To
The Additional Principal Chief Conservator of Forest,
Regional Office (Eastern Central Zone)
Ministry of Environment, Forests and Climate Change, Govt. of India
Bungalow No. A-2, Shyamali Colony,
Ranchi – 834002, Jharkhand.

Ref No. - JMB/ENV/BAC/39/ 166 /2019

May 23, 2019

Ref.: Environmental Clearance letter No.- J-11015/29/2012-IA.II(M) dated- April 28, 2017.

SUB: Half Yearly Compliance Status Report of Environment Clearance conditions issued by MoEFCC, New Delhi to Bhelatand A. Colliery & Bhelatand Coal Washery, Tata Steel Limited, Dhanbad for the period October'18 to March'19.

Dear Sir,

We are enclosing herewith compliance report for the period **October'18 to March'19** for the EC granted vide letter no.- J-11015/29/2012-IA.II(M) dated- April 28, 2017 issued by Ministry of Environment, Forest and Climate Change, New Delhi.

Copy of the compliance report is also being sent in soft format through email at ro.ranchi-mef@gov.in for your kind perusal. We trust the information furnished is in line with your requirement.

Thanking you,

Yours faithfully,

Head (Planning)
Jharia Division, Tata Steel Ltd.

Encl: As above.

Copy to: Member Secretary, CPCB, Eastern Zonal Office, Southend Conclave, 502, 5th Floor 1582, Rajdanga Main Road, Kolkata -700107.

Copy to: Member Secretary, JSPCB, T.A. Division Building (Ground Floor), H.E.C, Dhurwa, Ranchi - 834004.

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HALF YEARLY COMPLIANCE REPORT
(PERIOD: OCTOBER'18 – MARCH'19)

BHELATAND A. COLLIERY
(EXPANSION FROM 0.38 MTPA TO 0.41 MTPA OF RAW COAL PRODUCTION)
AND
BHELATAND COAL WASHERY
(EXPANSION FROM 0.96 MTPA TO 1.5 MTPA RAW COAL THROUGHPUT)

P.O.: BHELATAND, DIST: DHANBAD, JHARKHAND

TATA STEEL LIMITED, JHARIA DIVISION

P.O.- JAMADOBA, DIST. - DHANBAD,
STATE- JHARKHAND, PIN CODE – 828112.

Compliance status of Environmental Clearance of Expansion of Bhelatand A. Colliery (0.38 MTPA to 0.41 MTPA of raw coal production) and Bhelatand Coal Washery (Expansion from 0.96 MTPA to 1.5 MTPA raw coal throughput) of M/s Tata Steel Ltd., District- Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/29/2012-IA.II (M) dated April 28, 2017

<table>
<tr><th>S. No.</th><th>Condition</th><th>Compliance Status</th></tr>
<tr><td colspan="3">Specific Condition</td></tr>
<tr><td>(i)</td><td>The maximum production from the mine at any given time shall not exceed the limit as prescribed in the EC.</td><td>It is being strictly followed. The EC capacity of Bhelatand A. Colliery is for 0.41 MTPA raw coal production is well within the limit. The EC capacity of Bhelatand Coal Washery is for 1.5 MTPA raw coal throughput which is also being maintained within the limit. The production details of last three years are as follow-
<table>
<tr><th>Year</th><th>Bhelatand A. Colliery- Raw Coal Production (MTPA)</th><th>Bhelatand Coal Washery- Raw Coal Throughput (MTPA)</th></tr>
<tr><td>FY15</td><td>0.323</td><td>0.937</td></tr>
<tr><td>FY16</td><td>0.336</td><td>0.869</td></tr>
<tr><td>FY17</td><td>0.270</td><td>0.685</td></tr>
<tr><td>FY18</td><td>0.207</td><td>0.625</td></tr>
<tr><td>FY19</td><td>0.295</td><td>0.899</td></tr>
</table></td></tr>
<tr><td>(ii)</td><td>The washery shall be as per the project report submitted and presented to EAC.</td><td>It shall be strictly complied with and status report shall be submitted on regular basis.</td></tr>
<tr><td>(iii)</td><td>The validity of the EC is for the life of mine or as specified in the EIA Notification, 2006, whichever is earlier.</td><td>The mining lease of Bhelatand A. Colliery is valid for 999 years i.e. 20.01.2903 and life of mine as per approved mining plan is 25 years (Base year is FY13-14). However, the validity of EC for mines as per EIA Notification amendment dt. 14.09.2016 is kept as 30 years. Therefore, the EC is valid till 31.03.2038.</td></tr>
<tr><td>(iv)</td><td>Transportation of coal should be carried out by covered conveyor belts. Mitigative measures to be undertaken to control dust and other fugitive emission all along the roads by providing sufficient numbers of water sprinklers.</td><td>• The transportation of coal from underground colliery to coal handling plant (CHP) is through covered conveyor belt networks.
• Dry-fog system has been already installed to suppress the dust generated at CHP and transfer points of belt conveyor systems.
• Fixed-type water sprinklers are also installed on the internal roads of the washery. These are operated effectively at all times to check the fugitive emissions.
• Fugitive dust emission monitoring is done on half-yearly basis. The values are within the stipulated norms.</td></tr>
</table>

Compliance status of Environmental Clearance of Expansion of Bhelatand A. Colliery (0.38 MTPA to 0.41 MTPA of raw coal production) and Bhelatand Coal Washery (Expansion from 0.96 MTPA to 1.5 MTPA raw coal throughput) of M/s Tata Steel Ltd., District- Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/29/2012-IA.II (M) dated April 28, 2017

(v)	Continuous monitoring of occupational safety and other health hazards, and the corrective action need to be ensured.	The periodic health checkup of the workers is done regularly by our Occupational Health Department, Tata Central Hospital, Jamadoba. We have a PME (Periodic Medical Examination) centre approved by DGMS where 20 % of the workers identified from workforce engaged in active mining operations and washery plant are subjected to full medical checkup every year including hearing impairment checkup, etc. These results are regularly submitted to DGMS as per mines rules.
(vi)	Modern practices for agriculture to be encouraged with promotion of organic farming through training and demonstration (where ever feasible)	Total 413 farmers have been effectively trained in SRI (Systems of root intensification) in FY19 which helps in more production of quality grains with lesser seed requirement. This helps farmers to produce grains at lesser cost. Matka Khad, etc. promotes organic farming which helps farmers to use less chemicals (pesticides, insecticides etc.). In last two years, total 14 villages have been covered under this training program where farmers received hands on demonstration and training on organic farming.    
(vii)	Special emphasis should be on training and demonstration on conservation of crops and foods and food processing (Wherever feasible)	For the conservation of crops and foods, the following training programs are being through our CSR wing, TSRDS (Tata Steel Rural Development Society)- • SRI • Second crops (Rabi crops) • Dry land farming • Fisheries training Pisciculture • Animal Husbandry (goat farming)

Compliance status of Environmental Clearance of Expansion of Bhelatand A. Colliery (0.38 MTPA to 0.41 MTPA of raw coal production) and Bhelatand Coal Washery (Expansion from 0.96 MTPA to 1.5 MTPA raw coal throughput) of M/s Tata Steel Ltd., District- Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/29/2012-IA.II (M) dated April 28, 2017

<table>
<tr><td>(viii)</td><td>CCTV cameras to be installed at washery gate to check compliance of covering of trucks.</td><td>CCTV cameras at washery entrance gate and near weigh bridge gate have been provided. The details along with photographs is provided in Annexure-I. It is to be mentioned here that no truck is allowed into the premises which are not covered by tarpaulin sheets.</td></tr>
<tr><td>(ix)</td><td>This is an underground mine. Afforestation /green belt development takes place every year on the open surface within leasehold areas. Massive plantation shall be carried out in open spaces in and around the mine and a 3-tier avenue plantation along the main approach road to the mine.</td><td>• Tree plantation activities are carried out every year on the barren/ degraded areas, areas along road-side, infrastructure, etc of the colliery leasehold. Apart from these, fruit plants are distributed to employees and also to villagers, schools, institutions, etc.
• Avenue plantation is done in residential colony and along the road side every year.
• Approx. 10000 saplings have been planted in leasehold area this monsoon (FY19).
We have covered around 39 Nos of species under tree plantation jobs this year:
<table>
<tr><td>Babul</td><td>Mango</td><td>Areca palm</td><td>Semal</td></tr>
<tr><td>Bael</td><td>Mahaneem</td><td>Bargad</td><td>Palash</td></tr>
<tr><td>Kala siris</td><td>Imli</td><td>Guler/ Dumar</td><td>Ammda</td></tr>
<tr><td>Alostromia</td><td>Karipatta</td><td>Shisham</td><td>Mahua</td></tr>
<tr><td>Kaju</td><td>Karma</td><td>Gulmohar</td><td>Bija</td></tr>
<tr><td>Sitaphal</td><td>Kadam</td><td>Sal</td><td>Togger</td></tr>
<tr><td>Kathal</td><td>Teak/ Sagwan</td><td>Lagerstroemia</td><td>Jamun</td></tr>
<tr><td>Neem</td><td>Radhachuda</td><td>Pipal</td><td>Arjun</td></tr>
<tr><td>Kachnar</td><td>Phoenix palm</td><td>Guava</td><td>Ber</td></tr>
<tr><td>Jungle Jalebi</td><td>Amla</td><td>Ashoka</td><td></td></tr>
</table>
• Greenbelt development done with photographs is provided in Annexure I.</td></tr>
<tr><td>(x)</td><td>There will be no external /internal OB dumps</td><td>Since this is an underground mine, it is not applicable.</td></tr>
<tr><td>(xi)</td><td>Wastewater shall be effectively treated and recycled completely either for washery or maintenance of green belt around the plant.</td><td>Washery is already operating on a zero-discharge principle. No wastewater is discharged into the drains/ natural water systems. The recycled water is again used for plant operations and green-belt development.</td></tr>
<tr><td>(xii)</td><td>The assurances given during the Public Hearing and as per the Action plan developed by the proponent should be implemented.</td><td>The assurances given during the public hearing with respect to environment and CSR are already being executed. The detailed status report of implementation provided in Annexure-I.</td></tr>
</table>

(xiii)	Hoppers of the coal crushing unit and washer unit shall be fitted with high efficiency bag filters or mist spray water sprinkling system and operated effectively at all times of operation to check fugitive emissions from crushing operations , transfer points of closed belt conveyor systems and from transportation roads.	• Dry-fog system has been installed to suppress the dust generated at CHP and transfer points of belt conveyor systems. • Fixed-type water sprinklers are also installed on the internal roads of the washery. • The Dust Extraction system (Bag filters) is installed at Coal Handling Plant. Extracted dust is mixed in water and then fed into the Tailing Thickener. These are operated effectively at all times to check the fugitive emissions.
(xiv)	All approach roads shall be black topped and internal roads shall be concreted. The roads shall be regularly cleaned with mechanical sweepers.	All the internal roads have been concreted while the approach roads are black-topped. There is a facility for parking of trucks within the unit. We are in process for installation of Mechanical sweepers (Bob Kat machine with vacuum cleaning mechanism) for internal roads. Status of the same will be provided in next compliance report.

(xv)	Records of quantum and ash contain of raw coal being washed and clean coal and coal rejects produced from every batch of washing shall be maintained and details thereof be made available to Ministry whenever directed.	Proper records of quantity and ash content of raw coal being washed, clean/washed coal, and other by-products are being maintained regularly. Details are provided in Annexure-I.
(xvi)	No ground water shall be used for the plant operations. Any additional water requirement envisaged shall be obtained by recycle/reuse of treated effluent and from rainwater harvesting measure.	No ground water is used for washery plant operations. Since, washery is operating on Zero Liquid Discharge Principle; all processed water is recycled back and reused for operations. The make-up water requirement is met by mine water and river. There are total 8 ponds (Capacity- 20622 m3) for tailing management which also act as surface runoff and rainwater storage ponds. In addition to that, Rooftop rainwater harvesting structure has been constructed in office premises of Bhelatand washery is being extended to colliery office. 

(xvii)	Socio – economic and welfare measures for the local communities for the adjoining villages shall be implemented under CSR. Activities to be undertaken for the adjoining villages shall be identified in consultation with the local authorities, the details of status of implementation of CSR and expenditure thereon which should be annually updated on the company website.	CSR activities are being carried out through our CSR wing, TSRDS, which is managed by a team of experts who are full time involved in providing benefits and improving standard of living in over 30 villages. The list of activities are developed in consultation with the village representatives and implemented in a time-bound manner. The annual expenditure on CSR is updated in Integrated Report of Tata Steel every year which is uploaded in company's website.
(xviii)	Heavy metal content in raw coal, and washed coal shall be analysed once in a year and records maintained thereof.	Heavy metal content analysis in raw coal and washed coal was done by CIMFR, Dhanbad during EIA/EMP study. The analysis reports of the same is being submitted as Annexure-III.
General Conditions:		
A. Mining		
(i)	No change in mining technology and scope of work shall be made without prior approval of the Ministry of Environment Forest and climate Change. No change in the calendar plan including excavation, quantum of coal and waste should be made.	It is being strictly followed and complied with.
(ii)	Mining shall be carried out as per the approved mining plan, and also abiding by the relevant laws related to coal mining and the circulars issued by Directorate General Mines Safety (DGMS) An approved progressive Mine Closure Plan shall strictly be complied with and submitted.	It is being strictly followed. Mining is being carried out as per the approved mining plan in accordance with other mining rules, DGMS permissions etc. The mine closure plan was also approved along with mining plan by Ministry of Coal, Govt of India. The provisions of mine closure plan are being complied with. As per progressive closure activities, plantation for green cover in and around leasehold area is being done. Details on greenbelt development is provided in Annexure-I.
B. Land Reclamation		
(i)	Digital processing of the entire lease area using remote sensing technique shall be carried out regularly once in three years for monitoring land use pattern and report submitted to Ministry of Environment, Forest and Climate Change its Regional Office.	It shall be complied with and report shall be submitted once in three year. Since this is an underground mine, hence there is no proposed changes in existing land use pattern as per EIA/EMP. Though, we have engaged a consultant for the study of land use. Report of the same will be submitted in next compliance report.

(ii)	Final mine void depth should not be more than 40m. The void area should be converted into water body. The remaining area should be back filled up to ground level and covered with thick top soil. The land after mining should be restored for agriculture or forestry purpose.	It is not applicable as this is an underground mine.

(iii)	The top soil, if any, shall temporarily be stored at earmarked site (s) only and it should not be kept unutilized for long .The topsoil shall be used for land reclamation and plantation. The overburden dumps should be vegetated with suitable native species to prevent erosion and surface run off. The entire excavated area shall be backfilled and afforested in line with the approved Mine Closure Plan. Monitoring and management of rehabilitated areas should continue until the vegetation becomes self – sustaining Compliance status shall be submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office on six monthly basis.	There is no generation of top soil due to mining activities as this is an underground mine. Mining is being done by Bord and Pillar method with sand stowing. The rehabilitation is also not applicable in this case as there is no change in land use pattern due to underground mining operation.
(iv)	Greenbelt shall be developed all along the mine lease area in a phased manner. The width of the green belt along forest area should not be less than 7.5 m, and the total area covered by 3 tier green belt shall not be less than 100 ha. A 3 – tier green belt comprising of a mix of native species shall be developed all along the major approach roads.	• Greenery has been developed in many areas around the colliery and washery premises. There is no forest land in core and buffer zone. However, green belt is being developed in the leasehold area. • 3-Tier plantation along the roads shall be developed in coming monsoon season. Around 10,000 saplings have been planted in the leasehold area during this monsoon (FY19). Details are provided in Annexure-I.

Compliance status of Environmental Clearance of Expansion of Bhelatand A. Colliery (0.38 MTPA to 0.41 MTPA of raw coal production) and Bhelatand Coal Washery (Expansion from 0.96 MTPA to 1.5 MTPA raw coal throughput) of M/s Tata Steel Ltd., District- Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/29/2012-IA.II (M) dated April 28, 2017

C. Emissions, Effluents, and waste Disposal		
(i)	Transportation of coal by road should be carried out by covered trucks only. Effective measures such as regular water sprinkling shall be carried out in critical areas prone to air pollution and having high levels of PM10 and PM 2.5 such as haul road, loading and unloading point and transfer points. Fugitive dust emission from all the sources shall be controlled regularly it shall be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central/State Pollution Control Board in this regard.	• Transportation of raw coal from Bhelatand A. Colliery to washery is done through underground belt conveyors. The washed coal from washery is sent to Jamshedpur or Haldia plant via rail network. The sand used for stowing is transported through Tarpaulin sheet covered trucks only. • Dry-fog system has been already installed to suppress the dust generated at CHP and transfer points of belt conveyor systems. Fixed-type water sprinklers are also installed on the internal roads of the washery. In addition to these, movable water sprinkler ply on regular intervals for dust suppression. The ambient air quality report is submitted to SPCB every quarter.
(ii)	Vehicular emission shall be kept under control and regularly. Project should obtain 'PUC' certificate for all the vehicles from authorized pollution testing centres.	Raw coal transportation is done through underground belt network. Only the vehicles having valid PUC certificates are being allowed to operate for sand transportation.
(iii)	Adequate ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely PM10 PM2.5 SO2 and NOX. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive in consultation with the state pollution Control Board. Monitoring of heavy metals such as Hg,As,Ni,Cd,Cr,etc carried out at least once in six months.	Based on meteorological data, total four ambient air quality stations are established in core zone and buffer zone. Monitoring and analysis of PM10, PM2.5, SO2, NO2 are done on monthly basis. The Air quality monitoring stations are: (i) Bhelatand Office Area (Core Zone) (ii) Russi Vihar Colony, Sijua (Buffer Zone) (iii) Malkera Colony (Buffer Zone) (iv) Bhelatand Colony (Buffer Zone) Monitoring of heavy metals in ambient air is being performed by an independent laboratory (recognised by NABL/MoEFCC) once in six months. The results are enclosed as Annexure-II.

(iv)	Crusher / feeder and breaker material transfer points should invariably be provided with dust suppression system. Belt – Conveyors should be fully covered to avoid air borne dust. Drills shall be wet operated or fitted with dust extractors.	The following measures have been implemented: i) Dry-fog system at all transfers points of CHP. ii) Dust extraction system (Bag filters) in CHP ii) Enclosures around crushers. iii) Belts have been covered on top and both sides. These arrangements will protect the coal mass moving on belt from blowing wind. In this way, the dust getting air borne is being minimized. iv) Fixed water sprinklers on the haulage roads. v) In addition, movable water sprinklers are also being deployed on the roads for dust suppression.
(v)	The project proponent shall not alter the major channels around the site. Appropriate embankment should be provided along the side of the river/nallah flowing near or adjacent to the mine. The embankment constructed along the river/nallah boundary should be of suitable dimensions and critical patches should be strengthened by stone pitching on the river front side and stabilised with plantation so as to withstand the peak water flow and prevent mine inundation.	During the course of action, there is no proposed diversion or rechannelling of the water course is involved. The prominent stream in the region is Katri Nadi, a tributary of Damodar river. Appropriate embankment along the Katri river is already provided. Stone pitching has been provided on the embankment. The dense vegetation already exists between the river channel and lease which shall be strengthened further to check the peak water flow and prevent mine inundation.
(vi)	Rainwater harvesting shall be implemented for conservation and augmentation of ground water resource in the area in consultation with Central Ground Water Board.	In last nine years, total 38 Nos. of ponds (Total capacity-229150 m3) are either newly constructed or renovated/ deepened by removal of silts in and around Bhelatand lease area for conservation and augmentation of ground water. These ponds act as surface reservoir for rainwater. In addition to that, Rooftop rainwater harvesting structure has been constructed in office premises of Bhelatand washery is being extended to colliery office. 

(vii)	Catch drain and siltation ponds of appropriate size shall be constructed around the mine working coal heaps and OB dumps to prevent run off of water and flow of sediments directly into the river and other water bodies. The water so collected should be utilized for watering the mine area. Roads, green belt development etc. The drains shall be regularly desilted particularly after monsoon and maintained properly. Sump capacity should provide adequate retention period to allow proper setting of silt material. Dimension of the retaining wall to be constructed at the toe of the dump and OB benches within the mine to check run – off and siltation should be based on the rainfall.	• There are no soil or OB dumps in the colliery and washery premises. Only the by-products are stored in the stockyards located in the washery premises which are sold off within 10-15 days. • Garland drains of adequate size and gradient already exist around the washery area to channelize the surface runoff. The runoff is diverted to the tailing ponds and clear water after settle is re-utilized in the washery.
(viii)	Industrial waste water (CHP, workshop and waste water from the mine) should be properly collected and treated so as to conform to the standards prescribed under the Environment (Protection) Act, 1986 and the Rules made there under, and as amended from time to time. Oil and grease trap should be installed before discharge of workshop effluents.	No waste-water is discharged outside the washery premises. 100% water is re-circulated back for re-use in the washery. There is a central workshop and garage in Jamadoba where Effluent Treatment Plant having oil and grease trap facility has been provided. Approx half of the mine water is sent back into underground and remaining water is used for dust suppression, washery make-up water, greenbelt development and drinking water supply to colonies and stakeholders. We have also commissioned an Effluent Treatment Plant for canteen wastewater in Colliery premises. Treated water of ETP is used in horticulture and greenbelt development.
D. Noise & Vibration Control		
(i)	Adequate measure shall be taken for control of noise levels below 85dBA in the work environment Workers engaged in blasting in drilling operation of HEMM, etc shall be provided with plugs/muffs.	Regular noise survey is being conducted in the underground work environment. Workers are provided with ear-plugs/ muffs in high noise areas. Since this is an underground mine where no HEMM is used. Coal preparation is done by drilling & solid blasting. The noise levels report is provided as Annexure- I.
(ii)	Controlled blasting techniques should be practiced with use of delay detonators to mitigate ground vibrations and fly rocks.	Not applicable as it is an underground mine. However, due to implementation of various mitigation measures, and use of delay detonators due to blasting in underground vibration does not cause damage to any structure on the surface.

Compliance status of Environmental Clearance of Expansion of Bhelatand A. Colliery (0.38 MTPA to 0.41 MTPA of raw coal production) and Bhelatand Coal Washery (Expansion from 0.96 MTPA to 1.5 MTPA raw coal throughput) of M/s Tata Steel Ltd., District- Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/29/2012-IA.II (M) dated April 28, 2017

E. Occupational Health & Safety		
(i)	Besides carrying out regular periodic health check – up of their workers, 20% of the workers identified from workforce engaged in active mining operation shall be subjected to health check – up for occupational diseases and hearing impairment ,if any, through an specialised agency / institution within the District/ State and the results reported to this Ministry and to DGMS.	The periodic health check-up of the workers is done regularly by our Occupational Health Department, Tata Central Hospital, Jamadoba. We have a PME (Periodic Medical Examination) centre approved by DGMS where 20 % of the workers identified from workforce engaged in active mining operations are subjected to full medical check-up every year including hearing impairment check-up, etc. These results are regularly submitted to DGMS as per mines rules.
(ii)	Personal working in dusty area should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects. Supervisory staff shall be held responsible for ensuring compulsory wearing of dust mask.	Persons working in dusty area have been provided with dust masks & have been given awareness training on safety & health aspects. Regular PME (Periodic Medical Examinations) are also being done.
(iii)	In case of outsourcing of work through MDO, the project proponent shall ensure the strict enforcement of above condition.	Not applicable
F. Biodiversity		
(i)	The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered fauna, if any, spotted in the study area. Action plan for conservation of flora and fauna shall be prepared and implemented in consultation with the state Forest and Wildlife Department. A copy of action plan shall be submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office.	Tata Steel has engaged a global organisation viz. IUCN (International Union for Conservation of Nature) which work in the field of faunal and floral conservation. We have prepared a Biodiversity Management Plan (BMP) and thereafter prepared BMP action plan (BAP) in association with IUCN for enhancement of biodiversity. We have already started to implement the BAP in our area for conservation and enhancement of flora and fauna. The progress report with action plan is provided in Annexure-I. Some key initiatives for biodiversity enhancement are medicinal garden development, Native species plantation and Butterfly park development, artificial niche nesting etc.

Compliance status of Environmental Clearance of Expansion of Bhelatand A. Colliery (0.38 MTPA to 0.41 MTPA of raw coal production) and Bhelatand Coal Washery (Expansion from 0.96 MTPA to 1.5 MTPA raw coal throughput) of M/s Tata Steel Ltd., District- Dhanbad, Jharkhand vide MoEFCC Letter no J-11015/29/2012-IA.II (M) dated April 28, 2017

G. Implementation of Action Plan as per public Hearing And CSR Activities		
(i)	Implementation of Action Plan on the issues raised during the Public Hearing shall be ensured. The Project proponent shall complete all the tasks as per Action plan submitted with budgetary provisions during the public Hearing. Land oustees should be compensated as per the norms laid out R&R Policy of the Company or the National R&R Policy of the State Government, whichever is higher.	The implementation of action plan on the issues raised during public hearing is already in progress. The status of action plan along with expenditure incurred for FY19 is provided in Annexure-I. R&R is not applicable in this project.
(ii)	The Board of every company, shall ensure that the company spends in every financial year, at least two per cent. of the average net profits of the company made during the three immediately preceding financial year, in pursuance of its corporate Social Responsibility policy under Section 135 of the Companies Act,2013, for the socio economic development of the neighbourhood.	The proposed CSR expenditure for the entire company is decided as per the new Company Rules. Once the CSR budget for company is fixed, a share of that amount is dedicated and utilized for implementing the CSR activities at our Jharia Division level. The CSR expenditure for FY19 is Rs.5.65 crores. The CSR expenditure of Tata Steel in FY18 was Rs.232 crores which is much higher than 2% of PAT (Rs. 83.4 crores).
H. Corporate Environment Responsibility		
(i)	The Company should have a well laid down Environment Policy approved by the Board of Directors.	The Company already has an Environment Policy approved by the Managing Director. It is enclosed as Annexure- IV
(ii)	To have proper checks and balances, the Company should a well laid down system of reporting of non – compliances / violations of environmental norms to the Board of Directors of the Company and / or shareholders or stakeholders at large.	The status of adherence to the policy and compliance to Environmental laws and regulations is regularly discussed at higher levels. Any non-compliance noticed is corrected at divisional level. If any issue is beyond our control, it is brought to the notice of higher management.
(iii)	A separate environment management cell with suitable qualified personnel should be set – up under the control of a Senior Executive, who will report directly to the Head of the Organization	We have a separate Environmental Management Cell with four qualified personnel (One Head and Two Senior Managers and One Manager) and four employees. The reporting of Environmental Cell is directly to General Manager of the Division.

(iv)	The funds earmarked for environment protection measures should not be diverted for other purpose. Year wise expenditure should be reported to the Ministry and its Regional Office.	The Environment Cell has a separate fund for Environmental protection measures and for complying with legal requirements. The year-wise expenditure is being already submitted to JSPCB as Environment Statement in Form-V. The total annual environmental expenditure for the financial year 2017-18 is Rs. 666.35 lakhs. The details are given as annexure- VI.
I. Statutory Obligations		
(i)	Environment clearance is granted subject to final outcome of Hon'ble Supreme Court of India, High Court, NGT and any other Court of Law, if any, as may be applicable to the project.	It shall be strictly followed.
(ii)	This Environmental Clearance is subject to obtaining requisite NBWL Clearance from the Standing Committee of National Board for Wildlife , if any , applicable to the project	Not applicable.
(iii)	The project proponent shall obtain Consent to Establish and Consent to Operate from the concerned State Pollution Control Board prior to increase in capacity of washery and effectively implement all the conditions stipulated therein.	The consent to establish has been granted by JSPCB (Ref no.- JSPCB/HO/RNC/CTE-342731/2017/686 dt. 20.11.2017). The Consent to Operate has been granted by JSPCB (Ref no.- JSPCB/HO/RNC/CTO-1581391/2018/1733 dt. 01.11.2018). The conditions of CTE and CTO are being complied with and submitted to JSPCB.
(iv)	Project proponent shall obtain the necessary prior permission from the Central Ground Water Authority (CGWA) for drawl of water (surface and ground water).	No Objection Certificate for withdrawal of mine water has already been applied for to Central Ground Water Board in March'17 and it is under consideration at CGWA, Delhi.
J. Monitoring of Project		
(i)	Regular monitoring of ground water level and quality shall be carried out in and around the mine lease by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year pre –	The monitoring of groundwater level and quality is done four times a year. The groundwater quality report & groundwater level for the Post-Monsoon (November) and winter season (January) are provided in Annexure-I.

	monsoon (April-May) , monsoon (August), post-monsoon (November) and winter (January) and the data thus collected may be sent regularly to Ministry of Environment, Forest and Climate Change and its Regional Office, Central Ground water Authority and Regional Director , Central Ground Water Board.	
(ii)	The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental safeguards to the Ministry of Environment, Forest and Climate Change, its Regional Office, central Pollution Control Board and State Pollution Control Board.	It is being complied with. We are submitting the six-monthly compliance reports to MoEF, its regional office, CPCB and SPCB twice a year. In adherence with the guideline as per notification dt. 26.11.2018, from now onwards, we are sending only soft copy of the compliance status report over mail.
(iii)	The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information / monitoring reports.	It shall be complied with.
(iv)	The activities pertaining to development of green belt/horticulture shall be reported to concerned Regional Office of MoEF&CC on six monthly basis from the data of commencement of mining operation.	In our leasehold area, every year 5000 Nos of sapling plantation is being done. ₹40/per sapling is incurred as cost of sapling, pit digging, manure mixing and plantation. Total cost of sapling plantation is ₹2 lakh/year. Cost incurred for maintenance of sapling is ₹1 lakh/year. Around 2000 saplings are distributed every year at cost of 1.4 lakhs outside the leasehold area. In addition to above, we have a budget of Rs. 25 lakhs per year which includes maintenance of old saplings (converted into plants) and developing green area of the region. The greenbelt development plan has been submitted to MoEFCC earlier. Greenbelt development done so far is provided in Annexure-I.

(v)	For half yearly monitoring reports. The data should be monitored for period of April to September and October to March of the financial years and submitted to the concerned authorities Within 2 months of the completion of periodicity of monitoring.	The cycle of April to September and October to March of every financial year is being followed for submission of compliance and monitoring reports.
K. Miscellaneous		
(i)	A copy of clearance letter will be marked to concerned panchayat/local NGO, if any, from whom suggestion / representation has been received while processing the proposal.	The copy of Clearance letter has been sent to District Commissioner, Municipal Commissioner and other government offices on 11th May, 2017.
(ii)	An electronic copy of the EC letter shall be marked to the concerned State Pollution Control Board, Regional office , District Industry Sector and Collector's Office / Tehsildar Office for information in public domain within 30 days.	The electronic copy of EC letter has been forwarded to DC office, JSPCB Dhanbad office, JSPCB Ranchi office via mail on 11th May, 2017. Details are provided in Annexure-VII
(iii)	The EC letter shall be uploaded on the company's website. The compliance status of the stipulated EC conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in public domain. The monitoring data of environmental quality parameter (air, water, noise and soil) and critical pollutant such as PM10,PM2.5,SO2 and Nox (ambient) and critical sectoral parameters shall also be displayed at the entrance of the project premises and mine office and in corporate office and on company's website.	The EC letter is already uploaded in company's website. The compliance reports shall also be uploaded once in six months in company's website with all monitoring reports. Details are provided in Annexure-VII. The display board at entrance of mine and washery covers all environment quality parameters and applicable statutory requirements as per the guideline.
(iv)	The project authorities should advertise at least in two local newspapers widely circulated ,one of which shall be in the vernacular language of the locality concerned , within 7 days of the issue of the	The Notice has been advertised in two local newspapers viz. Prabhat Khabar (Hindi) and Hindustan (Hindi) on May 05, 2017. Details are provided in Annexure- VII.

	clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the SPCB and also at web site of the Ministry of Environment, Forest and Climate Change at www.environmentclearance.nic.in and a copy of the same should be forwarded to the Regional Office .	
(v)	The Environmental Statement for each financial year ending 31 March in From-V is mandated to be submitted by the PP for the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently ,shall also be uploaded on the Company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Office of the MoEF&CC by e-mail.	The environmental statement for financial year 2017-18 has been submitted to JSPCB on 24th September 2018 and it is also uploaded on the company website (Annexure- III). The soft copy of Environment Statement is also sent to MOEF by email at ro.ranchi-mef@gov.in.

Head Planning
Tata Steel Limited,
Jharia Division

AIR QUALITY REPORT

Core zone & Buffer zone

Period- October'18 to December'18 **No. of sampling points: 4**

Core zone (as per Air quality standards for coal mines in EPA Notification, 1988)							
Location	**Latitude/ Longitude**	**Date**	**Weather Condition**	**SPM 24 Hourly Limit- 700 µg/m³**	**RSPM 24 Hourly Limit- 300 µg/m³**	**SO_2 24 Hourly Limit- 120 µg/m³**	**NOx 24 Hourly Limit- 120 µg/m³**
Sijua Mine Office Area	23°46'33.2" N/ 86°19'51" E	17.10.18	Clear	169.3	69.2	13.7	14.7
		26.11.18	Clear	168.83	69.1	13.4	11.5
		12.12.18	Clear	171.23	65.83	14.2	11.8
Bhelatand Office Area	23°46' 11" N/ 86°18'51" E	12.10.18	Rainy	158.5	62.7	14.9	15.3
		05.11.18	Clear	151.9	67.3	14.7	12.3
		26.12.18	Clear	158.92	68.23	14.9	14.6
Buffer zone (as per NAAQS 2009 for ambient air quality standards)							
Location	**Latitude/ Longitude**	**Date**	**Weather Condition**	**PM10 24 Hourly Limit- 100µg/m³**	**PM2.5 24 Hourly Limit- 60µg/m³**	**SO_2 24 Hourly Limit- 80µg/m³**	**NO_2 24 Hourly Limit- 80µg/m³**
Sijua Russi Vihar Colony	23°46'45.8" N/ 86°20'18.6" E	23.10.18	Clear	74.7	44.6	7.7	8.5
		14.11.18	Clear	67.8	49.2	8.2	8.4
		05.12.18	Clear	72.73	48.1	7.9	8.1
Malkera Colony	23°47'10" N/ 86°17'39" E	03.10.18	Clear	73.8	38.7	8.3	7.9
		19.11.18	Clear	70.2	41.9	7.9	7.2
		20.12.18	Clear	71.98	40.2	8.1	7.8
Bhelatand Colony	23°46'10.7" N/ 86°18'49"E	31.10.18	Clear	77.4	45.3	11.2	9.2
		12.11.18	Clear	71.3	39.8	10.8	9.4
		28.12.18	Clear	81.23	38.6	11.4	10.3

Sr. Manager (Environment)

AIR QUALITY REPORT

Core zone & Buffer zone

Period- January'19 to March'19 **No. of sampling points:** 4

Core zone (as per Air quality standards for coal mines in EPA Notification, 1988)							
Location	**Latitude/ Longitude**	**Date**	**Weather Condition**	**SPM 24 Hourly Limit- 700 µg/m³**	**RSPM 24 Hourly Limit- 300 µg/m³**	**SO_2 24 Hourly Limit- 120 µg/m³**	**NOx 24 Hourly Limit- 120 µg/m³**
Sijua Mine Office Area	23°46'33.2" N/ 86°19'51" E	24.01.19	Clear	156.3	71.4	15.8	14.2
		26.02.19	Clear	160.7	72.3	13.6	15.4
		11.03.19	Clear	163.8	74.7	14.6	15.9
Bhelatand Office Area	23°46' 11" N/ 86°18'51" E	07.01.19	Clear	167.9	68.5	16.3	16.7
		19.02.19	Clear	171.2	69.4	15.2	16.3
		06.03.19	Clear	170.2	69.3	11.6	16.1
Buffer zone (as per NAAQS 2009 for ambient air quality standards)							
Location	**Latitude/ Longitude**	**Date**	**Weather Condition**	**PM10 24 Hourly Limit- 100µg/m³**	**PM2.5 24 Hourly Limit- 60µg/m³**	**SO_2 24 Hourly Limit- 80µg/m³**	**NO_2 24 Hourly Limit- 80µg/m³**
Sijua Russi Vihar Colony	23°46'45.8" N/ 86°20'18.6" E	29.01.19	Clear	78.3	41.3	7.8	9.2
		04.02.19	Clear	80.4	39.4	8.7	10.8
		27.03.19	Clear	80.8	38.2	8.9	9.6
Malkera Colony	23°47'10" N/ 86°17'39" E	04.01.19	Clear	82.2	47.8	7.4	7.1
		20.02.19	Clear	81.1	48.8	7.6	9.3
		12.03.19	Clear	82.4	41.6	8.2	10.1
Bhelatand Colony	23°46'10.7" N/ 86°18'49"E	22.01.19	Clear	74.3	39.6	12.3	10.8
		08.02.19	Clear	76.3	39.6	11.7	11.9
		19.03.19	Clear	77.4	39.1	10.6	9.8

Sr. Manager (Environment)

Ground Water Quality Analysis (Hand Pump & Dugwell)
Post Monsoon Season- November' 2018

S.No	Date	Location	Time	Sample Parameter			
				Depth in meter (m)	pH	Electrical Conductivity, µS/m	Total Hardness (as $CaCO_3$), mg/l
1	08.11.18	Ruddi Basti	11:30AM	3.16	7.5	600	416
2	08.11.18	Rampur Basti	01:15PM	4.80	7.5	588	512
3	08.11.18	Malkera Trigunait Basti	12:50PM	3.87	7.4	732	572
4	08.11.18	Sijua 6 No	01:00PM	5.72	7.3	586	488
5	08.11.18	Sijua 12 No	01:25PM	3.82	7.5	696	532
6	08.11.18	Rampur Basti, (Road Side)	01:10PM	6.34	7.6	548	484
7	08.11.18	Bansh Kapuria	02:00PM	12.10	7.5	592	488
8	08.11.18	Pasitand Basti	01:05PM	3.30	7.3	504	432
9	08.11.18	Bhelatand 500 Qtr. (Back Side)	12:40PM	1.00	7.4	616	496

Sr. Manager (Environment)

Ground Water Quality Analysis (Hand Pump & Dugwell)
Winter Season- January' 2019

S.No	Date	Location	Time	Sample Parameter			
				Depth in meter (m)	pH	Electrical Conductivity, µS/m	Total Hardness (as $CaCO_3$), mg/l
1	14.01.19	Ruddi Basti	01:15PM	1.10	7.2	796	810
2	14.01.19	Rampur Basti	10:00AM	6.64	7.2	412	396
3	14.01.19	Malkera Trigunait Basti	10:15AM	3.10	7.1	900	796
4	14.01.19	Sijua 6 No	10:45AM	2.75	7.0	812	716
5	14.01.19	Sijua 12 No	11:10AM	2.71	7.1	688	652
6	14.01.19	Rampur Basti, (Road Side)	12:00PM	7.63	7.2	712	640
7	14.01.19	Bansh Kapuria	01:50PM	3.25	7.0	640	636
8	14.01.19	Pasitand Basti	11:50AM	3.60	7.2	512	488
9	14.01.19	Bhelatand 500 Qtr. (Back Side)	12:30PM	1.15	7.2	594	532

Sr. Manager (Environment)

NOISE SURVEY REPORT- Bhelatand A. Colliery

Date- 29.01.2019

S.No.	Unit / Place	Equipment / Location	Distance (meter)	Leq (dB 'A')	Exposure Hours
1	14 Seam (Eest)	Pit Bottom, (14 Seam , 2 Pit)	-	67.1	8 hrs./shift
2		Switch Room, '0'D / 2nd Pit – 1st Pit	-	65.2	6 hrs./shift
3		Pit Bottom, (14 Seam , 1 Pit)	-	67.5	8 hrs./shift
4		Type 3 Pump, 'B'L / 1st D Junction, at Operator's Seat	-	73.7	8 hrs./shift
5		Transformer Room, 'B' L / 7th R	3m.	65.2	6 hrs./shift
6		Transformer Room, 11th R / 'B''L	3m.	63.7	6 hrs./shift
7		Auxillary Fan, 15th R / 'A' L- 'A'/2 L	10m.	81.6	6 hrs./shift
8		Transformer Room, 11th R / 'B''L	-	66.7	6 hrs./shift
9	Surface	Pit Top	-	70.1	8 hrs./shift
10		MMV Fan at operator's seat	-	79.7	8 hrs./shift
11		Pit Top Air lock Room	-	63.7	8 hrs./shift

NOISE SURVEY REPORT- Bhelatand Coal Washery

Date- 08.02.19

S.No.	Unit / Place	Equipment / Location	Distance (meter)	Leq (dB 'A')	Exposure Hours
1	Main Plant	Control Room	-	56.7	8 hrs./shift
2		Primary Pump House Floor	-	72.9	4 hrs./shift
3		Secondary Pump House Floor	-	73.4	4 hrs./shift
4		SCBC Floor	-	70.1	4 hrs./shift
5		Screen Floor	-	72.0	4 hrs./shift
6		Cyclone Floor	-	71.3	4 hrs./shift
7		Compressors Room	-	80.9	4 hrs./shift
8		Redial Blender	-	75.3	8 hrs./shift
9	Electrical Room	Sub Station	-	56.4	8 hrs./shift
10		MCC - I	-	60.8	8 hrs./shift
11		MCC - II	-	61.3	8 hrs./shift
12		MCC - III	-	59.2	8 hrs./shift
13		Clarified Water Pump House	-	71.2	4 hrs./shift
14	NRD	NRD Laboratory	-	59.4	8 hrs./shift
15		NRD Sample preparation Room	-	67.9	8 hrs./shift

The warning limit is 85dB "A" and the danger limit is 90 dB "A" for 8 (Eight) hours of working. All the values are within permissible limit.

Sr. Manager (Environment)

Annexure I Greenbelt development report

Statement showing measures taken for increasing tree and forest cover

AFFORESTATION: Plantation activities are carried out in the barren land of the colliery leasehold area to increase the green cover as well as in the washery premises. Care is taken to plant only the native species so that native ecosystem is preserved. Following are the details of mass plantation in our leasehold area of Jharia Division for greenery development.

Year	No. of trees planted
FY14	10195
FY15	15800
FY16	10000
FY17	10900
FY18	8500
FY19	10000

BIODIVERSITY ENHANCEMENT INITIATIVES:

Three projects are taken up in FY18 to enhance the biodiversity of the region in consultation with IUCN viz. Artificial Niche Nesting, Development of Butterfly park and Herbal park development.

Herbal Park Development:

As part of afforestation & tree plantation a herbal garden was developed in June'17 with more than fifteen varieties of medicinal plants viz. Ficus Compecta (Harit Kumari), Ficus black Japan (Golmirch), Phonexfam (Jaiphal), Caladinum Attala (Har singar) etc.

DEVELOPMENT OF MEDICINAL & HIBISCUS GARDEN

Around 46 variety of medicinal and 49 variety of Hibiscus species were identified to be planted in the park. Signage board were installed indicating the species name along with its medicinal uses.

Compliance to Specific Condition no. (viii)

Installation of high resolution revolving cameras at BCPP

Annexure I

STATUS OF POINTS RAISED IN PUBLIC HEARING

Issues raised by Public	Status (Oct'18- Mar'19)
Tree Plantation and its maintenance to be improved and extended outside the leasehold area.	• During this monsoon (FY19), total 10000 Nos of saplings of 35 Nos of species have been planted in and around leasehold area. The survival rate of plants as on Oct'18 is more than 80%. • Around 3000 Nos of fruit bearing saplings have been distributed among employees and local villagers. • In addition to above, approx Rs. 20 lakhs has been incurred for maintenance of old saplings (converted into plants) and developing green area of the region.
Measures expected to be taken for the increased dust levels due to increase in production.	• All precautionary as well as control measures are in place to control the fugitive dust emissions.
Noise generated due to plying of trucks near old weigh bridge. Ensure the proper covering of trucks.	• We have built a new weigh bridge as well as parking arrangement inside the washery premises for all the trucks and the old weigh bridge is being dismantled.
During expansion of washery, effluent discharge to Katri river may also increase so what will management do to stop this pollution?	• Zero discharge of effluents is being maintained which will also continue in future. Further installation of mechanical tailing dewatering system has been strengthened to maintain ZLD system in future too.
The waste discharge from the colonies pollutes the agricultural fields as well as the ponds. What steps will be taken to stop this?	We have already installed one STP of 200 KLD capacity which is operating successfully since July'15. Similarly, one more STP is being installed at Railway Colony, Jamadoba which will be commissioned by Mar'19. We have also commissioned one waste water treatment plant (based on MBBR technology) at Bhelatand Canteen.

STATUS OF POINTS RAISED IN PUBLIC HEARING

Issues raised by Public	Status (Oct'18- Mar'19)
Programmes run by TSRDS like Computer Hardware training, MRA camps, etc and Scholarship programmes for students undertaking ITI training to be provided in future also.	• In FY 17 & 18, the students trained in various skill programs are as follows: a) House keeping and F&B- 10 b) Panchyat Bandhu-1 c) Fire & Safety-3 d) SAHI exports-13
Provision of community toilets, dustbins and bathing place for women.	➢ Bathing Place constructed in Fy 16-17 and 17-18:- at Khatri river, Jahajtand, Kanchanpur, pasitand, Rampur Rajwar tola, Khatri river (Rampur-1), Lalubandh (Sijua 12 no.),;Chotki sher(Sijua No-12); Guard wall near Water reservoir at Chaitudih Basti; Water reservoir at Malkera Das Tola; Water reservoir at Barughutu ➢ Fy16-18: School toilets- Kapuria School, Bhowra school, Kendua school, SSNM School Sijua, Swami Vivekananda School Rampur-1; Sarthi Devi High school,Kapuria ; Adarsh High aschol; BBM School toilet renovation,
Increase in CSR budget of the company	Expenditure FY 17 : 3.51crores FY18: 3.94 crores + Coll. Fund Rs. 14.04Laks FY19: 5.65 crores
Repair and cleaning of drains and roads, water logging issues and removal of garbage regularly.	FY16-18 Sewage Drain constructed in Bhelatand, Patia, Dungri No. 3 and Alam Nagar
Construction of parks in the villages	Triangular park (Medicinal Garden, Hibiscus Park and Children Park) constructed by Tata Steel in Jamadoba

Annexure II Third Party monitoring reports

ECOMEN LABORATORIES PVT. LTD.

Flat No. 8, 2nd Floor, Arif Chamber-V, Sector H, Aliganj, Lucknow - 226 024
Phone No. : (91-522) 2746282, 2745726 Telefax No.: (91 - 522) 2745726
E-mail: ravi.bhargava@gmail.com, Website: www.ecomen.in, CIN - U74210UP1989PTC010601, GSTIN : 09AAACE6076H1ZI

An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/15 TEST REPORT NO: ECO Lab/AAQ-1/02/19
Test Report Issue date: 11.03.2019

TEST REPORT OF AMBIENT AIR*

Name of the Customer	:	Tata Steel Colliery (Sijua Grup)
Address of the Customer	:	Jamadoba, Distt. Dhanbad Jharkhand
Date of Sampling	:	25.02.2019
Sample Collected By	:	Ecomen Teem
Sampling Method	:	IS: 5182
Instrument Used	:	RDS & FDS
Location	:	Bhelatand Officer's Club

Sl. No.	Tests Conducted	Method	Results	Detection Range	NAAQ Standards as per CPCB, New Delhi, Nov. 18th, 2009
1.	$PM_{2.5}$ ($\mu g/m^3$)	SOP NO. A -15, Issue No.1 date 26.07.2016 (Gravimetric Method)	34.14	12.5-1000	60
2.	PM_{10} ($\mu g/m^3$)	IS:5182 (Part-23)	72.79	12.5-1000	100
3.	SO_2($\mu g/m^3$)	IS:5182 (Part-2)	14.25	9-200	80
4.	NO_2($\mu g/m^3$)	IS:5182 (Part-6)	24.12	6-200	80
5.	NH_3($\mu g/m^3$)	SOP NO. A -26, Issue No.1 date 26.07.2016 (Indophenol Method)	13.15	2-700	400
6.	O_3 ($\mu g/m^3$)	IS:5182(Part-9)	17.27	2-200	180
7.	CO (mg/m^3)	IS:5182 (Part-10)	0.51	0.2-500	04
8.	Pb($\mu g/m^3$)	IS:5182(Part-22)	BDL	1-100	1.0
9.	Cr ($\mu g/m^3$)	SOP NO. A -23, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
10.	Cd ($\mu g/m^3$)	SOP NO. A -24, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
11.	As (ng/m^3)	SOP NO. A -22, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	06
12.	Ni (ng/m^3)	SOP NO. A -21, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	20

*The results is related only to tested item.

Note: Below Detection Limit

Analyst

Authorized Signatory

Ecomen Laboratories Pvt. Ltd.
Flat No.-8 2nd Floor, Arif Chamber-V
Sector-H, Aliganj, Lucknow-226024
Ph.-2746282, Fax:2745726

Quality Manager

ECOMEN LABORATORIES PVT. LTD.

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E-mail: ravi.bhargava@gmail.com, Website: www.ecomen.in, CIN - U74210UP1989PTC010601, GSTIN : 09AAACE6076H1ZI

An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/15 TEST REPORT NO: ECO Lab/AAQ-2/02/19
Test Report Issue date: 11.03.2019

TEST REPORT OF AMBIENT AIR*

Name of the Customer	:	Tata Steel Colliery (Sijua Grup)
Address of the Customer	:	Jamadoba, Distt. Dhanbad Jharkhand
Date of Sampling	:	25.02.2019
Sample Collected By	:	Ecomen Teem
Sampling Method	:	IS: 5182
Instrument Used	:	RDS & FDS
Location	:	WTP Malkera

Sl. No.	Tests Conducted	Method	Results	Detection Range	NAAQ Standards as per CPCB, New Delhi, Nov. 18th, 2009
1.	$PM_{2.5}$ ($\mu g/m^3$)	SOP NO. A -15, Issue No.1 date 26.07.2016 (Gravimetric Method)	46.31	12.5-1000	60
2.	PM_{10} ($\mu g/m^3$)	IS:5182 (Part-23)	86.61	12.5-1000	100
3.	SO_2($\mu g/m^3$)	IS:5182 (Part-2)	17.22	9-200	80
4.	NO_2($\mu g/m^3$)	IS:5182 (Part-6)	29.14	6-200	80
5.	NH_3($\mu g/m^3$)	SOP NO. A -26, Issue No.1 date 26.07.2016 (Indophenol Method)	16.66	2-700	400
6.	O_3 ($\mu g/m^3$)	IS:5182(Part-9)	19.17	2-200	180
7.	CO (mg/m^3)	IS:5182 (Part-10)	0.97	0.2-500	04
8.	Pb($\mu g/m^3$)	IS:5182(Part-22)	BDL	1-100	1.0
9.	Cr ($\mu g/m^3$)	SOP NO. A -23, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
10.	Cd ($\mu g/m^3$)	SOP NO. A -24, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
11.	As (ng/m^3)	SOP NO. A -22, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	06
12.	Ni (ng/m^3)	SOP NO. A -21, Issue No.I date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	20

*The results is related only to tested item.

Note: Below Detection Limit

Analyst Authorized Signatory Quality Manager

Ecomen Laboratories Pvt. Ltd.
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ECOMEN LABORATORIES PVT. LTD.
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An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/15 TEST REPORT NO: ECO Lab/AAQ-3/02/19
Test Report Issue date: 11.03.2019

TEST REPORT OF AMBIENT AIR*

Name of the Customer	:	Tata Steel Colliery (Sijua Grup)
Address of the Customer	:	Jamadoba, Distt. Dhanbad Jharkhand
Date of Sampling	:	26.02.2019
Sample Collected By	:	Ecomen Teem
Sampling Method	:	IS: 5182
Instrument Used	:	RDS & FDS
Location	:	Sijua Colliery 15 Pit

Sl. No.	Tests Conducted	Method	Results	Detection Range	NAAQ Standards as per CPCB, New Delhi, Nov. 18th, 2009
1.	$PM_{2.5}$ ($\mu g/m^3$)	SOP NO. A -15, Issue No.1 date 26.07.2016 (Gravimetric Method)	48.25	12.5-1000	60
2.	PM_{10} ($\mu g/m^3$)	IS:5182 (Part-23)	89.17	12.5-1000	100
3.	SO_2($\mu g/m^3$)	IS:5182 (Part-2)	17.51	9-200	80
4.	NO_2($\mu g/m^3$)	IS:5182 (Part-6)	31.92	6-200	80
5.	NH_3($\mu g/m^3$)	SOP NO. A -26, Issue No.1 date 26.07.2016 (Indophenol Method)	18.99	2-700	400
6.	O_3 ($\mu g/m^3$)	IS:5182(Part-9)	25.24	2-200	180
7.	CO (mg/m^3)	IS:5182 (Part-10)	1.59	0.2-500	04
8.	Pb($\mu g/m^3$)	IS:5182(Part-22)	BDL	1-100	1.0
9.	Cr ($\mu g/m^3$)	SOP NO. A -23, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
10.	Cd ($\mu g/m^3$)	SOP NO. A -24, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
11.	As (ng/m^3)	SOP NO. A -22, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	06
12.	Ni (ng/m^3)	SOP NO. A -21, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	20

*The results is related only to tested item.

Note: Below Detection Limit

Analyst Authorized Signatory Quality Manager

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An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/15 TEST REPORT NO: ECO Lab/AAQ-4/02/19
Test Report Issue date: 11.03.2019

TEST REPORT OF AMBIENT AIR*

Name of the Customer	:	Tata Steel Colliery (Sijua Grup)
Address of the Customer	:	Jamadoba, Distt. Dhanbad Jharkhand
Date of Sampling	:	22.02.2019
Sample Collected By	:	Ecomen Teem
Sampling Method	:	IS: 5182
Instrument Used	:	RDS & FDS
Location	:	Russi Vihar Colony

Sl. No.	Tests Conducted	Method	Results	Detection Range	NAAQ Standards as per CPCB, New Delhi, Nov. 18th, 2009
1.	$PM_{2.5}$ ($\mu g/m^3$)	SOP NO. A -15, Issue No.1 date 26.07.2016 (Gravimetric Method)	46.18	12.5-1000	60
2.	PM_{10} ($\mu g/m^3$)	IS:5182 (Part-23)	93.16	12.5-1000	100
3.	SO_2($\mu g/m^3$)	IS:5182 (Part-2)	15.94	9-200	80
4.	NO_2($\mu g/m^3$)	IS:5182 (Part-6)	35.19	6-200	80
5.	NH_3($\mu g/m^3$)	SOP NO. A -26, Issue No.1 date 26.07.2016 (Indophenol Method)	17.55	2-700	400
6.	O_3 ($\mu g/m^3$)	IS:5182(Part-9)	27.44	2-200	180
7.	CO (mg/m^3)	IS:5182 (Part-10)	3.11	0.2-500	04
8.	Pb($\mu g/m^3$)	IS:5182(Part-22)	BDL	1-100	1.0
9.	Cr ($\mu g/m^3$)	SOP NO. A -23, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
10.	Cd ($\mu g/m^3$)	SOP NO. A -24, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	-
11.	As (ng/m^3)	SOP NO. A -22, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	06
12.	Ni (ng/m^3)	SOP NO. A -21, Issue No.1 date 26.07.2016 (CPCB-NAAQM Guideline)	BDL	1-100	20

*The results is related only to tested item.

Note: Below Detection Limit

Analyst

Authorized Signatory

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FORMAT NO. ECO/QS/FORMAT/15

TEST REPORT NO: ECO LAB/AAQ-1/03/19
TEST REPORT ISSUE DATE: 11.03.2019

TEST REPORT OF AMBIENT NOISE LEVEL

Name of the Customer : Tata Steel Colliery (Sijua Grup)
Address of the Customer : Jamadoba, Distt. Dhanbad Jharkhand
Sample Collected By : Ecomen Team
Instrument Used : Noise Meter (HTC)

Sl. No.	Locations	Date of Monitoring	Day Time			Night Time		
			Max.	Min.	Leq.	Max.	Min.	Leq
1.	Bhelatand Officer's Colony	25-26.02.2019	56.8	50.9	51.7	51.6	48.2	49.8
2.	WTP Malkera	25-26.02.2019	65.3	60.8	61.3	58.2	55.7	56.1
3.	Sijua Colliery 15 Pit	26-27.02.2019	69.5	65.3	66.1	64.6	61.1	62.3
4.	Russi Vihar Colony	22-23.02.2019	57.3	52.8	53.8	47.9	44.8	45.4

Noise (Ambient Standard)

Area Code	Category of area	Limit in dB (A) Leq	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Note:

1. Day time is reckoned in between 6:00 AM and 10:00 PM.
2. Night time is reckoned in between 10:00 PM and 6:00 AM
3. Silence zone is defined as area up to 100m around such premises as hospitals, educational institutions & courts. The silence zones are to be declared by a competent authority.
4. Mixed categories of areas should be declared as one of the four above-mentioned categories by the competent authority and the corresponding standard shall apply.

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FORMAT NO. ECO/QS/FORMAT/07 TEST REPORT NO:ECO LAB/WW/02/19
TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF WASTE WATER*

Name of the Customer	:	**M/s Tata Steel Ltd. (Sijua Group)**
Address of the Customer	:	Jamadoba, Distt. Dhanbad – 828 112
Sampling Method	:	APHA, 23rd Ed. 2017
Sample Collected by	:	Mr.R. K. Pandey
Sample Quantity	:	As per requirement
Date of Sampling	:	26.02.2019
Date of Sample Receiving	:	02.03.2019
Date of Analysis	:	02.03.2019 to 09.03.2019
Source of Sample	:	Bhelatand A. Colliery

Sl. No.	TESTS	PROTOCOL	RESULT	Range of Testing / Limits of Detection	G.S.R 422(E)
					Desirable Limit
1	pH	APHA, 23rd Ed. 2017, 4500H' A+B	8.02	2-12	5.5-9.0
2	Total Suspended Solid as TSS (mg/l)	APHA, 23rd Ed. 2017, 2540D	40.2	5-5000	100.0
3	Total Dissolved Solids as TDS (mg/l)	APHA, 23rd Ed. 2017, 2540C	711.0	10-10,000	-
4	Oil & Grease as O & G (mg/l)	APHA, 23rd Ed. 2017, 5520 (A+D	BDL	5-600	10.0
5	Biochemical Oxygen Demand as BOD (mg/l) 3days at 27°C	APHA, 23rd Ed. 2017,5210 A+B	3.8	5-10000	30.0
6	Chemical Oxygen Demand as COD (mg/l)	APHA, 23rd Ed. 2017, 5220 A+B	20.2	5-50000	250.0

*The result are related only to item tested.
BDL = Below Detection Limit

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FORMAT NO. ECO/QS/FORMAT/07 TEST REPORT NO:ECO LAB/WW/02/19
TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF WASTE WATER*

Name of the Customer	:	**M/s Tata Steel Ltd. (Sijua Group)**
Address of the Customer	:	Jamadoba, Distt. Dhanbad – 828 112
Sampling Method	:	APHA, 23rd Ed. 2017
Sample Collected by	:	Mr.R. K. Pandey
Sample Quantity	:	As per requirement
Date of Sampling	:	26.02.2019
Date of Sample Receiving	:	02.03.2019
Date of Analysis	:	02.03.2019 to 09.03.2019
Source of Sample	:	BCPP (Final Settling Pond)

Sl. No.	TESTS	PROTOCOL	RESULT	Range of Testing / Limits of Detection	G.S.R 422(E)
					Desirable Limit
1	pH	APHA, 23rd Ed. 2017, 4500H' A+B	7.56	2-12	5.5-9.0
2	Total Suspended Solid as TSS (mg/l)	APHA, 23rd Ed. 2017, 2540D	26.6	5-5000	100.0
3	Total Dissolved Solids as TDS (mg/l)	APHA, 23rd Ed. 2017, 2540C	623.0	10-10,000	-
4	Oil & Grease as O & G (mg/l)	APHA, 23rd Ed. 2017, 5520 (A+D	BDL	5-600	10.0
5	Biochemical Oxygen Demand as BOD (mg/l) 3days at 27^{0}C	APHA, 23rd Ed. 2017,5210 A+B	4.8	5-10000	30.0
6	Chemical Oxygen Demand as COD (mg/l)	APHA, 23rd Ed. 2017, 5220 A+B	30.6	5-50000	250.0

*The result are related only to item tested.
BDL = Below Detection Limit

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FORMAT NO. ECO/QS/FORMAT/07 TEST REPORT NO:ECO LAB/GW/02/19
TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF GROUND WATER*

Name of the Customer : **M/s Tata Steel Ltd. (Sijua Group)**
Address of the Customer : Jamadoba,
Distt. Dhanbad – 828 112
Sampling Method : APHA, 23rd Ed. 2017
Sample Collected by : Mr.R. K. Pandey
Sample Quantity : As per requirement
Date of Sampling : 23.02.2019
Date of Sample Receiving : 02.03.2019
Date of Analysis : 02.03.2019 to 09.03.2019
Source of Sample : Bhelatand Basti, Near 500 Quarters(HP)
Ground Water Level : 35.0 Meter

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	INDIAN STANDARDS as per IS 10500:1991(Reaff:2012)	
					Desirable	Permissible
1.	Colour (Hazen unit)	APHA, 23rd Ed. 2017, 2120 B	<5.0	5-100	5.00	15.0
2.	Temperature (0C)	APHA,23rd Ed.2017, (2550 A+B)	26.5	10-100	-	-
3.	Electrical Conductivity (µmhos/cm)	APHA,23rd Ed.2017, 2510-A+B	856.0	1-2000	-	-
4.	Dissolved Solids (mg/l)	APHA,23rd Ed.2017 (2540B)	485.0	5-10000	-	-
5.	pH	APHA, 23rd Ed. 2017, 4500H+ A+B	7.74	2-12	6.5-8.5	No Relax.
6.	Alkalinity (mg/l)	APHA, 23rd Ed. 2017, 2320 A+ B	208.0	5-1500	200	600
7.	Total Hardness as $CaCO_3$ (mg/l)	APHA, 23rd Ed. 2017, 2340 A+C	216.0	5-1500	200.0	600.0
8.	Calcium as Ca (mg/l)	APHA, 23rd Ed. 2017, 3500 Ca A+B	52.8	5-1000	75.0	200.0
9.	Magnesium as Mg (mg/l)	APHA, 23rd Ed. 2017, 3500 Mg A+B	20.41	5-1000	30.0	100.0
10.	Copper as Cu (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-5	0.05	1.5
11.	Iron as Fe (mg/l)	APHA, 23rd Ed. 2017, 3500 Fe B	0.14	0.02-50	0.3	No Relax.
12.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	42.02	5-1000	250.0	1000.0
13.	Sulfate as SO_4 (mg/l)	APHA, 23rd Ed. 2017, 4500-SO42- E	48.0	1.0-250	200.0	400.0
14.	Nitrate Nitrogen as NO_3 (mg/l)	APHA, 23rd Ed. 2017, 4500-NO3- B	14.2	5-100	45.0	No Relax.
15.	Fluorides as F (mg/l)	APHA, 23rd Ed. 2017, 4500-C	0.58	0.05-10	1.0	1.5
16.	Mercury as Hg (mg/l)	APHA, 23rd Ed. 2017, 3112 A+B	BDL	0.001-1	0.001	No Relax.
17.	Cadmium as Cd (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.002-2	0.003	No Relax
18.	Nickel as Ni (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.02-2	0.02	No Relax
19.	Arsenic as As (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-2.0	0.01	No Relax
20.	Lead as Pb (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-1.0	0.01	No Relax.
21.	Zinc as Zn (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	0.20	0.02-50	5	15
22.	Total Chromium as Cr (mg/l)	APHA, 23rd Ed. 2017,3111 A+B	BDL	0.05-50	0.05	No Relax
23.	Cyanide as CN (mg/l)	APHA, 23rd Ed. 2017, 4500CN , A+D	BDL	0.02-10	0.05	No Relax.

*The result are related only to item tested.
BDL = Below Detection Limit

Analyst

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FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO:ECO LAB/GW/02/19
TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF GROUND WATER*

Name of the Customer : M/s Tata Steel Ltd. (Sijua Group)
Address of the Customer : Jamadoba,
Distt. Dhanbad – 828 112
Sampling Method : APHA, 23rd Ed. 2017
Sample Collected by : Mr.R. K. Pandey
Sample Quantity : As per requirement
Date of Sampling : 23.02.2019
Date of Sample Receiving : 02.03.2019
Date of Analysis : 02.03.2019 to 09.03.2019
Source of Sample : Rampur Basti, Well
Ground Water Level : 14.6 Meter

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	INDIAN STANDARDS as per IS 10500:1991(Reaff:2012)	
					Desirable	Permissible
1.	Colour (Hazen unit)	APHA, 23rd Ed. 2017, 2120 B	<5.0	5-100	5.00	15.0
2.	Temperature (0C)	APHA,23rd Ed.2017, (2550 A+B)	26.1	10-100	-	-
3.	Electrical Conductivity (µmhos/cm)	APHA,23rd Ed.2017, 2510-A+B	895.0	1-2000	-	-
4.	Dissolved Solids (mg/l)	APHA,23rd Ed.2017 (2540B)	506.0	5-10000	-	-
5.	pH	APHA, 23rd Ed. 2017, 4500H+ A+B	7.62	2-12	6.5-8.5	No Relax.
6.	Alkalinity (mg/l)	APHA, 23rd Ed. 2017, 2320 A+ B	252.0	5-1500	200	600
7.	Total Hardness as $CaCO_3$ (mg/l)	APHA, 23rd Ed. 2017, 2340 A+C	288.0	5-1500	200.0	600.0
8.	Calcium as Ca (mg/l)	APHA, 23rd Ed. 2017, 3500 Ca A+B	75.2	5-1000	75.0	200.0
9.	Magnesium as Mg (mg/l)	APHA, 23rd Ed. 2017, 3500 Mg A+B	24.3	5-1000	30.0	100.0
10.	Copper as Cu (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-5	0.05	1.5
11.	Iron as Fe (mg/l)	APHA, 23rd Ed. 2017, 3500 Fe B	0.21	0.02-50	0.3	No Relax.
12.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	70.0	5-1000	250.0	1000.0
13.	Sulfate as SO_4 (mg/l)	APHA, 23rd Ed. 2017, 4500-SO42- E	45.6	1.0-250	200.0	400.0
14.	Nitrate Nitrogen as NO_3 (mg/l)	APHA, 23rd Ed. 2017, 4500-NO3- B	12.3	5-100	45.0	No Relax.
15.	Fluorides as F (mg/l)	APHA, 23rd Ed. 2017, 4500-C	0.60	0.05-10	1.0	1.5
16.	Mercury as Hg (mg/l)	APHA, 23rd Ed. 2017, 3112 A+B	BDL	0.001-1	0.001	No Relax.
17.	Cadmium as Cd (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.002-2	0.003	No Relax
18.	Nickel as Ni (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.02-2	0.02	No Relax
19.	Arsenic as As (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-2.0	0.01	No Relax
20.	Lead as Pb (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-1.0	0.01	No Relax.
21.	Zinc as Zn (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	0.12	0.02-50	5	15
22.	Total Chromium as Cr (mg/l)	APHA, 23rd Ed. 2017,3111 A+B	BDL	0.05-50	0.05	No Relax
23.	Cyanide as CN (mg/l)	APHA, 23rd Ed. 2017, 4500CN , A+D	BDL	0.02-10	0.05	No Relax.

*The result are related only to item tested.
BDL = Below Detection Limit

Analyst

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FORMAT NO. ECO/QS/FORMAT/07 TEST REPORT NO:ECO LAB/GW/02/19
TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF GROUND WATER*

Name of the Customer : M/s Tata Steel Ltd. (Sijua Group)
Address of the Customer : Jamadoba,
Distt. Dhanbad – 828 112
Sampling Method : APHA, 23rd Ed. 2017
Sample Collected by : Mr.R. K. Pandey
Sample Quantity : As per requirement
Date of Sampling : 23.02.2019
Date of Sample Receiving : 02.03.2019
Date of Analysis : 02.03.2019 to 09.03.2019
Source of Sample : Sijua 12 No., Hand Pump
Ground Water Level : 18.0Meter

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	INDIAN STANDARDS as per IS 10500:1991(Reaff:2012)	
					Desirable	Permissible
1.	Colour (Hazen unit)	APHA, 23rd Ed. 2017, 2120 B	<5.0	5-100	5.00	15.0
2.	Temperature (0C)	APHA,23rd Ed.2017, (2550 A+B)	26.5	10-100	-	-
3.	Electrical Conductivity (µmhos/cm)	APHA,23rd Ed.2017, 2510-A+B	802.0	1-2000	-	-
4.	Dissolved Solids (mg/l)	APHA,23rd Ed.2017 (2540B)	522.0	5-10000	-	-
5.	pH	APHA, 23rd Ed. 2017, 4500H+ A+B	7.69	2-12	6.5-8.5	No Relax.
6.	Alkalinity (mg/l)	APHA, 23rd Ed. 2017, 2320 A+ B	204.0	5-1500	200	600
7.	Total Hardness as $CaCO_3$ (mg/l)	APHA, 23rd Ed. 2017, 2340 A+C	264.0	5-1500	200.0	600.0
8.	Calcium as Ca (mg/l)	APHA, 23rd Ed. 2017, 3500 Ca A+B	65.6	5-1000	75.0	200.0
9.	Magnesium as Mg (mg/l)	APHA, 23rd Ed. 2017, 3500 Mg A+B	24.0	5-1000	30.0	100.0
10.	Copper as Cu (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-5	0.05	1.5
11.	Iron as Fe (mg/l)	APHA, 23rd Ed. 2017, 3500 Fe B	0.16	0.02-50	0.3	No Relax.
12.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	54.0	5-1000	250.0	1000.0
13.	Sulfate as SO_4 (mg/l)	APHA, 23rd Ed. 2017, 4500-SO42- E	38.6	1.0-250	200.0	400.0
14.	Nitrate Nitrogen as NO_3 (mg/l)	APHA, 23rd Ed. 2017, 4500-NO3- B	10.16	5-100	45.0	No Relax.
15.	Fluorides as F (mg/l)	APHA, 23rd Ed. 2017, 4500-C	0.50	0.05-10	1.0	1.5
16.	Mercury as Hg (mg/l)	APHA, 23rd Ed. 2017, 3112 A+B	BDL	0.001-1	0.001	No Relax.
17.	Cadmium as Cd (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.002-2	0.003	No Relax
18.	Nickel as Ni (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.02-2	0.02	No Relax
19.	Arsenic as As (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-2.0	0.01	No Relax
20.	Lead as Pb (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-1.0	0.01	No Relax.
21.	Zinc as Zn (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	0.14	0.02-50	5	15
22.	Total Chromium as Cr (mg/l)	APHA, 23rd Ed. 2017,3111 A+B	BDL	0.05-50	0.05	No Relax
23.	Cyanide as CN (mg/l)	APHA, 23rd Ed. 2017, 4500CN , A+D	BDL	0.02-10	0.05	No Relax.

*The result are related only to item tested.
BDL = Below Detection Limit

Analyst

Authorized Signatory

Quality Manager

ECOMEN LABORATORIES PVT. LTD.

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E-mail: ravi.bhargava@gmail.com, Website: www.ecomen.in, CIN - U74210UP1989PTC010601, GSTIN : 09AAACE6076H1ZI

An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO:ECO LAB/GW/02/19
TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF GROUND WATER*

Name of the Customer : M/s Tata Steel Ltd. (Sijua Group)
Address of the Customer : Jamadoba,
Distt. Dhanbad – 828 112
Sampling Method : APHA, 23rd Ed. 2017
Sample Collected by : Mr.R. K. Pandey
Sample Quantity : As per requirement
Date of Sampling : 23.02.2019
Date of Sample Receiving : 02.03.2019
Date of Analysis : 02.03.2019 to 09.03.2019
Source of Sample : Malkera Trigunait Basti
Ground Water Level : 15.0Meter

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	INDIAN STANDARDS as per IS 10500:1991(Reaff:2012)	
					Desirable	Permissible
1.	Colour (Hazen unit)	APHA, 23rd Ed. 2017, 2120 B	<5.0	5-100	5.00	15.0
2.	Temperature (0C)	APHA,23rd Ed.2017, (2550 A+B)	26.2	10-100	-	-
3.	Electrical Conductivity (µmhos/cm)	APHA,23rd Ed.2017, 2510-A+B	569.0	1-2000	-	-
4.	Dissolved Solids (mg/l)	APHA,23rd Ed.2017 (2540B)	389.0	5-10000	-	-
5.	pH	APHA, 23rd Ed. 2017, 4500H+ A+B	7.67	2-12	6.5-8.5	No Relax.
6.	Alkalinity (mg/l)	APHA, 23rd Ed. 2017, 2320 A+ B	196.0	5-1500	200	600
7.	Total Hardness as $CaCO_3$ (mg/l)	APHA, 23rd Ed. 2017, 2340 A+C	208.0	5-1500	200.0	600.0
8.	Calcium as Ca (mg/l)	APHA, 23rd Ed. 2017, 3500 Ca A+B	60.8	5-1000	75.0	200.0
9.	Magnesium as Mg (mg/l)	APHA, 23rd Ed. 2017, 3500 Mg A+B	13.60	5-1000	30.0	100.0
10.	Copper as Cu (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.05-5	0.05	1.5
11.	Iron as Fe (mg/l)	APHA, 23rd Ed. 2017, 3500 Fe B	0.14	0.02-50	0.3	No Relax.
12.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	34.0	5-1000	250.0	1000.0
13.	Sulfate as SO_4 (mg/l)	APHA, 23rd Ed. 2017, 4500-SO42- E	61.2	1.0-250	200.0	400.0
14.	Nitrate Nitrogen as NO_3 (mg/l)	APHA, 23rd Ed. 2017, 4500-NO3- B	16.2	5-100	45.0	No Relax.
15.	Fluorides as F (mg/l)	APHA, 23rd Ed. 2017, 4500-C	0.41	0.05-10	1.0	1.5
16.	Mercury as Hg (mg/l)	APHA, 23rd Ed. 2017, 3112 A+B	BDL	0.001-1	0.001	No Relax.
17.	Cadmium as Cd (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.002-2	0.003	No Relax
18.	Nickel as Ni (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.02-2	0.02	No Relax
19.	Arsenic as As (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-2.0	0.01	No Relax
20.	Lead as Pb (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	BDL	0.01-1.0	0.01	No Relax.
21.	Zinc as Zn (mg/l)	APHA, 23rd Ed. 2017, 3111 A+B	0.15	0.02-50	5	15
22.	Total Chromium as Cr (mg/l)	APHA, 23rd Ed. 2017,3111 A+B	BDL	0.05-50	0.05	No Relax
23.	Cyanide as CN (mg/l)	APHA, 23rd Ed. 2017, 4500CN , A+D	BDL	0.02-10	0.05	No Relax.

*The result are related only to item tested.
BDL = Below Detection Limit

Analyst

Authorized Signatory

Quality Manager

ECOMEN LABORATORIES PVT. LTD.

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E-mail: ravi.bhargava@gmail.com, Website: www.ecomen.in, CIN - U74210UP1989PTC010601, GSTIN : 09AAACE6076H1ZI

An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO:ECO LAB/SW/02/19
TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF SURFACE WATER

Name of the Customer	:	**M/s Tata Steel Ltd. (Sijua Group)**
Address of the Customer	:	Jamadoba, Distt. Dhanbad - 828 112
Sampling Method	:	APHA, 23rd Ed. 2017
Sample Collected by	:	Mr.R. K. Pandey
Sample Quantity	:	As per requirement
Date of Sampling	:	23.02.2019
Date of Sample Receiving	:	02.03.2019
Date of Analysis	:	02.03.2019 to 09.03.2019
Source of Sample	:	Katri River, Up Stream

SL No.	TESTS	PROTOCOL	RESULT	Detection Range	IS:2296 Class-C
1.	pH	APHA,23rd Ed.2017,4500H+A+B,	7.56	2-12	8.5
2.	Turbidity as (NTU)	APHA, 23rd Ed. 2017, 2130-A+B	9.5	1-100	-
3.	Total Dissolved Solids as TDS (mg/l)	APHA,23rd Ed.2017 (2540C)	352.0	5-10000	1500
4.	Dissolved Oxygen as DO (mg/l)	APHA,23rd Ed.2017 (4500 A+C)	6.2	2-10	4.0
5.	Biochemical Oxygen Demand as BOD (mg/l)	APHA,23rd Ed.2017 (5210A+ B)	BDL	5-10000	3.0
6.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	24.0	5-1000	-
7.	Fluorides as F (mg/l)	APHA,23rd Ed.2017 (4500 –C)	0.52	0.05-10	1.5
8.	Sulfate as SO_4 (mg/l)	APHA,23rd Ed.2017 (4500 -SO_4^{2-} E)	55.6	1.0-250	400.0

*The result are related only to item tested - The parameters are not included in IS: 2296 Class-C
BDL – Below Detection Limit

Analyst

Authorized Signatory

Quality Manager

ECOMEN LABORATORIES PVT. LTD.

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Phone No. : (91-522) 2746282, 2745726 Telefax No.: (91 - 522) 2745726
E-mail: ravi.bhargava@gmail.com, Website: www.ecomen.in, CIN - U74210UP1989PTC010601, GSTIN : 09AAACE6076H1ZI

An approved Laboratory from Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi (Valid Upto 02.01.19)

FORMAT NO. ECO/QS/FORMAT/07

TEST REPORT NO:ECO LAB/SW/02/19
TEST REPORT ISSUE DATE:09.03.2019

TEST REPORT OF SURFACE WATER

Name of the Customer	:	**M/s Tata Steel Ltd. (Sijua Group)**
Address of the Customer	:	Jamadoba, Distt. Dhanbad - 828 112
Sampling Method	:	APHA, 23rd Ed. 2017
Sample Collected by	:	Mr.R. K. Pandey
Sample Quantity	:	As per requirement
Date of Sampling	:	23.02.2019
Date of Sample Receiving	:	02.03.2019
Date of Analysis	:	02.03.2019 to 09.03.2019
Source of Sample	:	Katri River, Down Stream

Sl. No.	TESTS	PROTOCOL	RESULT	Detection Range	IS:2296 Class-C
1.	pH	APHA,23rd Ed.2017, 4500H+A+B,	7.79	2-12	8.5
2.	Turbidity as (NTU)	APHA, 23rd Ed. 2017, 2130-A+B	14.0	1-100	-
3.	Total Dissolved Solids as TDS (mg/l)	APHA,23rd Ed.2017 (2540C)	348.0	5-10000	1500
4.	Dissolved Oxygen as DO (mg/l)	APHA,23rd Ed.2017 (4500 A+C)	5.8	2-10	4.0
5.	Biochemical Oxygen Demand as BOD (mg/l)	APHA,23rd Ed.2017 (5210A+ B)	BDL	5-10000	3.0
6.	Chloride as Cl (mg/l)	APHA, 23rd Ed. 2017, 4500 Cl A+B	32.0	5-1000	-
7.	Fluorides as F (mg/l)	APHA,23rd Ed.2017 (4500 – C)	0.70	0.05-10	1.5
8.	Sulfate as SO_4 (mg/l)	APHA,23rd Ed.2017 (4500 -SO_4^{2-} E)	48.3	1.0-250	400.0

*The result are related only to item tested - The parameters are not included in IS: 2296 Class-C
BDL – Below Detection Limit

Analyst

Authorized Signatory

Ecomen Laboratories Pvt. Ltd.
Flat No.-8 2nd Floor, Arif Chamber-V
Sector-H, Aliganj, Lucknow-226024
Ph.-2746282, Fax:2745726

Quality Manager

Annexure – III

TEST ANALYSIS OF CHARACTERISTIC OF COAL

Central Fuel Research Institute
This is not a certificate and not valid for purposes of contracts and cannot be produced in a court of law.

(THE RESERVED HALF OF YOUR SAMPLE WILL BE DESTROYED AFTER (THIRTY) DAYS FROM DATE.

केंद्रीय खनन एवं ईंधन अनुसंधान संस्थान
पूर्ववर्ती केंद्रीय ईंधन अनुसंधान संस्थान, डिगवाडीह परिसर
(वैज्ञानिक एवं औद्योगिक अनुसंधान परिषद्)
विज्ञान एवं प्रोद्यौगिकी मंत्रालय, भारत सरकार

CIMFR

CSIR – CENTRAL INSTITUTE OF MINING AND FUEL RESEARCH
ERSTWHILE CENTRAL FUEL RESEARCH INSTITUTE, Digwadih Campus
(Council of Scientific & Industrial Research)
Ministry of Science & Technology, Govt. of India

II/TR/12-13/Pt4/330

Ref.No.: G/JMB/0045/25/12
Date - 19. 04. 2012.
Source:-S.K. Pandey
Regional Geologist
NRD, Jharia
P.O. Jamadoba
Dist. Dhanbad
Pin-828112,
Jharkhand

Date: 15.06.2012

INDUSTRY INTERFACE CIMFR Test Report RP BD ME

Sl N0.	Sample Particulars (As Stated)	CIMFR Sample No RQA/2012/T	wt (kg)	size (mm)	Air Dried Basis		C% (dmf)	H% (dmf)
					M%	Total Sulphur%		
1	JCPP-1) Raw Coal	505	5.000	x3-0	0.9	0.49	91.15	4.34
2	JCPP-2) Clean Coal	506	5.000	x3-0	1.0	0.52	90.65	4.53
3	JCPP-3) Tailings	507	5.000	x3-0	0.6	0.34	91.98	4.03
4	JCPP-4) Rejects	508	5.000	x3-0	0.9	0.32	92.15	3.79
5	BCPP-1) Raw Coal	509	7.000	x3-0	0.9	0.59	88.90	4.38
6	BCPP-2) Clean Coal	510	10.000	x3-0	0.9	0.50	89.71	4.51
7	BCPP-3) Middlings	511	1.000	x3-0	0.7	0.32	91.26	4.20
8	BCPP-4) Tailings	512	11.000	x3-0	0.7	0.49	91.98	4.20
9	BCPP-5) Rejects	513	10.000	x3-0	0.7	0.16	* 67.70	* 5.04

Remark:- Sampling not done by CIMFR Digwadih Campus.
* N.B. The Carbon% and Hydrogen% Value of Sample No.-513 on **daf** basis

For Analysis:-
IS : 1350 (Part-I) 1984 (Reaffirmed 2001)
IS : 1350 (Part-III) 1969 (Reaffirmed 2000)
IS : 1350 : (Part-IV / Sec.-1) 1974 (Reaffirmed 2000) Were followed.

21/6/12
प्रधान / HEAD
इन्डस्ट्री इन्टरफेस / INDUSTRY INTERFACE
आर.पी.बी.डी.एम.ई / RPBDME
सी.आइ.एम.एफ.आर. / CIMFR

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email :dnb_dcfri@sancharnet.in
website : http://www.cfriindia.nic.in

TOWARDS AN ENERGY EFFICIENT NATION

Central Institute of Mining & Fuel Research
This is not a certificate and not valid for purpose of contracts and can not be produced in a court of law.

केंद्रीय खनन एवं ईंधन अनुसंधान संस्थान
पूर्ववर्ती केंद्रीय ईंधन अनुसंधान संस्थान, डिगवाडीह परिसर
(वैज्ञानिक एवं औद्योगिक अनुसंधान परिषद)
विज्ञान एवं प्रोद्यौगिकी मंत्रालय, भारत सरकार

CIMFR

CENTRAL INSTITUTE OF MINING AND FUEL RESEARCH
ERSTWHILE CENTRAL FUEL RESEARCH INSTITUTE, Digwadih Campus
(Council of Scientific & Industrial Research)
Ministry of Science & Technology, Govt. of India

II/TR/12-13/Pu+/230

REPORT ON ANALYSIS

INDUSTRY INTERFACE
CIMFR
Test Report
RPBDME

To
S. K. Pandey
Regional Geologist,
NRD, Jharia
P.O. Jamadoba
Dist: Dhanbad, Jharkhand,Pin- 828112

Dated:21.06.2012

Ref. No. : G/JMB/0045/25/12 dated: 19.04.2012

sampling not done by CIMFR

CIMFR Sample No.	Details of Sample (As Stated)	Hg (ppm)	As (ppm)	Pb (ppm)	Cr (ppm)
Inor 108/12	Coal Sample	0.05	0.07	151	23
Inor 109/12	Coal Sample	0.04	0.04	166	20
Inor 110/12	Coal Sample	0.05	0.08	171	26
Inor 111/12	Coal Sample	0.09	0.10	147	30
Inor 112/12	Coal Sample	0.08	0.09	176	33
Inor 113/12	Coal Sample	0.05	0.10	24	26
Inor 114/12	Coal Sample	0.08	0.10	02	25
Inor 115/12	Coal Sample	0.08	0.11	24	30
Inor 116/12	Coal Sample	0.12	0.08	26	32

21/6/12
प्रधान / HEAD
इन्डस्ट्री इन्टरफेस / INDUSTRY INTERFACE
आर.पी.बी.डी.एम.ई / RPBDME
सी.आइ.एम.एफ.आर. / CIMFR

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email :dnb_dcfri@sancharnet.in
website :http://www.cfriindia.nic.in

TOWARDS AN ENERGY EFFICIENT NATION

TATA STEEL

TATA

ENVIRONMENTAL POLICY

Tata Steel's environmental responsibilities are driven by our commitment to preserve the environment and are integral to the way we do business.

1. We are committed to deal proactively with Climate Change issue by efficient use of natural resources & energy; reducing and preventing pollution; promoting waste avoidance and recycling measures; and product stewardship.
   - We shall identify, assess and manage our environment impact.
   - We shall regularly monitor, review and report publicly our environmental performance.
   - We shall develop & rehabilitate abandoned sites through afforestation and landscaping and shall protect and preserve the biodiversity in the areas of our operations.
   - We shall enhance awareness, skill and competence of our employees and contractors so as to enable them to demonstrate their involvement, responsibility and accountability for sound environmental performance.
2. We are committed to continual improvement in our environmental performance.
   - We shall set objective-targets, develop, implement and maintain management standards and systems, and go beyond compliance of the relevant industry standards, legal and other requirements.
3. We will truly succeed when we sustain our environmental achievement and are valued by the communities in which we work.

Date : November 1, 2017

T V Narendran
CEO & Managing Director

Annexure IV Environmental Policy

Annexure V

FOOD BASKET SURVEY

Food basket survey was conducted for 181 respondents of the neighbouring villages of Jamadoba and Bhelatand Group. The survey was conducted across 24 hamlets and wards nearby our operations area with the following objectives:-

1. To know the living conditions of the people.
2. To know the minimum wage of the people.
3. Develop an action plan to improve the living conditions by identifying gaps.

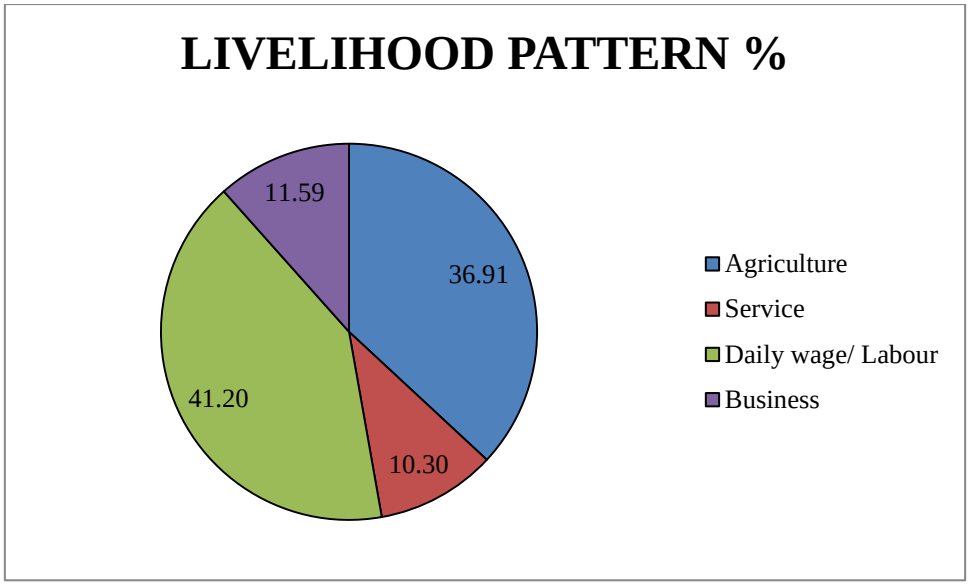
The following hamlets and municipal wards (24 villages) were surveyed:-

Baidnawadih, Banskapuria, Belubakhar, Bhelatand, Birajdih, Bustar, Chhatand, Debogram, Digwadih-10 no., Dukhidih, Dumri-4 no., Jahajtand, Jorapokhar, Kalimela, Kasiatand, Kushtand, Lalbunglow, Noonudih, Patia, Purnadih, Suyakanali, Tata Sijua-12 no, Tata Sijua 6 no., Upper Dungri.

Observations: -

- It was observed that there was a great skewedness in economic well among the population. The average income per Family is Rs. 8823.00 (181 beneficiaries).
- Out of 181 Households, 295 were earning members.
- The minimum earnings per day in unorganised sector and casual workers is approx. Rs208.00 (Total earning / total no. of earning members)
- No. of members per family is 991/181= 5.47
- Average Working persons per family is 295/181 = 1.63
- The major demands that have come up is ameliorating unemployment and Drinking water and combating social evils like Alcoholism, Dowry and Domestic Violence. Unemployment is especially to the new generation who may not be having adequate number of jobs.
- The major livelihood is wage labour and also a substantial number of Population is engaged in Agriculture. Only a few are unemployed.

Livelihood	Numbers	Percentage (%)
Agriculture	86	36.90
Service	24	10.30
Daily wage/ Labour	96	41.20
Business	27	11.59
TOTAL	233	100%



Expenditure in (Rs) Per Family Per Month

S.No.	Expenditure Item	Expenditure in Rupees per month	Expenditure per family per month in Rupees
1	Transportation	49376	272
2	House	0	0
3	Electricity	24005	132.62
4	Water	3003	17.00
5	Education	65426	361.46
6	Medical	84259	465.37
7	Clothing	88034	486.37
8	Soc. Oblg.	25581.31	141.33
9	Food	3598.16	3598.16
10	Fuel	37851	209.12
	Total	**381133.5**	**5683.43**

- Total Expenditure per month- Rs 3,81,133.5
- Average expenditure per family per month- Rs 5683.58
- Average expenditure per member- (5683.58/5.4)= Rs 1052.4
- Income per family- Rs 8823
- Income per month per individual Earning member= Rs 208.00 x 26= Rs 5,408.00
- Expenditure Per person on food per month= Rs 3598.16/5.4= Rs 719.63
- % of Expenditure Spent on food by per person per month= 719.63/1052.40*100=68.37%

BASIC NEED WAGE:

Basic food expense per person X 100/% expense on food X 1/Avg working persons per family X Avg Family Size X 1.1

=719.63 X 100/68.37 X 1/1.63 X 5.4 X 1.1 = Rs3835.68

So, The Basic Need Wage is Rs 3835.68

Annexure- VI Expenditure on Environment Management in FY 2017-18

Bhelatand A. Colliery-

S. No.	Environment Management Activity	Expenditure in Lakhs
1	Stowing activities i.e filling of U/G voids for surface protection and prevention of subsidence	496.33
2	Fire Control measures (Fire/Isolation Stopping and Nitrogen plant)	1.12
3	Goaf Filling activities, drain repairing and maintenance, settling tank maintenance jobs	9.99
4	Making potable water in Water Treatment Plant & Supply to colonies	33.39
5	Horticultural activities including green belt development and regular lawn and garden maintenance	9.20
6	Plantation of saplings and maintenance	1.66
	Total Cost incurred	**551.69**

Bhelatand Coal Washery-

S.No.	Environment Management Activity	Expenditure in Lakhs
1	Tailings Management System including recycling	35.8
2	Dust suppression system (Dry fog system)	7.2
3	Dust extraction system	0.2
4	Housekeeping measures includes removing spillage, improvement of roads	34.6
5	Mechanical dewatering system	8.5
6	Fixing of Hosch Scraper and tru track idler for spillage control of conveyor belt	8.2
7	Water spraying on roads for dust control	5.2
8	Horticultural activities including green belt development and regular lawn and garden maintenance	9.2
9	Plantation of saplings and maintenance	1.66
10	Replacement of reciprocating type air compressor by screw compressor for noise reduction	2.6
11	Any additional expenditure incurred such as constructing the rainwater harvesting structure	1.5
	Total Cost incurred	**114.66**

Total annual expenditure incurred towards environmental protection is **Rs. 666.35 lakhs**.

Coverage of Environment Clearance in newspapers

Environment Clearance coverage in Prabhat Khabar- Hindi Dainik, Dhanbad on 5th May'2017

प्रभात खबर

सिटी फर्स्ट

5.05.2017 03

बीसीसीएल.पब्लिक इंटरप्राइजेज सेलेक्शन बोर्ड ने जारी की तिथि

सीएमडी के लिए साक्षात्कार 18 को

कोल इंडिया की छह व चार अन्य कंपनियों के चार महाप्रबंधक देंगे साक्षात्कार

रेलवे लाइन शिफ्टिंग पर आज हो सकता है फैसला

रणधीर वर्मा स्मृति भवन में रेस्तरां खोलने का विरोध

हवाई सेवा के लिए अभियान चलायेगा चैंबर

महिला को सांप ने डंसा, अस्पताल में भरती

TATA STEEL

सूचना

सर्वसाधारण को एतद् द्वारा सूचित किया जाता है कि मे0 टाटा स्टील लिमिटेड, झरिया डीवीजन के भेलाटांड अमलगमेटेड कोलियरी को 0.38 MTPA से 0.41 MTPA के विस्तारीकरण (521.68 Ha क्षेत्र में) तथा भेलाटांड वाशरी को 0.96 MTPA से 1.5 MTPA के विस्तारीकरण (8 Ha क्षेत्र में) हेतु पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, नई दिल्ली से दिनांक 28.04.2017 के पत्रांक J-11015/29/2012-IA.II(M) के द्वारा पर्यावरण स्वीकृति प्रदान की गई है। जिसकी प्रतिलिपि राज्य प्रदूषण नियंत्रण बोर्ड तथा पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय के वेबसाईट : www.environmentclearance.nic.in. पर भी उपलब्ध है।

महाप्रबंधक (झरिया), टाटा स्टील जामाडोबा (धनबाद)

Environment Clearance coverage in Hindustan- Hindi Dainik, Dhanbad on 5th May'2017

आठ से डाउनलोड होगा प्रवेश पत्र

चुन्नू की गिरफ्तारी को सीएम से गुहार

तंतुलडंगा निवासी दो युवक सड़क दुर्घटना में जख्मी

झारखण्ड कर्मचारी चयन आयोग
कातीनगर, चायबगान, नामकोम, राँची–834010
स्नातकोत्तर प्रशिक्षित शिक्षक प्रतियोगिता परीक्षा–2016
आवश्यक सूचना

झारखण्ड सरकार
पर्यटन, कला संस्कृति, खेलकूद एवं युवाकार्य विभाग
(खेलकूद एवं युवाकार्य निदेशालय)
आवश्यक सूचना

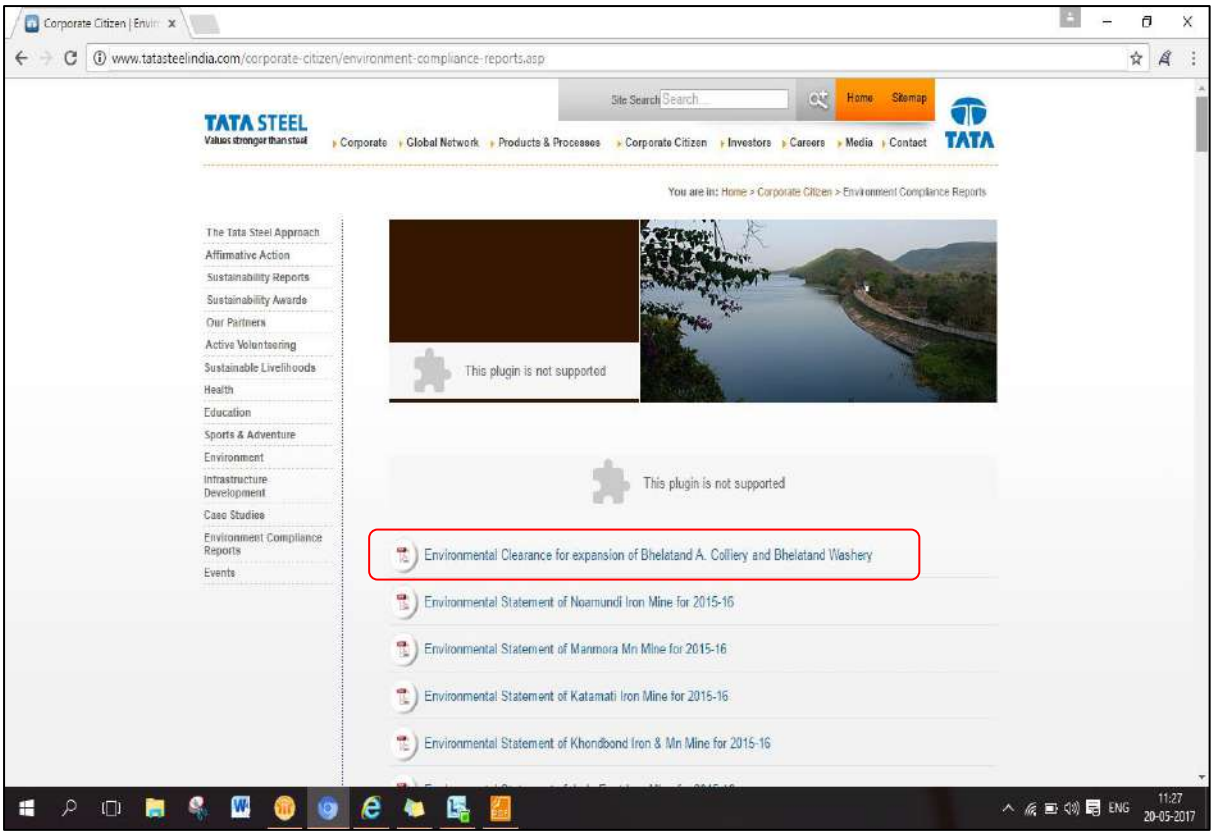
TATA STEEL

सूचना

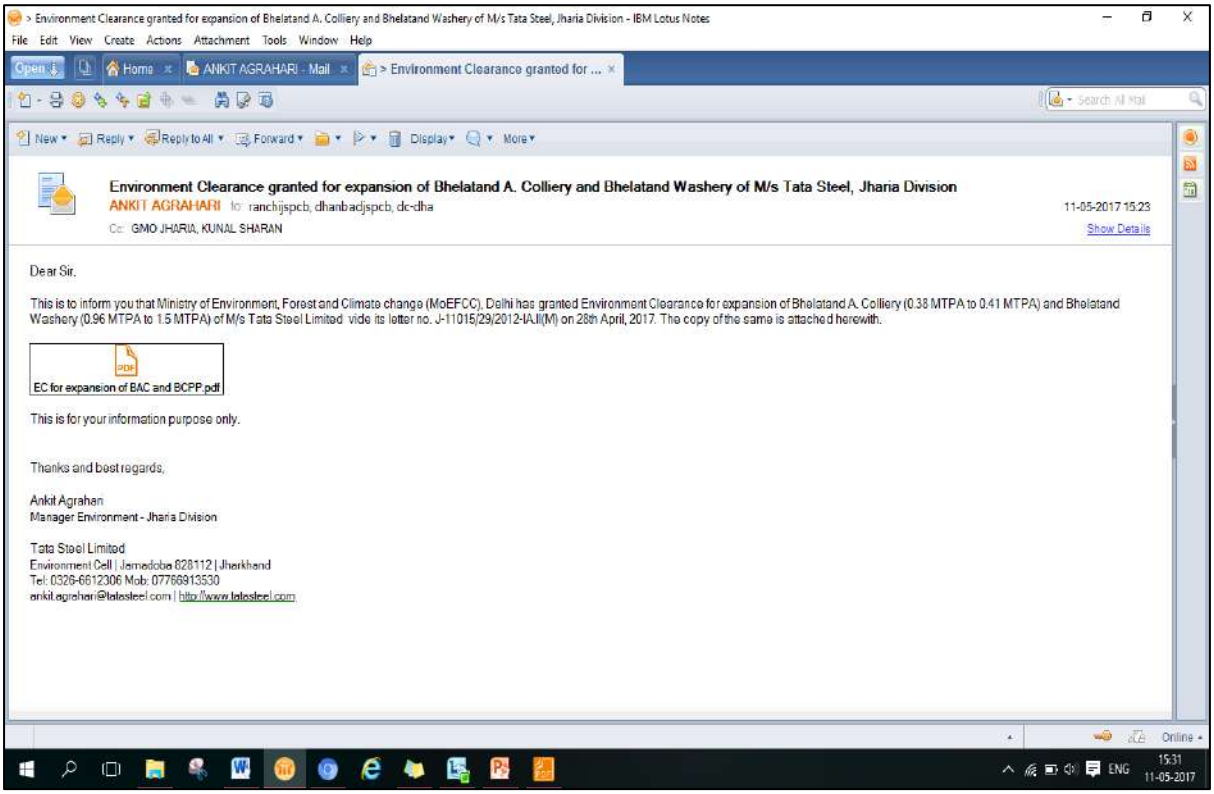
सर्वसाधारण को एतद् द्वारा सूचित किया जाता है कि मे0 टाटा स्टील लिमिटेड, झरिया डीवीजन के भेलाटांड अमलगमेटेड कोलियरी को 0.38 MTPA से 0.41 MTPA के विस्तारीकरण (521.68 Ha क्षेत्र में) तथा भेलाटांड वाशरी को 0.96 MTPA से 1.5 MTPA के विस्तारीकरण (8 Ha क्षेत्र में) हेतु पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, नई दिल्ली से दिनांक 28.04.2017 के पत्रांक J-11015/29/2012-IA.II(M) के द्वारा पर्यावरण स्वीकृति प्रदान की गई है। जिसकी प्रतिलिपि राज्य प्रदूषण नियंत्रण बोर्ड तथा पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय के वेबसाईट : www.environmentclearance.nic.in. पर भी उपलब्ध है।

महाप्रबंधक (झरिया), टाटा स्टील जामाडोबा (धनबाद)

Upload of copy of Environment Clearance in website



Communication to government offices regarding grant of EC



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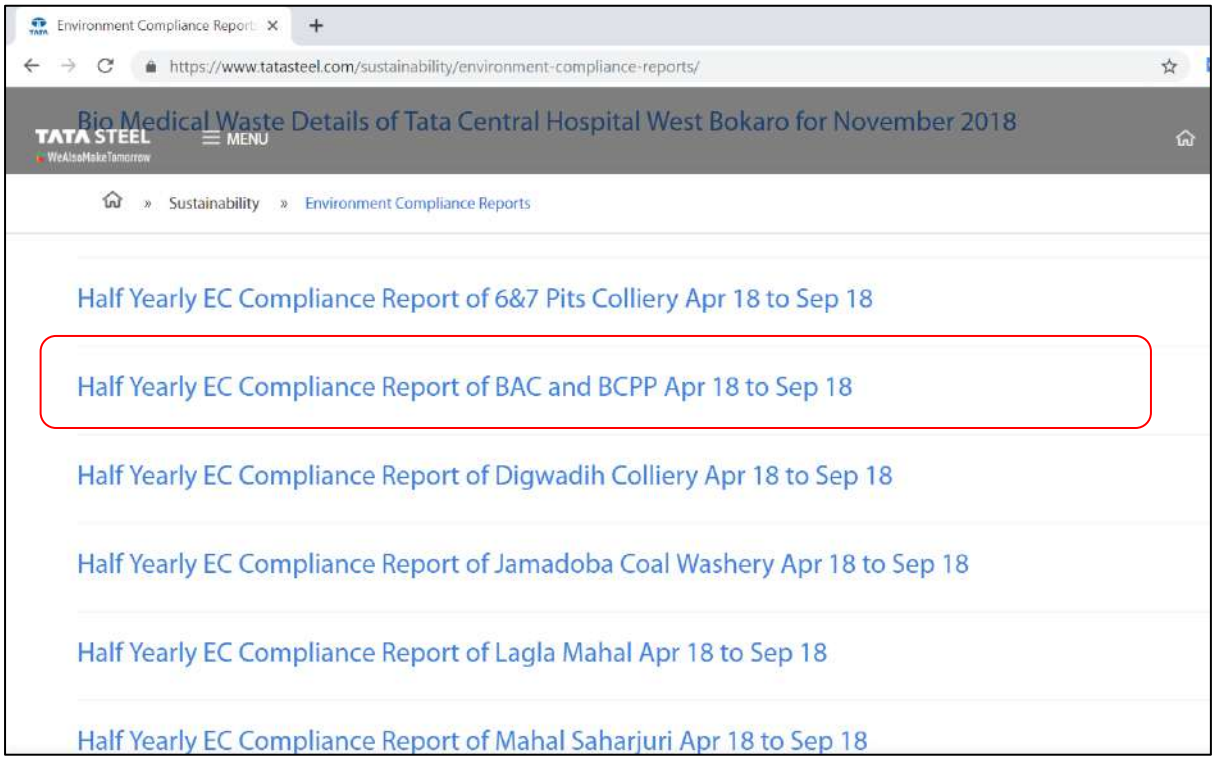

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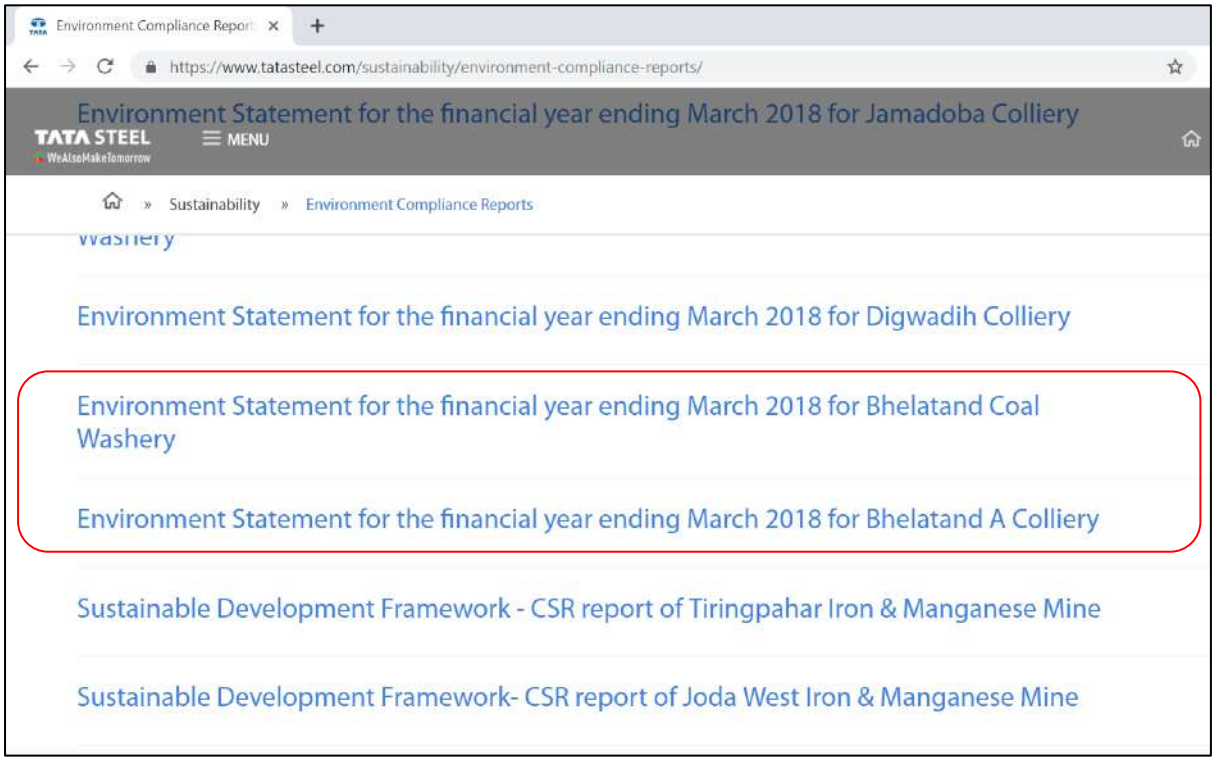
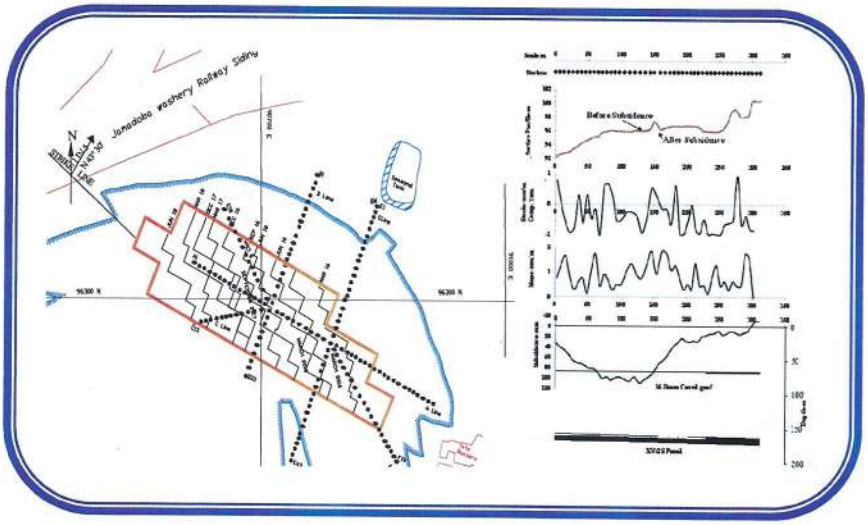


Annexure VI Subsidence Monitoring Report

REPORT

On

SAFETY EVALUATION OF DIFFERENT SURFACE FEATURES AND STRUCTURES DUE TO SUBSIDENCE MOVEMENTS AT TATA STEEL COLLIERIES IN JHARIA COALFIELD



January, 2019

MINE SUBSIDENCE AND SURVEYING
CSIR-CENTRAL INSTITUTE OF MINING & FUEL RESEARCH
(A Constituent of Council of Scientific & Industrial Research)
Barwa Road, Dhanbad – 826015, Jharkhand

REPORT
On

SAFETY EVALUATION OF DIFFERENT SURFACE FEATURES AND STRUCTURES DUE TO SUBSIDENCE MOVEMENTS AT TATA STEEL COLLIERIES IN JHARIA COALFIELD

(Period: October, 2017 to September, 2018)

Project No. SSP/237/2017-2018
Project No. CNP/4622/2017-2018

PROJECT PERSONNEL

Sri Aniket Verma, Scientist
Sri Ajay Kumar, Pr. Tech. Officer
Dr. A. Prakash, Pr. Scientist
Sri S. N. Rajak, Sr. Technician
Dr. K. K. K. Singh, Chief Scientist

Signature of the Project Proponents

(Aniket Verma) (Ajay Kumar)	(Amar Prakash)	(S. K. Mandal)
Scientist/ Pr. Tech. Officer	Pr. Scientist	Chief Scientist
Project Leaders	Head	HORG
CSIR-CIMFR, Dhanbad	CSIR-CIMFR, Dhanbad	CSIR-CIMFR, Dhanbad

CSIR-CIMFR, Authorized Signatories

(P. K. Mishra)	(R. V. K. Singh)
Principal Scientist & HOS,	Chief Scientist & HORG,
Project Monitoring	Business Development & Industrial Liaison

CONTENTS

EXECUTIVE SUMMARY

Subsidence investigations were conducted over 12 stowed panels during October, 2017 and September, 2018 at Jamadoba 2 Pit, Bhutgoria Amalgamated Jamadoba 6&7 Pit, Digwadih, Sijua and Bhelatand collieries of Tata Steel in Jharia Coalfield for the safety evaluation of different surface features and structures. All the panels were extracted by bord and pillar method of mining with 70-80 percent of coal extraction in conjunction with hydraulic sand stowing. Depillaring operations were carried out at depths varying from 133 m to 593 m. The width-depth ratio of the panels varied between 0.24 and 0.87, i.e., all the panels were under sub-critical width. All these panels were extracted under multi-seam mining condition with overlying old stowed and caved goaves. One panels namely IX/8S of Digwadih colliery was extracted completed during the study period. The important surface features over most of the panels include company quarters, private roads, ponds, filter plant, tank, high tension lines and private buildings. This study conducted during the above period led to the following conclusion and recommendation:

1) Maximum subsidence movement was 4.64 % of extraction thicknesses over the 2S panel in XV seam at Jamadoba 2 Pit.
2) Maximum slope, compressive and tensile strains observed over measured panels were 5.8 mm/m, 2.05 mm/m and 1.43 mm/m respectively.
3) Subsidence, slope and strains profiles were influenced by overlying old goaves, position of goaf edges, inclination of the seam, topography of the surface profiles as well as left out stooks/ribs in the overlying seams worked by bord and pillar method of mining.
4) Subsidence movements did not cause any adverse impact on surface features and structures.
5) It is recommended to erect subsidence monitoring stations at least one month before the commencement of depillaring over new panels.
6) It is also recommended to extend subsidence monitoring stations equal to panel depth outside the panel boundary.
7) It is recommended to continue subsidence investigations for the safety evaluation of different surface features and structures lying over different on-going and future depillaring panels.

1.0 INTRODUCTION

Subsidence investigation at different collieries of Tata Steel (erstwhile TISCO) in Jharia Coalfield is being carried out since 1982, on yearly sponsorship. General Manager of Tata Steel Jharia division requested Director, Central Institute of Mining and Fuel Research (CIMFR), Dhanbad to conduct subsidence investigations over depillaring panels in the collieries of Jharia Coalfield for the period between October, 2017 and September, 2018. Subsidence investigations were conducted in five collieries, namely, Jamadoba 2 Pit, Bhutgoria Amalgamated Jamadoba 6&7 Pit, Digwadih, Sijua and Bhelatand of Tata Steel in Jharia Coalfield. Mining leasehold areas of these collieries have important surface features and structures like railway lines, quarters, hospital, roads, forest land, high tension line, nallah, agricultural land, water tank, buildings, etc. The main objectives of this study are to evaluate the stability and safety of different surface features and structures lying above the depillaring panels and to generate data to develop subsidence predictive model for Jharia Coalfield.

It was proposed to conduct surface ground movement studies over 12 stowed panels between October, 2017 and September, 2018 located in the above-mentioned five collieries. This report covers outcome of subsidence investigations conducted over 12 panels at Tata Steel collieries in Jharia Coalfield during October, 2017 and September, 2018.

2.0 GEO-MINING DETAILS OF EXTRACTION

Jamadoba 2 Pit, Bhutgoria Amalgamated Jamadoba 6&7 Pit and Digwadih collieries are located in the eastern limb whereas Sijua and Bhelatand colliery is located in the western limb of Jharia Coalfield as depicted in Fig. 1. Geo-mining details of different panels are shown in Table - 1. The width-depth ratio of the panels varied between 0.24 and 0.87, i.e., all the panels were under sub-critical width. The lower width-depth ratios of the panels were maintained to minimize the magnitude of subsidence movements for the protection of important surface features and structures. All the stowed panels were under multi-seam working condition. Layouts of monitoring stations with overlying workings and surface features are shown in figures 2 through 13. Systematic erections of subsidence monitoring stations over and around the panels were not feasible at few places owing to constraints by different surface features and structures. Borehole sections of five collieries with lithology and strata thickness are shown in figures 14 to 18.

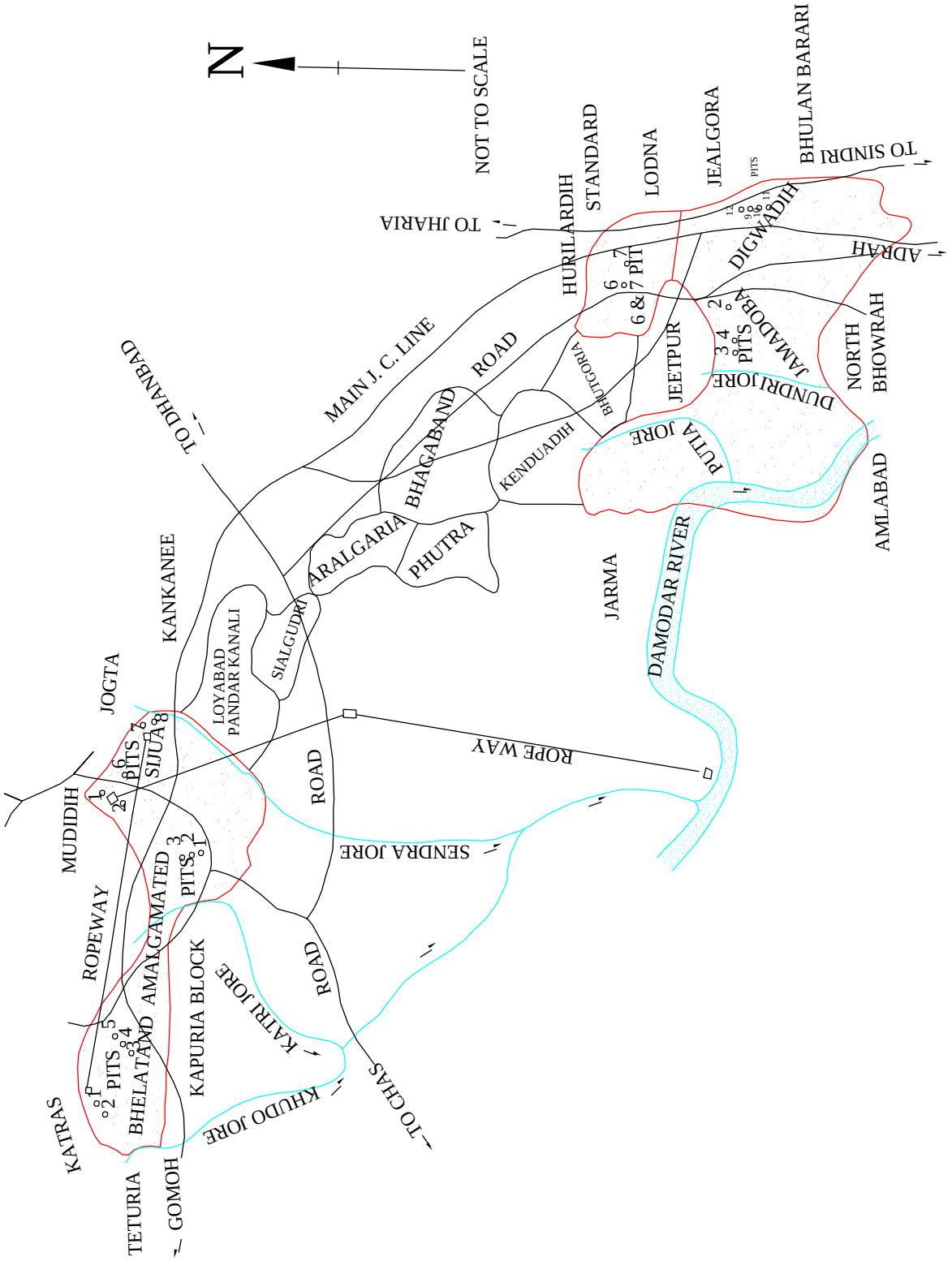


Fig. 1: Location of Tata Steel collieries in Jhaira Coalfield

Table-1: Geo-mining details of extraction in different collieries of Tata Steel in Jharia Coalfield

Sl. No.	Colliery	Seam/dip of seam/panel	Extraction thickness (m)	Average depth of extraction (m)	Panel size (m x m)	Mining method / extraction percentage (%) / Overburden sandstone (%)	Extraction period	Overlying goaf	Surface properties
1	Jamadoba 2 Pit	XV/1in 5/3S	4.50	133.00	140X116	B&P/80/60	08/2018 to cont.	Caved goaves in 16, 15A partly virgin	Private road, single storey company quarter, H.T. line, forest
2	Jamadoba 2 Pit	XI/1 in 7/3S	2.70	593.00	200X185	B&P/80/92	04/2017 to cont.	18, 14 seams caved; 17, 16, 16A and 15A seams partly caved; 13 seam fully stowed and 12 seam virgin.	Dungri jore and Private road
3	Jamadoba 2 Pit	XI/1 in 7/2S	4.50	530.00	150X250	B&P/80/92	15/01/16 to cont.	18 and 15A seams partly caved; 16A and 16 and 14 seams partly caved	Pucca road, seasonal tank, H.T. line, Aerial ropeway of SAIL central store and company quarters.
4	Jamadoba 2 Pit	XV/ 1in 5/2S	3.40	166.00	245X72	B&P/60/80	01/09/15 to cont.	XVI seam caved	Barren land
5	Bhutgoria Jamadoba 6&7 Pit	IX/ 1 in 7.2/6S	3.06	405.00	350X150	B&P/70/60	10/2016 to cont.	16A and 16 seams mostly caved; 14 and 11 seams mostly stowed	Quarters, H.T. Line, plantation & barren land
6	Bhutgoria Jamadoba 6&7 Pit	IX/1 in 7.2/1S	3.06	406.50	400X150	B&P/70/60	12/2015 to cont.	16A and 16 seams partly caved; 16, 14 and 11 seams stowed	Company quarters, road, private buildings

Sl. No.	Colliery	Seam/dip of seam/panel	Extraction thickness (m)	Average depth of extraction (m)	Panel size (m x m)	Mining method / extraction percentage (%) / Overburden sandstone (%)	Extraction period	Overlying goaf	Surface properties
7	Digwadih	IX/1 in 7/8S	2.94	410.00	240X150	B&P/70/62	12/2016 to 05/2018	15A, 16 and 16A seams caved; 15, 14 and 11 seams partly stowed	H.T. line, pucca road, private buildings and seasonal tank.
8	Digwadih	IX/1 in 6.8/6S	2.94	435.50	290X194	B&P/72/60	01/2018 to cont.	16A, 16 and 15A seams caved; 15, 14 and 11 seams stowed	Private buildings, two seasonal tanks, drain, road and H.T. line
9	Sijua	X/1 in 4.67 /10S(Ext.)	3.71	373.00	150X90	B&P/70/65	05/2017 to cont.	15, 14, 13, 12 and 11 seams stowed	Buildings, J.S.T. line, tank, village road
10	Sijua	IX/1 in 5.07 /1S	3.05 (Top)	273.90	215X200	B&P/80/65	08/2018 to cont.	13 and 16 seams stowed	Plantation, road, barren land
11	Bhelatand	XIV(E)/ 1 in 5.4/ 3S	2.70	382.19	220X130	B&P/75/63	12/2017 to cont.	16 seam partly caved and stowed; 15 seam stowed	Paddy land and H.T. line
12	Bhelatand	XIV(W)/ 1 in 6/ 1S	3.00	468.00	180X155	B&P/75/67	11/2017 to cont.	15, 16 and 17 seams caved	Barren & paddy land, PWD road

B&P = Bord & Pillar, S = Stowing; H.T. = High Tension; Ext. = extension

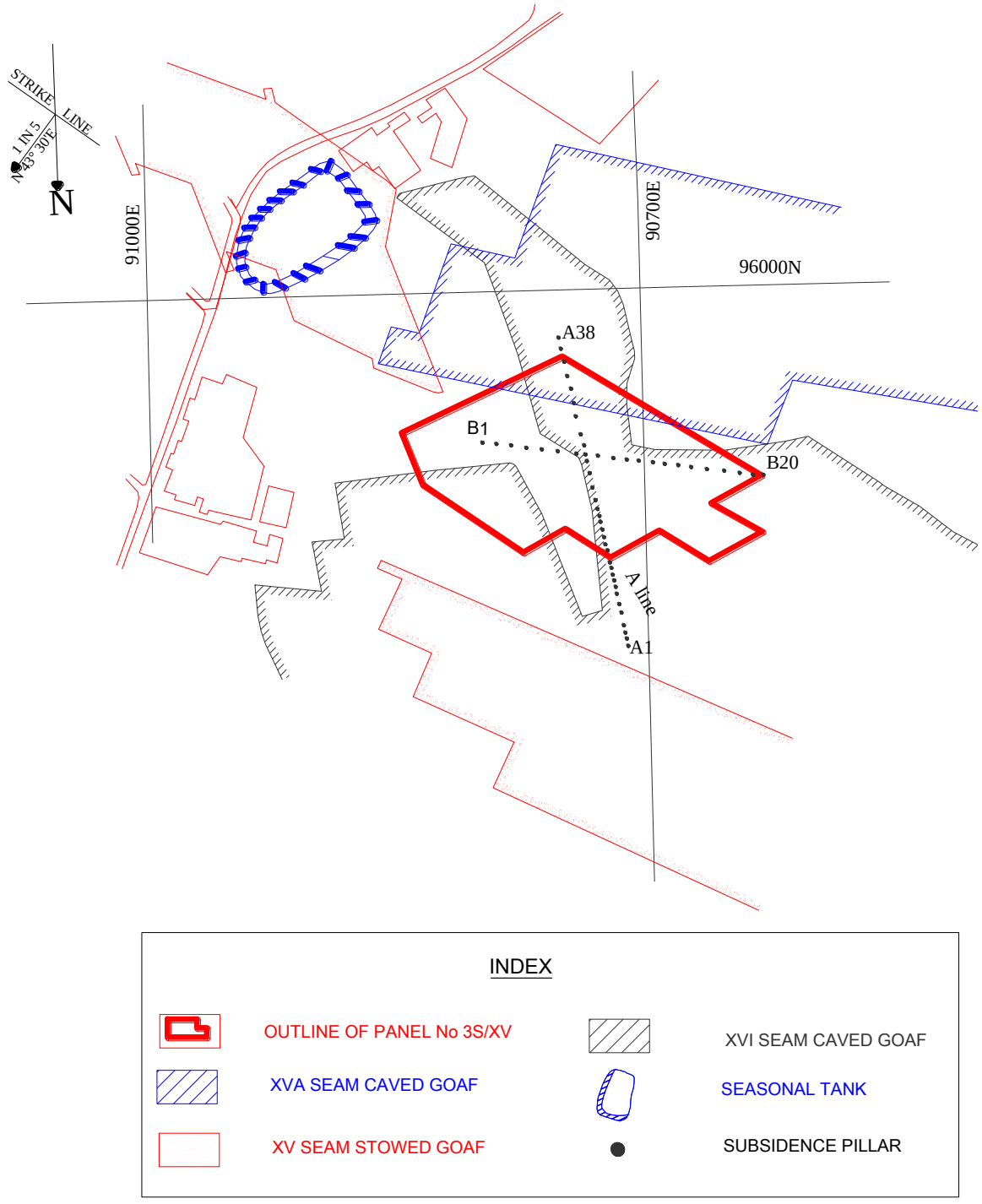


Fig. 2: Layout of monitoring stations over 3S panel in XV seam with overlying side goaf at Jamadoba 2 Pit colliery

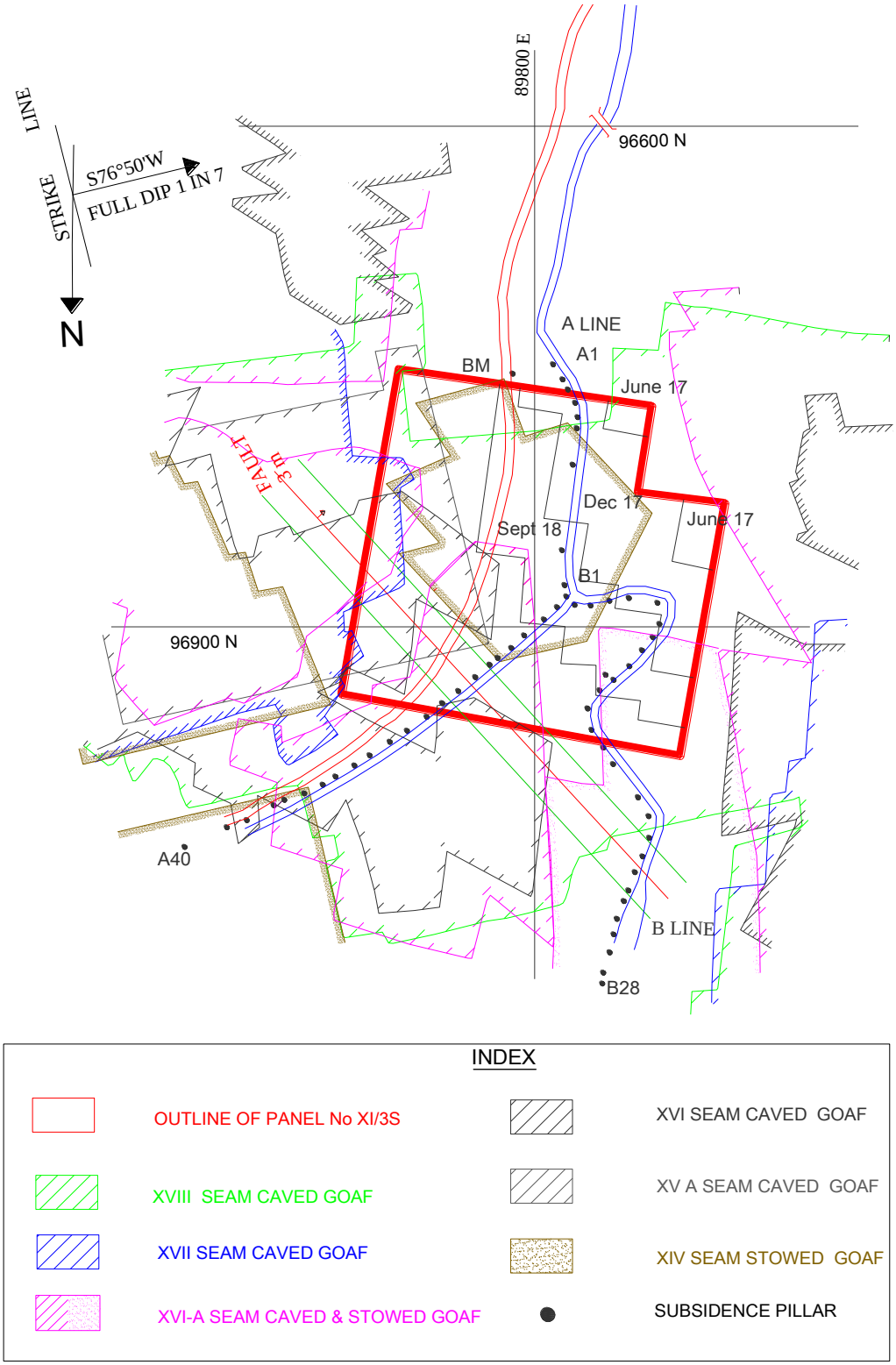


Fig. 3: Layout of monitoring stations over 3S panel in XI seam with overlying goaves at Jamadoba 2 Pit colliery

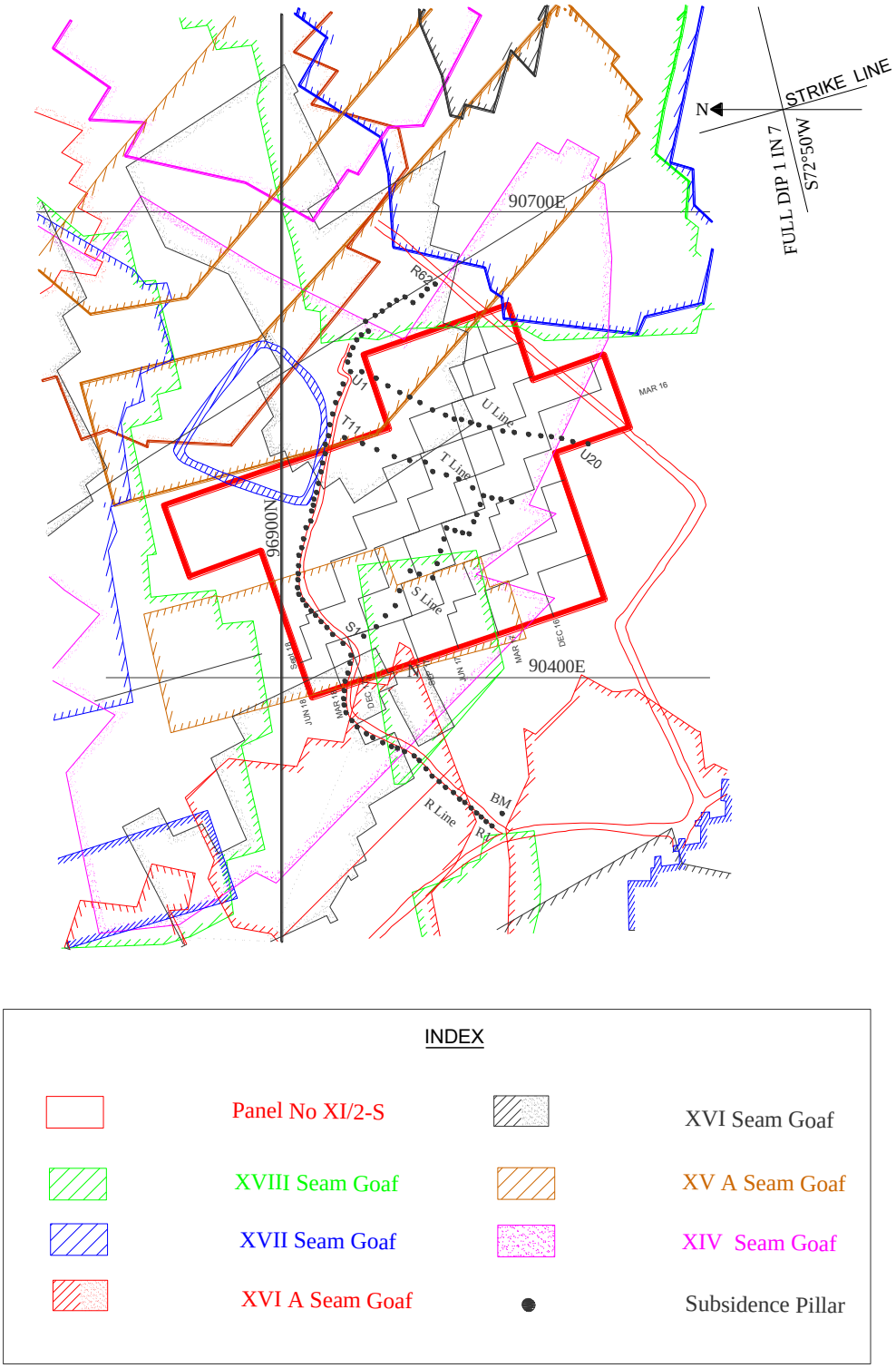


Fig. 4: Layout of monitoring stations over 2S panel in XI seam with overlying goaves at Jamadoba 2 Pit colliery

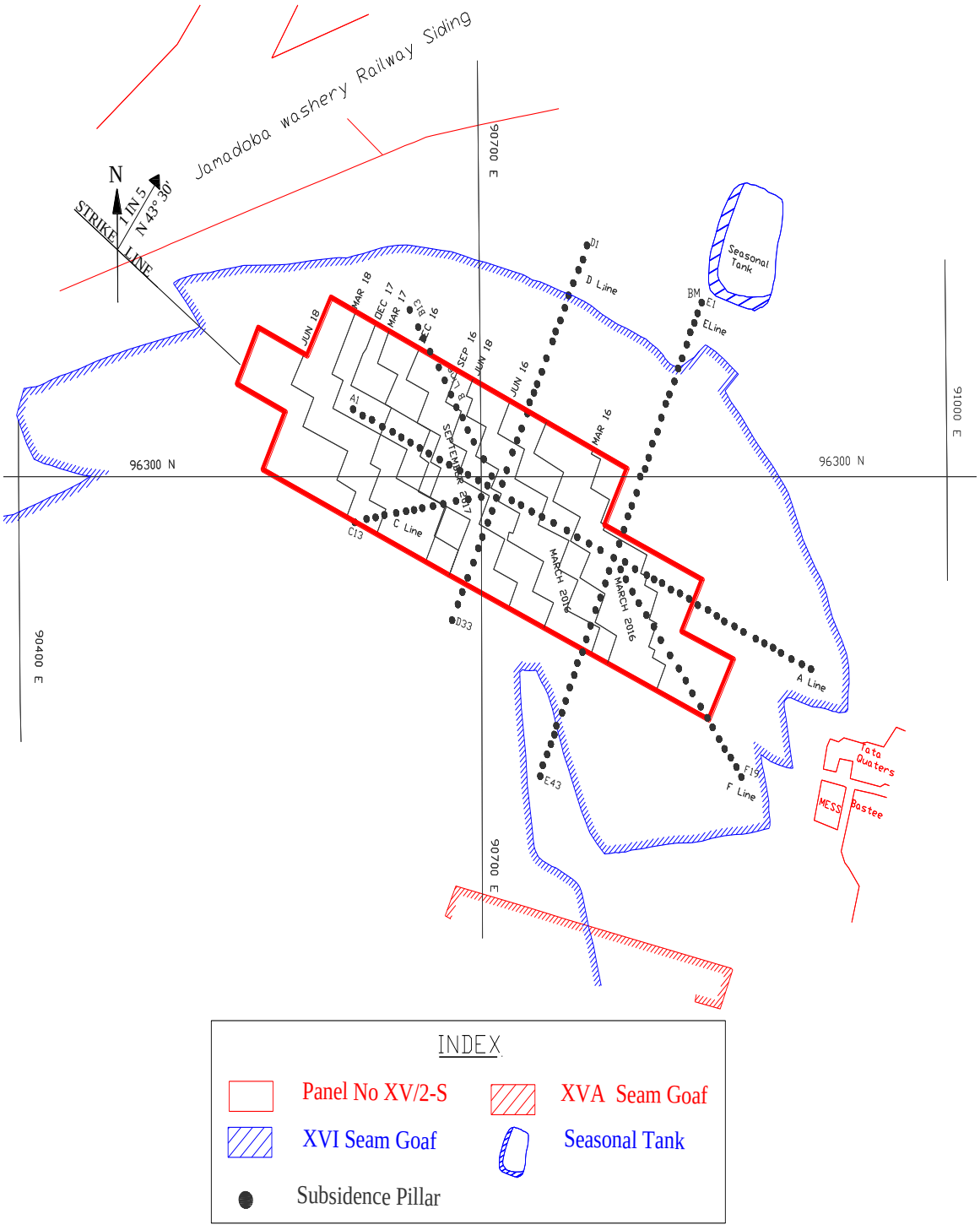


Fig. 5: Layout of monitoring stations over 2S panel in XV seam with overlying goaves at Jamadoba 2 Pit colliery

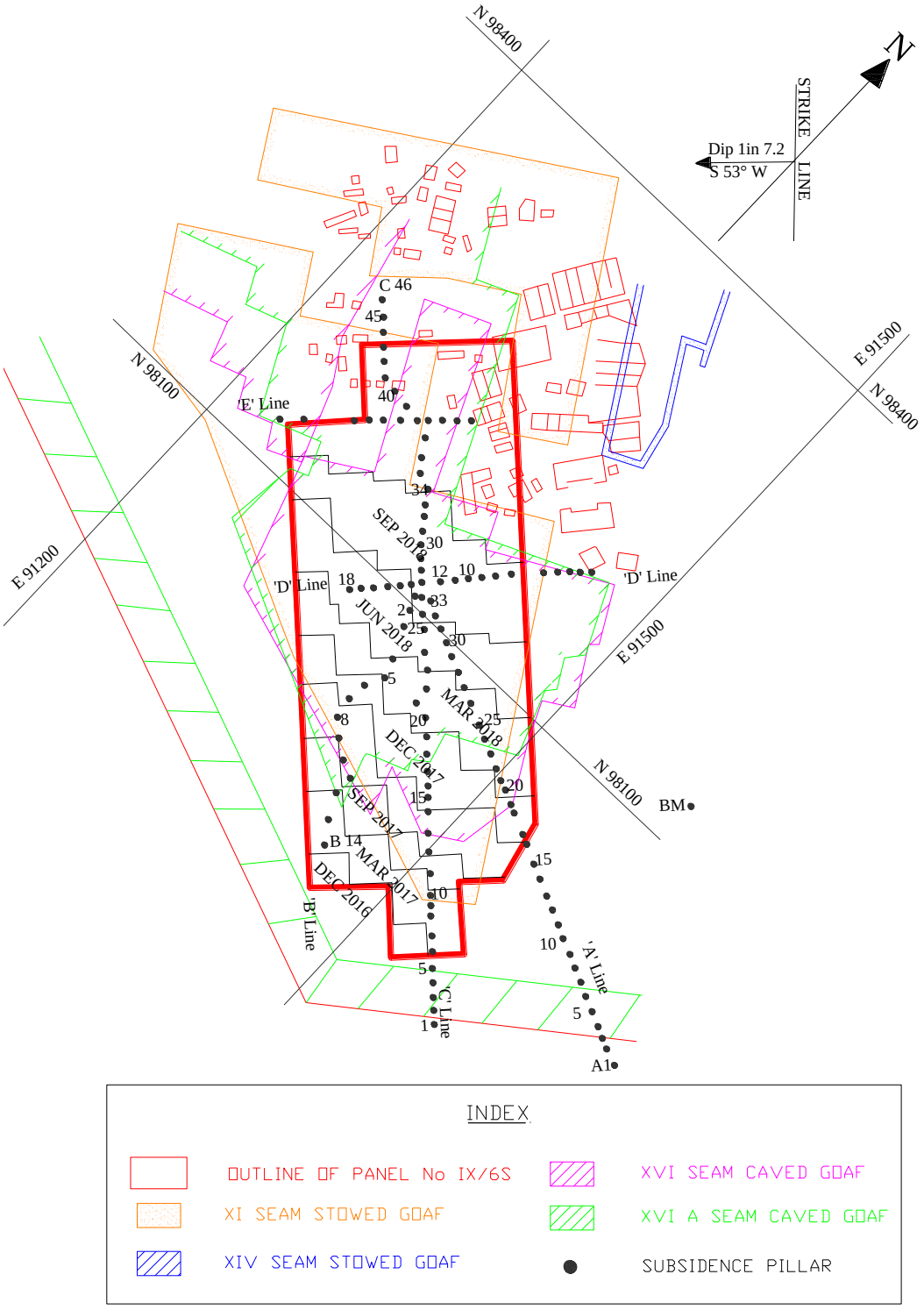


Fig. 6: Layout of monitoring stations over 6S panel in IX seam with overlying goaves at Bhutgoria Amalgamated Jamadoba 6&7 Pits colliery

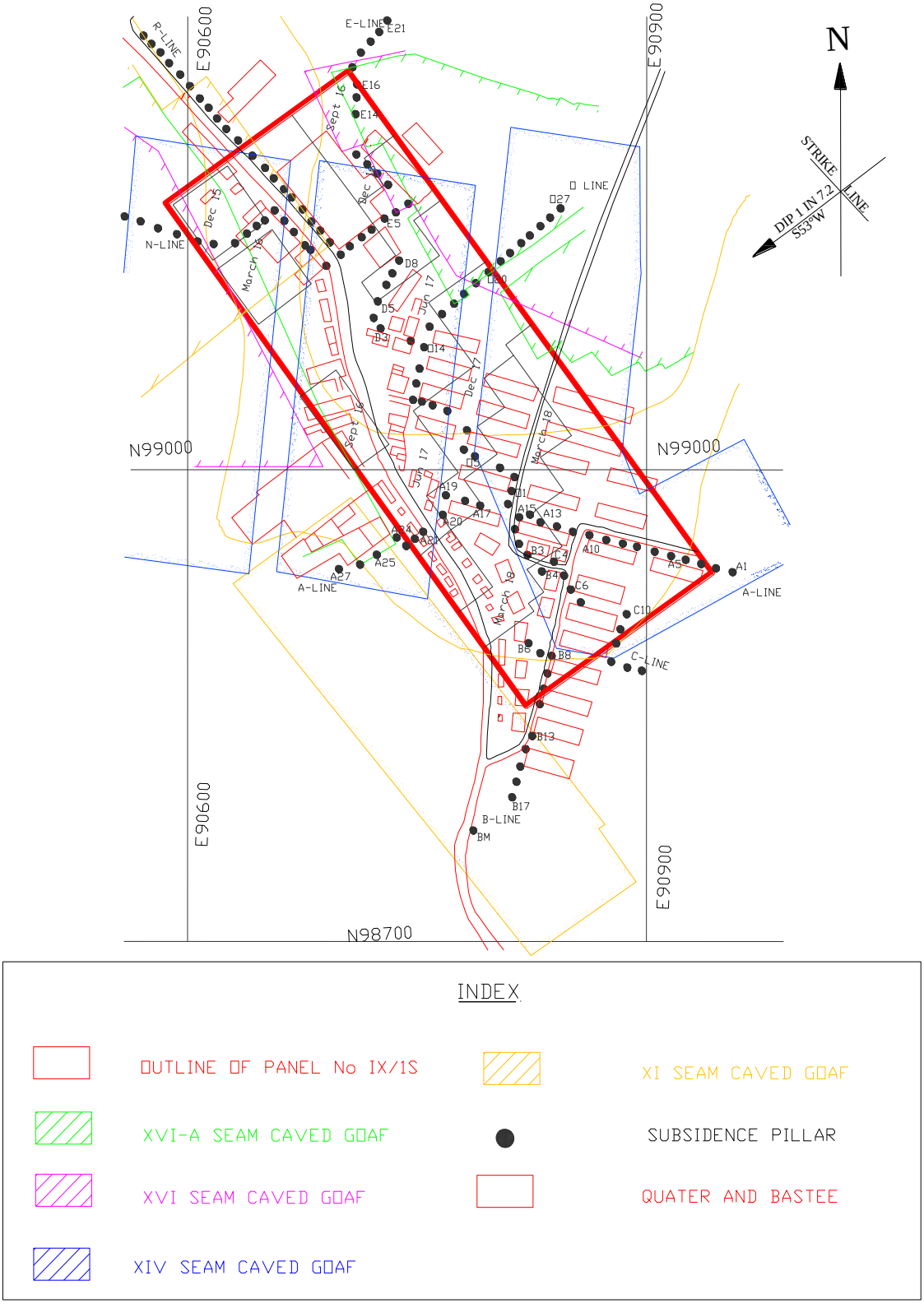


Fig. 7: Layout of monitoring stations over 1S panel in IX seam with overlying goaves at Bhutgoria Amalgamated Jamadoba 6&7 Pits colliery

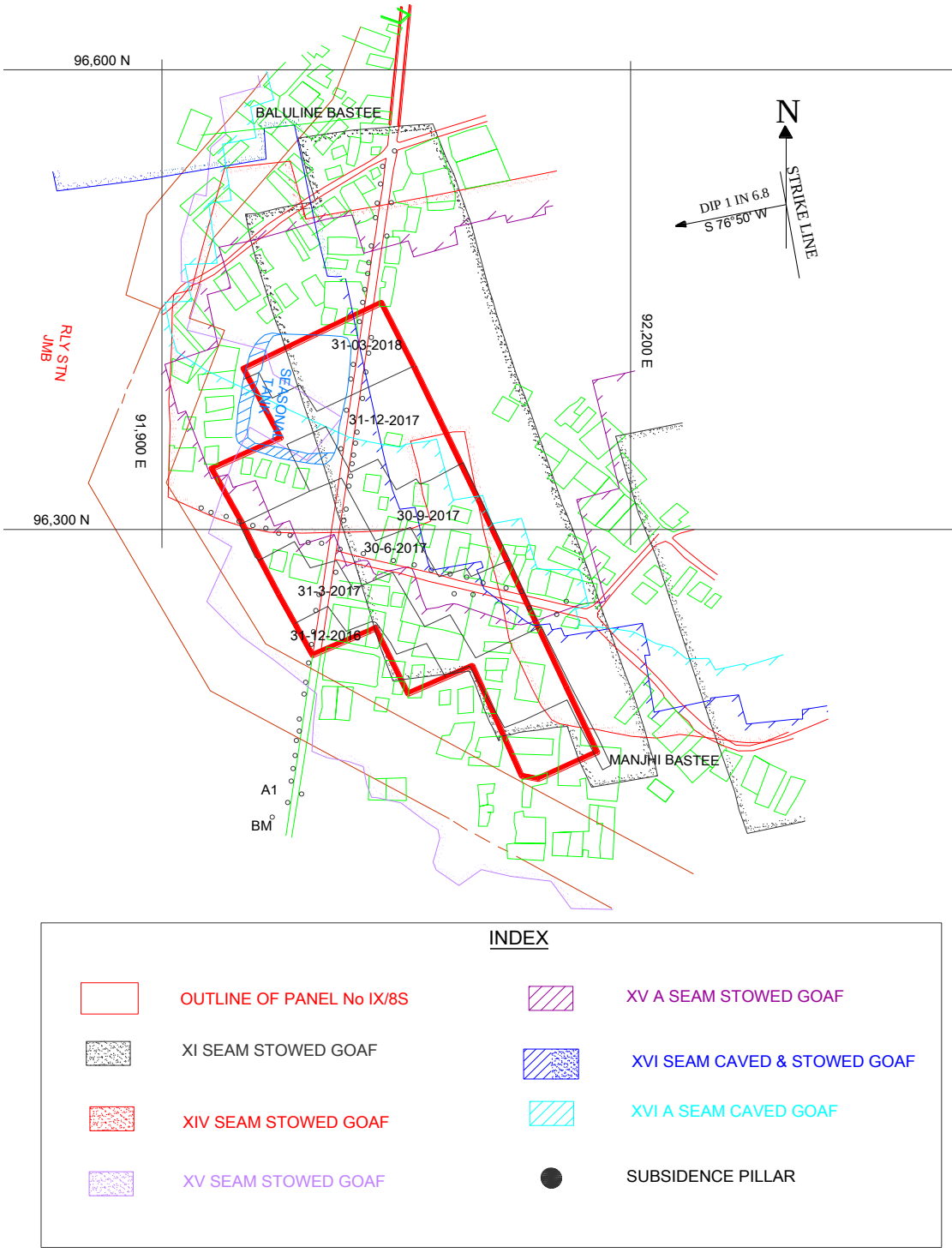


Fig. 8: Layout of monitoring stations over 8S panel in IX seam with overlying goaves at Digwadih colliery

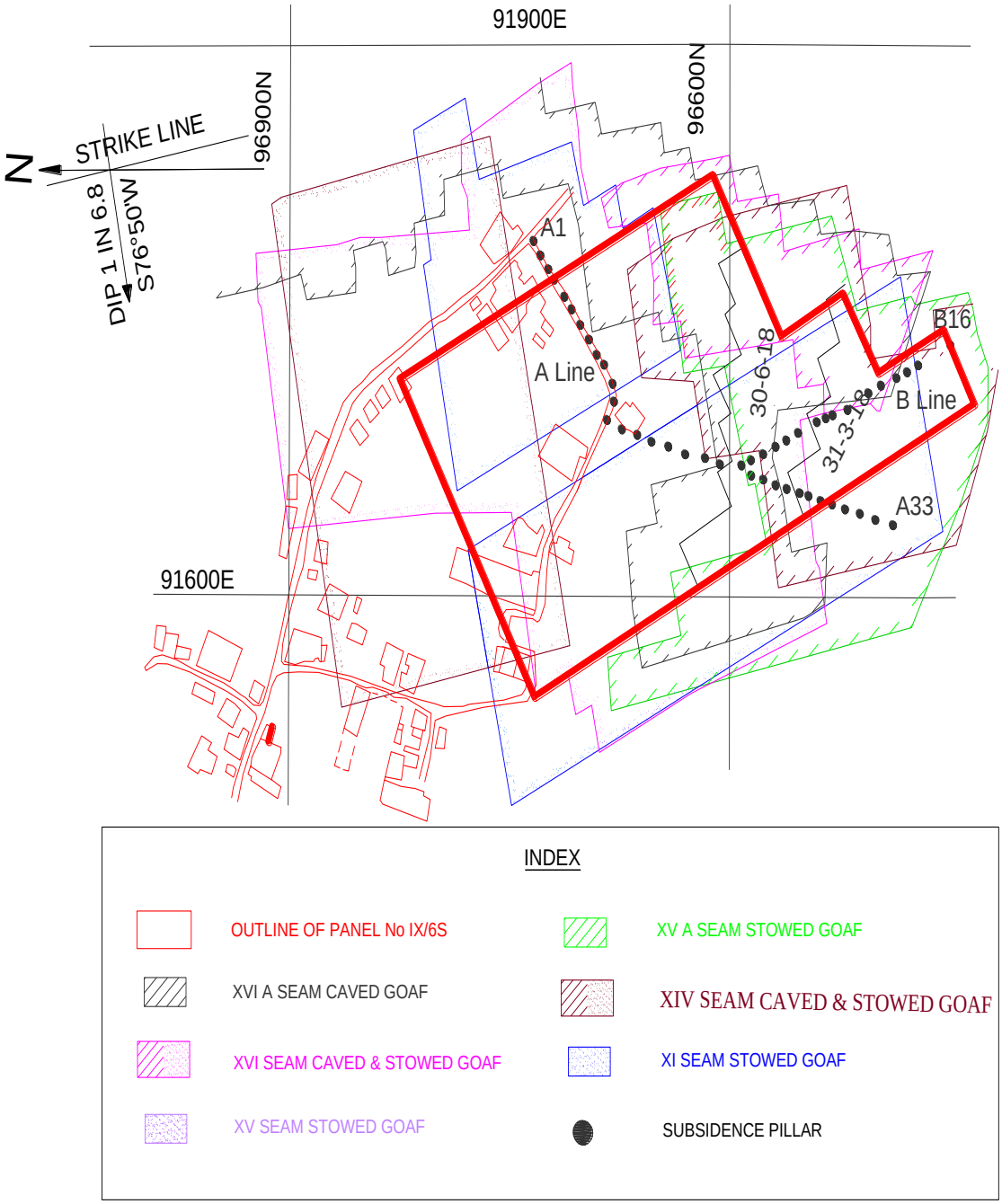


Fig. 9: Layout of monitoring stations over 6S panel in IX seam with overlying goaves at Digwadih colliery

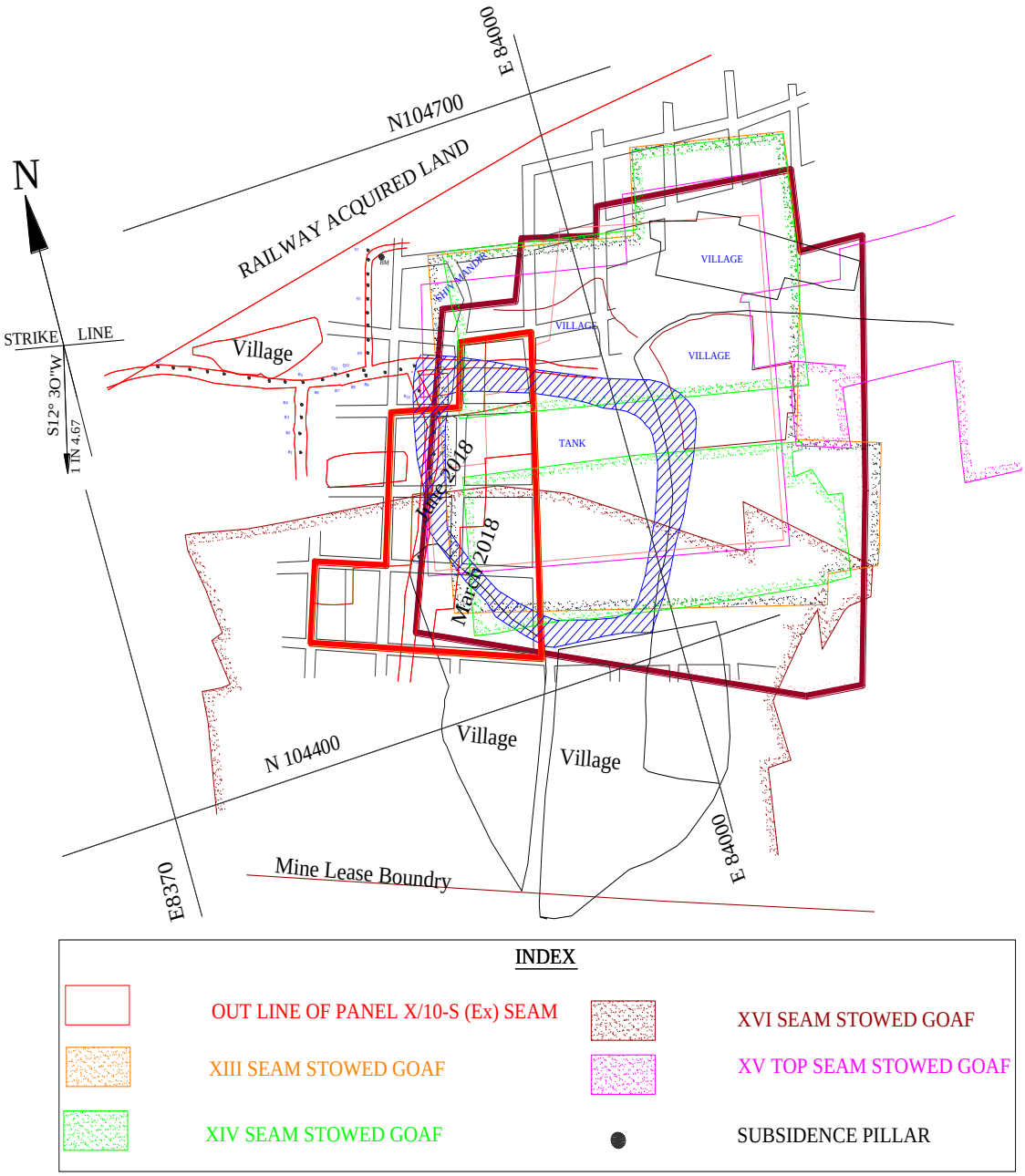


Fig. 10: Layout of monitoring stations over 10S (Ext.) panel in X seam with overlying goaves at Sijua colliery

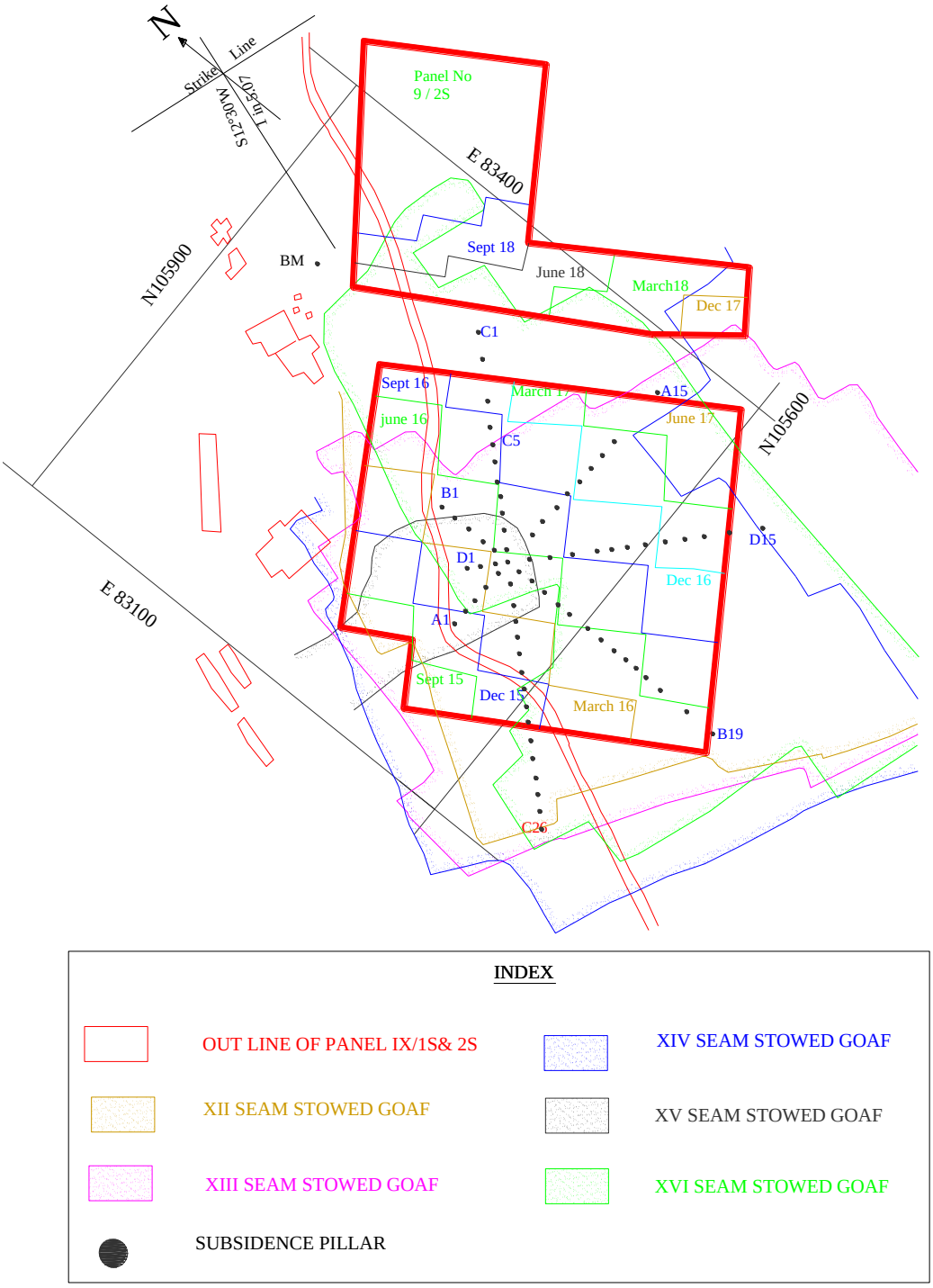


Fig. 11: Layout of monitoring stations over 1S panel in IX seam with overlying goaves at Sijua colliery

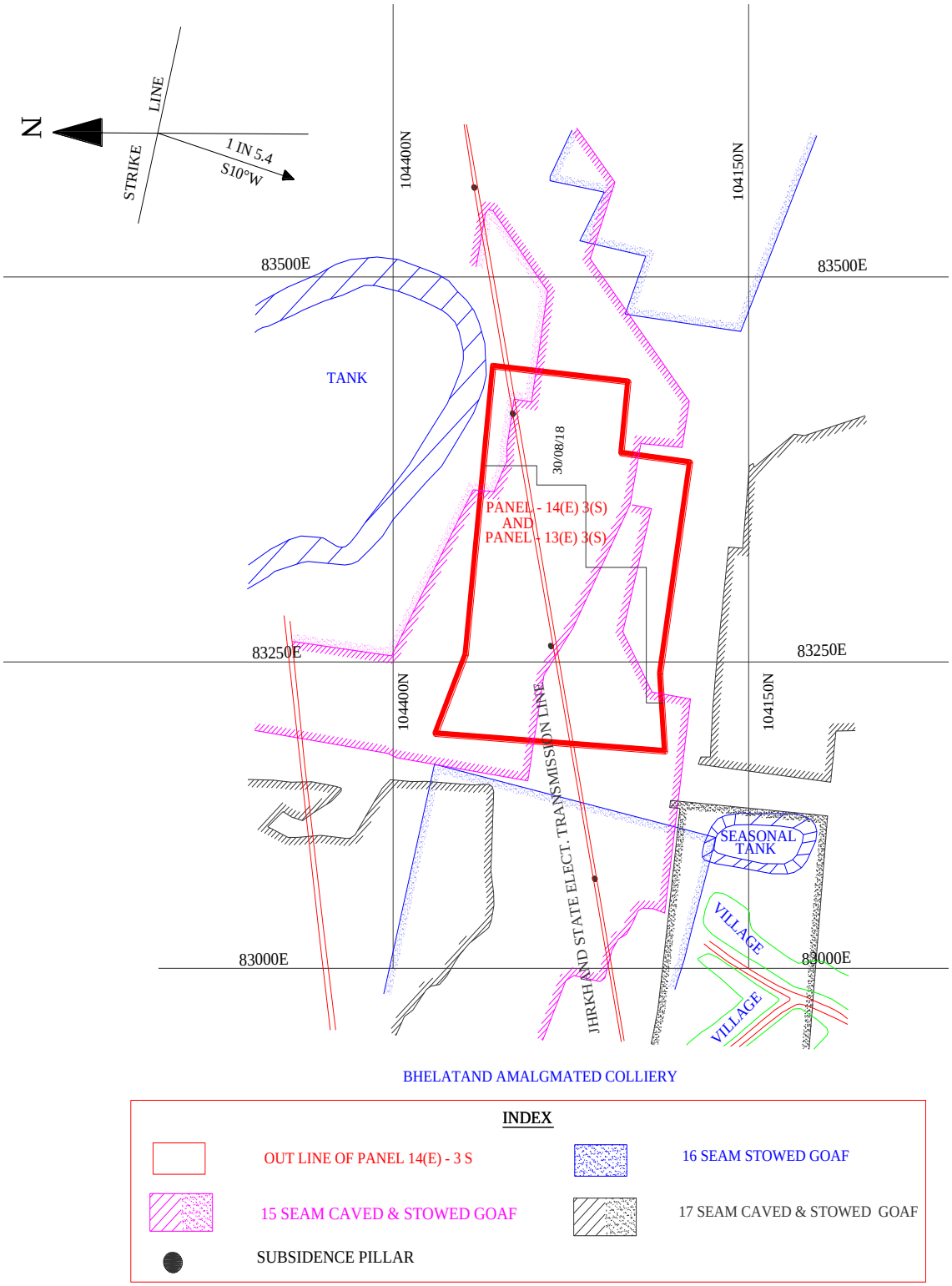


Fig. 12: Layout of monitoring stations over 3S panel in XIV (E) seam with overlying goaves at Bhelatand colliery

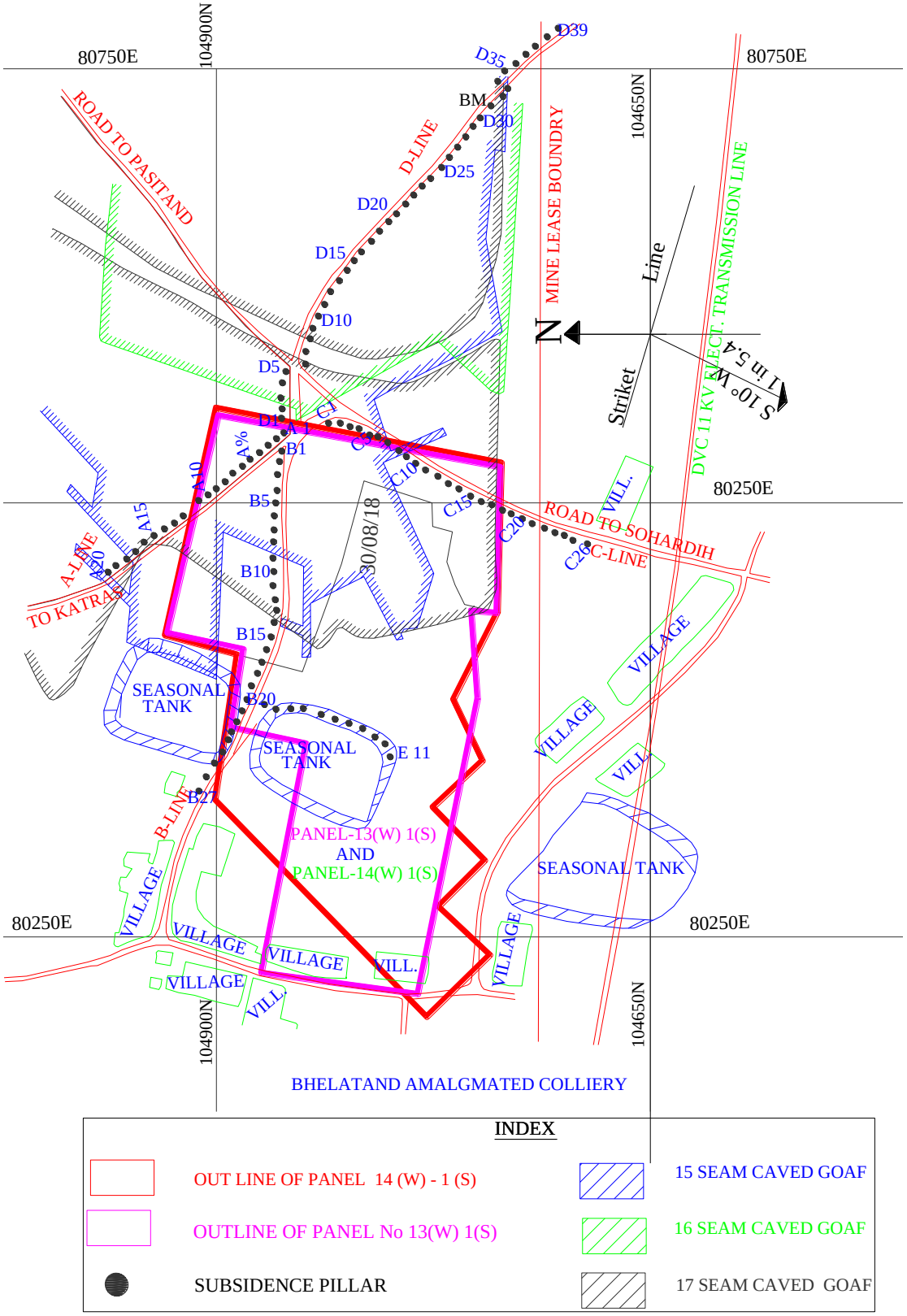


Fig. 13: Layout of monitoring stations over 1S panel in XIV(W) seam with overlying goaves at Bhelatand colliery

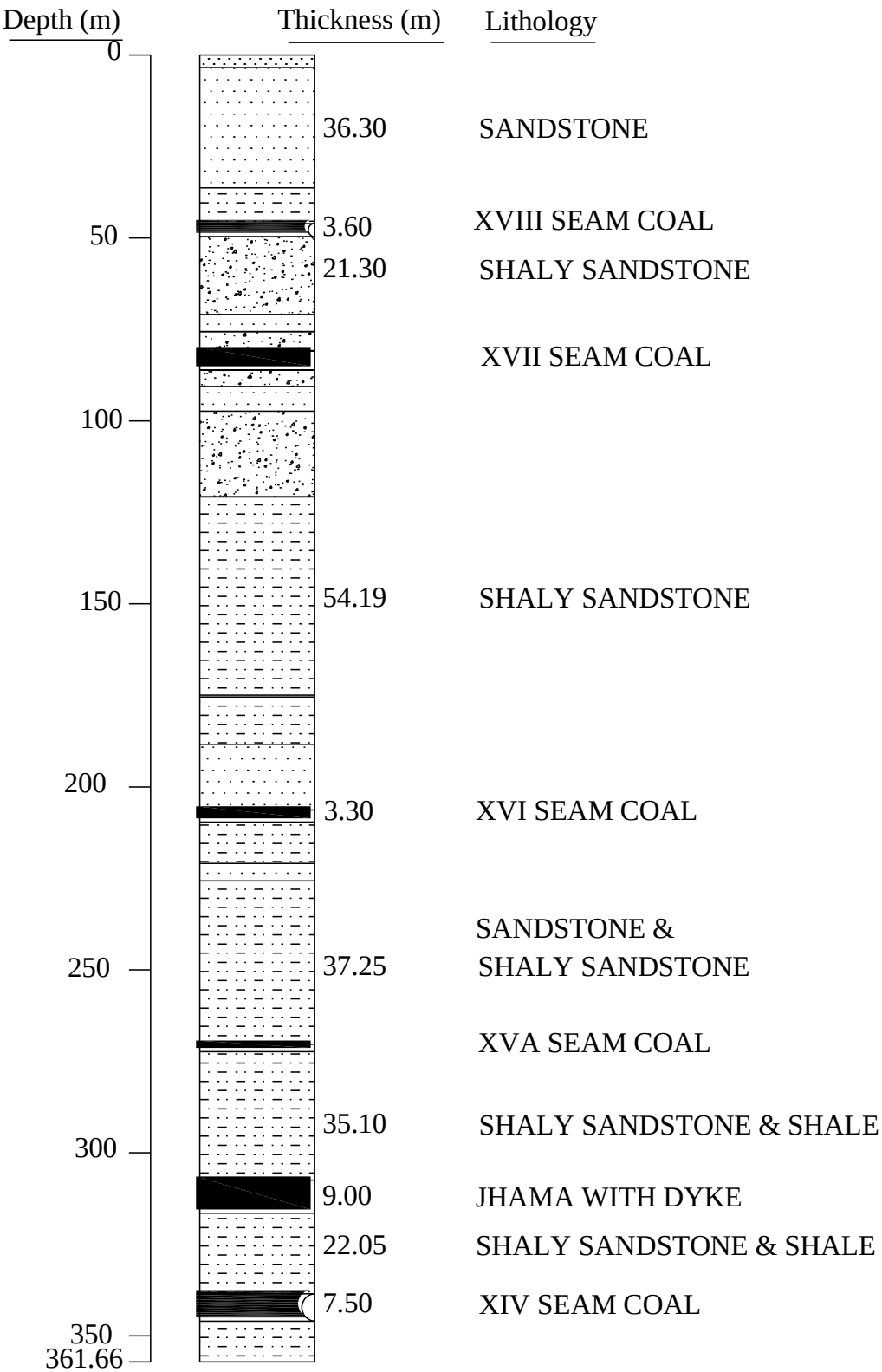


Fig. 14: Section of borehole no. J3 of Jamadoba 2 Pit

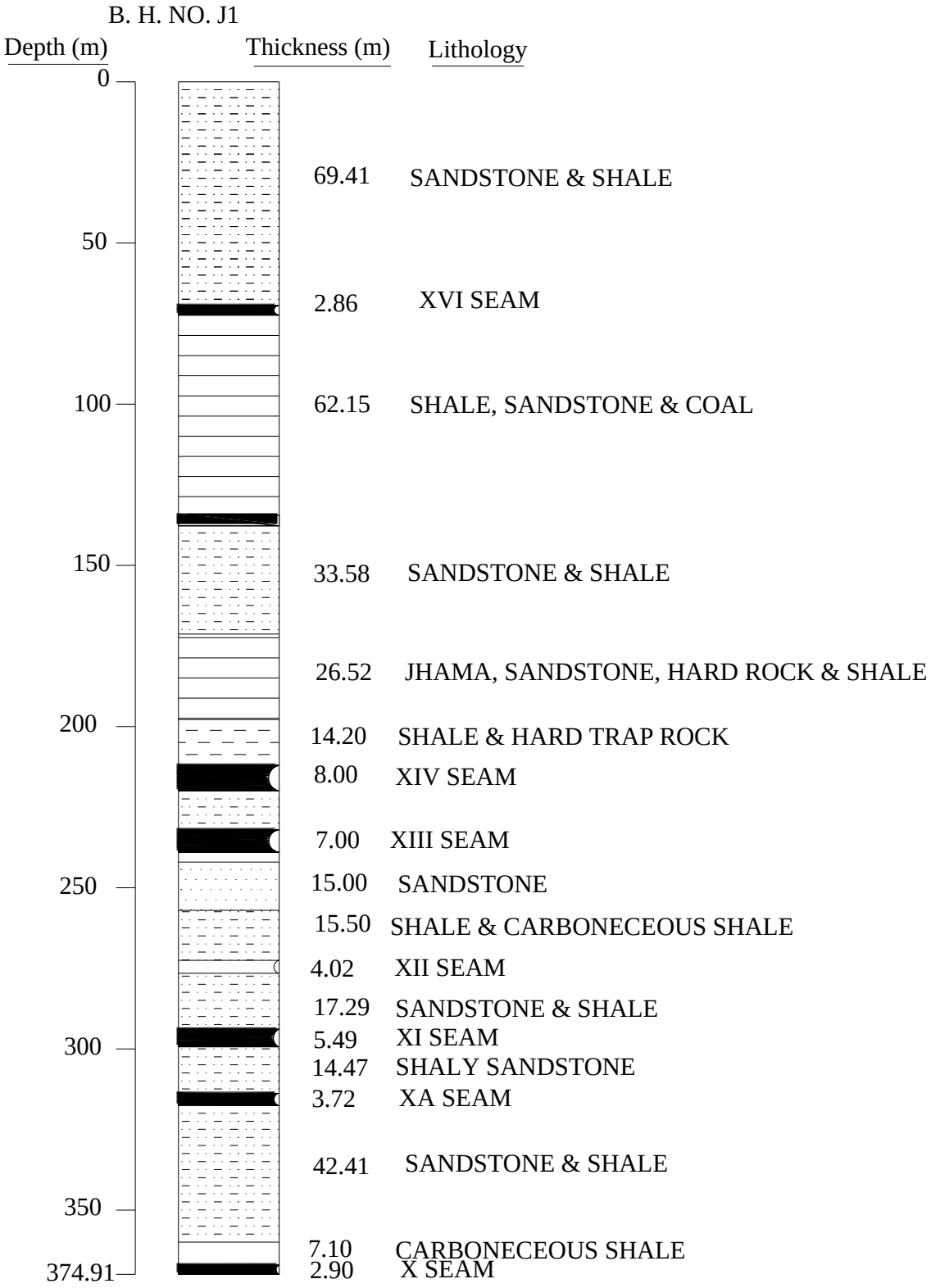


Fig. 15: Section of borehole no. J1 at Bhutgoria Amalgamated Jamadoba 6&7 Pit

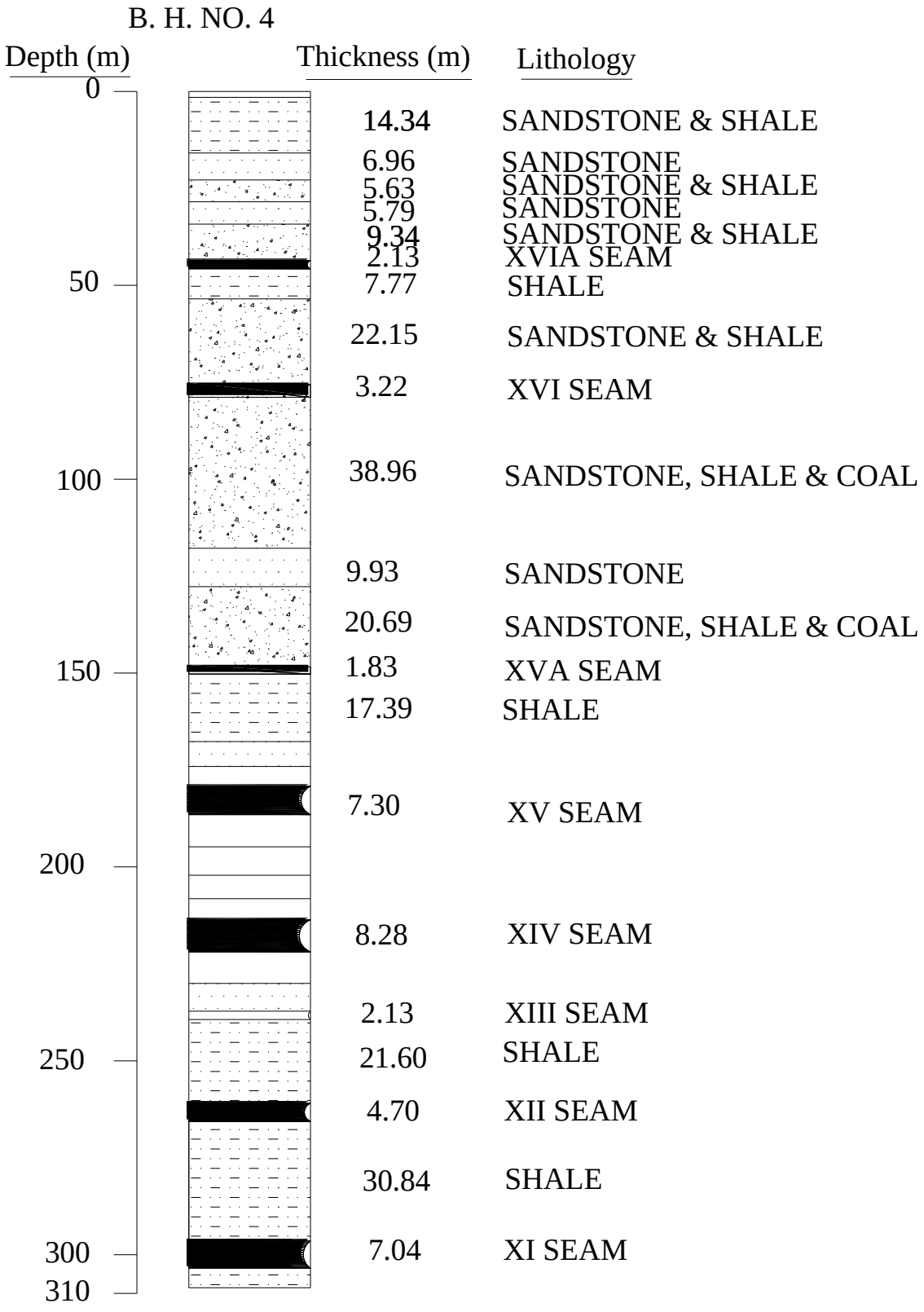


Fig.16: Section of borehole no. 4 at Digwadih colliery

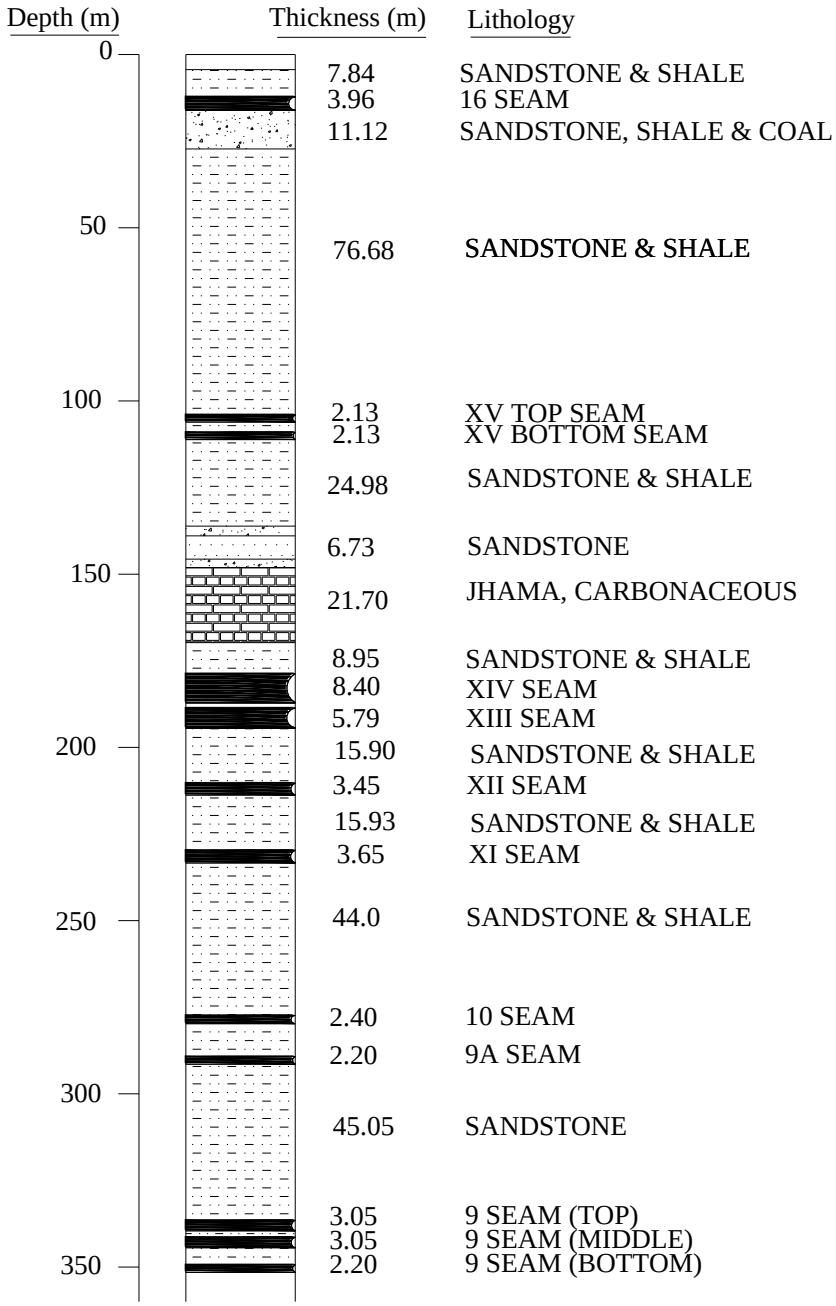


Fig. 17: Section of 2 Pit of Sijua colliery

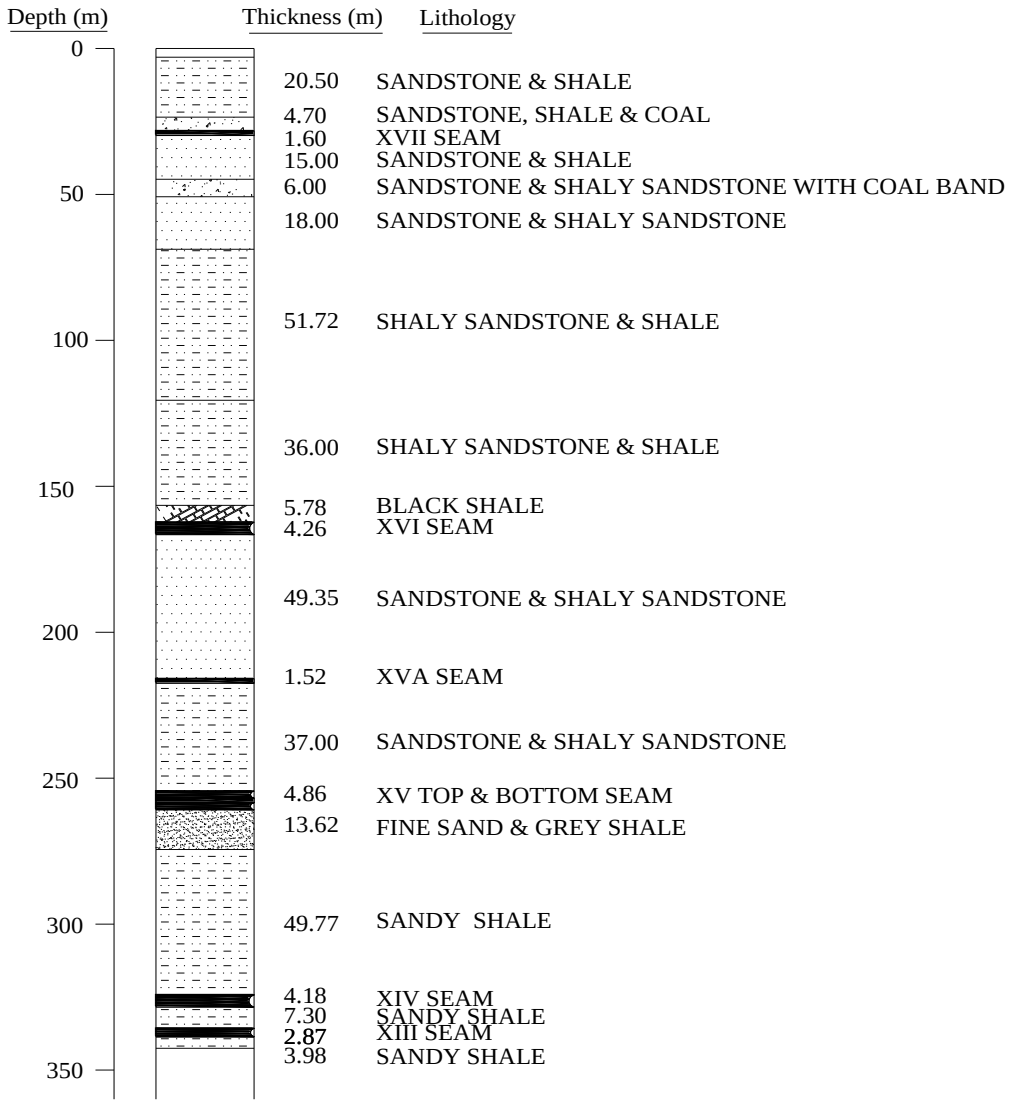


Fig. 18: Section of borehole no. B in Bhelatand colliery

The general lithologies of the overburden in all the five collieries comprise of sandstone, shale, shaly sandstone, sandy sandstone, carbonaceous shale and coal seams. Sandstone and shale are the dominant rock types in the overburden. Percentage of sandstone lying over the working panels varied from 60 to 92%. The gradient of seam varied from 1 in 4.67 to 1 in 7.2. All the coal seams lie in Barakar formation of Lower Gondwana. Depillaring was completed in IX/8S of Digwadih colliery. Depillaring was in progress in the remaining eleven panels. Most of the panels lie below company quarters, private buildings, high tension lines, water tank, filter plant and roads (Table-1).

3.0 Methodology

Monitoring stations are fixed on the ground as per the designed layout at regular interval covering the entire area of interest. Subsidence measurement is carried out from a reference station/Bench Mark (B.M.) fixed beyond the influence of ground movement. Total Station was used to conduct subsidence investigations in all the panels.

a) *Total Station*: Total Station, an outgrowth of theodolite, is used for measuring Reduced Level of subsidence monitoring stations and horizontal distance between the adjacent monitoring stations in the field (Fig. 19). This aids in computing subsidence (vertical displacement), strain (horizontal displacement) and slope of the subsidence. The key specification of Total Station is given in Table 2. Therefore, Missing Line Measurement (MLM) mode was adopted for subsidence investigation, as it calculates the horizontal distance, slope distance and difference in elevation between two target prisms as illustrated in Fig. 20.

Fig. 19: Total Station

Table 2: Specification of Total Station

Parameter	**Specification**
Make	Topcon
Model	GPT-7003
Measurement Range (1 prism)	3000 m
Linear accuracy	± (2mm + 2 ppm x D)
Linear Least count	1 mm
Angular accuracy	3”
Angular Least count	1”

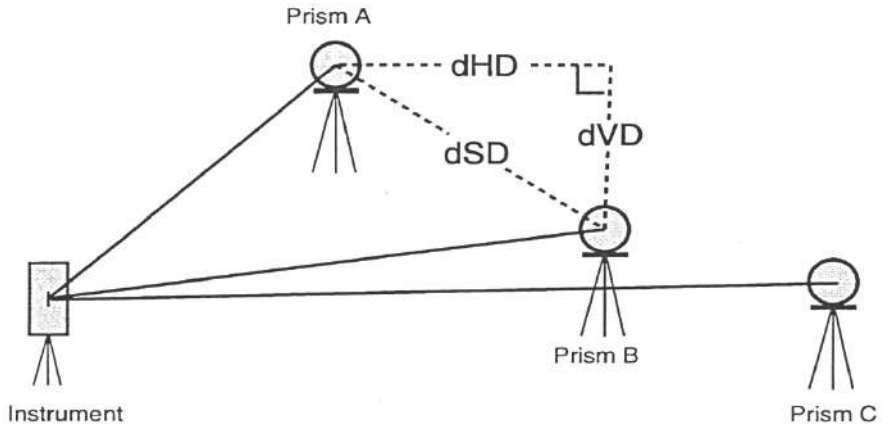


Fig. 20: Concept of Missing Line Measurement

4.0 RESULT OF SUBSIDENCE INVESTIGATIONS

Surface subsidence investigations were conducted over 12 stowed panels (4 panels at Jamadoba 2 Pit, 2 panels at Bhutgoria Amalgamated Jamadoba 6&7 Pit, 2 panels at Digwadih colliery, 2 panels at Sijua colliery and 2 panels at Belatand colliery) of Tata Steel collieries in Jharia Coalfield. Depillaring in 8S panel at Digwadih colliery was completed in May, 2018. Reduced levels of monitoring stations were measured for the computation of subsidence with the help of auto levels with 0.1 mm least count whereas inclined distance between two monitoring stations was measured by steel tape with 1 mm least count to compute compressive & tensile strains and slope. Total Station was also used in congested and highly undulating surface topographical areas for subsidence monitoring. It was not feasible to lay the monitoring stations over the depillaring panels as per the requirement owing to paddy field, built-up areas, local constraints etc. Table-3 shows the outcome of subsidence investigations conducted over 12 panels whereas figures 21 to 29 depict respective surface, strain, slope and subsidence profiles along different lines of monitoring stations erected over the studied panels. No ground movement was observed over XV/3S panel of Jamadoba 2 Pit as the depillaring operation was started in September, 2018 and the initial reading was taken in August, 2018. IX/6S and IX/8S panels of Digwadih colliery showed negligible ground movements till September, 2018. A brief description of the outcome of this study is discussed below:

4.1 Non-Effective Width

It was not possible to compute non-effective width of extraction which is expressed in terms of average depth of extraction. This is mainly due to presence of old goaves over

and around the panels in overlying seams as well as delay in erection of monitoring stations over the new panels.

4.2 Maximum Subsidence

The factors influencing the magnitude of subsidence movements include thickness of extraction, status of working over and around the panel, inclination of seam, type of goaf support, percentage of extraction, panel dimension etc. Maximum subsidence movements over different stowed panels varied between 16 and 158 mm. The maximum subsidence over completed panel was 1.66 % of extraction height.

4.3 Maximum Slope and Strains

Maximum slope, compressive and tensile strains measured over stowed panels were 5.8 mm/m, 2.05 mm/m and 1.43 mm/m respectively as depicted in Table – 4.

4.4 Subsidence Movement Profiles

Subsidence movement profiles over the investigated panels spreading over Jamadoba 2 Pit, Bhutgoria Amalgamated Jamadoba 6&7 Pit, Digwadih, Sijua and Bhelatand collieries of Tata Steel are shown in figures 21 through 29. The characteristics of subsidence movement profiles observed along different rows of monitoring stations are as follows:

1. The strata above the working panels were disturbed due to extraction of coal from the overlying seams. The resettlement of the fragmented strata contributes in augmenting subsidence value.
2. The shapes of the subsidence profiles were asymmetric in nature. This characteristic was primarily attributed due to the combined influence of irregular overlapping of overlying caved and stowed goaves, left out coal rib pillars in the seams of overlying panels, goaf edge effects and inclination of seams as well as varied panel geometry (Figs. 21 through 29). In a few cases maximum subsidence was found to be higher on the dip side of the panels.
3. Slope and strain profiles were also not regular. These were influenced by overlying goaves, seam inclination, topography of ground surface and left out stooks/ribs in bord and pillar mining (Figs. 21 through 29).
4. Overall ground slope and surface profiles (Figs. 21 to 29) were not changed remarkably due to underground mining with stowing as the magnitude of subsidence was low due to small width-depth ratios of the panels.

5. Goaf treatment by method of stowing was adopted for all the panels with an objective to have minimum ground deformation at the surface.

4.5 Angle of Draw

The angle of draw (AoD) was determined by projecting horizontal distance perpendicular to the panel edge. A subsidence of 5 mm was considered as reference point of no subsidence on the surface for calculation of AoD. The dynamic AoD was measured along the subsidence monitoring lines of XV/2S seam of Jamadoba 2 Pit. Irregular shape of the panel led to variation in angle of draw under multi-seam working condition. Measurement was possible both along dip and strike direction (Table-3). It was not possible to measure angle of draw for other panels due to insufficient extension of monitoring stations outside the panels and improper layout of monitoring stations.

Table-3: Angle of draw measured over active panel

Panel XV/2S Jamadoba 2 pit Dimension			Date of start	Total Face Advance (m)	Working days	Face Advance (m/days)	Angle of Draw (Dynamic)	Orientation of AOD	Remark
L	W	Depth (m)							
245	72	166	Sep15	241	841	0.29	2.86	Strike	Reduced panel width due to irregular shape
							22.9 2.4	Dip RISE	Influence of irregular panel shape and reduced panel width
							10.2	Dip	Full panel width

Table-4: Result of subsidence investigations at different collieries of Tata Steel in Jharia Coalfield

Sl. No.	Colliery/Panel	Width/depth ratio	Maximum subsidence (S)		Maximum slope (mm/m)	Maximum compressive strain (mm/m)	Maximum tensile strain (mm/m)	Remarks
			(mm)	(%)				
1	Jamadoba 2 Pit XV/3S	0.87	-	-	-	-	-	Extraction in progress
2	Jamadoba 2 Pit XI/3S	0.31	30	1.11	2.0	1.16	1.07	Extraction in progress
3	Jamadoba 2 Pit XI/2S	0.28	131	2.91	3.7	0.75	0.82	Extraction in progress
4	Jamadoba 2 Pit XV/2S	0.43	158	4.64	5.8	2.05	1.43	Extraction in progress
5	Bhutgoria Jamadoba6&7 Pit IX/6S	0.37	65	2.12	5.7	0.97	0.99	Extraction in progress
6	Bhutgoria Jamadoba6&7 Pit IX/1S	0.37	57	1.86	4.6	0.95	0.91	Extraction in progress
7	Digwadih IX/8S	0.37	49	1.66	3.2	0.84	0.96	Extraction completed
8	Digwadih IX/6S	0.45	16	0.54	0.98	0.39	0.38	Extraction in progress
9	Sijua X/10 S(Ext.)	0.24	101	2.7	3.0	0. 70	0.50	Extraction in progress
10	Sijua IX/1S (Top)	0.73	-	-	-	-	-	Extraction in progress
11	Bhelatand XIV(E)/3S	0.34	-	-	-	-	-	Extraction in progress
12	Bhelatand XIV(W)/IS	0.33	78	2.6	3.0	0.99	0.99	Extraction in progress

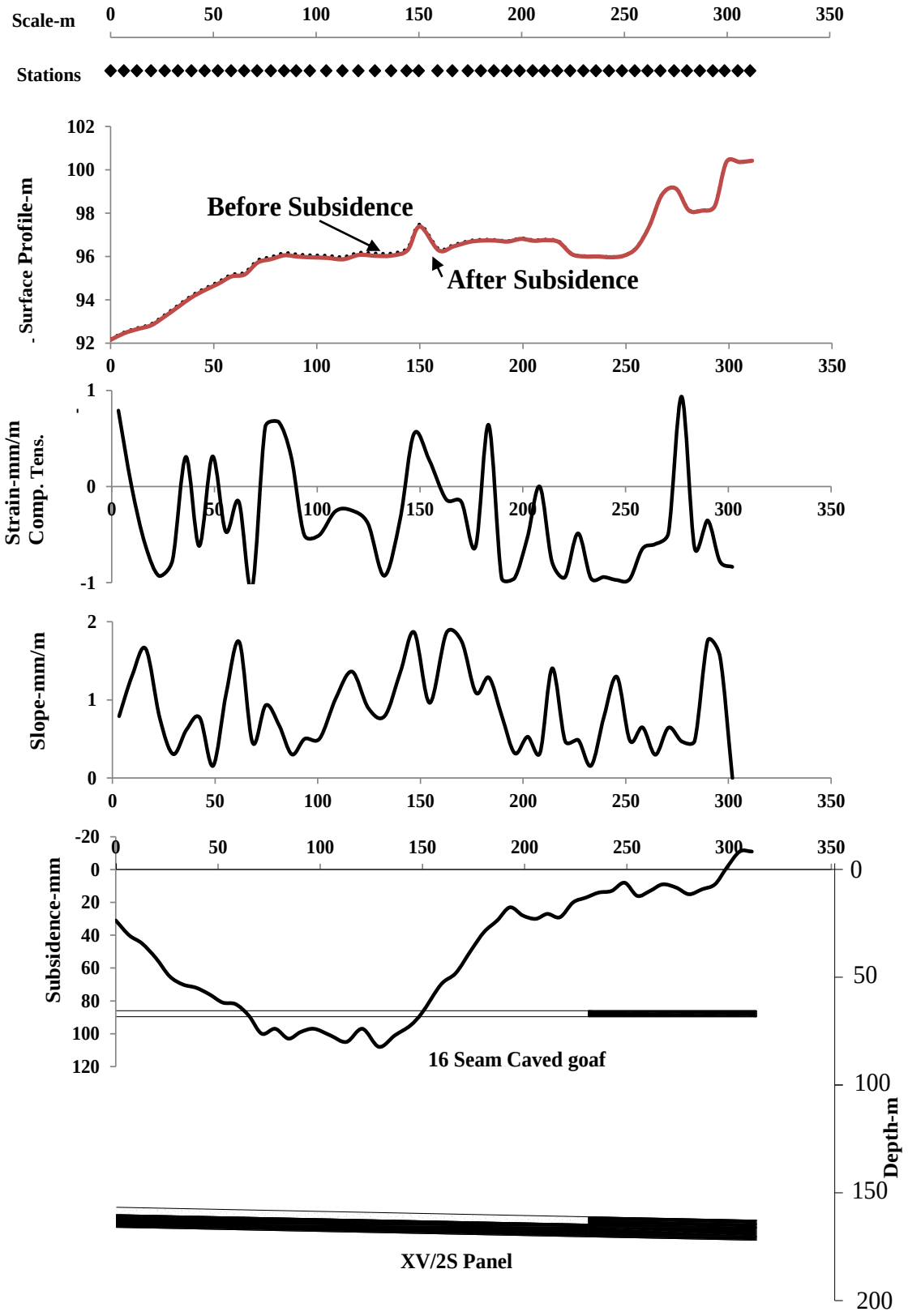


Fig. 21: Surface, strain, slope and subsidence profiles along A-line of monitoring stations over 2S panel in XV seam at 2 Pit Jamadoba colliery

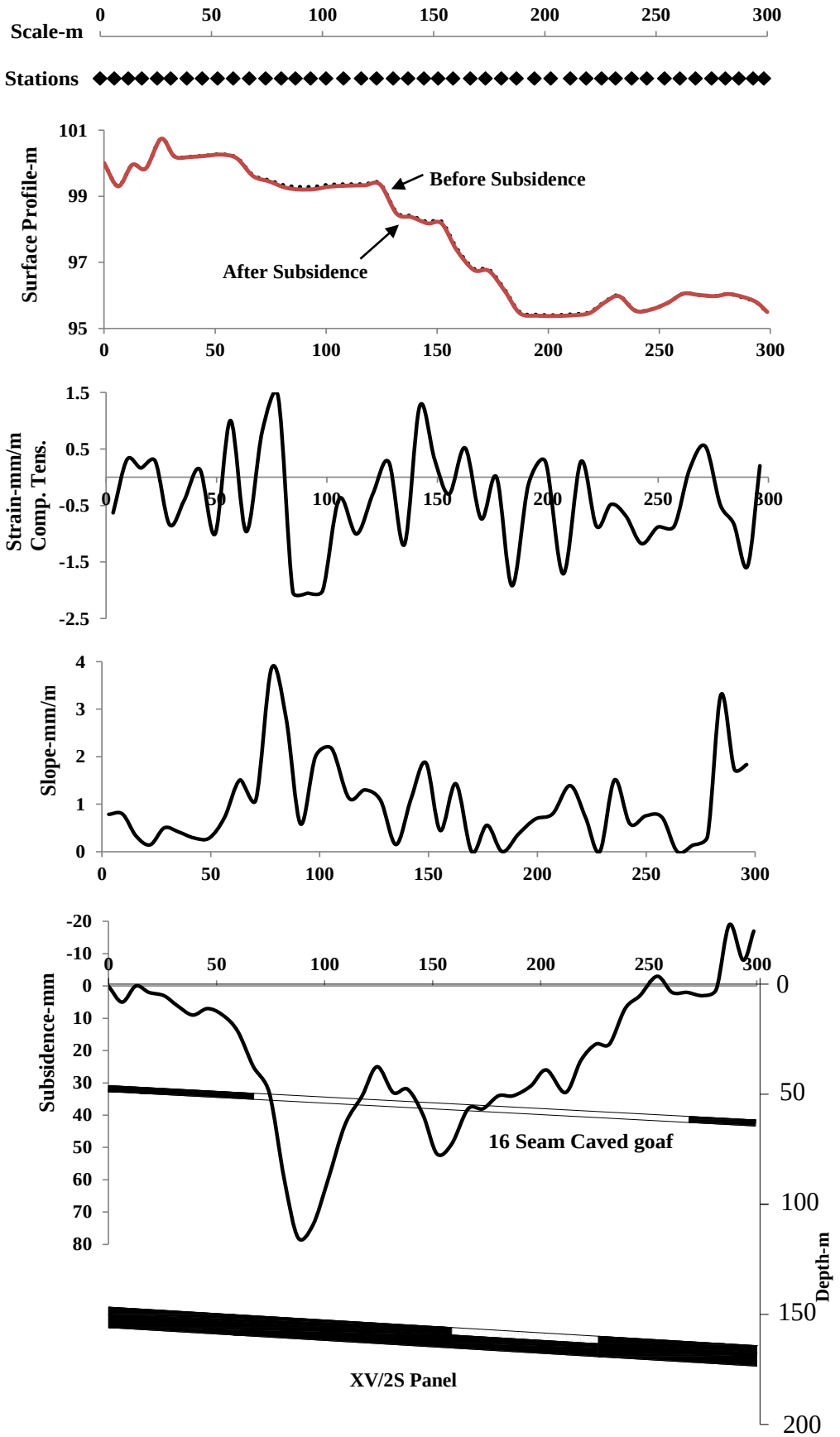


Fig. 22: Surface, strain, slope and subsidence profiles along E-line of monitoring stations over 2S panel in XV seam at Jamadoba 2 Pit colliery

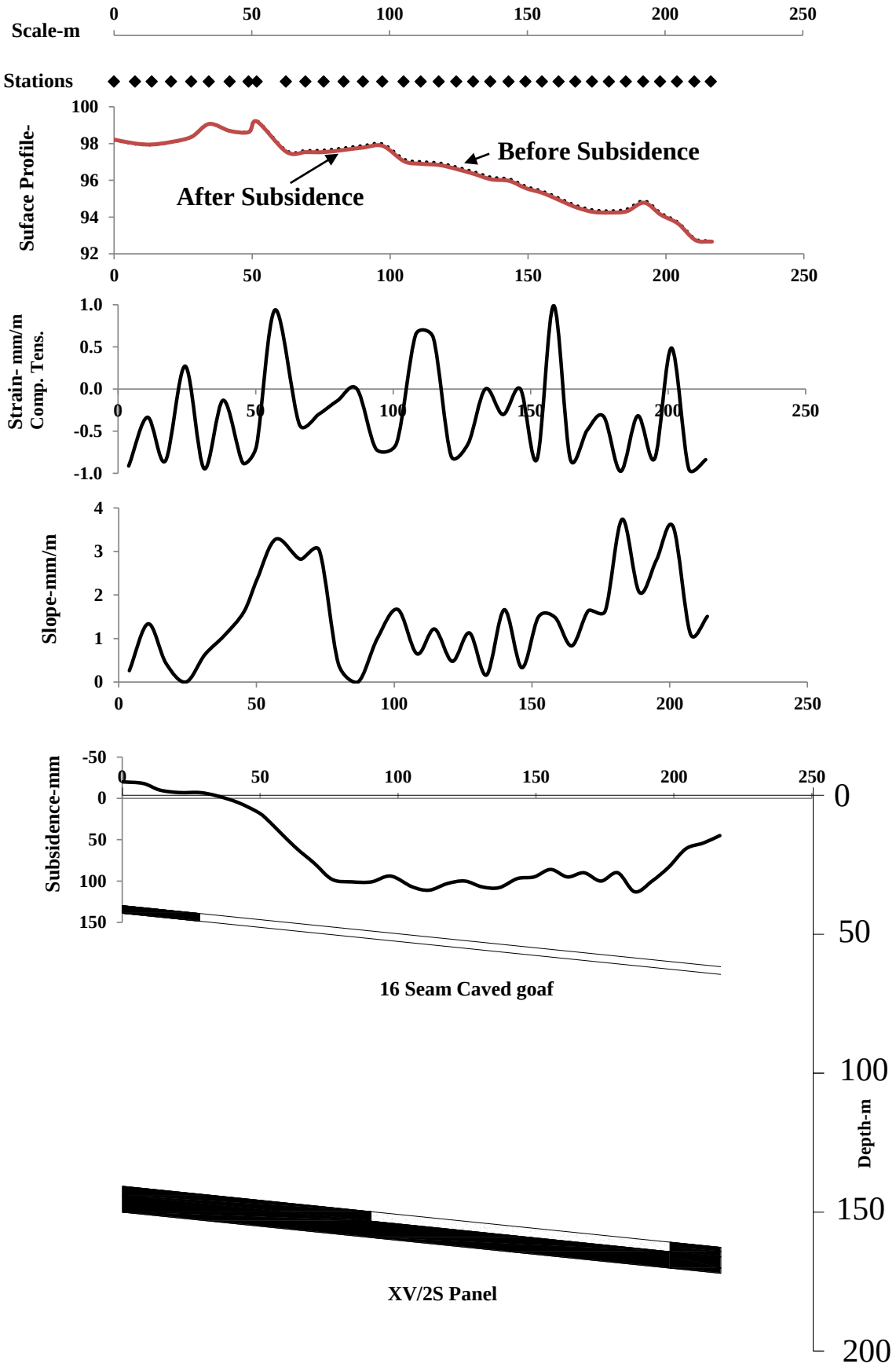


Fig. 23: Surface, strain, slope and subsidence profiles along D-line of monitoring stations over 2S panel in XV seam at Jamadoba 2 Pit colliery

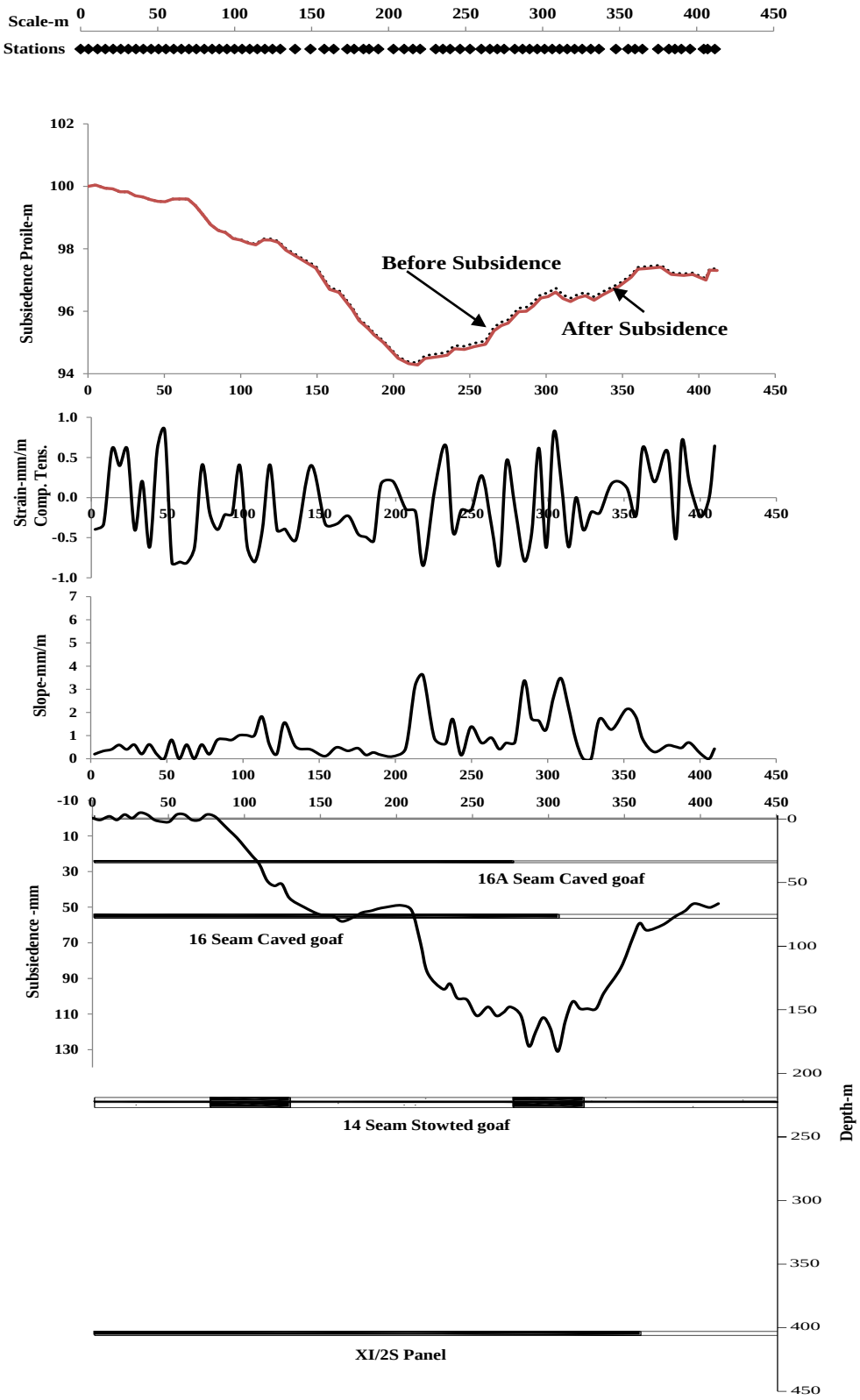


Fig. 24: Surface, strain, slope and subsidence profiles along R-line of monitoring stations over 2S panel in XI seam at Jamadoba 2 Pit colliery

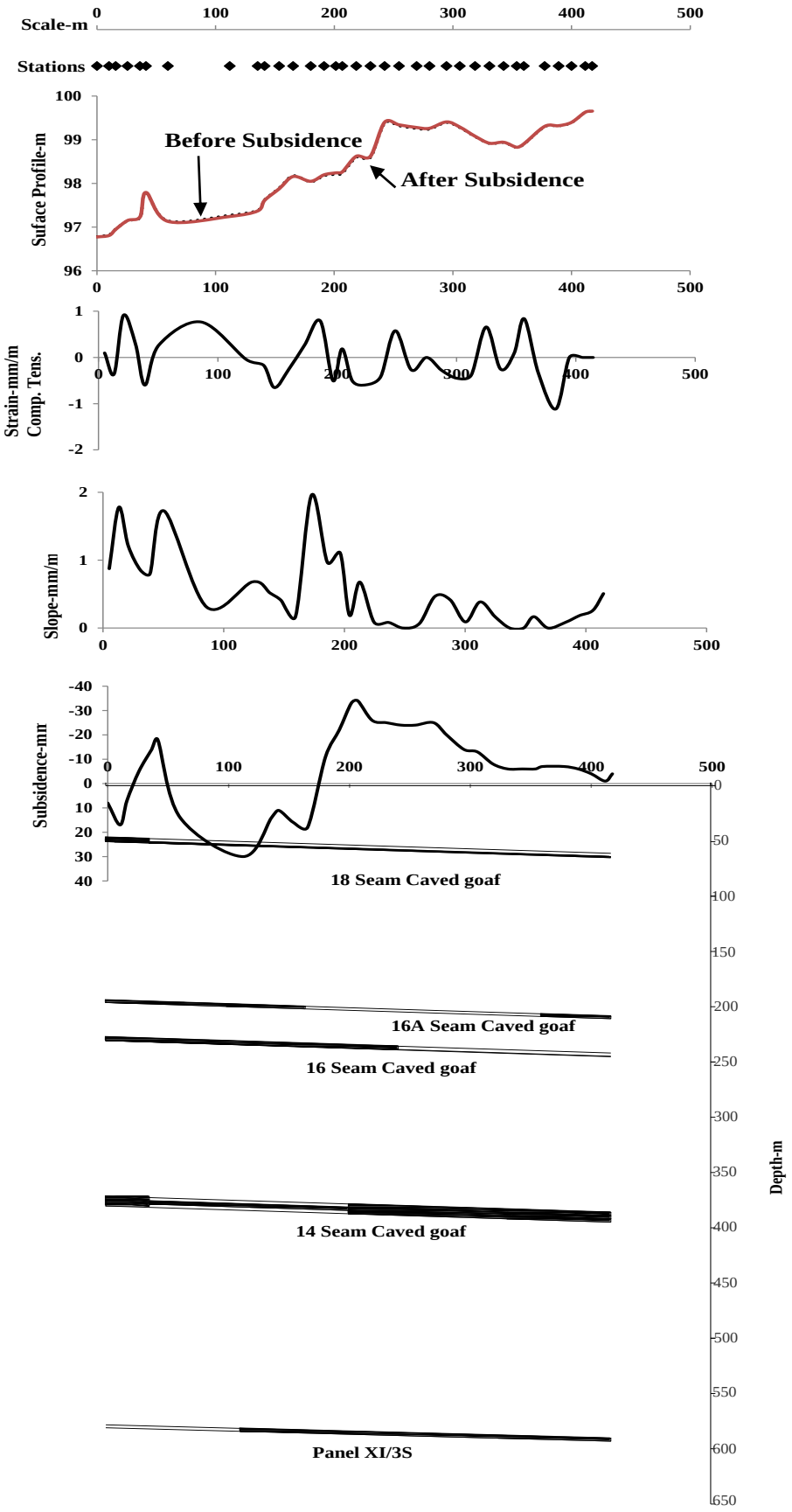


Fig. 25: Surface, strain, slope and subsidence profiles along A-line of monitoring stations over 3S panel in XI seam at Jamadoba 2 Pit colliery

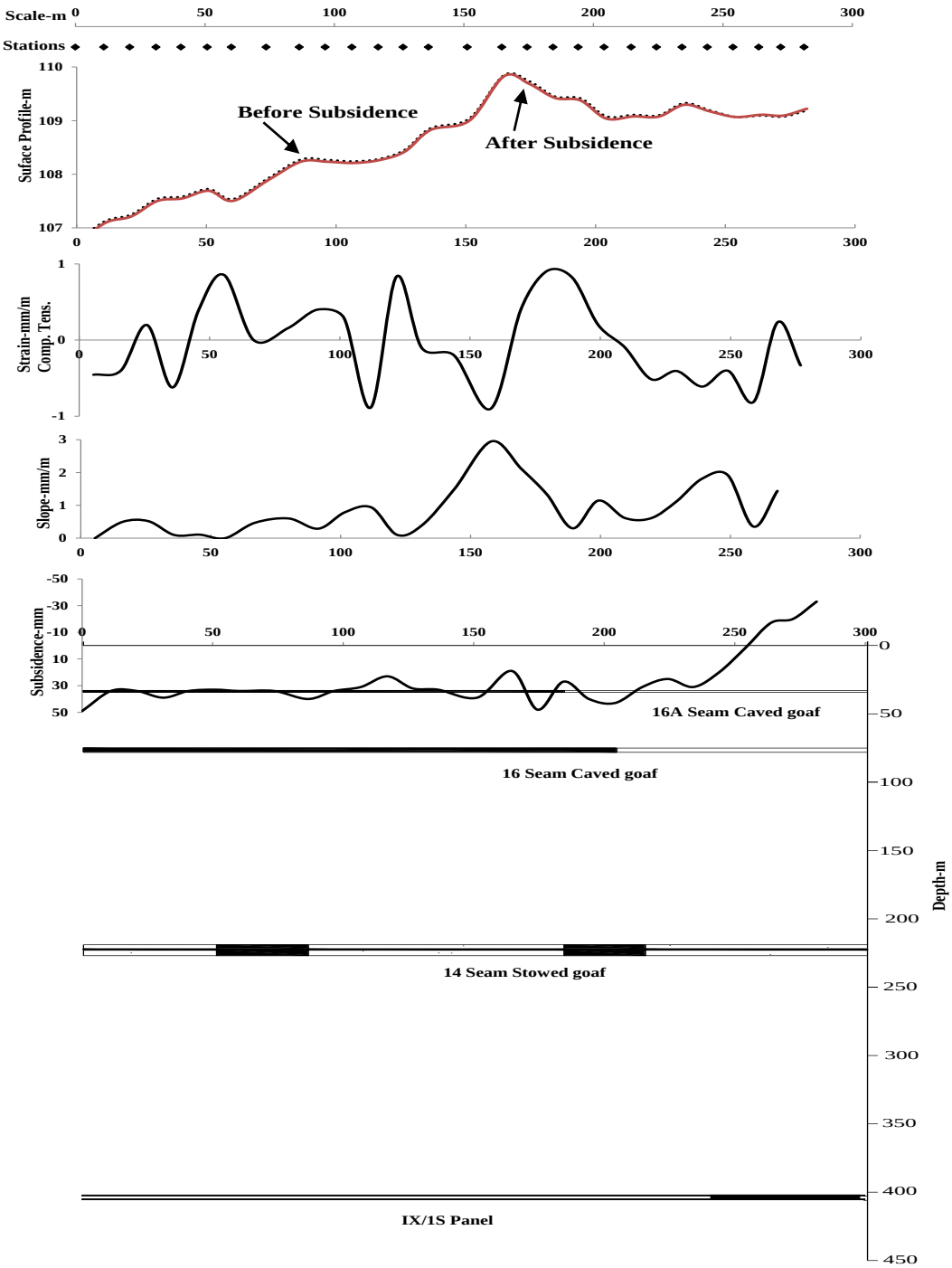


Fig. 26: Surface, strain, slope and subsidence profiles along O-line of monitoring stations over 1S panel in IX seam at Bhutgoria Amalgamated Jamadoba 6 & 7 Pit colliery

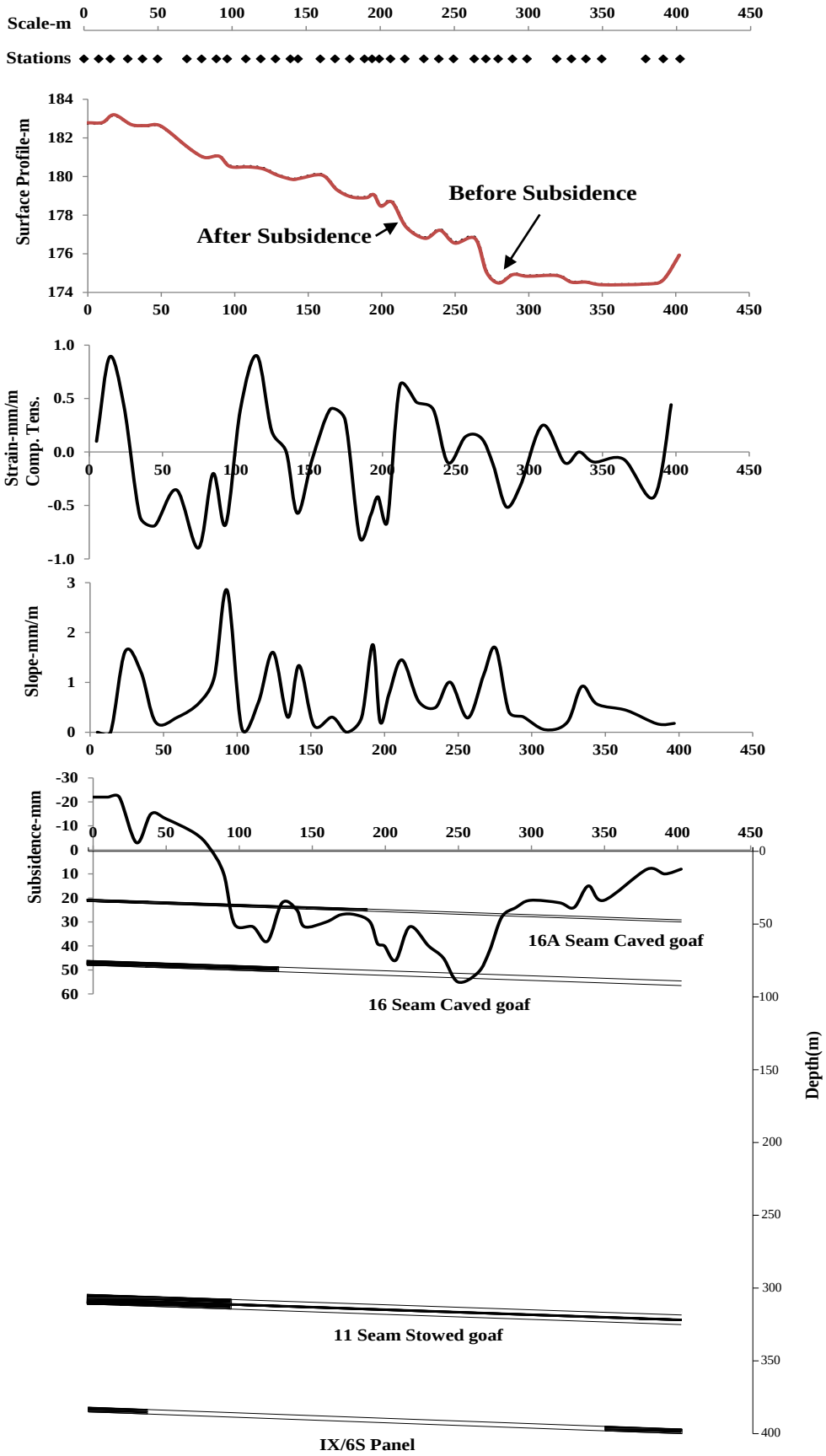


Fig. 27: Surface, strain, slope and subsidence profiles along C-line of monitoring stations over 6S panel in IX seam at Bhutgoria Amalgamated Jamadoba 6 & 7 Pit colliery

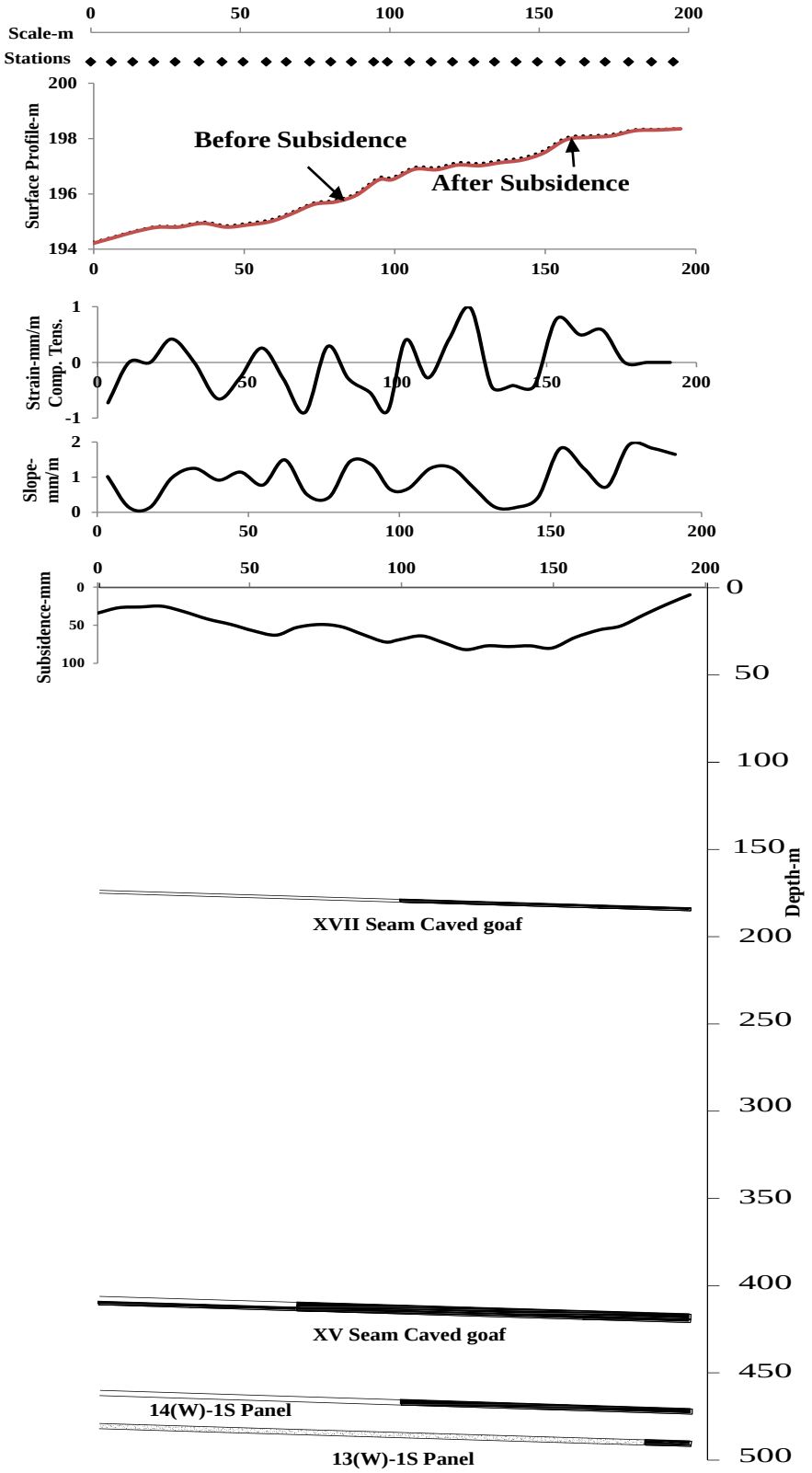


Fig. 28: Surface, strain, slope and subsidence profiles along B-line of monitoring stations over 1S panel in XIV (W)-1S seam at Bhelatand colliery

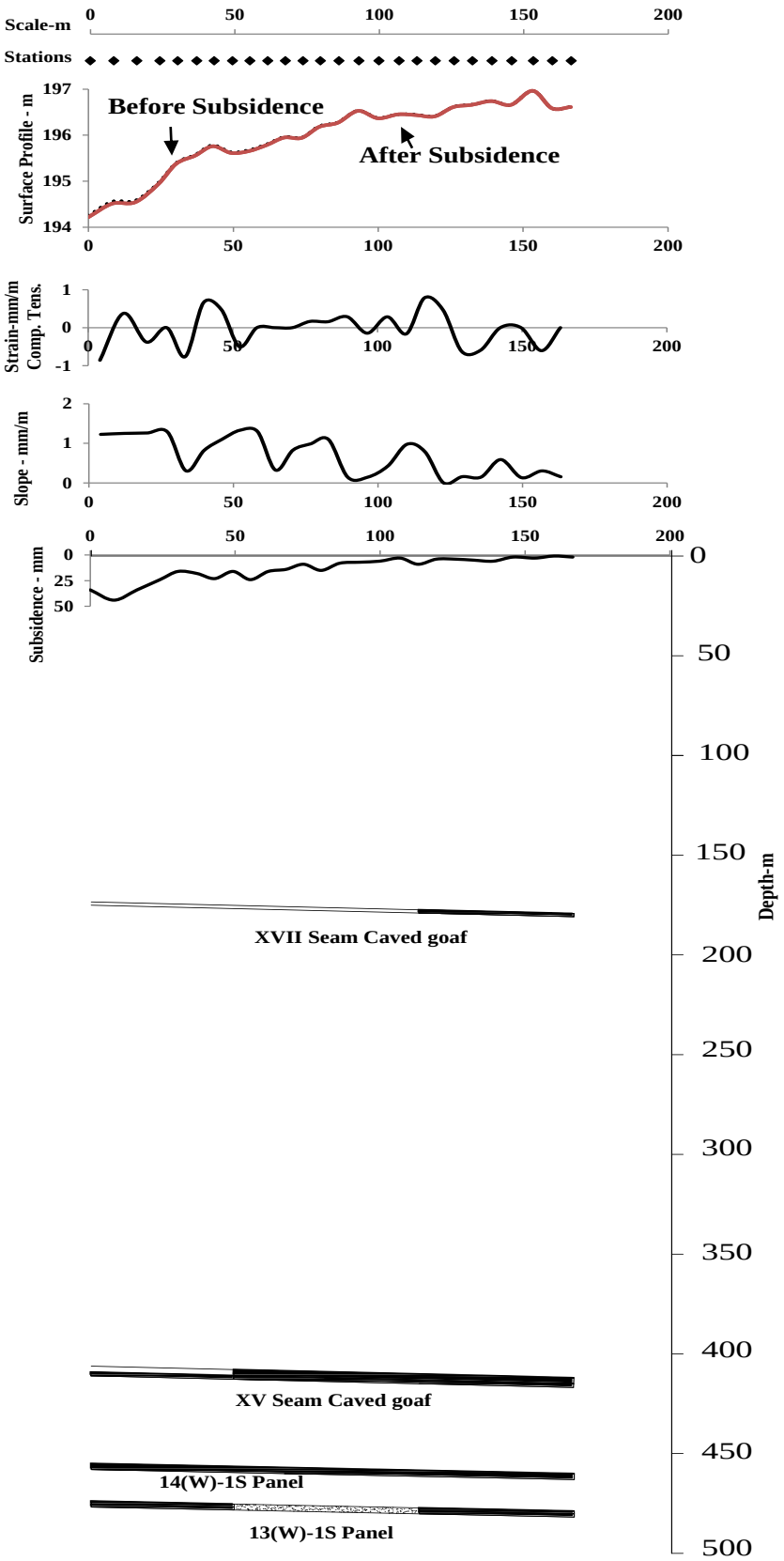


Fig. 29: Surface, strain, slope and subsidence profiles along C-line of monitoring stations over 1S panel in XIV(W)-1S seam at Bhelatand colliery

5.0 IMPACT OF SUBSIDENCE MOVEMENTS

Surface subsidence movements did not cause any adverse impact on surface features and structures as the magnitude of strains were within safe limit (Table - 4). No surface cracks were noticed during the course of measurement. Ground movements caused localized alteration in surface drainage pattern but the over all surface topography was intact. There was no adverse impact on the surface terrain due to mining induced subsidence.

6.0 CONCLUSIONS

Subsidence investigations conducted over 12 stowed panels during October, 2017 to September, 2018 at Jamadoba 2 Pit, 6 & 7 Pit Bhutgoria Amalgamated Jamadoba, Digwadih, Sijua and Bhelatand collieries of the Tata Steel in Jharia Coalfield led to the following conclusions:

1. Maximum subsidence movement was 4.64% of extraction thicknesses over the 2S panel in XV seam at Jamadoba 2 Pit.
2. Maximum slope, compressive and tensile strains observed over measured panels was 5.8 mm/m, 2.05 mm/m and 1.43 mm/m respectively.
3. Subsidence, slope and strains profiles were influenced by overlying old goaves, position of goaf edges, inclination of the seam, topography of the surface profiles as well as left out stooks/ribs in the overlying seams worked by bord and pillar method of mining.
4. Subsidence movements did not cause any adverse impact on surface features and structures.

7.0 RECOMMENDATIONS

The following recommendations are proposed for effective subsidence investigations over the Tata Steel collieries of Jharia Coalfield:

1. It is recommended to erect subsidence monitoring stations at least one month before the commencement of depillaring over new panels.
2. It is also recommended to extend subsidence monitoring stations equal to panel depth outside the panel boundary.
3. It is recommended to continue subsidence investigations for the safety evaluation of different surface features and structures lying over different on-going and future depillaring panels.