



Reliance Jio Infocomm Limited 4G OFC
Network

DGPS Survey report for Forest Diversion of
proposed OFC Cable Route from Ketma to
Hadmor with Route Length 23.98 Km in
District Korba



APPLICATION SUBMITTED BY:
RELIANCE JIO INFOCOMM LIMITED

DGPS SURVEY AND GIS MAPPING DONE BY:
Geotrax International Services
Raipur, Chhattisgarh.





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1. Introduction and Background

PROJECT 4G OPTICAL FIBER CABLE

1.1 Background

Reliance Jio Infocomm Limited is setting up 4G Optical Fiber Cable network across the country. In the state of Chhattisgarh, the company plans to set up the telecom network (including laying of OFC cable) along the NHAI/PWD Road corridor. Reliance Jio Infocomm is granted license by Ministry of Communications & IT, Dept. of Telecommunications, and Govt. Of India, to establish Optical Fiber Cable network under the license number 370/2011 dated. 23.06.2011 issued to M/S Infotel Broadband Services Limited (company name changed to Reliance Jio Infocomm Limited on 22.01.2013). The OFC Cable is laid under the ground at approx. depth of 1.65m and the trench width is 0.5m. In most of the places the cable trench line on National Highways is approx. at a distance of 14.5m from the road centerline and for State/District highways it is approx. 7m from the road centerline.

1.2 Location and Communication

The proposed OFC Cable route from Ketma to Hadmor is on the National Highway corridor NH-111 (Ambikapur Highway). The route length is approx. 23.98 km. The National Highway 111 links the town Bilaspur to Ambikapur via Katghora. OFC cable route falls in Kendai thesil of the Korba district. The survey site passes through Kendai forest range of Katghora forest division. The cable route's proposed starting point is Hadmor at Latitude 22°45'03.7035"N and Longitude 82°28'59.1200"E, and the end location is Ketma at Latitude 22°45'27.0391"N and Longitude 82°38'25.7543"E. The OFC Cable route is covered under Survey of India Toposheet 64 J/5, 64 J/9, & 64 J/10 on RF 1:50000.



1.3 Objective

As per directives of Ministry of Environment & Forests (MoEF) dated 8th July 2011; all applications for Forest Diversion, under Forest Conservation Act, 1980 must be accompanied with Geo-referenced shape file, showing the boundary of the proposed area (both soft copy and hard copy maps), prepared using Differential GPS (DGPS) and the same should be uploaded to MoEF website along with the online application.

To meet this requirement of MoEF, Reliance Jio Infocomm Limited, entrusted the DGPS survey work to M/s Geotrax International Services, Raipur, which is an empanelled agency of Directorate of Geology and Mines, Chhattisgarh (**Ref. Circular No. F-7-14/2013/12, dated. 10.11.2014**).



1.4 Geotrax Empanelment Certificate in Chhattisgarh

By Speed post

छत्तीसगढ़ शासन
खनिज साधन विभाग
मंत्रालय
महानदी भवन, नया रायपुर-492002

// अधिसूचना //

रायपुर, दिनांक नवम्बर 2014

क्रमांक: एफ 7-14/2013/12- राज्य शासन एतद् द्वारा चौफ कन्ट्रोलर ऑफ माइन्स, भारतीय खान भूरो भानपुर के परिषद क्रमांक 2/2010 दिनांक 08.4.2010 के पैरा-2 के बिन्दु-2 के तारतम्य में समस्त खनिजों के खनिज विभागों के सोफ स्तम्भ का Differential Global Positioning System (डीजीपीएस) का उपयोग करती हुए सर्वेक्षण करने के लिए तालिका में दर्शित संस्थानों को अधिमन्थता प्रदान करता है:-

| क्र. | एजेंसी का नाम एवं पता |
|------|---|
| 1 | M/S SHREERAM GEMICON (PVT.) LIMITED GEOLOGICAL AND MINING CONSULTANTS L-09, Songanga Colony Seepat Road, Bilaspur (Chhattisgarh) |
| 2 | M/S SINHA MINING CONSULTANCY, GOA Office No. 9, D.Costa Commercial Apartment, Near Old Railway Station Gate, Malibat, Margo - 403601, Goa-India |
| 3 | M/S SPATIAL PLANNING AND ANALYSIS RESEARCH CENTRE PVT. LTD E/11, Infocity, Chandaka Industrial Estate, Bhubaneswar, Orissa, India, Pin - 751024 |
| 4 | M/S SIDDHARTH GEO CONSULTANTS, 21/3, First Floor Ramkund, Santa Colony, Behind Lifeworth Hospital, Raipur (Chhattisgarh) 492001 |
| 5 | M/S SOHAM FERRO MANGANESE PVT. LTD. Block No. 16,17 Ground Floor N.K.Y. Tower, Anjali Sq. Wardha Road, Nagpur (Maharashtra) |
| 6 | M/S SAN SURVEY ENGINEERING - HOOGHLY(WB) Regd. Off - 465, Jiban Pal Bagan, Karbala (West), P.O. & Dist. - Hooghly, West Bengal, Pin - 712103 Contact Office - Anjali Complex, Bankim Kanan, Chinsurah Station Road, Chinsurah, Hooghly, West Bengal -712102 |
| 7 | M/S GEOTRAX INTERNATIONAL SERVICES, HYDERABAD (TELANGANA) Plot No 156 & 157, Lokayata Colony, Badangpet Nadargul, Hyderabad 500058, Telangana |
| 8 | M/S RAFT CONTRACTORS AND DESIGNERS, Plot No. D-36, Ground Floor, Koelnagar, Raurkela, Dist. Sundargarh, Orissa, Pin No. - 769014 |
| 9 | M/S MICRONET SOLUTION, Bisesar House, Opp. HSSC Board Office, (P.B. 85 G.P.O.) Civil Line, Nagpur, Maharashtra - 440001 |
| 10 | M/S BHARAT ALUMINIUM COMPANY LIMITED (BALCO) P.O. Buleo Nagar Korba(C.G.), India, Pin 495684 |

2/ अधिमन्थता प्राप्त संस्थानों के लिए शर्त-

- 2.1. The Survey Agency Shall Be responsible for the accuracy of the data collected and Survey.
- 2.2. Coordinates of boundry pillars shall be established in the World Geodetic System 1984 (WGS-84) Datum.
- 2.3. Each boundry pillar shall be served using DGPS, at least 2 Hours observation for its ground position.



(5)

1/2/1

- 2.4 The maximum distance between any two successive pillars should not be more than 100 meter.
- 2.5 All corner pillar should be of pyramid shaped whith base of 1 meter and height of 2 meter and should be placed 1 meter above the ground and 1 meter below the ground.
- 2.6 Distance and bearing to the forward and backward pillars and latitudes and longitudes should be marked on all the corner pillars.
- 2.7 डीजीपीएस सर्वे कार्य हेतु पारिश्रमिक का निर्धारण अधिमान्य प्राप्त संस्थान एवं खनिज रियायतधारी के मध्य आपसी सान्त्वय से किया जाएगा। किसी भी प्रकार का आपसी विवाद होने पर राज्य शासन उत्तरदायी नहीं होगा।
- 2.8 डीजीपीएस सर्वे कार्य के गुणवत्ता में कमी पाये जाने पर या किसी भी प्रकार की कार्य संबंधी शिकंशत पाये जाने पर जांच उपरांत राज्य शासन को यह अधिकार होगा कि उक्त अधिकृत एजेसी की मान्यता किसी भी समय समाप्त की जा सकती है।
- 2.9 डीजीपीएस सर्वे के संबंध में भारतीय खान ब्यूरो/राज्य शासन द्वारा समय-समय पर जारी निर्देशों का पालन अधिमान्यता प्राप्त संस्थान को करना होगा।
- 2.10 राज्य शासन द्वारा जारी यह अधिमान्यता 03 वर्ष के लिए होगी। समयावधि समाप्त से 03 माह पूर्व अधिकृत एजेसी नवीनीकरण हेतु आवेदन कर सकेगा।
- 2.11 भारत सरकार एवं राज्य शासन द्वारा डीजीपीएस सर्वे के संबंध में समय-समय पर जारी निर्देशों का पालन किया जाना होगा।
- 3/ उक्त अधिमान्यता अतिरूचना के जारी होने की तिथि से 03 वर्ष के लिए होगी।

छत्तीसगढ़ के राज्यपाल के नाम से
तथा आदेशानुसार,

(सुबोध कुमार सिंह)
सचिव
छत्तीसगढ़ शासन
खनिज साधन विभाग

सु. क्रमांक एफ 7-14/2013/12
प्रतिलिपि-

रायपुर, दिनांक नवम्बर, 2014

1. सचिव, भारत सरकार, खान मंत्रालय, शास्त्री भवन, नई दिल्ली,
2. कंट्रोलर जनरल, भारतीय खान ब्यूरो, सेकण्ड फ्लोर, ए-ब्लॉक, इन्दरा भवन, सिविल लाईन, नागपुर (महाराष्ट्र)
3. चीफ कन्ट्रोलर ऑफ माईन्स, भारतीय खान ब्यूरो, सेकण्ड फ्लोर, ए-ब्लॉक, इन्दरा भवन, सिविल लाईन, नागपुर (महाराष्ट्र)
4. क्षेत्रीय खान नियंत्रक, भारतीय खान ब्यूरो, छठवां तल, बी एवं सी -ब्लॉक, इन्दरा भवन, सिविल लाईन, नागपुर (महाराष्ट्र)
5. संचालक, भौतिकी तथा खनिकर्मा, छत्तीसगढ़ ब्लॉक-4, द्वितीय तल, इन्द्रावती भवन, नया रायपुर,
6. समस्त कोलेक्टर, जिला _____ छत्तीसगढ़

3

17311

42

7.2 समस्त संबंधित

- की और सूचनाएँ एवं आवश्यक कार्यवाही हेतु
- 8 संचालक, शासकीय भुद्रालय, गान्धिवारा, मनपुरी, रायपुर(छत्तीसगढ़) की ओर
- 9 शीलकृत में प्रकाशनाएँ।
- 9 श्री श्रीजगत राव सहायक भौतिकी विद्, रावालनालय भौतिकी तथा खनिकन
- द्वितीय पत्नी, इन्द्रावती भवन, नया रायपुर। कृपया उक्त आदेश/अतिरिक्तना को
- 10 संज्ञानालय की वेबसाईट में अपलोड करने का कष्ट करें।
- साई फाईल रजिस्टर

राशिब

akf

छत्तीसगढ़ शासन
खनिज राधान विभाग



Fig-1: Ketma to Hadmor 4G OFC Cable Proposed Route on Satellite Imagery

2. Scope of Work

1. Establishment of one base station with 72 Hours observation and secondary control points at every 10km along the proposed route.
2. DGPS Survey for collection of ground coordinates along the OFC Cable trench at every 50m interval and/or at every turn/bend along the proposed trench. The DGPS data is collected at forest patches only.
3. Data processing and Interpretation
 - a. Geo-referencing of SOI Toposheet (1:50000), Forest Stock map (1:15000, if available) and satellite imagery
 - b. Creation of OFC Cable trench boundary vector map using the DGPS Surveyed data
 - c. Superimposition of cable route layer on Georeferenced forest maps, SOI Toposheet and Satellite imagery.
 - d. Computation of Forest area proposed for diversion. It includes Reserved/Protected Forest & Revenue Forest.
 - e. Preparation of Geo-referenced forest map at 1:15000 scale, and SOI Toposheet at 1:50000 scale.
 - f. Preparation of DGPS survey report along with soft copy of – maps in shapefile format and kml file
4. Printing of report and Geo-referenced maps and Technical compliance.



3. Deliverables

The deliverables envisaged for the assignment are described below

1. Post processed DGPS observations data as well as raw data in RINEX format.
2. DGPS Reports - Base line & network adjustment report for the primary and Secondary Control Points.
3. Geo-referenced SOI maps & forest block maps based on DGPS observations – Hard and Soft Copy (SHP and KML formats).
4. Proposed Forest Diversion area statement as per DGPS Survey
5. DGPS Survey and mapping report

4. Brief description of the Technical approach

4.1 Input Data

The proposed 4G Cable Route plan is shown on the ground by the engineer/ Vendor of Reliance Jio Infocomm Ltd (RJIL). The Forest & SOI maps required for geo-referencing were provided by Reliance Jio Infocomm Limited. It is proposed that the cable is laid within the ROW of the NHAI/PWD road corridor (where possible). The cable trench is laid at a depth of 1.65m below ground and the trench width is 0.5m. The revenue village maps were collected from NIC online website (<http://cg.nic.in/bhunaksha/>). The revenue forest information & details are collected from the District Revenue department and were provided by RJIL.

4.2 GIS Data Preparation

Based on the input data (maps, boundary coordinates from CMPDI) and information provided by *Revenue Department of Surguja and Surajpur districts*, the DGPS base station - Primary and Temporary Benchmarks Control Points (PCP and TBM) in the project area are planned. One PCP with 72 hours observation was planned and established on the roof top of the Forest Department Guest House (Shiv Park), Surajpur. Secondary control points are planned for DGPS Static Observation for at least 12 hours duration at Tara Forest Guest House, Surajpur which is approximately 45 (aerial distance) from



Surajpur Primary Control Point. The Temporary Bench Mark are further established at Ketma which is 15km (aerial distance) from Tara Secondary control point. The coordinate of the PCP is given below:



Not to Scale

Fig-2: Satellite Image showing the location of the Surajpur Primary Control Point

4.3 Establishment of Primary Control Point (PCP)

The Primary Control Point (PCP) with 72 hours of DGPS Observation was established as the DGPS base station. The PCP was established in the roof top of the Forest Department Guest House (Shiv Park) in Surajpur. As per Survey of India (SOI) Guideline, the PCP is to be fixed through continuous observation for 72 hours duration. The 72 hours of observation was carried out using DGPS from 9th May 2016 to 12th May 2016. The observed data was processed with reference to the data of International GNSS Service (IGS) stations as per SOI guideline (IGS processed report is enclosed as Annexure-1).

The coordinate of the PCP is given below:

| Point ID | Latitude (d:m:s) | Longitude (d:m:s) | Ellipsoidal Height (m) |
|--------------|------------------|-------------------|------------------------|
| SurajpurBase | 23°12'52.39820"N | 082°52'59.05530"E | 486.559000 |



Fig-3: Images showing Primary Control Point (PCP)

4.4 Establishment of Secondary Control Point (SCP)

The Secondary Control Point with 12 hours of static observation was established at Tara Forest Guest House (Point ID: TARA Base). The TARA control point is established w.r.t to the Surajpur Primary Control Point.

Number Of Points: 2

Number Of Control Points: 1

| Control Point ID | Type | Latitude | Longitude | Ellipsoidal Height(m) |
|------------------|-------------|------------------|-------------------|-----------------------|
| SurajpurBase | Lat. Lon. H | 23°12'52.39820"N | 082°52'59.05530"E | 486.559000 |

Below table lists the coordinates of TBMs:

| Point ID | Latitude | Longitude | North(m) | East(m) | Ellipsoidal Height (m) |
|-----------|------------------|-------------------|-------------|-------------|------------------------|
| TARA_Base | 22°50'01.39550"N | 082°44'18.77644"E | 2526163.501 | 678405.9089 | 509.562031 |

4.5 DGPS Survey Procedure

DGPS survey was carried out using a pair of DGPS instrument. One DGPS Instrument was used as Base Station. The first base station for the survey was established at the Secondary control Point in Tara. The base is shifted using the Real Time Kinematic Survey method. The distance between the Base Station and rover was always less than 5km.



The other DGPS instrument was working as Rover. The survey was conducted in Real Time Kinematic (RTK) mode. The Survey team carried out DGPS Survey of boundary points by walking along the proposed cable trench boundary. DGPS readings were collected at every 50m distance along trench and at every turn or bend. For Geo-referencing village maps around 5 GCPs were collected for the each village having Govt. Forest Land.

During the survey the start and end of forest patch was identified in the field with the help of staff from the forest department. The forest department staff also provided information regarding the forest range, compartment number etc.

The static data is Post Processed using Trimble Business Centre software.

4.6 Creation of Vector Layers

The surveyed points captured through DGPS were plotted in the GIS Software and the Polygon and Polyline layers are created using the DGPS Surveyed points. Different layers such as the Forest Patch polygon, Forest Trench centerline, Non-Forest Trench line, polygon showing Revenue forest patches (Chote Jad ka Jungle + Bade Jad Ka Jungle) etc., are prepared. The vector layers prepared are then super-imposed on the Geo-referenced Forest map and Cadastral maps.

4.7 Specification of DGPS Equipment

Geotrax deployed the most advance and hi-precision devices to carry out the DGPS survey. The DGPS performance specifications are given below. The corresponding fact sheets are placed below for ready reference.

COMNAV

T300 GNSS Receiver



Features

- Ultra small
- Super light
- Many user-friendly conveniences built in
- GPS L1/L2/L5, BeiDou B1/B2/B3, GLONASS L1/L2
- Low power consumption
- Support long baseline E-RTK

RTK robust enough for challenging environments, in a device that is light and easy to carry

With decades of experience in the surveying GNSS receiver, the T300 is a product which combines lots of market proved advantages together. It can track all the working GNSS constellations. By using ComNav's unique QUAN™ algorithm technology, it can function in RTK mode with all the GNSS constellations or by using any single GNSS constellation such as GLONASS or BeiDou. The strong anti-interference ability of the receiver makes it possible to work in any environment.

Design driven to improve user experience

Our R&D people are always thinking about how to improve the physical experience of users and workflow in the field. With this in mind, the T300 integrates a cutting edge GNSS board, Bluetooth®, UHF (Rx&Tx) into a compact board. Smart design makes the T300 the lightest and smallest (volume) receiver in the world.

Hot swap battery design

Extending the field working time is also a passion for our R&D people. They do lots of tests and analysis to reduce the power consumption, and make the whole system work more efficiently. In parallel, they've designed in the capability to hot swap the battery source. When the warning sounds and LED flashes, put your second battery in place. Then recharge the first while you keep working.

Consumer grade batteries... always available

Losing power in the field is significantly inconvenient for users, as the batteries for GNSS receivers are often unusual types and not readily available. Once again our R&D people developed a solution so that the T300 runs on normal consumer batteries.

Technical Specifications T300

Signal Tracking

- 256 channels with simultaneously tracked satellite signals
- GPS: L1 C/A, L1 C, L2 P, L5
- BeiDou: B1, B2, B3
- GLONASS: L1, L2
- SBAS: WAAS, EGNOS, MSAS, GAGAN

Performance Specifications

- Cold start: <50 s
- Warm start: <30 s
- Hot start: <15 s
- Initialization time: <10 s
- Singal re-acquisition: <2 s
- Initialization reliability: >99.9%

Positioning Specifications

- Post Processing Static
 - Horizontal: 2.5 mm + 0.5 ppm RMS
 - Vertical: 5 mm + 0.5 ppm RMS
- Real Time Kinematic
 - Horizontal: 8 mm + 1 ppm RMS
 - Vertical: 15 mm + 1 ppm RMS
- E-RTK¹ (baseline<100 km)
 - Horizontal: 0.2 m + 1 ppm RMS
 - Vertical: 0.4 m + 1 ppm RMS
- Code differential GNSS positioning
 - Horizontal: 0.25 m+ 1 ppm RMS
 - Vertical: 0.5 m + 1 ppm RMS
- SBAS: Typically <1 m 3D RMS
- Standalone: <1.5 m 3D RMS

Communications and Memory

- 1 Serial port (7 pin Lemo).
Baud rates up to 921,600 bps.
- Radio modem: Tx/Rx with full frequency range from 410-470 MHz²
 - Transmit power: 0.5-2W adjustable
 - Range: 1-4 km
- Position data output rates: 1 Hz, 2 Hz, 5 Hz, 10 Hz
- 5 LEDs (indicating Power, Satellite Tracking, Bluetooth[®] and Differential Data)
- Bluetooth[®]: V 2.X protocol, work compatible with Windows 7, Windows mobile and Android

Data Format

- Correction data I/O:
 - RTCM 2.x, 3.x, CMR (GPS only), CMR+ (GPS only).
- Position data output:
 - ASCII: NMEA-0183 GSV, RMC, HDT, VHD, GGA, GSA, ZDA, VTG, GST, PJK, PTNL
 - ComNav Binary update to 20 Hz

Physical

- Size(WxH): 15.8 cm x 7.5 cm
- Weight: 0.95 kg (include 2 batteries)

Environmental

- Operating temperature: -40 °C to + 65 °C (40 °F to 149 °F)
- Storage temperature: -40 °C to + 85 °C (40 °F to 185 °F)
- Humidity: 100% condensation
- Waterproof and dust proof: IP67 protected from temporary immersion to depth of 1 meter, floats
- Shock: survives a 2 meter drop on to concrete

Electrical

- Input Voltage: 5-27 VDC
- Power consumption: 2.85 W (3 constellations)³
- Li-ion battery capacity: 2 x 1800 mAh, up to 8 hours typically
- Memory: 256 MB internal with up to 16 GB pluggable memory card

Software

- ComNav field data collection software CGSurvey
- Carlson's SurvCE field data collection software (optional)
- MicroSurvey's FieldGenius field data collection software (optional)

¹ E-RTK, BeiDou B3 signal used in RTK calculate engine; concern the current situation, this mode can be used in APAC.
² 410-470 MHz, 2 frequency range, 410-430, 430-460, 460-470, need to clarify when place the order.
³ Power consumption will increase if using internal radio modem transmitter.

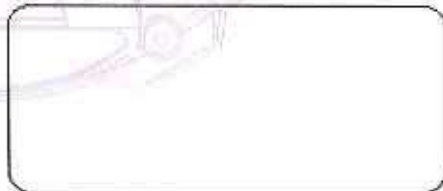
Specifications subject to change without notice.

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 www.comnavtech.com





5. Results

The total route length from Ketma to Hadmor is approx. 23.98 km and the proposed forest area for diversion is 0.813 Ha. DGPS Survey processing report and co-ordinates of the PCP are in Annexure-1, and DGPS coordinates of TBM and forest patch boundary coordinates is in Annexure-2. The geo-referenced maps are in Annexure -3.

AREA STATEMENT

| Ketma to Hadmor Proposed Forest Diversion Area Statement | | | |
|--|---|-----------------------------------|--|
| Total Route Length (in KM) | Total Forest Patch Length (in KM) | OFC Cable Trench Width (in KM) | Total Forest Diversion Area (in HA) |
| 23.98 | 16.26 | 0.0005 | 0.813 |

| SCHEDULE OF FOREST LAND - PROTECTED FOREST & ORANGE FOREST AREA | | | | | | |
|---|--------------|----------|--------|------------------|--------------------|------------------------|
| SL. NO. | PATCH NUMBER | DIVISION | RANGE | COMPARTMENT TYPE | COMPARTMENT NUMBER | DIVERSION AREA (in HA) |
| 1 | PATCH NO 1 | KATGHORA | KENDAI | PROTECTED FOREST | P403 | 0.052 |
| 2 | PATCH NO 2 | | | PROTECTED FOREST | P391 | 0.081 |
| 3 | PATCH NO 3 | | | PROTECTED FOREST | P391 | 0.035 |
| 4 | PATCH NO 3 | | | PROTECTED FOREST | P383 | 0.091 |
| 5 | PATCH NO 3 | | | PROTECTED FOREST | P382 | 0.049 |
| 6 | PATCH NO 3 | | | PROTECTED FOREST | P381 | 0.147 |
| 7 | PATCH NO 3 | | | PROTECTED FOREST | P353 | 0.127 |
| 8 | PATCH NO 3 | | | PROTECTED FOREST | P352 | 0.026 |
| 9 | PATCH NO 3 | | | PROTECTED FOREST | P354 | 0.097 |
| 10 | PATCH NO 6 | | | PROTECTED FOREST | P348 | 0.062 |
| 11 | PATCH NO 3 | | | ORANGE AREA | 708 | 0.018 |
| 12 | PATCH NO 4 | | | ORANGE AREA | 707 | 0.011 |
| TOTAL FOREST AREA | | | | | | 0.796 |

| SCHEDULE OF FOREST LAND - REVENUE FOREST (CJJ + BJJ) | | | | | | |
|--|--------------|----------|--------------|--------------|---------------|------------------------|
| SL. NO. | PATCH NUMBER | DISTRICT | TALUK | VILLAGE NAME | KHASRA NUMBER | DIVERSION AREA (in HA) |
| 4 | PATCH NO 5 | Korba | Pondi Uproda | Chotiya | 381/1 | 0.017 |
| TOTAL FOREST AREA | | | | | | 0.017 |
| TOTAL FOREST LAND (TABLE A+TABLE B) | | | | | | 0.813 |



6. Background of Organization

6.1 Company Profile: Geotrax

Geotrax International Services (www.geotrax.in) is a Professional Land Mapping and Services provider across India established in the year 1999. During the last 14+ years, we had an opportunity to execute a variety of surveying jobs all over India and in the Middle East to various customer specifications for RIS, LIS, and Municipal GIS oriented jobs. Cadastral Surveys using ETS/DGPS and Provision of Ground control conforming to stringent accuracy standards using high end instruments as RTK/GPRS DGPS is our specialty. We also have a UAV (Drone) and Ground Penetrating Radar (on Roaster).

Geotrax is headed by Mr. V.V.S Bandhakavi (Ex-Survey of India employee) who has more than 40+ years' experience in the field of surveying in India and abroad.

Some of our major clients include:

- Odisha Space Application Centre (ORSAC)
- Steel Authority of India (SAIL)
- National Thermal Power Corporation (NTPC)
- Survey Settlement and Land Records Department (Govt. Of Gujarat)
- Survey Settlement and Land Records Department (Govt. Of Madhya Pradesh)
- Irrigation Dept. (Govt. of Jammu and Kashmir)
- National Remote Sensing Agency (Hyderabad)
- Meinhardt India Private Limited (Delhi),
- Nagarjuna Construction Company (NCC, Hyderabad)
- Consulting Engineering Services (CES, New Delhi)
- Lee Associates of South Asia (LASA, Delhi)
- Power development Corporation (Govt. of Jammu and Kashmir)

Geotrax expertise covers:

- ❖ DGPS Surveys for Mining lease boundary, and Forest Diversion
- ❖ Consultancy services for Mining Plan & EIA
- ❖ Boundary and cadastral surveys using DGPS and Total station;
- ❖ Topographic surveys.



- ❖ Ground control surveys for photogrammetric projects, including Airborne GPS.
- ❖ Only one of the two companies in India who are empanelled by NRSA for DGPS survey for ground control point collection
- ❖ Route and alignment surveys combining conventional and photogrammetric methods.
- ❖ Construction and cross-section surveys (from road design to precision layout and quality control).


Being a client focused organization, GeoTrax's combination of survey equipment, personnel, and computer resources allow for the tailoring of the project approach to match the orders of accuracy and precision requirements for each project. GeoTrax's equipment resources include 250 DGPS, 33 hand-held GPS units, theodolites, electronic digital and automatic levels, 19 Electronic Total Stations, and data collectors.

On the mapping side, our CAD and GIS professionals assist the survey projects by creating accurate maps. We have dedicated CAD experts who have extensive experience with different CAD software.




7. Annexure

7.1 Annexure – 1: PCP Observation Processing Report



CSRS-PPP (V 1.05 34613)



| | | |
|------------------------------------|-------------------------|---|
| Data Start | Data End | Duration of Observations |
| 2016-05-09 01:00:20.000 | 2016-05-12 11:24:50.000 | 82h 24m 30.00s |
| Apri/ Aposteriori Phase Std | | Apri/ Aposteriori Code Std |
| 0.015m / 0.013m | | 2.0m / 1.468m |
| Observation: | Frequency | Mode |
| Phase and Code | L1 and L2 | Static |
| Elevation Cut-Off | Rejected Epochs | Observation & Estimation Steps |
| 10.000 degrees | 4.99 % | 10.00 sec / 10.00 sec |
| Antenna Model | APC to ARP | ARP to Marker |
| Unknown | Ant. not in PPP (0 m) | 0.000 m |

(APC = antenna phase center; ARP = antenna reference point)

Estimated Position for comnav12130_combined_160

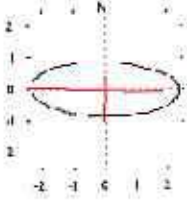
| | Latitude (+n) | Longitude (+e) | Ell. Height |
|----------------------------|------------------|------------------|-------------|
| NAD83(CSRS) (2016) | 23° 12' 52.3771" | 82° 52' 59.0012" | 485.081 m |
| Sigma(95%) | 0.001 m | 0.002 m | 0.004 m |
| Apriori | 23° 12' 52.452" | 82° 52' 58.948" | 493.493 m |
| Estimated - Apriori | -2.290 m | 1.524 m | -8.412 m |

95% Error Ellipse (mm)
 semi-major: 1.378mm
 semi-minor: 0.872mm
 semi-major azimuth: 91° 27' 15.95"

UTM (North) Zone 44

2568519.094m (N) 692696.176m (E)

Scale Factors
 1.00005872 (point)
 0.99998258 (combined)

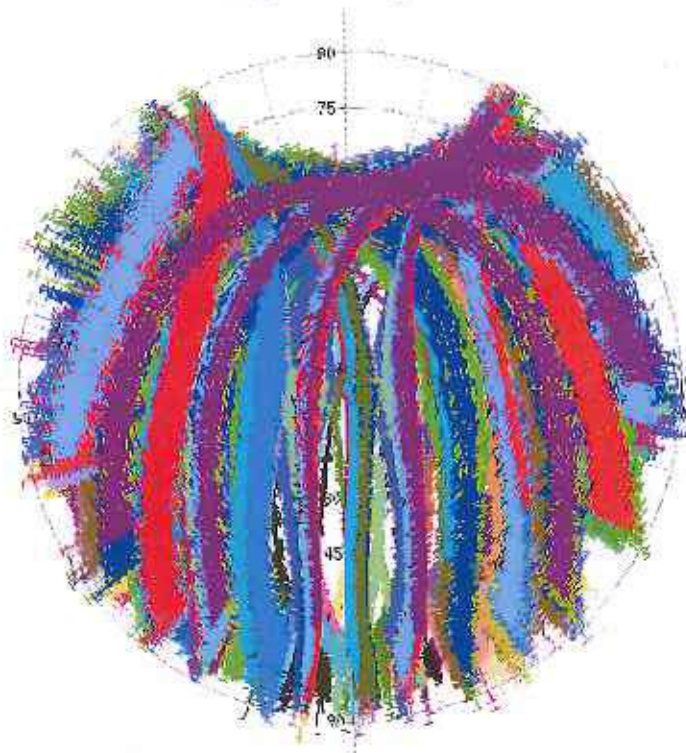


(Coordinates from RINEX file used as apriori position)



Estimated Parameters & Observations Statistics

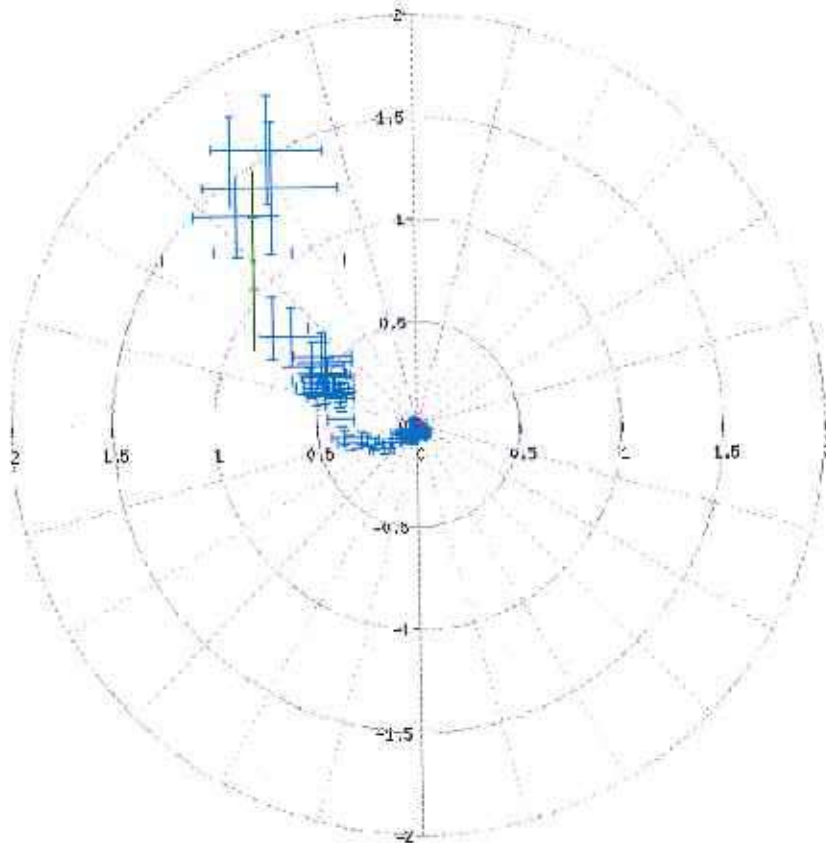
Post-Range Residuals Sky Distribution



| | | | | | | | |
|------|-------|-------|-------|-------|------|------|------|
| PRN1 | PRN9 | PRN16 | PRN23 | PRN30 | R_05 | R_14 | R_21 |
| PRN2 | PRN10 | PRN17 | PRN24 | PRN31 | R_06 | R_15 | R_22 |
| PRN3 | PRN11 | PRN18 | PRN25 | PRN32 | R_07 | R_16 | R_23 |
| PRN4 | PRN12 | PRN19 | PRN26 | R_01 | R_08 | R_17 | R_24 |
| PRN5 | PRN13 | PRN20 | R_02 | R_09 | R_18 | | |
| PRN6 | PRN14 | PRN21 | R_03 | R_10 | R_19 | | |
| PRN7 | PRN15 | PRN22 | R_04 | R_11 | R_20 | | |

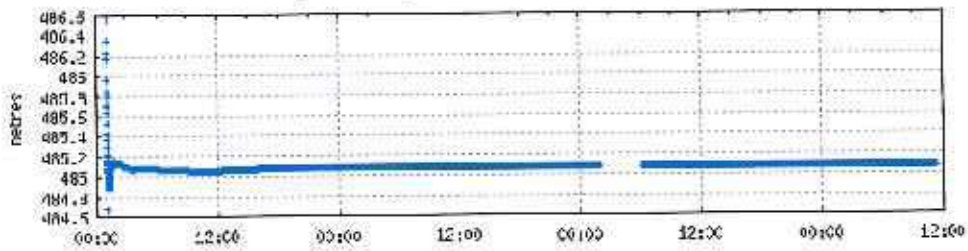


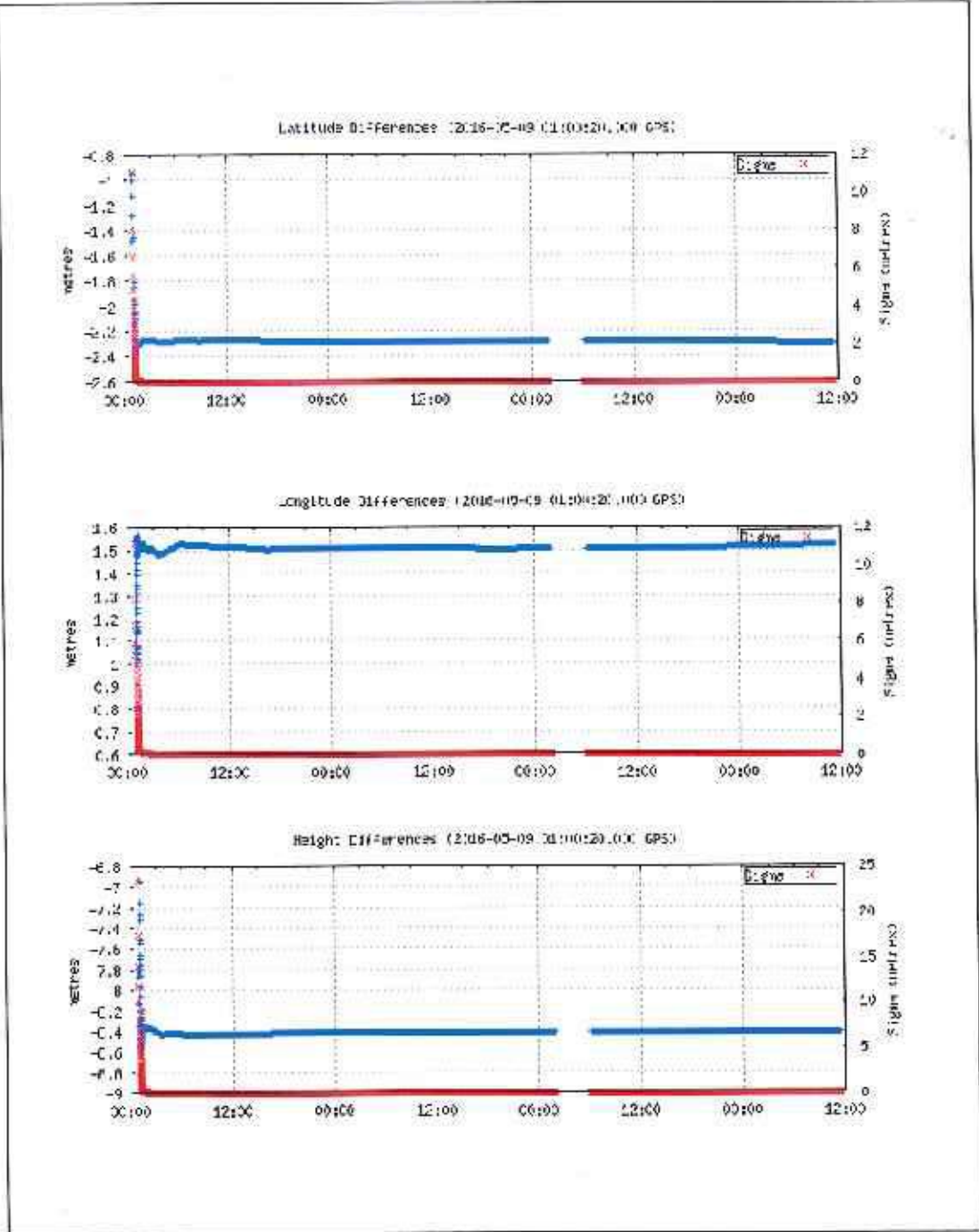
Corrections to a priori position (minus final corrections) (metres)



(1 sigma std. dev. position corrections) / ΔE
 (1 sigma std. dev. full a priori corrections) / ΔE
 (1 sigma std. dev. final position corrections) / ΔE

Ellipsoidal Height Profile (2016-05-09 01:00:20.000 GPS)

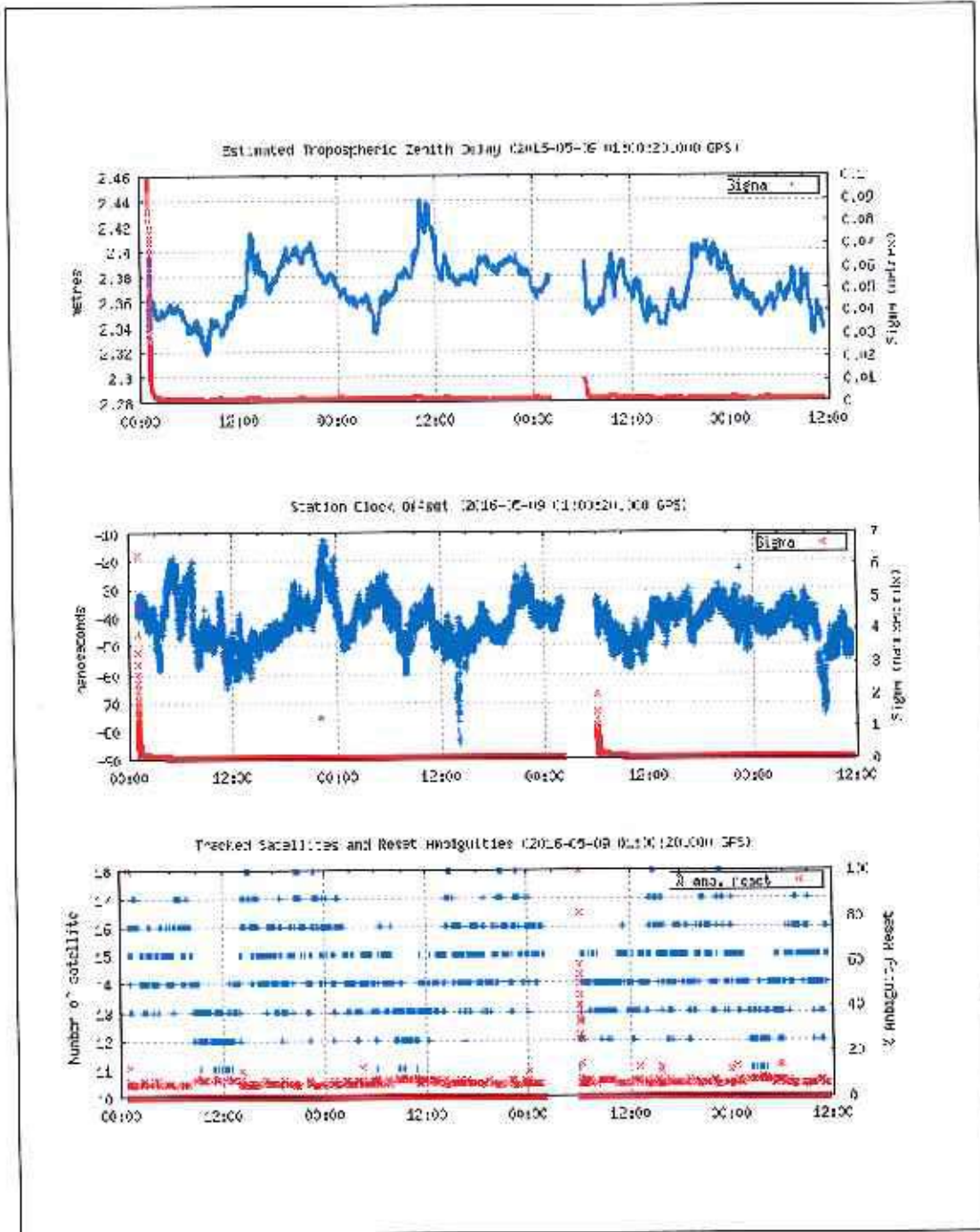




NRCan Rapid

4

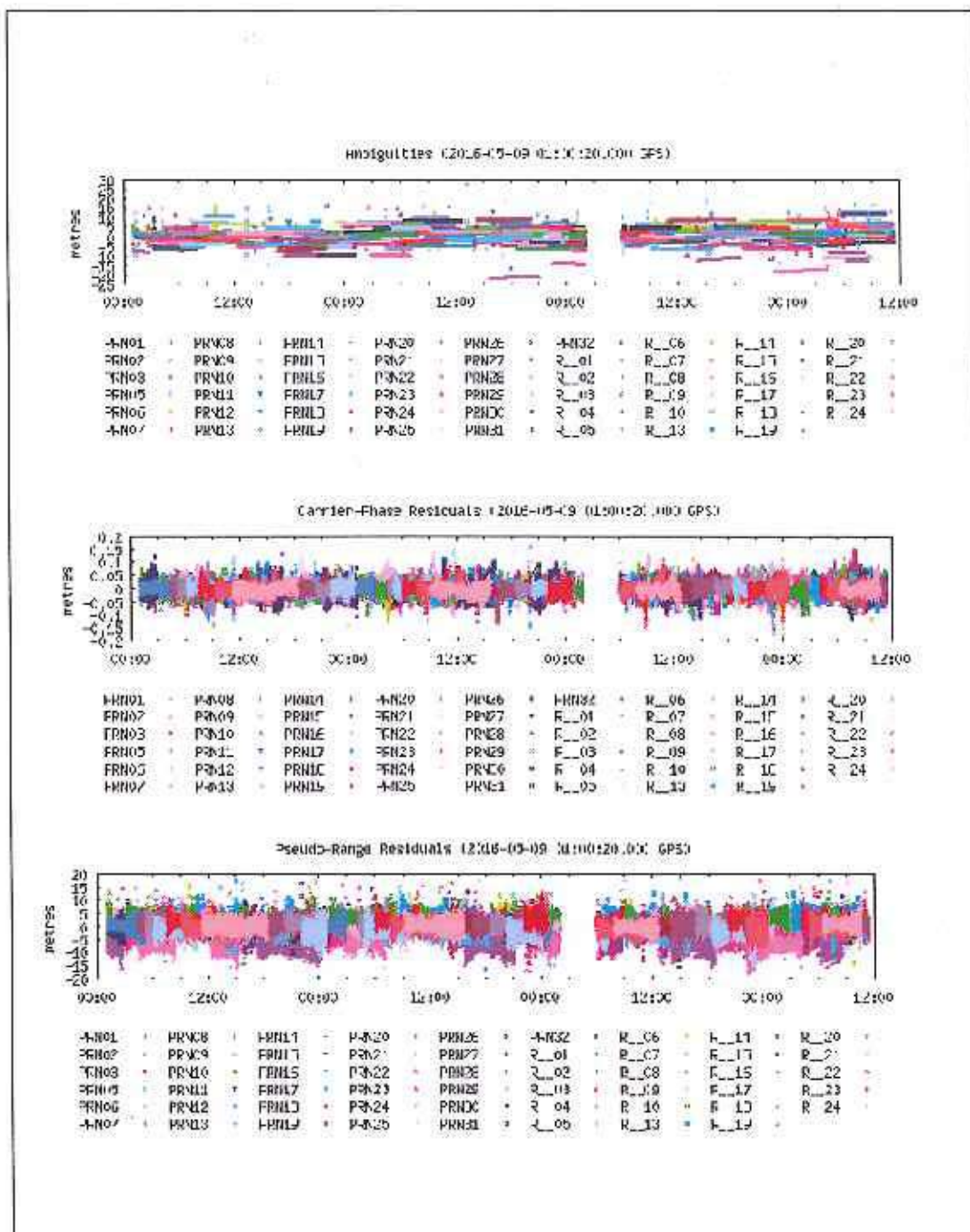
09:45:58 UTC 2016/05/15 / connav12130_combined_160



09:45:58 UTC 2016/05/16 / comnav12130_combined_150

6

NRCan Rapid





--- Disclaimer ---

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If you have any questions, please feel free to contact:

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Canada Centre for Remote Sensing
Natural Resources Canada
Government of Canada
615 Booth Street, Room 440
Ottawa, Ontario K1A 0E9
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EMail: information@geod.nrcan.gc.ca



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Canada



7.2 Annexure – 2: DGPS Surveyed coordinates of Forest Patches

| Sno. | Pillar ID | Patch No | Easting (m) | Northing (m) | Latitude "N" | Longitude "E" |
|------|-----------|---------------|-------------|-----------------|-----------------|-----------------|
| 1 | P1 | PATCH NO 1 | 668128.5586 | 2517450.542 | 22°45'21.97800" | 82°38'14.96400" |
| 2 | P2 | | 668100.0984 | 2517434.774 | 22°45'21.47400" | 82°38'13.95960" |
| 3 | P3 | | 668062.308 | 2517417.504 | 22°45'20.92680" | 82°38'12.62760" |
| 4 | P4 | | 667998.6854 | 2517391.489 | 22°45'20.10600" | 82°38'10.38840" |
| 5 | P5 | | 667963.926 | 2517381.507 | 22°45'19.79280" | 82°38'09.16440" |
| 6 | P6 | | 667893.1107 | 2517372.102 | 22°45'19.51200" | 82°38'06.68040" |
| 7 | P7 | | 667815.7343 | 2517361.692 | 22°45'19.20240" | 82°38'03.96240" |
| 8 | P8 | | 667771.1963 | 2517355.332 | 22°45'19.01160" | 82°38'02.40000" |
| 9 | P9 | | 667689.7038 | 2517342.196 | 22°45'18.61200" | 82°37'59.53800" |
| 10 | P10 | | 667575.9425 | 2517326.004 | 22°45'18.12600" | 82°37'55.54560" |
| 11 | P11 | | 667423.7817 | 2517303.46 | 22°45'17.44920" | 82°37'50.20320" |
| 12 | P12 | | 667271.9523 | 2517281.3 | 22°45'16.78320" | 82°37'44.87160" |
| 13 | P13 | | 667110.8124 | 2517259.272 | 22°45'16.12440" | 82°37'39.21600" |
| 14 | P14 | PATCH NO 2 | 666236.7735 | 2517028.65 | 22°45'08.93880" | 82°37'08.49000" |
| 15 | P15 | | 666191.1688 | 2516995.123 | 22°45'07.86600" | 82°37'06.88080" |
| 16 | P16 | | 666162.5013 | 2516974.048 | 22°45'07.18920" | 82°37'05.86560" |
| 17 | P17 | | 666135.7 | 2516954.345 | 22°45'06.55920" | 82°37'04.91880" |
| 18 | P18 | | 666095.8539 | 2516932.145 | 22°45'05.85000" | 82°37'03.51480" |
| 19 | P19 | | 666057.262 | 2516910.645 | 22°45'05.16600" | 82°37'02.15400" |
| 20 | P20 | | 666024.2859 | 2516876.574 | 22°45'04.07160" | 82°37'00.98400" |
| 21 | P21 | | 665965.0739 | 2516815.397 | 22°45'02.10240" | 82°36'58.88520" |
| 22 | P22 | | 665851.2798 | 2516697.827 | 22°44'58.32240" | 82°36'54.85320" |
| 23 | P23 | | 665740.1555 | 2516583.016 | 22°44'54.62880" | 82°36'50.91480" |
| 24 | P24 | | 665646.406 | 2516486.201 | 22°44'51.51480" | 82°36'47.59200" |
| 25 | P25 | | 665585.2195 | 2516409.259 | 22°44'49.03440" | 82°36'45.41760" |
| 26 | P26 | | 665563.335 | 2516381.739 | 22°44'48.14880" | 82°36'44.64000" |
| 27 | P27 | | 665552.5715 | 2516370.548 | 22°44'47.78880" | 82°36'44.25840" |
| 28 | P28 | | 665540.0795 | 2516337.768 | 22°44'46.72680" | 82°36'43.80840" |
| 29 | P29 | | 665515.011 | 2516308.475 | 22°44'45.78360" | 82°36'42.91920" |
| 30 | P30 | | 665503.3822 | 2516201.9 | 22°44'42.32040" | 82°36'42.46920" |
| 31 | P31 | | 665493.0814 | 2516107.495 | 22°44'39.25680" | 82°36'42.07320" |
| 32 | P32 | 665410.961 | 2516022.004 | 22°44'36.50640" | 82°36'39.16080" | |
| 33 | P33 | 665293.9395 | 2515909.92 | 22°44'32.90280" | 82°36'35.01720" | |
| 34 | P34 | 665232.6884 | 2515875.49 | 22°44'31.80840" | 82°36'32.85720" | |
| 35 | P35 | 665198.8965 | 2515856.496 | 22°44'31.20000" | 82°36'31.66560" | |
| 36 | P36 | PATCH NO 3 | 665031.621 | 2515775.014 | 22°44'28.61160" | 82°36'25.77240" |
| 37 | P37 | | 664993.9505 | 2515746.877 | 22°44'27.71160" | 82°36'24.44040" |
| 38 | P38 | | 664952.9175 | 2515716.228 | 22°44'26.72880" | 82°36'22.99320" |
| 39 | P39 | | 664912.2055 | 2515659.851 | 22°44'24.91080" | 82°36'21.54240" |
| 40 | P40 | | 664844.5056 | 2515566.102 | 22°44'21.88680" | 82°36'19.13400" |
| 41 | P41 | 664770.578 | 2515463.729 | 22°44'18.58560" | 82°36'16.50600" | |



| Sno. | Pillar ID | Patch No | Easting (m) | Northing (m) | Latitude "N" | Longitude "E" |
|------|-----------|----------|-------------|--------------|-----------------|-----------------|
| 42 | P42 | | 664645.6174 | 2515382.647 | 22°44'15.99360" | 82°36'12.09600" |
| 43 | P43 | | 664582.4771 | 2515342.889 | 22°44'14.72280" | 82°36'09.86760" |
| 44 | P44 | | 664562.1565 | 2515325.741 | 22°44'14.17200" | 82°36'09.14760" |
| 45 | P45 | | 664518.1893 | 2515314.772 | 22°44'13.83000" | 82°36'07.60320" |
| 46 | P46 | | 664517.3538 | 2515313.696 | 22°44'13.79400" | 82°36'07.57440" |
| 47 | P47 | | 664516.5357 | 2515312.642 | 22°44'13.76160" | 82°36'07.54560" |
| 48 | P48 | | 664480.6167 | 2515300.268 | 22°44'13.37280" | 82°36'06.28200" |
| 49 | P49 | | 664400.1838 | 2515272.557 | 22°44'12.49800" | 82°36'03.45240" |
| 50 | P50 | | 664352.4125 | 2515256.043 | 22°44'11.97960" | 82°36'01.77120" |
| 51 | P51 | | 664285.1996 | 2515232.243 | 22°44'11.23080" | 82°35'59.40600" |
| 52 | P52 | | 664194.6307 | 2515200.173 | 22°44'10.21920" | 82°35'56.22000" |
| 53 | P53 | | 664185.2539 | 2515203.191 | 22°44'10.32000" | 82°35'55.89240" |
| 54 | P54 | | 664121.3823 | 2515196.614 | 22°44'10.12920" | 82°35'53.65320" |
| 55 | P55 | | 664082.003 | 2515192.56 | 22°44'10.01040" | 82°35'52.27080" |
| 56 | P56 | | 664023.164 | 2515193.896 | 22°44'10.07520" | 82°35'50.20800" |
| 57 | P57 | | 663951.4437 | 2515212.831 | 22°44'10.71600" | 82°35'47.70240" |
| 58 | P58 | | 663891.0087 | 2515249.049 | 22°44'11.91480" | 82°35'45.59640" |
| 59 | P59 | | 663845.6658 | 2515299.307 | 22°44'13.56360" | 82°35'44.02680" |
| 60 | P60 | | 663771.074 | 2515477.294 | 22°44'19.37400" | 82°35'41.48160" |
| 61 | P61 | | 663714.18 | 2515613.051 | 22°44'23.80920" | 82°35'39.53760" |
| 62 | P62 | | 663613.9215 | 2515852.283 | 22°44'31.62120" | 82°35'36.11400" |
| 63 | P63 | | 663594.964 | 2515933.515 | 22°44'34.26720" | 82°35'35.48040" |
| 64 | P64 | | 663561.2775 | 2516013.456 | 22°44'36.87720" | 82°35'34.32840" |
| 65 | P65 | | 663527.2677 | 2516105.504 | 22°44'39.88320" | 82°35'33.17280" |
| 66 | P66 | | 663496.4481 | 2516187.586 | 22°44'42.56160" | 82°35'32.12160" |
| 67 | P67 | | 663488.2734 | 2516214.961 | 22°44'43.45440" | 82°35'31.84800" |
| 68 | P68 | | 663468.1772 | 2516265.192 | 22°44'45.09600" | 82°35'31.16040" |
| 69 | P69 | | 663447.4797 | 2516316.938 | 22°44'46.78440" | 82°35'30.45480" |
| 70 | P70 | | 663446.9319 | 2516319.47 | 22°44'46.86720" | 82°35'30.43680" |
| 71 | P71 | | 663432.9585 | 2516341.666 | 22°44'47.59440" | 82°35'29.95440" |
| 72 | P72 | | 663420.1979 | 2516361.935 | 22°44'48.25680" | 82°35'29.51520" |
| 73 | P73 | | 663368.8975 | 2516405.145 | 22°44'49.67880" | 82°35'27.73320" |
| 74 | P74 | | 663318.5915 | 2516447.518 | 22°44'51.07560" | 82°35'25.98720" |
| 75 | P75 | | 663295.7038 | 2516466.796 | 22°44'51.70920" | 82°35'25.19160" |
| 76 | P76 | | 663205.0029 | 2516507.442 | 22°44'53.06280" | 82°35'22.02720" |
| 77 | P77 | | 663128.0148 | 2516507.628 | 22°44'53.09520" | 82°35'19.33080" |
| 78 | P78 | | 663018.7689 | 2516512.667 | 22°44'53.29680" | 82°35'15.50400" |
| 79 | P79 | | 662910.6853 | 2516517.652 | 22°44'53.49840" | 82°35'11.71680" |
| 80 | P80 | | 662830.186 | 2516526.163 | 22°44'53.80080" | 82°35'08.89800" |
| 81 | P81 | | 662725.1708 | 2516537.267 | 22°44'54.20040" | 82°35'05.22240" |
| 82 | P82 | | 662601.7675 | 2516594.151 | 22°44'56.09040" | 82°35'00.91680" |
| 83 | P83 | | 662549.6498 | 2516618.175 | 22°44'56.88960" | 82°34'59.09880" |
| 84 | P84 | | 662495.021 | 2516643.714 | 22°44'57.73920" | 82°34'57.19440" |
| 85 | P85 | | 662393.6825 | 2516691.104 | 22°44'59.31600" | 82°34'53.65920" |



| Sno. | Pillar ID | Patch No | Easting (m) | Northing (m) | Latitude "N" | Longitude "E" |
|------|-----------|----------|-------------|--------------|-----------------|-----------------|
| 86 | P86 | | 662344.5326 | 2516714.047 | 22°45'00.07920" | 82°34'51.94560" |
| 87 | P87 | | 662314.8812 | 2516725.491 | 22°45'00.46080" | 82°34'50.91240" |
| 88 | P88 | | 662279.1624 | 2516720.464 | 22°45'00.30960" | 82°34'49.65600" |
| 89 | P89 | | 662243.7346 | 2516705.456 | 22°44'59.83440" | 82°34'48.41040" |
| 90 | P90 | | 662218.4768 | 2516695.957 | 22°44'59.53200" | 82°34'47.52120" |
| 91 | P91 | | 662217.8206 | 2516692.346 | 22°44'59.41680" | 82°34'47.49600" |
| 92 | P92 | | 662189.7677 | 2516670.84 | 22°44'58.72560" | 82°34'46.50600" |
| 93 | P93 | | 662135.8546 | 2516629.508 | 22°44'57.40080" | 82°34'44.60160" |
| 94 | P94 | | 662101.5874 | 2516603.238 | 22°44'56.55840" | 82°34'43.38840" |
| 95 | P95 | | 662054.9072 | 2516567.451 | 22°44'55.41360" | 82°34'41.73960" |
| 96 | P96 | | 662022.8353 | 2516534.098 | 22°44'54.34080" | 82°34'40.60200" |
| 97 | P97 | | 662000.1297 | 2516510.486 | 22°44'53.58120" | 82°34'39.79920" |
| 98 | P98 | | 661966.5505 | 2516475.566 | 22°44'52.45800" | 82°34'38.60760" |
| 99 | P99 | | 661867.7051 | 2516372.774 | 22°44'49.14960" | 82°34'35.10480" |
| 100 | P100 | | 661714.0361 | 2516212.968 | 22°44'44.00520" | 82°34'29.66160" |
| 101 | P101 | | 661648.0593 | 2516144.357 | 22°44'41.79840" | 82°34'27.32160" |
| 102 | P102 | | 661603.8367 | 2516098.368 | 22°44'40.31880" | 82°34'25.75560" |
| 103 | P103 | | 661507.1832 | 2516011.591 | 22°44'37.53240" | 82°34'22.33560" |
| 104 | P104 | | 661435.3041 | 2515947.18 | 22°44'35.46240" | 82°34'19.79040" |
| 105 | P105 | | 661394.7207 | 2515912.175 | 22°44'34.33920" | 82°34'18.35760" |
| 106 | P106 | | 661355.7603 | 2515886.146 | 22°44'33.50400" | 82°34'16.98240" |
| 107 | P107 | | 661313.1244 | 2515876.664 | 22°44'33.21240" | 82°34'15.48480" |
| 108 | P108 | | 661276.1665 | 2515896.9 | 22°44'33.88200" | 82°34'14.19600" |
| 109 | P109 | | 661249.6041 | 2515911.444 | 22°44'34.36440" | 82°34'13.27080" |
| 110 | P110 | | 661205.0464 | 2515952.944 | 22°44'35.72880" | 82°34'11.72280" |
| 111 | P111 | | 661156.908 | 2515959.98 | 22°44'35.97360" | 82°34'10.03800" |
| 112 | P112 | | 661137.8274 | 2515974.796 | 22°44'36.46320" | 82°34'09.37560" |
| 113 | P113 | | 661115.9716 | 2515935.328 | 22°44'35.18880" | 82°34'08.59440" |

| Sno. | Pillar ID | Patch No | Easting (m) | Northing (m) | Latitude "N" | Longitude "E" |
|------|-----------|---------------|-------------|--------------|-----------------|-----------------|
| 114 | P114 | PATCH NO 3 | 661105.2787 | 2515887.878 | 22°44'33.64800" | 82°34'08.20200" |
| 115 | P115 | | 661072.4768 | 2515839.281 | 22°44'32.07840" | 82°34'07.03560" |
| 116 | P116 | | 661061.2567 | 2515827.744 | 22°44'31.70760" | 82°34'06.63600" |
| 117 | P117 | | 661035.1141 | 2515826.403 | 22°44'31.67520" | 82°34'05.72160" |
| 118 | P118 | | 661009.429 | 2515835.735 | 22°44'31.98480" | 82°34'04.82520" |
| 119 | P119 | | 660992.2815 | 2515860.271 | 22°44'32.79120" | 82°34'04.23120" |
| 120 | P120 | | 661008.9196 | 2515957.572 | 22°44'35.94840" | 82°34'04.85040" |
| 121 | P121 | | 661007.3174 | 2515963.56 | 22°44'36.14280" | 82°34'04.79640" |
| 122 | P122 | | 661007.5552 | 2515967.421 | 22°44'36.26880" | 82°34'04.80720" |
| 123 | P123 | | 661016.8293 | 2516018.493 | 22°44'37.92480" | 82°34'05.15280" |
| 124 | P124 | | 661048.5808 | 2516257.438 | 22°44'45.68280" | 82°34'06.35160" |
| 125 | P125 | | 661063.3855 | 2516438.184 | 22°44'51.55440" | 82°34'06.93840" |
| 126 | P126 | | 661056.3344 | 2516447.928 | 22°44'51.87120" | 82°34'06.69360" |



| Sno. | Pillar ID | Patch No | Easting (m) | Northing (m) | Latitude "N" | Longitude "E" |
|------|-----------|----------|-------------|--------------|-----------------|-----------------|
| 127 | P127 | | 661044.3683 | 2516454.832 | 22°44'52.10160" | 82°34'06.27960" |
| 128 | P128 | | 660607.2388 | 2516562.379 | 22°44'55.74840" | 82°33'50.99760" |
| 129 | P129 | | 660570.9904 | 2516566.865 | 22°44'55.90680" | 82°33'49.72680" |
| 130 | P130 | | 660556.1004 | 2516558.144 | 22°44'55.62600" | 82°33'49.20120" |
| 131 | P131 | | 660539.1861 | 2516531.134 | 22°44'54.75480" | 82°33'48.60000" |
| 132 | P132 | | 660499.6503 | 2516457.163 | 22°44'52.36440" | 82°33'47.18520" |
| 133 | P133 | | 660489.5652 | 2516441.971 | 22°44'51.87480" | 82°33'46.82880" |
| 134 | P134 | | 660473.2214 | 2516423.399 | 22°44'51.27360" | 82°33'46.24920" |
| 135 | P135 | | 660407.76 | 2516372.218 | 22°44'49.63200" | 82°33'43.93440" |
| 136 | P136 | | 660378.5503 | 2516343.669 | 22°44'48.71400" | 82°33'42.90120" |
| 137 | P137 | | 660369.3609 | 2516337.746 | 22°44'48.52680" | 82°33'42.57720" |
| 138 | P138 | | 660363.9545 | 2516338.154 | 22°44'48.54120" | 82°33'42.38640" |
| 139 | P139 | | 660348.8334 | 2516346.937 | 22°44'48.83280" | 82°33'41.86080" |
| 140 | P140 | | 660238.9415 | 2516463.765 | 22°44'52.66680" | 82°33'38.05200" |
| 141 | P141 | | 660232.4474 | 2516487.855 | 22°44'53.45160" | 82°33'37.83240" |
| 142 | P142 | | 660219.0859 | 2516501.878 | 22°44'53.91240" | 82°33'37.36800" |
| 143 | P143 | | 660191.3857 | 2516514.322 | 22°44'54.32640" | 82°33'36.40320" |
| 144 | P144 | | 660092.5687 | 2516619.375 | 22°44'57.77520" | 82°33'32.97960" |
| 145 | P145 | | 659863.0166 | 2516804.952 | 22°45'03.88800" | 82°33'25.00200" |
| 146 | P146 | | 659820.0007 | 2516974.694 | 22°45'09.42120" | 82°33'23.55480" |
| 147 | P147 | | 659790.5924 | 2517043.455 | 22°45'11.66760" | 82°33'22.55040" |
| 148 | P148 | | 659735.5589 | 2517108.543 | 22°45'13.80240" | 82°33'20.64600" |
| 149 | P149 | | 659688.4756 | 2517136.271 | 22°45'14.71680" | 82°33'19.00440" |
| 150 | P150 | | 659325.4889 | 2517239.686 | 22°45'18.20520" | 82°33'06.31800" |
| 151 | P151 | | 659288.1243 | 2517269.128 | 22°45'19.17360" | 82°33'05.02200" |
| 152 | P152 | | 659214.6935 | 2517351.223 | 22°45'21.86640" | 82°33'02.47680" |
| 153 | P153 | | 659181.3749 | 2517365.868 | 22°45'22.35600" | 82°33'01.31400" |
| 154 | P154 | | 659164.443 | 2517389.544 | 22°45'23.13000" | 82°33'00.73080" |
| 155 | P155 | | 660774.699 | 2516521.498 | 22°44'54.35880" | 82°33'56.85120" |
| 156 | P156 | | 659132.2945 | 2517417.25 | 22°45'24.04080" | 82°32'59.61120" |
| 157 | P157 | | 659085.2599 | 2517431.904 | 22°45'24.53400" | 82°32'57.96960" |
| 158 | P158 | | 659009.9028 | 2517474.904 | 22°45'25.95960" | 82°32'55.34160" |
| 159 | P159 | | 658949.8615 | 2517498.772 | 22°45'26.75520" | 82°32'53.24640" |
| 160 | P160 | | 658950.0401 | 2517499.542 | 22°45'26.78040" | 82°32'53.25360" |
| 161 | P161 | | 658900.9638 | 2517514.778 | 22°45'27.29160" | 82°32'51.54000" |
| 162 | P162 | | 658877.4098 | 2517531.066 | 22°45'27.82800" | 82°32'50.71920" |
| 163 | P163 | | 658826.4279 | 2517529.617 | 22°45'27.79920" | 82°32'48.93360" |
| 164 | P164 | | 658804.1056 | 2517532.255 | 22°45'27.89280" | 82°32'48.14880" |
| 165 | P165 | | 658701.8209 | 2517528.933 | 22°45'27.82080" | 82°32'44.56320" |
| 166 | P166 | | 658624.7141 | 2517524.215 | 22°45'27.69120" | 82°32'41.85960" |
| 167 | P167 | | 658598.4936 | 2517524.223 | 22°45'27.70200" | 82°32'40.94160" |
| 168 | P168 | | 658525.1819 | 2517536.085 | 22°45'28.11240" | 82°32'38.37480" |
| 169 | P169 | | 658523.7052 | 2517537.699 | 22°45'28.16640" | 82°32'38.32440" |
| 170 | P170 | | 658508.8595 | 2517542.19 | 22°45'28.31760" | 82°32'37.80600" |



| Sno. | Pillar ID | Patch No | Easting (m) | Northing (m) | Latitude "N" | Longitude "E" |
|------|-----------|---------------|-------------|--------------|-----------------|-----------------|
| 171 | P171 | | 658386.8785 | 2517615.351 | 22°45'30.73680" | 82°32'33.55440" |
| 172 | P172 | | 658365.8373 | 2517629.058 | 22°45'31.18680" | 82°32'32.82360" |
| 173 | P173 | | 658253.3706 | 2517712.677 | 22°45'33.94440" | 82°32'28.91040" |
| 174 | P174 | | 658173.5267 | 2517771.678 | 22°45'35.88840" | 82°32'26.13480" |
| 175 | P175 | | 658146.6979 | 2517788.292 | 22°45'36.43920" | 82°32'25.19880" |
| 176 | P176 | | 658140.5556 | 2517791.228 | 22°45'36.53640" | 82°32'24.98640" |
| 177 | P177 | | 658112.347 | 2517816.531 | 22°45'37.36800" | 82°32'24.00720" |
| 178 | P178 | | 658013.783 | 2517888.236 | 22°45'39.73320" | 82°32'20.57640" |
| 179 | P179 | | 657992.21 | 2517909.621 | 22°45'40.43520" | 82°32'19.82760" |
| 180 | P180 | | 657942.857 | 2517942.99 | 22°45'41.53680" | 82°32'18.11040" |
| 181 | P181 | | 657912.443 | 2517969.714 | 22°45'42.41520" | 82°32'17.05560" |
| 182 | P182 | | 657746.059 | 2518087.036 | 22°45'46.28520" | 82°32'11.26320" |
| 183 | P183 | | 657723.081 | 2518104.53 | 22°45'46.86480" | 82°32'10.46400" |
| 184 | P184 | | 657701.54 | 2518116.858 | 22°45'47.27160" | 82°32'09.71520" |
| 185 | P185 | | 657641.982 | 2518137.84 | 22°45'47.97360" | 82°32'07.63440" |
| 186 | P186 | | 657586.271 | 2518151.929 | 22°45'48.44880" | 82°32'05.68680" |
| 187 | P187 | | 657542.204 | 2518160.916 | 22°45'48.75840" | 82°32'04.14600" |
| 188 | P188 | | 657506.54 | 2518171.903 | 22°45'49.12560" | 82°32'02.90040" |
| 189 | P189 | | 657480.809 | 2518177.636 | 22°45'49.32000" | 82°32'02.00040" |
| 190 | P190 | | 657443.0146 | 2518190.534 | 22°45'49.75200" | 82°32'00.67920" |
| 191 | P191 | | 657387.4731 | 2518205.292 | 22°45'50.25240" | 82°31'58.73880" |
| 192 | P192 | | 657280.3726 | 2518245.809 | 22°45'51.60600" | 82°31'54.99840" |
| 193 | P193 | | 657033.996 | 2518399.304 | 22°45'56.67840" | 82°31'46.41600" |
| 194 | P194 | | 656951.638 | 2518439.423 | 22°45'58.01040" | 82°31'43.54320" |
| 195 | P195 | | 656823.462 | 2518460.565 | 22°45'58.74120" | 82°31'39.05760" |
| 196 | P196 | | 656740.609 | 2518474.796 | 22°45'59.23080" | 82°31'36.15960" |
| 197 | P197 | | 656684.2298 | 2518480.425 | 22°45'59.43240" | 82°31'34.18320" |
| 198 | P198 | | 656646.909 | 2518487.084 | 22°45'59.66280" | 82°31'32.88000" |
| 199 | P199 | | 656529.316 | 2518500.821 | 22°46'00.14880" | 82°31'28.76160" |
| 200 | P200 | | 656423.8737 | 2518522.345 | 22°46'00.88320" | 82°31'25.07160" |
| 201 | P201 | | 656351.7456 | 2518526.517 | 22°46'01.04160" | 82°31'22.54440" |
| 202 | P202 | | 656328.2136 | 2518522.443 | 22°46'00.91920" | 82°31'21.72000" |
| 203 | P203 | | 655441.0318 | 2518224.03 | 22°45'51.51240" | 82°30'50.51160" |
| 204 | P204 | | 655433.208 | 2518222.245 | 22°45'51.45840" | 82°30'50.23440" |
| 205 | P205 | | 655404.1376 | 2518223.106 | 22°45'51.49440" | 82°30'49.21560" |
| 206 | P206 | PATCH NO 4 | 655360.0923 | 2518213.128 | 22°45'51.18480" | 82°30'47.67120" |
| 207 | P207 | | 655274.2031 | 2518207.202 | 22°45'51.01920" | 82°30'44.65800" |
| 208 | P208 | | 655257.085 | 2518201.105 | 22°45'50.82840" | 82°30'44.05320" |
| 209 | P209 | | 655219.7737 | 2518195.427 | 22°45'50.65560" | 82°30'42.74280" |
| 210 | P210 | | 652340.0684 | 2519401.953 | 22°46'30.82800" | 82°29'02.22000" |
| 211 | P211 | | 652283.382 | 2519409.392 | 22°46'31.08720" | 82°29'00.23280" |
| 212 | P212 | PATCH NO 5 | 652229.5964 | 2519393.951 | 22°46'30.60480" | 82°28'58.34280" |
| 213 | P213 | | 652188.0468 | 2519358.729 | 22°46'29.47080" | 82°28'56.87400" |
| 214 | P214 | | 652147.0758 | 2519304.892 | 22°46'27.73560" | 82°28'55.41960" |

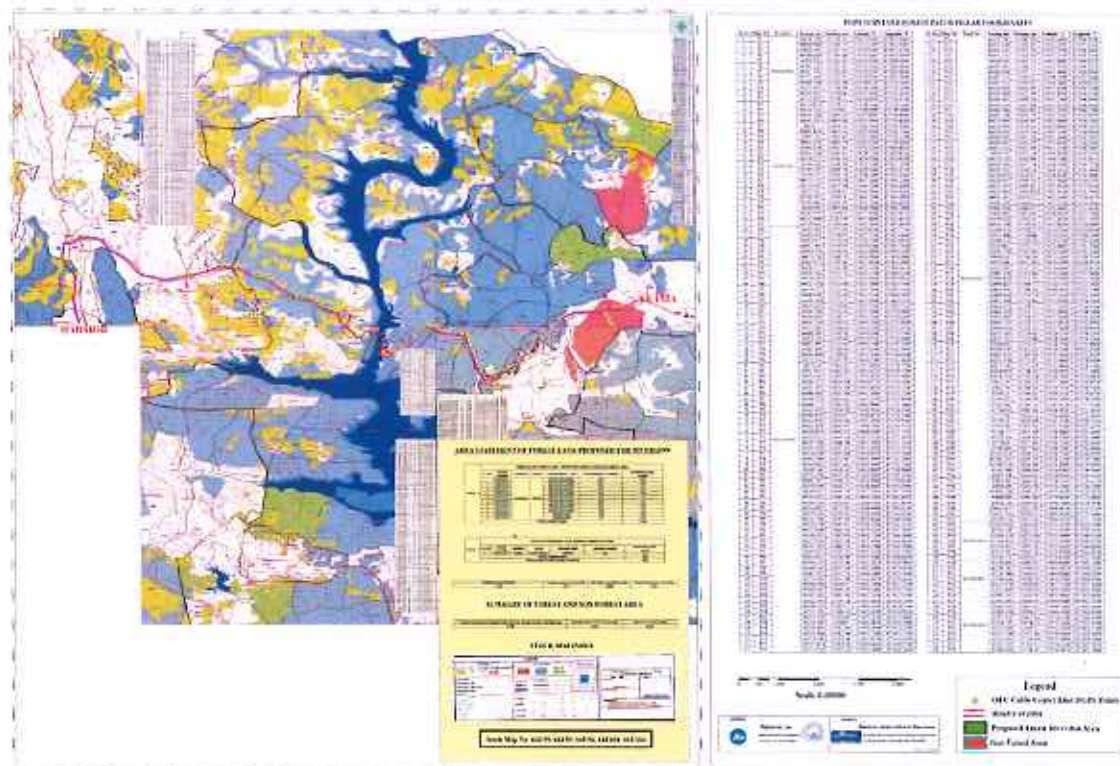


| Sno. | Pillar ID | Patch No | Easting (m) | Northing (m) | Latitude "N" | Longitude "E" |
|------|-----------|---------------|-------------|--------------|-----------------|-----------------|
| 215 | P215 | | 652115.6683 | 2519263.623 | 22°46'26.40360" | 82°28'54.30360" |
| 216 | P216 | | 652067.7435 | 2519250.59 | 22°46'25.99680" | 82°28'52.61880" |
| 217 | P217 | | 651791.3882 | 2518690.517 | 22°46'07.87800" | 82°28'42.73320" |
| 218 | P218 | | 651805.1423 | 2518657.412 | 22°46'06.79800" | 82°28'43.20480" |
| 219 | P219 | | 651856.5106 | 2518586.671 | 22°46'04.47960" | 82°28'44.97960" |
| 220 | P220 | | 651973.3142 | 2518425.816 | 22°45'59.21280" | 82°28'49.01880" |
| 221 | P221 | PATCH NO 6 | 652116.7597 | 2518228.272 | 22°45'52.74360" | 82°28'53.97960" |
| 222 | P222 | | 652125.5683 | 2518196.32 | 22°45'51.70320" | 82°28'54.27480" |
| 223 | P223 | | 652132.5288 | 2517972.284 | 22°45'44.41680" | 82°28'54.44040" |
| 224 | P224 | | 652131.814 | 2517744.444 | 22°45'37.00800" | 82°28'54.33600" |
| 225 | P225 | | 652111.3531 | 2517655.13 | 22°45'34.11360" | 82°28'53.58720" |
| 226 | P226 | | 652089.2638 | 2517558.707 | 22°45'30.98520" | 82°28'52.78080" |

7.3 Annexure – 3: Geo-Referenced Maps of the Proposed Route

7.3.1 Geo-referenced Forest Map showing Proposed 4G OFC Route

MAP SHOWING DGPS SURVEYED FOREST AREA PROPOSED FOR DIVERSION FOR LAYING OF OFC CABLE FROM KETMA TO HADNOR



Not to Scale

वन मण्डलाधिकारी
कटघोरा वनमण्डल, कटघोरा

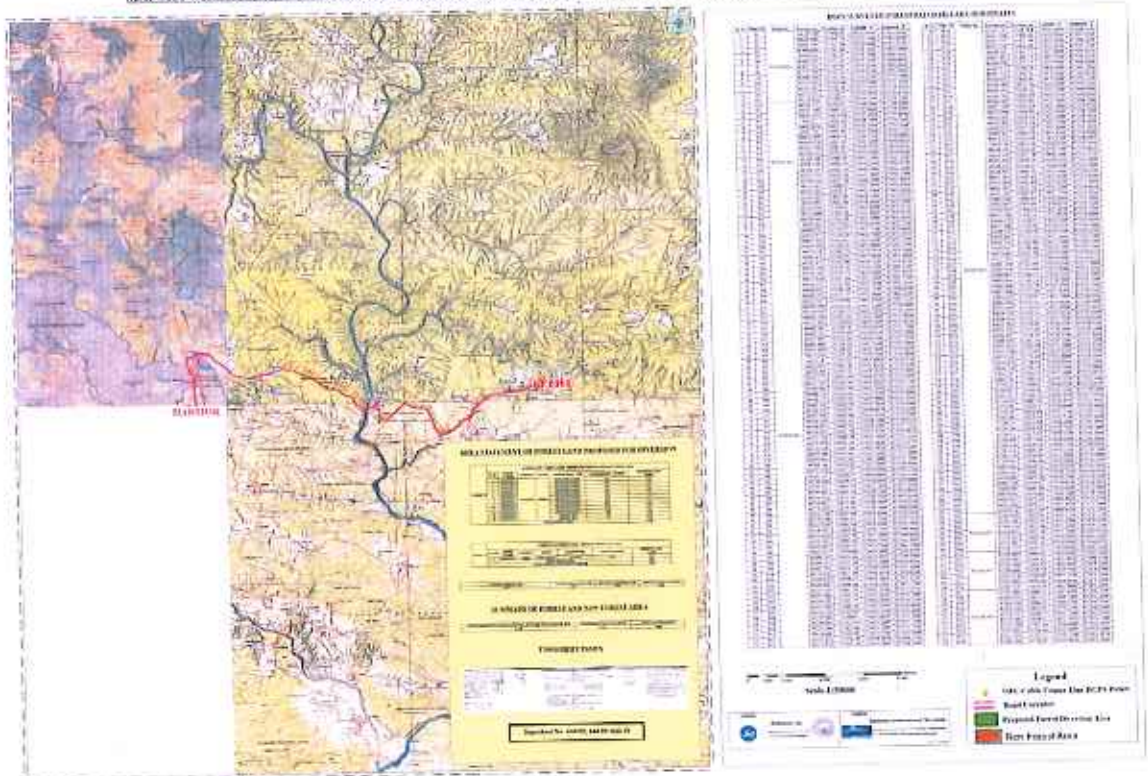
उप वनमंडलाधिकारी
कटघोरा

वन परिक्षेत्र अधिकारी
कटघोरा



7.3.2 Geo-referenced SOI Map (1:50000) showing Proposed 4G OFC Route

MAP SHOWING DGPS SURVEYED FOREST AREA PROPOSED FOR DIVERSION FOR LAYING OF OFC CABLE FROM KEYMA TO HADMOR



Not to Scale

