

TECHNICAL BID DOCUMENT

FOR

GIS DATA CREATE, CAPTURE, DEVELOP AND UPDATE LAND & GAS FEATURES

IN GGL GIS DATABASE

(Compatible to ESRI ARC GIS Products)

Rev. No	Revision Description	Date of Issue
0		13.10.2025

ABBREVIATIONS:

- AOI : Area of Interest
- CNG : Compressed Natural Gas
- PGDB: Personal Geo-database
- NDA: Non-disclosure agreement
- GGL : Gujarat Gas Limited
- GIS: Geographical Information System
- GPS: Global Positioning System
- SQKM (KM2): Square kilometre
- NTS : Not To Scale
- PPE: Personal Protective equipment
- HSE: Health Safety & Environment
- DGPS: Differential Global Positioning System
- GCP: Ground Control Points
- DP: Distribution Point
- IJ: Insulating Joint
- TLP: Test Lead Point
- TRU: Transformer Rectifier Unit
- PRS: Pressure Reduction Station
- EA: Each
- CPBG : Performance Bank Guarantee
- CO- Contract Owner

DETAILS OF SERVICES:

Create, capture, develop and update Land and Gas features including mapping customer with Distribution points/details in GGL's GIS database for the Geographic area of GGL across Gujarat, UT (D&NH), Maharashtra, Rajasthan, Madhya Pradesh, Punjab and Haryana States.

List of Geographic Area:

1. Ahmedabad (Rural) area of Ahmedabad district in Gujarat State
 2. Valsad district in Gujarat State
 3. UT of D&NH
 4. Navsari district in Gujarat State
 5. Surat-Tapi district including Hazira in Gujarat State
 6. Bharuch district including Dahej_Vagra_Taluka in Gujarat State
 7. Narmada (Rajpipala) district in Gujarat State
 8. Bhavnagar district in Gujarat State
 9. Botad district in Gujarat State
 10. Amreli district in Gujarat State
 11. Gandhinagar area of Gandhinagar district in Gujarat State
 12. Chandkheda (Ahmedabad) area in Gujarat State
 13. Surendranagar district in Gujarat State
 14. Morbi district in Gujarat State
 15. Kutchh (w) of Kutchh district in Gujarat State
 16. Jamnagar & Dev Bhoomi Dwarka district in Gujarat State
 17. Rajkot district in Gujarat State
 18. Nadiad district in Gujarat State
 19. Anand (Rural) area of Anand district in Gujarat State
 20. Panchmahal district in Gujarat State
 21. Dahod district in Gujarat State
 22. Palghar district & Thane rural area in Maharashtra State
 23. Ferozepur, Faridkot and Sri Muktsar Sahib districts in Punjab state
 24. Hoshiarpur & Gurdaspur districts in Punjab state
 25. Sirsa, Fatehabad and Mansa districts in Punjab & Haryana state
 26. Jalor & Sirohi districts in Rajasthan state
 27. Dungarpur, Banswara, Ratlam and Jhabua districts in Rajasthan and MP state
 28. Ujjain, Devas & Indore (Rural) area of Ujjain, Devas & Indore districts in MP state
 29. Amritsar district in Punjab State
 30. Bhatinda district in Punjab State.
- Collect GCPs based on the requirements by using dual frequency GPS (DGPS) Instruments from field and Geo-referencing of High resolution Satellite Image before using for creating vector/base map of respective locations/area/scene.
 - Create and Develop vector/base map from the Geo-referenced High Resolution Satellite Images. Vender shall submit vector/ base map to GGL for QA/QC along with the corresponding Geo-referenced High Resolution Satellite Image prior to start the field survey.

- Carry out Field survey to collect land use details/attribute and develop Landbase data as per GGL's GIS schema/model.
- Use dual frequency GPS instruments (DGPS) to collect GCP's of above ground Gas features and mapping in GIS database as identified and directed by GGL
- Manual digitisation/inserting Gas pipeline network, above ground and underground Gas features with reference to as-built documents and drawings as per GGL's GIS schema/model.
- Field survey to capture the spatial position of distribution points (DPs) and validate the customer locations/address/name including mapping of above ground Gas Features (DP).
- Manual digitisation of service lines connecting DP with Distribution mains.
- Data integration and submission - Integration of spatial and non-spatial data of Land, Gas and Customer, convert in to PGDB (Personal Geo Database) compatible to GGL's ArcGIS –Arc FM Schema and submit to GGL for QA/QC (desk top & field Validation).
- Update data of Landbase and Gas network as well as Customer data according to feedback/errors received from GGL and re-submit to GGL for QA/QC
- Final submission and get approval/ acceptance from GGL for finalised data based on the criteria sets for quality and approval.
- **PROJECT DELIVERY PERIOD:**
 - The project shall be completed within the stipulated timeframe based on mutually agreed project plan/project data delivery schedule.
 - Monthly review meetings (other than routine meetings with project team) shall be attended by the key persons of contractor to discuss the constraints of the project.
 - The MOM (Minutes of Meeting) shall be recorded for such meetings and the project schedule may be revised by GGL considering valid constraints.
 - In case of contractor fails to complete the project deliverables as per defined timelines, GGL reserves right to assign part or full of the project delivery to other contractor. The consistent failure to project delivery attributed to Contractor shall lead to sever actions including termination of Contract.

1. SERVICE PROVIDER'S SCOPE OF WORK:

Contractor shall arrange their own hardware and software of whatsoever nature required for executing the work.

- GGL shall provide the AOI along with High Resolution Satellite Imagery data wherever available to contractor post submission of Non-disclosure agreement (NDA) duly signed & Seal (Notarised copy) to GGL. The format of NDA will be shared post award of contract.
- For areas/Locations where latest high resolution satellite image data is not available with GGL, vendor shall have to arrange/purchase high resolution Satellite Image and developed vector map with desire accuracy of 0.5 meter.
- Contractor shall identify/select numbers of GCPs based on SQKM of each scene of satellite Image and generate hard copies of image chips displaying numbers and tentative locations of GCPs. GCPs Selection and marking shall be done in consultation with GGL.

- Acquire GCPs and label/mark description of GCP (Refer **Annexure V**).
 - Exact Identification of point from image chip map and in field.
 - Acquisition of the coordinates for the point using GPS (High Accuracy- GPS equipment)
 - Data entry in the tabular form in GCP collection form
 - Quality Check of GCP
 - Apply differential correction, by using Temporary Base Station (to be set by Contractor) data with Field GCP data.
- Re-sampling and Rectification of image if needed (Geo-referencing of the satellite Image data) so as to develop geo-referenced and accurate vector maps.
- Quality Check of geo-referencing.
- Feature Extraction to create Landbase (vector/base) map
 - Set a rules of feature digitization process, considering line, point and polygon features in line with the GGL schema.
 - Ensure layer identifications, while feature interpretation and digitization process.
 - Generate unique Ids for the features.
 - Quality Checking of the digitized data.
 - Check that not a single feature is missed out and add the missing features (point, lines, polygons) if any
 - Check that the attribute identifiers of features are correct.
 - Add the missing attribute identifiers and correct the wrongly put attribute identifiers
 - Check for extra or double digitization, overshoots and undershoots (Topological errors).
 - Delete / remove the extra or double digitized features (topological errors) if any.
- Integration of sub-scene as per master reference grid in GIS platform
 - Checking of input data
 - Edge matching and Mosaicking of the Landbase data
 - Quality checking of the integrated data
 - When more than one layer / images are to be mosaic it shall be ensured that edge matching is carried out for the respective lines in the adjacent layers to avoid the shifts, before proceeding with the mosaicking.
 - In case of polygons, after mosaicking, the polygons with common data shall be dissolved / merged so as to maintain the integrity of the data across adjacent layers.
 - Quality check routines shall ensure that there is no data loss in the process of mosaicking.
 - There should not be any feature in the Geo-database not having UNIQUEID.

1..1 Vector map development:

1.1.1 Satellite image interpretation and Land feature data extraction procedure should be defined and to be shared with GGL in the kick-off meeting of the project.

1.1.2 Contractor shall purchase OR /and use the satellite Images to develop vector map of Land features for area of operation (AOI) proposed by GGL.

1.1.3 Create and develop vector map (digital map) from the high resolution Satellite Images

(Image shall be supplied by GGL OR procured/arranged by the Contractor) of the all available/ required Land features to be digitised as per the GGL GIS feature list - refer **Annexure-I** for List of Land features.

1.1.4 Vector data map scale shall be 1:1000

1.1.5 For digitisation of any missing Land feature-not available in the Satellite Image OR not clearly interpreted/extracted by editor during the digitisation process: Contractor shall inform GGL all such instances well in advance before digitisation. Such Landbase feature shall be digitised with following means:

- Contractor shall collect those feature with cross/relative references from the nearby permanent structures (measurements from surrounding features in field) and digitise manually based on the field inputs and set geometry to the correct geographic position in the available Data /map.
- Contractor shall collect GPS coordinates by using GPS instruments having accuracy not less than 0.5 Meter after post processing and shall set geometry to the correct geographic position in the available Data /map.
- Contractor shall capture image snap from any other reliable sources with desired accuracy at the scale of 1:1000; the scene/snap should be geo-referenced and geometry shall be set to the correct geographic position in the available data sheets/maps etc.

1.1.6 The placement of the new Land features shall digitised be according to the desired accuracy require to merged with available data/map - refer Data acceptance criteria set by GGL.

1.1.7 Vector data/map shall be geo-referenced and matching to the true topographical conditions and existing GIS data of GGL.

1.1.8 Use Projection system in consultation with GGL wherever required.

1.1.9 All Landbase feature List are as per **Annexure-I**

1.1.10 Geographical placement and relative accuracy shall be maintained of all Landbase features (Point, Line & Polygon features).

1.1.11 Unique IDs should be generated for all Landbase features digitised from Image in consultation with GGL to avoid duplication.

1.1.12 Create sub scene to the entire area of maps and divide in legible grid with key route map for better understanding of field staff.

1.1.13 Generate hard copy map in two sets (legible and easy to handle) of vector data for field survey.

1.2 Field survey and Data Updation activity:

1.2.1 Carry out field survey activity to collect attribute data / locational information of all the Land features digitised/available in vector maps. Refer **Annexure-I** for

Landbase features list.

- 1..2..2 Capture all attribute information of Landbase features including missing features (missing in vector map) from the field. For Landbase feature-all attribute data/information to be filled in appropriate field book format given by GGL, use relevant type/subtype and coded value for the particular features as per **Annexure-IV**.
- 1..2..3 Capture and update missing features (missing in digitised/developed vector map) from the field with attribute information, ensure the placement of missing features with relative accuracy from the surrounding features.
- 1..2..4 Carry out field survey for collecting the attribute and locational information of all above ground Gas features available in Gas Pipeline network drawings and data given by GGL.
i.e. Terminal Station, CGS, Valve chamber, TLP, TRU, CNG Station and Regulator Station by using DGPS as well as take cross references/measurement (minimum three references) to fix the field position of particular Gas feature in the Map and ensure all shall be connected with the Gas Pipeline network.
- 1..2..5 Contractor shall rectify the vector map based on the inputs & observation collected from/during field survey and develop the correct and accurate base map. Develop final updated base map integrating spatial and non-spatial data and convert to Geo-database formats (PGDB/FGDB) confirming to GGL ARCGIS –ARC FM 10X schema/model.
- 1..2..6 Carry out field survey for identifying and validating Distribution Point (DP) of the particular customer according to the Customer list given by GGL. Capture and mark actual position/location of Distribution Point with reference to Building, Boundary wall & gate in base map. Collect attribute information of that particular DP with corresponding building for which it has been placed. For Gas Features-all attribute data/information to be filled in the appropriate table available in Gas dataset, which will be provided by GGL in the form of ArcGIS –ARC FM Empty schema, post award of work order.
- 1..2..7 Carry out field surveys, validate and match the customer information – according to the list of customer provided by GGL with actual available data in field (for customer address-Plot/Flat/House No., street/road/society/apartment/building, DP & Building, customer name and customer IDs) and allot relevant Building ID & DP_ID to that particular customer in consultation with GGL team.
- 1..2..8 Carry out Mosaicking of all individual scenes/maps with proper edge matching tools and maintaining the harmony.
- 1..2..9 Update Land and Gas data (feature geometry and attribute) according to the data collected from the field (Use updated base map/vector maps, pre-described format/table/book given by GGL for capturing attribute information/data from

field) as well as corresponding annexures for type/sub-type and code value.

- 1..2..10 Manual digitisation of Gas Pipeline network including associated Gas (point, line and polygon) feature in the base map i.e. Fittings, IJ, Reg. Station, Valve Chamber, Valve, marker, PRS, DP, TLP, TRU, Bond wire etc. from Gas pipeline network drawing provided by GGL and information shall be collected from the field for designated above ground Gas Features.
- 1..2..11 Perform manual digitisation of Service lines to connect DP with Distribution Mains (shortest possible route/length) with appropriate fittings in base map by maintaining accuracy and attribute information to establish the seamless connectivity.
- 1..2..12 Maintain accuracy for placement of geometry (Line, Point and Polygon) and references mentioned in as-built drawings provided by GGL.
- 1..2..13 Submit Soft copy (GDB) in editable forms with attribute data sheet (.xls) to GGL for QA/QC. Also share corresponding source imageries with GGL team for validation of digitized vector maps in case the Satellite Image procured by Contractor.
- 1..2..14 Carry out final Updation of all Land data (feature geometry and attribute) according to / incorporating the feedback /inputs given by GGL.
- 1..2..15 Contractor has to get approval/acceptance - Ensure the data has been corrected according to / incorporating the field and inputs given by GGL, and maintain the desired level of accuracy (acceptance criteria) before converting to Geo-database.
- 1..2..16 All updated and integrated data to be converted in to Geo-Database and PGDB to be created using Arc GIS –ARC FM Data model/schema given by GGL.
- 1..2..17 Submit Data to GGL in PGDB formats compatible to ESRI Arc GIS-ARC FM 10X.

2. OWNER'S SCOPE OF SUPPLY:

GGL will provide below mentioned formats/details/drawings, post issuing the work order.

AOI - Area of interest for developing vector maps for the area of operation. Only the list of areas/Towns/Villages shall be provided by GGL. Contractor shall create/develop and update the actual boundary of Areas/locations.

- 2.1. High Resolution satellite Image (0.5 Mtr. OR better Archive Image) – Geo corrected according to Image supplier with AOI- Area of Interest Whenever available on case to case basis whenever available.
- 2.2. Arc GIS-ARC FM Empty Schema/Model with customer format for creating and developing

database (Land-Gas & Customer).

- 2.3. Location wise GA/CA details for reference
- 2.4. Customer data for Field validation and integration time to time
- 2.5. Gas Pipeline network drawings with allied Gas features time to time

3. CONTRACTOR'S SCOPE OF WORK/SUPPLY:

Contractor shall submit Project Methodology, Activity Flow Chart, Project Plan with Timeline along with Data delivery schedule, Project Team Structure, QA/QC plan (Internal), and Manpower details with applicable legal documents within a week from award of contract before commencement of work.

Contractor shall maintain the documents require for legal compliance during the project execution period.

Contractor shall submit weekly and Monthly progress report to GGL as per mutually agreed formats (format shall be shared by GGL).

3.1 Geo-referencing of High resolution Satellite Imagery data

The required projection parameters will be decided in consultation with GGL. The satellite image data has to be geo-referenced by using sufficient number of GCPs. The data has to be then transformed into the new co-ordinate system; the projection parameters have to be then added to the transformed coverage so as to make it compatible with other spatial database.

3.1.1 Guidelines and Accuracy Standards

- Identify common points on the image and map where the GCPs are to be located.
- To select GCPs the below listed priority shall be followed, and points shall be marked on field as well as on image Map:
 - Corners of building boundaries
 - Intersections of river/stream.
 - Intersection of roads.
 - Intersection of roads and rivers/ rails.
- Optimum numbers of GCP for Urban and Rural area shall be taken to generate the transformation model.
- The first Eight GCPs shall be taken at the edges of the data so as to have a very precise transformation mode. The remaining GCPs shall be well spread out on the map.
- The error contribution for each of the GCPs in X & Y shall be less than 2 meters.

3.1.2 Final Data

After the completion of geo-referencing, correction, cleaning, editing/updating & topology creation, the following shall be ensured before archiving the data and sending it to GGL.

- The final data shall be internally checked for topology by Contractor.
- The various layers in the data shall have unique feature id.
- The data shall be perfectly edge matched and mosaicked.
- Separate files for the individual area/city coverage's shall be submitted.

3.2 Digitisation/Vectorization and data Development (Vector map development):

The scope includes the digitisation and development of vector map from the high resolution satellite Image.

- If an Image of Land feature for the area/Society/location is/are unavailable or not updated in the available Satellite Image, contractor shall get the written confirmation for arranging those images from any other reliable sources.
- The base mapping shall be undertaken to digitize the Transport, Buildings, Hydro and other land feature as per **Annexure-I**. The resultant digital maps shall be plotted on the scale of 1:1000 as per the input image resolution and shall be in sync with the existing data in GGL GIS Database.
- Setting-up of Digitization tolerances:
 - Node Snap Tolerance
 - Arc Snap Tolerance
 - Vertices Tolerance
 - Fuzzy tolerance
- Digitization of Point feature:
 - Zoom the image in 1x and identify one point feature
 - Set the correct attribute identifiers
 - Add the point by clicking exactly on the centres of the feature
 - Pan and Zoom different areas and use above steps till all the points and the corresponding attribute identifiers are added
 - Save the digitized point feature class
- Digitization of Line feature
 - Zoom the map around in one corner of the map and identify the line feature to be digitized. Make sure that the zoom level is 1x.
 - Set the attribute identifiers
 - Add the line by following the centre of the line
 - Pan and Zoom different areas till all the lines and the corresponding attribute identifiers are added
 - Save the line feature class

- Digitization of Polygon feature
 - Zoom the map around in one corner of the map and identify the polygon feature to be digitized. Make sure that the zoom level is 1x.
 - Set the attribute identifiers.
 - Add the polygon by following the centre of the polygon line
 - Pan and Zoom different areas till all the polygons and the corresponding attribute identifiers are added
 - Save the polygon feature class.
- Quality Assurance and Quality Control
 - Ensure that not a single feature is missed. Add the missing features (point, lines, polygons) if any.
 - Ensure that the attribute identifiers added to the concerned features are correct. Add the missing attribute identifiers and correct the wrongly put attribute identifiers
 - Check for extra or double digitization and Delete the extra or double digitized features if any.

3.3 Field Survey for validation of spatial features & collection of attribute data for Landbase features:

- The survey team shall validate the Landbase features (vector map v/s field) including identifying the missing and new features not available in Vector Map developed from corresponding high resolution satellite images.
- The survey team shall collect the missing and new Landbase features along with the attribute data available in field at the time of field survey.
- The survey team shall have to collect the true geometry of Landbase features from the field.
- The survey team shall collect attribute data for all the spatial features as mentioned in **Annexure-I**.
- The field survey team shall use Landbase feature code / type & subtype list provided by GGL, and collect the attribute information according to the Feature ID printed on paper maps, particularly for the Buildings, Transport, Hydro and other features. Fill all the attribute information/data (feature wise) in pre-described field book formats provided by GGL – refer **Annexure III and Annexure IV**.
- Contractor team shall perform internal QA/QC – shall verify the records of Landbase spatial features and attributes as filled by their survey team and match the desired accuracy set by GGL
- Map Grid wise field books shall be maintained for better reconciliation and future records.
- The survey work shall be carried out by walking down the localities along with hard copy map at 1:1000 scale pertaining to particular Map Grid and documents like area wise customer list and field book formats to collect data.

- Every building of the locality shall be verified for filling up the required attribute as mentioned in the field book.
- All the roads (road centreline, road edge and pavement) in the surveyed area to be entered with the required details as mentioned in the field book.
- All other transport features in the locality surveyed to be entered with the required details as mentioned in the field book.
- All hydro features in the locality surveyed to be entered with the required details as mentioned in the field book.
- All other Landbase features i.e. park, vegetation, monuments, and wildlife sanctuaries, etc. within the locality surveyed to be entered with the required details as mentioned in the field book.

3.4 Field Survey for validation of spatial features & collection of attribute data for Gas Features:

- The survey team shall validate/capture the Gas features (above ground gas features) in the field for positional/ relative accuracy with reference (measured from field) to Landbase data. List of Gas features shall be available in the Gas Pipeline Network Drawings/data (AutoCAD/sketches-NTS) provided by GGL.
- The field survey team shall capture the exact location/position of DP with relative reference from Landbase features (i.e. Building, Boundary, pavement, Road, Road centreline etc...) and mark/identify the customer associated with corresponding DP. GGL will provide the list of customers.
- The survey team shall collect/capture the missing and new above ground gas features from the field with relative reference (measured from field) to Landbase feature.
- GGL team will support from the office for understanding the feature and verification of records/attribute data of all the gas network features on request OR if required.
- Contractor shall manually digitise/insert/plot the Gas Network data as per the hard / soft copy maps of as laid drawings/ sketches provided by GGL. No direct importing of gas network shall be possible since the as-built drawings are Not to scale drawings.

3.5 Landbase Features Updation Procedure:

- Data collected during the surveys – both spatial and non-spatial shall be updated on the base maps.
- Feature validation/Updation of Landbase features (geometry and attribute) shall be carried out based on the field survey input data.
- Add geometry (line, point and polygon) of new features captured during field survey using GPS coordinates.
- The data entry for each field book shall be carried out for attaching the attribute data with respect to feature ID.
- Cross verification shall be done between the survey team member to avoid the errors in feature/ Attribute.

- The attribute information shall be linked / joined to the spatial database after data entry. The attribute data shall be linked to the corresponding features e.g., the data collected for the use of the buildings and the other facilities available shall be linked to the building polygons and likewise for the other features.

3.6 Gas Pipeline Network Placement/Overlaying Procedure:

The feature placement rules are defined for placing the features in relation to Landbase and other gas features.

- Contractor shall manually place the line (For Gas network) exactly as per the dimension, distance and references on the drawing/map (as-built drawing) provided by GGL.
- All gas mains shall be compiled such that it is true to the shape of the pipe as defined in the source documents. This includes showing all fittings (i.e. Elbow, Tee, Reducer/Enhancer, Saddle, End Cap, Coupler etc.)
- Gas mains shall be broken at material changes, size changes, devices (controllable and non-controllable), fittings, Valves, Stations and pressure changes.
- Mains and services that crosses map sheet edges shall not be broken on the map edge. Do not place a vertex at the point that a linear feature crosses a map edge.
- Network assets e.g., pipe-to-pipe, pipe to plant/device/fittings etc., shall be geo-referenced (topologically placed) on Landbase map.
- Create Nodes for various apparatus like tees, elbows, pipe ends etc.
- Develop/update all the attribute information about all pipeline objects
- Create the geometric Network of all the pipeline network elements based on the rules.
- The Contractor shall submit all gas asset mapping data in a format compatible with Gujarat Gas Limited's (GGL) existing GIS database structure to enable direct integration without additional data conversion or modification. The Contractor shall deploy adequate and qualified manpower for field verification, identification, and confirmation of exact pipeline end locations and asset positions to ensure seamless connectivity between the newly mapped/extended network and the existing GIS network.
- The data submitted shall be complete in all respects, including all spatial and attribute information required for integration into GGL's GIS database, and shall adhere to the coordinate system, data schema, and accuracy parameters specified by GGL. Any mismatch, gap, or connectivity error observed during integration shall be rectified by the Contractor at no additional cost to GGL.

3.7 Data Finalisation and submission:

- Contractor shall carry out a Quality Checks of the integrated data to prevent any loss in data such as features, matching and attribute consistency across tiles.
- Contractor shall ensure all new features identified in the field survey shall be incorporated in the database/base map. Linking of the attribute database for these new features carried out from field

- Contractor shall ensure creating new unique ID which shall be incrementally generated for the features in line with the existing Landbase data provided by GGL.
- Contractor shall ensure Edge matching and mosaicking the sub-scenes as per the Master reference grid.
- Contractor shall submit grid/location/area wise base map along with the attribute list (.xls) or data developed in GIS Map in PGDB.

4. DATA QA/QC PROCEDURE AND DATA ACCEPTANCE:

The purpose of outlining QA/QC procedures is to ensure that the database created adheres to GGL's requirements and meets GGL's acceptance criteria. The objective of this section is to establish and maintain a set of concrete and repeatable procedures for reviewing data, logging errors, and verifying corrections that conform to the acceptance criteria and specifications.

Automated SQL checks shall be implemented to ensure that the ID field is not kept 'Null'. Topological rules shall be applied and validated to verify the spatial integrity of the data. Once the data capture process and automated QC checks are complete, the Visual QC steps shall be performed on the data delivery. Spatial accuracy, completeness, feature placement, correct attribute population and adherence with the specifications shall be checked during Visual QC. PLTS Data Reviewer shall be used for checking and logging errors during the Visual QC.

All soft copies or hard copy maps submitted will go through the quality check procedure before acceptance. The data rejected in the quality check shall be resubmitted after due corrections. The following aspects regarding quality assurance shall be adhered to:

- The quality assurance of the data shall be carried out by GGL using automated routines as well as manual checks as required.
 - This shall include checks for topological correctness, unique feature coding, and completeness of data, naming conventions, and accuracy and RMS errors.
 - Sample checks for randomly selected area will be generated for quality assessment.
 - Data not complying with the standards and accuracy specifications will be rejected for correction and shall be re-submitted by the Contractor after necessary corrections.
 - If the data complies with the quality assurance standards and error limits are in the prescribed range the data will be accepted.
 - The quality assurance shall comply with the following aspects
 - i) Positional accuracy
 - ii) Logical consistency
 - iii) Completeness &
 - iv) Mosaicking fit of the data.
 - Quality assurance of database shall be done within a specified time.
- (a) The criteria and acceptance levels for various parameters are given below:
- | | |
|-------------------------|------|
| i) File naming | 100% |
| ii) Directory structure | 100% |
| iii) Data readability | 100% |

iv) Data structure	100%
v) Data format	100%
vi) Topology	100%
vii) Attribute correctness	100%
viii) Attribute completeness	100%
ix) Data mosaicking	98%

4.1 Quality Assurance & Database Validation:

A comprehensive quality control program for ensuring the quality of data shall be followed based on the criteria provided and permissible accuracy. The measure of accuracy derived, based on the allowable limits shall fall under one of the following heads:

4.1.1 Physical accuracy:

In any data conversion, some amount of variations shall creep into the data sets depending on the type of digitization procedures followed and the subsequent projection and transformation methods followed. Following tests shall be made to ensure that all the features in a dataset are within the permissible limits

Point Features:

- Location of a feature with reference to a standard layer shall be the same or within the prescribed limits.
- A feature carries the same information after digitisation.
- A features carries true shape - Maintain congruence between digitisation v/s field land use records.

4.1.2 Logical accuracy

This accuracy corresponds to completeness and correctness of data when a data set is analysed. Following tests shall be performed to ensure the logical accuracy of the data sets:

- An attribute query run on the datasets should give a consistent result in terms of
 - i) Number of features selected
 - ii) The content of the features selected
- Any data set resulting out of analysis of two or more datasets should be logical.
- Any spatial query run on the datasets should give the same result in terms of
 - i) Number of features selected
 - ii) The content of the features selected

4.1.3 Quality Check for Digitization

The various steps involved in the quality checks carried out as a part of the digitization process are listed below. The emphasis on the QA/QC is on the following aspects:

- Missing Features
- Check already captured feature (with imagery at the backdrop)
- Extra / Double Digitization
- Line Quality – smoothness
- Positional Accuracy

- Overshoot/Undershoot
- Connectivity of Lines
- Correctness of Topology
- In order to ensure the quality of the digitized data the following procedures are adopted:
 - Ensure that the vector line works, points and polygons sit exactly on top of the raster data at 1X magnification. (There is no shift between the raster and vector data at 1X magnification.)
 - Ensure that there are no missing points/lines/polygons.
 - Ensure that there is no double or extra digitization of lines/points/polygons.
 - Check and verify that the Attribute ids tagged are correct and complete.
 - The digitization work is complete and correct.
- **In case of errors:**
 - Minor errors (like 2% of missing features, extra or double digitization/ 2% of attribute ids errors) are to be corrected by the member of Quality Checking Team
 - Major and Fatal Errors (missing features more than 2%, attribute ids error more than 2%): - the digitized layer is sent back to the operator for corrections providing all the details of the digitization errors.
 - If no errors are found then QC is approved and the layers are sent for data preparation.
 - In case of polygon layers it is ensured that there are no dangles, unclosed polygons due to undershoot, all features are populated with correct data.
 - In case of line layers it is ensured that there are no extra lines because of pseudo nodes, less of number of line features because of merging of two lines and all line features are populated with correct data.
 - In case point layers it is ensured that all points are populated with correct data.
- Correction processes for the data failing in the QA/QC are indicated below, after which the data is resubmitted for QA/QC.
 - Correction of missing lines, missing labels or missing polygons: Digitization of the missing line, polygon or point is to be done
 - Correction of extra or double line works, extra labels or additional polygons:
 - Select the extra feature and delete it.
 - Correction of small sliver polygons: Build the topology with the required fuzzy tolerance and dangle length. The small slivers will be automatically removed.
 - Correction of the line which is digitized as two lines: Select the two lines and un-split to make it one line feature.
 - Correction of two or more lines being digitized as single line: Select the line and split it at the required point.

- Corrections of incorrect-ids: Select the feature and correct the ids.
- Missing Id: Select the feature and add the correct id.

4.1.4 Edge Matching

Data between delivery areas shall be edge matched to ensure a seamless database. The following steps shall be implemented in the edge matching process:

- Create a topology class with topology rules used to verify the spatial integrity of data across delivery areas.
 - In ArcCatalog, navigate to the feature dataset(s) requiring edge matching topology rules.
 - Inside the feature dataset, right-click and choose New Topology
 - Navigate through the wizard entering the Topology name, cluster tolerance (default), participating feature classes, ranks, and add rules.
 - If edge matching between 2 or more geo-databases, the data must be combined into one geo-database in order to take advantage of using topology rules.
 - To combine geo-databases, use the 'Simple Data Loader' in ArcCatalog or copy and pasting features by respective feature class using ArcMap.
 - Use a 'Query Expression' on unique field to only load features along boundaries that are necessary for edge matching. It is important to keep track of which features were loaded to the target geo-database, as these temporary features should be removed when edge matching is complete.
 - The temporary features can either be replaced in the originating geo-database if edits were made to them or simply deleted if no edits were performed.

Validate the geo-database feature datasets using the topology classes created in step 1.

- In ArcCatalog, click on the Topology Class and choose Validate. A message box will pop up when validation is complete.
- Errors will be stored in the topology class as graphics.
- Load the Topology Class into an ArcMap document to view the topology errors.
- Load the feature classes requiring edits to the ArcMap document.
- Set the snapping tolerance to be used for edge matching edits.
- From the Editor pull down Start editing and choose Snapping
- Check the vertex, edge and end checkboxes for the target feature class that will be edge matched.
- Set the initial snapping tolerance.
 - Use the Arc Map Edit tools to fix topology and edge matching errors.
 - Extend/Trim tools should be used to extend or trim the feature-part
 - To Extend a line, select the feature that undershoots, select the extend tool on the Advanced Editing Toolbar, and click the feature that the line needs to be extended to.
 - To trim a line, select the feature that overshoots, select the trim tool on the Advanced Editing Toolbar, and click on the feature that it will be trimmed to.

- Modify Polygon features can be used for polygonal feature adjustments.
- Alternatively, vertex-to-vertex adjustments may be performed.
- Save Edits and Re-Validate the Topology until all topology/edge matching issues have been addressed as fixed or noted as an exception.

4.1.5 Quality Assurance for Geo-referencing / Projection

- It shall be ensured that all the layers are referenced to a common geographic coordinate system, which shall require projection and transformation.
- Coordinate transformation shall be based on the process of establishing control points upon the digitized layer and defining real world coordinates for those points.
- Transformation routines shall be used to transform the coordinates of all features on the data layer based upon those control point coordinates.
- Once transformed, spatially adjacent data layers shall then be displayed simultaneously within their combined geographic extent.
- A determination shall then be made as to the effectiveness and accuracy of the coordinates assigned to the data layers and the RMS errors obtained. If not within the prescribed limits the process of coordinate transformation shall be reiterated to gain the desired accuracy.

4.1.6 Quality Assurance for Mosaicking

- When more than one layer / images are to be mosaicked it shall be ensured that edge matching is carried out for the respective lines in the adjacent layers to avoid the shifts, before proceeding with the mosaicking.
- In case of polygons, after mosaicking, the polygons with common data shall be dissolved / merging so as to maintain the integrity of the data across adjacent layers.
- Quality check routines shall ensure that there is no data loss in the process of mosaicking
- Random checks shall be carried out to ascertain that the attribute data is correct, for all features in the periphery after mosaicking vis-à-vis the individual tiles of data.

4.2 Data QA/QC Criteria:

- GGL will perform a 100% quality check for feature location placement of land and gas features.
- The quality check will also include attribute data of Landbase and gas features.
- GGL will perform a 100% quality check for connectivity.

4.3 Data Acceptance Criteria:

Contractor shall develop standard template for QA/QC process in consultation with GGL team and report to GGL on weekly basis.

4.3.1 Geo-database Schema

The Geo-database shall be created as per the existing Geo-database model of GGL (ESRI Arc GIS) using appropriate tool, field and Domain checker shall be used to ensure that there is no change in schema by any means.

- None of the features that are defined in GGL geo-database design shall be missing in database record.
- Features must correspond to their specific database record/schema.
- Attributes shall be populated with legal domain values & ranges as per schema.
- The number of database fields shall match the database design/schema.
- None of the database tables shall have incorrect database relationships.

4.3.2 Features

Desired Feature accuracy is defined as below for both Landbase and gas features.

➤ **Landbase**

- Features placement and geometry 98 % accuracy
- Attributes 100% accuracy

➤ **Gas Network**

- Features 100 % accuracy
- Placement +/- 0.1 meters
- Network logical connectivity 100%

4.3.3 Attributes

Contractor shall be responsible for achieving 100% accuracy rate for capturing of Feature Class and Object Class attributes for Landbase. GGL shall check the correctness of data on the field by comparing the original source with the delivery. If the source document is inaccurate or does not contain the necessary information, the attribute for that record shall not be considered for the 100% accuracy rate requirement.

➤ **Landbase**

- Attributes 100% accuracy

➤ **Gas Network**

- Attributes 100% accuracy (GGL will ensure to provide correct information/ drawings /reports to contractor)

4.3.4 Network Connectivity

Contractor is responsible for achieving 100% accuracy rate for system connectivity. There are two types of connectivity that must be met with. Contractor shall collect from existing database OR coordinate with GGL for populating the correct/logical field value of each feature participated in geometric network.

- The first type of network connectivity is defined as the physical connection of any Feature Class that participates in the network. Contractor shall be responsible for achieving a 100% accuracy rate for the snapping of all linear features to create a complete topological network. This requires the junctions of all network/lines to share the same coordinate values as the end points of edges.
- The second type of network connectivity is based on attribute values and status of Feature Classes participating in the network. Contractor shall be responsible for

producing a network that shall correctly connect based on the values and status of pipes and devices.

4.4 Level of Data Acceptance Criteria:

4.4.1 Accept

GGL accepts the delivery meeting or exceeding all acceptance criteria.

4.4.2 Conditionally Accepted

- Conditional acceptance means GGL will accept the data delivery with the understanding that contractor shall fix the identified errors and redeliver the data within the GGL defined timelines.
- Conditional acceptance does not restrict from invoicing for that delivery.

4.4.3 Reject

If the number of errors exceeds 5% in attributes and 2% in features, GGL may reject the delivery. GGL reserve the right to stop checking the delivery once the number of errors exceeds and does not meet the accepted limit. The Contractor shall correct all the errors necessary to meet the acceptance criteria in not more than One week.

Data Review Period: GGL will complete QA/QC, acceptance testing within two weeks of receipt of a delivery and submit their report for acceptance OR rejection.

GGL may extend the review period in case of other business priority.

Data Re-delivery: If the deliverable is conditionally accepted and resubmission by the Contractor is needed, then contractor is responsible for achieving a 100% accuracy rate for correcting errors identified by GGL.

In case the errors are repeated, Contractor shall carry out investigation of the problem and inform GGL about corrective and/or preventive measures to be implemented by Contractor.

5. MODE OF MEASUREMENT & PAYMENT:

Contractor shall responsible to take approval/ acceptance on every submission/delivery of data in writing from the GGL GIS Engineer OR Engineer In-charge. Actual executed and accepted /certified quantity shall be taken in to consideration for raising RA bill(s) and final bill based on the joint measurement sheet, and shall be consider for payment. Contractor shall submit interim/running/final Invoice with document(s) to endorse the actual accepted /certified/approved data and activity wise Joint measurement sheet(s) as mentioned in SOR (Schedule of Rate) with respect to location/Geo-graphic area of GGL. Data claim without approval/acceptance of GGL GIS Engineer shall not be considered for payment.

Activity wise measurement and payment criteria:

- 5.1 Landbase Data Development - Vector map creation process where, the actual area shall be measured with area measuring tool in **SQKM (KM2)** covering all the geometry with attribute data i.e. Line, Point and Polygon features. Payment shall be made on the actual

area measured in SQKM. The area shall be measured only for the list of features (As per GGL feature list) digitised from the given satellite images. Any area and features other than mentioned in GGL AOI /feature list shall not be considered for measurement and invoicing.

- 5.2 Landbase Data Development - Field survey for attribute data collection, Updation, integration and submitting PGDB to GGL compatible to ESRI Arc GIS:
 - Same level of data measurements and payment criteria shall be apply (as per Point no. 5.1).
 - Features without attribute data/value shall not be considered for measurement and Invoicing.
- 5.3 Gas Data – Gas line feature digitisation and Updation including gas fittings:
 - All Line features shall be measured in **Running Meter (M)** and payment shall be made accordingly.
 - Contractor shall not claim extra for digitisation and Updation of Gas Fittings (as mentioned in Annexure-II Gas feature list), it is included in the Length of Line Features.
- 5.4 Gas Data – Gas Point Feature digitisation and Updation excluding gas fittings:
 - All Gas Point features except Gas Fittings shall be measured in **Number (Each)** and payment shall be made accordingly.
- 5.5 Gas Data – Gas Polygon feature digitisation and Updation:
 - All Gas Polygon features shall be measured in **Number (Each)** and payment shall be made accordingly.
- 5.6 Customer – Customer data validation and integration:
 - Count of connected /integrated Customer shall be taken in consideration and shall be measured in **Number (Each)** and payment shall be made accordingly.
- 5.7 DGPS (GCP after post process with desire accuracy) point captured for Image geo-referencing and above ground Gas features as suggested by GGL's work/engineer in-charge
 - Count of DGPS point based on the supporting data submitted according to Annexure-V shall be taken in to consideration and measured in **Number (Each)** and payment shall be made accordingly.

6. DOCUMENT SHALL BE PRODUCED FOR LEGAL COMPLIANCE ALONG WITH INVOICE:

Sr. No.	Particulars	Frequency	Validity	Remarks
1	Valid Labour License under the CLRA Act, 1970 - if workmen is 20 or more	ONE-TIME (Last updated)	One year /contract validity.	Shall have valid date at the time of processing Invoice.
2	PF Registration	ONE-TIME (Last updated)	-	
3	ESI /WC Registration	ONE-TIME	-	

		(Last updated)		
4	EC/WC Policy under the Employees' Compensation Act, (Renewal copy on expiry – If work is continue)	ONE-TIME (Last updated)	One year /contract validity	
Sr. No.	Previous Month Register & Challan			
1	PF challan & ECR Copy			
2	ESI challan & ECR copy			
3	Form no. 16 Muster roll under CL (R&A) Act			
4	Form No. 17/18 Register of wages/ Muster cum Reg. of wages under CL (R&A) Act			
5	Salary Payment Proof - Salary payment through bank- With valid "Salary Transfer Proof"			
6	Undertaking, if PF/ESI or Both challan(s) is common with exempted employee details			

6.1. Contractor is liable to submit above listed documents and get 100 % compliance clearing reports from the GGL EIC.

6.2 Contractor shall give undertaking on INR 100/INR 300 stamp paper stating;

- Liable to make payment of employee/worker is according to the applicable Minimum Wages Act. as well as their PF/ESI.
- Liable to produce relevant documental evidence in front of relevant Government Authority as and when required.
- GGL will not be responsible and liable if any non-compliance, any penalty /charges imposed by Government Authority shall be bared by the contractor.

7. **PENALTY:**

GGL shall impose the penalty and may recover amount from actual invoices, if the CONTRACTOR neglects to execute his duties as per the Scope of Work or unnecessarily delays completion of Work during execution of CONTRACT. The amount of such recovery shall be as shown below for the given parameters or mutually determined in consideration of the consequence of CONTRACTOR's neglect.

Sr. No.	Parameters	SLA	Penalty
1	Employee employed less than 18 years old	-	INR 20,000.00 per instance OR termination of CONTRACT
2	Violation of GGL's HSE terms & conditions	-	INR 5,000.00 per instance
3	Fail to complete the Work in stipulated timelines	Mutually agreed project plan shall be signed off before commencing the project. This project plan shall work as base plan and penalties will be derived based on this project plan.	INR 2,000.00 per week of delay from committed/agreed project plan. This shall be applicable in case delay is due to reasons attributable to the contractor

The cumulative penalties arising out of Service Level Agreements detailed above shall not exceed 10% of the overall contract basic value or cumulative invoices basic value whichever is lower.

8. HEALTH, SAFETY AND ENVIRONMENT:

- CONTRACTOR shall ensure its personnel are:
 - Medically, physically and mentally fit to carry out the duties to which they are assigned in respect of the Work.
 - Technically competent and experienced in the tasks assigned to them.
 - Ensure competency training and subsequent assessment from GGL to all personal who will be deputed.
 - The Contractor shall ensure that all personnel engaged in surveying and field-related activities are medically fit to perform such duties. Accordingly, the Contractor shall submit a medical fitness certificate for each deployed staff member, issued by a competent and registered medical practitioner, in the format and periodicity as required by Gujarat Gas Limited (GGL). Deployment of any staff in the field without a valid medical fitness certificate shall not be permitted, and GGL reserves the right to deny site access or suspend work until compliance is ensured.
- Contractor shall not carry out any work at any premises under construction. Permission & instruction must be sought from GGL's Work-In-Charge in case of exceptional circumstances. Contractor shall ensure an injury free incident free workplace and protect people from harm caused by work activities.
- Contractor shall arrange Work related Personal Protective Equipment at their own cost (Hard Hat, Safety Shoes, Gum Boot, Reflector Jacket, etc.) to their staff and ensure to wear it during the execution of Work. GGL reserves the rights to impose penalty if proper use of agreed PPE's are not found on site. GGL reserves the rights to periodically inspect these PPEs and to demand for availability of better quality of any PPE if found improper. No extra payment shall be done for the same, quoted rates are inclusive of the same.
- Contractor shall ensure that all the HSE requirements are properly discussed for any sub-contracted activities with the staff employed to do the sub-contracted activity. No such activity shall be performed without clearance from GGL Work-In-Charge.
- During the execution of Work, contractor should ensure that their work should not obstruct any or all other routine activities performed by other agencies.
- Contractor must ensure that before using tools, appliances, machines, vehicles, or other equipment, the same are in safe working condition. Defective items must be repaired or removed from service promptly.
- GGL will provide Basic safety Training before commencement of work, Contractor shall ensure, their all personnel have been trained for that.

PPE Matrix

DOC. NO: GGL/ IT/CCR/GIS/TENDER/GIS DATA CREATION/2025/01	Service Provider Seal & Sign
Page 23	

Sr. No.	Item	Field Survey
1	PPEs:	
1.1	Hard hat	√
1.2	Safety shoes/Gum Boot	√
1.3	Reflector Jacket	√
2	First Aid Box	√
3	Cell phone with site supervisor/ Field Surveyor	√

9. Details of Resources to be engaged by the Contractor:

Contractor shall engaged sufficient numbers of complete sets of compatible hardware to run the following software-extensions and equipment as well as competent/skilled manpower to deliver the quality products/ data in scheduled/stipulated time frame;

- AutoCAD Maps
- Data Interpretation and data Extraction Software (e.g. ERDAS or equivalent)
- Arc GIS 10x Licenses with Arc FM extensions
- DGPS/GPS Instruments to capture Ground Control Points (GCPs) having sub-meter accuracy after post processing.

Manpower:

Job Title	Min. Qualification	Experience	Skills require
Project Manager	Graduates in any stream	Min. 5 Years' work experience in any field	Managing Projects – Manpower planning, execution, communication and deliver data in schedule time.
Supervisor	ITI/Diploma in any stream	Min. 2 years' work experience in any field, survey and utility/property data collection activity	Planning, organizing and Managing manpower and deliver anticipated work with quality and HSE compliance.
ARC GIS Editor	Graduates/ Diploma in any stream	Min. 2 years' work experience in data editing using ESRI Arc GIS, ERDAS & Auto CAD Map software	Knowledge of ESRI Arc GIS with ARC FM extension and ERDAS: Image Geo-referencing, Interpretation /data extraction Vector data processing and Field data attachment. Data Editing and data conversion to Geo-database from AutoCAD/Shape file. Knowledge of AutoCAD Map, MS Office, GIS Feature mapping/overlying/digitization and data attachment.

Draftsman	ITI – Draftsman (Mech./Civil)	Min. 2 years of Image data Vectorisation and Utility mapping activity	Knowledge of AutoCAD Map – Image interpretation and Extraction, vector data creation from raster image. Knowledge of MS Office, Arc GIS with ARC FM extension -GIS Feature mapping/overlying/digitization and data attachment.
Field Surveyor	ITI / 12 th . Pass	Min. 6 months in field jobs – Utility and Property data collection activity/survey	Feature Identification in field, Measuring feature and mapping in Map/Drawing, Computer knowledge - MS Office – Excel and word etc.

ANNEXURE- I

Landbase Dataset Features list

Object Class Name	Geometry	Type	Sub Type
Boundary (Compound wall/Boundary wall)	Polyline	Simple	Plot Residential
Bridge	Polygon	Simple	-
Building	Polygon	Simple	Residential Buildings, Religious Buildings, Commercial Buildings, Educational Buildings, Medical Buildings, Public Service Buildings, Recreational Buildings, Historic Buildings, Sports Buildings, Vacant Buildings, Under construction Buildings, Mixed Buildings, TRI , All Other Bldgs.
Canal	Polygon	Simple	-
City Boundary	Polygon	Simple	-
Culvert	Polyline	Simple	-
Divider	Polygon	Simple	-
Drainage	Polyline	Simple	-
Encroachment	Point	Simple	-
Gate	Point	Simple	-
Hydro Point	Point	Simple	Water Tank, Well
Hydro Poly	Polygon	Simple	Creek, Lake, Nullah
IndPlot Boundary	Polygon	Simple	-
Landmark	Point	Simple	-
Over Under Pass	Polygon	Simple	Flyover, Subway
Parks	Polygon	Simple	-
Pavement	Polygon	Simple	-

Object Class Name	Geometry	Type	Sub Type
Plot	Polygon	Simple	-
Railway Track	Polyline	Simple	Broad Gauge, Meter Gauge, Narrow Gauge , Others
Right Of Way	Polygon	Simple	-
River	Polyline	Simple	-
Road	Polyline	Simple	-
Road Centerline	Polyline	Simple	National Highway, State Highway, Major Road, Minor Road, Internal Road, Lane, Others
Sports Complex	Polygon	Simple	-
Tehsil Boundary	Polygon	Simple	-
Traffic Island	Polygon	Simple	-
Traffic Signal	Point	Simple	-
Transportation	Polygon	Simple	-
Utility Line	Polyline	Simple	-
Utility Point	Point	Simple	-
Utility Poly	Polygon	Simple	-
Village Boundary	Polygon	Simple	-
Vegetation	Polygon	Simple	Forest, Group of Tree, Park, Nursery, Natural Vegetation, Others
Ward Boundary	Polygon	Simple	-
Water Bodies	Polygon	Simple	Overhead Water tank Pond, Swimming Pool
Zone Boundary	Polygon	Simple	-
District Boundary	Polygon	Simple	-
Grid	Polygon	Simple	-

ANNEXURE- II

Gas Dataset Features list

Object Class Name	Geometry	Type	Subtype
Abandoned Gas Device	Point	Simple	
Abandoned Gas Pipe	Polyline	Simple	
City Gate Station	Point	Simple	
CNG Station	Point	Simple	Mother, Online, Daughter, Daughter-Booster
Controllable Fitting	Point	Simple	
CP Anode	Point	Simple	
CP Area	Polygon	Simple	
CP Bond Junction	Point	Simple	
CP Bond Wire	Polyline	Simple	
CP Rectifier	Point	Simple	
CP Rectifier Cable	Polyline	Simple	
Distribution Mains	Polyline	Simple	Polyethylene ,Steel Mains
Distribution Point	Point	Simple	DOM, COMM, IND, YHS, Others
Exposed Pipe Inspection	Point	Simple	
Gas Pipe Casing	Polygon	Simple	
Gas Pipe Crossing	Point	Simple	
Insulating Joint	Point	Simple	
Leakage Point	Point	Simple	
Leak Survey Area	Point	Simple	
Marker	Point	Simple	
Network Valve	Point	Simple	
Odoriser	Point	Simple	
Regulator Station	Point	Simple	CPRS,DPRC,DPRS,IPRS,MRS,SR
Gas Fittings	Point	Simple	Connector, Coupler, cross EF saddle, elbow, end cap Enhancer, GF saddle ,Inpesorf, PVC connector, PVC elbow, reducer Saddle, tee, unequal tee, Transition fitting, Weldolete

Object Class Name	Geometry	Type	Subtype
PRS	Polygon	Simple	As per Regulator Station
Service Line	Polyline	Simple	PE Pipeline - LP line to connect Customer Point (DP) with Distribution mains
Test Lead Point	Point	Simple	Voltage Measurement, Current Measurement, Casing/Carrier Volt Measurement, Coated casing Volt Measurement, Foreign Pipe volt Measurement, IJ Current Measurement HT Crossing Current Measurement Others
Valve Chamber	Polygon	Simple	

ANNEXURE-III

Type / Sub Type & Code value for Landbase Features

Feature Class	subtype (Code)	Subtype (Value)	Type (Value)	Type (Values)
Buildings	BW	Worship	BW1	Temple
			BW2	Church
			BW3	Mosque
			BW4	Gurudwara
			BW5	Jain Mandir
			BW6	Others
	BE	Educational	BE1	School
			BE2	College
			BE3	Library
			BE4	University
			BE5	Research Institute
			BE6	Hostels
			BE7	Other Institute
	BC	Commercial	BC1	Bank
			BC2	Business centre
			BC3	Industry
			BC4	Insurance Co.
			BC5	Petrol Pump/ CNG station
			BC6	Travel Agency / Courier
			BC7	Private Office
			BC8	corporate Office
			BC9	Commercial Office
			BC10	Guest House
			BC11	Motel
			BC12	Hotel
			BC13	Restaurant
			BC14	Shop/showrooms/ Departmental store
			BC15	Others
	BP	Public Service	BP1	PWD Office/ CPWD
			BP2	Local Admin Office (District and Taluka)
			BP3	Telephone Office
			BP4	Electricity Office (GEB/SEC)
			BP5	Post Office
			BP6	Municipal Corporation
			BP7	Forest Office
			BP8	Police Station
			BP9	Sale Tax office/ Income tax

Feature Class	SubType (Code)	SubType (Value)	Type (Code)	Type (Values)
Buildings	BP	Public Service	BP10	Collector Office
			BP11	Others
	BM	Medical	BM1	Hospital
			BM 2	Nursing Homes
			BM 3	Clinic
			BM 4	Laboratory
			BM 5	Others (Medical store)
	BR	Residential	BR1	Multi-storey Apartments
			BR2	Independent House
			BR3	Hutment
			BR4	Sheds
			BR5	Others
	BT	Recreation	BT1	Tourist Office
			BT2	Tourist Centre
			BT3	Stadium
			BT4	Club
			BT5	Cinema theatre
			BT6	Pub
			BT7	Others
	BV	Vacant	BV1	Plot (Open ground)
			BV2	Building
	BU	Under Construction	BU1	Residential
			BU2	Commercial
			BU3	Others
	BH	Historic	BH1	Forts
			BH2	Tombs
			BH3	Palace
			BH4	Shrine
			BH5	Museums
			BH6	Art Gallery
	BS	Sports	BS1	Stadium
			BS2	Golf Course
			BS3	Playground
		Mixed	i.e. BC/BR or BR/BC	Combination of any above types as per the predominance
	NB	Others	NB6	All Other Building /Slum
Transportation	Feature	Type/Owner	SubType	Code

Road	Road Road Centreline	RO/ Municipal Corporation Nagar Palika Gram Panchyat PWD, CPWD R&B, Private GIDC/MIDC *	NH	National Highway
			SH	State Highway
			RO1	Major Road
			RO2	Minor Road
			RO3	Internal Road
			RO4	Lane
			RO5	Others
Foot path/ pavement	Pavement Surface	PO	P01	Stone
			P02	Concrete
			P03	Tile/Block
			P04	Mud / Kutcha
			P05	Tar (bitumen)
Railway Line	Broad Gauge Meter Gauge Narrow gauge Others	RA/ Central Govt. State Govt. Private	RA1	Broad Gauge Route
			RA2	Meter Gauge Route
			RA3	Narrow gauge Route
			RA4	Others
Other Transport Feature	Bus Stand Terminal Bridge Fly-over Sub Way Traffic Island / Chanaliser Others	TS	TS1	Bus Stand
			TS2	Terminal
			TS3	Bridge
			TS4	Fly-over
			TS5	Sub Way
			TS6	Traffic Island / Chanaliser
			TS7	Others
Hydro Features	Feature	Type/Owner	SubType	Code
Hydro Feature	River Canals Drainage Nullah Creeks Lake Pond Overhead Tank/water Tank Swimming Pool others	RI	RI1	River
			RI2	Canals
			RI3	Drainage
			RI4	Nullah
			RI5	Creeks
			RI6	Lake
			RI7	Pond
			RI8	Overhead Tank/water Tank
			RI9	Swimming Pool
			RI10	others

ANNEXURE-IV

Field Book

				Field Book for Landbase - Building Feature						Date:		
Area / Location:										Sheet Number:		
Grid-Number:										Team Member:		
Sr. No.	Blgd_ID	Operation	Plot no.	Building Name	Type	Sub type	HH Units Res. Comm.		No. of DP	Floor	Society Name	Remarks

City:		Field Book for Landbase –Transport Feature (Road, Road Centreline, Pavement, Railway Line-Terminal /Station, Bus Terminal-Station/Stop)						Date:		
Area / Location:								Sheet Number:		
Grid-Number:								Team Member:		
Sr. no.	ID	Type	Name	Owner	Surface	Width	Footpath /Pavement Type Width (L) Width (R)			Remarks

City:		Field Book for Landbase- Hydro Feature (Hydro point, Hydro poly, Water Bodies, River, Drainage, Canal)						Date:	
Area / Location:								Sheet Number:	
Grid-Number:								Team Member:	

Sr. No.	ID	Type	width	Feature Name	Remarks

City:	Field Book for Landbase- Other Feature (Bridge, Boundary, Culvert, Under Over pass, Divider, Park, Sport Complex, Traffic Island, Transportation, Open space, Vegetation)	Date:
Area / Location:		Sheet Number:
Grid-Number:		Team Member:

Feature ID	Feature Type	Name	Owner

ANNEXURE - V

1. PROCEDURE (METHODOLOGY) FOR GCP COLLECTION:

- Schedule field survey for collecting GCPs.
- A Traverse survey to be carried out to create horizontal control points.
- Identify the Ground Control Points both from Image Chips and field for collection. Vendor to plan GCP points in consultation with GGL team.
- Each GCP value shall have to be entered with corresponding numbered and address/locational details.
- Data entry to be done in a form before proceeding to next location.
- Descriptive notes and diagrams of the GCPs should be captured.
- Each GCP ground marking and corresponding established equipment photos to be submitted to GGL along with the GCP data submission.

2. VALIDATION AND VERIFICATION

- The points are compared with the image chip for differences.
- GCPs data collected from the field and make GCP library.