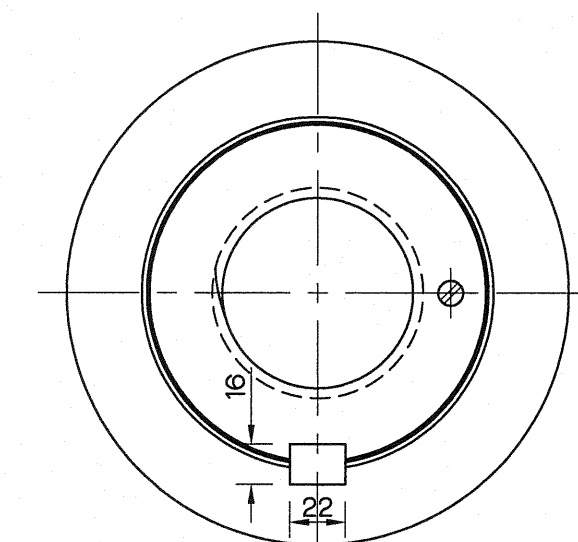
**BEVEL GEAR SHAFT**  
COLD ROLLED STEEL  
SCALE 1 : 3



**SPUR GEAR**  
SCALE 1 : 7.5



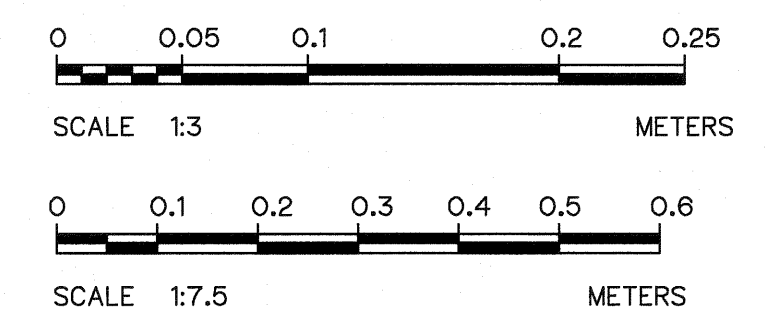
**BEVEL GEAR**  
CAST IRON  
SCALE 1 : 7.5



**LIFTING NUT**  
PHOSPHOR BRONZE  
SCALE 1 : 3

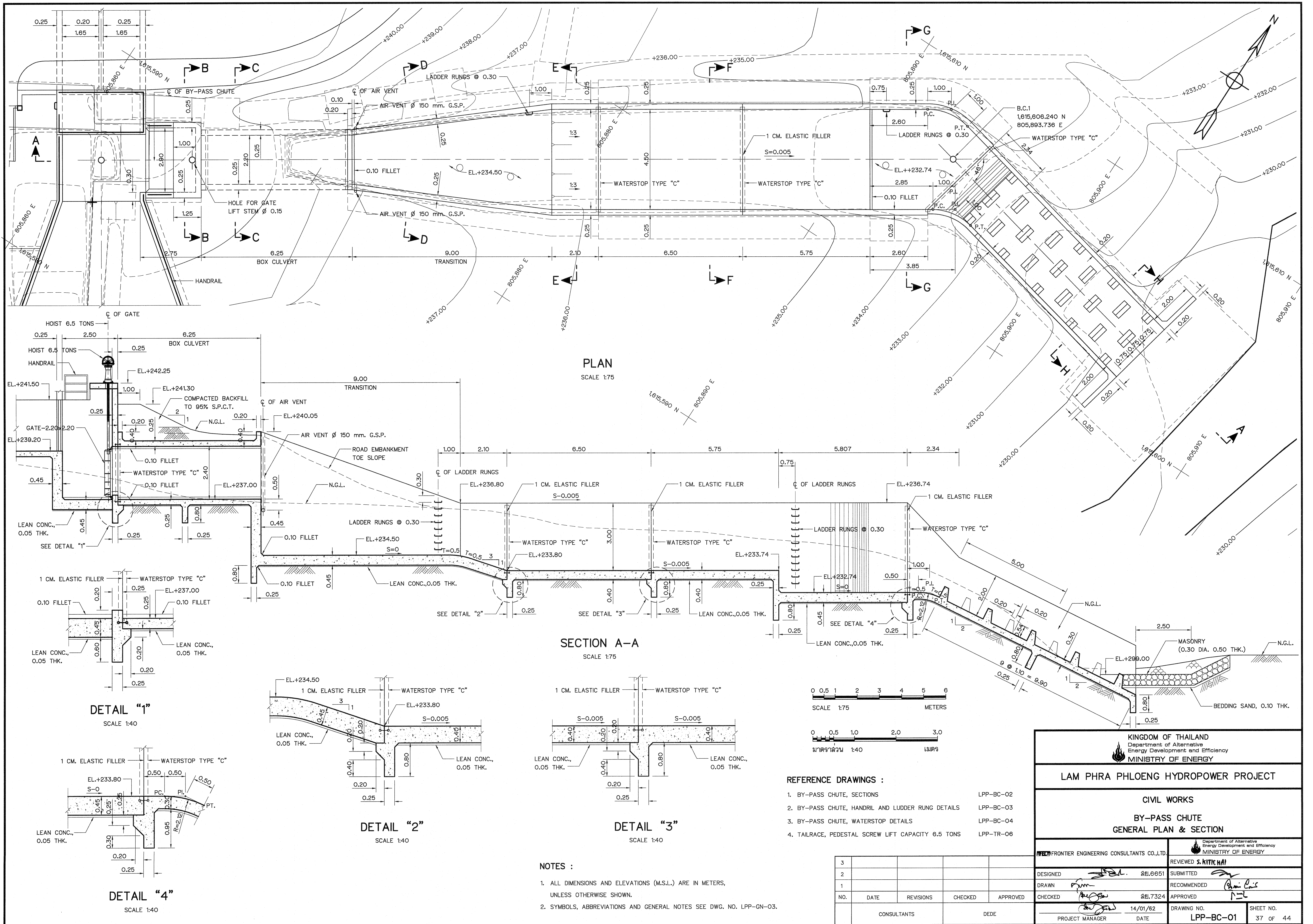
# NOTES :

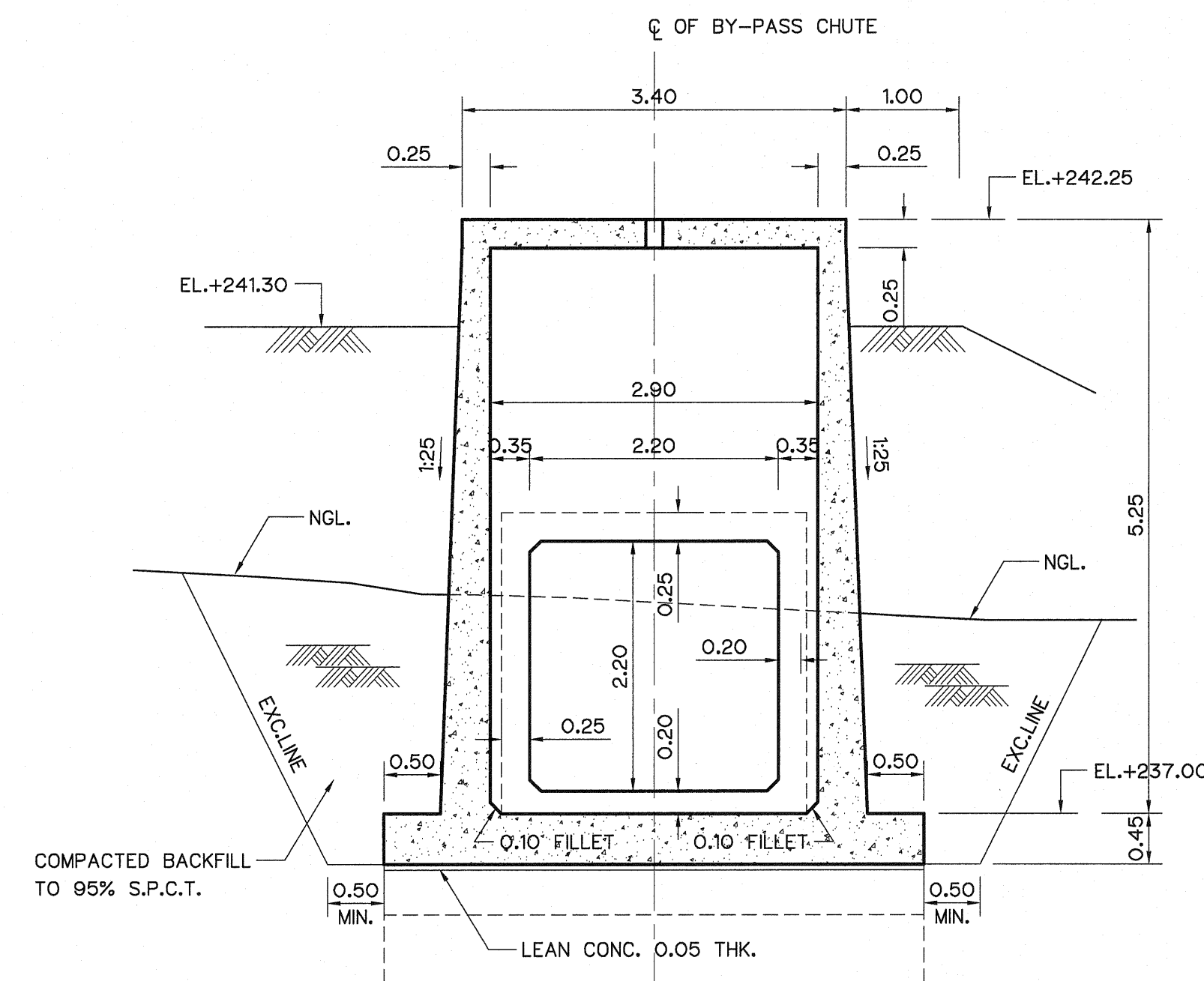
- ALL DIMENSIONS ARE IN MILLIMETER, UNLESS OTHERWISE SHOWN.
- THIS DRAWING IS DESIGNED FOR GUIDE LINE ONLY, THE CONTRACTOR HAS TO SUBMITTED SHOP DRAWING TO FIELD ENGINEER FOR APPROVAL.



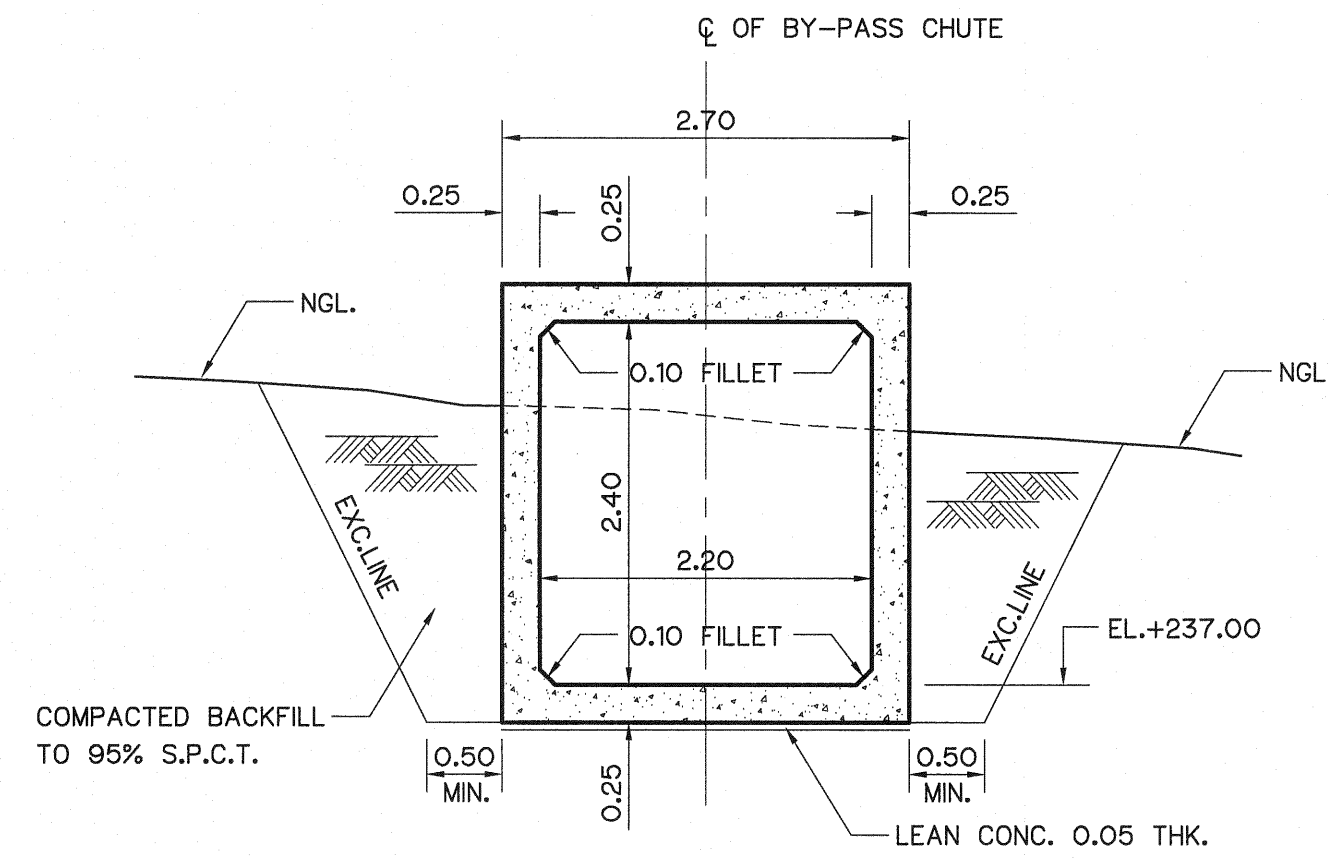
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|-------------------------------------------------------------------------------------------------------------|-----------------------|
| KINGDOM OF THAILAND<br>Department of Alternative<br>Energy Development and Efficiency<br>MINISTRY OF ENERGY |                       |
| LAM PHRA PHLOENG HYDROPOWER PROJECT                                                                         |                       |
| CIVIL WORKS                                                                                                 |                       |
| TAILRACE<br>PEDESTAL SCREW LIFT CAPACITY 6.5 TONS                                                           |                       |
| FRONTIER ENGINEERING CONSULTANTS CO.,LTD.                                                                   | REVIEWED S.KITICHAJ   |
| DESIGNED S.KITICHAJ 20/12/17                                                                                | SUBMITTED             |
| DRAWN S.KITICHAJ 20/12/17                                                                                   | RECOMMENDED           |
| CHECKED S.KITICHAJ 20/12/17                                                                                 | APPROVED              |
| PROJECT MANAGER                                                                                             | DRAWING NO. LPP-TR-06 |
| DATE 14/01/82                                                                                               | SHEET NO. 36 OF 44    |

|             |      |           |         |          |
|-------------|------|-----------|---------|----------|
| 3           |      |           |         |          |
| 2           |      |           |         |          |
| 1           |      |           |         |          |
| NO.         | DATE | REVISIONS | CHECKED | APPROVED |
| CONSULTANTS |      | DEDE      |         |          |

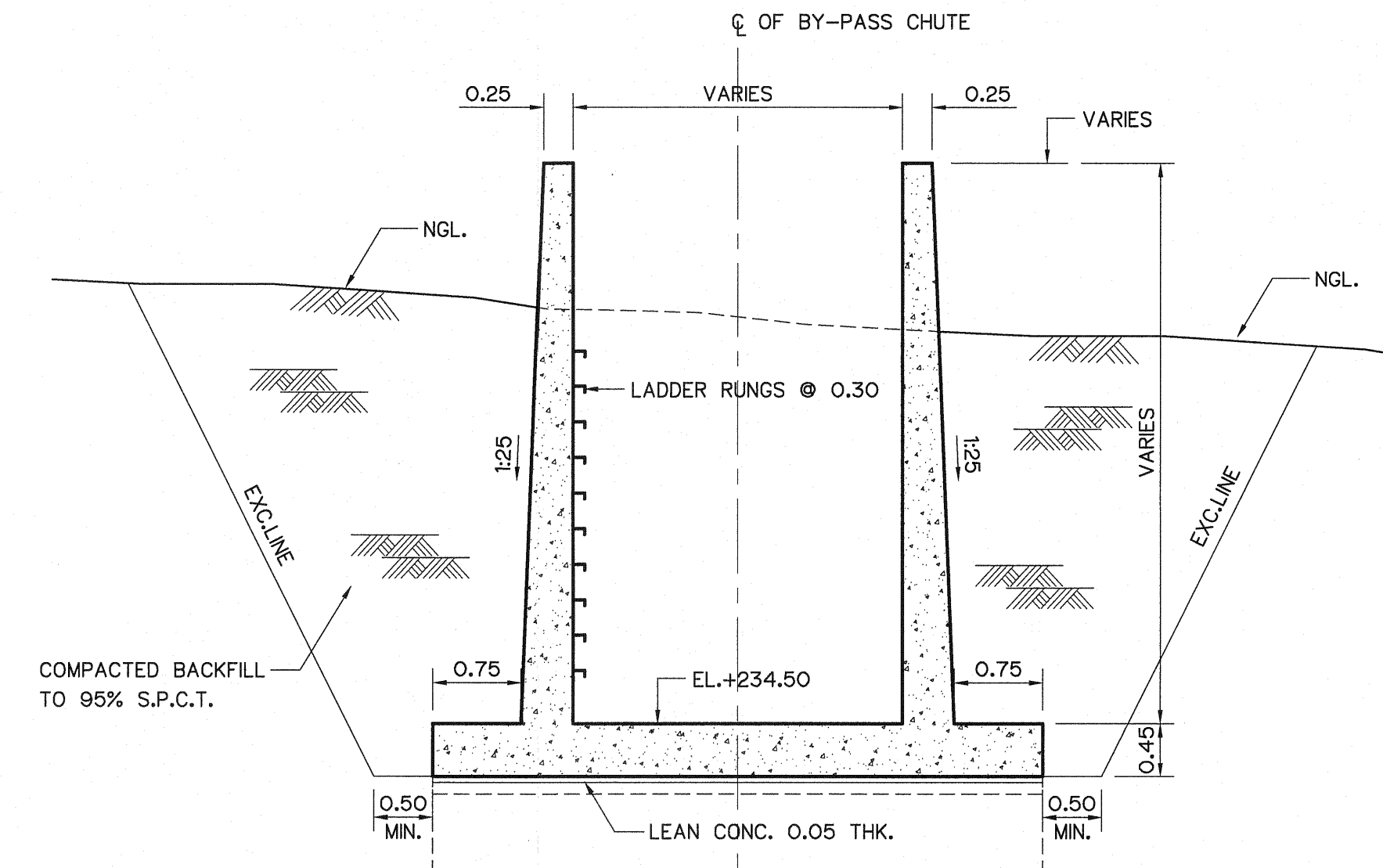




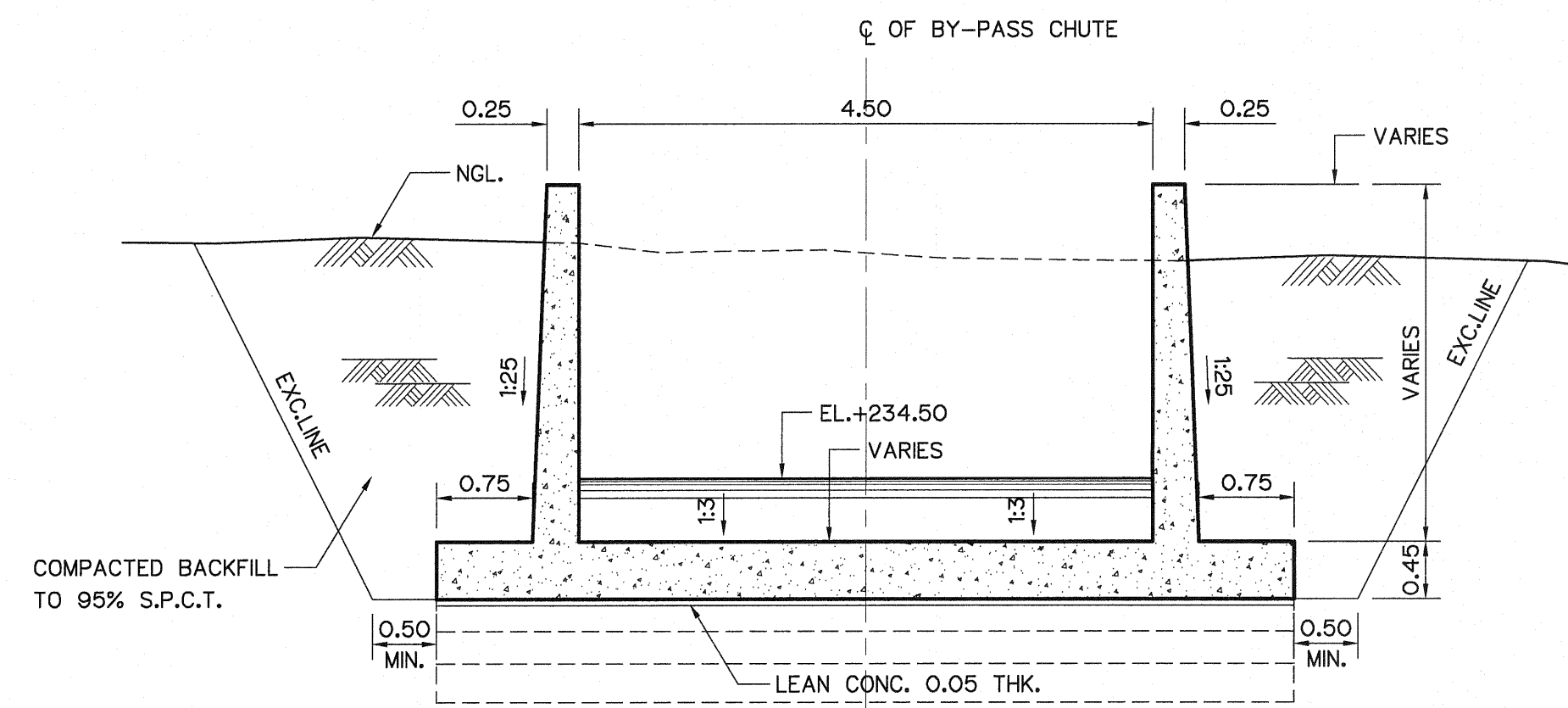
SECTION B-B  
SCALE 1:50



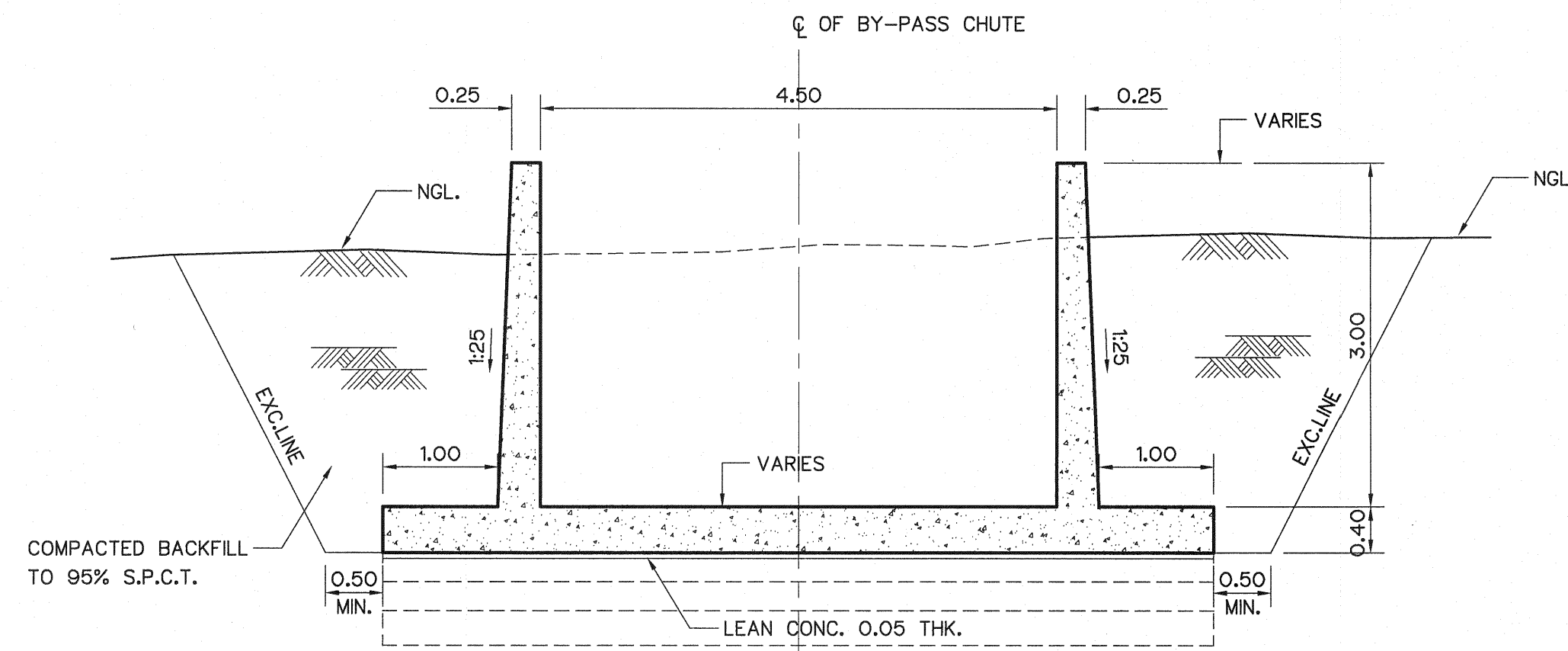
SECTION C-C  
SCALE 1:50



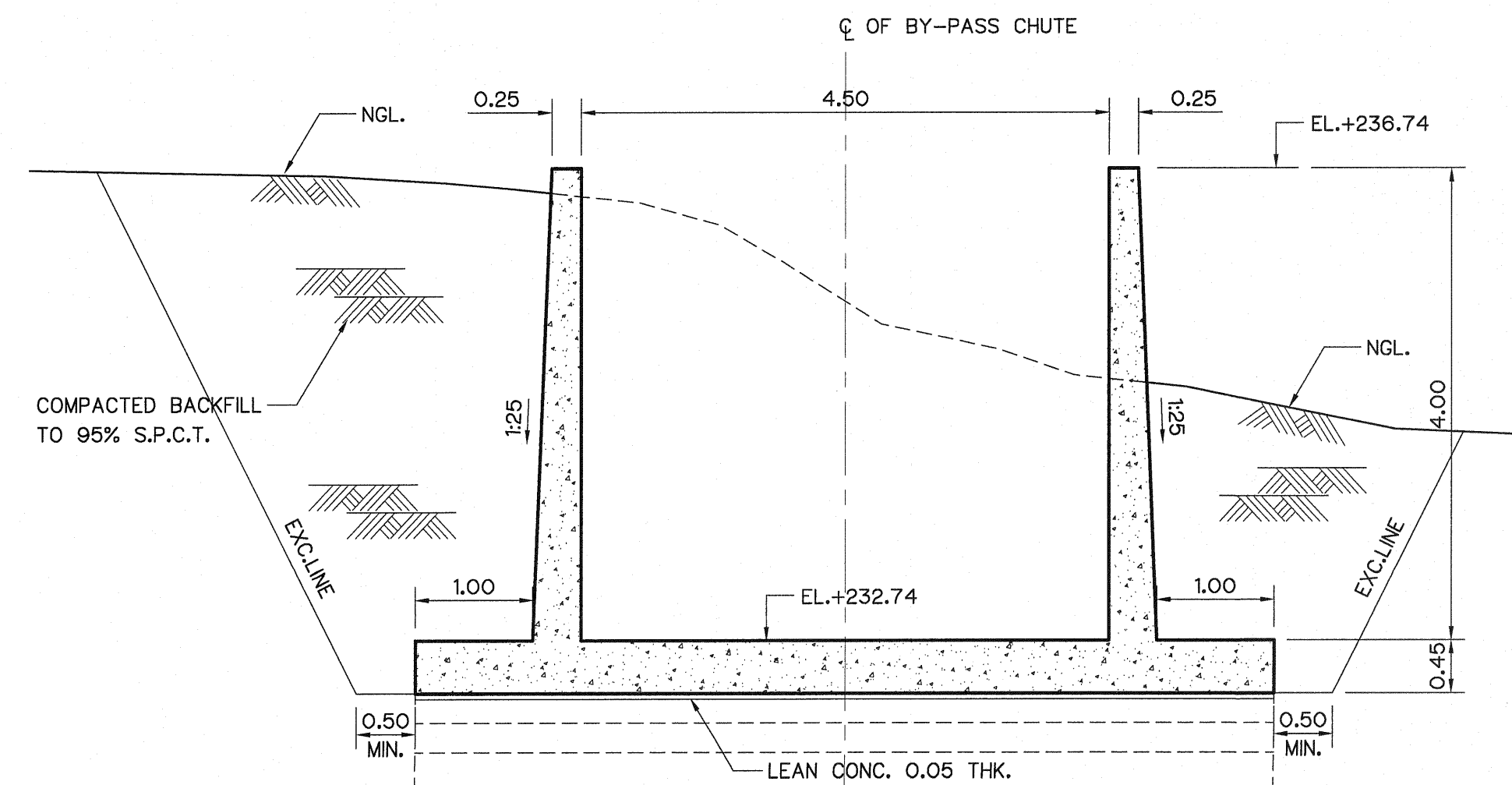
SECTION D-D  
SCALE 1:50



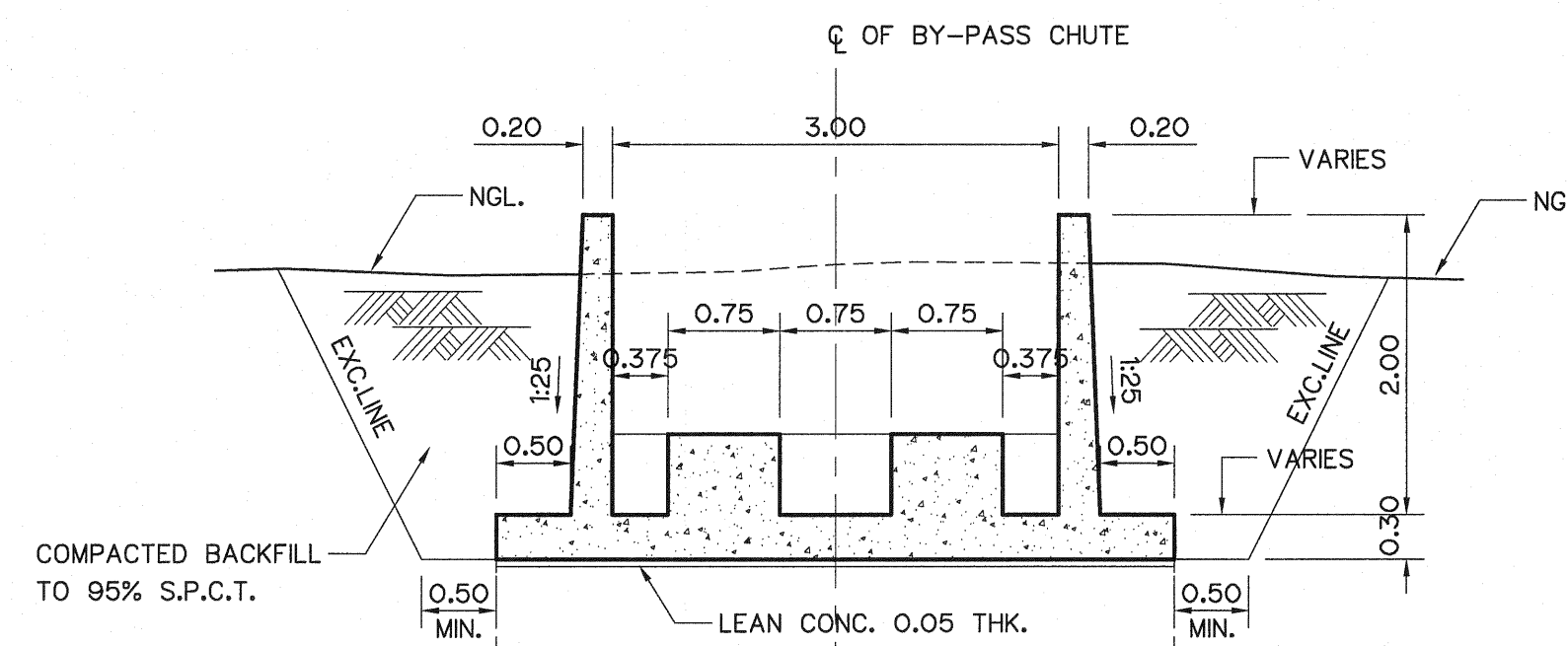
SECTION E-E  
SCALE 1:50



SECTION F-F  
SCALE 1:50



SECTION G-G  
SCALE 1:50



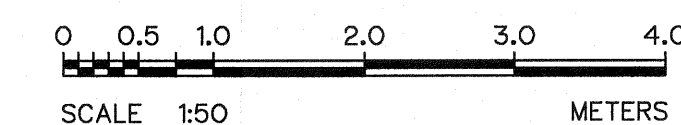
SECTION H-H  
SCALE 1:50

NOTES :

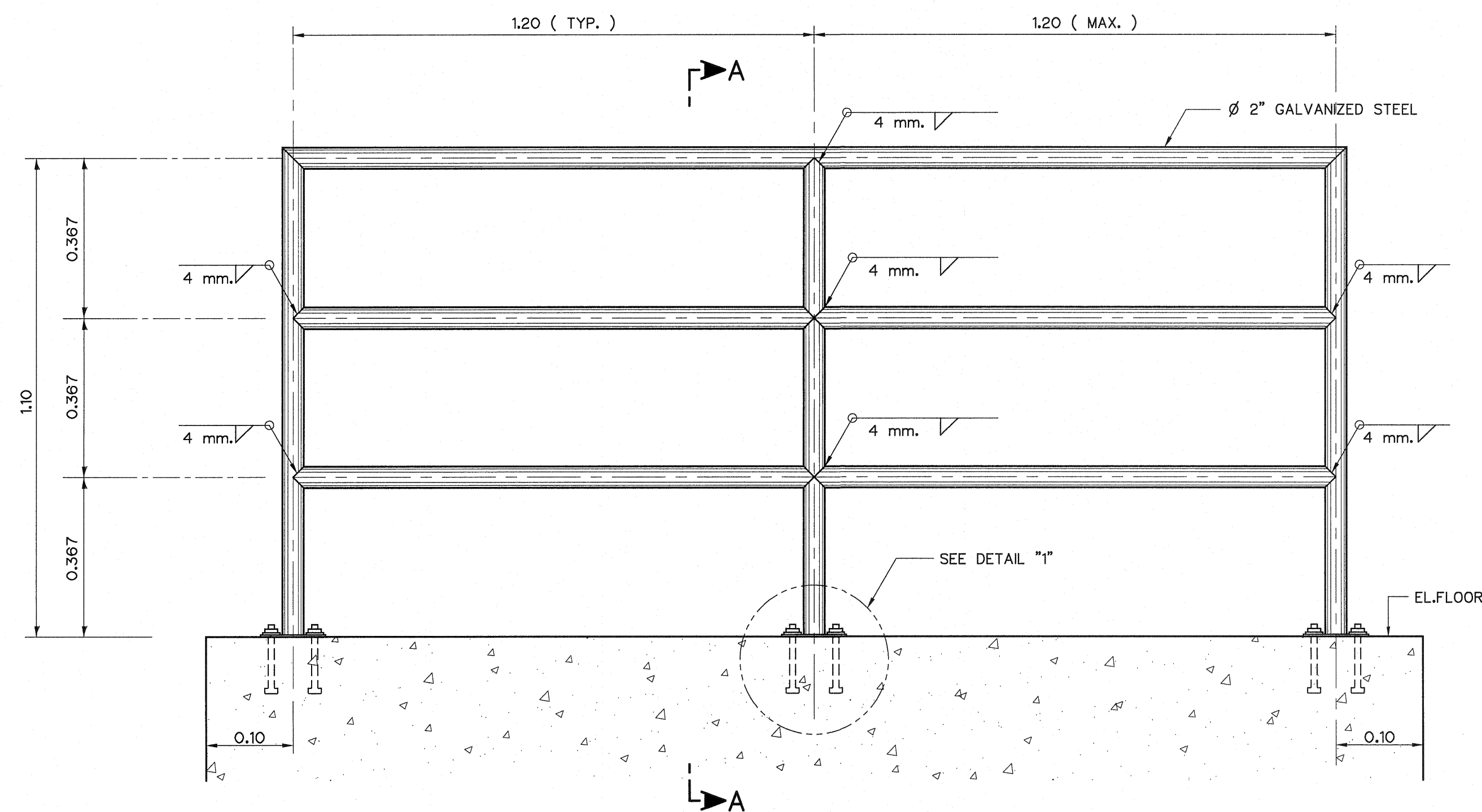
1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.

REFERENCE DRAWINGS :

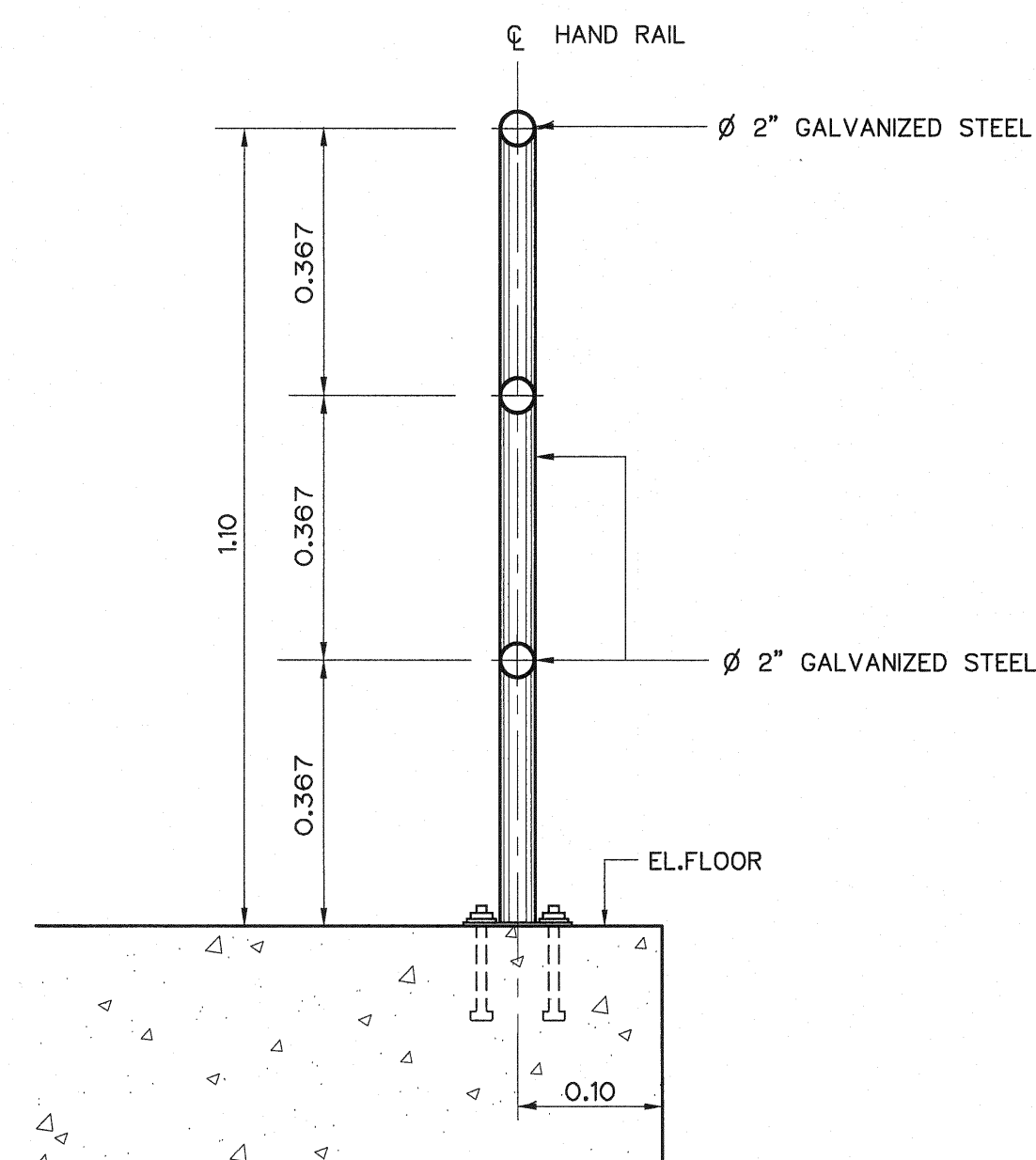
1. BY-PASS CHUTE, GENERAL PLAN & SECTION LPP-BC-01
2. BY-PASS CHUTE, HANDRAIL AND LUDDER RUNG DETAILS LPP-BC-03
3. BY-PASS CHUTE, WATERSTOP DETAILS LPP-BC-04
4. TAILRACE, PEDESTAL SCREW LIFT CAPACITY 8.5 TONS LPP-TR-06



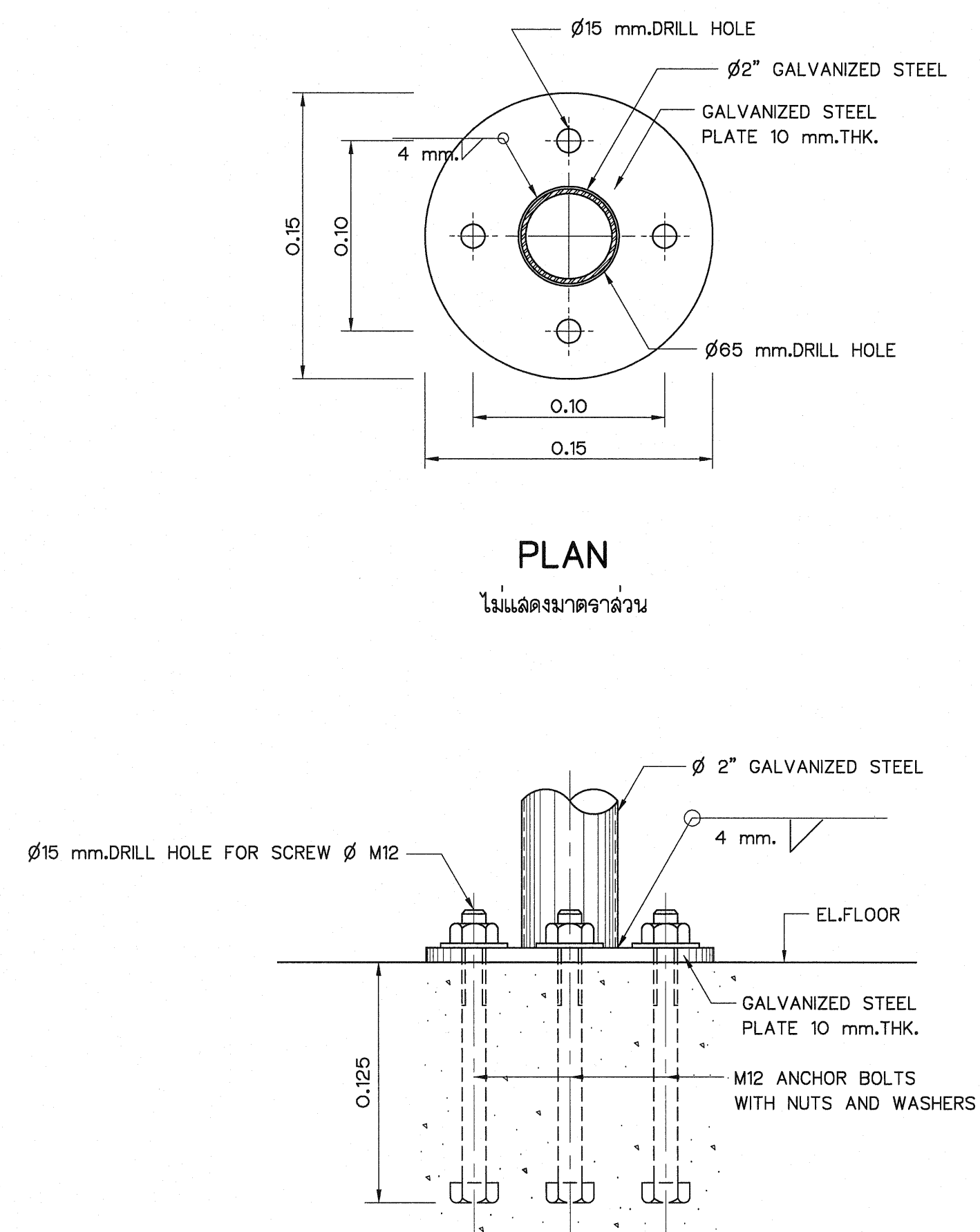
|                                                                                                                       |  |                                                                                               |  |
|-----------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------|--|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |                                                                                               |  |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |  |                                                                                               |  |
| <p>CIVIL WORKS<br/>BY-PASS CHUTE<br/>SECTIONS</p>                                                                     |  |                                                                                               |  |
| <p>FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                      |  | <p>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |
| <p>REVIEWED S. KIRICHAI</p>                                                                                           |  | <p>SUBMITTED</p>                                                                              |  |
| <p>DESIGNED S. KIRICHAI</p>                                                                                           |  | <p>RECOMMENDED</p>                                                                            |  |
| <p>DRAWN</p>                                                                                                          |  | <p>APPROVED</p>                                                                               |  |
| <p>CHECKED</p>                                                                                                        |  | <p>DATE 14/01/62</p>                                                                          |  |
| <p>CONSULTANTS</p>                                                                                                    |  | <p>DEDE</p>                                                                                   |  |
| <p>PROJECT MANAGER</p>                                                                                                |  | <p>DRAWING NO. LPP-BC-02</p>                                                                  |  |
| <p>SHEET NO. 38 OF 44</p>                                                                                             |  | <p></p>                                                                                       |  |



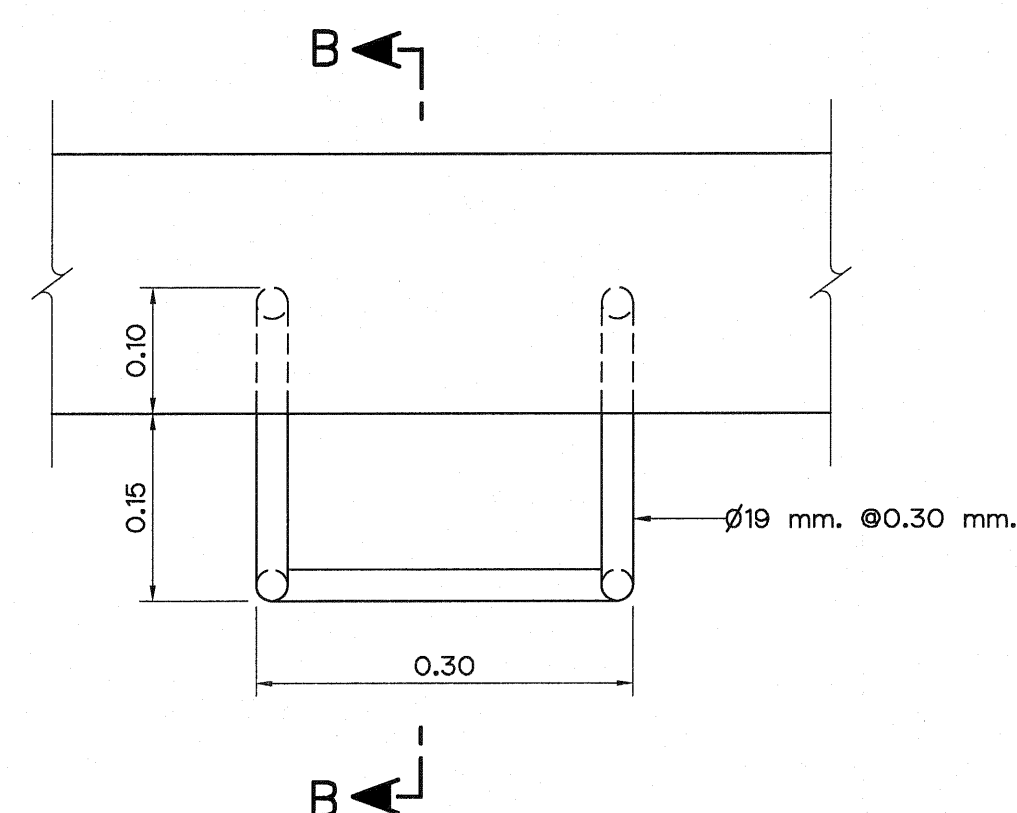
DETAIL OF HANDRAIL  
NOT TO SCALE



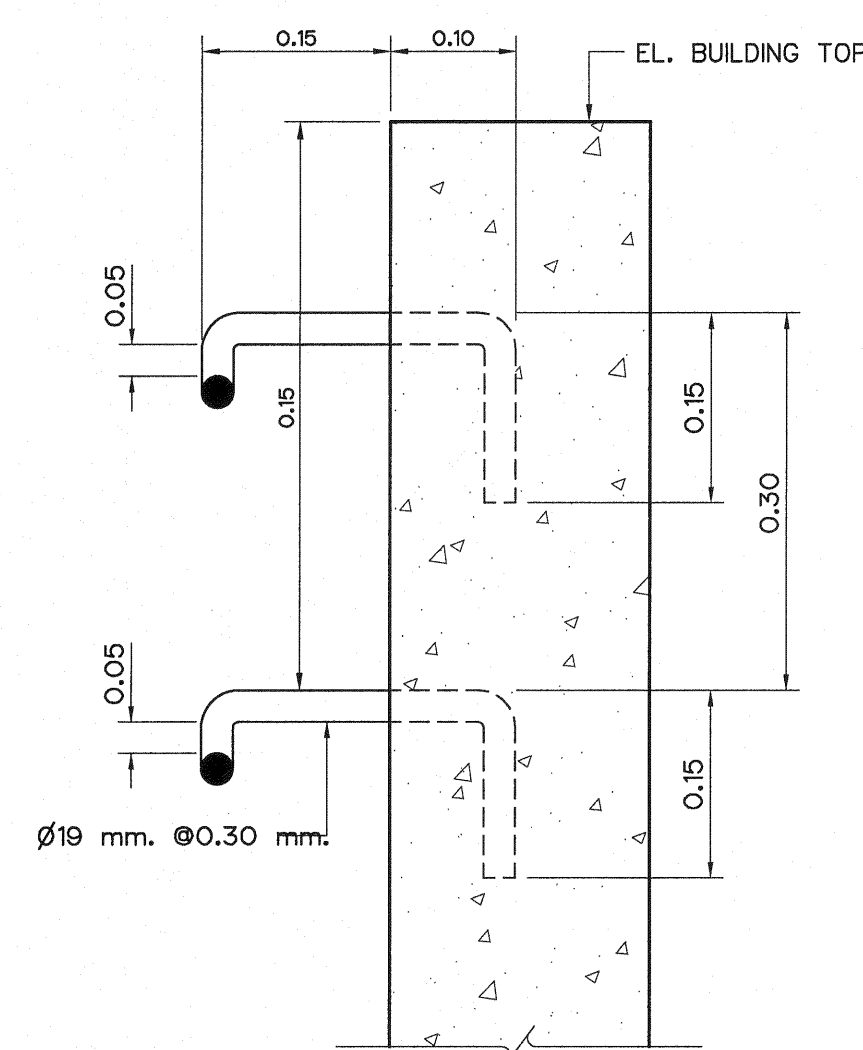
SECTION A-A  
NOT TO SCALE



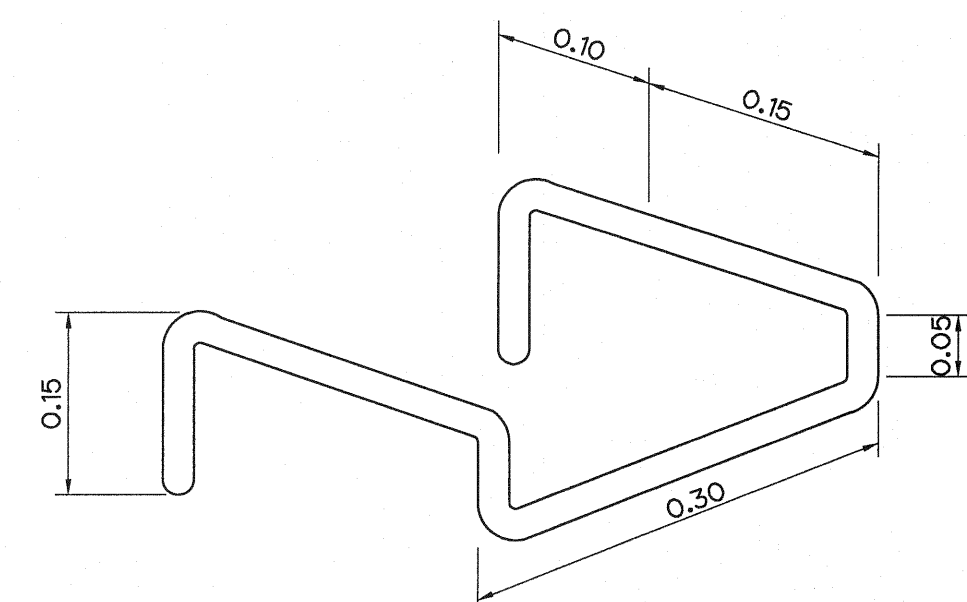
DETAIL "1"  
NOT TO SCALE



LADDER RUNG PLAN  
NOT TO SCALE



SECTION B-B  
NOT TO SCALE



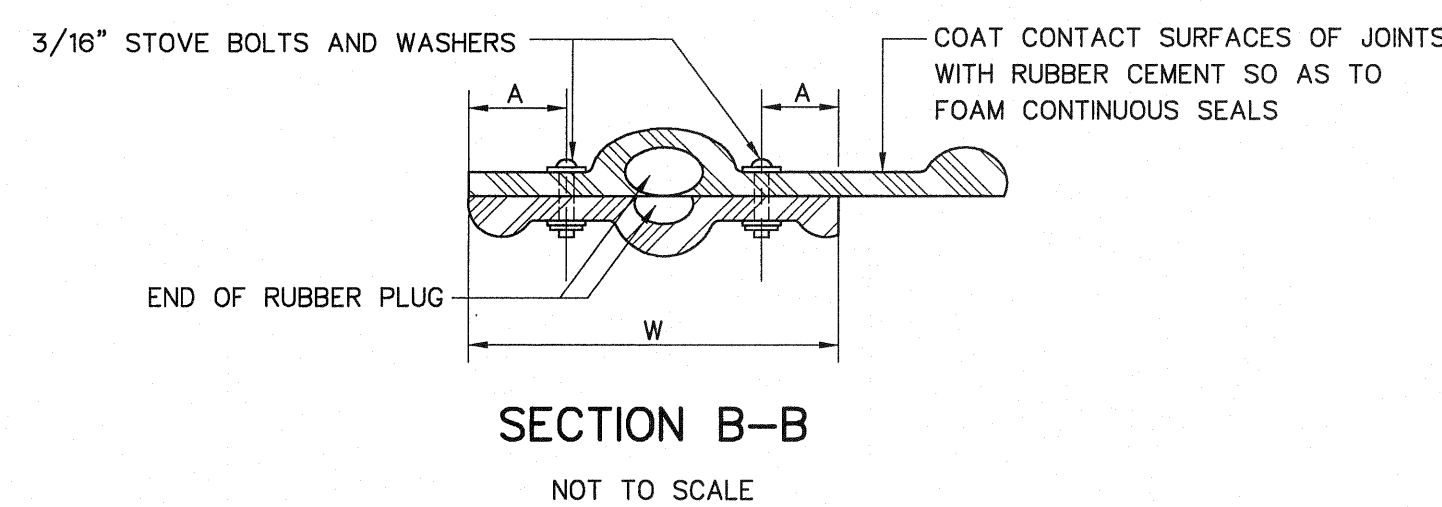
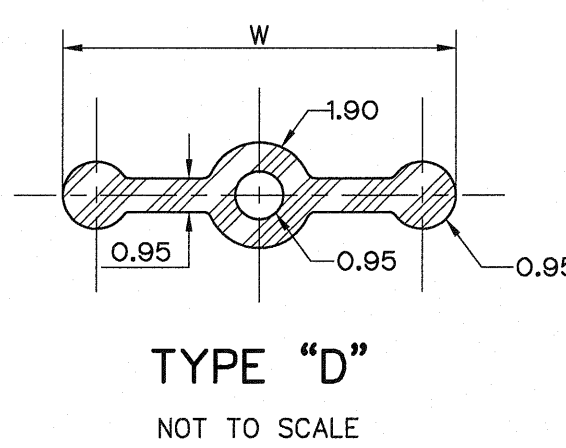
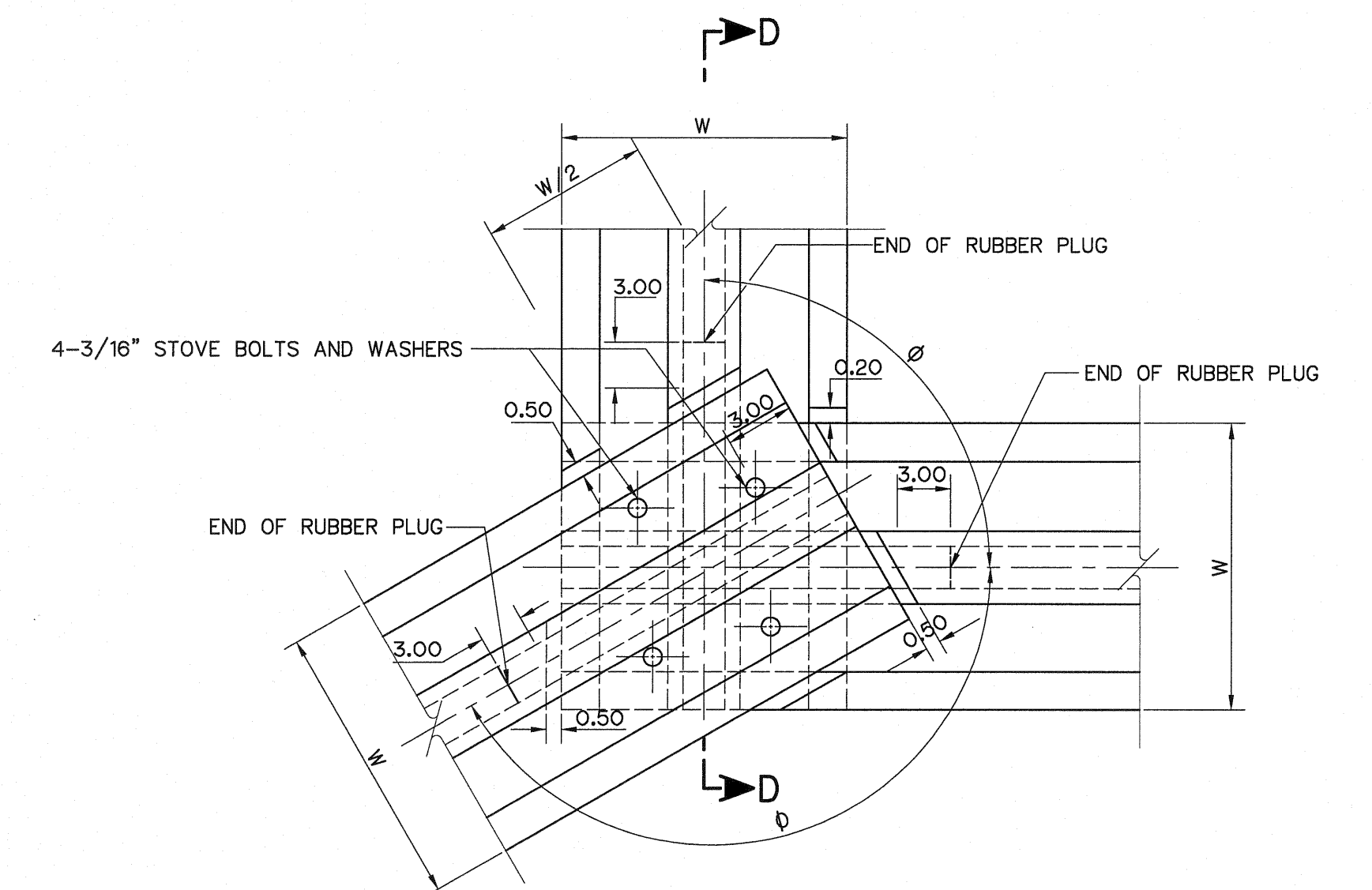
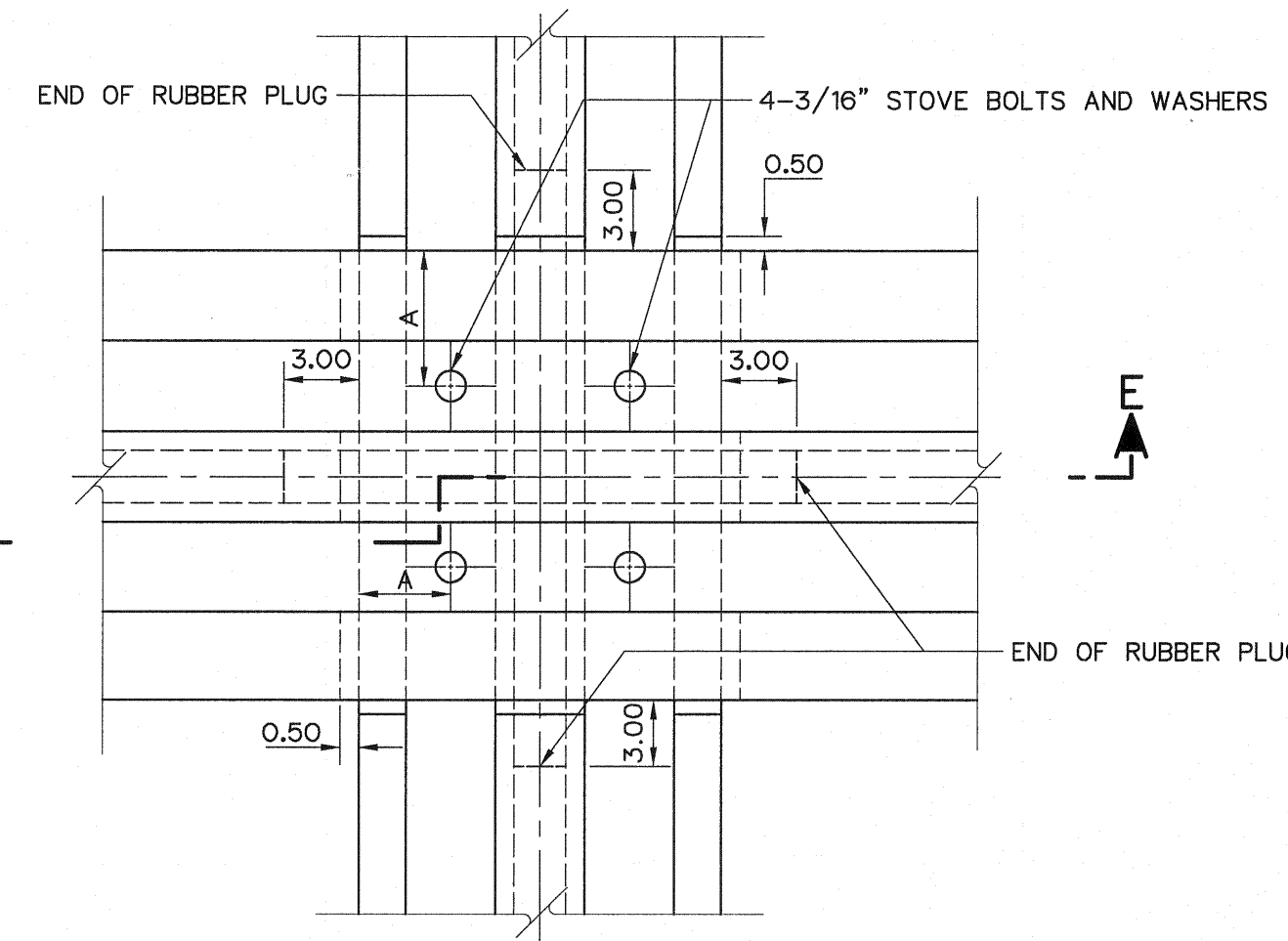
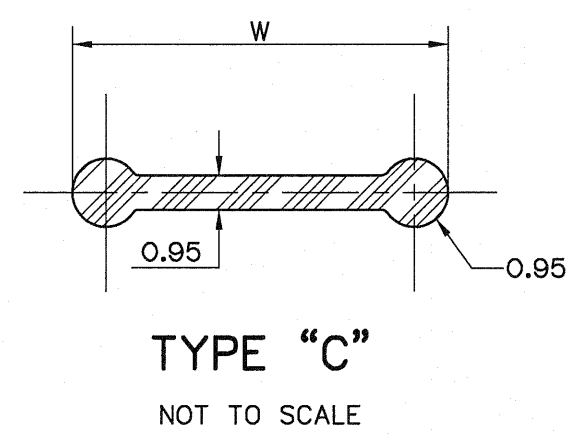
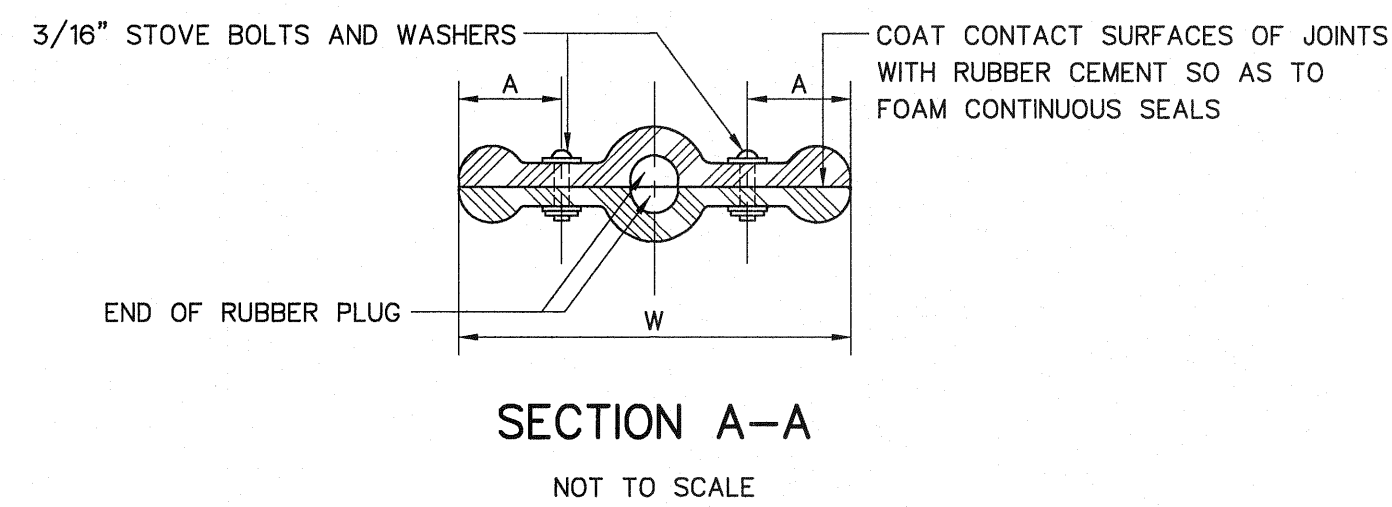
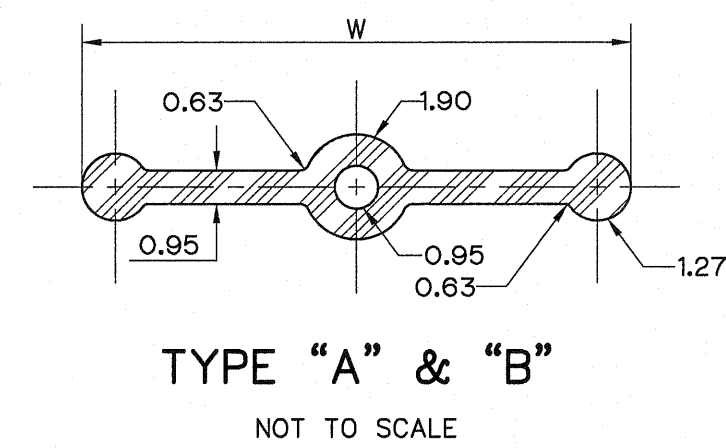
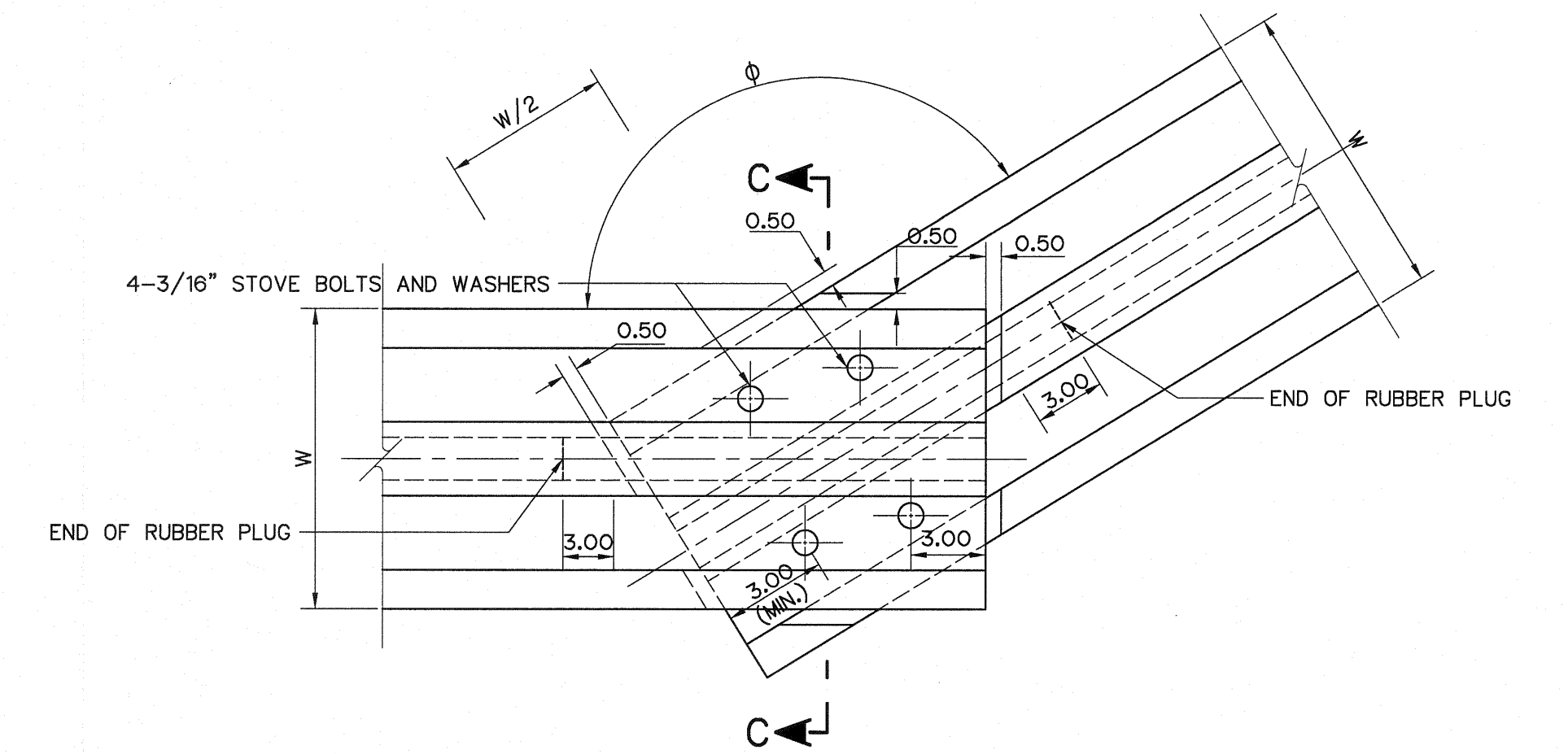
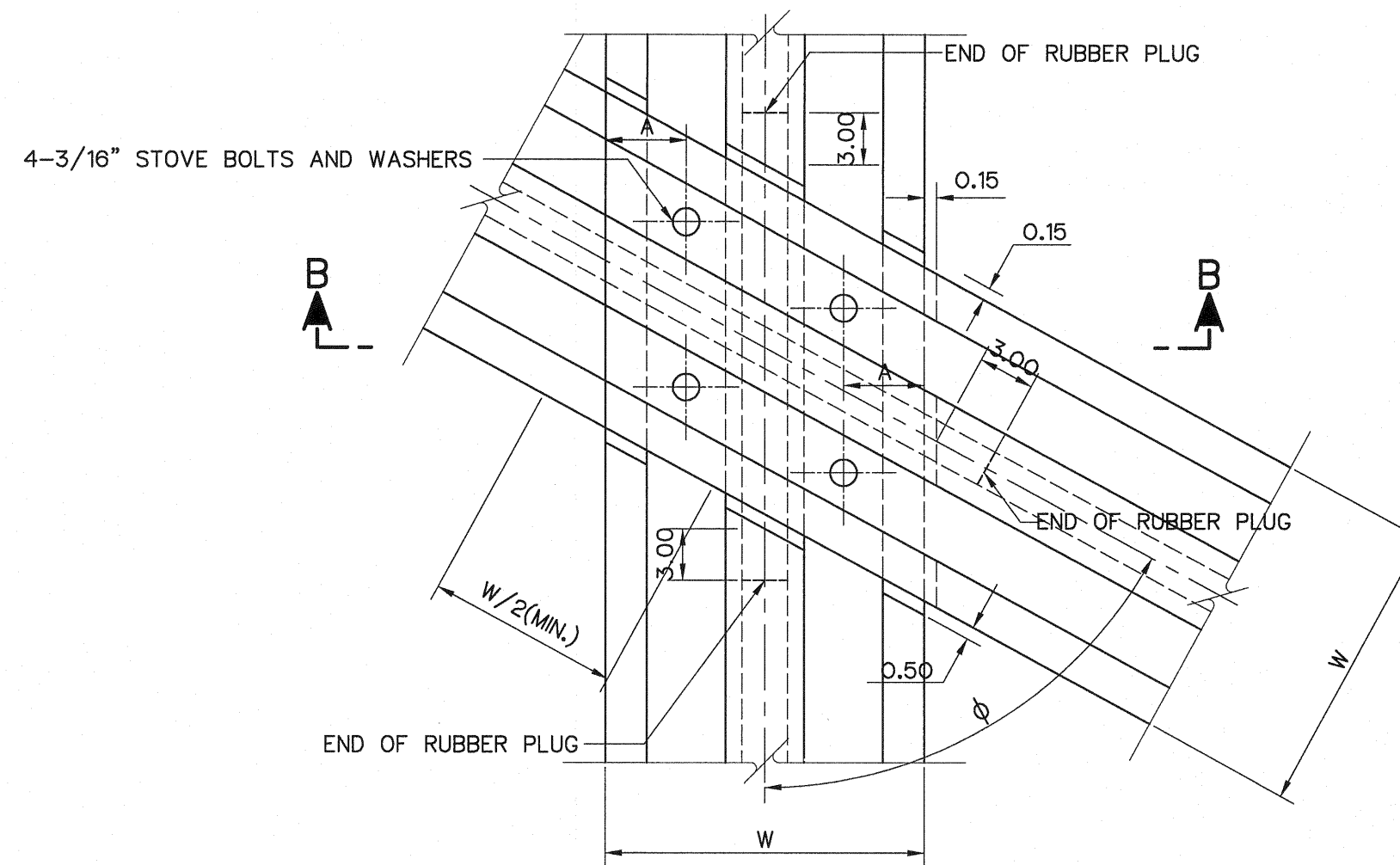
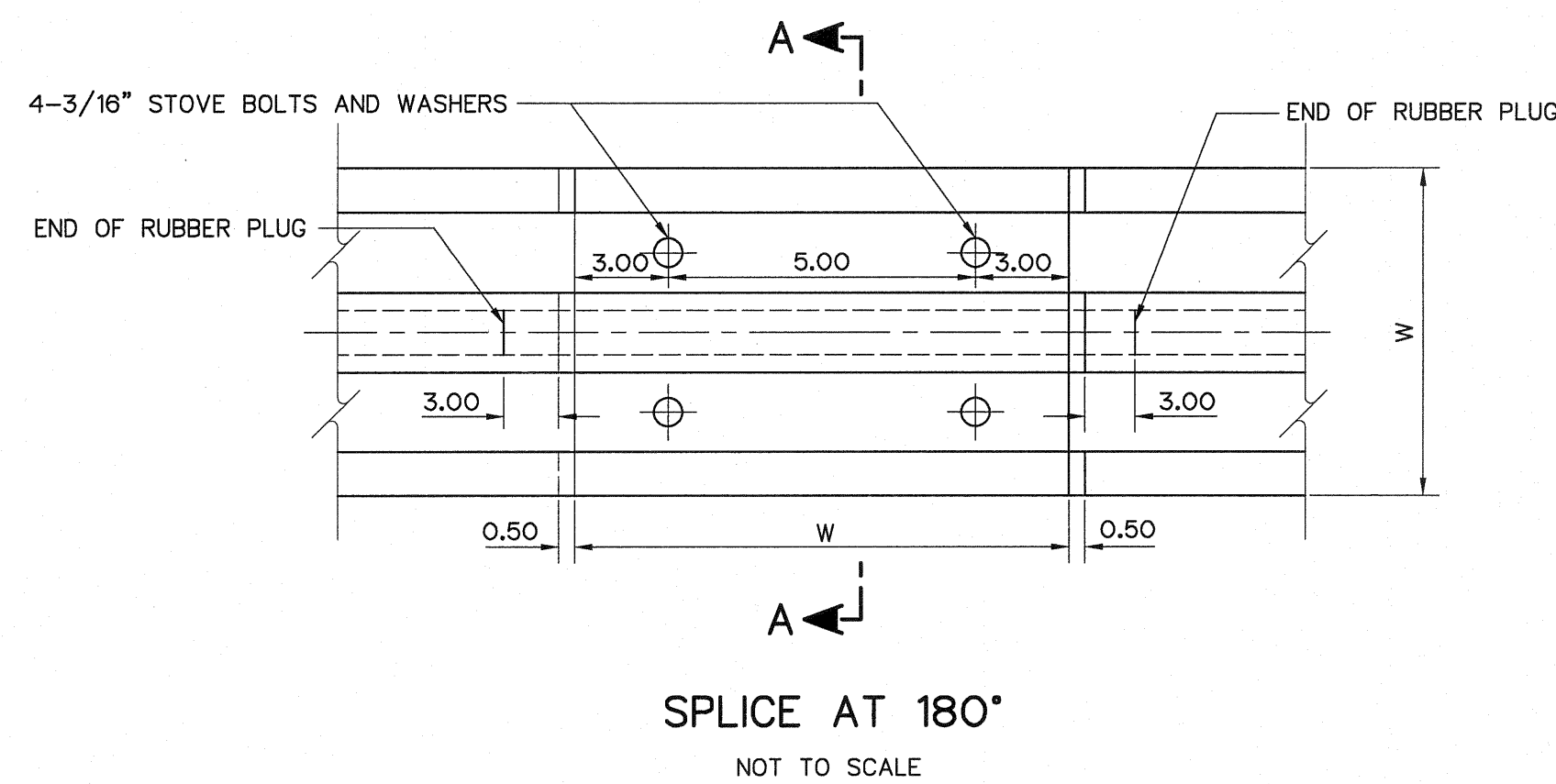
LADDER RUNG ISOMETRIC VIEW  
NOT TO SCALE

NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.

|                                                                                                                       |                                                               |
|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |                                                               |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |                                                               |
| <p>CIVIL WORKS<br/>BY-PASS CHUTE<br/>HANDRAIL AND LADDER RUNG DETAILS</p>                                             |                                                               |
| <p>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</p>                                                                     | <p>REVIEWED <b>S. KITICHAI</b></p>                            |
| <p>DESIGNED <b>S. KITICHAI</b> 28.6651</p>                                                                            | <p>SUBMITTED <b>S. KITICHAI</b></p>                           |
| <p>DRAWN <b>S. KITICHAI</b></p>                                                                                       | <p>RECOMMENDED <b>S. KITICHAI</b></p>                         |
| <p>CHECKED <b>S. KITICHAI</b> 28.7324</p>                                                                             | <p>APPROVED <b>S. KITICHAI</b></p>                            |
| <p>PROJECT MANAGER <b>S. KITICHAI</b> 14/01/62</p>                                                                    | <p>DRAWING NO. <b>LPP-BC-03</b> SHEET NO. <b>39 OF 44</b></p> |

| NO. | DATE | REVISIONS | CHECKED | APPROVED |
|-----|------|-----------|---------|----------|
| 3   |      |           |         |          |
| 2   |      |           |         |          |
| 1   |      |           |         |          |



**SPLICE BETWEEN TWO CONTINUOUS STRIP**  
NOT TO SCALE

**SPLICE AT ANGLE BETWEEN THREE PIECES**  
NOT TO SCALE

**NOTES :**

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SPLICE DETAILS FOR 6" RUBBER WATER STOP WITH OUT CENTER BULB  
ARE SIMILAR TO THOSE WITH CENTER BULB. EXCEPT THAT RUBBER PLUGS ARE NOT REQUIRED
3. RUBBER PLUGS TO BE COMMENTED TO RUBBER WATER STOP

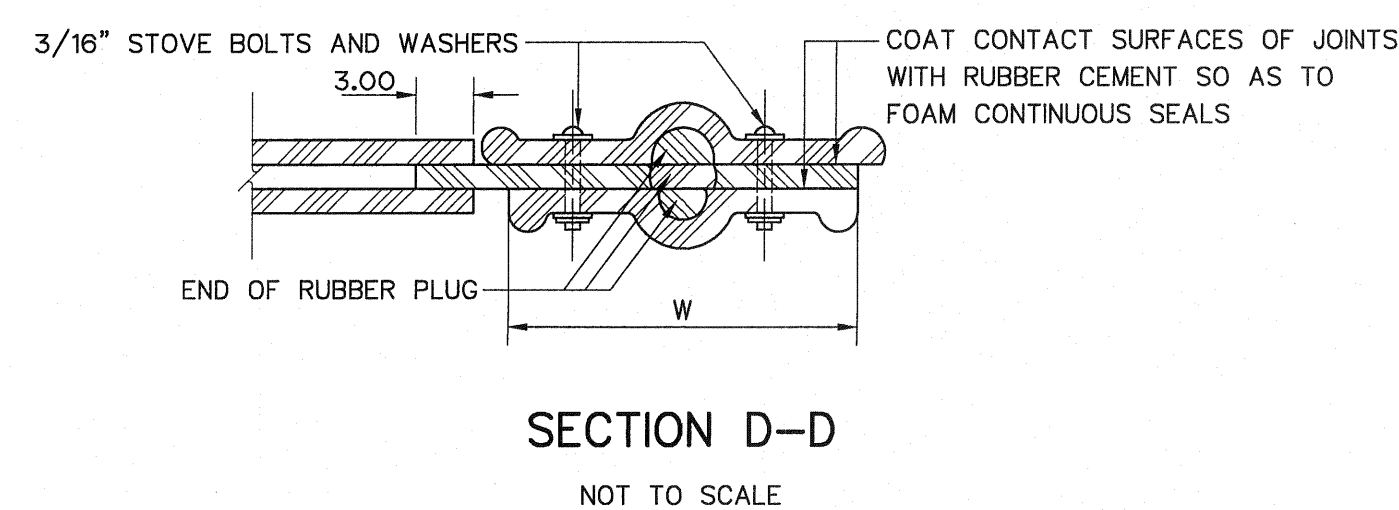
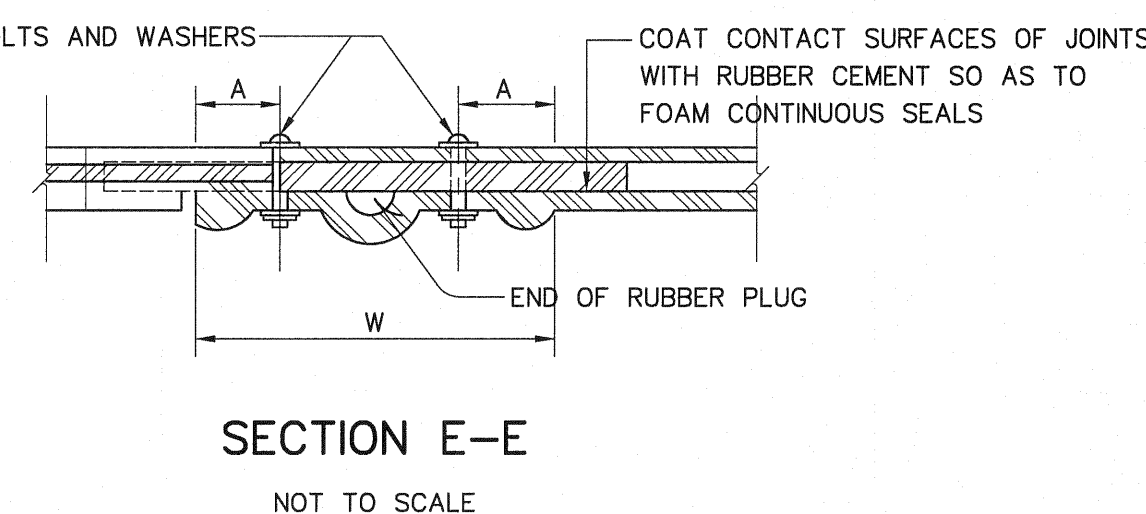
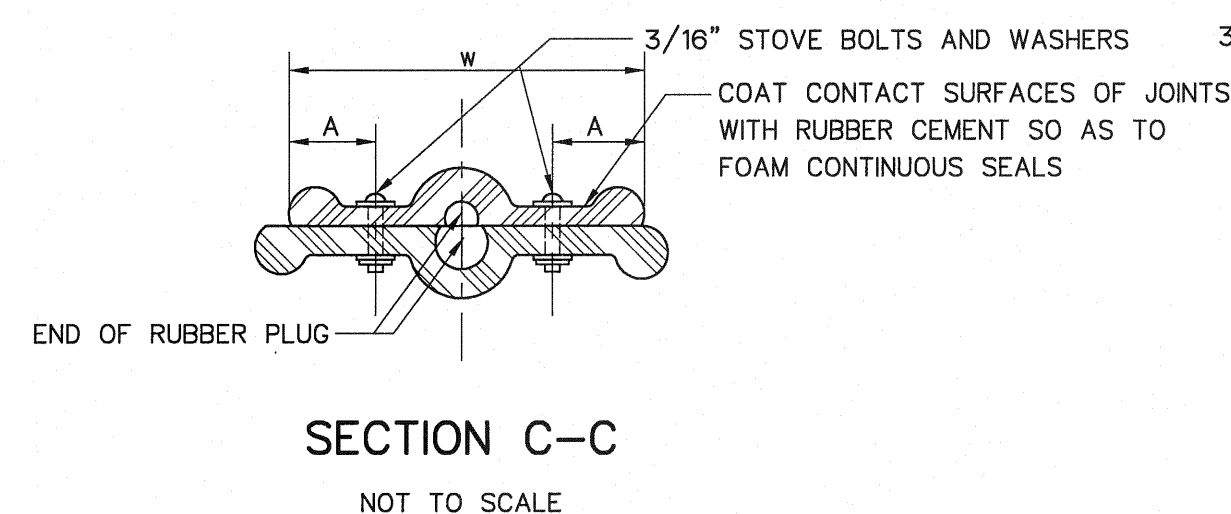
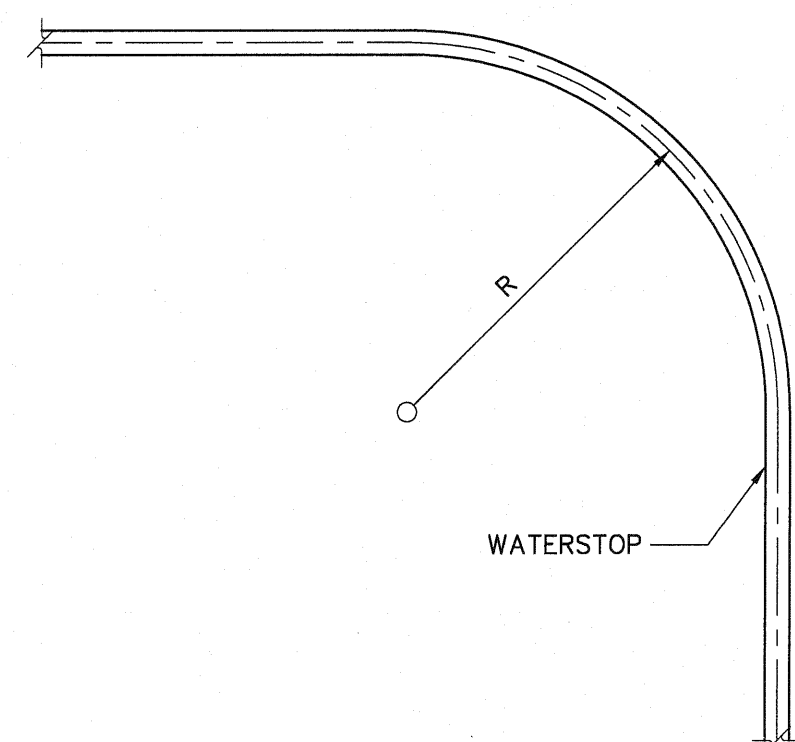
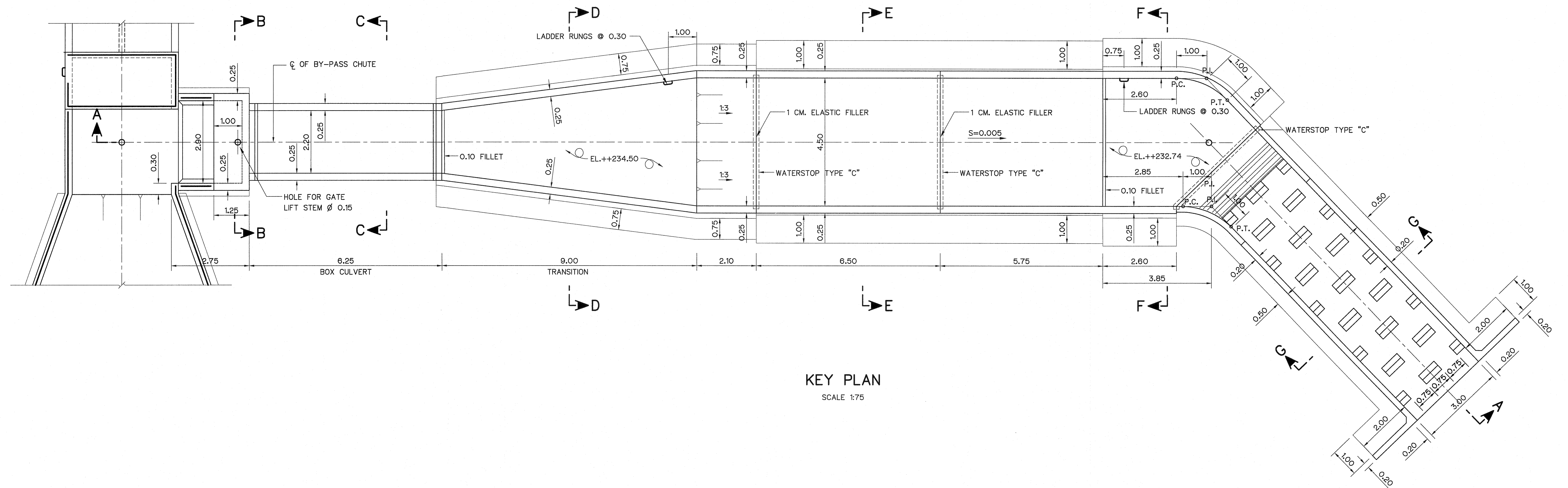


**TABLE OF DIMENSIONS**

| WATERSTOP TYPE | W     | A | R  |
|----------------|-------|---|----|
| A              | 22.86 | 4 | 20 |
| B              | 15.24 | 4 | 15 |
| C              | 15.24 | 4 | 10 |
| D              | 11.42 | 3 | 10 |

|                                            |      |           |         |          |                       |  |  |  |  |
|--------------------------------------------|------|-----------|---------|----------|-----------------------|--|--|--|--|
| 3                                          |      |           |         |          |                       |  |  |  |  |
| 2                                          |      |           |         |          |                       |  |  |  |  |
| 1                                          |      |           |         |          |                       |  |  |  |  |
| NO.                                        | DATE | REVISIONS | CHECKED | APPROVED |                       |  |  |  |  |
| CONSULTANTS                                |      |           |         |          | DEDE                  |  |  |  |  |
| FRONTIER ENGINEERING CONSULTANTS CO., LTD. |      |           |         |          | REVIEWED S. KITICHAJ  |  |  |  |  |
| DESIGNED                                   |      |           |         |          | SUBMITTED             |  |  |  |  |
| DRAWN                                      |      |           |         |          | RECOMMENDED           |  |  |  |  |
| CHECKED                                    |      |           |         |          | APPROVED              |  |  |  |  |
| PROJECT MANAGER                            |      |           |         |          | DATE 14/01/82         |  |  |  |  |
|                                            |      |           |         |          | DRAWING NO. LPP-BC-04 |  |  |  |  |
|                                            |      |           |         |          | SHEET NO. 40 OF 44    |  |  |  |  |

|                                                                                                                       |                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |                                                                                               |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |                                                                                               |
| <p>CIVIL WORKS<br/>BY-PASS CHUTE<br/>WATERSTOP DETAILS</p>                                                            |                                                                                               |
| <p>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</p>                                                                     | <p>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |
| <p>DESIGNED</p>                                                                                                       | <p>REVIEWED S. KITICHAJ</p>                                                                   |
| <p>DRAWN</p>                                                                                                          | <p>SUBMITTED</p>                                                                              |
| <p>CHECKED</p>                                                                                                        | <p>RECOMMENDED</p>                                                                            |
| <p>APPROVED</p>                                                                                                       | <p>DATE 14/01/82</p>                                                                          |
| <p>PROJECT MANAGER</p>                                                                                                | <p>DRAWING NO. LPP-BC-04</p>                                                                  |
| <p>DATE</p>                                                                                                           | <p>SHEET NO. 40 OF 44</p>                                                                     |



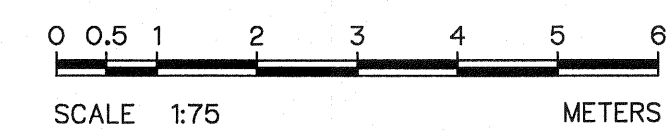
KEY PLAN  
SCALE 1:75

NOTES :

- ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
- SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
- LOCATIONS OF LAP SPLICES SHALL BE DETERMINED IN FIELD UNDER THE APPROVAL OF FIELD ENGINEER.

REFERENCE DRAWINGS :

- |                                             |           |
|---------------------------------------------|-----------|
| 1. BY-PASS CHUTE, GENERAL PLAN & SECTION    | LPP-BC-01 |
| 2. BY-PASS CHUTE, REINFORCEMENT DETAILS 1/2 | LPP-BC-06 |
| 3. BY-PASS CHUTE, REINFORCEMENT DETAILS 2/2 | LPP-BC-07 |



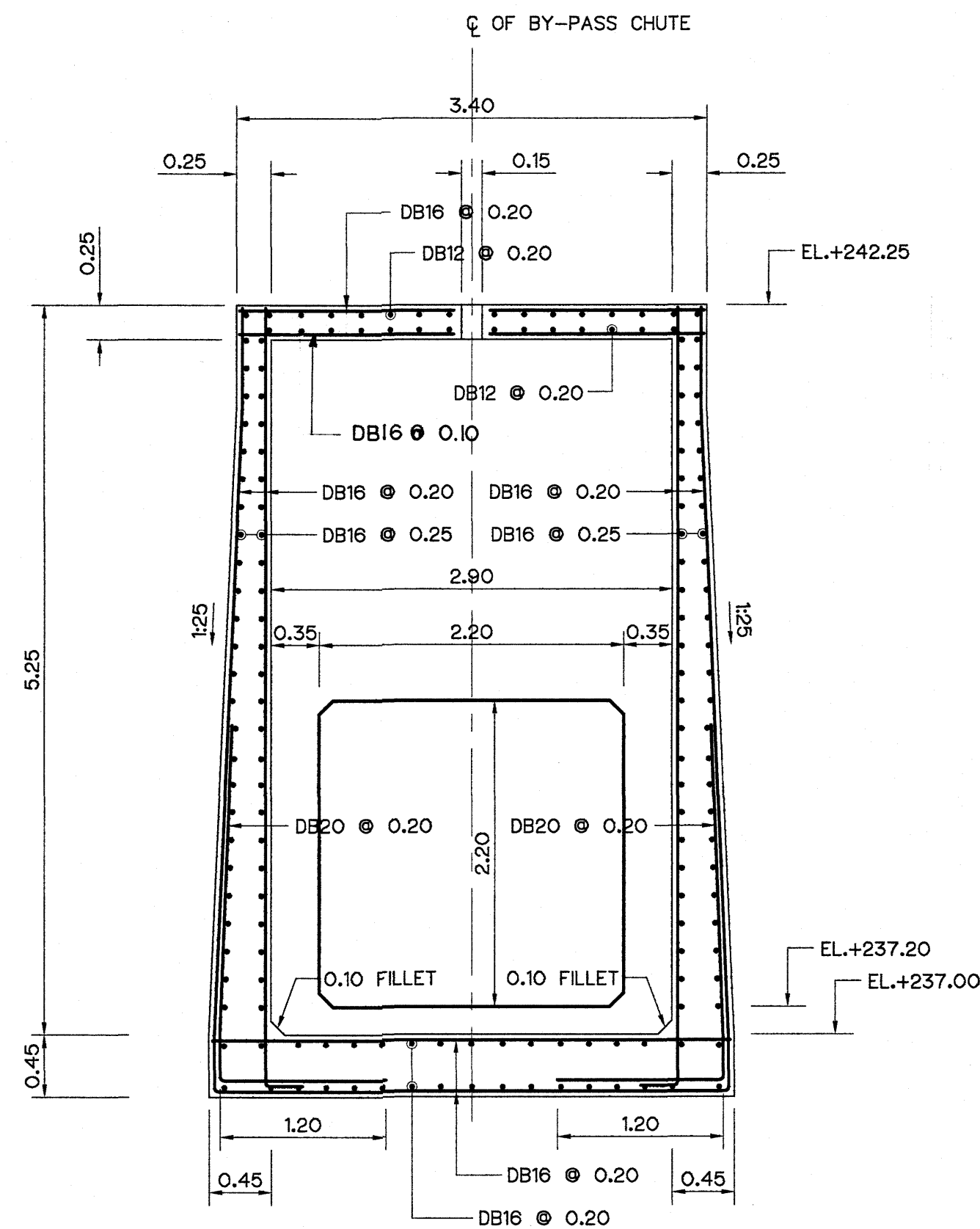
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|-----|------|-----------|---------|----------|
| 2   |      |           |         |          |
| 1   |      |           |         |          |
| NO. | DATE | REVISIONS | CHECKED | APPROVED |
|     |      |           |         |          |

CONSULTANTS

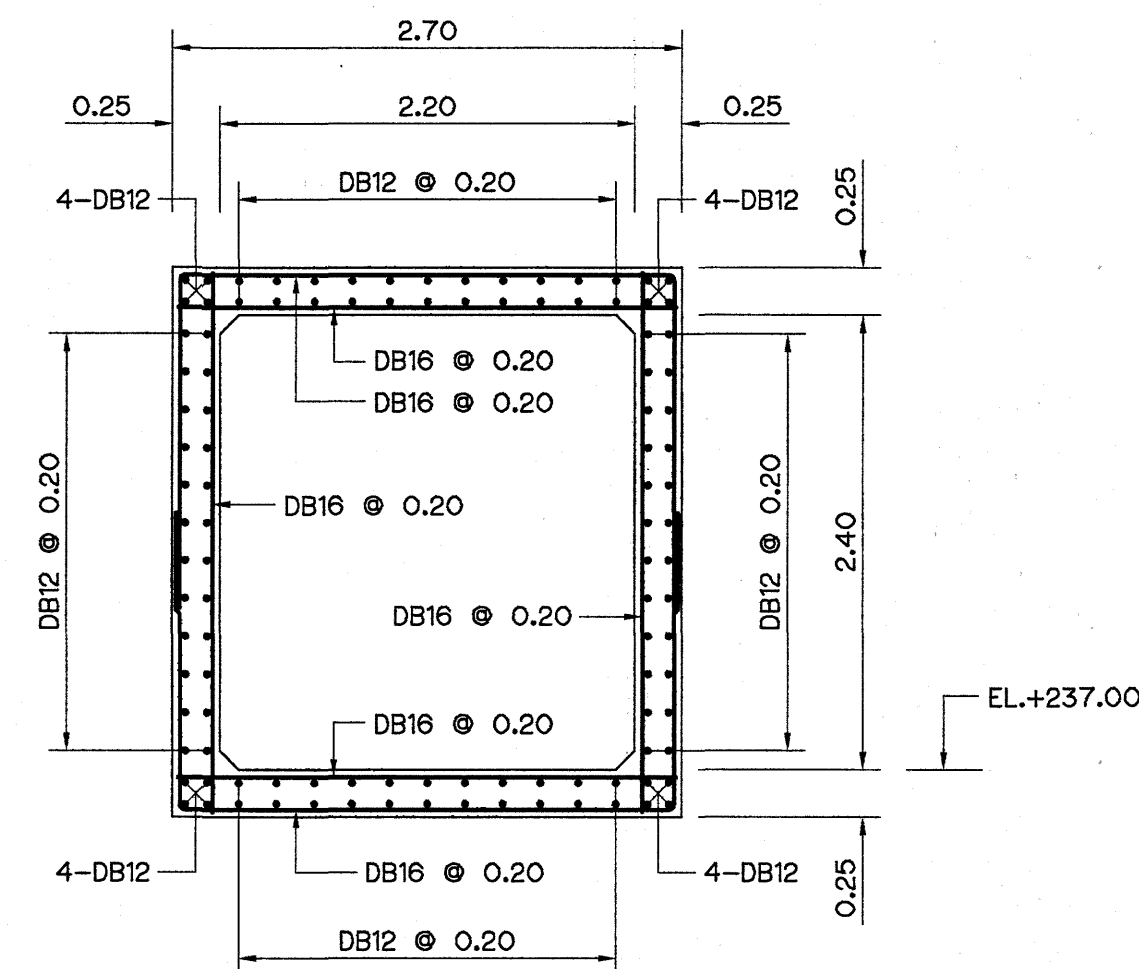
DEDE

|                                                                                                                       |                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |                                                                                               |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |                                                                                               |
| <p>CIVIL WORKS<br/>BY-PASS CHUTE<br/>REINFORCEMENT KEY PLAN</p>                                                       |                                                                                               |
| <p>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</p>                                                                     | <p>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |
| <p>DESIGNED <i>[Signature]</i> 22.6651</p>                                                                            | <p>REVIEWED <b>S. KITICHAJ</b></p>                                                            |
| <p>DRAWN <i>[Signature]</i></p>                                                                                       | <p>SUBMITTED <i>[Signature]</i></p>                                                           |
| <p>CHECKED <i>[Signature]</i> 22.7324</p>                                                                             | <p>RECOMMENDED <i>[Signature]</i></p>                                                         |
| <p>APPROVED <i>[Signature]</i></p>                                                                                    | <p>APPROVED <i>[Signature]</i></p>                                                            |
| <p>PROJECT MANAGER</p>                                                                                                | <p>DRAWING NO. LPP-BC-05</p>                                                                  |
| <p>DATE 14/01/62</p>                                                                                                  | <p>SHEET NO. 41 OF 44</p>                                                                     |

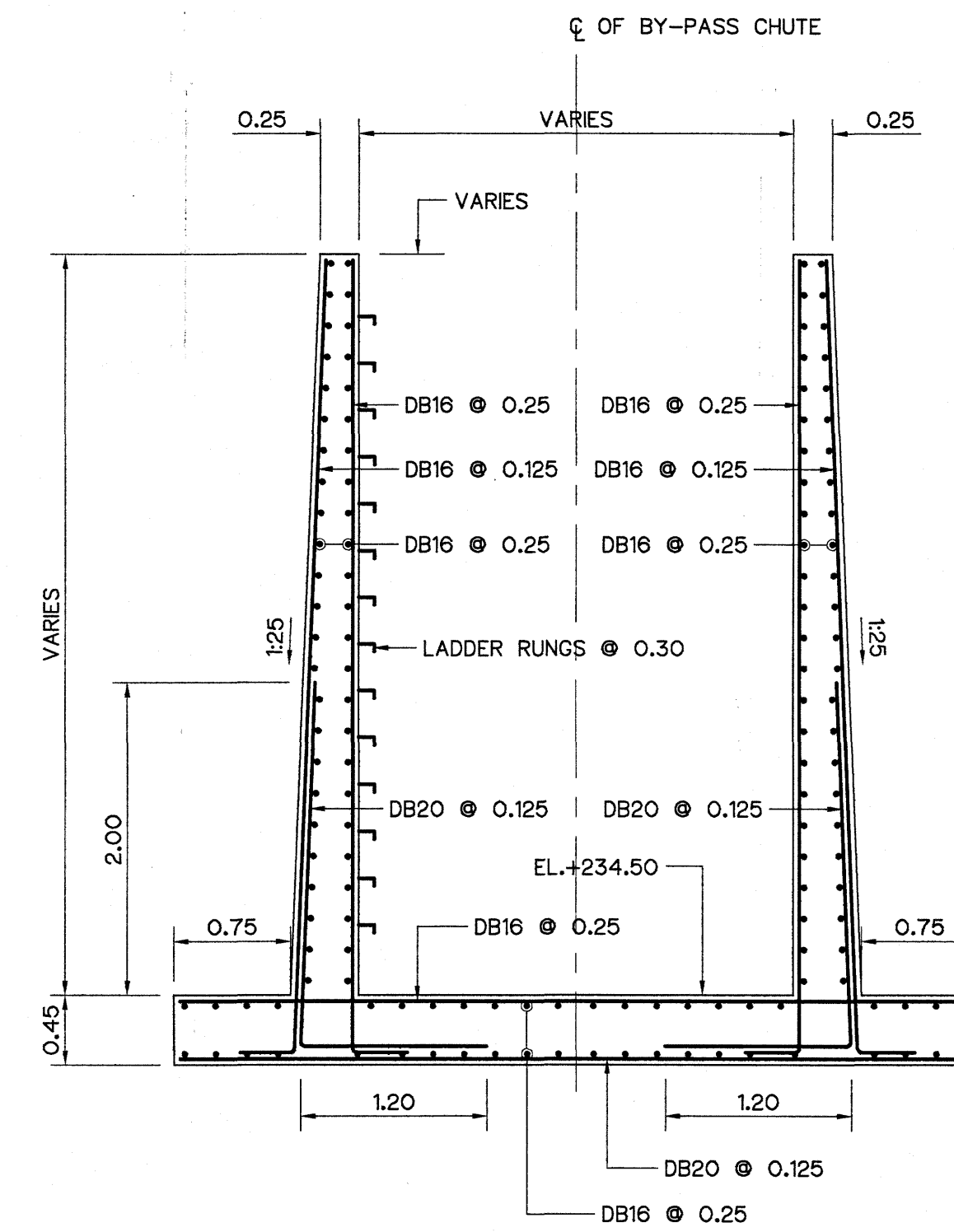




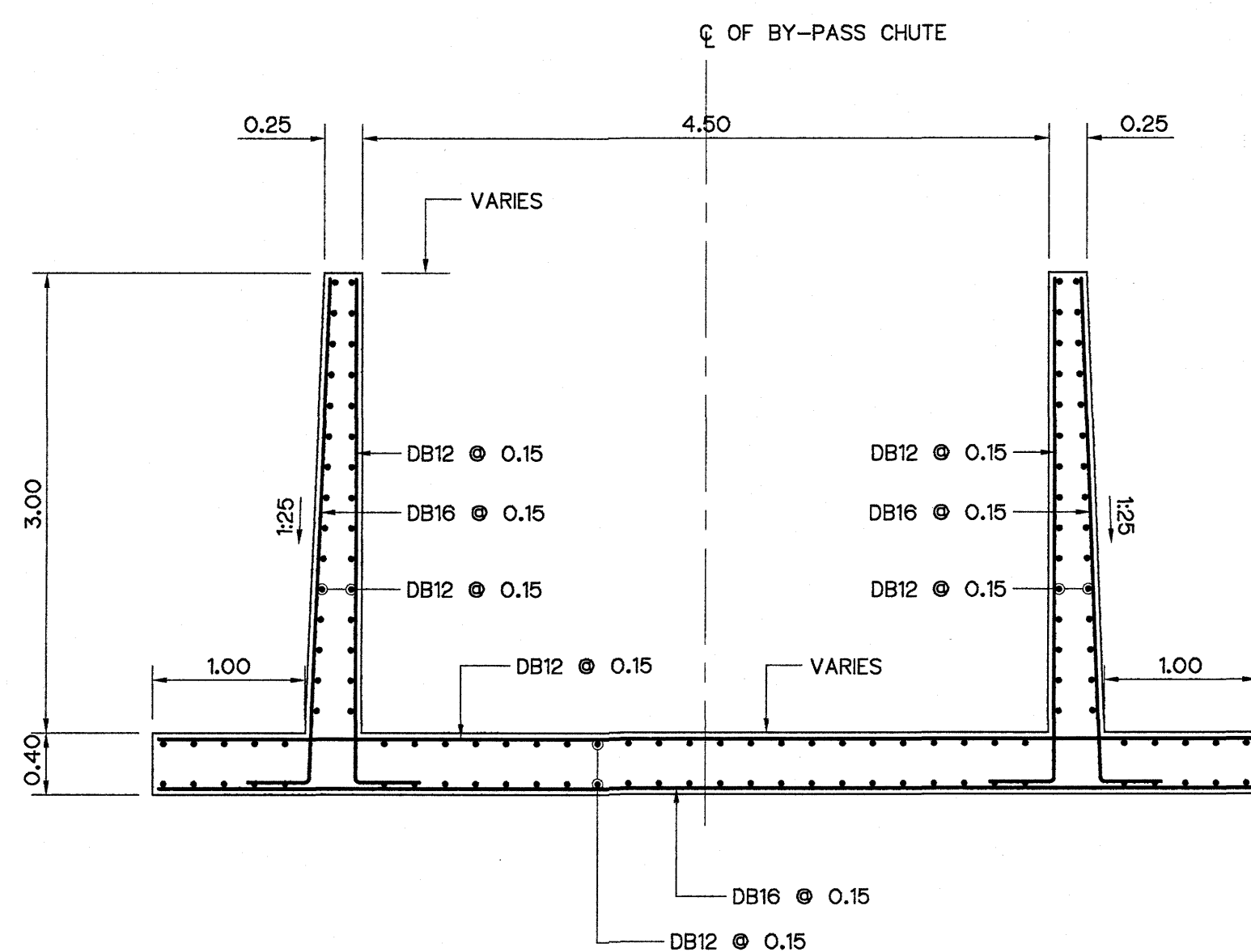
SECTION B-B  
SCALE 1:40



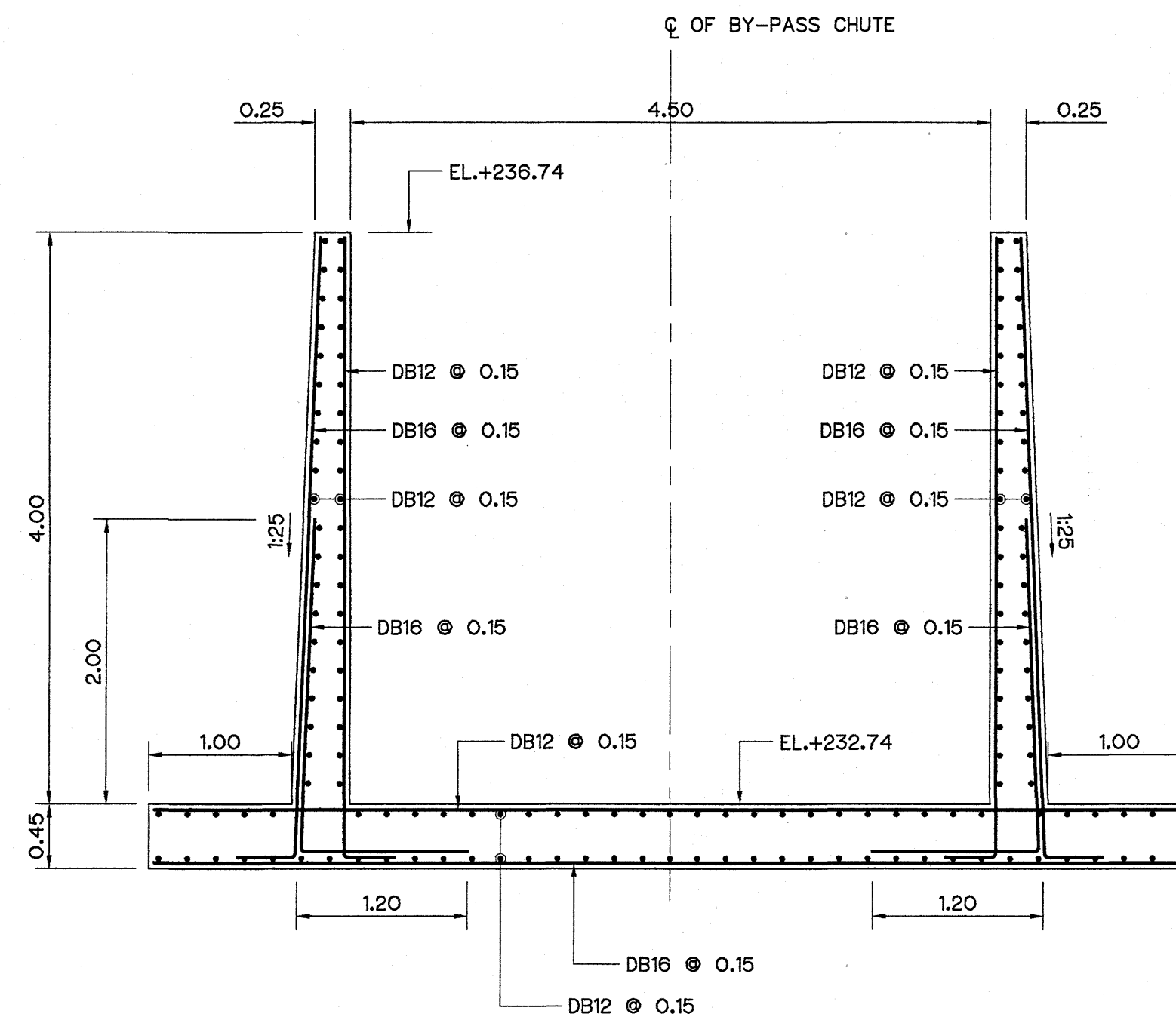
SECTION C-C  
SCALE 1:40



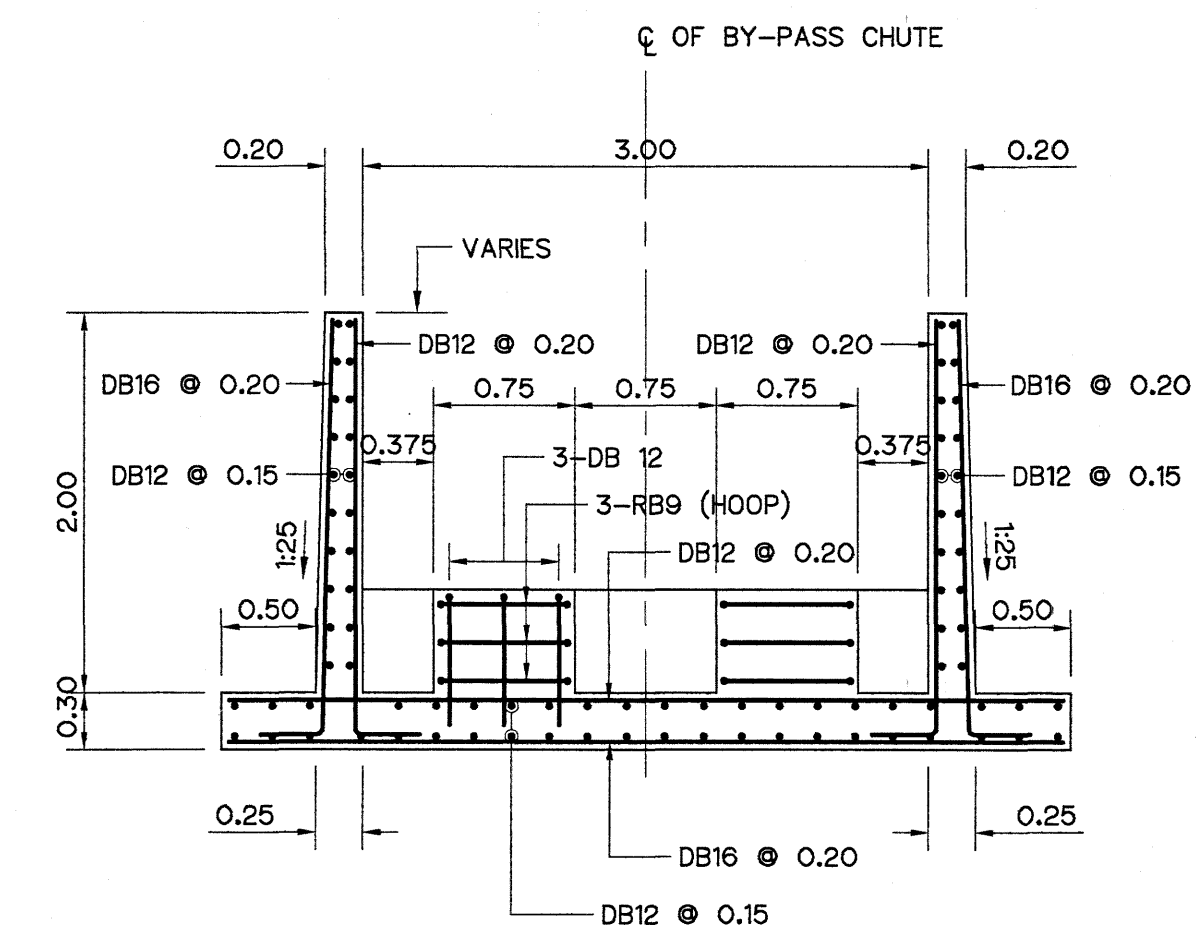
SECTION D-D  
SCALE 1:40



SECTION E-E  
SCALE 1:40



SECTION F-F  
SCALE 1:40



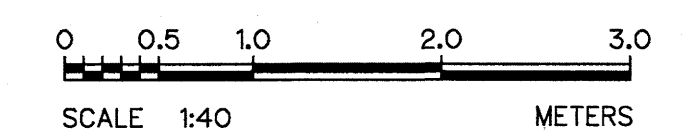
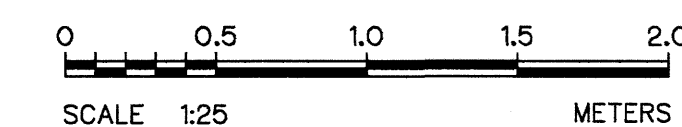
SECTION G-G  
SCALE 1:40

#### NOTES :

1. ALL DIMENSIONS AND ELEVATIONS (M.S.L.) ARE IN METERS, UNLESS OTHERWISE SHOWN.
2. SYMBOLS, ABBREVIATIONS AND GENERAL NOTES SEE DWG. NO. LPP-GN-03.
3. LOCATIONS OF LAP SPLICES SHALL BE DETERMINED IN FIELD UNDER THE APPROVAL OF FIELD ENGINEER.

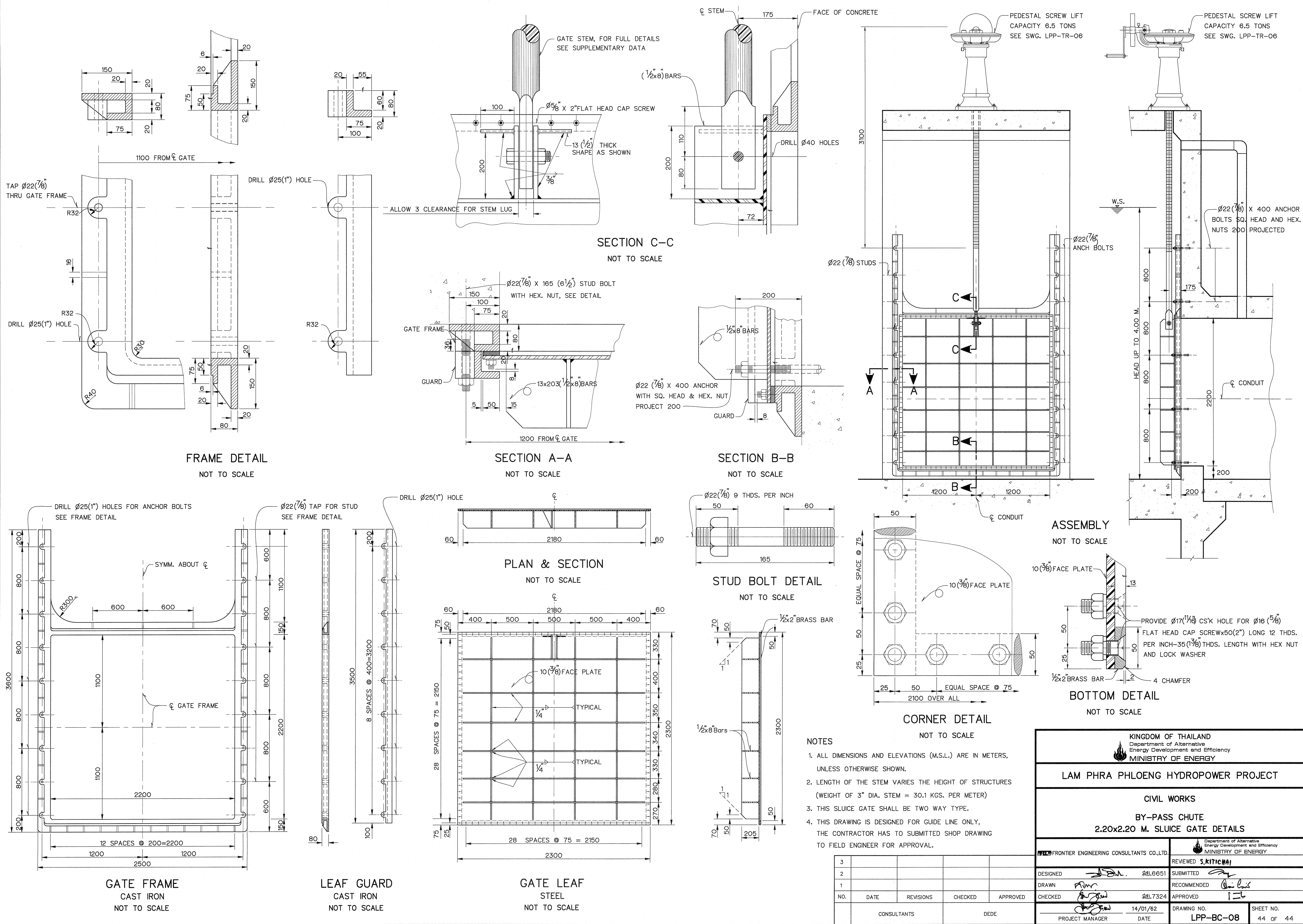
#### REFERENCE DRAWINGS :

1. BY-PASS CHUTE, REINFORCEMENT KEY PLAN LPP-BC-05
2. BY-PASS CHUTE, REINFORCEMENT DETAILS 1/2 LPP-BC-06



|                                                |  |  |  |  |                                                |  |  |  |  |
|------------------------------------------------|--|--|--|--|------------------------------------------------|--|--|--|--|
| <p>0 0.5 1.0 1.5 2.0<br/>SCALE 1:25 METERS</p> |  |  |  |  | <p>0 0.5 1.0 2.0 3.0<br/>SCALE 1:40 METERS</p> |  |  |  |  |
| <p>3</p>                                       |  |  |  |  | <p>DESIGNED <i>[Signature]</i> 22.0651</p>     |  |  |  |  |
| <p>2</p>                                       |  |  |  |  | <p>DRAWN <i>[Signature]</i> 22.7324</p>        |  |  |  |  |
| <p>1</p>                                       |  |  |  |  | <p>CHECKED <i>[Signature]</i> 14/01/62</p>     |  |  |  |  |
| <p>NO. DATE REVISIONS CHECKED APPROVED</p>     |  |  |  |  | <p>PROJECT MANAGER DATE</p>                    |  |  |  |  |
| <p>CONSULTANTS DEDE</p>                        |  |  |  |  | <p>SHEET NO. 43 OF 44</p>                      |  |  |  |  |

|                                                                                                                       |                                       |
|-----------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |                                       |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |                                       |
| <p>CIVIL WORKS<br/>BY-PASS CHUTE<br/>REINFORCEMENT DETAILS 2/2</p>                                                    |                                       |
| <p>FRONTIER ENGINEERING CONSULTANTS CO., LTD.</p>                                                                     | <p>REVIEWED <i>[Signature]</i></p>    |
| <p>DESIGNED <i>[Signature]</i> 22.0651</p>                                                                            | <p>SUBMITTED <i>[Signature]</i></p>   |
| <p>DRAWN <i>[Signature]</i> 22.7324</p>                                                                               | <p>RECOMMENDED <i>[Signature]</i></p> |
| <p>CHECKED <i>[Signature]</i> 14/01/62</p>                                                                            | <p>APPROVED <i>[Signature]</i></p>    |
| <p>DRAWING NO. LPP-BC-07</p>                                                                                          | <p>SHEET NO. 43 OF 44</p>             |



|                                                                                                                       |  |  |                                   |  |
|-----------------------------------------------------------------------------------------------------------------------|--|--|-----------------------------------|--|
| <p>KINGDOM OF THAILAND<br/>Department of Alternative<br/>Energy Development and Efficiency<br/>MINISTRY OF ENERGY</p> |  |  |                                   |  |
| <p>LAM PHRA PHLOENG HYDROPOWER PROJECT</p>                                                                            |  |  |                                   |  |
| <p>CIVIL WORKS</p>                                                                                                    |  |  |                                   |  |
| <p>BY-PASS CHUTE</p>                                                                                                  |  |  |                                   |  |
| <p>2.20x2.20 M. SLUICE GATE DETAILS</p>                                                                               |  |  |                                   |  |
| <p>FRONTIER ENGINEERING CONSULTANTS CO.,LTD.</p>                                                                      |  |  | <p>REVIEWED <b>S.KITICHAJ</b></p> |  |
| <p>DESIGNED <b>S.D.A.</b> 28.6.651</p>                                                                                |  |  | <p>SUBMITTED <b>S.D.A.</b></p>    |  |
| <p>DRAWN <b>S.D.A.</b></p>                                                                                            |  |  | <p>RECOMMENDED <b>S.D.A.</b></p>  |  |
| <p>CHECKED <b>S.D.A.</b> 28.7.324</p>                                                                                 |  |  | <p>APPROVED <b>S.D.A.</b></p>     |  |
| <p>CONSULTANTS</p>                                                                                                    |  |  | <p>DEDE</p>                       |  |
| <p>PROJECT MANAGER</p>                                                                                                |  |  | <p>DATE 14/01/82</p>              |  |
|                                                                                                                       |  |  | <p>DRAWING NO. LPP-BC-08</p>      |  |
|                                                                                                                       |  |  | <p>SHEET NO. 44 OF 44</p>         |  |