



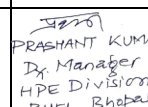
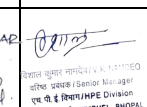
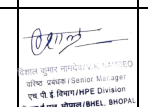
1025387/2022/HEP-III 	<b>HYDRO PROJECTS ENGINEERING DIVISION</b>	<b>SPECIFICATION NO.</b>	<b>REV 00</b>
	<b>TITLE : ULTRASONIC FLOW MEASUREMENT SYSTEM</b>	<b>241526468</b>	<b>Page 1 of 10</b>


**PROJECT: ARUN-III HEP****1. SCOPE:**

SL NO.	ITEM DESCRIPTION	QUANTITY
1.	SUPPLY OF 8-PATH INSERTION TYPE EXTERNALLY MOUNTED ULTRASONIC FLOW MEASUREMENT SYSTEM AS PER DETAILED SCOPE OF SUPPLY CLAUSE NO. 3	4 sets
2	SUPPLY OF 8 NOS INSERTION TYPE EXTERNALLY MOUNTED SENSORS <b>AS SPARES</b> FOR ULTRASONIC FLOW MEASUREMENT SYSTEM	1 Set
3	SUPPLY OF 2-PATH INSERTION TYPE EXTERNALLY MOUNTED ULTRASONIC FLOW MEASUREMENT SYSTEM FOR OVER VELOCITY PROTECTION, TRIPPING AND FLOW MEASUREMENT AS PER DETAILED SCOPE OF SUPPLY CLAUSE NO. 3	2 Sets
4.	INSTALLATION OF ALL THE ABOVE SENSORS (4 SETS & 2 SETS) AT ARUN-III HEP NEPAL	1 LOT
5	COMMISSIONING OF 2 SETS OF 8-PATH ULTRASONIC FLOW MEASUREMENT SYSTEM AND 1 SET OF OVER VELOCITY PROTECTION, TRIPPING & FLOW MEASUREMENT SYSTEM AT ARUN-III HEP NEPAL	1 LOT
6	COMMISSIONING OF 2 SETS OF 8-PATH ULTRASONIC FLOW MEASUREMENT SYSTEM AND 1 SET OF OVER VELOCITY PROTECTION, TRIPPING & FLOW MEASUREMENT SYSTEM AT ARUN-III HEP NEPAL	1 LOT

**2 APPLICATION:**

8-path Ultrasonic Flow Measurement System (Acoustic type) asked in this specification are to be used individually for continuous on-line monitoring of flow passing through the Turbine in all the 4 units. Externally Mounted Insertion Type Turbine Flow Meter in '4-Planes 8-Paths with 16 sensors' shall be provided in each Penstock for measurement of flow. The Turbine Flow Meter shall be supplied, installed and commissioned in accordance with IEC-60193, Appendix J for each Turbine for measurement of flow. The supplied instrument shall be compliant to IEC 60041-1991 and shall be suitable for dam/river water applications.

REV.NO.		DISTRIBUTION.	QTY.	APPROVED:			
PREPARED				 अमित पाण्डेय/AMIT PANDEY रा. प्र. वि. विभाग / Dy. General Manager रा. प्र. वि. विभाग / H.P.E. Division			
CHECKED		HTE	01	PREPARED	CHECKED	ISSUED	DATE
APPROVED		MM(H)	04	 प्रशान्त कुमार Dy. Manager HPE Division BHEL, Bhopal	 अमित पाण्डेय/AMIT PANDEY रा. प्र. वि. विभाग / Dy. General Manager रा. प्र. वि. विभाग / H.P.E. Division	 अमित पाण्डेय/AMIT PANDEY रा. प्र. वि. विभाग / Dy. General Manager रा. प्र. वि. विभाग / H.P.E. Division	29.07.22


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The flow meter system supplied shall include all the equipment and interconnecting wiring required to measure the flow rate & flow velocity for display the measured values. The interconnecting cables between the transducers and the flow meter system shall be properly shielded to keep the transducer signal free of undesirable noise normally encountered in a Hydro Power House. The Flow meter shall measure Flow velocity and totalize the volume of Flow to a **guaranteed accuracy of  $\pm 1$  %** or better compliant to IEC- 60041 requirement.

The equipment shall indicate flow rate through each Penstock via local display at flow meter console, the path velocity, signal strength and mean velocity in the pipe, 4-20 mA analogue output for the flow rate of each pipe and suitable communication port for data transfer and PC interface.

The 2-Path Over Velocity Detection, Tripping & Flow Measurement system Device shall use Externally Mounted Insertion Type Ultrasonic Sensors installed near Penstock Guard Valve. The flow measurement system shall not get affected by suspended solids like silt/ pebbles etc in the Penstock water. The signals from the 8-Path Flow Meters installed near Turbine shall be summed and compared with the Flow Measured by this flow meter installed near Penstock guard valve. An alarm shall be given when the flow exceeds 5% of maximum Penstock flow. Further, the units shall be stopped and Penstock Valve shall be closed when the difference in flow exceeds 10% (Penstock Burst Condition). The over velocity protection system shall provide the potential free contacts for using alarm and tripping the penstock valve. The device shall also be used for Over velocity trip mechanism to detect rupture of the Penstock. This shall actuate closing solenoid of the Penstock Valve, when the velocity of water exceeds a pre-determined value (in addition to the Penstock differential flow condition stated above).

The mechanism shall be so designed as to make easy and accurate adjustment for operation on overload. The adjustment shall be free from ageing effect and shall have no chance of Penstock vibration disturbing adjustment or causing faulty operations. The Penstock rupture device shall operate even during power failure. The Instrument shall measure Flow velocity and totalize the volume of flow to a **guaranteed accuracy of  $\pm 1$  %** or better compliant to IEC- 60041 requirement.

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### **3. DETAILED SCOPE OF SUPPLY:**

SL. NO.	ITEM DESCRIPTION	QUANTITY	EACH SET COMPRISING OF
1	8-Path Insertion Type Externally Mounted Ultrasonic Flow Measurement System	4 Sets	<p>(a) <b>Flow Meter Console</b> - With Digital Signal Processing, IP65/NEMA 6 X Wall Mounted Enclosure, 2 Line Front Panel Display, 8-Path Flow Measurement Capacity, Measuring Range For Up To +-20m/S, Cabinet to be inclusive of internal Surge Protection, 4-20mA isolated Output Channels , Communication Modbus RTU, Modbus TCP, IEC 60870- 5-104, Embedded Computer Module, Internal Data Logger , Watchdog Timer, Web Interface / browser, no software required, independent of operating system.</p> <p>(b) <b>16 Number Insertion Type Sensing Feed Through Transducers (Sensors)</b> suitable for - 80 bar pressure, Penstock Wall Thickness as specified in drawing, <math>\pm 20</math> m/sec Velocity, All Vent &amp; Shut-off Valves and other hardware for replacement under full flow operating condition, Frequency based on application and also suitable for partially filled pipe.</p> <p>(c) <b>16 Sets of Connectors each with 50 Meter Long cable</b> and all the necessary hardware like cable conduits, clamps, Junction Boxes and other accessories etc required for connection of cables to Flow meter Console.</p> <p>(d) <b>Common Items for 4 Units:</b> Programming Tool with Software, Special Tools &amp; Tackles required for Installation &amp; Commissioning (Like Hydraulic Jack etc), Technical Interface Manual for O&amp;M.</p>

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REV 00

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2	Spare Insertion Type Externally Mounted Ultrasonic Sensors	8 Nos	(a) <b>8 Number Insertion Type Sensing Feed Through Transducers (Sensors) as Spare</b> suitable for - 80 bar pressure, Penstock Wall Thickness as specified in drawing, $\pm 20$ m/sec Velocity, Replacement under full flow condition, Frequency based on application and also suitable for partially filled pipe.
3	2-Path Insertion Type Externally Mounted Ultrasonic Flow Measurement System for Over Velocity Protection, Tripping and Flow Measurement	2 Sets	<p>(a) <b>Flow Meter Console</b> - With Digital Signal Processing, IP65/NEMA 6 X Wall Mounted Enclosure, 2 Line Front Panel Display, 8-Path Flow Measurement Capacity, Measuring Range For Up To <math>\pm 20</math> m/S, Cabinet to be inclusive of internal Surge Protection, 4-20mA isolated Output Channels, Relay outputs for alarm and trip, Communication Modbus RTU, Modbus TCP, IEC 60870- 5-104, Embedded Computer Module, Internal Data Logger, Watchdog Timer, Web Interface / browser, no software required, independent of operating system</p> <p>(b) <b>4 Number Insertion Type Sensing Feed Through Transducers (Sensors)</b> suitable for - 80 bar pressure, Penstock Wall Thickness as specified in drawing, <math>\pm 20</math> m/sec Velocity, All Vent &amp; Shut-off Valves and other hardware for replacement under full flow operating condition, Frequency based on application and also suitable for partially filled pipe.</p> <p>(c) <b>4 Sets of Connectors each with 50 Meter Long cable</b> and all the necessary hardware like cable conduits, clamps, Junction Boxes and other accessories etc required for connection of cables to Flow Console.</p> <p><b>(d) Common Items for 2 Units:</b> Programming Tool with Software, Special Tools &amp; Tackles required for Installation &amp; Commissioning (Like Hydraulic Jack etc), Technical Interface Manual for O&amp;M.</p>

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4	Installation of all the above sensors (4 Sets + 2 Sets ) at Arun-III HEP Nepal	1 Lot	As per Clause 7.0
5	Commissioning of 2 Sets of 8-Path Ultrasonic Flow Measurement System & 1 Set of 2 Path Ultrasonic flow measurement system of Over Velocity Protection & Tripping Device at ARUN-III HEP NEPAL	1 Lot	As per Clause 7.0
6	Commissioning of 2 Sets of 8-Path Ultrasonic Flow Measurement System & 1 Set of 2 Path Ultrasonic flow measurement system of Over Velocity Protection & Tripping Device at ARUN-III HEP NEPAL	1 Lot	As per Clause 7.0

#### **4. SYSTEM DESCRIPTION:**

##### **a. Flow Meter Console:**

The flow meter console shall be an embedded computer based multi-path, acoustic transit-time type system with digital ISP technique or equivalent.


The Flow Meter Shall be Capable of operating 8 acoustic Paths for Measurement of Flow.

The Processing unit should have the **embedded processor** and it shall be the latest processor utilized by the manufacturer with real time OS (operating Software).

The flow meter console shall measure discrete acoustic travel times to arrive on an average velocity for each of the acoustic paths. The consoles shall evaluate each acoustic signal based on digital signal processing where the processor will have advance knowledge of the shape of the signal, which is expected, and then carries out correlation to identify the correct reflected signal and filter out all those which are distorted by reflections or reverberations.

The flow meter console shall be equipped with an Automatic Gain Control feature to ensure that all received acoustic signals are continuously amplified to useable levels without noise interference. The console shall have the feature to increase the system sensitivity if the processor detects weak signals because of silt/solid deposition on any sensor.

The console shall evaluate and display each acoustic signal received. Each travel time resulting from accepted signals shall be checked to ensure that the measured time is within user-selectable limits.

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These velocity data points shall be integrated to determine the flow rate through the pipe. The method of measuring and computing water velocity shall be independent of the speed of sound in water. The calculation must include the correction of protrusion effects, change in area of cross section, etc.

Flow meter console should be equipped with the integration method for flow and average velocity calculation software as per IEC-60041 recommendation. Flow profiles influenced by size and shape of pipe, by approach flow conditions or by eddies, swirls and wall roughness etc. shall be taken into account for flow calculation.

The flow meter shall provide Web interface / browser. The user shall be able to enter all site-specific and operational parameters via notebook locally or remote. Parameter entry shall be aided by menu-driven, English language prompts on the unit display or through equivalent HMI application.

The Console shall be capable of storing all measurement values for a minimum time period of one year. It shall be possible to download all values from this database.

The console shall be installed in an enclosure suitable for wall mounting. The console shall be equipped LED / LCD Display with touch panel. The display shall be mounted on Din Rail inside of the enclosure and shall be visible without opening the front door of the enclosure.


The system shall have the capability to display individual path variables inclusive a message that indicates the type and path location of a signal interruption or transducer failure.

The system shall have the capability to display individual received signals without using a separate analogous or digital oscilloscope.

The flow meter console shall have a self-test routine that periodically checks for proper operation of the flow meter transceiver, processor, and timing functions. The system shall alert the user to any self-test or acoustic path failure by displaying an error message on the flow meter display. The flow meter shall also provide a message indicating the type and location of any acoustic path problems.

The system shall provide analogous outputs of 4-20 mA current loops representing flow rate, mean velocity, mean signal strength and water temperature in the pipe. The instrument shall provide relay outputs contact closure. An Ethernet port for use with PC type computer shall be provided.

RTU & TCP slave console shall be provided. The RTU & TCP interface shall make flow rate variable including but not limited to flow volume path velocities, gains signals to noise ratio available using standard TRU protocol.

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The flow meter console shall be designated to return to full operation following a short term power interruption with all stored operational parameters value retained.

**b. Insertion Type Feed-through Transducers (Sensors):**

The ultrasonic transit time sensing transducer faces shall be of wetted type in direct contact with the flowing water. Sensing transducer assemblies and mountings shall be constructed of 316L type stainless steel. Maximum design pressure rating of the feed through sensing transducer shall be 80 bars.

The sensor feed through assembly must have safety interlock in order to prevent accidental removal under pressure.

**The sensors offered shall necessarily be of Stainless Steel.**

Special water resistance connectors must be used for the sensors. The sensors should be capable of operating in high silt conditions (silt concentration of 5000 ppm).

**c. Transducer Cables:**

The flow meter supplier shall furnish all cables between the transducers and the flow meter console, which shall be the Co-axial cable which are suitable for long term monitoring in the specified application. Further, all the lugs, ferrules, clamps, Junction Boxes conduits or any other items required for the installation of the system shall be in the scope of the vendor.


**d. Programming tool/ Laptop and Windows Interface:**

The vendor shall supply a suitable programming tool containing necessary software for running the system. This web application independent of operating system shall allow the flow meter operator to easily configure the flow meter for specific operational conditions, provide capability for flow data retrieval, storage & display. Web – application independent of operating system.

**5. PENSTOCK DIAMETER AND DISCHARGE:**

Please refer to the following enclosed drawings for details of Penstock and proposed location of Ultrasonic Flow Measurement System & Over Velocity Tripping Device:

1. PS-C2-AR3-C09
2. PS-C2-AR3-C10
3. PS-C2-AR3-C11

	<b>NEPAL HYDRO PROJECTS ENGINEERING DIVISION</b>	<b>SPECIFICATION NO.</b>	<b>REV 00</b>
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The un-concreted straight length available and access to the respective installation location has been elaborated in the above drawings.

*For 8-Path Ultrasonic Flow Measurement System:*

Penstock Diameter	:	4000 mm
Un-concreted Straight Length available	:	3800 mm
Rated Discharge	:	86.17 cubic meter / sec
Net Head	:	286.21 meters
Ambient Temperature Range	:	8 to 45 degrees Celsius
Humidity	:	95%

*For 2-Path Over Velocity Protection and Tripping System:*

Penstock Diameter	:	5500 mm
Un-concreted Straight Length available	:	5100 mm
Rated Discharge	:	172.4 cubic meter / sec
Static Head	:	60.89 meters
Ambient Temperature Range	:	8 to 45 degrees Celsius
Humidity	:	95%

## **6. FLOW ACCURACY AND STANDARDS APPLICABLE:**

As per contractual requirement, a Flow Accuracy of  $\pm 1$  % shall be required from both the system. The equipment shall be complaint to IEC 60041-1991 and shall be in accordance with IEC-60193, Appendix J.


## **7. INSTALLATION & COMMISSIONING :**

The installation and commissioning of the system shall be carried out at Arun-III HEP, Nepal. The project site is located at a distance of 50 km from Khandbari, the headquarters of Sankhuwa sabha district of Nepal. It is about 240 km from Biratnagar and about 740 km from Kathmandu. The distance from Tumlingtar Town (nearest domestic airport) is about 68 km.

Complete installation of all the sensors shall be carried out by the vendor in one visit. Sensors of all 4 units 8-path system and 2 units of Over Velocity Tripping Device shall be installed in this first visit. Vendor shall be given 4 weeks advance intimation for deputation of installation engineer to site for carrying out the complete installation (4 units + 2 units). The Penstock shall be dry and water filling / Penstock charging will not be done during this stage.

Commissioning of 2 units of 8- Path System and 1 unit of Over Velocity Tripping device shall be done by the vendor in the second visit. Based on the Penstock filling schedule of the end customer, vendor shall be given advance intimation of 2 weeks for deputing their service engineer for commissioning of the system.



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Commissioning of balance 2 units of 8- Path System and balance 1 unit of Over Velocity Tripping device shall be done by the vendor in the third visit. Based on the Penstock filling schedule of the end customer, vendor shall be given advance intimation of 2 weeks for deputing their service engineer for commissioning of the system.

**All the activities related to installation / commissioning/ parameterization should be completed by the vendor in the above three visits.**

Vendor shall offer lump-sum price of Installation/ Commissioning under respective head. Offer of installation / commissioning on per day charge basis/number of visits basis/ to-and-fro fare basis etc shall not be accepted.

The installation /commissioning of the equipment shall be completely in the scope of vendor. All the manpower & material required for installation including boarding /lodging and local transport, Visa , Airport Charges etc shall be borne by the vendor.

Vendors are advised to get necessary information regarding site conditions before submitting their offer.

#### **8. DOCUMENTS REQUIRED WITH THE OFFER:**

The vendor shall submit complete Technical Details/catalogues/write-up of the model offered complying to the specification. Detailed arrangement drawing for installation of sensors shall be required with the offer for our review. The relevant electrical wiring diagrams shall also be included with the offer.


The above documents shall include Sensor Installation and Simulation Procedure. Further, BHEL may ask for other relevant documents related to the offered model during technical evaluation of the offer.

#### **9. DOCUMENTS REQUIRED AFTER PLACEMENT OF ORDER :**

After award of contract, vendor shall submit following drawings / documents for end customer approval within 6 weeks of PO placement:

1. Sensor Installation Drawing of 8-Path System
2. Sensor Installation Drawing of 2-Path System
3. GA Drawing of Flow Meter Console
4. Complete Datasheet of Flow Meter
5. Wiring Diagram

The resubmission of revised drawings/ documents shall be within 1 week of comments. The vendor shall submit calibration certificates, material test certificates and applicable type test reports for BHEL approval and dispatch clearance as per enclosed QA Plan.

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#### **10. GUARANTEE:**

Instrument shall bear suppliers warranty for trouble free operation and good workmanship for a period of 24 Months from the date of dispatch or 12 months from the date of commissioning. Supplier should undertake to replace free of charge any material / components found defective in operation during warranty period.

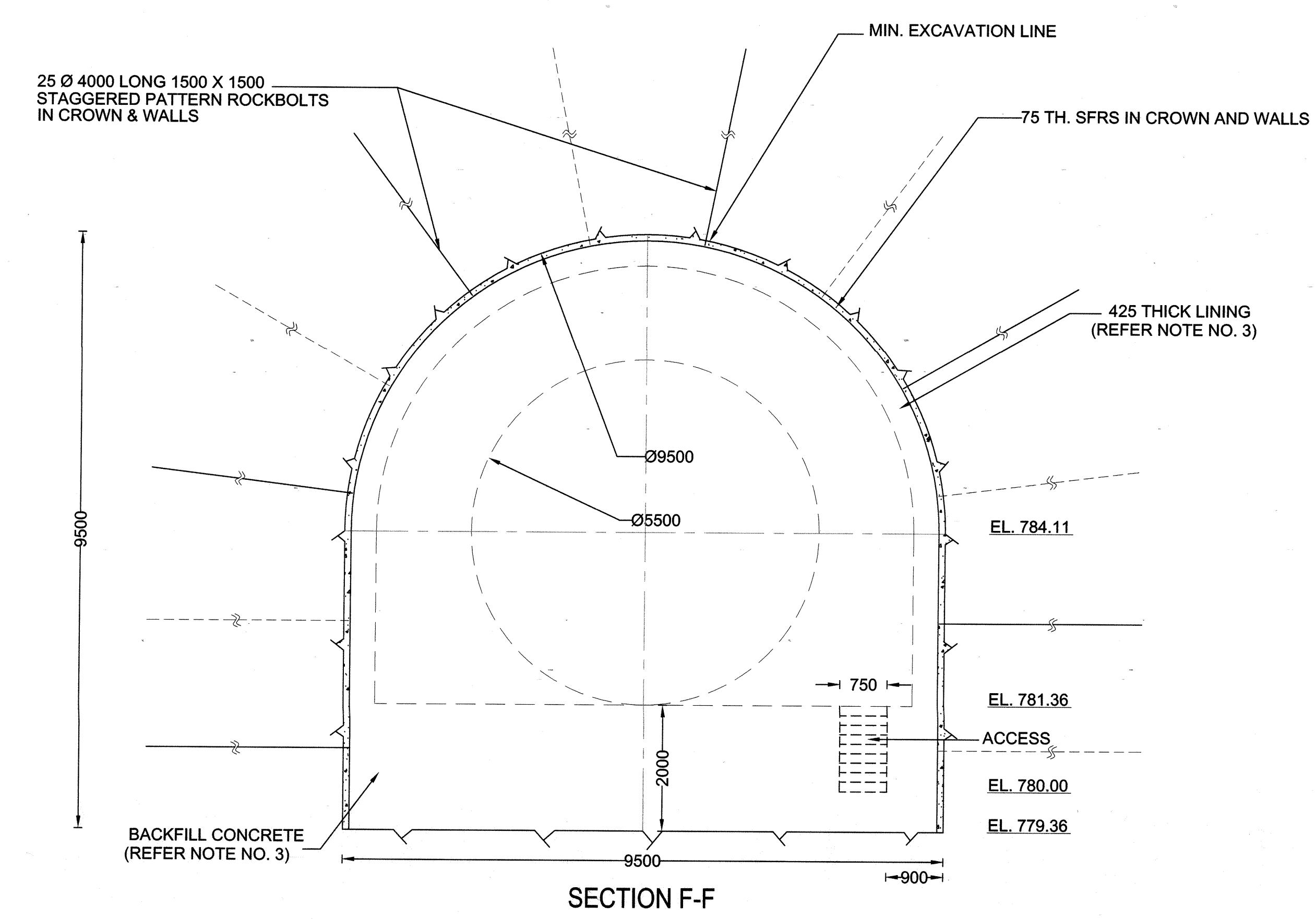
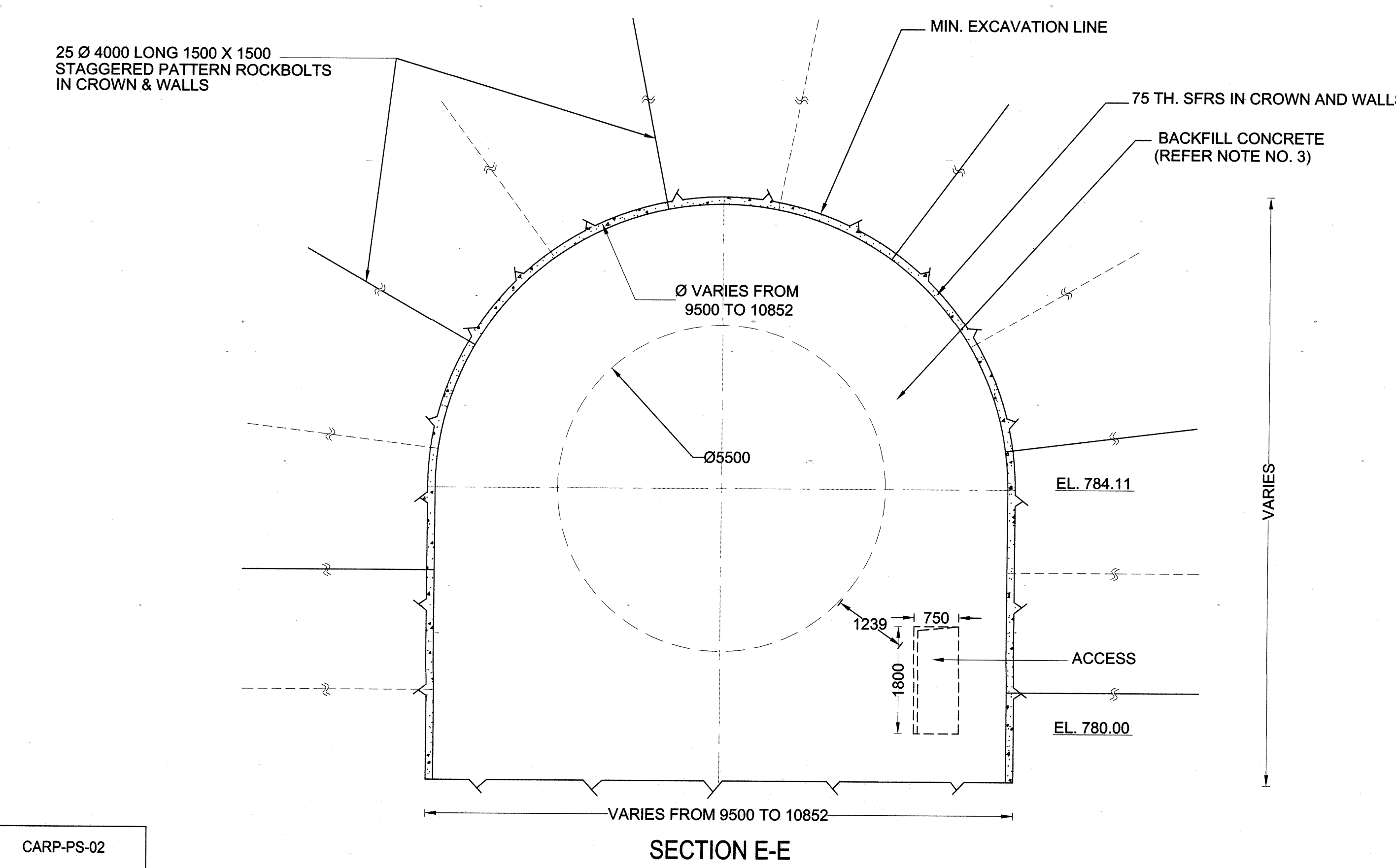
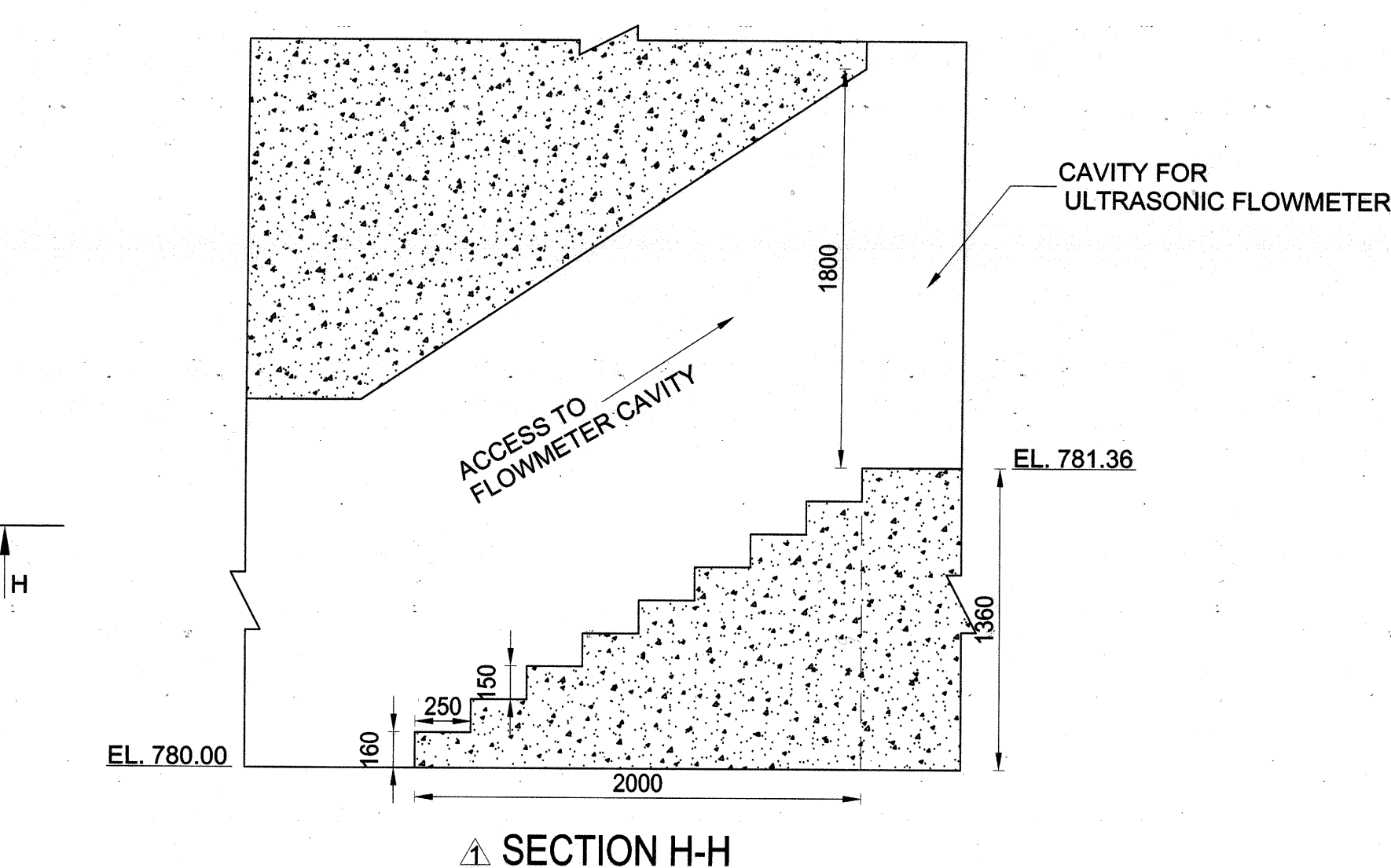
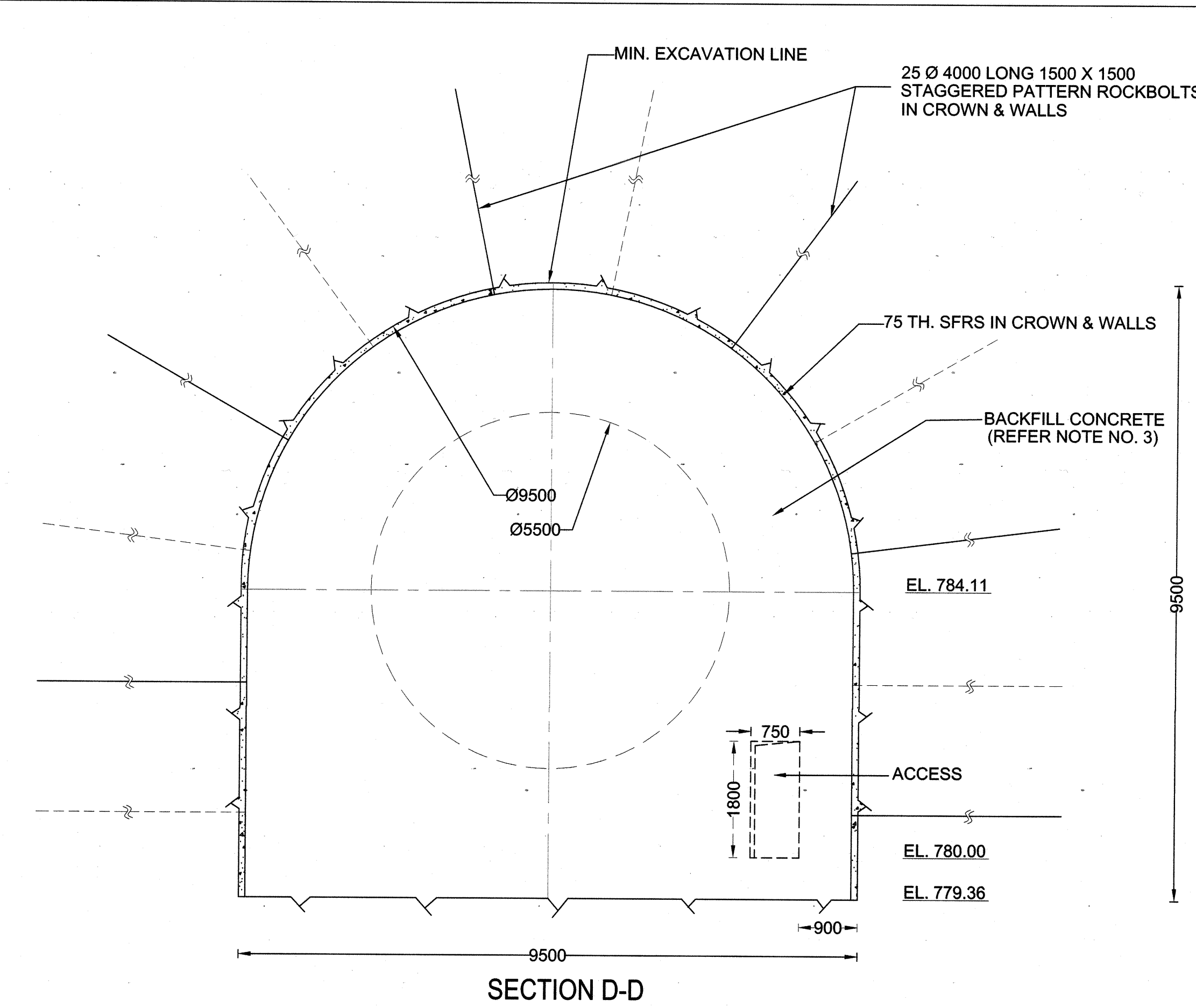
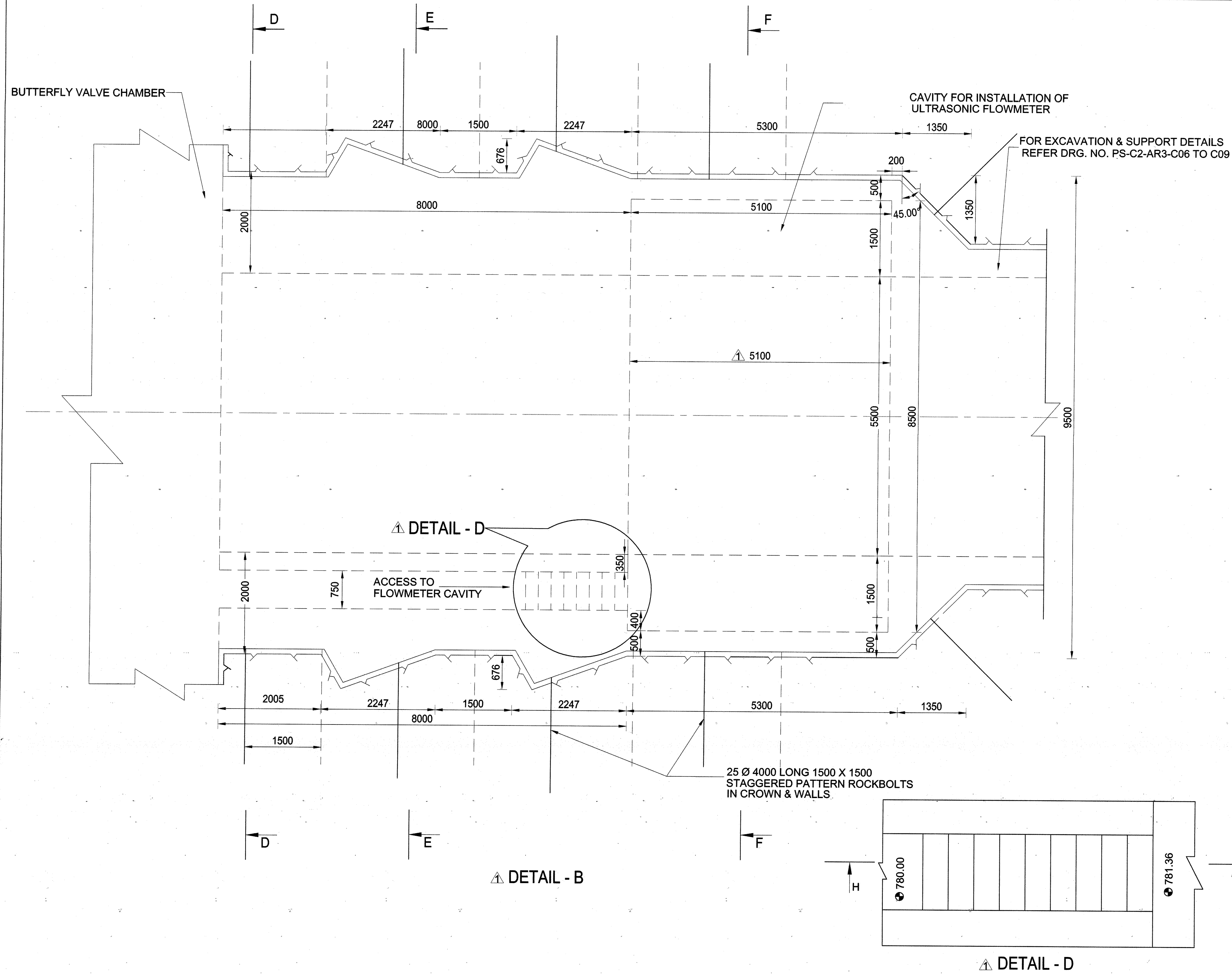
#### **11 PACKING AND O&M MANUALS:**

Instruments shall be packed in with silica gel packet and placed in a cartoon, or case adequate cushioning material, and water proof cover in minimize the movement of internals and ensure that the instrument is capable of withstanding the transit condition without damage.

The vendor shall provide one CD (soft copy of O&M Manuals) with the equipment . The box containing the equipment shall clearly mention Arun-III Project and other relevant details of the equipment inside the box including the Bill of Material.

#### **12 DEVIATIONS FROM THE SPECIFICATION:**

All the vendors have to strictly comply to BHEL's specification while offering the instruments. However, deviations (if any) and exclusions in the scope of supply, installation and commissioning shall be categorically enumerated separately by the vendor in the offer. BHEL reserves the right to accept or reject these deviations after assessing technical / financial implications of the same.

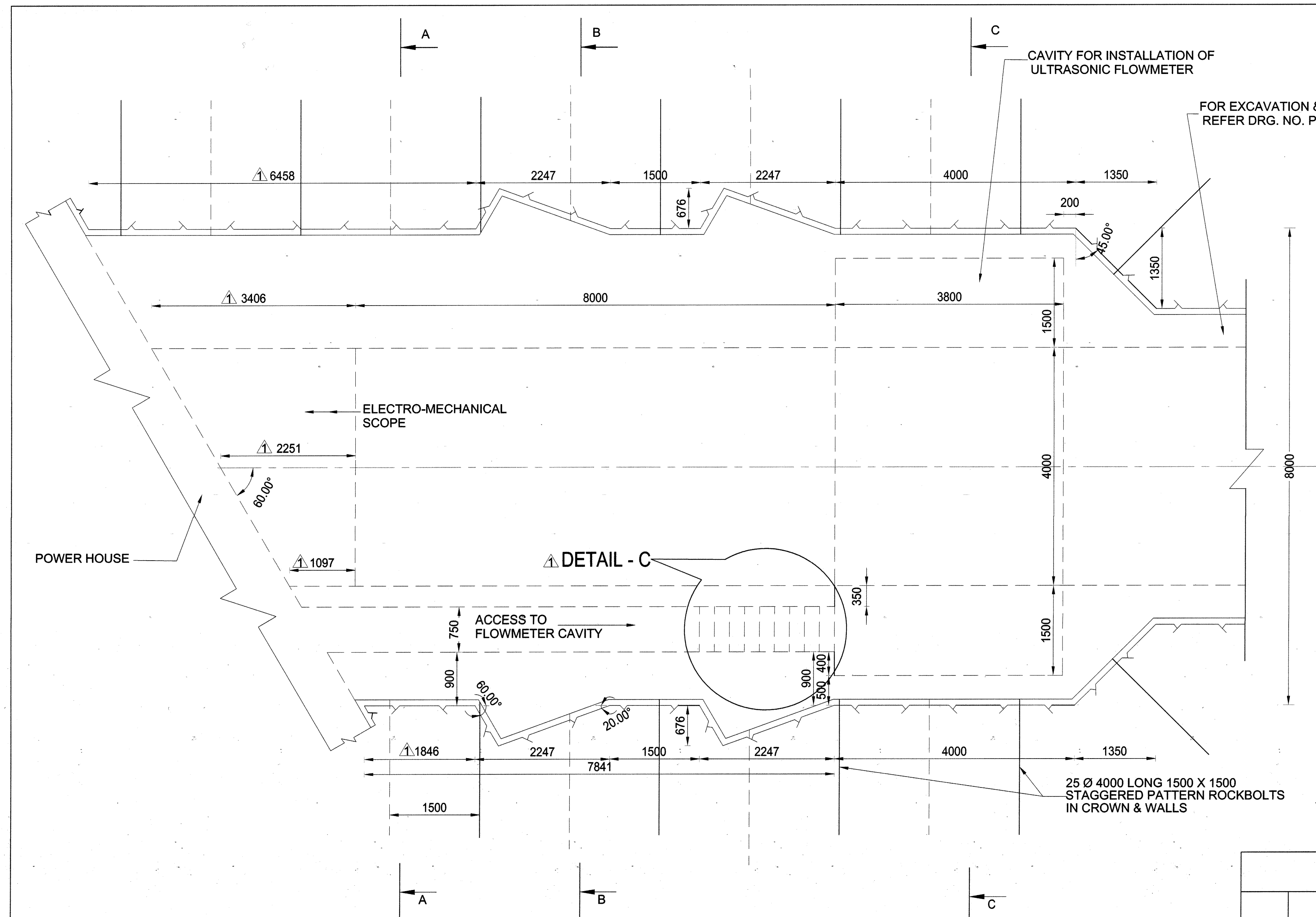


**CONNECTED DRAWINGS :-**

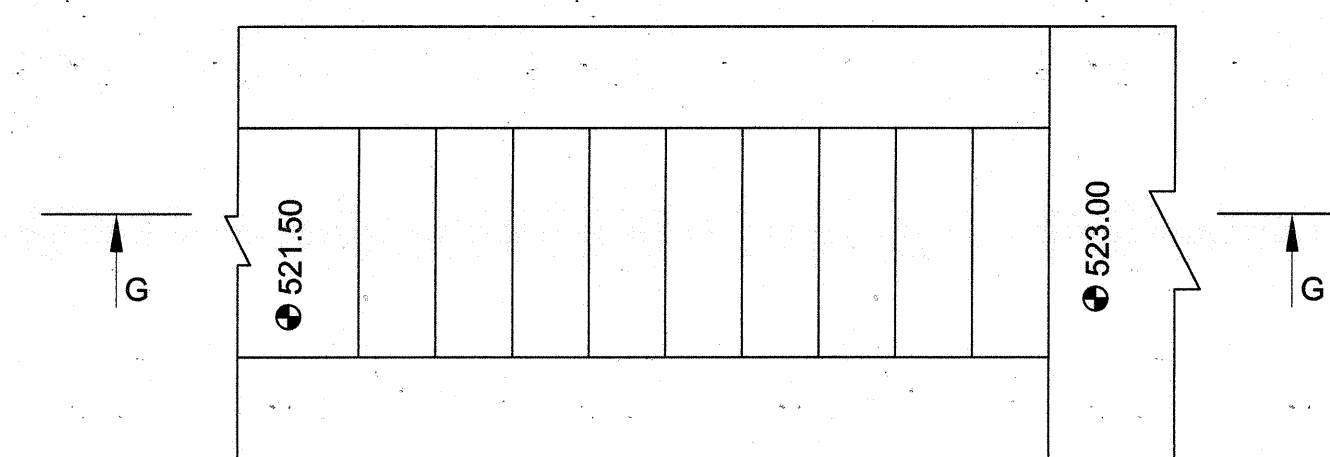
1. PRESSURE SHAFTS- THRUST BLOCKS ...PS-C2-AR3-C9/R1 & C10/R1  
BEHIND MIV & BVC  
EXCAVATION AND SUPPORT SYSTEM DETAILS

CARP-PS-02

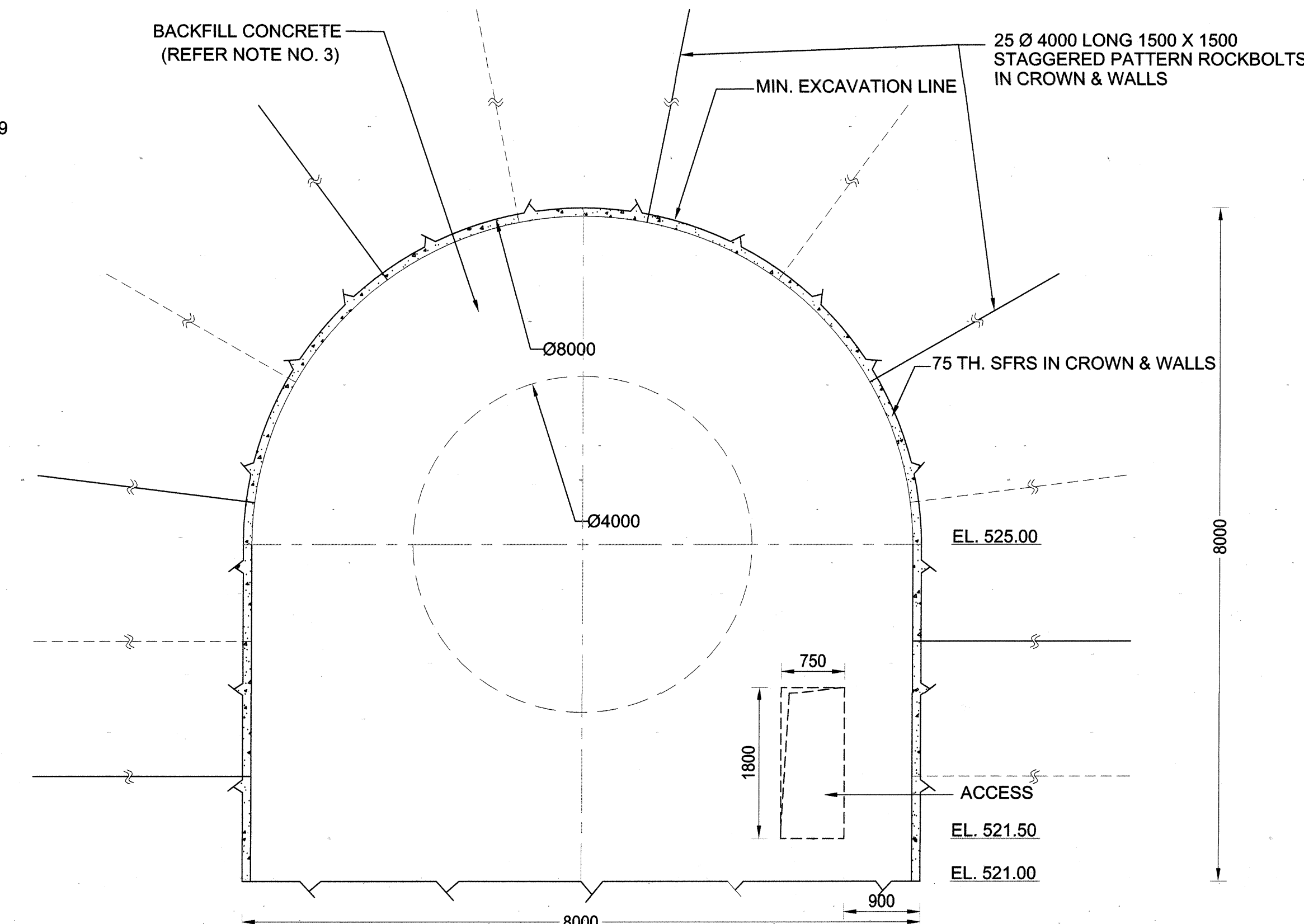
SHEET 3 OF 3		
APPD.	<b>CONSULTANT</b> <b>एसजेवीएन लिमिटेड</b> <b>SJVN LIMITED</b>	
SUBM.	<b>एसएपीडीसी प्रा० लिमिटेड</b> <b>SAPDC (P.) LIMITED</b>	
CHKD.	<b>अरुण ३ जल विद्युत परियोजना नेपाल (९०० मेगावाट)</b> <b>ARUN-3 HYDRO ELECTRIC PROJECT NEPAL (900MW)</b>	
DSGN.	<b>PRESSURE SHAFTS</b> <b>THRUST BLOCKS BEHIND MIV &amp; BVC</b> <b>EXCAVATION AND SUPPORT DETAILS</b>	
DATE	अभिकल्पित DSGN. -sd-	संशोधित CHKD. -sd-
REV.	रखांकित SUBM. -sd-	संशुद्ध RECM. -sd-
16.03.2020	रखांकित SUBM. -sd-	संशुद्ध RECM. -sd-
DRG.NO.	PS-C2-AR3-C11/R1	JAN. 15th, 2019
CD2-AR3-175		



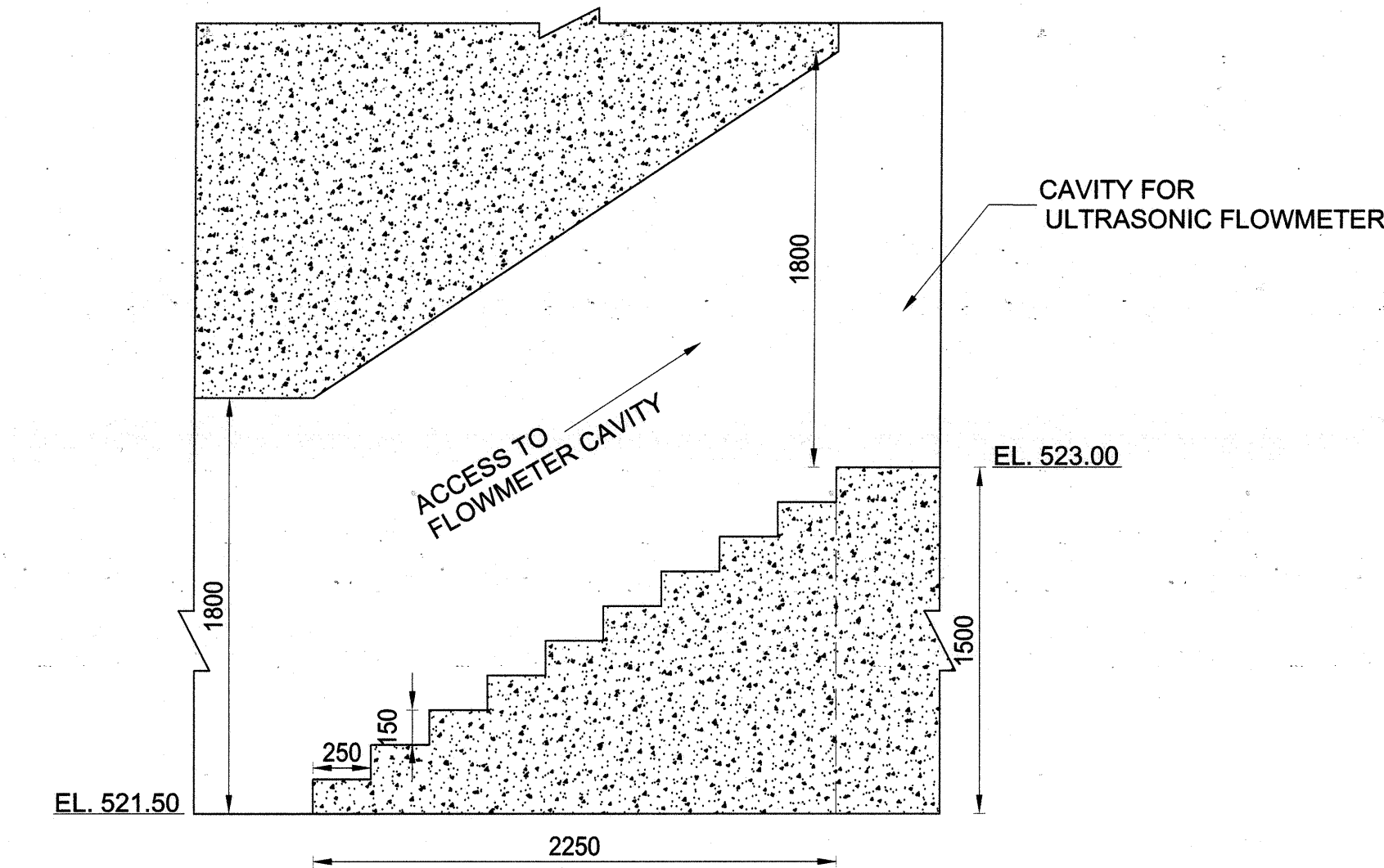
DETAIL - A



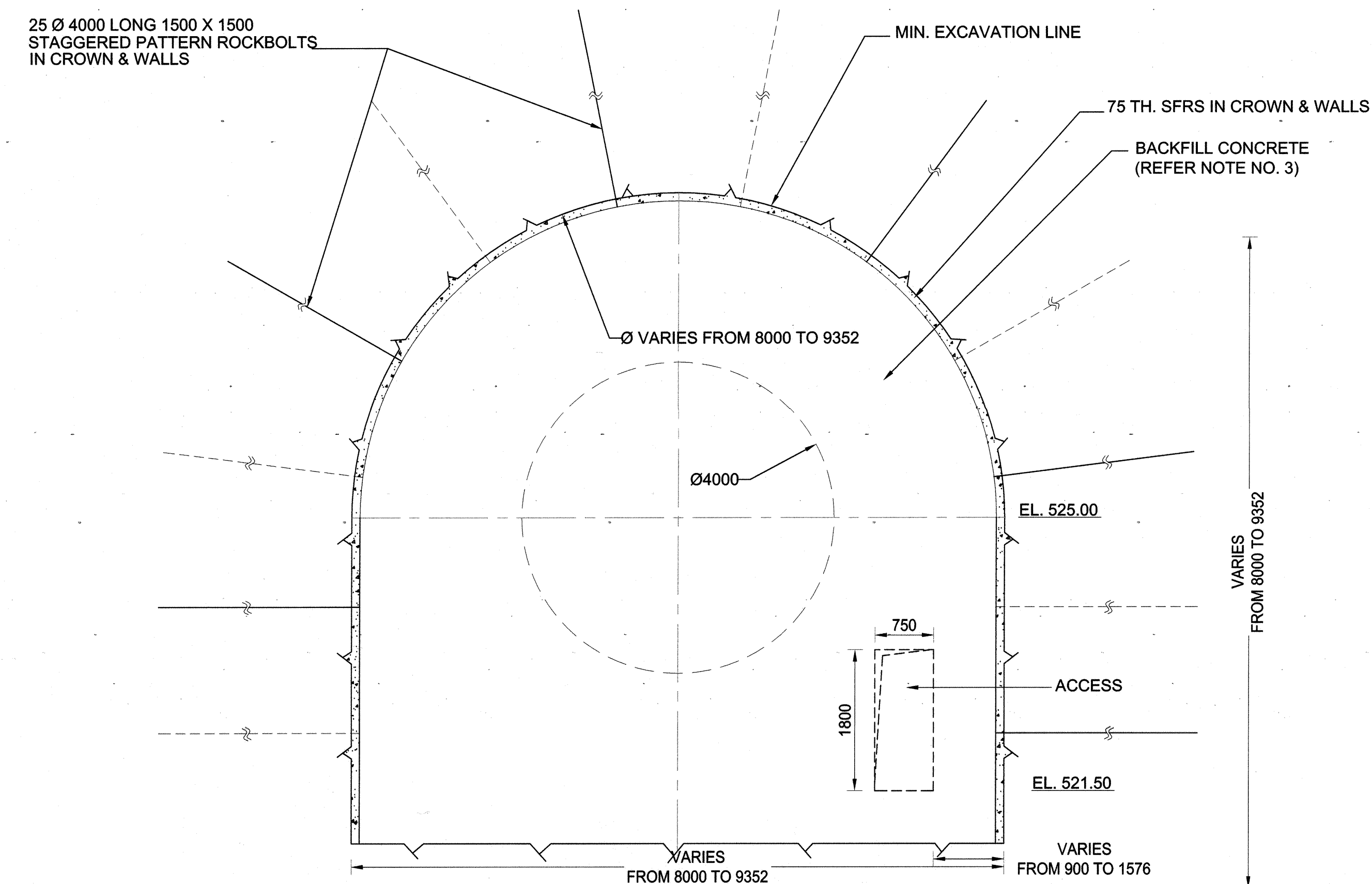
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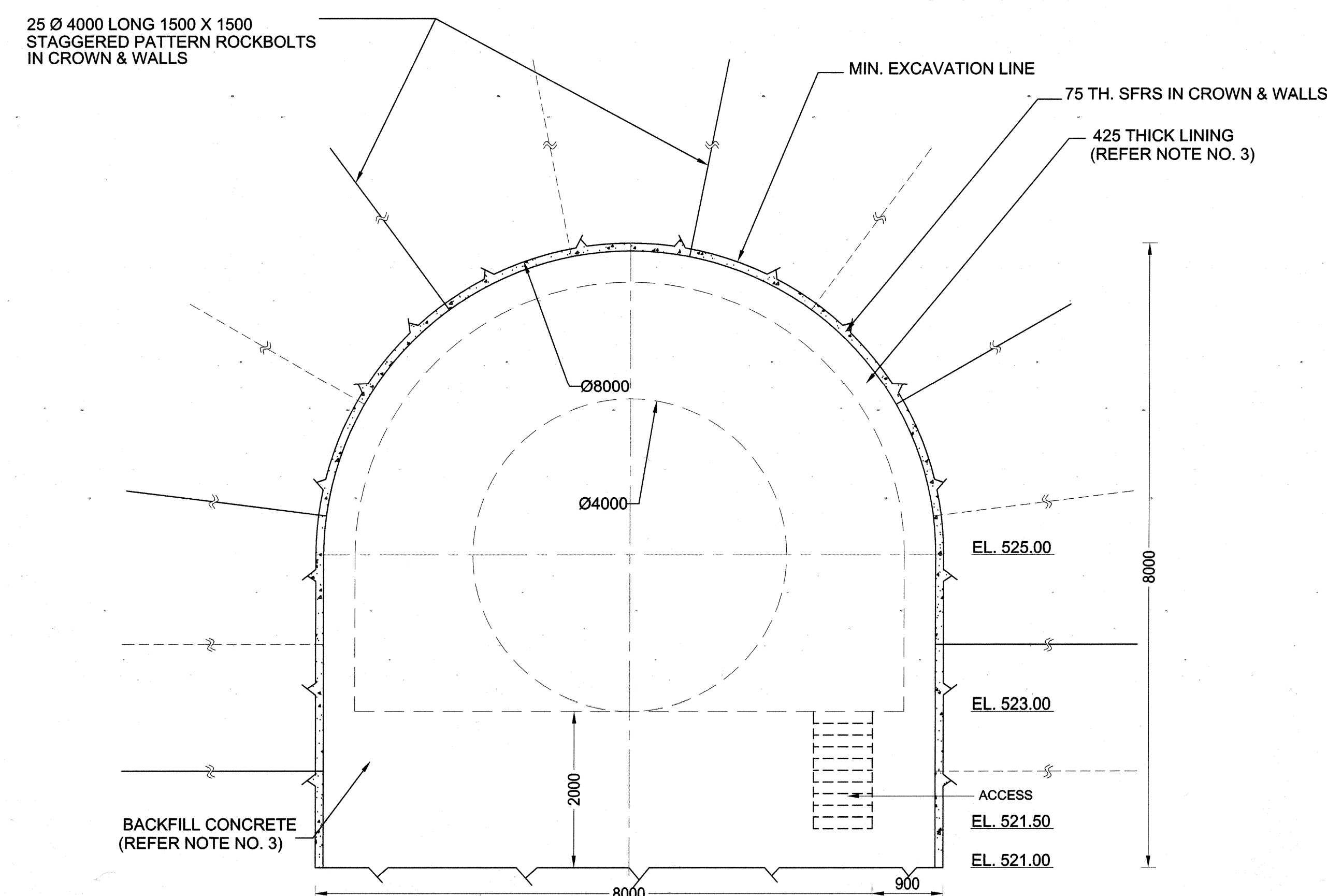
SECTION A-A



SECTION G-G



SECTION B-B



SECTION C-C

## CONNECTED DRAWINGS :-

1. PRESSURE SHAFTS- THRUST BLOCKS ... PS-C2-AR3-C9/R1 & C11/R1 BEHIND MIV & BVC EXCAVATION AND SUPPORT SYSTEM DETAILS

SHEET 2 OF 3

APPD.	CONSULTANT एसजेवीएन लिमिटेड SJVN LIMITED
SUBM.	एसएपीडीसी प्रा० लिमिटेड SAPDC (P.) LIMITED
CHKD.	अरुण 3 जल विद्युत परियोजना नेपाल (900 मेगावाट) ARUN-3 HYDRO ELECTRIC PROJECT NEPAL (900MW)
DSGN.	PRESSURE SHAFTS THRUST BLOCKS BEHIND MIV & BVC EXCAVATION AND SUPPORT DETAILS
DATE	16.03.2020
REV.	DRG.NO. PS-C2-AR3-C10/R1 JAN. 15th, 2020 CD2-AR3-174





CARP-PS-02

NOTE:-

- IMP.2

**REVISION NOTE :-**

1. SIZE OF FLOWMETER CAVITY IN DETAIL 'B' MODIFIED AS PER ELECTRICAL DESIGN LETTER NO. SJVN/CHQ/ED/1660 DATED 17.02.2020.
2. DETAIL 'A', SCOPE MODIFIED AS PER ELECTRICAL DESIGN LETTER NO. SJVN/CHQ/ED/1651 DATED 14.02.2020 & HYDRO-MECHANICAL DESIGN EMAIL DATED 16.03.2020.
3. DETAIL 'C', DETAIL 'D', SECTION G-G & SECTION H-H ADDED.


REFERENCE DRAWINGS :-

- |  |      |                      |
|--|------|----------------------|
| 1. PRESSURE SHAFTS- LAYOUT PLAN<br>AND L-SECTIONS    | .... | PS-C2-AR3-C01 TO C05 |
| 2. PRESSURE SHAFTS- EXCAVATION<br>AND SUPPORT SYSTEM | .... | PS-C2-AR3-C12 TO C14 |

CONNECTED DRAWINGS :-

1. PRESSURE SHAFTS- THRUST BLOCKS ... PS-C2-AR3-C10/R1 & C11/R1  
BEHIND MIV & BVC  
EXCAVATION AND SUPPORT SYSTEM DETAILS

SHEET 1 OF 3

MANUFACTURER'S Logo		MANUFACTURER'S Name and Address		SAMPLE QUALITY ASSURANCE PLAN			Project : ARUN-III HEP Indent No: 241526468				
				Item : Ultrasonic Flow measurement system		QP No. : 241526468-QAP Rev.No. : 00 Date : 31.08.2022 page : 01 OF 01					
SUB-System: Governing system											
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT / ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY		REMARKS	
1.	2.	3.	4.	5.	6.	7.	8.	1	2	10.	
1.	2.	3.	4.	5.	6.	7.	8.	9.			
(A)	ULTRASONIC FLOW MEASUREMENT SYSTEM (8 Path and 2 Path):										
1.1	A) Flow Meter Console B) Insertion Type Sensing Feed Through Transducers	• CALIBRATION CERTIFICATE / FUNCTIONAL TEST CERTIFICATE	Major	Performance	100%	Technical Specification, Approved Drawings & Approved Data Sheet	TC	P	R	TC	
1.2	ULTRASONIC FLOW MEASUREMENT SYSTEM	• PACKING & IDENTIFICATION	Major	Visual	100%	Technical Specification, Approved Drawings & Approved Data Sheet	TC / COC	P	R		
		<b>LEGEND:</b> 1: MANUFACTURER/SUB-SUPPLIER 2: BHEL/ NOMINATED INSPECTION AGENCY P: PERFORM W: WITNESS AND V: VERIFICATION R – REVIEW OF RECORD IR – INTERNAL RECORD JIR – JOINT INSPECTION REPORT									
QA-HYDRO		ENGINEERING- HPE									
(PREPARED & REVIEWED)				Accepted by (Vendor' QC representative)							

**NOTE : VENDOR HAS TO SUBMIT THE MANUFACTURER'S QUALITY ASSURANCE PLAN INLINE WITH BHEL SAMPLE QUALITY PLAN AFTER PLACEMENT OF PO FOR APPROVAL.**