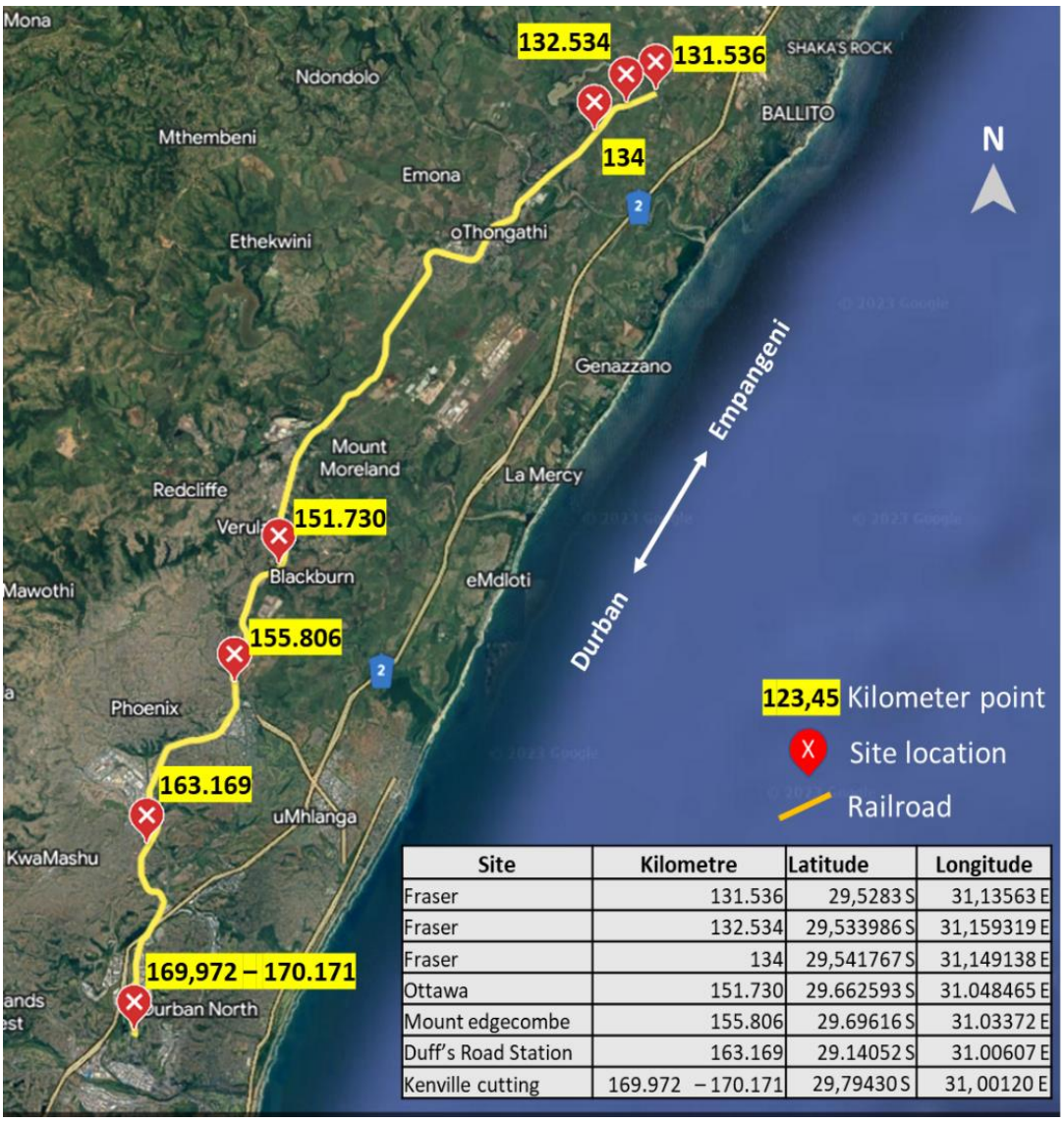
SURVEYING SERVICE REQUIREMENT
Durban Depot: North Coast

1. INTRODUCTION

This document outlines the specific guidelines for conducting topographical surveys along the North Coast of KwaZulu-Natal, South Africa, between Empangeni and Durban. These sites are located at various points along the line. This task is essential for developing and completing the necessary design solutions for the flood-affected sites mentioned.



Site	Kilometre	Latitude	Longitude
Fraser	131.536	29,5283 S	31,13563 E
Fraser	132.534	29,533986 S	31,159319 E
Fraser	134	29,541767 S	31,149138 E
Ottawa	151.730	29.662593 S	31.048465 E
Mount edgecombe	155.806	29.69616 S	31.03372 E
Duff's Road Station	163.169	29.14052 S	31.00607 E
Kenville cutting	169.972 – 170.171	29,79430 S	31, 00120 E

Figure 1a: Geospatial Representation of damaged railway sites on the Empangeni to Durban Line

2. SURVEYING SPECIFICATIONS

2.1 GENERAL SCOPE AND CONSTRAINTS OF PROFESSIONAL SERVICE REQUIRED (SURVEY SERVICE)

Transnet Freight Rail Maintenance Depot - Durban requires a comprehensive topographical survey of the locations delineated in Figure 1. This survey's primary objective is to assess formation and embankment failures, drainage issues, and propose potential solutions. Precise measurements will be conducted to support well-informed engineering decisions. The topographical survey may employ various equipment, including GPS machines and total stations, especially for ground control. The survey will cover an estimated perimeter of __. with specific site details provided in the forthcoming report.

The contractor shall conduct the service with an aim of adhering to the following requirements.

- Report to the Engineering Manager and/or a depot's representative with respect to the service provided.
- Review, familiarize, and understand the proposed site, including constraints and environmental factors.
- Communication with all members of the professional team with regards to the survey process and deliverables is advised to the contractor.
- Review, familiarize and understand the architectural and operational requirements of the facilities to be provided as part of the project.

2.2 SPECIFICATIONS.

2.2.1 Applicable Standard Specifications: There is no technical specification recommended by Transnet Freight Rail, however, the contractor is expected to conduct the work following relevant survey specifications.
2.2.2 Applicable Generic Specifications: Transnet E7/1 (July 1988). Specification for work on, over, under or adjacent to railway lines and high voltage equipment.
2.2.3 Access certificate – Obtained from the relevant authorities or property owner.
2.2.4 Transnet Freight Rail safety requirements – Issued by the Employer's representative.
2.2.5 Qualified surveyor – Registered with PLATO
2.2.6 Calibration and equipment certificates

2.3 TECHNICAL REQUIREMENTS

The consultant shall observe all relevant statuses, by-laws and associated regulations, applicable standards published by the South African Bureau of Standards, the international Organisation for Standardisation or learned societies and standards of professional conduct, and "best Practice", as laid down, or recommended, by their respective professional association, if any.

2.4 FACILITIES AND EQUIPMENT TO BE PROVIDED BY THE EMPLOYER.

No facilities or equipment is provided by the Employer. The Consultant may, however, plan with the relevant Transnet personnel to make use of facilities that might be on/or near the site.

2.5 DELIVERABLES. (Generic approach)

2.5.1 All local topography shall be surveyed on a grid not exceeding 20m x 20m.

2.5.2 Spot heights (surface shots) must accurately denote the peaks of hills and the lowest points of valleys and depressions. Sufficient spot heights should be provided to depict terrain variations that cannot be adequately represented by contour lines. It is imperative to identify and clearly depict stormwater trenches, streams, berms, and all other objects that may impact the layout, including mast poles, roads, fences, etc.

2.5.3 The precise location and coordinates of the railway bridge must be determined and documented.

2.5.4 For any structure within the area, the survey must encompass measurements of its length, width, and height, with a detailed representation of its distinctive features.

2.5.5 Rail survey shots, including measurements for both the left and right rails, along with top of ballast and bottom ballast readings at 10-meter intervals in the longitudinal direction of the railway line, are required.

2.5.6 In the case of culverts, a perimeter of 200 meters is preferred, though this may vary depending on the topographical characteristics of the sites and surrounding services.

2.5.7 For drainage channels, the survey should account for the affected length, considering the shape of the cuttings and including the surrounding area.

2.5.8 The consultant shall prepare drawings as per Transnet Freight Rail drawing standards and handover all documents in communicated file format. The following format shall be followed:

2.5.9 The survey information shall be supplied in digital format (Accessible in Bentley's Open rail, Micro station, AutoCAD or any other similar software format).

- All annotations on the plan shall be in English
- Levels shall be displayed in decimal points and be placed at the centre of the survey shot
- To prevent cluttering of the as-is drawings, when plotting these levels, the consultant shall ensure that they are spaced not closer than 1mm apart (at a 1:500 scale), and that the numerals indicating the levels do not overlap.
- Levels and description of the level shall be on separate CAD layers.
- Contours generated from the survey must accurately reflect the ground levels. The height intervals shall depend on site conditions and on the scale of the drawing. When practical, 0.5m contours shall be shown, but the space between plotted contours on the plan shall not be less than 5mm. Rail levels must not be considered when generating ground contours.
- All co-ordinates shall be based upon the WGS system
- The datum for levels shall be MSL

2.5.10 The survey should encompass all assets within the specified parameter, including those mentioned above.

These assets should be listed, and the presentation of results should incorporate the appropriate abbreviations as follows:

Table 1. Abbreviations/ Codes to be used for results presentations

Code/Abbreviation	Description
SRJ	Stock Rail Joint (of turnouts)
ETO	End of Turnout
ES	End of Set (or turnout)
OHTE	Overhead Track Equipment
C/M	Clearance marker
BB	Bottom of Bank (cutting or embankment)
CLRR	Railway line
FLOWDD	Flowline of drainage ditch/river
BM	Benchmark
TRRBAL	Top of Ballast edge
BRRB	Bottom of Ballast toe
FC	Fence
HWALL	Headwall of culvert/bridge
SDRIN	Storm drain Inlet/ culvert inlet an outlet invert levels
MP	Mast Pole (include the km number and mast pole number in the description)
UP	Utility Pole (does not include mast poles)
SUR	Surface Shot
EP	Edge of Service Road/Road
TB	Top of bank (cutting or embankment)
EDITCH	Edge of drainage ditch/river
WALL	Wingwall of culvert/Bridge
BLDG	Building corner
SSLINE	Sanitary sewer line
PROCRN	Property corner
ROCK	Rock
DRAPE	Drapery Mesh Net (Rockfall Netting)
ANCH	Steel Anchors used to secure rockfall netting to the rock slope or to the top/bottom of the rock slope cutting
MWH	Mean water height
WET	Wetland
TANK	Tank
GATE	Gate
EDAM	Edge of dam
ESW	Edge of sidewalk
CMP	Corrugated metal pipe
RCP	Reinforced concrete pipe

2.5.11 Central points

The consultant must make use of the new control points and pick up all existing control if any.

- The consultants shall provide a list showing the co-ordinates and elevation of each control points and survey stations.
- The new control points shall be located inter-visible and not more than 200m apart.
- Generally, control points shall be placed on the periphery of the area to be surveyed, within the Railway reserve and spaced in a way that a network of further control points can be established if required.
- Control points shall be in such a position as to minimise the likelihood of disturbance or damage
- The consultant and the Employee's representative shall agree on the minimum envisaged number of control points required for the survey.
- The control points shall be 600mm long Y-standard driven into the ground, leaving at least 20mm protruding, which must be encased in concrete of at least 200mm dia. And 100mm deep, or any other method which will protect these points permanently, as agreed between the consultant and the Employer's representative.
- Each control point shall be provided with a rust proof metal tag set into the concrete indicating its number.
- Each control points shall have its own photograph accompanied with the survey.

2.6 OWNERSHIP OF DATA, DESIGN AND DOCUMENTS

The parties shall agree that copyright in the data, design and documents shall, after payments by the Employer of the services to the contractor, lie with the Employer subject to the Employer's indemnification against any claim from any party that may arise as a result of the Employer's use of such a document due to the consultant's infringement of copyright.

3. SITES TO BE SURVEYED

Appendix A below gives a graphical representation for the surveying services required. Although the specific features within the area have not been explicitly labelled, it is imperative that the appointed surveyor diligently capture data points for all features, both those of a man-made and natural origin. Furthermore, it is essential that all streams situated within the boundaries of the area be surveyed with meticulous attention to detail

APPENDIX A: SURVEY DETAIL PER SITE

FRASER : **Km 131.536**

Site Co-ordinates : 29° 31'41.88''S, 31° 8'8.268''E

Perimeter size : 818 m

Area Size : 9 220 m²

Survey and document all significant features, both man-made and natural,

within the defined perimeter.

Northern Boundary : Service Road before the informal settlements

Eastern Boundary : Level Crossing

Western Boundary : Approximately 50m away from the Fraser station

Southern Boundary : Properties Fence

- Survey both the top and bottom of the bank on the landside.
- Survey the existing earth adjacent to the rail track.
- Comprehensive assessment of both railway lines.

LEGEND

Survey Parameter

Signal

Figure 3a: Detail surveying boundaries for Fraser Km 131.536 (Google earth)

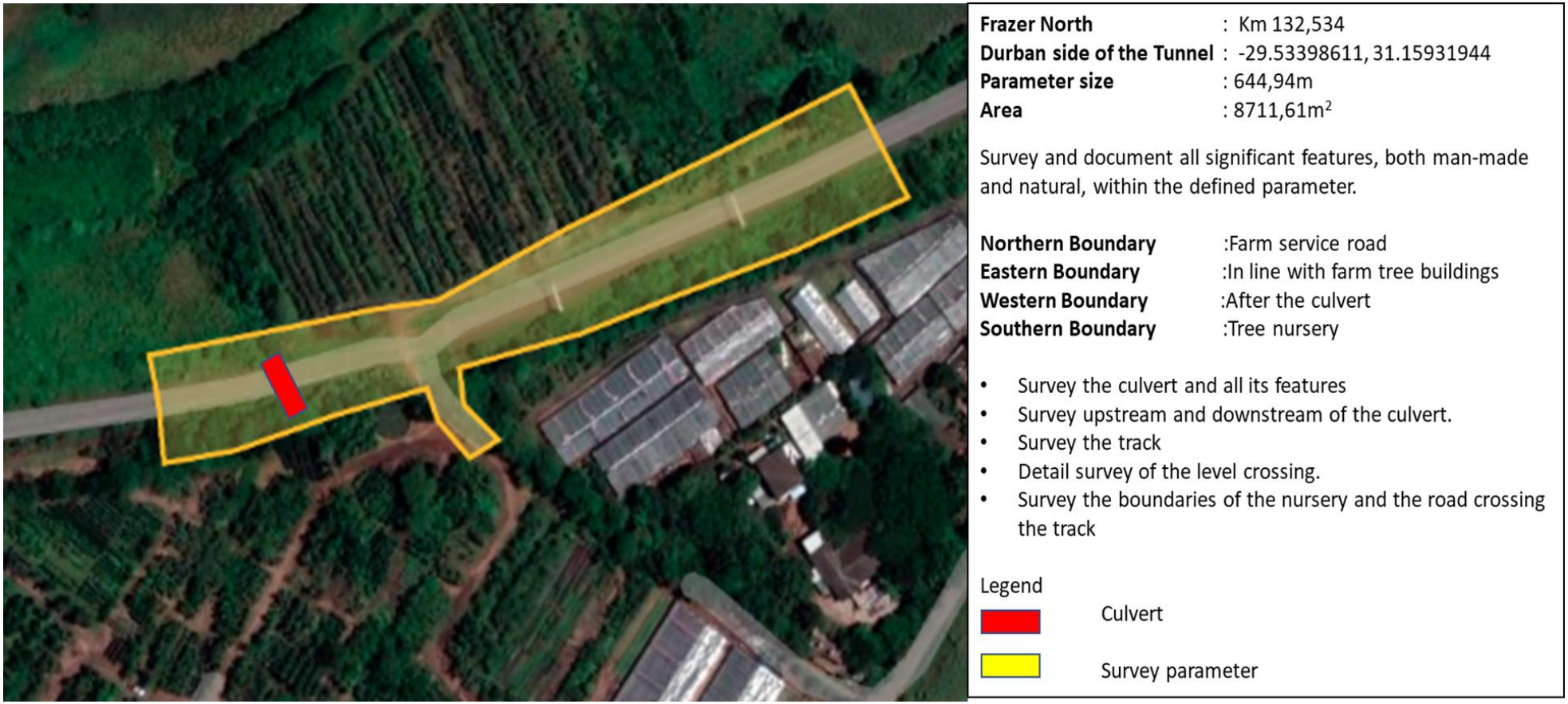


Figure 3b: Detail surveying boundaries for Fraser Km 132.534 (Google earth)

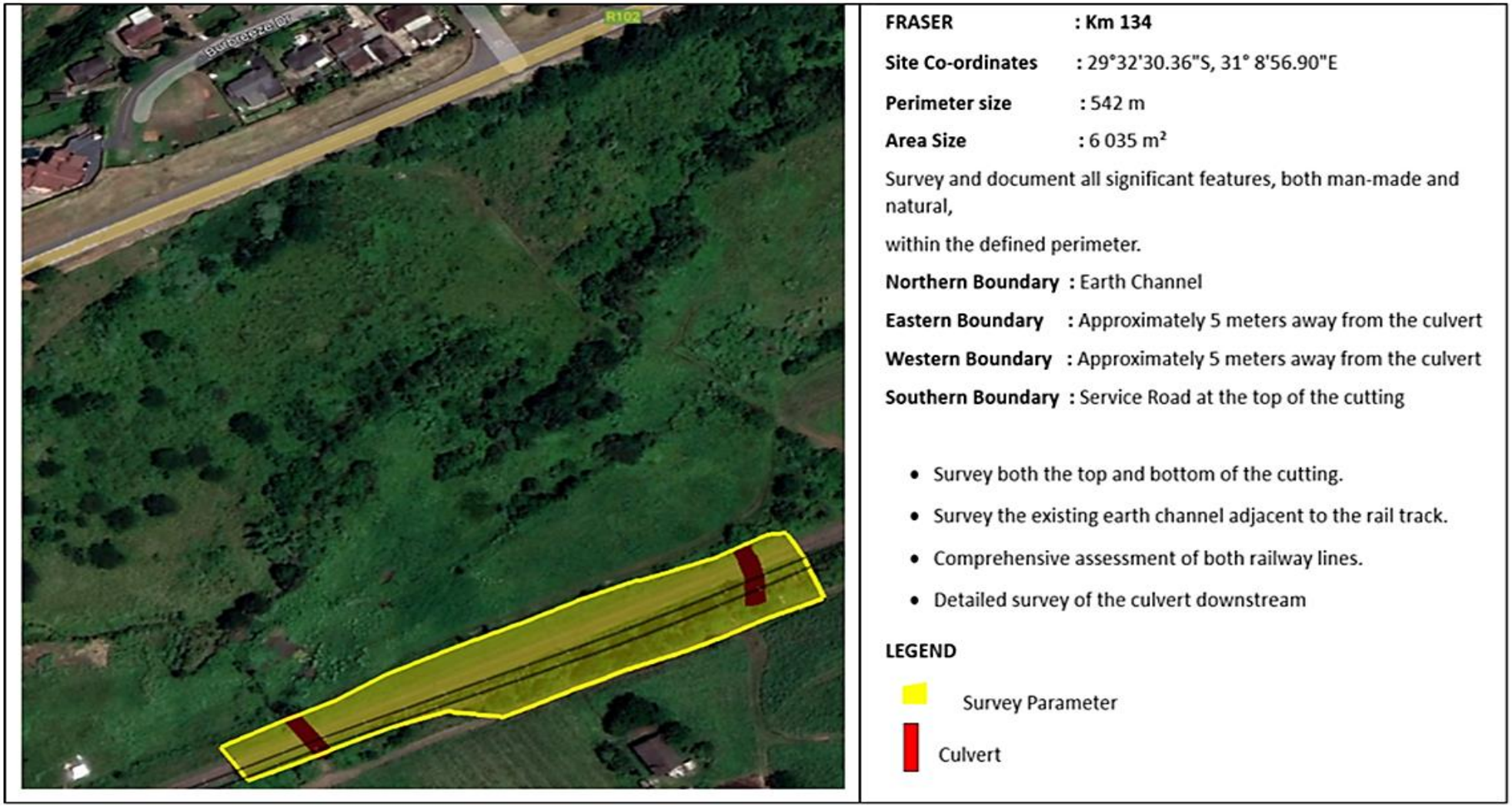


Figure 3c: Detail surveying boundaries for Fraser Km 134(Google earth)

OTTAWA : Km 151,730
Durban side of the Tunnel : -29.662593, 31.048465
Parameter size : 1236 m
Area : 29 925 m^2

Survey and document all significant features, both man-made and natural, within the defined parameter.

Northern Boundary :Top of the tunnel
Eastern Boundary :Embankment
Western Boundary :Cutting
Southern Boundary :Termination point just after the culvert is.

- Survey the cutting (top and bottom level) along the track from the tunnel opening to just after the culvert upstream.
- Survey the embankment where the embankment failure is exhibited, from the top of the embankment to the bottom of the embankment.
- Survey the culvert and channel on the smart stone property which leads to the upstream culvert on Transnet property.
- Comprehensive Assessment of both railway tracks.
- Detailed survey of tunnel edges.
- Survey the culvert features, 550m away from the opening of the tunnel.
- Survey culvert from smart stone property features upstream.

Figure 3d: Detail surveying boundaries for Ottawa Km 151.730 (Google earth)

MOUNT EDGECOMBE : **Km 157,730**
Empangeni side Tunnel : 29.14052 S, 31.00607 E

Parameter size : 2000 m
Area : 32700 m^2

Northern Boundary : After culvert.
Eastern boundary : property fence
Western boundary : Service road
Southern boundary : Tunnel end

All features of the tunnel opening to be surveyed
Survey 25m shots inside the tunnel
Only survey from cutting top and all features within the cutting.
Terminate survey by the culvert on the northern boundary and include stream surface shots as well.

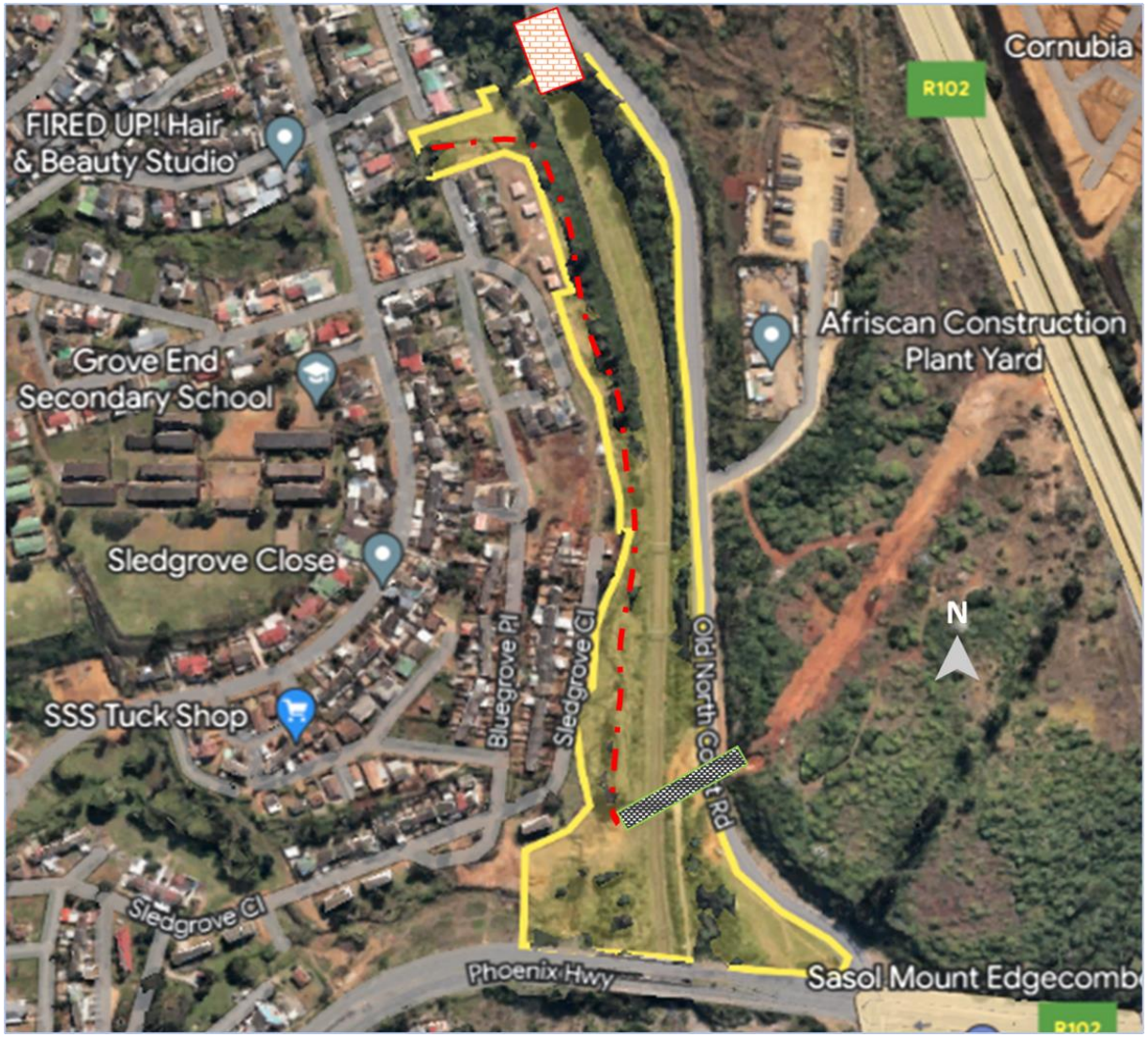
LEGEND

Survey parameter

Tunnel

Culvert

Figure 3e: Detail surveying boundaries for Mount Edgecombe Durban side Km 157.730 (Google earth)



MOUNT EDGECOMBE : Km 157,730

Durban side of Tunnel : 29.69616 S, 31.03372 E

Parameter size : 1789 m
Area : 57 508 m^2

Survey and document all significant features, both man-made and natural, within the defined parameter.

Northern Boundary : The top of the tunnel structure.
Eastern Boundary : The old North Coast Road.
Western Boundary : Properties fence.
Southern Boundary :Termination point at the Phoenix highway bridge.

- Surveying the river along the road, Specific attention to culvert features and the river crossing the track.
- Detailed survey of tunnel edges and points 25 m inside the tunnel.
- Comprehensive assessment of both railway tracks.
- Survey the cutting - both top and bottom levels.
- Attention to the collapsed canal berm located on the settlement side.

LEGEND

Tunnel
Canal
Survey parameter
Culvert

Figure 3f: Detail surveying boundaries for Mount Edgecombe- Durban side Km 157.730 (Google earth)

DUFF'S ROAD STATION : Km 163,169

Durban side of Tunnel : 29,7411111S, 31.0055556E

Parameter size : 1540 m
Area : 74 126m^2

Survey and document all significant features, both man-made and natural, within the defined parameter.

Northern Boundary : M25 rail Bridge and the Curve.
Eastern Boundary : Property fence.
Western Boundary : Properties fence.
Southern Boundary : Station pedestrian bridge

General

- Survey all rail level from the curve to the platform.
- Terminate next to the station building.
- Survey property fence and the stream emanating from the community.
- Locate the culvert, manholes, existing pipe and all other drainage structures that are on site.

LEGEND

Survey parameter

Figure 3g: Detail surveying boundaries for Duff's road, Km 163.169 (Google earth)

Kenville	: km 169,794 - 170,171
Coordinates	: 29,79430S, 31,00120E
Perimeter Size	:1063 m
Area	:25 413 m^2

Survey Requirements:

Track: Survey all the Rails, Ballast shoulder and ballast toe as well as the service road.
Culvert: Survey all the components of the culverts, this includes Headwalls, invert levels, wingwalls and inlet and outlet channels.
Cutting: Top and bottom of Cutting.
Embankment: Top and bottom of Embankment.
Drainage channels: Top and bottom of the existing channels.

Take **Spot shots** in and around the indicated area for the full length of the survey.
All point must be taken at 10m intervals.

Figure 3h: Detail surveying boundaries for Kenville Km 169.794 – 170.171 (Google earth)