

Preparation of the Geo-referenced map through
DGPS survey of Forest land in Durg Forest Division over
an area of 1.97 Ha. For 765kV D/C Jharsuguda
(Sundargarh)-Raipur Transmission Line of Odisha
Generation Phase-II Transmission Limited (OGPTL)
,Chhatisgarh



Consultant

SPARC Pvt. Ltd., Bhubaneswar



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Prepared for:

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1. INTRODUCTION AND BACKGROUND INFORMATION

The Government of India, Central Electricity Authority vide Gazette Notification dated February 06, 2015 has notified PFC Consulting Limited to be the Bid Process Coordinator (BPC) for the purpose of selection of Bidder as Transmission Service Provider (TSP) to establish transmission system for "Common Transmission System for Phase-II Generation Projects in Odisha and Immediate Evacuation System for OPGC (1320 MW) Project in Odisha" through tariff based competitive bidding process

Sterlite Grid 3 Limited had been participated in the international competitive bidding process for Transmission Scheme for "Common Transmission System for Phase-II Generation Projects in Odisha and Immediate Evacuation System for OPGC (1320 MW) Project in Odisha".

Power Finance Corporation Consulting Limited (PFCCCL), Government of India has accepted our Bid and SGL 3 has been declared as the successful bidder.

Special Purpose Vehicle (SPV) constructed for this project is "Odisha Generation Phase II Transmission Ltd". SPV acquisition process is under progress.

Prior approval under Section 68(1) of Electricity Act, 2003 from Ministry of Power, Government of India has been already taken for construction of transmission element by "Odisha Generation Phase II Transmission Ltd" (Associated Transmission Lines are 765kV D/C Raipur-Jharsuguda & 400kV D/C OPGC-Jharsuguda) vide letter no. 68/ER/2015/1301 dated 3rd June 2015.

The details of lines is mentioned here under: -

1. 765kV D/C Raipur-Jharsuguda Transmission Line: 300 K.M (Approx.)

Above said line passes through Durg, Bematara, Baloda Bazar, Bilaspur, Janjgir Champa & Raigarh districts of Chattisgarh State (Total Line length is 255 K.M Approx) and Jharsuguda district of Odisha State (Total Line length is 45 K.M Approx).

As per directives of Ministry of Environment & Forests dated 8th July 2011; all applications seeking diversion of forest land for non-forest purpose under Forest Conservation Act, 1980 must be accompanied with Geo-referenced shapefile (both soft copy and hard copy) of the forest land proposed for diversion prepared using Differential GPS (DGPS)

As per Online Submission and Monitoring of Forests Clearances Proposals of MoEF & CC, the following maps and files are required to be uploaded



- Survey of India Toposheet in 1:50,000 scale indicating location of the forest land proposed to be diverted
- Scanned copy of the geo-referenced map of the forest land proposed to be diverted by using DGPS or Total Station
- KML file of the geo-reference forest land proposed to be diverted

In order to comply with the conditions of DGPS survey guideline for PCCF given to OGPTL is enclosed at Annexure-1. To meet these requirements, SPGVL is entrusted this DGPS survey work to M/s SPARC Pvt. Ltd., Bhubaneswar, a Government recognized reputed firm specializing in such assignments. Credential of SPARC is enclosed at Appendix-1

2. SCOPE

The envisaged scopes of the assignments are described below

- Computation of Geo-referenced forest land through digitization and comparison with area indicated in the land schedule.
 - Establishment of Base Station by taking DGPS long Observation and fixing the coordinate by processing with IGS (International GNSS Services) data.
 - DGPS observation at the change point of the forest land
- Processing of DGPS observation and geo-referencing of the Forest land based on DGPS Surveyed co-ordinates.
- Generation of the *shape* file and *kml* file of the Forest land
- Printing of Hard copy maps and report.

3. DELIVERABLE

- Post processed DGPS observations data as well as raw data in RINEX format.
- Geo-referenced scanned cadastral/forest compartment maps based on field observation.
- Geo-referenced shape, kml file (soft copy) of the Forest land with area statement.
- Submission of maps & report in 10 nos. hard copy along with soft copy and shape/kml file as per requirement of MoEF guidelines.



4. METHODOLOGY

4.1 INPUT DATA

The land plan and maps required for geo-referencing was provided by OGPTL to M/s SPARC along with the land schedules for desk study. The following maps are used for the desk study.

- Revenue maps of the Forest land Map (*Fig-1*)
- Survey of India Topo Sheets (*Fig-2*)
- Land Schedule

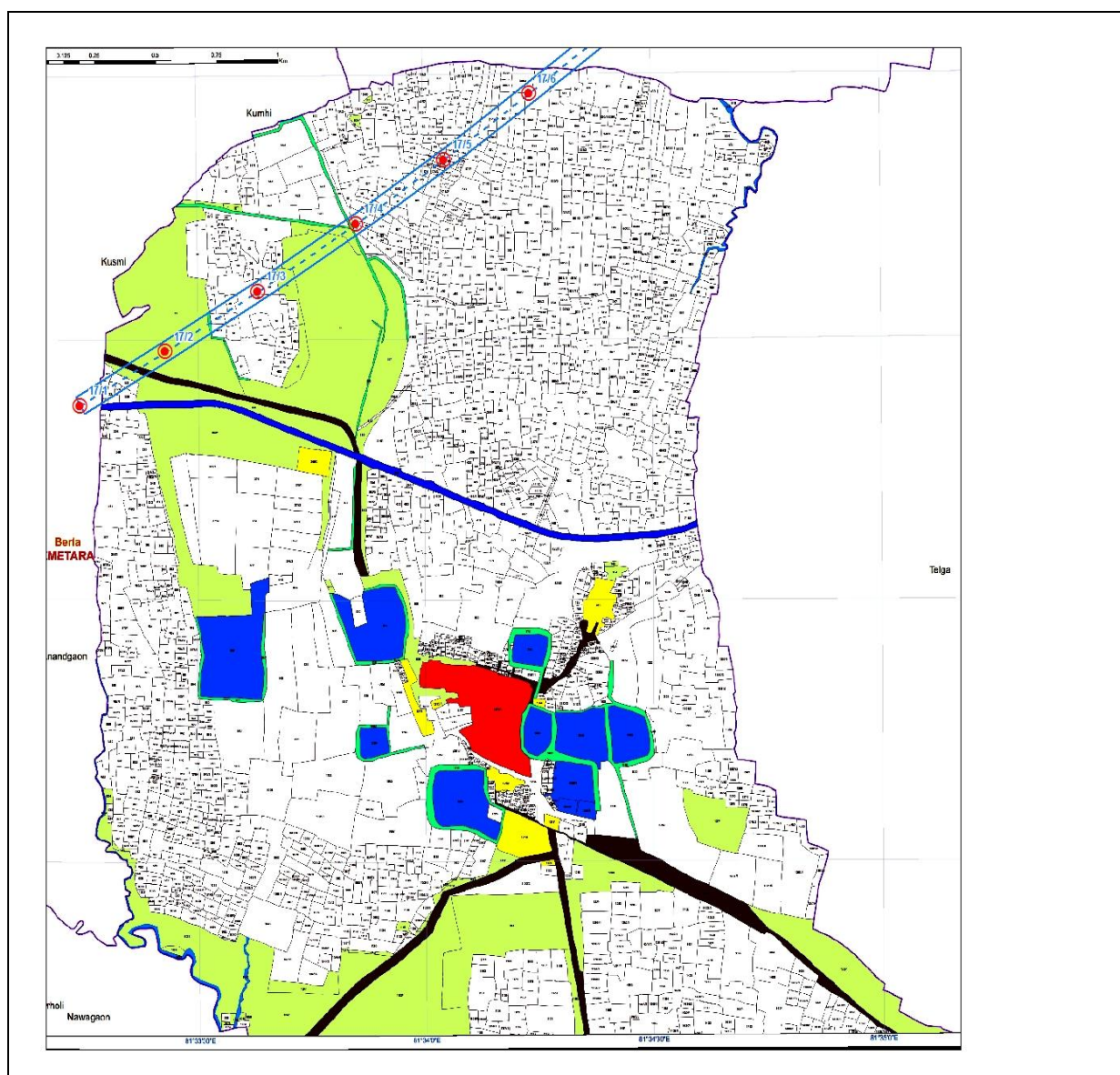


Fig-1: Transmission Line Superimposed on Cadastral Map



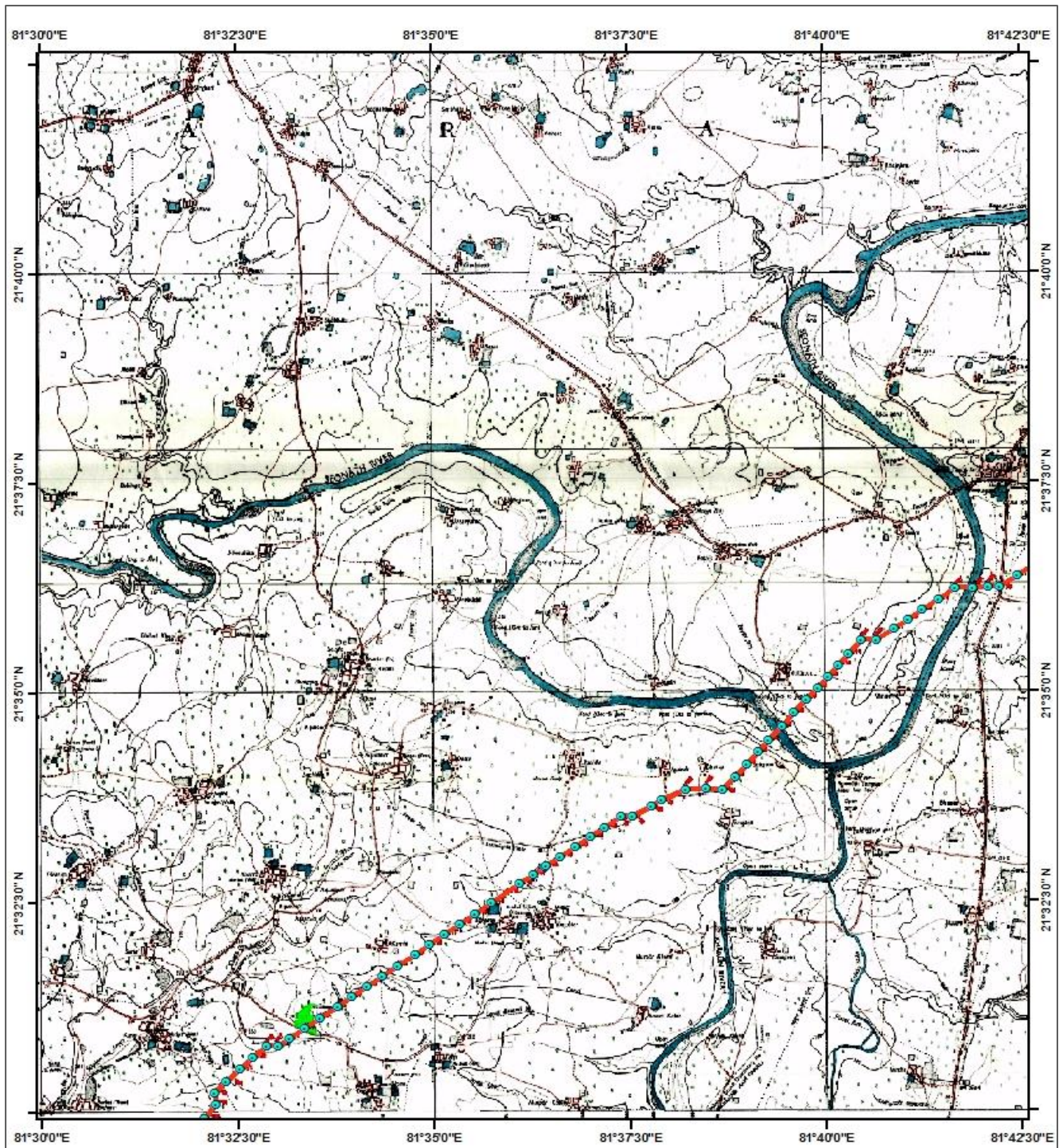


Fig-2: Transmission Line Superimposed on Topo Sheet



4.2 PRINCIPLE OF DGPS SURVEY

DGPS Survey is carried out by a pair of devices, one is called base and other is called as rover in order to eliminate the un-avoidable error which may occur during survey as transmission delays in the ionosphere, multipath signal due to foreign object which may induce in the DGPS observation.

Base is stationary and fixed in an ideal location (that has a clear line of sight to the sky in all directions away from vertical obstructions such as buildings, deep cuttings, site vehicles, towers, or tree canopy) which is act as the Primary Control Point (PCP) while the rover collects the reading at target locations.

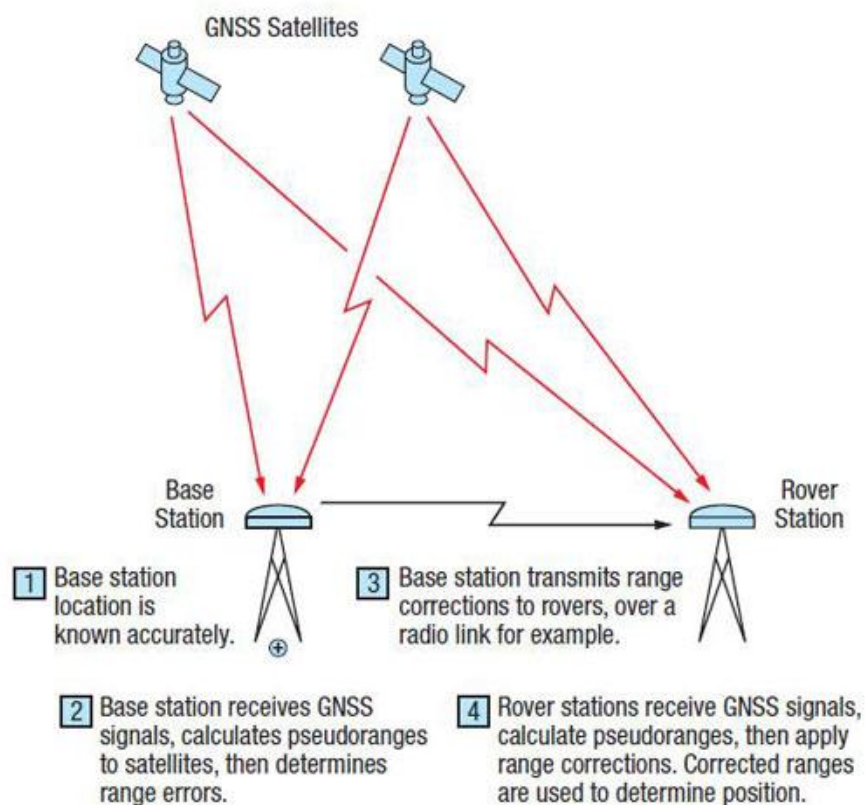


Fig-3: Concept of the DGPS survey

As the rover has no choice of sites and has to take reading at the pre fixed target location, it may induce error as discussed earlier. Therefore, the data received by the rover has to be processed with the observation received by the base rover in real time mode (through radio link) or during post process in a later stage to eliminate the error and get the final reading (coordinate value).



4.3 ESTABLISHMENT OF BASE STATION/PRIMARY CONTROL POINT (PCP)

The PCP was so planned to keep the entire project area within 3.0-4.0 Km from PCP for DGPS Survey.

GPS satellites complete one cycle of rotation around the earth in approximately 6 hours. Base Station was fixed through continuous observation of 12 hours (so that the base receives signals of all the satellite at least once) at the PCP on 22th July 2016 and further processing with the observed data of International GNSS Stations (IGS). The IGS processed report is enclosed at Annexure-2. The processed coordinate value is as follows.

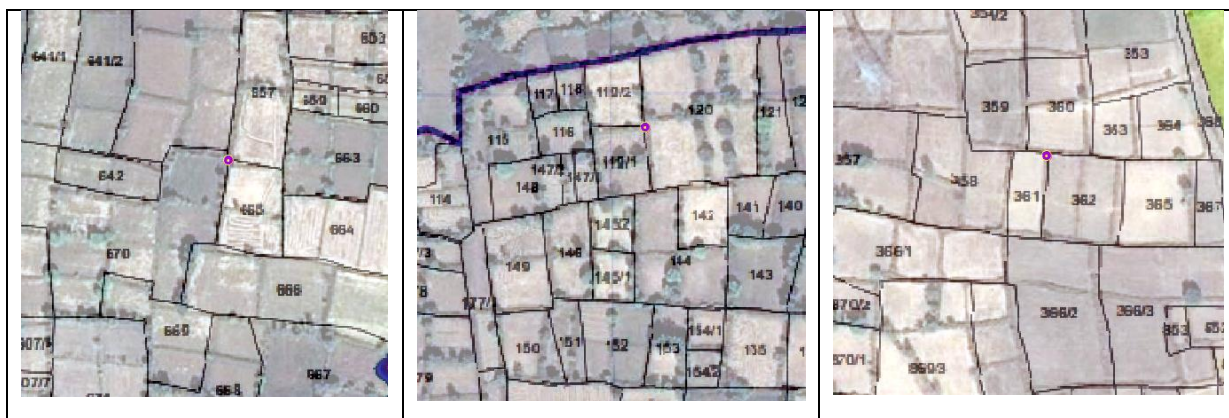
Table-2: Coordinate of Base Station

Location	Latitude	Longitude	Northing (m)	Easting (m)
Anandagaon	21°30'56.79002" N	81°33'23.72600" E	557645.409	2379334.303

As per the National Map policy is enclosed at Annexure-3, all the maps are prepared with UTM Projection using the Datum WGS-1984 to seamless integration with new Open Series Maps (OSM) Topo Sheets published by Survey of India.

4.4 SECONDARY CONTROL POINT (SCP) SURVEY

4-6 secondary point per revenue sheet are required to geo-reference the maps based on DGPS survey. The Secondary Control Points (SCPs) in the area of interest were planned at convenient location. SCPs are planned well distributing in the revenue maps covering Tri-junction, Bi-junction, undistributed field bund.



DGPS observations were taken SCPs location (for 15 minutes each) using rover. The data observed by base and rover were post processed using advanced Trimble Business Centre software for obtaining the final SCP Co-ordinates. The SCPs with fixed solutions only were used for Geo-referencing of the revenue maps.

4.5 PREPARATION OF GEO-REFERENCING OF REVENUE FOREST LAND

With geo-referencing of cadastral maps, each and every parcel of the revenue map also automatically geo-referenced. The forest patches were extracted from geo-referenced cadastral map as per land schedule provided by OGPTL to prepare the geo-referenced forest land map.

DGPS observations were taken at all change point of the Forest boundary using Trimble R-6 Dual frequency (with Glonass) DGPS. The data observed by base and rover were post processed using advanced Trimble Business Centre software for obtaining the final change point Co-ordinates. These co-ordinates were plotted in GIS software to prepare the geo-reference forest land map. 8 nos of change points are taken on both side of the forest boundary.

5. CONCLUSION

The observed DGPS co-ordinates of SCPs of Cadastral Map, forest boundary pillars and area are given in Table-3 and Table-5 respectively.



Table-3: Coordinates of Change point of Forest Land

Pillar No	UTM Co-ordinates		Geographic Co-ordinates	
	Easting	Northing	Longitude	Latitude
Village Name- Anandagaon				
and1	557757.292	2379769.612	81°33'27.6689"	21°31'10.93539"
and2	558565.512	2380409.443	81°33'55.84246"	21°31'31.65118"
and3	559607.794	2380100.645	81°34'32.3311"	21°31'21.48378"
and4	559503.786	2379239.883	81°34'28.30778"	21°30'53.50021"
and5	558542.852	2378543.665	81°33'54.82012"	21°30'30.96991"
and6	557477.552	2378810.144	81°33'17.82688"	21°30'39.76125"

Table-4: Coordinates of Change point of Forest Land

Pillar No	UTM Co-ordinates		Geographic Co-ordinates	
	Easting	Northing	Longitude	Latitude
Patch-1(Village Name- Anandagaon)				
1	557737.330	2379524.122	81°33'26.94457"	21°31'2.95318"
2	557612.034	2379447.831	81°33'22.58001"	21°31'0.48636"
3	557517.842	2379391.992	81°33'19.29913"	21°30'58.68112"
4	557472.799	2379404.234	81°33'17.73502"	21°30'59.84496"
5	557434.338	2379420.378	81°33'16.40017"	21°30'59.61401"
6	557577.593	2379505.302	81°33'21.38999"	21°31'2.35957"
7	557727.429	2379596.024	81°33'26.60934"	21°31'5.29292"
8	557732.781	2379542.888	81°33'26.78877"	21°31'3.56406"

Table-5: Area Statement of Forest Boundary

जिला	तहसील	(ग्राम)	(खसरा नं)	डी.जी.पी.एस सर्वेक्षण पश्चात रकबा		(मद)
				कुल रकबा(हे०)	प्रभावित रकबा (हे०)	
बेमेतारा	बेरला	आनन्दगांव	19	17.500	1.970	घास
Total Area (कुल रकबा)					1.970	

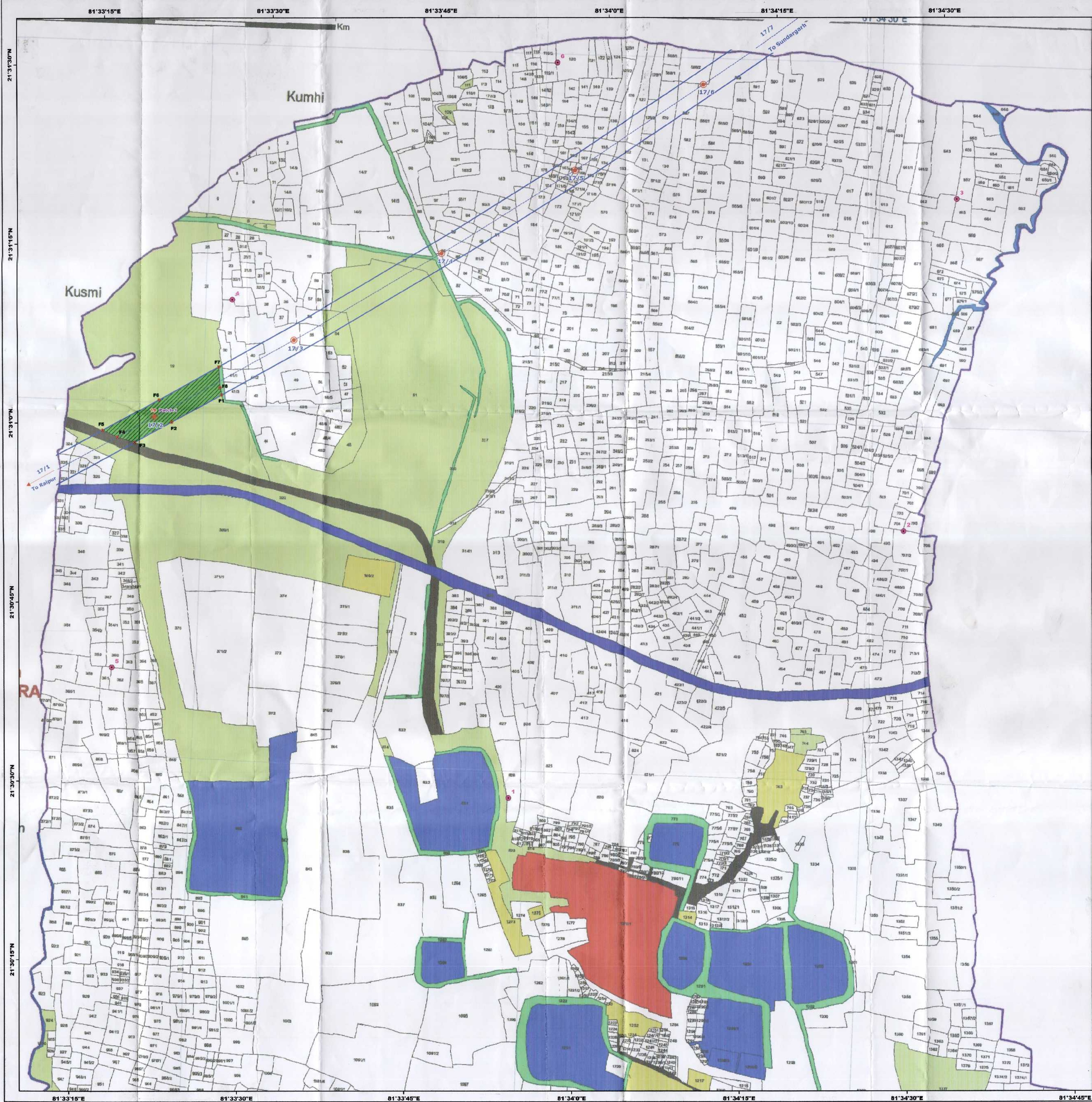
The forest boundary map is placed at Plate-1. The Geo-referenced forest boundary superimposed on Sol Topo sheet & High Resolution Satellites Image are enclosed at Plate-2 to Plate-3 respectively.



6. SPECIFICATION OF DGPS EQUIPMENT & SOFTWARE

SPARC deployed advanced and hi-precision devices to carry out the DGPS survey. The DGPS performance specifications are given below. The corresponding fact sheets are placed at Annexure-4 for ready reference.





Map Showing DGPS Surveyed Co-ordinates and Boundary of Forest Area Proposed to be Diverted for 765KV D/C Jharsuguda (Sundargarh-Raipur) Transmission Line OF Odisha Generation Phase-II Transmission Limited (OGPTL) in Village-Anandagaon, Tahasil-Berla,Durg Forest Division,District-Bemetara,Chhatisgarh

Scale: 1:4,000

LEGEND

- Observation Point
- AP Point
- Forest Plot
- Patch Boundary
- Forest Pillar
- Centre Line
- Alignment Boundary

CO-ORDINATES OF SC/DGPS OBSERVATION POINT

Pillar No	Geographic Co-ordinates		UTM Co-ordinates	
	Latitude	Longitude	Easting	Northing
1	N21°30'28.96232"	E81°33'53.73727"	558511.809	2378512.574
2	N21°30'53.43278"	E81°34'28.31548"	558504.015	2379237.811
3	N21°31'21.43578"	E81°34'32.04878"	558608.250	2380099.171
4	N21°31'10.96920"	E81°33'27.62232"	557755.950	2379770.340
5	N21°30'39.78401"	E81°33'17.87751"	557479.005	2378811.156
6	N21°31'31.71693"	E81°33'55.93501"	558567.304	2380411.471

CO-ORDINATES OF FOREST PILLAR

Pillar No	Geographic Co-ordinates		UTM Co-ordinates	
	Latitude	Longitude	Easting	Northing
F1	557737.330	2379524.122	81°33'26.94457"	21°31'2.95318"
F2	557612.034	2379447.831	81°33'22.58001"	21°31'0.48636"
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F8	557732.781	2379542.888	81°33'26.78877"	21°31'3.56406"

Area Statement:-

Village	Khasra No	Total Area (Hectare)	DGPS Area (Hectare)	Classification
Anandagaon	19	17.5	1.97	Grass Land
Total Area		17.5	1.97	

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DGPS Survey Conducted and Map Prepared by :-
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Bhubaneswar - 751024.

FOREST BOUNDARY SUPERIMPOSED ON
HIGH RESOLUTION SATELLITE IMAGE,
765KV D/C JHARSUGUDA (SUNDARGARH- RAIPUR)
TRANSMISSION LINE,DURG FOREST DIVISION,
DISTRICT-BEMETERA, CHHATISGARH



0 0.1 0.2 0.4 0.6 0.8 1 KM

SCALE:10,000

Image © 2016 CNES / Astrium

Legend

-  Forest Pillar
-  AP
-  Center line
-  Transmission Line
-  Forest Boundary



