5 ALTERNATIVES CONSIDERED

Alternatives being assessed for the construction and operation of the Kusile railway line can be divided into the following categories:

- Project alternatives;
- Corridor alternatives;
- Operation alternatives; and
- The No-Go (no development) alternative.

These alternatives are discussed in the sections below.

5.1 Project Alternatives

Several strategic alternatives were considered at the conceptual phase of the Kusile Power Station EIA. This strategic information was again revisited during the planning phase of the project. The following project alternatives were assessed during the planning phase due to the significant cost, time implications and safety implications:

- Other means of transportation of sorbent to the Kusile Power Station;
- Permanent rail transportation; and
- [4]A combination of road transportation (already authorised) and rail transportation as a function of the status quo.

These various alternatives were considered and the following was concluded:

- There are no other means of transporting sorbent to the power station other than by road and / or rail.
- Eskom has embarked on a major drive to reduce road transportation of its supplies due to the large increase in the coal fired power station and transportation of supplies with the subsequent safety issues and deterioration of road surfaces on longer corridors which increase the cost of supply transport/operational costs and subsequently electricity as well as the spreading road surface deterioration which inevitably impacts on other road users and freight transporters.

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[4] **The EIA undertaken for the Kusile Power Station included the proposed railway. The railway line was approved by the DEAT but was deemed technically unfeasible (during the detailed design phase) and hence the necessity for this EIA to be undertaken. As a direct result the construction of the railway line has been delayed until environmental authorisation is received. Consequently the railway line will not be operational by the time sorbent is required for the first two generating units of the power station, and a short term solution to the transportation of sorbent is required. Therefore transportation by road has been proposed as a short term intervention whilst the railway line is being constructed.**

- Following the original rail being deemed unfeasible technically, the planning process showed that the rail construction and operation might not be ready when the first two generation units come into operation, thus necessitating a temporary alternative sorbent transportation mechanism – the access roads already approved as part of the Kusile Power Station EIA processes. The road is in the process of being constructed and will serve to transport sorbent until the railway system is commissioned.

With the need to construct a reliable and feasible railway system for the permanent transportation of sorbent, guidance from the EIA regulations triggered an EIA – hence this project. It was therefore decided in the planning phase that, for the purposes of this EIA, rail transportation (long term) will be assessed.

5.2 Railway Corridor Alternatives

The new Kusile Power Station requires the delivery of sorbent (particles between +1mm and +18mm in size) to the plant as a reagent in the process of reducing SO_2 emissions from the power generation process. At present it is anticipated that this delivery will be best suited to rail transport. This proposed project is to construct a new railway line from the existing Pretoria - Witbank railway line to the Kusile Power Station. Prior to commencing with this EIA, a screening process was undertaken on six possible corridor alignments varying in length from 10 – 20 km. These six alternatives were screened in terms of environmental and social impacts. From the investigation the following three corridors were deemed most technically, economically, environmentally and socially feasible and are being further investigated in this EIA (Figure 5-1). Each corridor being assessed is 500 metres wide. The reason for assessing a corridor is to ensure that slight deviations are possible within the corridor, should any specific environmental sensitivity or technical limitation on the alignment be identified in the final detailed planning stage post authorisation:

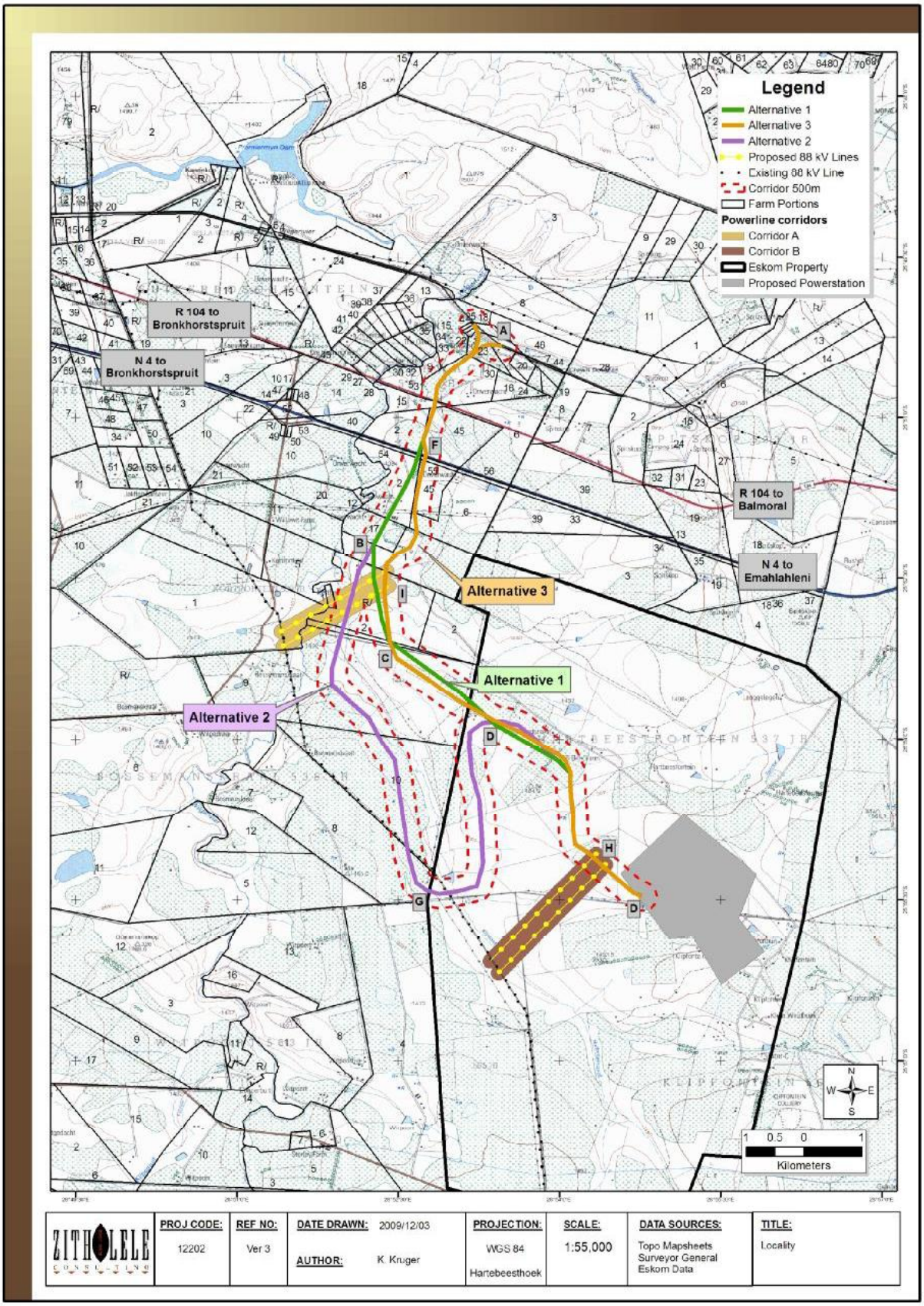


FIGURE 5-1: LOCALITY OF THE THREE RAILWAY LINE CORRIDOR ALTERNATIVES.

Railway Corridor Alternative 1: Kusile – Wilge River interchange shortcut

The Alternative 1 corridor alignment, which starts at the existing Pretoria-Witbank railway line (A), heads in a south westerly direction and crosses the N4 highway (next to F). Thereafter the corridor follows the course of the Wilge River (FB). This corridor then heads in a south easterly direction and crosses an unnamed tributary of the Wilge River continuing for six kilometres into the Kusile Power Station (BCDE). This corridor is approximately 12 km in length (Figure 5-2).

Railway Corridor Alternative 2: Kusile - Wilge River interchange

The second alternative follows the same initial alignment as Alternative 1 (AF), but after crossing the N4 highway the alignment continues in a south westerly direction for approximately 4.5 kilometres. Thereafter the corridor crosses over the Klipfonteinspruit river and turns in a south easterly direction for approximately two kilometres. The corridor then turns south south east for 2.5 kilometres, turns eastward and crosses the Klipfonteinspruit river a second time and then turns to run in a northerly direction for 3 kilometres before meeting up with alternative 1 approximately 3 kilometres from the Kusile Power Station (BGDE). This corridor is estimated at 18 km in length (Figure 5-3).

Railway Corridor Alternative 3: Kusile – Wilge River interchange shortcut alternative 2

The Alternative 3 corridor alignment follows the same initial alignment as Alternative 1 (AF) but it crosses the N4 highway 500 metres eastward of the Alternative 1 and 2 crossing (avoiding the farmstead complexes) (FCDE). The alternative rejoins alternative 1 and 2 for approximately three kilometres before entering the Kusile Power Station. This corridor is very similar to Alternative 1, with some minor deviations 12.2 km (Figure 5-4).

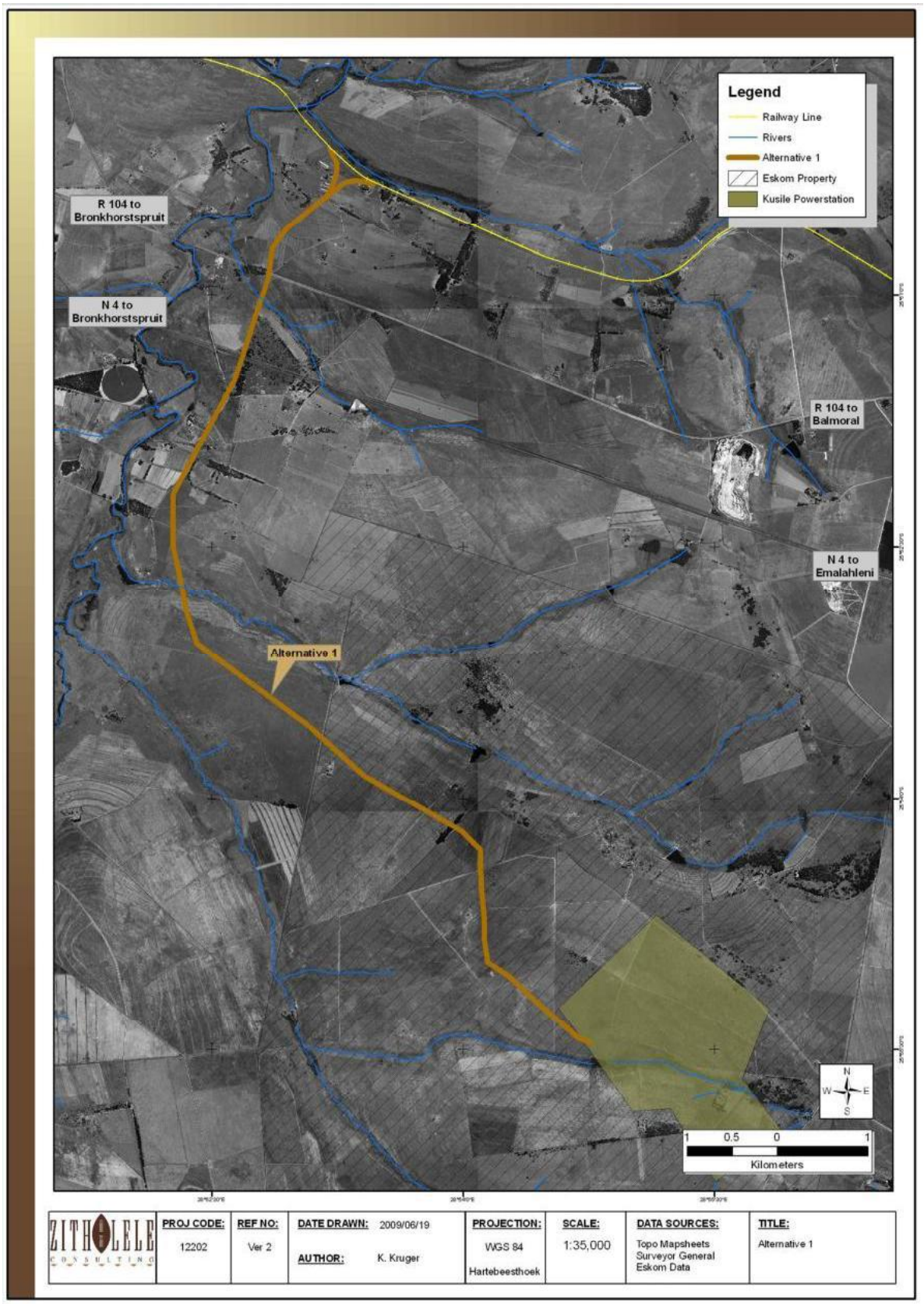


FIGURE 5-2: LOCALITY OF RAILWAY CORRIDOR ALTERNATIVE 1.

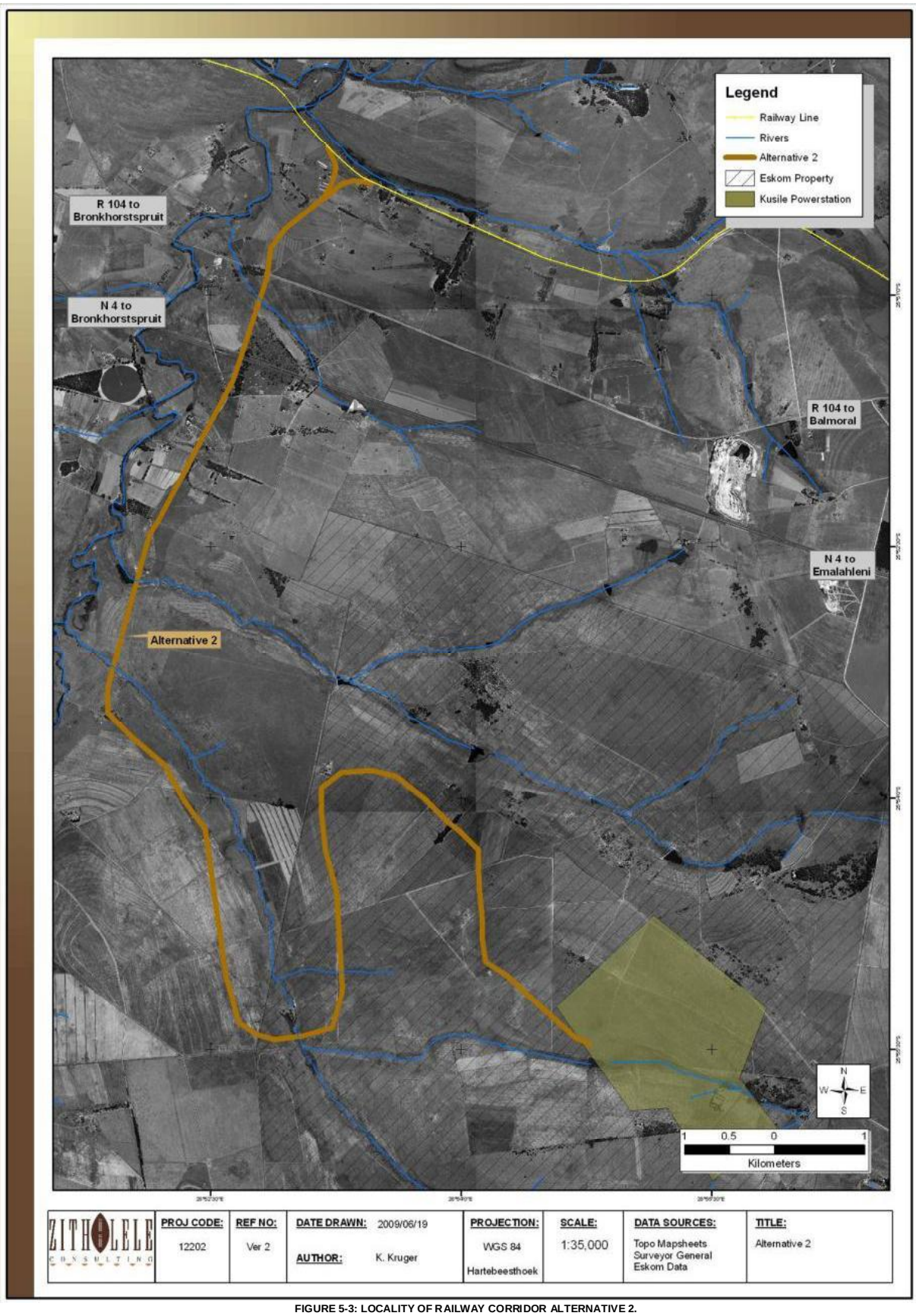


FIGURE 5-3: LOCALITY OF RAILWAY CORRIDOR ALTERNATIVE 2.

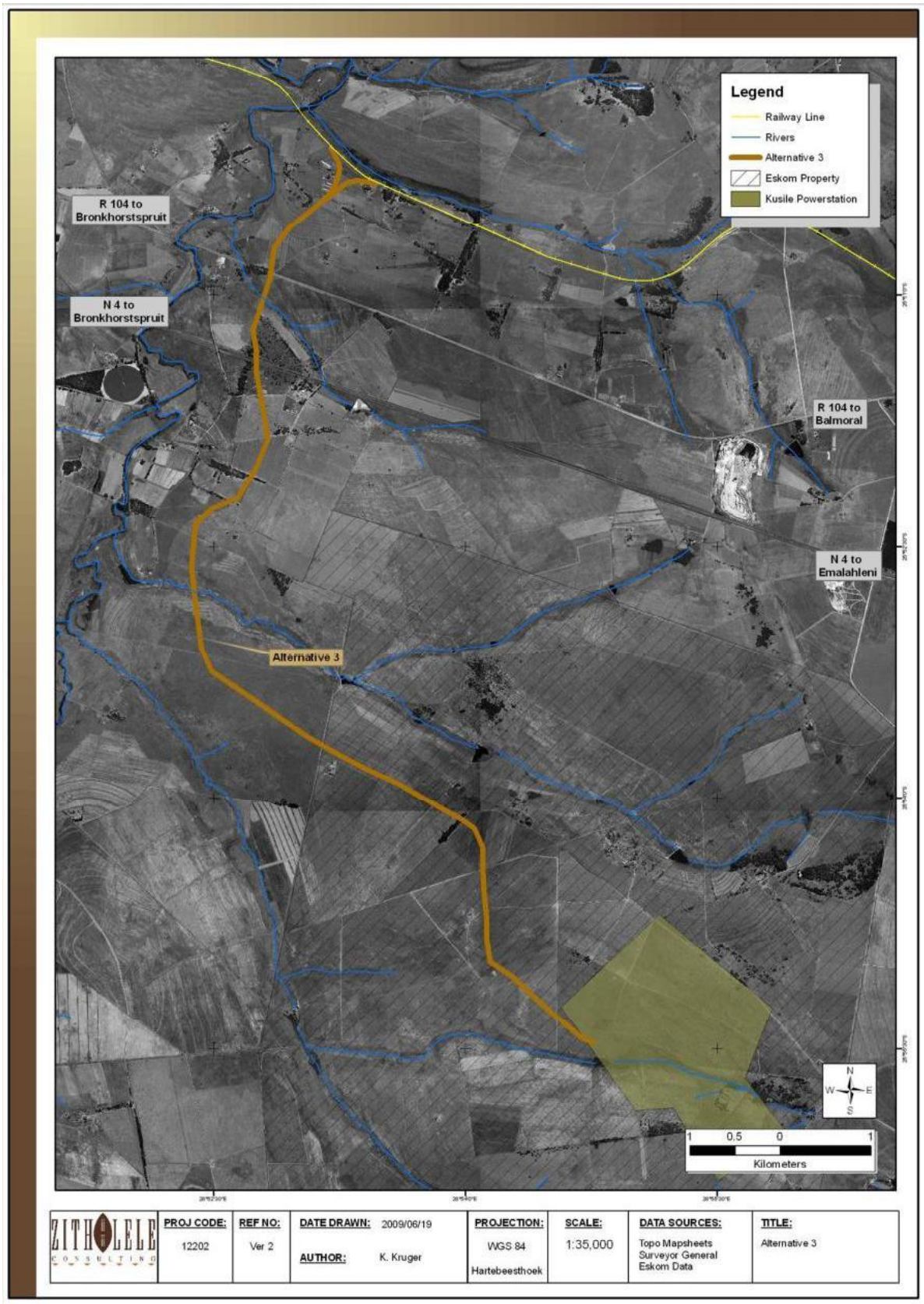


FIGURE 5-4: LOCALITY OF RAILWAY CORRIDOR ALTERNATIVE 3.

5.3 Power line and Substation Alternatives

As mentioned in Section 4 above a 88 / 132kV power line is required to provide electricity to the proposed railway. An existing 88kV power line runs from Grootpan to Witbank. It is proposed that two new 88 / 132 kV power lines (88 or 132 kV can be linked into the existing 88kV power line, should a 132 kV line be constructed it will be stepped down to 88kV) be constructed that feed off of this existing 88kV power line towards two new substations which are proposed to be constructed adjacent to the railway track, within the railway corridor.

Each of the three railway corridor alternatives presented in Section 5.2 above would require two 88 / 132kV power lines and two substations (one located near Kusile Power Station and one half way between the Kusile Power Station and the existing Pretoria – Witbank railway) to electrify the railway. Therefore in addition to assessing the three railway alternative corridors, two power line corridor alternatives for each proposed power line are also being assessed.

A brief description of the proposed power line corridors is provided below. It is important to note that **TWO** 88 / 132kV power lines (one 88 / 132kV power line within corridor A and one 88 / 132kV power line within corridor B) are required to feed into the new proposed substations. For each proposed power line two alternatives have been provided and are being assessed. The 88 / 132kV power line requires a servitude 36 metres in width however a 75 metre servitude was assessed for each alternative.

5.3.1 88kV/132kV Power Line Corridor A

Power Line corridor A is located approximately halfway between the Kusile Power Station construction site (north-west of Kusile Power station) and the existing Pretoria – Witbank railway line (Figure 5-5).

<u>88kV/132kV Power Line – Alternative A-(a)</u>

Alternative A-(a) starts at the existing 88kV power line (from Grootpan to Witbank) and heads in a north easterly direction. The length of the alternative is dependent on which alternative railway corridor is approved, that is:

- Railway Alternative Corridor 1: The length of the proposed 88 / 132 kV power line would be **1.68 km's** long.
- Railway Alternative Corridor 2: The length of the proposed 88/132 kV power line would be **1.3 km's** long.
- Railway Alternative Corridor 3: The length of the proposed 88 / 132kV power line would be **1.92 km's** long.

This alternative crosses the Wilge River three times and an unnamed tributary once (i.e. four river crossings in total).

88kV/132kV Power Line – Alternative A-(b)

Alternative A-(b) also starts at the existing 88kV power line (from Grootpan to Witbank), however it starts approximately 240 metres south of alternative A-(a) and heads in a north easterly direction parallel to alternative A-(a). The length of the alternative is dependent on which alternative railway corridor is approved, that is:

- Railway Alternative Corridor 1: The length of the proposed 88/132kV power line would be **1.68 km's** long.
- Railway Alternative Corridor 2: The length of the proposed 88/132kV power line would be **1.17 km's** long.
- Railway Alternative Corridor 3: The length of the proposed 88/132kV power line would be **1.82km's** long.

This alternative crosses the Wilge River once, the Klipfonteinspruit once and an unnamed tributary once (i.e. three river crossings in total).

5.3.2 88kV/132kV Power Line Corridor B

Power Line corridor B is located approximately to the immediate west of the Kusile Power Station construction site (Figure 5-6).

88kV/132kV Power Line – Alternative B-(a)

Alternative B-(a) starts at the existing 88kV power line and heads in a north easterly direction. The length of this alternative does not depend on the approved alternative railway corridor, as all three railway corridor alternatives merge towards the Kusile Power Station construction site. Therefore the length of this alternative is 2.37 km's.

This alternative crosses the Wilge River once and an unnamed tributary once (i.e. two river crossings in total).

88kV/132kV Power Line – Alternative B-(b)

Alternative B-(b) starts at the existing 88kV power line approximately 240 metres south of alternative B-(a) and heads in a north easterly direction parallel to alternative B-(a). The length of this alternative is also not dependent on which alternative railway corridor is approved, for the same reason as alternative B- (a). This alternative is the same length as alternative B-(a), that is 2.37 km, and has the same number of river crossings as alternative B-(a).

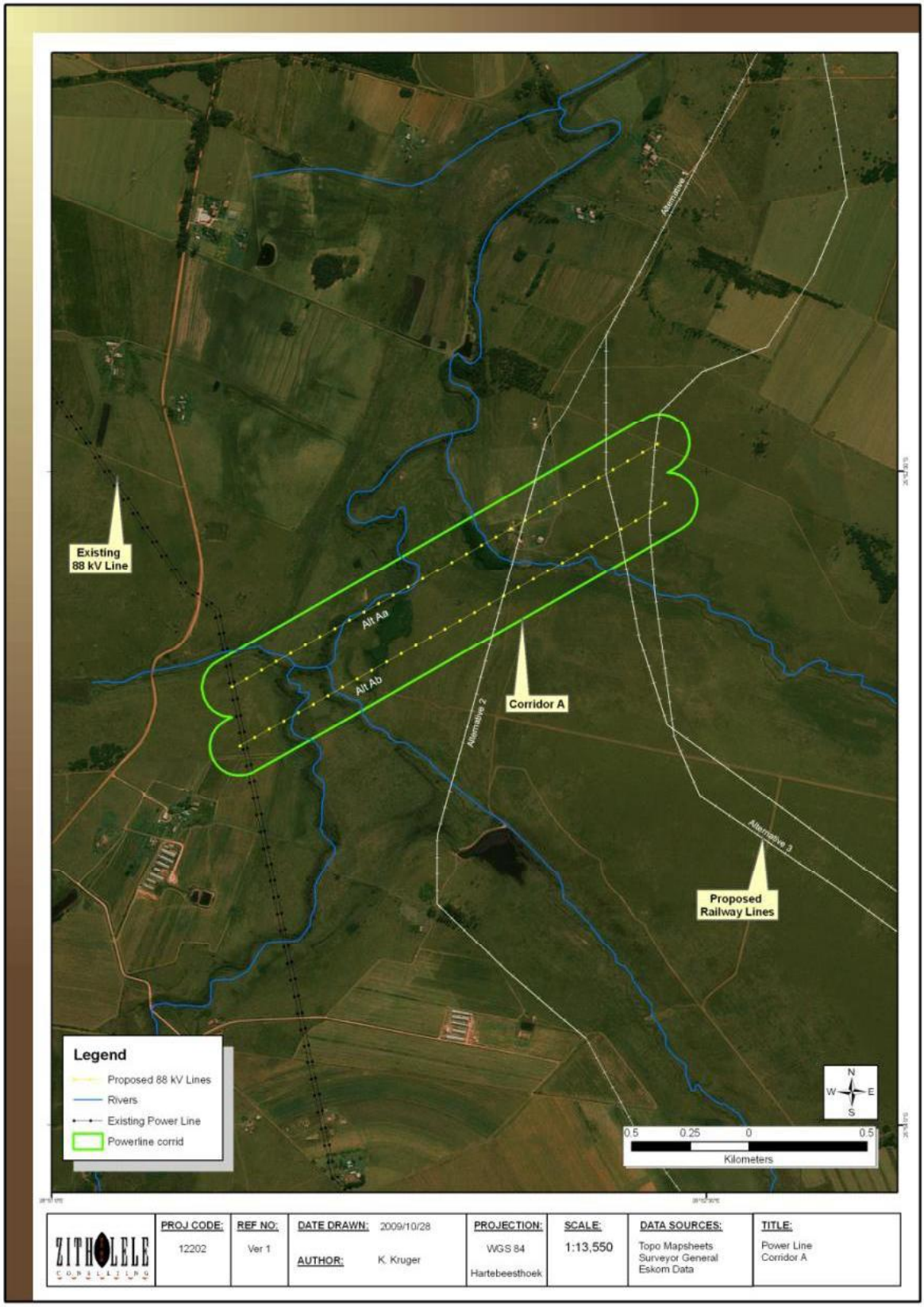


FIGURE 5-5: LOCALITY OF THE PROPOSED 88/132KV POWER LINE CORRIDOR FOR RAILWAY CORRIDOR ALTERNATIVE 1.

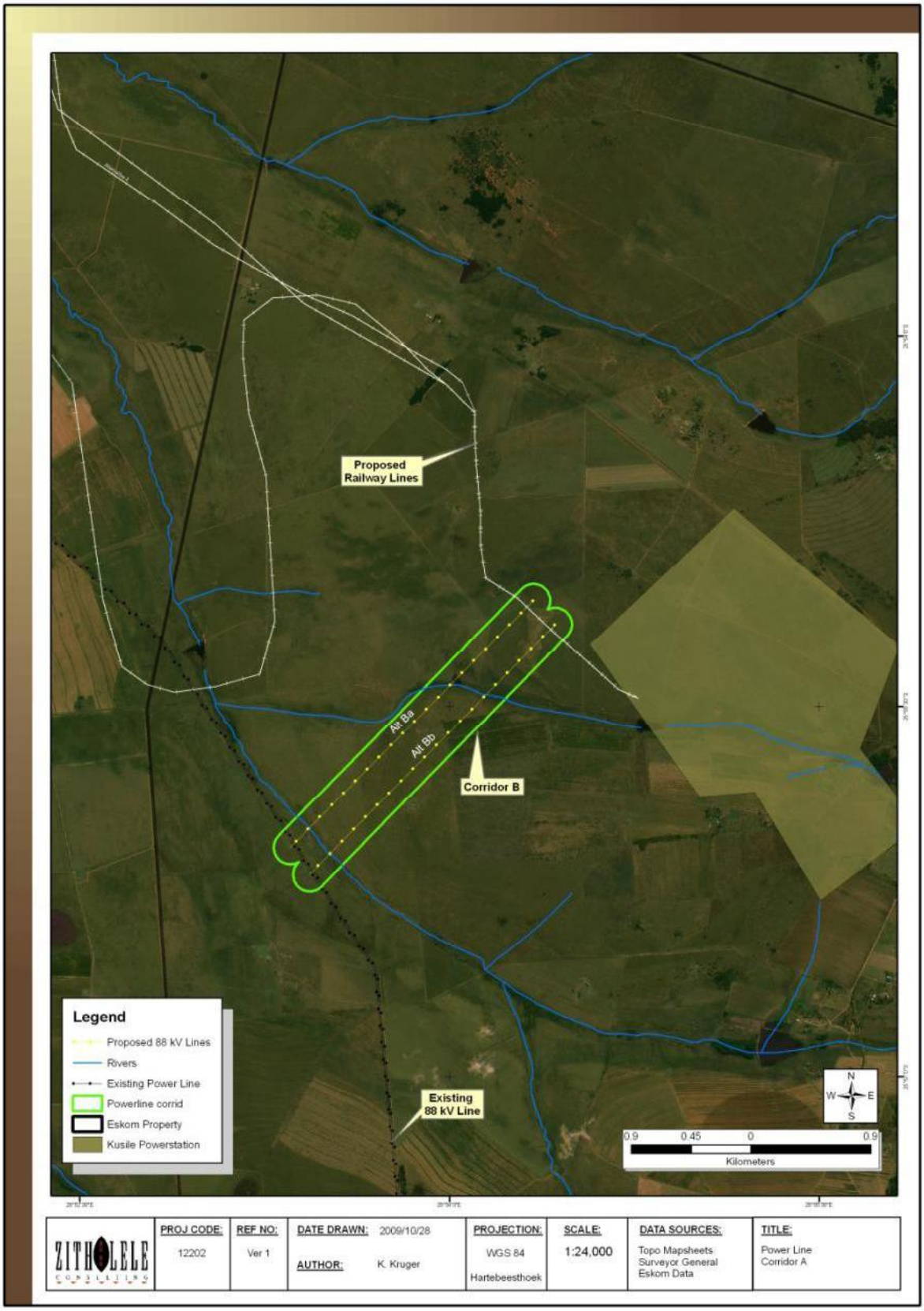


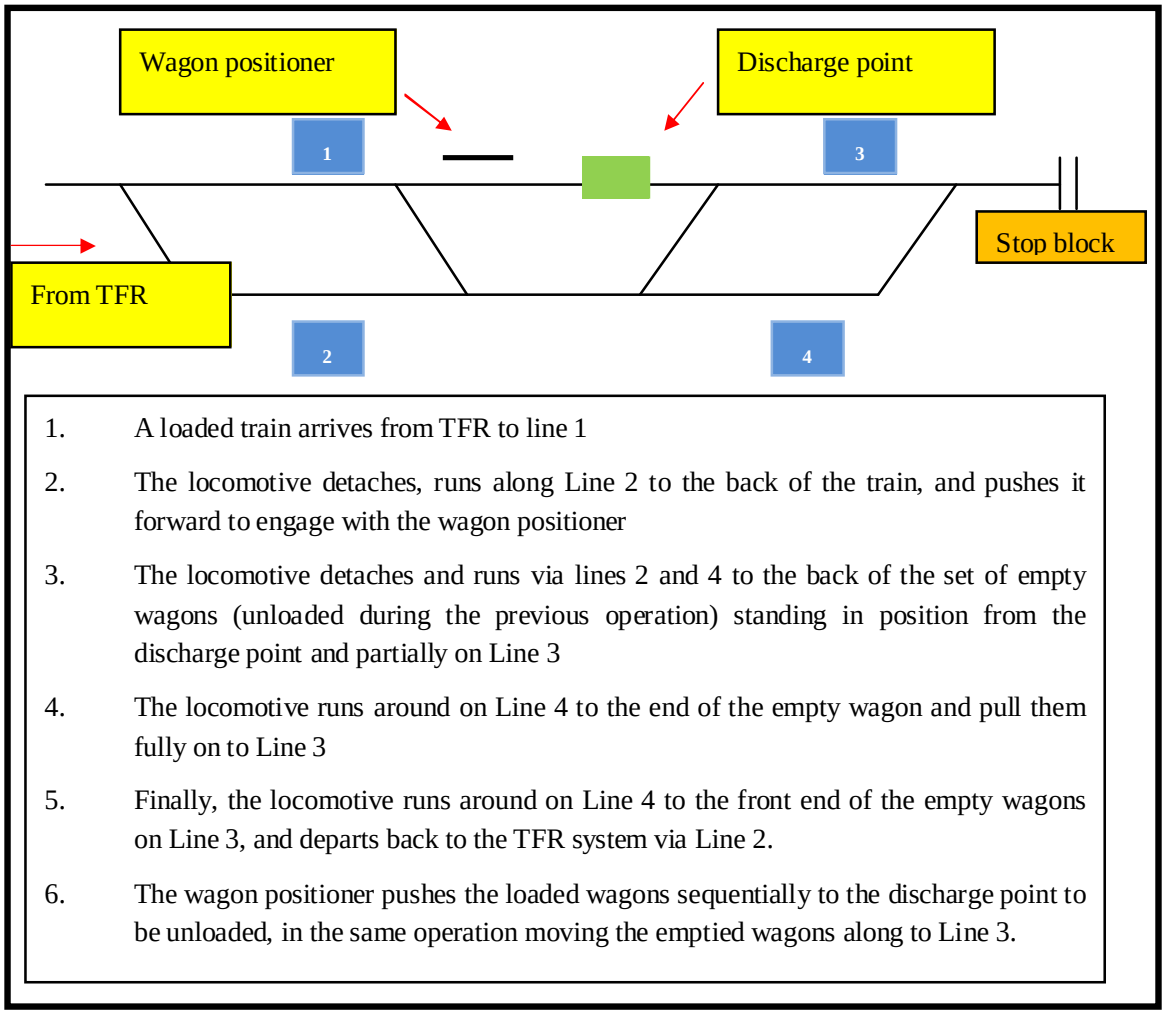
FIGURE 5-6: LOCALITY OF THE PROPOSED 88/132KV POWER LINE CORRIDOR FOR RAILWAY CORRIDOR ALTERNATIVE 2.

5.4 Operational Alternatives

Two modes of operation at the unloading facility are being investigated:

Option 1:

A loaded train will arrive on a line located in front of the unloading facility, where the locomotives will detach and run around to the back of the train to push the set of wagons to engage with an indexer (wagon positioner). The locomotive will then run back around the loaded wagons to the opposite side of the unloading facility to pull clear the set of empty wagons unloaded during the previous operation. Finally the locomotives will move around to the front of the empty wagons and the train will depart.



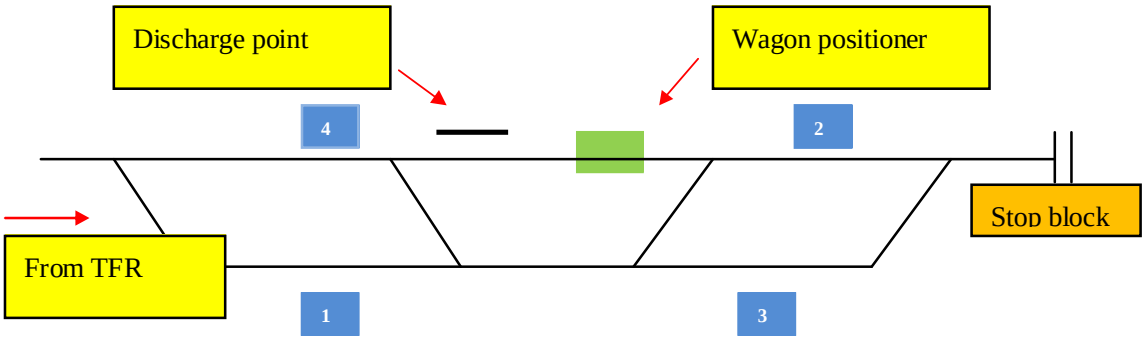
1. A loaded train arrives from TFR to line 1
2. The locomotive detaches, runs along Line 2 to the back of the train, and pushes it forward to engage with the wagon positioner
3. The locomotive detaches and runs via lines 2 and 4 to the back of the set of empty wagons (unloaded during the previous operation) standing in position from the discharge point and partially on Line 3
4. The locomotive runs around on Line 4 to the end of the empty wagon and pull them fully on to Line 3
5. Finally, the locomotive runs around on Line 4 to the front end of the empty wagons on Line 3, and departs back to the TFR system via Line 2.
6. The wagon positioner pushes the loaded wagons sequentially to the discharge point to be unloaded, in the same operation moving the emptied wagons along to Line 3.

FIGURE 5-7: SCHEMATIC LAYOUT OF THE OPERATION OPTION 1.

Option 2

A loaded train will arrive at the yard passing the unloading facility going back on the unloading facility line until the train is on this line. The locomotives will then push the train back until the wagons engage with the indexer system. The locomotives will then run back

around the wagons on the loop to the opposite side of the unloading facility to pull clear the set of empty wagons unloaded during the previous operation, and the train will depart.



1. A loaded train arrives from TFR to line 1 and 2 until the rear wagon clear the points on line 2. The train is then pushed backwards until the wagons engage with the wagon positioner.
2. The locomotives detach and run via line 3 and 1 to the back of the set of empty wagons, unloaded from the previous operation waiting on line 4 standing in position from the discharge point and partially over the points at offloading area.
3. Finally, the locomotives attach to the front end of the empty wagons on Line 4, and depart back to the TFR system via Line 4
4. The wagon positioner pushes the loaded wagons sequentially to the discharge point to be unloaded, in the same operation moving the empty wagons along from line 2 towards line 4.

FIGURE 5-8: SCHEMATIC LAYOUT OF THE OPERATION OPTION 2.

Recommended Option

The recommended operational method is to use Option 2 based on the following reasons:

- It requires fewer shunting operations;
- Reduced wear and tear of points; and
- Reduced safety risks.

5.5 "No Go" Alternative

The "No-Go" alternative will also be assessed further in the EIA. In the case that the project does not take place and no railway and associated activities are constructed the social, financial and environmental impacts will be assessed and compared to the aforementioned alternatives. However, this alternative is deemed not feasible as it would be against the strategic decision of rail transportation of sorbent, and would result in the developer incurring the impacts associated with the alternative means of transport.