

PIPELINE INFORMATION MANAGEMENT SYSTEM (PIMS)

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- g) Procedure reports, Approved procedures, job procedures, welding procedures specification and qualification, QAP's and ITP's for all pipeline activities including terminals, SV stations, IP stations etc. Scanning and digitization of gazette notifications from owner. All construction activity reports including crossings.
 - h) Cadastral survey documents- Survey numbers, ownership area of affected of survey no. in ROU. Permanent feature along center of pipeline. Village maps, talukas, districts etc. Nearest police station with details, hospital, fire station, village panchayat, district authority details.

14.0 Material Management Reports

- 14.1 Material tracking and ordering reports are generated for both Free Issue Materials for long lead items and also for procurement related items.

15.0 ROU Tracking Report

ROU tracking report helps in tracking the ROU / Permission documents, compensation details would be linked.

16.0 Deliverables of PIMS solution at the time of final submission:

a) Mode of Delivery

Data will be submitted in installable CD's. A platform independent solution, that can be installed on desktops, servers and accessible through the network will be configured.

b) User Access

Apart from the delivered CD's, as built data can be provided in either of the following methods: a) Present on Secure Web Space. b) The data with platform independent menu Interface will be installed on a Server/PC. It can be accessed by users from a URL from other PC's within the network.

c) Interface:

All submitted data can be accessed using menu interface. All data is input from authenticated Inspection Reports/ Documents. These documents are also linked along each entry. Data generated using PIMS is exportable to MS Excel and may be used to Interpret with applications as desired by the client.

- 16.1 List of minimum Deliverable's, but not limited to the following:

- a) Pipe-Book:
Complete pipe book with links to each inspection report and single click display of history of joints.

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- b) Electronic Documentation:
Approved documents, drawings, test certificates etc. scanned, linked and indexed.
- c) Project Corridor management System:
Corridor manager with layers of raster images, topographic details, photographs, stations, crossings, markers, etc.
- d) Material inventory:
Complete pipe tracking and reconciliation report with details.

17.0 Technical Specification of GIS Application and Services

- 17.1 Create Base Map along the corridor, having features like Roads, Water Bodies, Railways, important POI by remote sensing using Satellite Imagery and SOI sheets.
- 17.2 Create Shape Files for all Corridor Layer having Topographic details along 100M on either side of centreline.
- 17.3 Create Shape Files for Pipeline Centreline layers with pipeline joints, Depth, fittings and fixtures.
- 17.4 Create Shape Files for Cadastral Maps along with respective Landowner Data.
- 17.5 Create Geodatabase Segments, Line Series and Station Series for future analysis.
- 17.6 Attaching photos, videos, drawings, GAD's, Isometrics in related stations, crossings, utilities etc. to provide complete details of pipeline which helps O&M to identify the location, pipe details, joint details, related documents/drawings etc. for disaster management.
- 17.7 Loader module for Survey data to AutoCAD Map based alignment sheet.
- 17.8 Integration model for survey data to PCMS.
- 17.9 Loader module for Survey data and PCMS data in CLIENT Arc GIS GeoDataBase.
- 17.10 Ensure completeness of CLIENT GeoDataBase for all the Feature sets Locations and Tables.
- 17.11 GIS system should have features of Pan, Zoom, Info, Search, Measure and Print.
- 17.12 GIS system should have loader module for Survey data to AutoCAD Map based alignment sheet.
- 17.13 The GIS based management system should be able to handle the following applications:
 - a) Spontaneous potential graphing
 - b) Pipeline profiling
 - c) Handle CAD files which show the piping layout and other plan of the facilities
 - d) Images and scanned documents

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- e) Creation of alignment sheet from survey data
- g) Inspection and material data updating and listing through a form menu
- i) Record update and maintenance
- j) Emergency notification lists display
- k) Map creation
- l) Identification of the pipeline network facilities; tolerance setting for the same
- m) Query by location, by attribute, by logical selection (all queries based on logical selection parameters)
- n) Report generation as per user needs

17.14 GIS system may have the following suggested layers:

- a. Base Map layer
- b. Satellite Imagery Layer
- c. Pipeline Centre line Layer
- d. Cadastral Map Digital Layer
- e. Construction Activity Layers
- f. Pipeline Assets Layer

18.0 SCOPE OF GIS SURVEYS

This specification covers the minimum requirements for implementation of GIS for surveyed pipeline route. This specification deals with data acquisition, data recording, storage handling, processing and development of GIS on a specified format using standard and approved quality control parameters and its delivery to owner in a fully customized fashion. The work shall include but not limited to the following:

- 18.1 Survey along the pipeline ROW to capture GPS co-ordinates of weld joints, various pipeline markers (boundary pillars, kilometer post, direction marker, warning signs, etc.), despatch station(s), receiving station(s), intermediate pigging stations, consumer terminals etc. for preparation of GIS map of ROW.
- 18.2 Preparation of seamless GIS for the entire pipeline route with video clipping of salient features such as major crossings (Roads, Railway lines, Rivers, Nalas / Streams, Canals etc.) covering 5 Kms stretch either side of centre line of surveyed pipeline route. Any drawing/ documents if additionally required shall be the responsibility of the contractor. Generation of GIS module for the surveyed pipeline route, shall be capable of featuring the attributes as given hereunder:
 - a) Retrieve pipeline information like Chainage, Depth of pipeline, Dia. of pipe, coating details, CP details etc.
 - b) Route Map showing the alignment of the pipeline including crossings, TPs etc.
 - c) Major crossings such as National Highway, State Highway, Railways, Canals, Rivers, HDD etc.

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- d) Mainline Valve Locations, Despatch/ receiving stations
 - e) GPS coordinates of each weld joint during construction work to be taken immediately after lowering but before backfilling along with progress of mainline construction.
 - f) Cadastral Survey information including details of
 - i) Survey Nos.
 - ii) Ownership area of affected Survey no. in ROU
 - iii) ROW Corridor
 - iv) Permanent feature along 30 m either side of centre line of pipeline
 - v) Village maps, Talukas, Districts etc.
 - vi) Present crop details
 - vii) Land & crop Compensation details
 - viii) Land use pattern along the route
- 18.3 Incorporation of all permanent features, such as roads, railway lines/stations, water bodies, fire stations, important land marks etc. falling within the corridor width of 10 km on either side of the pipeline centre line. **The contractor shall arrange the satellite imageries, if required. Owner may facilitate the contractor (if required) by issuing authorization letters. However, the satellite imagery shall be procured by the contractor from authorized agency at his own expense.**
- 18.4 Scanning and digitization of Gazette notifications available with the owner. Scanning & digitization of EIA/ RA study reports, cadastral survey reports, soil resistivity reports, various crossing permissions, as built drawings, equipments details etc. Provision shall be kept for linking additional attributes as and when required in future pertaining to ROU related works.
- 18.5 The data so collected shall be re-verified to ensure correctness before their processing for the development GIS map of pipeline ROW, showing pipeline alignment and profile.
- 18.6 Provision shall be kept for system integration to existing CLIENT's SCADA network/ WAN.
- 18.7 All the data shall be uploaded to respective modules of GIS software developed by CLIENT.
- 18.8 Identification/ Generation of 3-D co-ordinates for turning points/ intermediate points along surveyed pipeline route, with the help of DGPS.
- 18.9 **Handheld GPS survey instruments with mapping facility**, shall be utilized for locating the intersection points/ turning points and other Geo-references, with its complete accessories of renowned make, **having 1 metre accuracy.**
- 18.10 The contractor shall impart training for operation and maintenance of software developed for Pipeline information system to two batches of CLIENT personnel, each batch consisting of up to 10 personnel.
- 18.11 The scope of work shall not be limited only to the work as described above. The contractor shall be required to execute all works required for generation of GIS module for the surveyed pipeline routes.

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18.12 GIS Surveys

18.12.1 Contractor shall carryout development and customization of GIS for the surveys covered in the present scope of work that includes:

- i) Geodetic engineering surveys
- ii) Soil investigations/ survey
- iii) Crossing surveys
- iv) Cadastral surveys
- v) ROU acquisition surveys records
- vi) Population density surveys
- vii) Land use pattern survey
- viii) Soil resistivity survey / corrosion survey
- ix) Disaster management requirement and environmental effect parameters.
- x) System design for GIS and integration with owner's central data information system etc.

This GIS is to be developed in such a fashion that there is a complete scope for horizontal and vertical expansion for the system growth and Integration. Theme coverage/ layers for GIS shall be as per requirement frozen by owner at the System Design and Customization Stage.

18.12.2 The required features of GIS application shall be as given below:-

- i) The entire system to be geo-referenced, i.e., from the point of dispatch to receipt station including the facilities at each end as well as en-route, the major crossing, landmark etc. shall be as per grid and projection system to be approved by the Owner. The GIS application should have pipe book data, materials data, alignment sheets (AFC and As built) and all related certificates available spatially on GIS layers in such a way that all the above details can be opened through the GIS application directly. This shall also involve (but not limited to) taking GPS coordinates of each weld joint during construction work immediately after lowering but before backfilling along with progress of mainline construction. The Pipeline construction activities such as ROW Clearing, Grading etc should be available spatially as GIS layers so that all the above details can be opened through the GIS application directly.
- ii) The Contractor shall submit a Quality Assurance Plan (QAP) which shall cover details of each activity, its scope, quality parameters, quality checks, inspection schedules, attributes for input and output/ deliverables, test check procedures and its correlation with implementation schedule. The QAP will be scrutinized, commented upon and approved by the Owner for implementation.
- iii) The Contractor shall deploy the best-suited methods, equipment, tools software, personnel, analyst and surveyors to carry out the development and customization of GIS.
- iv) The Contractor shall use the best and the approved quality material for preparation of maps, reports, software, storage mediums etc. Base maps of all the districts (50 km on both sides of ROW) are to be supplied & integrated in the system by the bidder & these maps should have clearance from **Ministry of Defence or Survey of India.**

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- v) The Contractor shall confirm having in his possession the requisite tools equipment, know-how and experience to carry out the development of GIS including facilities to handle, to process and deliver output from the satellite imageries. In case the contractor decides to tie up with an associate for this part of scope, the details of such sub-vendor/ associate shall be furnished along with the offer.
- vi) The development of GIS shall be thoroughly customized to suit owner's requirement on technical, organization, training, operational information management system areas and integration with existing / proposed organizational systems for planning, control and information management. Wherever owner is not in a position to clearly specify any individual attributes/ fields of information at the execution stage, adequate provision for implementation at a later stage would be created in the respective system for such cases.
- vii) Contractor to comply with Open GIS Consortium (OGC) data standards or as approved by EIC.
- viii) Development of GIS package shall be done using standard programming languages like visual basic, visual C++, java, oracle etc,

18.12.3 Contractor's scope of work shall include the following:

- i) Preparation and submission of implementation schedule, QAP and detailed methodology for security and approval of the same by owner.
- ii) Collection of input data, topo sheets, and satellite imageries based surveys maps, reports and store/handle for further processing with contractor's survey work.
- iii) Propose projection parameters, special data parameters, grid system, geo-coding and geo-referencing parameters, output/ deliverable parameters etc., for owner's approval.
- v) Carry out data validation of received input, carry out scanning of topo-sheets, and integrate the recordings made by GPS/ DGPS and other survey instruments to complete/collate the input data.
- vi) Carry out image processing and generation of rectified image on approved system like ERDAS IMAGINE or equivalent.
- vii) Carry out interpretation and digitization of all physical features symbolization/ legend structure, layering, edge matching, topographical integrity, mosaic king, database linking, incorporation of ground truth details, incorporation of processing techniques for attribute allocation etc. after passing through quality assurance stages as per approved QAP.
- viii) Generation of output maps in specified format and scale as per specification.

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- ix) In the cross-country zone all information as given in the technical specification shall be provided. In the densely populated portions all information requirement as per specification for detailed survey and cadastral survey shall be incorporated such as ward and property boundaries (house numbers, classification as residential, commercial, government, number of storeys etc.) roads, landmark features, locality names and connectivity with proposed facilities, major commercial and industrial establishment being studied as potential consumers etc.

The data to also include, nallahs, channels, drains, canals, existing electric and telephone lines, bridges, land crossings, proposed expansion of roads, railways, other facilities e.g. water supply, sewerage system, telecommunication networks etc.

Note: Contactor to collect, evaluate, ensure correctness of source, positional accuracy, ownership, attributes, authenticity of the data collected and only revalidated data to be include for the database.

- x) To customize each layer and attribute for present available data and future database as per requirement of the owner. To design system requirement for operation and maintenance of GIS package.
- xi) To deliver a draft GIS package to the owner along with a detailed demonstration scrutiny, trial run and observations; load the trial packages on owner's system and configure for optimal use.
- xii) To modify/ change and update GIS with respect to the finally approved survey reports and mapping carried out under the overall scope of work. Observation and detailed comments on submission by contractor at each stage of work, correction/ modifications and addition to route or methodology, etc shall be carried out by contractor. To provide training to the owner's engineers on development of GIS as per approved schedule.
- xiii) To deliver the owner the source code of the application package with proper documentation.
- xiv) To customize the GIS package as finished products and deliver to Company sets of O&M manuals and package and provide post delivery support services (software updating etc.) of operation and maintenance for a period of 3 years from the date of installation of complete system. For GIS server application server and desktop editing software, however, the successful bidder will provide one year software product warranty which includes both software upgrade update and technical support and next two years of technical support only on need basis (monthly at least) by authorized technical person of OEM. Maintenance of package during the period shall be provided at no additional cost to the Owner.

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Pipeline Survey & Route mapping

a.	Survey of the Pipeline Route Corridor and ROW	To be done as per details given under technical specification and Scope of work
b.	Accuracy of GPS Survey instruments/equipments	+/- 1 meter
c.	Capturing of Geospatial features of the Pipeline Corridor	To Be done as per details given under technical specification and Scope of work
e.	Digital Mapping of the Pipeline Route Corridor	Using Survey of India Maps / Other reputed map providers / Custom made map
f.	Digital Mapping formats to be used	Map info/ Shape file

18.13 **GIS Management Solution:** It should be able to archive the following measurements and details related to mainline route/ profile/ drawing and pipe books:

- a) Horizontal location of pipeline with regard to deviation and permanent grid pillars
- b) Vertical level with regard to mean sea level of pipeline and grade
- c) Location and type of bends, fittings etc. and grades, points of intersection
- d) Changes of wall thickness and materials
- e) Location and details of valves insulating joints fencing
- f) Location and details of bored/ cased road, railway, water crossing, suspension bridges
- g) Location and details of bored crossing pipes, vents
- h) Location and type of coating
- i) Location and type of weighting, anchoring
- j) Location and type of markers
- k) Location of further appurtenances (pig-signallers)
- l) Location of ROU and end of pipeline with respect to ROU
- m) Type of soil
- n) Type of rock
- o) Type of blasting and ripping
- p) Padding
- q) Type of road pavement
- r) Details of bank protection, number of insulators, seals

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18.14 Following layers (but not limited to- only indicative) are to be populated in the GIS solution. The information contained is also indicated in the layers:

a) Route Survey Input

This layer group contains information extracted from the Route Survey Final reports, including:

- Soil Stratification Report
- Temperature Measurement Records
- Soil Corrosion Report

b) Cadastral layer

This layer group contains all map format files, images and tabular data Obtained from local government or other external sources. All Cadastral Data, Landowner details and compensation to the farmers shall be Included in this layer.

c) Site Photo and Video details

This layer contains all photos and video clips from the sites which are spatially linked to the database.

d) Crossings details

All information regarding pipeline crossings (all crossings like river, HDD, roads, canal, railway line, foreign pipeline crossing, power transmission line etc.) are stored and presented in this layer group. Location, type and width of crossing is stored in attribute table of crossing layers.

e) Pipeline Routes

Pipeline routes, IPs, KP markers, history of routes and reroute layers are all collected in this group layer. TLP points, OFC points, valve location, coat & wrap details, pipe depth, CP details etc. will also be marked in this layer.

f) Logistics

All approach roads map is scanned, geocoded and imported to GIS, then suitable access routes are digitized on the map which illustrates an idea of accessibility of site from different access roads.

g) Satellite imageries

All satellite imageries are grouped in this layer group. Different visibility Scales are defined, so that by zooming in & out suitable satellite imageries become visible.

h) Important details

Plans of detailed survey collected from alignment sheets are put together and presented as a stand-alone layer which presents useful details of obstacles and features like Police station, post office, fire brigade, delivery station, major road, minor road, railway pond, river, forest land, CRZ (Coastal Regulation zone), restricted ROW, Common ROW, marshy areas, rocky areas, in the vicinity of the

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pipeline based on detailed survey.

i) Geology

Geological maps, fault maps, hazard maps and other relevant maps from reference books and journals are to be scanned and geo- referenced.

18.15 An indicative list of requirement from the GIS application is given below as minimum which should be available in the system :

1.	System Architecture	Web based
2.	Accessibility	Through Internet and intranet
3.	Compatibility	Compatible (with zero data loss) with industry standard mapping formats such as shape file/ Geo Database etc.
4.	Map integration with pipeline digital mapping	Integration with pipeline digital mapping of the pipeline route corridor and ROW.
5.	Integration with Google Map/Earth	Viewing pipeline data on top of Google map/Earth/ Bing Maps etc.
6.	Map Overlays	Facility to switch ON/OFF pipeline map Overlays
7.	Search/Query Features	Facility for Search/ Query on Pipeline data through web interface
8.	Scalability	Scalable to incorporate new Pipeline Data (whose data are provided in industry standard map formats)
9.	Modularity	Facility to accommodate new users/groups/pipelines as and when required
10.	Flexibility to change Communication Service Provider	Required
11.	Facility for updating of data at owner's end	Required
12.	Browser Compatibility	Compatible with Web Browser such as Internet

18.16 OTHER REQUIREMENTS OF PIPELINE INFORMATION MANAGEMENT SYSTEM

18.16.1 The software system/package of data information management system shall be able **to function on a LAN/ WAN, restricted to 100 users, with provision of security.**

18.16.2 The customized/ developed software should have

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- a) Input data validation.
- b) Control of internal processing
- c) Output data validation

18.16.3 The system shall enable quick retrieval and printing of relevant pipeline data/ as built information through a suitable application. It shall also be able to provide requisite information in following formats.

- a) Tabular reports
- b) Graphical representations of data
- c) Image (supporting document) retrieval
- d) Geographical information system
- e) Query based retrieval

18.16.4 The volume of documents/ information to be scanned and uploaded in the system shall be decided based on the requirement and shall be finalized in consultation with the Engineer -in - Charge.

18.16.5 The data captured from the scanned documents and alternate electronic data into the central database through extensive manual data entry and electronic validations.

- a) The GIS module of the application shall also function on a LAN with an Internet connection. **Contractor shall provide license access for this.**

18.16.6 Generation of as built alignment sheets based on chainage shall be provided in the scale as decided by the Engineer in Charge.

18.16.7 The system shall include the following :

- a) A run time version of the software
- b) The database with relevant licenses for standard usage
- c) Assistance for operation and maintenance of system (towards hand on / class room training etc.) for three years from the date of installation of the complete system.

18.16.8 Contractor shall be responsible for following up with the owners representative for collection of various QA/QC documents, daily inspection reports, equipments test certificates, as built drawings etc. **Contractor shall also be responsible for the manual data verification** (reports are verified for general errors like missing pipe number, missing heat number, repeated pipe number, missing supervisor signatures etc) before making data entry and publication into the system.

18.16.9 Contractor shall provide access of published data to the authorized users of owner over secured Internet/ WAN Network in the form of **web-based reports**.

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- 18.16.10 The scanned reports shall be given **identification code**/ name using a formal coding / naming convention as agreed upon between the owner and contractor. The reports shall be visually checked to ensure presence of identified mandatory information.
- 18.16.11 The data shall be protected through appropriate security systems and access shall be controlled using **access control systems**.
- 18.16.12 The Contractor shall submit along with offer the project organization detail, the plan for execution of work, execution methodology, quality control plan and project monitoring & control mechanism details for development of data management system.**
- 18.16.13 The Contractor shall submit a **weekly progress report** of the work assigned to him for monitoring the progress of the work
- 18.16.14 After acceptance of the system all software used in the data management system shall be supplied in CD/ DVD media and shall be licensed to the owner with certification to this effect. The owner shall be enabled to access all free downloads/ updates for the software provided as per contract. The bidder shall ensure registration of the owner of such facility with the respective software supplier and confirm. The license of the GIS server application server and desktop editing software should be in the name of CLIENT. If any software media is damaged / corrupted during the process of installation and commissioning, the contractor shall ensures replacement of media at his own risk and cost.

19.0 OWNERS RESPONSIBILITY

- 19.1 Owner's responsibility shall be limited to provide/ making available the drawings/ documents/ data required for providing services for implementation of Pipeline Information Management System. All other resources, logistic support, facilities, etc required to complete the work under the scope shall be arranged by the contractor himself without any cost to the owner.

The owner may also provide authorization letters, wherever required for collecting information/ data from Owner/ Owner's representative and other contractors/ vendors.

20.0 CONTRACTOR'S/ PIMS SERVICE PROVIDER'S PERSONNEL & EQUIPMENT

- 20.1 The persons employed by the Contractor / PIMS service provider shall be technically qualified and trained in development of requisite software and operation of various computer applications. **They should also be acquainted with pipeline construction.**
- 20.2 The contractor shall provide boarding & lodging arrangement for his personnel at all locations during execution of work under the contract. The contractor shall also provide boarding, lodging and transport arrangement for his personnel during visit to ROW for collection of data for GIS mapping.
- 20.3 The contractor shall provide insurance coverage of all his personnel employed for implementation of work under this contract.

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21.0 DOCUMENT/ DATA SUBMISSION

- 21.1 Contents and presentation of GIS Module shall be reviewed/approved by owner in the initial stage to be prepared by the Contractor. The Contractor shall incorporate all comments / suggestions given by owner and prepare all documents accordingly.
- 21.2 Two sets of paper copy of GIS Module developed shall be submitted by the Contractor for owner's review in the form of draft report immediately upon start of work. The contractor shall obtain approval of owner on draft report before final submission. Comments, if any, shall be incorporated by the Contractor. Report can be demanded in parts and in different phases as per discretion of the owner.
- 21.3 All drawings, report, formats etc. forming the part of submission to owner shall be prepared on electronic media.
- 21.4 Final drawings/ data / documents after incorporation of comments by contractor shall be submitted to owner in six sets paper copies and one copy on CD ROM/DVD.

22.0 SECURITY

The network used for data transfer should be secure:

- 22.1 Bidder should ensure that a clear description of the security attributes of all network services used is provided.
 - Data transfer using Internet
 - Bandwidth requirement for data access from (during construction phase) is to be furnished.
 - Public Key Infrastructure:
- 22.2 The **digital signatures and security tokens** system should be under hardware warranty and software support for three years from the date of installation of the complete system.
- 22.3 The web server should conform to the guidelines issued by "CERT-IN"
- 22.4 The successful bidder shall develop and install state-of-the-art security systems including all types of modern protection security systems, like "**SSL VPN**" to protect the software system and all the data base and confidential information of the CLIENT which would be kept on line to support the software system. The **SSL VPN** system should be under hardware warranty and software support for two years from the date of installation of the complete system.
- 22.5 It is the responsibility of the successful bidder to ensure that there is no security backdoors and loopholes existing in the solution that can be exploited. The Contractor shall wholly be responsible for any breach in security as a result of insecure implementation or loopholes in the solution, including the operating systems on which the systems are running.
- 22.6 There should be one time authentication. However, a guest user id may be there through which any user can see the documents available for public notices.

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- 22.7 Unauthorized user shall not be allowed to access to any of the Data.
 - 22.8 The Contractor shall establish an **access control matrix** for the system.
 - 22.9 The proposed system shall be equipped with security facilities to prevent data tampering, data theft, sabotage and virus attack.
 - 22.10 A parameterized, timeout and logout feature may be included for non-active sessions.
 - 22.11 The proposed system shall be equipped with database security access control to ensure the integrity of data during processing and updating of the database.
 - 22.12 The Contractor shall propose Application level access control to control the user's access to the application he/ she can access.
 - 22.13 The system shall be capable of invalidating any user after a specific number of attempts to gain access via invalid passwords.
 - 22.14 There shall be mechanisms to verify the authenticity and the integrity of the network services from un-trusted sources before the services are used.
 - 22.15 The audit trail solution shall be able to detect attempts of unauthorized access, security violations, logging staff's activities as well as any suspicious activity and alert the system owner using appropriate channels such as audible alarm, pager, e-mail or other interactive technology based on the criticality of the intrusion detected.
 - 22.16 The proposed security implementation shall be easy to administer, verifiable and sustainable. It shall be able to scale to cater for additional servers for future expansion programs.
 - 22.17 Application Security Assessment (Source code review) of the complete customized application should be done by CERT-IN empanelled organization (the organization should be in cert-in panel since 2006) covering OWASP's Ten Most Critical Web Application Security Vulnerabilities. A confirmation certificate is to be provided by the auditing organization. The cost of hiring third party is to be borne by successful bidder.



RESPONSIBILITY MATRIX

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1.0 Project Responsibility Matrix

RESPONSIBILITY MATRIX		
Activity	PIMS Contractor	CLIENT/VCS
Deployment of manpower for scanning, cataloguing, data entry of all reports along with GPS coordinates acquisition staff	√	
Deployment of hardware for the project implementation like desktops, server and scanner	√	
Insurance of PIMS contractor's equipment/ hardware	√	
CD's/DVDs and alternate consumables for backing up of data	√	
Consumables for scanning	√	
Organizing the onsite team's travel to site	√	
Application hosting for ensuring availability of information to external users	√	
Desktops for viewing web reports and GIS by the IOCL team (Standard configuration PC's with Windows operating systems, Internet explorer and MS Office). GIS module: 2 machines, Web Reports as per owner requirement	√	
Boarding and lodging for contractor's operators' deployed at site office.	√	
Local transport / conveyance for commuting to onsite location from the place of Boarding and commuting on the ROW for the GIS survey on a four-wheeler. (it would be in the interest of the contractor to accommodate the onsite team close to owner's office to take care of the logistics)	√	
Provision of appropriate office space for the onsite team to carry out their activities efficiently	√	
Provision for storage of documents that are classified by the contractor as Work In Progress	√	
Safe storage of the back up CDs/DVDs/ media *till such time the complete data is taken over by the owner.	√	

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RESPONSIBILITY MATRIX		
Activity	PIMS Contractor	CLIENT/ VCS
Provision of Internet connection for communication, E- mail and uploading and downloading of scanned documents	√	
Provision of telephone connection for usage by the onsite team	√	
Provision of Stationery for the onsite team	√	
Availability of procedure documents pertaining to all activities to be carried out by owner to onsite team		√
Availability of isometric drawings to the onsite team		√
Provide equipment certificates & certificates for all other assets deployed for the pipeline construction		√
Delivery of all required reports on end of day basis to the onsite team	√	√
Soft copy of AUT (IF APPLICABLE)		√
Availability of authority letters for contractor's personnel to carry out operation for executing the scope of work as required by owner.		√
Information pertaining to owner's routine processes required by the contractor for proper execution of contracted work		√
Allocation of a project coordinator from owner to coordinate / Liaising with the onsite team/ Laying contractor , Should have the thorough knowledge of pipeline route and its important indicators, markers and intermediate structures		√
Monthly audit of data in GIS based software system by Owner's personnel	√	√

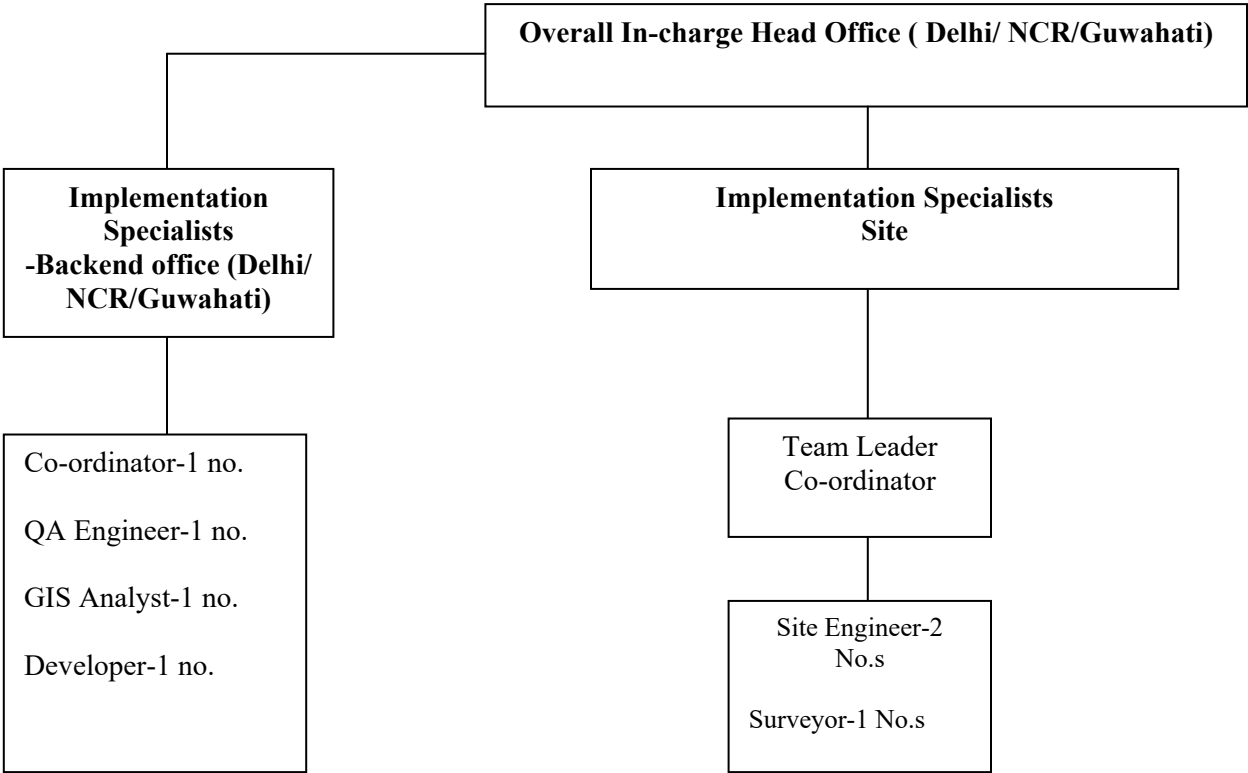
- 2.0** Bidder to submit a responsibility matrix covering the complete project implementation and clearly outlining the scope of work being covered by them.
- 3.0** Bidder shall procure the satellite imagery for implementation and shall facilitate and manage this activity as per detailed specification.

PROJECT EXECUTION ORGANOGRAM

PIPELINE INFORMATION MANAGEMENT SYSTEM (PIMS)



TYPICAL ORGANOGRAM FOR EACH PART



VOLUME I OF IV

**DESIGN BASIS: PROCESS
(APPLICABLE FOR ALL SPREAD OF ALL PARTS)**



Energising Quality

PROJECT NUMBER: C221052



Process Design Basis

Total Sheets

28

Document No

C221052

00

PC

DB

1001

INDRADHANUSH GAS GRID LIMITED

NORTH EAST GAS GRID PHASE-III OF IGGL

			<i>KT</i>	<i>AD</i>	<i>SKP</i>
D1	07.07.2022	Issued for Client Approval	KT	AD	SKP
C1	16.05.2022	Issued for Client Review	AD	SKP	SKP
REV	DATE	DESCRIPTION	PREP	CHKD	APPR



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ABBREVIATION

API	American Petroleum Institute
ASME	American Society for Mechanical Engineers
ASTM	American Society for Testing and Materials
BGPL	Barauni – Guwahati natural gas pipeline
IGGL	Indradhanush Gas Grid Limited
IP / SV	Intermediate Pigging / Sectionalizing Valve
KM	kilometer
MMSCMD	Million Metric Standard Cubic Meter per Day
MoPNG	Ministry of Petroleum and Natural Gas
MSL	Mean Sea Level
NB	Nominal Bore
NEGG	North East Gas Grid
NH	National Highway
OD	Outer Diameter
OISD	Oil Industry Safety Directorate
PDI	Population Density Index
PNGRB	Petroleum and Natural Gas Regulatory Board
PSV	Pressure Safety Valve
RL	Reduced Level
RoU / RoW	Right of Use / Right of Way
RP	Recommended Practice
SH	State Highway
DT	Dispatch Terminal
RT	Receipt Terminal

1.0 DEFINITION

Where used in this document, the following terms shall have the meanings indicated below, unless clearly indicated by the context to this order:

PROJECT	PMC Services for North East Gas Grid Phase-III of IGGL.
OWNER	Indradhanush Gas Grid Limited
CONSULTANT	VCS Quality Services Private Limited (VCSQSPL) the party to act for and on behalf of the OWNER for the Engineering Services
VENDOR / MANUFACTURER	Party, which manufactures and supplies equipment and services to the OWNER or to CONTRACTOR

2.0 INTRODUCTION

VCS Quality Services Pvt. Ltd. (VCS) has been appointed as an PMC (Project Management Consultant) by IGGL for the project **"PMC Services for North East Gas Grid Phase-III OF IGGL"**.

Indradhanush Gas Grid Limited (IGGL), a joint venture (JV) of IOCL, ONGC, GAIL, OIL and NRL has been entrusted with the responsibility to execute cross country natural gas pipeline connecting all states of the North East and Sikkim. The natural gas pipeline grid in North East would connect Guwahati to capital cities / major cities of North East states like Itanagar, Dimapur, Kohima, Imphal, Aizawl, Agartala, Shillong, Silchar, Gangtok and Numaligarh. The grid would be connected with upcoming Barauni-Guwahati natural gas pipeline as a part of Urja- Ganga scheme. The grid would also connect to sustainable and viable indigenous gas sources in North-East.

The pipeline grid has been designed with flexibility for gas injection in either direction.

3.0 PROJECT BRIEF

Salient details of tentative pipeline details under VCS scope of work in the route segment are as under:

A) Siliguri – Gangtok Pipeline (NPS 12") – tentative length is 186 Kms.

The pipeline in this section originates from a tap off point on Barauni-Guwahati pipeline at Siliguri and traverses through plain agricultural land and forest land for initial 50 odd kilometers which includes the crossing of Teesta River. Thereafter, the pipeline traverses through hilly terrain along the new highway under construction up to Lava, which is approximately at Ch.124.800 km of this pipeline

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section and thereafter follows the route of NH-717A up to near Ranipool area. The total area traversed by this pipeline section thus comes out to be approximately 186 km.

B) Dimapur – Kohima-Imphal Pipeline (NPS 12”) – tentative length is 199 Kms

The proposed pipeline route traverses through plain agricultural land and forest land for initial 5 odd kilometers and then enters the ghats/hilly terrain and traverses through it till Senapati town which is approximately at Ch.155.000 km of this pipeline section (en route taking the under construction Kohima Bypass Road) and then runs through more or less plain area till Sekmai. The total area traversed by this pipeline section thus comes out to be approximately 199 km.

Summary of various stations envisaged in the proposed North East Gas Grid Phase-III of IGGL are as under:

A) Siliguri – Gangtok Pipeline (SGPL)

Sr. No	Type of Station	Nos.	Location
1	Dispatch Terminal (DT / SGPL)	1	Siliguri (West Bengal)
2	Intermediate Pigging Station (IP/SGPL/01)	1	Tentatively at Lava (West Bengal)
3	Receipt Terminal (RT/SGPL) with/ without Tap off	1	Gangtok (Sikkim)
4	Sectionalizing Valves (SV/SGPL/01 to SV/SGPL/08) with Tap off	8	Along the Siliguri-Gangtok route

B) Dimapur – Kohima- Imphal Pipeline (DIPL)

Sr. No	Type of Station	Nos.	Location
1	Dispatch Terminal (DT/DIPL)	1	Dimapur (Nagaland)
2	Intermediate Pigging Station (IP/DIPL/01))	1	Tentatively at Tadubi (Manipur)
3	Receipt Terminal (RT/DIPL) with Tap off	1	Sekmai, Imphal (Manipur)
4	Sectionalizing Valves (SV/DIPL/01 to SV/DIPL/10) with Tap off	10	Along the Dimapur-Kohima-Imphal route

4.0 SCOPE OF DOCUMENT

The scope of the document is to describe the basic information and design criteria which will be used for "PMC Services for Phase-III of Gas Grid Development of Natural Gas Pipeline in North-East."

5.0 DESIGN PARAMETERS

Tap-Off point	Upstream of Guwahati Compressor Station in BGPL Pipeline
Design pressure	92 Kg/cm ² (g)
Operating Pressure	30 - 37 Kg/cm ² (g)
Specific gravity of natural gas	0.58 – 0.60
Density of Gas	0.76 kg/m ³
Design Temperature	-29 °C to 65 °C
Operating Temperature	0 °C to 55 °C D1
Ambient Temperature	25 °C
Joint Factor	1.00
Pipeline Operating Life	25 years
Pipeline Design Life	35 years
On-stream	355 days
Pipeline specifications	PNGRB Design and Safety Standards, ASME B31.8 and OISD-226
Corrosion allowance	0.5 mm for the pipeline, 3.2 mm for equipment (pig launchers/receivers and pressure vessels)
Sub-Soil Temperature	20-25 °C throughout the entire length of pipeline (1.2 m below ground)

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Soil Thermal Conductivity	0.3 W/m.K
Pipeline efficiency	0.9 to 1.0
Material Grade of Line Pipe	API 5L Gr. X70 PSL 2
Pipeline Fitting and Flanges	600# ANSI
Gas supply temperature	5 °C to 50 °C
Location Class	As per ASME B31.8 and PNGRB Regulations
Internal Coating	Liquid Epoxy 100 micron
Roughness	15 micron (Internally coated pipeline)
External Coating	2.5 to 3.2 mm, 3 Layer Polyethylene (3LPE)
Gas Equation	Panhandle (A)

6.0 PIPELINE SIZE, LENGTH AND DESIGN CONDITIONS

Detail of the pipeline is given below:


Sr. No	Process Fluid	From	To	Size (Inch)	Length (km)	Design Pressure Kg/cm ² g	Design Temp. °C
1	Natural gas	Siliguri	Gangtok	12"	186	92	-29 to +65
2	Natural gas	Dimapur	Imphal	12"	199	92	-29 to +65

7.0 PIPELINE SPECIFICATION


SR. No.	Location Class	OD (mm)	ID (mm)	Thickness (mm)	Pipe Grade
1	Class-2	323.9	311.1	6.4	API 5L X70
2	Class-3	323.9	309.7	7.1	API 5L X70
3	Class-4	323.9	307.1	8.4	API 5L X70

8.0 BATTERY LIMIT CONDITIONS

A. Siliguri – Gangtok Pipeline

Sr. No.	Conditions	Unit	Siliguri Tap-Off	Gangtok RT
1	Pressure	kg/cm ² (g)	30	29.86
2	Temperature	°C	0 to 55 	0 to 55
3	Flow Rate	MMSCMD	0.07	0.07

B. Dimapur – Kohima – Imphal Pipeline

Sr. No.	Conditions	Unit	Dimapur Tap-Off	Imphal RT
1	Pressure	kg/cm ² (g)	37	36.88 – 36.52
2	Temperature	°C	0 to 55 	0 to 55
3	Flow Rate	MMSCMD	0.07 to 0.15	0.07 to 0.15

C. SV Stations for Siliguri – Gangtok Pipeline

Sr. No.	SV Stations	Pressure (kg/cm ² (g))	Temperature (°C)	Flow Rate (MMSCMD)
1	SV-01 @ 12.8 km	29.99	0 to 55	0.07
2	SV-02 @ 28.8 km	29.98	0 to 55	0.07
3	SV-03 @ 52.8 km	29.96	0 to 55	0.07
4	SV-04 @ 76.8 km	29.94	0 to 55	0.07
5	SV-05 @ 100.8 km	29.93	0 to 55	0.07
6	IP Station @ 124.8 km	29.90	0 to 55	0.07
7	SV-06 @ 140.8 km	29.89	0 to 55	0.07
8	SV-07 @ 164.8 km	29.87	0 to 55	0.07
9	SV-08 @ 174.4 km	29.86	0 to 55	0.07

D. SV Stations for Dimapur – Kohima – Imphal Pipeline △ D1

Sr. No.	SV Stations	Pressure (kg/cm ² (g))	Temperature (°C)	Flow Rate (MMSCMD)
1	SV-01 @ 16 km	36.99 - 36.96	0 to 55	0.07 – 0.15
2	SV-02 @ 32 km	36.98 - 36.92	0 to 55	0.07 – 0.15
3	SV-03 @ 48 km	36.97 - 36.89	0 to 55	0.07 – 0.15
4	SV-04 @ 72 km	36.96 - 36.83	0 to 55	0.07 – 0.15
5	SV-05 @ 88 km	36.95 - 36.79	0 to 55	0.07 – 0.15
6	SV-06 @ 103.6 km	36.94 - 36.75	0 to 55	0.07 – 0.15
7	IP Station @ 119.6 km	36.92 - 36.67	0 to 55	0.07 – 0.15
8	SV-07 @ 135.6 km	36.91 - 36.64	0 to 55	0.07 – 0.15
9	SV-08 @ 151.6 km	36.90 - 36.60	0 to 55	0.07 – 0.15
10	SV-09 @ 167.6 km	36.89 - 36.56	0 to 55	0.07 – 0.15
11	SV-10 @ 183.6 km	36.88- 36.52	0 to 55	0.07 – 0.15

9.0 FACILITIES REQUIRED

9.1 Facilities under this project for Siliguri – Gangtok Pipeline shall broadly consist of the following.

➤ **Tap-off Point: Dispatch Station at Siliguri**

- Creation of 12" tap off through tee, flange, valve etc. on GAIL'S BGPL tap-off point at Siliguri.
- Permanent Pig Launcher facility.
- Future provision for Check Metering Skid
- Future provision for KOD and Filter Separator
- Actuated valves (GOOV) type for pipeline isolation.
- Insulating Joint (IJ) for underground/above ground section of pipeline.

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- **Pipeline:**
 - Laying of 12" x 186 km (600#), from tap-off to Pig Receiver at Gangtok Receiving Terminal.
- **SV Station:**
 - 08 numbers complete SV Station having GOOV type actuated valve.
 - Provisions & creation of future pipe tap-offs from pipeline.
 - SV Valves shall be installed underground with rising stem.
- **Intermediate Pigging Station at Lava:**
 - One number complete IP Station having GOOV valve actuated type.
 - Permanent Pig Launcher and Receiver facility.
 - Provisions & creation of future pipe tap-offs from pipeline.
 - Future provision for Check Metering Skid.
 - Insulating Joint (IJ) for underground / above ground section of pipeline.
- **Receipt Terminal at Gangtok:**
 - Permanent Pig Receiver facility
 - Actuated valves (GOOV) type for pipeline isolation
 - Insulating Joint (IJ) for underground / above ground section of pipeline.
- **Civil Work:**
 - Structural work, paving, foundations, gate fencing for the terminal etc.
- **Telecom:**
 - OFC based system telecom system has been considered.
- **Future Tap-off:**
 - Provision for future tap-off shall be provided.
- **Exclusion:** Heater etc.

9.2 Facilities under this project for Dimapur – Kohima - Imphal shall broadly consist of the following.

- **Tap-off Point: Dispatch Station at Dimapur**
 - Creation of 12" tap off through tee, flange, valve etc. on tap-off point at Dimapur.
 - Permanent Pig Launcher facility.
 - Future provision for Check Metering Skid.
 - Actuated valves (GOOV) type for pipeline isolation.
 - Insulating Joint (IJ) for underground/above ground section of pipeline.
- **Pipeline:**
 - Laying of 12" x 199 km (600#), from tap-off to Pig Receiver at Imphal Receiving Terminal.

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- **SV Station:**
 - 10 numbers complete SV Station having GOOV type actuated valve.
 - Provisions & creation of future pipe tap-offs from pipeline.
 - SV Valves shall be installed underground with rising stem.
- **Intermediate Pigging Station at Tadubi:**
 - One number complete IP Station having GOOV valve actuated type.
 - Provisions & creation of future pipe tap-offs from pipeline.
 - Permanent Pig Launcher and Pig Receiver facility.
 - Future provision for Check Metering Skid.
 - Insulating Joint (IJ) for underground / above ground section of pipeline
- **Receipt Terminal at Imphal:**
 - Permanent Pig Receiver facility
 - Actuated valves (GOOV) type for pipeline isolation
 - Insulating Joint (IJ) for underground/above ground section of pipeline.
- **Civil Work:**
 - Structural work, paving, foundations, gate fencing for the terminal etc.
- **Telecom:**
 - OFC based system telecom system has been considered.
- **Future Tap-off:**
 - Provision for future tap-off shall be provided.
- **Exclusion:** Heater etc.

10.0 UTILITY REQUIREMENTS

Relevant utilities required for the above shall be available at the battery limit.

- Nitrogen shall be arranged in bottles with regulators for purging etc.
- Suitable packaged drinking water shall be provided & outsourced during operation, if manned facility is envisaged.
- Utility water shall be arranged through water tanker for flushing purpose as & when required during maintenance.

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
11.0 METEOROLOGICAL DATA

Sr. No.	Location	°C (min)	°C (max)
1	Gangtok	05	25
2	Nagaland	10	35

12.0 PROCESS FACILITIES ENVISAGED AT SILIGURI TAP-OFF POINT

12.1 PIG LAUNCHER

A permanent Pig launcher shall be installed to facilitate the pigging operation of the Pipeline. The Pig trap shall be suitable for all types of Pigging Operations, including Intelligent Pigging of the Pipeline. The Pig Traps shall be designed based on the following design criteria:

LOCATION	SILIGURI TAP-OFF
Tag No.	DT/SGPL-001
Total Quantity	1 No.
Size (Major/Minor)	18" / 12"
MOC	Carbon Steel
Operating Pressure	30 Kg/cm ² (g)
Operating Temperature	0 to 55 °C 
Corrosion Allowance	3 mm
Design Pressure	92 Kg/cm ² (g)
Design Temperature	-29 / 65 °C
Design Code	ASME B31.8/ASME VIII, Div1

Launching operation shall be handled manually by Operators and not depending on full automation of the process. Operators shall manually open and close the Valves to launch, load, receive, and retrieve the scrapers. Pigging operations involves coordination of Station Bypass Valve and kicker line Valve operations (opening, throttling, closing) such that pigs launch successfully and arrive safely without damaging themselves or the trap equipment.

13.0 PROCESS FACILITIES ENVISAGED AT SV STATION

13.1 Sectionalizing Valve (SV)

Sectionalizing valve is provided at suitable spacing for the purpose of isolating the pipeline for maintenance and for response to operating emergencies in line with the requirements of PNGRB, ASME-31.8 and OISD 226 regulations.

Sectionalizing valves shall be installed underground. It is gas over oil operated (GOOV), Fail to Stay-put and full-bore type to facilitate the pigging operation. Pressure and Temperature transmitters / sensors have been provided to monitor pipeline integrity with the help of SCADA.

The facility is designed for remote operations and control from the Pipeline operation centers via the SCADA System. During steady state operations, the GOOV valve shall be remotely operated under the supervision and control of the SCADA System.

However, local control capability allowing the site operator to control or isolate the valve shall also be available. Switching from Remote to Local or back shall not affect the process.

The operator shall be permitted via software / Hand switches to put GOOV Valves in Local (Manual, Hand) or Remote mode. The Changes in the control mode shall raise alarms in the SCADA. Remote mode shall accept commands from the SCADA through Station RTU and Operators shall control them via the SCADA HMI's. Local (or manual) mode shall not be available for remote control and shall be supervised by personnel present on site.


Welded Thermopad is provided on the depressurization line up-stream of blow down valve to monitor the metal surface temperature of the pipeline during emergency venting.

14.0 PROCESS FACILITIES ENVISAGED AT IP STATION LAVA

14.1 PIG LAUNCHER

A permanent Pig launcher shall be installed to facilitate the pigging operation of the Pipeline. The Pig trap shall be suitable for all types of Pigging Operations, including Intelligent Pigging of the Pipeline. The Pig Traps shall be designed based on the following design criteria:


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LOCATION	LAVA
Tag No.	IP/SGPL-1602
Total Quantity	1 No.
Size (Major/Minor)	18" / 12"
MOC	Carbon Steel
Operating Pressure	30 Kg/cm2(g)
Operating Temperature	0 to 55 °C 
Corrosion Allowance	3 mm
Design Pressure	92 Kg/cm2(g)
Design Temperature	-29 / 65 °C
Design Code	ASME B31.8/ASME VIII, Div1

Launching operation shall be handled manually by Operators and not depending on full automation of the process. Operators shall manually open and close the Valves to launch, load, receive, and retrieve the scrapers. Pigging operations involves coordination of Station Bypass Valve and kicker line Valve operations (opening, throttling, closing) such that pigs launch successfully and arrive safely without damaging themselves or the trap equipment.

14.2 PIG RECEIVER

A permanent Pig Receiver shall be installed to facilitate the pigging operation of the Pipeline. The Pig trap shall be suitable for all types of Pigging Operations, including Intelligent Pigging of the Pipeline. The Pig Traps shall be designed based on the following design criteria:

LOCATION	LAVA
Tag No.	IP/SGPL-1601
Total Quantity	1 No.
Size (Major/Minor)	18" / 12"
MOC	Carbon Steel
Operating Pressure	30 Kg/cm2(g)
Operating Temperature	0 to 55 °C 
Corrosion Allowance	3 mm
Design Pressure	92 Kg/cm2(g)
Design Temperature	-29 / 65 °C
Design Code	ASME B31.8/ASME VIII, Div1


Receiving operation shall be handled manually by Operators and not depending on full automation of the process. Operators shall manually open and close the Valves to launch, load, receive, and retrieve the scrapers. Pigging operations involves coordination of Station Bypass Valve and kicker line Valve operations (opening,

throttling, closing) such that pigs receive successfully and arrive safely without damaging themselves or the trap equipment.

15.0 PROCESS FACILITIES ENVISAGED AT GANGTOK RECEIPT STATION

15.1 PIG RECEIVER

A permanent Pig Receiver shall be installed to facilitate the pigging operation of the Pipeline. The Pig trap shall be suitable for all types of Pigging Operations, including Intelligent Pigging of the Pipeline. The Pig Traps shall be designed based on the following design criteria:

LOCATION	GANGTOK
Tag No.	RT/SGPL-2001
Total Quantity	1 No.
Size (Major/Minor)	18" / 12"
MOC	Carbon Steel
Operating Pressure	30 Kg/cm ² (g)
Operating Temperature	0 to 55 °C 
Corrosion Allowance	3 mm
Design Pressure	92 Kg/cm ² (g)
Design Temperature	-29 / 65 °C
Design Code	ASME B31.8/ASME VIII, Div1


Receiving operation shall be handled manually by Operators and not depending on full automation of the process. Operators shall manually open and close the Valves to launch, load, receive, and retrieve the scrapers. Pigging operations involves coordination of Station Bypass Valve and kicker line Valve operations (opening, throttling, closing) such that pigs receive successfully and arrive safely without damaging themselves or the trap equipment.

16.0 PROCESS FACILITIES ENVISAGED AT DIMAPUR DISPATCH STATION

16.1 PIG LAUNCHER

A permanent Pig launcher shall be installed to facilitate the pigging operation of the Pipeline. The Pig trap shall be suitable for all types of Pigging Operations, including Intelligent Pigging of the Pipeline. The Pig Traps shall be designed based on the following design criteria:

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LOCATION	DIMAPUR
Tag No.	DT/DIPL-3401
Total Quantity	1 No.
Size (Major/Minor)	18" / 12"
MOC	Carbon Steel
Operating Pressure	37 Kg/cm ² (g)
Operating Temperature	0 to 55 °C 
Corrosion Allowance	3 mm
Design Pressure	92 Kg/cm ² (g)
Design Temperature	-29 / 65 °C
Design Code	ASME B31.8/ASME VIII, Div1

Launching operation shall be handled manually by Operators and not depending on full automation of the process. Operators shall manually open and close the Valves to launch, load, receive, and retrieve the scrapers. Pigging operations involves coordination of Station Bypass Valve and kicker line Valve operations (opening, throttling, closing) such that pigs launch successfully and arrive safely without damaging themselves or the trap equipment.

17.0 PROCESS FACILITIES ENVISAGED AT SV STATION

17.1 Sectionalizing Valve (SV)

Sectionalizing valve is provided at suitable spacing for the purpose of isolating the pipeline for maintenance and for response to operating emergencies in line with the requirements of PNGRB, ASME – 31.8 and OISD 226 regulations.

Sectionalizing valves shall be installed underground. It is gas over oil operated (GOOV), Fail to Stay-put and full-bore type to facilitate the pigging operation. Pressure and Temperature transmitters / sensors have been provided to monitor pipeline integrity with the help of SCADA.

The facility is designed for remote operations and control from the Pipeline operation centers via the SCADA System. During steady state operations, the GOOV valve shall be remotely operated under the supervision and control of the SCADA System.

However, local control capability allowing the site operator to control or isolate the valve shall also be available. Switching from Remote to Local or back shall not affect the process.

The operator shall be permitted via software / Hand switches to put GOOV Valves in Local (Manual, Hand) or Remote mode. The Changes in the control mode shall raise

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
alarms in the SCADA. Remote mode shall accept commands from the SCADA through Station RTU and Operators shall control them via the SCADA HMI's. Local (or manual) mode shall not be available for remote control and shall be supervised by personnel present on site.

Welded Thermopad is provided on the depressurization line up-stream of blow down valve to monitor the metal surface temperature of the pipeline during emergency venting.

18.0 PROCESS FACILITIES ENVISAGED AT IMPHAL RECEIPT STATION

18.1 PIG RECEIVER

A permanent Pig Receiver shall be installed to facilitate the pigging operation of the Pipeline. The Pig trap shall be suitable for all types of Pigging Operations, including Intelligent Pigging of the Pipeline. The Pig Traps shall be designed based on the following design criteria:

LOCATION	IMPHAL
Tag No.	RT/DIPL-4601
Total Quantity	1 No.
Size (Major/Minor)	18" / 12"
MOC	Carbon Steel
Operating Pressure	37 Kg/cm ² (g)
Operating Temperature	0 to 55 °C 
Corrosion Allowance	3 mm
Design Pressure	92 Kg/cm ² (g)
Design Temperature	-29 / 65 °C
Design Code	ASME B31.8/ASME VIII, Div1

Receiving operation shall be handled manually by Operators and not depending on full automation of the process. Operators shall manually open and close the Valves to launch, load, receive, and retrieve the scrapers. Pigging operations involves coordination of Station Bypass Valve and kicker line Valve operations (opening, throttling, closing) such that pigs receive successfully and arrive safely without damaging themselves or the trap equipment.


19.0 PROCESS FACILITIES ENVISAGED AT IP STATION TADUBI

19.1 PIG LAUNCHER

A permanent Pig launcher shall be installed to facilitate the pigging operation of the Pipeline. The Pig trap shall be suitable for all types of Pigging Operations, including

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
Intelligent Pigging of the Pipeline. The Pig Traps shall be designed based on the following design criteria:

LOCATION	TADUBI
Tag No.	IP/DIPL-4102
Total Quantity	1 No.
Size (Major/Minor)	18" / 12"
MOC	Carbon Steel
Operating Pressure	37 Kg/cm ² (g)
Operating Temperature	0 to 55 °C 
Corrosion Allowance	3 mm
Design Pressure	92 Kg/cm ² (g)
Design Temperature	-29 / 65 °C
Design Code	ASME B31.8/ASME VIII, Div1

Launching operation shall be handled manually by Operators and not depending on full automation of the process. Operators shall manually open and close the Valves to launch, load, receive, and retrieve the scrapers. Pigging operations involves coordination of Station Bypass Valve and kicker line Valve operations (opening, throttling, closing) such that pigs launch successfully and arrive safely without damaging themselves or the trap equipment.

19.2 PIG RECEIVER

A permanent Pig Receiver shall be installed to facilitate the pigging operation of the Pipeline. The Pig trap shall be suitable for all types of Pigging Operations, including Intelligent Pigging of the Pipeline. The Pig Traps shall be designed based on the following design criteria:

LOCATION	TADUBI
Tag No.	IP/DIPL-4101
Total Quantity	1 No.
Size (Major/Minor)	18" / 12"
MOC	Carbon Steel
Operating Pressure	37 Kg/cm ² (g)
Operating Temperature	0 to 55 °C 
Corrosion Allowance	3 mm
Design Pressure	92 Kg/cm ² (g)
Design Temperature	-29 / 65 °C
Design Code	ASME B31.8/ASME VIII, Div1

Receiving operation shall be handled manually by Operators and not depending on full automation of the process. Operators shall manually open and close the Valves to



launch, load, receive, and retrieve the scrapers. Pigging operations involves coordination of Station Bypass Valve and kicker line Valve operations (opening, throttling, closing) such that pigs receive successfully and arrive safely without damaging themselves or the trap equipment.

20.0 SCADA

The pipeline and end user stations shall normally be remotely monitored from the SCADA system in Master Control Station (MCS), and RWS (Remote Work Station). The SCADA system shall accommodate both local and remote control functions as well as data storage and trending.

All Station RTU will be integrated with SCADA system at Central control room. All operating equipment will normally be controlled by RTU programming, with set-points adjustable from SCADA. A control room with Local Control Panel shall be provided for use in the event of failure of the Master Control Room.

In addition, Fire and Leak detection system shall be provided at all stations. Real time leak detection system integral with SCADA will be provided.

21.0 PRESSURE SAFETY DEVICES

Any equipment / skids containing Natural Gas in the form of trapped volume shall be protected against excessive pressure developed due to rise in surrounding temperature by installing suitable safety relief valves. Pressure safety valves of sufficient capacity and sensitivity and other safety devices / system (as applicable) shall be installed to ensure that the pressure inside the system / equipment does not exceed the prescribed limits.

For all critical equipment like Pig Launcher and Receiver, the PSV shall be set for Fire case.

All such safety relief valves shall have lock open type isolation valve upstream of relief valve.

22.0 VENT LINES

Vent line shall be designed and installed to vent out the gas from relief valves, if provided, to atmosphere. Blow down piping connected to vent line should extend to location where the discharge of gas shall not create a hazard to the station or the surrounding area.

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The Blow Down system shall be designed in accordance with the requirements of applicable codes / industry standard. Pipeline specifications for the same shall be normal carbon steel.

The discharge from safety valve shall be vented vertically upwards to atmosphere at an elevation of 3 meter (minimum) above working level or the tallest structure within a radius of 15 meters whichever is higher for effective dispersion of hydrocarbons.

23.0 GAS QUALITY SPECIFICATIONS

Sr. No.	Parameters	Limit
1	Hydrocarbons Dew Pt. (Degree Celsius, max.)*	0
2	Water Dew Pt. (Degree Celsius, max.)*	0
3	Hydrogen Sulphide (ppm by wt. max.)	5
4	Total Sulphur (ppm by wt. max.)	10
5	Carbon dioxide (mole % max.)	6
6	Total Inerts (mole %)	8
7	Temperature (Degree Celsius, max.)	55
8	Oxygen (% mole vol. max.)	0.2

* At the pipeline operating pressure.

24.0 INLET GAS COMPOSITION

Natural Gas Composition

Sr. No.	Components	Mole %
1	Methane	98.34
2	Ethane	1.50
3	Propane	0.02
4	i-Butane	0.00
5	n-Butane	0.00
6	i-Pentane	0.00
7	n-Pentane	0.00

8	n-Hexane	0.00
9	CO ₂	0.02
10	Nitrogen	0.12

25.0 SITE CONDITIONS

Sr. No.	Parameters	Limit
1	Max / Min. Temperature	35 / 5 °C
2	Design Temperature	-29 to 65 °C
3	Relative Humidity	90%
4	Altitude above Sea level	Up to 1000 Meters
5	Atmospheric pollution	Designed to withstand the site conditions, dust, vapour, Industrial Gases
6	Hazardous Area Classification	Zone-2, Gas group IIA, IIB, for Temp. Class T3
7	Control Room/ Electrical room/ D.G. Room/Guard	Safe Area

26.0 LIST OF STANDARDS

Pipeline Codes and Standards

a) Petroleum and Natural Gas Regulatory Board

b) American Society of Mechanical Engineers (ASME)

ASME B31.8	: Gas Transmission and Distribution Piping System
ASME B16.25	: Gas Transmission and Distribution Piping System
ASME B16.9	: Factory – Made Wrought Iron Steel Butt-Welding Fittings
ASME B31.3	: Process Piping
ASME B31.4	: Pipeline Transportation System for Liquid Hydrocarbons and others

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ASME B16.5	: Pipe Flanges and Flanged Fittings
ASME B16.9	: Factory Made Wrought Steel Butt Welding Fittings
ASME B16.10	: Face to Face and End to End – Dimensions of Valves
ASME B16.11	: Forged Fittings, Socket-Welding and Threaded
ASME B16.20	: Metallic Gaskets for Pipe Flanges – Ring Joint, Spiral Wound and Jacketed.
ASME B16.21	: Non-Metallic Flat Gaskets for Pipe Flanges
ASME B16.25	: Butt Welding Ends
ASME B16.28	: Wrought Steel Butt Welding Short Radius Elbows
ASME B16.34	: Valves – Flanged, Threaded & Welding Ends
ASME B16.36	: Orifice Flanges
ASME B16.47 Series "A"	: Large Diameter Steel Flanges NPS 26 through NPS 60
ASME B18.2.1	: Square and Hex. Bolts and Screws
ASME B18.2.2	: Square and Hex. Nuts
ASME B31.3	: Process Piping
ASME B36.10M	: Welded and Seamless Wrought Steel Pipe
ASME Boiler & Pressure: Section-IX	: Qualification standard for welding and Brazing Vessel Code procedures, welders, brazes, and welding and brazing operators
ASME Boiler & Pressure: Part C	: Specifications for Welding Rods, Electrodes, Vessel Code-II and Filter Metals
ASME Boiler & Pressure: Section-V	: Nondestructive Examination Vessel Code
ASME Boiler & Pressure : Section-II Materials Part A	: Ferrous Materials Vessel Code Specifications

c) American Petroleum Institute (API)

API Spec 5L	: Specification for Line Pipe
API RP 1102	: Recommended Practice for Liquid Petroleum Pipelines Crossing Railroads and Highways
API Std 1104	: Standard for Welding Pipeline and Related Facilities
API RP 1110	: Recommended Practice for the Pressure Testing of Liquid Petroleum Pipelines
API Std 607	: Fire Test for Soft Seated Quarter Turn Valves

API RP 500	: Recommended practice for classification of locations of Electrical installations at Petroleum Facilities classified as Class I, Div. 1 and 2.
Spec 6FA	: Specification for Fire Test for Valves
STD 590	: Steel Line Blanks
STD 594	: Check Valves, Wafer, Wafer Lug and Double Flanged Type
STD 598	: Valve Inspection and Testing
STD 600	: Steel Gate Valves Flanged or Butt Welding Ends, Bolted and Pressure Seal Bonnets
STD 602	: Compact Steel Gate Valves – Flanged, Threaded, Welding and Extended Body Ends.
STD 607	: Fire Test for Soft-Seated Quarter-Turn Valves

d) British Standard Institute (BSI)

BS1868	: Steel Check Valve (Flanged and Butt-Welding Ends) for Petroleum, Petro-Chemical and Allied Industries
BS1873	: Steel Globe, Globe Stop and Check Valves (Flanged and Butt Welding Ends) for the Petroleum, Petrochemical and Allied Industries
BS5154	: Copper Alloy Globe, Globe Stop and Check, Check and Gate Valves
BS5351	: Steel Ball Valves for Petroleum, Petrochemical and Allied Industries
BS5352	: Steel Wedge Gate, Globe and Check Valves 50mm and Smaller for Petroleum, Petro-Chemical and Allied Industries
BS6755 Part-I	: Testing of Valves Part-1 : Production Pressure Testing Requirements
BS6755 Part-2	: Testing of Valves Part-2 : Specification for Fire Type Testing Requirements.
EN 288-9	: Specification and approval of welding procedures for metallic materials – part 9. Welding procedure test for pipeline welding on land and offshore site butt-welding of transmission pipeline

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NDB EN 1594	: Gas supply systems – pipeline for maximum operating pressure over 16 bar – Functional requirements
NBN EN 10208-2	: Steel pipes for pipelines for combustible fluids – Technical delivery conditions - Part 2
ISO-15590-1	: International Standard for Petroleum and natural gas industries – Induction bends, fittings and flanges for pipeline transportation systems
DIN 30672	: Coatings of corrosion protection tapes and heat-shrinking products for pipelines for operational temperatures up to 50°C
SEL 072 – 1 st Edition	: Ultrasonically tested heavy plate
DIN 20670	: Polyethylene coatings for steel pipes and fittings
DIN 2413 Part-II	: Design of steel bends used in pressure pipelines
ISO/TR 5168	: Measurement of fluid flow-Evaluation of uncertainties

e) Oil Industry Safety Directorate (OISD Standards)

OISD-GDN-115	: Guidelines on Fire Fighting, Equipment and appliances in Petroleum Industry
Fire Protection Manual	: Fire Engines, Trailer Pumps and Hydrant Systems - TAC
OISD-Standard-141	: Design and construction requirements for cross country hydrocarbon pipelines
OISD-Standard-226	: Natural Gas Transmission Pipelines & City Gas Distribution Networks
OISD-Standard-118	: Layouts for oil and gas installations

f) American Society for Testing and Materials (ASTM)

ASTM A82	: Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A185	: Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM E92	: Standard Test Method for Vickers Hardness Testing of Metallic Materials
ASTM E94	: Standard Practice for Radiographic Testing

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|-----------|---|--|
| ASTM E165 | : | Standard Practice for Liquid Penetrate Inspection Method |
| ASTM E709 | : | Standard Guide for Magnetic Particle Examinations |

g) MSS Standard Practices

- | | | |
|-----------|---|--|
| MSS SP 75 | : | Specification for High Test Wrought Welding Fittings |
|-----------|---|--|

h) Manufacturers Standardization Society (MSS)

- | | | |
|-----------|---|--|
| MSS-SP-6 | : | Standard Finishes for Contact Faces |
| MSS-SP-9 | : | Spot Facing for Bronze, Iron and Steel Flanges |
| MSS-SP-25 | : | Standard Marking Systems for Valves, Fittings, Flanges and Union |

27.0 REFERENCES

- Detailed Feasibility Report for Development of Natural Gas Pipeline Grid in North-East for M/s IGGL Rev 00.

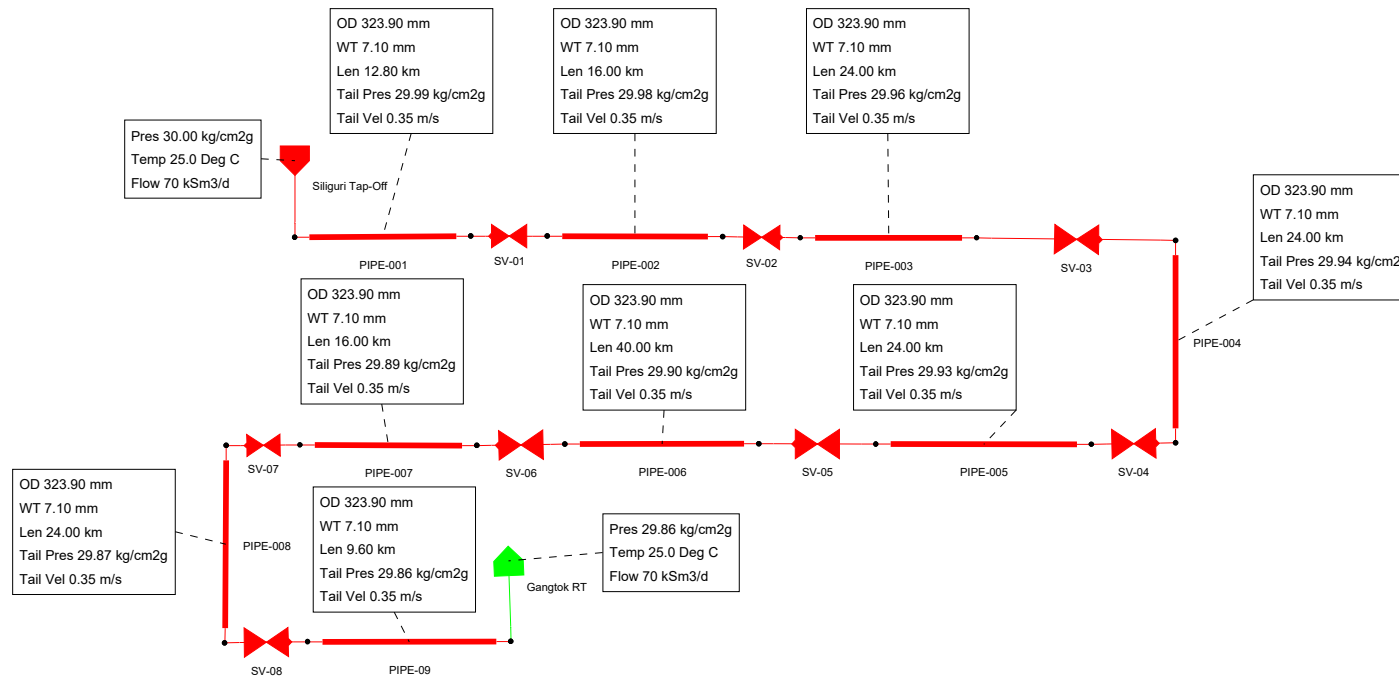


ANNEXURE – 1

SIMULATION FOR SILIGURI-GANGTOK PIPELINE AT 0.07 MMSCMD

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SILIGURI - GANGTOK PIPELINE

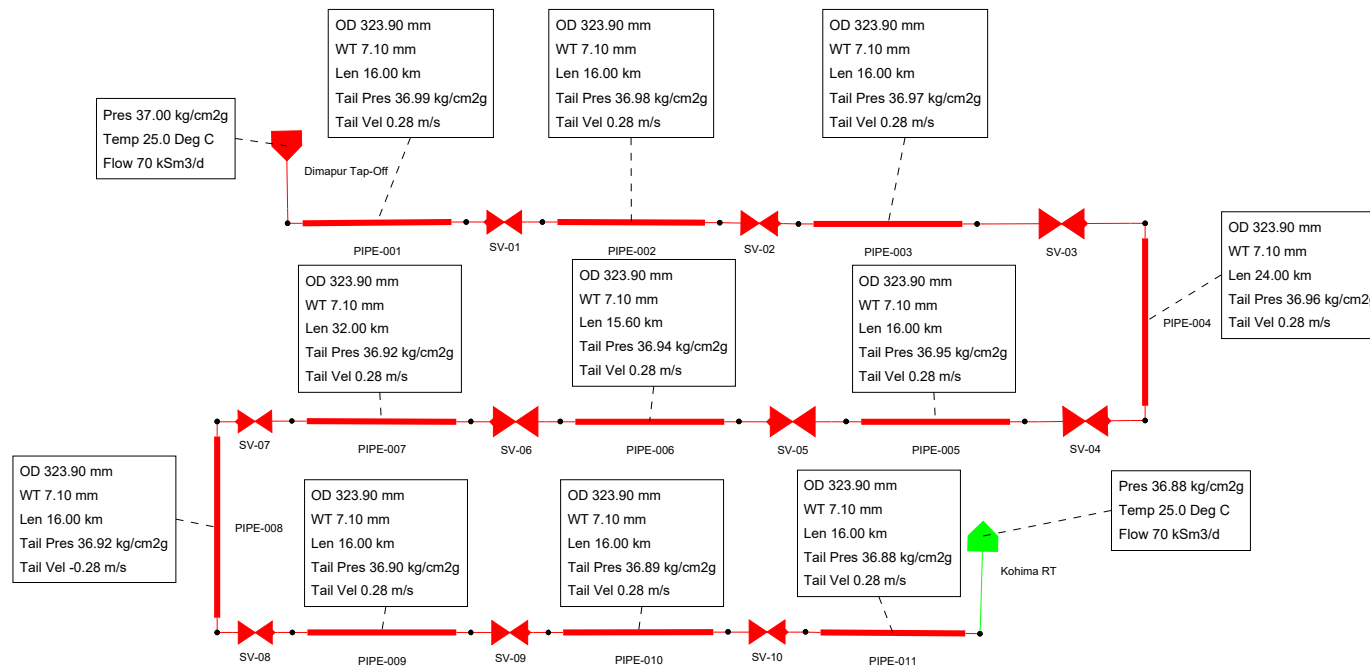




ANNEXURE – 2

SIMULATION FOR DIMAPUR-IMPHAL PIPELINE AT 0.07 MMSCMD

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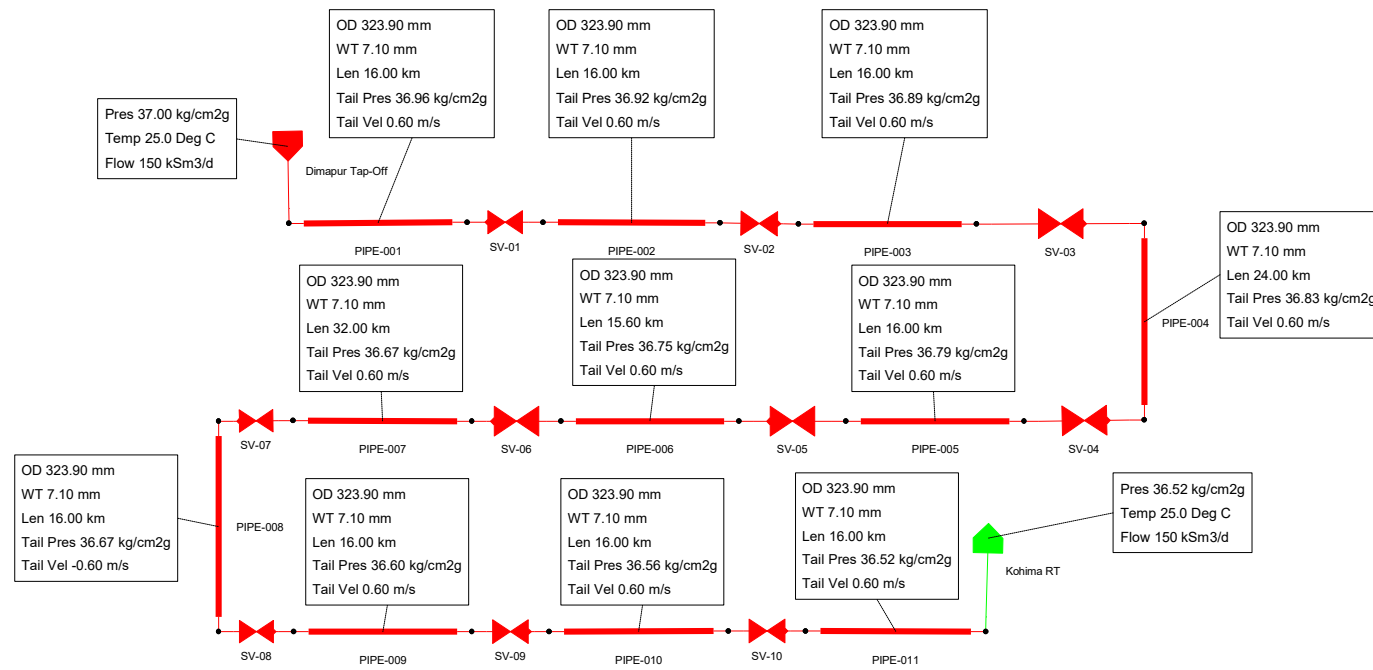
DIMAPUR - IMPHAL PIPELINE AT 0.07 MMSCMD



ANNEXURE – 3

SIMULATION FOR DIMAPUR-IMPHAL PIPELINE AT 0.15 MMSCMD

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DIMAPUR - IMPHAL PIPELINE AT 0.15 MMSCMD

SECTION - VII
SCHEDULE OF RATES
Attached Separately