

BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI
Original Application No. 580/2022

IN THE MATTER OF: -

Mukesh Singh

...Applicant(s)

VERSUS

State of Uttar Pradesh and Ors.

...Respondent(s)

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Date:13/05/2025



(**Ravinder Singh**)
Counsel for MoEF&CC
Mobile No. 9811614545
Email: adv.ravsingh@gmail.com

**BEFORE THE NATIONAL GREEN TRIBUNAL
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IN THE MATTER OF: -

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**ADDITIONAL AFFIDAVIT ON BEHALF OF RESPONDENT NO. 6 i.e.,
THE MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE
CHANGE**

I Dr. A.K. Gupta S/o Shri Jagdish Prasad presently working as Scientist 'E' in the Ministry of Environment, Forest & Climate Change (hereinafter referred to as "MoEF&CC"), Regional Office, Lucknow, do hereby, in my official capacity, solemnly affirm and state on oath as under-

1. That, I am acquainted with the facts and circumstances of the instant case and duly competent to swear the present affidavit on behalf of the



Ministry of Environment, Forest & Climate Change based on the official records maintained therein.

2. It is humbly submitted that, all the averments made in the instant Original Application are denied except those, which are specifically admitted herein this Reply Affidavit.
3. It is humbly submitted that the present Additional Affidavit is being filed in continuation to the previously filed affidavit in the instant matter. To contextualize, the Environmental Clearance (hereinafter referred to as "EC") to the project "Khadia Opencast Coal Mine Expansion Project from 10 MTPA to 14 MTPA in an area of 1640 ha located in District Sonebhadra (WP) and in Tehsil Singrauli, District Sidhi (MP) of M/s Northern Coalfields Limited vide letter no. J- 11015/255/2006-IA-II (M) dated 23.03.2016. Subsequently, two Expansion ECs were granted to the project vide letter dated 27.07.2022 and 07.02.2024, respectively. In accordance with the Standard Operating Procedure (hereinafter referred to as "SoP") established vide Office Memorandum dated 25.11.2022, the Answering Respondent vide letter dated 13.09.2024 requested Regional Office (hereinafter referred to as "RO") of the Ministry at Lucknow to



furnish a factual status report concerning the issues raised in the Original Application, along with a condition wise compliance status report (s) for the ECs associated with this project.

4. It is humbly submitted that, pursuant to the Ministry's letter dated 13.09.2024, the RO Lucknow conducted a site inspection on 27.11.2024 and 28.11.2024. Based on the said inspection, an inspection report (hereinafter referred to as "IR") was submitted to the Answering Respondent vide letter dated 16.12.2024. The IR was examined within the Ministry, and it was observed that several conditions of the EC were reported as either 'partially complied' or 'not complied' by the Project Proponent (hereinafter referred to as "PP"). Accordingly, vide letter dated 14.01.2025 the Answering Respondent directed the PP to submit a clarification or an Action Taken Report (hereinafter referred to as "ATR") addressing the observed non-compliance within 30 days from the date of issuance of the letter.

5. It is humbly submitted that in response to the Ministry's letter dated 14.01.2025 the PP has submitted an ATR vide letter no. NCL/KHD/GM/Min/Env/ECcompliance/2024-25/4711 dated



14.02.2025. A copy of the ATR dated 14.02.2025 has been annexed herewith as **Annexre-R6/1**.

6. It is humbly submitted that in accordance with the Ministry's SoP dated 25.11.2022, the Answering Respondent vide letter dated 19.02.2025 requested the RO Lucknow to review the ATR submitted by the PP and accordingly submit an ATR Review Report. A copy of the letter dated 19.02.2025 has been annexed herewith as **Annexure-R6/2**.

7. It is humbly submitted that in furtherance to Ministry's letter, the RO Lucknow again conducted a site visit on 17-18 March 2025 and subsequently submitted an ATR Review report vide letter no. IV /ENV /UP/MINE-50/409/2016/19 dated 03.04.2025. A copy of the ATR Review Report dated 03.04.2025 has been annexed herewith as **Annexure-R6/3**.

8. It is humbly submitted that the ATR review report dated 03.04.2025 was examined within the Ministry and continued non- compliance have been reported without much improvement in compliance status of some of the major conditions. The continued non-compliance for EC conditions



which are reported as 'Partly Complied' / 'Not Complied' are as follows:

- i. Garland drain has not been cleaned and maintained. (Specific Condition-xi of EC dated 23.03.2016)
- ii. Green belt has not been developed as per the EC condition. (Specific Condition-xx of EC dated 23.03.2016, Additional Specific condition-iii, iv of EC dated 27.07.2022, (Standard Condition g (ii) of EC dated 07.02.2024)
- iii. Greenbelt of adequate quality has not been developed on the OB dump. (Specific Condition-xx, xxii of EC dated 23.03.2016, (Standard Condition f (v)) of EC dated 07.02.2024)
- iv. Pucca road has not been constructed to control dust emissions within the lease area. Three tier planation all along the major road has not been developed. Management of OB dump is not up to the mark. (Specific Condition- xxiv, xxviii, xxx, xxxi, xxxiii of EC dated 23.03.2016, Specific condition-xxiv, Standard Condition f (iii) of EC dated 07.02.2024)
- v. Cleaner fuel has not been used in the dumpers/trucks. (Additional Specific condition-ii of EC dated 27.07.2022, Specific condition-xxviii of EC dated 07.02.2024)

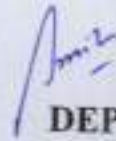


- vi. Status of Hazardous waste management such as oil containers, ETP sludge, etc. is in deplorable state. Further, ETP sludge is being dumped with OB without consulting with the UPPCB/CPCB. (Additional Specific condition-x of EC dated 27.07.2022, (Standard Condition a (vi)) of EC dated 07.02.2024)
 - vii. Construction of the Rapid Loading System has not yet completed. (Specific condition-i of EC dated 07.02.2024)
 - viii. NOC for expanded capacity has been made to the Central Ground Water Authority. (Specific condition-v of EC dated 07.02.2024)
 - ix. Construction of the digital library has not yet completed. (Specific condition-xxi of EC dated 07.02.2024)
 - x. Solar-mediated light systems on the roads has not been provided. (Specific condition-xxv of EC dated 07.02.2024)
9. It is humbly submitted that in view of the above-cited persisting partial/non-compliance, the Answering Respondent vide letter no. IA-L-11011/51/2024-A dated 30.04.2025 issued a Show Cause Notice (SCN) to the Project Proponent. A copy of the SCN dated 30.04.2025 has been annexed herewith as **Annexure- R6/4**.



10. It is humbly submitted that, the present Additional Affidavit may kindly be taken on record and into consideration and the Hon'ble Tribunal may pass appropriate Order(s), direction(s) as deemed fit and proper under the facts and circumstances of the present case.

11. It is humbly submitted that, the Answering Respondent seeks leave to make additional submissions, if required, during the course of the proceedings.


DEPONENT

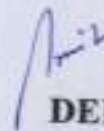
VERIFICATION

I, the above named Deponent, do hereby verify that the contents of the above affidavit are true and correct to my knowledge as per the records of the answering respondents. No part of it is false and nothing material has been concealed there from. Verified at Lucknow on this ...^{13th} day of May, 2025.



EXECUTION ADMITTED
BEFORE ME


Ajeet Kumar Mathur
Advocate Notary
Faizabad Road, Lucknow


DEPONENT

I identify the deponent/executionant
who has signed put TI before me


नॉर्थर्न कोलफील्ड्स लिमिटेड
खडिया परियोजना
(मिनिरात्रा कंपनी)
कोल इण्डिया लिमिटेड की अग्रभंगी कंपनी



Office of General Manager

Northern Coalfields Limited
Khadia Project
(A Miniratna Company)
(A subsidiary of Coal India Limited)



CIN- U10102MP1885GOI001160

An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company

थाना-शक्तिनगर, जनपद-सोनभद्र (उ. प्र.), पिन - 231222/ Thana-Shaktinagar, Dist. Sonebhadra (U.P.) Pin- 231222
Phone: 05446- 232274, (FAX) 05446- 232274 Email: cgm.khd@gmail.com, website : www.ncclil.in

Ref: NCL/KHD/GM/Min/Env/ EC compliance/2024-25/4711

Date: -14/02/2025

To,
Shri Pankaj Verma,
Scientist 'F'
Compliance & Monitoring Division-IA Division
Ministry of Environment, Forest & Climate Change
Indira Paryawaran Bhawan,
Jor Bhag Road, New Delhi – 110003

Subject:- Submission of Clarifications / Action Taken Report against the Non-conformities observed with respect to the Project "Expansion of Khadia Opencast coal mining project for increase in production capacity from 14 MTPA to 15 MTPA (increase of 10% w.r.t. 10 MTPA) in land area of 1640 Ha by M/s Northern Coalfields Ltd. Located in the village Khadia, Tehsil Dudhi, District Sonebhadra (Uttar Pradesh) & village Dudhichua, Tehsil- Singrauli, District- Singrauli (Madhya Pradesh)
Ref:- (i) Your good office's letter dated 14.01.2025 with F. No. IA-L-11011/51/2024-IA-I.

Respected Sir,

Khadia Opencast Project of M/s Northern Coalfields Limited (EC capacity 15 MTPA for coal production) is in receipt of your good office's letter dated 14.01.2025 with F. No. IA-L-11011/51/2024-IA-I.

In pursuance with the letter, please find enclosed herewith the clarification/ Clarifications / Action Taken Report against the Non-conformities observed with respect to the Project "Expansion of Khadia Opencast coal mining project for increase in production capacity from 14 MTPA to 15 MTPA (increase of 10% w.r.t. 10 MTPA) in land area of 1640 Ha by M/s Northern Coalfields Ltd. Located in the village Khadia, Tehsil Dudhi, District Sonebhadra (Uttar Pradesh) & village Dudhichua, Tehsil- Singrauli, District- Singrauli (Madhya Pradesh).

Yours faithfully,

14.02.2025
General Manager
Khadia Area, NCL

Copy to:-

1. Deputy Director General of Forests (C), Ministry of Environment, Forest and Climate Change, Integrated Regional Office, Kendriya Bhawan, 5th Floor, Sector "H", Aliganj, Lucknow – 226020.

2. The Member Secretary, Uttar Pradesh Pollution Control Board, Building, No. 1C-12V V bhuti Khand, Gomti Nagar Lucknow-226010.
3. The Member Secretary, Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi-110032
4. General Manager (Environment & Forest), NCL Singrauli.

CC-0-0-0-0

Northern Coalfields Limited
Khadia Area

Clarifications / Action Taken Report against the Non-conformities observed with respect to the Project "Expansion of Khadia Opencast coal mining project for increase in production capacity from 14 MTPA to 15 MTPA (increase of 10% w.r.t. 10 MTPA) in land area of 1640 Ha by M/s Northern Coalfields Ltd. Located in the village Khadia, Tehsil Dudhi, District Sonebhadra (Uttar Pradesh) & village Dudhichua, Tehsil- Singrauli, District- Singrauli (Madhya Pradesh)

Sl. No.	Observation	Compliance																					
1	Garland drain has not been provided as per the EC condition. (Specific Condition-xi of EC dated 23.03.2016)	Proper drainage system has been provided by Khadia OCP. Currently about 14.9 KM of the garland drain exists at Khadia OCP. Same has also been mentioned in the monitoring report submitted by Regional Office, MoEF&CC, Lucknow against the EC condition. All the permanent drains are cemented (Shown as Pic - 1). However, some of the drains remain temporary in nature and are built as the active mine dump shifts in the course of mining. Besides this, restoration work i.e. cementing of about 400 m retaining wall and drain is in process and will be completed by June 2025. For the purpose, a tender has already been floated and copy of the relevant page of Notice Inviting Tender issued is enclosed herewith as Annexure-A.																					
2	Dust mask has not been provided to the workers. (Specific Condition-xvi, xvii, xviii, General Condition-ix of EC dated 23.03.2016, Standard Condition h (iii) of EC dated 07.02.2024)	Dust Mask are regularly being provided to the workers. Details of the dust mask provided in current Financial year is as below. <table border="1"> <thead> <tr> <th>Sl. No.</th><th>Month</th><th>Dust Mask issued to workers</th></tr> </thead> <tbody> <tr> <td>1</td><td>April 2024</td><td>940</td></tr> <tr> <td>2</td><td>May 2024</td><td>917</td></tr> <tr> <td>3</td><td>June 2024</td><td>836</td></tr> <tr> <td>4</td><td>July 2024</td><td>812</td></tr> <tr> <td>5</td><td>August 2024</td><td>748</td></tr> <tr> <td>6</td><td>Sept 2024</td><td>720</td></tr> </tbody> </table>	Sl. No.	Month	Dust Mask issued to workers	1	April 2024	940	2	May 2024	917	3	June 2024	836	4	July 2024	812	5	August 2024	748	6	Sept 2024	720
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7	October 2024	920												
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3	Green belt has not been developed as per the EC condition. (Specific Condition-xx of EC dated 23.03.2016, Additional Specific condition-iii, iv of EC dated 27.07.2022, (Standard Condition g (ii) of EC dated 07.02.2024)	Green Belt at Overburden Dump:- On overburden dump, plantation is regularly being carried out through UP Forest Department. Till date, plantation has been completed on 216.16 Ha of overburden dumps. In the FY 2025-26, plantation on about 08 Ha overburden dump is to be carried out, out of which 05 Ha shall be done through ICFRE, Dehradun and 03 Ha shall be done through Renukoot Forest Division, UP Forest Department. The work awarded to ICFRE, Dehradun is for ecological restoration of the area. (Copy of the work order issued to ICFRE and request for MoU to UPFD are enclosed as Annexure C & D). Green Belt at outside mine area:- Green belt outside the project premises is being done by M/s Northern Coalfields Limited. It is to mention that in FY 2024-25, plantation has been carried out in Renukoot Forest Department on 100 Ha The executive agencies like Renukoot Forest Department and Singaruli Forest Division are specialised agencies for carrying out plantation works and species of plants are selected by them based on the local area and geography of the area. In FY 2025-26, area of 100 Ha in UP and 270 Ha in MP shall be carried out through UP Forest Department and MPRVVN, Singrauli respectively and efforts shall be made for plantation of native species with broad leaves and long life plants. Green Belt along road side:- As stated in the monitoring report, plantation is required along the coal transportation road and												

		approach road, it is to state that an MoU has been finalised with UP Forest Department for planation besides newly constructed CC road and mine boundary, wherever planation is required. The plantation will be carried out in FY 2025-26 monsoon. Copy of the MoU Signed is enclosed herewith as Annexure-E. Pictures of various plantation sites are enclosed as pic 3 to 7. Further, it is pertinent to state here that as per approved mining plan of 15 MTPA, out of total 1640 Ha lease hold area, planation will be done in around 1378 Ha at the time of mine closure. Cost of this plantation shall be borne by NCL. Plantation is continuously being done as per availability of finalised overburden dump and will be continued.
4	Greenbelt has not been developed on the OB dump. (Specific Condition-xxii of EC dated 23.03.2016, (Standard Condition f (v)) of EC dated 07.02.2024)	On overburden dump, plantation is regularly being carried out through UP Forest Department. UP Forest department is a specialized agency for the purpose of plantation and species of plants are selected by them based on the local area and geography of the area. Till date, plantation has been completed on 216.16 Ha of overburden dumps. In the FY 2025-26, plantation on about 08 Ha overburden dump is to be carried out, out of which 05 Ha shall be done through ICFRE, Dehradun and 03 Ha shall be done through Renukoot Forest Division, UP Forest Department. The work awarded to ICFRE, Dehradun is for ecological restoration of the area. Pictures of various plantation sites on OB dump are enclosed as pic 3 to 6. As pointed out in the report against condition no. f (v)) of EC dated 07.02.2024, it shall be ensured that only native species shall be planted as suggested. Further, it is pertinent to state here that as per approved mining plan of 15 MTPA, out of total 1640 Ha lease hold area, planation will be done in around 1378 Ha at the time of mine closure.

A

		Cost of this plantation shall be borne by NCL. Plantation is continuously being done as per availability of finalised overburden dump and will be continued.
5	Pucca road has not been constructed to control dust emissions within the lease area. Three tier planation all along the major road has not been developed. Management of OB dump is not up to the mark. (Specific Condition-xxii, xxiv, xxviii, xxx, xxxi, xxxiii of EC dated 23.03.2016, Specific condition-xxiv, Standard Condition f (iii) of EC dated 07.02.2024)	Pucca roads have been developed at all the permanent roads. Khadia OCP has constructed Cement Concrete Road of 6.61 KM Length within the mine premises in order to reduce the dust generation during transportation of coal with date of completion as 31.10.2023. Further, 1.5 KM CC road has also been built for movement of light vehicle. Photograph of the recently built CC road is enclosed herewith as Pic 8. For the purpose of three tier plantation along CC road, it is to state that an MoU has been finalised with UP Forest Department for planation besides newly constructed CC road and mine boundary, wherever planation is required. The plantation will be carried out in FY 2025-26 monsoon. With regard to management of OB dump, it is to state that Overburden dumps are being maintained scientifically with proper technical and biological reclamation. For the purpose of stability of the OB dump, a scientific study conducted by M/s CMPDIL, Ranchi is enclosed herewith as Annexure-F.
6	Adequate steps to stop the dust emission from the CHP has not been undertaken. (Specific Condition-xxvi of EC dated 23.03.2016)	As pointed out in the monitoring report for CHP of 04 MTPA, a cyclone arrangement is in place for the purpose of dust extraction. The CHP is equipped with automatic sprinkler system at receiving pits and closed conveying system along with nozzles at transfer points. Further, loading into the wagons is being done through silo, which is an eco-friendly technology and is also suggested in the guidelines issued by Central Pollution Control Board (CPCB) in the name of "Inventorization of Railway Sidings and Guidelines for their Environment Management" and published on March 2015. Photographs of the Pollution control arrangement of CHP of 04 MTPA is enclosed herewith as Pic 9 to 12.



		Further efforts shall be taken for maintaining the same.										
7	Third party monitoring of the project has not been conducted through the NABL accredited laboratory. (General Condition-iii, iv of EC dated 23.03.2016)	Environment Laboratory, CMPDIL, Ranchi is NABL accredited (certificate no.TC-7470 issue date 16/12/2022). The environment monitoring samples collected at CMPDI, RI-6, Singrauli are sent to CMPDIL, Ranchi laboratory for analysis. The upgradation of CMPDIL, RI-6, Singrauli lab and its NABL accreditation is under process.										
8	PPEs have not been provided to the workers. (General Condition-x of EC dated 23.03.2016)	Distribution of PPEs to the workers is a regular activity. Photographs of the personnel wearing PPEs are enclosed herewith as pic 13 – 14. Further, the copy of the issuance register showing distribution of the PPEs is enclosed herewith as Annexure – G.										
9	PP has not advertise the EC as per the EC condition. (General Condition-xiii of EC dated 23.03.2016)	The EC of 14 MTPA, was granted on 23.03.2016. However, the EC was uploaded by MoEF&CC on 30.03.2016 and NCL management came to know about its grant only on 30.03.2016. Same can be proved from the enclosed letter issued by GM (Environment), NCL Singrauli (Enclosed as Annexure-H). Accordingly EC was advertised within 07 working days i.e. on 06 and 07 April 2016. The details of the publication of advertisement of EC are as below. <table><tr><td><u>Newspaper</u></td><td><u>Date of publication</u></td></tr><tr><td>Dainik Jagran, Rewa</td><td>06.04.2016</td></tr><tr><td>Rashtriya Jagran, Varanasi</td><td>07.04.2016</td></tr><tr><td>Amar Ujala, Varanasi-</td><td>07.04.2016</td></tr><tr><td>Dainik Bhaskar, Satna-</td><td>07.04.2016</td></tr></table>	<u>Newspaper</u>	<u>Date of publication</u>	Dainik Jagran, Rewa	06.04.2016	Rashtriya Jagran, Varanasi	07.04.2016	Amar Ujala, Varanasi-	07.04.2016	Dainik Bhaskar, Satna-	07.04.2016
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Amar Ujala, Varanasi-	07.04.2016											
Dainik Bhaskar, Satna-	07.04.2016											
10	Cleaner fuel has not been used in the dumpers/trucks. (Additional Specific condition-ii of EC dated 27.07.2022, Specific condition-xxviii of EC dated 07.02.2024)	Khadia Project is equipped with three nos. of draglines, which are not only electricity driven but also reduces truck movement (which would otherwise be required for transportation of overburden). Besides draglines, 06 nos. of shovel and 07 nos. of drills are also electrical driven. Besides, maximum of coal is being transported through Coal Handling Plants of 04 MTY and 06										

		MTY and are electricity driven, which also reduces truck movement (which would otherwise be required for transportation of coal within mine premises). An RLS of 04 MTPA is under construction. For the purpose of cleaner fuel, a study for the use of 'XtraGreen Diesel' is under process at Khadia OCP in collaboration with IOCL. Xtragreen is an optimized combination having higher Cetane Number for providing improved performance by increasing the efficiency & reducing the emission of vehicle. Copy of the letter showing trial run to be conducted by M/s Indian Oil Corporation Limited (IOCL) to explore the possibility of using XtraGreen HSD in Khadia mine to verify the emission efficiency and fuel economy benefits is enclosed as Annexure-I. Specific condition-xxviii of EC dated 07.02.2024 states that, "PP shall explore at least 20% of the overall fleet of dumpers / trucks / other vehicles as electrical or CNG/NLG based transporation of coal / OB etc.". Khadia Opencast Project has applied for amendment of the said condition to MoEF&CC, New Delhi vide EC amendment proposal no. IA/UP/CMIN/509697/2024. The reasons for amendment sought are as below. • As per the approved mining plan, this project is already equipped with adequate no. of HEMMs and there was no additional provision for procurement of HEMM. • For the purpose of exploring the possibility to deploy CNG/LNG/ electrical dumpers /trucks/other vehicles in NCL, a letter seeking availability of such vehicles have been submitted on 06.08.2024 to all major Manufacturers and response of them are still awaited. (Copy of the letters issued are enclosed herewith as Annexure-J).
11	Installed CEQMS has not been connected to the SPCB and CPCB server. (Additional Specific condition-vii of EC dated 27.07.2022)	CEQMS has been installed and has been connected with CPCB and MPCCB server. Copy of the mail received from CPCB for confirming that the CEQMS has been integrated with RTDMS



		portal of CPCB is enclosed herewith as Annexure – K. Further, Connection has also been provided with MPPCB website. Copy of the screenshot is enclosed herewith as Annexure-L.
12	Adequate measure for the management of hazardous waste, such as oil containers, ETP sludge, etc. has not been taken, further, ETP sludge is being dumped with OB without consulting with the UPPCB/CPCB. (Additional Specific condition-x of EC dated 27.07.2022, (Standard Condition a (vi)) of EC dated 07.02.2024)	The spilled oil as observed during the monitoring was due to recent lifting of burnt oil to auctioned party. The same has been cleaned using lime as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Current Picture of the site visited at the time of visit of MoEF&CC official is enclosed herewith as pic 15 & 16. With regard to ETP sludge, it is hereby stated that as per Schedule-I of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, 'The inclusion of wastes contained in this Schedule does not preclude the use of Schedule II to demonstrate that the waste is not hazardous' (Copy enclosed as Annexure-M) i.e. Use of Schedule-II can be made to demonstrate that the waste is not hazardous. Accordingly, a testing has been conducted for the probable heavy metals which may be found in the Coal Industry ETP sludge and all the metals were found below the limit provided in Schedule II of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Copy of the sample report is enclosed herewith as Annexure – N. Further, after receipt of the letter dated 14.01.2025 from MoEF&CC, New Delhi, a mail has also been sent to premier institutes viz. <u>IIT(ISM), Dhanbad, IIT-BHU Varanasi and IITR, Lucknow</u> for enquiry about testing of ETP Sludge as per Schedule-II of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. However, no reply has been received from any of the organisation. Copy of the Mails sent are enclosed herewith as Annexure-O.
13	Expenditure incurred under CER has not been provided. (Additional Specific	As per EC dated 07.02.2024, details of the expenditure, required to be performed as

	condition-xii of EC dated 27.07.2022, Standard Condition i (iii) of EC dated 07.02.2024)	Corporate Environment Responsibility, are as below. <table><tr><th>Sl. No.</th><th>Nature of Activity to be performed as per EC dated 07.02.2024 in FY 2024-25</th><th>Details of activity performed</th><th>Expenditure incurred in 2024-25 till Jan 2025</th></tr><tr><td>1</td><td>Sanitation (Cleaning of Public Road)</td><td>Deployment of sweeping machines the purpose of cleaning of public road.</td><td>56,34,429</td></tr><tr><td>2</td><td>Roads (Control of road dust due to public transport)</td><td>Deployment of truck mounted fog cannons on public roads.</td><td>57,70,699</td></tr><tr><td>3</td><td>Plantation in community Area</td><td>Plant distribution has been done</td><td>1,98,600/-</td></tr></table> Photographs of the Operation of Road Sweeping Machine and Truck Mounted fog cannons are enclosed herewith as Pic 17 & 18.	Sl. No.	Nature of Activity to be performed as per EC dated 07.02.2024 in FY 2024-25	Details of activity performed	Expenditure incurred in 2024-25 till Jan 2025	1	Sanitation (Cleaning of Public Road)	Deployment of sweeping machines the purpose of cleaning of public road.	56,34,429	2	Roads (Control of road dust due to public transport)	Deployment of truck mounted fog cannons on public roads.	57,70,699	3	Plantation in community Area	Plant distribution has been done	1,98,600/-
Sl. No.	Nature of Activity to be performed as per EC dated 07.02.2024 in FY 2024-25	Details of activity performed	Expenditure incurred in 2024-25 till Jan 2025															
1	Sanitation (Cleaning of Public Road)	Deployment of sweeping machines the purpose of cleaning of public road.	56,34,429															
2	Roads (Control of road dust due to public transport)	Deployment of truck mounted fog cannons on public roads.	57,70,699															
3	Plantation in community Area	Plant distribution has been done	1,98,600/-															
14	Construction of the Rapid Loading System has not yet completed. (Specific condition-i of EC dated 07.02.2024)	Work order for construction of CHP/ RLS of 04 MTPA capacity has been issued to M/s S . K. Samanta & Co. Pvt. Ltd. On 08.01.2024 (Copy enclosed as Annexure- P). Further, site handover letter has been issued to M/s S. K. Samanta & Co. Pvt. Ltd. On 15.03.2024, with date of start of work as 17.03.2024 (Copy enclosed as Q). Currently the work is in progress and will be completed by Feb 2026. Further, an application has been submitted vide proposal no. IA/UP/CMIN/509697/2024 for amendment of EC conditions for extension of timeline of completion of Rapid Loading System																

		(04 MTPA) by February 2026 instead of December 2024 as stipulated in EC conditions.
15	Sal nursery has not been set up by PP. (Specific condition-iv of EC dated 07.02.2024)	In compliance of EC Condition of Khadia OCP, NCL has invited offers for establishment of Sal Nursery from various premier institutes viz. Forest Research Institute (FRI), Dehradun, Renukoot Forest Division, Singaruli Forest Division, Madhya Pradesh Rajya Van Vikash Nigam and Chhatisgarh Rajya Van Vikas Nigam Limited vide letter dtd. 31.10.2023 and 17.01.2024 (Copy attached as Annexure-R). The telephonic discussions were made to pursue for submission of proposal for development of Sal Nursery at Khadia project, NCL. Renukoot Forest Division has submitted the proposal for development of Sal Nursery at Khadia project, NCL. The response from other premier institutes/organizations except DFO Renukoot is still awaited. The proposal submitted by DFO Renukoot for development of Sal Nursery at Khadia project is under scrutiny. The Sal Nursery development work at Khadia project will be taken-up during FY 2025-26.
16	NOC for expanded capacity has been made to the Central Ground Water Authority. (Specific condition-v of EC dated 07.02.2024)	Application for NOC with expanded capacity has been made on 19.03.2024 and application verification has been completed on 22.03.2024. The application is currently at the stage of Application Processing and pending with approval officer since 12.02.2025. (The online screenshot of the application is enclosed herewith as Annexure-S)
17	Wheel washing system and procurement of electric vehicles has not been undertaken by the PP. (Specific condition-vi of EC dated 07.02.2024)	An LoA for wheel washing facility has been issued on 18.08.2024 (Copy enclosed as Annexure-T). The work is in progress and will be completed in February 2025. With regard to deployment of Electrical Vehicle, a tender has been floated on GeM portal vide GeM ID No. GEM/2025/B/5827091 dated 16.01.2025. The copy of the bid documents is

		enclosed herewith as Annexure – U. The vehicles will be deployed by July 2025.
18	Compliance of the Standard Operating Procedure (SoP) issued by CPCB regarding the dumping of mine voids with fly ash has not been provided. (Specific condition-xv of EC dated 07.02.2024)	Khadia OCP has sought amendment of EC condition for exemption of this condition vide EC amendment proposal no. IA/UP/CMIN/509697/2024. The reason given for amendment are as below. A study has been conducted by IIT-BHU Varanasi for "Scientific study of fly ash utilization/dumping/Mixing in the OB of the running/active mines of Khadia Opencast Project along with its viability and safety aspect of man and machinery" As per the study done by IIT-BHU, Varanasi dumping of fly ash in active mine of Khadia OCP, following conclusions were made: • Mixing of fly ash with overburden will reduce the permeability of overall dump material, leading to increase in the pore water pressure and in-turn reduce the factor of safety of dump • As per the simulation carried out, it was found that final dump slope will fall under unsafe category ($FoS < 1.5$) as per DGMS guidelines in case of saturation level beyond 25%. • Fly-ash will make the dump floor slippery when contact with water and reduce the movement of dumper and other HEMM, and hence its not suggestible to use fly ash for HEMM roads within the mine. • Highest conc. of toxic trace metal (Mg, Mn and Ni) ranging upto 41.70 mg/l, 5.39 mg/l and 0.45 mg/l respectively found in the fly ash material, which will increase the conc. of toxic trace material in the surrounding area when this fly ash is mixed with OB or dumped in the mine pit. Based on the above facts, IIT BHU has concluded that it is technically not feasible to dump the fly ash in Mine dump due to geo mining conditions, instability of dump during rainy season in present condition, high stripping ratio and leaching effects.

		Copy of the report of IIT-BHU is enclosed herewith as Annexure- V.																								
19	Solar parks have not been developed. (Specific condition-xvi of EC dated 07.02.2024)	Specific Condition no. -XVI of the EC dated 07.02.2024 states that, "<i>The Project Proponent shall include development of solar parks, picnic spot and sports compound in its Mine Closure report. Further if possible, maximum possible area of quarry shall be brought upto original ground level and handover the land to Project affected families.</i>" In this regard, it is to state that Khadia OCP is envisaging expansion of Khadia OCP from 15 MTPA to 20 MTPA and provision of solar park has been made in Mining Plan and Mine Closure Plan) of 20 MTPA. Mining Plan and Mine Closure Plan) of 20 MTPA has been approved by NCL Board. (Relevant pages of Mining Plan is enclosed herewith as Annexure-X)																								
20	Data on the plantation of fruit-bearing trees has not been provided. (Specific condition-xviii of EC dated 07.02.2024)	In compliance of specific condition no. xviii of the EC dated 07.02.2024, the details of fruit bearing plants planted within Khadia OCP after grant of EC is as below. <table border="1"> <thead> <tr> <th>Sl. No.</th><th>Name of Species</th><th>No. of Plants</th></tr> </thead> <tbody> <tr> <td>1.</td><td>Amla</td><td>600</td></tr> <tr> <td>2</td><td>Bel</td><td>100</td></tr> <tr> <td>3</td><td>Amrud</td><td>100</td></tr> <tr> <td>4</td><td>Jamun</td><td>200</td></tr> <tr> <td>5</td><td>Aam</td><td>150</td></tr> <tr> <td>6</td><td>Mahua</td><td>300</td></tr> <tr> <td>7</td><td>Anar</td><td>100</td></tr> </tbody> </table> Copy of the report submitted by Range Officer, Renukoot Forest Division, UP Forest Department is enclosed herewith as Annexure – Y for reference. Besides this, total 4500 fruit bearing plant saplings have been distributed among employees of Khadia OCP and nearby population (Copy of the supply order is enclosed herewith as Annexure-Z). Details of the plants distributed are as below.	Sl. No.	Name of Species	No. of Plants	1.	Amla	600	2	Bel	100	3	Amrud	100	4	Jamun	200	5	Aam	150	6	Mahua	300	7	Anar	100
Sl. No.	Name of Species	No. of Plants																								
1.	Amla	600																								
2	Bel	100																								
3	Amrud	100																								
4	Jamun	200																								
5	Aam	150																								
6	Mahua	300																								
7	Anar	100																								

		Sl. No.	Name of Plants	Nos. of plants distributed
		1	Mango	1200
		2	Papita	600
		3	Lemon(Kagji)	300
		4	Kathal	300
		5	Jamun	300
		6	Anar	400
		7	Banana	400
		8	Amla(Grafted)	300
		9	Lichi	200
		10	Guava(Allahabadi)	300
		11	Bel	200
21	Construction of the digital library has not yet completed. (Specific condition-xxi of EC dated 07.02.2024)	Digital lab/library has been set up in DAV Khadia which is equipped with 02 Virtual Reality Device with all the science practical materials to give digital learning to students. It is pertinent to mention that DAV Khadia is the resource schools which shall cater to the needs of the local students to enhance learning on science. Further, mail from Principle, DAV Khadia is enclosed herewith as Annexure- AA. stating that <i>"The School shall provide all support towards catering to needs of academic excellence in nearby area students."</i>		
22	Solar-mediated light systems on the roads has not been provided. (Specific condition-xxv of EC dated 07.02.2024)	For the purpose of installation of solar light system, an NOC has been applied to District Administration for the purpose of carrying out the work of solar mediated lights through UPNEDA (Uttar Pradesh New and Renewable Energy Development Agency). Copy of the application made for NOC enclosed as Annexure-AB. Financial assistance shall be provided to UPNEDA for the purpose of installation of Solar lights after obtaining NOC and necessary approval. Financial assistance shall be provided within 120 days.		
23	Bio-toilets in the study villages have not been provided. (Specific condition-xxvi of EC dated 07.02.2024)	For the purpose of establishment of bio-toilets, proposal is under progress and need assessment meeting with the local community (Gram Pradhan) is held for understanding the proper site selection so as to cater the mass at large. The activity shall be completed by 120 days.		

		Further, it is pertinent to mention here that Khadia Opencast Project has constructed 05 nos. of 'Sulabh Sauchalaya' as below. <table border="1"> <tr> <th>SL. No.</th><th>Location</th><th>Nos.</th></tr> <tr> <td>1</td><td>Shaktinagar Bus stand</td><td>01 No.</td></tr> <tr> <td>2</td><td>Ambedkar Nagar Village</td><td>01 No.</td></tr> <tr> <td>3</td><td>Nimiatand Village</td><td>01 No.</td></tr> <tr> <td>4</td><td>Khadia Village</td><td>02 nos.</td></tr> </table>	SL. No.	Location	Nos.	1	Shaktinagar Bus stand	01 No.	2	Ambedkar Nagar Village	01 No.	3	Nimiatand Village	01 No.	4	Khadia Village	02 nos.
SL. No.	Location	Nos.															
1	Shaktinagar Bus stand	01 No.															
2	Ambedkar Nagar Village	01 No.															
3	Nimiatand Village	01 No.															
4	Khadia Village	02 nos.															
24	Feasibility study for the utilization of fly ash with this mine has not been conducted. (Specific condition-xxix of EC dated 07.02.2024)	A study has been conducted by IIT-BHU Varanasi for "Scientific study of fly ash utilization/dumping/Mixing in the OB of the running/active mines of Khadia Opencast Project along with its viability and safety aspect of man and machinery" Copy enclosed as Annexure – V.															
25	Suitable action on the use of fly ash as an external dump in the mine as per the study has not been taken. (Standard Condition f (iv) of EC dated 07.02.2024)	Khadia OCP has sought amendment of EC condition for exemption of this condition vide EC amendment proposal no. IA/UP/CMIN/509697/2024. The reason given for amendment are as below. A study has been conducted by IIT-BHU Varanasi for "Scientific study of fly ash utilization/dumping/Mixing in the OB of the running/active mines of Khadia Opencast Project along with its viability and safety aspect of man and machinery" As per the study done by IIT-BHU, Varanasi dumping of fly ash in active mine of Khadia OCP, following conclusions were made: • Mixing of fly ash with overburden will reduce the permeability of overall dump material, leading to increase in the pore water pressure and in-turn reduce the factor of safety of dump • As per the simulation carried out, it was found that final dump slope will fall under unsafe category (FoS < 1.5) as per DGMS guidelines in case of saturation level beyond 25%. • Fly-ash will make the dump floor slippery when contact with water and reduce the movement of dumper and other HEMM,															

	and hence its not suggestible to use fly ash for HEMM roads within the mine. • Highest conc. of toxic trace metal (Mg, Mn and Ni) ranging upto 41.70 mg/l, 5.39 mg/l and 0.45 mg/l respectively found in the fly ash material, which will increase the conc. of toxic trace material in the surrounding area when this fly ash is mixed with OB or dumped in the mine pit. Based on the above facts, IIT BHU has concluded that it is technically not feasible to dump the fly ash in Mine dump due to geo mining conditions, instability of dump during rainy season in present condition, high stripping ratio and leaching effects. Copy of the report of IIT-BHU is enclosed herewith as Annexure-V.
--	---

P
14/02/25
Nodal Officer (Environment)
Khadia Area

[Signature]
14/02/25
Staff Officer (Mining)
Khadia Area

[Signature]
14/02/25
Project Officer
Khadia Project

[Signature]
14-02-2025
General Manager
Khadia Area

Pictures in support of the clarifications / ATR submitted.



Pic 1:-
Drain Besides OB dump



Pic 2:-
Personnel wearing Dust Mask



Pic-3
Plantation on overburden dumps



Pic-4
Plantation on overburden dumps



Pic 5
Recent Plantation on overburden dumps



Pic 6
Plantation on overburden dumps



Pic 7

Miyawaki Plantation done in Plain area



Pic 8

Cement Concreting of the permanent roads.



Pic 9

Water Sprinkling at the CHP of 04 MTPA at the time of unloading



Pic 10

Cyclone attached with Crusher of CHP pf 04 MTPA



Pic 11

Closed conveying system with loading in rail wagons through silo



Pic 12

Sprinkling at the time of unloading of coal into railway wagons



Pic 13

Personnel Wearing PPEs



Pic 14

Personnel Wearing PPEs



Pic 15

spilled oil during lifting has been cleaned.



Pic 16

Cleaning of the spilled oil during lifting with all burnt oil under shed.



Pic 17
Deployment of Road Sweeping Machine on public road



Pic 18
Deployment of truck mounted fog cannon on public road



NORTHERN COALFIELDS LIMITED
(A Miniratna Company & Subsidiary of Coal India Limited)
OFFICE OF THE GENERAL MANAGER (KHADIA PROJECT)

Civil Engineering Department
P.O. Shaktinagar, DISTT. Sonbhadra (U.P.) 231222
Phone No.05446-232274
E-mail: socivilkhdncl@gmail.com
WEB SITE: www.coalindiatenders.nic.in

NIT संख्या.: GM/KHD/C/24-25/ETN-28

दिनांक: 03.02.2025

Notice Inviting Tender

1. Tenders are invited on-line under two part system on the website <https://coalindiatenders.nic.in> from the eligible bidders having Digital Signature Certificate (DSC) issued from any agency authorized by Controller of Certifying Authority (CCA), Govt. of India and which can be traced up to the chain of trust to the Root Certificate of CCA, for the following work:

Description of work	Location	Estimated Cost of Work (Including GST) (In Rs.)	Earnest Money (In Rs.)	Period of Completion (In Days)
Restoration , Repair & Maintenance of Retaining wall with drain along road from OB Time Office to Barrier No 1 at Khadia Project.	Khadia Project NCL	40192251.99	502500/-	120

(i). For Site visit of location of work, the prospective bidder(s) may contact

Tender inviting authority	Contact Person(s)/Tender Dealing Officer(s)	
Sri A K Bansal, SO (C) Contact No 9479713410	Sri SM Wasif, PE (C) Contact no. 9406963432	Sri Rohit Jain , Dy Mgr (C) Contact no. 9406965028

2. Time Schedule of Tender:

Sl. No	Particulars	Date	Time
a.	Tender e-Publication date	03.02.2025	06:55 PM
b.	Document download start date	03.02.2025	06:55 PM
c.	Document download end date	19.02.2025	11:00 AM
d.	Bid Submission start date	04.02.2025	11:00 AM
e.	Bid submission end date	19.02.2025	11:00 AM
f.	Start date for seeking Clarification on-line	04.02.2025	11:00 AM
g.	Last date for seeking Clarification on-line	12.02.2025	11:00 AM
h.	Technical Bid (Cover I) opening date	20.02.2025	11:00 AM
i.	Price Bid (Cover II) opening date	To be opened after finalisation of Part-1 TCR	

Note: The auto extension of submission of bid shall be applicable as per details mentioned in clause No.14 of NIT.

Date	Received From	Quantity	up to issue	Issue TO	Quantity	Balance
			01.01.2023			140 Nos
			01.01.23 to 31.01.2023	Employees	58	82 Nos
03.03.23 R/s		800	01.02.23 to 28.02.23	"	41	37 Nos
		800	—	—	—	837 Nos
			01.03.23 to 31.03.23	"	128	709 Nos
			01.04.23 to 30.04.23	"	105	604 Nos
			01.05.23 to 31.05.23	"	128	476 Nos
			01.06.23 to 30.06.23	"	56	420 Nos
			01.07.23 to 31.07.23	"	58	362 Nos
			01.08.23 to 31.08.23	"	72	290 Nos
			01.09.23 to 30.09.23	"	86	204 Nos
			01.10.23 to 31.10.23	"	60	144 Nos
			01.11.23 to 30.11.23	"	75	79 Nos
			01.12.23 to 31.12.23	"	70	09 Nos
			01.01.2024 to 31.01.24	"	03	02 Nos
22.02.24 R/s		10020	—	—	—	10022 Nos
			01.02.24 to 29.02.24	"	963	9059 Nos
			01.03.24 to 31.03.24	APR 25 to March 24 = 2735	1059	8000 Nos
13.04.24 R/s		5600	—	(2675)	—	13000 Nos
			01.04.24 to 30.04.24		940	12060 Nos
			01.05.24 to 31.05.24		917	11143
			01.06.24 to 30.06.24		836	10307
			01.07.24 to 31.07.24		812	9495
			01.08.24 to 31.08.24		748	8747
			01.09.24 to 30.09.24		720	8027
			01.10.24 to 31.10.24		920	7107
			01.11.24 to 30.11.24		870	6237
			01.12.24 to 31.12.24		817	5420
			01.01.2025 to 31.01.2025		895	4525

कोलइण्डियालिमिटेड

(भारतसरकारकाउपक्रम)

COAL INDIA LIMITED

(A Govt. of India Enterprise)

कोलभवन "COAL BHAWAN"

PREMISES NO: 04, MAR, PLOT NO: AF-III

ACTION AREA-1A, NEW TOWN, RAJHARHAT A Maharatna Company

KOLKATA-700156 (WB)



महारातकंपनी

ENVIRONMENT DIVISION

पर्यावरण विभाग

E-MAIL: cgmenv.cil@coalindia.in

TEL: 033-2324 6638

FAX: 033-2324 4232

WEBSITE: www.coalindia.in

CIN:L23109WB1973GOI028844

(An ISO 9001:2015, ISO 50001:2018 & ISO 14001:2015 Certified Company)

Ref: CIL/ENV/WO/11451

दिनांक 14 June 2024

To

Centre of Excellence, Sustainable Land Management

Indian Council of Forestry Research and Education, Dehradun

Kind Attention: Shri Sanjeev Kumar, Scientist-E, CoE-SLM, ICFRE

Sub: Work Order for "Standardization of Package and Practices for Eco-rehabilitation of Degraded Coal Mines Falling under Different Agro-climatic Zones of India through Forestry Interventions".

Ref: Proposal from Centre of Excellence on Sustainable Land Management (CoE-SLM), Indian Council of Forestry Research and Education (ICFRE), Dehradun regarding eco-restoration of degraded mined out areas in Coal India Limited and its Subsidiaries received vide email dated 14.03.2024 (Enclosed Annexure 1)

Sir,

Competent Authority agreed to your offer for carrying out the assignment for "Standardization of Package and Practices for Eco-rehabilitation of Degraded Coal Mines Falling under Different Agro-climatic Zones of India through Forestry Interventions" with total project cost of Rs 24,44,08,680 (inclusive of 18% GST)

Year wise project cost break up is as below-

Sl. No.	Head	1 st Year	2 nd Year	3 rd Year	4 th Year	5 th Year	Total
A	Project Expenses	3,88,31,000	4,99,08,000	5,27,51,000	3,31,68,000	2,64,68,000	20,11,26,000
B	Intellectual fee	12,00,000	12,00,000	12,00,000	12,00,000	12,00,000	60,00,000
C	GST (18%)	72,05,580	91,99,440	97,11,180	61,86,240	49,80,240	3,72,82,680
	Total	4,72,36,580	6,03,07,440	6,36,62,180	4,05,54,240	3,26,48,240	24,44,08,680

Scope of Work:

1. Study the extent of degradation in the proposed sites (three sites in each agro-climatic zone)
2. Developing techno-scientific improvisations in top-soil management to facilitate conservation and utilization of the top soils for biological rehabilitation of mined over areas and overburden dumps.
3. Developing agro-climatic zone specific models for eco-rehabilitation of the mined over areas in different representative locations of Coal India Limited.
4. Support capacity building of the concerned personnel of Environment Management Units of subsidiaries of Coal India Ltd. in eco-restoration techniques by way of association with the project activities.
5. Developing RS-GIS based land degradation and eco-rehabilitation monitoring model.

6. Other relevant points related to the proposed study.

Study Area: 39 sites in 13 agro-climatic zones falling under 8 states under which coal mines of CIL are lying (As per enclosed Annexure-2). (5 Ha area to be restored per site). As per availability of land modification in area/ site if required shall be made.

List of 39 sites in CIL will be communicated after acceptance of work order from ICFRE.

Duration of Project – 5 Years

Deliverables & Timeline:

1. Annual submission of Interim reports and utilization certificate of funds as proposed.
2. Submission of soft copy of draft reports within 15 days after completion of project.
3. Submission of Soft copy and ten set of hard copies of final report within 15 days of approved draft.
4. Accepting Authority GM (Env) CIL Kolkata.

Payment Terms:

- i. 50 % of the total amount of the project cost in advance before the commencement of the project after acceptance of order.
- ii. 15% of the total amount of above project cost after completion of activities mentioned up to 2nd year of Work Plan and submission of interim report of work and utilization certificate of previous payments.
- iii. 15% of the total amount of above project cost after completion of activities mentioned up to 3rd year of Work Plan and submission of interim report of work and utilization certificate.
- iv. 20 % of the total amount of above project cost after completion of all the activities and submission of final report at the end of 5th Year.

Acceptance of Work Order:

Letter of acceptance of Work Order should be communicated to CIL within 7 days of receipt of Work Order.


 14-06-24
 General Manager (Env)
 CIL Kolkata

Copy to:

1. DT(P&P), ECL/BCCL/CCL/MCL/NCL/SECL/WCL
2. ED (Coordination), CIL
3. TS to D(T), CIL
4. GM (NEC)
5. GM (Env), ECL/BCCL/CCL/MCL/NCL/SECL/WCL

नॉर्थर्न कोलफील्ड्स लिमिटेड
(मिनिरातना कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)



वन विभाग / Forest Department

CIN- U10102MP1985GOI003160

An ISO 9001, ISO 14001 & ISO 45001 Certified Company

पोस्ट-सिंगरौली कोलियरी, जिला- सिंगरौली, म.प्र., पिन 486889 / Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone: 07805- 266615, (FAX) 266652, email: gmforest.ncl@coalindia.in website : www.nclcil.in

क्रमांक: एनसीएल/मुख्यालय/पर्यावरण/वन/2025/966

दिनांक :-04.01.2025

प्रति,

प्रभागीय वनाधिकारी

रेनुकूट वन प्रभाग

सोनभद्र उत्तर प्रदेश – 231217.

विषय :- Plantation & its subsequent maintenance including Gap & Miyawaki Plantation along with Grassing on OB dumps for the Year 2025-26 at NCL.

महोदय,

NCL projects located in Madhya Pradesh have finalized the following targets of Plantation/Miyawaki/Gap Plantation works to be carried out during the monsoon season of the year 2025-26:-

A. Plantation of OB and Plain Area during FY 2025-26:

Project	Plantation on Overburden Dumps with CPW/CPT		Plantation in Plain Areas & Road side with Fencing/CPT etc.		Total No. of Plants
	Area (Ha.)	No. of Plants @2500 /Ha.	Area (Ha.)	No. of Plants @2500 /Ha.	
Bina	26 (Int.)	65000	0	0	65000
Khadia	3.0 (Ext.)	7500	0	0	7500
Dudhichua	15(Int)	37500	0	0	37500
Krishnashila	05 (Int.)	12500	0	0	12500
Total (UP)	49	122500	0	0	122500

B. Miyawaki Plantation Target of the year 2025-26:-

Project	Area in Ha.	Total No. of Plants @35000 /Ha.
Bina	1.0	35000
Kakri	0.55	19250
Total (UP)	1.55	54250

नॉर्थन कोलफील्ड्स लिमिटेड
(मिनीरत्न कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)



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CIN- U10102MP1985GOI003160

An ISO 9001, ISO 14001 & ISO 45001 Certified Company

पोस्ट-सिंगरौली कोलियरी, जिला- सिंगरौली, म.प्र., पिन 486889 / Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone: 07805- 266615, (FAX) 266652, email: gmforest.ncl@coalindia.in website : www.nclcil.in

---2---

C. Gap Plantation Target of the year 2025-26:-

Project	Area in Ha.
Khadia	2.82

It is requested to kindly submit detailed proposal in shape of a draft MoU including Terms and Conditions as well as detailed year wise estimates of the aforesaid plantation works in 2025-26 and subsequent maintenance works during next four years period showing clearly all the items of works/expenditures including all the fencing materials for the areas suitable for plantation works. Proper documents related to rates of fencing, seeds etc. material procurements shall require to be attached with the estimates.

Maps for the proposed plantation sites are enclosed for necessary action. While preparing the aforesaid proposal, the following points are to be kept in mind-

1. On overburden dumps, suitable native species (endemic species should be given priority) including fruit bearing species and Sal plantation & bamboo, suitable species of medicinal values like Neem, Karanj etc. are to be planted depending upon local site conditions shall be planted which efficiently bind the loose soils. OB dumps shall be stabilized by making terraces of proper sizes and these terraces are to be further reinforced with pebbles, stones and by planting suitable grass species.
2. Plantation areas are to be secured through proper fencing arrangement like Barbed Wire Fencing (BWF) or Cattle Proof Trench (CPT) or Cattle Proof Wall (CPW) as per the local site requirements.
3. Provisions for providing appropriate safety gears (Helmets, Safety Shoes etc.) for the safety of labours working in plantation areas located inside coal mines should be made in the estimates.

नॉर्दर्न कोलफील्ड्स लिमिटेड
(मिनीरल कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)



वन विभाग / Forest Department

CIN- U10102MP1985GOI003160

An ISO 9001, ISO 14001 & ISO 45001 Certified Company

पोस्ट-सिंगरौली कोलियरी, जिला- सिंगरौली, म.प्र., पिन 486889 / Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone: 07805- 266615, (FAX) 266652, email: gmforest.ncl@coalindia.in website : www.nclcil.in

---3---

This may be taken as preliminary call to Renukoot Forest Division, the Govt. of UP for submission of their offer to the NCL. The proposal & estimate, as submitted by you, shall be considered and decided by the NCL. The final work order will be issued only after the competent approval. No financial liability shall accrue to the NCL as result of the present call for offer.

In case, the proposal & estimate of Renukoot Forest Division is accorded approval, Renukoot Forest Division shall be required to execute a MoU for the period from 2025-26 to 2029-30 (plantation works in 2025-26 and maintenance works during next four years from 2026-27 to 2029-30).

You may kindly submit the required draft MoU including estimates as earliest.

Encl.: As above.

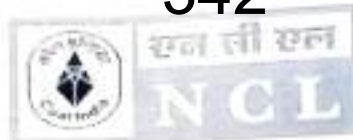
भवदीय

महाप्रबंधक (पर्यावरण एवं वन),
एन.सी.एल.-सिंगरौली

प्रतिलिपि :

1. निदेशक (तकनीकी / परियोजना व योजना), एनसीएल.....सूचनार्थ
2. महाप्रबंधक (दुधिचुआ, बीना, खडिया, ककरी एवम् कृष्णशिला)- उचित कार्यवाही हेतु ।

नॉर्दर्न कोलफील्ड्स लिमिटेड
खडिया परियोजना
(मिनिरल कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)



Northern Coalfields Limited
Khadia Project
(A Miniratna Company)
(A subsidiary of Coal India Limited)

Office of General Manager



CIN: 110102NP1985G01001160

AN ISO 9001, ISO 14001 & OHSAS 18001 Certified Company

थाना-शक्तिनगर, जमशेदपुर-सोनभद्र (उ.प्र.), पिन - 231222 / Thana-Shaktinagar, Dist. Sonbhadra (U.P.) Pin- 231222

Phone: 05446- 232274, (FAX) 05446- 232274 Email: cgm.khdi@gmail.com, website: www.ncl.co.in

KHD/ Mining / Env / Plantation /24-25/4710

Date: 13/02/2025

To,
The Divisional Forest Officer
Renukoot Forest Division
Distt. - Sonbhadra (U. P.)-231217

Sub: - Work order for 3 tier plantation along newly constructed CC Road and mine boundary

Dear Sir,

Enclosed please find herewith the original copy of Memorandum of Understanding (MoU) executed between the Khadia Project NCL and the Renukoot Forest Division for the plantation works to be carried out at Khadia Project besides newly constructed CC Road and mine boundary.

As per the MoU, plantation targets on newly constructed Cement Concrete Road and mine boundary and financial provisions are as follows:

Sl. No.	Area of Plantation	No. of Plants	Total cost of plantation work including maintenance
1	2.8 Ha	1750	6746800/-

It is requested to commence plantation work as per the terms and conditions of enclosed MoU. It is further requested that saplings to be planted should only include native species with plants of broader leaves and long life.

Yours faithfully,

[Signature]
General Manager
Khadia Area, NCL

Copy to:

- (1) The General Manager (Environment & Forest), NCL Singrauli
- (2) Staff Officer (Mining), Khadia Area
- (3) AFM, Khadia Area

MEMORANDUM OF UNDERSTANDING (MoU) BETWEEN NORTHERN COALFIELDS LIMITED KHADIA PROJECT AND FOREST DEPARTMENT RENUKOOT DIVISION, GOVERNMENT OF UTTAR PRADESH FOR YEARS 2024-25 to 2027-28 FOR C.C. ROAD PLANTATION WORKS (ADVANCE WORKS, PLANTING WORKS AND SUBSEQUENT TWO YEARS MAINTENANCE) IN KHADIA PROJECT NCL

1. (i) The word 'Company' hereinafter shall mean, for the purpose of this Memorandum of Understanding (MoU), the Northern Coalfields Limited (NCL KHADIA PROJECT) (A Project of M/s Northern Coalfields Limited) having its registered office at P.O. Shaktinagar, District Sonbhadra, U.P. represented by General Manager, Khadia Area, NCL or his authorized representative or any other person deputed on his behalf for carrying out all or any of the provisions of this MoU.
 (ii) The word 'Department' hereinafter shall mean, for the purpose of this MOU, the Department of Forest, Government of Uttar Pradesh represented by the Divisional Forest Officer (DFO), Renukoot Forest Division or his authorized representative or any other person deputed on his behalf for carrying out all or any of the provisions of this MoU.
2. The Department shall carry out plantation works on Company's acquired/ leased /purchased/transferred lands of various types viz. tenancy lands, Government revenue lands, forest lands etc., with professional expertise, as per the details of works along with terms and conditions and other provisions of this MOU. On NCL's side, the Environmental Officer of the Khadia project shall be Nodal Officer for carrying out day to day activities as per this MoU, whereas General Managers, Khadia Projects shall be Officers-in-Charge who shall be overall responsible for implementation of the provisions of this MoU.
3. The Department as well as the Company shall always exercise due precautions for ensuring safety of human lives and properties involved in the plantation activities undertaken by the Department. The GM Khadia project and the DFO, Renukoot shall abide by the legally and technically appropriate advices, as tendered by either officials for the safety of human lives and properties involved in the plantation activities. During the entire period of this MoU, the plantation sites shall be "closed sites", which means that any activity other than plantation and forestry related activities shall not be allowed in the plantation site.


 प्रभागीय वन्यविकसरी
 रेंकुट वन प्रभाग
 रेंकुट-सोनभद्र (उ०प्र०)


 12-02-2025
 General Manager
 Khadia Area

4. In case of any accident, its causes shall be investigated under the statutory framework of the mine. Based on its findings, the responsibilities of the concerned officials of the Department or/ and the Company shall be fixed by the statutory body. After this, all the consequential liabilities (including compensation etc.), as per the concerned provisions of the Workmen's Compensation Act, 1923 and related laws, shall be borne by the Department or the Company as the case may be.
5. The Department shall carry out all the plantation activities while observing all related laws, rules, regulations and statutory orders applicable to the site and nature of work which has been issued in connection with such site and nature of work by the Government of Uttar Pradesh, the Government of India and NCL.
6. The Company shall furnish to the DFO, Renukoot Forest Division the relevant details of the lands to be covered under the plantation works along with its maps. Various items of plantation works and their rates shown in the enclosed annexures of this MoU have been finalized on the basis of site specific scheme/estimate of the plantation works submitted by the DFO, Renukoot Forest Division. Following works are stipulated:-
 1. Advance soil works – Nursery related works and all site preparation works (to be carried out during 15.02.2025 to 30.06.2025).
 2. Planting works –Planting during monsoon season of 2025 and its subsequent aftercare works including protection and maintenance (to be carried out up-to 31.03.2026)
 3. 1st year maintenance works- Aftercare works including 30% causality replacements and protection works (to be carried out during 01.04.2026 to 31.03.2027)
 4. 2nd year maintenance works- Aftercare works including 20% causality replacements and protection works (to be carried out during 01.04.2027 to 31.03.2028)
7. Six months to twelve months old (polythene) plants shall be used for plantation works by the Department. Mixed Plantation species for planting shall be selected by concerned range forest officer with the consultation of SDO Pipari and DFO Renukoot as per the local site conditions. The selection of species shall also be guided by the opinion of the local villagers with a appropriate blend of fast growing species naturally growing in those areas, fruit bearing trees and trees of commercial value. In no case, however, a particular species shall constitute more than 30% of the total plantation in a particular area.


प्रकाश चंद्रा
रेनुकूट वन प्रयाग
रेनुकूट-सोनगढ (उप्र)


General Manager
Khadia Area

8. The Department and the Company shall comply with the following schedule of Joint Inspections and verifications of the concerned plantation works to be done jointly by the concerned nominated officials of the Department and the NCL:

Schedule of Joint Inspections

S.N.	Joint Inspection	Tentative date of its Completion
1.	1 st Joint Inspection – Verification of Advance Works	30 th June, 2025
2.	2 nd Joint Inspection – Verification of Planting Works	15 th October, 2025
3.	3 rd Joint Inspection – Verification of 1 st year maintenance works	15 th October, 2026
4.	4 th Joint Inspection – Verification of 2 nd year maintenance works	15 th October, 2027
5.	5 th and final Joint Inspection – Verification of 2 nd year maintenance works (full works) including 100% enumeration of planted saplings at the time of handing over of plantation works by the Department to Company	31 st March, 2028

10. (i) In the joint inspections and verification of the plantation works in the concerned projects, two officials of the concerned projects, preferably Environmental Officers/ Survey Officers/ Civil Engineers, as nominated by the General Managers Khadia Project shall participate from the NCL side whereas the concerned Range Forest Officer of Renukoot Forest Division as nominated by the DFO, Renukoot shall participate from the Department side. The joint inspection reports shall be signed immediately by the aforesaid officials from both the side who have carried out the joint inspections and later on shall be countersigned by the concerned Chief General Managers / General Managers of the projects. The DFO Renukoot and the CGMs/GMs of the concerned projects shall be responsible for carrying out all the stipulated joint inspections within the stipulated time limit.
- (ii) In case of any dispute in the process / result of the joint inspections of the plantation works in the concerned projects, The DFO, Renukoot and the


 प्रशासीत सनाधिकारी
 रनुकुट वन प्रभाग
 रनुकुट-सोनमड (उ०प्र०)


 General Manager
 Khadia Area

CGMs/GMs of the concerned projects shall within 15 days, after mutual consultation and consent, carry out joint inspections by another team of superior officers different from those officials earlier nominated for joint inspections. The results / findings of this team shall be binding on both the parties.

11. Payment Scheduled and submission of expenditure Bills/details: Fund shall be released (through Cheques or Demand Draft as the case may be) by the Chief General Managers/General Managers of the Khadia project in installments as per the following schedule, subject to submission of physical and financial details of completed works by the Department:-

Note- After the utilization of 80% of the budget released for afforestation activity, utilization certificate will be submitted by DFO for demand of next work. Remaining 20% budget will be utilized and final utilization of 100% budget will be submitted afterwards.

- a. 1st Installment- As "Advance Fund" equal to 100% of the total amount estimated for the "Advance Soil Works" component will be released on issue of work order in 2025.
- b. 2nd Installment- As "Advance Fund" equal to 80% of the total amount estimated for 'Planting Works' component as per approved scheme will be released by 15th July, 2025 on receipt of 1st joint inspection/verification report of "Advance works" subject to submission of physical and financial details of "Advance work".
- c. 3rd Installment- An amount equal to 20% of the total amount estimated for 'Planting Works' component will be released by 15th October, 2025 on receipt of 2nd Joint inspection report subject to submission of physical and financial details of 'Planting Works' and on adjustment of previous advances paid to the Department.
- d. 4th Installment- An amount equal to 80% of the total amount estimated for '1st year maintenance works' shall be released by 15th April, 2026 on adjustment of previous installments paid to the Department.
- e. 5th Installment- An amount equal to 20% of the total amount estimated for '1st year maintenance works' shall be released by 1st November, 2026 after submission of 3rd Joint inspection report and on adjustment of previous installments paid to the Department.
- f. 6th Installment- An amount equal to 80% of the total amount estimated


प्रकाश चन्द्र
रेनुकट दन प्रमाण
मुद्रा-सोनमद्र (उ०प्र०)


12-02-2025
General Manager
Khadia Area

for '2nd year maintenance works' shall be released by 15th April, 2027 on adjustment of previous installments paid to the Department.

- g. 07th Installment- An amount equal to 20% of the total amount estimated for '2nd year maintenance works' shall be released by 15th of April, 2028 after submission of 4th and 5th joint inspection report (including results of 100 % enumeration on the basis of which the minimum survival percentage shall have to be ensured) and on final adjustment of all the previous advances/ installments paid to the Department. **Proforma for submission of Physical and financial details for release of subsequent installments:**

Year of Plantation	Nos. of Plants planted		No. of Installment as per Clause 11 of the MoU	Advance Amount paid by the Project as Installment (In Rs.)	Amount spent against paid installment (In Rs.)	Balance Amount to be adjusted from the next installment (In Rs.)
	Location	Nos.				
1	2	3	4	5	6	7
	OBD					
	Plain					

12. Adjustments, if any, from installments released shall be made from the subsequent installments before their release to the Department.
13. The Department will ensure 80% survival of plants during the final joint inspection before handing over of the plantation works to the Company and which shall signify 100% success of plantation works.

"If survival of plants falls below 80% at the time of handing over of plants after ~~Two~~ years of completion of plantation, proportionate deduction of amount paid during ~~Two~~ years for the plants less than 80% shall be recovered except in incidences of natural calamities."

14. The Department shall pay wages not less than the minimum wages fixed by the Govt. of U.P. to the laborers engaged in plantation works. It will be the sole responsibility of the Department to ensure due compliance of existing labour related laws and obtain labour license, permission etc. whatsoever are applicable / required. The company shall in no way be held responsible for the above.


प्रभागीय वनाधिकारी
रेनुकट वन प्रभाग
रेनुकट-खोन्मव (उ०प्र०)


General Manager
Khadia Area

15. In case of revision of labour rates (applicable for the Forest Department by the Govt. of UP) an appropriate escalation in costs of the concerned work items shall be allowed and payable (within 30 days) as per the following formula:

$$\Delta R = 0.85 \times P / 100 \times R \times (L_1 - L_0) / L_0$$

Where,

ΔR = Increase in the cost of Work Item

P = Percentage of labour component of the work = 80 % agreed

R = Original Cost of work

L_1 = Revised labour Rate of work

L_0 = Original labour Rate of work (base rate Rs. 230.00/mandays)

16. In case either the Department or the Company fails, at any stage of implementation of the MoU, to abide by the schedules of inspections and payments, as envisaged in Clause - 9 and Clause - 11 of this MoU respectively, the first defaulter shall be responsible for all the ensuring the consequences and further action in such cases will be dealt as per the provisions of Clause no.-17.
17. In case of any dispute, confusion or difference between the parties hereto, the concerned Chief Conservator of Forests, Mirzapur Forest Circle and the Head of the Forest section of the NCL Hqtrs. shall confer together and arrive at a mutually agreeable solution, which shall henceforth be binding upon both the parties.
18. No claims whatsoever shall lie against the Company for any loss or damage suffered by the Department due to any act of God viz. Natural Calamity, Excessive Rains, Floods, Land Slides, Mine fire etc. in the Project area or due to any eventuality of War, Civil unrest, Strike, Lockout, etc. beyond the control of the Company. However, the Department shall not be responsible for any damage to the plantation works due to the act of God, viz. Natural Calamity, Excessive Rains, Floods, Land slides, Mine fire etc. in the Project area or due to any eventuality of War, Civil unrest, Strike, Lockout, etc. Natural Calamity, War, Civil commotion, Strikes, Lockout, etc. beyond the control of the Department subject to the condition that due precautions have been taken by the Department. In the eventuality of any damage to the plantation works due to any of the above factors, the DFO, Renukoot shall immediately intimate the CGM/GM of the concerned project and a joint assessment of the damages will be carried out within 72 hours and if necessary, photography / videography of the concerned sites / damages shall be carried out.


प्रशान्तीय वन्यधिकारी
रेनुकूट वन प्रभाग
रेनुकूट-सोनमठ (उ०प्र०)


12.02.2015
General Manager
Khadia Area



19. Any modification, alteration, addition or deletion in terms and conditions of MoU shall be done as and when required during the course of MoU mutually agreed by the Director, Technical (Project & Planning), NCL and the Chief Conservator of Forests, Mirzapur Forest Circle.

This Memorandum of Understanding is executed between the Department and the Company on the 28/09/2025 Day of the Month of FEBRUARY in the Year 2025 and will be effective from the date of its execution and shall be valid up-to 31.03.2028 unless any modification or alteration takes place as per the terms and conditions of this MoU.

Name:

Designation: प्रमुख वनाधिकारी

Authorized रेनुकट मन प्रभाग
Representative of the
Department

Name:

Designation: General Manager

Authorized Representative
of
the Company

एन०सी०एल० खडिया परियोजना द्वारा निर्मित सी०सी० रोड एवं माईन बाउण्ड्री के पास
मिश्रित साल प्लांटेशन हेतु माहल व्यय अनुमान पत्र.

क्षेत्रफल- 2.8 हे०

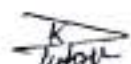
प्रभाग का नाम :- रेनुकूट वन प्रभाग

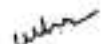
गड्डों की संख्या-1750

सुरक्षा फेंसिंग-11759 मी०

प्रथम चरण (अधिम मृदा कार्य)

क्र०स०	कार्य का विवरण	अनुसूची दर कम रु०	इकाई	मात्रा	दर प्रति इकाई	मनराशि
1	2	3	4	5	6	7
1	रोड का चौकाल एवं सीमांकन	3.1	मी०	2.8	81.79	173.01
2	रोड की चौकाल	3.2	मी०	2.8	1981.89	5549.29
3	आवारापट्टी/गोम का हटान एवं अपूर्ण	स्थानीय दर	रु०	3919	505	1979095.00
4	रेलवे लाइन का हटान एवं अपूर्ण	स्थानीय दर	रु०/मी०	11759	250	2939750.00
5	रेलवे लाइन	3.3				
	(क)- गड्डे (3.00x3.00 मी०)		प्रति गड्डा	1750	0.56	980.00
7	अधिम मृदा कार्य	4				
	(क)- गड्डा का खुदाय (0.45X0.45X0.45 मी०)	4.2	प्रति गड्डा	1750	11.90	20825.00
	बाउण्ड्री निर्माण (0.80X1.80X0.45)	13.3		1750	55.10	96425.00
8	वर्गचौकरी को दखई, धानी की सुकिया	11	प्रति रो०	2.8	197.16	552.05
11	मोटीकापी व दोन तीरिगोप्रापी एवं हलकन खंभारन	स्थानीय दर				4000.00
12	अन्य व्यय (अवसादनिक व्यय, बीजों का हटान व मरम्मत, स्टेशनरी आदि पर व्यय)	-	रु०	2.8		1932.00
					योग-	5049281.35
					बा-	5049300.00


प्रनारी क्षेत्रीय वन अधिकारी
खडिया प्रोजेक्ट
रेनुकूट वन प्रभाग, रेनुकूट


उप प्रभागीय वनाधिकारी
फिनर, उप वन प्रभाग, रेनुकूट


प्रभागीय वनाधिकारी
रेनुकूट वन प्रभाग, रेनुकूट
खोनभर, उत्तर प्रदेश


प्रभागीय वनाधिकारी
रेनुकूट वन प्रभाग
रेनुकूट-खोनभर (उ०प्र०)

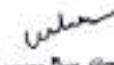

12-02-2025
General Manager
Khadia Area

द्वितीय चरण (वृक्षारोपण कार्य)

क्र.सं.	वर्ग या विवरण	अनुसूची दर कम साठ	इकाई	मात्रा	दर प्रति इकाई	धनराशि
1	2	3	4	5	6	7
1	गडदा का भरण कार्य	5.1	प्रति गडदा	1750	1.37	2397.50
2	पौधा का (3 प्रतिशत ऑटोरिक्त पौधा)	स्थानीय दर	प्रति पौधा	1803	80.00	144240.00
3	पौधा की स्थानीय वृक्षारोपण सहित				3.34	6022.02
	(क) पौधा रोटी (3 प्रतिशत ऑटोरिक्त पौधा)	7.3 a	प्रति पौधा	1803	5.05	8837.50
4	गडदा में पौधा रोपण के समय सभी तकसेट (800 मात्रा) प्रति पौधा मिलाई सहित	7.5 a	प्रति पौधा	1750		
5	पौधा बगान 12 मी चौड़ा	7.8	प्रति पौधा	1750	3.03	5302.50
6	निचोटा-गडदा (2 बार) प्रतिवर्षीय सहित				1.03	3605.00
	क- गडदा पौधा 1250X2=3500	8.1 a	प्रति पौधा	3500	2.40	226800.0
7	पौधा की सिंचाई औराना पत्र में 6 बार	13.6	प्रति पौधा	94500.0		
	10x1750=94500			1750	0.70	1225.00
8	25 साल पुराना एक बार अप्रत्यक्ष दूसरी बार प्रतिवर्षीय पत्र में 6 बार (पूरिषा का मुख्य सहित)	8.3	प्रति पौधा			
9	आवर्तकीयता सभी का स्थानीय वृक्षारोपण एवं प्रति गडदा तक फैलना आदि कार्य	9.2 b	प्रति	3919	7.58	29627.64
10	आवर्तकीयता सभी की गडदा गडदा सुवाक सहित	स्थानीय दर	प्रति	3919	13.10	51338.90
	45 गडदा 1250X30 सेमी मात्रा का गडदा			11759	20.00	235180.00
11	सिटल जाली की सिंचाई एवं सभी पर गडदा	स्थानीय दर	प्रति गडदा	2	5323.18	10646.36
13	वृक्षारोपण रोटी की बगदा	10.5	प्रति रोटी	520	230.00	119900.00
14	वृक्षारोपण सुवाक 10 प्रतिशत पर व्यय पत्र में 6 बार (प्रति)	10.4	प्रति			
16	रोटी की सफाई	3.2	प्रति	2.8	1981.85	5549.29
17	अन्य व्यय (प्रशासनिक व्यय, ऑटोरिक्त का समय व मरम्मत, स्टेशनरी आदि पर व्यय)	—	प्रति	2.8		12800.00
					योग-	863171.71
					बा-	863100.00

नोट-रोपित पौधों की सिंचाई हेतु पानी टैंकर द्वारा एन0सी0एल0 खडिया परियोजना के द्वारा वृक्षारोपण के पास उपलब्ध कराया जायेगा।


प्रदेशी क्षेत्रीय वन अधिकारी
खडिया प्रोजेक्ट
रेनुकट वन प्रभाग, रेनुकट


उप प्रदेशीय वन अधिकारी
विपरी, वन वन प्रभाग, रेनुकट


प्रदेशीय वन अधिकारी
रेनुकट वन प्रभाग, रेनुकट
गोनमन, उत्तर प्रदेश


प्रदेशीय वन अधिकारी
रेनुकट वन प्रभाग
रेनुकट-गोनमन (उ0प्र0)


General Manager
Khadia Area

प्रांतीय वनरक्षण (प्रभाग अनुसूचना)

क्र.सं.	कार्य वन विवरण	अनुसूची क्र. सं.	इकाई	मात्रा	दर प्रति इकाई	घनराशि
1	2	3	4	5	6	7
1	पेपल की सिंघाई - गुंजाई (दो बार) 1750X2=3500	8.18	प्रति पेपल	3500	1.03	3605.00
2	पेपल की सिंघाई - औसत माप से 5 बार 1205X1750=105000	13.6	प्रति पेपल	105000.0	2.40	252000.00
3	कुलपरीक्षण सुदृष्टता हेतु अधिक पर समय अर्पण से माप (2 प्रकरी)	10.4	दिन	555.0	230.00	127650.00
5	होम की सफाई	3.2	दिन	2.8	1981.89	5549.29
6	अन्य व्यय (प्रशासनिक व्यय, औजारों का क्रय व परम्परा स्थानीय आदि पर व्यय)	—	दिन	2.8	MPH	1600.00
					योग—	390404.29
					या—	390400.00

नोट—रोपित पेपलों की सिंघाई हेतु पानी टैंकर द्वारा एन0सी0एल0 खड़िया परियोजना के द्वारा वृक्षारोपण के पास संपन्न कराया जाएगा।

Kishor
सहायी क्षेत्रीय वन अधिकारी
खड़िया प्रोजेक्ट
रेनुकूट वन प्रभाग, रेनुकूट

ultra
उप प्रभागीय वनाधिकारी
विपरीत उप वन प्रभाग, रेनुकूट

h
प्रभागीय वनाधिकारी
रेनुकूट वन प्रभाग, रेनुकूट
सोनमध, उत्तर प्रदेश

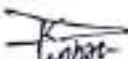
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प्रभागीय वनाधिकारी
रेनुकूट वन प्रभाग
रेनुकूट-सोनमध (उत्तर)

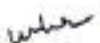
12/05/2025
General Manager
Khadia Area

समुच्चय चरण (द्वितीय अनुसूचन)

क्र.सं.	कार्य का विवरण	अनुसूची वर्ग क्रम सं०	इकाई	मात्रा	दर प्रति इकाई	घनराशि
1	2	3	4	5	6	7
1	गडदो पीप की सिंचाई-गुआई तथा स्प्रेडिंग कार्य दो बार(1750X2=3500)	8.18	प्रति पीप	3500	1.03	3605.00
2	पीपों की सिंचाई औसतन ग्राह में 5 बार 12x5x1750=105000	13.6	प्रति पीप	105000.0	2.40	252000.00
4	सुरक्षा अभियन्ता का पारिश्रमिक जपेट से माघ तक (2 प्रहरी)	10.4	दिन	555	230.00	127650.00
5	अभियन्ता हेतु पेरजल एवं प्राथमिक चिकित्सा पर व्यय	11	प्रति हे०	5	197.16	985.80
7	डाडी की सफाई	3.2	हे०	2.8	1981.89	5549.29
8	फोर्सिंग मरम्मत कार्य					50000.00
10	प्रजातिवार लघुईवार गोलाईवार पीपों की गणना		प्र०हे०	2.8	924.58	2588.82
11	अन्य व्यय (प्रशासनिक व्यय, औजारों का क्रय व मरम्मत, स्टेशनरी आदि पर व्यय)	—	हे०	2.8	628.57	1700.00
					योग	444078.91
					या-	444000.00

नोट-रोपित पीपों की सिंचाई हेतु पानी टैंकर द्वारा एनसीएलए खड़िया परियोजना के द्वारा वृक्षारोपण के पास
उपलब्ध कराया जायेगा।


सुपरीवेन्टरीय वन अधिकारी
खड़िया प्रोजेक्ट
रेनुकूट वन प्रभाग, रेनुकूट


उप-प्रभागीय वनाधिकारी
पिपर, उ० व० प्रभाग, रेनुकूट


प्रभागीय वनाधिकारी
रेनुकूट वन प्रभाग, रेनुकूट
सोनमठ, उत्तर प्रदेश


प्रभागीय वनाधिकारी
रेनुकूट वन प्रभाग
रेनुकूट-सोनमठ (उ०प्र०)


12-05-2025
General Manager
Khadia Area

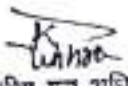
प्रोजेक्ट की कुल लागत

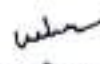
प्रभाग का नाम- रेनुकूट वन प्रभाग, रेनुकूट सोनमद्र

खड़िया प्रोजेक्ट

क्षेत्रफल-2.8 हे०

कार्य मद	भौतिक (हे० में)	धनराशि (रुपये में)
प्रथम चरण (अग्रिम मृदा कार्य)	2.8	5049300.00
द्वितीय चरण (वृक्षारोपण कार्य)	2.8	863100.00
तृतीय चरण (प्रथम अनुरक्षण कार्य)	2.8	390400.00
चतुर्थ चरण (द्वितीय अनुरक्षण कार्य)	2.8	444000.00
2.8 हे० क्षेत्र हेतु कुल आवश्यक धनराशि योग-		6746800.00


प्रदेशी क्षेत्रीय वन अधिकारी
खड़िया प्रोजेक्ट
रेनुकूट वन प्रभाग, रेनुकूट


उप प्रभागीय वन अधिकारी
विपरी उप वन प्रभाग, रेनुकूट


प्रभागीय वन अधिकारी
रेनुकूट वन प्रभाग, रेनुकूट
सोनमद्र, उत्तर प्रदेश


प्रभागीय वन अधिकारी
रेनुकूट वन प्रभाग
रेनुकूट-सोनमद्र (उ०प्र०)


12-02-2025
General Manager
Khadia Area



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(वैज्ञानिक अध्ययन)
SCIENTIFIC STUDY
(UNDER REGULATION 106 OF CMR- 2017)
FOR
(खड़िया विस्तार खुली खनन परियोजना)
KHADIA EXPANSION OCP
(NORTHERN COALFIELDS LIMITED)



SEPTEMBER 2023

ओपनकास्ट विभाग,
सीएमपीडीआई-मुख्यालय

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PREFACE

GM (CP) NCL, Singrauli, vide Letter No: NCL/CP/CMPDI/23/5155 Dated 21.03.2023, confirmed that the assignment for Scientific Study under Regulation 106(2) of CMR 2017 be taken up for Khadia OCP of Northern Coalfields Limited (NCL) by CMPDI HQ under annual action programme of CMPDIL for FY 2023-24 for NCL. The Job no allotted for the assignment is 024622273.

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1 INTRODUCTION

1.1 BACKGROUND

The Singrauli Coalfield comprises of two separate sedimentary domains, covering an area of about 2375 sq. km. It consists of Main Basin in the western part covering an area of 2075 sq. Km. and the eastern part covering an area of 300 sq. Km. known as Moher Sub-Basin.

The Feasibility Study of Singrauli Coalfield prepared by CMPDI in collaboration with the Soviet Experts in 1974, identified Khadia OCP for a rated capacity of 10 Mtpa. The Project Report for 10 Mtpa capacity was prepared by CMPDI in November, 1982, but Considering the constraint in demand and linkage Govt. of India sanctioned the Project Report for 4 Mtpa capacity on 18.09.1985.

The Detailed Project Report/RCE (4 Mtpa) was prepared jointly by CMPDI and Soviet Experts and was sanctioned by the Govt. of India on 27.09.1991 for a capital investment of `588.75 Crores. Coal production was started from the year 1991-92. The Completion Report for 4Mtpa stage was sanctioned by NCL Board on 29.01.1998

The Scheme for development of Eastern Section as envisaged in the sanctioned PR and also to maintain coal production from Central Section was prepared in April, 2002, and the scheme was sanctioned by the NCL Board in June, 2002.

The scheme for production of additional 4.50 Mt of coal (1.50 Mt in 2006-07, 1.50 Mt in 2007-08 and 1.50 Mt in 2008-09) for three years over and above the sanctioned target production was approved in 2005 under Emergency Coal Production Plan (ECP).

The scheme for development of Western Section was prepared by CMPDI for proper deployment of draglines and for production of additional 1.00 Mt of coal to meet the higher demand and this scheme was approved by the NCL Board in December, 2006.

Subsequently, another scheme for further development of Western Section and to sustain coal production for three years i.e. from 2009-10 to 2011-12 was prepared by CMPDI and approved by the NCL Board on 20.03.2009

PR for Khadia OCP (4 Mtpa to 10 Mtpa), incremental 6 Mtpa coal production was sanctioned by CIL Board on 28th June, 2011 with option of Coal winning by Departmental Shovel-Dumper and Partial OB removal by outsourcing and Dragline departmental.

The RCE for Khadia OCP (4Mtpa to 10Mtpa)) has been prepared mainly due to change in No. of Dragline and associated Drill as well as its impact on electrical P&M and also dropout of some activities as per requirement of the project with respect to additional provision in the sanctioned PR (6Mtpa incremental)

The RCE of Khadia OCP (4 Mtpa to 10 Mtpa) has been sanctioned by CIL Board for additional capital on 11.02.2020.

The Completion Report for Khadia OCP (4Mtpa to 10Mtpa) has been sanctioned by CIL Board on 11.02.2020.

Khadia project is presently a 14MTPA project and being expanded to 16MTPA project as per approved PR No:- NCL/Board/7C/265/1554 date 25.06.21

GM (CP) NCL, Singrauli , vide Letter No: NCL/cp/c,pdil/23/5155 Dated 21.03.2023, confirmed that the assignment for Scientific Study under Regulation 106(2) of CMR 2017 be taken up for Khadia OCP of Northern Coalfields Limited (NCL) by CMPDI HQ under annual action programme of CMPDIL for FY 2023-24 for NCL. The Job no allotted for the assignment is 024622273

A field visit by a team from CMPDI HQ, Ranchi was undertaken for site reconnaissance and sample collection on 11.04.2023. Inputs related to the Scientific Study were requested from Khadia OCP, NCL, which were received from Project on 03-05-2023 and overburden samples from the Khadia project was received at Geotechnical lab, CMPDI on 30-04-2023.

The Scientific Study has been undertaken based on inputs taken from the mine, base documents from CMPDI, RI-VI and Lab test results for material properties.

1.2 SCOPE OF STUDY

The Scope of Services for the Scientific Study is largely in line with the requirement of regulation 106 (2) of CMR 2017 and is broadly outlined below;

- a. Review of existing mining operations viz method of mining, sequence of extraction, dumping strategy as practiced by the mine management as per the existing mine layout vis-a vis the “Approved PR” for Khadia OCP and suggest for any modifications if necessary.
- b. Overview of the geological setting of the project in respect of lithology, disposition of seams and geological structure (dip/strike/faults/intrusions etc.)
- c. Stability analysis of mine slopes (highwall/working benches and OB dump) considering the current profiles/geo-mining conditions.
- d. Analysis on Design of Ultimate Pit slope, OB dumps; external or internal in accordance approved Project report /Mining Plan.
- e. Review and Suggest slope monitoring techniques.

1.3 FIELD VISIT

A team from CMPDI HQ, Ranchi visited the mine and held discussions with the officials of Khadia OCP , collected sample from the mine and data from mine management on 11-04-2023 to 12-04-2023.

Field investigation has been done to assess the current status mine workings and dumps. The overburden/waste rock contains various materials such as clay, sand, fine grained sandstone, medium grained sandstone, coarse grained sandstone carbonaceous shale, sandy shale, shale, etc. Figure 1.1 below shows the Khadia OCP taken from online coal block information system (OCBIS).



Figure: 1.1 Khadia OCP as taken from online coal block information system (OCBIS).



Figure: 1.2 A team of CMPDI and Khadia Project during site visit to Khaidia OCP

1.4 BASE DOCUMENT

The base documents referred for input data in this study are;

1. Geological Report for Khadia block Vol I (October 1980)
2. Hydrogeological inputs for GW application
3. Project Report for Khadia Expansion Ocp (16 Mtpa)
4. OB samples collected from field visit on 11.04.2023
5. Working Plan and section as on 1-04-2023 in AutoCAD format provided by project authorities during field visit and some drawings were sent through email
6. Geotechnical Lab Test Results

Based on the study and review of the above documentation, a Scientific Study of Khadia OCP has been prepared and presented in this document

2 PROJECT SITE INFORMATION

2.1 LOCATION

The Khadia Expansion OCP (16 Mtpa) includes Khadia Geological Block, part of Ruhela Geological Block and small part of Marrak Geological Block is located in the South-eastern part of Moher Sub-basin of Singrauli Coalfield under command area of Northern Coalfields Limited. The proposed Khadia Expansion OCP is situated partly in District of Sonebhadra (UP) and partly in the District of Singrauli (MP) as shown vide Plate No.MIN-I. The proposed Khadia Expansion OCP is located on the east of Dudhichua OCP and on the west of Krishnashila OCP. The area is covered under Topo-sheet No. 63L/12 and L/16 of the Survey of India on 1:50000 scale and special sheet Nos. 9 & 11 (RF 1:10000). The State Boundary between Madhya Pradesh (Singrauli district) and Uttar Pradesh (Sonebhadra district) passes through the proposed Khadia Expansion OCP.

Geographic co-ordinates are latitude 24°06'50.48" N to 24°09'16.70" N and longitude 82°41'20.91" E to 82°44'27.55" E and is covered in the Survey of India Toposheet 63-L/12 (R.F. 1:50,000) and Special sheet Nos. 9 & 11 (R.F. 1:10,000).

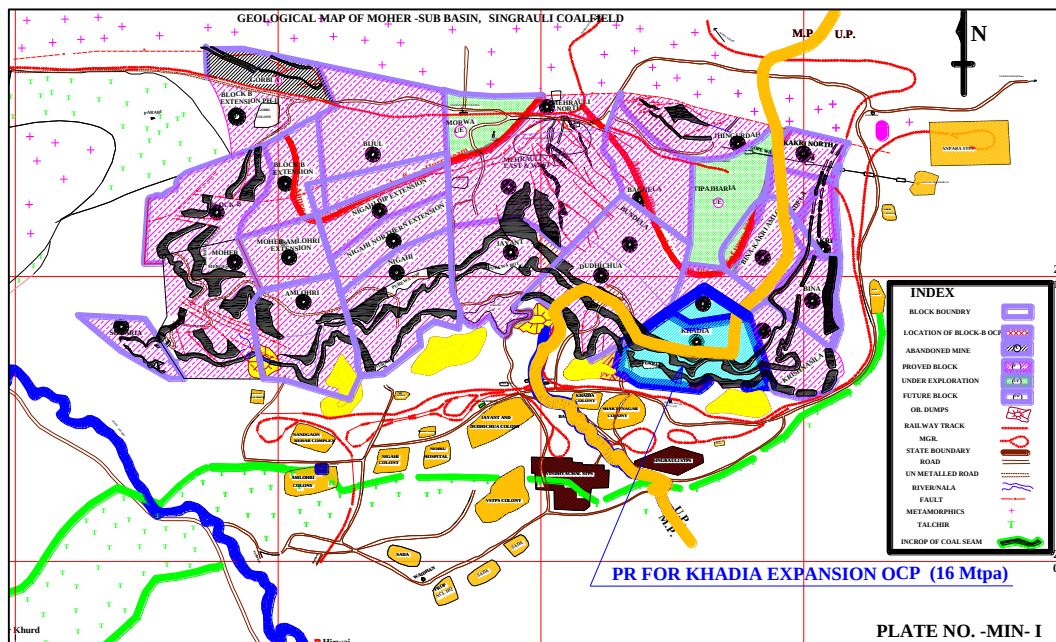


Figure 2.1 Location map with contiguous blocks

2.2 COMMUNICATION AND ACCESSIBILITY

Khadia Expansion OCP is well connected by all-weather roads. The nearest railway station Shaktinagar is at a distance of about 2 km and Singrauli railway station on Katni-Chopan Branch Line of East Central Railway is at a distance of about 12 km from the project. The project is connected with all weathered metalled road to Shaktinagar and Renukut. The project is also approachable from the NCL (HQ) at Singrauli by a fair-weather road. The nearest town Waidhan, the Singrauli district HQ (MP) is located about 12 km to the south, Renukut (UP) is about 45 Km in the east and Varanasi (UP) is about 200 km in the north. The road connecting Renukut to Waidhan passes through the southern part near by the project colony. The nearest air-strip is at Myorpur, located at a distance of about 80 Km from Singrauli, NCL (HQ).

2.3 PHYSIOGRAPHY AND DRAINAGE

2.3.1 Physiography

The Khadia Expansion OCP lies between Krishnashila OCP on the east and Dudhichua OCP on the west. The Khadia Block stands out as a hilly plateau above the plains on its south. The plateau is pronounced by steep escarpment facing south rising from an elevation of 290 m at the base to 425m at the top of the plateau. The area on the top of the plateau is gently undulating except one hill in the north-east corner have an altitude of 490 m. The general elevation of the plateau varies from 425 to 440 m. The drainage of the area is controlled by many small seasonal nallas with southerly flow. All these seasonal nallas discharge into the Balia Nalla in the south which ultimately drains into the GBP Sagar in south.

2.3.2 Climate and Rainfall Data

The climate of the area is tropical with severe summer. The temperature in summer goes as high as 48°C in May-June and the average minimum summer temperature is 21°C. In winter the temperature varies from 4°C to 21°C (November-February). The average annual rainfall is about 1200 mm out of which about 95% of the precipitation is during rainy season from June to September.

2.3.3 Topography with Drainage Pattern of Area

The area is undulating and hilly terrain. The elevation of the plateau varies from 425m to 490m above MSL (Mean Sea Level). It stands out as a hilly plateau with elevations as high as 490m. The mining block area maintains an undulating rugged topography (RL varying from 290 m to 490 m) sloping towards south and west. The base of the plateau extends with elevation around 290m above MSL. Numerous seasonal nalas flowing from north to south and south to north drain through this area and meet the master drain the Rihand dam (Govind Ballabh Pant Sagar) which is located south of this area. The local drainage is mainly radial in nature. Tippa Jharia Nala, Motwani Nala, Balia Nala, drains this area. Tippa Jharia nala drains the Khadia (Expansion) OCP area in north and Ballia nalla drains this OCP in south and meet the Gobind Ballabh Panth Sagar

3 EXPLORATION AND GEOLOGY

The Singrauli coalfield (Latitude $23^{\circ}46'37''$ N & $24^{\circ}13'17''$ N and Longitude $81^{\circ}45'24''$ E & $82^{\circ}47'50''$ E) covering an area of 2375 sq. km is centrally located in the map of India. It constitutes the northern most part of the Son-Mahanadi master Gondwana basin. Singrauli Coalfield is divided in two parts on the basis of geological setup, namely (i) Moher sub-basin (300 sq. km, eastern part) and (ii) Main basin (2075 sq.km, western part), separated by a basement high almost parallel to the Kachan River. The Khadia block is located in the south eastern portion of Moher Sub-basin and has been named after Khadia village situated in the south of the block.

3.1 EXPLORATION ACTIVITY AND PRESENT STATUS

Geological Report on Khadia Block was published in October,1980 by CMPDI, Regional Institute-III, Darbhanga House, Ranchi, Jharkhand (prev. Bihar) on the basis of:

- a) Report on the Geology and Coal Reserves of the north-eastern part of the Singrauli coalfield lying in parts of Sidhi District, MP and Mirzapur district, UP, 1964 (field session 1961-62) by GSI.
- b) A note on the Exploration for coal carried out till 20th March, 1964, in UP area of Singrauli Coalfield, August,1964 by IBM.
- c) A note on the Exploration for coal carried out in Karwari block UP/ MP area of Singrauli Coalfield, during 1963-64 by IBM
- d) Report on the Geology and Coal Reserves of Dudhichua sector, Exploration carried out during 1970-72

3.2 GEOLOGY

PR for Khadia Expansion OCP consists Khadia Geological Coal Block, part of Ruhela Geological Coal Block and a small part of Marrak Geological Coal Block. The entire block consist rocks of Barakar formations are exposed in this block along with recent soil/alluvium cover at places. Barakar Formation consists mainly sandstone, coal and occurrence clay horizons. The generalized sequence as established by GSI and updated by IBM, NCDC and CMPDI.is given in table 3.1.

Table-3.1: The general geological sequence of North Eastern Part of Singrauli Coalfield

Group	Formation	Lithology	Thickness (m)
Damuda Group Lower Gondwana	Recent	Soil/ Alluvium Sandstone, Carbonaceous shale & fireclay	150
	Raniganj Formation	Coal, shaly coal & Carbonaceous shales (Jhingurdah Top seam)	131 to 135
		Medium grained sandstone and shale	39 to 58
		Coal, shaly coal & Carbonaceous shales (Jhingurdah Bottom seam)	10 to 15
		Sandstone, carbonaceous shale with coaly stringes	60
	Barren Measures	Medium to coarse grained sandstone with greenish shale Bands changing into red & green clay near outcrop	125
		Carbonaceous shale, sand-stone & thin coal bands Coal, shaly coal and carbonaceous shale (Panipahari Seam)	45 to 70 1 to 2
		Fine to coarse grained sandstone	110 to 125
		Coal & shale	10 to 0
		Sandstone and shale Carbonaceous shale, shaly coal and coal (Purewa Top Seam)	30 to 40 8 to 12 8 to 12
	Barakar Formation	Fine to coarse grained sandstone	0 to 60
		Coal Carbonaceous shale & shaly coal (Purewa Bottom Seam)	10 to 14
		Fine to coarse grained sandstone	45 to 75
		Coal, carbonaceous shale & shaly coal (Turra Seam)	14 to 23
		Fine to coarse grained sandstone	45 to 90
		Coal & shaly coal (kota Seam)	1 to 3
		Fine to coarse grained sandstone	150 to 230
	Talchir Formation	Khaki green shale & sandstone	230 -250

3.2.1 Geological Structure

Dip and Strike:- The strike is NW-SE in the west which swings to ENE- WSW in the eastern part of the area. The strike is E-W in the central part of the area. The dip generally varies from 2° to 3° (1 in 28 to 1 in 19)).

Faults/Joints: - The areas devoid of any fault. However, two sets of prominent vertical joints (NE-SW and NW-SE) and one set less prominent (E-W) joints have been observed in the area.

3.2.2 Mine Boundary Delineation

The mine boundaries of Khadia OCP Expansion have been delineated and fixed as follows:

Southern Boundary: The Southern boundary (rise side) has been fixed in the incrop zone of Turra seam.

Eastern Boundary: The Eastern boundary of Khadia OCP Expansion shares its boundary on the floor of Turra seam with Krishnashila OCP.

Western Boundary: Khadia OCP Expansion shares its western boundary on the floor of Turra seam with Dudhichua OCP.

Northern Boundary: The Northern boundary (dip side) of the Khadia OCP Expansion has been fixed considering the alignment of dragline cuts in the dip side of Khadia Geological Block.

3.2.3 Description of Seams

There is no exposure of coal within the block. The outcrops of clay occurring along with the incrops of coal seams are residual product of spontaneous combustion of the coal seams. Due to the occurrence of this clay, the incrop of coal is rather at depth depending on the depth of penetration of spontaneous combustion.

Five coal seams occur in the block viz. (i) Kota, (ii) Turra, (iii) Purewa Bottom, (iv) Purewa Top and (v) Khadia seam in ascending order. Purewa Bottom and Purewa Top Seams are fairly thick and are potential for exploitation. Other seams viz. Kota and Khadia have not been explored in detail because of its thinness, impersistent and inter-banded nature. The geological sequence of Khadia Expansion OCP is given in table 3.2.

Table 3. 2: Geological sequence of Khadia Exp. OCP

Lithology	Thickness (m)	Normal thickness
Soil and Sub-soil	0 to 8.15	0 to 1.00
Sandstone & shale	Upto74.65	
Khadia seam	0.25-1.25	0.50-0.60
Sandstone & shale	20.66-26.67	23-26
Purewa Top Seam	4.85-10.35	8-10
Sandstone & shale	30.34-43.70	32-40
Purewa Bottom seam	7.10-13.39	9-12.5
Sandstone & shale	50.78-64.28	54-61
Turra Seam	18.20-23.37	19.5-21.5
Sandstone & shale	50.73-79.69	62-70
Kota seam	0.40-2.13	1-2

Turra Seam

Turra Seam is the thickest of all the seams containing comparatively better quality coal. The immediate roof of the Turra seam is generally represented by inter banded horizons of shale, sandy shale and sandstone and carbonaceous shale. The roof of Turra seam within the incrop region is represented by clay. The immediate floor of Tura Seam is generally either shale or alternate Bands of shale and sandstone. Parting in the Turra seam overlies Kota Seam after a parting of 69m to 79.69m. The full thickness of Turra Seam including all dirt Bands varies from 18.20m to 23.37m. The dirt bands in Turra seam are represented by carb, Shale, carb, sandy shale, and sandstone varying in thickness from 0.05m to more than 2 meters.

Purewa Bottom seam

The Purewa Bottom Seam has been encountered in 54 boreholes. Out of these boreholes, full seam has been encountered in 52 boreholes and part thickness in 2 boreholes. The Purewa Bottom Seam overlies Turra Seam with a parting of 50.78 to 64.28m. The lithology of parting is mostly medium to coarse grained sandstone. The full thickness of Purewa Bottom Seam including all dirt bands varies from 7.10m to 13.39m. The full seam occurs within a depth range of 71.60m to 179.30m. Based on

the available borehole data the thickness of Purewa Bottom Seam within incrop zone varies from 4.81m to 8.80m and occurs within a depth range from 76.00 m to 76.04m.

Roof and floor characteristics:

The immediate roof of the Purewa Bottom Seam is largely represented by medium to coarse grained sandstone. In incrop zone, the immediate roof is always represented by clay.

The immediate floor of Purewa Bottom Seam is represented either by alternate bands of shale and sandstone or fine grained sandstone.

Purewa Top Seam

General: The Purewa Top Seam is thinner than Turra and Purewa Bottom Seam and its incrop occurs generally on the plateau just above the escarpment. The outcrop of the seam is always burt and is represented by clay/clayey soil.

Parting: The Purewa Top Seam overlies Purewa Bottom Seam after a parting of 30.34m to 43.70m. The Lithology of parting between Purewa Bottom and Purewa Top Seams are medium to coarse grained sandstone.

Thickness: The full thickness of Purewa Top Seam including all din bands varies from 4.85mto 10.35m. In the incrop region the seam was encountered at a depth range of 35.35m to 57.85m Purewa Top Seam is fairly uniform in its thickness.

Roof and Floor Characteristics

The immediate roof of the Purewa Top Searn is exclusively represented by sandstone. Only in incrop zone the roof has been represented by clay.

3.3 PHYSIO-MECHANICAL PROPERTIES

Cores from five boreholes CMSK- 4,10,14,30 and 49 were tested for uniaxial compressive strength and tensile strength, shear strength and density. The detail of test results are given below:

Table No.-3.3 Lithological unit-wise uniaxial compressive strength,Protodyaknov
Index and category of rock

Lithological unit	Average % of rock	No. of samples analyzed	Compressive Strength in Kg/cm ²		Protodyaknov strength Index as per USSR norm	Category of rock
			Range	Mean(+SD)	Normal Range	Normal range
					Maximum Range	Maximum range
1. Very coarse grained sandstone	3	19	5.83-231.14	34.58 (49.03)	<u>0.06-0.8</u> 2.3	<u>I - II</u> IV
2. Coarse grained sandstone	56	455	3.91-389.33	60.31 (40.01)	<u>0.2-1.0</u> 3.9	<u>I - II</u> IV
3. Medium grained sandstone	7	120	3.93-279.90	93.20 (55.55)	<u>0.4-1.5</u> 2.8	<u>I-III</u> IV
4. Fine grained sandstone	3	52	45.20-616.44	121.03 (121.20)	<u>0.5-2.4</u> 6.2	<u>I-III</u> IV
5. Sandy shale	1	20	49.85-242.50	137.93 (46.61)	<u>0.9-1.8</u> 2.4	<u>II-III</u> III
6. Shale	2	34	44.38-433.07	137.15 (98.90)	<u>0.4-2.4</u> 4.3	<u>I-III</u> IV
7. Alternate bands of shale & sand stone	3	73	21.16-537.06	230.17 (127.23)	<u>1.0-3.6</u> 5.4	<u>II-IV</u> IV
8. Carbonaceous sandy shale	2	41	15.99-692.91	341.23 (178.41)	<u>1.6-5.2</u> 6.9	<u>III-IV</u> IV
9. Carbonaceous shale	5	128	17.08-740.07	303.66 (147.44)	<u>1.6-4.5</u> 7.4	<u>III-IV</u> IV
10. Coal/shalyCoal	15	204	19.06-721.79	270.46 (156.08)	<u>1.1-4.3</u> 7.2	<u>III-IV</u> IV
	3	Nil	Soft rock			

Beside this, an approximate estimation was also done to show the horizon-wise rock and coal seam strength.

Purewa Bottom seam appears to be hardest among the three seams and Purewa Top Seam is the weakest. Similarly, floor rocks of Turra seam are comparatively hard among the other rock horizon.

Tensile Strength: The tensile strength characteristics were determined on 640 specimens of four boreholes in Khadia Block. A compiled range is given in table 4.5 along with other characteristics.

Table No.-3.4 Litho-logical unit wise tensile strengths, shear strength and density of rocks

Sl. No.	Litho-unit description	Compressive Strength Kg/cm ²	Shear Strength Kg/cm ²	Tensile Strength Kg/cm ²	Young's Modulus Kg/cm ²	Density gm/cm ³
1	Very coarse grained sandstone	5.83 - 231.14	7.97 - 7.97	0.79 - 9.50	Not-det.	1.45 - 2.31
2	Coarse grained sandstone	3.91 - 389.33	4.45 - 56.80	1.69 - 32.29		1.34 - 4.44
3	Medium grained sandstone	3.93-279.90	18.28 - 86.17	3.78 - 44.01		1.38 - 2.72
4	Fine grained sandstone	45.20-616.44	27.59 - 144.13	6.56 - 44.48		1.39 - 3.25
5	Sandy shale	49.85-242.50	10.30 - 29.71	5.74 - 14.16		1.58 - 2.76
6	Shale	44.38-433.07	4.89 - 38.78	4.89 - 38.78		1.18 - 2.58
7	Alt. Bands of shale & sandstone	21.16-537.06	8.74 - 49.03	8.74 - 49.03		1.53 - 2.38
8	Carbonaceous sandy shale	15.99-692.91	9.55 - 48.22	9.55 - 48.22		1.31 - 2.42
9	Carbonaceous shale	17.08-740.07	2.80 - 54.47	2.80 - 54.47		1.15 - 2.19
10	Coal / shaly coal	19.06-721.79	4.80 - 61.77	4.80 - 61.77		1.01 - 2.02
11	Soil / clay	Soft rocks.	-	-	-	-

It may be seen from the table that the carbonaceous shale shows the maximum tensile strength followed by carbonaceous sandy shale, alternate bands of shale and sandstone, coal and other stone. This also confirms that the rocks are generally weaker than coal and carbonaceous rocks.

Density of rock and coal

As usual the density of coal is quite less in comparison to rocks and normally varies between 1.12 gm/cm³ to 1.44 gm/cm³. The density of rocks within the normal range reaches as high as 2.51 gm/cm³ in fine grained sandstone.

3.4 GEOLOGICAL RESERVES

Coal seams for opencast mining have been defined considering 1 metre and above coal/shaly coal or carbonaceous shale low bands at roof and floor, despite of thicker following or preceding dirt band respectively.

Thickness and quality considered for preparation of isochore and isograde plans are inclusive of combustible, non-combustible and obvious dirt bands of less than 1 metre in thickness. Dirt bands of 1 metre and above in thickness have been added to the overburden.

Block-wise geological reserves projectized in Khadia OCP since inception is given in table below:

Table No.-3.5 Geological block-wise net geological reserves

Block Name	Net Proved Reserve (Mt)
Khadia	287.59
Ruhela	89.81
Marrak	28.77
Grand Total	406.17

On the basis of inter-spacing of borehole data, the estimated coal reserves have been placed under proved category.

3.5 HYDROGEOLOGICAL SETTING

Aquifer Description

The permeable formations within the Gondwanas behave as aquifer units. The three persistent thick coal seams, shales developed behave as impermeable beds i.e. aquiclude. Below the soil cover thick Barakar formations have been developed. The formation comprising mainly of alluvium, weathered sandstone and sandstone within shale lying above top most working coal seam- Purewa Top behaves as unconfined aquifer. Whereas, lower formations consisting of compact sandstone with secondary porosity behave as semi-confined to confined aquifer.

In the unconfined aquifer groundwater moves laterally through the inter-granular pore spaces in the sandstone. Whereas in lower aquifers the groundwater movement is

restricted mainly through joints and fractures (i.e. secondary porosity) developed. With the presence of intercalated shale and carbonaceous shale beds and reduction in permeability with depth, the lower aquifers are poor in potential. The deeper aquifers are divided into multi aquifer system due to the presence of clay, shale beds and persistent impervious thick Coal seams (i.e. Purewa Top and Purewa Bottom and Turra seam). The deeper aquifers behaves as unconfined aquifers at the outcrop region.

The water table configuration in the unconfined aquifer is conforming to the local topography. A ground water divide is running across the centre of the area from west to east more or less following the high ground of coal mining projects. A flat water table with a gradient of 7.6×10^{-3} , slopping towards south east and east has been observed in the area. The aquifer units present above the working coal seams are the major sources for inflow into present and the proposed mine workings. With the presence of shale and compaction, the seepage from Mine floor may be considered as negligible.

Recharge and Discharge zone

The emergence of water table contour in higher altitude area and their sloping towards the low lying areas (i.e. GBP Sagar) indicate that the high altitude area (north and northeast of the project) is acting as recharge zone for unconfined aquifer and low lying areas (GBP Sagar) located in the east and south of Khadia project act as a discharge zone. The core area of project also acts as discharge area for underlying semi-confined aquifer by losing its water through fractures, faults, etc.

Ground Water Level Monitoring : Sampling Location and rationale

For ground water level monitoring of Khadia OCP, a network of 63 nos. existing dug wells has been identified by CMPDI. NCL has also established, 6 Nos Piezometers (3 Nos Shallow and 3 Nos Deep Piezometer) in the core zone of the project.

The seasonal water level of the established hydrographic monitoring stations and Piezometers has been carried out four times a year in pre-monsoon, monsoon, post-monsoon and winter seasons. The water levels are measured through measuring tape below ground level from the marking point for dug wells. For piezometers, electronic water level sounder is used to measure water level from marked measuring point.

The monitoring reveals that from the period Nov'16 to Aug'20, the water levels during Pre-Monsoon varies from 1.18 m.bgl (2017) to 14.20 m.bgl (2019), Monsoon varies from 0.13 m.bgl (2017) to 14.40 m.bgl (2017), Post-Monsoon it varies from 0.55 m.bgl (2019) to 15.60 m.bgl (2016) and during Winter it varies from 0.74 m.bgl (2017) to 14.10 m.bgl (2017) in the monitored Dug wells.

A detailed Aquifer Performance Test (APT) was carried out in the Jayant Block by Russian experts for confined aquifer between Purewa Bottom and Turra seam in 1975 (As per the Hydrogeological chapter incorporated in Geological report of Jayant block).

The hydraulic conductivity was found to be 0.13 to 0.15 m/day.

Another hydrogeological investigation carried out by CMPDI in the nearby Kakri Project reveal that the hydraulic conductivity and permeability of the aquifer system lying above the working seams are 82 m/d and $k=1.0$ m/d respectively.

3.5.1 Likely Impact on Ground water

It is generally observed that the trend of water table contours, its gradient and configuration are mainly controlled by topography, drainage pattern, rainfall, geologic controls and induced flow of ground water towards mine excavation.

Mining is associated with groundwater problems, particularly when it is below water table. The impact of mining on groundwater is mainly dependent on parameters of mines and aquifers, groundwater recharge-discharge processes etc. In opencast mining, the unconfined aquifer and the semi-confined aquifers are get affected due to continuous gravity drainage and conventional sump pumping for efficient and safe working.

4 PROJECT STATUS, MINING METHODOLOGY AND TECHNOLOGY (AS PER PR)

4.1 STATUS OF EXISTING OPERATIONS

The minefield is being worked in two sections namely East Section and West Section with a central haul road located on the floor of Turra seam. Overburden has been dumped in internal dumps in both the sections.

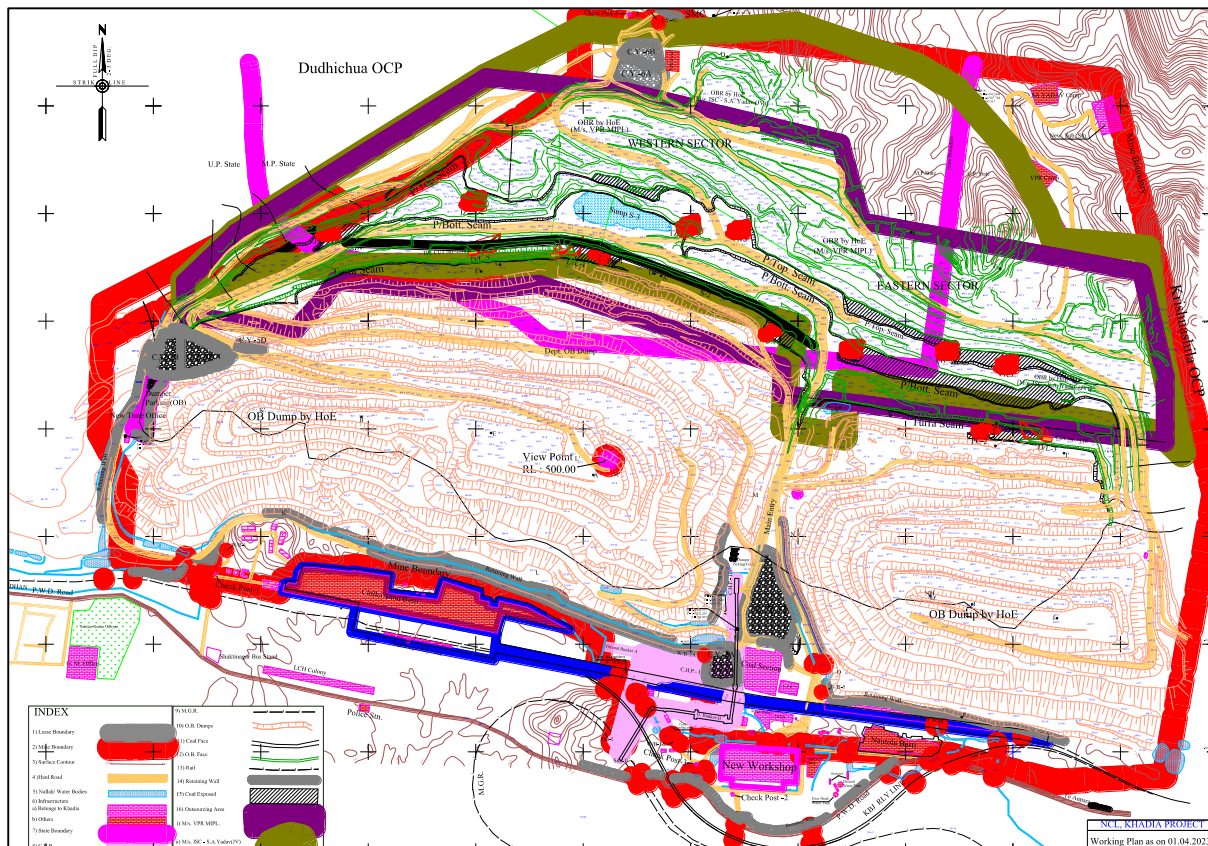


Figure: 4.1 Present working plan of Khadia OCP

Currently, the mine is being worked by Departmental equipment and Hiring of Equipment HoE/Outsourcing.

West Section:

Top OB up to Purewa top seam is handled by HOE. Overburden between Purewa top and Purewa Bottom seam is handled by departmental shovel dumpers. OB above 30-32m of Tura Seam in west section is handled by two Draglines.

East section:

Only 30-32 m of OB above the Tura seam is being handled by dragline , and rest of the part in East section is handled by HoE.

The current workings of the mine are presented in the Working Plan drawing (provided by the mine authorities) showing the benches, dumps, sumps, haul roads, public roads, location of mine infrastructure, underground workings etc.

With due consideration to geo-mining characteristics of the deposit, the mine is proposed to be worked by combined system of mining using dragline and shovel-dumper combination. All the OB of expansion area are dumped in internal dumps in both the sections. Total Turra seam Coal and part of Purewa Bottom seam coal in both sections is proposed to be extracted by shovels and transported to receiving pits/coal stockyards by 100 T Rear Dumpers. Total Purewa Top seam coal and part of Purewa Bottom seam coal in both sections is proposed to be extracted by Surface Miner but it is being extracted by shovels as on date loading and transportation of coal by outsourcing means. The detailed existing equipment is given below sections.

4.1.1 Production Phasing

The Khadia Expansion OCP (16 Mtpa) has been planned to achieve its target production capacity of 16 Mtpa of ROM Coal in the year 2024-25 i.e. 5th year of quarry operation considering 2020-21 as Yr-1. The production programme up to achieving the rated capacity is given below:

Table: 4.1 Production Phasing from Zero date upto target year

Year of Production		Coal Production (Mtpa)	OB Removal (Mm ³)	SR (m ³ /t)
Yr-1	2020-21	14.0	57.28	4.09
Yr-2	2021-22	14.0	57.28	4.09
Yr-3	2022-23	14.0	57.28	4.09
Yr-4	2023-24	15.0	59.69	3.89
Yr-5	2024-25	16.0	59.90	3.74

The combined coal production and overburden removal by departmental means and outside agency for last 6 years of Khadia OCP is given below:

Table 4.2 Coal and OB removal in the last 8 years

Year	Coal (Mt)	OB (Mcum)
2016-2017	6.006	24.67
2017-2018	8.8	39.31
2018-2019	11.40	44.56
2019-2020	13.183	39.62
2020-2021	14.00	49.28
2021-2022	14.00	51.68

4.2 BROAD PARAMETERS OF THE MINING PLAN

The PR for Khadia OCP (10 Mtpa) was prepared mainly in Khadia Geological Block and partly in Ruhela Block. The PR for Khadia Expansion OCP (16 Mtpa) has been envisaged with the inclusion of balance reserve of existing Khadia OCP (10 Mtpa) as on 01.04.2020, dip side reserves of part of Ruhela Geological Block and eastern side reserves of small part of Marrak Geological Block of Moher Sub-basin of Singrauli coalfield. The existing mine working plan of Khadia OCP is as given in figure 4.1 above

4.2.1 Mining Method

The method of mining proposed to extract coal and OB in Khadia Expansion OCP will be open cast mining deploying dragline and Shovel-Dumper combination in OB Removal and Shovel-Dumper as well as Surface miner in coal winning. However, there is no surface miner is deployed in the current operations. Combined system of Mining Deploying Draglines and Shovel-Dumpers is being practiced.

4.2.2 Mine Boundaries

The Boundaries of Khadia Expansion OCP (16Mtpa) have been delineated and fixed as follows:

- i) Southern Boundary: (Rise side) The southern boundary of Existing Khadia OCP as on 01.04.2020, forms the southern boundary of proposed Khadia Expansion OCP;
- ii) Western Boundary: The western boundary has been fixed considering common boundary on the floor of Purewa Bottom seam with eastern boundary of Purewa Bottom Seam of Dudhichua OCP (20 Mtpa) within sanctioned area of Khadia OCP (10

Mtpa) and in the rest of the dip side area western boundary has been fixed considering leaving a barrier of 7.5m with common mine lease hold boundary with adjoining Dudhichua OCP (20 Mtpa) on the surface and accordingly Turra seam floor has been delineated;

iii) Northern Boundary: (Dip side) The northern boundary has been fixed considering leaving a barrier of 7.5m with common mine leasehold boundary with adjoining Bina-Kakri Amalgamation OCP on the surface and accordingly Turra seam floor has been delineated;

iv) Eastern Boundary: The eastern boundary has been fixed considering leaving a distance of 7.5m from common mine leasehold boundary with adjoining Krishnashila OCP on the surface and accordingly Turra seam floor has been delineated;

the existing Khadia OCP boundaries have been extended in the dip side by adding the part of Ruhela Geological Block and a small part of Marrak Geological Block in the eastern side for exploitation of coal in the proposed Khadia Expansion OCP (16 Mtpa). The Final Stage Quarry boundary has been shown below

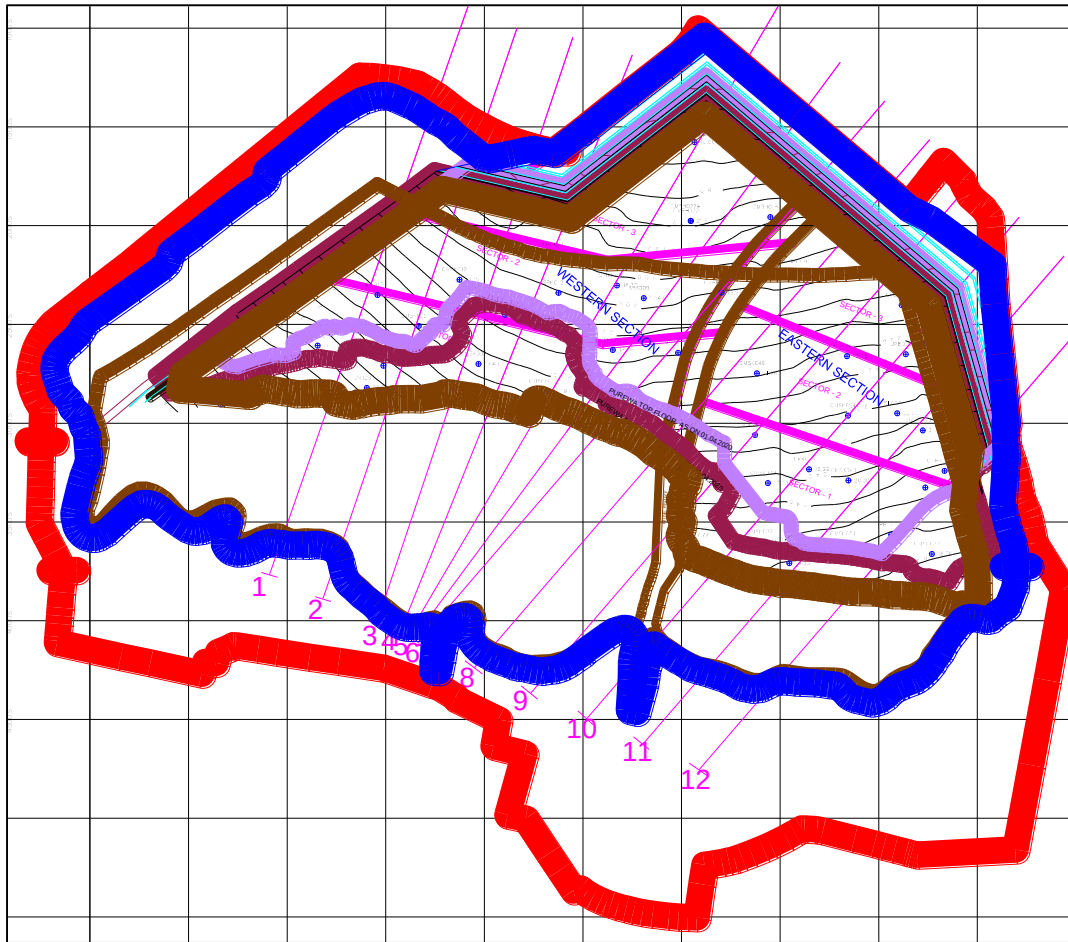


Figure 4.2: Final Stage Plan (As per Mining Plan)

4.2.3 Sequence of Mining

The minefield is being worked in two sections namely East section and West section. It is proposed in PR that PR for Khadia Expansion OCP (16 Mtpa), East and West sections are to be worked simultaneously with the deployment of 2 Nos. of 20m³/83mR Draglines in tandem operation in west section and 1 No. 33m³/72mR in East section with central sump located near the central haul road. Both the sections are advancing from rise to dip simultaneously.

The same sequence is continued in the proposed stage also. Presently, the working of West section is leading and East section is lagging.

Considering the flat dip (20-30) of the seams, it is proposed to excavate the OB from advanced benches by inclined layers parallel to the seam roof. This system eliminates the need to cut new horizons from the roof of seam and simplifies water drainage from the benches to the central sump

4.2.4 Geo-Mining Parameters

Table 4.3 Quarry Parameters

Quarry Parameters		Eastern Section	Western Section
Maximum Strike length of quarry along Turra Seam Floor	Km	1.49	2.08
Maximum Strike length of quarry along Surface	Km	1.60	2.20
Dip-rise width of the quarry on Turra Seam floor	Km	1.76	1.78
Dip-rise width of the quarry on Surface	Km	2.03	2.10
Maximum depth of the quarry from surface	m	250	275
Final quarry surface area	Sq. Km	3.50	6.45

Table 4.4 Description of Coal Seam proposed to be worked

Coal Seam	Effective Seam Thick-ness Range (m)	Thickness/ Parting Thick-ness (m)
Purewa Top	3.75-10.35	37.55- 117.60
Purewa Bottom	5.60- 13.39	30.34- 43.70
Turra	14.57- 22.56	50.78- 64.28

4.2.5 Mining System & System Parameters

Elements of mining system have been determined in accordance with the parameters of excavation, transport equipment and the parameters of drilling and blasting. The minefield is being worked in two sections namely East Section and West Section with a central haul road located on the floor of Turra seam.

Presently, two Nos. of 20m³/83mR Draglines and one No. of 33m³/72mR Dragline are deployed for excavation of OB bench above Turra Seam in both the sections. 2 Nos. of 20m³/83mR Draglines in tandem operation are deployed for excavation of OB bench above Turra seam in west section and 1 No. of 33m³/72mR Dragline is

deployed for excavation of OB bench above Turra Seam in East section. This is in line with the proposed system in the PR.

In the PR it is proposed that, the height of main OB bench over Turra seam are to be sidecast by Dragline in the previous decoaled cut would vary from 30m to 38m at production level of 16 Mtpa. The Dragline cut width adopted is 65m in East section and 70m in the West section. With two-way traffic along the bench, the width of the Shovel-Dumper OB working bench would vary from 55m to 61m and 35m for non-working OB bench.

Persistent in-seam bands of thickness 1m and above present in Turra coal seam is proposed to be mined separately by Shovel-Dumper provided for coal winning.

Table 4.5 System Parameters

SL. No.	Particulars	Unit	Overburden		Coal
			D/L	Shovel	
1	Bench Height	m	40-45	15-18	10-15
2	Working Bench Width	m	70	55-60	45
3	Non-working Bench Width	m	70	35-40	25
4	Bench slope	Deg.	70	70	80
5	Blast Hole Dia.	mm	311	250	160
6	Inclination of Boreholes		Inclined	Vertical	Vertical
7	Powder Factor		0.6	0.3	0.2

The width of cut for coal benches has been adopted as 10-15m. The width of working bench in coal seam has been considered as 35-70m while width of non-working benches has been kept at 25m. The slope of each bench is proposed as 70° in OB and 80° in coal. But the overall running slope in working faces are about 18°-19°.

The above mining system and system parameters have been proposed in PR for departmental HEMM deployed for coal winning and OB removal

Mining System parameters for outsourcing of OB as proposed in depends upon the size of HEMM deployment

OB Dump Benches

Bench height of OB dumps formed by Shovel-Dumper system will be 30m and slope of individual dump benches will be 37° (equal to angle of natural repose of OB material). Width of berm between two adjacent benches will be 40m. Overall slope of dump works out to be 28°

4.2.6 Balancing Diagrams for Dragline Combination

The dragline balancing diagrams for 70m cut width at different bench heights for the working of 2 Nos. of $20\text{m}^3/83\text{mR}$ draglines in tandem operation for single bench blasting have been drawn and presented in the PR for Khadia Expansion OCP (16Mtpa) and The dragline balancing diagrams for 65m cut width at different bench heights for the working of 1 No. of $33\text{m}^3/72\text{mR}$ dragline for single bench blasting have been drawn and presented in the PR for Khadia Expansion OCP (16Mtpa).

The coal exposure, dragline load along with the quantity of re-handling for different bench heights are given in Table No.6.4 and 6.5.

Dragline deployment scheme with single bench blasting as envisaged in the PR for Khadia Expansion OCP (16Mtpa) is being presently practiced

The dragline deployment scheme envisages leaving of coal rib in the balancing diagrams as per permission of DGMS. It is suggested to extract the coal rib to the extent possible while coming back after finishing the cut so that there is no chance of accumulation of water against the coal rib causing hydraulic thrust on the dump.as suggested in PR.

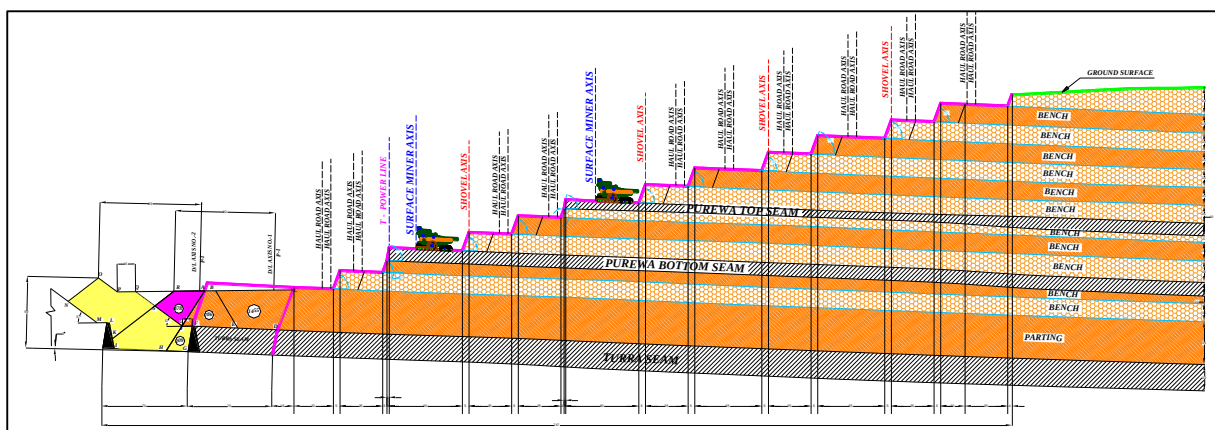


Figure 4.3 Proposed System parameters in west section as per PR

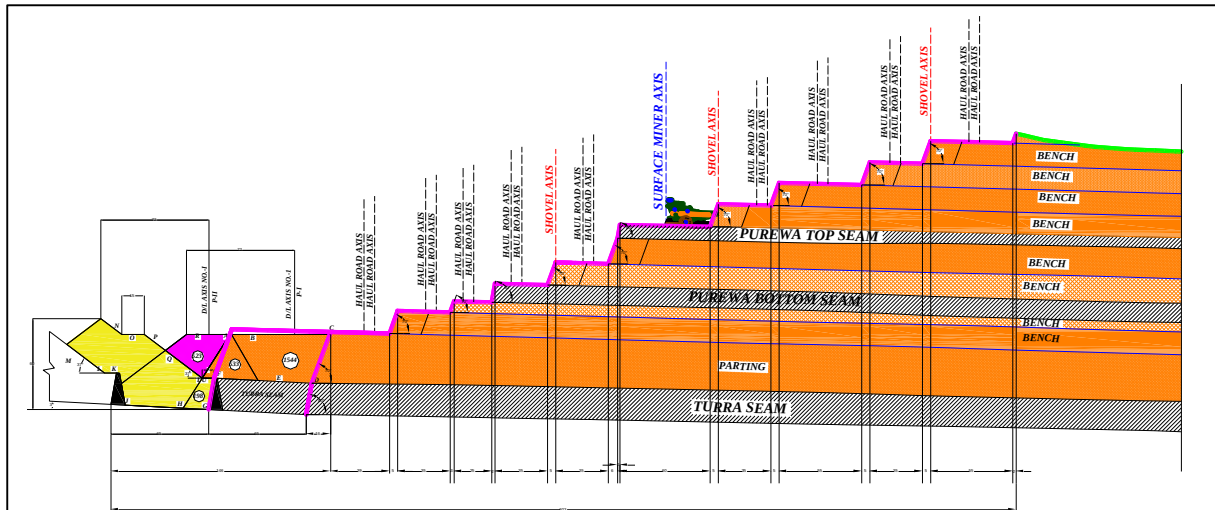


Figure 4.4 Proposed System parameters in East section as per PR

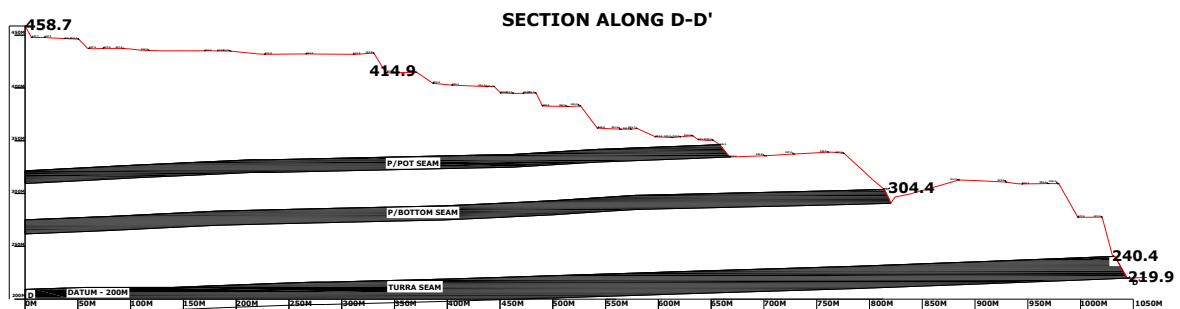


Figure 4.5 Bench parameters along West section –Existing

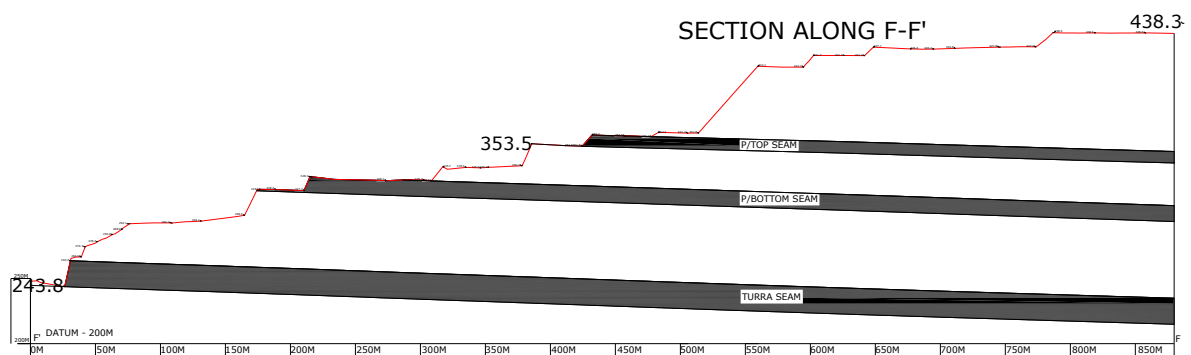


Figure 4.6 Bench parameters along East section –Existing

As per the working plan as on 01-04-2023 provided during the site visit, the existing system parameters are in line with the proposed parameters in some patches/benches. Bench geometries are deviated with those as proposed in PR. There is no surface miner deployment as proposed in PR

4.2.7 Equipment Provisioning

A combined system of mining with the use of Dragline and Shovel-Dumper combination for OB removal and Shovel-Dumper & Surface Miner combination for coal winning is the most suitable option for the project as Indicated in the PR.

The Two options have been suggested in PR as given below:

Option-I: Departmental (Sanctioned 10 Mtpa + Incremental 6Mtpa coal winning by Departmental Surface Miner & Loading and transportation by outsourcing means and incremental OB Removal by Departmental HEMM)

Option-II: Partial OB Outsourcing (Sanctioned 10 Mtpa+ Incremental 6Mtpa coal winning by Departmental Surface Miner & Loading and transportation by outsourcing means and incremental OB Removal by Outsourcing). In both the options, coal winning has been proposed departmentally.

For selection of size and population of departmental HEMM, the parameters that should be considered are

- Existing population of HEMM,
- Existing method of mining, ,
- Geo-mining characteristics of the deposit,
- Annual workload,
- Equipment deployment and equipment life.
- General technology-culture, standardization of equipment

Based on the above selection criteria and keeping in view of the Geological and Mining parameters of working quarries of Khadia OCP, the deployment proposed as per PR (in partings, seams, etc.) of the selected equipment is given below.

Table: 4.6: Major HEMM Deployed

Major HEMM Deployed for Coal winning						
HEMM	Cap/ Size	Existing (Upgraded) (10Mtpa)	Option-I		Option-II	
			Incre- mental (6Mtpa)	Inte- grated (16Mtpa)	Incre- mental (6Mtpa)	Inte- grated (16Mtpa)
Surface Miner	4000mm		2	2	2	2
Diesel Hyd. Shovel	10-12m3	4		4		4
Rear Dumper	100 T	28		28		28
RBH Drill	160 mm	6		6		6
Dozer	410 HP	4		4		4

Major HEMM Deployed for OB Removal						
Dragline	20m3/83m R	2		2		2
Dragline	33m3/72m R	1		1		1
Elect. Rope Shovel	20 m3	3	5	8		3
Dumper	190 T	21	33	54		21
RBH Drill	311 mm	3		3		3
RBH Drill	250 mm	5	6	11		5
Dozer	850 HP	7	4	11		7

Against the proposed deployment in the PR the following departmental and outsourced HEMM are being deployed as on August 2023 at Khadia OCP.

Table 4.7: Existing List of Departmental Major HEMM deployed at Khadia Project as on August 2023

S.No	Equipments	Capacity	Quantity	
1	Dragline	33/72	1	3
2	Dragline	20/90	2	
3	Electric Rope shovel	20 Cum	1	5
4	Electric Rope shovel	10 cum	4	
5	Hyd. Shovel	11.5 cum	2	
6	Pay Loader	10.7 cum & 6.5 cum	2	
7	PC	3.8 cum & 3.5 cum	2	
8	Rear Dumper	190T	7	58
9	Rear Dumper	100 T	50	
10	Rear Dumper	85T/100T	1	
11	Drill	311 mm, 250 mm & 160 mm	13	
12	Dozer	850 HP, 450 HP & 410 HP	7	

Table 4.8: Existing List of equipment (HOE) of M/S S A Yadav (JV) as on August 2023

S.No	equipment	Capacity	Quantity	
1	PC	3.1 Cu.M	16	
2	Tipper	20.2 Cu.M	15	90
3	Tipper	22 Cu.M	51	
4	Tipper	24 Cu.M	15	
5	Tipper	18 Cu.M	9	
7	Dozer	160,200&175 HP	7	
8	Grader	145 HP	4	
9	Loader	160 HP	3	
10	Drill	130 HP & 140 HP	4	

Table 4.9: Existing List of Equipment of equipment (HoE) of M/S VPR-MIPL as on August 2023

S.No	Equipments	Capacity	Quantity	
1	PC	3.1 Cu.M	20	
2	Tipper	18.8 Cu.M	6	114
3	Tipper	20.2 Cu.M	73	
5	Tipper	18 Cu.M	35	
7	Dozer	200 HP	12	
8	Grader	145 HP& 200 HP	4	
9	Loader	180 HP	2	
10	Drill	130 HP	4	

On the basis of geo-mining characteristics of the deposit, mining system parameters like slope of the quarry batter, bench height, bench width, dump height, final dump slope and slope of the working benches have been decided. Design of mining system has been done considering technical parameters of HEMM and safety guidelines of Directorate General of Mines Safety (DGMS).

However, during mine operations, the safety rules, regulations and various circulars issued by DGMS should be strictly followed and adhered to. The parameters of benches and deployed equipment should be in line with the DGMS guidelines in departmental as well as outsourced patches.

4.2.8 Excavation, Transport & Dumping

OB Excavation

All the OB benches above dragline bench horizon is to be excavated by 20m³ Elect. Rope Shovel. The OB immediately above Turra Seam roof will be sidecast by using 2 Nos. of 20m³/83mR Draglines working in horizontal tandem in west section and 1 No. of 33m³/72mR Dragline in East section.

The height of main bench over Turra seam excavated by draglines varies according to the requirement of coal exposure from Turra Seam. 30-38 m bench height at production level of 16 Mtpa has been proposed for dragline working. The dragline cut width is adopted as 70m in west section and 65 m in East section.

The balance OB above Dragline bench has been proposed to be excavated by 20m³ Elect. Rope Shovels working in conjunction with 190-210T Rear Dumpers.

the upper OB benches are proposed to be worked by 20m³ Elect. Rope shovels working in conjunction with 190-210 T Rear Dumpers and balance OB have been proposed to be outsourced in Option-II of the PR

OB Transportation

For OB transportation, 190-210T rear dumpers are proposed to be deployed , However, for partial OB outsourcing option (Option-II), the lead will vary from year to year and therefore, fresh assessment of lead will have to be done on year to year basis for finalization of rate of OB transportation.

OB Dumping

The main OB bench overlying Turra seam is to be removed by dragline system and proposed to be side cast in the decoaled cut. The OB from upper benches is being handled by Shovel-dumper system and accommodated over the dragline side cast spoil within the pit.

The volume of OB (including in-seam band) to be handled as per PR of Khadia Expansion OCP as on 31.03 2020 is 844.0 Mm³, out of which 156.35 Mm³ OB will be directly sidecast by draglines including throw blast of 13.35 Mm³ in the decoaled cut and balance 687.65 Mm³ is proposed to be removed and dumped by shovel-dumper system in the internal dumps in both the sections.

The mine is being worked since 1981-82 and 487.66 Mm³ of OB has already been dumped in external/internal dumps since inception till 31.03.2020. The final stage dump plan shows that apart from existing dump volume of 487.66 Mm³, further 844.0 Mm³ will be accommodated in the internal dumps in both the sections

Shovel-dumper spoil dumps will be formed in benches of 30m in height. For the formation of dumps and leveling of dumps, 850 HP and 410 HP dozers have been envisaged.

The Tier-wise OB volume of internal dumps is given below:

Table No.4.10 Tire wise OB volume of internal dumps

Sl. No.	Tier (RL)	Volume (Mm ³)
A	EAST SECTION	
1	Dragline Dump	66.65
2	Upto 290 & 290-320	69.00
3	320-350	45.12
4	350-380	41.40
5	380-410	34.43
6	410-440	28.90
7	440-470	20.97
8	470-500	12.95
9	500-530	6.90
TOTAL EAST (A)		326.32
B	WEST SECTION	
1	Dragline Dump	89.70
2	Upto 270 & 270-300	78.78
3	300-330	60.08
4	330-360	57.36
5	360-390	53.26
6	390-420	46.91
7	420-450	44.16
8	450-480	39.98
9	480-510	29.16
10	510-540	18.29
TOTAL WEST (B)		517.68
GRAND TOTAL (A+B)		844.00

Since inception, 487.66 Mm³ of OB has already been dumped in internal/external OB dumps of the mine. Apart from the above OB, the volume of OB estimated in the PR (16Mtpa) is 844.0 Mm³, which will be accommodated in internal OB dumps in both the sections. The final stage dump plan has been reproduced below.

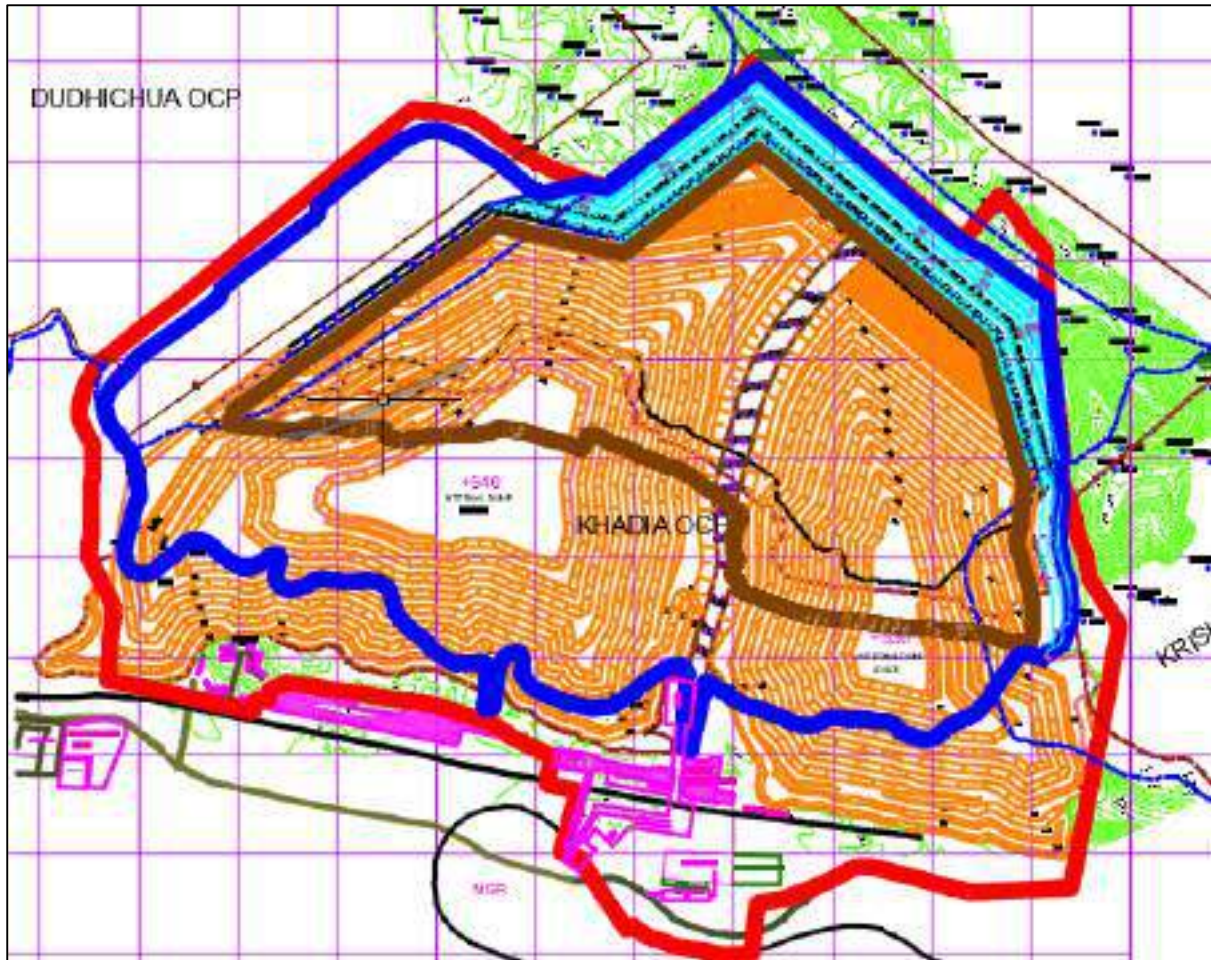


Figure: 4.7: The final stage dump plan

OB Dump Benches

Shovel-dumper spoil dumps are proposed to be formed in benches of 30m and slope of individual dump bench will be 37° (equal to angle of natural repose of OB material). The width of berm between two adjacent benches will be 40m. Overall slope of dump works out to 28°. Top soil wherever available is proposed to be stacked separately which will be used up for spreading over the completed OB dumps. The Tier-wise OB volume of internal dumps is given in table 4. There are deviations observed in the current bench geometries in comparison with the those proposed in khadia expansion PR.

4.2.9 Elements of Drilling and Blasting:

The elements of drilling and blasting are decided during actual operation after trial blasting in the field. Controlled blasting is being practiced near project boundary. However, drilling of coal & OB benches is recommended to be done vertically at 90°.

It is suggested to use slurry explosive in cartridge / site mixed slurry for better result and enhance safety with proper stemming material. Secondary blasting is not suggested in any circumstances.

4.2.10 Sump and Drainage

The planning of de-watering of the mine has been done in such a way that as far as possible the working faces and haul roads remain dry. The layout of the quarry provides suitable gradient along the quarry floor and the benches to facilitate self-drainage of water to the lowest level of the quarry.

Khadia Block stands as hilly plateau above the plains in the south, a steep escarpment faces the southern part of the plateau rising from elevation of 290 m at the base to 425 m at the top of the plateau. The plateau surface is gently undulating. In the north-east corner the area rises to an altitude of 490 m. The general elevation of the plateau varies from 425 to 440 m.

The entire pumped out water will be discharged near the mine entry where from water will be drained to nearby its natural gravity.

Within the quarry, the alignment of dragline cut is so planned that most of the water from the flanks will flow into the central sump due to gravity. From the central sump, the main pumps will pump the water out of the mine.

4.3 SAFETY MANAGEMENT

Safety of men and machine deployed in the mining area should be properly taken care of irrespective of whether the mining activities are performed by departmental or by outsourcing means.

All the statutory provisions laid down in The Mines Act 1952, Coal Mine Regulation 2017 and specific permission from DGMS relating to mining in general and opencast mining in particular have to be adhered to and implemented in order to maintain day to day safety.

4.3.1 Safety aspects for of HEMM / equipment

Special precaution should be taken while deploying workers in the mine. Before employing any person to the mine proper vocation training should be imparted and recommendations of various Safety Conferences should be strictly followed.

4.3.2 Stability of Benches, Quarry Highwalls and Spoil Dumps:

During quarry operations, it is necessary to adopt required mining parameters for the stability of benches, highwalls and spoil dumps. It is also mandatory to examine systematically the fencing of mine workings, landslides and cracks between benches. It is required to maintain well-graded and wide roads on benches keeping the width of working areas sufficient for spreading of blasted rock and movement of the mining and transport equipment.

- During actual mining operation, systematic observations of the condition of benches, high wall slopes and spoil dumps should be carried out and the dimensions be modified if necessary, to suit the local conditions.
- During actual mining operation, systematic observations of the condition of benches, high wall slopes and spoil dumps should be carried out and the dimensions be modified, if necessary to suit the local conditions.
- Provisions laid down in Reg. 106 and 108 of the Coal Mines regulation 2017 shall be strictly adhered to for the safety of quarry and OB/ spoil dumps. Further all related / relevant DGMS Technical Circulars shall also require to be considered during the mine operations. In addition to above, the following precaution should also be taken:
- The individual dump bench should not exceed 30m and overall spoil dump height should not exceed 90m with an overall slope of 28° or less. In the event of encountering steep floor gradient, floor blasting should be done and the area properly levelled by dozer before spoil dumping in addition to creating a toe wall to arrest falling boulders/rocks.
- No working or construction should be allowed within the 100m toe of the OB dump.
- Before dumping the OB on the floor of seam if required, at least 10m width all along the strike length should be made horizontal at every 50 meters by floor ripping/blasting.

- Dump should be created in such a way that there is no chance of accumulation of water in and around the top and base of dump as it could adversely affect the shear strength of the base material of dump
- The toe and face of the dump should not be eroded or cut at any point of time to avoid slope failure. A suitable toe wall should be created along the dump periphery.
- Formation of dumping should be done in square or circular or any regular shape as far as possible.
- Proper drainage system should be provided to bring down rain water by construction of inclined drain on dump face and catch drain on all benches.
- During active period of dump, all rain water should be diverted away from mining site as far as possible.
- Sump and pumping capacity should be sufficient to accommodate peak surface run-off and seepage of water.
- Gabion wall and garland drain should be constructed and maintained to trap the surface run-off and sludge coming from dump.
- Plantation and grassing should be done on top and slope of the dump respectively.
- Regular monitoring is required for development of tension crack, gullies, movement of soil mass, stagnation of water and any other unusual occurrence. In case of dump movement, rate of movement of dump should be monitored. Special attention should be given at curve area/turning area of the dump.

4.3.3 Precautions Against Danger of Inundation from Surface Water:

- Adequate protection against any danger of inrush of surface water into the mine or part shall be provided and maintained to the satisfaction of DGMS, whose decision shall be final.
- The entrance into the mine shall be so designed, constructed and maintained that its lowest point (which means the point at which a body of rising water on

surface can enter the mine) shall be not less than 3.0 meters above the highest flood level at that point.

- Every year, during the rains constant watch shall be kept on the flood levels on the surface of the mine and if at any time the levels cross the highest levels earlier recorded, such levels shall be marked by permanent posts along the edges of water and the new highest levels thus observed shall be recorded with the date as the highest flood level on the plans by an actual survey.
- If water dams or reservoirs are built across rivers and water courses on the upstream side of the mine, arrangements shall be made for communication between appropriate authorities for the purpose of ascertaining the quantity and timing of water released from the dams which is likely to endanger safety of the mine and arrangement for similar communication shall be made when water level rises on the upstream side which is likely to endanger the mine.
- The highest flood levels and danger levels at least 1.2 meters below the highest flood level, shall be permanently marked at appropriate places on the surface and whenever water rises towards the danger level at any place, all persons shall be withdrawn from the mine sufficiently in advance and for this purpose adequate arrangements of quick communication to all parts of the mine by effective systems shall be provided and maintained.
- No working shall be made in the mine at any spot lying within a horizontal distance of 15 meters from either bank of a river or nala.
- A competent person shall, once at least in every fourteen days during the rainy season and once at least in every thirty days during other periods of the year, examine every protective measure provided under regulations 149, whether in use or not, for their stability, and a report of every such examination shall be recorded. The protective measures and workings shall also be inspected, once at least in every quarter by the Manager personally.
- A careful assessment is to be made against the danger from surface water before the onset of rainy season. The necessary precautions should be clearly laid down and implemented. A garland drain needs to be provided to drain away the surface rainwater from coming into the mine.

- Inspections for any accumulation of rainwater, obstruction in normal drainage and weakening in the embankment should be made.
- Standing order for withdrawal of working persons in case of apprehended danger. During heavy rain inspection of vulnerable points is essential. In case of any danger persons are to be withdrawn to safer places for Protection of Equipment Deployed at bottom horizons from flooding.
- During the heavy monsoon period, the mining operation in the lower-most bench may have to be stopped. Therefore, it is proposed to drown the lower-most bench, which would work as a sump. The water will be pumped out and discharged into the nearby nala/ river after proper sedimentation.
- For ensuring safety of the equipment while working out bottom horizons with no access to surface profile, the following measures should be taken:
- Drivage of initial trenches if any and coal cutting on bottom benches should be done during the dry period of the year.
- Ramps should be made for quick shifting of equipment from bottom horizons, liable to be flooded during monsoon period, to the top horizons.

4.4 SLOPE MONITORING AS AN INTEGRAL PART OF MINE PLANNING

Monitoring is indispensable way to safeguard loss of mine and machinery from slope failure.

Every slope is subjected to movement. The monitoring methods are generally based on displacement of slope mass. It is crucial to judge the change of displacement or velocity which may be critical. A critical review of the available literature by the many researchers reveals that, a significant component of the slope stability surveillance plan should involve regular inspection of the bench faces and crest areas to promptly detect any signs of potential slope instability.

Ideally, these routine inspections should be carried out by the same individual to ensure consistent observations over time.

The primary objectives of monitoring the waste dump and mine slope are as follows:

- o Sustain safe operational conditions.
- o Offer insights into the mechanisms causing instability.
- o Provide early alerts for emerging instability.

- o Measure displacements and their rates.
- o Establish and uphold a record of facility performance.

The findings from monitoring need to be meticulously documented in either a diary or a computer system. This documentation is essential to maintain a historical record of the stability performance for every stage of pit development. The frequency of monitoring should be adjusted based on factors such as slope stability, time of year, mining rate, and the specific mining activities conducted in the open pit.

During both summer and winter months, the slope monitoring prisms should be surveyed on a monthly basis, assuming visual inspections indicate stable slopes. However, during the rainy season, the frequency should be escalated to weekly surveys. Intensive slope monitoring will only be necessary when mining operations are being carried out in proximity to unstable sections of the open pit slopes. The available methods for slope monitoring are discussed below along with necessary recommendations.

4.4.1 Visual Monitoring

Visual Monitoring is the best practice when done vigilantly. Visual inspection of any cracks, seepage in high wall helps to spot any movement. Development of tension cracks and any change in them can be carefully observed. Visual monitoring also includes demarcating weak strata on the basis of spontaneous combustion, weathered zone or any deformation. A diligent visual survey always helps in taking preventive measures and/or safeguarding man and machinery.

Crack monitoring:

Crack monitoring techniques typically consist of:

- Regular detailed mapping of location, depth, width of cracks, rate of extension and opening;
- Installation of targets on opposite sides of cracks to monitor rates of opening;
- Installation of surface (wireline) extensometers;
- Installation of picket lines or lines of targets that can be monitored using theodolites or precise levels to detect changes in alignment, location or elevation along a given crack or the crest of the slope

4.4.2 Monitoring by Total Station

Geodetic Surveys:

Traditional ground-based geodetic surveys involve measuring the precise positions of slope features using total stations or GPS devices. These surveys provide accurate data on the movement of specific points on the slope over time. Monitoring points are established along the slope, and their positions are periodically measured to detect any significant movement.

Prism Monitoring:

Prism monitoring is a subset of geodetic surveys where reflective prisms are placed at monitoring points on the slope. Total stations are used to measure the distances and angles to these prisms, allowing for accurate determination of their positions. Any displacement of the prisms indicates slope movement.

Monitoring stations or pillars are generally installed at the places susceptible to displacement. It includes rehandled OB dumps, high wall etc. Change in RL of these monitoring stations needs to be continuously monitored for any unwanted movement. A dedicated team of personnel should monitor and record RL of each monitoring stations of the mine.

4.4.3 Monitoring by Slope Stability Radar (SSR)

Slope stability Radars are state of art instrument to detect slope instability and give early warning depending upon the threshold limit. Slope stability radar can remotely scan the pit slope and dump slope as within certain range in vertical and horizontal direction depending upon its specification. A slope stability radar continuously scans the slope wall within its range. SSR are so precise it can detect movement up to millimetres. Slope stability's radar effectiveness is evident from the fact that it captures and stores the scan image of target area and any minute movement can be distinctively marked. Depending upon the critical velocities considering site specific geo mining conditions a threshold limit can be set for slope stability radar to give out early warning in case of undesirable movement. Slope stability radar waves can penetrate through rain, dust and smoke to provide supreme accuracy in monitoring.

4.4.4 Recommendations on Slope Monitoring

- o The monitoring program include visual inspection of the pit and dump slopes, with focus on crest, face of slope, toe areas for any evidence of cracks, seepage, erosion, gully formation, deformation etc. It is recommended that the shift supervisor or field engineer visually inspect these areas. Other observations such as cracking, seepage, erosion, deformation should also be recorded properly. It should be ensured that benches have gradient in any direction for proper drainage.
- o Continuous slope monitoring is essential to detect any instability in advance to safeguard against impending slope failure. The OB dumps shall be regularly surveyed to produce up to date and accurate dump geometry.
- o The monitoring should be done for strata movement on weekly basis. If any crack, deformation, movement in benches is detected, it shall be immediately informed to higher management. If the symptoms are abnormal, it must be referred to DGMS authority and the work will be stopped till further instructions from statutory bodies are obtained. Monitoring system should be implemented as described in the paragraph as described in the paragraph slope monitoring above. In case of any dump movement observed during “Conventional Monitoring or Semi-advanced slope monitoring technique” Mine management should initiate steps for implementation of advance monitoring technique for the prediction of impending failure at critical areas of mine.

5 SLOPE STABILITY -LITERATURE REVIEW AND DATA PREPARATION

5.1 SLOPE STABILITY

Overburden Dumps (Inpit/Internal and Out of pit/External) and Mine Pit Slopes (Working slopes, Final pit slopes) are the essential parts of the opencast mining systems, particularly over different phases of mining life cycle. The slope stability aspects of mine design were generally based on slope – height relationship curves for a given factor of safety under similar geo-mining conditions, which, despite being time tested and at times conservative, ignored, the design needs required in special cases involving complex geology, structure, conditions and varied material properties.

Challenges in land acquisition and various surface constraints and restrictions, generally result in non-availability of land make it difficult to maintain the designed slopes, both on highwall/working slopes and on OB dump. This leads to steeper slopes and higher dumps to accommodate material, affecting the stability and compromising safety. The problem gets compounded as mines get deeper and involve higher stripping ratios.

It has thus now become inevitable to scientifically study/assess the stability of such slopes to attain maximum productivity with adhering to highest standard of safety.

5.2 FACTORS GOVERNING SLOPE STABILITY

There are two main aspects of slope failure and they are natural and manmade disturbances. The seismic activities of the earth crust, rain, tornado and geology come under the naturally occurred disturbance. Blasting, excavation are manmade disturbance for slope instability. Following are the main factors that influence the slope stability.

5.2.1 Properties of Material Forming the Slope

- a. Shear strength parameter:

This is the basic parameter that holds the key role to control the stability of the slope. All stability analysis involves knowledge of the shearing strength of the soil but it is most difficult to comprehend it accurately. The shearing resistance of soil comprises basically of the following components:

- The frictional resistance between the individual soil particles at their contact points.
- The cohesion between the surfaces of the soil particles, i.e. the structural resistance to displacements of the soil because of the interlocking of the particles.
- The shear strength in cohesion-less results from inter-granular friction alone, while in other soils, it results from both: internal friction as well as cohesion.
- The fundamental shear strength equation proposed by French engineer Coulomb is $S = C + \sigma \tan(\Phi)$.

b. Hydro-geological parameters:

The effect of ground water present within the rock mass surrounding an open pit can be detrimental to the stability of the slope (Hoek and Bray, 1981) Therefore, it is expedient to constantly monitor groundwater levels as well as pore pressure to assist in the assessment of slope stability (Ding, et al. 1998). Piezometers are important for monitoring the effectiveness of mine dewatering programmes (Girard and McHugh, 2000). Measurement or calculation of water pressure is an integral part of site investigation for slope stability studies. Information on water pressures is essential for designing and maintaining safe slopes (Girard, et al. 1998).

For hydrogeology study as part of PR, monitoring of profile of water table in and around active mining areas, through groundwater monitoring points, using dugwells/ Piezometers was carried out. The same are assumed to be representative of hydrostatic condition of the mine bench for the current analysis.

For stability analysis of undisturbed material viz Working faces and High wall Phreatic line were assumed considering the groundwater level/ piezometric data as provided by the hydro geology dept, CMPDI.

Hydrostatic pressure/ water level condition (above the ground) within the overburden dumps (recent/old) can't be directly measured as OB dumps are not

stratified Geological Formation. Study of groundwater monitoring/levels may be not directly required in case of stability of OB dumps as it will not intersect the groundwater table of the surrounding area. However, rate of infiltration of rainwater may be increased due to loose OB dump material.

Ground water level and phreatic surface assumptions, piezometric levels were based on the hydrological data of hydrogeological study of khadia OCP as provided in PR. of Khadia OCP

5.2.2 Geology of Mine Pit

Geology of the mine pit plays a vital role towards determining the stability of working pit. Understanding subsoil condition includes the knowing seam alignment, type of material underneath. In addition to this it is prudent to know various geological disturbances present in the mineable area.

5.2.3 Seismic Forces

(a) Earthquake Effect

Earthquake experience by a structure depends on its own dynamic characteristics and ground motions such that random motion of ground, vibration intensity, magnitude of the earthquake; depth of focus, distance from the epicentre and the strata on which the structure stands.

Seismic forces are considered as per “Indian standard criteria for earth quake resistant design of structures (fifth revision) IS 1893:1984 (reprint 2002) in the following manner: -

Seismic force/coefficient a_h is calculated as per the above IS Code by following two methods and higher value is taken for slope stability calculation

a). Seismic Coefficient Method,

$$a_h = \beta I \alpha_0$$

β = Coefficient depending on soil foundation system

I = Factor depending upon importance of structures

α_0 = basic horizontal seismic coefficient

b) Response Spectrum method

$$\alpha_h = \beta I F_0 S_a/g$$

F_0 = Seismic zone factor for average acceleration spectra

S_a/g = Average acceleration coefficient for appropriate natural period and damping of structure. Value taken from T- S_a/g graph

$$T = 2.9 H t (\rho/G)^{1/2},$$

T = Natural period of vibration for earth fill structure.

Ht = Height, P = Mass density, G = modulus of rigidity.

Since Khadia OCP, is situated in Zone III expected Ground Acceleration for zone III due to earthquake has been calculated as follows

I. Seismic Coefficient Method,

$$\alpha_h = \beta I \alpha_0$$

Here

$$\beta = 1.0, I = 1.5, \alpha_0 = 0.04$$

$$\text{Hence, } \alpha_h = 0.06$$

II. Response Spectrum method

$$\alpha_h = \beta I F_0 S_a/g$$

$$F_0 = 0.2$$

S_a/g = Value taken from graph between natural period of vibration verses average acceleration coefficient

Natural period of vibration T for earth fills structure will be calculated as follow

$$T = 2.9 H t (\rho/G)^{1/2}, H t = 80\text{m}$$

$$P = 18000\text{N/m}^3$$

$$G = 15 \text{ MPa} \times 1000$$

$$\text{Hence, } T = 0.239 \text{ sec.}$$

Now $\alpha h = 1 \times 1.5 \times 0.2 \times 0.16 = 0.048$

Hence it was found that the value of horizontal acceleration from seismic coefficient method is more than the value obtained from response spectrum method. Hence the same value was considered for incorporating earthquake effect during stability analysis.

(b) Blasting Effect

Blasting plays a devil's role towards stability of Pit and Dump Slopes in Mines. Generally a blast vibration wave of low frequency has hostile impact on stability (Dowding and Gilbert 1988). Wong and Pang(1992) suggested Pseudo-Static approach to evaluate blasting effect on slopes.

Hoek et al (2002) introduced Disturbance factor due to blasting, "D" applicable to rock slope. The value of D varies from "0" to "1" where "0" signifies minimal effect of blasting where "1" means large scale blast having significant effect to slopes.

The ground motion is directly influence by scaled distance and a square root of the explosive. Microsecond-delayed blasts are used for reduction of PPV of ground vibrations which are connected with the maximum charge weight detonated per delay. Peak particle velocity has been widely accepted as criteria for evaluating effect of blasting. Langefors and Khilstrom has suggested predictor equation to calculate peak particle velocity. DGMS has laid down accepted parameter in terms of PPV as shown in table

Permissible peak particle velocity (PPV) at the foundation level of structures in mining area is in mm/sec:

Table 5.1

TYPE OF STRUCTURES		Dominant excitation frequency (Hz)		
		< 8 Hz	8-25 Hz	> 25 Hz
A	Building/structures not belonging to owner			
	(i) Domestic houses/structures (Kuchha, Brick in cement).	5	10	15
	(ii) Industrial building (RCC) framed structures.	10	20	25
		2	5	10

	(iii) Object of historical importance and domestic structures.			
B	Building belonging to owner with limited span of life			
	(i) Domestic houses/structures (Kuchha, Brick in cement)	10	15	25
	(ii) Industrial building (RCC) framed structures	15	25	50

5.3 CALCULATION OF FOS

The shear resistance of the sliding slope is assessed by an index called the factor of safety. The factor of safety gives relative static state of the studied slope about its mobilization. This also gives an indication of risk factor of failure at a glance. This is a ratio of the shear resistance to shear force develop at the sliding surface (mobilization force).

Literature found to have categorized that slope is safe with the ratio more than the value of 1.20.

In many literature and different agencies such as National Coal Board, UK, Appolonia Consulting Engineers, mine branch, Canada, GL Fiesenko, Russia, etc has envisaged a factor of safety more than 1.10 in the design of slope stability is safe, if appropriate seismic acceleration is considered and more than 1.20 if seismic acceleration is not considered.

As per DGMS Tech Circular no 3 of Dt 16.01.2020 the suggested factor of safety are as follows

1. FoS greater than or equal to 1.3 for temporary slopes
2. FoS greater than or equal to 1.5 for permanent slopes.

5.4 SOFTWARE USED

The following software tools from Rocscience have been used in this study:

1. SLIDE2 -2D Limit equilibrium software
2. RS2- 2D Finite element software
3. RSData: Strength & Stress Analysis of Rock and Soil Materials

SLIDE2: Limit equilibrium method software

The conventional limit equilibrium method is used in many geotechnical practices to investigate the equilibrium condition and analyse the stability of slope with varying geotechnical data and geometry. The most common methods for limit equilibrium analysis are method of slices. The soil mass above the assumed slip surface is divided into vertical slices for purpose of analysis. Several different methods of slices are available for analysing the circular and non-circular condition.

In the present study limit equilibrium method has been used to compute the factor of safety using bishop method and janbu method

The Slope analysis of Pit Slopes and OB Dump Slopes in Khadia OCP is performed by limit equilibrium method software namely SLIDE2. Slide2 is a 2D limit equilibrium slope stability program for evaluating the safety factor or probability of failure, of circular or non-circular failure surfaces in soil or rock slopes. Slide2 analyse the stability of slip surfaces using vertical slice or non-vertical slice limit equilibrium methods. Slide2 also includes finite element groundwater seepage analysis built right into the program, for both steady state and transient conditions.

Slide2 analyses the stability of slip surfaces using vertical slice or non-vertical slice limit equilibrium methods (e.g. Bishop, Janbu, Spencer, Sarma, etc). Individual slip surfaces can be analysed, or search methods can be applied to locate the critical slip surface for a given slope. Deterministic (safety factor) or probabilistic (probability of failure) analyses can be carried out.

Finite element groundwater (seepage) analysis, for steady-state or transient conditions, is built right into the Slide2 program

SLIDE2 has the Multi-Modal Optimization feature was introduced to help address some of the real-world complexities of analysing a slope. Slope stability analyses generally focus on the search for the single global minimum surface. Yet in reality, a slope will often have multiple critical regions that may fail, instead of a single critical region. This is where MMO comes into play.

RS2- 2D Finite element software

RS2 is a program for 2D finite element analysis of geotechnical structures for civil and mining applications. Applicable for both rock and soil (RS2 = Rock and Soil 2-dimensional analysis program), RS2 is a general purpose finite element analysis program for tunnel and support design, underground excavations, surface excavation, slope stability, embankments, dynamic analysis, foundations, consolidation, groundwater seepage and more. RS2 is used to determine the safety factor of a simple homogeneous slope using the shear strength reduction (SSR) method. SSR analysis is the ability to plot maximum deformation versus SRF. As the SRF is increased, the strength properties are decreased. As the strength decreases the maximum displacement increases. At some point, the slope will fail, deformations will increase rapidly, and the finite-element analysis will not converge. It is this point of non-convergence that defines the critical SRF.

RSData: It is a versatile toolkit for the analysis of rock and soil strength data, and the determination of strength envelopes and other physical parameters. RSData includes RocProp, a database of intact rock properties that runs as a standalone application.

5.5 SAMPLE COLLECTION AND TESTING

It is generally difficult and expensive to sample and test large samples of rock mass. Consequently, empirical methods of determining the friction angle and cohesion of rock masses are available in the literature (Duncan C. Wyllie et al.). In empirical methods also it is necessary to categorize the rock mass in terms of both the intact rock strength and the characteristics of the fractures/joints.

One of the methods is Strength Determination by Back Analysis of Failures: Probably the most reliable method of determining the strength of a rock mass is to back analyse a failed, or failing, slope. This procedure involves carrying out a stability analysis with the factor of safety set at 1.0 and using available information on the position of the rupture surface, the groundwater conditions at the time of failure, and any external forces such as foundation loads and earthquake motion, if applicable. In many cases it may not be feasible to carry out a back analysis of a slope in geological conditions similar to those in which the new slope is to be

excavated. In these circumstances, published results of rock mass shear strength can be used in design. (Duncan C. Wyllie et al)

As an alternative to back analysis to determine the strength of fractured rock masses, an empirical method was developed by Hoek (1983) and Hoek and Brown (1988) in which the shear strength is represented as a curved envelope. This strength criterion was derived from the Griffith crack theory of rock fracture, as well as from observations of the behaviour of rock masses in the laboratory and in the field (Marsal 1973; Jaeger 1970).

The three parameters defining the curved strength envelope of the rock mass are the uniaxial strength of the intact rock, and two dimensionless constants m and s .

Estimation of Rock Mass Properties for Highwall:

RSData developed by Rocscience is used in this study for estimation of rock mass properties, which developed on Hoek-Brown strength criterion based on intact rock strength. RSData is a versatile toolkit for the analysis of rock and soil strength data, and the determination of strength envelopes and other physical parameters. RSData includes RocProp, a database of intact rock properties that runs as a standalone application. the additional Output Parameters that can be generated from RSdata Includes

- Hoek-Brown: rock mass tensile strength, compressive strength, deformation modulus
- Mohr-Coulomb: uniaxial compressive strength, alpha angle
- Power Curve: uniaxial compressive strength, tensile strength

Samples were collected appropriate to ground conditions and transported them to Geotechnical Lab at CMPDI. Laboratory tests were conducted to determine the strength properties of OB materials such as cohesion and angle of internal friction. The purpose of the sample collection and laboratory studies is to predict subsurface conditions, classification and identifying strata and estimating strength properties. Field and Laboratory works were conducted based on Indian Standard specifications and, as per the requirement of project.



Figure 5.1 Pictures showing Sample collection and compositions of Ob material at field

5.5.1 Large Scale Direct shear testing of OB samples.

Different compositions of materials found at various benches of overburden dumps, were collected from the field and packed in approximately 30 bags were transported to CMPDI, HQ, Ranchi.

These samples were tested on an automatically servo-controlled Large Direct shear machine which has a shear and normal load capacity of 2500kn, with a shear box size of 300X300x300MM and 1000X1000X1000 mm. Mohr-Coulomb failure criteria were used to determine the shear parameters cohesion 'c' and friction angle ' ϕ ' using equation $\tau = \sigma \tan \phi + c$.



Figure 5.2 Pictures showing sample testing on Large Direct Shear Machine, CMPDI

5.6 INPUT PARAMETRS FOR SLOPE STABILITY ANALYSIS

The mixed material found in the interface of top soil and coalmine overburden material is very complex in terms of both material type and its size distribution. The materials properties of these overburden rocks or rock-soil mixture are most likely to change due to repeated exposure to weathering and particle crushing during loading and hauling process. The crushed sandstone material being formed by similar kind of sand grains during sedimentation possesses characteristics somewhat similar to that of

sand, while the weak, weathered and crushed materials of shale tends to behave like a clay material formation when subjected to watery condition.

Estimation of the key physico-mechanical properties of coalmine waste dumps was done using the large scale testing of representative sample from OB dumps on Large direct shear machine at field scale stresses, as well as considering laboratory studies (from available literature) on mixed earth rock observed in Indian coalmine waste dumps where the properties of all major constituent materials are taken into consideration.

For high wall/working face material each material profile is defined by referring lithological data of the nearby borehole.

RSDData software based with observations during field visit and Physio-mechanical properties of the strata in GR/PR is used for deriving the rock mass properties of different strata depth wise to use as input parameters in stability analysis using SLIDE2.

After correlating the test results from the laboratory test and with lithology data available from borehole along with site specific literature review with judicial judgment g value of shear strength parameters considered are given below.

Large Direct Shear Machine Testing of Over Burden Dump samples from Khadia OC, NCL.

Different compositions of materials found at various benches of overburden dumps, both internal and external dumps were collected from Khadia OCP, NCL during the filed visit. The collected samples which were packed and labelled in approximately 16 bags are transported (by RI-VI) to CMPDI, HQ, Ranchi

These samples were tested on an automatically servo-controlled Large Direct shear machine which has a shear and normal load capacity of 2500kN, with a shear box size of 300X300x300MM and 1000X1000X1000 mm.

Mohr-Coulomb failure criteria were used to determine the shear parameters cohesion 'c' and friction angle ' ϕ ' using equation $\tau = \sigma \tan \phi + c$.

The summary of Direct shear test results is placed below.

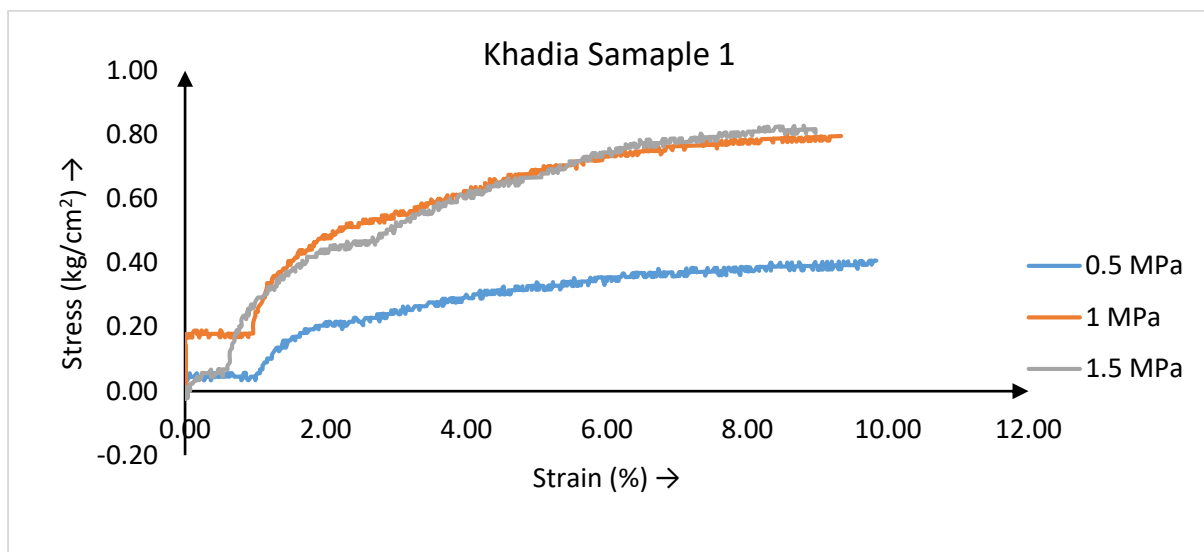
A) Results for Khaidia OCP

Table 5.2: Input strength parameters for OB dumps

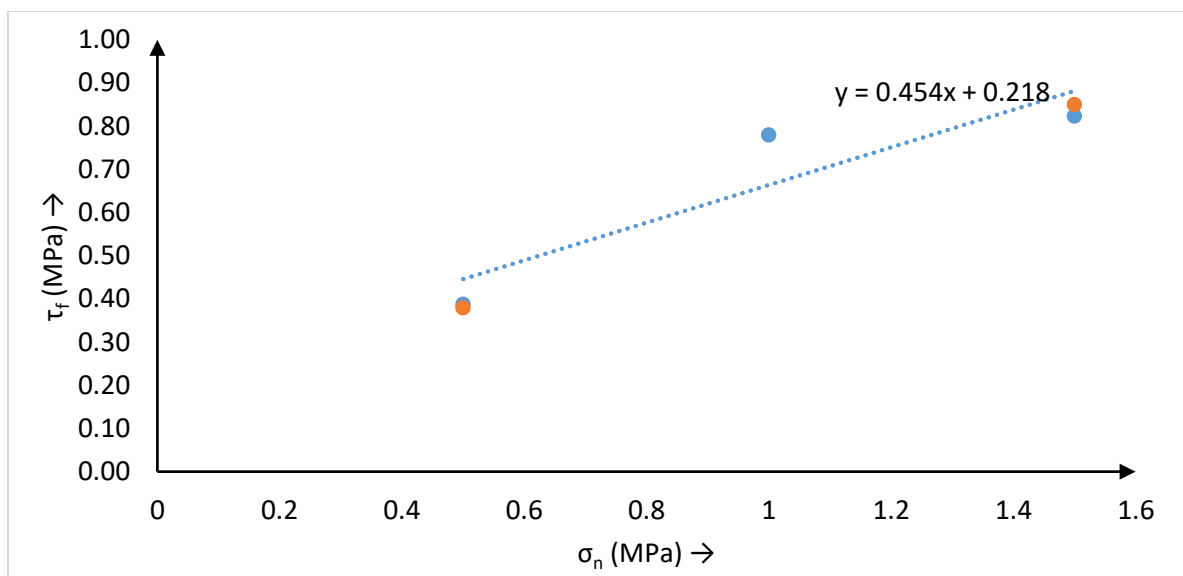
Sample No	Sample Code	Site	C(MPa)	Phi (Degree)
1	KH1	OB DUMP	0.21	24.23
2	KH2	OB DUMP	0.18	28.37
3	KH7	OB DUMP	0.15	29.68
4	KH8	OB DUMP	0.21	23.27

Sample wise Stress-strain plots and Mohr–Coulomb failure envelopes are given below

1. Sample KH1



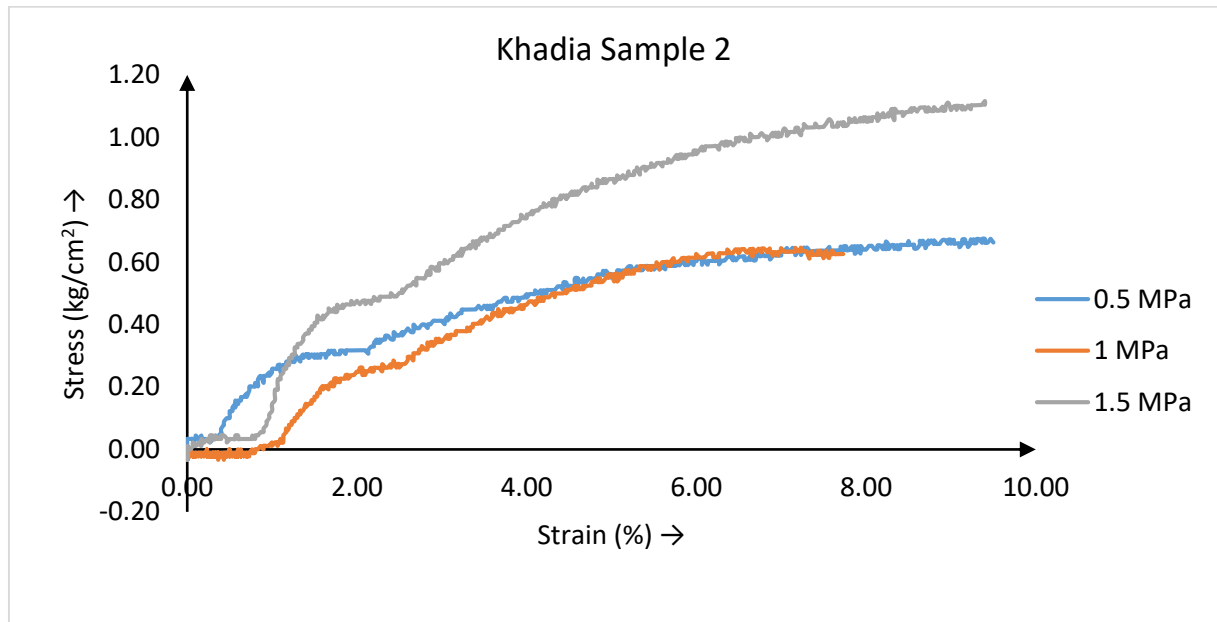
Stress strain Plot of Sample KH1



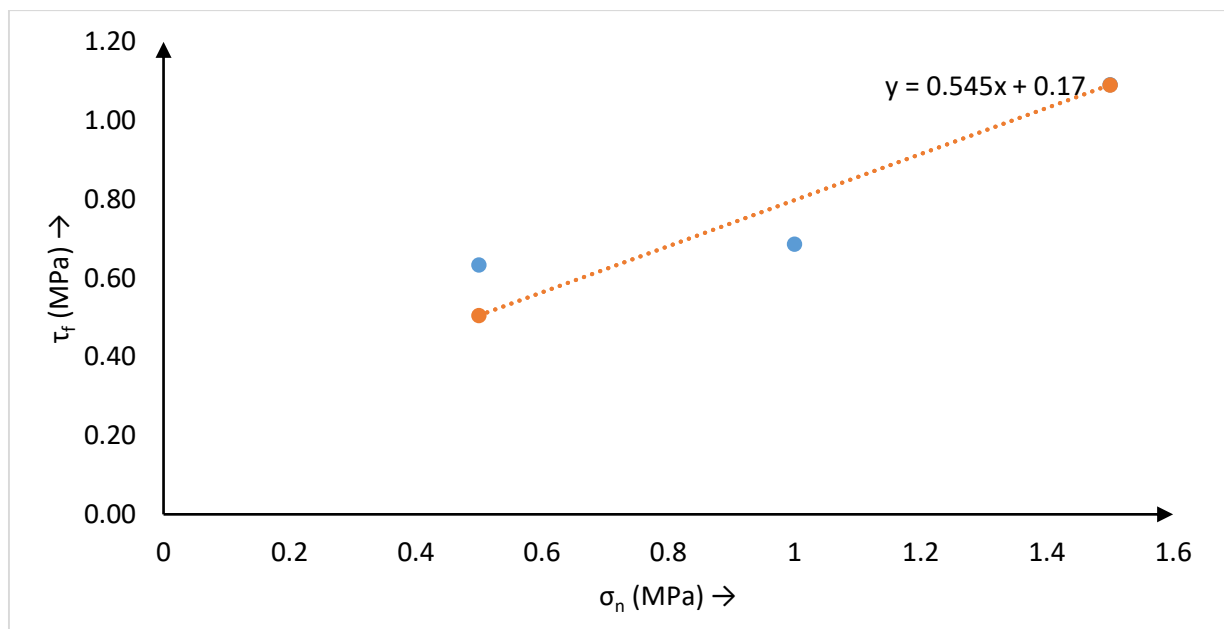
Failure Envelope for Sample KH1

m	0.45	C (MPa)	0.21
c	0.21	ϕ (°)	24.23

2. Sample KH2



Stress strain Plot of Sample KH2

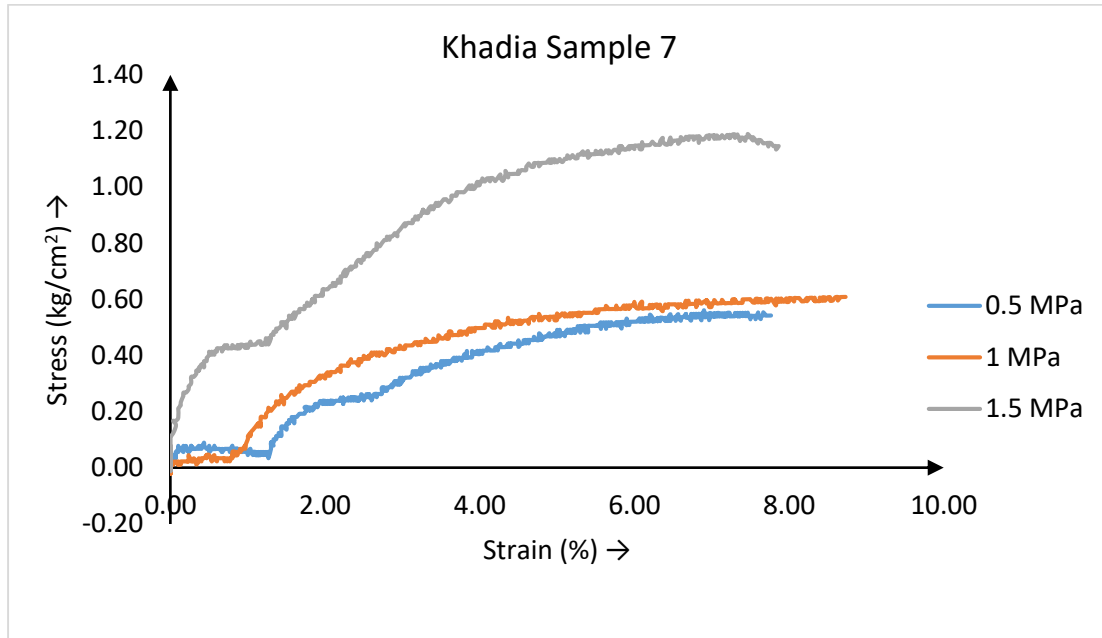


Failure Envelope for Sample KH2

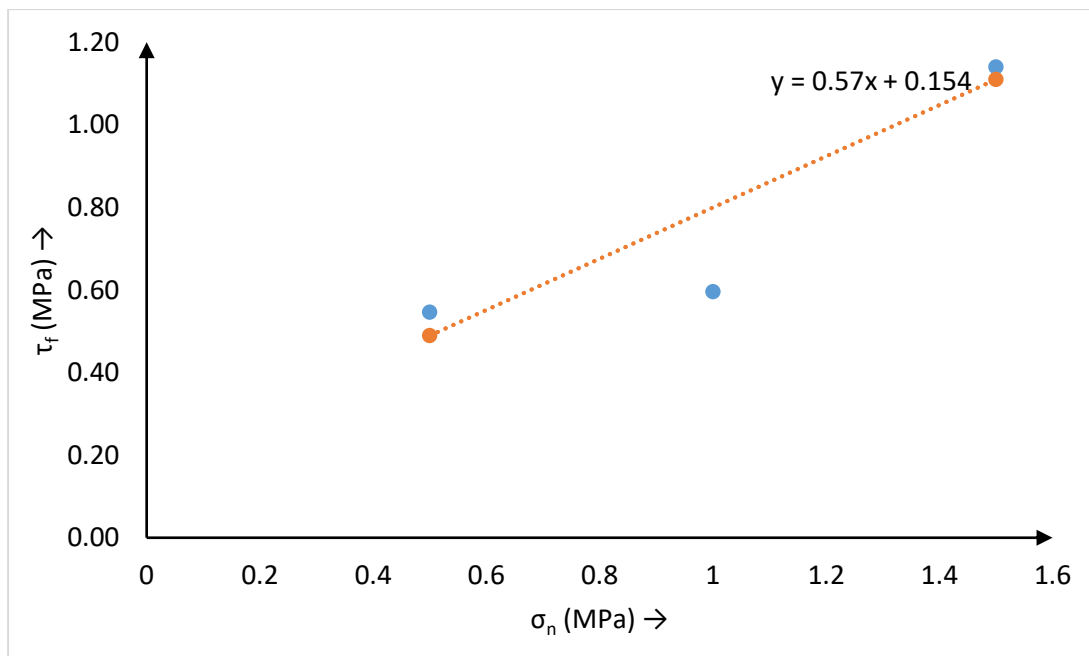
m	0.58	C (MPa)	0.18
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c	0.17	ϕ (°)	28.37
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3. Sample KH7



Stress strain Plot for Sample KH7

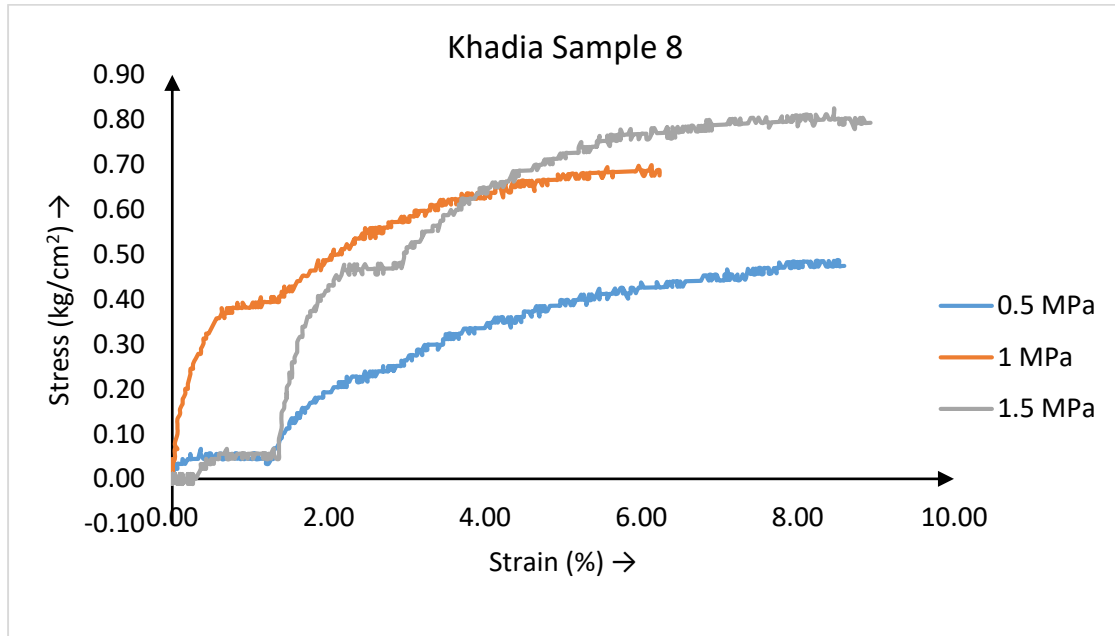


Failure Envelope for Sample KH7

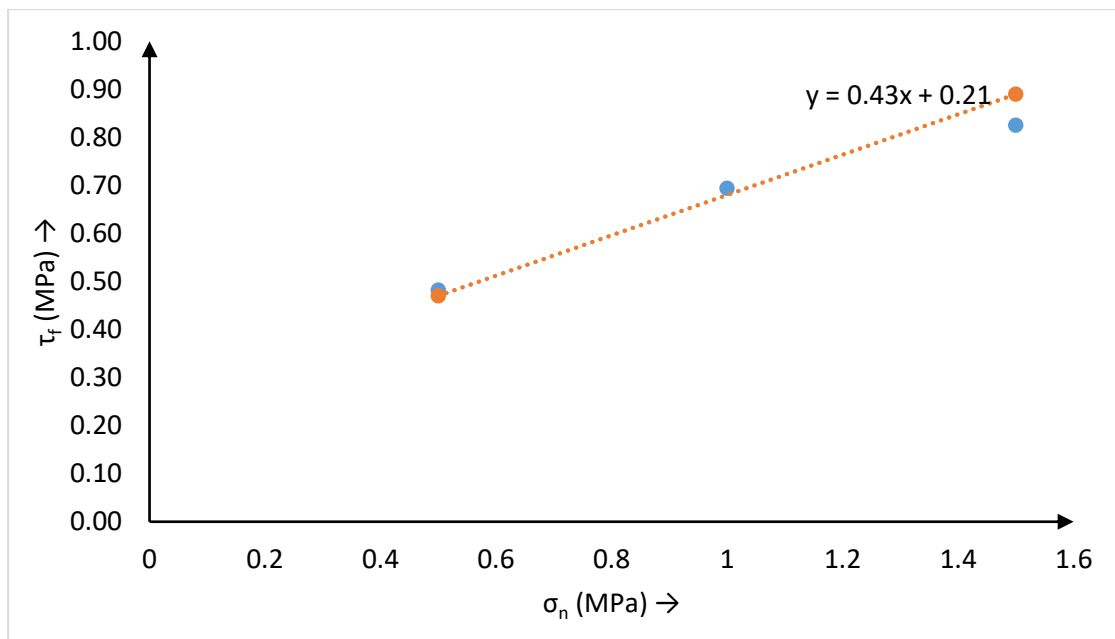
m	0.57	C (MPa)	0.15
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c	0.15	ϕ (°)	29.68
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4. Sample KH8



Stress strain Plot for Sample KH8



Failure Envelope for Sample KH8

For Highwall :

Rock samples from the field were collected and cores recovered from the sample were tested for UCS and density. Using the UCS of intact rock from lab tests and compressive test values available in GR for the intact rock Rock mass properties were derived.

The intact rock may be considered as a continuum or polycrystalline solid among discontinuities comprising an aggregate of minerals or grains. The rock mass is the in situ medium comprising intact rock blocks separated by discontinuities such as joints, bedding planes, folds, sheared zones, and faults.

In general, compared to intact rock, a rock mass has reduced tensile strength (almost zero), and reduced shear strength especially along discontinuity planes. Furthermore, if a rock mass is cut by directional joint sets, the rock mass strength is anisotropic.

The rockmass strength properties were derived using RocData software by incorporating the lab test data of CMPDI, rock testing properties available in the Khadia GR, previous test data from IIT BHU and BIT Mesra and correlating test data from adjacent mines the input strength parameters are derived using Rocdata software and few plots are reproduced below.

Table 5.3 : Input strength parameters for highwall

Description	Unit weight (Kn/m ³)	C (kPa)	Phi (Degree)
Coal seam	16	150	17
Sand stone	23	275	30
Shaly sand stone	22	200	26
Base rock	26	350	35

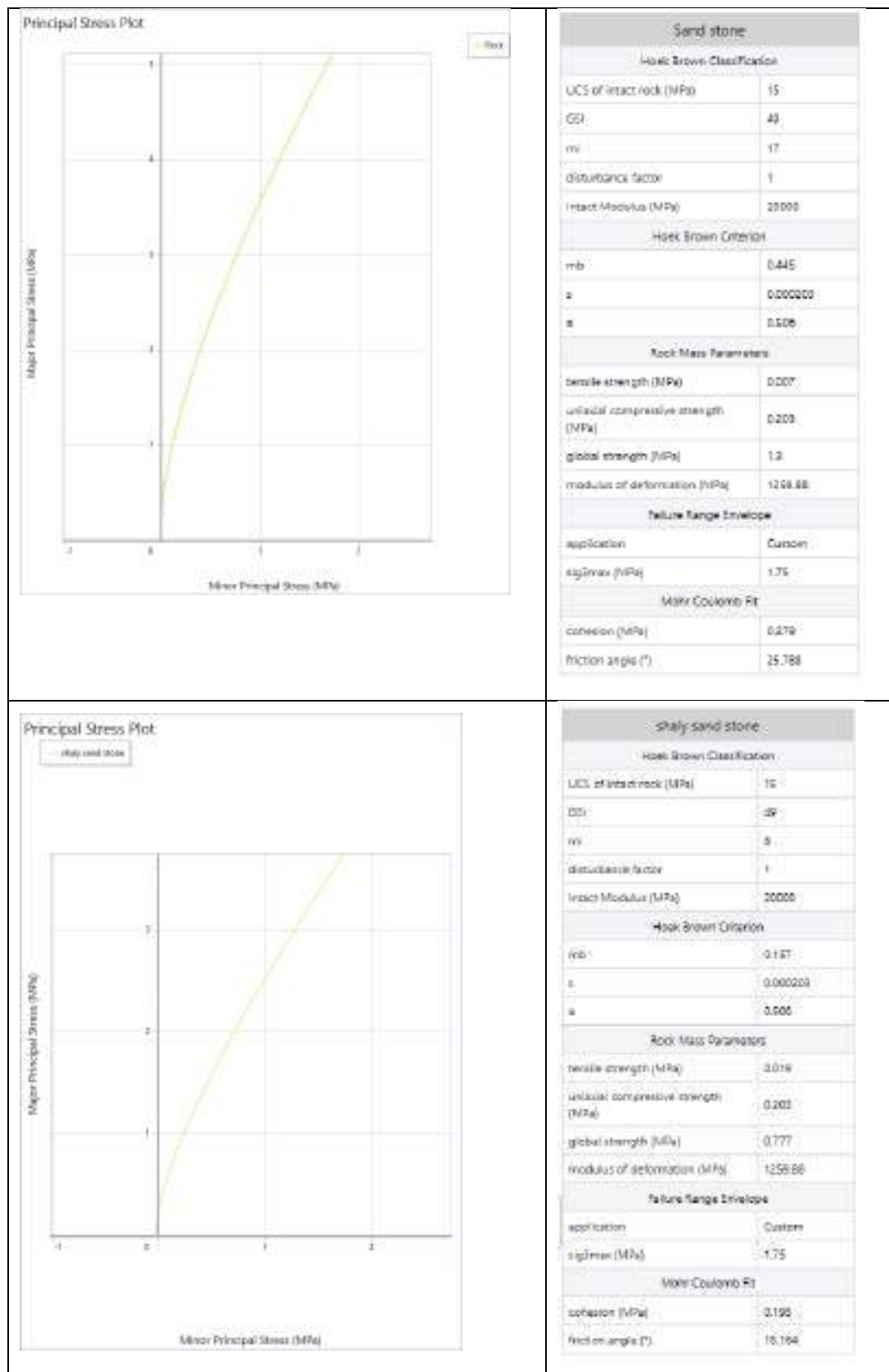


Figure 5.3 Plots showing RSDData Analysis results for Rock mass properties

6 STABILITY ANALYSIS

6.1 SCOPE OF ANALYSIS

There are many areas within the excavation area and the dumps where the mining and dump profiles are in deviation with the designed/desired profiles, the details of which have been deliberated earlier in the report. Stability analysis for the Pit and Dump slopes for the khadia coal mine was performed for the

- Existing Highwall Slopes, where the working benches have been clubbed to form highwall profile, steeper/flatter than the designed/proposed profile.
- Ultimate Pit Slope as per Approved Mining Plan/ PR
- Existing Overburden Dump Slopes
- Final Dump slope as per approved mining plan/ PR
- Proposed High wall and OB dump slope profiles for specified areas

Considerations in the analysis:

Cross sections along various alignments were drawn across the mine workings and dump profiles were superimposed on the seam and topographic dispositions, generated through the digital model in Minex. Existing profiles on such sections were taken from the Working plan of the mine dated 01.04.2023, showing the position of mining operations, in consultation with mine officials. These sections have formed the basis of the profiles used for Slope stability analysis for highwall and dump slopes.

Slope Stability Analysis for the Ultimate Pit slopes and Final Dump profiles are as proposed in the Project Report/Mining Plan.

The factor of safety 1.5 has been considered for long term stability of the dump slope. The angle of repose was considered to be 37° . The stability analyse were done to determine the safe dump slope configuration.

Locations of the cross sections and models and analysis results of the stability analysis using SLIDE2 and RS2 software are presented below.

Stability Analysis:

Figure 6.2 showing location of sections considered along final stage pit and dump

1. Section A-A'

Section along A-A' represents overburden dump on western side of the mine near view point. The elevation at toe of the dump is 222 m and top of the dump is 500 m. The average height of the dump along the section from the toe is 278m and overall slope angle is 18° , the intermediate benches have bench angles ranging from 36° - 40° .

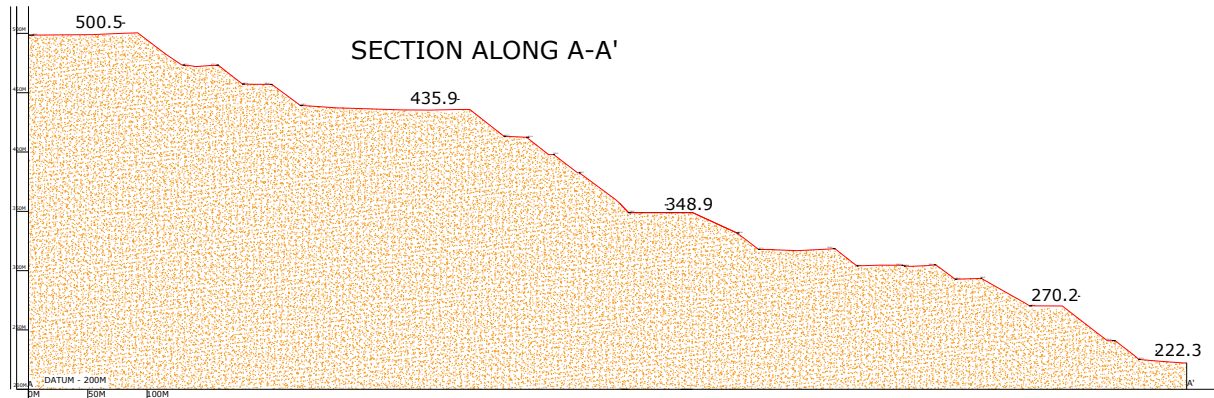


Figure 6.3: A-A' represents overburden dump on western section

2. Section B-B'

Section along B-B' represents a section along western most part of the overburden dump. The elevation at toe of the dump is 257 m and top of the dump is 502 m. The average height of the dump along the section from the toe is 245 m and overall slope angle is 21° , the intermediate benches have bench angles ranging from 34° - 40° .

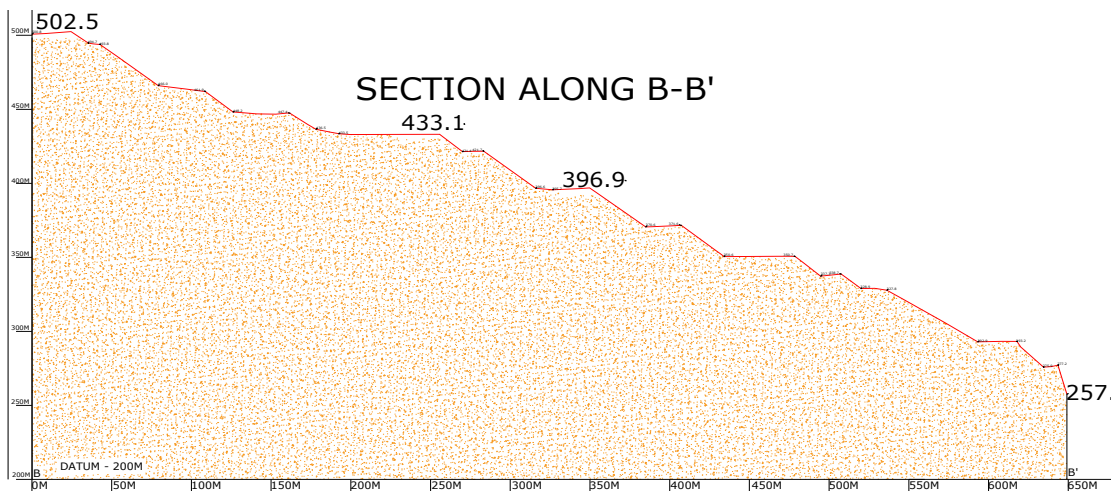


Figure 6.4: B-B' represents a section along western most part of OB

3. Section E-E'

Section along E-E' represents a section along middle of the western overburden dump. The elevation at toe of the dump is 239.2 m and top of the dump is 505 m. The average height of the dump along the section from the toe is 265 m and overall slope angle is 22° . The intermediate benches have bench angles ranging from 30° - 38° .

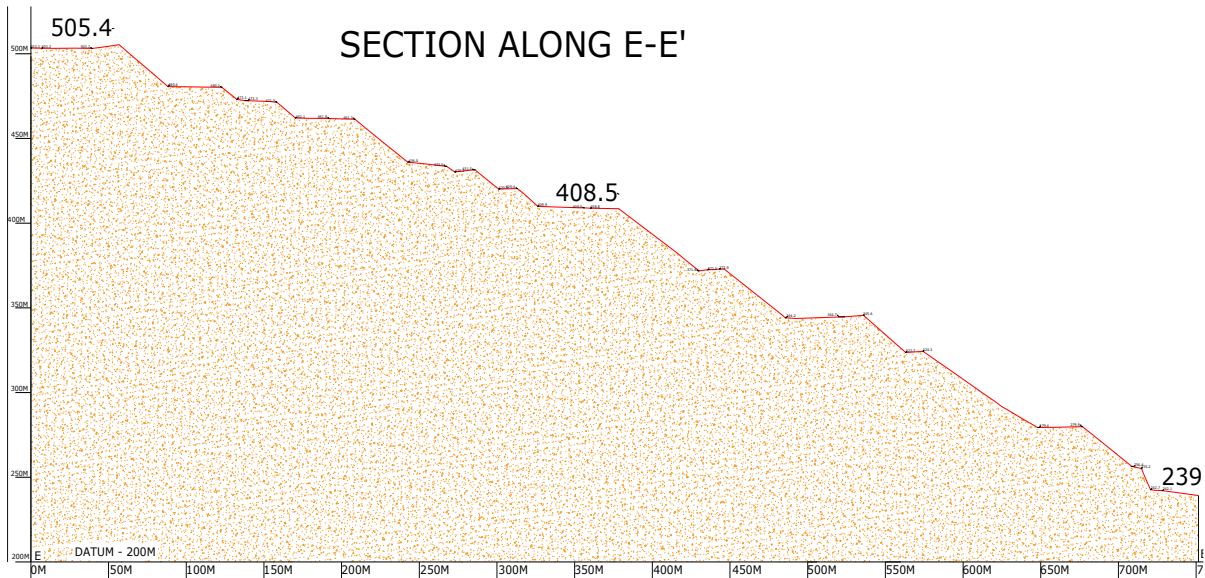


Figure 6.5: E-E' represents a section along middle of the western overburden dump

4. Section H-H'

Section along H-H' represents a section along left part of the eastern overburden dump. The elevation at toe of the dump is 247 m and top of the dump is 495 m. The average height of the dump along the section from the toe is 248 m and overall slope angle is 17° . The intermediate benches have bench angles ranging from 34° - 40° . Except the initial bench at toe.

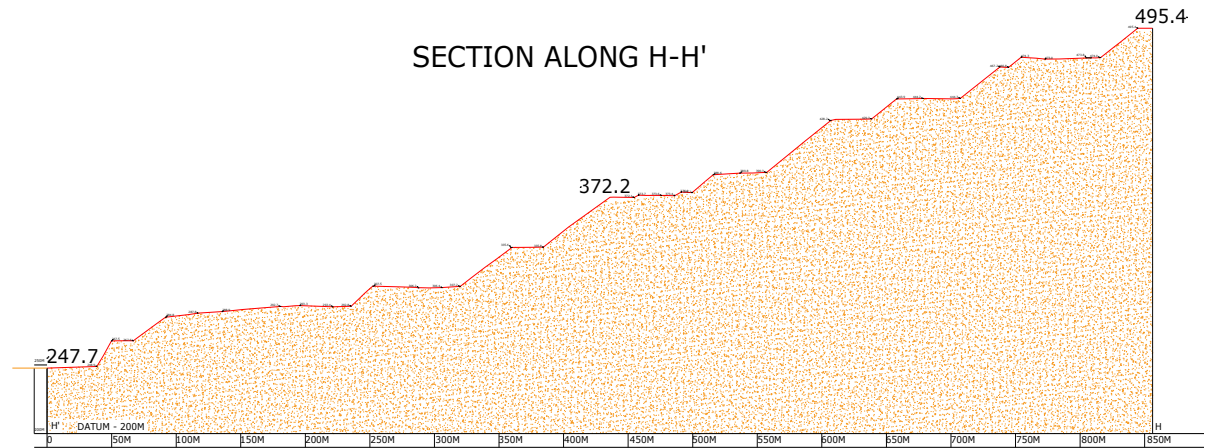


Figure 6.6: H-H' represents a section along left part of the eastern overburden dump

5. Section I-I'

Section along I-I' represents a section along middle of the eastern overburden dump. The elevation at toe of the dump is 257 m and top of the dump is 495 m. The average height of the dump along the section from the toe is 238 m and overall slope angle is 18° . The intermediate benches have bench angles ranging from 34° - 45° . Except the initial bench at toe

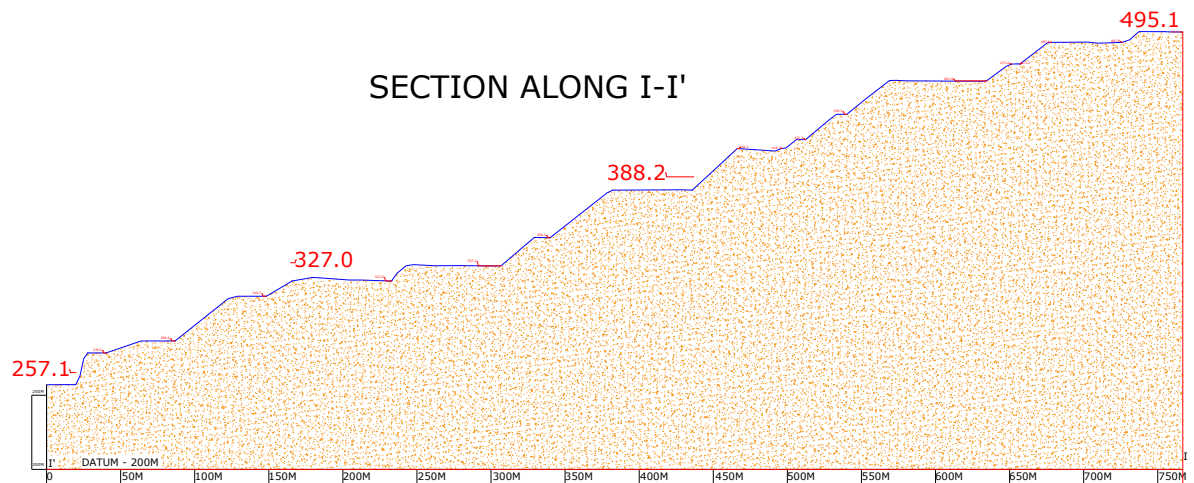


Figure 6.7: I-I' represents a section along middle of the eastern overburden dump

6. Section J-J'

Section along J-J' represents a section along eastern overburden dump. The elevation at toe of the dump is 280 m and top of the dump is 499 m. The average height of the dump along the section from the toe is 220 m and overall slope angle is 23° . The intermediate benches have bench angles ranging from 34° - 43° .

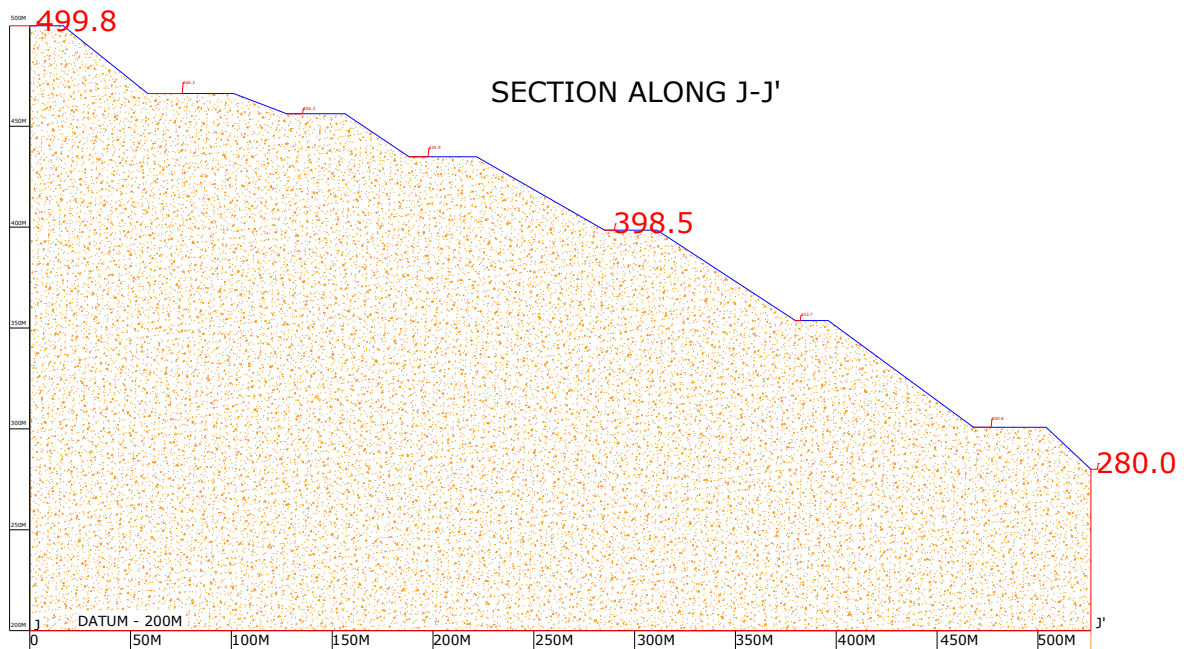


Figure 6.8: J-J' represents a section along eastern overburden dump

7. Section K-K'

Section along K-K' represents a section along western overburden dump. The elevation at toe of the dump is 320 m and top of the dump is 502 m. The average height of the dump along the section from the toe is 192 m and overall slope angle is 24° . The intermediate benches have bench angles ranging from 29° - 55° . But one intermediate bench has a height of 82m placed at angle of 36°

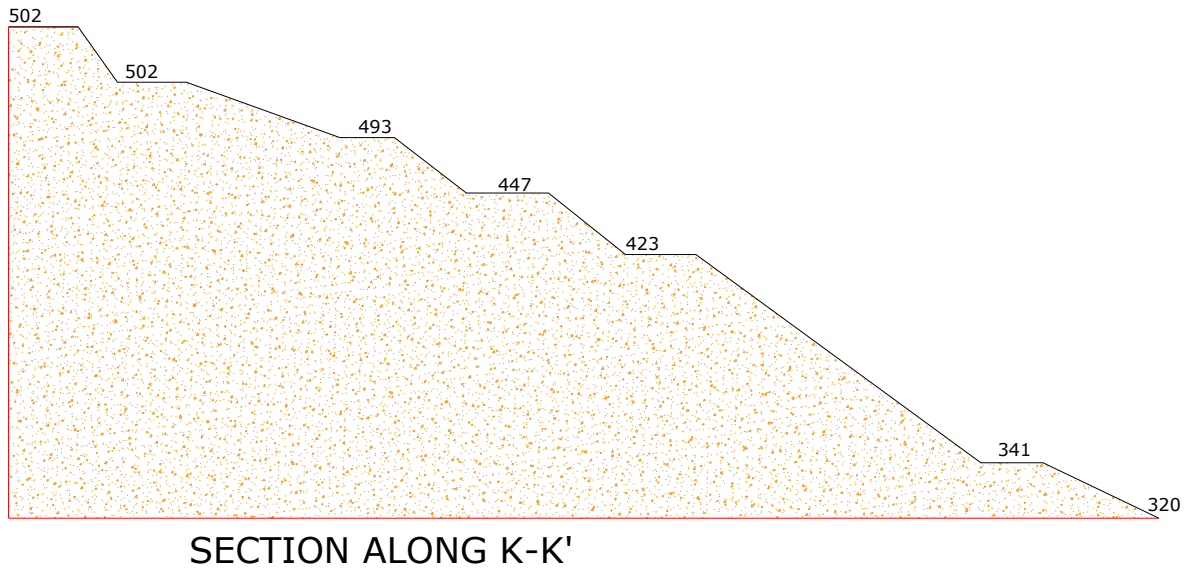


Figure 6.9: K-K' represents a section along western overburden dump

8. Section L-L'

Section along L-L' represents a section along western overburden dump. The elevation at toe of the dump is 304 m and top of the dump is 500 m. The average height of the dump along the section from the toe is 195 m and overall slope angle is 33° . The intermediate benches have bench angles ranging from 34° - 45° . But one intermediate bench has a height of 100m placed at angle of 40°

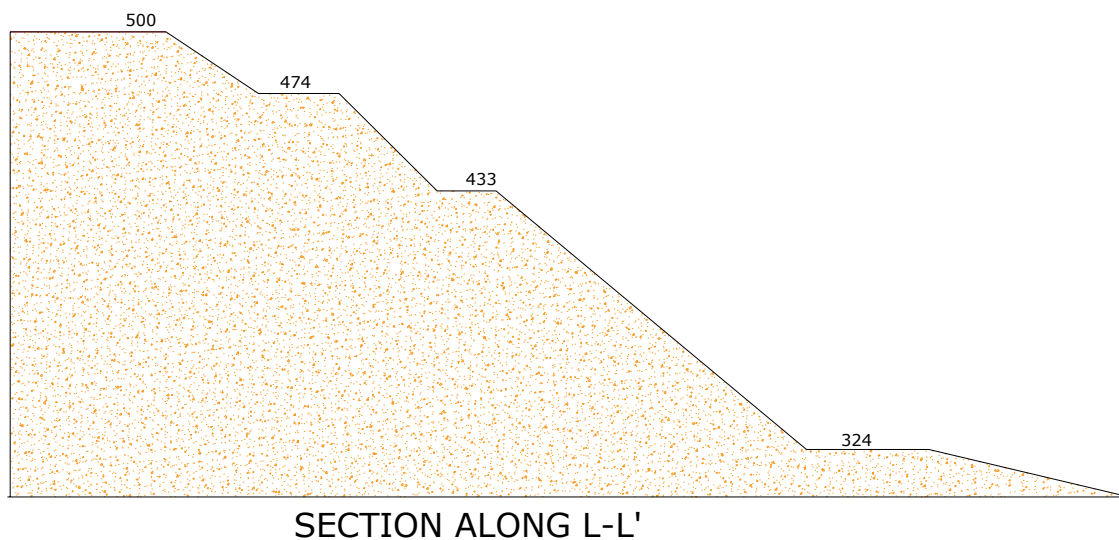


Figure 6.10: L-L' represents a section along western overburden dump

9. Section M-M'

Section along M-M' represents a section along western overburden dump. The elevation at toe of the dump is 275 m and top of the dump is 497 m. The average height of the dump along the section from the toe is 222 m and overall slope angle is 21° . The intermediate benches have bench angles ranging from 26° - 46° .

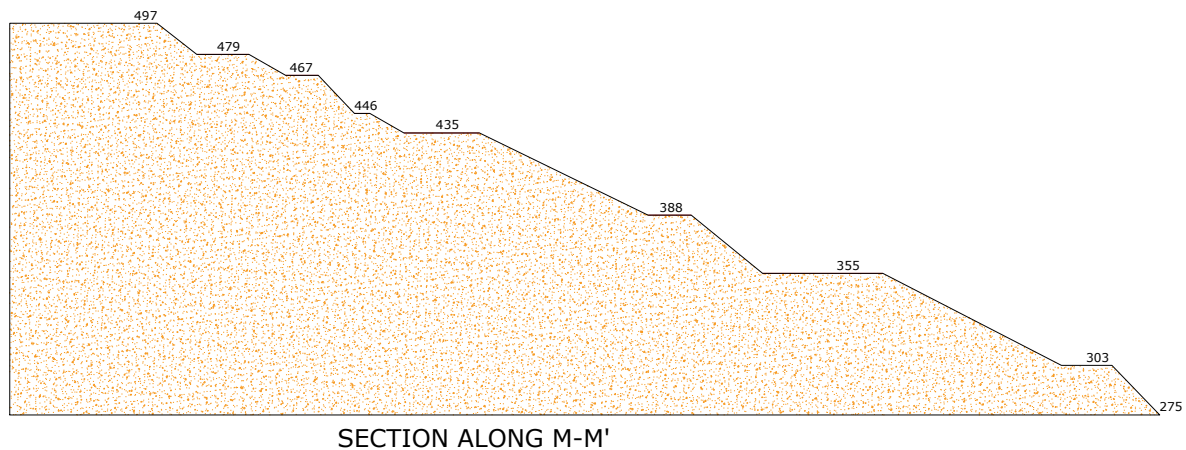


Figure 6.11: M-M' represents a section along western overburden dump

10. Section O-O'

Section along O-O'' represents a section along eastern overburden dump. The elevation at toe of the dump is 293 m and top of the dump is 495 m. The average height of the dump along the section from the toe is 202 m and overall slope angle is 20° . The intermediate benches have bench angles ranging from 30° - 33° .

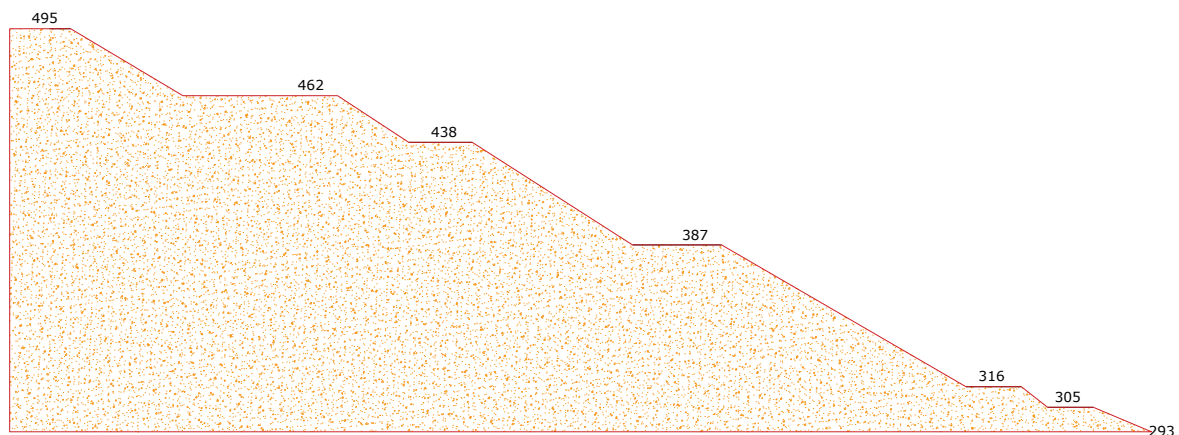


Figure 6.12: O-O'' represents a section along eastern overburden dump

11. Section N-N'

Section along N-N' represents a section along eastern overburden dump. The elevation at toe of the dump is 280 m and top of the dump is 495 m. The average height of the dump along the section from the toe is 215 m and overall slope angle is 19° . The intermediate benches have bench angles ranging from 34° - 55°

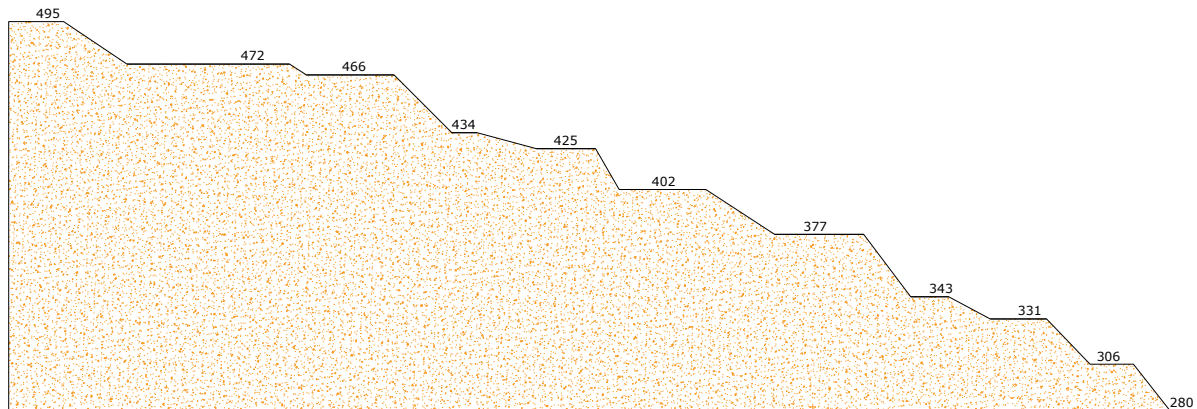


Figure 6.13: O-O'' represents a section along eastern overburden dump

12. Final stage Dump : Section 1-1 Along western dump

The elevation at toe of the dump is 300 m and top of the dump is 540 m. The average height of the dump along the section from the toe is 240 m and overall slope angle is 18° . The intermediate benches have bench angle of 37° and bench height of 30m.

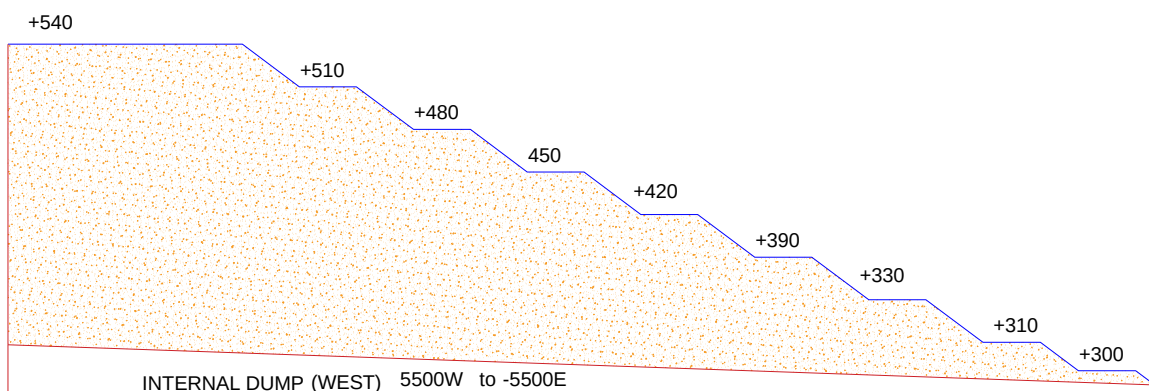
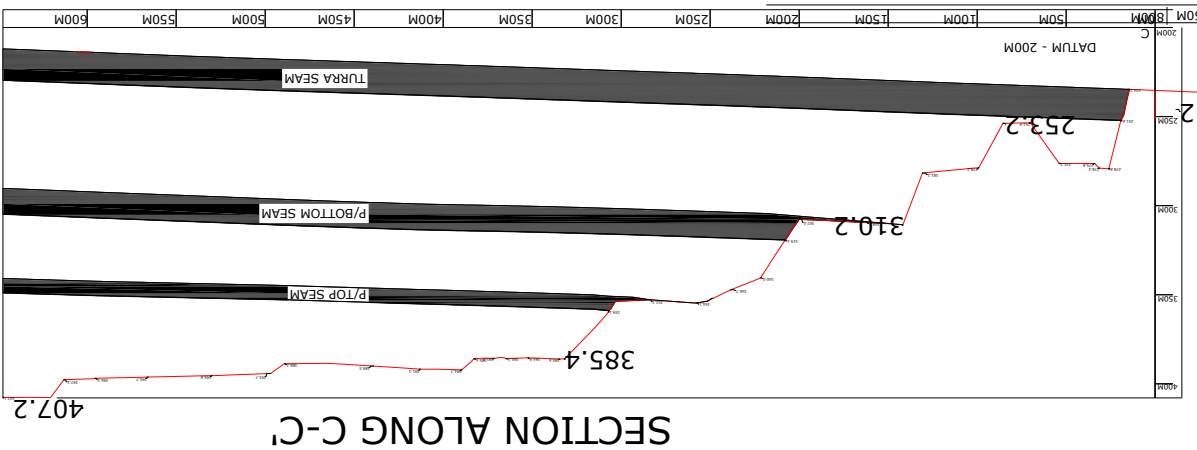


Figure : 6.14: Final stage Dump : Section 1-1 Along western dump

13. Final stage Dump: Section 2-2 Along Eastern dump

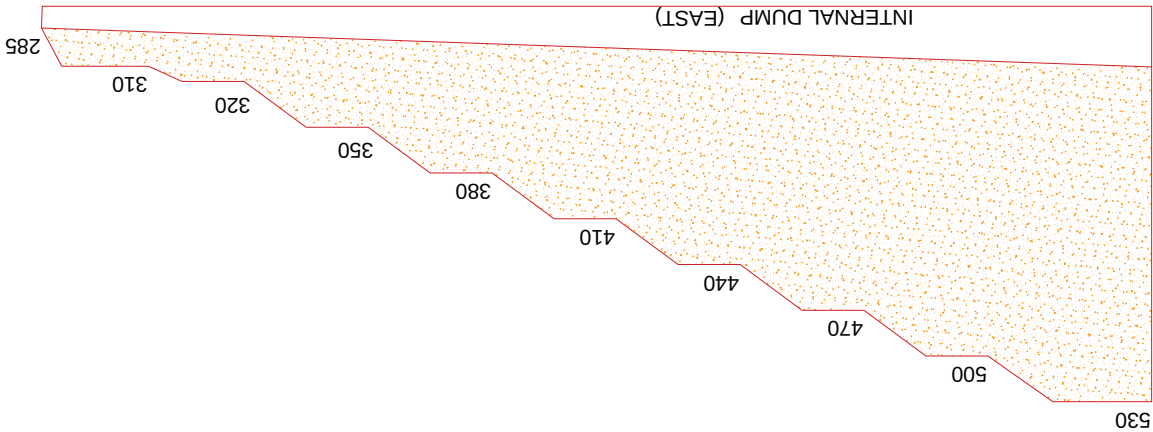
Figure 6.16: C-C' represents a profile along working benches at western quarry



Section along C-C' represents a profile along working benches at western quarry. The elevation at floor is 234 m and at the top is 407 m. The average height of the face along the section from the floor is 195 m and overall slope angle is 25°. The intermediate benches have bench angles ranging from 49°-69°. The part of the profile near the floor is having a height of 45 m with an angle of 80°.

14. Section C-C'

Figure : 6.15: Final stage Dump : Section 1-1 Along Eastern dump



The elevation at toe of the dump is 285 m and top of the dump is 530 m. The average height of the dump along the section from the toe is 245 m and overall slope angle is 18°. The intermediate benches have bench angle of 36° and bench height of 30m.

15. Section D-D'

Section along D-D' represents a profile along working benches at western quarry. The elevation at floor is 220 m and at the top is 458 m. The average height of the face along the section from the floor is 250 m and overall slope angle is 16° . The intermediate benches have bench angles ranging from 54° - 67° . The part of the profile towards the floor is having a height of 90 m with two benches. The with an individual bench angle of 75° and overall slope the particular section is 67° .

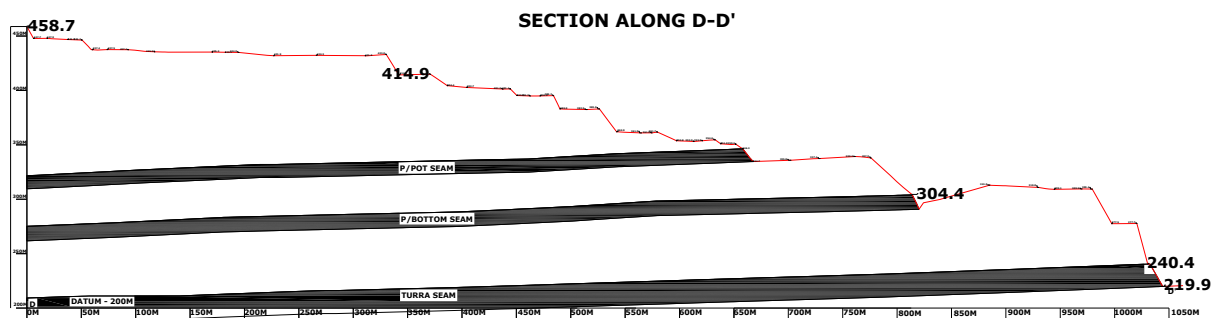


Figure 6.16: D-D' represents a profile along working benches at western quarry

16. Section F-F'

Section along F-F' represents a profile along working benches at eastern quarry. The elevation at floor is 243 m and at the top is 438 m. The average height of the face along the section from the floor is 224 m and overall slope angle is 16° . The intermediate benches have bench angles ranging from 47° - 64° . The part of the profile towards the floor is having a height of 48 m with two benches. The with an individual maximum bench angle of 77° and overall slope the particular section is 44° .

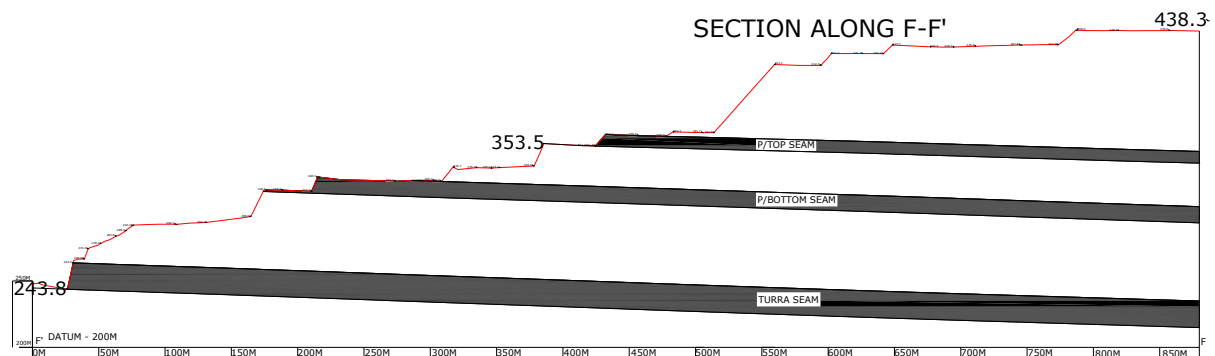


Figure 6.17: F-F' represents a profile along working benches at eastern quarry

17. Section G-G'

Section along G-G' represents a profile along working benches at eastern quarry. The elevation at floor is 270 m and at the top is 474 m. The average height of the face along the section from the floor is 250 m and overall slope angle is 18° . The intermediate benches have bench angles ranging from 47° - 65° . The part of the profile towards the floor is having a height of 45 with bench angle of 77° .

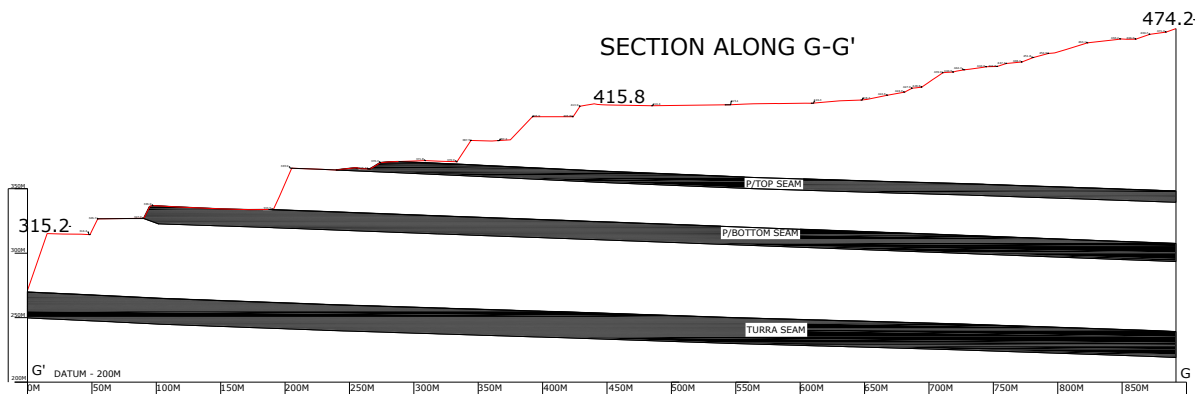


Figure 6.18: G-G' represents a profile along working benches at eastern quarry

18. Final stage pit slope : along Eastern Section

The particular profile indicates a final pit slope considered along the final stage quarry as proposed in approved PR. The toe of the profile is having an RL of 215m and at the top the RL is 480m, there by the average height of the final pit slope along that section is 265m. the overall slope of the profile is 36° with individual bench angle of 70° in OB.

19. Final stage pit slope: along western Section

The particular profile indicates a final pit slope considered along the final stage quarry as proposed in approved PR. The toe of the profile is having an RL of 175m and at the top the RL is 400m, there by the average height of the final pit slope along that section is 220m. the overall slope of the profile is 36° with individual bench angle of 70°

6.2 CONCLUSIONS OF STABILITY ANALYSIS

Table 6.1: Summary of analysis results

S.No	Section Description	FoS (Dry condition)	FoS (with Phreatic surface)
Existing Internal OB DUMP –West			
1	Section A-A'	1.37	1.37
2	Section B-B'	1.48	1.41
3	Section E-E'	1.32	1.26
4	Section K-K'	1.25	1.21
5	Section L-L'	1.02	0.95
6	Section M-M'	1.41	1.33
Existing Internal Dump –East			
7	Section H-H'	1.49	1.44
8	Section I-I'	1.45	1.42
9	Section J-J'	1.25	1.21
10	Section O-O'	1.35	1.33
11	Section N-N'	1.40	1.37
Proposed Final Stage Dump			
12	Section 1-1' along West	1.37	1.32
13	Section 2-2' along East	1.40	1.38
Existing High Wall –West			
14	Section C-C' - Overall slope	1.54	1.50
16	Section D-D' Overall slope	1.07	1.06
17	Section D-D'- Analysis for Intermediate Benches	1.6	
Existing High Wall –East			
18	Section F-F'	1.52	1.52
19	Section G-G'	1.73	1.68
Proposed Final stage Pit slope			
20	Along East	1.48	1.37
21	Along West	1.42	1.40

For stability analysis of existing sections viz section of dump, highwall , ultimate pit slope and final stage dump plans sections (as indicated above in figure 6.19 & 6.20) are considered for modelling using SLIDE2 software as these appears to be critical by virtue of geometry of slope profile and consequence of failures.

All these sections are analysed for deterministic global minimum Factor of safety for dry condition and also with elevated phreatic surface condition for simulating rise in water table above ground level during monsoon or due to any hydrological conditions

Out of these sections,

- i) Analysis for existing dump Section K-K' along dump (west) results in a FoS of 1.25 for dry condition and 1.21 with phreatic surface respectively for given conditions.
- ii) Along existing dump section L-L' Analysis along dump (west) results in a FoS of 1.02 for dry condition and 0.95 with phreatic surface respectively for given conditions.
- iii) Analysis for existing dump Section J-J' along dump (East) results in a FoS of 1.25 for dry condition and 1.21 with phreatic surface respectively for given conditions.
- iv) Existing highwall section D-D' along highwall (west) result in FoS of 1.07 and 1.06 dry and phreatic surface conditions respectively

The lesser FoS for profile along Section K-K', could be due to an 83 m high single bench OB dump. The lesser FoS for profile along Section-L-L', could be the approx. 100 m high single bench with slope angle of around 40 degrees. Along highwall section D-D', the lesser FOS may be due to the part of profile towards the floor, which is having a height of 90 m with two benches. The with an individual bench angle of 75° and overall slope the particular section is 67°. The geometry of these sections should be modified to attain better safety.

The remaining existing working sections in highwall and OB yields factor of safety more than 1.30 in all cases, which is required for temporary working slopes. This indicates these existing profiles along these sections appears to be safe for the given site conditions.

Final batter sections along section east and west in PR as shown in figure 6.19 & 6.20 are considered for stability analysis. Analysis for overall stability of sections results in FoS of 1.48 and 1.42 respectively and it is nearly 1.50 which is the stipulated FoS for

permeant slopes. Final batter slope along East and west indicates that the slope profile along this is safe for the present given strata properties and slope conditions. However further detailed analysis in later stage of mining may be required to confirm the impact of water and with exact strength properties of depth wise start along final pit slope.

Stability analysis for final stage external dump along section 1-1' and 2-2' along west and East dumps as per PR results in the FoS of 1.37 and 1.40 (>1.3 but <1.5) which indicates the proposed external dumping appears safe for the given conditions. The final stage dump section as proposed in PR results in FoS of less than stipulated FoS (i.e 1.5) for permanent slopes. Better Drainage management and not allowing to accumulate water along with proper benching as proposed in PR may result in further stability.

6.2.1 Geometry of the benches recommendations

6.2.2 Ultimate Pit slope

The overall slope angle of ultimate pit should be limited to 36° - 38° as proposed in PR. The Elements of mining system have been determined in accordance with the parameters of excavation and transport equipment and the parameters of drilling and blasting (table 4.5). The main OB bench overlying Turra seam is to be removed by dragline system and proposed to be side cast in the decoaled cut. The OB from upper benches is being handled by Shovel-dumper system and accommodated over the dragline side cast spoil within the pit. The proposed ultimate pit slope section is shown below

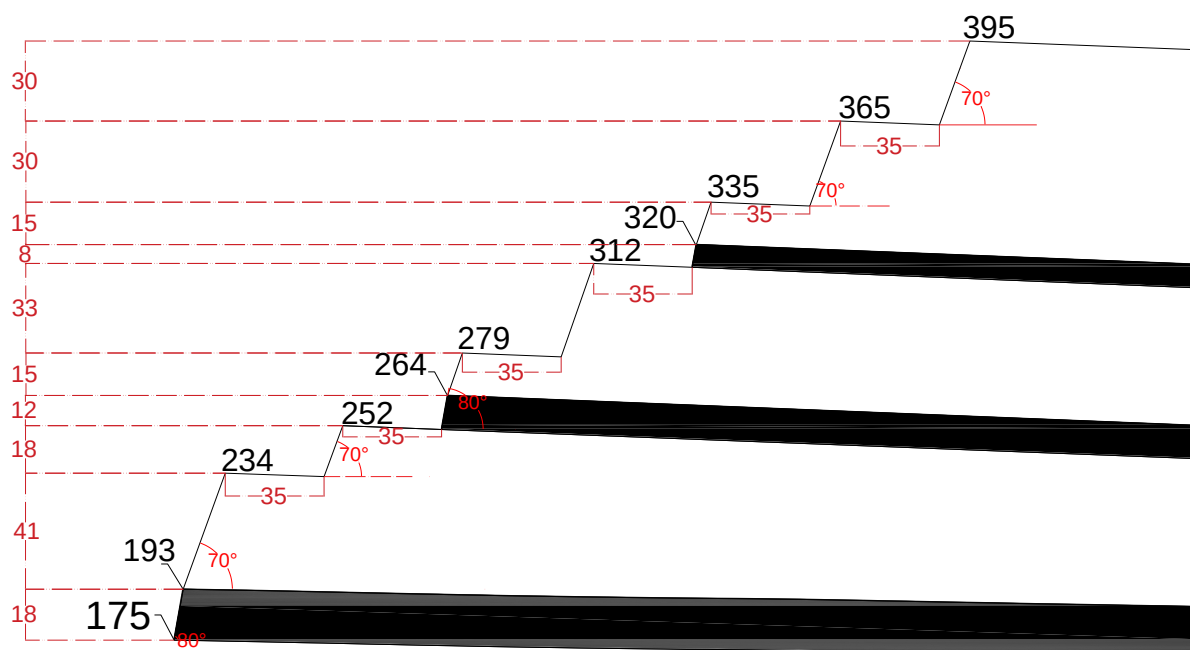


Fig 6.21 Proposed Ultimate pit slope with various elements

6.2.3 Overburden dumps

The geometry for the benches is recommended as per the dump geometry proposed in the PR/Mining plan i.e the Bench height of OB dumps formed by Shovel-Dumper system will be 30m and slope of individual dump benches will be 37° (equal to angle of natural repose of OB material). Width of berm between two adjacent benches will be 40m. Overall slope of dump works out to be 28°.

While forming any new dumps or modifying the slope profile of existing dumps attention should be given to the CMR 2017 guidelines, which says any spoil bank exceeding 30 meter in height shall be benched so that no bench exceeds 30 meter in height and the overall slope shall not exceed 1 vertical to 1.5 horizontal.

The below suggested typical profile as per CMR 2017 is to be followed for any new OB dumps that are being planned as well as it is to be adopted where ever it is practically possible along existing sections for any further dumping that may be planned or while modifying any existing dump sections. However, along sections of old and abandoned dumps where active dumping is not going or further dumping is not proposed or planned, the existing dump profile may be continued with imposing restrictions on movement of men and machinery by placing proper fence/signboards

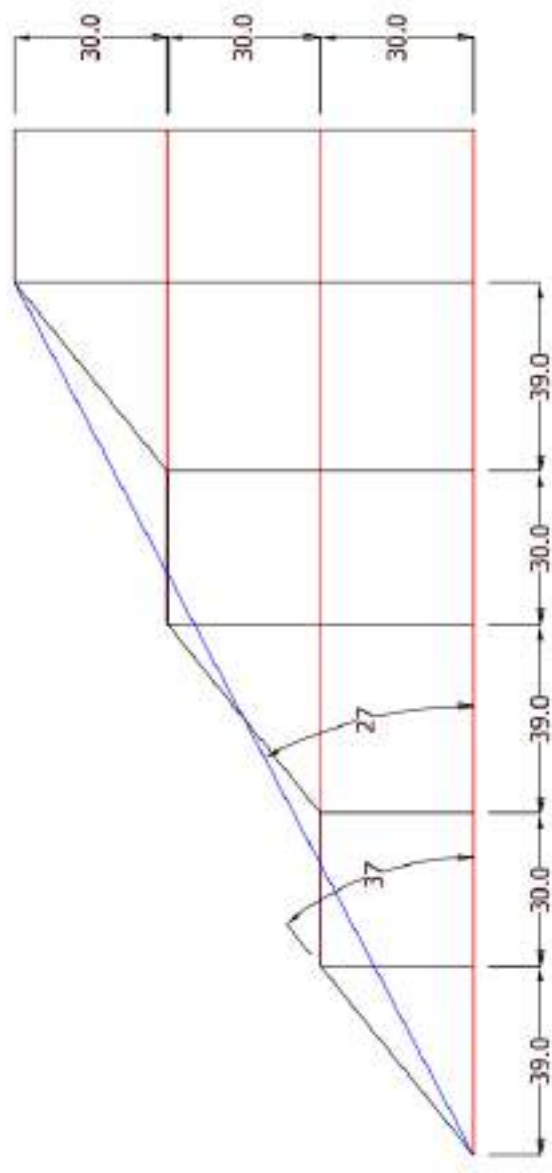


Fig 6.22 proposed typical profile of benches to be incorporated as per CMR 2017

6.3 RECOMMENDATIONS

The mine is being worked by shovel-dumps combination. The stability of the slope primarily depends on the strength properties of the dump material, orientation and geology of the dump foundation, infiltration of the rainfall, and drainage and ground water conditions within the slope.

The bench geometry of mine pit should strictly follow specifications as mentioned in Mining plan. In case of use of any other machinery, the bench geometry will be guided by maximum width of machinery & related DGMS guidelines.

Failures can occur in local level, even if the overall slope of the working pit is found to be safe, if the individual benches are steeper and doesn't follow the specified criteria. Locally, in many areas of working benches, individual benches are narrow with some localized failures and gulley formations. It is necessary to maintain proper bench geometry having adequate bench width & proper bench height for better stability. Bench geometries stipulated in regulation 106 of CMR 2017 should be adhered wherever it is practically feasible for the existing and future planned slopes and critical slopes.

Presence of water causes negative consequence towards pit stability. Garland drains are to be provided along crest side for smooth passage of water. Benches are to be properly graded to inhibit formation of sludge. Semi horizontal pipes may be inserted for draining out water wherever necessary.

In the formation of external dumps, the slope profile, viz bench height and bench angle should be as indicated in PR/Mining Plan.

In dragline mining, the toe of the dragline dump/coal barrier is generally at a distance equivalent to the cut width of the dragline bench. Permission/exemption, if required may have to be taken as per the requirement of mine.

As the rehandled dumps are comparatively newer and of less height, strict measures should be taken so as to maintain tier system of dumping, where each tier should not exceed a height of 30 meters.

Placement of the materials in the dump in accordance with the planned development and operating plans, including lift height and location.

A dedicated geotechnical cell should be formed at project level which should undertake frequent visual inspection and all the relevant information should be recorded.

RL measurement of monitoring stations should be thoroughly carried out. The monitoring work is to be supervised and verified by a senior survey officer.

Visual inspection of any cracks should be done diligently. Widening of cracks should be measured by crack meters and recorded regularly.

For continuous monitoring of slope movement installation of Slope Stability Radar may be considered. Today almost all SSR are equipped with mechanisation to provide early warning signals about approaching failure.

6.4 LIMITATIONS OF THE STABILITY ANALYSIS

- Soil/OB is a very complex material. In nature, heterogeneous type of soil is found which has different properties at different depth and places.
- Accurate soil/OB properties cannot be derived in laboratory by merely testing few samples, because no theory can exactly simulate the field conditions.

- It is very difficult to take the soil/OB sample from the deep inside the OB dump and measures were taken to collect the representative samples as per IS codes.
- Judicious judgement based on combination of theory and practical experience from the past studies help to arrive at the necessary assumptions for the study.
- In geotechnical engineering field there are many uncertain factors which govern the stability analysis which depends on the assumptions made for the study. As a result, factor of safety determined may vary to some extent from study to study. In the study, all normal failure conditions are checked for determination of FoS with the best possible assumptions and judgment

6.4.1 Disclaimer

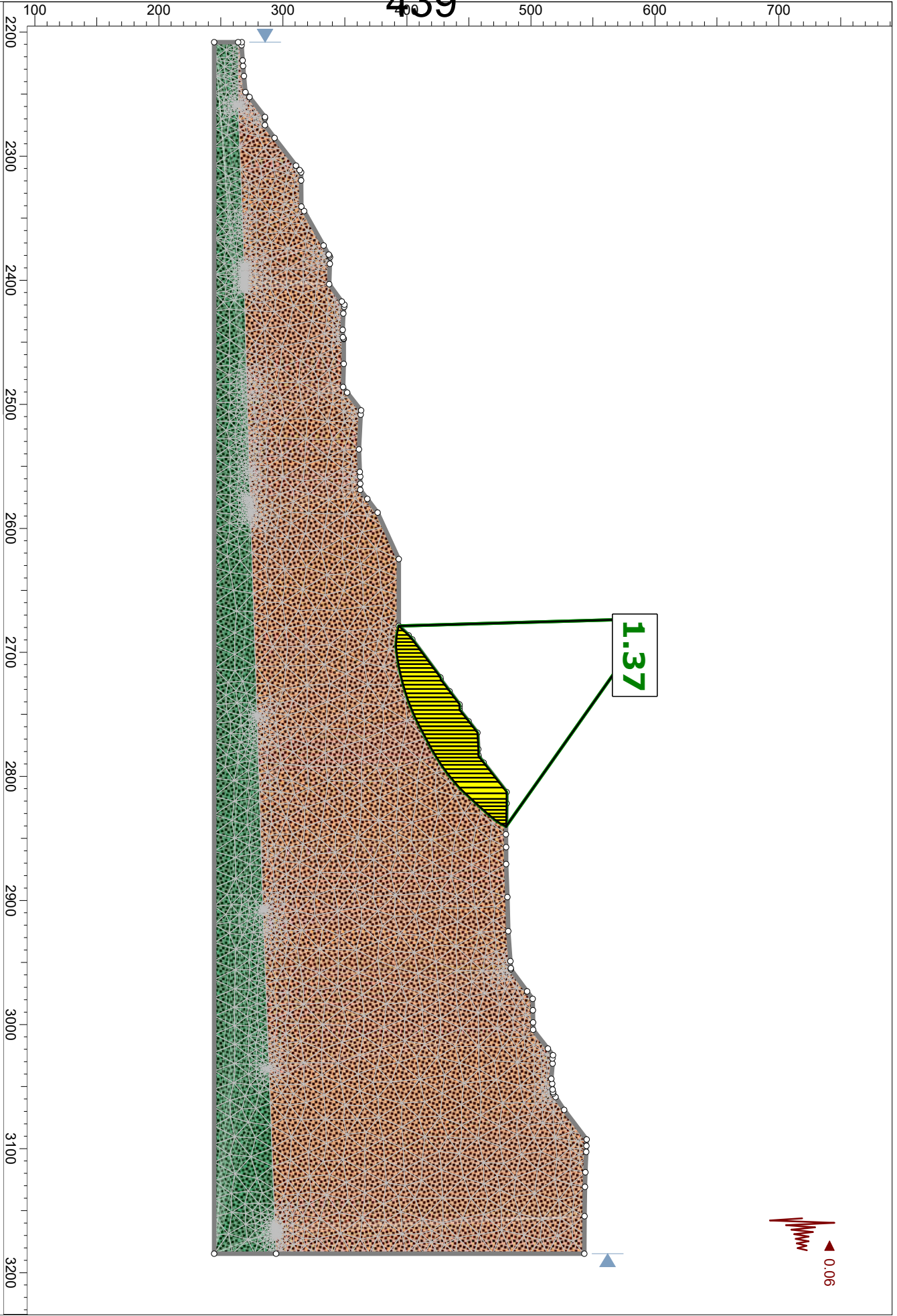
This scientific study is based on the data and information available at the time of the study, as well as on certain assumptions and models used in the analysis. The study may not have been able to fully account for the inherent variability and uncertainties associated with geological and mining conditions, as well as for the limitations of the data and the analysis methods used. Therefore, the study results and recommendations should be considered as estimates and subject to some degree of uncertainty. The actual conditions at the coal mine may differ from those assumed in the study, and unexpected events or changes in mining operations may impact the reliability and validity of the study results.

In summary, this study provides a preliminary assessment of the geological and mining conditions at the coal mine and recommends design measures and strategies based on the available information and analysis methods. However, it is subject to the inherent uncertainties and variability associated with geotechnical work and should be considered in conjunction with other available information and professional judgment.

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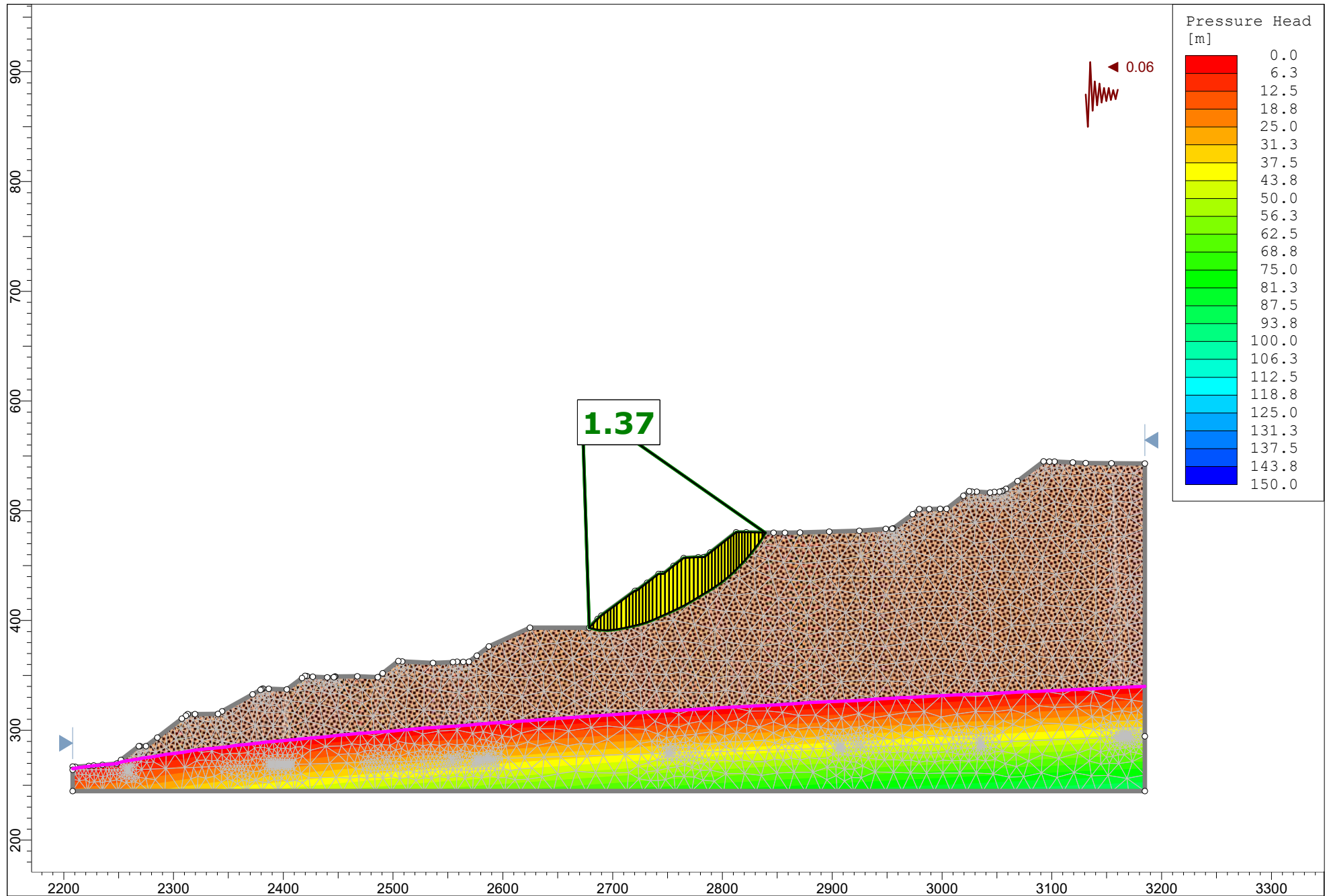
Slope Analysis Models and Results: *The detailed slope stability models developed by SLIDE2 by LEM using steady state ground water FEM for existing sections and ultimate pit and dump slopes (As indicated in section 6.2 above) are presented below as Annexure-1*

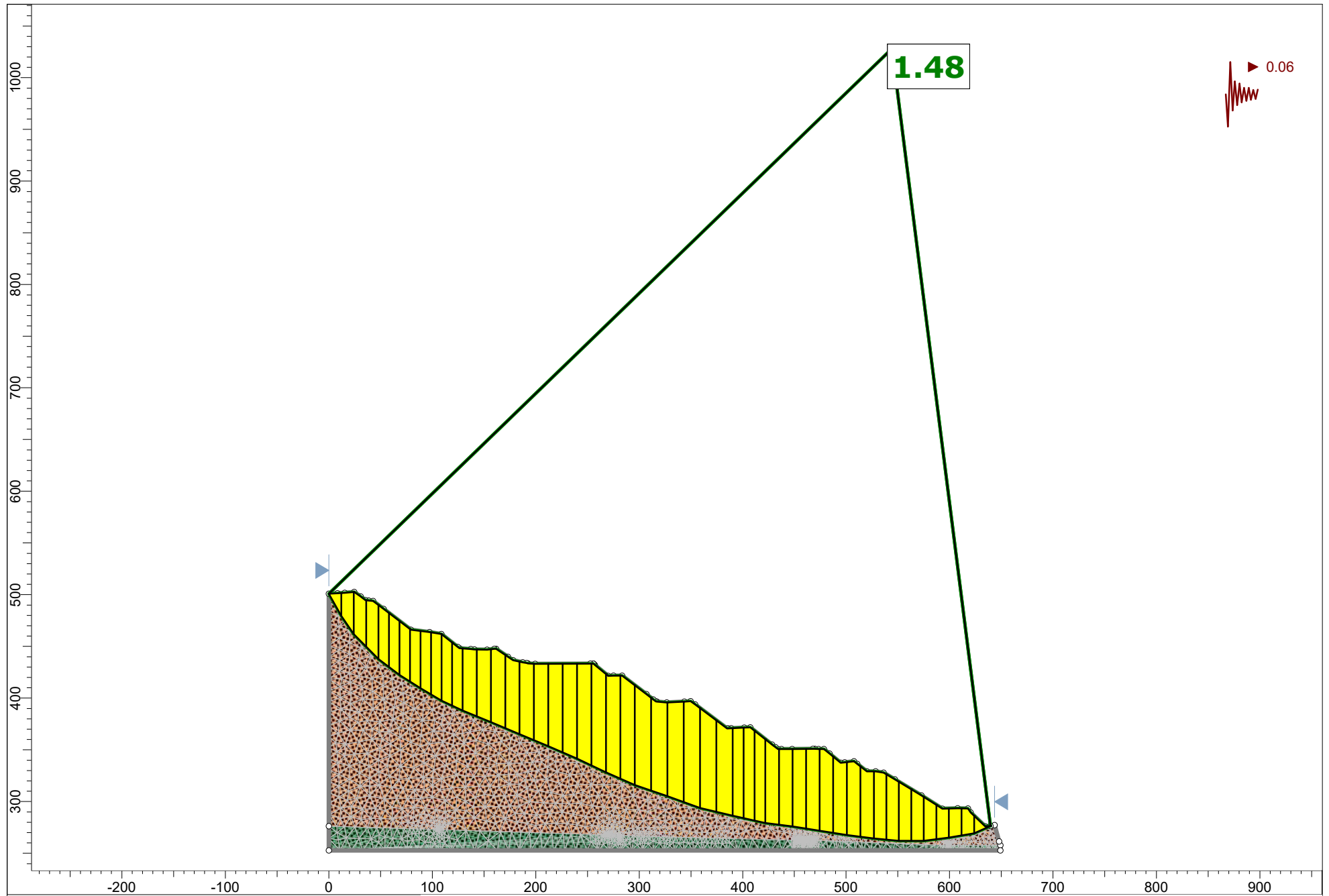
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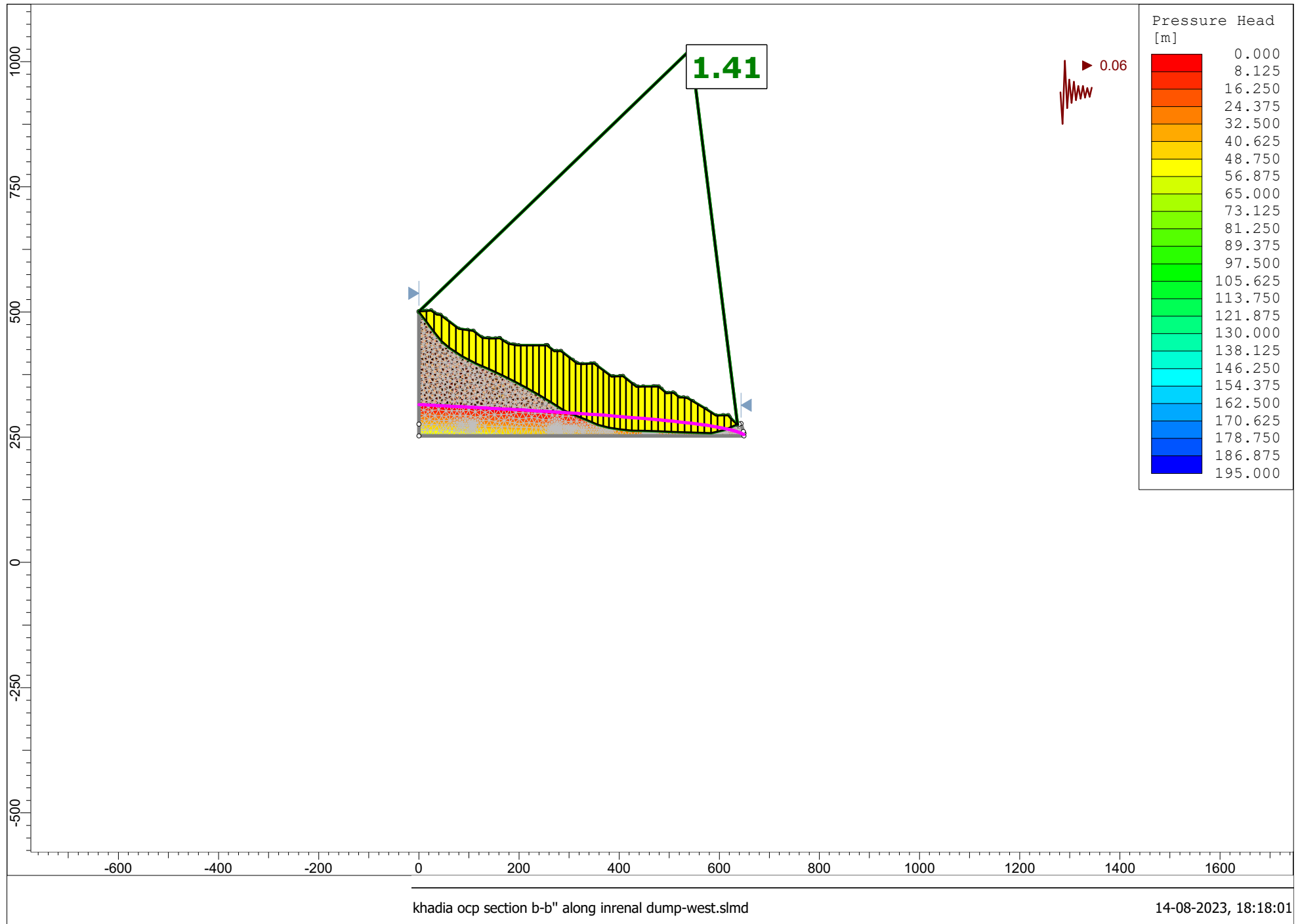
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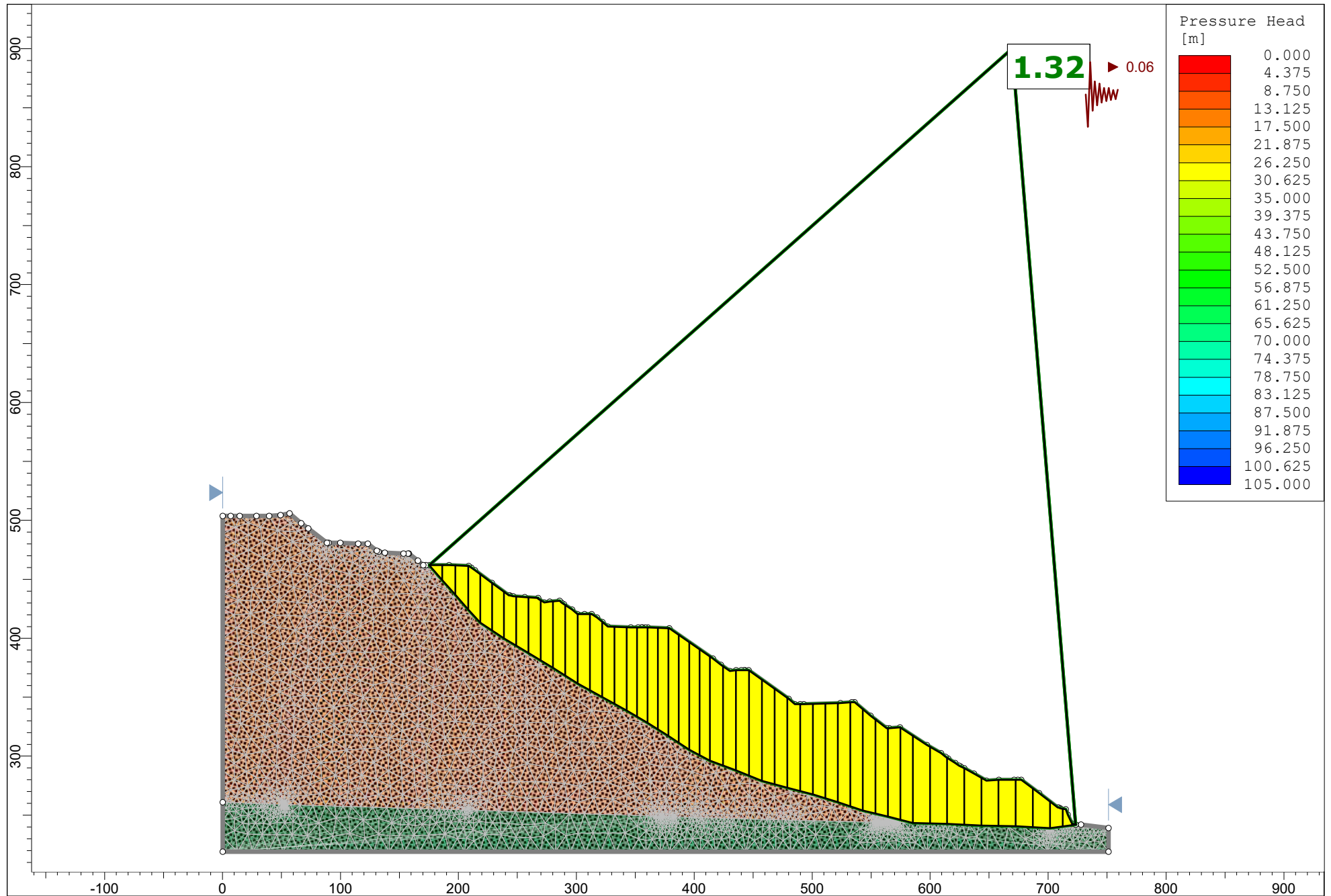


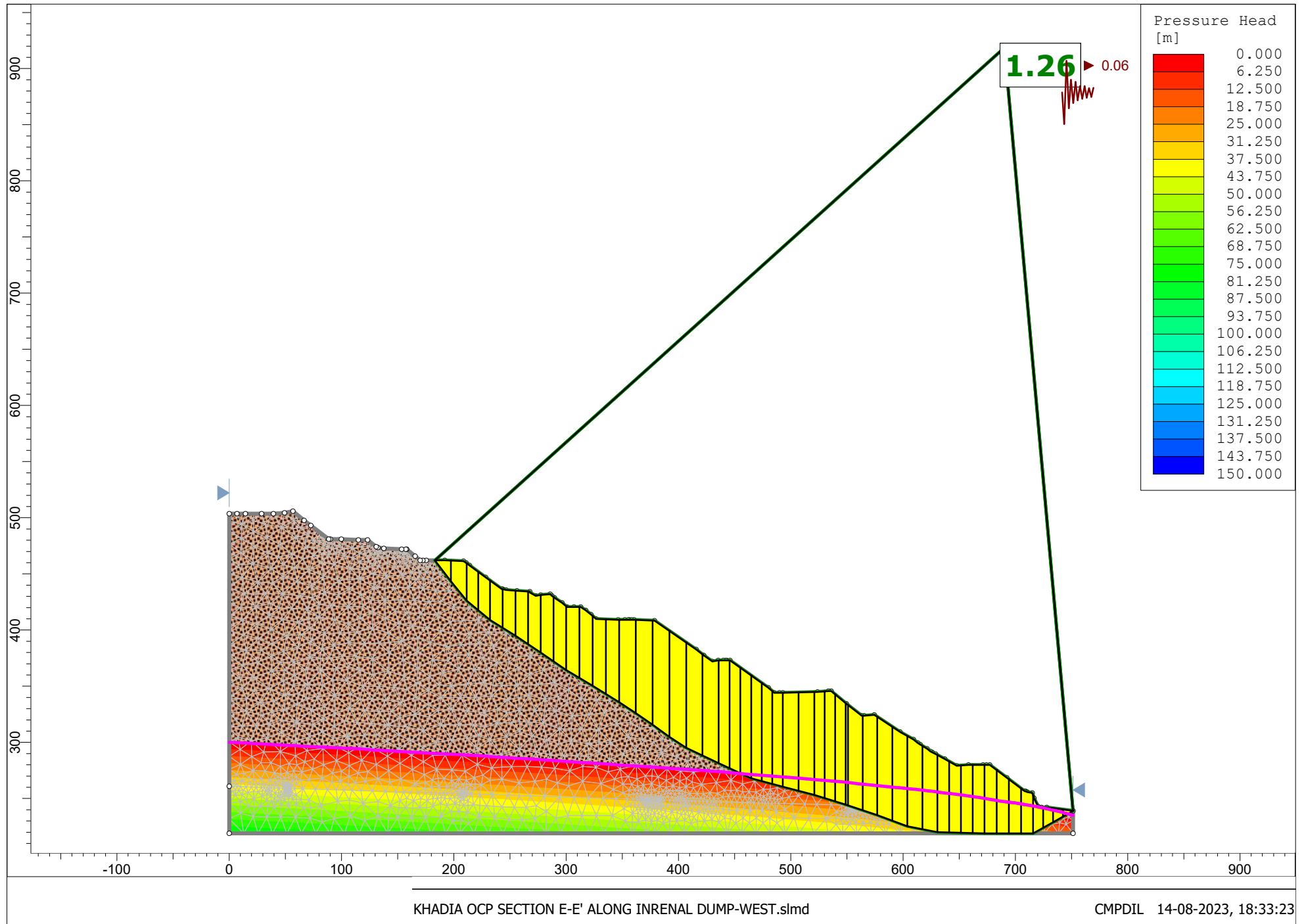


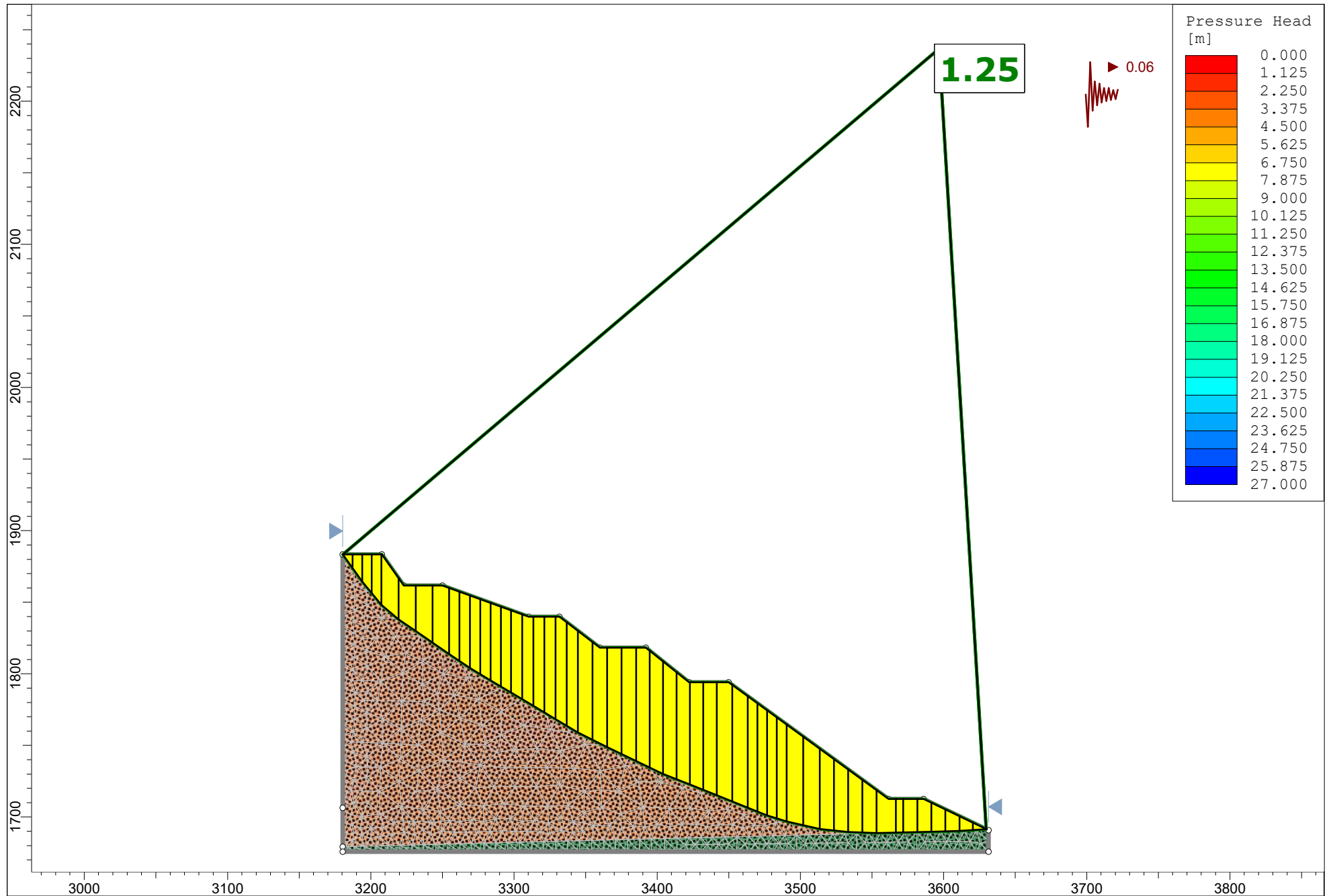
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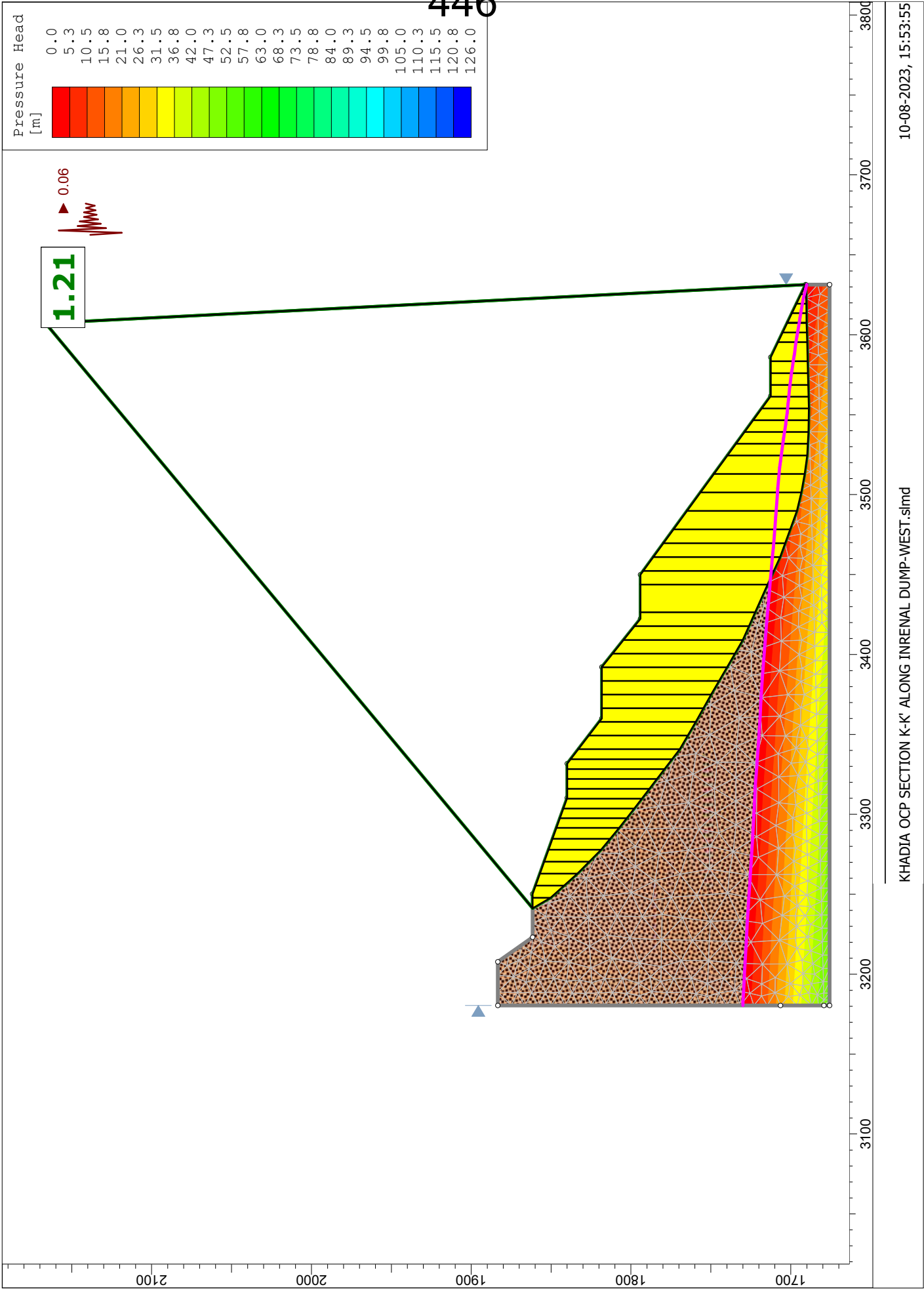
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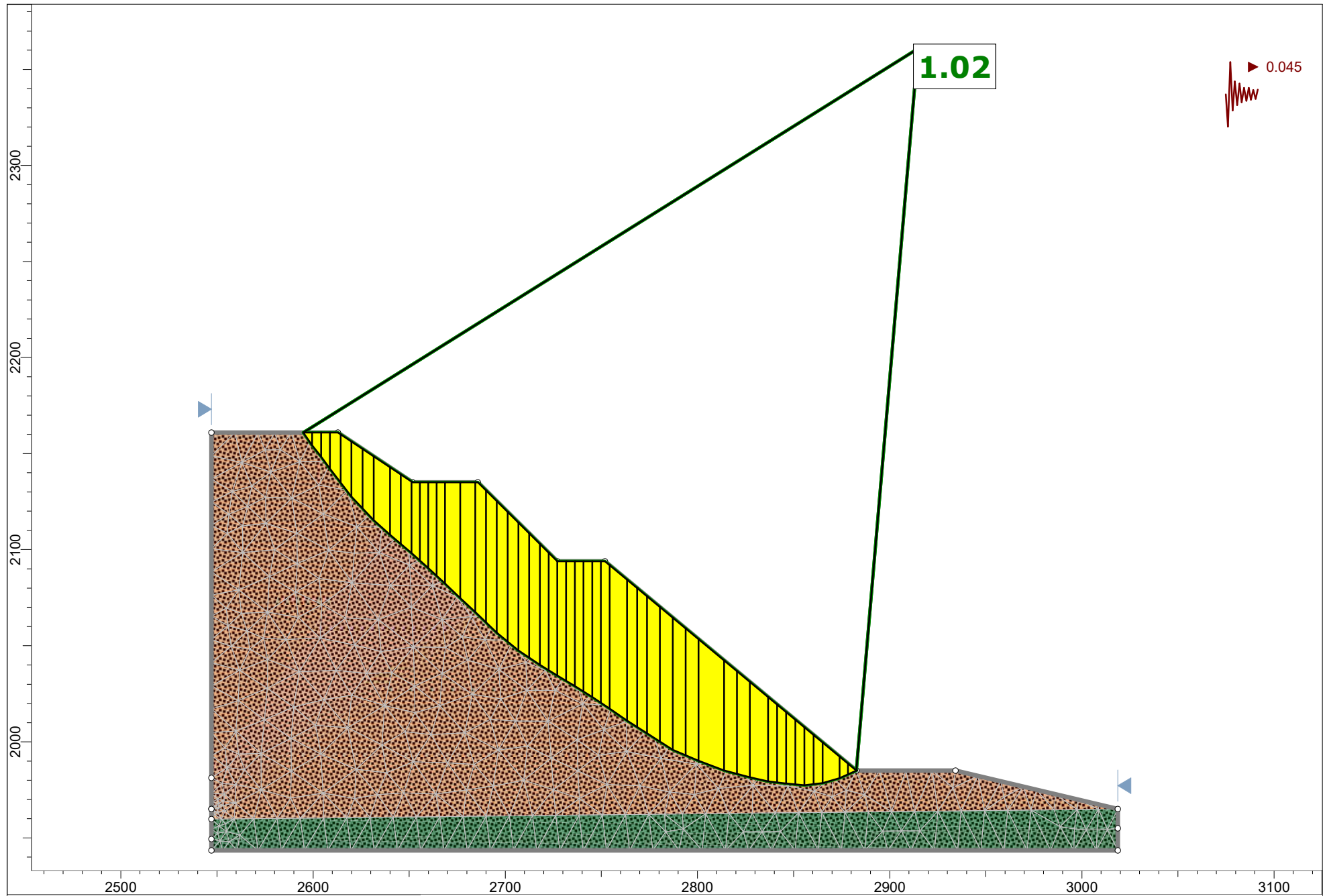


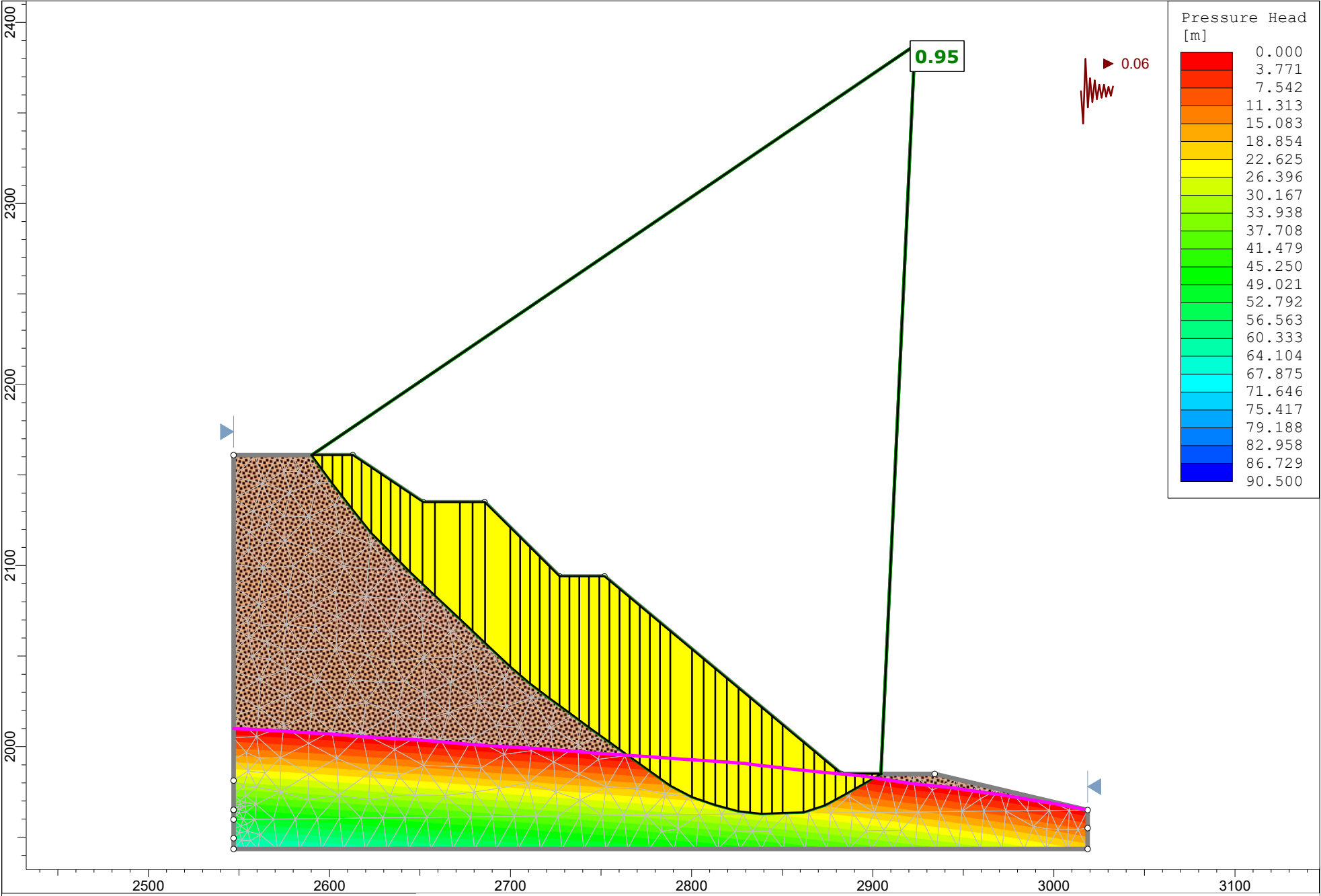




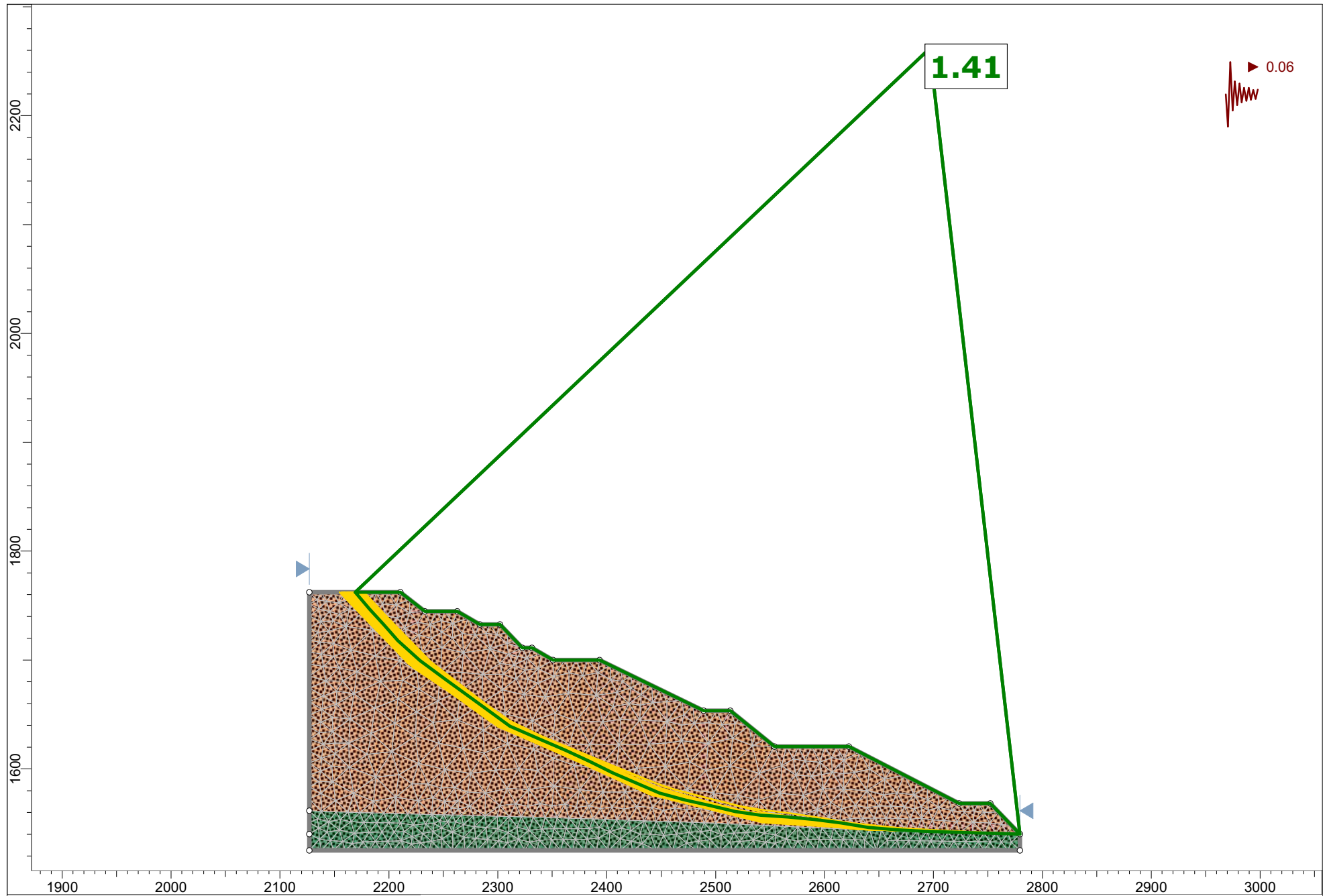


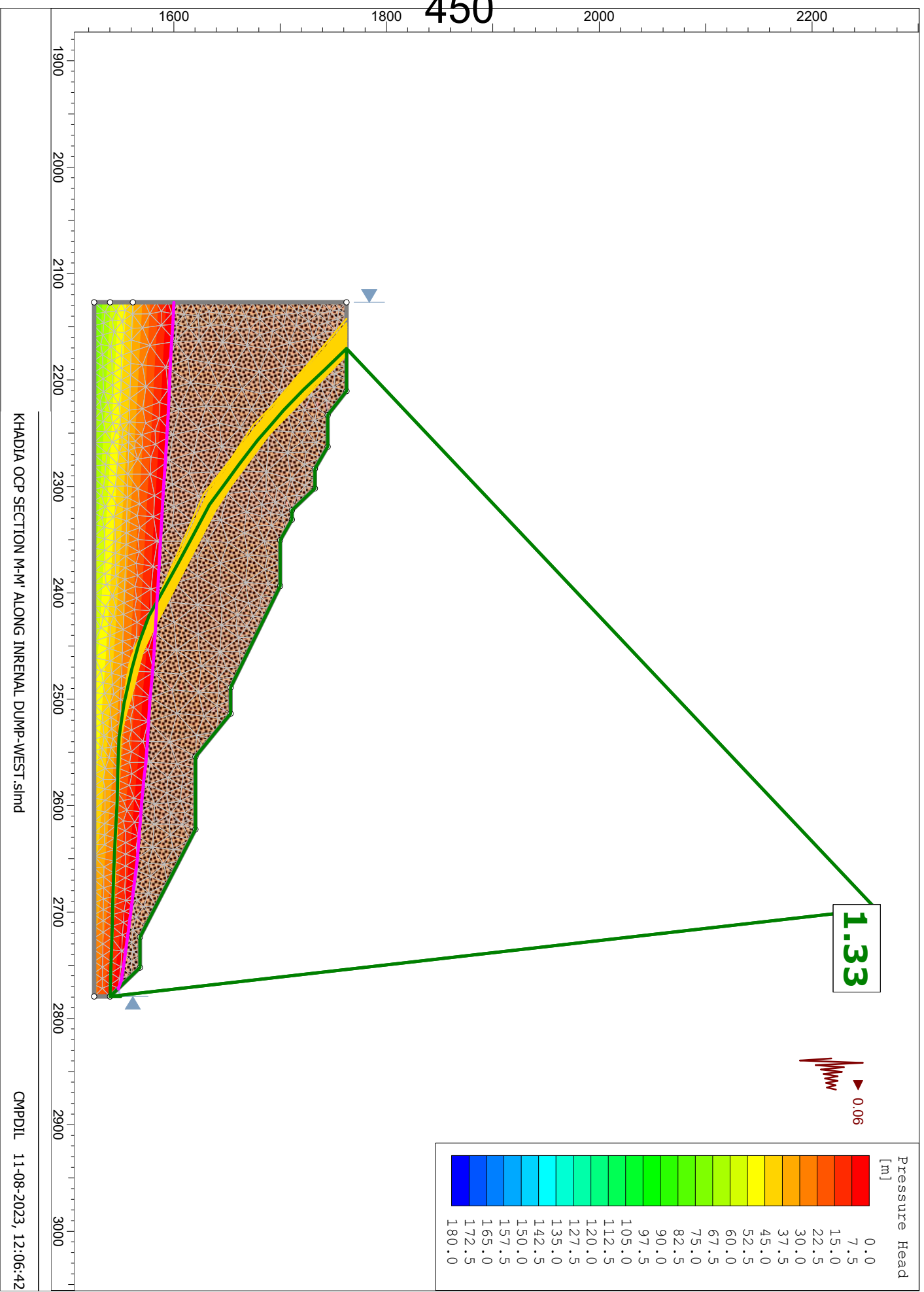


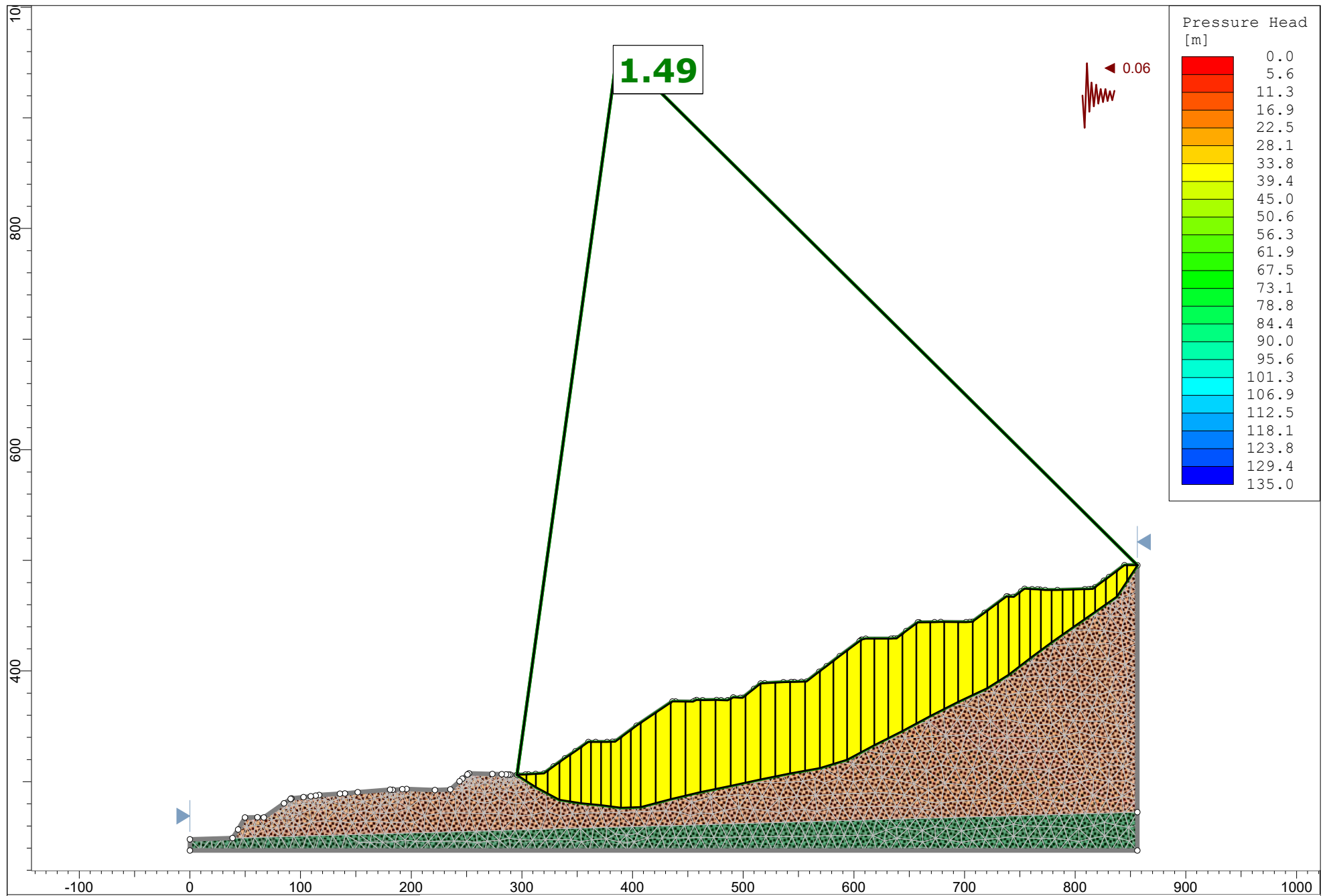


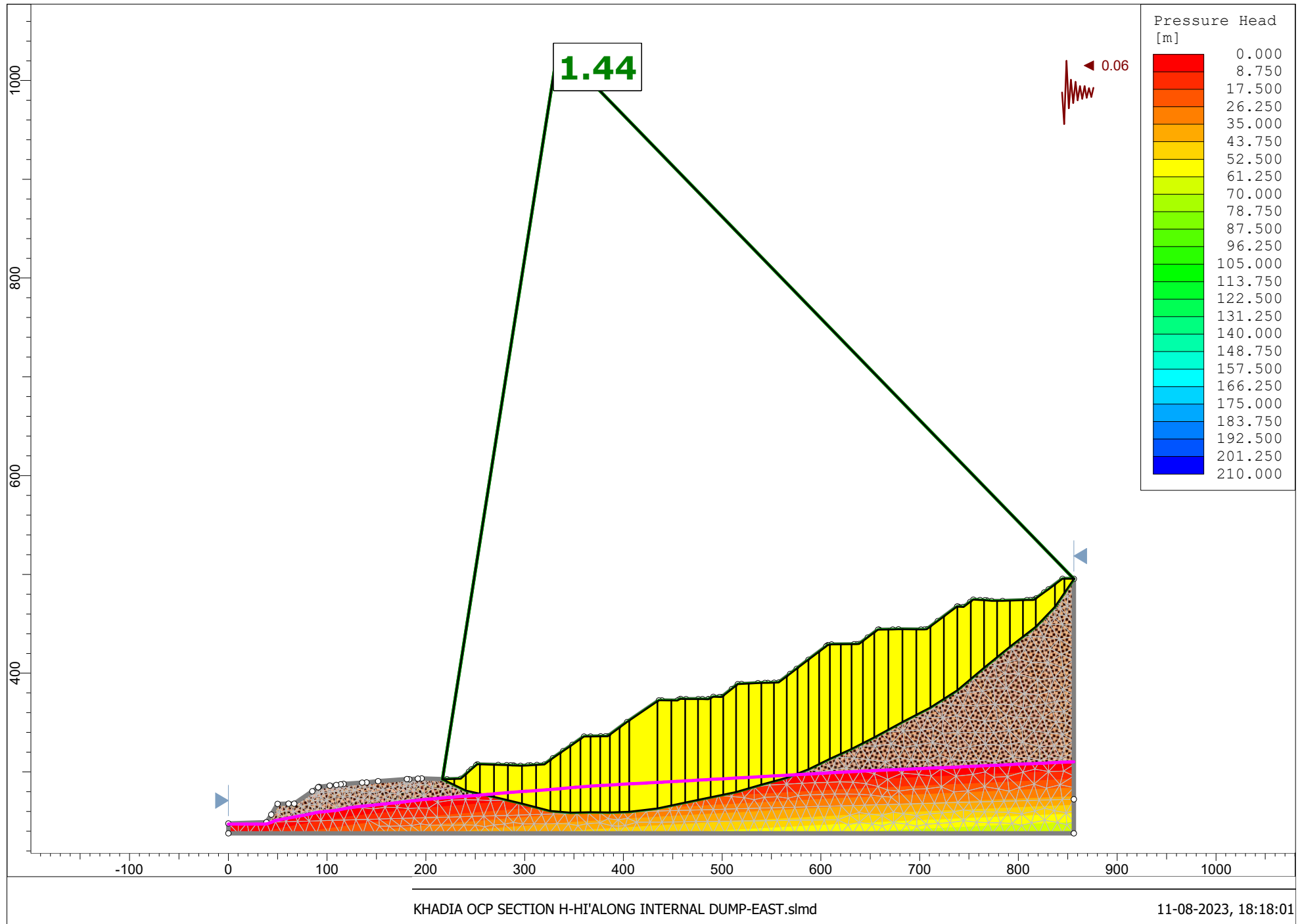


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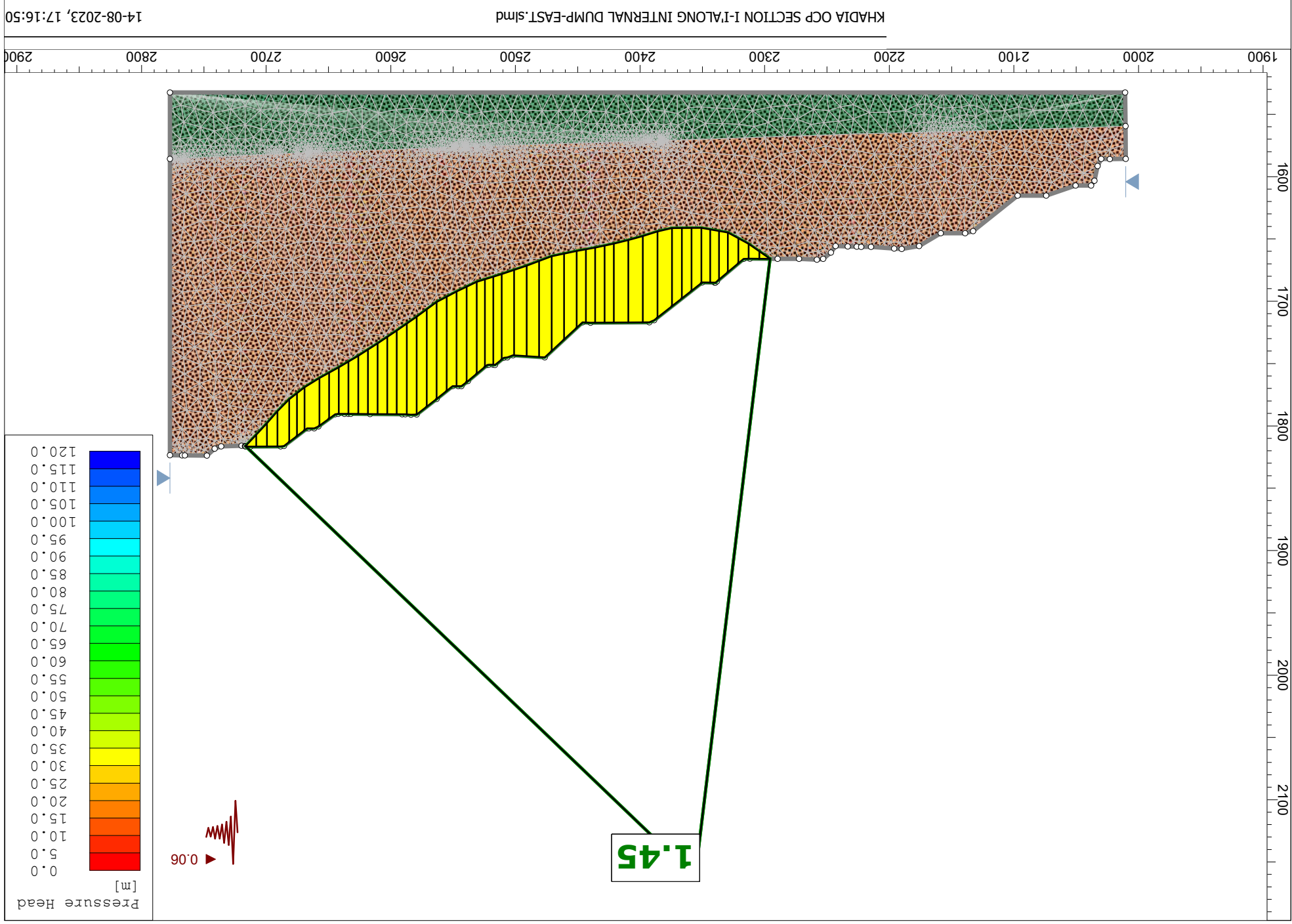


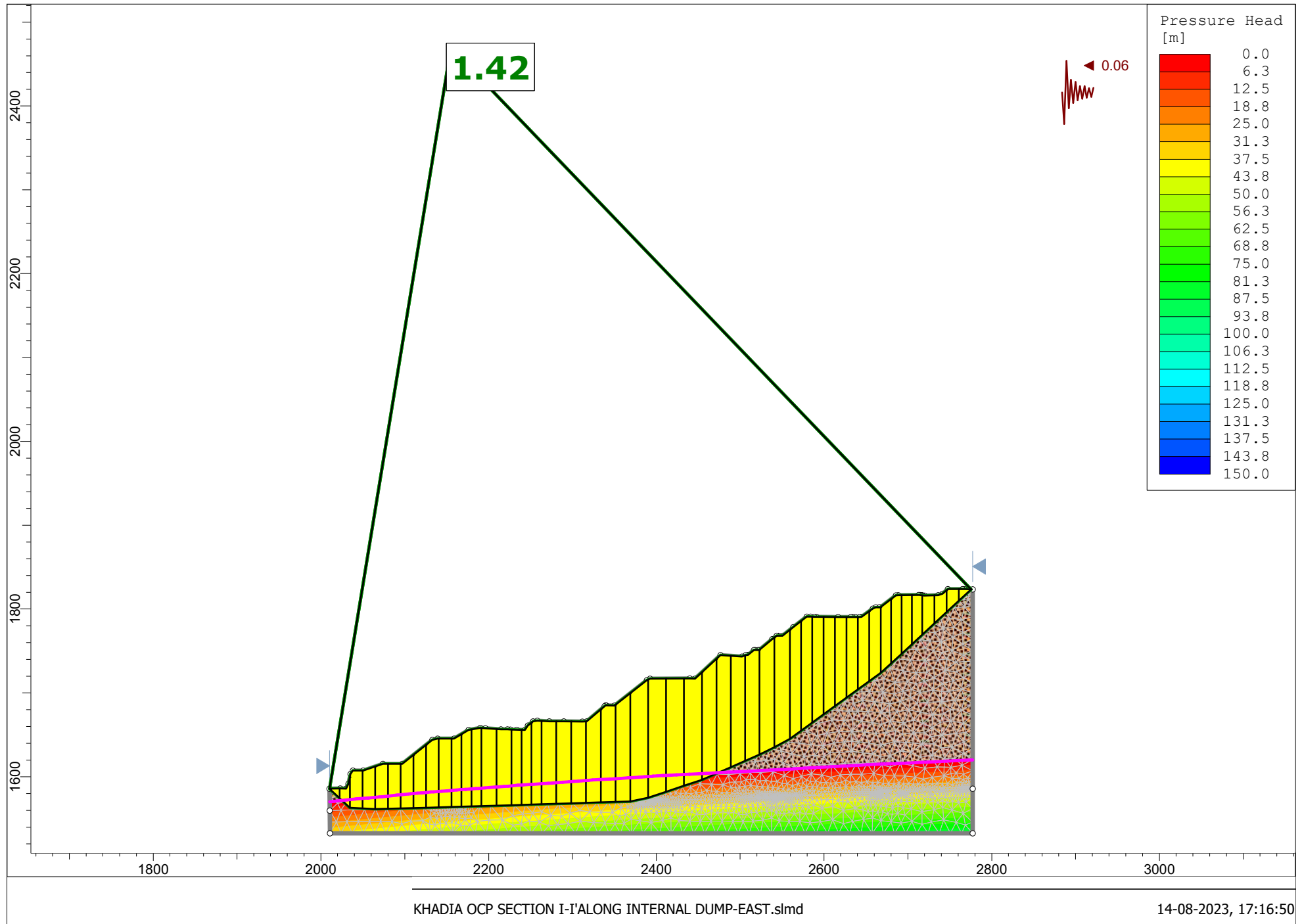


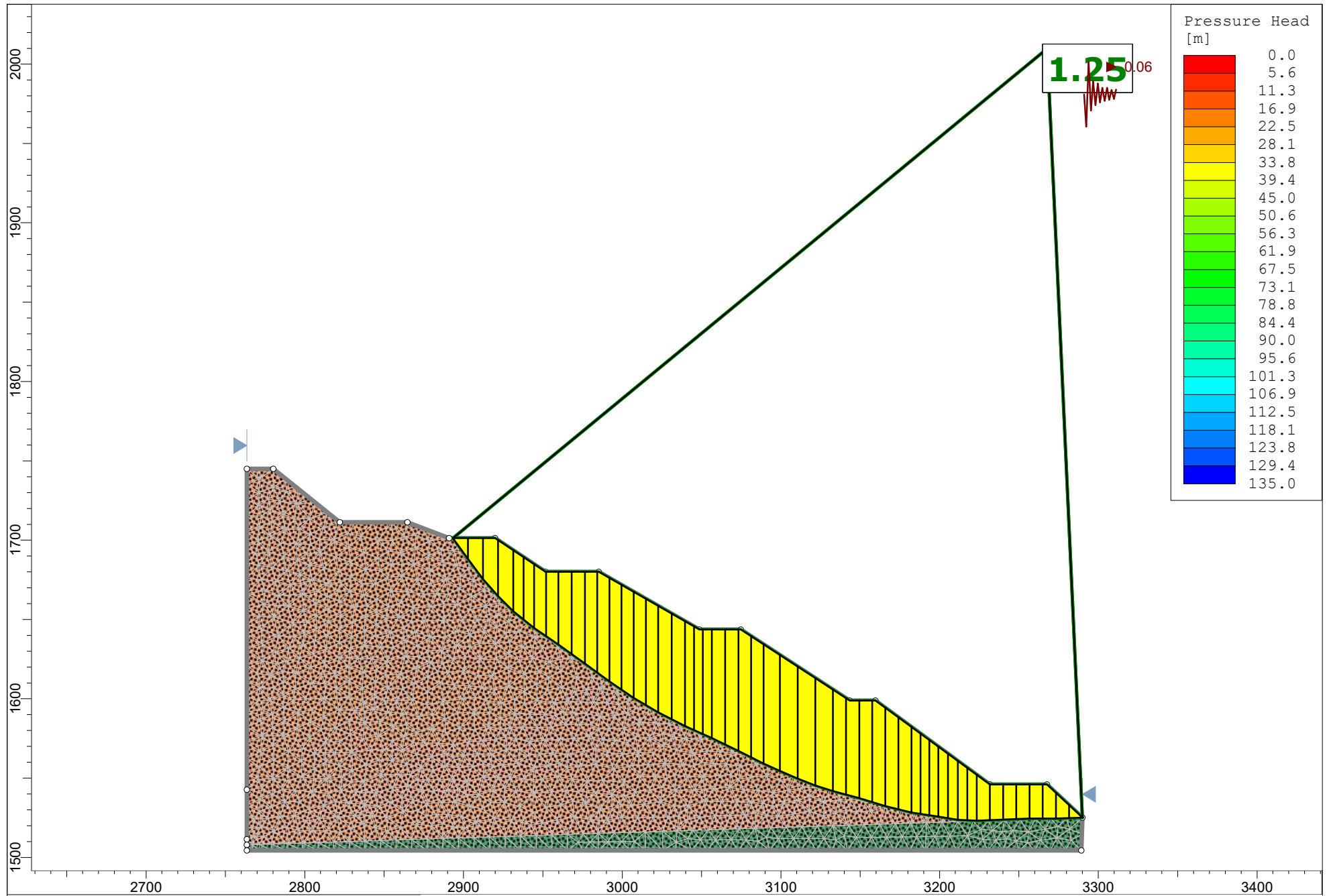


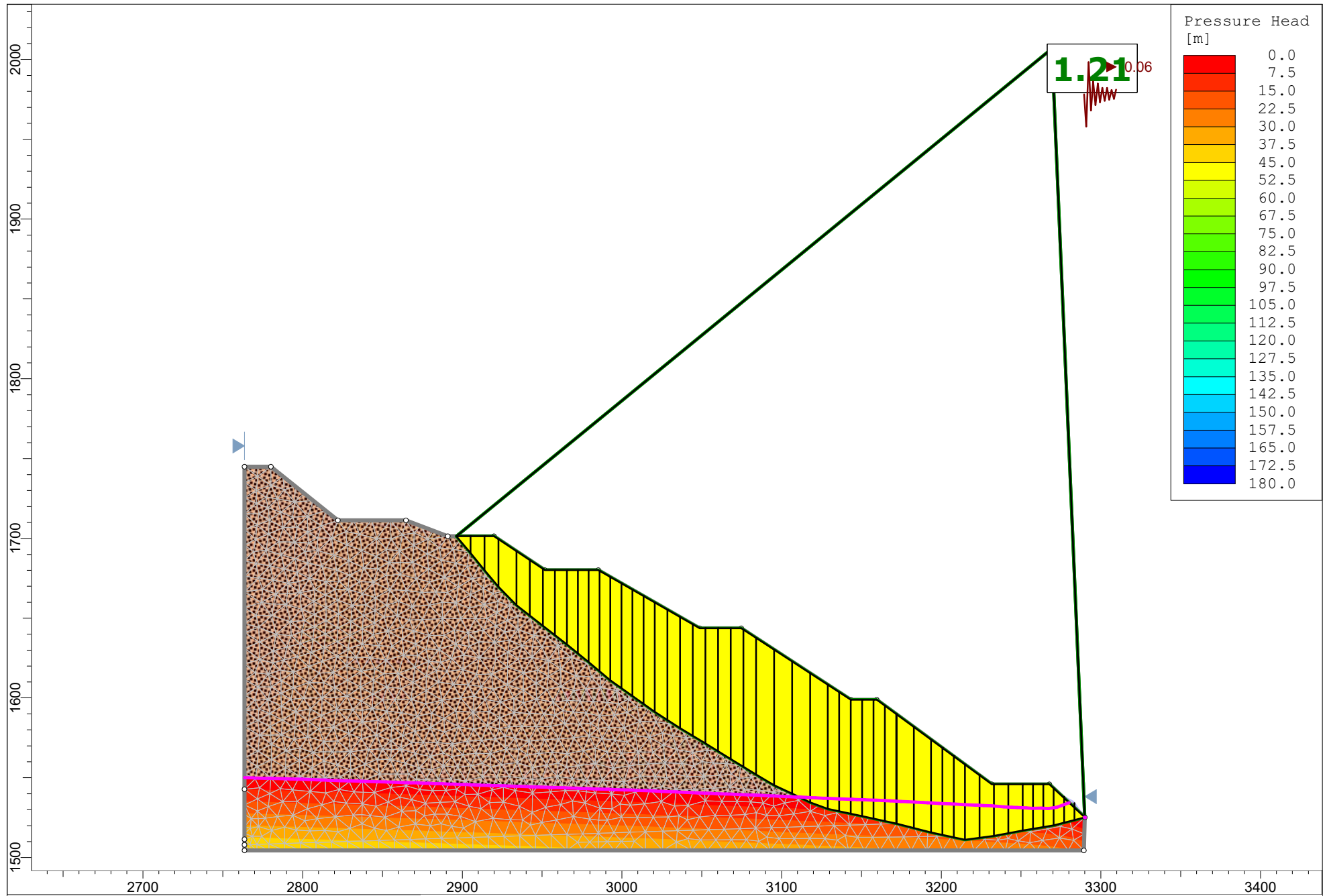


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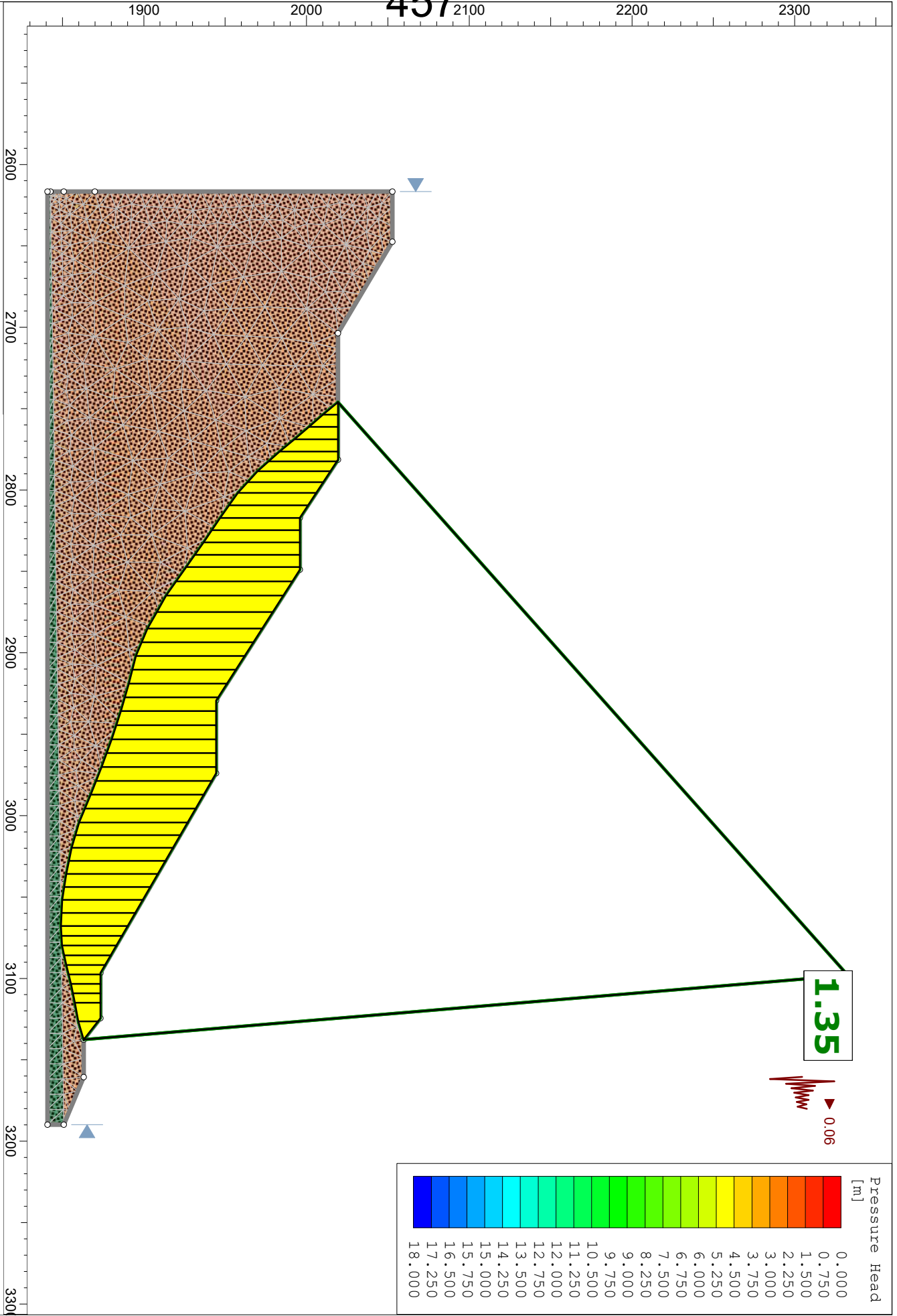






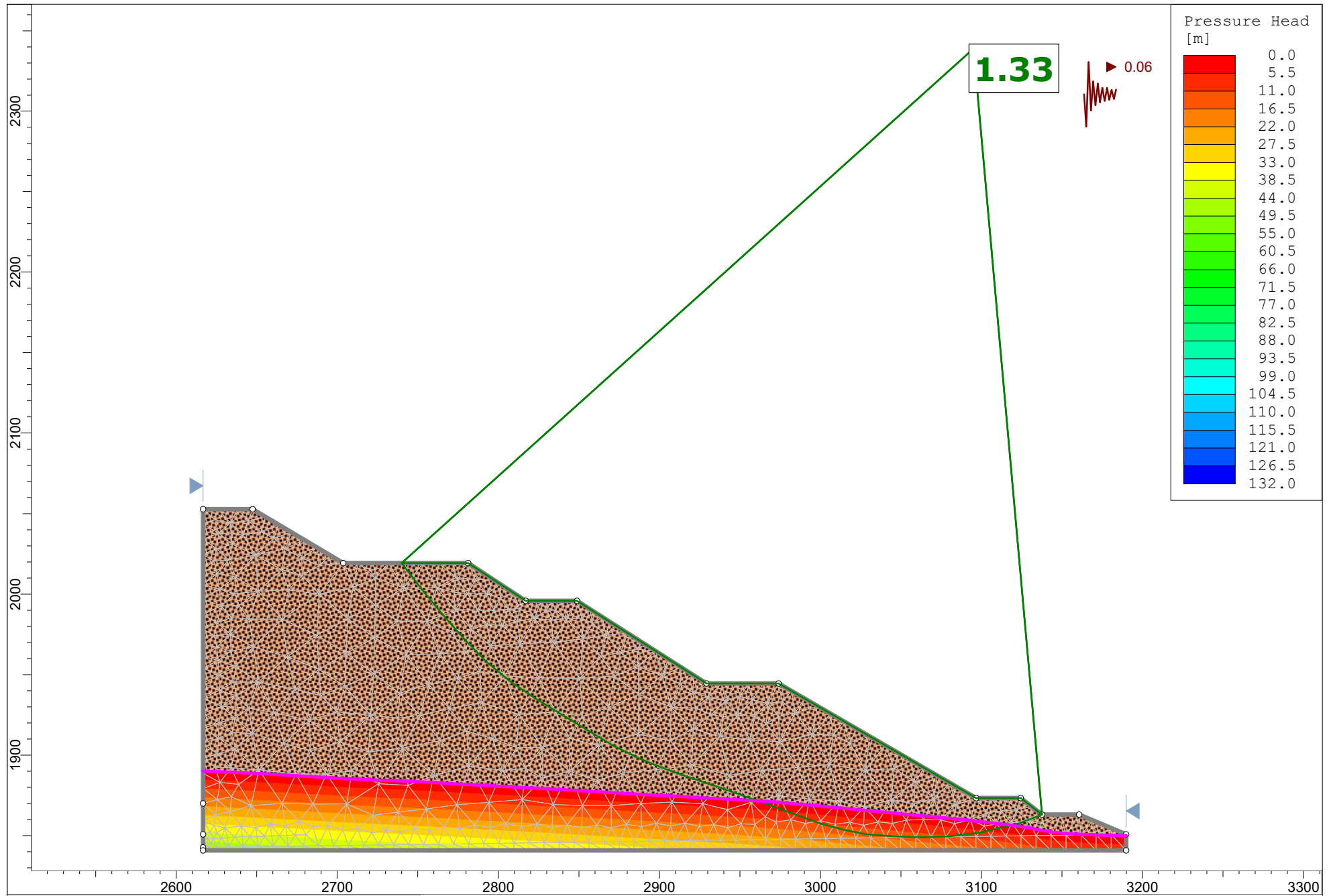


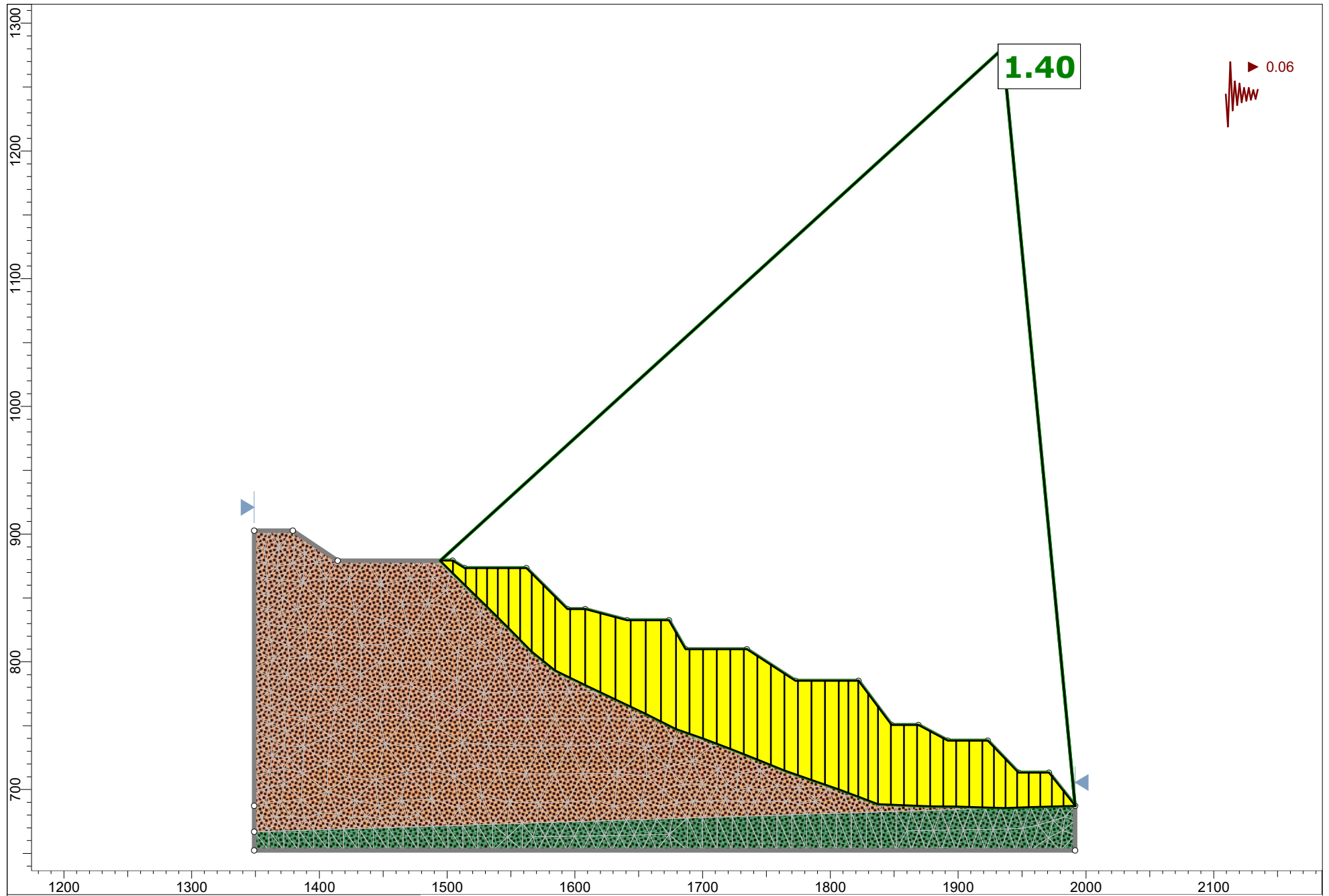
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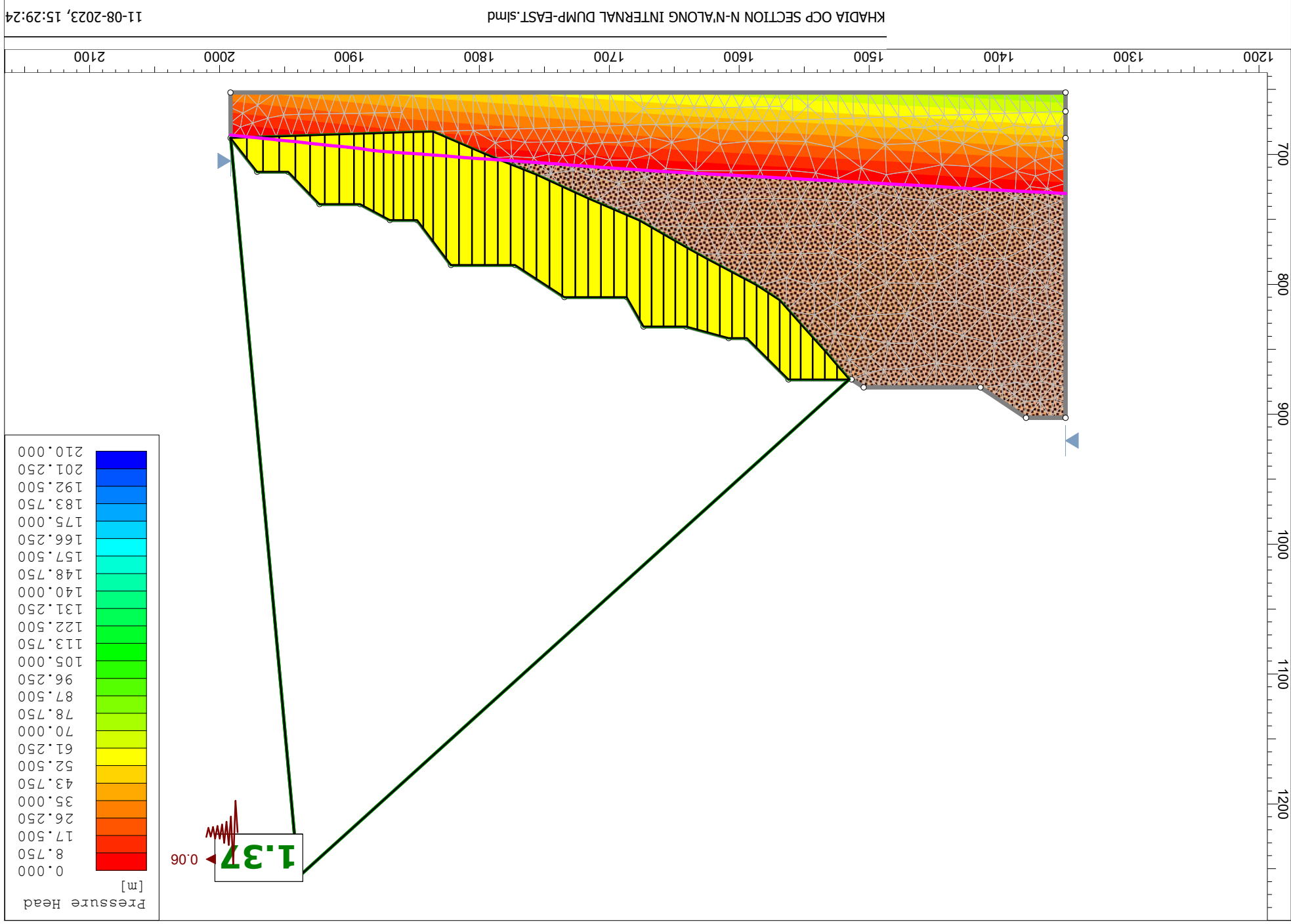
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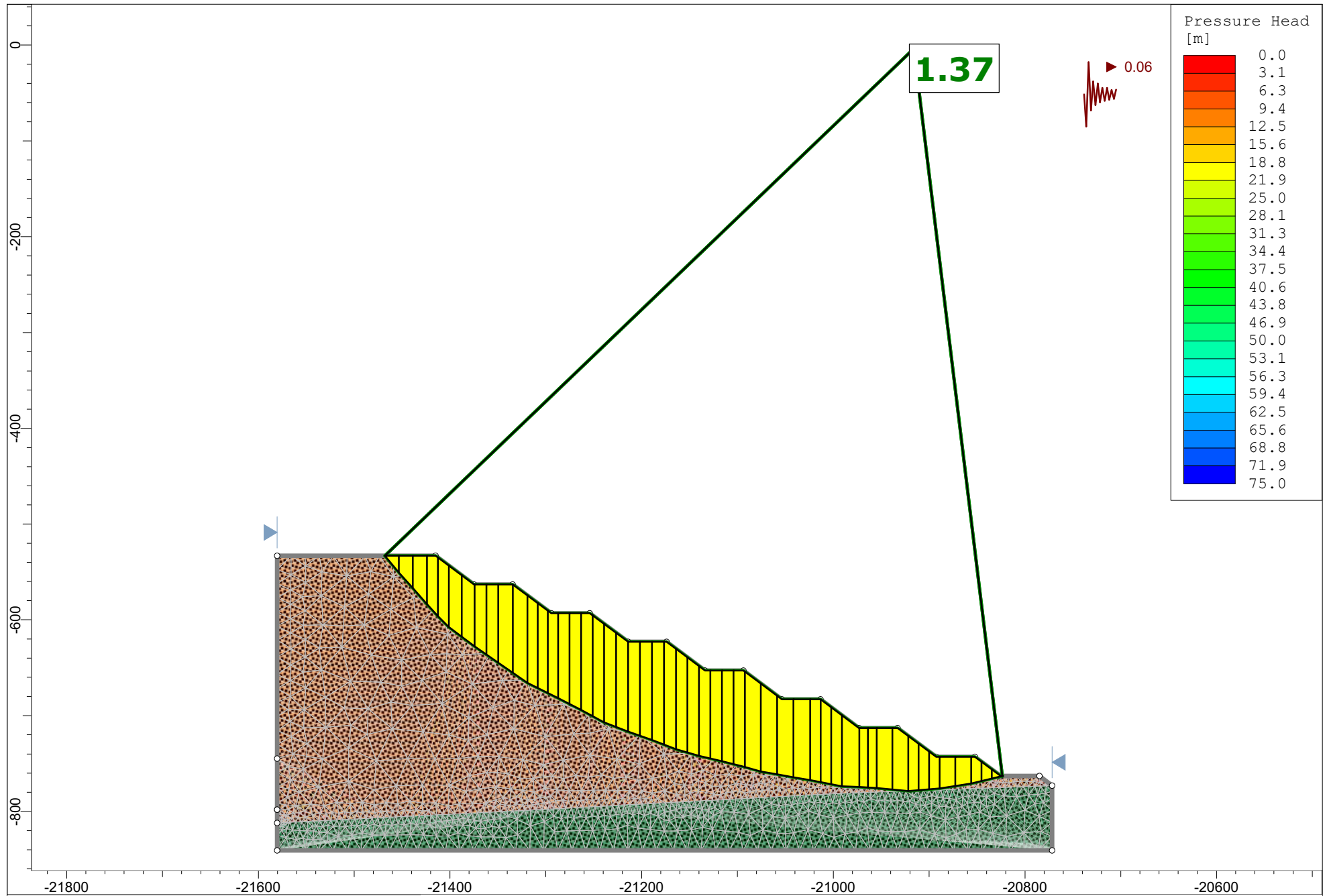
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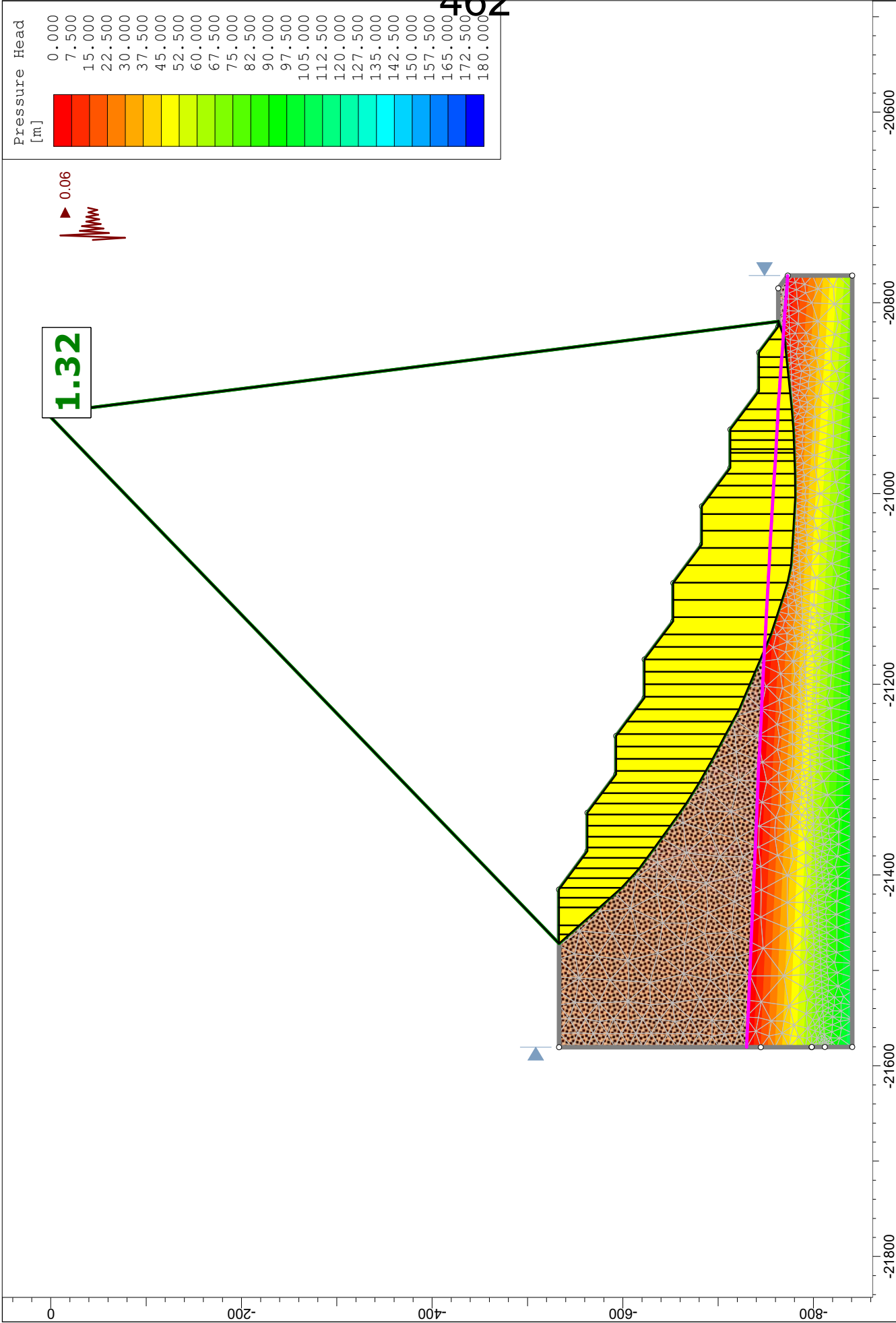


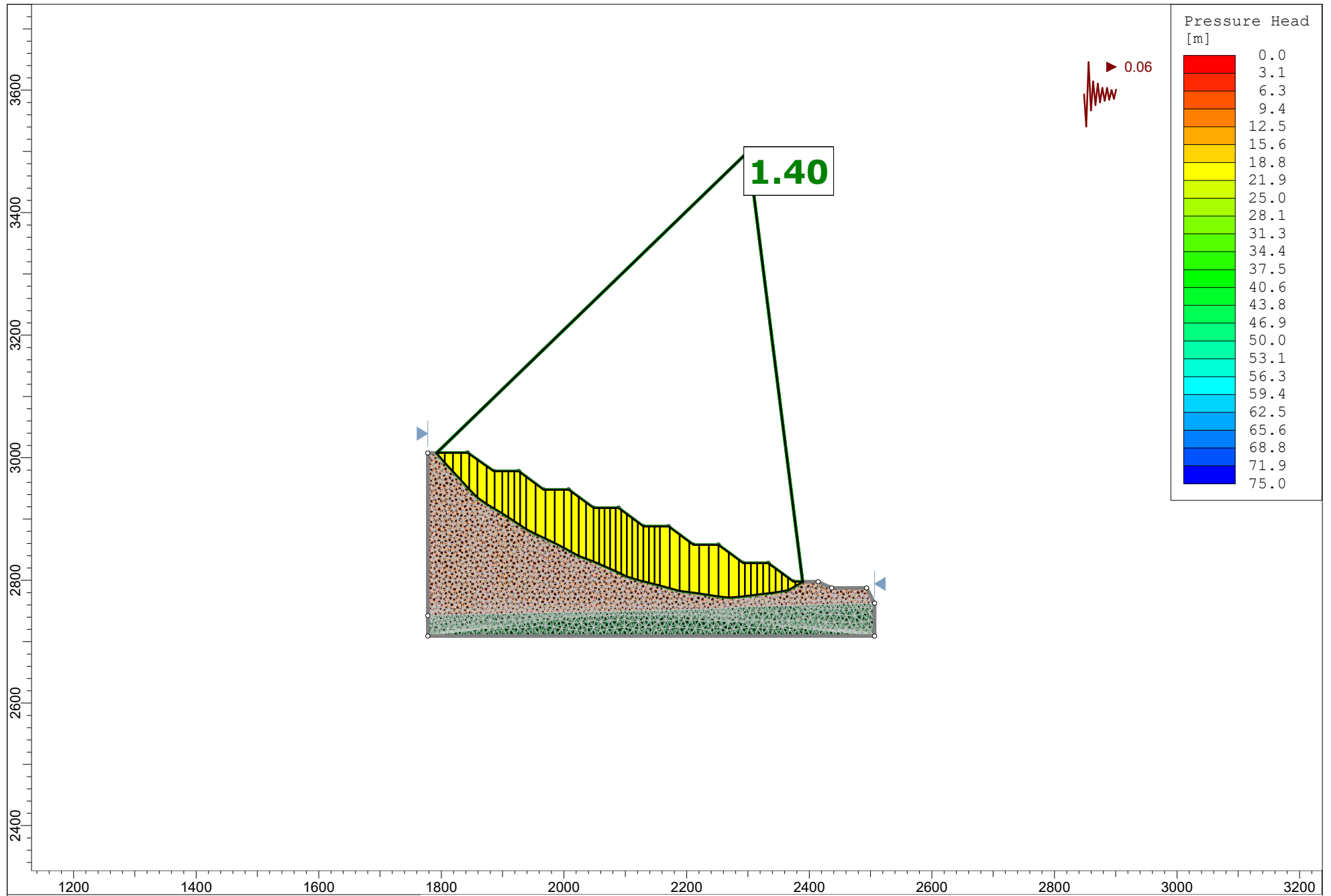


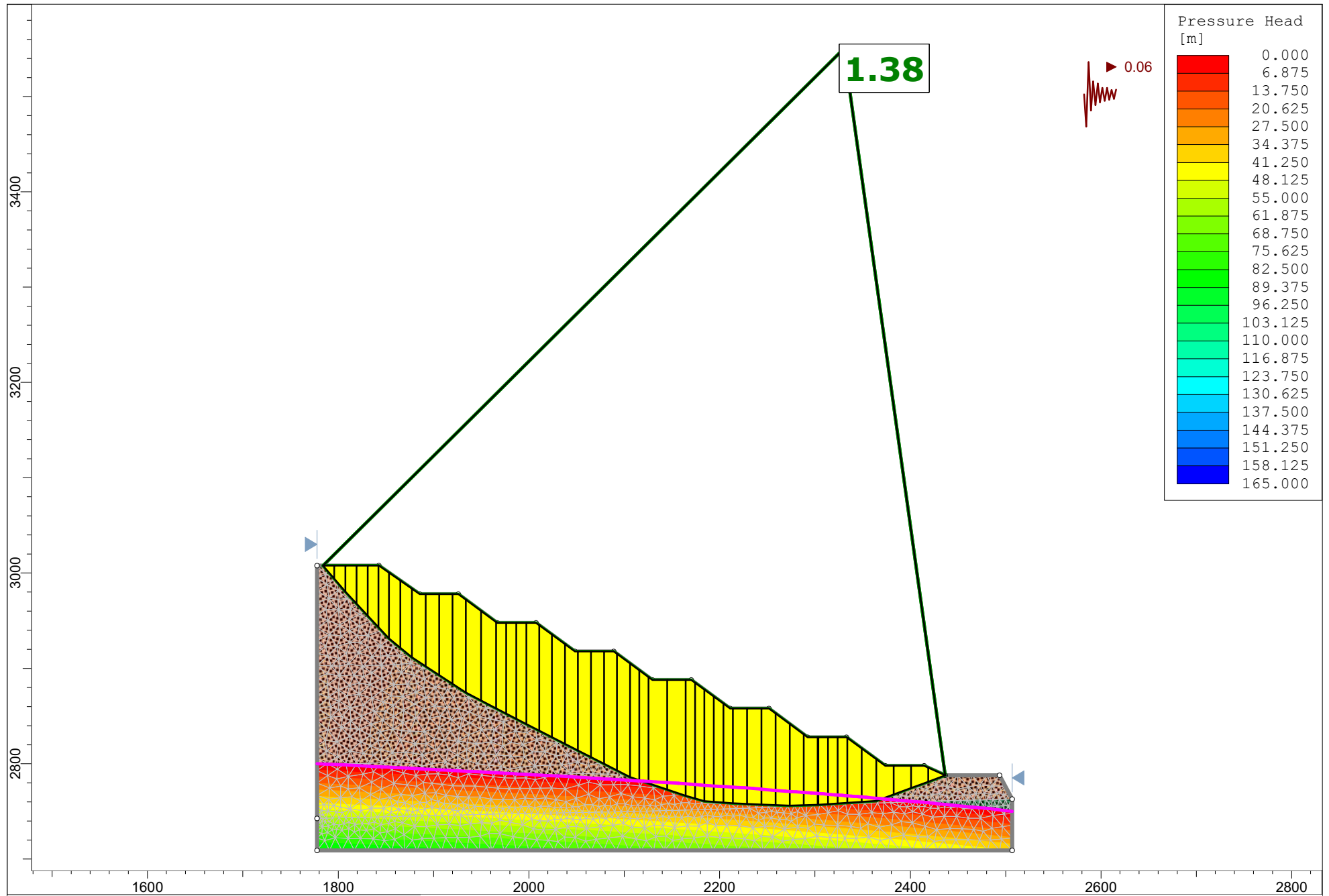
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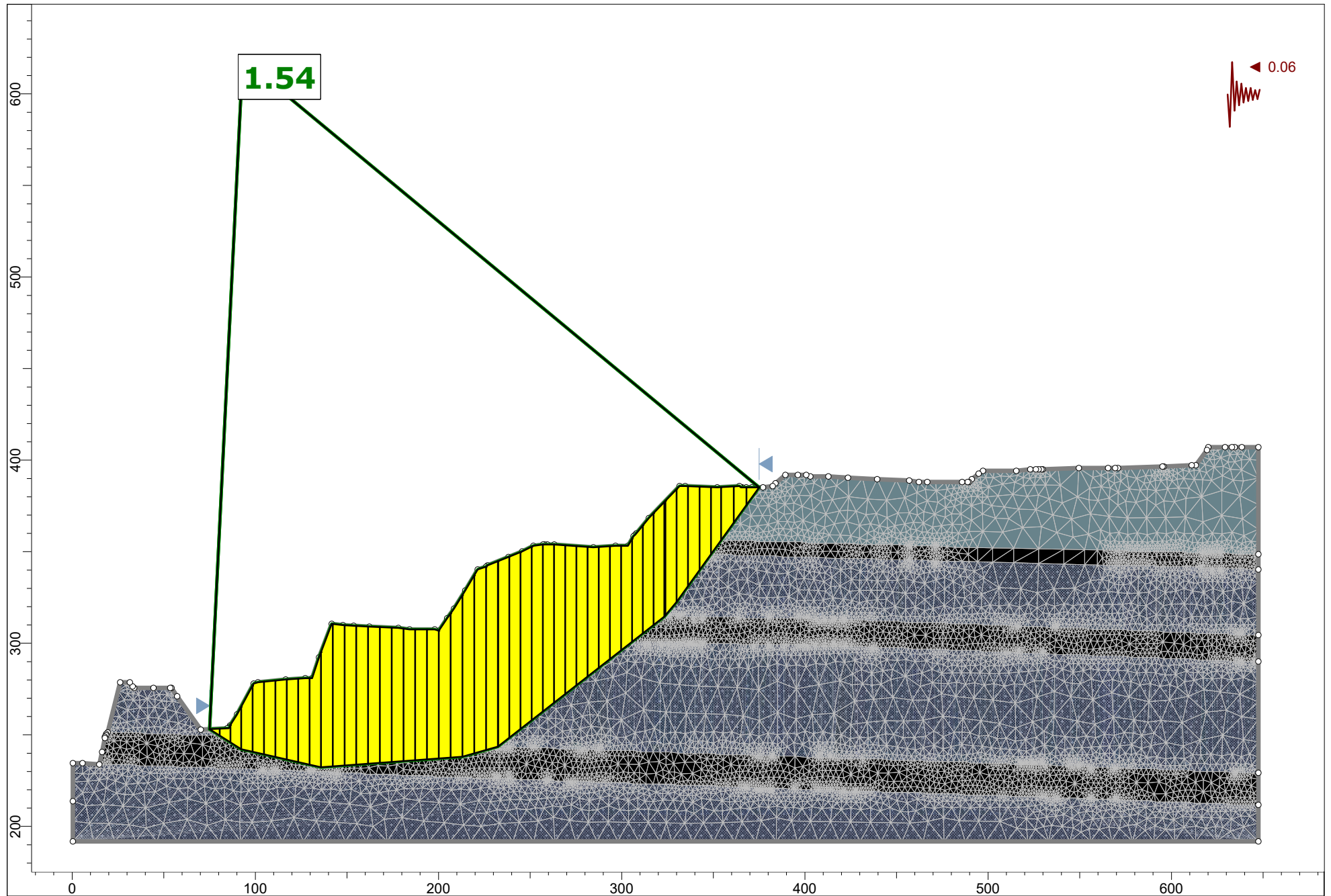


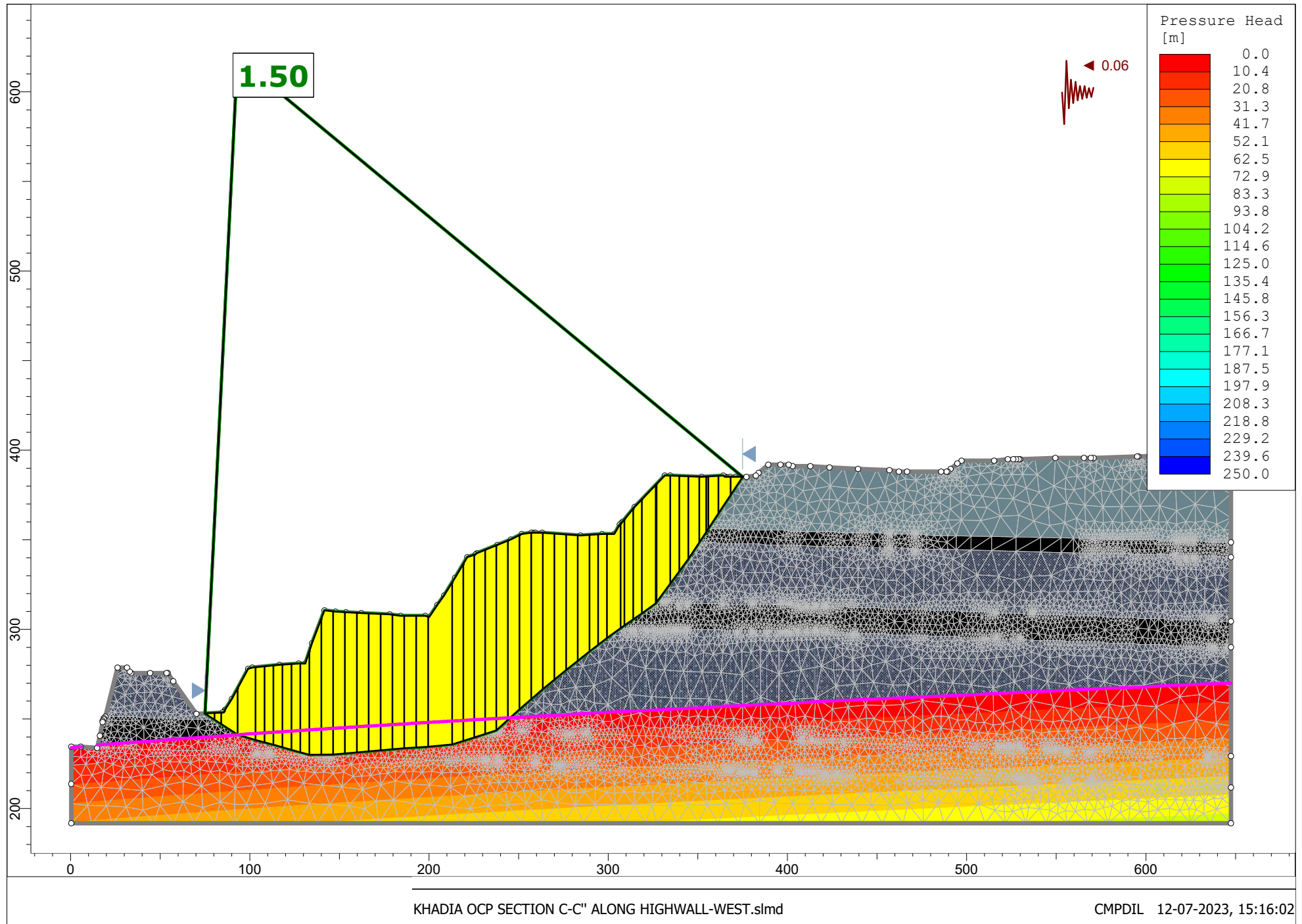


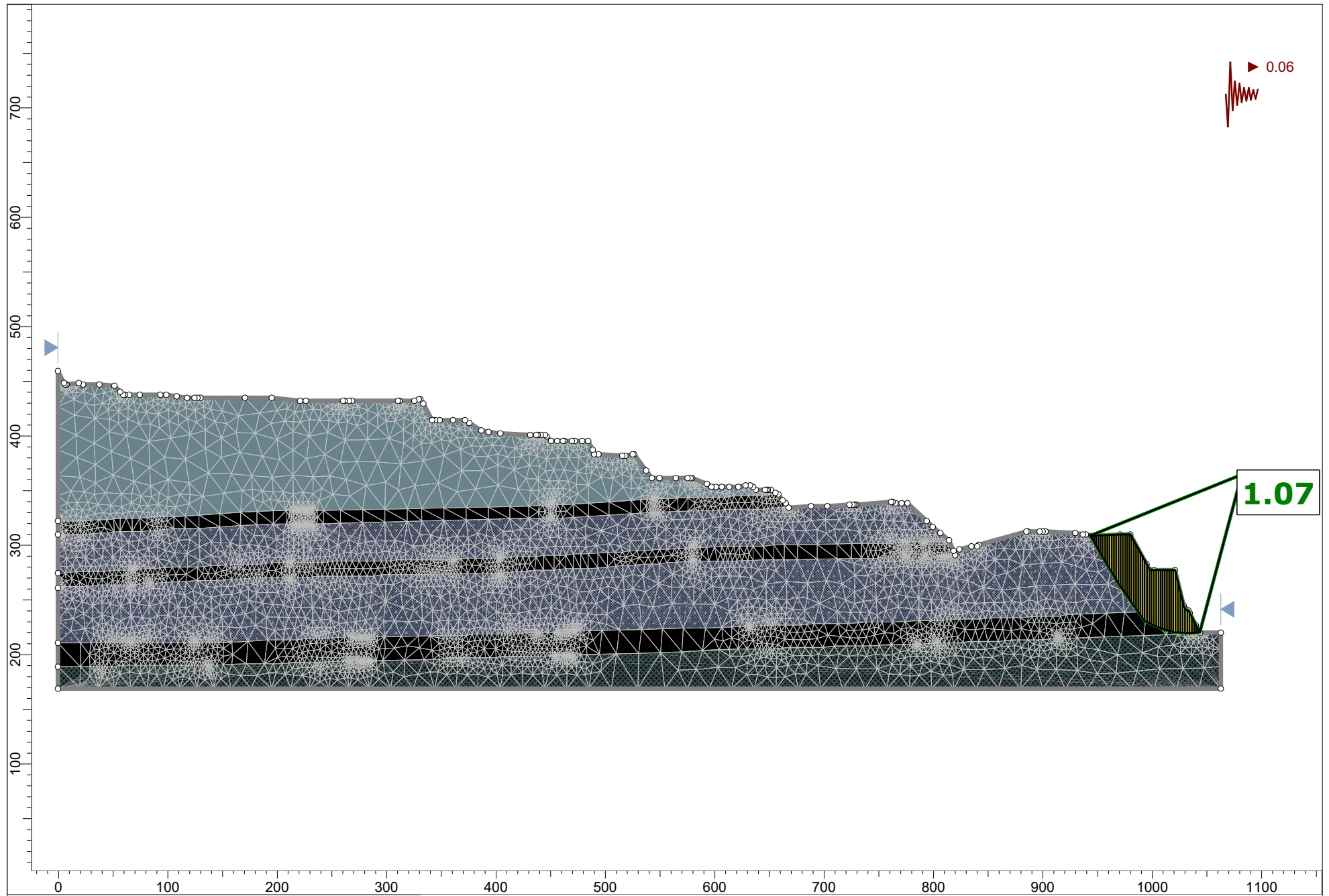


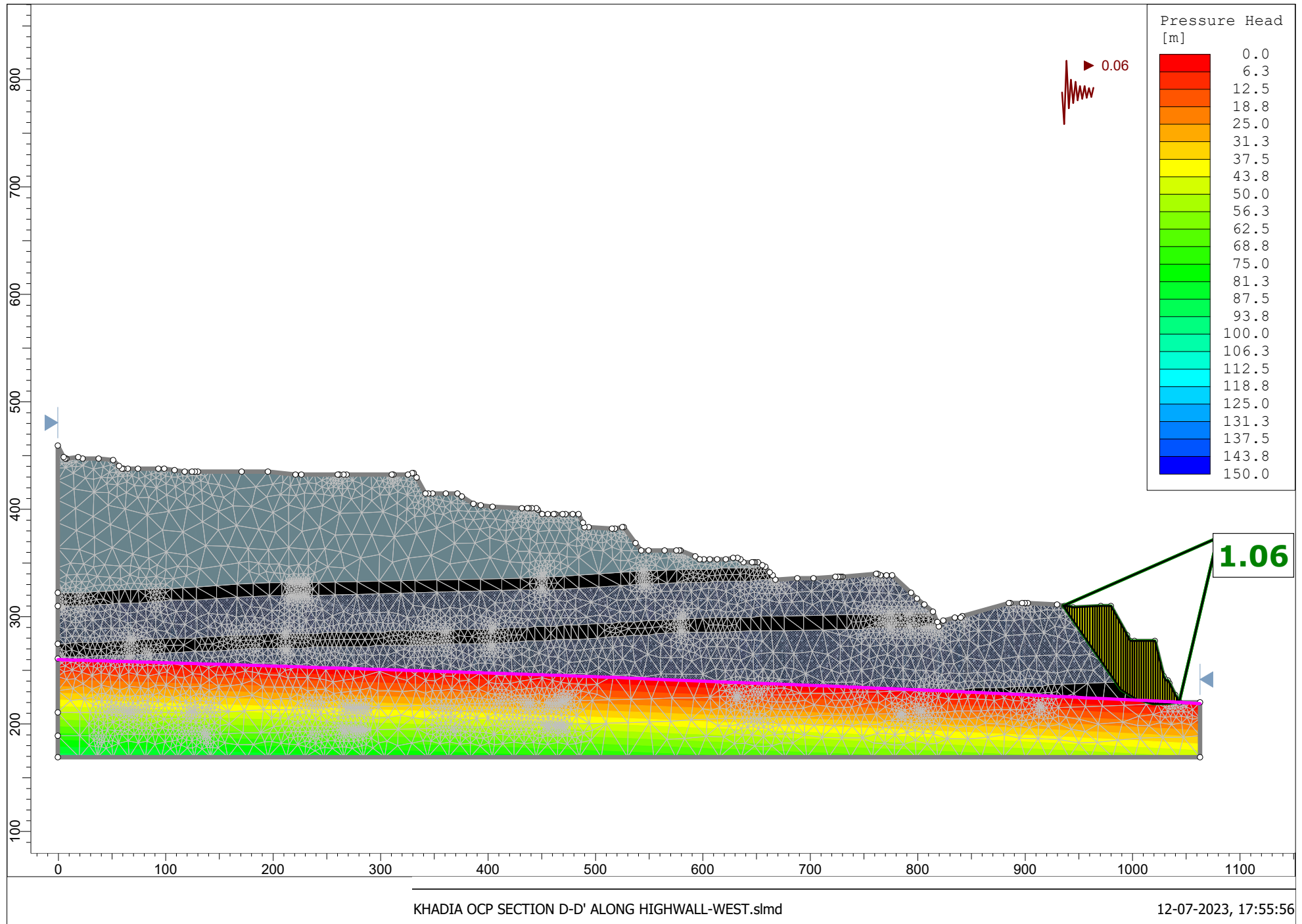


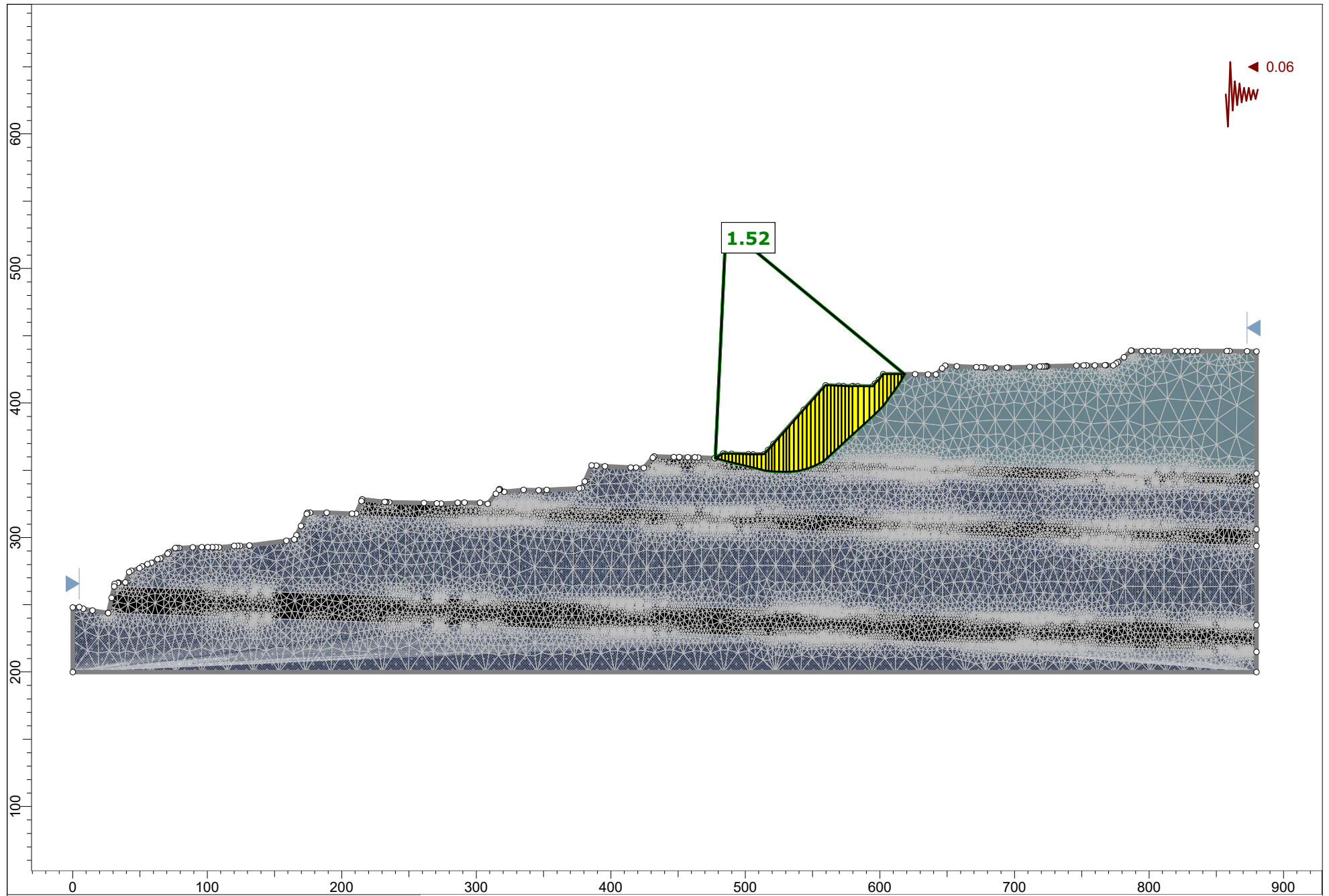


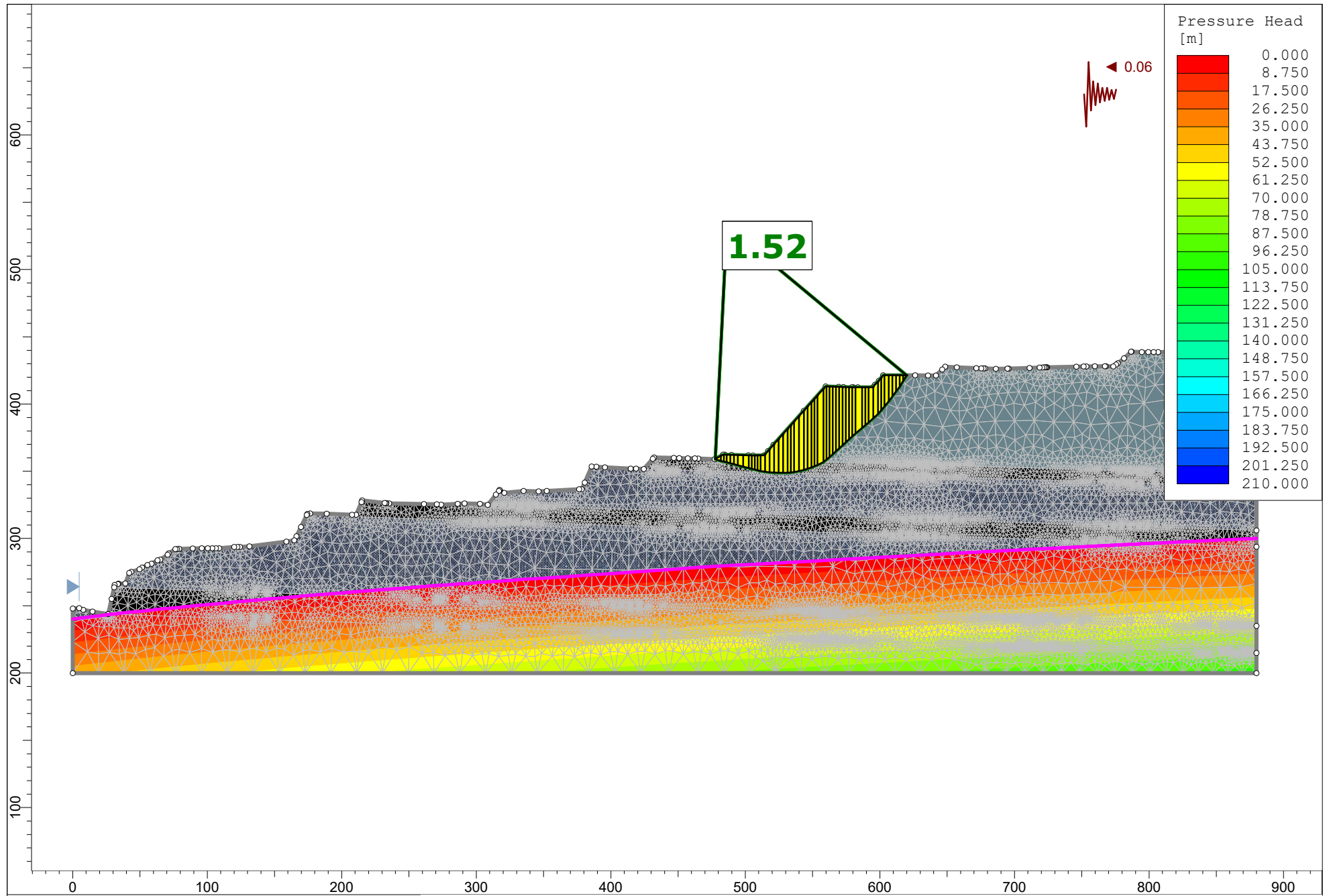


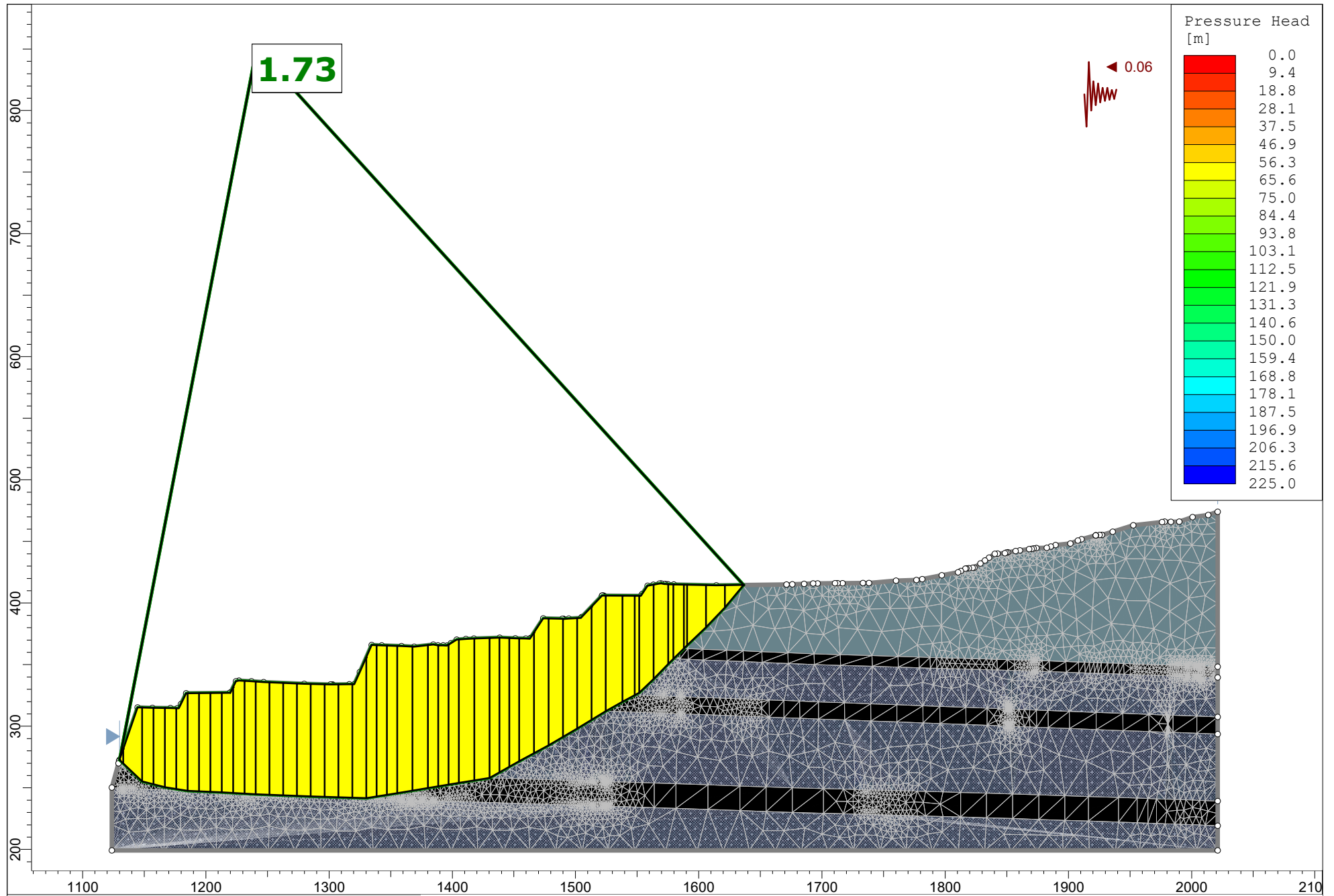


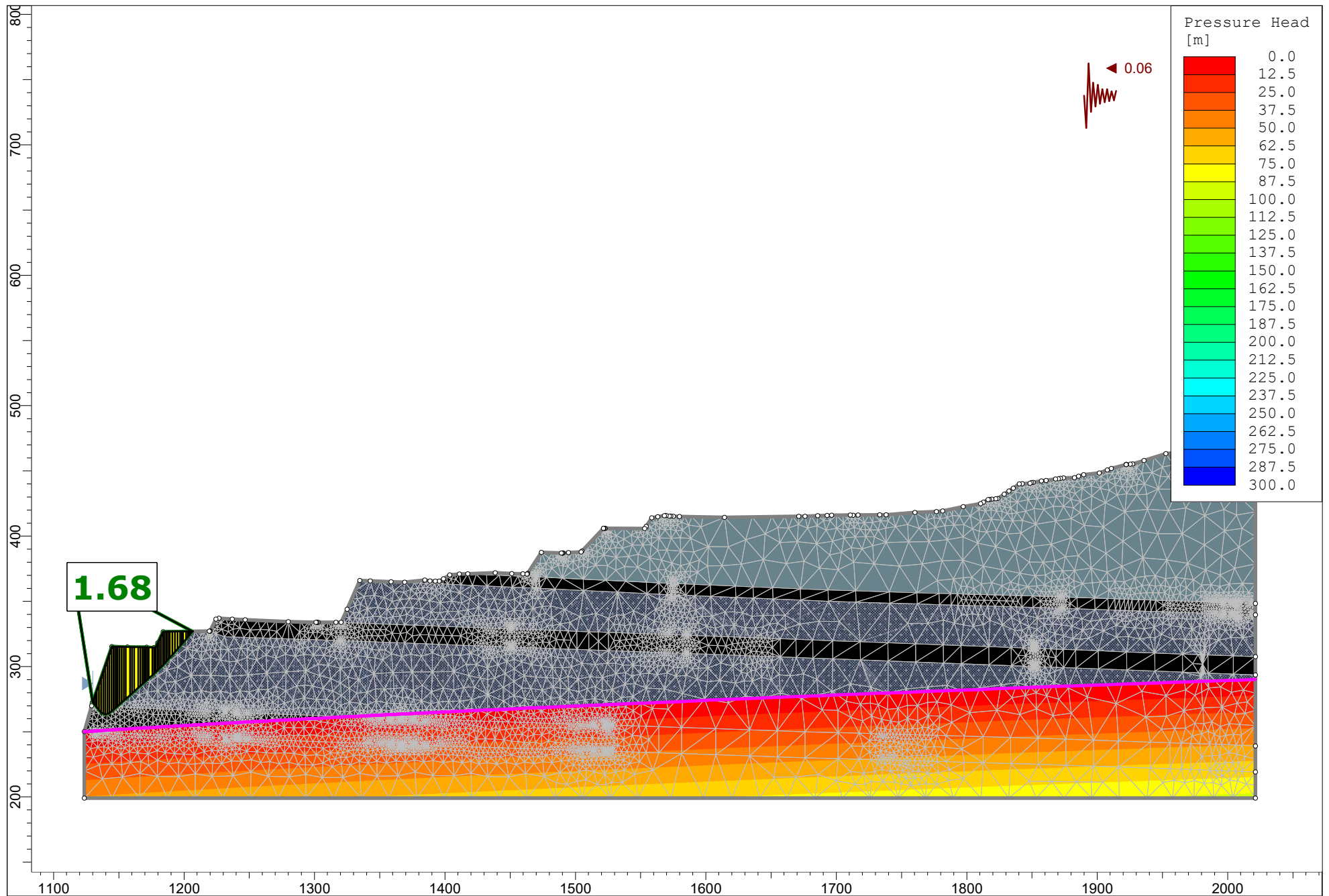


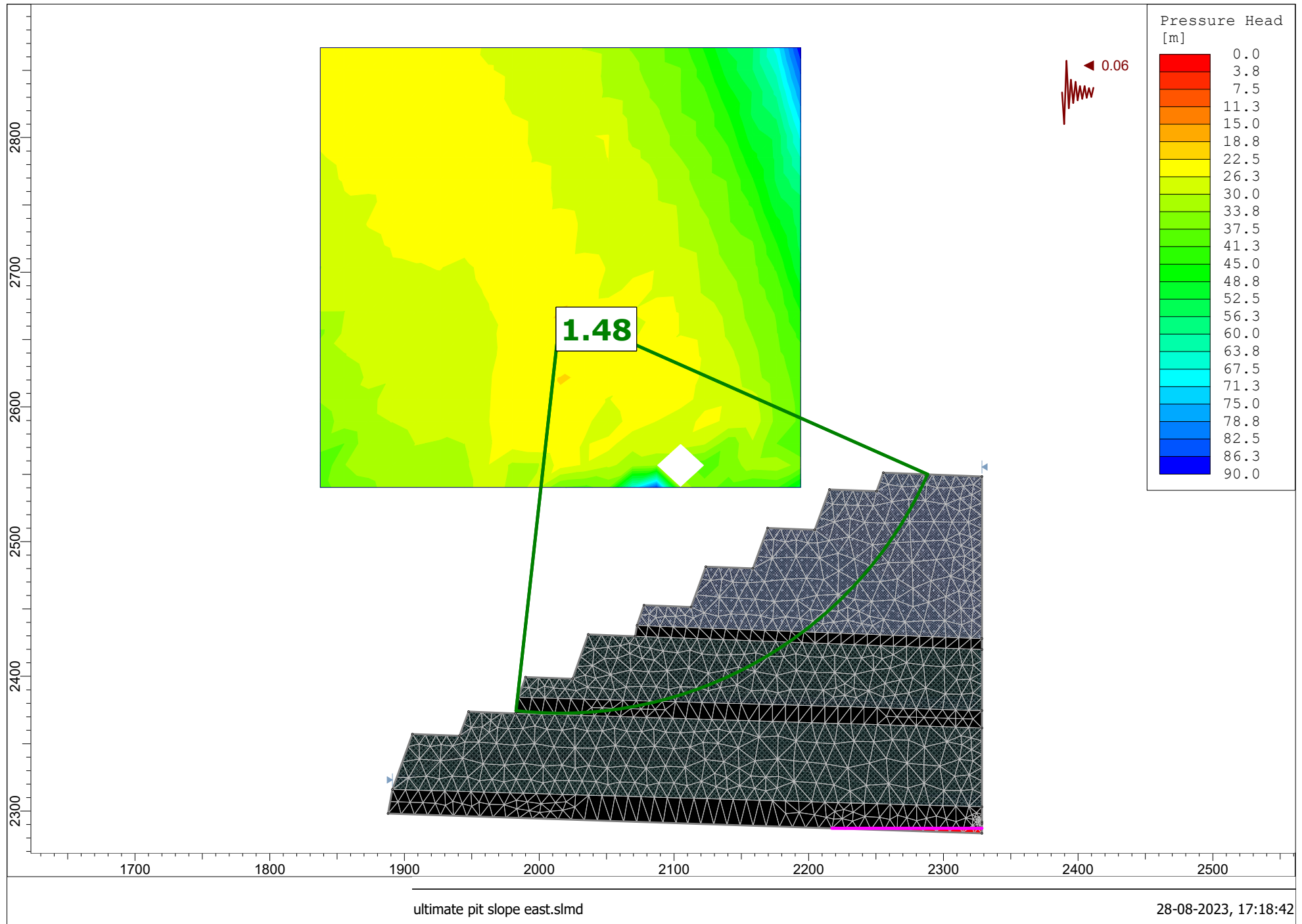


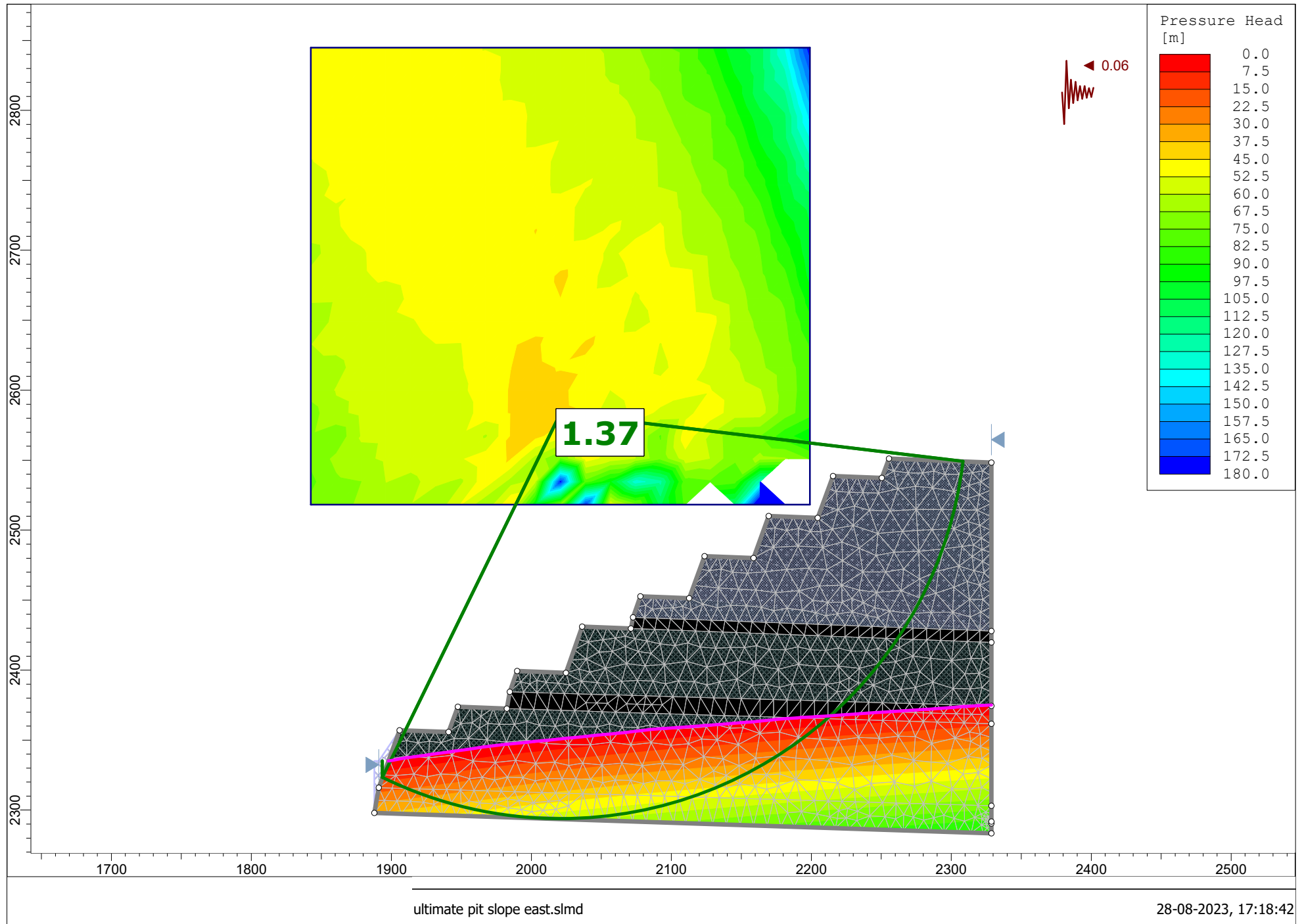


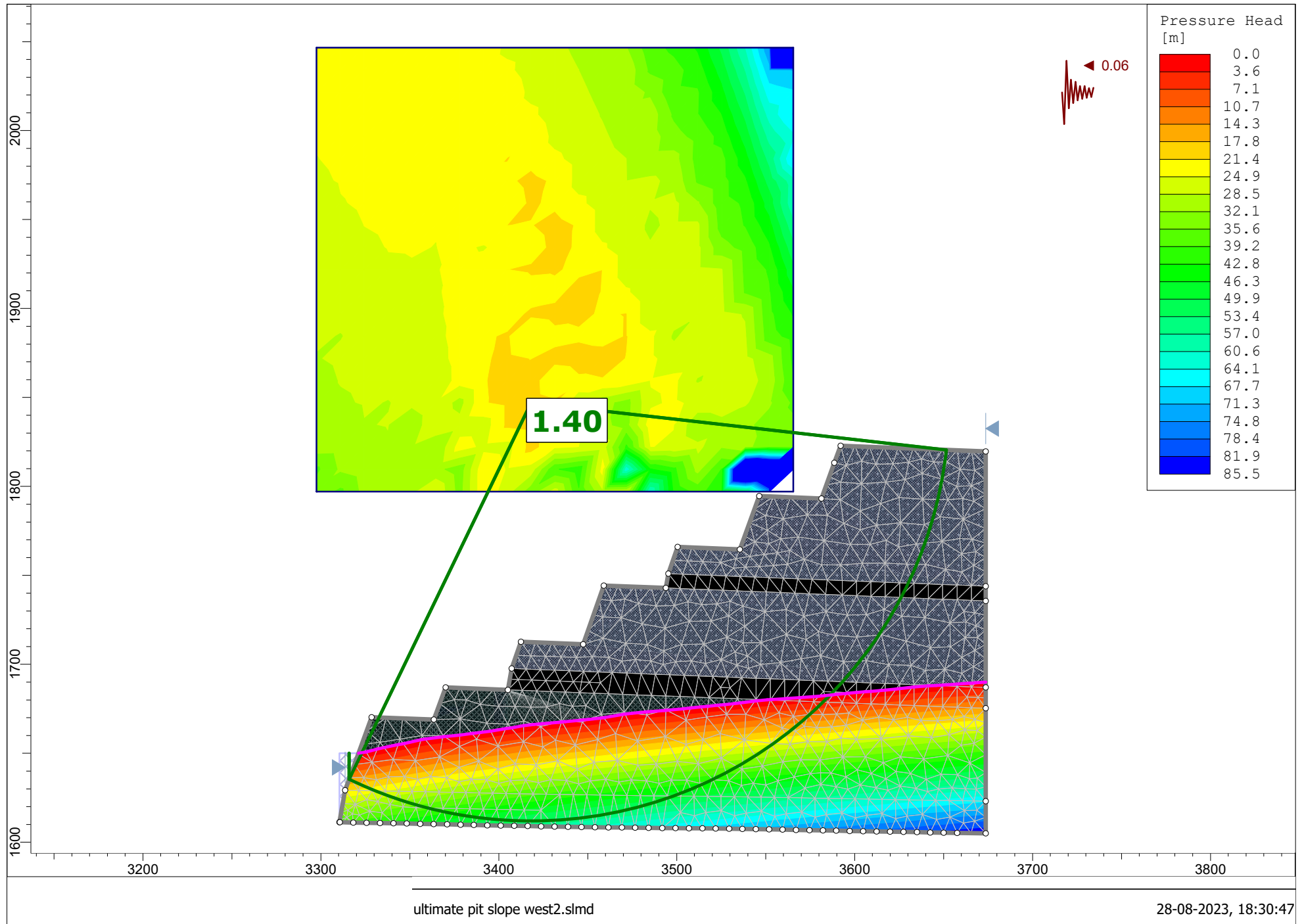


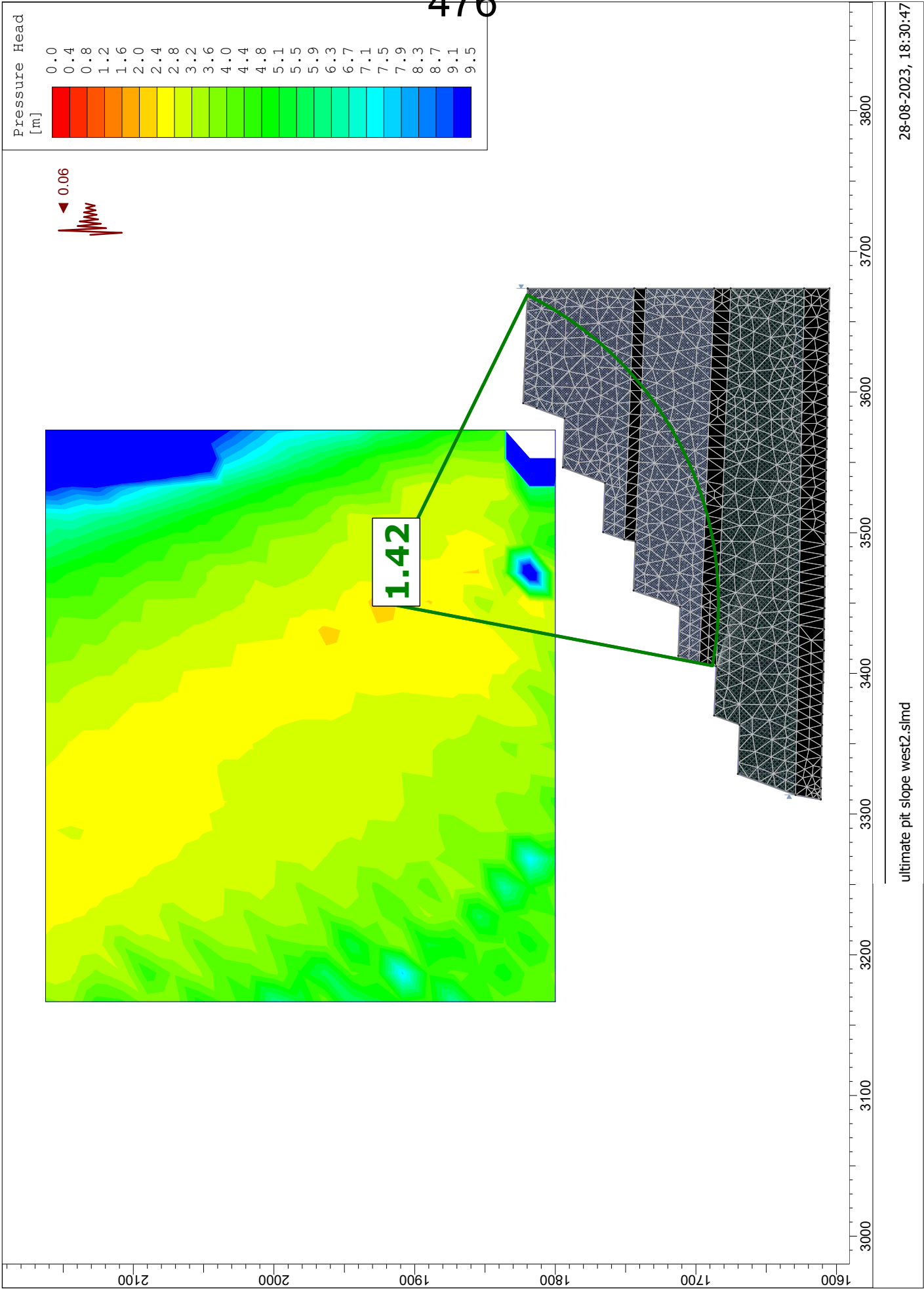












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			01.04.23 to 30.04.23	"	07	127 Nos
			01.05.23 to 31.05.23	"	26	101 Nos
17/06/23	R/S	600		-	-	701 Nos
			01.06.23 to 30.06.23	-	24	677 Nos
			01.07.23 to 30.07.23	-	57	620 Nos
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28/09/23	R/S	250		-	-	848 Nos
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			01.12.23 to 31.12.2023		47	566 Nos
			01.01.24 to 29.02.2024		68	498 Nos
			01.03.24 to 31.03.24	(591)	85	413 Nos
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Date	Received From	Quantity	Up to Issued.	Issued To	Quantity	Balance
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			01.09.24 to 30.09.24		03	12 Nos
			01.10.24 to 31.10.24		08	04 Nos
			01.11.24 to 30.11.24		-	04 Nos
			01.12.24 to 31.12.24		-	04 Nos

Water Bottle

4

172

Date	Received From	Quantity	Up to Issued	Issued TO	Quantity	Balance
			01.01.2023 - 31.01.2023	Employee	FF	11 Nos
			01.01.2023 to 31.01.2023	"	11	00
			01.02.2023 to 28.02.2023	"	—	00
			01.03.23 to 31.03.2023	"	—	00
			01.04.23 to 30.04.23	"	—	00
			01.05.23 to 31.05.23	"	—	00
			01.06.23 to 30.06.23	"	—	00
			01.07.23 to 31.07.23	"	—	00
			01.08.23 to 31.08.2023	"	—	00
			01.09.23 to 30.09.2023	"	—	00
			01.10.23 to 30.11.2023	"	—	00
22.12.24	R/S	900	—	—	—	900 Nos
			01.12.23 to 31.12.2023	"	70	830 Nos
			01.01.2024 to 31.01.2024	"	62	768 Nos
			01.02.2024 to 29.02.2024	"	39	729 Nos
			01.03.2024 to 31.03.24	" (325)	154	575 Nos
			01.04.24 to 30.04.24	"	147	428 Nos
			01.05.24 to 31.05.24		27	401 No.
			01.06.24 to 30.06.24		79	322 Nos
			01.07.24 to 31.07.24		38	284 Nos
			01.08.24 to 31.08.24		24	260 Nos
			01.09.24 to 30.09.24		43	217 Nos
			01.10.24 to 31.10.24		58	159 Nos
			01.11.24 to 30.11.24		22	137 Nos
			01.12.24 to 31.11.24		25	112 Nos

Dunt Mark

480

173

Date	Received from	Quantity	up to issue	Issue TO	Quantity	Balance
			01.01.2023			140 Nos
			01.01.23 to 31.01.2023	Employees	58	82 Nos
			01.02.23 to 28.02.23	"	45	37 Nos
03.03.23	0. Receipt	800				837 Nos
		800	01.03.23 to 31.03.23	"	128	709 Nos
			01.04.23 to 30.04.23	"	105	604 Nos
			01.05.23 to 31.05.23	"	128	476 Nos
			01.06.23 to 30.06.23	"	56	420 Nos
			01.07.23 to 31.07.23	"	58	362 Nos
			01.08.23 to 31.08.23	"	72	290 Nos
			01.09.23 to 30.09.23	"	86	204 Nos
			01.10.23 to 31.10.23	"	60	144 Nos
			01.11.23 to 30.11.23	"	75	79 Nos
			01.12.23 to 31.12.23	"	70	09 Nos
			01.01.2024 to 31.01.24	"	03	02 Nos
22.02.24	R/S	10020				10022 Nos
			01.02.24 to 29.02.24	"	963	9059 Nos
			01.03.24 to 31.03.24	APR 23 to March 24 = 2735	1059	8000 Nos
13.04.24	R/S	5600		(2735)		13000 Nos
			01.04.24 to 30.04.24		940	12060 Nos
			01.05.24 to 31.05.24		917	11143
			01.06.24 to 30.06.24		836	10307
			01.07.24 to 31.07.24		812	9495
			01.08.24 to 31.08.24		748	8747
			01.09.24 to 30.09.24		720	8027
			01.10.24 to 31.10.24		920	7107
			01.11.24 to 30.11.24		870	6237
			01.12.24 to 31.12.24		817	5420
			01.01.2025 to 31.01.2025		895	4525

Date of Received	Received From	Quantity received	Date of Issued	Issued To	Quantity Issued	Balance
			01.01.2023			897 No
			01.01.23 to 31.01.2023	Employ	245	652 Nos
			01.02.23 to 28.02.23	"	105	547 Nos
			01.03.23 to 31.03.23	"	110	437 Nos
			01.04.23 to 30.04.23	"	51	386 Nos
			01.05.23 to 31.05.23	"	88	298 Nos
			01.06.23 to 30.06.23	"	20	278 Nos
			01.07.23 to 31.07.23	"	42	236 Nos
			01.08.23 to 31.08.23	"	20	216 Nos
			01.09.23 to 30.09.23	"	—	216 Nos
			01.10.23 to 31.10.23	"	65	151 Nos
			01.11.23 to 30.11.23	"	39	112 Nos
			01.12.23 to 31.12.23	"	70	42 Nos
			01.01.24 to 31.01.24	"	40	02 Nos
			01.02.24 to 29.02.24	"	02	Nil
11.03.24	R/S	3200	01.03.24 to 31.03.24	—	—	3200
			01.03.24 to 31.03.24	— (1458)	1019	2181
			01.04.24 to 30.04.24	—	481	1700
			01.05.24 to 31.05.24		295	1405
			01.06.24 to 30.06.24		308	1097
			01.07.24 to 31.07.24		376	721
			01.08.24 to 31.08.24		—	2021
20.08.24	R/S	2100	01.08.24 to 31.08.24		532 140	2289
			01.09.24 to 30.09.24		338	1951
			01.10.24 to 31.10.24		244	1663
2.11.24	R/S	1100	01.11.24 to 30.11.24		209	2554
			01.12.24 to 31.12.24		153	2401

Date Received.	Received From	Quantity Received.	Date of Issued	Issued To	Quantity Issued.	Balance
			01.01.2023			05 Pair
			01.01.23 to 31.01.23	—	—	05 Pair
			01.02.23 to 28.02.23	—	—	05 Pair
			01.03.23 to 31.03.23	—	—	05 Pair
			01.04.23 to 30.04.23	—	01	04 Pair
			01.05.23 to 31.05.23	—	—	04 Pair
			01.06.23 to 30.06.23	—	01	03 Pair
02.06.23	R/S	200 Pair		—	—	203 Pair
			01.07.23 to 31.07.23	—	12 No.	185 Pair
			01.08.23 to 31.08.23	—	30	155 Pair
			01.09.23 to 30.09.23	—	—	155 Pair
			01.10.23 to 31.10.23	—	07	148 Pair
			01.11.23 to 30.11.23	—	06	142 Pair
			01.12.23 to 31.12.23	—	—	142 Pair
			01.01.24 to 31.01.24	—	—	142 Pair
			01.02.24 to 29.02.24	—	14	128 Pair
			01.03.24 to 31.03.24	(83)	06	122 Pair
			01.04.24 to 30.04.24		08	114 Pair
			01.05.24 to 31.05.24		—	114 Pair
			01.06.24 to 30.06.24		12	102 Pair
11.07.24	R/S	695 Pair	01.07.24 to 31.07.24		40	747 Pair
			01.08.24 to 31.08.24		115	642 Pair
			01.09.24 to 30.09.24		68	574 Pair
			01.10.24 to 31.10.24		60	514 Pair
			01.11.24 to 30.11.24		58	456 Pair
			01.12.24 to 31.12.24		25	431 Pair

Date	Received From	Quantity	Up to	Issue TO	Quantity	Balance
			01.01.2023 -			678 Nos
			01.01.23 to 31.01.23	Employee	10	668 Nos
			01.02.23 to 28.02.23	"	45	623 Nos
			01.03.23 to 31.03.2023	"	28	595 Nos
			01.04.23 to 30.04.23	"	96	499 Nos
			01.05.23 to 31.05.2023	"	16	483 Nos
17/06/23	R/S	950 Nos				1433 Nos
			01.06.23 to 30.06.23	Visitors + Employ	148	1285 Nos
			01.07.23 to 31.07.23	"	136	1149 Nos
			01.08.23 to 31.08.23	New Joining	196	953 Nos
			01.09.23 to 30.09.23	Warfaint Siding Study	125	828 Nos
			01.10.23 to 31.10.23		85	743 Nos
			01.11.23 to 30.11.23		110	633 Nos
			01.12.23 to 31.12.23		68	565 Nos
			01.01.24 to 31.01.24	New Joining	117	448 Nos
			01.02.24 to 29.02.24	Employee	44	404 Nos
			01.03.24 to 31.03.24	" (1248)	107	297 Nos
			01.04.24 to 30.04.24	"	55	242 Nos
			01.05.24 to 31.05.24		47	195 Nos
			01.06.24 to 30.06.24		-	195 Nos
			01.07.24 to 31.07.24		38	157 Nos
			01.08.24 to 31.08.24		12	145 Nos
			01.09.24 to 30.09.24		27	118 Nos
			01.10.24 to 31.10.24		63	55 Nos
19.11.24	R/L	100 Nos	01.11.24 to 30.11.24		35	155 Nos
			01.12.24 to 31.12.24		85	120 Nos
						35 Nos

Date	Received From	Quantity	Up to issue	Issue TO	Quantity	Balance =
			01.01.2023			140 Nos
			01.01.23 to 31.01.2023	Employee	58	82 Nos
			01.02.23 to 28.02.23	"	45	37 Nos
03.03.23	R. Next	800				837 Nos
		800	01.03.23 to 31.03.23	"	128	709 Nos
			01.04.23 to 30.04.23	"	105	604 Nos
			01.05.23 to 31.05.23	"	128	476 Nos
			01.06.23 to 30.06.23	"	56	420 Nos
			01.07.23 to 31.07.23	"	58	362 Nos
			01.08.23 to 31.08.23	"	72	290 Nos
			01.09.23 to 30.09.23	"	86	204 Nos
			01.10.23 to 31.10.23	"	60	144 Nos
			01.11.23 to 30.11.23	"	75	79 Nos
			01.12.23 to 31.12.23	"	70	09 Nos
			01.01.2024 to 31.01.24	"	03	02 Nos
22.02.24	R/S	10020				10022 Nos
			01.02.24 to 29.02.24	"	963	9059 Nos
			01.03.24 to 31.03.24	APR 23 to March 24 = 2335	1059	8000 Nos
13.04.24	R/S	5500		(2335)		13000 Nos
			01.04.24 to 30.04.24		940	12060 Nos
			01.05.24 to 31.05.24		917	11143
			01.06.24 to 30.06.24		836	10307
			01.07.24 to 31.07.24		812	9495
			01.08.24 to 31.08.24		748	8747
			01.09.24 to 30.09.24		720	8027
			01.10.24 to 31.10.24		920	7107
			01.11.24 to 30.11.24		870	6237
			01.12.24 to 31.12.24		817	5420
			01.01.2025 to 31.01.2025		895	4525

Leather safety shoe

485

10

178

Date	Received From	Quantity	Up to Issue	Issue TO	Quantity Issue	Bailance =
			01.01.2023			493
			01.01.23 to 31.01.2023	Emp.	92	401 Pair
			01.02.23 to 28.02.2023	"	64	337 Pair
			01.03.23 to 31.03.2023	"	96	241 Pair
9.05.23	R/store	87	01.04.23 to 30.04.2023	"	48	193 Pair
			In place of old shoe.	—	—	280 Pair
			01.05.2023 to 31.05.2023	"	102	178 Pair
12.07.23	R/store	47	01.06.23 to 30.06.2023	"	39	139 Pair
			01.07.23 to 31.07.2023	→	93	186 Pair
			01.08.23 to 31.08.2023	"	04	93 Pair
			01.09.23 to 30.09.2023	"	—	89 Pair
10.23	R/s	1100	01.10.23 to 31.10.2023	—	—	1189 Pair
			01.10.23 to 31.10.2023	"	365	824 Pair
			01.11.23 to 30.11.23	"	120	704 Pair
			01.12.23 to 31.12.23	"	112	592 Pair
			01.01.24 to 31.01.2024	"	109	483 Pair
			01.02.24 to 29.02.2024	"	89	394 Pair
			01.03.24 to 31.03.2024	"	124	270 Pair
			01.04.24 to 30.04.24		120	150 Pair
			01.05.24 to 31.05.24		50	100 Pair
			01.06.24 to 30.06.24		26	24 Pair
			01.07.24 to 31.07.24		24	0
06.8.24	R/-	1300	01.08.24 to 31.08.24	→	211	1300
			01.09.24 to 30.09.24	→	204	1089
			01.10.24 to 31.10.24	→	101	988
			01.11.24 to 30.11.24	→	61	927
			01.12.24 to 31.12.24	→	171	756
						585

1. De (T/D) - For kind information
2. De (T/P&P) - For kind information
3. GM - TS to CMD - For kind information of CMD
4. RD, RI, VI, CMPDI, Jayant
5. GM (CP)

नॉर्थन कोलफील्ड्स लिमिटेड
(पब्लिक लिमिटेड कंपनी)
(कोल इंडिया लिमिटेड की अनुषंगी
कंपनी)

एन सी एल NCL

487



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)

सापेक्षी प्रबंधन विभाग / Materials Management Department
CIN: U10102MP1985GOI003100

As ISO 9001, ISO 14001 & ISO 45001 Certified Company

पोस्ट सिंगरौलीकोलियरी, जिला: सिंगरौली म.प्र. पिन 486889 / Post Singrauli Colliery, Distt: Singrauli, M.P. PIN-486889

Annexure- I

Ref: NCL/SGR/STR/XtraGreen Diesel/24-25/114 E

Date: 12 /06/2024

To,
Genral Manager/HOD (Excv.)
Northern Coalfields Limited

Sub: XtraGreen Diesel trial run at Khadia & Amlori

Ref:

1. Letter No JDO/IB/NCL dated 24/04/2024 from IOCL
2. MOM Dated 6 June 2024 on TFM & Automation
3. e-Office File No- NCL/SGR/MMD/STORE/XTRAGREENDIESEL (Computer No 1495034)

Dear sir,

A trial run to explore the possibility of using XtraGreen HSD in Khadia and Amlori may be initiated, to verify the emission efficiency and fuel economy benefits claimed by M/s IOCL.

Administrative approval (Note # 11 Computer no 1495034) by the Director (Technical / Operation) has also been attached.

Yours faithfully

12/6/24
GM(MM)Store/HOD

Copy to:

- TS to DT(O), NCL

नॉर्दर्न कोलफील्ड्स लिमिटेड
(मिनिरात्र कंपनी)

(कोल इण्डिया लिमिटेड की अनुबंधी कंपनी)



Northern Coalfields Limited

A Miniratna Company

A subsidiary of Coal India Limited

उत्खनन विभाग, एनसीएल मुख्यालय / Excavation Department, NCL HQ

CIN- U10102MP1985GO1003160

An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company

पोस्ट- सिंगरौली कोलियरी, जिला- सिंगरौली, म.प्र., पिन 486889/ Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone & Fax: 07805-256231, email: gmexcav.ncl@coalindia.in website : www.nclcil.in

NCL/SGRL/HQ/EXCV-DEPT/H-350

Date: 06.08.2024

To

M/s Komatsu India Private Limited

Plot No. A-1, Sipcot Industrial Park

Growth Centre, Oragadam, Thenneri (Via),

Kanchipuram, Tamilnadu- 631604

Email: lal.asokansumangala@global.komatsu; Manish.Jhamb@larsentoubro.com; prajeeshchandra@Lntecc.com

Sub: Exploring the possibility of CNG/LNG/Electrical battery Driven 100 Ton / 190 Ton Rear Dumpers for transportation of Coal/Overburden at NCL.

Dear Sir,

NCL is exploring the possibility of acquiring CNG/LNG/Electric Battery-Driven 100 Ton / 190 Ton Rear Dumpers for the transportation of coal and overburden at Northern Coalfields Limited (NCL). Adopting more sustainable practices in compliance of environment, NCL is exploring the availability and feasibility of these Dumpers.

Specifically, NCL is interested in understanding whether your company currently manufactures or is planning to manufacture of CNG/LNG/Electrical battery Driven Dumpers for transportation of Coal/Overburden.

In view of above, it is requested to provide the information of CNG/LNG/Electrical battery Driven 100 Ton / 190 Ton Rear Dumpers for transportation of Coal / Overburden being manufaured / proposed to be manufactured at your company.

Regards,

B. Kum

General Manager (Excav)/HOD

महाप्रबंधक विभागाध्यक्ष/(उत्खनन) (एन.सी.एल)

Pradeep

For kind information- D.T. (O), NCL

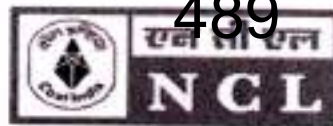
Copy to: 1. G.M (CP), NCL, G.M. (R&D), NCL, G.M. (Environment), NCL

2. Area G.M- Khadia Project

3. M/s Larsen & Toubro Limited, Mining Machinery, #32, Shivaji Marg, New Delhi-110015

नॉर्थन कोलफील्ड्स लिमिटेड
(मिनिरत्ना कंपनी)

(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)



Northern Coalfields Limited

A Miniratna Company

A subsidiary of Coal India Limited

उत्खनन विभाग, एनसीएल मुख्यालय / Excavation Department, NCL HQ

CIN- U10102MP198SGOI003160

An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company

पोस्ट- सिंगरौली कोलियरी, जिला- सिंगरौली, म.प्र., पिन 486889/ Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone & Fax: 07805-256231, email: gmexcv.ncl@coalindia.in website : www.nclcl.in

NCL/SGRL/HQ/EXCV-DEPT/H-351

Date: 06.08.2024

To

M/s BEML Limited

23/1, 4th Main Road

Sampangiram Nagar (S.R.Nagar)

Bengaluru, Karnataka-560027

Email: mmd@beml.co.in; mtt@beml.co.in; rm.singrauli@beml.co.in

Sub: Exploring the possibility of CNG/LNG/Electrical battery Driven 100 Ton / 190 Ton Rear Dumpers for transportation of Coal/Overburden at NCL.

Dear Sir,

NCL is exploring the possibility of acquiring CNG/LNG/Electric Battery-Driven 100 Ton / 190 Ton Rear Dumpers for the transportation of coal and overburden at Northern Coalfields Limited (NCL). Adopting more sustainable practices in compliance of environment, NCL is exploring the availability and feasibility of these Dumpers.

Specifically, NCL is interested in understanding whether your company currently manufactures or is planning to manufacture of CNG/LNG/Electrical battery Driven Dumpers for transportation of Coal/Overburden.

In view of above, it is requested to provide the information of CNG/LNG/Electrical battery Driven 100 Ton / 190 Ton Rear Dumpers for transportation of Coal / Overburden being manufaured / proposed to be manufactured at your company.

Regards,

B. Kumar
General Manager (Excv)/HOD

महाप्रबंधक विभागाध्यक्ष/(उत्खनन) (एन.सी.एल)

Radeep

For kind information- D.T.(O), NCL

Copy to;

1. G.M (CP),NCL, G.M. (R&D),NCL, G.M. (Environment),NCL
2. Area G.M- Khadia Project

नॉर्दर्न कोलफील्ड्स लिमिटेड
(मिनिरात्र कंपनी)

(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)



Northern Coalfields Limited

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उत्खनन विभाग, एनसीएल मुख्यालय / Excavation Department, NCL HQ

CIN- U10102MP1985GOI003160

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पोस्ट- सिंगरौली कोलियरी, जिला- सिंगरौली, म.प्र., पिन 486889/ Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone & Fax: 07805-256231, email: gmexcav.ncl@coalindia.in website : www.ncl.co.in

NCL/SGRL/HQ/EXCV-DEPT/H-353

Date: 06.08.2024

To

M/s Tata Hitachi Construction Machinery Company Private Limited

Jubilee Building, 45 Museum Road

Bengaluru, Karnataka-560025

Email: Rishi.Raj@tatahitachi.co.in

Sub: Exploring the possibility of CNG/LNG/Electrical battery Driven 100 Ton / 190 Ton Rear Dumpers for transportation of Coal/Overburden at NCL.

Dear Sir,

NCL is exploring the possibility of acquiring CNG/LNG/Electric Battery-Driven 100 Ton / 190 Ton Rear Dumpers for the transportation of coal and overburden at Northern Coalfields Limited (NCL). Adopting more sustainable practices in compliance of environment, NCL is exploring the availability and feasibility of these Dumpers.

Specifically, NCL is interested in understanding whether your company currently manufactures or is planning to manufacture of CNG/LNG/Electrical battery Driven Dumpers for transportation of Coal/Overburden.

In view of above, it is requested to provide the information of CNG/LNG/Electrical battery Driven 100 Ton / 190 Ton Rear Dumpers for transportation of Coal/Overburden being manufaured / proposed to be manufactured at your company.

Regards,

B. Kum

General Manager (Excav)/HOD

महाप्रबंधक विभागाध्यक्ष/(उत्खनन) (एन.सी.एल.)

Pradeep

For kind information- D.T. (O), NCL

Copy to: 1. G.M (CP), NCL, G.M. (R&D), NCL, G.M. (Environment), NCL

2. Area G.M- Khadia Project

उत्खनन विभाग, एनसीएल मुख्यालय / Excavation Department, NCL HQ

CIN- U10102MP1985GO1003160

An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company

पोस्ट: सिंगरौली कोलियरी, जिला: सिंगरौली, म.प्र., पिन-486889/ Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone & Fax: 07805-256231, email: gmexcv.ncl@coalindia.in website : www.nclil.in

NCL/SGRL/HQ/EXCV-DEPT/H-354

Date: 06.08.2024

To

M/s OJSC "BELAZ"

Management Company of Holding "BELAZ-HOLDING"

Republic of Belarus

Email: export@belaz.minsk.by; import@belaz.minsk.by; jvgokal@vsnl.com

Sub: Exploring the possibility of CNG/LNG/Electrical battery Driven 100 Ton / 190 Ton Rear Dumpers for transportation of Coal/Overburden at NCL.

Dear Sir,

NCL is exploring the possibility of acquiring CNG/LNG/Electric Battery-Driven 100 Ton / 190 Ton Rear Dumpers for the transportation of coal and overburden at Northern Coalfields Limited (NCL). Adopting more sustainable practices in compliance of environment, NCL is exploring the availability and feasibility of these Dumpers.

Specifically, NCL is interested in understanding whether your company currently manufactures or is planning to manufacture of CNG/LNG/Electrical battery Driven Dumpers for transportation of Coal/Overburden.

In view of above, it is requested to provide the information of CNG/LNG/Electrical battery Driven 100 Ton / 190 Ton Rear Dumpers for transportation of Coal / Overburden being manufaured / proposed to be manufactured at your company.

Regards,

B. K. M.

General Manager (Excv)/HOD

महाप्रबंधक विभागाध्यक्ष/(उत्खनन) (एन.सी.एल.)

Pradeep

For kind information- D.T. (O), NCL

Copy to: 1. G.M (CP), NCL, G.M. (R&D), NCL, G.M. (Environment), NCL

2.Area G.M- Khadia Project

3.M/s J.V. Gokal & Co. Private Limited, Mumbai



Annexure-K

Environment Khadia <environmentkhadia@gmail.com>

Approval Request-New Unit Connectivity-Mining-KHADIA PROJECT NORTHERN COALFIELDS LIMITED-Uttar Pradesh-Reg.

RTDMS Connectivity <rtdmsapproval1.cpcb@gov.in>

Fri, Dec 13, 2024 at 5:43 PM

To: environmentkhadia <environmentkhadia@gmail.com>

Cc: Archit Uprit <archituprit.cpcb@nic.in>, B Vinod Babu <itdiv.cpcb@gov.in>, "rajasekar.r"

<rajasekar.r@rockwellautomation.com>, connect <connect@enggenvironment.com>, "cgm.khd" <cgm.khd@gmail.com>,

somingkhdpro <somingkhdpro@gmail.com>, Sanjeev kumar <gmenv.ncl@coalindia.in>, B Vinod Babu

<itdiv.cpcb@nic.in>, arpitnavati <arpitnavati@dcmsshriram.com>, Anurag Sharma <anurag.cpcb@gov.in>, KRISHAN

DEV <kd.cpcb@gov.in>, NEHA SINGH <neha.cpcb@gov.in>

Sir/Ma'am,

PFA provisional connectivity sheet of M/s **KHADIA PROJECT NORTHERN COALFIELDS LIMITED, UP**. The connectivity is provisional but subjected to Future review of measurement principles used in the device and/or device capability, by any CPCB Division, and any corrective action including direction for replacement of these devices if found unsuitable.

Note: **The unit/Station has been integrated with RTDMS Portal**, kindly update the industry code in CPCB Registration portal.

Thanks & Regards

IT Division
Central Pollution Control Board
Delhi

--- On Mon, 25 Nov 2024 17:56:22 +0530 <environmentkhadia@gmail.com> wrote ---

[Quoted text hidden]

NCL Khadia Project,Shaktinagar | Delay

Reports

Quick Range

1 Day

3 Days

7 Days

30 Days

From Date *

1/14/2025, 1:59 PM

To Date *

1/20/2025, 1:59 PM

Station

ETP_of_Khadia_Project

Frequency

15 Minutes

table View ☒

Fetch

Average Report

Print

Excel

Pdf

Calibration Expected	Calibration Span
Error	Faulty
Invalid	Maintenance
Negative	Out of Range
Raw	Validated
Zero Calibration	Estimates
Corrected	Drift
Failure	Correct
Non-obtained	warning
Anomaly	Out of Field

Time Stamp ×

BOD (mg/l) ×

COD (mg/l) ×

TSS (mg/l) ×

pH (pH) ×

+4 ×

▼



Search...

2025-01-14 13:45	14.36	225.57	169.16	6.97	0.36
2025-01-14 14:00	14.31	224.58	168.42	7.03	0.08
2025-01-14 14:15	0.00	0.00	0.00	0.00	0.00
2025-01-14 14:30	14.10	221.32	165.97	7.10	0.23
2025-01-14 14:45	14.17	222.22	166.75	6.92	0.14

37.	Hazardous waste treatment processes, e.g. pre-processing, incineration and concentration	37.1 Sludge from wet scrubbers 37.2 Ash from incinerator and flue gas cleaning residue 37.3 Concentration or evaporation residues
38.	Chemical processing of Ores containing heavy metals such as Chromium, Manganese, Nickel, Cadmium etc.	38.1 Process residues 38.2 Spent acid

*** The inclusion of wastes contained in this Schedule does not preclude the use of Schedule II to demonstrate that the waste is not hazardous. In case of dispute, the matter would be referred to the Technical Review Committee constituted by Ministry of Environment, Forest and Climate Change.**

Note: The high volume low effect wastes such as fly ash, Phosphogypsum, red mud, jarosite, Slags from pyrometallurgical operations, mine tailings and ore beneficiation rejects are excluded from the category of hazardous wastes. Separate guidelines on the management of these wastes shall be issued by Central Pollution Control Board.

SCHEDULE II

[See rule 3 (1) (17) (ii)]

List of waste constituents with concentration limits

Class A: Based on leachable concentration limits [Toxicity Characteristic Leaching Procedure (TCLP) or Soluble Threshold Limit Concentration (STLC)]

Class	Constituents	Concentration in mg/l
(1)	(2)	(3)
A1	Arsenic	5.0
A2	Barium	100.0
A3	Cadmium	1.0
A4	Chromium and/or Chromium (III) compounds	5.0
A5	Lead	5.0
A6	Manganese	10.0
A7	Mercury	0.2
A8	Selenium	1.0
A9	Silver	5.0
A10	Ammonia	50*
A11	Cyanide	20*
A12	Nitrate (as nitrate-nitrogen)	1000.0
A13	Sulphide (as H ₂ S)	5.0
A14	1,1-Dichloroethylene	0.7
A15	1,2-Dichloroethane	0.5
A16	1,4-Dichlorobenzene	7.5
A17	2,4,5-Trichlorophenol	400.0
A18	2,4,6-Trichlorophenol	2.0
A19	2,4-Dinitrotoluene	0.13
A20	Benzene	0.5
A21	Benzo (a) Pyrene	0.001
A22	Bromodichloromethane	6.0
A23	Bromoform	10.0
A24	Carbon tetrachloride	0.5
A25	Chlorobenzene	100.0
A26	Chloroform	6.0
A27	Cresol (ortho+ meta+ para)	200.0
A28	Dibromochloromethane	10.0
A29	Hexachlorobenzene	0.13
A30	Hexachlorobutadiene	0.5
A31	Hexachloroethane	3.0
A32	Methyl ethyl ketone	200.0

A33	Naphthalene	5.0
A34	Nitrobenzene	2.0
A35	Pentachlorophenol	100.0
A36	Pyridine	5.0
A37	Tetrachloroethylene	0.7
A38	Trichloroethylene	0.5
A39	Vinyl chloride	0.2
A40	2,4,5-TP (Silvex)	1.0
A41	2,4-Dichlorophenoxyacetic acid	10.0
A42	Alachlor	2.0
A43	Alpha HCH	0.001
A44	Atrazine	0.2
A45	Beta HCH	0.004
A46	Butachlor	12.5
A47	Chlordane	0.03
A48	Chlorpyrifos	9.0
A49	Delta HCH	0.004
A50	Endosulfan (alpha+ beta+ sulphate)	0.04
A51	Endrin	0.02
A52	Ethion	0.3
A53	Heptachlor (& its Epoxide)	0.008
A54	Isoproturon	0.9
A55	Lindane	0.4
A56	Malathion	19
A57	Methoxychlor	10
A58	Methyl parathion	0.7
A59	Monocrotophos	0.1
A60	Phorate	0.2
A61	Toxaphene	0.5
A62	Antimony	15
A63	Beryllium	0.75
A64	Chromium (VI)	5.0
A65	Cobalt	80.0
A66	Copper	25.0
A67	Molybdenum	350
A68	Nickel	20.0
A69	Thallium	7.0
A70	Vanadium	24.0
A71	Zinc	250
A72	Fluoride	180.0
A73	Aldrin	0.14
A74	Dichlorodiphenyltrichloroethane (DDT), Dichlorodiphenyldichloroethylene (DDE), Dichlorodiphenyldichloroethane (DDD)	0.1
A75	Dieldrin	0.8
A76	Kepone	2.1
A77	Mirex	2.1
A78	Polychlorinated biphenyls	5.0
A79	Dioxin (2,3,7,8-TCDD)	0.001

Class B: Based on Total Threshold Limit Concentration (TTLC)

Class	Constituent	Concentration in mg/kg
(1)	(2)	(3)
B1	Asbestos	10000
B2	Total Petroleum Hydrocarbons (TPH) (C5 - C36)	5,000

Note:

- (1) The testing method for list of constituents at A1 to A61 in Class-A, shall be based on Toxicity Characteristic Leaching Procedure (TCLP) and for extraction of leachable constituents, USEPA Test Method 1311 shall be used.
- (2) The testing method for list of constituents at A62 to A79 in Class- A, shall be based on Soluble Threshold Limit Concentration (STLC) and Waste Extraction Test (WET) Procedure given in Appendix II of section 66261 of Title 22 of California Code regulation (CCR) shall be used.
- (3) In case of ammonia (A10), cyanide (A11) and chromium VI (A64), extractions shall be conducted using distilled water in place of the leaching media specified in the TCLP/STLC procedures.
- (4) A summary of above specified leaching/extraction procedures is included in manual for characterization and analysis of hazardous waste published by Central Pollution Control Board and in case the method is not covered in the said manual, suitable reference method may be adopted for the measurement.
- (5) In case of asbestos, the specified concentration limits apply only if the substances are in a friable, powdered or finely divided state.
- (6) The hazardous constituents to be analyzed in the waste shall be relevant to the nature of the industry and the materials used in the process.

Wastes which contain any of the constituents listed below shall be considered as hazardous, provided they exhibit the characteristics listed in Class-C of this Schedule :

1.	Acid Amides
2.	Acid anhydrides
3.	Amines
4.	Anthracene
5.	Aromatic compounds other than those listed in Class A
6.	Bromates, (hypo-bromites)
7.	Chlorates (hypo-chlorites)
8.	Carbonyls
9.	Ferro-silicate and alloys
10.	Halogen- containing compounds which produce acidic vapours on contact with humid air or water e.g. silicon tetrachloride, aluminum chloride, titanium tetrachloride
11.	Halogen- silanes
12.	Halogenated Aliphatic Compounds
13.	Hydrazine (s)
14.	Hydrides
15.	Inorganic Acids
16.	Inorganic Peroxides
17.	Inorganic Tin Compounds
18.	Iodates
19.	(Iso- and thio-) Cyanates
20.	Manganese-silicate
21.	Mercaptans
22.	Metal Carbonyls
23.	Metal hydrogen sulphates
24.	Nitrides
25.	Nitriles
26.	Organic azo and azoxy Compounds
27.	Organic Peroxides
28.	Organic Oxygen Compounds
29.	Organic Sulphur Compounds
30.	Organo- Tin Compounds
31.	Organo nitro- and nitroso compounds

32.	Oxides and hydroxides except those of hydrogen, carbon, silicon, iron, aluminum, titanium, manganese, magnesium, calcium
33.	Phenanthrene
34.	Phenolic Compounds
35.	Phosphate compounds except phosphates of aluminum, calcium and iron
36.	Salts of pre-acids
37.	Total Sulphur
38.	Tungsten Compounds
39.	Tellurium and tellurium compounds
40.	White and Red Phosphorus
41.	2-Acetylaminofluorene
42.	4-Aminodiphenyl
43.	Benzidine and its salts
44.	Bis (Chloromethyl) ether
45.	Methyl chloromethyl ether
46.	1,2-Dibromo-3-chloropropane
47.	3,3'-Dichlorobenzidine and its salts
48.	4-Dimethylaminoazobenzene
49.	4-Nitrobiphenyl
50.	Beta-Propiolactone

CLASS C : Based on hazardous Characteristics

Apart from the concentration limit given above, the substances or wastes shall be classified as hazardous waste if it exhibits any of the following characteristics due to the presence of any hazardous constituents:

Class C1: Flammable- A waste exhibits the characteristic of flammability or ignitability if a representative sample of the waste has any of the following properties, namely:-

- (i) flammable liquids, or mixture of liquids, or liquids containing solids in solution or suspension (for example, paints, varnishes, lacquers, etc; but not including substances or wastes otherwise classified on account of their dangerous characteristics), which give off a flammable vapour at temperature less than 60°C. This flash point shall be measured as per ASTM D 93-79 closed-cup test method or as determined by an equivalent test method published by Central Pollution Control Board;
- (ii) it is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns vigorously and persistently creating a hazard;
- (iii) it is an ignitable compressed gas;
- (iv) It is an oxidizer and for the purposes of characterisation is a substance such as a chlorate, permanganate, inorganic peroxide, or a nitrate, that yields oxygen readily to stimulate the combustion of organic matter.

Class C2: Corrosive- A waste exhibits the characteristic of corrosivity if a representative sample of the waste has either of the following properties, namely:-

- (i) it is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5;
- (ii) it is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm per year at a test temperature of 55 °C;
- (iii) it is not aqueous and, when mixed with an equivalent weight of water, produces a solution having a pH less than or equal to 2 or greater than or equal to 12.5;
- (iv) it is not a liquid and, when mixed with an equivalent weight of water, produces a liquid that corrodes steel (SAE1020) at a rate greater than 6.35 mm per year at a test temperature of 55 °C.

Note:

For the purpose of determining the corrosivity, the Bureau of Indian Standard 9040 C method for pH determination, NACE TM 01 69 : Laboratory Corrosion Testing of Metals and EPA 1110A method for corrosivity towards steel (SAE1020) to establish the corrosivity characteristics shall be adopted.

Class C3: Reactive or explosive- A waste exhibits the characteristic of reactivity if a representative sample of the waste it has any of the following properties, namely:-

- (i) it is normally unstable and readily undergoes violent change without detonating;
- (ii) it reacts violently with water or forms potentially explosive mixtures with water;
- (iii) when mixed with water, it generates toxic gases, vapours or fumes in a quantity sufficient to present a danger to human health or the environment;
- (iv) it is a cyanide or sulphide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapours or fumes in a quantity sufficient to present a danger to human health or the environment;
- (v) it is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement;
- (vi) it is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure;
- (vii) it is a forbidden explosive.

Class C4: Toxic- A waste exhibits the characteristic of toxicity, if, :-

- (i) the concentration of the waste constituents listed in Class A and B (of this schedule) are equal to or more than the permissible limits prescribed therein;
- (ii) it has an acute oral LD50 less than 2,500 milligrams per kilogram;
- (iii) it has an acute dermal LD50 less than 4,300 milligrams per kilogram;
- (iv) it has an acute inhalation LC50 less than 10,000 parts per million as a gas or vapour;
- (v) it has acute aquatic toxicity with 50% mortality within 96 hours for zebra fish (*Brachidanio rerio*) at a concentration of 500 milligrams per litre in dilution water and test conditions as specified in BIS test method 6582 – 2001.
- (vi) it has been shown through experience or by any standard reference test- method to pose a hazard to human health or environment because of its carcinogenicity, mutagenicity, endocrine disruptivity, acute toxicity, chronic toxicity, bio-accumulative properties or persistence in the environment.

Class C5: Substances or Wastes liable to spontaneous combustion - Substances or Wastes which are liable to spontaneous heating under normal conditions encountered in transport, or to heating up on contact with air, and being then liable to catch fire.

Class C6: Substances or Wastes which, in contact with water emit flammable gases- Substances or Wastes which, by interaction with water, are liable to become spontaneously flammable or to give off flammable gases in dangerous quantities.

Class C7: Oxidizing - Substances or Wastes which, while in themselves not necessarily combustible, may, generally by yielding oxygen cause, or contribute to, the combustion of other materials.

Class C8: Organic Peroxides - Organic substances or Wastes which contain the bivalent O–O structure, which may undergo exothermic self-accelerating decomposition.

Class C9: Poisons (acute) - Substances or Wastes liable either to cause death or serious injury or to harm human health if swallowed or inhaled or by skin contact.

Class C10: Infectious substances - Substances or Wastes containing viable micro-organisms or their toxins which are known or suspected to cause disease in animals or humans.

Class C11: Liberation of toxic gases in contact with air or water - Substances or Wastes which, by interaction with air or water, are liable to give off toxic gases in dangerous quantities.

Class C12: Eco-toxic- Substances or Wastes which if released, present or may present immediate or delayed adverse impacts to the environment by means of bioaccumulation or toxic effects upon biotic systems or both.

Class C13: Capable, by any means, after disposal, of yielding another material, e.g., leachate, which possesses any of the characteristics listed above.



Annexure-N499

भारतीय प्रौद्योगिकी संस्थान 192
INDIAN INSTITUTE OF TECHNOLOGY
(काशी हिन्दू विश्वविद्यालय)
(BANARAS HINDU UNIVERSITY)
रासायनिक अभियांत्रिकी एवं प्रौद्योगिकी विभाग
DEPARTMENT OF CHEMICAL ENGINEERING & TECHNOLOGY
(उत्पादशुद्धीकरण केन्द्र एवं सी एस टी प्रायोजित 'फिस्ट' विभाग)
(CENTRE OF ADVANCED STUDY & DST DEPARTMENT UNDER FIST)
(वाराणसी - 221004) Varanasi - 221005

Ref. No. ChE/2017-18/245

Date: November 23, 2017

30

To,
Mr. A.N. Pandey
General Manager
Khadia Project
Northern Coal Field Ltd.
P.O - Saktinagar
Dist - Sonbhadra - 231 222

Dear Sir,

In reference to your letter No. KHS/Min/Sampling/17/381 dated 02.05.2017, the test report of your sample submitted and collected by you are as under:

Test Report

EPT Sludge Sample KHSL1	Pb (ppm)	Hg (ppm)	As (ppm)	Cd (ppm)	Ni (ppm)	Co (ppm)
1.	0.0006	00	4.312	0.014	00	.0291

Forwarded

(P.K. Mishra)

Head of the Department

विभागाध्यक्ष / Head

रासायनिक अभियांत्रिकी प्रौद्योगिकी विभाग

Department of Chemical Engg. & Tech.

भारतीय प्रौद्योगिकी संस्थान / Indian Institute of Technology

काशी हिन्दू विश्वविद्यालय / Banaras Hindu University

वाराणसी / Varanasi-221005

(A.S.K. Sinha)

Lab-Incharge

Hydrogen Energy Lab

प्रभारित/Professor

रासायनिक अभियांत्रिकी एवं प्रौद्योगिकी विभाग

Dept. of Chemical Engg. & Tech.

भारतीय प्रौद्योगिकी संस्थान

Indian Institute of Technology

काशी हिन्दू विश्वविद्यालय

Banaras Hindu University

वाराणसी/Varanasi-221005

AMC (Env)
31/11/18



एन सीएस नमूना के लिए

Fax (फैक्स): 091-0542-2368092, Email : head.che@itbhu.ac.in

0542-2368092, 6702029, 6702024

500

Annexure-O



Environment Khadia <environmentkhadia@gmail.com>

Testing of ETP Sludge

Environment Khadia <environmentkhadia@gmail.com>

Mon, Jan 27, 2025 at 7:16 PM

To: director@iitism.ac.in

Cc: staff officer mining khadia project <sominingkhdpro@gmail.com>, Cgm Khadia <cgm.khd@gmail.com>

Dear Sir,

Khadia Opencast Project is an opencast coal mine of M/s Northern Coalfields Limited. During its operation, Khadia OCP treats its effluent generated from coal mine in an Effluent Treatment Plant and in this process, ETP sludge is generated.

As per schedule -I of the Hazardous & Other Waste (Management & Transboundary Movement) Rules, 2016, the use of Schedule II can be done to demonstrate that the waste is not hazardous.

Khadia Project wishes to ascertain the hazardous nature of ETP sludge being generated as per Schedule- II of the Hazardous & Other Waste (Management & Transboundary Movement) Rules, 2016. (Copy enclosed).

It is requested to kindly furnish the quotation / estimated amount and necessary details for above work.

With regards
Nodal Officer (Environment)
Khadia Area, NCL

 **Schedule-II_Hz Waste.pdf**
85K

501



Environment Khadia <environmentkhadia@gmail.com>

Testing of ETP Sludge

Environment Khadia <environmentkhadia@gmail.com>

Mon, Jan 27, 2025 at 7:13 PM

To: director@iitbhu.ac.in

Cc: staff officer mining khadia project <sominingkhdpro@gmail.com>, Cgm Khadia <cgm.khd@gmail.com>

Dear Sir,

Khadia Opencast Project is an opencast coal mine of M/s Northern Coalfields Limited. During its operation, Khadia OCP treats its effluent generated from coal mine in an Effluent Treatment Plant and in this process, ETP sludge is generated.

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Khadia Project wishes to ascertain the hazardous nature of ETP sludge being generated as per Schedule- II of the Hazardous & Other Waste (Management & Transboundary Movement) Rules, 2016. (Copy enclosed).

It is requested to kindly furnish the quotation / estimated amount and necessary details for above work.

With regards
Nodal Officer (Environment)
Khadia Area, NCL

**Schedule-II_Hz Waste.pdf**

85K

502



Environment Khadia <environmentkhadia@gmail.com>

Testing of ETP Sludge

Environment Khadia <environmentkhadia@gmail.com>

Mon, Jan 27, 2025 at 7:11 PM

To: "rpbd@iitrindia.org" <rpbd@iitrindia.org>

Cc: staff officer mining khadia project <sominingkhdpro@gmail.com>, Cgm Khadia <cgm.khd@gmail.com>, "Hemendra B. Shinde" <gmenv.ncl@coalindia.in>

Dear Sir,

Khadia Opencast Project is an opencast coal mine of M/s Northern Coalfields Limited. During its operation, Khadia OCP treats its effluent generated from coal mine in an Effluent Treatment Plant and in this process, ETP sludge is generated.

As per schedule -I of the Hazardous & Other Waste (Management & Transboundary Movement) Rules, 2016, the use of Schedule II can be done to demonstrate that the waste is not hazardous.

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It is requested to kindly furnish the quotation / estimated amount and necessary details for above work.

With regards
Nodal Officer (Environment)
Khadia Area, NCL

**Schedule-II_Hz Waste.pdf**

85K



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)

Call 800 451 7000 Contract Management Cell



CIN- U10102NP1985GCI001140

An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company

卷一 御内教 御内教 御内教 御内教

Phone: 07805-266671, FAX: 266680 email: info@nrcs.in website: www.nrcs.in

Ref.No: NCL/SGR/CMC/KHADIA CHP/ LOA/2024/ 02)

Date: 08.01.2024

To,
M/s. S. K. Samanta & Co. Pvt. Ltd.,
2/5, Sarat Bose Road
Kolkata - 700020.
E-mail id: kol@sksl.in

Sub: Letter of Acceptance (LoA) / Work order for the work of: "Planning, Design, Engineering, Construction, Fabrication, Erection, Supply, Installation, Testing, Trial Run and Commissioning of Coal Handling Plant of 4 MTPA consisting of all Civil, Structural, Electrical and Mechanical Works and all other accessories and facilities required to make it complete in all respects on turnkey basis and Operation and Maintenance of plant for five years in Khadia OCP of NCL."

Ref: 1. NIT No.: GM (CMC)/NCL/NIT/KHD CHP/105 Date: 31.05.2023
2. Tender Id: 2023_NCL_280513_1
3. Your submitted bid with Bid ID: 956949 along with confirmatory documents on www.coalindiatenders.nic.in including Price Justification..

Dear Sir,

With reference to above, this is to communicate the approval of the Competent Authority for award of the subject work to M/s S K Samanta & Co Pvt Ltd for an amount of Rs. 272,69,80,000/- (Rupees Two Hundred Seventy Two Crore Sixty Nine Lakh Eighty Thousand only including GST@18%)

[Capital Cost: Rs. 251,34,00,000/- including GST, Revenue Cost (O&M): Rs. 21,35,80,000/- including GST], subject to the following terms and conditions:

1. PERFORMANCE SECURITY DEPOSIT (PSD) / SECURITY DEPOSIT

You have to deposit a sum of Rs. 11,55,50,000/- (Rupees Eleven Crores Fifty Five Lakh Fifty Thousand only) only as 5% of the Contract Price, within 21 days of issuance of LOA, as per Clause No. 3 'Contract Performance Guarantee/ Security Deposit' of General Terms & Conditions of Contract of the NIT.

Work shall commence only after submission of Performance Security. In case the successful bidder fails to submit the Performance Security within the stipulated time then the award of work shall be cancelled and bidder will be banned for two years from being eligible to submit bids in CIL and its subsidiaries. In addition to the above penal measures, the bidder will not be allowed to participate in the retendering process.

All running on Account bills shall be paid at 95% (ninety five percent) of the executed work value. This 5% (Five percent) deduction towards Retention Money will be the second part of Security Deposit.

उत्तर कोयला लिमिटेड
(पब्लिक कंपनी)
(एक सार्वजनिक निधि में सूचीबद्ध है)



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)



संग्रहीत कार्य Cell / Contract Management Cell



CIN: U10102MP1985GD000180
An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company

पता: संग्रहीत कोयला लिमिटेड, एन. ए. सिंगरौल कोयला खान, सिंगरौल, म.प्र., पिन-486009
Phone: 07835- 266671, (FAX) 266680 email: encl@ncl.coalindia.in website : www.ncl.co.in

2. Goods & Service Tax :

The payment of the Goods & Service Tax shall be governed as per the Terms and Conditions of the NIT / Tender document.

3. Contract Period:

The contract period for this work shall be 2555 days from the date of commencement which shall be within 30 (Thirty) days of issue of letter of acceptance and submission of Performance Security or from 7th day of handing over of the site for the first activity as per PERT network chart, whichever is later.

• Work shall commence only after submission of Performance Security.

2555 days shall comprise of:

- 730 days for Construction including Trial Run, PGT & Commissioning of the Plant
- 1825 days (05 years) for Operation & Maintenance of Plant during Defect Liability Period.

The date of uploading of this Letter of Acceptance / Work order on e-Procurement Portal (www.coalindiatenders.nic.in) shall be treated as the date of receipt of this LOA / Work order by you.

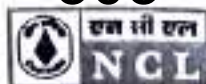
4. Price Variation (Escalation/De-escalation) :

- That the contract price shall remain firm without any price variation due to escalation for the portions of survey, geo-engineering investigations, design and engineering and supply of equipments, plant and machineries as envisaged in the scope of work and the price agreed thereon as per the contract except the statutory increase/decrease in taxes and duties such as GST, GST (Compensation to State) Cess etc.

If the contract is to be extended beyond the stipulated period for completion of the work due to fault on the part of the contractor escalation on prices should not be allowed further if not provided otherwise in the accepted contract.

- That for the portions of Civil and Structural Works and Erection and commissioning Works of the Plant and machineries, the Price Variation due to Escalation shall be in compliance with Cl.No.2 of Additional Terms & Conditions of Contract (Price Variation Clause).
- That the base date for working out Escalation/De-escalation is 14.07.2023 i.e. the last date of submission of bid.
- That the ceiling on price variation due to escalation covered under clauses mentioned hereinbefore on the contract, limited to 10% of that portion of Contract Price for which price variation is applicable.

नॉर्थ कोलफील्ड लिमिटेड
(पब्लिक कंपनी)
(कोल इंडिया लिमिटेड की संपूर्ण संपत्ति)



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)

संविदा प्रबंधन कक्ष (Contract Management Cell)



CIN- U10102MP1985GO003160

An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company

पता: नोर्थ कोलफील्ड लिमिटेड, को

पता: नोर्थ कोलफील्ड लिमिटेड, को. सि. 466002 Post: Singrauli Colliery, Dist: Singrauli, M.P. PIN-466002

Phone: 07805- 266671, (FAX) 266640 email: genm.ncl@coalindia.in website: www.ncl.co.in

5. EMPLOYMENT OF LABOUR:

The provisions / guidelines as incorporated in the NIT and Bid Document with regard to "Employment of Labours" and the wages & others to be paid shall be followed.

6. **INSURANCE:** That you have to take necessary insurance policies required for this work, in compliance with the provisions of NIT and Bid Document, in the joint name of Northern Coalfields Limited (NCL) and the Contractor, M/s. S. K. Samanta & Co. Pvt. Ltd.
7. **SAFETY:** That you will be responsible for any damage resulting from your operations. You will also be responsible for protection of all persons including members of public and employees of the NCL and the employees of other contractors and sub-contractors and all public and private property including structures, buildings, other plants and equipment and utilities either above or below the ground. You will ensure provision of necessary safety arrangement/equipment such as barriers, sign-boards, warning lights and alarms, etc. to provide adequate protection to persons and property. You will be responsible to give reasonable notice to the Engineer-in-Charge and the owners of public or private property and utilities well in advance, when such property and utilities are likely to get damaged or injured during the performance of your works and shall make all necessary arrangements with such owners, related to removal and/or replacement or protection of such property and utilities.
8. That the matters relating to any dispute or differences arising out of this work order and subsequent contract agreement entered, based on this tender and work order shall be subject to the jurisdiction of District Court, Waidhan (Singrauli) Madhya Pradesh only.
9. That you have to submit a detailed PERT network within the time frame agreed as per NIT consisting of adequate number of activities covering all key phases of the works such as design, procurement, manufacturing, shipment, field erection activities etc. within fifteen (15) days after the date of acceptance of tender in compliance with Clause No.6 of General Terms & Conditions of Contract.
10. That the Engineer-in-Charge (EIC) for this work will be **Area General Manager, Khadia project**, NCL certifying payment due to the contractor, valuing variations to the contract, awarding extension of time and valuing compensation events. Engineer-in-charge/Designated Officer-in-charge may further appoint his representatives i.e. another person / Project Manager or any other competent person and notify to the contractor who is directly responsible for supervising the work being executed at the site, on his behalf under the Delegation of Powers of the company. However, overall responsibility, as far as the contract is concerned will be that of the Engineer-in-charge/Designated Officer-in-charge.
11. No sub-letting of the work as a whole by the contractor is permissible. Prior permission is required to be taken from the principal employer for engagement of sub- contractors in part work/piece rated work.
12. That the Paying Authority for this work will be the **Area Finance Manager, Khadia NCL**.
13. Schedule of Quantity / BOQ for this work is enclosed.

उत्तरी कोयला क्षेत्र
(पश्चिमी खंड)
(एन सीएल लिमिटेड की संपत्ति है)



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)

अंतरिम प्रबंधन कोष (Contract Management Cell)



CIN- U10102MP1985GO0003160

An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company

पता: सिंगरौली कोयला क्षेत्र, पिन- 486889

फोन: 07805- 266671, (FAX) 266669 email: cmmc.ncl@coalindia.in website: www.ncl.in

14. That you have to submit the following documents within 30 days of issue of this LOA/Work Order (except Performance Security which is to be submitted within 21 days) for execution of Agreement:

- PSD amounting to Rs. 11,55,50,000/- (Rupees Eleven Crores Fifty Five Lakhs Fifty Thousand only) as per Cl. No.1 of LOA i.e. within 21 days.
- Non Judicial Stamp Paper of Rs. 500.00
- Site handover and takeover certificate, jointly signed by Engineer-in-Charge and the Contractor.
- Labour License as per Contract Labour (Regulation & Abolition) Act, 1970.
- Insurance Policy certificates (Worker's Compensation Policy & All Risk Policy) duly pledged in the name of NCL.
- CMPF / EPF Registration certificate.
- Valid H.T. Electrical Contractor's license
- Detail Time and Progress Chart, jointly signed by Engineer-in-Charge and the Contractor.
- List of Technical & Supervisory Personnel to be deployed for execution of the work.
- Integrity Pact on Non Judicial Stamp Paper of Rs. 500.00
- Copy of PAN card
- Copy of GST Registration Certificate
- Copy of Certificate of Incorporation, Memorandum and Article of Association alongwith Power of Attorney for person signing the contract agreement.
- E-payment Mandate form as per NIT
- Any other document, if required, as per NIT / Tender document.

15. All other terms and conditions as detailed in the NIT and Bid Document and subsequent clarifications made thereof with regard to bidder's queries and uploaded on e-Procurement portal shall be followed and form an integral part of the contract agreement.

Enclosure: Schedule of Quantities / BOQ.

For further instructions, please contact Area General Manager, Khadia NCL.

Yours faithfully

[Signature]
08/01/24

General Manager (CMC)

Copy for kind information to:

1. CMD, NCL
2. Director (Technical)/Operations
3. Director (Technical)/P&P, NCL
4. Director (Finance), NCL
5. CVO, NCL

Office of the General Manager
Khadia Area

Annexure-Q



CIN- U10102MP1985GOI003160

An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company

Post- SHAKTINAGAR Distt- SONEBHADRA U.P. PIN-231222

Phone: 05446- 232274, (FAX) 232274 email: gm.khdia@gmail.com website : www.nclci.in

No. NCL/KHD/GM/24/4194

Dated: 15.03.2024

To,

M/s S.K. Samanta & Co.(P)Ltd.
Suite 4A,2/5, Sarat Bose Road
Kolkata -700020
E-mail id:kol@sksl.in

Sub: Regarding Handing over of site for the work of Planning, Design, Engineering, Construction, Fabrication, Erection, Supply, Installation, Testing, Trial run and Commissioning of Coal handling Plant of 4MTPA consisting of all Civil, Structural, Electrical & Mechanical works and all other accessories and facilities required to make it compete in all respect on Turnkey basis and Operation & Maintenance of plant for five years in Khadia OCP of NCL.

Ref: i) NIT No: GM(CMC)/NCL/NIT/KHD CHP/105 dated 31.05.2023
ii) LOA No. NCL/SGR/CMC/KHADIA CHP/LOA/2024/02 dated. 08.01.2024
iii) Letter No. NCL/KHD/GM/NewCHP/4181 dated 06.03.2024
iv) Letter No. NCL/SGR/CMC/23-24/79 dated 06.03.2024

Dear Sir,

Consequent to Joint inspection by the representatives of NCL, Khadia and M/s S.K.Samanta & Co.Pvt.Ltd on dt.11.03.24, the site has been handed over as per LOA Clause no.3. The date of commencement of the work shall be reckoned from 17.03.2024 and accordingly date of completion of construction shall be 16.03.2026.

You are requested to take-up the work observing all formalities as per LOA and commence the work only after submission of Performance Security.

Yours faithfully.

15/03/2024
Area General Manager
Khadia Area

Copy for kind information to:

1. TS to DT (P&P),NCL HQ

Copy to :

- 1) GM(E&M),NCL HQ
- 2) GM(CMC),NCL HQ
- 3) GM(C)/HOD, NCL HQ
- 4) SO(Mining), Khadia Area
- 5) Project Officer, Khadia
- 6) S.O.(Civil) , Khadia Area
- 7) S.O.(E&M) , Khadia Area
- 8) A.F.M, Khadia Area
- 9) S.O.(P) , Khadia Area

For needful action
for administration of Contract.

509

नॉर्दर्न कोलफील्ड्स लिमिटेड
(मिनीरल कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)



वन विभाग / Forest Department

CIN- U10102MP1985GOI003160

An ISO 9001, ISO 14001 & ISO 45001 Certified Company

पोस्ट-सिंगरौली कोलियरी, जिला- सिंगरौली, म.प्र., पिन 486889 / Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone: 07805- 266615, (FAX) 266652, email: gmforest.ncl@coalindia.in website : www.nclcil.in

क्रमांक: एनसीएल/मुख्यालय/पर्यावरण/वन/2023/ 666

दिनांक :-31.10.2023

प्रति,
Director,
Forest Research Institute,
Chakarata Rd, New Forest,
P.O, Indian Military Academy,
Dehradun, Uttarakhand 248006,

विषय : Submission of offer/quotation/Estimate for Development of SAL Nursery at different Projects of NCL.

महोदय,

In the Environment Clearance conditions of different projects of NCL, MoEF&CC has included the condition for establishing Sal Nursery for increasing the availability of saplings for Sal plantation in the vicinity of mining areas in NCL. The Location/Projects and area of Nursery as under:

SL. No.	Name of the projects/Location of Nursery	Area of Nursery in Ha.
1.	Jhingurda Area	5.0 Ha.
2.	Bina Area	10.0 Ha.
3.	Nigahi, Area	5.0 Ha.
4.	Khadia, Area	10.0 ha.

In view of the above you are requested to submit the offer/quotation/Estimate for Development of SAL Nursery at above locations/Projects/area of NCL.

प्रतिलिपि:

1. निदेशक (तकनीकी /परियोजना व योजना), एन सी एल.....सूचनार्थ

भुवदीय
31.10.23
महाप्रबंधक/ विभागाध्यक्ष (पर्यावरण एवं वन),
एन.सी.एल.-सिंगरौली

नॉर्थर्न कोलफील्ड्स लिमिटेड
(मिनीरत्ना कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)



वन विभाग / Forest Department

CIN- U10102MP1985GOI003160

An ISO 9001, ISO 14001 & ISO 45001 Certified Company

पोस्ट-सिंगरौली कोलिपरी, जिला- सिंगरौली, म.प्र., पिन 486889 / Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone: 07805- 266615, (FAX) 266652, email: gmforest.ncl@coalindia.in website : www.nclcil.in

क्रमांक: एनसीएल/मुख्यालय/पर्यावरण/वन/2023/ 667

दिनांक:-31.10.2023

प्रति,
Divisional Forest Officer (DFO)
District- Singrauli, Waidhan
MP-486886.

विषय : Submission of offer/quotation/Estimate for Development of SAL Nursery at different Projects of NCL.

महोदय,

In the Environment Clearance conditions of different projects of NCL, MoEF&CC has included the condition for establishing Sal Nursery for increasing the availability of saplings for Sal plantation in the vicinity of mining areas in NCL. The Location/Projects and area of Nursery as under:

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In view of the above you are requested to submit the offer/quotation/Estimate for Development of SAL Nursery at above locations/Projects/area of NCL.

प्रतिलिपि:

1. निदेशक (तकनीकी /परियोजना व योजना), एन सी एल.....सूचनाय

भवदीय
31.10.23
महाप्रबंधक/ विभागाध्यक्ष (पर्यावरण एवं वन),
एन.सी.एल.-सिंगरौली
डी.सेना

नॉर्थर्न कोलफील्ड्स लिमिटेड
(मिनीरत्न कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)

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Azadi Ka
Amrit Mahotsav

G20



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)

वन विभाग / Forest Department

CIN- U10102MP1985GOI003160

An ISO 9001, ISO 14001 & ISO 45001 Certified Company

पोस्ट-सिंगरौली कोलियरी, जिला- सिंगरौली, म.प्र., पिन 486889 / Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone: 07805- 266615, (FAX) 266652, email: gmforest.ncl@coalindia.in website : www.nclcil.in

क्रमांक: एनसीएल/मुख्यालय/पर्यावरण/वन/2023/ 668

दिनांक :-31.10.2023

प्रति,
प्रभागीय वनाधिकारी
रेनुकूट वन प्रभाग
सोनभद्र उत्तर प्रदेश - 231217

विषय : Submission of offer/quotation/Estimate for Development of SAL Nursery at different Projects of NCL.

महोदय,

In the Environment Clearance conditions of different projects of NCL, MoEF&CC has included the condition for establishing Sal Nursery for increasing the availability of saplings for Sal plantation in the vicinity of mining areas in NCL. The Location/Projects and area of Nursery as under:

SL. No.	Name of the projects/Location of Nursery	Area of Nursery in Ha.
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In view of the above you are requested to submit the offer/quotation/Estimate for Development of SAL Nursery at above locations/Projects/area of NCL.

भवदीय

31.10.23

महाप्रबंधक/ विभागाध्यक्ष (पर्यावरण एवं वन), 11C

एन.सी.एल.-सिंगरौली

सी.सी.एल.

प्रतिलिपि :

1. निदेशक (तकनीकी /परियोजना व योजना), एन सी एल.....सूचनार्थ

नॉर्थन कोलफील्ड्स लिमिटेड
(मिनिरात्र कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)



वन विभाग / Forest Department

CIN- U10102MP1985GOI003160

An ISO 9001, ISO 14001 & ISO 45001 Certified Company

पोस्ट-सिंगरौली कोलियरी, जिला- सिंगरौली, म.प्र., पिन 486889 / Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889

Phone: 07805- 266615, (FAX) 266652, email: gmforest.ncl@coalindia.in website: www.nclcil.in

क्रमांक: एनसीएल/मुख्यालय/पर्यावरण/वन/2023/ 669

दिनांक :-31.10.2023

प्रति,

सम्भागीय प्रबंधक

रीवा- सीधी परियोजना मण्डल

सीधी मध्यप्रदेश -486661.

विषय : Submission of offer/quotation/Estimate for Development of SAL Nursery at different Projects of NCL.

महोदय,

In the Environment Clearance conditions of different projects of NCL, MoEF&CC has included the condition for establishing Sal Nursery for increasing the availability of saplings for Sal plantation in the vicinity of mining areas in NCL. The Location/Projects and area of Nursery as under:

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3.	Nigahi, Area	5.0 Ha.
4.	Khadia, Area	10.0 ha.

In view of the above you are requested to submit the offer/quotation/Estimate for Development of SAL Nursery at above locations/Projects/area of NCL.

प्रतिलिपि :

1. निदेशक (तकनीकी/परियोजना व योजना), एन सी एल.....सूचनार्थ

भवदीय
31.10.23
महाप्रबंधक/ विभागाध्यक्ष (पर्यावरण एवं वन), NCL
एन.सी.एल.-सिंगरौली
बी.दीन

नॉर्दर्न कोलफील्ड्स लिमिटेड
(मिनीरल कंपनी)
(कोल इण्डिया लिमिटेड की अनुषंगी कंपनी)



Northern Coalfields Limited
(A Miniratna Company)
(A subsidiary of Coal India Limited)



वन विभाग / Forest Department

CIN- U10102MP1985GOI003160

An ISO 9001, ISO 14001 & ISO 45001 Certified Company

पोस्ट-सिंगरौली कोलियरी, जिला- सिंगरौली, म.प्र., पिन 486889 / Post- Singrauli Colliery, Distt- Singrauli, M.P. PIN-486889
Phone: 07805- 266615, (FAX) 266652, email: gmforest.ncl@coalindia.in website : www.nclcl.in

क्रमांक: एनसीएल/मुख्यालय/पर्यावरण/वन/2023/670

दिनांक :-31.10.2023

प्रति,
Managing Director,
Chhattisgarh Rajya Van Vikas Nigam Limited
Industrial Plantation Division (Korba)
Office Campus, Block - A, Sector- 24,
Nava Raipur, Atal Nagar, Raipur (C.G)- 492002
Email: vanvikasnigam@yahoo.com, cgrrvn@gmail.com

विषय : Submission of offer/quotation/Estimate for Development of SAL Nursery at different Projects of NCL.

महोदय,

In the Environment Clearance conditions of different projects of NCL, MoEF&CC has included the condition for establishing Sal Nursery for increasing the availability of saplings for Sal plantation in the vicinity of mining areas in NCL. The Location/Projects and area of Nursery as under:

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4.	Khadia, Area	10.0 ha.

In view of the above you are requested to submit the offer/quotation/Estimate for Development of SAL Nursery at above locations/Projects/area of NCL.

भवदीय
ह.शिन्डे 31.10.23

महाप्रबंधक/ विभागाध्यक्ष (पर्यावरण एवं वन),

एन.सी.एल.-सिंगरौली
श्री.सेन

प्रतिलिपि:

1. निदेशक (तकनीकी/परियोजना व योजना), एन सी एल.....सूचनार्थ



Government of India
Ministry of Jal Shakti
Department of Water Resources, River Development and Ganga Rejuvenation
Central Ground Water Authority (CGWA)

**Application for Issue of NOC to Abstract Ground Water (NOCAP)**

Welcome : khadiaproject

Previous Login Date Time: 12/02/2025 13:05:55 PM , IP Address: 1.7.142.58

[Logout](#)

Applicant Home	Apply	Feedback	Change Password	Update PAN	Profile	Grievance	Submitted Application Payment
User Request	Application Pass Book	Upload IAR	Upload Attachment	Payment for Associate			

Information[Guidelines](#)[Steps for Filling Online Application](#)**Documents Required**[Documents Required for Online Application](#)

- [Industrial](#)
- [Infrastructure](#)
- [Mining](#)

Track Status[Application Status](#)

- [Online](#)

Location

[Area Type](#)
[Segment-B Area Type](#)
[Regional office](#)
[Location](#)
[CGWA Headquarters](#)
[Know Your Environmental](#)
[Compensation\(EC\)](#)
[Know Your Penalty](#)
[Ground Water Abstraction/Restoration Charges](#)

Reports

[Applied for NOC - Online](#)
[NOC Issued-Online](#)

Contact Us[Contact](#)**Application Status****Application No :** 21-4/1269/MP/MIN/2022**Receive Date :** 12/02/2025**Name of Mining :** KHADIA OPENCAST PROJECT**Application Processing Fee :** Rs. 5000.00/- (Rupees Five Thousand Only) (Submitted: Yes)**Ground Water Abstraction/Restoration Charge :**

Charge:

S.No.	Amount	Arear Amount	Total	Ref No	Date	Status	View
1	2626175.00	0.00	2626175.00	1903240021880	19/03/2024	Success	View

☐ Environment Compensation

SN	Date From	Date To	Daily Quantum (m3/day)(KLD)	Annual Quantum (m3/Year)(KLY)	Area Type Category	Reason Name	Rate	Amount	Remark
----	-----------	---------	-----------------------------	-------------------------------	--------------------	-------------	------	--------	--------

No Record Exists.

Current Stage : Application Processing Stage**Current Status :** In Process**Address :** Central Ground Water Authority
18/11,Jamnagar House, Man Singh Road
NEW DELHI
DELHI**Current Status****Application Verification**

Receive Date	From User Name	To User Name	Forwarded User Name	Action Date	Action Internal Status	Action Comment	Copy of Application Received On
19/03/2024		(Evaluation Officer) Central Ground Water Authority	(Evaluation Officer) Central Ground Water Authority	22/03/2024	Approved	Approved and forwarded for processing	

Application Processing

Receive Date	From User Name	To User Name	Forwarded User Name	Action Date	Action Internal Status	Action Comment	Ground Water Recom Per Day	Ground Water Recom Annual
--------------	----------------	--------------	---------------------	-------------	------------------------	----------------	----------------------------	---------------------------

515

22/03/2024	(Evaluation Officer) Central Ground Water Authority	(Evaluation Officer) Central Ground Water Authority	(Approval Officer) Central Ground Water Authority	12/02/2025	Forward	Forwarded to AO (HQ)	2878.00	1050470.00
12/02/2025	(Evaluation Officer) Central Ground Water Authority	(Approval Officer) Central Ground Water Authority			In Process		2878.00	1050470.00

NOC Processing						
Receive Date	From User Name	To User Name	Forwarded User Name	Action Date	Action Internal Status	Action Comment
No Record for this Stage.						

NOC Disbursement						
Receive Date	From User Name	To User Name	Forwarded User Name	Action Date	Action Internal Status	Action Comment
No Record for this Stage.						

[Go Back](#)

NORTHERN COALFIELDS LIMITED
OFFICE OF THE GENERAL MANAGER: KHADIA AREA
CIVIL DEPARTMENT
PO: KHADIA PROJECT, DISTT. SONEBHADRA(UP)-231222

No.-2620/Kh/C/LOA/Providing One no. Wheel Washing/2299/2024/ 394 Dated- 18-08-2024

To,

M/s Shakti Engineering,
 Bus Stand, Shaktinagar,
 Distt.- Sonebhadra (UP)-231222

Bank A/C No. 20896454342, Indian Bank, Shaktinagar.
 PAN No. AUAPS7002E
 GST No. 23AUAPS7002E1Z4
 Email ID- Shakti.sktn@gmail.com

Sub-LOA for the work "Providing one no. wheel washing facility with complete recirculation system at the exit gate of Khadia Project with three years AMC after one year warranty"

Ref: (i) NIT No.-GM/KHD/C/24-25/ETN-05 Dated: 22.05.2024
 (ii) Tender ID No- 2024_NCL_308807_1
 (iii) Your offer dated 10.06.2024

Dear Sir,

With reference to the above we are pleased to convey that your offer to undertake the subject work at a total value of **Rs. 11314769.11 (Rs. 9588787.38 + GST @18 % Rs. 1725981.73) (Rupees One Crore Thirteen lakh Fourteen Thousand Seven Hundred & Sixty Nine and paise Eleven)** only has been accepted subject to the following stipulations:

- 1-All the materials and equipment required for the work will be arranged by you.
- 2-You are required to submit the Registration/license under Contract Labour (R&A) Act, 1970 within 10 (Ten) days from the date of receipt of this letter of acceptance, if required.
- 3-The Performance Security (first part of security deposit) shall be **5% of the contract value amounting to Rs. 479440.00 (Rupees Four lakh Seventy Nine Thousand Four Hundred Forty) only. The Earnest money amounting to Rs. 172400.00** deposited by you along with the tender through Axis Aggregator Bank **PRN No. 3199881058169** has been taken as part of Performance Security. All ruining account bills shall be paid @ 95% of work value without GST. This 5% deduction towards retention money will be the second part of security deposit.
- 4-You are required to submit the following **within 21 (twenty one) days** from the date of issue of this letter of acceptance for issuing formal work order and executing agreement for the work.
 - (i) **Rs. 307040.00 towards balance amount of 5% Performance Security** in acceptable form.
 - (ii) **Rs. 345963.08** towards amount of Additional Performance Security in acceptable form.
 - (iii) Copy of Income Tax PAN
 - (iv) Copy of **UPGST** registration Certificate & Service Accounting Code (SAC) of works/services.
 - (v) Copy of Memorandum and Article of Association/Power of attorney/partnership deed, if any.
 - (vi) Copy of CMPF/EPF Registration or Copy of Affidavit for implementation of CMPF Act.
 - (vii) Authorization form for e-payment duly filled-in.
 - (viii) PERT/BAR chart showing percentage of periodical progress for completion of work.
 - (ix) Non-judicial Stamp Paper for Rs. 500/- of UP State.
 - (x) Copy of the letter of handing over the site.
 - (xi) A certificate from practicing Chartered Accountant having a valid Membership Number for complying of Anti-Profiting Clause U/S 171 as well as Office Memorandum F. No. 296/07/2017-CX.9 dated 15.06.2017 issued by Department of Revenue, Ministry of Finance, GOI, if required. If Security Money is deposited in the form of Bank Guarantee, it should be issued through Structural financial Messaging System (SFMS) Platform as per format given in the Tender Document.

- (xii) That you have to take necessary insurance for the full contract period for (i) Workmen compensation policy, (ii) Contractors all risk policy in the joint name of **Northern coalfields limited and the contractor**. The policies and certificates for the insurance as per clause no. 13 (xviii) of General Terms & Condition of Tender document shall be delivered by you to the Engineer-in-charge for his approval before commencement of the work.
- 5- The work shall be completed within **1580 (One Thousand Five Hundred Eighty)** days (i.e. 120 days for construction & 1460 days for operation & maintenance, total period 1580 days). The work shall be deemed to have commenced on the expiry of 10 (ten) days from the issue of Letter of Acceptance of Tender or 7 (Seven) days after handing over the site of work whichever is later.
- 6- In case you, without reasonable cause or valid reasons, commits default in commencing the work as per clause no 5 of the LOA, the company shall, without prejudice to any other right or remedy, be at liberty, by giving 15 day's notice in writing to you to commence the work, failing which to **Forfeit the Earnest Money** deposited by you, rescind the Letter of Acceptance of Tender/Work order and debarring to take part in the future re-tender along with other actions as per tender documents.
7. In case you fail to submit the performance security and Additional performance security, if any within 21 days
- a) Then the award of the work shall be cancelled with forfeiture of earnest money.
 - b) Debar from participating in future tenders for a minimum period of 12 months as per NIT.
- 8- The work should be executed as per General Terms & Conditions, Additional Terms & Conditions, Special Terms & Conditions, CPWD Specification/BIS Standards/description of the items of the accepted Tender documents and instructions of EIC.
- 9- You shall not pay less than the minimum Wages Act or such other legislation or award of minimum wages fixed by the respective State Govt. Or Central Govt. as may be in force.
- 10- You should ensure implementation of CMPF and Miscellaneous Provision Act 1948 or Employees Provident Fund and Miscellaneous Provisions Act, 1952 as the case may be and allied scheme framed there under in respect of workers deployed by you and will have to recover statutory dues and deposit the same along with employer's contribution (Contractor's share) to the respective CMPF/EPF Office and to submit statutory returns under intimation to Principal Employer.
- 11- All Texas (Except GST), local, municipal, provincial or central etc. and cess, royalties etc as payable shall be to the contractor's account and shall be deemed to have been included in the tendered rate for the work to be executed.
- 12- Regarding GST, the following may please be noted:
- a- GST will be reimbursed on production of uploaded invoice/documentary evidence. Amount of statutory levies like CGST, SGST or IGST will be released when the same will appear in GSTR-2A of NCL in the common portal of GST and after submission of documentary evidence of deposition of GST taxes and filing of GST returns.
 - b- You will have to pass in input tax credit by way of enclosing original tax input invoice with bill.
 - c- All invoice submitted by you will have to be in the form of GST invoice giving all details as required under the law. You will raise invoice strictly adhering to provisions of Section 31 under CGST Act 2017 along with Rule 46 & 47 of CGST Rule, 2017. You will indicate the rate as well as amount of CGST, SGST or IGST in invoice. You will upload the details of invoice on GST portal as per provisions of GST Act. Invoice issued by you should bear GST Registration Number of NCL(23AABCN4884HEM1ZE (MP) & 09AABCN4884H1Z4 (UP) to enable NCL to claim input tax credit.
 - d- You will file all the Returns and details as applicable under GST laws & rules with due dates.
 - e- You will give an undertaking on invoice or as separate Annexure along with the invoice that the Invoice/applicable GST returns has been/will be uploaded on GST Portal within due time as prescribed in CGST Act and CGST, SGST or IGST has been deposited as per the provision of GST Act and rules thereof.
 - f- If there is any delay of payment against the invoice due to your fault and if any reversal of input tax arises, the same will be recovered from you along with interest and penalty if any, as paid by NCL/Khadia Project due to reversal.
 - g- In case the GST rating of vendor on the GST Portal/Government's official website is negative/black listed at any stage even after award of work, NCL has right to cancel the letter of award.. NCL shall not be obliged or liable to pay or reimburse GST to such vendor and shall also be entitled to deduct/recover such GST along with all penalties/interest, if any incurred by NCL.

- h- You will issue credit note as per provisions of Rule 53 of CGST Rule, 2017 on quality deduction or liquidated damages, if any arises.
- i- If you default in uploading the invoice/applicable GST returns or default in deposit of applicable GST taxes, NCL reserves the right to upload such defaulter on NCL website and may also debar you from participating in future tenders for a minimum period of one year.

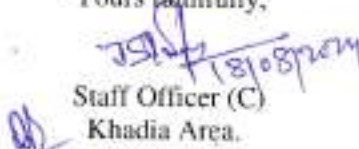
13.

Sl No	Estimated cost put to tender incl GST	Quotes % by L-1 bidder w.r.t estimated cost put to tender	Accepted/awarded amount incl GST
1	Rs. 13791771.22	-17.96%	Rs. 11314769.11

14. As per Clause no. 8.4 of NIT, only material conforming to approved samples shall only be brought to site, as such, you immediately contact **Project Engineer (C) & Incharge of the work** for the approval of samples of materials to be used in the work.
15. **The Project Engineer(C)/Khadia** shall be **Incharge of the work (ICW hence forth) and Second Level Check Officer**. Please contact the ICW/**Project Engineer(C)** for receiving work details, scope of work, drawings, sites & instructions regarding commencement of work.
16. **SO(C)/Khadia will be Engineer-In-Charge of the work (EIC)**. The ICW shall be authorized representative of EIC for the work.
17. The ICW/authorized representative of EIC is to ensure the list of approved materials to be used in the work is conveyed to the contractor in writing alongwith a copy to Quality Control Cell, HQ before commencement of work as per Clause 8.4 of NIT.
- 18- You are hereby requested to contact **Manager(P)/Nodal Officer Biometric Attendance/Khadia** and to observe following system regarding Attendance & payments of contract workers and bill payments for the work:-
- All the contract workers engaged for the subject work shall be covered with Biometric Attendance system for payment of wages, which is under control of Nodal Officer (Biometric Attendance) of Personnel Department.
 - You are requested to issue photo I-card to contract workers engaged for the work, containing details like Name, AADHAR No., LOA No. and photograph and ensure their registration in the Biometric Attendance system under close supervision of Nodal Officer (Biometric Attendance)/Khadia.
 - Accordingly, Nodal Officer (Biometric Attendance)/Khadia will provide copy of the I-card alongwith Biometric Registration details of individual contract workers to the civil Engg. Department.
 - You shall ensure submission of **Monthly Attendance Sheet** of daily attendance of contract workers to the respective **Site In-Charge** of the work, which will be sent to the Nodal Officer (Bio-metric Attendance)/Khadia after due certification.
 - Nodal Officer (Biometric Attendance)/Khadia will issue LPC (Labour payment certificate) on monthly basis to you, as per monthly attendance sheet sent from civil department. No RA bill or final bill shall be sent to the personnel department for any certification on the bills.
 - You are to follow the above system without any lapses/fail, otherwise, all the onus will lie on you in case of otherwise, and you will be responsible solely as such for any losses &/or delays in payment for the work executed & accepted by the department.
- 19- All the clauses of safety code on the tender document, as laid down in additional safety measures to be taken by the contractor, are to be strictly followed.
- 20- Please contact **Project Engineer(Civil)/Khadia** for commencement of the work.

Encl -BOQ

Yours faithfully,


 Staff Officer (C)
 Khadia Area.

Copy to:

- 1) GM/Khadia Area.
- 2) GM(C)/NCL/Singrauli.
- 3) PO/KHD

-4-

- 4) AFM/Khadia: - Ref to: Capital Budget No.-KHD/CB/24-25/Environment/172/01 dtd. 12.08.2024 for Rs. 7083772.91 against Capital Budget BE 2024-25 Point NO. 15.1. & Revenue Budget vide FD No.-FC/AFM/KHD/2024-25/ENVIRONMENTAL EXP/92/34 for Rs. 286946.78 and Dated 11.08.2024 & Noted for 2025-26 Rs.1147787.14, 2026-27 Rs.1147787.14, 2027-28 Rs.1147787.14, 2028-29 Rs 860840.35 however fund will be certified in the respective years of expenditure subject to availability & provisio of budget.
- 5) SO (P), Khadia Area- with a request to observe minimum wages etc. as per laid down guidelines.
- 6) Area Safety Officer/Khadia Area- To observe safety norms.
- 7) ALC(C)/LEO(C), Allahabad, 189/A-4, Alopibagh, PO-Daraganj, Prayagraj(UP)
- 8) Project Engineer (Civil)/Khadia Project, SLC Officer
- 9) Dy. Manager(Civil)/Mines, Khadia Project, FLC Officer. (First Level Check Officer)
- 10) Sri B. K. Shukla, EA(C), Khadia , MEL. Engineer and Site In-Charge(SIC)





Bid Number/बोली क्रमांक (बिड संख्या):
GEM/2025/B/5827091
Dated/दिनांक : 16-01-2025

Bid Document/ बिड दस्तावेज़

Bid Details/बिड विवरण	
Bid End Date/Time/बिड बंद होने की तारीख/समय	31-01-2025 13:00:00
Bid Opening Date/Time/बिड खुलने की तारीख/समय	31-01-2025 13:30:00
Bid Offer Validity (From End Date)/बिड पेशकश वैधता (बंद होने की तारीख से)	120 (Days)
Ministry/State Name/मंत्रालय/राज्य का नाम	Ministry Of Coal
Department Name/विभाग का नाम	Coal India Limited
Organisation Name/संगठन का नाम	Northern Coalfields Limited
Office Name/कार्यालय का नाम	Ncl Singrauli Madhya Pradesh
क्रेता ईमेल/Buyer Email	gmem.ncl@coalindia.in
Item Category/मद केटेगरी	Leasing of Electric Vehicles (Long Term) - Wet Lease; Tata Nexon EV or Equivalent as per Bid Document; 2250 KM Per Month and 12 Hours per day; 60 Months Lease; White
Contract Period/अनुबंध अवधि	5 Year(s) 1 Month(s) 18 Day(s)
MSE Exemption for Years of Experience and Turnover/ अनुभव के वर्षों से एमएसई छूट	No
Startup Exemption for Years of Experience and Turnover/ अनुभव के वर्षों से स्टार्टअप छूट	No
Document required from seller/विक्रेता से मांगे गए दस्तावेज़	Experience Criteria, Certificate (Requested in ATC), Additional Doc 1 (Requested in ATC), Additional Doc 2 (Requested in ATC), Additional Doc 3 (Requested in ATC), Additional Doc 4 (Requested in ATC) *In case any bidder is seeking exemption from Experience / Turnover Criteria, the supporting documents to prove his eligibility for exemption must be uploaded for evaluation by the buyer
Do you want to show documents uploaded by bidders to all bidders participated in bid?/	No
Bid to RA enabled/बिड से रिवर्स नीलामी सक्रिय किया	No
Type of Bid/बिड का प्रकार	Two Packet Bid
Time allowed for Technical Clarifications during technical evaluation/तकनीकी मूल्यांकन के दौरान तकनीकी स्पष्टीकरण हेतु अनुमत समय	7 Days

Bid Details/बिड विवरण	
Estimated Bid Value/अनुमानित बिड मूल्य	98112263
Evaluation Method/मूल्यांकन पद्धति	Total value wise evaluation
Financial Document Indicating Price Breakup Required/मूल्य दर्शाने वाला वित्तीय दस्तावेज ब्रेकअप आवश्यक है	Yes
Arbitration Clause	No
Mediation Clause	No

EMD Detail/ईएमडी विवरण

Advisory Bank/एडवाइजरी बैंक	ICICI
EMD Amount/ईएमडी राशि	245300

ePBG Detail/ईपीबीजी विवरण

Required/आवश्यकता	No
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(a). EMD EXEMPTION: The bidder seeking EMD exemption, must submit the valid supporting document for the relevant category as per GeM GTC with the bid. Under MSE category, only manufacturers for goods and Service Providers for Services are eligible for exemption from EMD. Traders are excluded from the purview of this Policy./जेम की शर्तों के अनुसार ईएमडी छूट के इच्छुक बिडर को संबंधित केटेगरी के लिए बिड के साथ वैध समर्थित दस्तावेज प्रस्तुत करने हैं। एमएसई केटेगरी के अंतर्गत केवल वस्तुओं के लिए विनिर्माता तथा सेवाओं के लिए सेवा प्रदाता ईएमडी से छूट के पात्र हैं। व्यापारियों को इस नीति के दायरे से बाहर रखा गया है।

(b). EMD & Performance security should be in favour of Beneficiary, wherever it is applicable./ईएमडी और संपादन जमानत राशि, जहां यह लागू होती है, लाभार्थी के पक्ष में होनी चाहिए।

Beneficiary/लाभार्थी :

Northern Coalfields Limited
NCL Singrauli Madhya Pradesh, COAL INDIA LIMITED, Northern Coalfields Limited, Ministry of Coal
(Northern Coalfields Limited)

MII Compliance/एमआईआई अनुपालन

MII Compliance/एमआईआई अनुपालन	Yes
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MSE Purchase Preference/एमएसई खरीद वरीयता

MSE Purchase Preference/एमएसई खरीद वरीयता	Yes
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1. Purchase preference to Micro and Small Enterprises (MSEs): Purchase preference will be given to MSEs as defined in Public Procurement Policy for Micro and Small Enterprises (MSEs) Order, 2012 dated 23.03.2012 issued by Ministry of Micro, Small and Medium Enterprises and its subsequent Orders/Notifications issued by concerned

Ministry. If the bidder wants to avail the Purchase preference for services, the bidder must be the Service provider of the offered Service. Relevant documentary evidence in this regard shall be uploaded along with the bid in respect of the offered service. If L-1 is not an MSE and MSE Service Provider (s) has/have quoted price within L-1+ 15% of margin of purchase preference /price band as defined in the relevant policy, then 100% order quantity will be awarded to such MSE bidder subject to acceptance of L1 bid price. The buyers are advised to refer to the [OM No.1_4_2021_PPD_dated_18.05.2023](#) for compliance of Concurrent application of Public Procurement Policy for Micro and Small Enterprises Order, 2012 and Public Procurement (Preference to Make in India) Order, 2017. Benefits of MSE will be allowed only if the credentials of the service provider are validated on-line in GeM profile as well as validated and approved by the Buyer after evaluation of submitted documents.

2. Estimated Bid Value indicated above is being declared solely for the purpose of guidance on EMD amount and for determining the Eligibility Criteria related to Turn Over, Past Performance and Project / Past Experience etc. This has no relevance or bearing on the price to be quoted by the bidders and is also not going to have any impact on bid participation. Also this is not going to be used as a criteria in determining reasonableness of quoted prices which would be determined by the buyer based on its own assessment of reasonableness and based on competitive prices received in Bid / RA process.

Excel Upload Required/एक्सेल में अपलोड किए जाने की आवश्यकता :

BID SUBMISSION CONFIRMATION (BSC) SHEET - [1737012504.xlsx](#)

Additional Qualification/Data Required/अतिरिक्त योग्यता /आवश्यक डेटा

Buyer may upload Scope of Work for the bid:[1737012512.pdf](#)

Additional Condition pertaining to Past Experience/Service specific Turnover - 1 (Also specify the documents to be uploaded by Service Provider in Compliance of this condition):[1737012528.pdf](#)

Leasing Of Electric Vehicles (Long Term) - Wet Lease; Tata Nexon EV Or Equivalent As Per Bid Document; 2250 KM Per Month And 12 Hours Per Day; 60 Months Lease; White (30)

Technical Specifications/तकनीकी विशिष्टियाँ

Specification	Values
Core	
Type of Lease	Wet Lease
Type of Vehicle	Tata Nexon EV or Equivalent as per Bid Document
Packages	2250 KM Per Month and 12 Hours per day
Lease Period	60 Months Lease
Color of the Vehicle	White
District	NA
Zipcode	NA
Addon(s)/एडऑन	

Additional Specification Documents/अतिरिक्त विशिष्टि दस्तावेज़

Consignees/Reporting Officer/परेषिती/रिपोर्टिंग अधिकारी

S.No./क्र. सं.	Consignee Reporting/Officer/ परेषिती/रिपोर्टिंग अधिकारी	Address/पता	Number of Vehicles	Additional Requirement/अतिरिक्त आवश्यकता
1	Aman Lavania	486890,CENTRAL STORES, JAYANT COLLIERY, PO - JAYANT	1	Number of Lease Months within Contract Period : 60
2	Shiveshwar Prasad	486887,REGIONAL STORES, NCL, AMLOHRI PROJECT, PO - AMLOHRI	1	Number of Lease Months within Contract Period : 60
3	Rohan Kumar Lahangir	231224,O/O GENERAL MANAGER, E&M DEPARTMENT, KAKRI PROJECT, KAKRI, DISTT - SONEBHADRA (U.P. - 231224)	4	Number of Lease Months within Contract Period : 60
4	Amit Pratap Singh	231222,GM OFFICCE, E&M DEPARTMENT, KHADIA PROJECT, DISTT - SONBHADRA (U.P.) 231222	3	Number of Lease Months within Contract Period : 60
5	Shailendra Kumar	486890,O/O GM CWS JAYANT, E&M DEPARTMENT, CWS JAYANT, SINGRAULI, M.P. 486890	8	Number of Lease Months within Contract Period : 60
6	RAMESH KUMAR MISHRA	486892,E&M DEPARTMENT, BLOCK-B PROJECT, NCL PO - GORBI/ BLOCK-B	5	Number of Lease Months within Contract Period : 60
7	Jitendra Kumar Prajapati	231220,OFFICE OF STAFF OFFICER (E&M), GM'S OFFICE, KRISHNASHILA PROJECT, BINA	5	Number of Lease Months within Contract Period : 60
8	Bhupendra Singh	486890,REGIONAL STORES, JAYANT PROJECT, NCL, PO - JAYANT, DISTT - SINGRAULI M.P.	3	Number of Lease Months within Contract Period : 60

Buyer Added Bid Specific Terms and Conditions/क्रेता द्वारा जोड़ी गई बिड की विशेष शर्तें

1. Buyer Added Bid Specific ATC

Buyer Added text based ATC clauses

Bidders are advised to go through Buyer Uploaded ATC for Eligibility Criteria, Evaluation Process, Terms and Condition of Contract, Location-wise deployment, Applicable Performance Security and Additional Performance Security, Arbitration Clauses etc.

2. Buyer Added Bid Specific ATC

Buyer uploaded ATC document [Click here to view the file.](#)

Disclaimer/अस्वीकरण

The additional terms and conditions have been incorporated by the Buyer after approval of the Competent Authority in Buyer Organization, whereby Buyer organization is solely responsible for the impact of these clauses on the bidding process, its outcome, and consequences thereof including any eccentricity / restriction arising in the bidding process due to these ATCs and due to modification of technical specifications and / or terms and conditions governing the bid. If any clause(s) is / are incorporated by the Buyer regarding following, the bid and resultant contracts shall be treated as null and void and such bids may be cancelled by GeM at any stage of bidding process without any notice:-

1. Definition of Class I and Class II suppliers in the bid not in line with the extant Order / Office Memorandum issued by DPIIT in this regard.
2. Seeking EMD submission from bidder(s), including via Additional Terms & Conditions, in contravention to exemption provided to such sellers under GeM GTC.
3. Publishing Custom / BOQ bids for items for which regular GeM categories are available without any Category item bunched with it.
4. Creating BoQ bid for single item.
5. Mentioning specific Brand or Make or Model or Manufacturer or Dealer name.
6. Mandating submission of documents in physical form as a pre-requisite to qualify bidders.
7. Floating / creation of work contracts as Custom Bids in Services.
8. Seeking sample with bid or approval of samples during bid evaluation process. (However, in bids for [attached categories](#), trials are allowed as per approved procurement policy of the buyer nodal Ministries)
9. Mandating foreign / international certifications even in case of existence of Indian Standards without specifying equivalent Indian Certification / standards.
10. Seeking experience from specific organization / department / institute only or from foreign / export experience.
11. Creating bid for items from irrelevant categories.
12. Incorporating any clause against the MSME policy and Preference to Make in India Policy.
13. Reference of conditions published on any external site or reference to external documents/clauses.
14. Asking for any Tender fee / Bid Participation fee / Auction fee in case of Bids / Forward Auction, as the case may be.
15. Any ATC clause in contravention with GeM GTC Clause 4 (xiii)(h) will be invalid. In case of multiple L1 bidders against a service bid, the buyer shall place the Contract by selection of a bidder amongst the L-1 bidders through a Random Algorithm executed by GeM system.

Further, if any seller has any objection/grievance against these additional clauses or otherwise on any aspect of this bid, they can raise their representation against the same by using the Representation window provided in the bid details field in Seller dashboard after logging in as a seller within 4 days of bid publication on GeM. Buyer is duty bound to reply to all such representations and would not be allowed to open bids if he fails to reply to such representations.

All GeM Sellers / Service Providers are mandated to ensure compliance with all the applicable laws / acts / rules including but not limited to all Labour Laws such as The Minimum Wages Act, 1948, The Payment of Wages Act, 1936, The Payment of Bonus Act, 1965, The Equal Remuneration Act, 1976, The Payment of Gratuity Act, 1972 etc. Any non-compliance will be treated as breach of contract

and Buyer may take suitable actions as per GeM Contract.

This Bid is governed by the [General Terms and Conditions/सामान्य नियम और शर्तें](#), conditions stipulated in Bid and [Service Level Agreement](#) specific to this Service as provided in the Marketplace. However in case if any condition specified in General Terms and Conditions/सामान्य नियम और शर्तें is contradicted by the conditions stipulated in Service Level Agreement, then it will over ride the conditions in the General Terms and Conditions.

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---Thank You/धन्यवाद---

Final Report

On

Scientific study of fly ash utilization/dumping/Mixing in the OB of the running/active mines of NCL along with its viability and safety aspect of man and machinery

For

Khadia Opencast Project

Feb 2022

Submitted By

DEPARTMENT OF MINING ENGINEERING**INDIAN INSTITUTE OF TECHNOLOGY****(BANARAS HINDU UNIVERSITY)****VARANASI 221 005****UP (INDIA)**

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1.0 Introduction

1.1 Project Brief

Northern Coalfields Limited (NCL), a subsidiary company of Coal India Limited (CIL) is operating Opencast Mines in Singrauli coalfield. The Singrauli Coalfield is divided into two basins namely Main basin and Moher sub-basin. Moher sub-basin having an area of 312 Sq.KM. Out of which 80 Sq.KM on Eastern side lies in Sonebhadra Distt. of U.P. and rest in Singrauli Distt. of M.P. The Main basin is located west of Waidhan. The Moher sub basin is the centre of mining activities. The southern half of the Moher basin is preserved while the northern half was up thrown by a metamorphic fault and is eroded, hence called Moher Sub basin.

The PR for Khadia OCP (4Mtpa to 10Mtpa) was prepared by RI-VI, CMPDI with coal winning by Department Shovel-Dumper and Partial OB removal by outsourcing (Dragline departmental) on 28.06.2011. The existing Environmental Clearance of Khadia OCP is 14 MTPA. To meet the growing demand of coal, it has been proposed to increase the production capacity of Khadia OCP from 14Mtpa to 20Mtpa, incremental 6Mtpa. To augment the production for an optimum life of the project, it is necessary to encompass the additional coal reserves from the dip side blocks, namely, remaining part of Khadia block, small part of Ruhela Geological Coal Block and a small part of Marrak Geological Coal Block.

1.2 Scope of the work

Fly Ash is the fine particulate matter outcome of coal-burning, mainly primarily from the coal-based electricity generation plants. Fly ash is considered a harmful product for the environment and it is becoming a concern for everyone. Fly ash disposal in an unscientific way affects the local ecosystems due to the heavy metal pollution through erosion and leachate generation. Fly ash contaminates surface and groundwater, soils and vegetation by mobilization of its hazardous metals.

Ministry of Environment and Forest has notified to reduce the impact of fly ash on the environment and to lower the requirement of land for its disposal. MOEF also compelled 100% utilization of fly ash. Therefore, many mining companies plan to get back the fly ash generated from the neighboring coal-fired thermal power plants, namely NTPC, Anapara, Renusagar, etc. These companies are facing tremendous space constraints. The enormous quantities of fly ash occupy vast tract of land area, and adversely affects the environment due to its storage and disposal problem.

As per Fly Ash Notification dated 3rd November, 2009, issued by MoEF&CC, Government of India, it is mandated to use fly ash in different sectors with the objective of its gainful utilization. This Notification states that:

- i. No person or agency shall within 50 kms (by road) from coal or lignite based thermal power plants, undertake or approve stowing of mines without using at least 25% of fly ash on weight to weight basis, of the total stowing material used and this shall be done under the guidance of the Director General of Mines Safety (DGMS), and*
- ii. No person or agency shall within 50 kms (by road) from coal or lignite based thermal power plants, undertake or approve without using at least 25% of fly ash on volume to volume basis of the total material used for external dump of overburden and the same percentage in upper benches of back filling of opencast mines and this shall be done under the guidance of the Director General of Mines Safety (DGMS).*

Therefore, scientific assessment of fly ash from selected locations is required to be carried out and analyzed for any possibility of its disposal in the mine by mixing with overburden materials in appropriate proportions considering the environmental, safety and other statutory conditions. Based on the above discussion the following objectives have been taken for the present project study

1. Geotechnical Study of Overburden dump form mine
2. Geotechnical study of Fly ash sample collected from power plants
3. Geotechnical investigation of mix overburden and fly ash
4. Fly ash characterization study
5. Leaching study
6. Slope stability of mix overburden and fly ash
7. Traffic study for fly ash dumping (Route and Mode of Fly ash Transportation).

1.3 Work order and term of reference

The NCL Board in their 265th meeting vide reference no. NCL/SGRL/R&D/2021/90, dated 10.07.2021, has approved the subject proposal –“Scientific study of fly ash utilization/dumping/Mixing in the OB of the running/active mines of NCL along with its viability and safety aspect of man and machinery”. The Department of Mining Engineering, Indian Institute of Technology (Banaras Hindu University) was assigned the job vide work order No.NCL/SGRL/R&D/2021/90, dated 10.07.2021.

2.0 Study Area

2.1 Project site

Khadia OCP is an existing working mine under sanctioned Khadia OCP (10 Mtpa). The project has Environmental Clearance for production capacity of 14.0 Mtpa within the leasehold boundary of sanctioned Project Report of 10 Mtpa. The existing Khadia OCP (10Mtpa) is working in Khadia Geological Coal Block, which is located in the South-eastern part of Moher Sub-Basin of Singrauli Coalfield and lies partly in Sonebhadra district of Uttar Pradesh and partly in Singrauli district of Madhya Pradesh.

The proposed PR of Khadia Expansion OCP (16 Mtpa; Peak Capacity 20 MTPA). incremental 6 Mtpa has been envisaged with inclusion of remaining part of Khadia Geological Coal Block, part of Ruhela Geological Coal Block and a small part of Marrak Geological coal Block. Khadia Geological Block having an area of 7.72 sq.km. and Geological reserve of 287.59 Mt is located in the South-eastern part of Moher Sub-basin of Singrauli Coalfield. Ruhela Geological Block having an area of 4.82 Sq.km and Geological reserve of 228.43 Mt lies in the dip side of Khadia Geological Block. Marrak Geological Block having an area of 5.37 Sq.km and Geological reserve of 162.82 Mt lies in the Eastern side of Khadia Geological Block.

Krishnashila OCP (4Mtpa) lies on its east and Dudhichua OCP (20Mtpa) in the west. The terrain of the opencast minefield represents the hilly plateau with varying RLs of about 290m 490m above MSL. The drainage of the area is controlled by many seasonal nallas with southerly flow in a major portion of the minefield which discharges into Balia Nalla and which ultimately drains into the GBP Sagar in south. There are three coal seams namely Turra (14.57-22.56m), Purewa Bottom (5.60-13.39m) and Purewa Top (3.75-10.35m) which are envisaged to be mined within the quarry boundary.



Figure 1: Location MAP of Khadia OCP

2.2 Location, topography and drainage

The area is undulating and hilly terrain. The elevation of the plateau varies from 425m to 490m above MSL (Mean Sea Level). It stands out as a hilly plateau with elevations as high as 490m. The mining block area maintains an undulating rugged topography (RL varying from 290 m to 490 m) sloping towards south and west. The base of the plateau extends with elevation around 290m above MSL.

Khadia OCP is situated partly in district of Sonebhadra (UP) and partly in the district of Singrauli (MP), within Singrauli Coalfield. The Khadia block lies between Latitude $24^{\circ}7'26''$ & $24^{\circ}8'47''$ and Longitude $82^{\circ}41'40''$ & $82^{\circ}44'47''$ and is covered in the Survey of India Toposheet 63-L/12 (R.F. 1:50,000) and Special sheet Nos. 9 & 11 (R.F. 1:10,000). Khadia block is adjacent to Dudhichua OCP in the west and Krishnashila OCP in the east.

Climate

The climate of the area is dry to moist, tropical with well-defined summer from April to June, rainy season from July to September and winter from November to February. The temperature varies from a maximum of 48°C to a minimum of 8°C. The area receives an average annual rainfall of 1200.00 mm (Based on rainfall data from 2006 onwards). The daily highest rainfall has been recorded as 264.40 mm on 18.07.71

Drainage

The Khadia block stands out as a plateau above the plains on its south. The plateau is pronounced by steep escarpment facing south rising from an elevation of 290 m at the base to 425 m at the top of the plateau. The area on the top of the plateau is gently undulating except one hill in the north-east corner have an altitude of 489 m. The general elevation of the plateau varies from 420-440 m.

The drainage is controlled by a few seasonal nallas with southerly flow. All these seasonal nallas meet the Balia Nalla in the south which is semi-perennial and join the GBP Sagar on the south.

Numerous seasonal nallas flowing from north to south and south to north drain through this area and meet the master drain the Rihand dam (Govind Ballabh Pant Sagar) which is located south of this area. The local drainage is mainly radial in nature. Tippa Jharia nala drains the Khadia (Expansion) OCP area in north and Ballia nalla drains this OCP in south and meet the Gobind Ballabh Pant Sagar.

Accessibility and Communication

Khadia OCP is well connected by all weather roads. The nearest railway station Shaktinagar is at a distance of about 2 km. Another railway station 'Singrauli' on Katni-Chopan Branch Line of East-Central Railway is at a distance of about 12 km from the project. The nearest town Waidhan, the Singrauli district HQ is located about 12 km to the south, Renukut (UP) is 50 Km in the east and Varanasi (UP) is about 225 km in the north. Renukut-Waidhan all weather road passes through the southern part of the block without blocking any coal reserves.

2.3 Geological features

The Singrauli coalfield (Latitude 23°46'37'' N & 24°13'17'' N and Longitude 81°45'24'' E & 82°47'50'' E) covering an area of 2375sq. Km is centrally located in the map of India. It constitutes the northern most part of the Son-Mahanadi master Gondwana basin. Singrauli Coalfield is divided in two parts on the basis of geological setup, namely (i) Moher sub-basin (300sq km, eastern part) and (ii) Main basin (2075 sq. Km western part), separated by a basement high almost parallel to the Kachan River. The Khadia block is located in the south eastern portion of Moher Sub-basin and has been named after Khadia village situated in the south of the block.

Geology of the Block

PR for Khadia Expansion OCP consists Khadia Geological Coal Block, part of Ruhela Geological Coal Block and a small part of Marrak Geological Coal Block.

The entire block consist rocks of Barakar formations are exposed in this block along with recent soil/alluvium cover at places. Barakar Formation consists mainly sandstone, coal and occurrence clay horizons. The generalised sequence as established by GSI and updated by IBM, NCDC and CMPDI is as follows:

Table 1: The general geological sequence of North Eastern Part of Singrauli Coalfield

Group	Formation	Lithology	Thickness (m)
Damuda Group Lower Gondwana	Recent	Soil/ Alluvium Sandstone, Carbonaceous shale & fireclay	150
	Raniganj Formation	Coal, shaly coal & Carbonaceous shales (Jhingurdah Top seam)	131 to 135
		Medium grained sandstone and shale	39 to 58
		Coal, shaly coal & Carbonaceous shales (Jhingurdah Bottom seam)	10 to 15
		Sandstone, carbonaceous shale with coaly stringes	60
	Barren Measures	Medium to coarse grained sandstone with greenish shale Bands changing into red & green clay near outcrop	125
		Carbonaceous shale, sand-stone & thin coal bands Coal, shaly coal and carbonaceous shale (Panipahari Seam)	45 to 70 1 to 2

		Fine to coarse grained sandstone	110 to 125
		Coal & shale	10 to 0
		Sandstone and shale	30 to 40
		Carbonaceous shale, shaly coal and coal (Purewa Top Seam)	8 to 12 8 to 12
	Barakar Formation	Fine to coarse grained sandstone	0 to 60
		Coal Carbonaceous shale & shaly coal (Purewa Bottom Seam)	10 to 14
		Fine to coarse grained sandstone	45 to 75
		Coal, carbonaceous shale & shaly coal (Turra Seam)	14 to 23
		Fine to coarse grained sandstone	45 to 90
		Coal & shaly coal (kota Seam)	1 to 3
		Fine to coarse grained sandstone	150 to 230
	Talchir Formation	Khaki green shale & sandstone	230 -250

Description Of Seams

There is no exposure of coal within the block. The outcrops of clay occurring along with the incrops of coal seams are residual product of spontaneous combustion of the coal seams. Due to the occurrence of this clay, the incrop of coal is rather at depth depending on the depth of penetration of spontaneous combustion.

Five coal seams occur in the block viz. (i) Kota, (ii) Turra, (iii) Purewa Bottom, (iv) Purewa Top and (v) Khadia seam in ascending order. Purewa Bottom and Purewa Top Seams are fairly thick and are potential for exploitation. Other seams viz. Kota and Khadia have not been explored in detail because of its thinness, impersistent and inter-banded nature.

Table 2: Geological sequence of Khadia Exp. OCP

Lithology	Thickness (m)	Normal thickness
Soil and Sub-soil	0 to 8.15	0 to 1.00
Sandstone & shale	Upto 74.65	
Khadia seam	0.25-1.25	0.50-0.60
Sandstone & shale	20.66-26.67	23-26
Purewa Top Seam	4.85-10.35	8-10
Sandstone & shale	30.34-43.70	32-40
Purewa Bottom seam	7.10-13.39	9-12.5
Sandstone & shale	50.78-64.28	54-61
Turra Seam	18.20-23.37	19.5-21.5

Sandstone & shale	50.73-79.69	62-70
Kota seam	0.40-2.13	1-2

DIP AND STRIKE: The strike is NW-SE in the west which swing to ENE-WSW in the eastern part of the area. The strikes is E-W in the central part of the area. The dip generally varies from 2° to 3° (1 in 28 to 1 in 19) towards north.

Faults/Joints

The areas devoid of any fault. However, two sets of prominent vertical joints (NE-SW and NW-SE) and one set less prominent (E-W) joints have been observed in the area.

Turra Seam

Turra Seam is the thickest of all the seams containing comparatively better quality coal. The immediate roof of the Turra seam is generally represented by inter banded horizons of shale, sandy shale and sandstone and carbonaceous shale. The roof of Turra seam within the incrop region is represented by clay. The immediate floor of Tura Seam is generally either shale or alternate Bands of shale and sandstone. Parting in the Turra seam overlies Kota Seam after a parting of 69m to 79.69m. The full thickness of Turra Seam including all dirt Bands varies from 18.20m to 23.37m. The dirt bands in Turra seam are represented by carb, Shale, carb, sandy shale, and sandstone varying in thickness from 0.05m to more than 2 meters.

Purewa Bottom seam

The Purewa Bottom Seam has been encountered in 54 boreholes. Out of these boreholes, full seam has been encountered in 52 boreholes and part thickness in 2 boreholes. The Purewa Bottom Seam overlies Turra Seam with a parting of 50.78 to 64.28m. The lithology of parting is mostly medium to coarse grained sandstone. The full thickness of Purewa Bottom Seam including all dirt bands varies from 7.10m to 13.39m. The full seam occurs within a depth range of 71.60m to 179.30m. Based on the available borehole data the thickness of Purewa Bottom Seam within incrop zone varies from 4.81m to 8.80m and occurs within a depth range from 76.00 m to 76.04m.

Roof and floor characteristics:

The immediate roof of the Purewa Bottom Seam is largely represented by medium to coarse grained sandstone. In incrop zone, the immediate roof is always represented by clay.

The immediate floor of Purewa Bottom Seam is represented either by alternate bands of shale and sandstone or fine grained sandstone.

Purewa Top Seam

General: The Purewa Top Seam is thinner than Turra and Purewa Bottom Seam and its incrop occurs generally on the plateau just above the escarpment. The outcrop of the seam is always burt and is represented by clay/clayey soil.

Parting: The Purewa Top Seam overlies Purewa Bottom Seam after a parting of 30.34m to 43.70m. The Lithology of parting between Purewa Bottom and Purewa Top Seams are medium to coarse grained sandstone.

Thickness: The full thickness of Purewa Top Seam including all din bands varies from 4.85m to 10.35m. In the incrop region the seam was encountered at a depth range of 35.35m to 57.85m. Purewa Top Seam is fairly uniform in its thickness.

Roof and Floor Characteristics

The immediate roof of the Purewa Top Seam is exclusively represented by sandstone. Only in incrop zone the roof has been represented by clay.

2.4 Geo mining Characteristics

Considering the existing working of Dudhichua east section and Khadia west section and also the gap between the working front of both the mines, it is not possible to follow the working limit as per sanctioned Western boundary of Khadia OCP (10 Mipa) as it involves major rehandling of OB Dump from eastern section of Dudhichua OCP and about 200 m strike length is being left by Khadia West section from the sanctioned boundary of Dudhichua OCP on the floor of Turra seam. So, common boundary on the floor of Purewa Bottom Seam has been envisaged for proposed Khadia Expansion OCP (16Mtpa). As Dudhichua OCP (20Mtpa) is a leading mine, there will not be any restriction for the working of Dudhichua OCP.

The working limit of proposed Khadia OCP will be restricted upto the working limit of Purewa Bottom and Purewa Top seam of eastern section of Sanctioned Dudhichua OCP and about 200m strike length of Turra seam will be left as barrier between East section of Dudhichua OCP and west section of Khadia OCP. The position of faces in east section of Dudhichua OCP vis-à-vis west section of Khadia OCP have been so planned as to maintain a sufficient lag for maintaining the transport horizon from advance benches to the spoil dumps.

Table 3: Geological and Mining Characteristics

SL.NO	PARTICULARS	UNIT	VALUE
1	Thickness of coal Seam (Full seam thickness zone)		
	Seam	Stratigraphic Thickness (m)	Effective Thickness (m)

	a) Purewa Top Seam	m	4.85-10.35 (8.28)	3.75-10.35 (7.20)
	b) Purewa Bottom Seam	m	7.10-13.39 (11.40)	5.60-13.39 (10.84)
	c) Turra Seam	m	18.20-23.37 (20.76)	14.57-22.56 (18.74)
2	Thickness of OB and Partings			
	a) OB above Purewa Top seam	m	37.55-117.60	
	b) Parting between Purewa Bottom & Purewa Top Seams		30.40-43.70	
	c) Parting between Turra & Purewa Bottom Seams	m	50.78-64.28	
3	Seam Gradient	Deg.	2-3	
4	Volume weight of Coal (with dirt band upto 1 m thick)			
	a) Turra Seam	t/m ³	1.58	
	b) Purewa Bottom Seam	t/m ³	1.61	
	c) Purewa Top seam	t/m ³	1.62	
5	Volume Weight of OB	t/m ³	2.35	
6	Volume weight of dirt band	t/m ³	2.00	
7	Excavation Category			
	a) Coal	Cat-III – 90% & Cat-IV – 10%		
	b) Overburden	Cat-III – 90% & Cat-IV – 10%		
8	Total mineable reserves of Khadia Expansion OCP (16 Mtpa) as on 01.04.2020	Mt	233.50	
9	Total volume of OB of Khadia Expansion OCP (16 Mtpa) as on 01.04.2020 (without in-seam band)	Mm ³	830.00	
10	Average Stripping Ratio (without in-seam band)	m ³ /t	3.55	
11	Total volume band of Khadia OCP (16 Mtpa) as on 1.04.2020	Mm ³	14.00	
12	Total volume of OB of Khadia Expansion OCP (16 Mtpa) as on 01.04.2020 (with in-seam band)	m ³ /t	844.00	
13	Average stripping ratio (with in-seam band)	m ³ /t	3.61	

Characteristics of Coal & OB

The average stratigraphic thickness of Turra coal seam, Purewa Bottom coal seam and Purewa Top coal seam are 20.76m, 11.40m and 8.28m respectively. The roof and floor of the seams are composed mainly of coarse grained sandstone, shale and sandy shale.

The bulk of the overburden is represented by sandstones, which forms 80 to 90% and shales forms 6 to 10% of the OB. Soil and clay constitutes 4 to 10% of the OB. Shales present in block are grey shale, sandy shale & carbonaceous shale which are normally associated with the floor and roof strata of the coal seams. Sandstones are generally grey to white, medium to coarse grained and are often gritty.

The coal seams are dipping at angles 2-3 towards the north. The area is devoid of any fault and intrusive. The surface RL at the opencast minefield varies in the range of 290m to 490m above mean sea level.

Khadia OCP (10Mtpa) has been working since 2010-11 with combined system of mining using Dragline and Shovel-Dumper combination for OB removal. The existing system has been proposed to be continued with up gradation of equipment size for achieving higher production level. Surface Miner has been envisaged for coal winning from total Purewa Top and part of Purewa Bottom Seams and existing shovel-dumper for Turra seam and partially for Purewa Bottom seam coal winning in the proposed PR for Khadia Expansion OCP (16Mtpa)

2.5 Mining and Dumping Strategy

The estimation of mineable coal reserve and volume of OB has been done, based on existing mine working plan as on 01.04.2020.

The total Mineable Reserve as on 01.04.2020 has been estimated as 233.50 Mt and corresponding total OB including inseam band as 844.00Mm³ with an average stripping ratio of 3,61mt (table 4).

Table 4: The section-wise MR, OBR & Average Stripping Ratio

Particulars	West section	East section	Total
Mineable Coal Reserves			
Purewa Top Seam	25.03	16.27	41.30
Purewa Bottom Seam	40.04	30.61	70.65
Turra Seam	67.38	54.17	121.55
Total	132.45	101.05	233.50
Volume of OBR (Mm³) without Band			
Top OB	246.18	108.24	354.42
Parting between Purewa Top and Purewa Bottom Seams	105.93	73.57	179.50
Parting between Purewa Bottom and Turra Seams	168.73	127.35	296.08
Total	520.84	309.16	830.00
Volume of Band (Mm³)			
Purewa Top Seam	2.90	0.98	3.88
Purewa Bottom Seam	1.18	0.71	1.89
Turra Seam	4.35	3.88	8.23
Total	8.43	5.57	14.00
Total OB including Band	529.27	314.73	844.00
Average Stripping Ratio including in-seam band (m³/t)	4.00	3.11	3.61

Mine Development Strategy

Khadia OCP (10 Mtpa) is existing working mine. The PR for Khadia Expansion OCP Expansion (16 Mtpa) has been proposed to be worked by extending the existing workings in the dip side of Khadia Block, part of Ruhela Block and a small part of Marrak Block. The existing Khadia

OCP (10 Mtpa) is being worked in two sections viz Eastern and Western sections and proposed Khadia Expansion OCP (16 Mtpa) has also been envisaged to be worked in two sections viz. Eastern and Western Sections.

Dumping

The main OB bench overlying Turra seam is to be removed by dragline system and proposed to be sidecast in the decoaled area of previous cut. The OB from upper benches will be handled by Shovel-dumper system and is proposed to be stacked upto the extent possible over the dragline sidecast spoil within the pit.

The volume of OB (including in-seam band) to be handled as per PR of Khadia Expansion OCP as on 31.03 2020 is 844.0 Mm³, out of which 156.35 Mm³ OB will be directly sidecast by draglines including throw blast of 13.35 Mm² in the decoaled cut and balance 687.65 Mm³ is proposed to be removed and dumped by shovel-dumper system in the internal dumps in both the sections. The mine is being worked since 1981-82 and 487.66 Mm³ of OB has already been dumped in external/internal dumps since inception till 31.03.2020. The final stage dump plan shows that apart from existing dump volume of 487.65 Mm³, further 844.0 Mm³ will be accommodated in the internal dumps in both the sections.

Table 4A: The Tier-wise OB volume of internal dumps is given below:

SL.No.	Tier (RL)	Volume (Mm ³)
A	EAST SECTION	
1	Dragline Dump	66.65
2	Upto 290 & 290-320	69.00
3	320-350	45.12
4	350-380	41.40
5	380-410	34.43
6	410-440	28.90
7	440-470	20.97
8	470-500	12.95
9	500-530	6.90
TOTAL EAST (A)		
1	Dragline Dump	89.70
2	Upto 270 & 270-320	78.78
3	300-330	60.08
4	330-360	57.36
5	360-390	53.26
6	390-420	46.91
7	420-450	44.16
8	450-480	39.98

9	480-510	29.16
10	510-540	18.29
Total West (B)		517.68
Grand Total (A+B)		844.00

Since inception, 487.66 Mm³ of OB has already been dumped in internal/external OB dumps of the mine. Apart from the above OB, the volume of OB estimated in the PR (16Mtpa) is 844.0 Mm³, which will be accommodated in internal OB dumps in both the sections.

OB Dump Benches

Shovel-dumper spoil dumps will be formed in benches of 30m and slope of individual dump bench will be 37 (equal to angle of natural repose of OB material). The width of berm between two adjacent benches will be 40m. Overall slope of dump works out to 28. Top soil wherever available will be stacked separately which will be used up for spreading over the completed OB dumps. The total mineable reserves within the sanctioned mine boundary of Khadia OCP as well as volume of OB and stripping ratio are given table 5

Table 5: Overburden and stripping ratio

Seam	Sanctioned MR (10Mtpa)	Estimated Balance MR as on 01.04.2020 (10 (Mtpa)	Incremental in Expansion area (6 Mtpa)	Total in PR (16 Mtpa) as on 01.04.2020
Purewa Top Seam (Mt)	32.07	26.00	15.3	41.30
Purewa Bottom Seam (MT)	67.95	53.00	1.65	70.65
Turra Seam (Mt)	142.53	10150	20.05	121.55
Total Coal (Mt)	343.55	180.5	53.00	2.33
Volume of OBR (Mm ³) (with band)	1039.67	653.50	190.55	844.00

2.6 Mining Technology

Elements of mining system have been determined in accordance with the parameters of excavation and transport equipment and the parameters of drilling and blasting.

Table 5A: Element of Mining system

SL.No.	Particulars	Unit	Overburden		Coal
			D/L	Shovel	
1	Bench Height	m	40-45	15-18	10-15
2	Working Bench Width	m	70	55-60	45
3	Non-working Bench Width	m	70	35-40	25
4	Bench slope	Deg	70	70	80
5	Blast Hole Dia.	mm	311	250	160
6	Inclination of Boreholes		Inclined	Vertical	Vertical
7	Powder Factor		0.6	0.3	0.2

The main OB bench overlying Turra seam is to be removed by dragline system and proposed to be side cast in the decoaled cut. The OB from upper benches is being handled by Shovel-dumper system and accommodated over the dragline side cast spoil within the pit. However, a part of OB is being accommodated in external dumps. Total volume of OB to be handled has been estimated as 844 Mm³ as on 01.04.2020.

2.7 Existing Environmental condition

Ambient air quality

Parameters chosen for assessment of ambient air quality were Suspended. Particulate Matter (SPM), Particulate Matter (PM₁₀), Fine Particulate Matter (PM_{2.5}), Sulphur Dioxide (SO₂) and Nitrogen Oxides (NO_x). Respirable Dust Samplers (RDS) were used for sampling of SPM, PM₁₀, So₂ & NO_x and Fine Dust Samplers (PM 2.5 sampler) were used for sampling of PM_{2.5} at 24 hours interval once in a fortnight. The samples were analysed in Environmental Laboratory of CMPDI.

It has been seen from the analysis results that the 24 hours average concentration of parameters like SPM, PM₁₀, PM_{2.5}, SO₂ and NO_x are mostly within the permissible limits in all sampling locations as per MoEF & CC Gazette Notification No. GSR 742 (E) dt 25.09.2000 standards for coal mines and national ambient air quality standard – 2009. Sometimes the concentration of SPM, PM₁₀ & PM_{2.5} exceeds the limits due to presence of numbers of thermal powers in the vicinity.

Water quality

Water samples were collected as per standard practice. Drinking water samples were collected and analysed for four/five parameters on fortnightly basis. The drinking water sample was collected and analysed for all parameters on quarterly basis. Parameters like pH, Temperature and Dissolved Oxygen were analysed on site while collecting the samples. Thereafter the samples were preserved and analysed at the laboratory of CMPDI. The test results indicate that the major parameters compared with MoEF & CC Gazette Notification No. GSR 742 (E) dt 25.09.2000 standards for coal mines (For 4/5 parameters of drinking and effluent water) IS. 10500/2012 (All parameters of Drinking water) are within permissible limits.

Noise level quality

Noise level measurement is in form of 'LEQ' were taken using integrated Averaging sound level meter (CR: 812 C) during day and night time. Noise levels were measured for about one hour time in day and night time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A). During the noise level survey it has been observed that the noise level in the sampling locations is within the permissible limits prescribed as per MoEF & CC Gazette Notification No. GSR 742 (E) dt 25.09.2000 standards for Coal Mines for Industrial Area and Noise pollution (Regulation and Control) Rules, 2000, for residential Area.

2.8 Impact of fly Ash on Environment and dumping

The combustion of pulverized coal at high temperatures and pressures in power stations produces different types of ash. The ash fraction is carried upwards with the flue gases and captured before reaching the atmosphere by highly efficient electro-static precipitators. It is composed mainly of extremely fine, glassy spheres and looks similar to cement. Fly ash is a fine, glass powder recovered from the gases of burning coal during the production of electricity. These micron-sized earth elements consist primarily of silica, alumina and iron.

Fly ash is left behind when coal is burnt. Coal-fired power plants are the biggest sources of fly ash mainly contain quartz, mullite and the iron oxides hematite, magnetite. It also contains toxic chemicals such as arsenic, barium, cadmium, nickel and lead, among others. These are known to cause cancer, lung and heart ailments and neurological damage, and contribute to premature mortality.

Irregular accumulation and inappropriate disposal of fly ash will lead to its disposal over vast areas of land, with resultant degradation of the soil and danger to both human health and the environment. Fly ash particles, small enough to escape emission control devices, are easily suspended in air and have become a major source of air pollution. Repeated exposure to fly ash can cause irritation of the eyes, skin, nose, throat and respiratory tract, and can even result in arsenic poisoning. Fly ash can even reach the sub-soil and ultimately cause siltation, clog natural drainage systems and contaminate the ground water with heavy metals. (Yao et.al, 2015).

Coal contains significant amount of various trace metals, and after combustion these metal concentrations in fly ash are higher than that of in parent coal. Sometime, under favouring conditions, a considerable amount of these trace elements can easily be leached out from the surface of fly ash particles by the interaction with water in ponds or landfills (Bhattacharyya et

al., 2009). It has been reported that the metal contaminants like V, Cr, Ni, Cd and Pb are potential hazards to the environment even at low levels (Patra et al., 2012).

The effect of fly ash on soils and microorganisms in the soils are influenced by the pH of the ash and trace metal concentrations in the ash. Microbial communities in contaminated soil have shown reductions in respiration and nitrification. These contaminated soils can be detrimental or beneficial to plant development. Most detrimental effects were observed when boron phytotoxicity was observed. Plants absorb elements elevated by the fly ash from the soil. Arsenic, molybdenum, and selenium were the only elements found at potentially toxic levels for grazing animals.

2.9 Fly ash Dumping in Mine Voids

As per the approved mining plan Khadia OC expansion, the available voids, at end of mining of Khadia OC quarry could be utilized by the backfilling of overburden. In addition, a part of the overburden will have to be accommodate in internal dumps. As the external dump is already reached to its maximum height (as reported by mine official). In such, there will not be any possibility of accommodating fly ash dump into External dump. Therefore, the only option is left is to accommodate the overburden material into internal dump or at end of mine void.

3.0 Sample Collection and laboratory testing

3.1 Introduction

The important geotechnical properties of overburden dump materials are grain size distribution, specific gravity, optimum moisture content, Atterbergs limits, Cohesive properties, shear strength, etc. These properties play important role in slope stability and characteristic of fly ash material. Properties have been determined for overburden, fly ash and of overburden and fly mixture of various proportions. These has been determined to know the suitability of OB and fly ash as aback filling material in the Khadia opencast project.

3.2 Collection and Preparation of Samples

The overburden sample has been collected from different places of Khadia OCP dump. Ten to fifteen kg of overburden samples have been collected in the bags. Care has been taken to collect enough samples to represent the various conditions of strata in the mines. Total 6-8 bags have been taken from mines. The fly ash is taken from power plants in bags. The mouth of each bag was sealed immediately after collection and the same was again inserted in another poly bag to prevent atmospheric influences. The bags were transported with almost care from the plant to the laboratory/field and kept in a secure and controlled environment. The sample of OB and fly ash are brought in the Laboratory of Department of Mining IIT (BHU) in tightly packed condition (to avoid contamination or moistening). Representative samples were then prepared by coning and quartering in the laboratory for the analysis. The location of collection point in the Khadia opencast project is shown in figure 2.



Figure 2 : Sampling location and collection of samples

3.3 Geotechnical Properties of soil and fly ash

3.3.1 Specific Gravity and bulk density

The specific gravity of soil is the ratio of the mass of a given volume of the material at a stated temperature. The specific gravity of soil is used in relating the weight of soil to its volume. It is obtained using a specific gravity bottle (50ml) for fine grain soils or pycnometer (1000ml) for coarse grain soil. The following formula obtains specific Gravity of Soil (G_s):

$$G_s = \frac{(W_2 - W_1)}{(W_4 - W_1) - (W_3 - W_2)}$$

Where, W_1 (gm) is the weight of sp. gr. Bottle, W_2 (gm) is the weight of sp. gr. bottle + soil, W_3 (gm) is the weight of sp. gr. bottle + soil + water and W_4 (gm) is the weight of sp. gr. bottle + water. The complete test procedure is given in IS: 2720 part 3: Sec 1:1980.

Bulk density is an indicator of soil compaction. It is calculated as the dry weight of soil divided by its volume. This volume includes the volume of soil particles and the volume of pores among soil particles. Bulk density is typically expressed in g/cm^3 . Bulk density is measured using proctor compaction mold. The Bulk Density (γ_{Bulk}) is obtained using the following formula:

$$\gamma_{Bulk} = \frac{W_2 - W_1}{V_m}$$

Where, W_2 (gm) is the Weight of mold + compacted soil, W_1 (gm) is the weight of empty mould and V_m (cc) is the volume of the mold. The complete test procedure is given in IS-2720-PART-7-1980.

Table 6 and 7 show the specific gravity and bulk density of various samples taken from mine and power plant. The average specific gravity and bulk density of overburden ash samples was found to be 2.66 and 1.86 t/m³, respectively. The specific gravity of Fly Ash sample was 2.29 for UPRVUNL, Anpara and 2.10 for Hindalco, Renusagar. The average bulk density of the fly ash samples was found to be 1.25 t/m³ and 1.29 t/m³ for Hindalco Renusagar and UPRVUNL Anpara respectively.

Table 6: Specific gravity and bulk density Khadia OCP

Sample No	Specific gravity	Bulk density t/m ³
Sample 1	2.50	1.85
Sample 2	2.71	1.86
Sample 3	2.56	1.84
Sample 4	2.86	1.89
Average	2.66	1.86

Table 7: Specific gravity and bulk density of fly ash Samples

Sample No	Specific gravity	Bulk density t/m ³
Hindalco Renusagar		
Sample 1	2.11	1.19
Sample 2	2.09	1.21
Average	2.10	1.25
UPRVUNL Anpara		
Sample 1	2.24	1.28
Sample 2	2.34	1.31
Average	2.29	1.29

3.3.2 Grain Size Distribution

Soil gradation is the distribution of particle sizes expressed as a percent of the total dry weight. It is determined by passing the material through a series of sieves stacked with progressively smaller openings from top to bottom and weighing the material retained on each sieve. Sieve analysis is performed according to IS 2720: Part 4: 1985.

The results of testing will reflect the condition and characteristics of the aggregate from which the sample is obtained. Therefore, it is important to obtain a disturbed representative sample of the source being tested the distribution of different grain sizes affects the engineering properties of soil. The sieves of different standard IS size (4.75mm, 2.00mm, 1.00mm, 425 μ m, 75 μ m) are used for analysis. Samples were placed in the top sieve (4.75mm) and it was covered. A receiver, known as pan, which has no opening, was placed at the bottom of the smallest sized sieve. The set of sieves was kept on a mechanical shaker and the machine was started. Mechanical shaking was done for 15-20 minutes. The mass of the samples retained on each sieve and on the pan was weighed and percentages of different sizes were calculated.

Hydrometer analysis is a measurement method used to determine soil particle size in a sample. Hydrometer analysis is specifically for soil particle sizes that are less than approximately 0.75 mm in diameter. The hydrometer is placed in a container filled with a water and soil mixture and measurements are taken over time to perform the test.

Figure 3 shows the size distribution of two samples from Khadia Overburden dump. It indicates that the presence of fine material in overburden sample is very less. Moreover, this has been done neglecting large boulders and fragmentation. If we considered, then the percentage of fine material in overburden soil is negligible. The percentage of fine material in overburden soil is negligible after considering large boulders. Therefore, the amount of clay is very less that is act and use as binding material of overburden soil.

The figure 4 shows the size distribution of fly ash of two power plants. It indicates that the percentage fine is high compare to overburden soil. This will lead to reduce the permeability of overburden soil when it mixed with overburden soil.

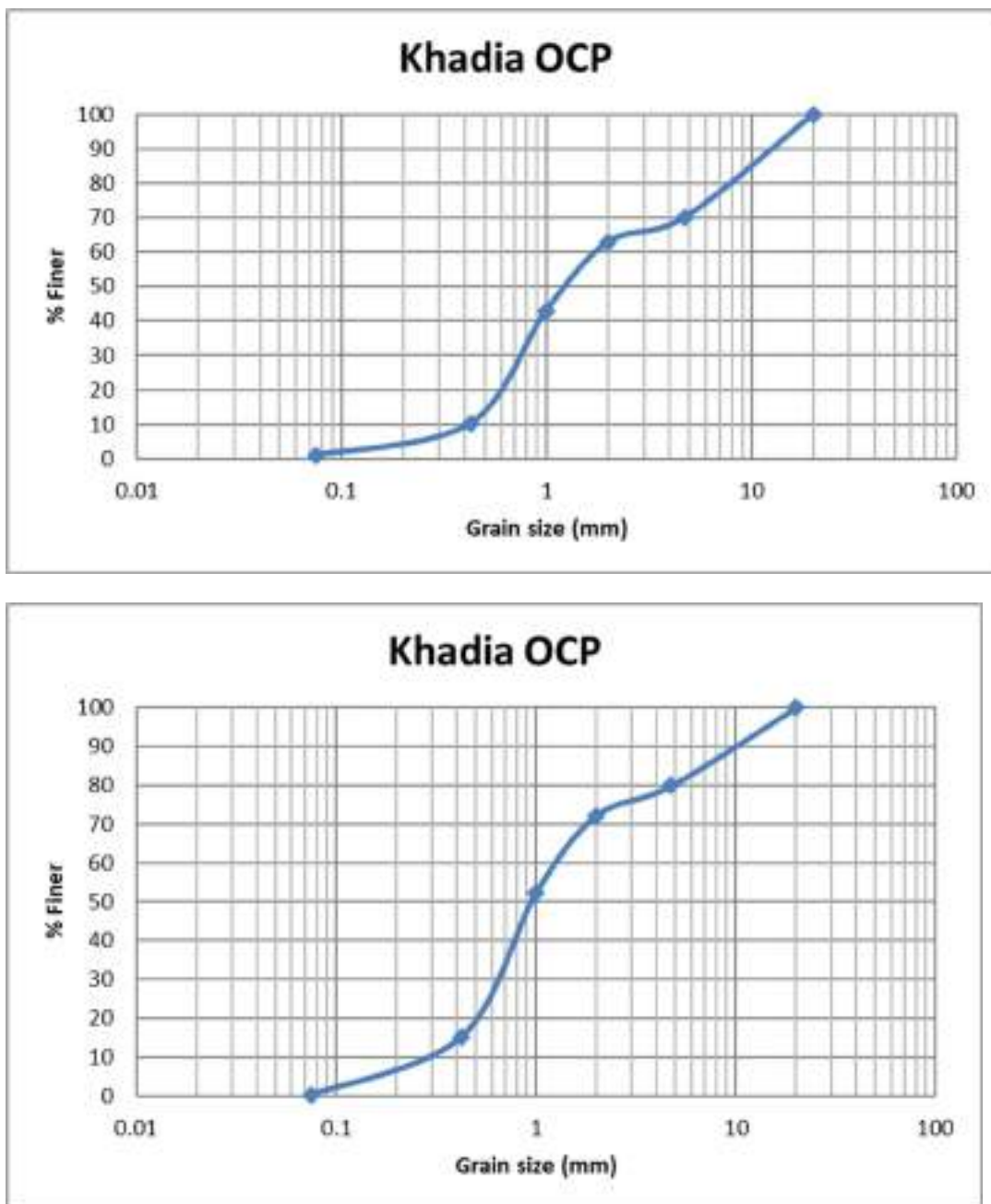


Figure 3 : Size distribution of different samples from Khadia Overburden dump

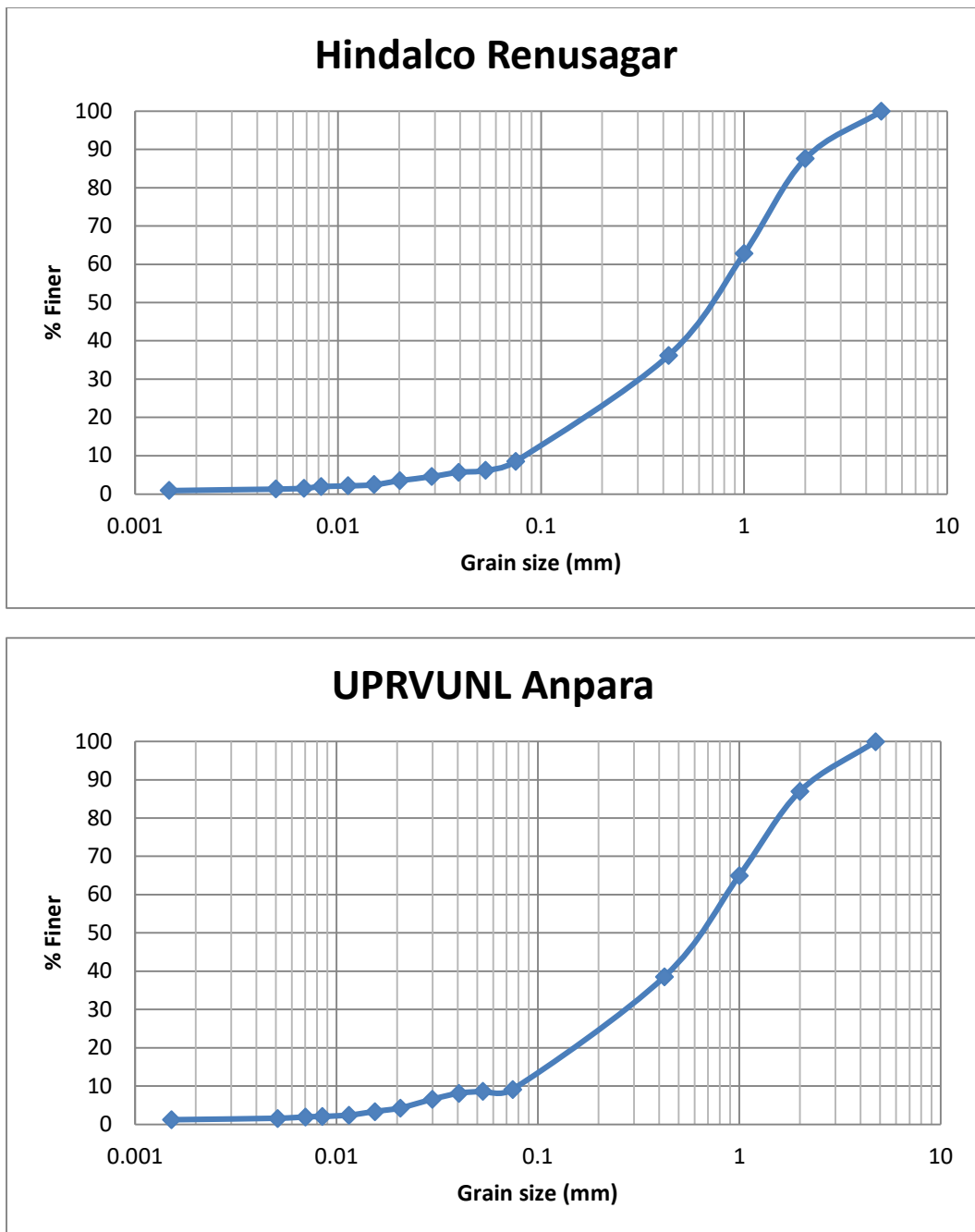


Figure 4: Size distribution of different samples of Fly Ash

The Co-efficient of Uniformity (Cu) and Co-efficient of curvature (Cc) has been calculated. D_{10} is defined as the effect size of the material, lesser the D_{10} having less permeability of material. A soil is considered to be well graded if the coefficient of curvature Cc is between 1 and 3, with Cu greater than 4 for gravels and 6 for sands.

Table 8 shows the Coefficient of curvature and coefficient of uniformity of overburden soil and Fly ash. The percentage of distribution has been determined using graph of D_{60} , D_{30} and D_{10} . The coefficient of uniformity is greater than 4, and coefficient of curvature is near to 1. Hence, the material is classified as uniformly graded sand with particles of same size. It contains particles of the same sizes which allow more drainage of water. Poorly graded soils are more susceptible to soil liquefaction than well graded soils.

Table 8 : Coefficient of curvature and coefficient of uniformity

	Particles at different size (mm)			Co-efficient of Uniformity (Cu)	Co-efficient of curvature (Cc)
	D_{60}	D_{30}	D_{10}	D_{60} / D_{10}	$D_{30}^2 / D_{60} * D_{10}$
Overburden	1.1	0.85	0.45	2.44	1.46
Overburden	1.05	0.75	0.25	4.20	2.14
Fly Ash (R)	0.90	0.30	0.07	11.33	1.22
Fly Ash (A)	0.85	0.20	0.65	9.00	1.36

3.3.3 Atterberg's Limits (Liquid and Plastic Limits)

The water content at which the soil changes from one state to other (i.e., from solid to plastic to liquid) is known as consistency limits or Atterberg's limit. The consistency of a fine-grained soil refers to the physical state in which it exists. A fine-grained soil can exist in four states, namely, liquid, plastic, semi-solid and solid states. Atterberg's limit consists of the determination of liquid limit, and plastic limit of soil or soil like material. It is performed according to (IS: 2720 part 5: Sec 1:1985).

Casagrande cup method has been used to determine the liquid limit. In the Casagrande cup method, the soil paste is placed in the Casagrande cup, and a groove is made at its center (see procedure below). The limit is defined as the moisture content, in percent, required to close a distance of 0.5 inches along the bottom of a groove after 25 blows in a liquid limit device. It is difficult to adjust the moisture content in the soil to meet the required 12.5 mm (0.5 in.) closure of the groove in the soil pat at 25 blows. Hence, at least three tests for the same soil are conducted at varying moisture contents, with the number of blows, N , varying between 15 and 35. The graph between water content (on y-axis) and number of blows (on x-axis) on semi-log graph is plotted for different test under different water content. The curve obtained is called flow curve. The moisture content corresponding to 25 drops (blows) as read from the represents liquid limit.

The Plastic limit test is performed by repeatedly rolling an ellipsoidal-sized soil mass on a non-porous surface. Casagrande defined the plastic limit as the water content at which a thread of soil just crumbles when it is carefully rolled out to a diameter of 3 mm (1/8"). If the thread crumbles at diameter smaller than 3 mm, the soil is too wet. If the thread crumbles at a diameter greater than 3 mm, the soil is drier than the plastic limit. The sample can then be remolded and the test repeated. Once the appropriate size rolls are made, their moisture content is assessed using the procedure described previously.

The overburden soil having large boulder to fine soil. The size range is varying from micron to meters. The Atterberg's limit is determined for clay and silt type soil. The finer soil (clay and silt) has been taken out from overburden material through sieve analysis and Atterberg's limit has been determined.

The table 9 and 10 show the Atterberg's Limits of fine soil (Clay) present in overburden soil and fly ash. The significance of Liquid limit in this study is that it indicates at what moisture content the fly-ash and OB mixture will get liquefied. The overburden soil has liquid limit of 24% which means the moisture content of the material should not exceed 24% otherwise the dump or slope may get liquefied. However, the overburden material consists of well graded sand and silt with large gravel and boulders. This will allow drainage through the overburden material. Therefore, Atterberg's Limits is not applicable to the OB material as this is coarse grain size. However due to presence of some clay material in the OB its Liquid limit was found to be 24%.

The Liquid limit of fly ash is 17 and 14 for Hindalco Renusagar and UPRVUNL Anpara fly ash respectively. The liquid limits and plastic limit of overburden considering of boulders also is very less and exhibit only small amount of liquid limit and are generally slightly plastic. However, when it will be mixed with fly ash the amount of fines will may be increased. Therefore, it may generate pre water pressure in water. The pore water pressure will not quickly dissipate in the overburden and fly ash mixed material.

Table 9 : Atterberg's Limits of clay present in overburden soil

Sample No	Liquid Limit	Plastic limit
Sample 1	25.5	12
Sample 2	26.5	15
Sample 3	22	16
Sample 4	21	13
Average	23.75	14

Table 10 : Atterberg's Limits of fly ash

Name of Power Plant	Liquid Limit	Plastic limit
Hindalco Renusagar	17	-NA-
UPRVUNL Anpara	14	-NA-

3.3.4 Procter Compaction Test

The Proctor compaction test is a laboratory method of experimentally determining the optimal moisture content at which a given soil type will become most dense and achieve its maximum dry density (γ_d). Higher the dry density of the material, higher is the stability. Determination of the relationship between the moisture content and density of soils compacted in a mold of a given size with a 2.5 kg rammer dropped from a height of 30 cm. This test is performed according to IS: 2720 part 7: 1980.

$$\gamma_d = \frac{W - W_m}{(1 + w) * V}$$

Where, W (gm) is the weight of the mold and the soil mass, W_m (gm) is the weight of the empty mold, w (%) is the water content of the soil and V (cc) is the volume of the mold.

After obtaining maximum dry density for different water content, the curve (compaction curve) between dry density and moisture content is plotted to determine the maximum dry density and optimum moisture for the soil. The peak point of the compaction curve is the point with the maximum dry density $\gamma_{d \max}$. Corresponding to the maximum dry density $\gamma_{d \max}$ is a water content known as the optimum water content (also known as the optimum moisture content, OMC).

Figure 5 shows the relation between water content and maximum dry density of overburden material and fly ash respectively. Table 11 shows the MDD and OMC for Khadia overburden samples 11 and 1.98, respectively. Table 12 shows the MDD and OMC for fly ash. The OMC for Hindalco Renusagar and UPRVUNL Anpara are 22 and 21 percentages. Whereas, The MDD are 1.28 and 1.29 for fly ash of Hindalco Renusagar and UPRVUNL Anpara respectively.

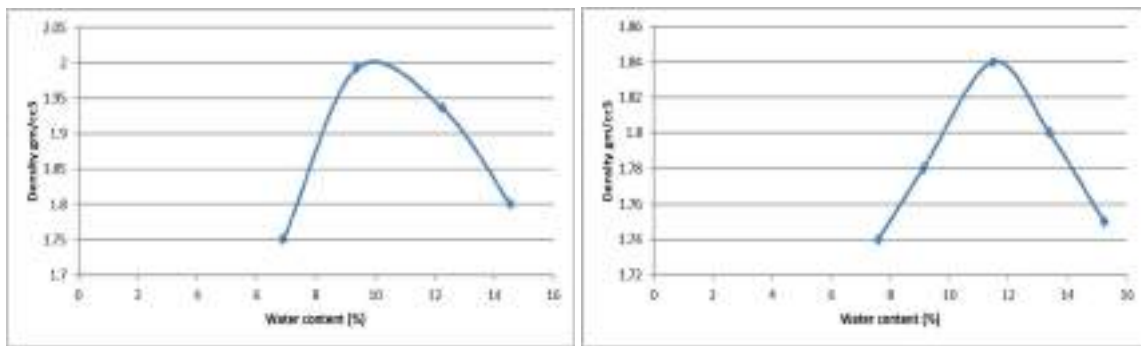


Figure 5 : Compaction curve of overburden material

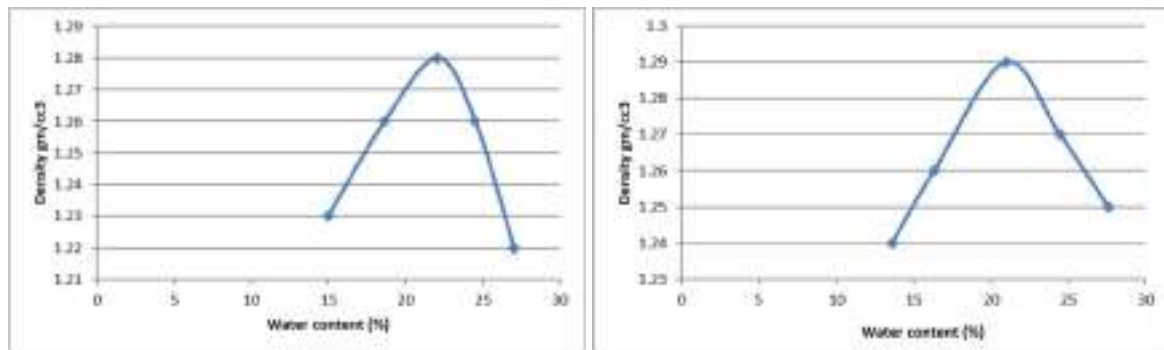


Figure 6 : Compaction curve of Fly ash material (Hindalco Renusagar and UPRVUNL Anpara)

Table 11 : OMC and MDD of Khadia OCP

Sample No	OMC	MDD
Sample 1	10.6	1.81
Sample 2	9.8	1.89
Average	10.2	1.85

Table 12 : OMC and OMD of fly ash sample

Sample No	OMC	MDD
Hindalco Renuagar		
Sample 1	21	1.27
Sample 2	23	1.30
Average	22	1.28
UPRVUNL Anpara		
Sample 1	22	1.32
Sample 2	21	1.26
Average	21	1.29

3.3.5 Permeability

The rate of flow under laminar flow conditions through a unit cross sectional area of porous medium under unit hydraulic gradient is defined as the coefficient of permeability. Permeability is useful in solving problems involving yield of water bearing strata, seepage through earthen dams, stability of earthen dams, and embankments of canal bank affected by seepage, settlement etc. It is very important factor for the structures which are in contact with water. Flow of water in soil takes place through void spaces, which are interconnected.

The falling head method of determining permeability is used for soil with low discharge, whereas the constant head permeability test is used for coarse-grained soils with a reasonable discharge in a given time. The permeability test is performed using Permeameter mould made up of non-corrodible material having a capacity of 1000 ml, with an internal diameter of 100 ± 0.1 mm and internal effective height of 127.3 ± 0.1 mm. The coefficient of permeability (k) is obtained by using the following equations:

$$k = \frac{QL}{Aht}$$

Where, k (m/sec) is the coefficient of permeability, Q (cc) is discharge, L (cm) is the length of specimen, A (cm^2) is the area of specimen, h (cm) is the height of water column and t (sec) is the time for testing. Table 13 shows the permeability of overburden sample and fly ash sample. It shows the permeability of fly ash is low compared to overburden sample.

Table 13 : show the permeability of overburden sample and fly ash sample

Sample No	Permeability (k in m/s)
Khadia overburden	5.18E-05
Fly ash (Hindalco Renusagar)	5.92E-07
Fly ash (UPRVUNL Anpara)	1.60E-07

3.3.6 Shear strength

The two methods have been used to determine the shear strength of overburden, fly ash, and mixed material, i.e. triaxial and direct shear tests. A triaxial shear test is a common method to measure the mechanical properties of many deformable solids, especially soil (e.g., sand, clay) and rock, and other granular materials or powders. Shear box test is a testing method used to determine the shear strength of a soil sample. Since granular soils cannot be retrieved undisturbed, the soil is re-compacted inside a shear box. Shear strength testing is carried out for analyses of short term and long term slope stability.

In soil mechanics, the shear strength is evaluated using the Mohr-Coulomb (M-C) Failure Criterion. The M-C Criterion assumes that the shear strength depends on three factors:

1. The normal effective stress (σ_n)
2. The friction angle of the material (ϕ)
3. The cohesion of the material (c)

The qualitative correlation of those components is expressed as:

$$\tau = c + \sigma_n * \tan (\phi)$$

Table 14 show the cohesion and friction angle of over burden sample and fly ash sample of different power plants. Table 15 shows the shear strength of mixed overburden and fly ash material. It is observed from table 15 that around 20 percentage of fly ash will increase the cohesion of dump material. However, the friction angle is reducing with increase in fly ash in the overburden material.

Table 14 : Shear strength of overburden and fly ash

Sample No	Cohesion kPa	Friction angle Degree
Overburden sample 1	55	32
Overburden sample 2	48	30
Fly ash (Hindalco Renusagar)	18	28
Fly ash (UPRVUNL Anpara)	48	24

Table 15 : Shear strength of mixed material of overburden and fly ash

Sr. No	% Overburden	% Fly Ash	Cohesion (kPa)	Friction angle (degree)
1	100	0	55	31
2	95	5	76	30
3	90	10	98	29
4	80	20	126	28
5	70	30	90	29
6	60	40	82	28

4.0 Characterization of Fly ash

Introduction

The combustion of pulverized coal at high temperatures and pressures in power stations produces different types of ash. The 'fine' ash fraction is carried upwards with the flue gases and captured before reaching the atmosphere by highly efficient electro static precipitators. This material is known as Pulverized Fuel Ash (PFA) or 'fly ash'. It is composed mainly of extremely fine, glassy spheres and looks similar to cement. Fly ash is one of the residues generated in the combustion of coal. Fly ash is generally captured from the chimneys of coal-fired power plants, whereas bottom ash is removed from the bottom of the furnace.

To investigate the geotechnical properties of fly ash such as grain size, moisture content, water holding capacity, specific gravity, optimum moisture content, settling velocity, density, etc., should be tested for safety and environmental suitability. Other characterizations such as chemical composition, elemental composition, surface morphology, etc. also have been done.

4.1 Chemical / physical properties of Characterization of fly ash

4.1.1 pH

Acidic/basic water is characterized by pH of the sample, and range goes from 0 to 14, with 7 being neutral. pH value of less than 7 indicate acidity, whereas pH value of greater than 7 indicates a base. The pH of water is a very important measurement concerning water quality. pH is really a measure of the relative amount of free hydrogen and hydroxyl ions in the water.

Practically this parameter does not affect stability of the filling material however it may affect the biological reclamation process. The nutrient deficiencies that occur on alkaline soils often cause crop failure, but if a balanced plant nutrition program is implemented, most crops can be successfully grown. In this case high pH will lead to failure in plantation program, if no measures are taken to neutralize it.

About 10g of samples were taken in 250ml conical flask and 100ml of distilled water was added, maintaining the sample to soil ratio of 1:10. The fly ash water suspension was stirred at regular intervals for 30 minutes and then the pH was recorded. The suspension was stirred well just before electrodes were immersed and readings were taken. The instrument was first calibrated with buffer solutions of known pH values. The pH of the fly ash samples was found to be in the range of 6.0 to 7.0.

The pH of the fly ash samples was found to be in the range of 6.4 and 6.3 for UPRVUNL, Anpara TPS and Hindalco, Renusagar TPS respectively. It means the pH of fly ash is Slightly

acidic in nature. It can be considered as natural in all practical purpose. This will help in biological reclamation in the backfilled land.

S.No.	Name of sample	pH value
1.	UPRVUNL, Anpara TPS	6.4
2.	Hindalco, Renusagar TPS	6.3

4.1.2 Electrical Conductivity

The electrical conductivity (EC) of any solution is a fundamental property of a material that measures how strongly it resists electric current. A low resistivity indicates a material that readily allows electric current which is dependent on the soluble salts present in it. Thus the measurement of electrical conductivity (EC) can be directly related to soluble salts concentration of the soil at any temperature. With an electrical conductivity **between 0.05 and 0.1 S/ m**, fly ash-based geopolymer are considered as semiconductor materials.

Calibration of the instrument has been done with KCl solution at a specified temperature. As in the case of EC, 20g of sample was shaken intermittently with 40ml of distilled water in a 250ml conical flask (keeping the ratio of soil-water as 1:2) for an hour and allowed to stand. The clear extract was then taken and used for the electrical conductivity measurement using the Cyber Scan 200 Conductivity meter. It was found to be in the range of 1.062 to 1.065mS/cm for both fly ash samples. The range electrical conductivity is suitable for seedlings for salt sensitive plants mainly.

Table 16: electrical conductivity of fly ash

S.No.	Name of sample	EC value (mS/cm.)
1.	UPRVUNL, Anpara TPS	1.062
2.	Hindalco, Renusagar TPS	1.065

The electrical conductivity of the fly ash is around 1.06 ms/cm. It is suitable for seeding and salt sensitive plants, which growth and occurrence is rare. Therefore, it is not advisable to directly mix in the overburden dump materials. The mixing of fly ash may increase the salinity of overburden/soil mixed with fly ash.

4.1.3 Chemical composition of fly ash (XRF)

The chemical composition of the as-received FA ash was determined using X-ray fluorescence spectroscopy (XRF), which is a non-destructive analytical technique that used to determine the elemental composition of materials. XRF analyzers determine the chemistry of a sample by measuring the fluorescent (or secondary). X-ray emitted from a sample when it is excited by a primary X-ray source. Each of the elements present in a sample produces a set of characteristic fluorescent X-rays (“a fingerprint”) that is unique for that specific element.

Fly ash samples were analyzed by the PAN alytical, Netherland Model Axios MAX at the Birbal Sahini Institute of Palaeosciences in Lucknow, Uttar Pradesh, India. It is a nondestructive analysis technique for the major oxides and trace elements present in the sample. Wavelength dispersive (WD XRF) Machine (power: -3KW, 60kV-160mA) is used for detecting the elements. Analysis can be done on pressed powder pellets made from fine powder. The chemical compositions of fly ash are shown in Table 17-18.

According to American Society for Testing and Materials (ASTM) fly ash is classified into two classes (C & F) based on the amount of lime present. Oxides of silicon, aluminum, calcium and iron in fly ash are responsible for pozzolanic activity, which decreases by loss of ignition. According to ASTM classification method, the FA used in this study is Class F types since the summation of SiO_2 , Al_2O_3 and Fe_2O_3 is greater than 70%.

The burning of harder, older anthracite and bituminous coal typically produces Class F fly ash. This fly ash is pozzolanic in nature, and contains less than 10% lime (CaO). Possessing pozzolanic properties, the glassy silica and alumina of Class F fly ash requires a cementing agent, such as Portland cement, quicklime, or hydrated lime, with the presence of water in order to react and produce cementious compounds. Alternatively, the addition of a chemical activator such as sodium silicate (water glass) to a Class F ash can leads to the formation of a geopolymer. The geochemical analysis of fly ash is summarized in tables 17-18. From the tables, its shows that oxides of silica composition are relatively higher in both the sample which is ranging from 47.5- 45.85% however the lowest concentration of oxides of Manganese (MnO) was found in UPRVUNL, Anpara TPS whereas in case of Hindalco, Renusagar TPS the lowest concentration of oxide was sodium dioxide i.e. only (0.64%).

Table 17: Major and trace elements in the fly ash obtained by XRF of UPRVUNL, Anpara TPS Fly ash sample

Sr. No	XRF analysis data of fly ash Composition	Percentage
1	SiO ₂	47.53%
2	Al ₂ O ₃	21.10%
3	CaO	5.04%
4	FeO	9.32%
5	MgO	1.36%
6	MnO	0.50%
7	Na ² O	1.19%
8	K ₂ O	0.67%

Table 18 : Major and trace elements in the fly ash obtained by XRF of Hindalco, Renusagar TPS Fly ash sample

Sr. No	XRF analysis data of fly ash com Composition	Percentage
1	SiO ₂	45.85%
2	Al ₂ O ₃	27.33%
3	CaO	7.40%
4	FeO	3.19%
5	MgO	2.90%
6	MnO	1.04%
7	Na ² O	0.64%
8	K ₂ O	0.71%

4.1.4 Metal composition of Fly ash (ICP-MS)

Inductively coupled plasma-optical emission spectroscopy (ICP-MS) is an analytical technique used for the elemental determination in samples. The samples were analyzed by the Agilent 7700 ICP-MS at the Birbal Sahni Institute of Palaeosciences in Lucknow, Uttar Pradesh, India. The Agilent 7700 ICP-MS produces unparalleled accuracy and precision in high-matrix samples, with the help of redefining cell performance in helium mode with a revolutionary third-generation cell design of the ORS3. Microwave digestion-coupled ICP-MS were used to determine REEs' concentrations in the samples.

For the analysis of metal composition the digestion was carried out by taking 0.25 g of the fly ash sample was weighed into a Teflon cup. 2 cm³ of concentrated HF and 5 cm³ aqua regia were added. The Teflon cup was put in a digestion vessel (Parr bomb), sealed and heated to 200°C for 2 hours in an oven. The Parr bomb was removed from the oven and allowed to cool down. 25 cm³ of H₃BO₃ was added to the sample in order to prevent the formation of sparingly soluble in the sample. The digestate was filtered through 0.45 µm membrane filter and made up to 100 cm³ with ultra-pure water (ELGA Pure lab UHQ). The solution obtained from the total acid digestion experiments was analyzed for major and trace concentration using Varian 710-ES ICP Optical Emission Spectrometry.

The sample was introduced through a high sensitivity glass, single-pass cyclone spray chamber and conical nebulizer using argon gas. It was then passed through axially oriented plasma. The wavelength released by different analytes was detected with a CCD detector and auto integrated using ICP Expert II software. The ICP-OES instrument was calibrated before analysis with three calibration standards and a blank (2% HNO₃). The certified standards used in calibrating and checking the accuracy of the instrument was supplied by Industrial Analytical. Potentially toxic metals and elements concentration of fly ash samples are shown in Table 19-20.

From the tables its shown that the Al concentration found highest 160379.04 and 154547.24ppb for UPRVUNL, Anpara TPS and Hindalco, Renusagar TPS respectively, as compare with other metal like Ti, Fe and Ba was 11405.11, 48517.85 and 1073.87ppb in UPRVUNL, Anpara TPS and 11463.53, 44867.04 and 940.00ppb for Renusagar TPS respectively. Other earthly earth metal was found less than 1000ppb, shown in tables.

Table 19: Metal Composition of fly ash ICP-MS of UPRVUNL, Anpara TPS Fly ash sample

Sr. No	ICP-OES analysis data of fly ash com Composition	Values in PPB	Sr. No	ICP-OES analysis data of fly ash com Composition	Values in PPB
1.	Mg	2908.25	21.	Cs	7.38
2.	Al	160679.04	22.	Ba	1073.87
3.	Sc	33.93	23.	La	89.74
4.	Ti	11405.11	24.	Ce	191.17
5.	V	206.32	25.	Pr	19.39
6.	Cr	332.64	26.	Nd	71.87
7.	Mn	946.79	27.	Sm	14.40
8.	Fe	48517.85	28.	Eu	2.69
9.	Co	40.24	29.	Gd	12.45
10.	Ni	113.13	30.	Tb	1.77
11.	Cu	101.85	31.	Dy	10.31
12.	Zn	281.29	32.	Ho	1.99
13.	As	15.47	33.	Er	5.40
14.	Rb	68.09	34.	Tm	0.74
15.	Sr	204.05	35.	Yb	4.95
16.	Y	52.68	36.	Lu	0.70
17.	Zr	224.96	37.	Hf	5.52
18.	Nb	42.72	38.	Pb	81.28
19.	Mo	8.81	39.	Th	28.13
20.	Cd	1.20	40.	U	7.56

Table 20: Metal Composition of fly ash ICP-OES of Hindalco, Renusagar TPS Fly ash sample

Sr. No	ICP-OES analysis data of fly ash com Composition	Values in PPB	Sr. No	ICP-OES analysis data of fly ash com Composition	Values in PPB
1.	Mg	2858.04	21.	Cs	6.59
2.	Al	154547.24	22.	Ba	940.13
3.	Sc	34.11	23.	La	117.98
4.	Ti	11463.53	24.	Ce	220.03
5.	V	175.39	25.	Pr	22.68
6.	Cr	226.01	26.	Nd	83.70
7.	Mn	821.51	27.	Sm	16.32
8.	Fe	44867.04	28.	Eu	2.99
9.	Co	36.25	29.	Gd	14.09
10.	Ni	105.97	30.	Tb	2.00
11.	Cu	88.17	31.	Dy	11.34
12.	Zn	194.11	32.	Ho	2.12
13.	As	10.96	33.	Er	5.71
14.	Rb	73.06	34.	Tm	0.81
15.	Sr	192.09	35.	Yb	5.21
16.	Y	60.35	36.	Lu	0.71
17.	Zr	211.64	37.	Hf	5.33
18.	Nb	43.26	38.	Pb	60.66
19.	Mo	5.26	39.	Th	32.07
20.	Cd	0.88	40.	U	6.96

4.1.5 Mineralogical Composition by SEM and EDS

The **scanning electron microscope (SEM)** is a type of electron microscope that images the sample surface by scanning it with a high-energy beam of electrons in a raster scan pattern. The electrons interact with the atoms that make up the sample producing signals that contain information about the sample's surface topography, composition and other properties such as electrical conductivity.

The three signals which provide the greatest amount of information in SEM are the secondary electrons, backscattered electrons, and X-rays. A high-resolution image can be obtained because of the small diameter of the primary electron beam. Backscattered electrons are primary beam electrons which are 'reflected' from atoms in the solid. The contrast in the image produced is determined by the atomic number of the elements in the sample. The image will therefore show the distribution of different chemical phases in the sample.

The types of signals produced by an SEM include secondary electrons, back-scattered electrons (BSE), characteristic X-rays, light (cathodoluminescence), specimen current and transmitted electrons. Secondary electron detectors are common in all SEMs, but it is rare that a single machine would have detectors for all possible signals. The signals result from interactions of the electron beam with atoms at or near the surface of the sample. In the most common or standard detection mode, secondary electron imaging or SEI, the SEM can produce very high-resolution images of a sample surface, revealing details about less than 1 to 5 nm in size. Due to the very narrow electron beam, SEM micrographs have a large depth of field yielding a characteristic three-dimensional appearance useful for understanding the surface structure of a sample

Suitable samples include most solids which are stable under vacuum (metals, ceramics, polymers, minerals). Sample must be less than 2 cm in diameter. Sample preparation: non-conducting samples are coated with a thin layer of carbon or gold. Metallographic embedding, polishing, and sectioning is available for samples requiring special preparation. Samples are usually mounted and coated and introduced into the vacuum chamber. Digital images are acquired with an electron microscope image scanner. Images may be printed on a laser printer or transferred to disk or an e-mail account.

SEM/EDS investigations involved two different fly ash samples from UPRVUNL, Anpara TPS and Hindalco, Renusagar TPS. Fly ash samples were analyzed by Carl Zeiss EVO-MA15/18 scanning electron microscope (SEM-EDX). SEM-EDX instrument helps in producing the detailed high-resolution images of sample by restoring a focused electron beam across the surface and detecting secondary or backscattered electron signal.

SEM analysis showed that the ash is primarily composed of small glassy particles (some as cenospheres and pleuroospheres), and minor coarse unburned carbon particles (the LOI was determined at 2%). Obtained SEM images show that FA is made of spherical particles of less than 10 μm and irregular shaped particles like bubbles (Figure 7-8). In the SEM image of both the fly ash sample, spherical bubbles like structure. The fly ash particles are spherical as can be viewed in the images of SEM. Figure 9- and 10 show the EDS analysis and Spectrum of the UPRVUNL, Anpara TPS. Whereas figure 11 and 12 show the EDS analysis and Spectrum of the Hindalco, Renusagar TPS fly ash. During the combustion process, the heat causes the inorganic mineral to become fluid or volatile or to react with oxygen. During cooling, it may form crystalline solids, spherical amorphous particles or condense as coatings on particles. Volatiles trapped in a particle cause it to have swelled surfaces, varying the shape of the particles and bubbles, which alters its surface. The bubbles formed may be attributed to the release of volatile matter from the internal zones of the particle as the solid particle's surface is softening and melting. The bubbles can generate large cavities under the surface, which are smooth zones and considered to be less reactive for the subsequent steps of oxidation. There is no significant difference in morphology of the particles collected at various locations, apart from the particle size. Spherically and colourless particles indicate glassy textures or predominance of crystallinity and spherical, rounded light colored particles indicate a glassy surface. Rounded particles indicate a glassy particle, irregular shapes indicate partly crystalline particles, and angular shapes indicate a crystalline nature.

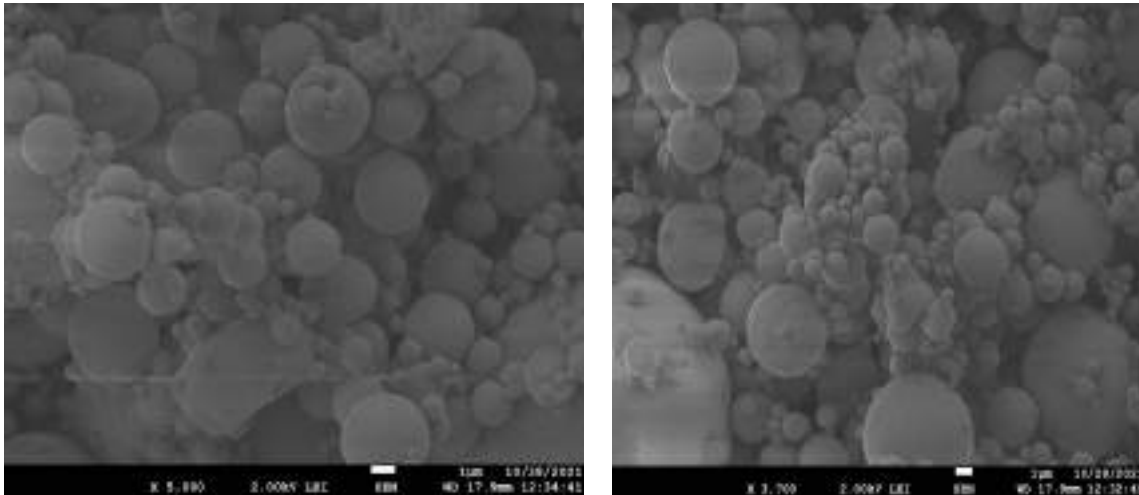


Figure 7 : Surface Morphology image at different magnification of **UPRVUNL, Anpara TPS** Fly ash sample

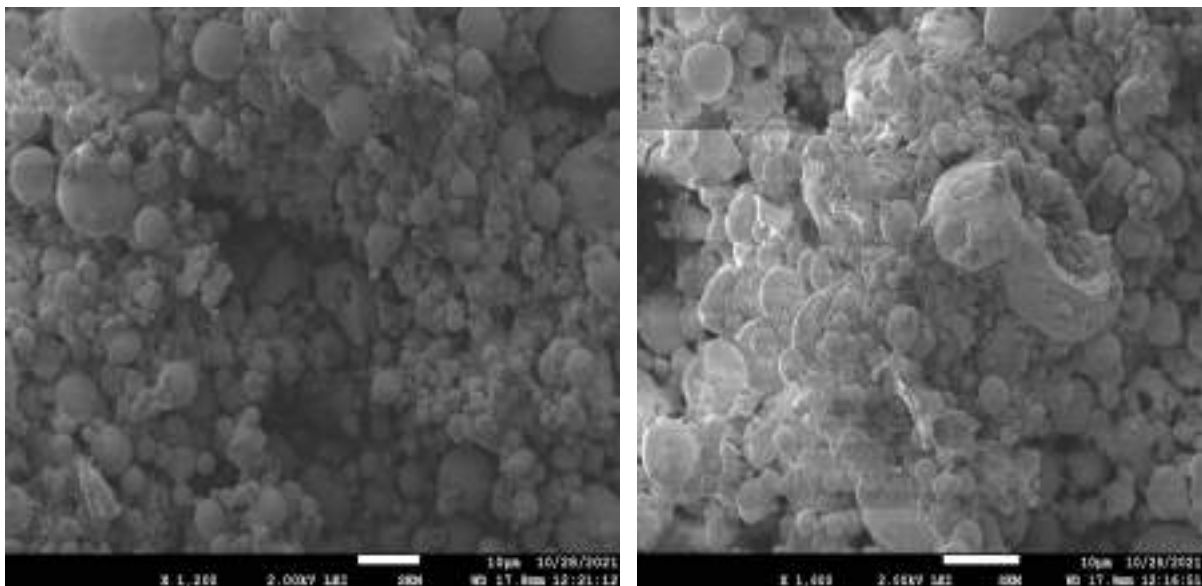


Figure 8 : Surface Morphology image at different magnification of **Hindalco, Renusagar** TPS Fly ash sample

4.1.6 Elemental Composition Analysis

The elemental composition of fly ash by various advanced technique (EDS) has also being studies and the result are shown in table 21 and 22. All the elements were analysed for both the fly ash samples and peaks were obtained for them according to their weight and atomic concentrations. Oxygen, aluminium, silica and carbon were the most abundant elements observed in all the fly ash samples. Oxygen percentage was found to be high (58.75 and 55.73 weight % of Anpara and Renusagar sample respectively).

The presence of Ca was found to be very less (0.12 and 0.20%) in all the fly ash samples hence it is expected that the material is very less cohesive in nature. Other major elements were not significant. The morphology and elemental data indicated that the fly ash samples were composed of over 50% amorphous alumino-silicate spheres and a lesser amount of iron-rich spheres. Hence these are very light materials and can become easily air borne. Due to presence of very less amount of Ca will not enhance stability in the slopes.

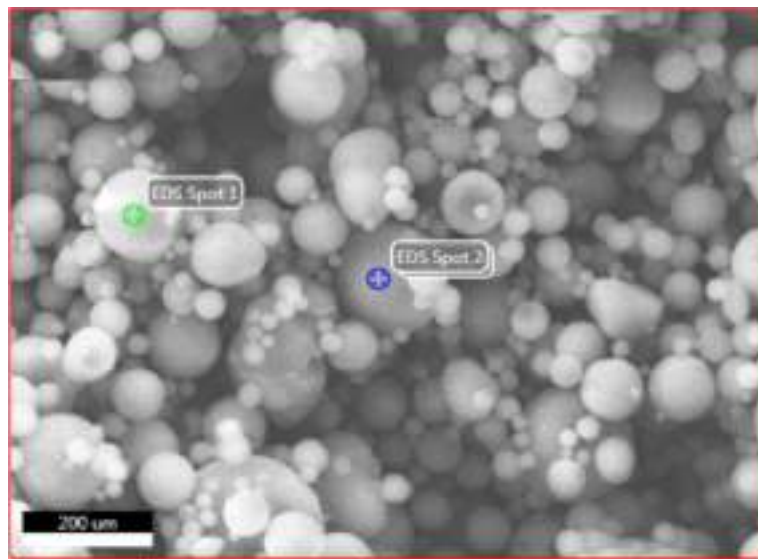


Figure 9 : EDS analysis of UPRVUNL, Anpara TPS ash

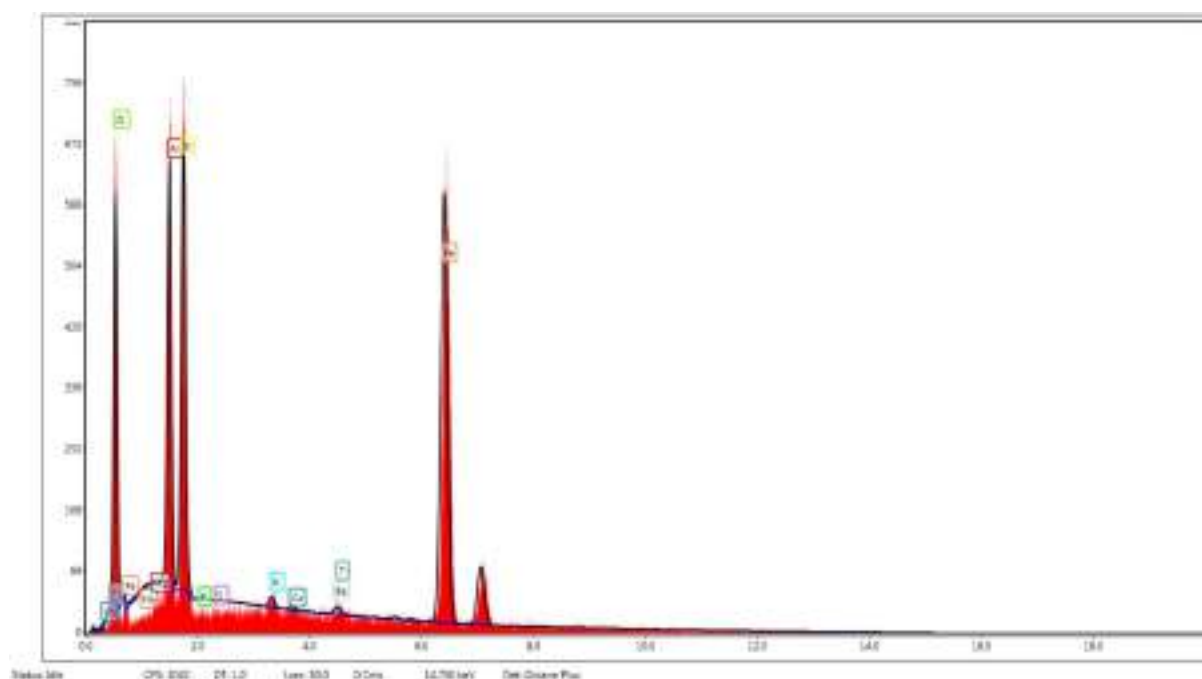


Figure 10 : EDS Spectrum of the UPRVUNL, Anpara TPS fly ash

Table 21 : Elemental analysis of UPRVUNL, Anpara TPS fly ash

Element	Weight %	Atomic %
O K	58.75	71.81
Na K	0.34	0.29
Mg K	0.26	0.21
Al K	18.19	13.18
Si K	18.44	12.84
P K	0.61	0.38
S K	0.06	0.03
K K	0.90	0.45
Ca K	0.12	0.06
Ba L	0.38	0.05
Ti K	0.06	0.02
Fe K	1.89	0.66
Total	100.00	100.00

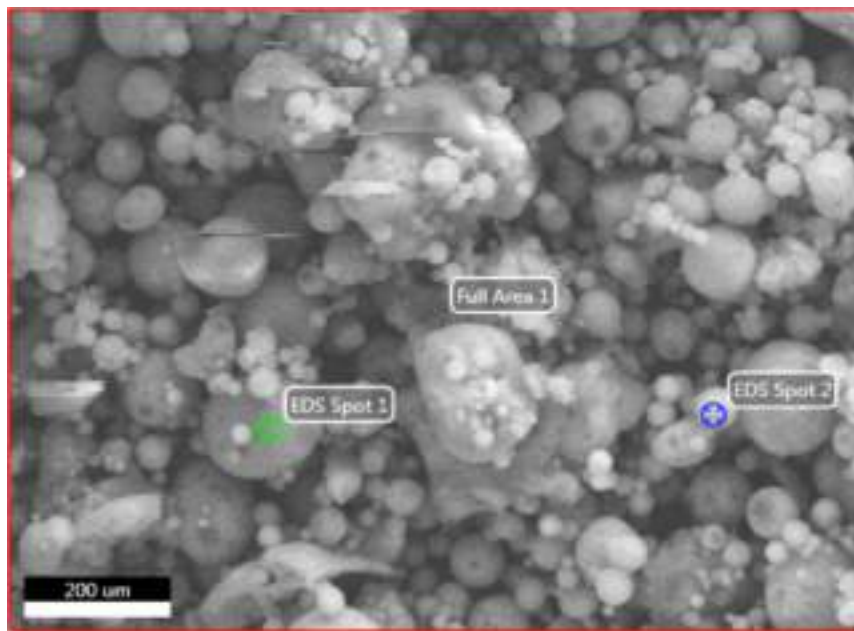


Figure 11 : EDS analysis of Hindalco, Renusagar TPS fly ash

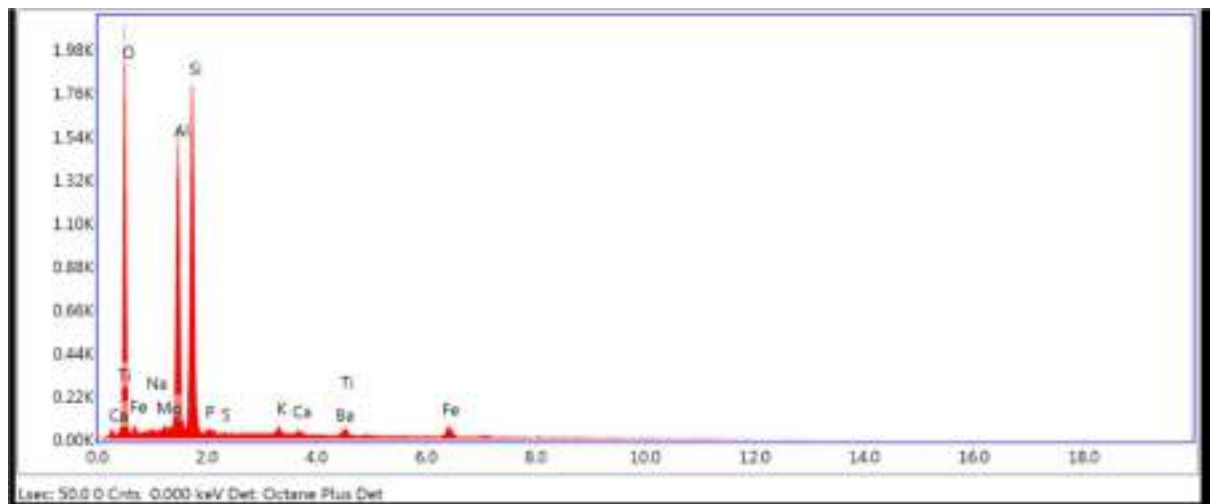


Figure 12 : EDS spectrum of Hindalco, Renusagar TPS ash

Table 22 : Elemental analysis of Hindalco, Renusagar TPS ash

Element	Weight %	Atomic %
O K	55.73	68.51
Na K	0.06	0.05
Mg K	0.31	0.25
Al K	16.89	12.39
Si K	24.70	17.46
P K	0.24	0.15
S K	0.07	0.04
K K	0.66	0.33
Ca K	0.20	0.10
Ba L	0.21	0.03
Ti K	0.13	0.06
Fe K	0.80	0.28
Total	100.00	100.00

It is observed from the table 21 and 22 that alkali and alkaline earth metals concentration also present in the samples. Highest alkali and alkaline earth metals present in Hindalco Renusagar sample i.e. 1.96% as compare to UPRVUNL Anpara (1.05%). Due to presence of alkali and alkaline metal in fly ash sample it may utilize for the neutralization of acidic mine water. Alkalis (i.e., alkalis (K_2O and Na_2O), as sodium oxide equivalent) limits are stated to minimize the effect of alkalis reacting with aggregates, containing a reactive form of silica (alkali-silica reaction, or ASR), in the presence of moisture. The reaction under those conditions produces a gel that can absorb water and swell, generating a pressure that causes expansion and cracking. The high potassium content of the biomass, the fly ash quality did not have an adverse impact regarding unwanted alkali levels.

As determined by EDX, the predominant elements in the fly ash samples were calcium, silicon, aluminium, iron, magnesium and sulphur in various compounds. Calcium was observed to primarily be associated with oxygen, sulphur, and silica, or possibly with carbon (calcite).

4.2 Physical Properties of Fly ash

4.2.1 Moisture content

Water content or moisture content is the quantity of water contained in a material. moisture content is used in a wide range of scientific and technical areas, and is expressed as a ratio, which can range from 0 to the value of the materials' porosity at saturation. Fixed amount of finely powdered (212 micron) air-dried fly ash sample is weighed in a tray and then placed inside an electric hot air oven, which was maintained at $105^{\circ}\pm 5^{\circ}\text{C}$. The tray with the fly ash sample is allowed to remain in the oven for 24 hours and is then taken out, cooled at room temperature for about 15 minutes and then weighed. The loss in weight is reported as moisture (on % basis). Table 23 shows the moisture content of fly ash. Then calculation is done as per the following formula.

$$\text{Moisture percentage} = \frac{Y-Z}{Y-X} \times 100$$

Where X= weight of empty crucible, gram

Y= weight of crucible + fly ash sample before heating, gram

Z= weight of crucible + fly ash sample after heating, gram

Y-X= weight of fly ash sample, gram

Y-Z= weight of moisture

Table 23 : Moisture content of fly ash

Sample name	Weight of empty petry plate (g)	Weight of fly ash (g)	Weight of petry plate and fly ash before heating (gm)	Weight of petry plate and fly ash after heating (gm)	Moisture content (%)
UPRVUNL, Anpara TPS	42.338	10.010	52.346	52.312	0.34
Hindalco, Renusagar TPS	29.444	10.015	39.456	39.425	0.31

4.2.2 Water Holding Capacity

It can be defined soil water holding capacity is the amount of water that a given soil can hold for crop use. Field capacity is the point where the soil water holding capacity has reached its maximum for the entire field. Water holding capacity is important to soil health. Soils that can retain a balanced amount of water are able to nourish crops and keep soil organic matter alive. Healthy soil structure forms into aggregates, lessening the density in the soil to create more pores, where water can filter in and out.

A cylindrical cup having pores of **diameter 1–2 mm** was fitted with filter paper (No. 41). The cup was then filled with **125gm** of fly ash and then poured in water in such a way that the cup remains submerged up to half its height for 24 hrs. After a time of interval **24 hrs** the cup was removed from water and hung for **1hr** so that excess water, adhering to the inner wall of the cup, is drained off in a trough containing water its height. Figure 13 shows the method to determine the settling properties of fly ash. The water holding capacity was determined using the following equation (%):

$$\text{Water holding capacity} = \frac{X-Y}{X} * 100$$

Sr. No.	Samples	Initial Weight of fly ash (X)	Final Weight of Fly ash (Y)	Water holding capacity in %age $(X-Y/X)100$
1.	UPRVUNL, Anpara TPS	125 gram	155.011	24.00
2.	Hindalco, Renusagar TPS	125 gram	156.709	25.36

The retention capacity of fly ash study at laboratory stage, conclude that there is ample water retention capacity in the fly ash. Hence when water availability will increase from 24% or more a swamp like condition will be created where in fly ash would be dumped. Figure 14 and 15 shows fly ash settling characteristic of Hindalco Renusagar and UPRVUNL Anpara. Hence for proper utilization of fly ash as a filling material along with overburden dump, proper blending with OB is required. Hence a separate detailed study is required for mixing of fly ash with OB in case of higher dumped height. The sequential dumping (alternate layer of OB & FA) technique will do in the pit surrounded by wall with no free space.

4.2.3 Settling Properties

Settling rates establish the ease with which solid-liquid separation takes place in slurries during filling activity, and the tests also provide a means of determining the recycled water quality. Take a measuring jar graduated in ml. clean it thoroughly with pure water. Take water into the flask up to certain level (x ml) and then add fly ash (100-x ml) slowly into the jar. Mix the water and fly ash thoroughly with a stirrer for some time. Note down upper and lower meniscus of the mixture. Then note down time for each ml settling of fly ash in water. Repeat the other sample and tabulate the results.



Figure 13 : Settling properties of fly ash

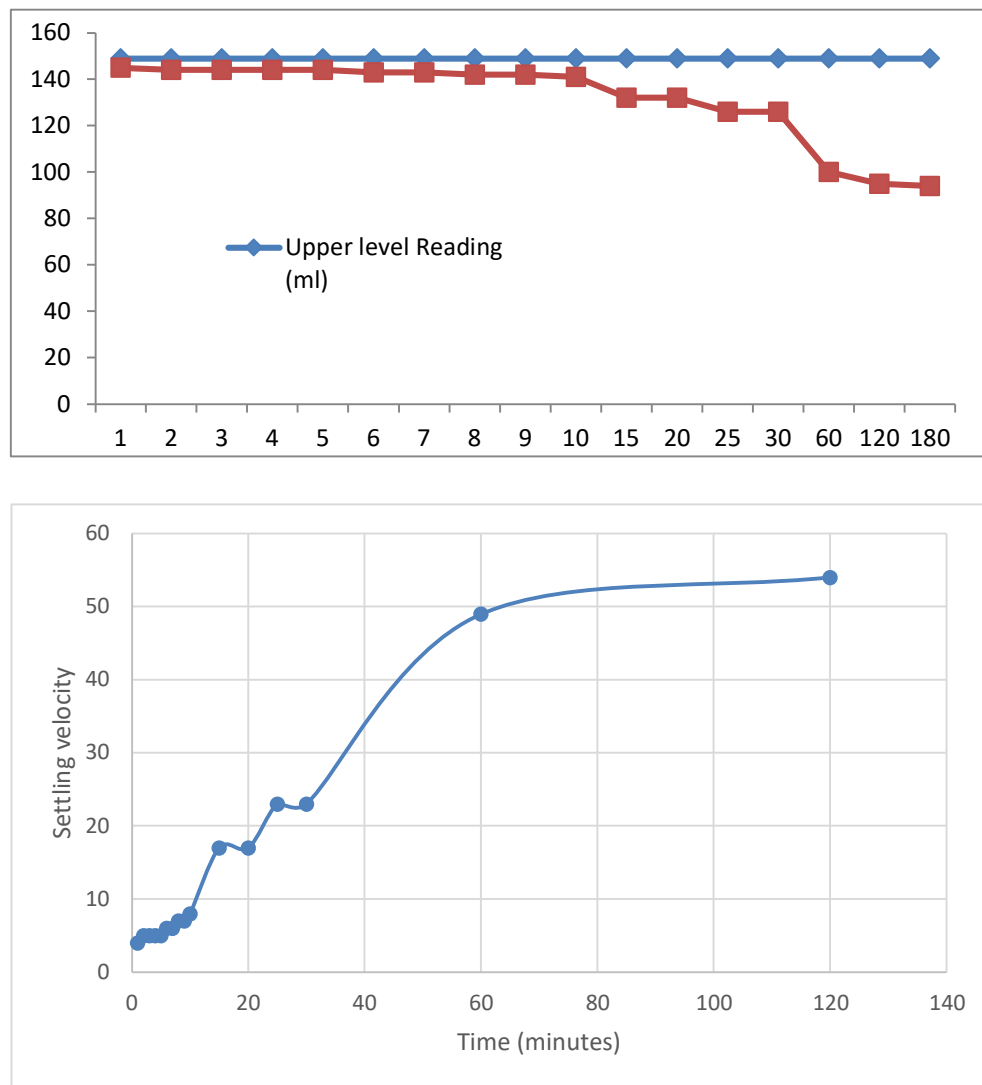


Figure 14 : Fly ash settling characteristic of UPRVUNL, Anpara TPS

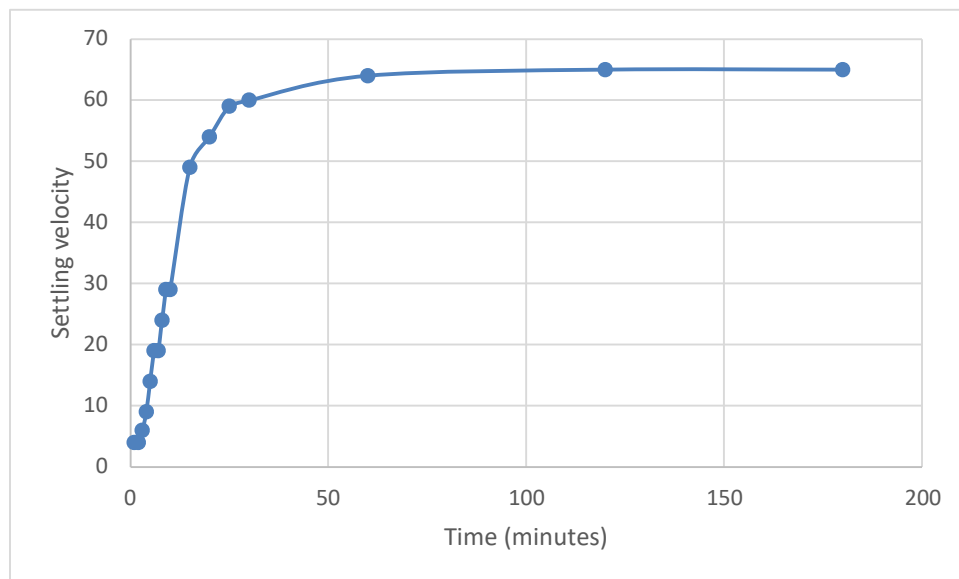
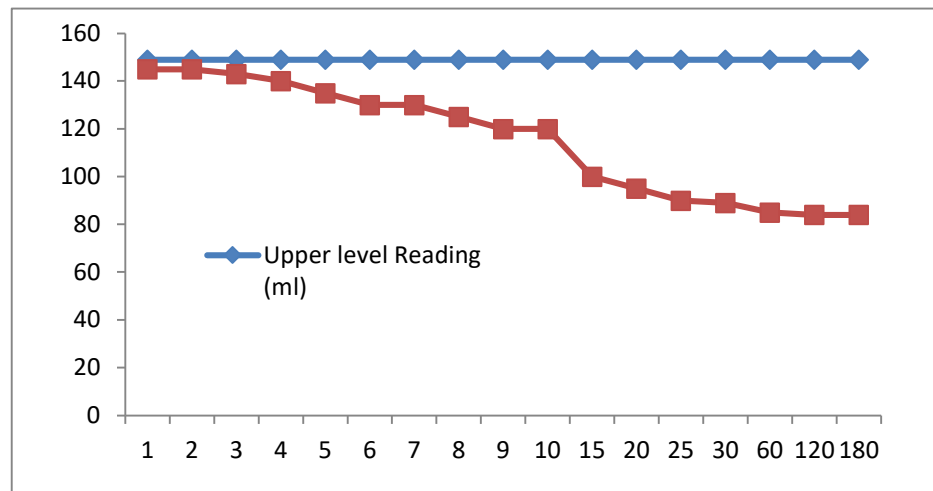


Figure 15 : Fly ash settling characteristic of Hindalco, Renusagar TPS

The fly ash is mostly ranging in fine size. The settling rate study has been conducted in laboratory in order to assess the impact of leachate to the discharge from overburden fly ash mixed filling. It concludes that the fly ash settling is relatively fast and within one hour maximum settling took place. Further, it also reached that maximum fly ash will be accumulated very near to dump area and it will not travel for longer distance. Hence, maximum fly ash impact will be there in nearby land and soil.

4.3 Leaching Characteristics of Fly Ash

The ash from thermal power plants if used for the disposal in opencast mines then there is every possible chance of the leachate coming in contact with the ground water. This may occur in two ways either by the recharge of the area by the percolation of the leachate under gravity or lateral movement of the water through the filled mine. Hence there is always risk of contamination of ground water and which may affect human health. The purpose of this study is to assess the potential contamination of trace/heavy metals by leaching experiments (open column percolation test).

Open column percolation test was used for long- term leaching characteristic study. A set up for the test consist of a column of PVC pipe approximately 1.0m height, 10cm diameter, and open at the top end and closed at bottom end. A small hole is made at the centre of the bottom for collection of leachate. The fly ash samples with their optimum moisture contents were placed in the columns. The samples were packed in each tube/column in layers Here mili-Q water was used as the leaching medium. Leachate was collected in conical flasks. The column percolation experiment is the only experiment that predicts the leaching behaviour that could be observed in the field. In the test there are however, chances that material develops preferential pathways for the water in the column experiments due to the formation of cracks, this possibility exist in the field also. Using groundwater/rain as the leaching medium one can even arrive at site-specific results.

Open column percolation test (result)

In fly ash the elemental composition generally increased 2-3 times depending upon the mineral matter content in coal. The details elemental analysis (table 21) of the fly ash indicates that there are 16 Element present in fly ash. The highest concentration of toxic trace metal (Mg and Mn,) are ranging from 41.69, 41.35 and 46.48, 53.90mg/L in Anpara and Renusagar fly ash sample respectively. All other metal concentration is shown in table 24.

After interaction of fly ash with water, there will be migration of metal from dumped depending upon the pH level of water (mine water and rain water).

In acidic range of pH the solubility of metal is more hence the migration of toxic metal in the soil and nearby land will also be enriched. Therefore, the mine suffering with acidic water will allow to used fly ash filling in active mine.

heavy metals and radioactive components that can be released into the soil. The environmental impact of fly ash, either used in an application or sent to a landfill depends to a large extent on the mobility of the polluting components in the ash. Concentration for Cu, Pb, and Cd were below the detection limit in both the fly ash samples whereas the concentration of Ni and As more in leaching sample.

Table 24 : Open column leaching analysis of Fly ash samples by ICP OES

S. No.	Elements	UPRVUNL, Anpara TPS	Hindalco, Renusagar TPS
1	B	2007.98	4392.52
2	Mg	41698.00	41356.31
3	Al	46.21	1218.21
4	Ti	0.26	1.84
5	Cr	0.76	0.72
6	Mn	4648.01	5390.69
7	Fe	<0.000	21.55
8	Co	107.79	155.64
9	Ni	75.49	447.04
10	Cu	7.88	7.70
11	Zn	521.97	173.05
12	As	9.40	14.32
13	Mo	386.49	527.24
14	Cd	5.35	8.51
15	Ba	102.62	49.26
16	Pb	0.66	0.67

4.4 Dispersion of Fly ash

The transportation and dumping of fly ash will be further increased the particulate matter concentration in the mining area. The suspended particulate matter more than 10micron will reduce the visibility in the core zone. Hence the accidental cases will be increased by light and heavy vehicle and earth moving machinery.

Not only this, occurrence of incident health issue will also be further increase and need advanced dust separation devices and equipment to bring the dust concentration below permissible limit.

4.5 Toxicity of fly ash

When fly ash is filled directly into voids of active mine, heavy metals are able to enter in environment and human body through leaching and inhalation or dermal contact. As can be seen from Table 25, the maximum heavy metal content in leached was within the permissible limits such as Mg, Cr, Co, Cu, Zn, As etc. Among the above metal in leached sample, only five metals (B, Al, Mn, Ni and Mo) concentration was beyond the permissible limit.

As we know that fly ash contains trace amounts of toxic metals that may have negative effects on human health and on plants. Globally, fly ash is considered to be a toxic waste creating hazards to the environment. Due to the presence of metals, plants growing nearby ash disposal sides can be found to have disparity in plant enzymatic activities. The microbial activity in soil may be decreased due to the deposition of fly ash to soil. Adverse effects can be observed on bird population nest in around dumping side and accumulation of Sr, Cd, As, and Se in their offspring. People can be affected to suffer from cancer and other disorders those living to nearby dumped side.

Plants growing in fly ash amended soil are reported to be rich in elements such as Ba, Mo, and B, As, V, Sr, and Se etc. These elements are required for plant growth and animal nutrition in trace amounts. It is reported that higher levels of these elements can be toxic. Highly phytotoxic elements are dangerous for plant growth and often kill plants. Elements such as Mo and Se are not that toxic to plants but are concentrated in plant tissues that cause toxicities in grazing animals. Fly ash addition at higher rates to soil may accumulate Mo and thus causes molybdenosis in cattle.

It was reported that when plants were grown in fly ash amended soil elevated concentrations of As, Se, Mo, B, Sr, and S are commonly reported in plant tissue. When fly ash was added to soil, concentrations of different metals such as Mn, Zn, Fe, Cr, Cd, and Ca have were found to decrease. The decrease in concentration was observed in plant tissues, due to the alkaline nature of fly ash. The high pH brings about precipitation and strong absorption of elements onto soil and surface of fly ash thus decreasing their availability to the plant

It was also reported that the dumping of fly ash, increases the microbial population, however, the higher doses of fly ash resulted in the deposition of toxic elements such as Arsenic and Boron in soil which had adverse effects on soil microorganisms and enzyme activity.

The chromium accumulates in plants can affects the growth of plants and Lead (Pb) in fly ash is of more serious concern because it is toxic to animals and human beings especially young children.

Arsenic concentration in fly ash generally ranges from 4 to 440mg/kg however, depending on the quality of coal the concentration may reach up to 1000 mg/kg.

When the plants are grown in soil amended with fly ash undesirable and stunted growth occurs due to B toxicity in plants. Boron has a tendency to accumulate in soils. Boron concentration in fly ash varies depending upon the origin and nature of the coal.

Boron contents of > 0.30 mg/g were considered as highly toxic while boron contents of < 0.10 mg/g, and 0.20 mg/g and 0.30 mg/g were considered as slightly toxic, moderately toxic and toxic to plants respectively. As leaching of fly ash occurs there is gradual decrease in concentration of boron.

Although, fly ash is toxic on one hand but on the other hand it contains nutrients and trace elements required for the vegetation to grow. Therefore, study of toxicity of fly ash and its possibilities to explore its utility from environmental perspective are important.

Table 25: Heavy metal concentration (mg/g) in leached sample of different thermal power plant fly ash

S. No.	Elements	Anpara	Renusagar	Permissible limit
1	B	2.01	4.39	0.1-0.3
2	Mg	41.70	41.36	100
3	Al	0.05	1.22	0.03
4	Ti	0.00	0.00	0.1
5	Cr	0.00	0.00	0.05
6	Mn	4.65	5.39	0.3
7	Fe	0.00	0.02	1.00
8	Co	0.11	0.16	1.3
9	Ni	0.08	0.45	0.1
10	Cu	0.01	0.01	0.05
11	Zn	0.52	0.17	5
12	As	0.01	0.01	0.01
13	Mo	0.39	0.53	10PPB
14	Cd	0.01	0.01	0.003
15	Ba	0.10	0.05	2
16	Pb	0.00	0.00	0.01

5.0 Slope Stability Analysis

5.1 General

Computer-based modeling offers the ability to evaluate the slope stability over the short and long term. Computer programs provide an efficient and detailed rapid analysis of a wide variety of slope geometry and loading conditions. Modeling has advantages that design ideas can be tested, different material properties can be evaluated and risk analysis carried out. Analysis has been conducted using and finite element method (FEM). These methods have also been used to assess the failure mechanisms and determine the factor of safety. The numerical method is widely used for slope stability analysis now-a-days. The term numerical analysis and numerical modeling are used here to describe analysis method or numerical solution for a problem. The numerical methods take into account the physical constraints under which the OB dumps are generated and effect of both of dynamic acceleration & static force. The techniques are widely used to perform stability analysis where the condition are complex and possible consequences of failure are significant.

The factor of safety of dump slope have been determined by strength reduction technique. The shear strength reduction technique has two advantages over the conventional approach. The critical failure surface is found automatically and it is not necessary to specify the shape of the failure surface. In general, the failure mode of slopes is more complex than simple circles or segmented surfaces. Further, numerical methods automatically satisfy translational and rotational equilibrium. To perform slope stability analysis with the shear strength reduction technique, simulations are run for a series of increasing trial factor of safety, F^{trial} (Griffiths and Lane, 1999). The actual shear strength properties cohesion (c) and internal friction angle (Φ) are reduced for each trial according to the equations 1 and 2. If the multiple materials are present, the reduction is made simultaneously for all materials. The trial factor of safety is gradually increased until the slope fails. At failure, the safety factor equals the trial safety factor. The factor of safety is defined according to the equation

$$C^{trial} = \frac{1}{F^{trial}} C \quad \dots\dots(1)$$

$$\phi^{trial} = \arctan\left(\frac{1}{F^{trial}} \tan \phi\right) \quad \dots\dots(2)$$

The factor of safety generally used is in the range of 1.2–1.5 for open pit mines (table 22). This factor of safety could either be directly calculated based on limit equilibrium method or indirectly by numerical modeling based on strength reduction technique. The factor of safety must be greater than 1 for stable slope. Due to uncertainties involved in determining the properties of material, leaving some of the parameters in simulation for simplification and

presence of some external factors that are not considered for simulation, it is advisable to have factor of safety of slope as 1.5.

Table 26 : Values of minimum safety factors (Duncan and Christopher 2004)

Failure type	Category	factor of Safety
Shearing	Earthworks	1.3–1.5
	Earth retaining structures, excavations	1.5–2.0
	Foundations	2–3

5.2 Overburden Dump simulation

Field investigation has been done to assess the current status of dragline dump, shovel dumper dump and external dump. The overburden contains various materials such as clay, sand, fine grained sandstone, medium grained sandstone, coarse grained sandstone carbonaceous shale, sandy shale, shale, etc. Figure 16 shows the mine plan of the Khadia OCP. The overburden is removed by dragline and coal is removed by shovel dumper combination. The internal dump is initially formed by dragline operation. Subsequently, dump material with a help of shovel dumper combination is dumped over this internal dump formed by dragline. The stability analysis has been carried out for various height for Internal Dragline dump along with Shovel dumper internal dump. Finite element method has been used for analysis of different geo mining condition. The value 1.5 is taken minimum factor of safety for optimum design of slope for long term stability.

Mine Plan of dump slope as provided by Company has been shown in figure 16. Four different scenarios have been created (with varying height) and simulated. The simulation has been done for height 60m, 90m, 150m and 180m as shown in figure 17. This height has been taken above from dragline dump. The simulation has been done in two stage one is only from dragline dump and other is for shovel dumper dump. The factor of safety is varying for dragline dump is 1.29 to 1.34. The dragline dump is short term stable therefore, during the simulation of shovel dumper dump the dragline dump slope is excluded. Figure 18 shows the shear strain in opencast mine slope with factor of safety. The factor of safety is varying from 1.61 to 1.76 for shovel dumper dump. Table 27 shows the summarized factor of safety for both cases. It has been observed that the factor of safety decreasing with the increase in height of dump. The overall slope angle is decreasing as the height of overburden is increasing, therefore decreasing trend in factor of

safety is not significantly. It indicates that shovel dumper slope sections are stable for long term. The factor of safety is more than 1.5 for shovel dumper dump, therefore the dump is stable for long term.

Table 27: factor of safety of overburden dump

Sr. No	Height of dump (m)	Factor of safety for Internal dragline dump	Overall slope angle of shovel dumper dump (degree)	Only overburden
1	60	1.30	26.4	1.76
2	90	1.29	25.7	1.70
3	120	1.32	25.2	1.67
4	180	1.31	24.5	1.61

Figure 16 : Mine Plan shown in working plan of Khadia OCP

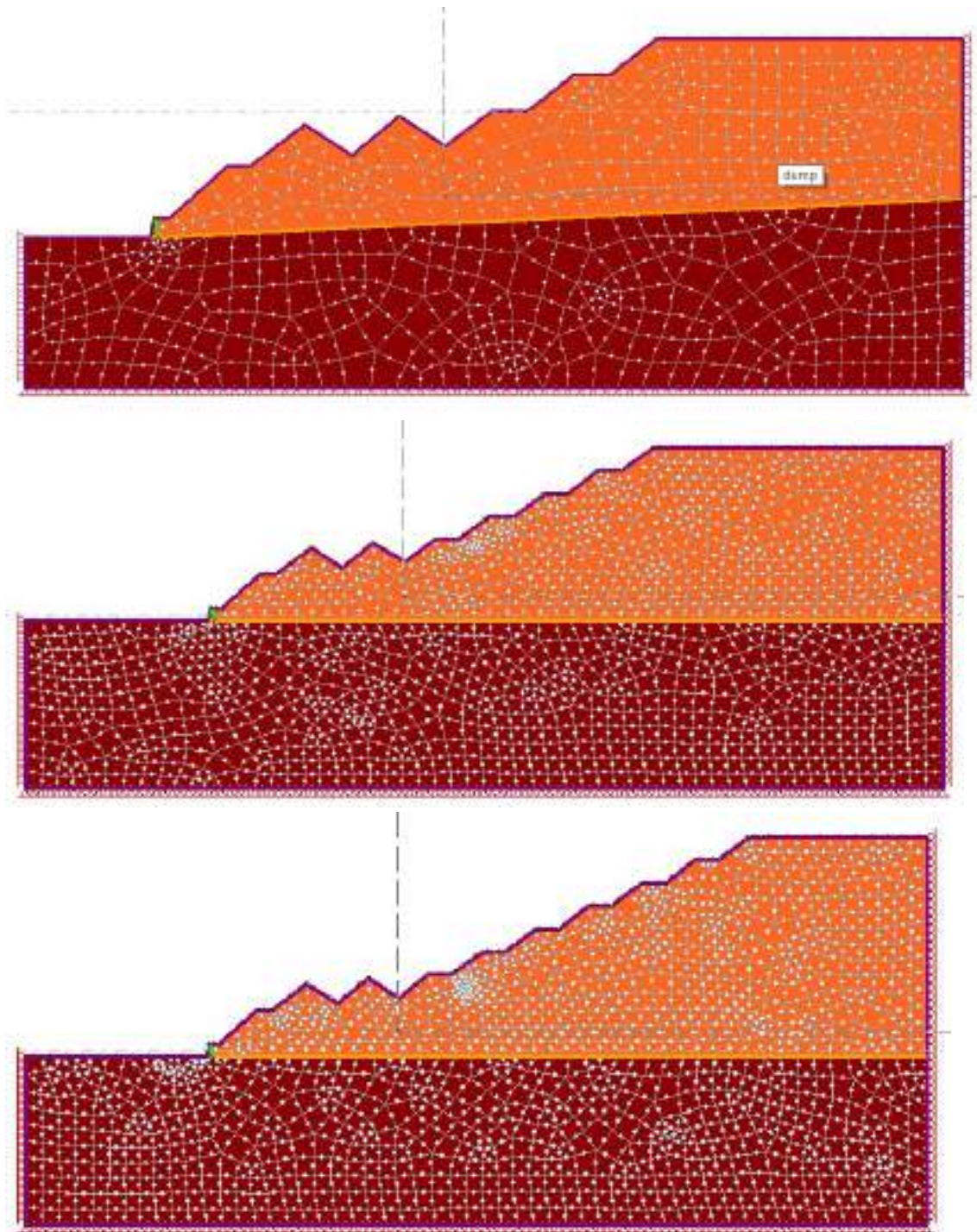


Figure 17 : Discretized view of opencast mine benches at different height

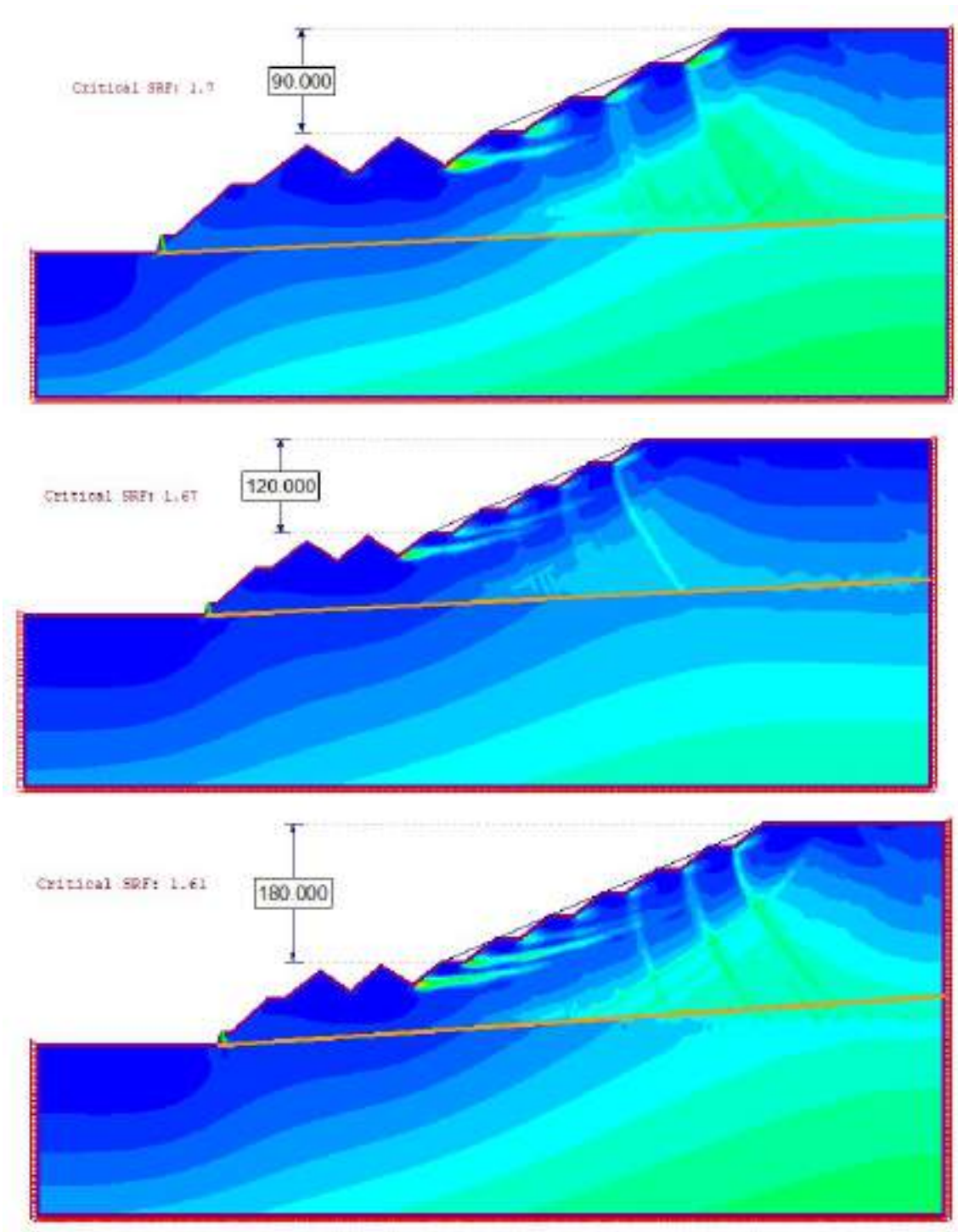


Figure 18 : Shear strain in opencast mine slope with factor of safety

5.3 Fly ash simulation with mixing with OB (% Variation)

The fly ash samples collected from Hindalco Renusagar and UPRVUNL Anpara power plants have been mixed as a single fly ash mixture in equal proportions by weight for preparing the sample for mixing with overburden of Khadia OCP. Table 15 shows the effect of percentage fly ash on shear strength of dump material. It is observed from table 15 that the best suitable option is 20 % of fly ash.

The dump configurations are likely to be stable against large-scale failure only in drained condition. The maximum height of a single bench should be 30m. The minimum exposed bench width after each lift should be 30m.

The fly ash has been mixed with overburden in various options. The following procedure has been used of dumping of fly ash:

1. The Fly Ash may be dumped in alternative layer/stages of height not exceeding 5m in each layer/stage
2. Initially a row of Overburden dump (bund) not less than 15m width shall be dumped of height upto 5m all around the area proposed for ash dump.
3. A number of such areas shall be formed in a layer/stage wherein the fly ash shall be dumped so that one dump of fly ash is separated by otherer with 15m wide overburden dump.
4. Thereafter, Fly Ash will be dumped within the area surrounded by such overburden dumps. In this matter the dumping shall be laid in the section/layer containing both overburden as well as fly ash
5. Immediately above the bottom section/stage., only overburden dumping shall be made to ensure that the Fly Ash is totally covered and protected from the Overburden dump all around.
6. In the same matter the alternative layer /section of the overburden and overburden with fly ash shall be dumped.
7. The percentage of Fly Ash content in the overburden mix shall be determined by scientific study.

The bund around the mixed fly ash and overburden can be design in three ways: Centre line, Upstream and downstream. Figure 19 shows the simulation of Fly ash with different laying options (a) fly ash mixed model (b) downstream (c) downstream and (d) center line. The numerical simulation has been done for all three options. 20% Fly ash have been simulated and factor of safety is calculated. The factor of safety for only dump material and mixed material is tabulated in table 28. Figure 20 shows shear strain in opencast mine slope with factor of safety.

Table 28 shows the factor of safety of dump and mixed fly ash of overburden layering options. The factor of safety of over burden dump material is 1.72 for 90m dump height and 1.61 for 180m dump height. Whereas, the factor of safety of fly ash mixed dump is 1.79 for 60m and 1.68 for 120m dump.

It is observed that the increase in factor of safety for fly ash mixed dump is 0.02 for 90m and 0.01 for 180m dump height. The increment in the factor safety is not very high due to some reduction in friction angle of mixed material. Moreover, as the height is increased the effect of fly ash will be negligible in stability.

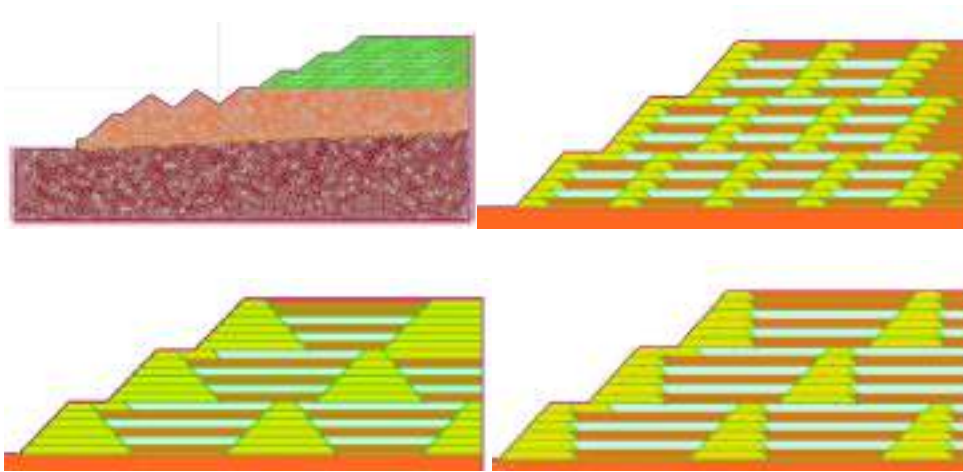


Figure 19 : Simulation of Fly ash with different laying options (a) fly ash mixed model (b) downstream (c) upstream and (d) center line

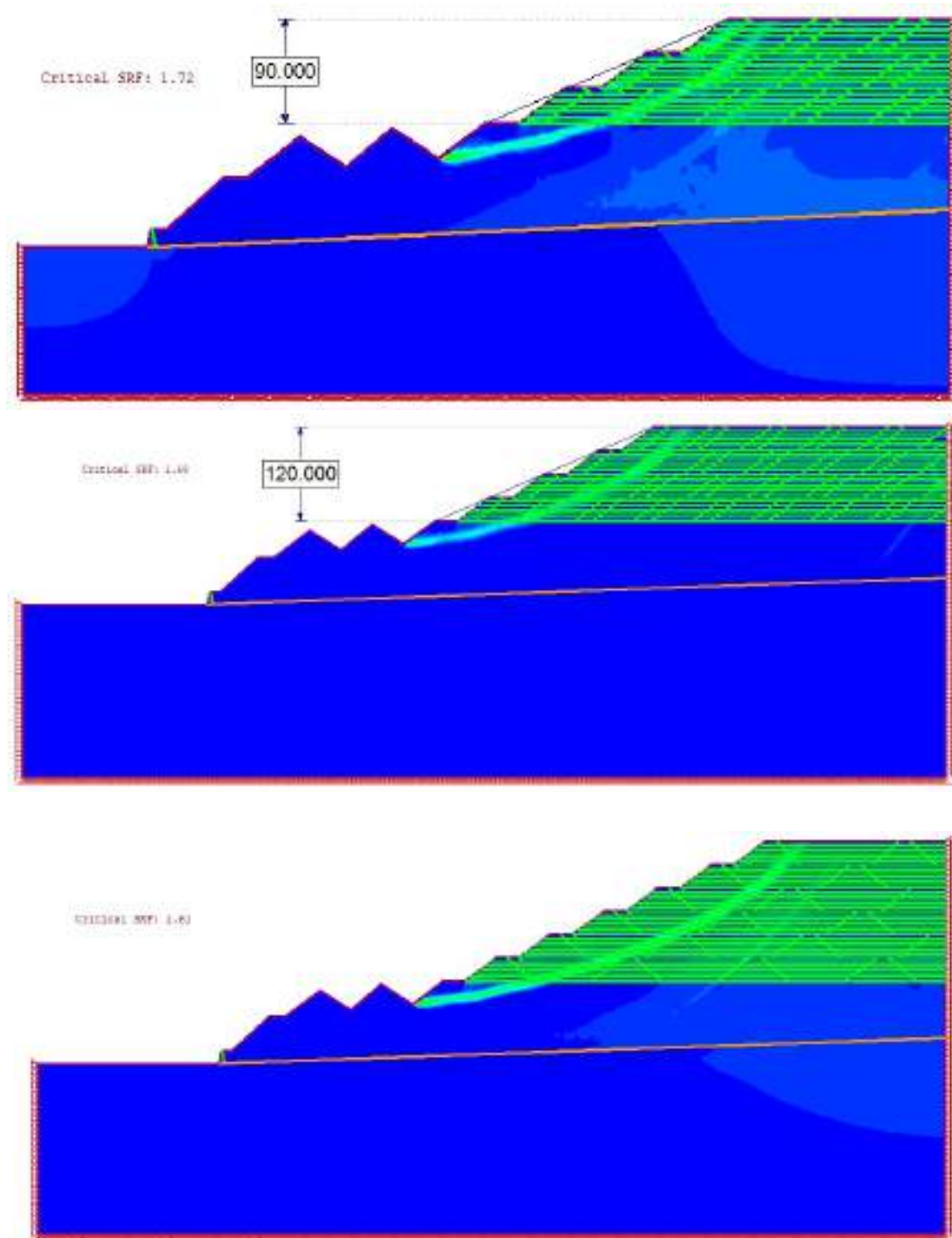


Figure 20 : Shear strain in opencast mine slope with factor of safety

Table 28 : Factor of safety of dump and mixed (Dump and Fly ash)

Sr. No	Height of dump (m)	Only overburden	Overburden with fly ash (20%) + overburden (80) in alternative layers			Average Factor of safety
			Centre line	Downstream	Upstream	
1	60	1.76	1.78	1.79	1.79	1.79
2	90	1.70	1.72	1.71	1.72	1.72
3	120	1.67	1.69	1.68	1.68	1.68
4	180	1.61	1.61	1.61	1.62	1.61

Table 29: Factor of safety at 180m dump height with percentage variation of fly ash with OB

Sr. No	OB %	Fly ash %	Factor of safety
1	100	0	1.61
2	95	5	1.62
3	90	10	1.61
4	80	20	1.63
5	70	30	1.62

5.4 Effect of water on dump stability

A dump of 180m height has been taken to simulate the effect of water on overburden mixed dump. The term 'mixed OB' dump has used for a dump of fly ash material and overburden material in varied proportions. The saturation level of dump, fly ash or mixed material has been varied. The fly ash percentage in the mixed dump have been varied to study the impact of water on mixed dump stability. The shear strength of different level of saturation has been taken from literature and laboratory testing.

Table 31 shows the effect of saturation of water on dump stability. It indicates the factor of safety of mixed dump increases at 10 % and at 25% saturation of water. However, the factor of safety reduces drastically. It reduces upto 1.04 which is critical in term of stability

Table 32 shows the effect of saturation of water on dump stability (with 5% fly ash + 95 % OB). It indicates the dump stability increase at 10 % of saturation and at 25% saturation of water. The factor of safety reduces drastically upto 1.04 at higher level of saturation of water which is critical in terms of stability.

Table 33 shows the effect of saturation of water on mixed ump stability (with 10% fly ash + 90 % OB). It indicates the dump stability increase at 10 % of saturation and at 25% saturation of water. The factor of safety reduces drastically upto 1.02 at higher level of saturation of water which is very critical in terms of stability.

Table 34 shows the effect of saturation of water on dump stability (with 20% fly ash + 80 % OB). It indicates the dump stability increase at 10 % of saturation and at 25% saturation of water it is stability. However, at a higher level of saturation of water, the factor of safety reduces drastically and it is below 1.00 which indicates failure of dump slope.

Table 30: Effect of water saturation on dump stability

Sr. No	% of saturation	Cohesion MPa	Friction angle Degree	Factor of safety
1	0	0.055	31	1.61
2	10	0.076	30	1.56
3	25	0.097	28	1.56
4	50	0.070	26	1.37
5	100	0.043	21	1.04

Table 31: Effect of water saturation on mixed material of dump slope (5% Fly ash + 95 OB)

Sr. No	% of saturation	Overburden		Mixed (5% Fly ash + 95 OB)		Factor of safety
		Cohesion MPa	Friction angle Degree	Cohesion MPa	Friction angle Degree	
1	10	0.076	30	0.102	29	1.64
2	25	0.097	28	0.113	28	1.60
3	50	0.070	26	0.036	26	1.36
4	100	0.043	21	0.018	21	1.04

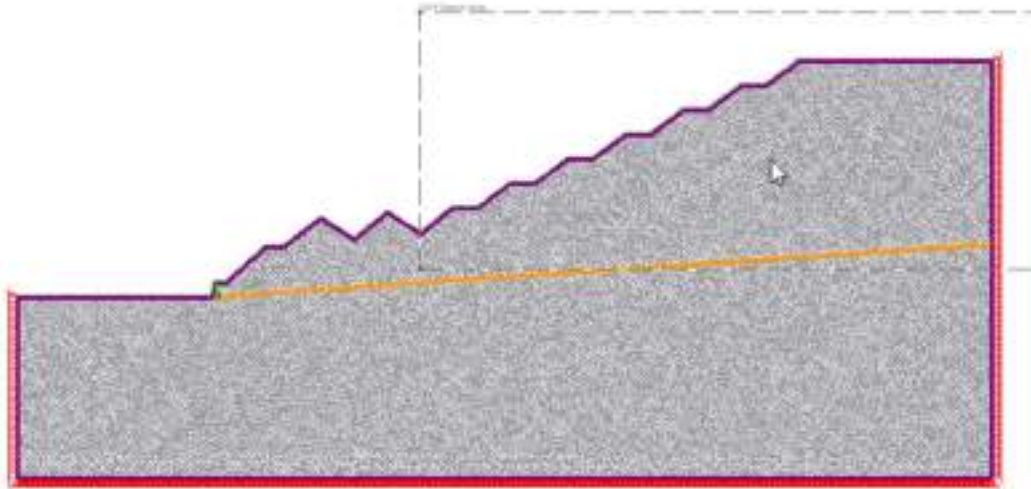
Table 32: Effect of water saturation on mixed material of dump slope (10% Fly ash + 90 OB)

Sr. No	% of saturation	Overburden		Mixed (10% Fly ash + 90 OB)		Factor of safety
		Cohesion MPa	Friction angle Degree	Cohesion MPa	Friction angle Degree	
1	10	0.076	30	0.131	28	1.64
2	25	0.097	28	0.146	29	1.63
3	50	0.070	26	0.046	25	1.36
4	100	0.043	21	0.023	19	1.02

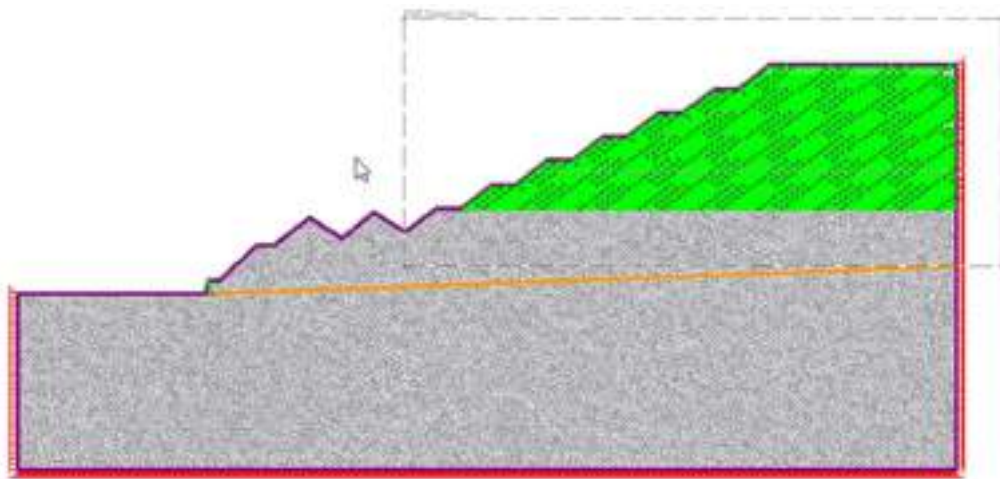
Table 33: Effect of water saturation on mixed material of dump slope (20% Fly ash + 80 OB)

Sr. No	% of saturation	Overburden		Mixed (10% Fly ash + 90 OB)		Factor of safety
		Cohesion MPa	Friction angle Degree	Cohesion MPa	Friction angle Degree	
1	10	0.076	30	0.143	28	1.65
2	25	0.097	28	0.162	26	1.54
3	50	0.070	26	0.047	22	1.31
4	100	0.043	21	0.017	16	0.93

(A)



(B)



**Figure 21 : Discretized model for simulation of water (A) Simulation of only dump
(B) Simulation of Fly ash with OB**

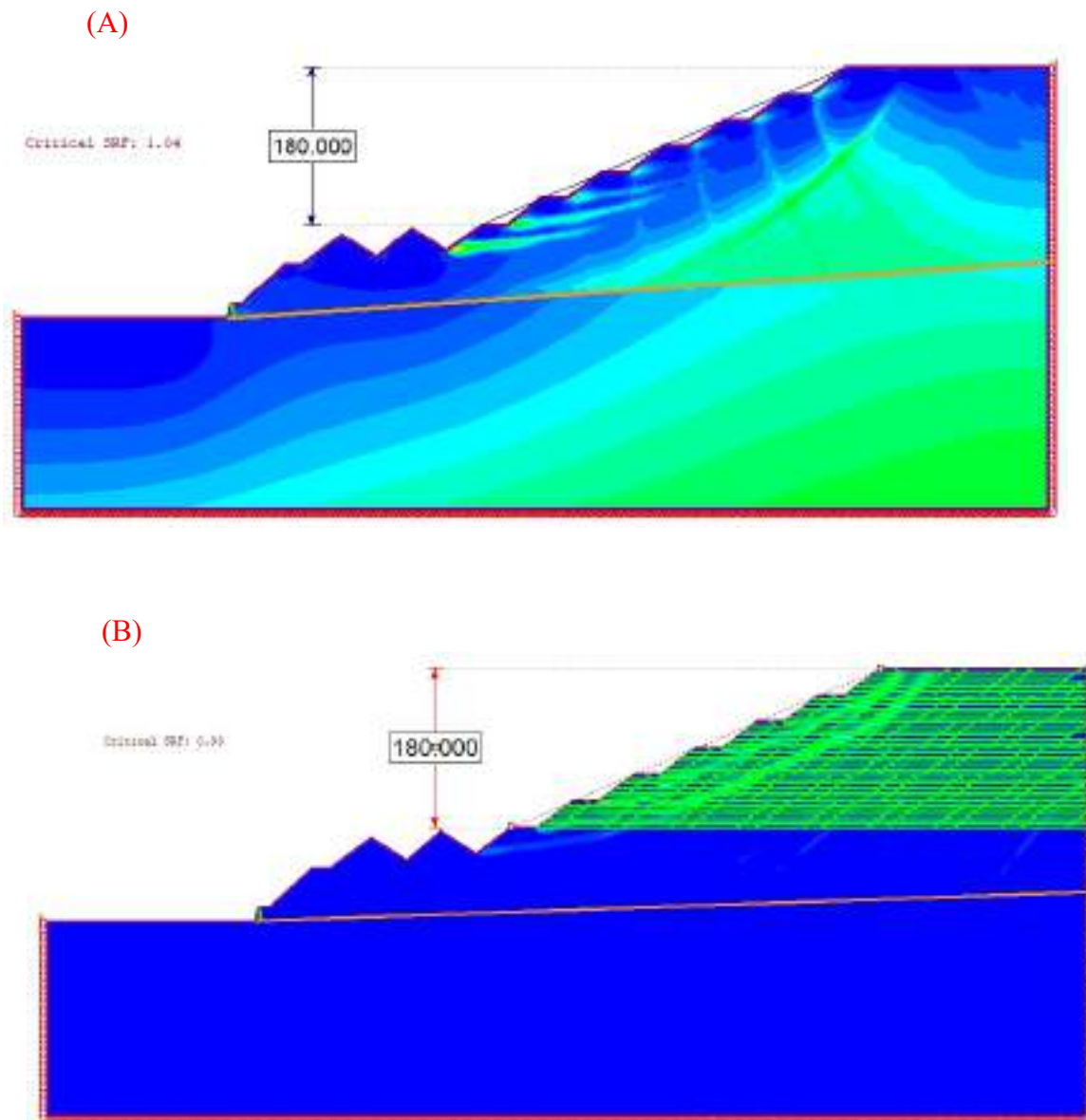


Figure 22 : Shear strain and factor of safety of only dump (A) and Fly ash with OB (B)

6.0 Mode of Transportation of Fly ash

Road Capacity Analysis for Fly Ash Transportation

An intersection is a traffic bottleneck which can be responsible for (1) hazardous materials to stay on the road (in trucks) for a longer time thereby increasing the chance for exposure, or (2) possible traffic conflicts between trucks when the crossing vehicles are significant in number. In order to assess the traffic movements from and to the mines, six major intersections were considered to assess the amount of traffic during the peak hours. Traffic at these intersections has been observed to be higher than at other intersections. Five (1,2,4,5,6) of these are directly on NH-39 with access to mines or power plants. These intersections are three-legged intersections.

Data was collected for 30 minutes peak hour on each of the six approaches (incoming and outgoing) at each intersection to estimate the peak flow rate. Flow rate or traffic volume is the number of vehicles that pass a given point on the road during a designated duration (generally 1 hour) of time. Road capacity is a measure of traffic volume during peak hours. Traffic volume near the capacity implies vehicles would be moving slowly making the fly ash truck to spend more time on the road. This is not desirable. Therefore, the chosen routes for the dump truck to transport fly ash to the mines, should have as less traffic below the capacity as possible.

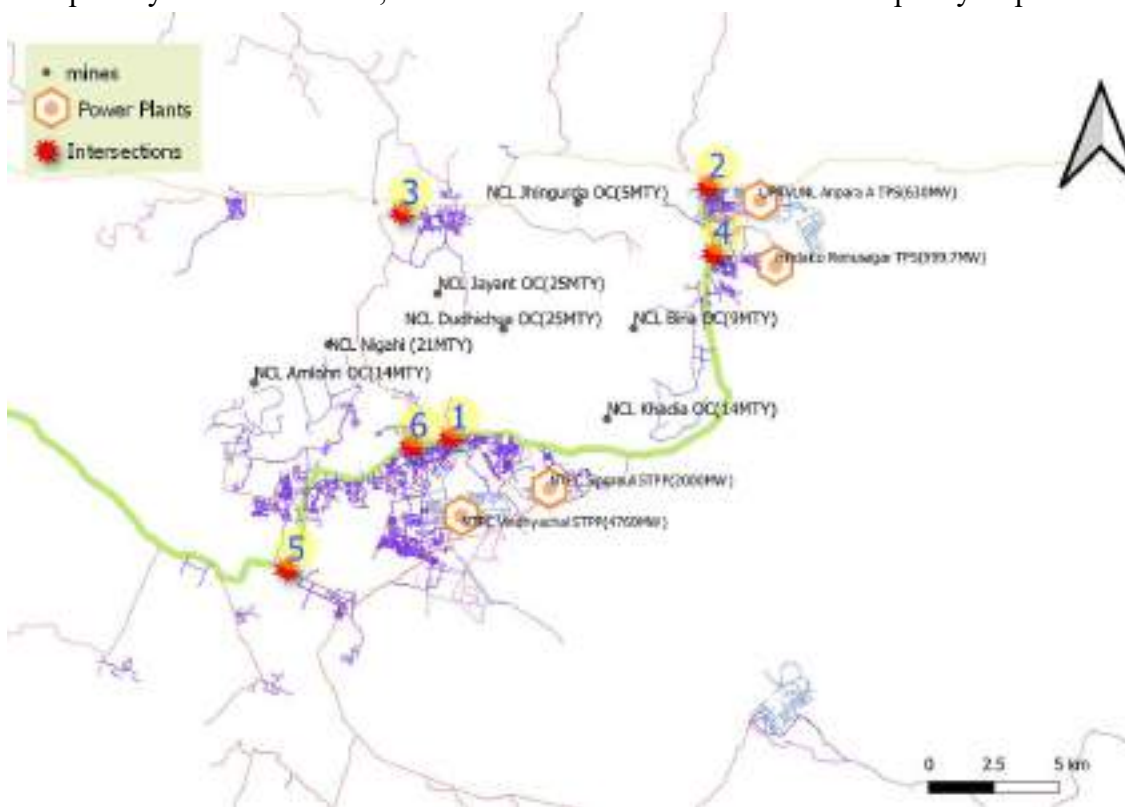


Figure 23: Layout of mine and road for transportation for fly ash

The major vehicle types observed were motorbikes (and scooters), car/jeep, trucks, and bus. Different vehicles contribute to the traffic impedance differently. A factor called Passenger Car

Unit is used in this regard. Passenger Car Unit is a measure of relative interaction between a vehicle and a traffic stream with respect to a standard passenger car under a specified set of roadway and traffic conditions. It is used to convert a heterogeneous traffic stream into an equivalent homogeneous stream to enable expressing flow and density in a common unit. The Indian Highway Capacity Manual (2017) suggests median values of passenger car unit on semi urban road for truck, bus, cars, and motorized two-wheelers as 5, 4.5, 1.0 and 0.5 respectively. Based on these values the peak hour traffic volume was estimated for each intersection approaches. IRC provides tentative capacities of urban roads. Almost all approaches and road sections in the area (including NH-39) are two lanes. According to IRC, the capacity of such a road is 1200 (no parked vehicles) or 750 (with parked vehicles and crossing heavy vehicles). As seen in the figure 24 below, intersections 2 and 5 crosses the 750 PCU per hour mark while traffic at intersection 5 crosses the 1200 mark. This suggest that trucks carrying fly ash may not be routed through intersection 2 ad 5 in case of significant crossing vehicles and parked trucks, or at least not through intersection 5 even with limited stranded vehicles. At least a provision should be made to transport fly ask during pre-identified low volume hours.

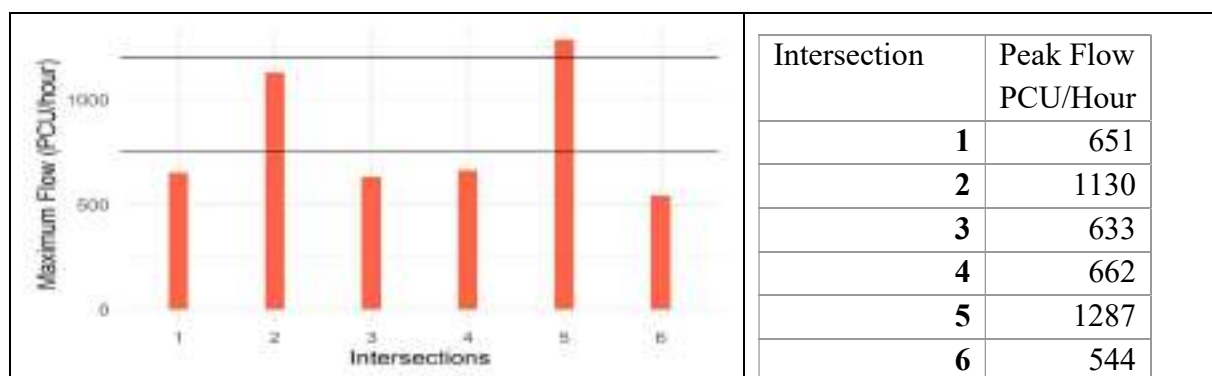


Figure 24: Maximum flow and intersection of transportation

Based on traffic study and estimated congestion at major intersections where trucks are likely to enter and exit NH-39, the following table 29 depicts the illustrative routes (called desire lines) that the fly ash trucks can take. These origin-destination desire lines can be used as a guide to plan fly ash transport. The planned route may consider maximum distance travelled on the national highway (NH-39). The planned route should also avoid entering or exiting locations where the traffic is reaching the road capacity.

Table 34: Routes (called desire lines) for fly ash transportation

Mine	Thermal Powerplant	Distance (~km)	Exit from NH-39	Remark
Amlohri	NTPC Vindhyachal	29	6	Avoid Intersection #5
Khadia	Renusagar	6.8	4	
Khadia	NTPC Shaktinagar	14	1	
Jayant	NTPC Shaktinagar	14	4	
Jhingurda	UPRVUNL Anpara	16	4	Avoid Intersection #2
Khadia	UPRVUNL Anpara	17	4	
Nigahi	NTPC Vindhyachal	24	1	
Total Mean Distance		17.25		

The following map (figure 23) shows desire lines from (NTPC) power plants to (NCL) mines based on traffic study and minimizing total distance travelled. A further analysis can be done that weighs the amount of fly ash that need to be transported from the power plants.

7.0 Dumping strategy and Mine closure

The estimation of mineable coal reserve and volume of overburden has been obtained from mine officials. The total Mineable Reserve estimated based on existing mine working plan was 233.50 Mt and corresponding total OB was 844.0 Mm³ with average stripping ratio of 3.61m³ as on 31.03.2020. The main OB bench overlying Turra seam is to be removed by dragline system and proposed to be side cast in the decoaled cut. The OB from upper benches is being handled by Shovel-dumper system and accommodated over the dragline side cast spoil within the pit. However, a part of OB is being accommodated in external dumps. Total volume of OB to be handled has been estimated as 844.00 Mm³, as on 31.03.2020 which completely filled or accommodated in internally.

Table 35 : Seam-wise, Section wise MR, OB, in-seam Band & SR as on 31.03.2020

Sl. NO.	EAST SELECTION		WEST SELECTION	
	Tier (RL)	Volume (Mm ³)	Tier (RL)	Volume (Mm ³)
1	Dragline Dump	66.65	Dragline Dump	89.70
2	Up to 290 & 290-320	69.00	Up to 270 & 270-300	78.78
3	320-350	45.12	300-330	60.08
4	350-380	41.40	330-360	57.36
5	380-410	34.43	360-390	59.26
6	410-440	28.90	390-420	46.91
7	440-470	20.97	420-450	44.16
8	470-500	12.95	450-480	39.98
9	500-530	6.90	480-510	29.16
			510-540	18.29
TOTAL EAST (A)		326.32	TOTAL WEST (B)	517.68
GRAND TOTAL (A+B) = 844.00				

Since inception, 487.66 Mm³ of OB has already been dumped in internal/external OB dumps of the mine. Apart from the above OB, the volume of OB estimated in the PR (16Mtpa) is 844.0 Mm³, which will be accommodated in internal OB dumps in both the sections.

The volume of OB (including in-seam band) to be handled as per PR of Khadia Expansion OCP as on 31.03 2020 is 844.0 Mm³, out of which 156.35 Mm³ OB will be directly sidecast by draglines including throw blast of 13.35 Mm² in the decoaled cut and balance 687.65 Mm³ is

proposed to be removed and dumped by shovel-dumper system in the internal dumps in both the sections. The mine is being worked since 1981-82 and 487.66 Mm³ of OB has already been dumped in external/internal dumps since inception till 31.03.2020. The final stage dump plan shows that apart from existing dump volume of 487.65 Mm³, further 844.0 Mm³ will be accommodated in the internal dumps in both the sections. Figure show the Final mine closure plan of Khadia OCP.

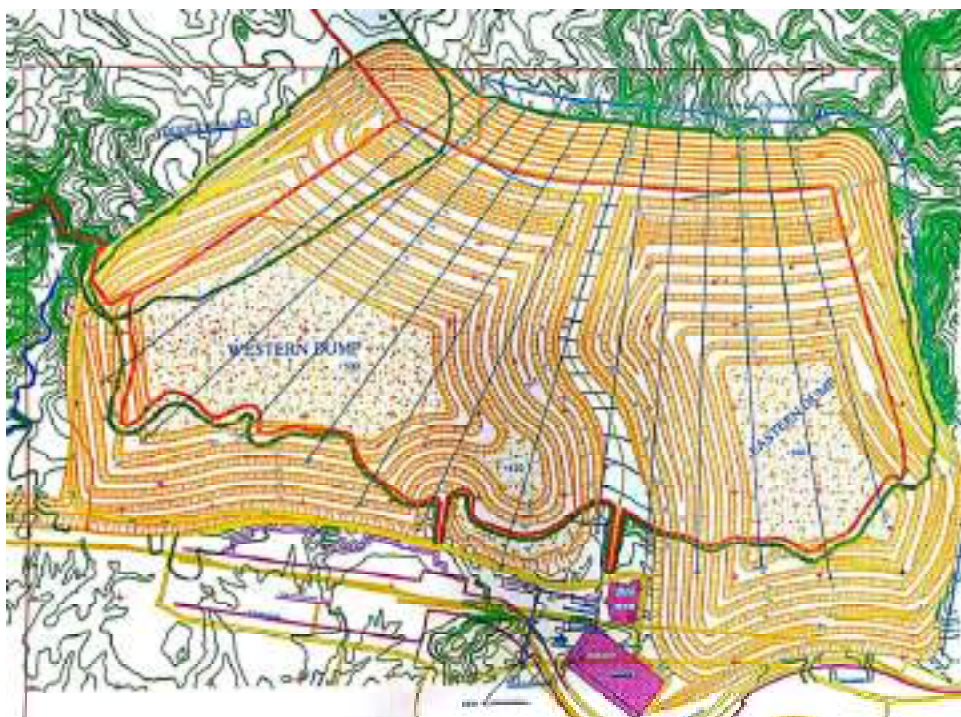


Figure 25 : Final mine closure plan

Solid waste that would be generated in course of coal mining are overburden material consisting of fragments of sandstone of assorted size. The Open cast mining of Khadia involves removal of 487.66 as on 31.03.2020. The OB from upper benches being handled by Shovel-Dumper system is to be stacked up to the extent possible over the dragline cast spoil within the pit.

The over burden will be dumped in internal dumps (in two to three tiers in each year). The height of each tier will be 30 m. The total estimated OB of 844.0Mm³, for expansion will be accommodated in the internal and external dumps. As per mine plan of Khadia OCP, total portion of quarry will be back filled and reclaimed; only an area of 37 Ha would be left out to be void. In due course of time, dip side of void will be filled with rain & ground water. This water reservoir may be developed for pisci-culture. At the time of final closure of mine, fencing with RCC post and barbed wire will be erected around the water body.

To maintain proper depth of water amicable for pisci-culture, the void will be back filled with OB dump material to certain height. In the final mine closure plan, design of voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation wherever possible and for hydro reclamation wherever feasible.

The final quarry slope has been so designed and then subsequently developed that after the closure of the mine, there is no likelihood of any slope failure. The final slope of the quarry has been designed with above consideration.

The final quarry slope has been so designed that after the closure of the mine, there is no likelihood of any slope failure. The internal dump will be completely filled by overburden material. We have created a scenario where 8-10 % fly ash is used. The fly ash will be put in layers (i.e. 80% overburden + 20% fly ash) as per stability analysis. The total volume will increase in the internal dump which will subsequently increase the final height of de-cold area. It will results further change the mine closure plan.

It has been proposed in PR that 844.0Mm³ of OB of Khadia OCP is to be dumped in Internal dump. If fly ash with a mixture (i.e. 80% overburden + 20% fly ash) will be dumped then around 80 Mm³ would be added to the mine overburden dump. Therefore, there will be land shortage for dumping of 80 Mm³ of extra OB. Dumping of fly ash will require additional land for dumping and it also require proper planning. The height of external or internal dump could not be increased without taking prior permission from regularity authority.

1. The extra overburden has to be left out i.e. approximately 80-90 Mcum³ which will lead to requirement of extra space for dumping.
2. If the void is left out and filled with water for pici-culture at end of mines. It is most likely to have contaminated the water as the base and side will have fly ash material. then the water
3. Mine closure plan has to be changed looking above extra material need to be dumped in mining area. This will lead to extra work load to production system;

Therefore, it is not advisable to used fly ash in fill with overburden dump in internal dumps.

8.0 Conclusions and Recommendations

The present Scientific study of fly ash dumping with overburden in the internal dump of Khadia Opencast Project, NCL has been done considering various aspects. The overburden samples have been brought from Khadia Opencast Project and fly ash sample from Hindalco Renuagar and UPRVUNL Anpara. Various geotechnical tests and characterization have been done for overburden, fly ash and various combination of mixed material (overburden and fly ash). Leaching study, dump slope stability, traffic study has been done to know the dumping possibility of fly ash with mixed overburden material in running mines. The conclusions and suggestions of the present study are summarized below.

Dumping of fly ash in external dump

- In opencast mining, handling of overburden (OB) is considered the most important activity requiring very careful and elaborate planning. The purpose is to reduce land requirement for external dumping of overburden and accommodate maximum overburden in internal dumps. There are also restrictions on maximum dump height from above surface level. The external dump is already reached to its maximum height (as reported by mine official). In such, there will not be any possibility of accommodating fly ash dump into External dump.
- The plantation is usually carried out on top of external dump after putting top soil layers. This has already been done for external dump of Khadia OCP. The growth of plant is healthy. If planning is done for putting fly ash on top of external dump, then the plantation has to be removed and top soil layer has to be scraped and kept aside. However, mixing of fly ash with dump material leads to increase the height beyond the permissible limit and lead to safety issue.
- Therefore, keeping above points it is advisable not to dump the fly ash on external dump in Khadia OCP.

Dumping of fly ash in Internal dump

Various geotechnical tests of overburden and fly ash material has been done to know the suitability of mixing fly ash with overburden material in Internal dump. The conclusions and recommendation have been summarized in the following headings.

Geotechnical properties of dump and fly ash

- The size distribution of dump material and fly ash material indicates that the fly ash is having more fine material than the dump material. It will reduce the permeability of dump material when mixed with overburden material. The permeability of overburden is 1.23×10^{-4} m/sec whereas for fly ash it is around 1.6×10^{-5} . Therefore, mixing of fly ash with overburden will reduce the permeability of overall dump material. The lower permeability will have the chances of generating water pressure during rain water.
- The Atterberg's limits indicates that the overburden dump is having very low amount of clay and silt. It contains sand, gravels and boulders. Therefore, the liquid and plastic limit is very high for overburden material considering the large size particles. The liquid and plastic limit of fly ash is low comparing to overburden material. It can be concluded that if dump material is mixed with fly ash the liquid limit and plastic limit will reduce significantly. Therefore, the material can slide on low water content. Moreover, if fly ash is not mixed properly with the OB, it will slide more rapidly to the bottom of the slope
- The Optimum moisture content (OMC) and Maximum dry Density (MDD) of overburden is 11 % and 1.92 t/m^3 respectively. OMC is in range of 20-32 % and MDD is in range of 1.28-1.29 for fly ash of Hindalco Renuagar and UPRVUNL Anpara respectively. The OMC will increase and MDD will reduce when the overburden material is mixed with fly ash. Therefore, it is not advisable to mix dump material with fly ash.
- The average cohesion and friction angle of dump material are 52 KPa and 31 degree respectively. The friction angle of fly ash is range between 24-28 degree and cohesion is 18-48 KPa. The shear strength has been determined by mixing fly ash with overburden in different proportions. The maximum shear strength is observed at 20 % of fly ash mixed with 80% of dump material. The cohesion has increased from 52 kPa to 126 kPa whereas, the friction angle has reduced from 31 degree to 28 degree. The fly ash of the area does not have much binding capacity; therefore, cohesion will not increase significantly. The friction angle reduces due to presence of material in the fly ash.

Fly Ash characterization

- The pH of the fly ash samples are found to be in the range of 6.4 and 6.3 for Hindalco Renusagar and UPRVUNL Anpara respectively. It means the pH of fly ash is slightly acidic in nature. This will help in biological reclamation in the backfilled land
- The electrical conductivity of the fly ash is around 1.06 mS/cm. It is suitable for seedlings and salt sensitive plants. Therefore, it is not advisable to directly mix in the overburden dump material. Some additive should be added to increase the electrical conductivity of the fly ash.
- The major trace elements in the fly ash obtained by XRF are SiO_2 and Al_2O_3 . The amount of CaO is around 2%. The fly ash is not having self-binding capacity. Some activator needed to be properly mixed and filled with overburden for proper binding.
- The water holding capacity of fly ash is 24 % and 25.36 % for Hindalco Renusagar and UPRVUNL Anpara respectively. It will increase the more water content in the dump material for longer time. Therefore, the haul road/ pathway become slippery and it will hamper the movement of dumper/tipper.
- The retention capacity of fly ash study at laboratory stage, conclude that there is ample water retention capacity in the fly ash. Hence when water availability will increase from 24% or more a swamp like condition will be created where in fly ash would be dumped.
- Fly ash used in this study is Class F (As per ASTM). Fly ash having low pozzolanic properties therefore mixing of this fly ash with overburden will not lead to hardening of material after some time. It requires a cementing agent (such as Portland cement, quicklime, or hydrated lime) in the presence of water in order to react and produce cementitious compounds
- The highest concentration of toxic trace metal (Mg and Mn) are ranging from 41.69, and 41.39 mg/L in UPRVUNL Anpara fly ash sample whereas in Hindalco Renusagar fly ash sample the concentration of Mg and Ni is 46.48 and 53.90 mg/L respectively. The solubility of metal is more in acidic range of pH hence the migration of toxic metal in the soil and nearby land will also be enriched. Mixing of fly ash with Overburden will increase toxic trace metal in surrounding area.

Environmental and safety

- The transportation and dumping of fly ash will further increase the particulate matter concentration in the mining area. It will increase the chances of the accidental cases between earth moving machinery.
- Fly-ash will make the dump floor slippery when contact with water. It will hamper or reduce the movement of dumper and other heavy machinery in mine and dump area. It will also increase the chances of accident in rainy water during movement of dumper/tippers

- In very large open cast operating mines, it is difficult to mix fly ash with external and internal overburden dumps. Operational difficulties will be encountered with safety issues during heavy rains with slippery roads and sliding of dump benches owing to fly ash.
- Due to increase in stripping ratio in coal mines, the quantum of OB is increasing and its safe disposal has become a matter of concern in the coal sector.
- In operating opencast mines, fly ash will be required to be dumped in dry form in separate layers or by mixing with OB while dumping. Both these processes would require elaborate and complex scheduling of various activities/equipment, hampering mine production and creating unsafe conditions owing to high equipment density in limited space of mines.
- The adding of fly ash will increase the pollution level in the running mine, which may exceed the allowable limit of various pollution level.

Fly Ash Transportation

- The routes from the power plant to the mine are not adequately constructed for additional fly ash transportation. Hence it is not advisable under the present road condition to transport fly ash through these roads.
- Fly-ash carrying trucks will cause hindrance to movement of dumper carrying both O.B and Coal.
- Fly-ash will make the dump floor slippery in contact with water. It will limit the movement of dumper/tipper in the haul roads.
- The lead distance of each mine already optimizes based on present equipment and production. The adding of fly ash in same layout/road will increase the traffic density and reduce the distance between two subsequent tripper/dumper.

Geo-Mining conditions

- In operating opencast mines, fly ash will be required to be dumped in dry form in separate layers or by mixing with OB while dumping. Both these processes would require elaborate and complex scheduling of various activities/ equipment, hampering mine production and creating unsafe conditions owing to high equipment density in limited space of mines operations.
- The dumping with overburden required proper mixing of fly ash in the mine overburden itself. It requires huge logistic and space for mixing plant for OB and Fly ash.
- The quarry will be back filled and reclaimed as per mine plan of Khadia OCP. An area of 37 Ha would be left as void after filling the remaining area with dump material. In

due course of time, dip side of void will be filled with rain & ground water. This water reservoir may be developed for pisciculture. By adding fly ash to internal dumping/backfilled areas there could be possibility of fly ash leaching into the void/water reservoir rendering it unsuitable for pisciculture.

- The dump material consists of large quantity of fly ash material (if dumping is to be done with fly ash). Therefore, at end of mining around 80 Mcum of dump material will be left out (which have been accommodate in original plan in place of fly ash). Therefore, the mine closure plan should be change accordingly, so that the provision of accommodation of 80 Mcum of overburden material.
- It will change the mine closure plan and it will have environmental impact in surroundings. Therefore, as per mine closure plan the fly ash should not be advisable to dumped in internal dump.

Dump Slope stability

- The dump slope stability has been carried out based on finite element method. The factor of safety has been determined for height varying from 60m to 180m. It varies from 1.76 to 1.61 for overburden dump material.
- The factor of safety of mixed overburden (fly ash mixed with OB material) has also been determined. The simulation has been carried out considering that the fly ash has been put in alternative layers in the dump. The fly ash is mixed with layer in the ration of 80% overburden material and 20% fly ash. The factor of safety of mixed dump material in dry condition is varying from 1.79 to 1.61 for dump height from 60m to 180m.
- It was expected that factor of safety will increase due to increase in cohesion of mixed material. However, it has been observed that the increase in factor of safety for fly ash mixed dump is marginal i.e. 0.04 for 60m and 0.01 for 180m dump height. The reason for marginal increase in the factor safety is due to reduction in friction angle of mixed material. The impact of mixing of fly ash on overburden will not affect the stability in dry condition.
- Water has important role to play in stability of dump material. Study has also been carried out to determine the factor of safety of dump as well as of mixed dump. The material will get saturated due to water and the shear strength reduces significantly depending upon amount of water and material type.

- The table given below summarize the factor of safety of varying % of fly ash and degree of saturation.

Sr. no	% of saturation	Factor of safety of mixed material			
		0% fly ash	5% fly ash	10% fly ash	20% fly ash
1	10	1.56	1.64	1.64	1.65
2	25	1.56	1.60	1.63	1.54
3	50	1.37	1.36	1.36	1.31
4	100	1.04	1.04	1.02	0.93

It is obvious from above table that mixed dump will not be stable in high saturation condition if fly ash is mixed more than 10%. The formation of layers of fly ash in layer may lead to formation of weak shear failure zones which may lead to dump slope failure.

- Generally, the cracks are generated in the top surface of overburden dump. The rain water entering in the crack will create water pressure, waters generally get drained from the dump material. However, the water pressure will be created in crack of overburden dump with fly ash as water will get retained which lead to low factor of safety.

Therefore, it is technically not feasible to dump the 25% fly ash in Mine dump in Khadia OCP due to geo mining conditions, high stripping ratio, and huge rate of OB removal and instability of dump during rainy season in present condition.


(Dr Rajesh Rai)


(Professor B K Shrivastva)


(Professor A Jamal)

DISCLAIMER

The report is based on field reconnaissance, laboratory tests as per IS codes on small size soil samples and analysis results using Phase2 slope stability analysis software. Neither IIT (BHU) nor any of its employees makes any warranty, express or implied or assume any legal liability or responsibility for the accuracy completeness or use of the result of such information, product or process in the report KHADIA OCP

	Parameters	Details			
		possibility of dumping of fly ash in backfilled are as per MOEF&CC guideline.			
8.10	Abandonment Cost and Financial Assurance				
8.10.1	Abandonment Cost				
	Proposed Cost break-up for carrying out progressive and final mine closure activities as per the yardstick of CMPDI formulated based on the revised mine closure guidelines is as given below:				
			</		

Parameters		Details				
		Garland Drain				
		Garland Drain around the dump				
		Drainage channel from main Ob dump	m	500	4500	22.50
		Any other Activity				
		TOTAL				211.50
	Technical and Biological Reclamation of mined out of land and OB Dump	Filling of Void				
		Top soil management				
		OB Rehandling for backfilling	Mm3	50	2400000.00	1200.00
		Terracing, blanketing with soil and vegetation of External OB Dump				
		Paripharel road, gates, view point, cemented steps on bank				
		Expenditure on development of Agriculture land	Ha			
		Landscaping and Plantation	LS			200.00
		Any other Activity				
		TOTAL				1400.00
	Post Closure management and supervision	Power Cost	LS			150.00
		Post mining water quality management	LS			80.00
		Post mining air quality management	LS			150.00
		Subsidence monitoring for 5 years				
		Waste management	LS			100.00
		Manpower Cost and supervision	LS			50.00
		Any other Activity				
		TOTAL				530.00
	Others	Enterpreneursip development(vocational/skill development training for sustainable income of affected people)	LS			100.00
		Golden Handshake/Retrenchment benefits to 100 employees of OC				132.36
		Golden Handshake/Retrenchment benefits to 200 employees of UG				
		Onetime financial grant to societies/ institutions/ organisations which is dependent upon the project	LS			100.00
		Provide Jobs in other mines of company				
		Continuation of other services like running of school etc.	LS			100.00
		Any other Activity (Development of Solar Park, eco-friendly Parks, fish farming pond, picnic spot and sport compound)	LS			640.90
		TOTAL				1073.26
	G TOTAL					22812.54
	Note: Above G Total Amt. includes Closing Balance of Rs. 8749.96 Lakh as on 31.03.2023 and Amt. to be deposited Rs. 14062.58 Lakh in ESCROW Account.					

कार्यालय क्षेत्रीय वन अधिकारी, खड़िया प्रोजेक्ट, रेनुकूट वन प्रभाग, (सोनभद्र)
पत्रांक- 17 / रेनुकूट / 29 (वृक्षारोपण) दिनांक, रेनुकूट, सितम्बर, 14, 2024
सेवा में,

महाप्रबन्धक,

एन सी एल खड़िया प्रोजेक्ट ।

विषय:- वृक्षारोपण वर्ष-2024-25 (वर्षाकाल 2024) में रोपित किये गये पौधों का प्रजातिवार विवरण के सम्बन्ध में ।

महोदय,

उपरोक्त विषयक के क्रम में सादर अवगत कराना है कि एन.सी.एल. खड़िया प्रोजेक्ट द्वारा वृक्षारोपण वर्ष-2024-25 (वर्षाकाल 2024) में 18175 पौधों के रोपण हेतु लक्ष्य आवंटित किया गया था, उक्त आवंटित लक्ष्य के अनुरूप प्रजातिवार पौधों का रोपण निम्न विवरण के अनुसार किया गया है-

वृक्षारोपण वर्ष-2024-25 (वर्षाकाल 2024) में रोपित पौधों का प्रजातिवार विवरण:-

क्र.सं.	प्रजाति	रोपित पौध संख्या
1	सीसम	1500
2	बेचनबीलिया	500
3	बिल्वित	700
4	कनेत	200
5	कड़ी	2000
6	बकसिया अरिका	500
7	बाग	800
8	बंसियागुनिया	500
9	कचनार	100
10	अरिता	600
11	बंसियागुनिया	500
12	प्रोरोपित	500
13	बेत	100
14	पेल्लोका	2200
15	जपल जलेशी	100
16	बुबकूल	200
17	अपराध	100
18	जामुन	200
19	आम	150
20	महुआ	300
21	अमर	100
22	छोशिया	1500
23	अशोक	100
24	नीम	2200
25	काठईया	200
26	रोपल	300
27	बकसिया	1500
28	अन्य प्रजाति	525
	योग-	18175

अतः महोदय की सेवा में सूचनार्थ एवं आवश्यक कार्यवाही हेतु रिपोर्ट प्रेषित है।

भवदीय



(धीरेन्द्र कुमार मिश्र)

क्षेत्रीय वन अधिकारी,

खड़िया प्रोजेक्ट रेंज,

रेनुकूट वन प्रभाग, रेनुकूट

नॉर्थन कोलफील्ड्स लिमिटेड
[kfM+;k ifj;kstuk
(मिनिरात्र कंपनी)
(कोल इण्डिया लिमिटेड की अग्रभूमी कंपनी)



Northern Coalfields Limited
Khadia Project
(A Miniratna Company)
(A subsidiary of Coal India Limited)



Office of Staff Officer (Mining)



CIN- U10102MP1985GO003160

An ISO: 9001, ISO: 14001 & OHSAS: 18001 Certified Company

Fkkuk&"kfDruxj] ftyk&lksuHknz Xmoiz0% flu&231222/ Thana-Shaktinagar, Dist. Sonebhadra (U.P.) Pin- 231222

Phone: 05446- 232274, (FAX) 05446- 232274 Email: egm.kho@gmail.com, website : www.nclil.in

No. KHD/M/Env./Plant Distr./S.O./24-25/ 11

Date : 29.06.2024

Supply Order

To,
M/S Harit Sone Nursery,
Karhiya (Dibulganj),
Renukut - Anpara road, Anpara,
Sonebhadra (U.P.).

Sub. : Supply order for "Distribution of plant saplings among employees of Khadia Area and Nearby Population."

Ref. : KHD/Min/Committee/Plant Dist./2024/10 dated 25.06.2024

Dear Sir,

It is to inform you that your offer has been accepted for the work "Distribution of plant saplings among employees of Khadia Area and Nearby Population" as per details given below in accordance with the terms and conditions given here under :-

S.NO.	Particulars	Quantity	Rate	Amount (in Rs.)
1	Distribution of plant saplings among employees of Khadia Area and Nearby Population	4500 nos.	As per enclosed BoQ	198600.00

Terms & Conditions

1. Total order value : Rs. 198600.00 (Rupees One Lakh Ninty Eight Thousands Six Hundred Only) (including GST)
2. Work Completion : Within 03 days from issuance of Work Order
3. Payment terms : 100% payment within 21 days on completion of work or submission of bill whichever is later through e-payment for which bank details should be mentioned on the body of your bill.
4. Taxes & Duties : Inclusive of all taxes in the above quoted rates.
5. Consignee : Staff Officer (Mining), Khadia Area

(Signature)

6. Paying authority : Area Finance Manager, Khadia Area
7. Submission of Bills : Bills in duplicate in GST format to be submitted to the consignee and GST no. of Khadia Area, NCL must be mentioned on it.
8. Inspection : The Work must be completed as per specification and under supervision of Staff Officer (Mining), Khadia Area or his representative. They will inspect the work and have the right to reject the work, if is found below specification.
9. All Other terms and conditions will be followed as per NIT & General terms and conditions of NCL.

Yours faithfully,


29/6/24
Staff Officer (Mining)
Khadia Area.

- CC : (1) The G.M., Khadia Area
(2) The AFM, Khadia (FC/AFM/KHD/2024-25/ENVIRONMENTALEXP / 91 / 16 for Rs. 198600.00 and Dated 29-06-2024)
(3) Nodal Officer (Environment), Khadia Area



NCL Khadia Area CSR <csrkhadia@gmail.com>

Information regarding Virtual Reality Device laboratory

2 messages

NCL Khadia Area CSR <csrkhadia@gmail.com>

Fri, Jan 31, 2025 at 2:20 PM

To: CDO Sonbhadra <cdoson.up@gmail.com>

Cc: cgm.khd@gmail.com, sopkhd ncl <sopkhdncl@gmail.com>, khddavssps@gmail.com

Dear Mam,

This is to inform you that NCL khadai under its CSR initiative has developed a science laboratory equipped with Virtual Reality Device. DAV Khadia is the resource school for addressing the students with respect to same.

This laboratory can cater the academic needs of students and has more than 40 laboratory practical module for Std. IXth & Xth.

Accordingly, the students from across the districts can pay a visit to DAV Khadai and take benefits of this innovative Science practical laboratory in consultation with CSR cell Khadia and DAV Khadia.

--

Thanking you.

Regards.

Amrendra Kumar
Nodal Officer (CSR & PR).
NCL Khadia Area.
Uttar Pradesh
Pin: 231222
Mobile: 09406966223

Sandhya Pandey <khddavssps@gmail.com>

Fri, Jan 31, 2025 at 3:58 PM

To: NCL Khadia Area CSR <csrkhadia@gmail.com>

Cc: CDO Sonbhadra <cdoson.up@gmail.com>, Cgm Khadia <cgm.khd@gmail.com>, sopkhd ncl <sopkhdncl@gmail.com>

Sir,

Thank you very much for choosing DAV Khadia as the resource centre for Sci Lab and enriching it by providing Virtual Reality device .
The School shall provide all support towards catering to needs of academic excellence in nearby area students.

The School requests you to provide training to our nominated teachers and updation of Software in English too.

Warm regards

Principal
[Quoted text hidden]

621

Subject	Data
Title	Financial assistance to UPNEDA, Sonbhadra for installation of 15 Nos. of High Mast Solar light & 200 Nos. of Solar Street light in the vicinity of NCL.
Category	Others
Department	0
Status	Pending at admin side
Expected Amount(In Lac)	62.72
Added Date	02/02/2025 12:37
Approved Date	
Rejected Date	
Last Update Date	02/02/2025 12:37
Description	
Review By	0
Review Date	
Review Comments	
Comment by Admin	
Comment by Department	

Speed Post/Online/URGENT COURT MATTER

F. No. IA-L-11011/51/2024-IA-I

Government of India

Ministry of Environment, Forest and Climate Change
(Compliance & Monitoring Division-IA Division)

Indira Paryavaran Bhavan

Jor Bagh Road, Aliganj

New Delhi-110 003

Email: moefcc-monitoring@gov.in

Dated: 19th February, 2025

To,

Deputy Director General of Forests (C),
Ministry of Env., Forest and Climate Change,
Regional Office, Kendriya Bhawan, 5th Floor, Sector "H",
Aliganj, Lucknow – 226020

Sub: Non compliances observed with respect to the project on "Expansion of Khadia Opencast coal mining project for increase in production capacity from 14 MTPA to 15 MTPA (increase of 10% w.r.t 10 MTPA) in land area of 1640 Ha by M/s Northern Coalfields Ltd. located in the village Khadia, Tehsil Dudhi, District Sonbhadra (Uttar Pradesh) & village Dhudhichua, Tehsil Singrauli, District Singrauli (Madhya Pradesh)"- reg.

Ref: i. Ministry's EC letter No J-11015/255/2006 IA. II (M) dated 23.03.2016, 27.07.2022 and 07.02.2024

ii. RO, Lucknow monitoring report

iii. Ministry's letter seeking ATR dated 14.01.2025

iv. ATR by PP dated 14.02.2025

Sir,

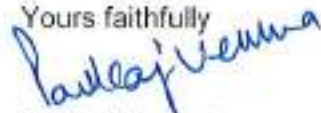
This has reference to the response from project proponent vide letter no.NCL/KHD/GM/Min/Env/EC compliance/2024-25/4711 dated 14.02.2025, to the ATR/Clarification sought from M/s Northern Coalfields Ltd. by the Ministry vide letter dated 14.01.2025.

2. The Regional Office (RO) is requested to verify the inputs submitted by the project proponent in reference to observations of RO on the issue of non-compliance and submit ATR review report to the Ministry at the earliest.

This issues with the approval of the Competent Authority.

Encl: As above

Yours faithfully

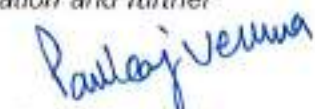


(Pankaj Verma)

Scientist 'F'

Copy to:

1. The General Manager, Northern Coalfields Ltd. (NCL), General Manager Khadia, P.O. Shaktinagar, Distt.:Sonebhadra, Uttar Pradesh PIN 231222
2. Member Secretary, Coal sector, MoEF&CC, New Delhi-110003. (For information and further necessary action)



(Pankaj Verma)

Scientist 'F'



आवास सरकार
पर्यावरण, वन और जलवायु परिवर्तन मन्त्रालय
क्षेत्रीय कार्यालय, लखनऊ



Government of India
Ministry of Environment, Forest & Climate Change
Regional Office, Lucknow

केन्द्रीय भवन, 11वां तल, सेक्टर एच, अलिगंज लखनऊ 226024

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File no. : IV/ENV/UP/MINE-50/409/2016/ 19

Dated: 03.04.2025

To,

Director

Compliance and Monitoring Division (CMD)

Ministry Of Environment, Forest and Climate Change

Indira Paryaran Bhawan, JorBagh, Aliganj, New Delhi-110003

Email: moefcc-monitoring@gov.in

Subject: EC to "Expansion of Khadia Opencast coal mining project for increase in production capacity from 14 MTPA to 15 MTPA (increase of 10% w.r.t 10MTPA) in land area of 1640 Ha by M/s Northern Coalfields Ltd. located in the village- Khadia, Tehsil- Dudhi, District- Sonbhadra (Uttar Pradesh) & village- Dhudhichua, Tehsil- Singrauli, District- Singrauli (Madhya Pradesh)" - reg..

- References:** 1. Ministry's EC letter No J-11015/255/2006 IA. II (M) dated 23.03.2016, 27.07.2022 and 07.02.2024
2. Non-Compliance RO letter no-IV/ENV/UP/MINE-50/409/2016/IV/ENV/UP/MINE-62/644/2016 Dated 16.12.2024
3. The Ministry letters dated 14.01.2025 and 19.2.2025

Sir,

I am directed to draw your kind attention to the above-referred letter on the captioned subject. As per the record, the above project was monitored by the Regional Office, Lucknow on 27.11.2024. During monitoring, fifteen non-compliances were observed, which were communicated to PP vide letter no. IV/ENV/UP/MINE-50/409/2016/IV/ENV/UP/MINE-62/644/2016 Dated 16.12.2024. However Ministry has also issued a Non-compliance letter to PP vide letter no. IA-L-11011/51/2024-IA-I, dated 14.01.2025, in which twenty-five non-compliances were mentioned. In reply, PAs have submitted a reply report to this office vide email dated 14.02.2025. In compliance to the above, this office recently monitored the site on 17-18 March, 2025. Based on the submitted reply of non-compliance raised by this Ministry, and recent observations, point-wise observations of this office are tabulated below:

SN	Status of compliance
i	Non-compliance observed during Post EC monitoring: Garland drain has not been provided as per the EC condition. (Specific Condition-xi of EC dated 23.03.2016) PP Reply dated.14.02.2025 Proper drainage system has been provided by Khadia OCP. Currently about 14.9 KM of the garland drain exists at Khadia OCP. Same has also been mentioned in the monitoring report submitted by Regional Office, MoEF&CC, Lucknow against the EC condition. All the

permanent drains are cemented (Shown as Pic -1).

However, some of the drains remain temporary in nature and are built as the active mine dump shifts in the course of mining.

Besides this, restoration work i.e. cementing of about 400 m retaining wall and drain is in process and will be completed by June 2025. For the purpose, a tender has already been floated and copy of the relevant page of Notice Inviting Tender issued is enclosed herewith as Annexure-A.

Present status of the compliance:

During recent monitoring of the project, it has been found that the PP has floated the tender for the restoration work of the garland work. And assured to complete the above work before June 2025.

Partially Complied

ii Non-compliance observed during Post EC monitoring:

Dust mask has not been provided to the workers. (Specific Condition-xvi, xvii, xviii, General Condition-ix of EC dated 23.03.2016, Standard Condition h (iii) of EC dated 07.02.2024)

PP Reply dated 14.02.2025:

Dust Mask are regularly being provided to the workers. Details of the dust mask provided in current Financial year is as below.

Sl. No.	Month	Dust Mask issued to workers
1	April 2024	940
2	May 2024	917
3	June 2024	836
4	July 2024	812
5	August 2024	748
6	Sept 2024	720
7	October 2024	920
8	November 2024	870
9	December 2024	817
10	January 2025	895

Copy of the issuance register is enclosed as Annexure -B. Personnel wearing dust masks are shown in pic 2.

Present status of the compliance:

During recent monitoring of the project. It has been found that the majority of the workers wearing required PPEs including dust mask. It is required to be strict on the use of PPEs on project site.

Being Complied

iii. Non-compliance observed during Post EC monitoring:

Green belt has not been developed as per the EC condition, (Specific Condition-xx of EC dated 23.03.2016, Additional Specific condition-iii, iv of EC dated 27.07.2022, and (Standard Condition g (ii) of EC dated 07.02.2024.

PP Reply on dated 14.02.2025:

Green Belt at Overburden Dump:-

On overburden dump, plantation is regularly being carried out through UP Forest Department. Till date, plantation has been completed on 216.16 Ha of overburden dumps. In the FY 2025-26, plantation on about 08 Ha overburden dump is to be carried out, out of which 05 Ha shall be done through ICFRE, Dehradun and 03 Ha shall be done through Renukoot Forest Division, UP Forest Department. The work awarded to ICFRE, Dehradun

is for ecological restoration of the area. Copy of the work order issued to ICFRE and request for MoU to UPFD are enclosed as Annexure C & D).

Green Belt at outside mine area:-

Green belt outside the project premises is being done by M/s Northern Coalfields Limited. It is to mention that in FY 2024-25, plantation has been carried out in Renukoot Forest Department on 100 Ha

The executive agencies like Renukoot Forest Department and Singaruli Forest Division are specialised agencies for carrying out plantation works and species of plants are selected by them based on the local area and geography of the area.

In FY 2025-26, area of 100 Ha in UP and 270 Ha in MP shall be carried out through UP Forest Department and MPRVVN, Singrauli respectively and efforts shall be made for plantation of native species with broad leaves and long rotation plants.

Green Belt along road side:-

As stated in the monitoring report, plantation is required along the coal transportation road and approach road, It is to state that an MoU has been finalised with UP Forest Department for planation besides the newly constructed CC road and mine boundary, wherever plantation is required. The plantation will be carried out in the FY 2025-26 monsoon. Copy of the MoU Signed is enclosed herewith as Annexure-E.

Pictures of various plantation sites are enclosed as pic 3 to 7.

Further, it is pertinent to state here that as per the approved mining plan of 15 MTPA, out of total 1640 Ha lease hold area, planation will be done in around 1378 Ha at the time of mine closure. Cost of this plantation shall be borne by NCL. Plantation is continuously being done as per availability of finalized overburden dump and will be continued.

Present status of the compliance:

During the recent monitoring of the project, it has been found that Ecological Restoration work has been awarded the work to ICFRE, Dehradun. Besides, PAs have conducted biological reclamation of the OB through the Renukoot Forest Division, but the quality of the plantation is not conducive for the OB. It is required to improve the planting technique for OB by using a practical scientific approach for better and significant output.

Partially Complied

iv Non-compliance observed during Post EC monitoring:

Greenbelt has not been developed on the OB dump. (Specific Condition-xxii of EC dated 23.03.2016, (Standard Condition f (v)) of EC dated 07.02.2024).

PP Reply on dated 14.02.2025:

On overburden dump, planation is regularly being carried out through UP Forest Department. UP Forest department is a specialized agency for the purpose of planation and species of plants are selected by them based on the local area and geography of the area. Till date, plantation has been completed on 216.16 ha of overburden dumps. In the FY 2025-26 planation of about 08 ha overburden dump is to be carried out, out of which 05 ha shall be done through Renukoot Forest Division, UP Forest Department. The work awarded to ICFRE, Dehradun, is for ecological restoration of the area. Pictures of various plantation sites of OB dump are enclosed as pic 3 to 6.

As pointed out in the report against condition no. f (v) of EC dated 07.02.2024, it shall be

	ensured that only native species shall be planted as suggested. Further, it is pertinent to state here that for the approved mining plan of 15 MTPA, out of the total 1640 ha leasehold area, plantation will be done in 1378 ha at the time of mine closures. Cost of this plantation shall be borne by NCL. Planting is continuously being done as per availability of finalized overburden dump and will be continued. Present status of the compliance: During the recent monitoring of the project, it has been found that Ecological Restoration work has been awarded to ICFRE, Dehradun. Besides, PAs have conducted biological reclamation of the OB through the Renukoot Forest Division, but quality of the plantation is not as desired for the OB. It is required to improve the planting technique for OB by using a practical scientific approach for better and significant output. Partially Complied
v	Non-compliance observed during Post EC monitoring: Pucca road has not been constructed to control dust emissions within the lease area. Three-tier plantation all along the major road has not been developed. Management of OB dump is not up to the mark. (Specific Condition-xxii, xxiv, xxviii, xxx, xxxi, xxxiii of EC dated 23.03.2016, Specific condition-xxiv, Standard Condition f (iii) of EC dated 07.02.2024) PP Reply dated 14.02.2025: Pucca roads have been developed at all the permanent routes. Khadia OCP has constructed Cement Concrete Road of 6.61 KM Length within the mine premises in order to reduce dust generation during transportation of coal with date of completion as 31.10.2023. Further, 1.5 KM CC road has also been built for movement of light vehicles. Photographs of the recently built CC road is enclosed herewith as Pic 8. For the purpose of three tier plantation along CC road, it is to state that an MoU has been finalised with UP Forest Department for plantation besides newly constructed CC road and mine boundary, wherever plantation is required. The plantation will be carried out in FY 2025-26 monsoon. With regard to management of OB dump, it is to state that Overburden dumps are being maintained scientifically with proper technical and biological reclamation. For the purpose of stability of the OB dump, a scientific study conducted by M/s CMPDIL, Ranchi is enclosed herewith as Annexure-F. Present status of the compliance: It has been found that the PAs have constructed around 6 km of cemented roads within the lease area, which have been used for the transportation of coal. Besides, a significant km of road still needs to be cemented, which has been used near gates 3 and 4, where hundreds of dumpers/truck etc. have been parked within the lease area. This area is just 10-25 meters from the national highway. In addition to the above, a three-tier plantation work MoU has been signed with UP Forest Department and will be carried out in 2025-26 monsoon period. Besides, it is still required to take suitable measures for better management of the OB dumps in the mine area on priority basis. Not Complied
vi	Non-compliance observed during Post EC monitoring: Adequate steps to stop the dust emission from the CHP has not been undertaken. (Specific Condition-xxvi of EC dated 23.03.2016) PP Reply on dated 14.02.2025: As pointed out in the monitoring report for CHP of 04 MTPA, a cyclone arrangement is in place for the purpose of dust extraction. The CHP is equipped with automatic sprinkler system at receiving pits and closed conveying system along with nozzles at transfer

	points. Further, loading into the wagons is being done through silo, which is an eco-friendly technology and is also suggested in the guidelines issued by Central Pollution Control Board (CPCB) in the name of "Inventorization of Railway Sidings and Guidelines for their Environment Management" and published on March 2015. Photographs of the Pollution control arrangement of CHP of 04 MTPA is enclosed herewith as Pic 9 to 12. Further efforts shall be taken for maintaining the same. Present status of the compliance: During the recent monitoring of the project, it has been found that the cyclone arrangement is in place for dust extraction. Besides, it is also equipped with an automatic water sprinkler. It is required to take suitable measures for its continuous working. Being Complied
vii	Non-compliance observed during Post EC monitoring: Third-party monitoring of the project has not been conducted through the NABL-accredited laboratory. (General Conditions-iii, iv of EC dated 23.03.2016) PP Reply on dated 14.02.2025: Environment Laboratory, CMPDIL, Ranchi is NABL accredited (certificate no.TC-7470 issue date 16/12/2022). The environment monitoring samples collected at CMPDI, RI-6, Singrauli are sent to CMPDIL, Ranchi laboratory for analysis. The upgradation of CMPDIL, RI-6, Singrauli lab and its NABL accreditation is under process. Present status of the compliance: During the recent monitoring of the project, it has been found that the sampling for third-party analysis was conducted by CMPDI, RI-6, Singrauli, and sent to CMPDIL, Ranchi laboratory for further analysis. And both the laboratories have yet to obtain accreditation by NABL or MOEF&CC. It is required to conduct third-party monitoring, including sampling by MOEF&CC and NABL-accredited laboratories. Not Complied
viii	Non-compliance observed during Post EC monitoring: PPEs have not been provided to the workers. (General Condition-x of EC dated 23.03.2016) PP Reply dated 14.02.2025: Distribution of PPEs to the workers is a regular activity. Photographs of the personnel wearing PPEs are enclosed herewith as pic 13 – 14. Further, the copy of the issuance register showing distribution of the PPEs is enclosed herewith as Annexure – G. Present status of the compliance: During the recent monitoring of the project, it was found that the majority of the workers were wearing the required PPEs including dust masks. It is required to be strict on the use of PPEs in lease area. Being Complied
ix	Non-compliance observed during Post EC monitoring: PP has not advertised the EC as per the EC condition. (General Condition-xiii of EC dated 23.03.2016) PP Reply dated 14.02.2025: The EC of 14 MTPA, was granted on 23.03.2016. However, the EC was uploaded by MoEF&CC on 30.03.2016 and NCL management came to know about its grant only on 30.03.2016. Same can be proved from the enclosed letter issued by GM (Environment), NCL Singrauli (Enclosed as Annexure-H). Accordingly EC was advertised within 07 working

days i.e. on 06 and 07 April 2016. The details of the publication of advertisement of EC are as follows:

Newspaper 629 Date of publication

Dainik Jagran, Rewa	06.04.2016
Rashtriya Jagran, Varanasi	07.04.2016
Amar Ujala, Varanasi-	07.04.2016
Dainik Bhaskar, Satna-	07.04.2016

Present Status of the compliance:

During the recent monitoring of the project, it was found that the new paper advertisement was done due to the late receipt of the accorded EC.

Complied

x

Non-compliance observed during Post EC monitoring:

Cleaner fuel has not been used in the dumpers/trucks. (Additional Specific condition-ii of EC dated 27.07.2022, Specific condition-xxviii of EC dated 07.02.2024)

PP Reply dated 14.02.2025:

Khadia Project is equipped with three nos. of draglines, which are not only electricity driven but also reduces truck movement (which would otherwise be required for transportation of overburden).

Besides draglines, 06 nos. of shovel and 07 nos. of drills are also electrical driven.

Besides, maximum amount of coal is being transported through Coal Handling Plants of 04 MTY and 06 MTY and are electricity driven, which also reduces truck movement (which would otherwise be required for transportation of coal within mine premises). An RLS of 04 MTPA is under construction.

For the purpose of cleaner fuel, a study for the use of 'Xtra Green Diesel' is under process at Khadia OCP in collaboration with IOCL. Xtra green is an optimized combination having higher Cetane Number for providing improved performance by increasing the efficiency & reducing the emission of vehicle. A copy of the letter showing trial run to be conducted by M/s Indian Oil Corporation Limited (IOCL) to explore the possibility of using Xtra Green HSD in Khadia mine to verify the emission efficiency and fuel economy benefits is enclosed as Annexure-I.

Specific condition-xxviii of EC dated 07.02.2024 states that, "PP shall explore at least 20% of the overall fleet of dumpers / trucks / other vehicles as electrical or CNG/NLG based transportation of coal / OB etc." Khadia Opencast Project has applied for amendment of the said condition to MoEF&CC, New Delhi vide EC amendment proposal no. IA/UP/CMIN/509697/2024. The reasons for amendment sought are as follows:

- As per the approved mining plan, this project is already equipped with adequate no. of HEMMs and there was no additional provision for procurement of HEMM.

For the purpose of exploring the possibility to deploy CNG/LNG/ electrical dumpers /trucks/other vehicles in NCL, a letter seeking availability of such vehicles have been submitted on 06.08.2024 to all major Manufacturers and response of them are still awaited. (Copy of the letters issued are enclosed herewith as Annexure-J).

Present status of the compliance:

During the recent monitoring of the project, it has been observed that the project is already equipped with an adequate no. of HEMMs and there was no additional provision for the procurement of HEMM. In addition to the above, PAs have also stated that the NCL is

	exploring the possibility of the inclusion of CNG/LNG/electrical dumpers etc based vehicles. Partially Complied
xi	Non-compliance observed during Post EC monitoring: Installed CEQMS has not been connected to the SPCB and CPCB server. (Additional Specific condition-vii of EC dated 27.07.2022) PP Reply dated 14.02.2025: CEQMS has been installed and has been connected with CPCB and MPPCB server. A copy of the mail received from CPCB for confirming that the CEQMS has been integrated with RTDMS portal of CPCB is enclosed herewith as Annexure – K. Further, Connection has also been provided with MPPCB website. Copy of the screenshot is enclosed herewith as Annexure-L. Present status of the compliance: During the recent monitoring of the project, it has been found that the CEQMS is working and connected to the CPCB server. Being Complied
xii	Non-compliance observed during Post EC monitoring: Adequate measure for the management of hazardous waste, such as oil containers, ETP sludge, etc. has not been taken, further, ETP sludge is being dumped with OB without consulting with the UPPCB/CPCB. (Additional Specific condition-x of EC dated 27.07.2022, (Standard Condition a (vi)) of EC dated 07.02.2024) PP Reply dated 14.02.2025: The spilled oil as observed during the monitoring was due to recent lifting of burnt oil to the auctioned party. The same has been cleaned using lime as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Current Picture of the site at the time of visit of MoEF&CC official is enclosed herewith as pic 15 & 16. With regard to ETP sludge, it is hereby stated that as per Schedule-I of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016, 'The inclusion of wastes contained in this Schedule does not preclude the use of Schedule II to demonstrate that the waste is not hazardous' (Copy enclosed as Annexure-M) i.e. Use of Schedule-II can be made to demonstrate that the waste is not hazardous. Accordingly, a test has been conducted for the probable heavy metals which may be found in the Coal Industry ETP sludge and the result showed, all the metals were found below the limit provided in Schedule II of Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. Copy of the sample report is enclosed herewith as Annexure – N. Further, after receipt of the letter dated 14.01.2025 from MoEF&CC, New Delhi, a mail has also been sent to premier institutes viz. IIT(ISM), Dhanbad, IIT-BHU Varanasi and IITR, Lucknow for enquiry about testing of ETP Sludge as per Schedule-II of the Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016. However, no reply has been received from any of the organisations. Copies of the Mails sent are enclosed herewith as Annexure-O.

Present status of the compliance:

During the recent monitoring of the project, it has been found that the management of the hazardous waste is still pathetic, efforts taken by PP is non-significant. Spillage of used/burned oil, waste cotton cloth etc has been found not only in the hazardous waste storage area, but also in several places. Every third-party vendor has their workshop within the lease area. It is of utmost importance to accommodate all vendors in the dedicated area for better hazardous waste management.

Not Complied

xiii

Non-compliance observed during Post EC monitoring:

Expenditure incurred under CER has not been provided. (Additional Specific condition-xii of EC dated 27.07.2022, Standard Condition i (iii) of EC dated 07.02.2024)

PP Reply on dated 14.02.2025:

Corporate Environment Responsibility, are as below.

SN	Nature of Activity to be performed as per EC dated 07.02.2024 in FY 2024-25	Details of activity performed	Expenditure incurred in 2024-25 till Jan 2025
1	Sanitation (Cleaning of Public Road)	Deployment of sweeping machines the purpose of cleaning of public road.	56,34,429
2	Roads (Control of road dust due to public transport)	Deployment of truck mounted fog cannons on public roads.	57,70,699
3	Plantation in community Area	Plant distribution has been done	1,98,600/-

Photographs of the Operation of Road Sweeping Machine and Truck Mounted fog cannons are enclosed herewith as Pic 17 & 18.

Present status of the compliance:

During the recent monitoring of the project, PAs have done various work under CER, including sanitation, road construction, and plantation.

Being Complied

xiv

Non-compliance observed during Post EC monitoring:

Construction of the Rapid Loading System has not yet been completed. (Specific condition-i of EC dated 07.02.2024)

PP Reply on dated 14.02.2025:

Work order for construction of CHP/ RLS of 04 MTPA capacity has been issued to M/s S. K. Samanta & Co. Pvt. Ltd. On 08.01.2024 (Copy enclosed as Annexure- P). Further, site handover letter has been issued to M/s S. K. Samanta & Co. Pvt. Ltd. On 15.03.2024, with date of start of work as 17.03.2024 (Copy enclosed as Q). Currently the work is in progress and will be completed by Feb 2026.

Further, an application has been submitted vide proposal no. IA/UP/CMIN/509697/2024 for amendment of EC conditions for extension of timeline of completion of Rapid Loading System (04 MTPA) by February 2026 instead of December 2024 as stipulated in EC conditions.

Present status of the compliance:

During the recent monitoring of the project, it has been found that the construction work of rapid loading system was in progress on the site and would be completed by February 2026.

	It is required to expedite the above work on a priority basis. Partially Complied
xv	Non-compliance observed during Post EC monitoring: Sal nursery has not been set up by PP. (Specific condition-iv of EC dated 07.02.2024) PP Reply dated 14.02.2025: In compliance of EC Condition of Khadia OCP, NCL has invited offers for establishment of Sal Nursery from various premier institutes viz. Forest Research Institute (FRI), Dehradun, Renukoot Forest Division, Singaruli Forest Division, Madhya Pradesh Rajya Van Vikash Nigam and Chhatisgarh Rajya Van Vikas Nigam Limited vide letter dtd. 31.10.2023 and 17.01.2024 (Copy attached as Annexure-R). The telephonic discussions were made to pursue for submission of proposal for development of Sal Nursery at Khadia project, NCL. Renukoot Forest Division has submitted the proposal for development of Sal Nursery at Khadia project, NCL. The response from other premier institutes/organizations except DFO Renukoot is still awaited. The proposal submitted by DFO Renukoot for development of Sal Nursery at Khadia project is under scrutiny. The Sal Nursery development work at Khadia project will be taken-up during FY 2025-26. Present status of the compliance: During the recent monitoring of the project, it has been found that the PAs have submitted a proposal to DFO Renukoot for the development of sal nursery. As assured, the above work will start during FY 2025-26. Assured to Comply
xvi	Non-compliance observed during Post EC monitoring: NOC for expanded capacity has been made to the Central Ground Water Authority. (Specific condition-v of EC dated 07.02.2024) PP Reply dated 14.02.2025: Application for NOC with expanded capacity has been made on 19.03.2024 and application verification has been completed on 22.03.2024. The application is currently at the stage of Application Processing and pending with approval officer since 12.02.2025. (The online screenshot of the application is enclosed herewith as Annexure-S) Present status of the compliance: During the recent monitoring of the project, it has been stated that the application for NOC with expanded capacity has been made on 19.3.2024 and application verification has been completed on 22.03.2024. The application is currently at the stage of Application Processing and pending with approval officer since 12.02.2025. Therefore, it is requested to follow up the matter with concern department. Partially Complied
xvii	Non-compliance observed during Post EC monitoring: Wheel washing system and procurement of electric vehicles has not been undertaken by the PP. (Specific condition-vi of EC dated 07.02.2024)

PP Reply dated 14.02.2025:

An LoA for wheel washing facility has been issued on 18.08.2024 (Copy enclosed as Annexure-T). The work is in progress and will be completed in February 2025.

With regard to deployment of Electrical Vehicle, a tender has been floated on GeM portal vide GeM ID No. GEM/2025/B/5827091 dated 16.01.2025. The copy of the bid documents is enclosed herewith as Annexure – U. The vehicles will be deployed by July 2025.

Present status of the compliance:

During the recent monitoring of the project, it has been found that the wheel washing system has been commissioned and is working.

Being Complied

xviii

Non-compliance observed during Post EC monitoring:

Compliance of the Standard Operating Procedure (SoP) issued by CPCB regarding the dumping of mine voids with fly ash has not been provided. (Specific condition-xv of EC dated 07.02.2024)

PP Reply on dated 14.02.2025:

Khadia OCP has sought amendment of EC condition for exemption of this condition vide EC amendment proposal no. IA/UP/CMIN/509697/2024. The reasons given for amendment are as below.

A study has been conducted by IIT-BHU Varanasi for "Scientific study of fly ash utilization/dumping/Mixing in the OB of the running/active mines of Khadia Opencast Project along with its viability and safety aspect of man and machinery"

As per the study done by IIT-BHU, Varanasi dumping of fly ash in active mine of Khadia OCP, following conclusions were made:

- Mixing of fly ash with overburden will reduce the permeability of overall dump material, leading to increase in the pore water pressure and in-turn reduce the factor of safety of dump
- As per the simulation carried out, it was found that final dump slope will fall under unsafe category ($FoS < 1.5$) as per DGMS guidelines in case of saturation level beyond 25%.
- Fly-ash will make the dump floor slippery when contacted with water and reduce the movement of dumper and other HEMM, and hence its not suggestible to use fly ash for HEMM roads within the mine.
- Highest conc. of toxic trace metal (Mg, Mn and Ni) ranging upto 41.70 mg/l, 5.39 mg/l and 0.45 mg/l respectively found in the fly ash material, which will increase the conc. of toxic trace material in the surrounding area when this fly ash is mixed with OB or dumped in the mine pit.

Based on the above facts, IIT BHU has concluded that it is technically not feasible to dump the fly ash in Mine dump due to geo mining conditions, instability of dump during rainy season in present condition, high stripping ratio and leaching effects. Copy of the report of IIT-BHU is enclosed herewith as Annexure- V.

Present status of the compliance:

It has been found that the PAs have conducted the study through IIT-Banaras Hindu

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	University (BHU), the report stated that "it is technically not feasible to dump the fly ash in Mine dump due to geo mining conditions, instability of dump during rainy season in present condition, high stripping ratio and leaching effects" Complied																																							
xix	Non-compliance observed during Post EC monitoring: Solar parks have not been developed. (Specific condition-xvi of EC dated 07.02.2024) PP Reply dated 14.02.2025: Specific Condition no. -XVI of the EC dated 07.02.2024 states that, "The Project Proponent shall include development of solar parks, picnic spot and sports compound in its Mine Closure report. Further if possible, maximum possible area of quarry shall be brought upto original ground level and handed over the land to Project affected families." In this regard, it is to state that Khadia OCP is envisaging expansion of Khadia OCP from 15 MTPA to 20 MTPA and provision of solar park has been made in Mining Plan and Mine Closure Plan) of 20 MTPA. Mining Plan and Mine Closure Plan of 20 MTPA has been approved by NCL Board. (Relevant pages of Mining Plan is enclosed herewith as Annexure-X) Present status of the compliance: During the recent monitoring of the project, it has been found that the provision of a solar park has been made in the Mining Plan and Mine Closure Plan of 20 MTPA. The Mining Plan and Mine Closure Plan of 20 MTPA have been approved by the NCL Board Being Complied																																							
xx	Non-compliance observed during Post EC monitoring: Data on the plantation of fruit-bearing trees has not been provided. (Specific condition-xviii of EC dated 07.02.2024) PP Reply dated 14.02.2025: In compliance to the specific condition no. xviii of the EC dated 07.02.2024, the details of fruit bearing plants planted within Khadia OCP after grant of EC is as below. <table><tr><th>Sl. No.</th><th>Name of Species</th><th>No. of Plants</th></tr><tr><td>1.</td><td>Amla</td><td>600</td></tr><tr><td>2</td><td>Bel</td><td>100</td></tr><tr><td>3</td><td>Amrud</td><td>100</td></tr><tr><td>4</td><td>Jamun</td><td>200</td></tr><tr><td>5</td><td>Aam</td><td>150</td></tr><tr><td>6</td><td>Mahua</td><td>300</td></tr><tr><td>7</td><td>Anar</td><td>100</td></tr></table> Copy of the report submitted by Range Officer, Renukoot Forest Division, UP Forest Department is enclosed herewith as Annexure – Y for reference. Besides this, a total of 4500 fruit bearing plant saplings have been distributed among employees of Khadia OCP and nearby population (Copy of the supply order is enclosed herewith as Annexure Z). Details of the plants distributed are as below. <table><tr><th>Sl. No.</th><th>Name of Plants</th><th>Nos. of plants distributed</th></tr><tr><td>1</td><td>Mango</td><td>1200</td></tr><tr><td>2</td><td>Papita</td><td>600</td></tr><tr><td>3</td><td>Lemon(Kagji)</td><td>300</td></tr><tr><td>4</td><td>Kathal</td><td>300</td></tr></table>	Sl. No.	Name of Species	No. of Plants	1.	Amla	600	2	Bel	100	3	Amrud	100	4	Jamun	200	5	Aam	150	6	Mahua	300	7	Anar	100	Sl. No.	Name of Plants	Nos. of plants distributed	1	Mango	1200	2	Papita	600	3	Lemon(Kagji)	300	4	Kathal	300
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5	Jamun	300
6	Anar	300
7	Banana	400
8	Amla(Grafted)	300
9	Lichi	200
10	Guava(Allahabadi)	300
11	Bel	200

Present status of the compliance:

During the recent monitoring of the project, it has been found that the PAs have distributed several fruit-bearing trees to the local people. Besides, PAs have also planted around 1500 fruit-bearing saplings on the OB dumps.

Being Complied

xxi

Non-compliance observed during Post EC monitoring:

Construction of the digital library has not yet been completed. (Specific condition-xxi of EC dated 07.02.2024)

PP Reply dated 14.02.2025:

Digital lab/library has been set up in DAV Khadia, which is equipped with 02 Virtual Reality Device with all the science practical materials to give digital learning to students. It is pertinent to mention that DAV Khadia is the resource school which shall cater to the needs of local students to enhance learning on science. Further, mail from Principle, DAV Khadia is enclosed herewith as Annexure- AA. Stating that "The School shall provide all support towards catering to needs of academic excellence in nearby area students."

Present status of the compliance:

During the recent monitoring of the project, it has been stated that the DAV Khadia is equipped with 02 virtual Reality Devices, and by email, DAV Khadia states that the School shall provide all support towards catering to the needs of academic excellence in nearby area students. In this connection, it is required to invite all students of nearby schools for such facilities in every academic session regularly.

Partially Complied

xxii

Non-compliance observed during Post EC monitoring:

Solar-mediated light system on the roads has not been provided. (Specific condition-xxv of EC dated 07.02.2024)

PP Reply dated 14.02.2025:

For the purpose of installation of solar light system, an NOC has been applied to District Administration for the purpose of carrying out the work of solar mediated lights through UPNEDA (Uttar Pradesh New and Renewable Energy Development Agency). Copy of the application made for NOC enclosed as Annexure-AB.

Financial assistance shall be provided to UPNEDA for the purpose of installation of Solar lights after obtaining NOC and necessary approval. Financial assistance shall be provided within 120 days.

Present status of the compliance:

During the recent monitoring of the project, it has been stated that an NOC application has been pending before the District Administration for the purpose of carrying out the work of solar-mediated lights through UPNEDA (Uttar Pradesh New and Renewable Energy Development Agency). It is required to expedite the above work/or PP may explore the

	possibility for installation of solar solar powered lighting system within their boundary, close to National Highway/State Highway etc. Not Complied															
xxiii	Non-compliance observed during Post EC monitoring: Bio-toilets in the study villages have not been provided. (Specific condition-xxvi of EC dated 07.02.2024) PP Reply on dated 14.02.2025: For the purpose of establishment of bio-toilets, proposal is under progress and assessment meeting with the local community (Gram Pradhan) is held for understanding proper site selection so as to cater to the mass at large. The activity shall be completed within 120 days. Further, it is pertinent to mention here that Khadia Opencast Project has constructed 05 nos. of 'Sulabh Sauchalaya' as below. <table><tr><td>S No.</td><td>Location</td><td>Nos.</td></tr><tr><td>1</td><td>Shaktinagar Bus stand</td><td>01 No.</td></tr><tr><td>2</td><td>Ambedkar Nagar Village</td><td>01 No.</td></tr><tr><td>3</td><td>Nimiatand Village</td><td>01 No.</td></tr><tr><td>4</td><td>Khadia Village</td><td>02 nos.</td></tr></table> Present status of the compliance: During the recent monitoring of the project, it has been stated that the proposal is in progress and assured to be completed within 120 days Assured to Comply	S No.	Location	Nos.	1	Shaktinagar Bus stand	01 No.	2	Ambedkar Nagar Village	01 No.	3	Nimiatand Village	01 No.	4	Khadia Village	02 nos.
S No.	Location	Nos.														
1	Shaktinagar Bus stand	01 No.														
2	Ambedkar Nagar Village	01 No.														
3	Nimiatand Village	01 No.														
4	Khadia Village	02 nos.														
xxiv	Non-compliance observed during Post EC monitoring: Feasibility study for the utilization of fly ash with this mine has not been conducted. (Specific condition-xxix of EC dated 07.02.2024) PP Reply dated 14.02.2025: A study has been conducted by IIT-BHU Varanasi for "Scientific study of fly ash utilization/dumping/Mixing in the OB of the running/active mines of Khadia Opencast Project along with its viability and safety aspect of man and machinery" Copy enclosed as Annexure – V. Present status of the compliance: It has been found that the PAs have conducted the study through IIT-Banaras Hindu University (BHU), the report stated that "it is technically not feasible to dump the fly ash in Mine dump due to geo mining conditions, instability of dump during rainy season in present condition, high stripping ratio and leaching effects" Complied															

Non-compliance observed during Post EC monitoring:

Suitable action on the use of fly ash as an external dump in the mine as per the study has not been taken. (Standard Condition f (iv) of EC dated 07.02.2024)

PP Reply dated 14.02.2025:

Khadia OCP has sought amendment of EC condition for exemption of this condition vide EC amendment proposal no. IA/UP/CMIN/509697/2024. The reasons given for amendment are as follows:

A study has been conducted by IIT-BHU Varanasi for "Scientific study of fly ash utilization/dumping/Mixing in the OB of the running/active mines of Khadia Opencast Project along with its viability and safety aspect of man and machinery"

As per the study done by IIT-BHU, Varanasi, dumping of fly ash in active mine of Khadia OCP, following conclusions were drawn:

- Mixing of fly ash with overburden will reduce the permeability of overall dump material, leading to increase in the pore water pressure and in-turn reduce the factor of safety of dump
- As per the simulation carried out, it was found that final dump slope will fall under unsafe category ($FoS < 1.5$) as per DGMS guidelines in case of saturation level beyond 25%.
- Fly-ash will make the dump floor slippery when contacted with water and reduce the movement of dumper and other HEMM, and hence it is not suggestible to use fly ash for HEMM roads within the mine.
- Highest conc. of toxic trace metal (Mg, Mn and Ni) ranging upto 41.70 mg/l, 5.39 mg/l and 0.45 mg/l, respectively found in the fly ash material, which will increase the conc. of toxic trace material in the surrounding area when this fly ash is mixed with OB or dumped in the mine pit.

Based on the above facts, IIT BHU has concluded that it is technically not feasible to dump the fly ash in Mine dump due to geo mining conditions, instability of dump during rainy season in present condition, high stripping ratio and leaching effects.

Copy of the report of IIT-BHU is enclosed herewith as Annexure-V.

Present status of the compliance:

It has been found that the PAs have conducted the study through IIT-Banaras Hindu University (BHU), the report stated that the "it is technically not feasible to dump the fly ash in Mine dump due to geo mining conditions, instability of dump during rainy season in present condition, high stripping ratio and leaching effects"

Complied

Sincerely,

14/2/25
(डा० ए. के. गुप्ता)
अतिरिक्त निदेशक (वै०)

Copy to:

1. The General Manager, Northern Coalfields Ltd. (NCL), PO Shaktinagar, Distt:Sonbhadra, Uttar Pradesh, PIN-231222. Email: cpm.khd@gmail.com .

 4P99+9Q1, Shakti Nagar, Khadia, Uttar Pradesh 231222, India few clouds 32.0 °C 18 Mar 2025 05:47 pm	 4P99+9Q1, Khadia, Shakti Nagar, Uttar Pradesh 231222, India few clouds 31.0 °C 18 Mar 2025 05:56 pm
 4P99+9Q1, Shakti Nagar, Khadia, Uttar Pradesh 231222, India clear sky 33.0 °C 18 Mar 2025 06:23 pm	 4P99+9Q1, Khadia, Shakti Nagar, Uttar Pradesh 231222, India clear sky 33.0 °C 18 Mar 2025 06:54 pm
 4P99+9Q1, Shakti Nagar, Khadia, Uttar Pradesh 231222, India few clouds 32.0 °C 18 Mar 2025 05:41 pm	 4P99+9Q1, Shakti Nagar, Khadia, Uttar Pradesh 231222, India few clouds 32.0 °C 18 Mar 2025 05:41 pm

  3MW+CCC, MGB Rd, Shakti Nagar, Uttar Pradesh 231222, India few clouds 31.0 °C 18 Mar 2025 05:09 pm	  4MPW+CCC, MGB Rd, Shakti Nagar, Uttar Pradesh 231222, India few clouds 31.0 °C 18 Mar 2025 05:10 pm
  3MW+CCC, MGB Rd, Shakti Nagar, Uttar Pradesh 231222, India few clouds 31.0 °C 18 Mar 2025 05:09 pm	  4MPW+CCC, MGB Rd, Shakti Nagar, Uttar Pradesh 231222, India few clouds 31.0 °C 18 Mar 2025 05:10 pm
  4P00+P02, Shakti Nagar, Khadla, Uttar Pradesh 231222, India few clouds 32.0 °C 18 Mar 2025 06:47 pm	  4P00+P02, Shakti Nagar, Khadla, Uttar Pradesh 231222, India few clouds 31.0 °C 18 Mar 2025 06:48 pm





By Speed Post/Online

F.No. IA-L-11011/51/2024-IA-I
Government of India
Ministry of Environment, Forest and Climate Change
(Compliance & Monitoring Division- IA Division)

Indira Paryavaran Bhavan
Jor Bagh Road, Aliganj
New Delhi-110 003
Email: moefcc-monitoring@gov.in

Dated: 30th April, 2025

Sub: Show Cause Notice under Section 5 of Environment (Protection) Act, 1986 for Non- Compliances observed with respect to the project "Expansion of Khadia Opencast coal mining project for increase in production capacity from 14 MTPA to 15 MTPA (increase of 10% w.r.t 10 MTPA) in land area of 1640 Ha by M/s Northern Coalfields Ltd. located in the village Khadia, Tehsil Dudhi, District Sonbhadra (Uttar Pradesh) & village Dhudhichua, Tehsil Singrauli, District Singrauli (Madhya Pradesh)" - reg.

Ref i. EC Letter No. J-11015/255/2006 IA. II (M) dated 23.03.2016, 27.07.2022 and 07.02.2024..

ii. RO Lucknow monitoring report dated 16.12.2024.

iii. Ministry's letter seeking ATR dated

iii. PP's ATR dated 14.02.2025

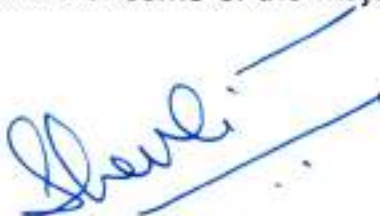
iv. RO Lucknow ATR review report dated 03.04.2025

WHEREAS, Environmental Clearance (EC) Clearance was granted to M/s Northern Coalfields Ltd. for the above mentioned project vide letter No- J-11015/255/2006 IA. II (M) dated 23.03.2016, 27.07.2022 and 07.02.2024, subject to implementation of various conditions and environmental safeguards contained therein, and

2. WHEREAS, the project was monitored for ascertaining compliance to the conditions stipulated in the aforesaid environmental clearance by RO Lucknow on 27-28.11.2024. The report was submitted to the Ministry vide letter dated 16.12.2024. **(Copy enclosed).**

3. WHEREAS, based on the reported non-compliance letter seeking ATR was sought by the Ministry vide letter dated 14.02.2025. In response, the PP submitted the ATR to the Ministry vide letter dated 14.02.2025. Subsequently, an ATR Review Report was received from the RO vide letter dated 03.04.2025.

4. WHEREAS, the ATR review report dated 03.04.2025 was examined in the Ministry and continued non-compliance have been reported without much improvement in compliance status of some of the major conditions. The continued



non-compliance for EC conditions which are reported as partly complied/not complied are as follows:

- i. Garland drain has not been cleaned and maintained (Specific Condition-xi of EC dated 23.03.2016)
- ii. Green belt has not been developed as per the EC condition (Specific Condition-xx of EC dated 23.03.2016, Additional Specific condition-iii, iv of EC dated 27.07.2022, (Standard Condition g (ii) of EC dated 07.02.2024)
- iii. Greenbelt of adequate quality has not been developed on the OB dump. (Specific Condition-xx, xxii of EC dated 23.03.2016, (Standard Condition f (v)) of EC dated 07.02.2024)
- iv. Pucca road has not been constructed to control dust emissions within the lease area. Three tier planation all along the major road has not been developed. Management of OB dump is not up to the mark (Specific Condition- xxiv, xxviii, xxx, xxxi, xxxiii of EC dated 23.03.2016, Specific condition-xxiv, Standard Condition f (iii) of EC dated 07.02.2024)
- v. Cleaner fuel has not been used in the dumpers/trucks (Additional Specific condition-ii of EC dated 27.07.2022, Specific condition-xxviii of EC dated 07.02.2024)
- vi. Status of Hazardous waste management such as oil containers, ETP sludge, etc. is in deplorable state. Further, ETP sludge is being dumped with OB without consulting with the UPPCB/CPCB (Additional Specific condition-x of EC dated 27.07.2022, (Standard Condition a (vi)) of EC dated 07.02.2024)
- vii. Construction of the Rapid Loading System has not yet completed. (Specific condition-i of EC dated 07.02.2024)
- viii. NOC for expanded capacity has been made to the Central Ground Water Authority. (Specific condition-v of EC dated 07.02.2024)
- ix. Construction of the digital library has not yet completed. (Specific condition-xxi of EC dated 07.02.2024)
- x. Solar-mediated light systems on the roads has not been provided (Specific condition-xxv of EC dated 07.02.2024)

5. In the above context, your attention is drawn to provision of Section 5 of the Environment (Protection) Act, 1986 which is as reproduced below:

"For the avoidance of doubts, it is hereby declared that the power to issue directions under this section includes power to direct-

a. The closure, prohibition or regulation of any industry, operation or process;

or

b. Stoppage or regulation of the supply of electricity or water or any other service."

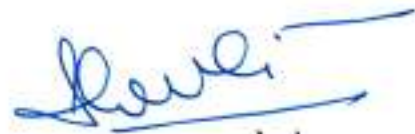
6. Now, therefore, you are directed to submit your response to the aforesaid non-compliance and explain as to why this Ministry should not take action against you under the provisions of Environment (Protection) Act, 1986 for the non-compliance and violation of the environmental conditions mentioned above.

7. You are also advised to submit your reply within 30 (thirty) days of the receipt of this Notice falling which the ministry will be constrained to initiate action, as deemed fit and appropriate under the provision of section 5 of the Environment (protection) Act, 1986 and the circumstances of the case, with or without any further notice to the project. In your response, it may also be clearly stated whether a hearing is required by the project proponent before a final order is passed by this ministry. Further, this Show Cause is without prejudice to any other legal action which may be taken against you.

This issues with the approval of the Competent Authority.

To,

The General Manager
Northern Coalfields Ltd. (NCL)
General Manager Khadia, P.O. Shaktinagar,
Distt.:Sonebhadra, Uttar Pradesh



(Dr. Shruti Rai Bhardwaj)
Director/Scientist 'F'

Copy to:

1. Deputy Director General of Forests (C), Ministry of Env., Forest and Climate Change, Integrated Regional Office, Kendriya Bhawan, 5th Floor, Sector "H", Aliganj, Lucknow – 226020
2. The Member Secretary, Uttar Pradesh Pollution Control Board, Building No. TC-12V Vibhuti Khand, Gomti Nagar Lucknow-226 010
3. The Member Secretary, Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi-110032.
4. Member Secretary, Coal Mining, MoEF&CC. (For information and further necessary action)



(Dr. Shruti Rai Bhardwaj)
Director/Scientist 'F'