

**Phase 1 Heritage Impact Assessment for the
proposed development of a new Taxi Rank in
Mahikeng, NW Province.**

Report prepared by
Paleo Field Services
PO Box 38806
Langenhovenpark 9330
June 2021

Summary

A Phase 1 Heritage Impact Assessment was carried out over a 1.7 ha – area designated for the development of a new taxi rank in Mahikeng, North West Province. Located within the CBD, the terrain is moderately to severely degraded and is underlain by Ventersdorp Supergroup volcanics and associated conglomerates (*Rm*), capped by residual soils with a sandy parent material (*Qs*, Kalahari Group). A foot survey of the surrounding veld has indicated no evidence of intact or capped Quaternary fossil remains or Stone Age archaeological material, distributed as surface scatters on the landscape within the study area. Iron Age structures, rock engravings, marked graves or buildings with historical significance older than 60 years are absent within the study area. The proposed development will primarily impact palaeontologically insignificant volcanic rocks (Kameeldoorns Formation) and geologically recent Quaternary deposits. Impact on potential *in situ* palaeontological or archaeological material within the study area is considered unlikely. A large cemetery located next to the site will not be impacted by the proposed development. The study area, is rated *Generally Protected C*.

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Introduction

A Phase 1 Heritage Impact Assessment was carried out over a 1.7 ha – area designated for the development of a new taxi rank in Mahikeng, North West Province (**Fig. 1 & 2**). The assessment is required as a prerequisite for new development in terms of the National Environmental Management Act and is also called for in terms of the National Heritage Resources Act (NHRA) 25 of 1999. The region's unique and non-renewable archaeological heritage sites are 'Generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. As many such heritage sites are threatened daily by development, both the environmental and heritage legislation require impact assessment reports that identify all heritage resources in the area to be developed, and that make recommendations for protection or mitigation of the impact of such sites. The NHRA identifies what is defined as a heritage resource, the criteria for establishing its significance and lists specific activities for which a heritage specialist study may be required. In this regard, categories relevant to the proposed development are listed in Section 34 (1), Section 35 (4), Section 36 (3) and Section 38 (1) of the NHR Act and are as follows:

34. (1) No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

35 (4) No person may, without a permit issued by the responsible heritage resources authority—

- destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
- *b)* destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

36 (3) No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

- (a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

- (b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
- (c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

38 (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

- The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- The construction of a bridge or similar structure exceeding 50m in length;
- Any development or other activity which will change the character of the site
 - a) exceeding 5000 m² in extent; or
 - b) involving three or more existing erven or subdivisions thereof; or
 - c) involving three or more subdivisions thereof which have been consolidated within the past five years;
- The rezoning of a site exceeding 10 000 m²; or
- Any other category of development provided for in regulations by the South African Heritage Resources Agency (SAHRA).

Methodology

The archaeological and palaeontological significance of the affected area were evaluated based on existing field data, database information and published literature. This was followed by a field assessment by means of a pedestrian survey. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes. Relevant heritage information, aerial photographs and site records were integrated with data acquired during the on-site inspection. Site significance standards, as prescribed by SAHRA, were used for the purpose of this report (**Table 1**).

Terms of Reference

The task involved the following:

- Identify and map possible heritage sites and occurrences using available resources.

- Determine and assess the potential impacts of the proposed development on potential heritage resources;
- Recommend mitigation measures to minimize potential impacts associated with the proposed development.

Locality Data

1 : 50 000 scale topographic map: 2525 DC Mafikeng

1:250 000 scale geological map 2524 Mafikeng

General Site Coordinates (**Fig. 2**): 25°51'30.59"S 25°38'14.55"E

The study area covers 1.7 ha of flat terrain in the CBD at the corner of Carney and Carrington Street (**Fig. 2**).

Geology

The area around Mahikeng is underlain by Basement Complex rocks belonging to the Kraaipan Group (*Zg*), volcanic breccias, and andesitic lavas of the Kameeldoorns (*Rm*) and Allanridge Formations (*Ra*) (Platberg Group, Ventersdorp Supergroup) (**Fig. 3**). Superficial sediments are primarily represented by Tertiary calcretes (*T-Qc*) and residual soils (*Qs*, aeolian sand).

Background

Potentially fossiliferous Rietgat Formation outcrop of the Ventersdorp Supergroup is located to the north of Mahikeng. The Rietgat Formation is palaeontologically significant since stromatolite structures have been recorded from borehole samples taken from this unit in the Free State Province (MacRae, 1999). Malmani Subgroup dolomites of the overlying Transvaal Supergroup (Chuniespoort Group) crop out to the east and northeast of Mahikeng. Thick deposits of stromatolitic dolomite, have been described from the Malmani Subgroup near Pretoria (MacRae, 1999).

The archaeological footprint of the region is primarily characterized by stone-walled settlements of early farming communities that are associated with early Tswana speakers who settled in the region between the 14th century and the early 19th century AD (**Fig. 4**). The first residents who can be directly linked to the current people in the Mahikeng area were the BaRolong who were descendants of Morolong, one of the founding ancestors of the Tswana lineage (**Fig. 5**).

Material remains consist of stone-walled complexes, refuse dumps and iron-smelting furnaces. High concentrations of Iron Age settlements are found in the area between Mafikeng, Zeerust and Swartruggens towards Rustenburg in the east (**Fig. 6**). Kraal structures extend along the Klein Marico River and the Baskop Hills south of Zeerust, and at Dithakong south of Mahikeng. Iron-smelting furnaces at Modderfontein and Schietkraal and stone-walled complexes have been recorded on the farms Buispoort, Braklaagte, Riefontein, Honingkrans, Rietvlei, Broekmansfontein, Syferfontein and Bronkhorstfontein in the Marico district. Stone-walled structures are also recorded on the farms Moedwil, Selonskraal, Elandsdrif and Doornlaagte between Rustenburg and Swartruggens. Mega-sites have been recorded at Vergenoegd 279 (Mmakgame) and at Bloemfontein 63 JP (Kaditshwene), which are respectively situated 10km south and 25km northeast of Zeerust.

Field Assessment

Located within the CBD, the terrain is moderately to severely degraded and is underlain by Ventersdorp Supergroup volcanics and associated conglomerates (*Rm*), capped by residual soils with a sandy parent material (*Qs*, Kalahari Group) (**Fig. 7 & 8**). A foot survey of the surrounding veld has indicated no evidence of intact or capped Quaternary fossil remains or Stone Age archaeological material, distributed as surface scatters on the landscape within the study area. Iron Age structures, rock engravings, marked graves or buildings with historical significance older than 60 years are absent within the study area.

Impact Statement and Recommendations

The proposed development will primarily impact palaeontologically insignificant volcanic rocks (Kameeldoorns Formation) and geologically recent Quaternary deposits . Impact on potential *in situ* palaeontological or archaeological material within the study area is considered unlikely. A large cemetery located next to the site will not be impacted by the proposed development (**Fig. 9 & 10**). The study area, is rated *Generally Protected C* (**Table 1**).

References

- Boeyens, J.C.A. 2003. The Late Iron Age sequence in the Marico and early Tswana history. *South African Archaeological Bulletin* 58 (178): 63 – 78.
- Breutz, P.L. 1956. Stone Kraal settlements in South Africa. *African Studies* 15 (4): 157 – 175.
- MacRae, C. 1999. *Life Etched in Stone*. Fossils of South Africa. The Geological Society of South Africa, Johannesburg.
- Michaluk, E. Keyser, N. Klop, A.A.C. et al. 1991. Geology of the Mafikeng Area. Geological Survey of South Africa. Pretoria.
- Pistorius, J.C. 1992. *Molokwane: an Iron Age Bakwena village. Early Tswana settlement in the western Transvaal*. Department of Anthropology and Archaeology, University of Pretoria. Perskor. Johannesburg.

DECLARATION OF INDEPENDENCE

I, Lloyd Rossouw, declare that I act as an independent specialist consultant. I do not have or will not have any financial interest in the undertaking of the activity other than remuneration for work as stipulated in the terms of reference. I have no interest in secondary or downstream developments as a result of the authorization of this project and have no conflicting interests in the undertaking of the activity.

15 / 06 / 2021

Tables and Figures

Table 1. Field rating categories as prescribed by SAHRA.

Field Rating	Grade	Significance	Mitigation
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP.A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

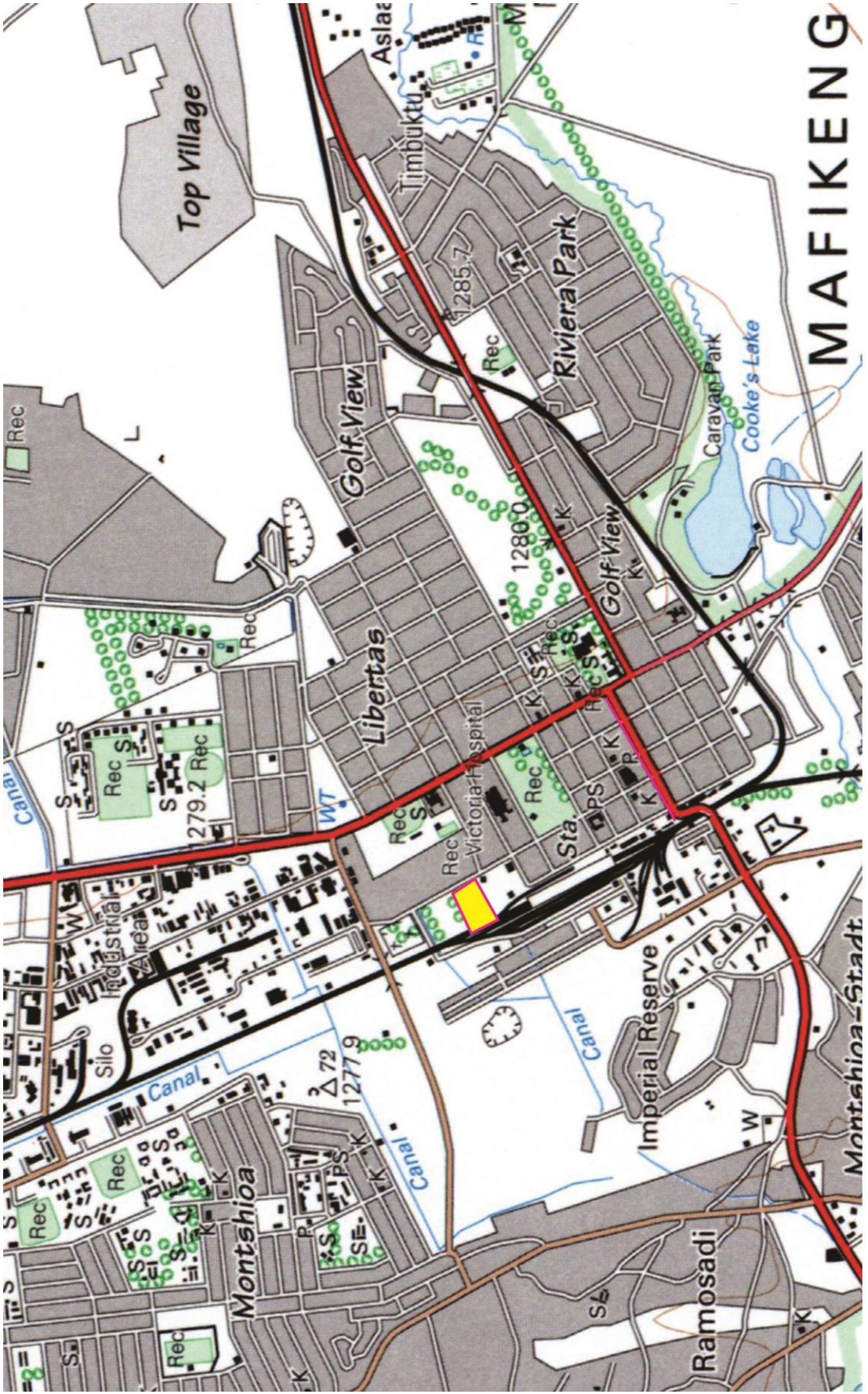


Figure 1. map of the proposed development area (portion of 1:50 000 scale topographic map 2525DC Mafikeng).



Figure 2. Aerial view of the study area.

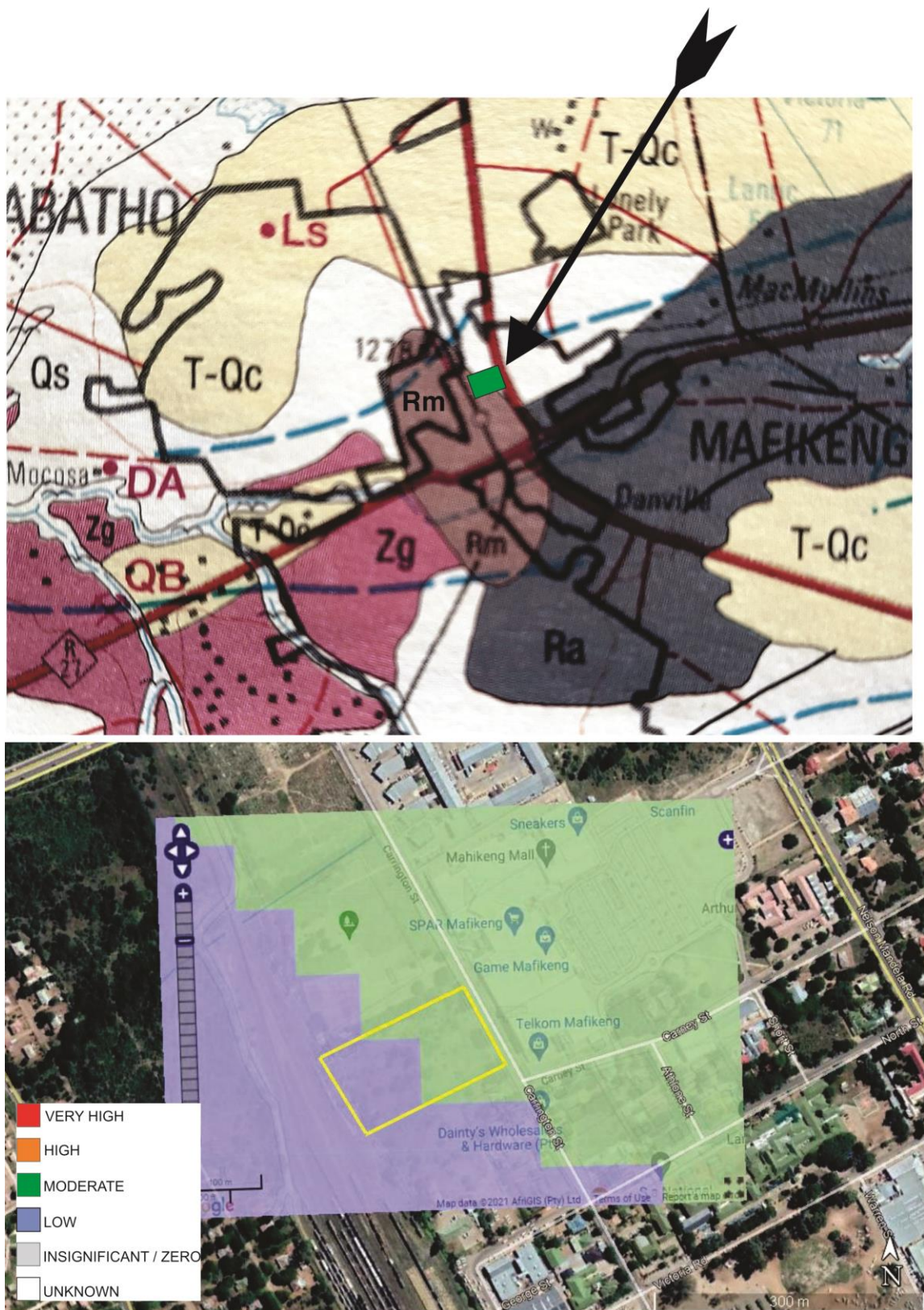


Figure 3. Portion of 1:250 000 scale geological map 2526 Mafikeng, showing site locality (above) and overlay of SAHRIS palaeosensitivity map (below). The site is underlain by Venterdorp Supergroup volcanics and associated conglomerates (*Rm*)

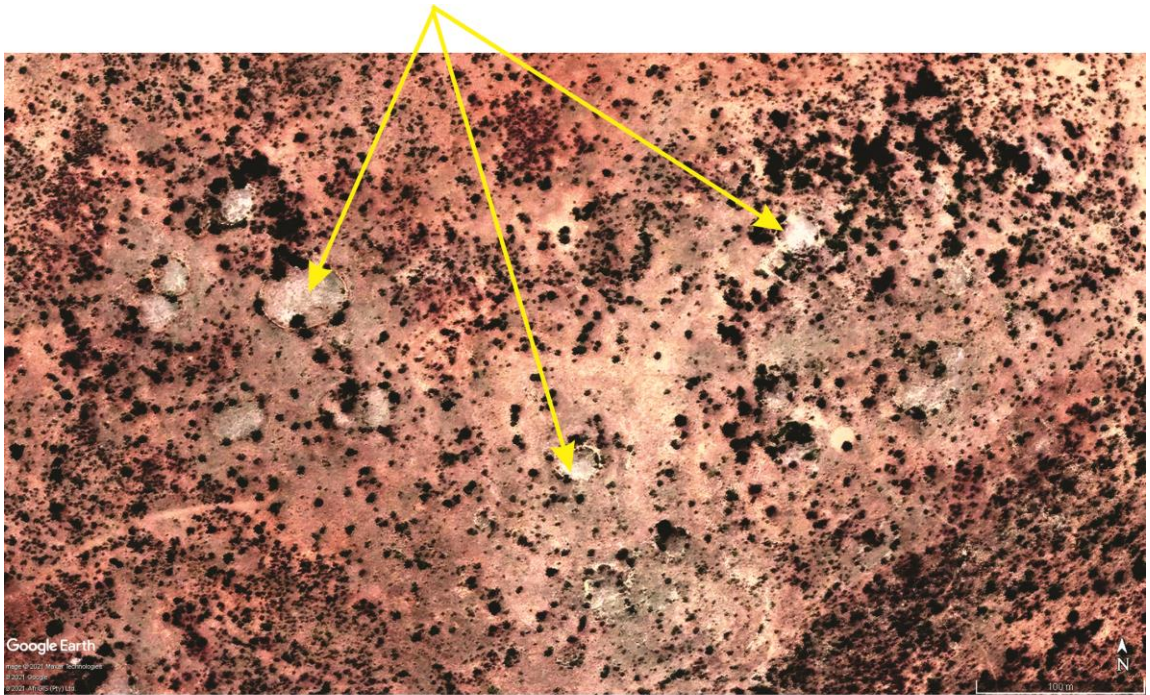


Figure 4. Aerial view of stonewalled settlements (above) and remains of hilltop-situated kraals and enclosures in the region.

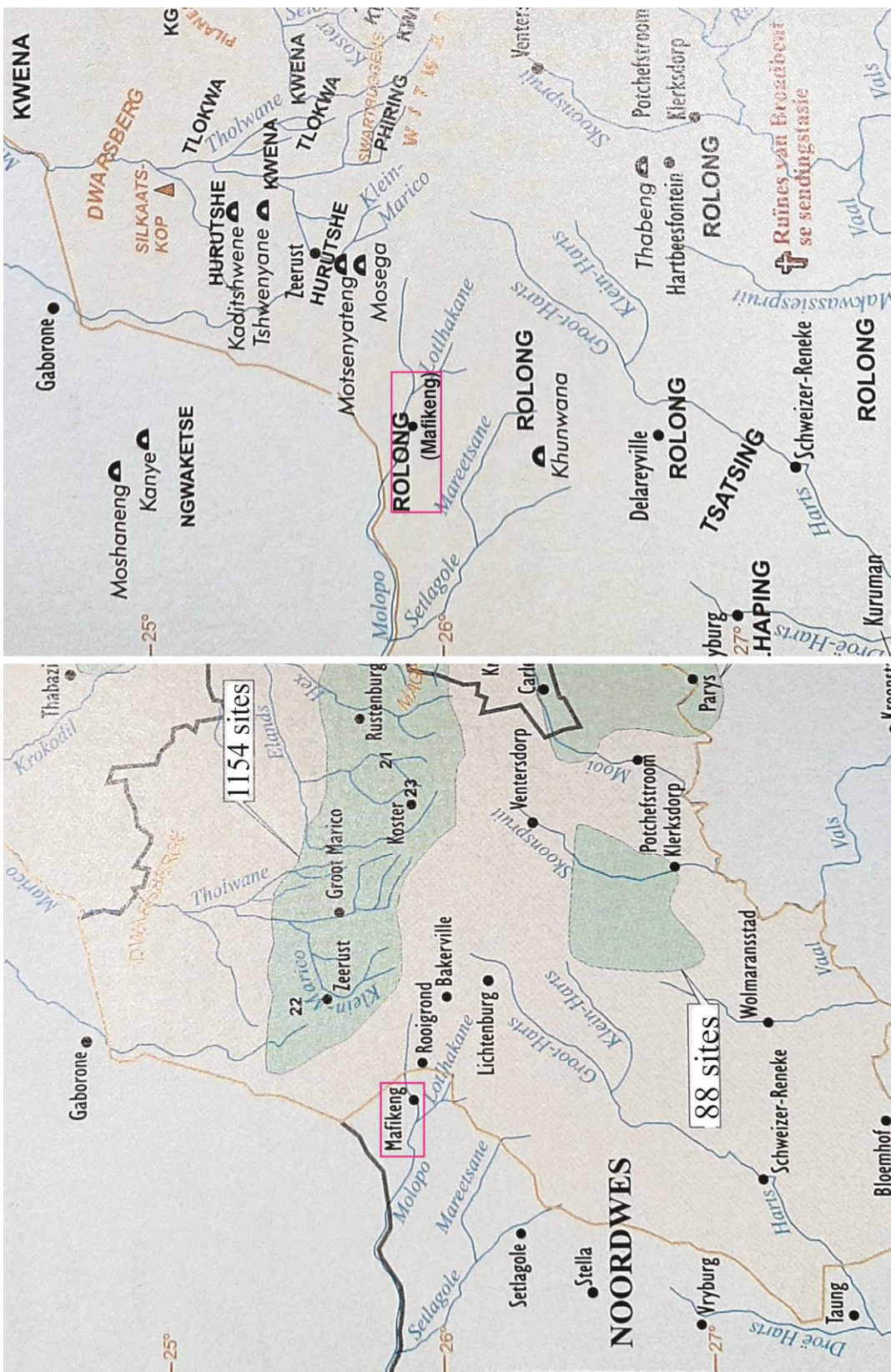
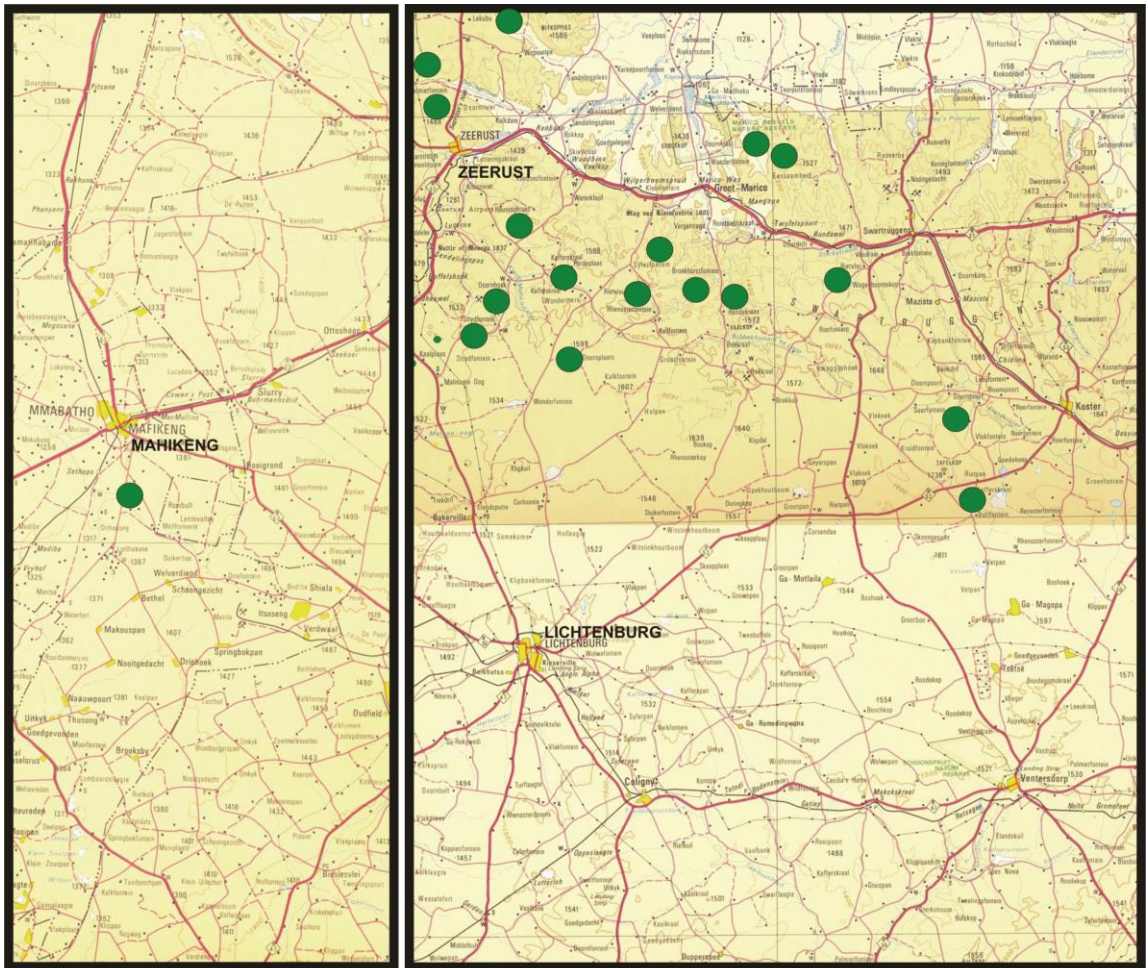


Figure 5. Later Iron Age sites marked by green areas in the region (left) and agricultural communities at the beginning of the 19th century (right) (after Bergh 1998).



● Stone-walled settlements

Figure 6. Distribution of well-known Iron Age stone-walled structures between Mahikeng, Zeerust and Lichtenburg.



Figure 7. General view of the study area, looking west (above) and northwest (below).



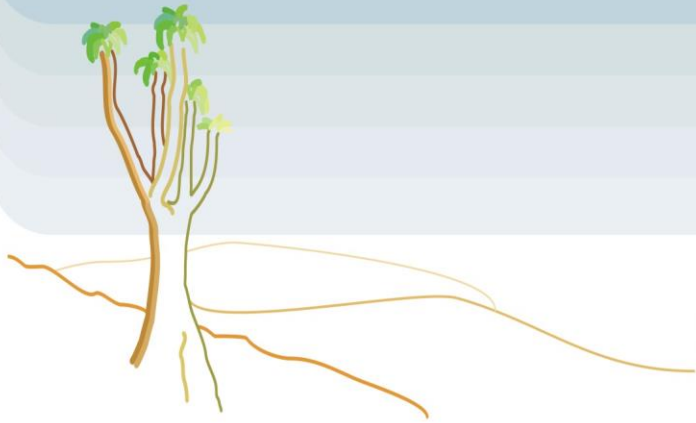
Figure 8. General view of open veld conditions and cuttings located about 2 km north of the study area.



Figure 9. Aerial view and layout of cemetery



Figure 10. General view of cemetery, looking west



DPR

Ecologists & Environmental Services

Report on the ecological and wetland assessment for the proposed taxi rank development situated in Mahikeng, North West Province.

June 2021

Prepared by:

Darius van Rensburg

Pr.Sci.Nat. 400284/13

T 083 410 0770

darius@dprecologists.co.za

P.O. Box 12726 | 61 Topsy Smith Street
Brandhof | Langenhovenpark
9324 | 9300

Prepared for:

Environmental Management Group


P.O. Box 28242

Danhof

9310

DECLARATION OF INDEPENDENCE

DPR Ecologists and Environmental Services is an independent company and has no financial, personal or other interest in the proposed project, apart from fair remuneration for work performed in the delivery of ecological services. There are no circumstances that compromise the objectivity of the study.

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Title	Report on the ecological and wetland assessment for the proposed taxi rank development situated in Mahikeng, North West Province.		
Author	DP van Rensburg (Pr.Sci.Nat)		Jun'21

Executive Summary

The proposed taxi rank development will be situated within the CBD of the city of Mahikeng (Appendix A: Map 1). The extent of the site is approximately 2.6 hectares.

According to Mucina & Rutherford (2006) the area consists of Klerksdorp Thornveld (Gh 13). The vegetation type is only represented by remnant patches on the site and is also not regarded as a Threatened Ecosystem which therefore does not contribute toward its conservation value. However, the North West Biodiversity Sector Plan (NW BSP – 2015) considers the site to form part of a Terrestrial Critical Biodiversity Area 2 (CBA 2) as it is located close to the Mahikeng Nature Reserve (Appendix A: Map 2). The site is however isolated by dense urban development and will in no way be able to affect the integrity of this conservation area. The site being regarded as a terrestrial CBA 2 will not contribute significantly towards its conservation value. In addition, the site is largely transformed from the natural condition, degraded and does not contain any elements of conservation significance. The species diversity is notably low without any protected, rare or endangered species. The loss of habitat and diversity which will result from the development is therefore anticipated to be quite low. The site is also listed as being an Aquatic Ecological Support Area 1 (ESA 1) which forms part of the catchment of the Molopo River, a National Freshwater Ecosystem Priority Area (NFEPA): Fish system (Appendix A: Map 2). Impacts that may therefore affect runoff and storm water on the site would therefore impact the Molopo River downstream.

The majority of the site has been transformed from the natural condition by several impacts and land uses (Appendix A: Map 1). The level of degradation is to such an extent that the vegetation on the site is no longer regarded as representative of the natural vegetation type and is considered transformed. Large volumes of rubble and refuse is being dumped on the site. Historically, the site was also affected by dumping and shallow excavations and the survey indicated clearly that the surface topography has largely been modified, where it should consist of a relatively flat plain it now has an irregular surface of small mounds and shallow excavations.

From the description of the vegetation on the site it is clearly transformed from the natural condition, degraded and does not contain any elements of conservation significance. The species diversity is notably low without any protected, rare or endangered species (Appendix B). It is also considered highly unlikely that any such species would occur here. The site is therefore of relatively low conservation value and suitable for the proposed development while not resulting in any large impacts.

Soil samples collected along the storm channel show clear indications of wetland conditions and is a consequence of prolonged saturation of the soils (Appendix C). The channel is however completely dominated by the invasive Spanish Reed (*Arundo donax*) and consequently obligate wetland plants are absent and do not confirm the presence of wetland conditions, a consequence of the artificial nature of the storm water system. Although soils still indicate the presence of wetland conditions, it should be kept in mind that these wetland conditions are an artificial manifestation caused by the storm water system.

The wetland conditions which has formed as a result of the storm water channel is completely artificial. However, historical aerial imagery seem to indicate that a small drainage line may have been present in this area though it would already have been modified by as early as 1958 (National Geo-Spatial Information). Whichever the case may be, at the present the channel is

completely artificial and does not contain any riparian habitat. The wetland conditions do resemble to some degree a channel wetland system, though due to its current artificial nature it differs in several important instances (SANBI 2009).

The storm water channel on the site is the recipient of a large volume of storm water generated within the urban areas to the east of the site. Large portions of the channel is covered and situated underground, while portions, such as occurs on the site is open. As can be expected the runoff feeding into the channel system is highly polluted and this also has a highly detrimental effect on the storm water system and surroundings. This storm water channel therefore still has an important function in terms of the management of the storm water generated within the urban area and evacuating the storm water out of the urban area.

As can be seen from the description of the storm water channel on the site, though it may have had a natural origin, many decades of modification and urbanisation has caused it to now be completely artificial and does not contribute to any wetland habitat, be it natural or artificial, in any significant manner. Its conservation value is therefore relatively low. However, in urban areas it is important to adequately manage the large volumes of storm water generated by means of such an artificial system. Furthermore, this channel will eventually feed into the Molopo River, an important watercourse which should not be affected by any additional impacts caused by the urban area. The functioning of the storm water channel on the site should therefore be preserved and not modified in any way by the proposed development.

The storm water channel on the site is artificial and functions in management of the storm water generated by the surrounding urban area. As long as the storm water channel is retained intact and a storm water management system is implemented on the site which does not contribute to any further significant deterioration of the water quality the risk of impact on the storm water channel should remain low. The proposed development is therefore unlikely to contribute to any significant impacts on it. It is however still recommended that the necessary authorisation be obtained from the Department of Water and Sanitation (DWS) but given the low risk that the General Authorisation (GA) route be taken.

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Ecological and wetland assessment.

1. INTRODUCTION

1.1 Background

Natural vegetation is an important component of ecosystems. Some of the vegetation units in a region can be more sensitive than others, usually as a result of a variety of environmental factors and species composition. These units are often associated with water bodies, water transferring bodies or moisture sinks. These systems are always connected to each other through a complex pattern. Degradation of a link in this larger system, e.g. tributary, pan, wetland, usually leads to the degradation of the larger system. Therefore, degradation of such a water related system should be prevented.

Though vegetation may seem to be uniform and low in diversity it may still contain species that are rare and endangered. The occurrence of such a species may render the development unviable. Should such a species be encountered the development should be moved to another location or cease altogether.

South Africa has a large amount of endemic species and in terms of plant diversity ranks third in the world. This has the result that many of the species are rare, highly localised and consequently endangered. It is our duty to protect our diverse natural resources.

South Africa's water resources have become a major concern in recent times. As a water scarce country, we need to manage our water resources sustainably in order to maintain a viable resource for the community as well as to preserve the biodiversity of the system. Thus, it should be clear that we need to protect our water resources so that we may be able to utilise this renewable resource sustainably. Areas that are regarded as crucial to maintain healthy water resources include wetlands, streams as well as the overall catchment of a river system.

Development around cities and towns are necessary to accommodate an ever-growing population. Areas along the boundaries of cities and towns are usually in a degraded state due to the impact of the large population these areas house. Though this may be the case in most situations there may still be areas that consist of sensitive habitats such as watercourses, wetlands or rare vegetation types that need to be conserved. These areas may also contain endangered fauna and flora.

The proposed taxi rank development will be situated within the CBD of the city of Mahikeng (Appendix A: Map 1). Although the site is still dominated by a well-developed vegetation layer it is considered largely transformed from the natural condition due to its location in the city centre. The site contains an abundance of exotic vegetation including scattered clumps of exotic trees, rubble and rubbish dumps are abundant and remnants of structures and buildings. An artificial storm water channel also transects the site and aids in storm water management within the city centre. The topography of the site is relatively uniform and is dominated by a relatively flat area but which has been modified by dumping and shallow excavations. The extent of the site is approximately 2.6 hectares.

A site visit was conducted on 26 May 2021. The entire footprint of the taxi rank development was surveyed over the period of one day. The site survey was conducted during late autumn

after sufficient rain and allowed for accurate species identification and an active hydrological regime.

For the above reasons it is necessary to conduct an ecological and wetland assessment of an area proposed for development.

The report together with its recommendations and mitigation measures should be used to minimise the impact of the proposed development.

1.2 The value of biodiversity

The diversity of life forms and their interaction with each other and the environment has made Earth a uniquely habitable place for humans. Biodiversity sustains human livelihoods and life itself. Although our dependence on biodiversity has become less tangible and apparent, it remains critically important.

The balancing of atmospheric gases through photosynthesis and carbon sequestration is reliant on biodiversity, while an estimated 40% of the global economy is based on biological products and processes.

Biodiversity is the basis of innumerable environmental services that keep us and the natural environment alive. These services range from the provision of clean water and watershed services to the recycling of nutrients and pollution. These ecosystem services include:

- Soil formation and maintenance of soil fertility.
- Primary production through photosynthesis as the supportive foundation for all life.
- Provision of food, fuel and fibre.
- Provision of shelter and building materials.
- Regulation of water flows and the maintenance of water quality.
- Regulation and purification of atmospheric gases.
- Moderation of climate and weather.
- Detoxification and decomposition of wastes.
- Pollination of plants, including many crops.
- Control of pests and diseases.
- Maintenance of genetic resources.

1.3 Details and expertise of specialist

DPR Ecologists and Environmental Services (Pty) Ltd.

Darius van Rensburg *Pr. Sci. Nat.*

61 Topsy Smith

Langenhoven Park

Bloemfontein

9300

Tel: 083 410 0770

darius@dprecologists.co.za

Professional registration:

South African Council for Natural Scientific Professions No. (400284/13) (Ecological Science).

Membership with relevant societies and associations:

- South African Society of Aquatic Scientists (SASAQS0091)
- South African Association of Botanists
- South African Wetlands Society (3SLY4IG4)

Expertise:

- Qualifications: B.Sc. (Hons) Botany (2008), M.Sc. in Vegetation Ecology (2012) with focus on ephemeral watercourses.
- Vegetation ecologist with over 10 years experience of conducting ecological assessments.
- Founded DPR Ecologists & Environmental Services (Pty) Ltd in 2016.
- Has conducted over 200 ecological and wetland assessments for various developments.
- Regularly attend conferences and courses in order to stay up to date with current methods and trends:

2017: Kimberley Biodiversity Symposium.

2018: South African Association of Botanists annual conference.

2018: National Wetland Indaba Conference.

2019: SASS5 Aquatic Biomonitoring Training.

2019: Society for Ecological Restoration World Congress 2019.

2019: Wetland rehabilitation: SER 2019 training course.

2020: Tools For Wetlands (TFW) training course.

2. SCOPE AND LIMITATIONS

- To evaluate the present state of the vegetation and ecological functioning of the area proposed for the taxi rank development.
- To identify possible negative impacts that could be caused by the proposed clearing of vegetation and establishment of a taxi rank development.
- Identify and delineate wetland and riparian areas associated with the artificial storm water system situated on the site.
- Determine the Present Ecological State (PES) and Ecological Importance & Sensitivity (EIS) for the storm water system in the study area.

2.1 Vegetation

Aspects of the vegetation that will be assessed include:

- The vegetation types of the region with their relevance to the proposed site.
- The overall status of the vegetation on site.
- Species composition with the emphasis on dominant-, rare- and endangered species.

The amount of disturbance present on the site assessed according to:

- The amount of grazing impacts.
- Disturbance caused by human impacts.
- Other disturbances.

2.2 Fauna

Aspects of the fauna that will be assessed include:

- A basic survey of the fauna occurring in the region using visual observations of species as well as evidence of their occurrence in the region (burrows, excavations, animal tracks, etc.).
- The overall condition of the habitat.

2.3 Wetlands and watercourses

Aspects of the wetlands that will be assessed include:

- Identification and delineation of watercourses including rivers, streams, pans and wetlands.
- Describe condition and status of watercourses and importance relative to the larger system.
- Conduct habitat integrity assessment of perennial systems to inform the condition and status of watercourses.

2.4 Limitations

- Several bulbous and herbaceous species may have finished flowering and may have been overlooked or not identifiable.

- Although a comprehensive survey of the site was done it is still likely that several species were overlooked.
- Due to high levels of disturbance several plant species may have been overlooked as they would be unidentifiable without inflorescences.
- Smaller drainage lines may have been overlooked where a distinct channel or riparian vegetation is absent.
- Some animal species may not have been observed as a result of their nocturnal and/or shy habits.

3. METHODOLOGY

3.1 Several literature works were used for additional information.

General ecology:

- Red Data List (Raymondo *et al.* 2009).
- Vegetation types (Mucina & Rutherford 2006).
- NBA 2018: South African Inventory of Inland Aquatic Ecosystems (SAIIAE).
- NBA 2018 Technical Report: Inland Aquatic (Freshwater) Realm.
- NBA 2018 Technical Report Volume 1: Terrestrial Realm.
- National Freshwater Ecosystem Priority Areas 2011 (NFEPA).
- Strategic Water Source Areas 2018 (SWSA).
- SANBI (2011): List of threatened ecosystems.
- NEM:BA: List of threatened ecosystems and Threatened Or Protected Species (TOPS).
- North West Province Biodiversity Sector Plan (2015).

Vegetation:

Red Data List (Raymondo *et al.* 2009)

Vegetation types (Mucina & Rutherford 2006)

Field guides used for species identification (Bromilow 1995, 2010, Coates-Palgrave 2002, Fish *et al* 2015, Gerber *et al* 2004, Gibbs-Russell *et al* 1990, Manning 2009, Van Ginkel *et al* 2011, Van Oudtshoorn 2004, Van Rooyen 2001, Van Rooyen & Van Rooyen 2019, Van Wyk & Malan 1998, Van Wyk & Van Wyk 1997).

Terrestrial fauna:

Field guides for species identification (Smithers 1986a, Child *et al* 2016, Cillié 2018).

Wetland methodology, delineation and identification:

Department of Water Affairs and Forestry 2004, 2005, 2008, Collins 2006, Duthie 1999, Gerber *et al* 2004, Kleynhans 2000, Marnewecke & Kotze 1999, Macfarlane *et al* 2014, Nel *et al* 2011, SANBI 2009, Van Ginkel *et al* 2011.

3.2 Survey

The site was assessed by means of transects and sample plots. Observation w.r.t. the general ecology of the area includes:

- Noted species include rare and dominant species.
- The broad vegetation types present at the site were determined.
- The state of the environment was assessed in terms of condition, grazing impacts, disturbance by humans, erosion and presence of invader and exotic species.
- The state of the habitat was also assessed.

Animal species were also noted as well as the probability of other species occurring on or near the site according to their distribution areas and habitat requirements.

The state of the habitat was also assessed.

All rivers, streams, pans and wetlands were identified and surveyed where they occurred in the study area. These systems were determined by use of topography (land form and drainage pattern) and riparian vegetation with limited soil sampling (Appendix B & C). The following outlines the process applied during the on-site survey in order to obtain all required data:

- Perform desktop overview of the study area utilising available resources (Section 3.1). From the desktop overview identify the different landscape forms, possible wetland areas, watercourses and their relative flow patterns. Using this information, identify transects and sample plots for possible on-site survey. This should be both representative of the wetland or watercourse as a whole but should also include any prominent or significantly unique features.
- Possible sites identified during the desktop overview should be surveyed on-site. Where access is not possible or where desktop features are considered poor representatives of the wetland or watercourse the survey site or transect should be moved to another location, without compromising a comprehensive overview of the system.
- Where a lateral transect is taken of a watercourse this is done from the water's edge, across the marginal, lower and upper zones and extended across the floodplain until the edge of the riparian zone is reached.
- Where a transect is taken of a wetland system, this should preferably be taken across the entire wetland at its widest part or where it is most relevant to the proposed development, from the terrestrial surroundings, across the temporary, seasonal and perennial zones across the wetland.
- Soil samples are taken at 10 meter intervals along the survey transect, or where a distinct transition into a different zone is observed.
- A survey of the plant species within each distinct riparian or wetland zone is undertaken and includes the identification of obligate wetland species, riparian species, terrestrial species, exotic species and the general species composition and vegetation structure which allows for an accurate description of the watercourse or wetland.
- Visual survey of the general topography which substantiates the presence of riparian zones and wetland forms.
- Other general observations include any impacts observed, the overall ecosystem function, presence of fauna, surrounding land uses and the overall condition of the watercourse or wetland.
- Data is recorded by means of photographs with GPS coordinates taken at all relevant soil sampling sites and borders of riparian and wetland zones.

Data obtained during the on-site survey is utilised to provide the following information on the system:

- Desktop overview and assimilation of information on the likely impacts and functioning of the wetland system.
 - Review all available spatial data and resources in order to provide an estimate of the likely impacts and condition of the wetland or watercourse system.
- Confirm the presence of the wetland or watercourse system and provide an estimate of its borders.
 - The border of wetland conditions or the edge of the riparian zone will be confirmed by using soil sampling, obligate wetland vegetation and topography. This will also include the delineation of any temporary, seasonal or perennial

zones of wetness along wetlands and the marginal, lower, upper and riparian zones along watercourses.

- Provide a description of the wetland or watercourse.
 - Provide the hydrogeomorphic setting of the wetland, a longitudinal profile which will aid in determining the erodibility of the wetland and provide an overall description of the wetland and impacts affecting it.
 - Provide a general description of the lateral zonation of the watercourse banks including the marginal, lower, upper and riparian zones and a description of the riparian vegetation along the banks of the watercourse. This will also include the description of any impacts or modification of the watercourse.
- Assess the current condition of the wetland or watercourse.
 - Utilising information obtained from the assessments listed above, determine the condition of this portion of the wetland by applying the WET-Health 2 tool.
 - Utilising information obtained from the assessments listed above, determine the condition of the relevant section of the watercourse by applying the Index of Habitat Integrity (IHI) tool.
- Utilising all of the information obtained from the assessment, provide recommendations to mitigate anticipated impacts that the development will have.

The following guidelines and frameworks were used to determine and delineate the rivers, streams, pans and wetlands in the study area:

- Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria.
- Mamewecke & Kotze 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

The following guidelines and frameworks were used to determine the sensitivity or importance of these identified watercourses in the study area:

- Nel *et al.* (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.
- Government of South Africa. 2008. National Protected Area Expansion Strategy for South Africa 2008: Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Government of South Africa, Pretoria.
- Duthie, A. 1999. Appendix W5: IER (floodplain and wetlands) determining the Ecological Importance and Sensitivity (EIS) and Ecological Management Class (EMC). In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

These guidelines provide the characteristics which can be utilised to determine if a wetland or watercourse is present and also aids in determining the boundary of these systems.

3.3 Criteria used to assess sites

Several criteria were used to assess the site and determine the overall status of the environment.

Vegetation characteristics

Characteristics of the vegetation in its current state. The diversity of species, sensitivity of habitats and importance of the ecology as a whole.

Habitat diversity and species richness: normally a function of locality, habitat diversity and climatic conditions.

Scoring: Wide variety of species occupying a variety of niches – 1, Variety of species occupying a single nich – 2, Single species dominance over a large area containing a low diversity of species – 3.

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species can potentially be a fatal flaw.

Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

Ecological function: All plant communities play a role in the ecosystem. The ecological importance of all areas though, can vary significantly e.g. wetlands, drainage lines, ecotones, etc.

Scoring: Ecological function critical for greater system – 1, Ecological function of medium importance – 2, No special ecological function (system will not fail if absent) – 3.

Degree of rarity/conservation value:

Scoring: Very rare and/or in pristine condition – 1, Fair to good condition and/or relatively rare – 2, Not rare, degraded and/or poorly conserved – 3.

Vegetation condition

The sites are compared to a benchmark site in a good to excellent condition. Vegetation management practises (e.g. grazing regime, fire, management, etc.) can have a marked impact on the condition of the vegetation.

Percentage ground cover: Ground cover is under normal and natural conditions a function of climate and biophysical characteristics. Under poor grazing management, ground cover is one of the first signs of vegetation degradation.

Scoring: Good to excellent – 1, Fair – 2, Poor – 3.

Vegetation structure: This is the ratio between tree, shrub, sub-shrubs and grass layers. The ratio could be affected by grazing and browsing by animals.

Scoring: All layers still intact and showing specimens of all age classes – 1, Sub-shrubs and/or grass layers highly grazed while tree layer still fairly intact (bush partly opened up) – 2, Mono-layered structure often dominated by a few unpalatable species (presence of barren patches notable) – 3.

Infestation with exotic weeds and invader plants or encroachers:

Scoring: No or very slight infestation levels by weeds and invaders – 1, Medium infestation by one or more species – 2, Several weed and invader species present and high occurrence of one or more species – 3.

Degree of grazing/browsing impact:

Scoring: No or very slight notable signs of browsing and/or grazing – 1, Some browse lines evident, shrubs shows signs of browsing, grass layer grazed though still intact – 2, Clear browse line on trees, shrubs heavily pruned and grass layer almost absent – 3.

Signs of erosion: The formation of erosion scars can often give an indication of the severity and/or duration of vegetation degradation.

Scoring: No or very little signs of soil erosion – 1, Small erosion gullies present and/or evidence of slight sheet erosion – 2, Gully erosion well developed (medium to large dongas) and/or sheet erosion removed the topsoil over large areas – 3.

Faunal characteristics

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species or very unique and sensitive habitats can potentially be a fatal flaw.

Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely.

3.4 Biodiversity sensitivity rating (BSR)

The total scores for the criteria above were used to determine the biodiversity sensitivity ranking for the sites. On a scale of 0 – 30, six different classes are described to assess the suitability of the sites to be developed. The different classes are described in the table below:

Table 1: Biodiversity sensitivity ranking

BSR	BSR general floral description	Floral score equating to BSR class
Ideal (5)	Vegetation is totally transformed or in a highly degraded state, generally has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area has lost its inherent ecological function. The area has no conservation value and potential for successful rehabilitation is very low. The site is ideal for the proposed development.	29 – 30
Preferred (4)	Vegetation is in an advanced state of degradation, has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area's ecological function is seriously hampered, has a very low conservation value and the potential for successful rehabilitation is low. The area is preferred for the proposed development.	26 – 28
Acceptable (3)	Vegetation is notably degraded, has a medium level of species diversity although no species of concern are present. Invasive plants are present but are still controllable. The area's ecological function is still intact but may be hampered by the current levels of degradation. Successful rehabilitation of the area is possible. The conservation value is regarded as low. The area is acceptable for the proposed development.	21 – 25
Not preferred (2)	The area is in a good condition although signs of disturbance are present. Species diversity is high and species of concern may be present. The ecological function is intact and very little rehabilitation is needed. The area is of medium conservation importance. The area is not preferred for the proposed development.	11 – 20
Sensitive (1)	The vegetation is in a pristine or near pristine condition. Very little signs of disturbance other than those needed for successful management are present. The species diversity is very high with several species of concern known to be present. Ecological functioning is intact and the conservation importance is high. The area is regarded as sensitive and not suitable for the proposed development.	0 - 10

4. ECOLOGICAL OVERVIEW OF THE SITE

4.1 Overview of ecology and vegetation types

Refer to the list of species encountered on the site in Appendix B.

According to Mucina & Rutherford (2006) the area consists of Klerksdorp Thornveld (Gh 13) which is characterised by plains with clumps trees amidst an arid grass layer. The vegetation type is currently listed as being of Least Concern (LC) according to the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1). It is currently affected by extensive transformation for agriculture and urban development but not to the extent that it is regarded as a Threatened Ecosystem.

The North West Biodiversity Sector Plan (NW BSP – 2015) has recently been published and has identified areas which are essential to meeting conservation targets for specific vegetation types, i.e. Critical Biodiversity Areas. The site in question is listed as a Terrestrial Critical Biodiversity 2 (CBA 2) and Aquatic Ecological Support Area 1 (ESA 1) (Appendix A: Map 2). The reasoning for being listed as a CBA 2 is because it is located within 5 km of the Mahikeng Nature Reserve to the south. However, since the site is almost completely transformed and situated within the city centre makes this classification poorly justified. The proposed development should not have any impact on the nearby situated Mahikeng Nature Reserve. The reasoning for the site being listed as ESA 1 is that it forms part of the catchment of the Molopo River, a National Freshwater Ecosystem Priority Area (NFEPA): Fish system. Impacts that may therefore affect runoff and storm water on the site would therefore impact the Molopo River downstream. This will require adequate mitigation on the site to prevent any downstream deterioration of surface and groundwater.

The proposed taxi rank development will be situated within the CBD of the city of Mahikeng (Appendix A: Map 1). Although the site is still dominated by a well-developed vegetation layer it is considered largely transformed from the natural condition due to its location in the city centre. The site contains an abundance of exotic vegetation including scattered clumps of exotic trees, rubble and rubbish dumps are abundant and remnants of structures and buildings. An artificial storm water channel also transects the site and aids in storm water management within the city centre. The topography of the site is relatively uniform and is dominated by a relatively flat area but which has been modified by dumping and shallow excavations. The extent of the site is approximately 2.6 hectares.

The vegetation structure on the site contains a dense grass layer with scattered trees. These trees are however dominated by exotic and invasive species and a prominent herbaceous weed layer also cause significant modification of the vegetation structure. An artificial storm water channel is also located along the southern border of the site and the dense infestation of Spanish Reed (*Arundo donax*) along this channel also contribute to significant modification of the vegetation structure.



Figure 1: General view of the site. Note a dominant grass layer with scattered trees, though the majority of these are exotic invasive species (red). Note also the general modification of the surface topography.

As mentioned, the majority of the site has been transformed from the natural condition by several impacts and land uses (Appendix A: Map 1). The level of degradation is to such an extent that the vegetation on the site is no longer regarded as representative of the natural vegetation type and is considered transformed. Impacts which cause this high level of degradation include several significant anthropogenic impacts. Small dirt tracks cause local disturbance but more importantly are used to gain access to the interior of the site and large volumes of rubble and refuse is being dumped here. Historically, the site was also affected by dumping and shallow excavations and the survey indicated clearly that the surface topography has largely been modified, where it should consist of a relatively flat plain it now has an irregular surface of small mounds and shallow excavations. A few small structures and remnants of buildings also indicate previous disturbance of the site.



Figure 2: Rubbish and rubble dumping is abundant on the site and cause extensive degradation.

The topography of the site is relatively uniform but is also clearly modified, at least in terms of the surface topography. Rubble dumping and shallow excavations as well as general surface disturbances have all contributed to a modified surface topography. The site is almost completely flat, without any discernible slope. A linear storm water channel is also situated along the southern portion of the site (Appendix A: Map 1). This is considered a completely artificial system although it does feed into the storm water system of Mahikeng and does eventually discharge into the Molopo River, approximately 2.5 km to the south west of the site. The elevation on the site is 1283 m without any discernible changes and also confirm the largely flat topography of it.



Figure 3: The natural surface topography of the site has clearly been modified.



Figure 4: The artificial storm water channel on the site is clearly completely artificial and dominated by the invasive Spanish Reed (*Arundo donax*).

The underlying geology of the area consists of the Kameeldoorns Formation of the Platberg Group of the Ventersdorp Supergroup (Council for Geoscience 2016). No outcrops occur on the site and soils are considered relatively deep. Soils are dominated by eutrophic red plinthic soils derived from the Ventersdorp Supergroup volcanics and sediments (Mucina & Rutherford 2006).

The site is situated in a warm-temperate region, strictly summer rainfall, with a mean annual rainfall of 533 mm. Summer temperatures are high while frequent frost may also occur during winter (Mucina & Rutherford 2006).

As previously mentioned, the site is dominated by a dense grass layer with scattered trees while a prominent exotic weed component is also present (Appendix B). Disturbance of the site has caused extensive degradation, to the point that it is no longer regarded as a representative sample of the natural vegetation type. The following description of the species composition should provide a good overview of the ecology on the site and should indicate the degraded condition of it.



Figure 5: Though also heavily degraded, remnants of the natural vegetation type do still occur on the site.

The site still contains dense stands of the grasses *Cenchrus ciliaris* and *Heteropogon contortus*. These are semi-climax species which are considered to be remnants of the remaining natural vegetation type on the site. However, an abundance of other pioneer grass species also indicate degradation of this grass layer. These include *Cynodon dactylon*, *Melinis repens*, *Urochloa panicoides*, *Eragrostis echinochloidea*, *Enneapogon cenchroides*, *Hyparrhenia tamba* and *Eragrostis lehmanniana*. This species assemblage is a clear indication of a degraded natural grass layer. In addition, the shade loving grass, *Setaria verticillata* occurs underneath some of the trees on the site and the moisture loving grass, *Panicum coloratum* is present in depressions where moisture may collect. The tree layer contains scattered specimens of the indigenous *Vachellia karroo*, *Ziziphus mucronata* and *Vachellia tortillis* var. *heteracantha*. These are also considered as remnants of the natural vegetation type. A single small specimen of *Vachellia sieberana* var. *woodii* was also noted near the roadway but is considered planted since this species does not naturally occur in this region and is considered highly unlikely to be a natural range extension. Underneath some of the trees the climber, *Pergularia daemia* was also noted, an indigenous species, also considered a remnant of the natural vegetation. The above description is however the full extent to which natural vegetation still remains on the site, with the remaining proportion consisting only of exotic weeds and invasive plant species. Exotic weeds are prominent and dominate significant portions of the site. These include *Sphaeralcea bonariensis*, *Bidens pillosa*, *Flaveria bidentis*, *Amaranthus hybridis*, *Datura stramonium*, *Sonchus oleraceus* and *Euhorbia heterophylla*. The invasive climber *Ipomoea purpurea* is also abundant in the undergrowth and in shrubs. The shrub and tree layer also contains an abundance of invasive species of which a few are also regarded as serious invaders. These include *Tipuana tipu*, *Parkinsonia aculeata*, *Caesalpinia gilliesii*, *Robinia pseudoacacia*, *Prosopis glandulosa*, *Morus alba*, *Melia azedarach* and *Schinus molle*. The artificial storm water channel on the site is also dominated by the highly invasive Spanish Reed, *Arundo donax*, to the exclusion of all other vegetation which this invasive plant is known for. The above should clearly indicate the abundance of exotic and invasive plants which cause extensive degradation and contributes to the largely transformed condition of the site. The site also does not contain any protected, rare or endangered species and given the severe degradation of the site it is highly unlikely that any such species would still remain.

From the description of the vegetation on the site it is clearly transformed from the natural condition, degraded and does not contain any elements of conservation significance. The species diversity is notably low without any protected, rare or endangered species (Appendix B). It is also considered highly unlikely that any such species would occur here. The site is therefore of relatively low conservation value and suitable for the proposed development while not resulting in any large impacts.

As indicated the natural vegetation on the site has been largely transformed from the natural condition. Furthermore, the natural vegetation type which originally occurred on the site, Klerksdorp Thornveld (Gh 13), is only represented by remnant patches and is also not regarded as a Threatened Ecosystem which therefore does not contribute its conservation value (Appendix A: Map 1). However, the North West Biodiversity Sector Plan (NW BSP – 2015) considers the site to form part of a Terrestrial Critical Biodiversity Area 2 (CBA 2) as it is located close to the Mahikeng Nature Reserve (Appendix A: Map 2). The site is however isolated by dense urban development and will in no way be able to affect the integrity of this conservation area. The site being regarded as a CBA 2 will not contribute significantly towards its conservation value. In terms of the aquatic component the site is regarded as an Ecological Support Area 1 (ESA 1) as it forms part of the catchment of the Molopo River, a National Freshwater Ecosystem Priority Area (NFEPA): Fish system (Appendix A: Map 2). Impacts that may therefore affect runoff and storm water on the site would therefore impact the Molopo River downstream. The preservation of the artificial storm water channel on the site is therefore of importance and would therefore have to be accommodated within the development.

4.2 Overview of terrestrial fauna (actual & possible)

Signs and tracks of mammals were absent from the site and surroundings. This is largely to be expected, although it remains likely that a few generalist species may have been overlooked on the site. As a result of the urban surroundings which cause transformation of the available habitat and also isolates the site from any surrounding natural areas this will dissuade most mammals, except a few generalist species, from inhabiting the area. In addition, high levels of disturbance on the site and human activity will also further degrade the available remaining habitat. As a consequence it is considered highly unlikely that any species of conservation concern would remain in the area. Furthermore, any remaining mammals are considered highly likely to consist of generalist species able to survive in these urban and transformed areas.

The impact the proposed taxi rank development will have is mainly concerned with the loss of habitat. However, as previously indicated the habitat which will be affected has already been transformed and degraded to a large extent by the urban environment and associated land uses. Furthermore, the footprint of the development will not be extensive and should therefore limit the impact on mammals. The anticipated impact can therefore not be regarded as significant.

The hunting, capturing or harming in any way of fauna on the site must be prohibited. In the event of venomous animals, such as snakes, encountered on the site an experienced snake handler should be contacted to remove it from the site.

Table 2: Red Listed mammals likely to occur in the study area (Mammalmap & Child *et al* 2016).

Scientific name	Common name	Status
Otomys auratus	Southern African Vlei Rat (Grassland type)	Near Threatened
Aonyx capensis	African Clawless Otter	Near Threatened
Crocidura mariquensis	Swamp Musk Shrew	Near Threatened
Hyaena brunnea	Brown Hyena	Near Threatened
Panthera pardus	Leopard	Vulnerable
Leptailurus serval	Serval	Near Threatened
Acinonyx jubatus	Cheetah	Vulnerable

Atelerix frontalis	Southern African Hedgehog	Near Threatened
Lycaon pictus	African wild dog	Endangered

The likelihood that one or several of these endangered species may occur on the site is considered highly unlikely. These species require pristine grassland and waterbodies with suitable habitat and good water quality, all of which is certainly absent from the site and surroundings.

4.3 Wetland Assessment

The artificial storm water system occurring in the southern portion of the site will be discussed below (Appendix A: Map 1).

The term watercourse refers to a river, stream, wetland or pan. The National Water Act (NWA, 1998) includes rivers, streams, pans and wetlands in the definition of the term watercourse. This definition follows:

Watercourse means:

- A river or spring.
- A natural channel in which water flows regularly or intermittently.
- A wetland, lake or dam into which water flows.
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Riparian habitat is an accepted indicator of watercourses used to delineate the extent of wetlands, rivers, streams and pans (Department of Water Affairs and Forestry 2005).

The artificial storm water system and any associated wetland conditions were delineated by use of topography (land form and drainage pattern) and riparian vegetation with limited soil sampling (Appendix C). The following guidelines and frameworks were used to determine and delineate the watercourses and wetlands in the study area:

- Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria.
- Marnewecke & Kotze 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

Obligate wetland vegetation was utilised to determine the presence and border of wetlands. Soil samples were used to determine the border and also to confirm the presence of wetland soils along the storm water channel (Appendix C). Soil samples collected along the storm channel show clear indications of wetland conditions and is a consequence of prolonged saturation of the soils. The channel is however completely dominated by the invasive Spanish Reed (*Arundo donax*) and consequently obligate wetland plants are absent and do not confirm the presence of wetland conditions, a consequence of the artificial nature of the storm water system. When utilising topography this also does not substantiate the presence of a natural wetland system. Soils do however still indicate the presence of wetland conditions, though it

should however be kept in mind that these wetland conditions are an artificial manifestation caused by the storm water system.

4.3.1 Classification of wetland systems

The wetland conditions which has formed as a result of the storm water channel is completely artificial. Historical aerial imagery seem to indicate that a small drainage line may have been present in this area though it would already have been modified by as early as 1958 (National Geo-Spatial Information). Whichever the case may be, at the present the channel is completely artificial and does not contain any riparian habitat. The wetland conditions do resemble to some degree a channel wetland system, though due to its current artificial nature it differs in several important instances.

The wetland conditions associated with the storm water channel has several similarities with a channel wetland system (SANBI 2009):

“An open conduit with clearly defined margins that (i) continuously or periodically contains flowing water, or (ii) forms a connecting link between two water bodies. Dominant water sources include concentrated surface flow from upstream channels and tributaries, diffuse surface flow or interflow, and/or groundwater flow. Water moves through the system as concentrated flow and usually exits as such but can exit as diffuse surface flow because of a sudden change in gradient. Unidirectional channel-contained horizontal flow characterises the hydrodynamic nature of these units. Note that, for purposes of the classification system, channels generally refer to rivers or streams (including those that have been canalised) that are subject to concentrated flow on a continuous basis or periodically during flooding, as opposed to being characterised by diffuse flow. As a result of the erosive forces associated with concentrated flow, channels characteristically have relatively obvious active channel banks. An active channel is a channel that is inundated at sufficiently regular intervals to maintain channel form and keep the channel free of established terrestrial vegetation. These channels are typically filled to capacity during bankfull discharge (i.e. during the annual flood, except for intermittent rivers that do not flood annually).”

As can be seen the storm water channel has several similarities with a channel wetland system. However, several important aspects are absent and also confirm the artificial nature of this system. Some of these differences include:

- Large portions of the channel has been enclosed and no longer forms an open conduit.
- It is only fed by surface water and diffuse or interflow and groundwater flow is absent.
- According to the definition of a watercourse (National Water Act (NWA, 1998)) the storm water channel cannot be regarded as a watercourse since it does not form a natural channel but rather an artificial channel.
- Despite these differences the storm water channel may still represent a drainage line that has been canalised. As has been indicated previously, the channel also feeds into the storm water system of Mahikeng and does eventually discharge into the Molopo River, approximately 2.5 km to the south west of the site which is of significant importance relative to the larger system.

4.3.2 Description of the storm water channel

The storm water channel was surveyed where it enters the site, exits the site as well as the section that is situated on the site (Appendix A: Map 1).

Where FW or OW is indicated it refers to Facultative or Obligate Wetland species. A facultative wetland species is often associated with wetlands but is also able to occur in non-wetland areas. Obligate wetland species are confined to wetlands and are only able to occur in wetlands. They are therefore reliable indicators of wetland conditions. Field observations over time as well as the following sources were used to determine Facultative Wetland (FW) and Obligate Wetland (OW) species:

- Marnewecke, G. & Kotze, D. 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.
- DWAF. 2008. Updated manual for the identification and delineation of wetlands and riparian areas, prepared by M.Rountree, A.L. Batchelor, J. MacKenzie and D. Hoare. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

Natural watercourses can be divided into different riparian zones within the lateral section of the system. Being an artificial storm water channel, this cannot be done for the storm water channel on the site. Instead a description of the vegetation, geomorphology and functioning of the storm water channel will be provided.

Currently the storm water channel seems to be completely artificial, without any natural connection. However, when looking at historical images it is probable that a small natural drainage line may have been present in this area. It was however already heavily modified by as early as 1958 (National Geo-Spatial Information). By 1976 the drainage line had already been integrated into the storm water system of the urban area of Mahikeng. Currently the channel is completely artificial and though it does not seem to have a downstream connection it is simply being covered by the adjacent railway network. It is connected to a downstream channel which is situated within a dense urban area which eventually (approximately 2.5 km) flows into the Molopo River to the south west of the site.

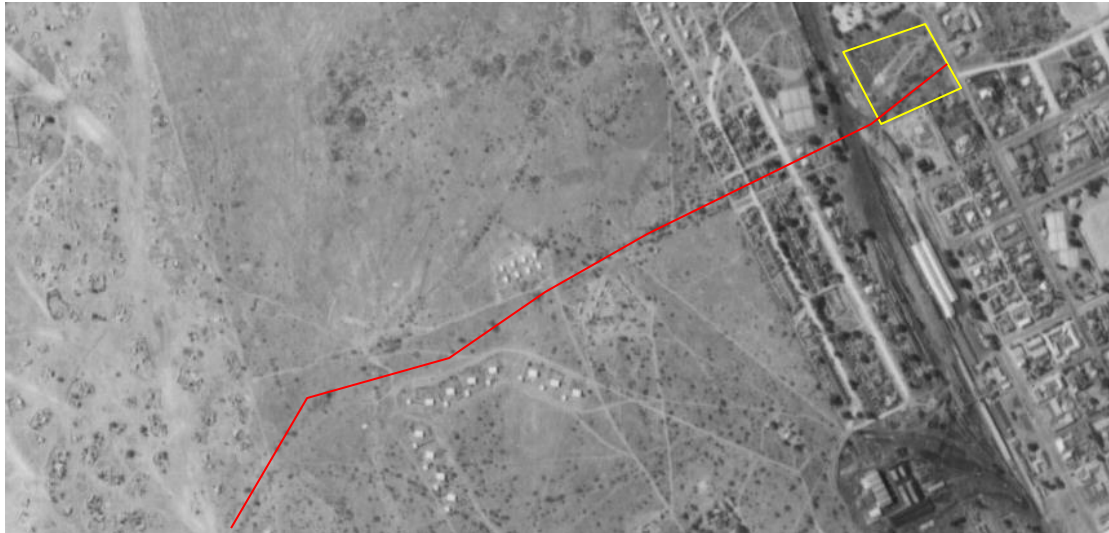


Figure 6: Historical images indicate that a small natural drainage line may have been present in this area though it would have been very small and already modified by as early as 1958 (National Geo-Spatial Information).



Figure 7: By 1976 the area is already highly urbanised and any natural drainage line completely removed and now largely canalised to manage storm water generated by the urban area (National Geo-Spatial Information).



Figure 8: Currently the storm channel is quite obscured but careful observation may indicate that it still forms part of the downstream storm water system.

The storm water channel on the site is the recipient of a large volume of storm water generated within the urban areas to the east of the site. Large portions of the channel is covered and situated underground, while portions, such as occurs on the site is open. Surface runoff feeds into numerous above- and belowground channels and conduits which feeds into this storm water channel on the site. As can be expected the runoff feeding into the channel system is highly polluted and this also has a highly detrimental effect on the storm water system and surroundings. Although the storm water system is fed by a constant low inflow it is during storm events that heavy flows occur within it. This storm water channel therefore still has an important function in terms of the management of the storm water generated within the urban area and evacuating the storm water out of the urban area. This function should certainly be preserved by the development and should in no way be modified. As previously indicated, the storm water channel also drains into the Molopo River which is regarded as a National Freshwater Ecosystem Priority Area (NFEPA): Fish system. This is due to the Near Threatened Waterberg barb (*Barbus sp. 'Waterberg'*) occurring within the Molopo River, above Mahikeng (Roux 2015). The storm water generated by the urban area is already causing significant impacts on this river system and it is therefore unlikely that the development will contribute significantly toward any additional impacts. Nonetheless, the development should in no way further modify this artificial storm channel or cause further deterioration of its water quality.

The storm water channel is now a completely artificial system used to manage the storm water generated by the urban areas. As a result, riparian vegetation and habitat is completely absent from it. It is dominated, exclusively, along its entire length situated on the site, by the exotic and invasive *Arundo donax* (Spanish Reed). This is a highly invasive species which prevents the establishment of any other vegetation along the channel. It is here rather regarded as an indicator of the artificial nature of the channel.



Figure 9: Where the storm water channel enters the site, it emerges from an underground section. Water quality is quite clearly very poor.



Figure 10: View of the storm water channel section located on the site.



Figure 11: The section of the storm water channel on the site consists exclusively of a dense infestation of the exotic *Arundo donax* (Spanish Reed) and riparian vegetation and habitat is absent.



Figure 12: Where the storm water channel exits the site it is again situated underground.

As can be seen from the description of the storm water channel on the site, though it may have had a natural origin, many decades of modification and urbanisation has caused it to now be completely artificial and does not contribute to any wetland habitat, be it natural or artificial, in any significant manner. Its conservation value is therefore relatively low. However, in urban areas it is important to adequately manage the large volumes of storm water generated by means of such an artificial system. Furthermore, this channel will eventually feed into the Molopo River, an important watercourse which should not be affected by any additional impacts caused by the urban area. The functioning of the storm water channel on the site should therefore be preserved and not modified in any way by the proposed development.

4.3.3 Condition and importance of the affected system

Watercourses and wetlands can be assessed according to the health of the system and the result expressed as the Present Ecological State (PES). The categories of a system may range from Category A: Unmodified/Natural to Category F: Critically/Extremely Modified (Table 2). This condition can be determined by several indices with amongst the most common being the Index of Habitat Integrity (IHI), WET-Health or a combination of several indices. In order to determine the condition of such a system the results obtained from any of these indices must be compared against a reference condition of the system. This is the unmodified condition without any impacts on the system. The storm water channel on the site is completely artificial and though it may historically have been associated with a small natural drainage line it is now difficult to estimate what the natural, if any, condition of the system would have been. It should therefore be clear that such a reference condition can only be determined for a natural system and that artificial systems such as the storm water channel on the site does not contain a reference condition. The PES for this system was therefore not assessed.

Table 2 refers to the determination and categorisation of the Present Ecological State (PES; health or integrity) of various biophysical attributes of rivers relative to the natural or close to the natural reference condition. The purpose of the EcoClassification process is to gain insights and understanding into the causes and sources of the deviation of the PES of biophysical attributes from the reference condition. This provides the information needed to derive desirable and attainable future ecological objectives for the river (Kleynhans & Louw 2007).

Table 2: Ecological categories for Present Ecological Status (PES).

Ecological Category	Description
A	Unmodified, natural
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominately unchanged.
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem function has occurred.
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	Critically/Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.

4.3.4 Risk Assessment

A Risk Assessment for the proposed taxi rank development and the artificial storm water channel on the site which may be affected by it has been undertaken according to the Department of Water & Sanitation's requirements for risk assessment and the provisional Risk Assessment Matrix for Section 21(c) & (i) water use (Appendix D). The storm water channel will form part of the development and the necessary mitigation will therefore have to be implemented to ensure that this does not contribute to any downstream impacts (Appendix A: Map 1). Being an artificial channel, which functions in the management of the storm water generated by the urban it is however unlikely that the development will contribute significantly toward any downstream impacts. The storm water channel will be retained intact and the development should therefore not have any direct impacts on it. This will also ensure that the function of this channel, storm water management, is also retained intact. The proposed taxi rank will however be associated with high volume traffic movement which in turn will result in an increase in petrochemical runoff generated which may contribute toward a decrease in water quality within the storm water channel. The development should consider covering this channel (concrete covering) and the surface area of the taxi rank itself should also be lined (paving, asphalt, etc.). A comprehensive storm water management system should be designed and implemented to ensure that runoff generated on the site feeds into the existing system without contributing significantly toward further deterioration of the water quality. An oil separation system or similar should also be considered in order to prevent contaminated runoff from entering the storm water system, though such a system does require periodic maintenance.

The storm water channel on the site is artificial and functions in management of the storm water generated by the surrounding urban area. As long as the storm water channel is retained intact and a storm water management system is implemented on the site which does not contribute to any further significant deterioration of the water quality the risk of impact on the storm water channel should remain low. The proposed development is therefore unlikely to contribute to any significant impacts on it. It is however still recommended that the necessary

authorisation be obtained from the Department of Water and Sanitation (DWS) but given the low risk that the General Authorisation (GA) route be taken.

Lower Risks: Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.

For the complete risk assessment please refer to Appendix D.

No.	Phases	Activity	Aspect	Impact	Risk Rating	Confidence level	Control measures
1	All phases.	Taxi rank development	Development of taxi rank which may affect the storm water channel or contribute towards a decrease in water quality.	The storm water channel on the site will be retained intact by the development and should therefore not have any direct impact on it. The channel also does not contain any riparian vegetation or habitat which may be affected by the development. However, storm water runoff generated on the site, especially where this contains petrochemical contaminants may contribute toward a deterioration in water quality.	L	5	Despite the storm water channel already forming part of the storm water system managing runoff generated by the Mahikeng urban area, additional measures are still recommended to ensure downstream water quality is not deteriorated any further. The storm water channel should be retained intact and as is, a concrete covering should also be considered to prevent increased littering within the channel. A comprehensive storm water system should be designed and implemented for the development and a oils separation system or similar device should be considered to prevent petrochemical contamination of storm water. The required maintenance for such a system should however be taken into account.

5. ANTICIPATED IMPACTS

Anticipated impacts that the development will have is primarily concerned with the loss of habitat and species diversity.

The natural vegetation type which originally occurred on the site, Klerksdorp Thornveld (Gh 13), is only represented by remnant patches and is also not regarded as a Threatened Ecosystem which therefore does not contribute its conservation value (Appendix A: Map 1). However, the North West Biodiversity Sector Plan (NW BSP – 2015) considers the site to form part of a Terrestrial Critical Biodiversity Area 2 (CBA 2) as it is located close to the Mahikeng Nature Reserve (Appendix A: Map 2). The site is however isolated by dense urban development and will in no way be able to affect the integrity of this conservation area. The site being regarded as a CBA 2 will not contribute significantly towards its conservation value. In addition, the site is largely transformed from the natural condition, degraded and does not contain any elements of conservation significance. The species diversity is notably low without any protected, rare or endangered species. The loss of habitat and diversity which will result from the development is therefore anticipated to be quite low.

The species diversity is notably low without any protected, rare or endangered species (Appendix B). Given the largely transformed nature and high levels of disturbance it is also considered highly unlikely that any such species would occur here. The anticipated impact that the development will have on such conservation significant species is negligible.

The storm water channel on the site is artificial and functions in management of the storm water generated by the surrounding urban area (Appendix A: Map 1). It does however still have some conservation value. In terms of the aquatic component the site is regarded as an Ecological Support Area 1 (ESA 1) as it forms part of the catchment of the Molopo River, a National Freshwater Ecosystem Priority Area (NFEPA): Fish system (Appendix A: Map 2). Impacts that may therefore affect runoff and storm water on the site would therefore impact the Molopo River downstream. The preservation of the artificial storm water channel on the site is therefore of importance and would therefore have to be accommodated within the development. As long as the storm water channel is retained intact and a storm water management system is implemented on the site which does not contribute to any further significant deterioration of the water quality the risk of impact on the storm water channel should remain low. The proposed taxi rank will however be associated with high volume traffic movement which in turn will result in an increase in petrochemical runoff generated which may contribute toward a decrease in water quality within the storm water channel. The development should consider covering this channel (concrete covering) and the surface area of the taxi rank itself should also be lined (paving, asphalt, etc.). A comprehensive storm water management system should be designed and implemented to ensure that runoff generated on the site does feed into the existing system without contributing significantly toward further deterioration of the water quality. An oil separation system or similar should also be considered in order to prevent contaminated runoff from entering the storm water system, though such a system does require periodic maintenance. The proposed development is therefore unlikely to contribute to any significant impacts on it.

As previously discussed the site contains numerous exotic weeds and invaders with a few forming heavy infestations (Appendix B). These should be eradicated from the site during construction. Construction activities will also increase disturbance and therefore increase the susceptibility for the establishment of weeds and their spread into the surroundings. Monitoring

of weed establishment and eradication should form a prominent part of management of the development. Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

The impact the proposed taxi rank development will have on mammals is mainly concerned with the loss of habitat. However, as previously indicated the habitat which will be affected has already been transformed and degraded to a large extent by the urban environment and associated land uses. Furthermore, the footprint of the development will not be extensive and should therefore limit the impact on mammals. The anticipated impact can therefore not be regarded as significant. In order to ensure no direct impact on the mammals on the site the hunting, capturing or harming in any way of fauna on the site must be prohibited. In the event of venomous animals, such as snakes, encountered on the site an experienced snake handler should be contacted to remove it from the site.

The impact significance has been determined and overall impacts should only be low-moderate, while impacts on the storm water channel on the site may cause only moderate impacts. With recommended mitigation these impacts can be decreased even further and should then all be low-moderate. Please refer to Appendix F for the impact methodology.

Significance of the impact:

Impact	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Before Mitigation								
Loss of vegetation type and clearing of vegetation	2	5	1	2.6	5	2	3.5	9.1
Loss of protected species	1	5	1	2.3	1	1	1	2.3
Impact on watercourses	2	5	2	3	4	3	3.5	10.5
Infestation with weeds and invaders	3	4	2	3	3	3	3	9
Impact on Terrestrial fauna	1	4	1	2	2	2	2	4
After Mitigation								
Loss of vegetation type and clearing of vegetation	1	5	1	2.6	5	2	3.5	9.1
Loss of protected species	1	5	1	2.3	1	1	1	2.3
Impact on watercourses	1	5	2	2.6	3	3	3	7.8
Infestation with weeds and invaders	2	3	2	2.3	2	2	2	4.6
Impact on Terrestrial fauna	1	4	1	2	2	2	2	4

6. SITE SPECIFIC RESULTS

Habitat diversity and species richness:

As has previously been indicated, the site is quite heavily degraded and transformed with only remnants of the natural vegetation still being present. The natural habitat would also have been quite uniform and would not have significantly contributed toward diversity. As a result, the species diversity on the site is also quite low.

Presence of rare and endangered species:

The species diversity is notably low without any protected, rare or endangered species (Appendix B). Given the largely transformed nature and high levels of disturbance it is also considered highly unlikely that any such species would occur here.

Ecological function:

The ecological function of the site is modified and hampered to a large extent. The site should function as habitat for a variety of fauna, support a specific vegetation type and also function in terms of surface runoff and water transportation as part of the catchment of surrounding watercourses. The natural vegetation has however been transformed to such an extent that it is no longer representative of the natural vegetation type and those remnants of natural vegetation are so degraded that they do not markedly improve this condition. As a result, the habitat provided to fauna is also heavily degraded from the natural condition. Due to the surrounding dense urban area, degradation and modification of the site and the artificial storm water channel on the site the surface runoff patterns have been modified to a large extent also modifying the functioning of the site in terms of the surrounding surface drainage. The function that the storm water channel does provide (water transportation and storm water management) is however still important and should be retained on the site.

Degree of rarity/conservation value:

The natural vegetation type which originally occurred on the site, Klerksdorp Thornveld (Gh 13), is only represented by remnant patches and is also not regarded as a Threatened Ecosystem which therefore does not contribute its conservation value (Appendix A: Map 1). However, the North West Biodiversity Sector Plan (NW BSP – 2015) considers the site to form part of a Terrestrial Critical Biodiversity Area 2 (CBA 2) as it is located close to the Mahikeng Nature Reserve (Appendix A: Map 2). The site is however isolated by dense urban development and will in no way be able to affect the integrity of this conservation area. The site being regarded as a CBA 2 will not contribute significantly towards its conservation value. In addition, the site is largely transformed from the natural condition, degraded and does not contain any elements of conservation significance.

Percentage ground cover:

Under natural conditions the percentage vegetation cover would have contained a quite dense grass layer. Portions of the site still contains such a dense grass cover, however, exotic weeds now take up a large proportion of the site and other impacts such as rubbish and rubble dumping also contribute toward a decreased vegetation cover.

Vegetation structure:

The vegetation structure on the site should naturally consist of grassland with a scattered tree layer. This is still the case though quite substantially modified by a variety of exotic weeds and invasive trees. Barren patches, dumping of rubbish and rubble and modification of the surface topography also further contribute towards the modification of the vegetation structure.

Infestation with exotic weeds and invader plants:

Infestation by exotic weeds and invaders is extensive in most portions of the site and are even dominant in some portions. This includes a variety of herbaceous weeds, shrubs and invasive trees and dense clumps of the invasive Spanish Reed (Appendix B). The infestation is no longer considered eradicable but will by default be cleared during construction.

Degree of grazing/browsing impact:

Being situated within a dense urban environment grazing and browsing is largely absent.

Signs of erosion:

Signs of erosion is present though only considered moderate.

Terrestrial animals:

Signs and tracks of mammals were absent from the site and surroundings. This is largely to be expected, although it remains likely that a few generalist species may have been overlooked on the site. As a result of the urban surroundings which cause transformation of the available habitat and also isolates the site from any surrounding natural areas this will dissuade most mammals, except a few generalist species, from inhabiting the area. In addition, high levels of disturbance on the site and human activity will also further degrade the available remaining habitat. As a consequence it is considered highly unlikely that any species of conservation concern would remain in the area. Furthermore, any remaining mammals are considered highly likely to consist of generalist species able to survive in these urban and transformed areas.

Table 4: Biodiversity Sensitivity Rating for the proposed taxi rank development.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness	3		
Presence of rare and endangered species	3		
Ecological function	3		
Uniqueness/conservation value	3		
Vegetation condition			
Percentage ground cover		2	
Vegetation structure	3		
Infestation with exotic weeds and invader plants or encroachers	3		
Degree of grazing/browsing impact			1
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species	3		
Sub total	21	4	1
Total		26	

7. BIODIVERSITY SENSITIVITY RATING (BSR) INTERPRETATION

Table 5: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Taxi rank development	26	Preferred	4

8. DISCUSSION AND CONCLUSION

The site proposed for the taxi rank development has been rated as being preferred for the development mostly as a result of the already modified and degraded nature of the site and the absence of elements of high conservation value.

The proposed taxi rank development will be situated within the CBD of the city of Mahikeng (Appendix A: Map 1). Although the site is still dominated by a well-developed vegetation layer it is considered largely transformed from the natural condition due to its location in the city centre. The site contains an abundance of exotic vegetation including scattered clumps of exotic trees, rubble and rubbish dumps are abundant and remnants of structures and buildings. An artificial storm water channel also transects the site and aids in storm water management within the city centre. The topography of the site is relatively uniform and is dominated by a relatively flat area but which has been modified by dumping and shallow excavations. The extent of the site is approximately 2.6 hectares.

According to Mucina & Rutherford (2006) the area consists of Klerksdorp Thornveld (Gh 13). The vegetation type is currently listed as being of Least Concern (LC) according to the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1). The vegetation type is only represented by remnant patches on the site and is also not regarded as a Threatened Ecosystem which therefore does not contribute toward its conservation value. However, the North West Biodiversity Sector Plan (NW BSP – 2015) considers the site to form part of a Terrestrial Critical Biodiversity Area 2 (CBA 2) as it is located close to the Mahikeng Nature Reserve (Appendix A: Map 2). The site is however isolated by dense urban development and will in no way be able to affect the integrity of this conservation area. The site being regarded as a terrestrial CBA 2 will not contribute significantly towards its conservation value. In addition, the site is largely transformed from the natural condition, degraded and does not contain any elements of conservation significance. The species diversity is notably low without any protected, rare or endangered species. The loss of habitat and diversity which will result from the development is therefore anticipated to be quite low. The site is also listed as being an Aquatic Ecological Support Area 1 (ESA 1) which forms part of the catchment of the Molopo River, a National Freshwater Ecosystem Priority Area (NFEP A): Fish system (Appendix A: Map 2). Impacts that may therefore affect runoff and storm water on the site would therefore impact the Molopo River downstream. This will require adequate mitigation on the site to prevent any downstream deterioration of surface and groundwater.

The vegetation structure on the site contains a dense grass layer with scattered trees. These trees are however dominated by exotic and invasive species and a prominent herbaceous weed layer also cause significant modification of the vegetation structure. An artificial storm water channel is also located along the southern border of the site and the dense infestation of Spanish Reed (*Arundo donax*) along this channel also contribute to significant modification of the vegetation structure. The majority of the site has been transformed from the natural condition by several impacts and land uses (Appendix A: Map 1). The level of degradation is to

such an extent that the vegetation on the site is no longer regarded as representative of the natural vegetation type and is considered transformed. Large volumes of rubble and refuse is being dumped on the site. Historically, the site was also affected by dumping and shallow excavations and the survey indicated clearly that the surface topography has largely been modified, where it should consist of a relatively flat plain it now has an irregular surface of small mounds and shallow excavations. A few small structures and remnants of buildings also indicate previous disturbance of the site.

From the description of the vegetation on the site it is clearly transformed from the natural condition, degraded and does not contain any elements of conservation significance. The species diversity is notably low without any protected, rare or endangered species (Appendix B). It is also considered highly unlikely that any such species would occur here. The site is therefore of relatively low conservation value and suitable for the proposed development while not resulting in any large impacts.

Signs and tracks of mammals were absent from the site and surroundings. This is largely to be expected, although it remains likely that a few generalist species may have been overlooked on the site. As a result of the urban surroundings which cause transformation of the available habitat and also isolates the site from any surrounding natural areas this will dissuade most mammals, except a few generalist species, from inhabiting the area. In addition, high levels of disturbance on the site and human activity will also further degrade the available remaining habitat. As a consequence it is considered highly unlikely that any species of conservation concern would remain in the area. Furthermore, any remaining mammals are considered highly likely to consist of generalist species able to survive in these urban and transformed areas.

Soil samples collected along the storm channel show clear indications of wetland conditions and is a consequence of prolonged saturation of the soils (Appendix C). The channel is however completely dominated by the invasive Spanish Reed (*Arundo donax*) and consequently obligate wetland plants are absent and do not confirm the presence of wetland conditions, a consequence of the artificial nature of the storm water system. When utilising topography this also does not substantiate the presence of a natural wetland system. Although soils still indicate the presence of wetland conditions, it should be kept in mind that these wetland conditions are an artificial manifestation caused by the storm water system.

The wetland conditions which has formed as a result of the storm water channel is completely artificial. However, historical aerial imagery seem to indicate that a small drainage line may have been present in this area though it would already have been modified by as early as 1958 (National Geo-Spatial Information). Whichever the case may be, at the present the channel is completely artificial and does not contain any riparian habitat. The wetland conditions do resemble to some degree a channel wetland system, though due to its current artificial nature it differs in several important instances (SANBI 2009).

The storm water channel on the site is the recipient of a large volume of storm water generated within the urban areas to the east of the site. Large portions of the channel is covered and situated underground, while portions, such as occurs on the site is open. As can be expected the runoff feeding into the channel system is highly polluted and this also has a highly detrimental effect on the storm water system and surroundings. This storm water channel therefore still has an important function in terms of the management of the storm water generated within the urban area and evacuating the storm water out of the urban area. As previously indicated, the storm water channel also drains into the Molopo River which is

regarded as a National Freshwater Ecosystem Priority Area (NFEPA): Fish system (Appendix A: Map 2). The storm water generated by the urban area is already causing significant impacts on this river system and it is therefore unlikely that the development will contribute significantly toward any additional impacts.

The storm water channel is now a completely artificial system used to manage the storm water generated by the urban areas. As a result, riparian vegetation and habitat is completely absent from it. It is dominated, exclusively, along its entire length situated on the site, by the exotic and invasive *Arundo donax* (Spanish Reed).

As can be seen from the description of the storm water channel on the site, though it may have had a natural origin, many decades of modification and urbanisation has caused it to now be completely artificial and does not contribute to any wetland habitat, be it natural or artificial, in any significant manner. Its conservation value is therefore relatively low. However, in urban areas it is important to adequately manage the large volumes of storm water generated by means of such an artificial system. Furthermore, this channel will eventually feed into the Molopo River, an important watercourse which should not be affected by any additional impacts caused by the urban area. The functioning of the storm water channel on the site should therefore be preserved and not modified in any way by the proposed development.

A Risk Assessment for the proposed taxi rank development and the artificial storm water channel on the site which may be affected by it has been undertaken according to the Department of Water & Sanitation's requirements for risk assessment and the provisional Risk Assessment Matrix for Section 21(c) & (i) water use (Appendix D). The storm water channel will form part of the development and the necessary mitigation will therefore have to be implemented to ensure that this does not contribute to any downstream impacts (Appendix A: Map 1). The storm water channel will be retained intact and the development should therefore not have any direct impacts on it. The proposed taxi rank will however be associated with high volume traffic movement which in turn will result in an increase in petrochemical runoff generated which may contribute toward a decrease in water quality within the storm water channel. The development should consider covering this channel (concrete covering) and the surface area of the taxi rank itself should also be lined (paving, asphalt, etc.). A comprehensive storm water management system should be designed and implemented to ensure that runoff generated on the site feeds into the existing system without contributing significantly toward further deterioration of the water quality. An oil separation system or similar should also be considered in order to prevent contaminated runoff from entering the storm water system, though such a system does require periodic maintenance.

The storm water channel on the site is artificial and functions in management of the storm water generated by the surrounding urban area. As long as the storm water channel is retained intact and a storm water management system is implemented on the site which does not contribute to any further significant deterioration of the water quality the risk of impact on the storm water channel should remain low. The proposed development is therefore unlikely to contribute to any significant impacts on it. It is however still recommended that the necessary authorisation be obtained from the Department of Water and Sanitation (DWS) but given the low risk that the General Authorisation (GA) route be taken.

9. RECOMMENDATIONS

- Adequate monitoring of weed establishment and their continued eradication must be maintained (Appendix B). Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.
- Although the storm water channel the site is completely artificial, it still performs an important function in terms of water transportation and storm water management and some mitigation is still recommended in order to preserve its function (Appendix A: Map 1):
 - The artificial storm water channel on the site should be excluded from development.
 - The storm water channel should be treated as no-go area during the construction phase and kept in its current condition (Appendix A: Map 1). This should include that the channel not be used as stockpile areas, laydown areas, parking or any other activities associated with construction.
 - The functioning of the system should be retained unmodified, i.e. should still be able to manage storm water generated by the surrounding urban area.
 - The development should consider covering the channel with concrete or culverts in order to isolate it from any impacts the development may have on it.
 - A comprehensive storm water management system should be designed and implemented to ensure that runoff generated on the site feeds into the existing system without contributing significantly toward further deterioration of the water quality.
 - An oil separation system or similar should also be considered in order to prevent contaminated runoff from entering the storm water system, this will be particularly relevant where a washbay or similar activity is undertaken. Such a system does however require periodic maintenance.
 - The necessary authorisation should be obtained from the Department of Water and Sanitation (DWS) for construction taking place in close proximity to the storm water channel, but given the low risk that the General Authorisation (GA) route be taken.
- In order to ensure no direct impact on the mammals on the site the hunting, capturing or harming in any way of fauna on the site must be prohibited.
 - In the event of venomous animals, such as snakes, encountered on the site an experienced snake handler should be contacted to remove it from the site.
- No littering must be allowed and all litter must be removed from the site.
- Monitoring of construction and compliance with recommended mitigation measures must take place.
- After construction has ceased all construction materials should be removed from the area.

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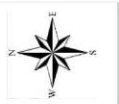
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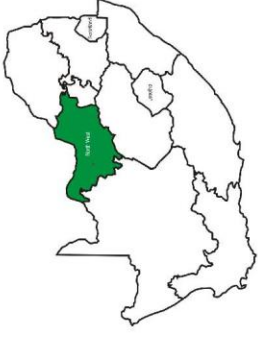
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Annexure A: Maps

North West Biodiversity Sector Plan map for the proposed taxi rank development situated in Mahikeng, North West Province.








Map 1: Locality map of the proposed taxi rank development in Mahikeng. The National Biodiversity Assessment 2018 indicates the remnants of Klerksdorp Thornveld in the area though from the aerial perspective it is already evident that these areas are degraded and isolated by urban surroundings. The location of the artificial storm water channel on the site and downstream is also indicated. Note that it flows into natural wetland areas to the west of the site.



Prepared for:
Environmental Management Group
P.O. Box 28242
Danhof
9310

Legend:

-  Storm water channel
-  Site location
-  Wetlands and impoundments
-  Aquatic
-  Klerksdorp Thornveld

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:10 000

DPR Ecologists

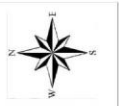
Contact Darius van Rensburg at:

darius@dprecologists.co.za

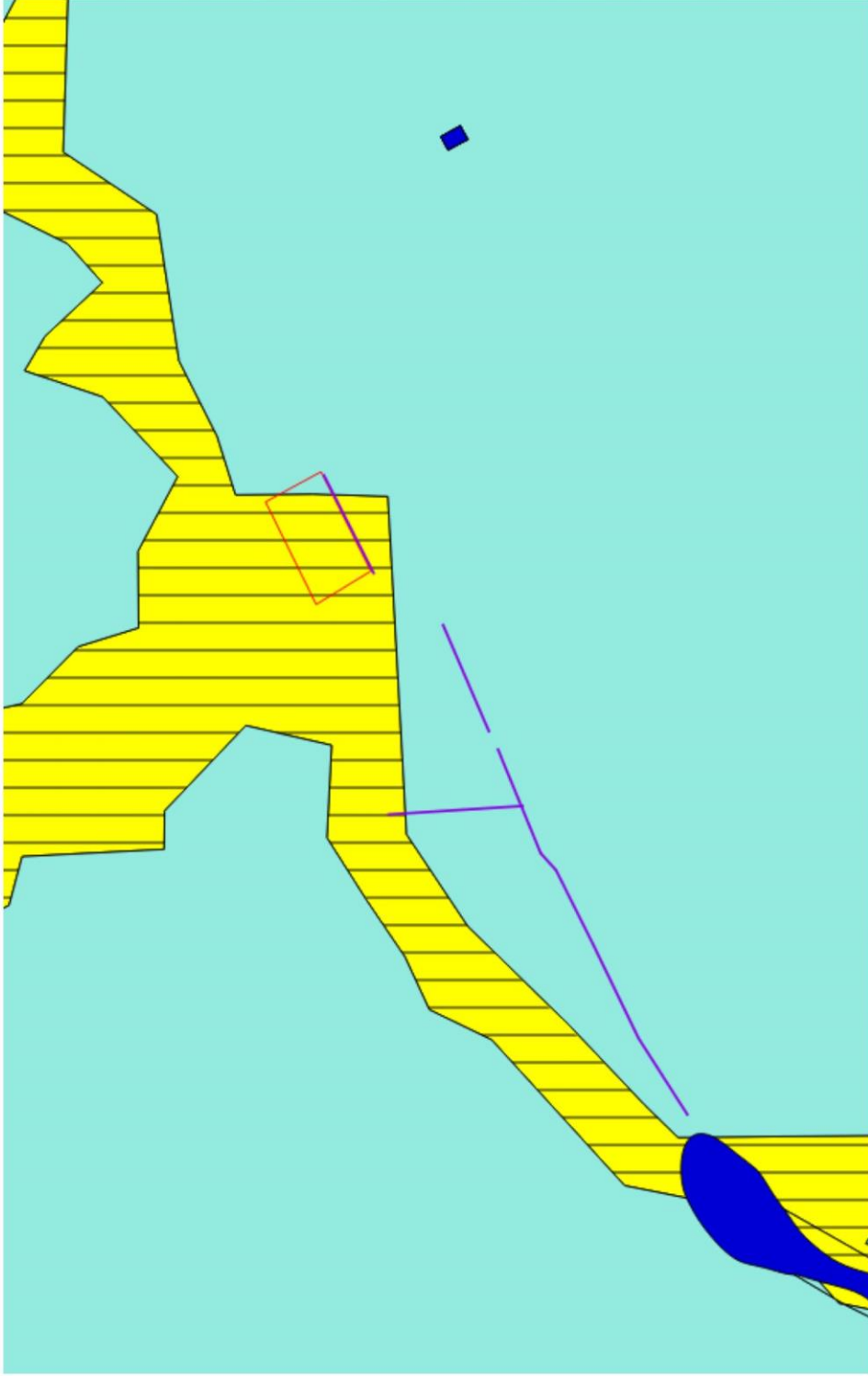
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Tel: 083 410 0770

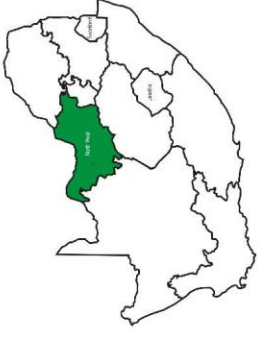




North West Biodiversity Sector Plan map for the proposed taxi rank development situated in Mahikeng, North West Province.



Map 2: Biodiversity Sector Plan map of the proposed taxi rank development in Mahikeng. The site is situated within a Terrestrial CBA 2 and forms part of the buffer zone for the nearby Mahikeng Nature Reserve while forming part of an ESA 1 as it functions in support of downstream Molopo River which is regarded as a National Freshwater Priority Area (NFEPA): Fish system.



Prepared for:
Environmental Management Group
P.O. Box 28242
Danhof
9310

Legend:

- Storm water channel
- Site location
- Wetlands and impoundments
- Aquatic
- Critical Biodiversity Area 1
- Critical Biodiversity Area 2
- Ecological Support Area 1
- Ecological Support Area 2
- Terrestrial
- Critical Biodiversity Area 1
- Critical Biodiversity Area 2
- Ecological Support Area 1
- Ecological Support Area 2

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:10 000

DPR Ecologists

Contact Darius van Rensburg at:

darius@dprecologists.co.za

P.O. Box 12726, Brandhof, 9324

Tel: 083 410 0770



Appendix B: Species list

Species indicated with an * are exotic.

Protected species are coloured orange and Red Listed species red.

Species	Growth form
* <i>Amaranthus hybridus</i>	Herb
* <i>Arundo donax</i>	Reed
* <i>Bidens pillosa</i>	Herb
* <i>Datura stramonium</i>	Herb
* <i>Eucalyptus camaldulensis</i>	Tree
* <i>Euphorbia heterophylla</i>	Herb
* <i>Flaveria bidentis</i>	Herb
* <i>Ipomoea purpurea</i>	Climber
* <i>Melia azedarach</i>	Tree
* <i>Morus alba</i>	Tree
* <i>Prosopis glandulosa</i>	Tree
* <i>Robinia pseudoacacia</i>	Tree
* <i>Schinus molle</i>	Tree
* <i>Sonchus oleraceus</i>	Herb
* <i>Sphaeralcea bonariensis</i>	Herb
* <i>Tipuana tipu</i>	Tree
<i>Cenchrus ciliaris</i>	Grass
<i>Cynodon dactylon</i>	Grass
<i>Dichanthium sp.</i>	Grass
<i>Enneapogon cenchroides</i>	Grass
<i>Eragrostis echinochloidea</i>	Grass
<i>Eragrostis lehmanniana</i>	Grass
<i>Heteropogon contortus</i>	Grass
<i>Hyparrhenia tamba</i>	Grass
<i>Melinis repens</i>	Grass
<i>Panicum coloratum</i>	Grass
<i>Pergularia daemia</i>	Climber
<i>Setaria verticillata</i>	Grass
<i>Urochloa panicoides</i>	Grass
<i>Vachellia karroo</i>	Tree
<i>Vachellia sieberiana</i> var. <i>woodii</i>	Tree
<i>Vachellia tortillis</i> var. <i>heteracantha</i>	Tree
<i>Ziziphus mucronata</i>	Tree

Appendix C: Soil Samples

Obligate wetland vegetation was utilised to determine the presence and border of wetlands. Soil samples were used to confirm the wetland conditions along the artificial storm water system. Soil samples were taken at approximately 10 meter intervals. Soil samples were investigated for the presence of anaerobic evidence which characterises wetland soils.

Within wetlands the hydrological regime differs due to the topography and landscape. For instance; a valley bottom wetland would have a main channel that is below the water table and consequently permanently saturated, i.e. permanent zone of wetness. As you move away from the main channel the wetland would become dependent on flooding in order to be saturated. As a result along this hydrological regime areas of permanent saturation, seasonal and temporary saturation would occur. At some point along this gradient the saturation of the soil would be insufficient to develop reduced soil conditions and therefore will not be considered as wetland.

Within wetland soils the pores between soil particles are filled with water instead of atmosphere. As a result available oxygen is consumed by microbes and plantroots and due to the slow rate of oxygen diffusion oxygen is depleted and biological activity continues in anaerobic conditions and this causes the soil to become reduced.

Reduction of wetland soils is a result of bacteria decomposing organic material. As bacteria in saturated soils deplete the dissolved oxygen they start to produce organic chemicals that reduce metals. In oxidised soils the metals in the soil give it a red, brown, yellow or orange colour. When these soils are saturated and metals reduced the soil attains a grey matrix characteristic of wetland soils.

Within this reduction taking place in the wetland soils there may be reduced matrix, redox depletions and redox concentrations. The reduced matrix is characterised by a low chroma and therefore a grey soil matrix. Redox depletions result in the grey bodies within the soil where metals have been stripped out. Redox concentrations result in mottles within the grey matrix with variable shape and are recognised as blotches or spots, red and yellow in colour.

Soil wetness indicator is used as the primary indicator of wetlands. The colour of various soil components are often the most diagnostic indicator of hydromorphic soils. Colours of these components are strongly influenced by the frequency and duration of soil saturation. Generally, the higher the duration and frequency of saturation in a soil profile, the more prominent grey colours become in the soil matrix.

Coloured mottles, another feature of hydromorphic soils, are usually absent in permanently saturated soils and are at their most prominent in seasonally saturated soils, becoming less abundant in temporarily saturated soils until they disappear altogether in dry soils (Collins 2005).

The following soil wetness indicators can be used to determine the permanent, seasonal and temporary wetness zones. The boundary of the wetland is defined as the outer edge of the temporary zone of wetness and is characterised by a minimal grey matrix (<10%), few high chroma mottles and short periods of saturation (less than three months per year). The seasonal zone of wetness is characterised by a grey matrix (>10%), many low chroma mottles and significant periods of wetness (at least three months per year). The permanent zone of wetness

is characterised by a prominent grey matrix, few to high chroma mottles, wetness all year round and sulphuric odour (rotten egg smell).

According to convention hydromorphic soil must display signs of wetness within 50 cm of the soil surface (DWAF 2005).

Table 1: Soil samples taken on the site and especially along the artificial storm water system on the site.

	
<p>Soil sample taken in the central portion of the site and which will be utilised as control sampling against which wetland samples are compared. Soils have a uniform grey-red colouration without mottling and with a high sand content. A grey matrix is also clearly absent and wetland conditions are therefore absent.</p>	<p>Soil sample taken at the inlet of the storm water channel. Note a clear grey matrix with some mottling which is a clear indication of saturated soils indicative of wetland conditions, though completely artificial in this instance.</p>
	
<p>Soil sample taken along the storm water</p>	

channel.

Note again a clear grey matrix is present with some mottling which is a clear indication of saturated soils indicative of wetland conditions, though completely artificial in this instance.

Appendix D: Risk Assessment Matrix

RISK MATRIX (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)

Risk to be scored for construction and operational phases of the project. MUST BE COMPLETED BY SACNASP REGISTERED PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE

No.	Phases	Activity	Aspect	Impact	Severity				Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Confidence level	Control Measures
					Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Veg etation)	Biota													
	All phases	Taxi rank development	Development of taxi rank which may affect the storm water channel or contribute towards a decrease in water quality.	The storm water channel on the site will be retained intact by the development and should therefore not have any direct impact on it. The channel also does not contain any riparian vegetation or habitat which may be affected by the development. However, storm water runoff generated on the site, especially where this contains petrochemical contaminants may contribute toward a deterioration in water quality.	1	2	0	0	0.75	3	2	5.75	3	3	5	1	12	69	L	5	Despite the storm water channel already forming part of the storm water system managing runoff generated by the Mahikeng urban area, additional measures are still recommended to ensure downstream water quality is not deteriorated any further. The storm water channel should be retained intact and as is, a concrete covering should also be considered to prevent increased littering within the channel. A comprehensive storm water system should be designed and implemented for the development and a oils separation system or similar device should be considered to prevent petrochemical contamination of storm water. The required maintenance for such a system should however be taken into account.

Appendix E: Impact methodology

The environmental significance assessment methodology is based on the following determination:

Environmental Significance = Overall Consequence x Overall Likelihood

Determination of Consequence

Consequence analysis is a mixture of quantitative and qualitative information and the outcome can be positive or negative. Several factors can be used to determine consequence. For the purpose of determining the environmental significance in terms of consequence, the following factors were chosen: **Severity/Intensity, Duration and Extent/Spatial Scale**. Each factor is assigned a rating of 1 to 5, as described below and in tables 6, 7, 9 and 10.

Determination of Severity

Severity relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects impact on the biophysical and socio-economic environment.

Table 7 will be used to obtain an overall rating for severity, taking into consideration the various criteria.

Table 7: Rating of severity

Type of criteria	Rating				
	1	2	3	4	5
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small Potentially harmful /	Significant / Harmful	Great / Very harmful	Disastrous Extremely harmful
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable/ Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate/ High potential to mitigate impacts to level of insignificance / Easily reversible	Low cost to mitigate	Substantial cost to mitigate / Potential to mitigate impacts / Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate / Little or no mechanism to mitigate impact Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Moderate change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

Determination of Duration

Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.

Table 8: Rating of Duration

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Determination of Extent/Spatial Scale

Extent refer to the spatial influence of an impact be local (extending only as far as the activity, or will be limited to the site and its immediate surroundings), regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders).

Table 9: Rating of Extent / Spatial Scale

Rating	Description
1: Low	Immediate, fully contained area
2: Low-Medium	Surrounding area
3: Medium	Within Business Unit area of responsibility
4: Medium-High	Within Mining Boundary area
5: High	Regional, National, International

Determination of Overall Consequence

Overall consequence is determined by adding the factors determined above and summarised below, and then dividing the sum by 4.

Table 10: Example of calculating Overall Consequence

Consequence	Rating
Severity	Example 4
Duration	Example 2
Extent	Example 4
SUBTOTAL	10
TOTAL CONSEQUENCE:(Subtotal divided by 4)	3.3

Likelihood

The determination of likelihood is a combination of Frequency and Probability. Each factor is assigned a rating of 1 to 5, as described below and in Table 11 and Table 12.

Determination of Frequency

Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.

Table 11: Rating of frequency

Rating	Description
1: Low	Once a year or once/more during operation/LOM
2: Low-Medium	Once/more in 6 Months
3: Medium	Once/more a Month
4: Medium-High	Once/more a Week
5: High	Daily

Determination of Probability

Probability refers to how often the activity/event or aspect has an impact on the environment.

Table 12: Rating of probability

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Overall Likelihood

Overall likelihood is calculated by adding the factors determined above and summarised below, and then dividing the sum by 2.

Table 13: Example of calculating the overall likelihood

Consequence	Rating
Frequency	Example 4
Probability	Example 2
SUBTOTAL	6
TOTAL LIKELIHOOD (Subtotal divided by 2)	3

Determination of Overall Environmental Significance

The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will then fall into a range of LOW, LOW-MEDIUM, MEDIUM, MEDIUM, MEDIUM-HIGH or HIGH, as shown in the table below.

Table 14: Determination of overall environmental significance

Significance or Risk	Low	Low-Moderate	Moderate	Moderate-High	High
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 - 14.9	15 - 19.9	20 - 25

Qualitative description or magnitude of Environmental Significance

This description is qualitative and is an indication of the nature or magnitude of the Environmental Significance. It also guides the prioritisations and decision making process associated with this event, aspect or impact.

Table 15: Description of the environmental significance and the related action required.

Significance	Low	Low-Moderate	Moderate	Moderate-High	High
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to the company	Impact is real and substantial in relation to other impacts. Pose a risk to the company. Unacceptable	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible improve	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.



ENVIRONMENTAL MANAGEMENT GROUP

Specialists in Environmental Management
Integrating Industry and Infrastructure with the Environment

Tel: +27 51 412 6350
Fax: +27 51 412 6351
Email: ckruger@envmgrp.com
Postal Address:
P.O.Box 37473,
Langenhoven Park 9330

DEVELOPMENT: BUS AND TAXI HOLDING AREA; INCLUDING A
FILLING STATION, CAR WASH, TYER OUTLET, WORKSHOP,
RESTAURANT AND OFFICE BUILDINGS, MAFIKENG 3782/RE
MAHIKENG, NORTH WEST PROVINCE

Geohydrological Investigation



EMG

Prepared for:
JM Professional Services cc.

Client:	Mr. Johan Mans
Contact Information:	Work: Cell:
e-mail:	admin@jmprof.co.za
Postal Address:	

Prepared by:
Environmental Management Group (Pty)Ltd

Specialist:	Morné van Wyk <i>Geohydrologist and Environmental Assessment Practitioner</i>
Contact Information:	084 205 5769
e-mail:	morne@envmgp.com
Postal Address:	P.O Box 37473 Langenhoven Park 9330

Declaration:

I act as an independent, professionally registered Geohydrologist for this proposed project requiring geohydrological services. Work relating to the project will be conducted in an objective manner, even if this results in views and findings that are not favourable to the applicant.

I have no, and will not engage in, conflicting interests in the undertaking of the activity. I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed.



Project Name:	DEVELOPMENT: BUS AND TAXI HOLDING AREA; INCLUDING A FILLING STATION, CAR WASH, TYER OUTLET, WORKSHOP, RESTAURANT AND OFFICE BUILDINGS, MAHIKENG, NORTH WEST PROVINCE Version 1
Date Finished:	07 June 2021
Specialist:	Morné van Wyk SACNASP Candidate 121107 GSSA Member  Signature
Date Reviewed:	07 June 2021
Reviewer:	CW Vermeulen <i>Director & Environmental Assessment Practitioner</i> <i>Environmental Management Group</i>  Signature

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1. Introduction

The Environmental Management Group (**EMG**) was contracted by JM Professional Services to conduct a Geohydrological Assessment as part of the Basic Assessment Report specialist requirements. This Geohydrological Assessment will assess the site and proposed development. The development includes the clearing of the Mafikeng 3782/RE and constructing a taxi holding area, as well as a small filling station and accompanying wash bay.

This report aims to aid the development in terms of the Geohydrological conditions and to both avoid detrimental impacts and the selection of an appropriate layout which benefits the development and the Geohydrological environment.

2. Geographical setting

2.1. Site Layout

The proposed development on property Mafikeng 3782/RE, is situated in the middle of the town Mafikeng and surrounded by the Industrial Area to the North, a railway system to the West and Commercial/Residential areas to the East. The site is highly degraded and was confirmed during the site visit that the whole area was used to dump rubble. The centre of the site contains a large open storm water drain which contains water that seem to be highly polluted. Only the south section of the site is currently used as a taxi stand/ holding area.



Figure 1: Site Layout

2.2. Topography and drainage

The proposed site is situated in the middle of Mahikeng next to a major railway section. The site itself is fairly flat (due to the small size), but slightly slopes in a South West direction towards the railway. The site is also very uneven as a result of past construction rubble dumping that took place. **Figure 2** shows a cross-sectional profile view from a North – South and West – East direction. These elevation profile shows that the whole area of Mahikeng slopes towards the Molopo River, South of the proposed site and seen in **Figure 3** which shows the general drainage direction. The general slope is ranges between 0 – 2% but increases to 2 – 6% when approaching the Molopo River.

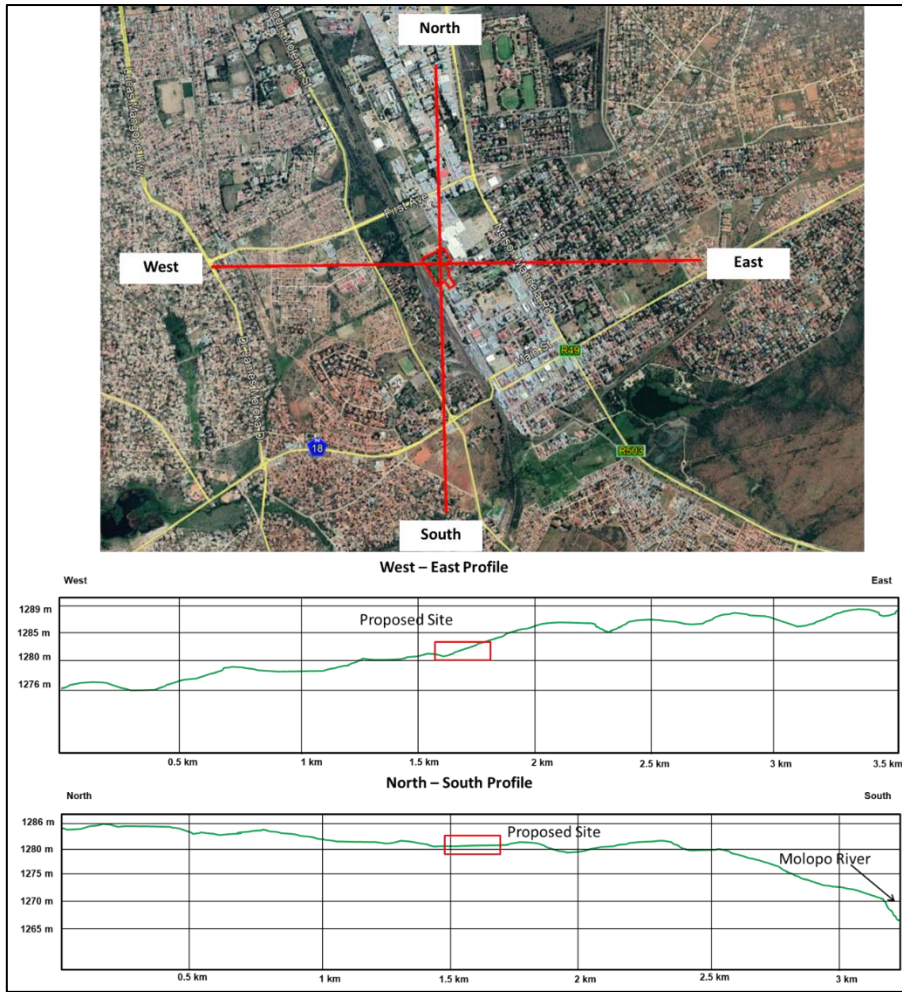


Figure 2: Topography and elevation of the proposed and surrounding area.



Figure 3: The red polygon indicates the proposed site and the blue arrows indicated inferred flow direction.

2.3. Climate

“Mafikeng is 1290m above sea level. Mafikeng's climate is a local steppe climate. During the year there is little rainfall. The temperature here averages 18.5 °C | 65.3 °F. The annual rainfall is 571 mm | 22.5 inch”. (*climate data.org*)

“The Koppen Climate Classification subtype for this climate is "Bsh". (Mid-Latitude Steppe and Desert Climate). (*Weatherbase.com*) (Figure 4).



Figure 4: Figure showing the locality of the site and its Koppen Geiger classification zone.

Precipitation is the lowest in July, with an average of 3 mm. Most of the precipitation here falls in February, averaging 96 mm. At an average temperature of 23.1 °C, January is the hottest month of the year. July is the coldest month, with temperatures averaging 11.2 °C. (Figure 5)

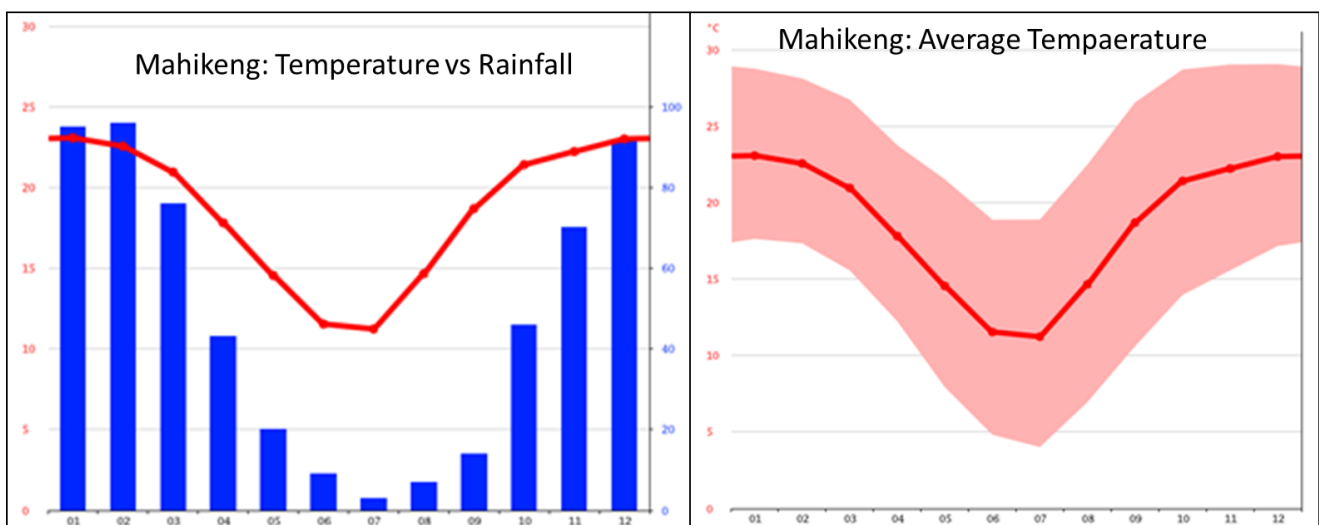


Figure 5: Mahikeng monthly weather data.

3. Scope of Work

The scope of work includes a preliminary Geohydrological assessment. At this stage of the project (design and planning phase) only a basic Geohydrological assessment can be made. Once boreholes have been drilled and water samples taken, a more detailed analysis of the Geohydrological environment can be made. The Geohydrological assessment report aims to:

- Assess the surface through a site visit.
- Determine hydrological factors such as slope, environmental conditions and geology.
- Initial site assessment about current site factors, potential risks and site suitability for the development.
- Development of a site specific Risk Assessment Matrix highlighting current and potential risks to the Geohydrological environment.

Note that the developer indicated that boreholes will be drilled before construction activities commence as a prerequisite for erecting a filling station. This report will recommend possible localities on the property which are most favourable to erect a filling station along with a wash bay and the precautionary/mitigating measures in terms of the Geohydrological environment.

4. Methodology

4.1. Desk study

The client indicated a preliminary Geohydrological report will be required for this development. The desktop study involved map consultation as well as site visit to assess ground and environmental conditions.

Note that as the development progresses this report will be updated with the relevant information as it becomes available.

4.2. Hydro-census

No hydro-census will be conducted as boreholes will be drilled on site which will yield more accurate data on the Geohydrological conditions present.

4.3. Drilling and siting of boreholes

It was indicated that before the construction starts boreholes will be sited and drilled for the purpose of water abstraction and water quality monitoring.

4.4. Aquifer testing

The borehole that will be drilled serve only a monitoring purpose and no abstraction will occur, thus it is not recommended to test the strength of the aquifer for the site.

4.5. Sampling and chemical analysis

As per **4.3**, boreholes will be drilled. Once they are drilled sampling will be conducted and the data and analysis added to this report.

4.6. Groundwater modelling

A conceptual model will be completed once all the data is obtained from the boreholes.

4.7. Groundwater availability assessment

Only a desktop groundwater availability assessment was conducted from readily available data. This will be sufficient enough for this type of development considering that no abstraction will occur and the quality and quantity of groundwater reserve will be either depleted or contaminated due to the centre location in the Mafikeng business district.

5. Prevailing groundwater conditions

5.1. Geology

5.1.1. Regional geology

According to the geological map in **Figure 6**, the expected geology for the area surrounding Mafikeng consists of volcanic rocks of the Ventersdorp Supergroup, Nelspruit Group belonging to the Barberton Supergroup and cover by Kalahari Sands Group.

Both the Ventersdorp Supergroup and the Nelspruit Group was volcanically deposited between 3100 and 2650 Ma ago.

“The Kraaipan greenstone belts, consisting of metamorphosed mafic volcanic rocks and interlayered metasediments (mainly banded iron formations, jaspilites and ferruginous cherts), occur poorly exposed beneath cover sequences comprising mainly Neoproterozoic Ventersdorp Supergroup volcanic rocks and a blanket of Tertiary-Recent Kalahari sediments”.(C.R. Anhaeusser, F. Walraven, Feb 1999).

“The older rocks especially the Swazian migmatites and gneisses as well as the Giyani, Pietersburg and Gravelotte greenstone belts underwent several periods of deformation during which they were intensely folded and metamorphosed. The younger intrusive granites were less deformed. Two prominent directions of shear fracture are developed in the Nelspruit area the oldest strikes north-northeast; the second and younger trends north-northwest. The latter developed after the intrusion of the pre-Godwan diabase”.(J.R Vegter, Oct 2003)

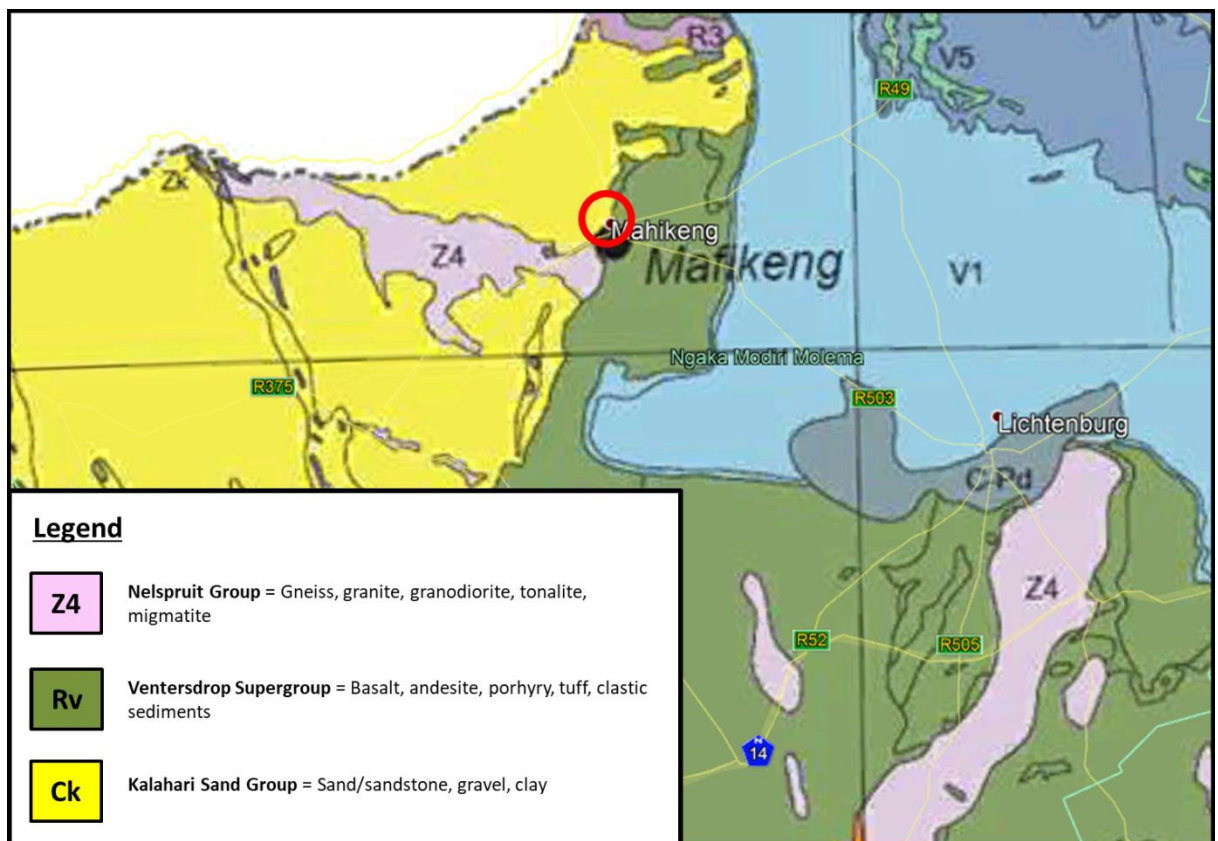


Figure 6: Regional Geology of Mafikeng.

5.1.2. Local geology

Nelspruit Group (3100 Ma ago)

- **Goudplaats and Makhutswi gneisses**

“Goudplaats and Makhutswi Gneisses underlie most of the area between the Soutpansberg in the north and latitude 24°45' south. They consist of medium to fine-grained grey biotite bearing rocks of tonalitic composition. The Goudplaats Gneiss is strongly foliated and characterized by alternating bands of leucocratic and melanocratic material. In places it grades into migmatite. The gneiss occurring south of the Murchison Range has been termed the Makhutswi Gneiss. It is very similar to the Goudplaats Gneiss. The relationship of the Goudplaats and Makhutswi Gneiss to the greenstone belts is uncertain. The older view was that both Gneisses probably formed a basement to the Bandelierkop Complex and to the Pietersburg, Giyani and Gravelotte Groups. On the 1997 1:1 000 000 geological map and the stratigraphic table published by the Council for Geoscience in 1998 the greenstone belts occupy the bottom of the table i.e. they are assumed to be older than the Gneisses. A broad zone of leucocratic biotite granite (Rbg) extends from Tzaneen towards the Giyani Greenstone Belt. It is thought to have formed through complete anatexis of the Goudplaats Gneiss” (*J.R Vegter, Oct 2003*).

- **Southern Swazian intrusives**

“On the Pilgrim’s Rest sheet, in the vicinity of Klaserie, an unnamed (informally called Orpen) variable suite of migmatite and gneiss (ZB) more or less intervenes between the Makhutswi Gneiss to the north and the Nelspruit Suite to the south. It consists predominantly of lightgrey medium-grained biotite-rich gneiss with coarse-grained quartz-feldspar leucosomes. Amphibolite dykes and xenoliths and inter-layered amphibolite are present in the migmatite and gneiss terrain. The greater part of the area south of latitude 24° 45' is underlain by medium- to coarse-grained biotite granite, porphyritic granite and potassic gneiss and migmatite grouped together as the Nelspruit Suite (Zne). In many places a coarse-grained pegmatite is present. The Hebron Granodiorite, occurs as isolated bodies within the Nelspruit Suite. Bodies of tonalitic biotite-trondhjemite granite and gneiss (ZC) border on the Barberton Mountain Land (Region 45). Divergent opinions exist about which is the older: the meta-volcanic and sedimentary rocks of the Barberton Sequence or the tonalitic granite gneiss and migmatite” (*J.R Vegter, Oct 2003*).

Ventersdorp Supergroup (3100 – 2650 Ma ago)

The Ventersdorp Supergroup is one of the least deformed late Archaean-early Proterozoic lowgrade metamorphosed supracrustal sequences in the world and can serve as a model for tectonic, geochemical and volcanological evolution. The development of the Ventersdorp Supergroup on the Kaapvaal Craton was initiated by the outflow of lava of komatiitic affinity during an epoch of crustal extension. The Ventersdorp sequence comprises three groups namely the Klipriviersberg Group at the base followed by the Platberg Group and Pniel Sequence. The Klipriviersberg Group consists of mafic volcanics whilst the Platberg Group is composed of sediments deposited in grabens followed by a bimodal volcanic suite with intermixed sediments and tuff towards the top. The presence of stromatolitic cherty limestone and mature sedimentary material indicates an abatement in tectonic activity towards the end of Platberg times. The uppermost Pniel Sequence overlies the Platberg Group with a marked unconformity and consists of an arenaceous unit, followed by a mafic to intermediate volcanic sequence. (*W.A. Van der Westhuizen, H. De Bruijn, P.G. Meintjes, 1991*)

Kalahari Sands Group (65 – 1.8 ma ago)

The basal unit of the Kalahari Group consists of gravels deposited by the Cretaceous rivers as well as on scree slopes. As down-warp of the basin continued, so more gravels were deposited as well as the sand and finer sediment carried by the rivers. Thick clay beds accumulated in the lakes that formed by the back-tilted rivers, with sandstone being deposited in braided streams interfingering with the clays and covering them in some areas as the shallow lakes filled up with sediment. The calcretes in the Kalahari Gemsbok Park and towards the east along the Molopo River form prominent cliffs between the aeolian sands of the Gordonia formation and the underlying Eden Formation sandstones. As these calcretes appear to occupy a fixed stratigraphic position in the area they were proposed as the Mokalanen Formation by M.A. Thomas (1981). The formation name has not yet been accepted by SACS, and the problems associated with assigning a fixed stratigraphic position to calcretes is discussed at the end of this chapter (*I.G Haddon 2005*)

5.1.3. On-site Geology

It was confirmed during the site visit that the site contains 3 main types of rock. **Figure 7** indicates the 3 types of rocks found and are as follows:

- **Ventersdorp Lava:** Characterised by the greenish colouration and amygdoidal inclusions (“lava bubbles”).
- **Hydrothermal Quartz:** This type of quartz indicates that volcanic activities and super-heated fluids moved along fractures and crack and then solidified.
- **Chert:** This black chert found on site is also a form of quartz and is directly linked to the volcanic activity of the Ventersdorp volcanic activities.

It can be said with a fair amount of certainty that the underlying geology consists of Green Ventersdorp lavas, and due to the hard and resistant nature of the rock, the aquifer will most likely be a fracture aquifer.

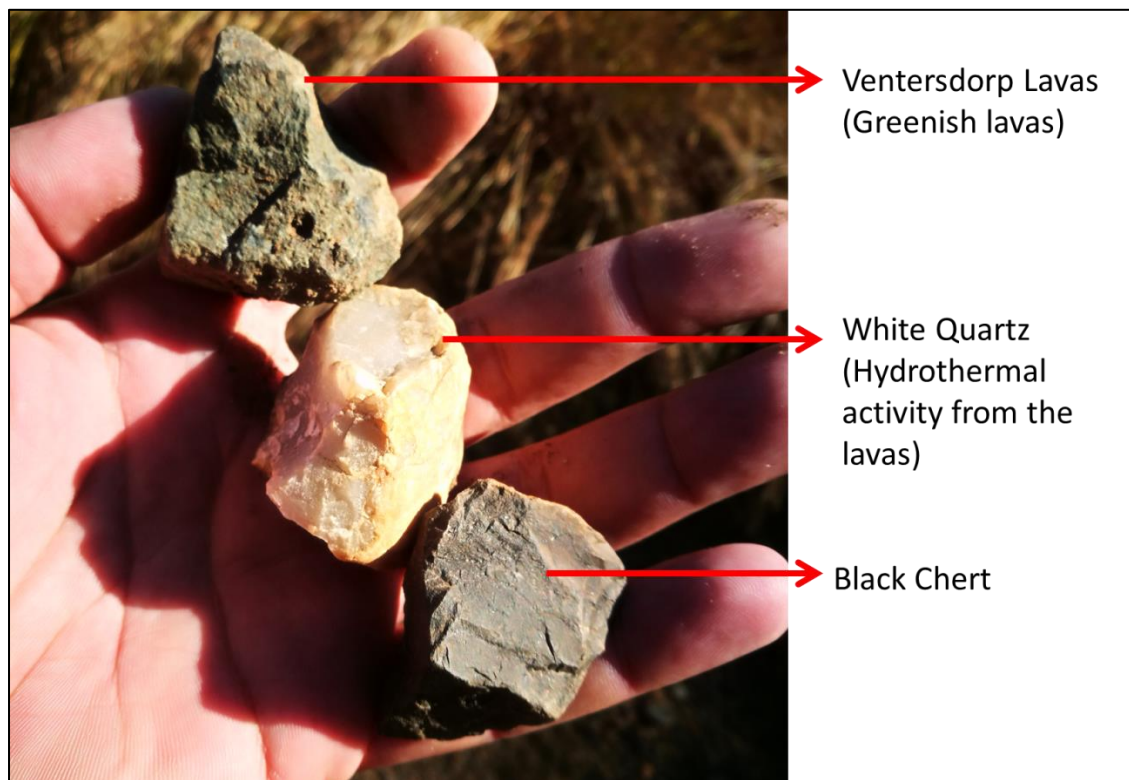


Figure 7: Rock types on site

5.2. Hydrogeology

5.3.1. Unsaturated zone

**This can only be determined once a borehole constructed, which will be done before construction of this development occurs. This information will be added later when the data becomes available.*

It is predicted that the unsaturated zone will span from the surface up until the first contact with hard rock (lavas). This can range from 0 mbgl to between 15 -30 mbgl.

5.3.2. Saturated zone

**This can only be determined once a borehole constructed, which will be done before construction of this development occurs. This information will be added later when the data becomes available.*

For this environment an aquifer will be found on a contact between the lavas (impermeable) and a water bearing geology (permeable / semi-permeable). The start of the saturated zone for this area is estimated to be between 15 – 30 mbgl.

5.3. Groundwater levels

**Note that accurate groundwater levels will only become available once a hydro census is conducted as well as the establishment of new boreholes on site.*

From readily available data and maps for Southern Africa it can be determine that the water levels for the area of Mahikeng is between 15 -30 meters below ground level (**mbgl**) (**Figure 8**). This is fairly deep and coincides with the relatively dry environmental conditions found around Mahikeng.

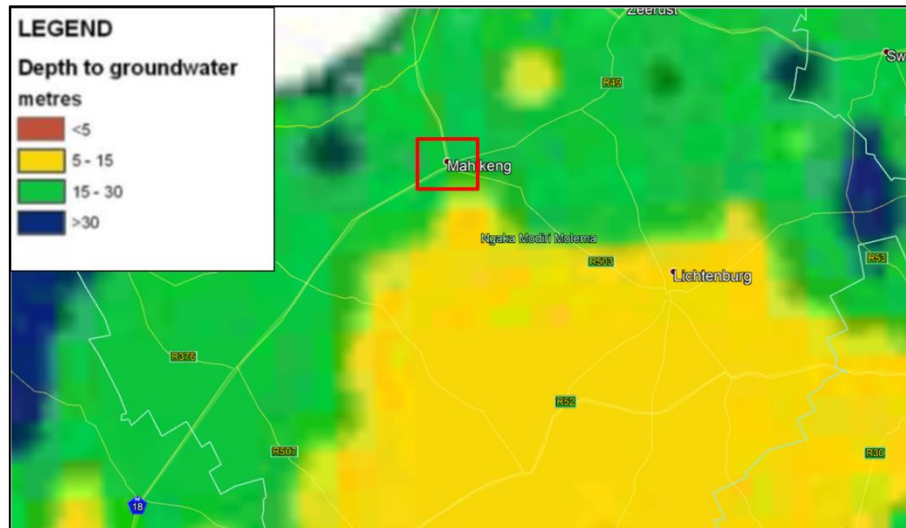


Figure 8: Average ground water levels for the area of Mahikeng.

5.4. Groundwater potential contaminants

**Note that water sample will be taken during the full Geohydrological investigation once boreholes are drilled and a hydro census conducted.*

During the site visit it was noticed that a storm water drain (containing still standing water) runs through the site towards the railway. It is very likely that this water contains a form of sewage and hydrocarbon substances from the oily surface noticed during the site visit (**Figure 9**). It is expected that this water is much more contaminated than expected due to its centre location in the middle of Mafikeng.

From a developing standpoint and the proposed erection of a filling station and wash bay this site would be preferable as the area's ground water will likely be polluted with the same contaminants. None the less, it is concluded, that to prevent further deterioration of the ground water resource with hydrocarbons (petrochemical substances) and soaps (from wash bay and the storm water drain), that certain mitigation measures must be implemented. The potential risks and their mitigation measure are fully described in the risk assessment in **Chapter 8**.



Figure 9: Photographic evidence during the site visit of the storm water drain on site.

5.5. Groundwater quality

**Note that water sample will be taken during the full Geohydrological investigation once boreholes are drilled and a hydro census conducted.*

The desktop study (**Figure 10**) indicates that the electrical conductivity ("salts indicator") is between 70 -150 mS/m, which is classified as being the standard for groundwater. However the site is situated in the centre of a highly populated Mahikeng and right next to a working train yard/ railway. It is thus expected that the quality of water will be poor and not suitable for human use.

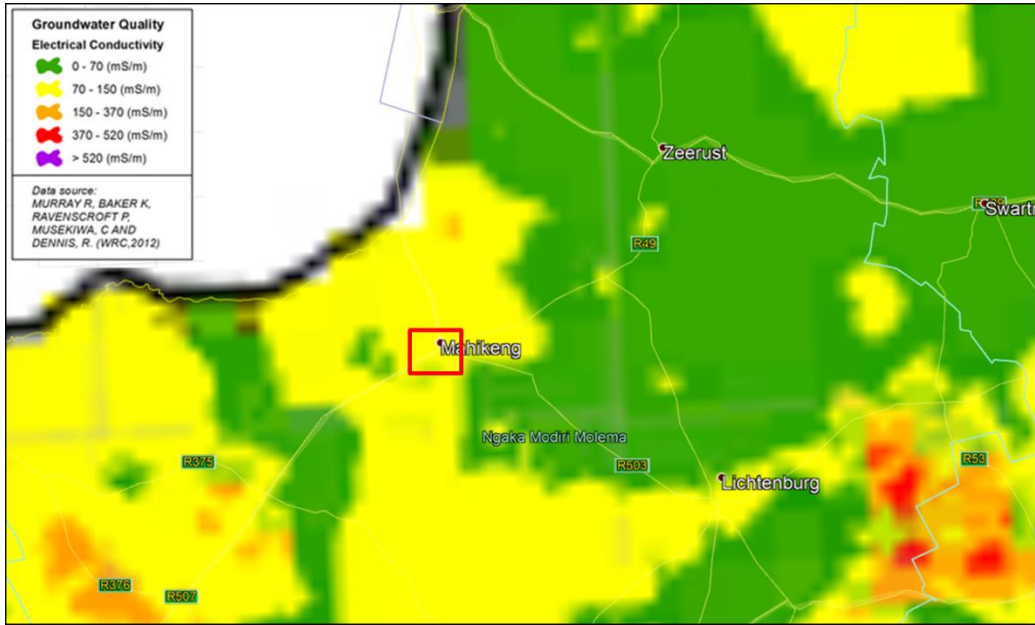


Figure 10: Map indicating average quality of ground water resources in Mahikeng.

6. Aquifer Characterisation

6.1. Groundwater vulnerability

The ground water vulnerability map of South Africa classifies the aquifer in the area of ranging between a moderate to high risk (Figure 11). This overall factor will be considered during the Risk Assessment in Chapter 8.

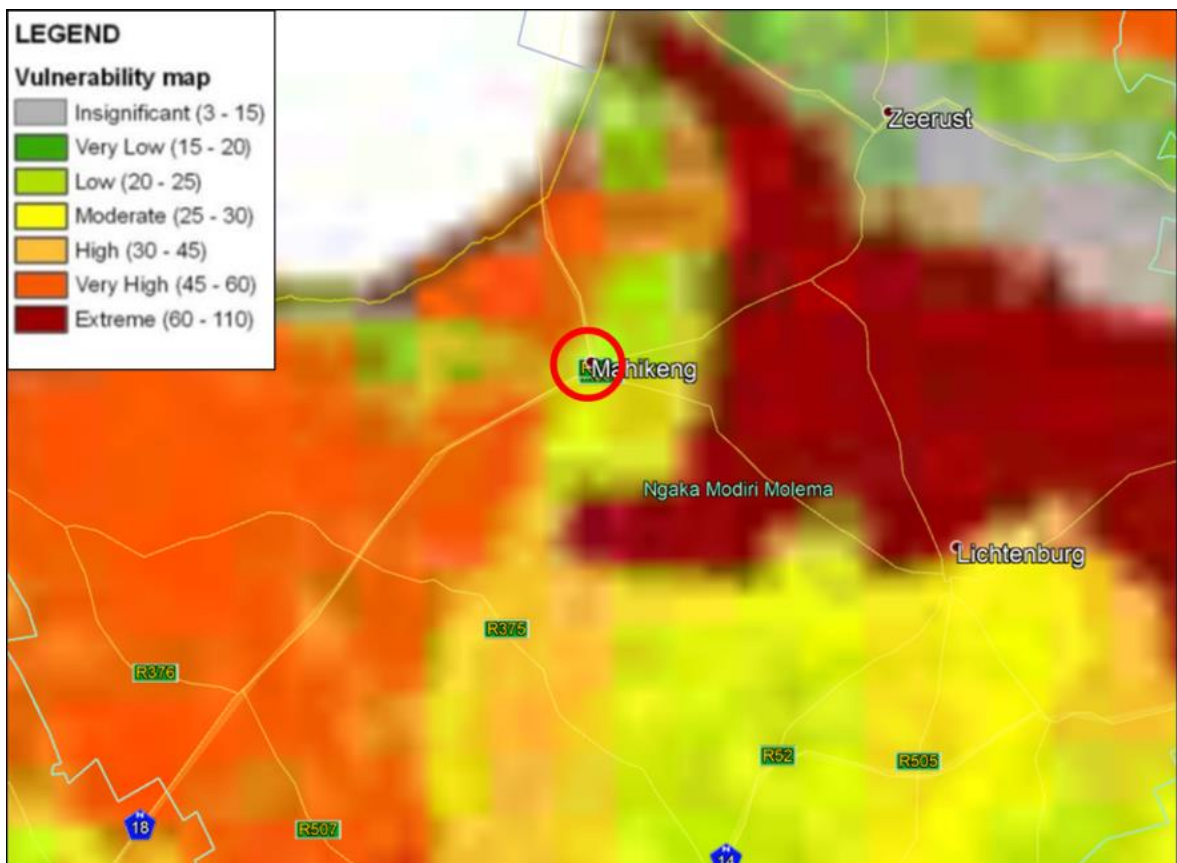


Figure 11: Aquifer vulnerability map of South Africa.

6.2. Aquifer classification

**Note that once a borehole is constructed a detailed geology log will be included in this report which details the aquifer characteristics.*

Both maps in **Figure 12** indicated that the aquifer is classified as fractured, inter-granular or both. Fractured aquifers generally tend to deliver high yields, but for the area of Mafikeng the average expected yields range from 0.1 – 0.5 L/s.

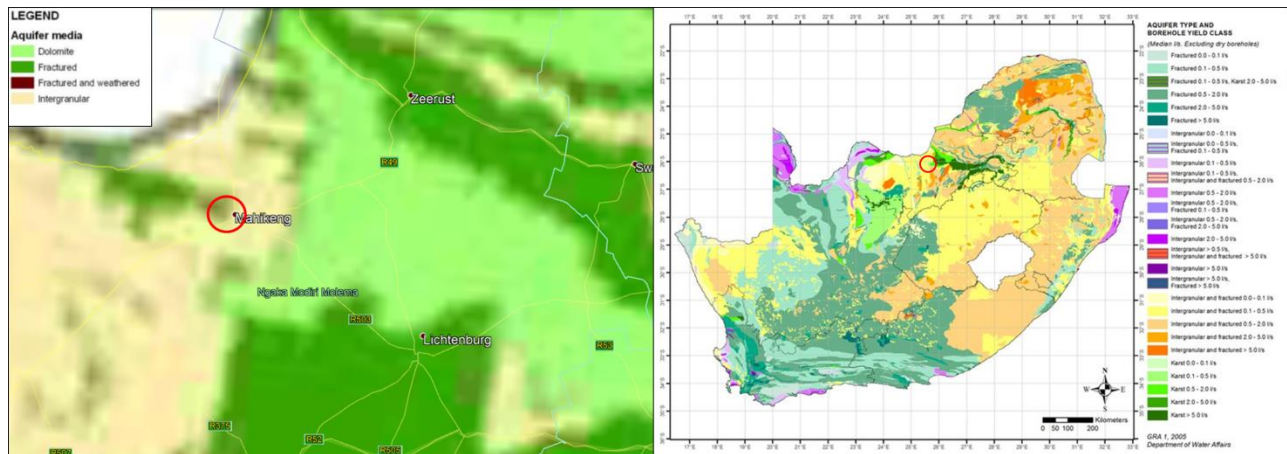


Figure 12: Aquifer classification maps

6.3. Aquifer protection classification

Taking into consideration the vulnerability index and that it rates the aquifer as a medium to high risk, it stands justified that the groundwater resources in this area need to be protected. On the other side, the site is located in the middle of Mafikeng's industrial/business areas and is highly deteriorated.

It stands to reason that this area would be ideal for the construction of a taxi holding area, which include a wash bay and filling station, due to the degraded nature of the site and its locality. It however also means that additional/stricter mitigation measures must be employed to protect the sensitive nature of the aquifer and not contribute to the contamination thereof.

Overall the aquifer protection classification can be seen as degraded/contaminated but still requires protection which classifies this aquifer as a medium risk.

7. Groundwater Modelling

7.1. Conceptual model

This conceptual model will be completed and visualised once the monitoring boreholes have been drilled, providing key data on geology, water level and aquifer characteristics.

8. Geohydrological Impacts

8.1. Methodology

The environmental significance assessment methodology is based on the following determination:

Environmental Significance = Overall Consequence x Overall Likelihood.

8.1.1. Determination of Consequence

Consequence analysis is a mixture of quantitative and qualitative information and the outcome can be positive or negative. Several factors can be used to determine consequence. For the purpose of determining the environmental significance in terms of consequence, the following factors were chosen: Severity/Intensity, Duration and Extent/Spatial Scale. Each factor is assigned a rating of 1 to 5, as described in the tables below.

Determination of Severity

Severity relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects impact on the biophysical and socio-economic environment (**Table 1**).

Table 1: Rating Criteria for the determination of severity of the impact.

Type of criteria	Rating				
	1	2	3	4	5
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small / Potentially harmful	Significant / Harmful	Great / Very harmful	Disastrous / Extremely harmful
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable/ Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate/ High potential to mitigate impacts to level of insignificance / Easily reversible	Low cost to mitigate	Substantial cost to mitigate / Potential to mitigate impacts / Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate / Little or no mechanism to mitigate impact / Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Medium change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

Determination of Duration

Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place (**Table 2**).

Table 2: Rating criteria for determination of duration.

Rating	Description
1: Low	1 Month
2: Low-Medium	1 – 3 Months
3: Medium	More than 3 Months
4: Medium-High	5 – 10 Years
5: High	More than 10 Years

Determination of Extent/Spatial Scale

Extent refers to the spatial influence of an impact, be it contained to the immediate surroundings (site), extending to the surrounding area, regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders) (**Table 3**).

Table 3: Rating criteria for determination of duration.

Rating	Description
1: Low	Immediate, fully contained area (site)
2: Low-Medium	Surrounding Area
3: Medium	Regional
4: Medium-High	National
5: High	International

Determination of Overall Consequence

Overall consequence is determined by adding the factors determined above and summarised below, and then dividing the sum by 3 (**Table 4**).

Table 4: Calculation of Overall Consequence.

Consequence	Rating
Severity	Example 4
Duration	Example 2
Extent	Example 4
SUBTOTAL	Example 10
TOTAL CONSEQUENCE:(Subtotal divided by 3(Severity, Duration, Extent))	Example 3.3

8.1.2. Determination of Likelihood

The determination of likelihood is a combination of Frequency and Probability. Each factor is assigned a rating of 1 to 5 (Tables 5 and 6).

Determination of Frequency

Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken (Table 5).

Table 5: Rating criteria for determination of frequency.

Rating	Description
1: Low	Once a year / once during construction
2: Low-Medium	Once / more in 6 Months
3: Medium	Once / more a Month
4: Medium-High	Once / more a Week
5: High	Daily

Determination of Probability

Probability refers to how often the activity/event or aspect has an impact on the environment (Table 6).

Table 6: Rating criteria for determination of probability.

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Overall Likelihood

Overall likelihood is calculated by adding the factors determined above and summarised below, and then dividing the sum by 2 (Table 7).

Table 7: Calculation of Likelihood.

Likelihood	Rating
Frequency	Example 4
Probability	Example 2
SUBTOTAL	Example 6
TOTAL LIKELIHOOD (Subtotal divided by 2 (Frequency, Probability))	Example 3

8.1.3. Determination of Overall Environmental Significance

The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will then fall into a range of LOW, LOW-MEDIUM, MEDIUM, MEDIUM-HIGH or HIGH (**Table 8**).

Table 8: Rating criteria for impact significance.

Significance or Risk	Low	Low-Medium	Medium	Medium-High	High
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 - 14.9	15 – 19.9	20 - 25

Qualitative description or magnitude of Environmental Significance

This description is qualitative and is an indication of the nature or magnitude of the Environmental Significance. It also guides the prioritisations and decision-making process associated with this event, aspect or impact (**Table 9**).

Table 9: Rating criteria for impact.

Significance	Low	Low-Medium	Medium	Medium-High	High
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to the company	Impact is real and substantial in relation to other impacts. Pose a risk to the company and environment. Unacceptable	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible improve	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.

8.2. Geohydrological Risk Assessment

8.2.1. Groundwater Quantity

Groundwater quantity refers to the amount of available groundwater in the aquifer at any one time, which is available for abstraction or for monitoring purposes. Factors that influence groundwater quantity are rainfall, recharge, and other abstraction points in the area and aquifer composition.

1. Current Quantity and Abstraction								
Impact	Loss of aquifer and groundwater resources.							
Description of Impact	Over abstraction of groundwater can lead to total dewatering and collapse of the aquifer.							
Constructional Phase								
Before Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	NO IMPACT							
Mitigation								
After Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	NO IMPACT							
Operational Phase								
Before Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	4	3	3	3.3	4	2	3	10
Mitigation	<ul style="list-style-type: none"> There are no plans to abstract groundwater for the planned activity. Pollution control through safe dewatering of monitoring boreholes (Requires pump test) Pump test will be conducted to determine the optimal abstraction for pollution control. 							
After Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	2	2	1	1.3	1.7	2	1	2.5
Cumulative Impacts	Possible over abstraction of nearby ground water users							
Additional Notes:	Keep in mind that no groundwater abstraction is planned for this development and thus no pump tests will be required, but if dewatering of contaminated water is required a pump test will be required to determine safe yields.							

Groundwater Quantity Summary						
Impacts	Constructional Phase		Operational Phase		Total Before Mitigation	Total After Mitigation
	Before Mitigation	After Mitigation	Before Mitigation	After Mitigation		
1. Abstraction of Groundwater	NO IMPACT		10	2.5	10	2.5
Total:					10	2.5

Concerning the risk, the new development poses to the groundwater quantity, only the operational phase will have an impact. The impact is rated to be **MEDIUM (10)** before mitigation and **LOW (2.5)** after mitigation. It is recommended that if the development is contaminating the groundwater system, that low yield dewatering be implemented, which will stop contamination from spreading further into the surrounding areas and will protect the aquifer for over abstraction. If it is decided that this method will be implemented in the future, it is recommended that an initial pump test be conducted to determine the yield of the aquifer.

8.2.2. Groundwater Quality

Groundwater quality refers to the quality of water within the aquifer and measured as standard against the SANS 2015 for drinking water unless otherwise specified. This environmental parameter is assessed by determining what contamination might come forth from the development as well as external factors that contribute to a deteriorating water quality.

1. Current Contamination								
Impact	Various contaminants from the surrounding area polluting the aquifer.							
Description of Impact	A large uncontained storm water drain is running through the center of the proposed development and still standing contaminated water is seeping into the ground water.							
Constructional Phase								
Before Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	4	5	3	4	4	4	4	16
Mitigation	<ul style="list-style-type: none"> Determine the quality of water through sampling. Upgrade and clean the storm water drain or divert it around the development Any hazardous substances using in the construction must be stored correctly and spillages clean and disposed of immediately. 							
After Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	2	2	1	1.7	2	2	2	3.3
Operational Phase								
Before Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	5	5	3	4.3	4	4	4	17.3
Mitigation	<ul style="list-style-type: none"> Ensure the installation of impermeable layers for the filling station/ Install clean and dirty water separators and storm water collection drains. Constant maintenance on the site through cleaning oil spills and maintaining storm water drains, Monitoring for any leaks from the facility. 							
After Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	3	2	2	2.3	2	3	2.5	5.8
Cumulative Impacts	A major cumulative impact has already occurred from the development around the proposed site.							
Additional Notes:	This development must ensure that proper mitigation measures are employed as to not further lower the quality of the ground water resource.							

This impact is rated to be of **MEDIUM-HIGH (16)** impact during the constructional phase as the groundwater is already contaminated for this area and that construction activities will only worsen the effects if mitigation isn't applied. If mitigation is applied during the constructional phase the impact might be a **LOW (3.3)**. The operational phase carries more risk as it will actively store hydrocarbons, which poses a large risk to the groundwater quality. The operational phase thus carries a **MEDIUM-HIGH (17.3)** risk and if proper mitigation measures are implemented can be brought down to a score of **LOW-MEDIUM (5.8)**.

Keep in mind that this is one of the major impacts of the new development and constant monitoring will be required to keep the impact low. If contamination is detected within the aquifer and originates from the development, immediate action will be required, which is usually associated with fixing the leak and abstraction of contaminated water for the aquifer.

2. Contamination from Development								
Impact	Contaminating the aquifer with hazardous substances.							
Description of Impact	The construction activities may involve using hazardous chemicals which are not biodegradable and will seep into the aquifer where it can contaminate the water for years. The same principle applies for the filling station and wash bay during the operational phase.							
Constructional Phase								
Before Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	3	2	2	2.3	3	3	2.5	7
Mitigation	<ul style="list-style-type: none"> Ensure that all hazardous substances are stored correctly on impermeable areas. All hazardous spills must be clean immediately and removed properly. 							
After Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	2	1	1	1.3	1	2	1.5	2
Operational Phase								
Before Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	5	5	3	4.3	4	4	4	17.3
Mitigation	<ul style="list-style-type: none"> Early detection of any storage tank leaks. Constant monitoring of borehole and chemical sampling. Ensuring the liners of the fuel tanks are in optimal condition. Implementing remediation activities. 							
After Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	3	3	2	2.3	2.7	2	2	5.3
Cumulative Impacts	Due to the high density of development around the site a cumulative impact has occurred through the construction of multiple filling stations and wash bays.							
Additional Notes:	Care should be taken when installing the fuel tanks and ensure that the liners are sufficient and properly placed.							

This type of risk is a major parameter during this assessment and attention should be given to this parameter and its mitigation measures. The constructional phase only considers hazardous chemicals which originate from constructing the filling station and wash bay. Due to the polluted nature of the aquifer the construction phase on score a **LOW-MEDIUM (7)** impact and a **LOW (2)** if mitigation is applied. The operational phase which includes the underground fuel tanks, potential for large spills of hydrocarbons and soaps/oils from the wash bay, is by far the largest risk to this development. It is thus of key importance to implement all mitigations measures, monitor constantly and implement remediation measures. The operational phase scores a **MEDIUM-HIGH (17.3)** and if all mitigation measures are applied will still carry a small risk of **LOW-MEDIUM (5.3)**.

3. Monitoring								
Impact	Lack of monitoring and further environmental degradation							
Description of Impact	If no monitoring of groundwater quality and regular maintenance occurs, contaminated water can seep into the groundwater resources and continue to worsen.							
Constructional Phase								
Before Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	NO IMPACT							
Mitigation								
After Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	NO IMPACT							
Operational Phase								
Before Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	4	5	3	4	4	5	4.5	18
Mitigation	<ul style="list-style-type: none"> • Chemical sample analysis every 6 months. • Drilling of one upstream borehole for background quality. • Drilling four shallow boreholes around the facility for immediate leak detection. • Drilling two boreholes downstream for plume delineation and tracking speed and concentration of pollution. 							
After Mitigation	Severity	Duration	Extent	Consequences	Frequency	Probability	Likelihood	Significance
	2	2	2	2	2	2	2	4
Cumulative Impacts								
Cumulative Impacts	A lack of monitoring and continual contamination has caused the aquifer to become polluted with various substances.							
Additional Notes:								
Additional Notes:	Determine if any ground water users use the water in the vicinity of the development for consumption or any other domestic use and include that borehole in the monitoring program.							

Monitoring the new development can only be implemented once the construction activities have ceased and the operational phase has commenced. The operational phase carries large environmental risk concerning monitoring of water quality. It is crucial that monitoring boreholes be drilled and samples analysed for any contamination. The impact is thus rated at a score of **MEDIUM-HIGH (18)** before mitigation (no monitoring boreholes) and a score of **LOW (4)** if all mitigation measures are implemented. The client is reminded that drilling of boreholes for monitoring purposes is a requirement according to the Department of Water and Sanitation.

Groundwater Quality						
Impacts	Constructional Phase		Operational Phase		Total Before Mitigation	Total After Mitigation
	Before Mitigation	After Mitigation	Before Mitigation	After Mitigation		
1. Current Contamination	16	3.3	17.3	5.8	16.7	4.6
2. Contamination from development	7	2	17.3	5.3	12.2	3.7
3. Monitoring	NO IMPACT	NO IMPACT	18	4	18	4
Total:					15.6	4.1

Assessing groundwater quality as a whole, it scores an average of **MEDIUM-HIGH (15.6)** before mitigation and an average score of **LOW (4.1)** after mitigation. Improving and maintaining groundwater quality will be the most important environmental parameter facing the new development, due to the underground storage of hazardous hydrocarbon/ petrochemical substances.

8.2.3. Risk Assessment and conclusions

The Total Combined Impacts refer to all the environmental parameters concerning the Geohydrological environment before and after mitigation to assess the overall impact the development will have on the environment.

Total Combined Impacts		
Factors	Impact Before Mitigation	Impact After Mitigation
1. Groundwater Quantity	10	2.5
2. Groundwater Quality	15.6	4.1
Overall Impact	12.8	3.3

In total the whole area and its Geohydrological environment is rated to be of **MEDIUM (12.8)** risk before mitigation, as previous activities have detrimentally affected the current condition of the environment. The major parameter that will play a significant role in the condition of the Geohydrological environment is the quality which specifically includes the contamination of the development and water quality monitoring. However, these risks can be avoided if proper mitigation measure as described in the risk assessment are applied. This brings the minimal environmental risk to a **LOW (3.3)** risk.

9. Groundwater monitoring system

9.1. Groundwater monitoring network

9.1.1. Source, plume, impact and background monitoring

It is recommended that a Geohydrologist be contracted to make an assessment once a year on the quality of groundwater and if a pollution plume has established itself. All monitoring data will be included in this report and an assessment and possible remediation option will be discussed.

9.1.2. System response monitoring network

Once it has been confirmed that pollution has occurred during regular monitoring or by a geohydrologist the following responses can be implemented:

- Immediate inspection of the underground fuel tanks to detect any leaks.
 - If no leaks are detected in the fuel tanks, dirty contaminated runoff and its containment in oil separators or storm water drains must be inspected.
- If underground leaks are detected the tanks must be immediately repaired or removed every 5-10 years depending on the quality of the tank. Additionally, all the contaminated ground around the fuel tanks must also be removed.
- If underground leaks or surface spills are significant and large, a low yield dewatering program can be implemented (on geohydrologist's recommendations), to physically remove the contaminated water.

9.1.3. Monitoring frequency

Frequency of monitoring and analysis of ground water is usually specified in a water use license by the Department of Water and sanitation, but it is recommended that 6-month intervals be adopted. If pollution occurs on a large scale a 3-month interval is recommended to determine if mitigation measures implemented are successful.

9.2. Monitoring parameters

Besides the major elements as described by SANBS (2015) for drinking water quality, it is additional recommended that all parameters for detecting **hydrocarbons** be included as well as detecting soaps. Elements that need to be specifically added include Lead (**Pb**) and volatile organic compounds (**VOC's**).

9.3. Monitoring boreholes

The exact location of the monitoring boreholes is still to determined and will be included in this report on a map alongside it's specific role as monitoring point.

It is known that 1 upstream borehole will either be drilled or selected (already in the vicinity) for background quality standards. 1 downstream borehole will be drilled to detect the extent of any potential contaminants emanating from the filling station. Also, as part of the regulations for erecting a filling station with underground fuel tanks , 4 shallow monitoring borehole must be drilled on each corner just below the lowest elevation of the tanks to detect immediate leaking.

10. Conclusion and Recommendations

The Geohydrological desktop study and site visit revealed that although the aquifer is rated to be of MEDIUM to HIGH sensitivity the actual site conditions revealed a highly degraded site including it being used as a rubble dump site and a contaminated storm water drain running through the middle of the proposed site. There are no environmental objections to erect a taxi holding area with a wash bay and filling station on this site, as long as the project adheres to the mitigations measures recommended in Chapter 8 and not contributing to the already contaminated aquifer.

What follows is the ideal layout, from a Geohydrological aspect, on where to construct the filling station and wash bay (Figure 13). The objectives of this layout is as follows:

- To prevent contaminated runoff from leaving the site or seep into the ground water resources.
- To select an area on the proposed site which will allow for water quality monitoring.
- To select an area, that if spillages or leaks occur, it could be remediated sufficiently.

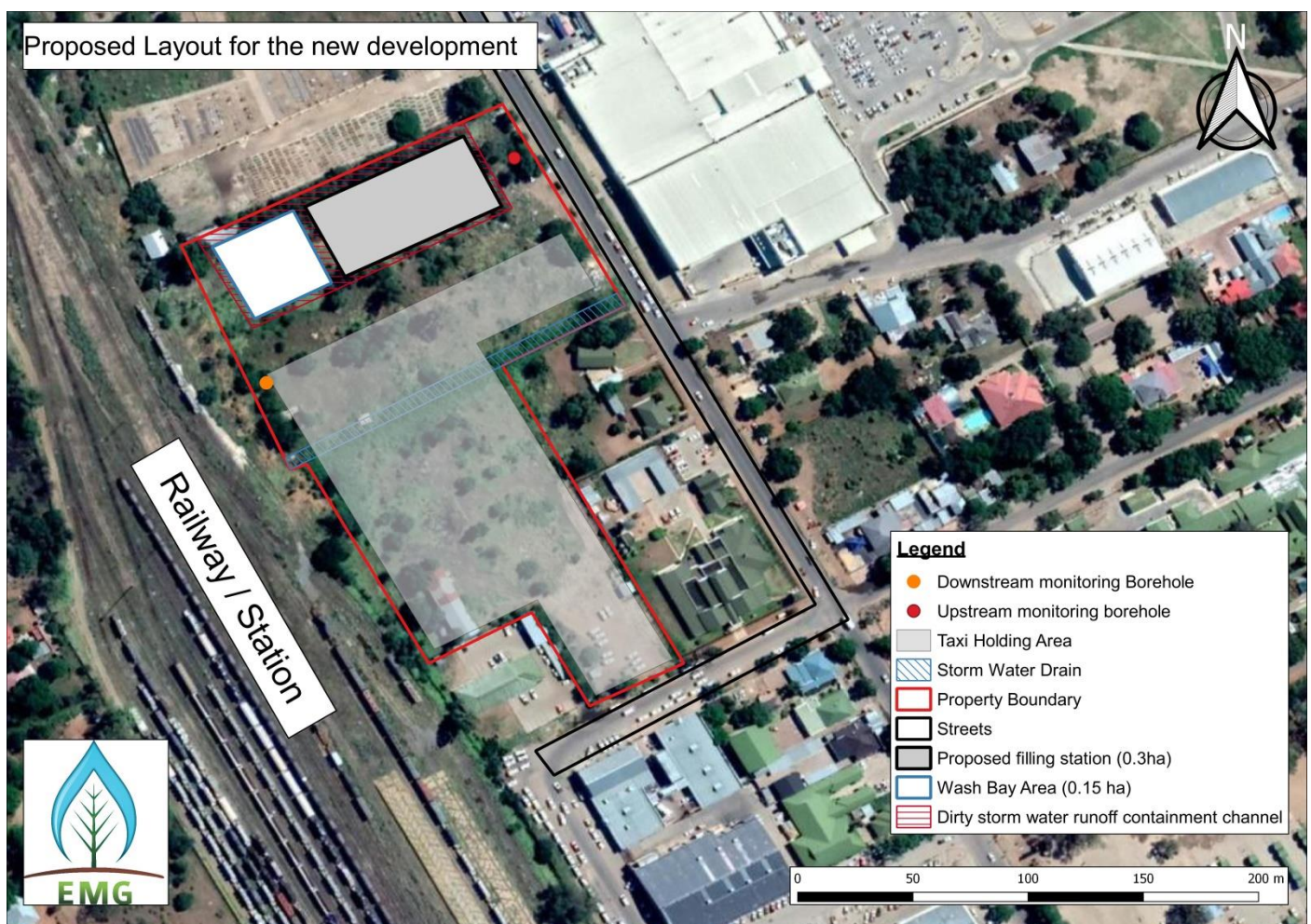


Figure 13: Geohydrological ideal layout for the development.

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MAHIKENG INTERMODAL FACILITY: URBAN ECONOMIC IMPACT & DEVELOPMENT POTENTIAL

27 MAY 2021

CLIENT
MAHIKENG LOCAL MUNICIPALITY

PREPARED BY
DR DIRK A PRINSLOO AND
DIRK NICO PRINSLOO

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EXECUTIVE SUMMARY

The main objective of the project is to develop a plan for an integrated intermodal public passenger facility as a part of the Mahikeng CBD revitalization programme. This plan will add to the Spatial Development Framework, conducted earlier.

COMMUTER SURVEY People making use of public transport on a regular basis



GENERAL USE OF TAXI TRANSPORT

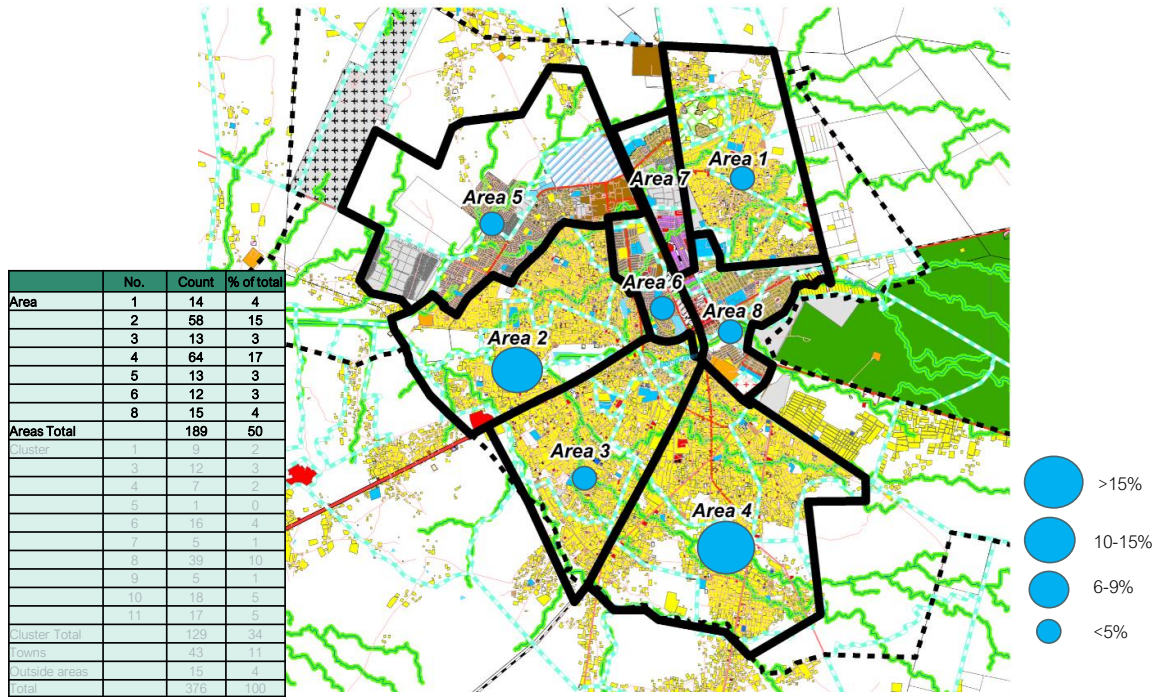
- 98% use taxis
- Only 20% car ownership
- Less than 5% make use of car transport to the CBD
- 2.3 people per household use taxis
- Taxis will dominate for the next 15 – 20 years



DEMOGRAPHIC AND SOCIO-ECONOMIC PROFILE

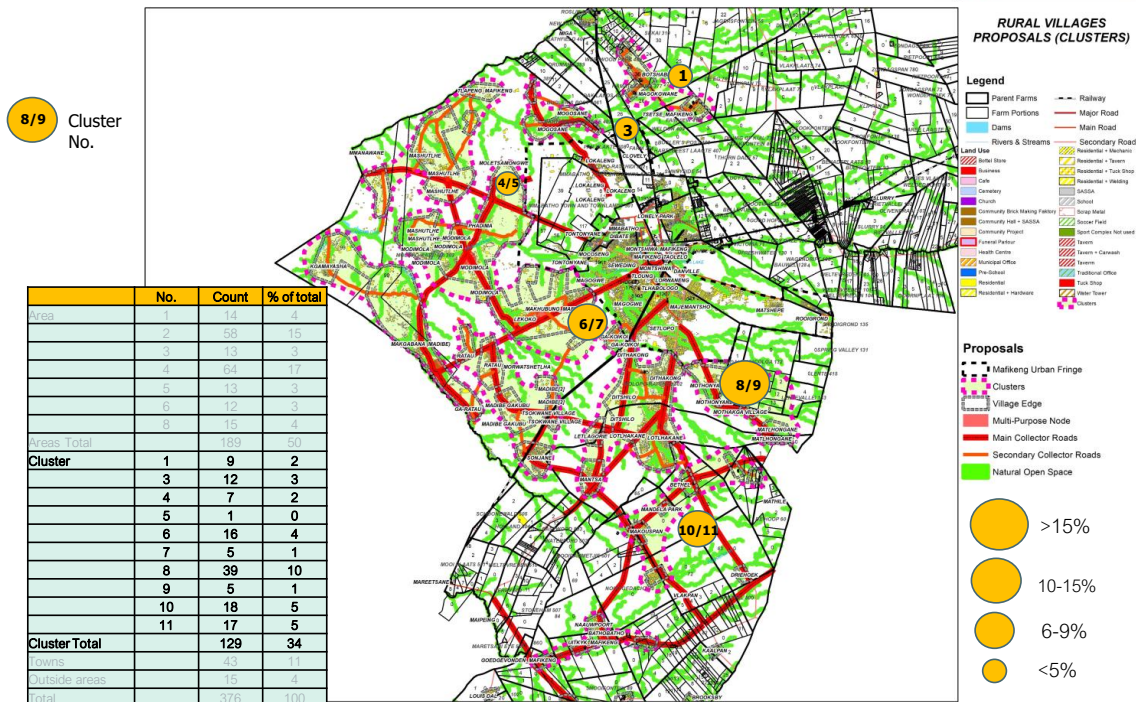
- Mainly female
- 35 years of age
- large households
- 90% one or more earners
- Household income of between R5 000 and R7 000 per month
- 60% in LSM 1 – 5

MAP 3: MAHIKENG TOD - COMMUTER ORIGIN FROM SURROUNDING MAHIKENG SUBURBS (AREAS 1-8)



Map Produced by Urban Studies, 2021
Source: Maxim

MAP 4: MAHIKENG TOD – COMMUTER ORIGIN FROM SURROUNDING RURAL SETTLEMENTS (CLUSTERS 1-11)



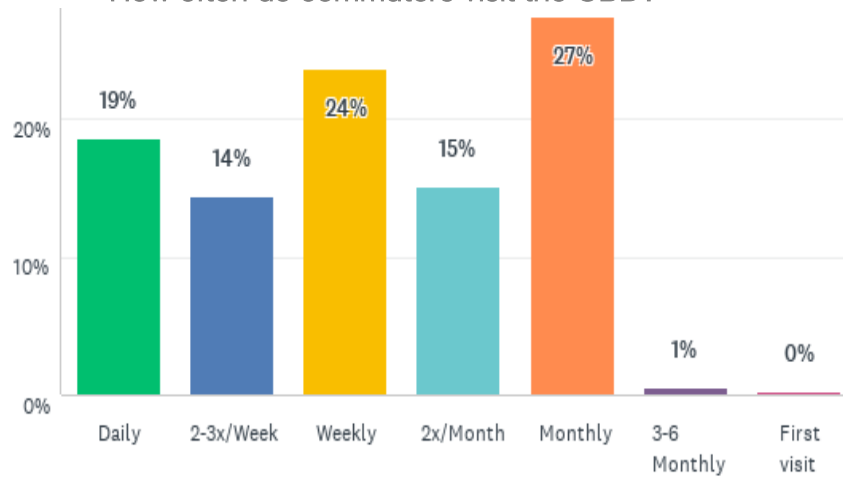
Map Produced by Urban Studies, 2021
Source: Maxim



MAIN REASON FOR USING TAXIS

- Shopping 72%
- Pay accounts 23%
- Collect pension/SASSA payments 17%
- To go to work 15%

How often do commuters visit the CBD?



Result

- 31% from Mondays to Fridays
- 59% visit on no specific day



TRAVEL BEHAVIOUR

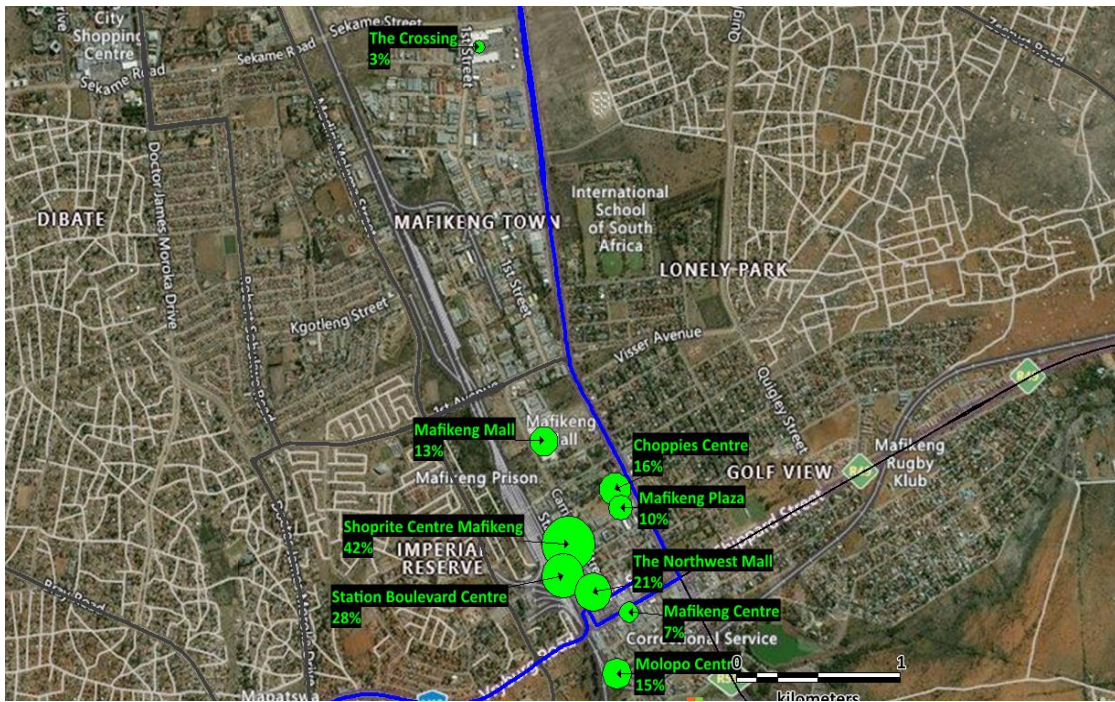
- 67% leave home at between 6 and 9 a.m.
- The median travel time is 22 – 25 minutes
- The return trip starts between 3 and 6 p.m.
- There is normally a short waiting period
- 54% wait for less than 20 minutes
- A round trip is R24, while longer trips are as high as R168



SHOPPING CENTRES VISITED

- 42% mainly visit Shoprite Centre
- 28% Station Boulevard
- 21% Northwest Mall
- 16% Choppies Centre

MAP 7: MAHIKENG – CENTRES MOST USED FOR SHOPPING



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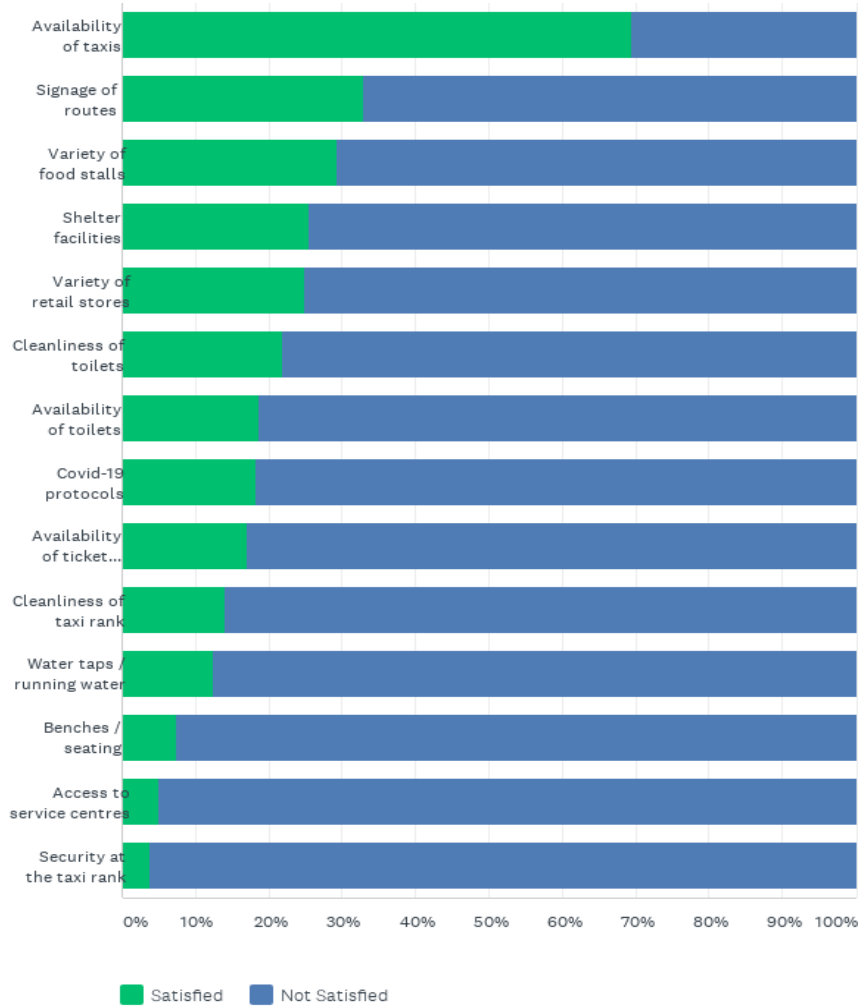
Map Produced by Urban Studies, 2021
Software: MapInfo Pro v19

15% are workers, of which 89% work in the CBD



SATISFACTION RATING

“65% of all commuters rates Bradford taxi rank as poor to very poor.”



RECOMMENDATION

- Improve security
- Sort out water problems
- Clean up the taxi rank
- Offer more retail facilities
- Provide better shelter facilities
- Provide ticket sales office and an information kiosk



GENERAL COMMENTS

- 98% use taxis on a regular basis
- Spending on average R750 per month
- Very dissatisfied with most facilities at Bradford taxi rank

BUSINESS SURVEY



CHARACTERISTICS OF BUSINESSES IN CBD

- 52% employ 5 or less people
 - Larger firms employ 20 or more people (18%)
 - 35% of businesses in operation for less than 5 years
 - 28% for longer than 20 years
 - 93% of all workers make use of taxi transport
- The majority of businesses have a negative attitude towards Bradford Taxi Rank.



RECOMMENDATION

IMPROVE TAXI RANK

- Upgrade and renew existing facility
- Improve security
- Upgrade toilet facilities
- Provide shelter
- Clean up the area
- Sort out water problems
- Provide permanent structure stalls

IMPROVE CBD

- Maintenance of streets and potholes
- Clean up and improve infrastructure
- Increase visible policing
- Improve shopping facilities
- Offer incentives for developers
- Improve and upgrade the taxi rank
- Improve parking
- Address congestion during peak traffic
- Upgrade toilet facilities
- Provide shelter
- Stimulate economic growth to increase job opportunities



SATISFACTION RATING

High levels of dissatisfaction include:

- Availability of public toilets
- Security
- Enough parking
- Cleanliness of the streets
- No benches or seating

IMPORTANT POINT!

Businesses in CBD are very dependent on the commuters and are highly successful. Specific concerns are associated with existing taxi facilities and the maintenance of the CBD.



INFORMAL/HAWKER SURVEY



CHARACTERISTICS OF INFORMAL TRADERS

Mainly female
40 years of age
The main breadwinner
4 – 5 people per household
75% do not own a car
Average household income is between R5 000 and R7 000 per month



BUSINESS CHARACTERISTICS

- 95% of the hawkers are also owners
- 75% occupy an open-air stall on the pavement
- 25% occupy sheltered stalls
- Only 2% forms part of the taxi rank
- Wide variety of products are sold, the most important are:
 - Fruit and vegetables
 - Food and take-aways
 - Coldrinks
 - Cigarettes
 - Clothing
- Only 10% buy groceries from the informal traders
- Hawkers mainly operate six days per week (70%)
- 77% have regular customers
- 41% has a turnover of between R250 and R500 per day
- Average turnover per day is R525
- 91% was negatively impacted by Covid-19
- 81% make use of taxi transport
- 85% get their products from elsewhere in the Mahikeng CBD
- 46% make use of lockup storage facilities at a fee
- 30% take products home
- 90% indicated a need for storage facilities



RECOMMENDATION

- Provide permanent structures
- Provide running water
- Provide tables and desks
- Provide lockup storage facilities
- Considerer larger warehouse facilities
- Clean up the area
- Improve security



SATISFACTION RATING

- Very high levels of dissatisfaction:
- Refuge removal
 - Shelter to store products
 - Cleanliness and availability of the toilets
 - Cleanliness of the streets
 - Safety and security
 - Availability of electricity
 - Availability of running water

RESULTS OF TAXI DRIVER SURVEY



DEMOGRAPHIC AND SOCIO-ECONOMIC PROFILE

Mainly male
40 years of age
Main breadwinner
Only earner
Higher car ownership
Household income of between R5 000 and R7 000 per month

TAXI DRIVER CHARACTERISTICS

- 82% operate from local townships
- Drivers operate mainly 3 or 4 days per week
- Very long working hours of 12 hours plus per day
- Majority do 6 – 10 trips per day
- 11 to 15 passengers per trip
- 90% experienced negative impact of Covid-19

**“Bradford Taxi Rank:
Mainly use on daily
and weekly basis
42% never use
Bradford Taxi Rank**



SATISFACTION RATING

- Very low ratings for:
- Washing facilities
- Toilets for drivers
- Running water
- Benches
- Security

- Shelter for drivers
 - Cleanliness of toilets
 - Enough holding areas
 - Lights at night
 - Variety of stalls
- All this clearly indicate high level of dissatisfaction

56% positive regarding the location
60% will use it all the time



PROPOSED
HOLDING
AREA



**SPECIFIC
SERVICES
REQUIRED**

Undercover parking
Toilets
Fuel supply
Good security and Policing
Washing facilities/showers and rest areas
Taxi washing bays

Support will be high

- Ablution facilities for drivers
- Restroom for drivers
- Filling station
- Spares shop
- Taxi washing bays
- Tyre outlets
- Small workshop



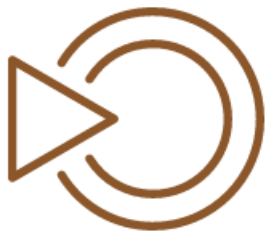
ANTICIPATED SUPPORT

The taxi drivers, operators and association share the same views.

DISCUSSIONS WITH EXECUTIVE MEMBERS AND OPERATORS OF TAXI ASSOCIATIONS



- Management
- Limited co-operation exists
- No one body responsible for running Bradford Taxi Rank
- Rules and regulations are not adhered to
- Taxi drivers are uncontrollable with bad behaviour
- Management of traffic flow and congestion in taxi rank
- Issues regarding the land ownership at the rank
- All taxis parking along the streets should get attention



FUTURE PLANNING

- According to this Group there are currently no future plans
- Better inform this Group about specific plans available
- A co-ordinated, redevelopment and upgrade program for the taxi rank
- Buses have to compete with taxis
- Bradford taxi rank is unregulated and disorganised
- Facilities must be top class
- Emphasis on safety

Holding area and other taxi ranks

- A positive attitude towards proposed new holding area

Marketing plan and funding

- There must be a clear marketing plan for the development and redevelopment of the taxi facilities plus the CBD
- Funding must be obtained from various sources

“Maintenance: broad overview of problem areas include water, cleanliness, drainage, toilet facilities and potholes”



Redevelopment and upgrade strategy

- A combined strategy based on all the above mentioned must be in place



SWOT ANALYSIS

Based on Key Issues

<p>STRENGTHS</p> <ul style="list-style-type: none">• Capital of North West Province• Very large population• 98% of commuters use taxi's• 82% of households mainly depend on taxi transport• Well serviced• Strong contribution to local economy	<p>WEAKNESSES</p> <ul style="list-style-type: none">• Ownership• Management lacking• Maintenance lacking• Facilities lacking• Unlicensed taxis• Poor law enforcement• Operating licences
<p>OPPORTUNITIES</p> <ul style="list-style-type: none">• Taxi industry will remain main transport next 15 to 20 years• New/upgrade/revitalise facilities• Provide in needs of taxi industry• Upgrade business sector/formal/informal• Future plan/marketing/funding• Involvement of all stakeholders	<p>THREATS</p> <ul style="list-style-type: none">• Not to do anything• Further decay and deterioration

The Economic Contribution made by the Taxi Industry:



Based on Taxi Commuters and Hawkers/Informal Traders:

- 3.8million passengers per month
- Annual spend on taxi fees per household R740m
- Annual taxi fees by passengers R766m
- Annual Spend on Formal Retail by Commuters R5bn
- Total retail spending in CBD of Mahikeng between R 11bn and R 12bn
- Annual Spend on Informal Retail by Commuters R71m



Based on Taxi Operations:

- 3.8million passengers per month increasing to 4.0 to 4.2 million passenger trips by 2026
- Number of passengers per day 126 667
- Number of taxi trips per day 8 444
- Number of taxis based on 6.5 trips per day 1 299
- Number of Taxis Arriving Morning peak 870
- Number of Taxis departing afternoon peak 1 052
- Total distance travelled per year is 56 million km increasing to 62million km by 2026
- Total spend on fuel per year R122m
- Annual expenditure on taxi operations R174m
- Total income generated by taxi industry is ±R740m
- Total Income for Taxi Associations is ±R277m

A BILLION RAND BUSINESS AND SERVICE TO THE COMMUNITY WITH UPSCALE OPPORTUNITIES

1. BACKGROUND

Mahikeng is the **capital city** of the North West Province. The CBD, as a strong economic node, is **very busy, vibrant** and **commercially successful**, and fulfils a strong **regional role** supporting a very well established local and long-distance Taxi Industry.

The **purpose** of this report is to get a much better understanding of the whole Taxi Industry including commuters, formal and informal businesses, the Taxi Association and operators, as well as taxi drivers. Bus operators were also included in the broader survey.

A better understanding will assist in the upgrade and improvement of all Public Passenger Facilities (including bus and rail) as well as the revitalisation of the CBD.

2. RESEARCH OBJECTIVES

The **objectives** of the market surveys were the following:

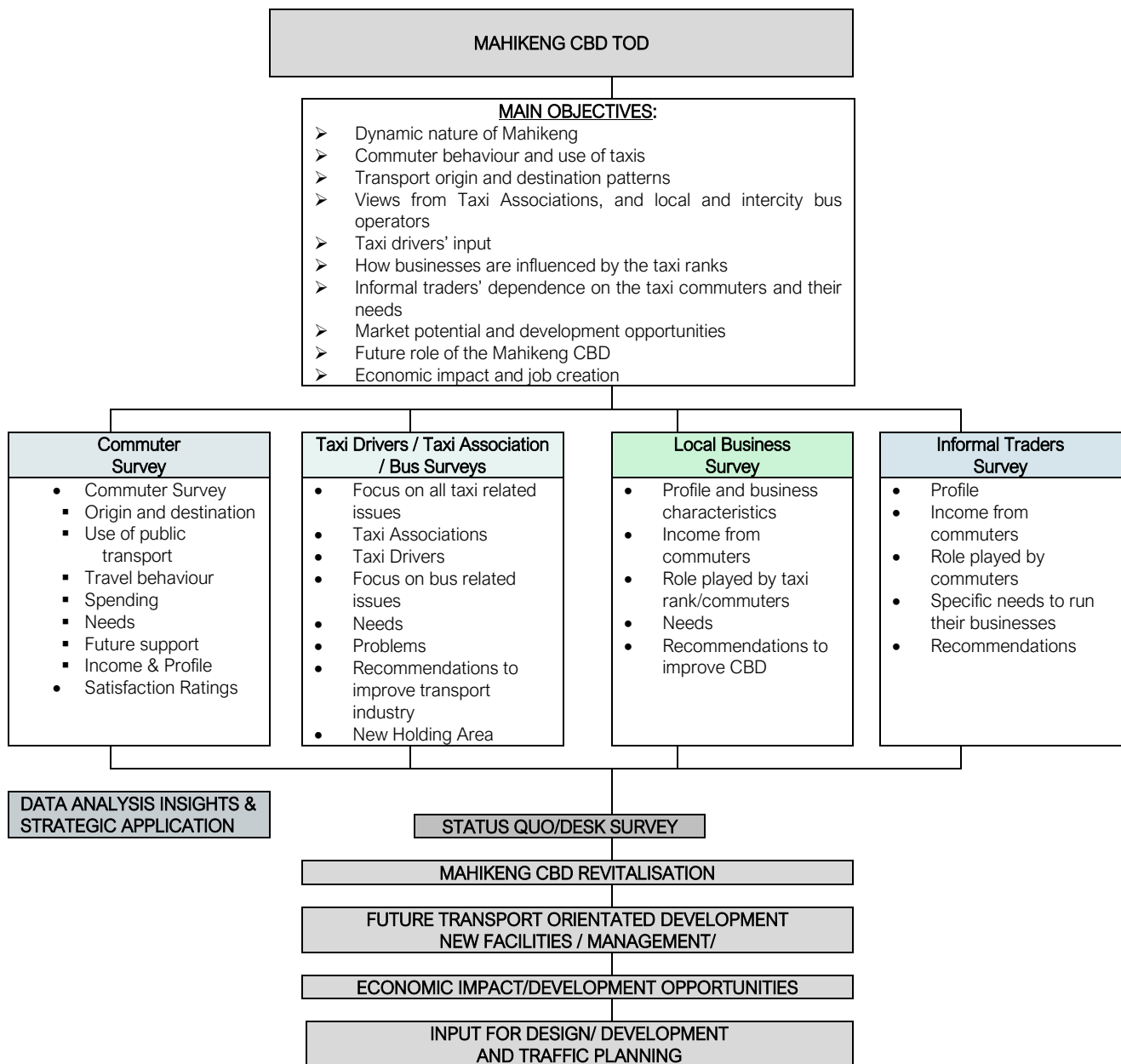
- To understand the **commuters** and their behaviour in terms of taxi transport;
- To focus on **formal and informal businesses**, the contribution made by taxis and their involvement in the CBD of Mahikeng;
- To determine from the **Taxi Associations**, their **operators** and **taxi drivers** their specific needs in terms taxi facilities, the operation of the taxi rank and their specific recommendations to upgrade the area; and
- To focus on their views regarding a **new taxi holding area**.

All this information forms the basis for further transport planning and the establishment of quality taxi facilities. The secondary outcome will assist in the redevelopment of the CBD

3. RESEARCH METHODOLOGY

Diagram 3.1 gives an indication of the research process followed to answer the abovementioned questions. This research focused on data **collection** as well as to add **insights** to formulate strategic objectives to **upgrade existing and new taxi facilities** and to **revitalise** the CBD of Mahikeng.

DIAGRAM 3.1 DIFFERENT RESEARCH STUDIES INCLUDED IN MAHIKENG TOD



3.1 Commuter Survey

The commuter survey was conducted from Tuesday 2 March to Saturday 6 March 2021. In total **376** face to face interviews were conducted by trained fieldworkers under direct supervision of senior staff.

Table 3.1: Number of Commuter Interviews Conducted

Day of interview	Total
Tuesday	84
Wednesday	86
Thursday	87
Friday	88
Saturday	31
Total Responses	376
Place of interview	Total
Block 1 – Bradford Rank	112
Block 2 - Towers	67
Block 3 - Waltloo	65
Block 4 – Northwest Mall	65
Block 5 – Cash & Carry	67
Total Responses	376

3.2 Taxi Driver Survey

Face to face discussions were held with **50** taxi drivers at different locations throughout the CBD and specifically at Bradford taxi rank.

Table 3.2: Number of Taxi Driver Interviews Conducted

Location of interview	Total
Total Responses	50
Block 1: Bradford	22
Station Road (Blocks 2-5)	28

3.3 Workshop with Executive members and operators of different Taxi Associations

Face-to-face group discussions were held on 2 March 2021 with Leadership and Operators of the Ngaka Modiri Molema District Regional Taxi Council and 8 Local Taxi Associations. The workshop consisted of **two components** namely:

- A completion of a **questionnaire**, focusing on the **strengths** and **weaknesses** associated with the current taxi facilities as well as identifying their specific **needs** in terms of the operation and running of the taxi business;
- to obtain inputs from the Taxi Industry on the **PRE origin / destination statistics**;
- A **group discussion** with the same operators focusing on **recommendations** how to improve the taxi industry in Mahikeng.

In total number of people (**25**) participated in this group discussion (see name list as **Annexure 1**).

3.4 Informal Trade Survey

In total **60** hawkers/informal traders were included in this particular face to face survey.

Table 3.3: Number of Informal Trader Interviews Conducted

Location of interview	Total
Total Responses	60
Block 1: Bradford Taxi Rank	15
Block 2: Station / Towers	14
Block 3: Waltloo & Boxer	13
Block 4: Northwest Mall	9
Block 5: Cash & Carry	9

3.5 Formal Business Survey

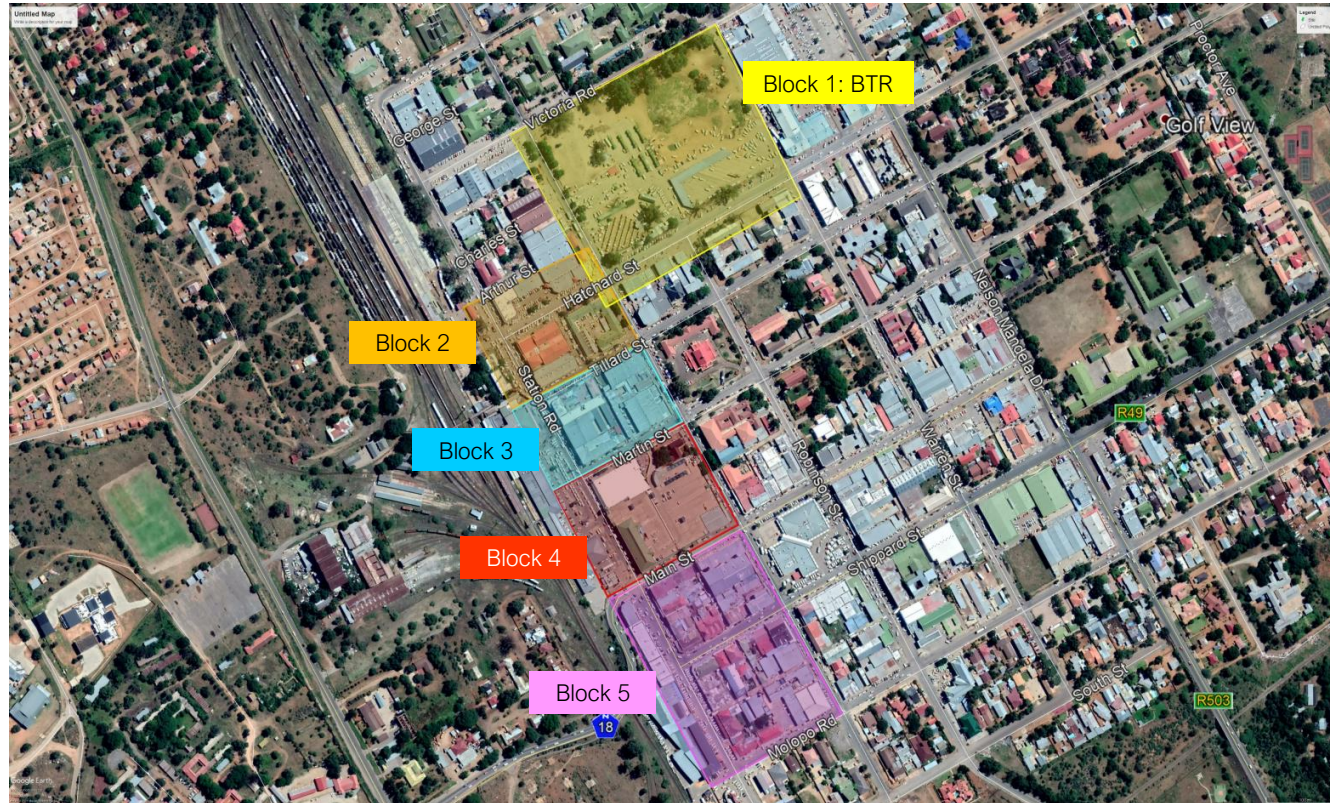
In total **60** businesses all over the CBD were included in a face-to-face interview.

Table 3.4: Number of Formal Trader Interviews Conducted

Number of interviews	Total
Total Responses	60
Retail	46
Service	14
Total Responses	60
Block 1: Bradford Taxi Rank	9
Block 2: Station / Towers	9
Block 3: Waltloo & Boxer	16
Block 4: Northwest Mall	18
Block 5: Cash & Carry	8

3.6 Mahikeng CBD Study Area

MAP 1: MAHIKENG TOD – BLOCKS IN CBD



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Map Produced by Urban Studies, 2021
Software: Google Earth Pro

MAP 2: MAHIKENG TOD – NEW PROPOSED HOLDING AREA



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Map Produced by Urban Studies, 2021
Software: Google Earth Pro

3.7 Report Format

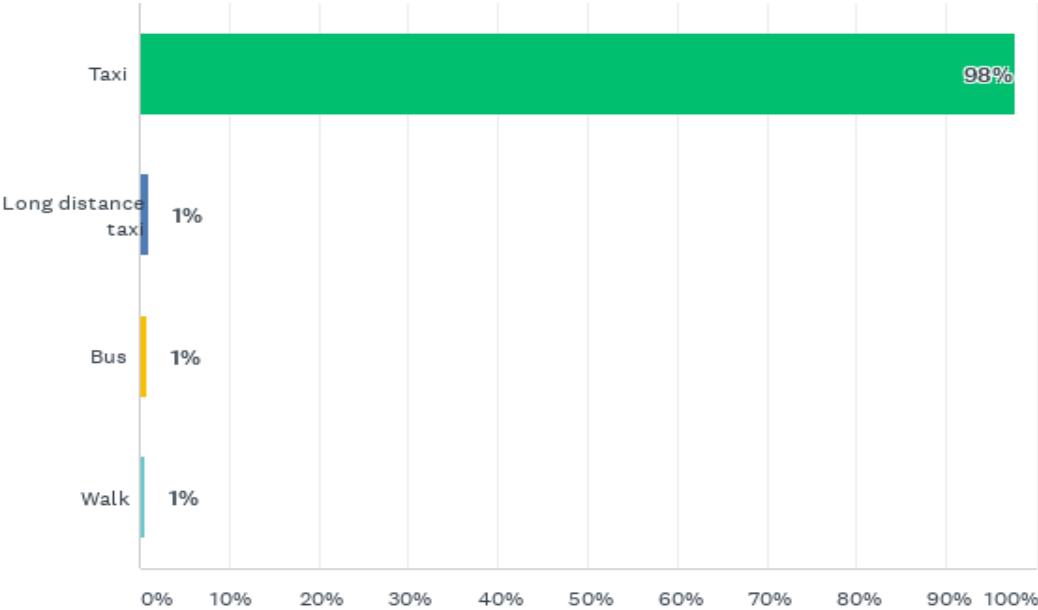
The rest of the report consists of tables, graphs and maps. The headings of the graphs and tables are **similar** to the question used in the questionnaire. This is done to get a very clear understanding of the content of each graph and table.

4. RESULTS OF COMMUTER SURVEY

4.1 Type of Transport

Of all 376 commuters interviewed, **98%** make use of **taxi transport** to the CBD. Long distance taxis as well as buses are limited to 1% each. The estimated percentage using private **motor vehicles** was less than **5%**. This clearly indicates the dominance of taxis transport. **20%** of these commuter households own motor cars. This will further increase in future but taxi transport will still dominate for at least 15 to 20 years.

The most important type of transport that is used, to get to the CBD

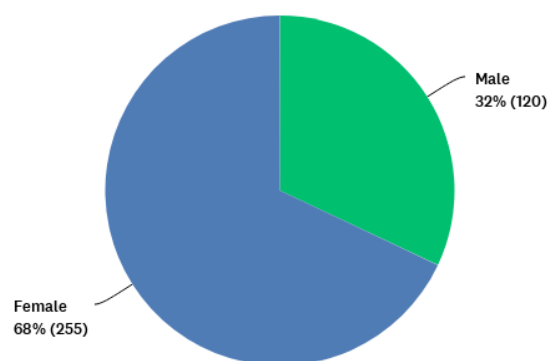


4.2 Demographic and Socio-economic Profile of the commuters

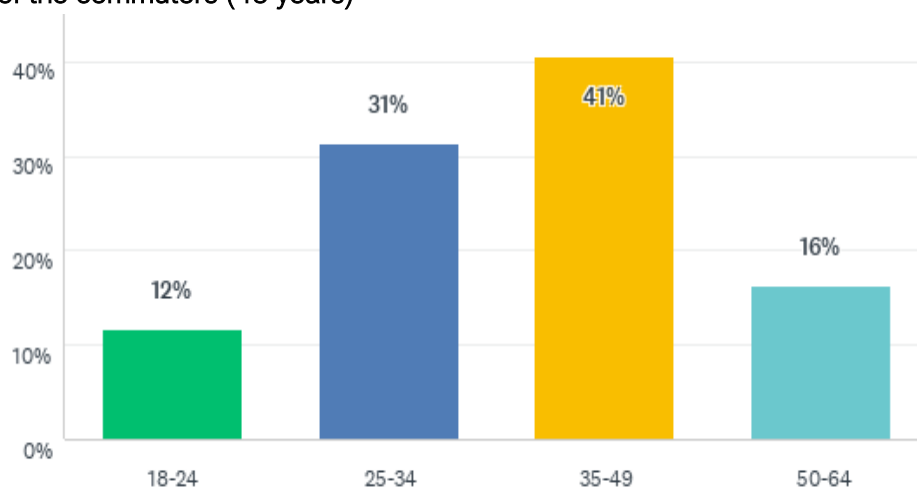
The commuter profile is characterised by the following:

- The majority of the taxi commuters are **female** (68%);
- Average age of **35** years;
- Household size is 4.5, which is larger than the South African average of 3.6 people per household;
- **90%** of all households have at least one earner or more earner per household;
- **70%** of all households are in the full nest life cycle stage-mainly families with school going children.

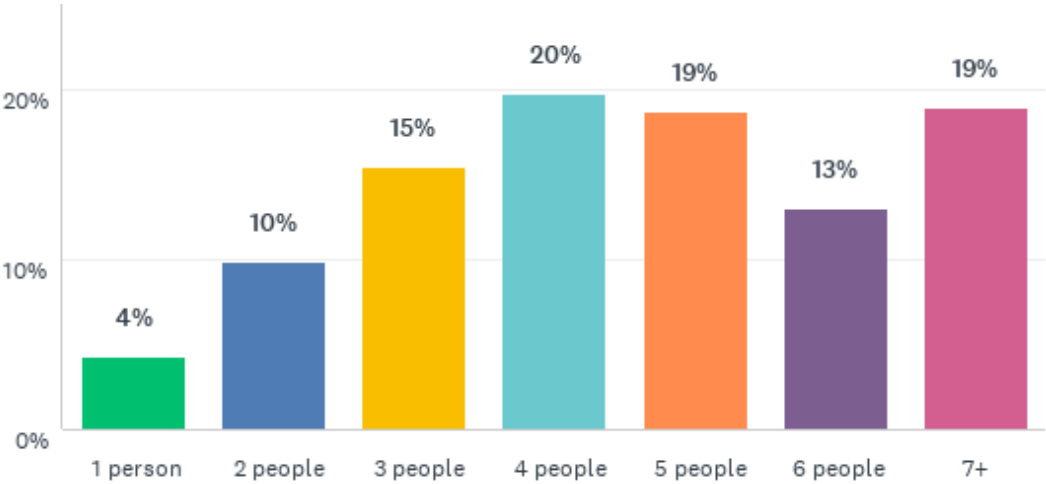
Gender Profile



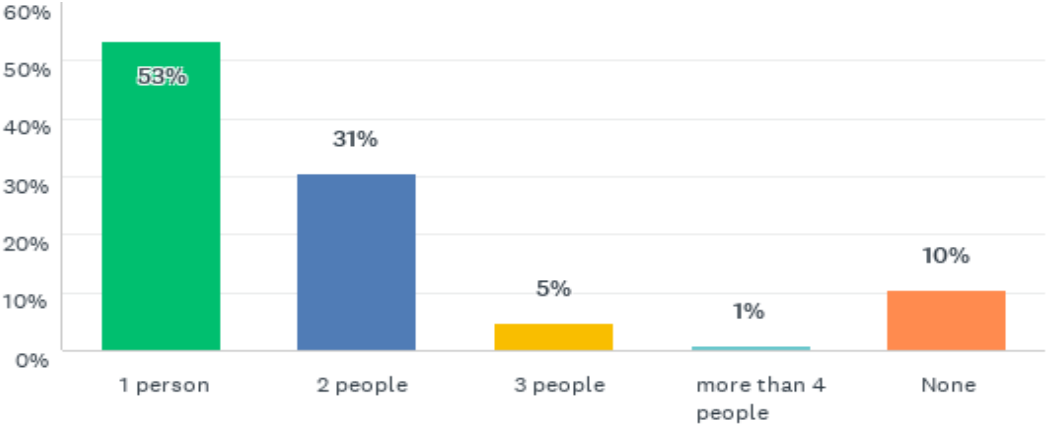
Average age of the commuters (43 years)



Number of people living per household (Average of 4.5)

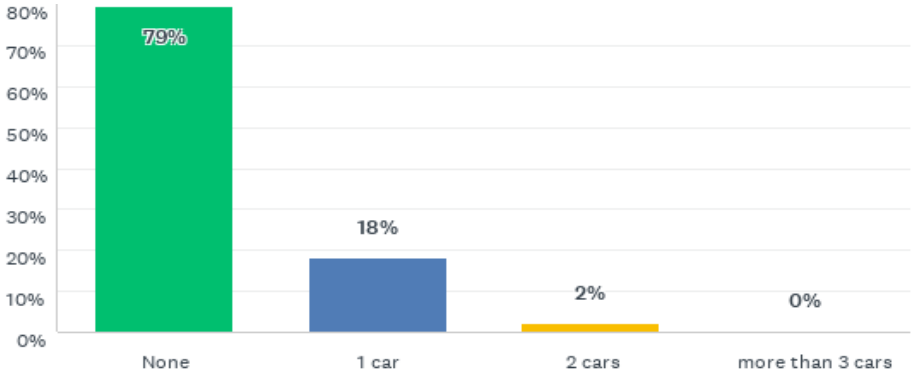


Number of earners (Average 1.8)



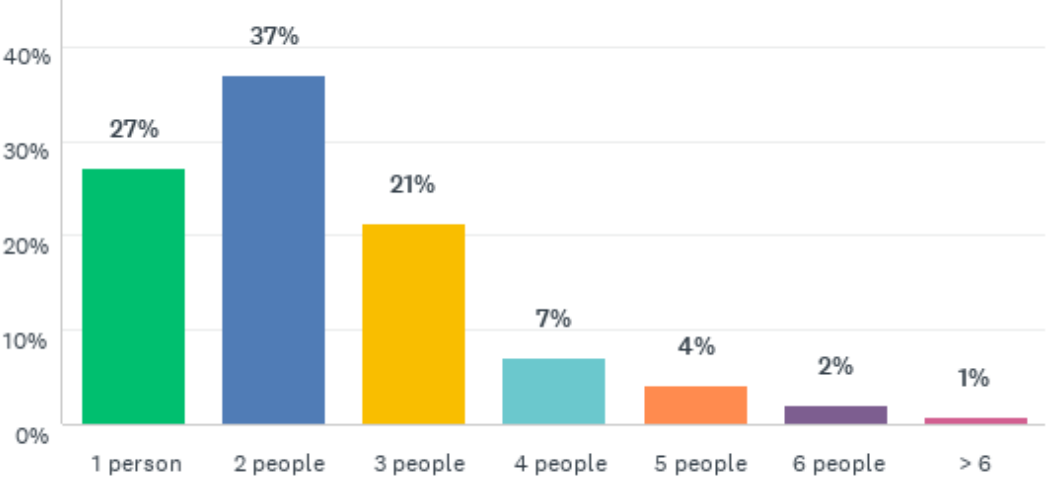
It is very important to note that **79%** of all respondents **do not** own a car. This corresponds with similar market research where $\pm 20\%$ of households in rural and smaller township areas own a car.

Cars per household

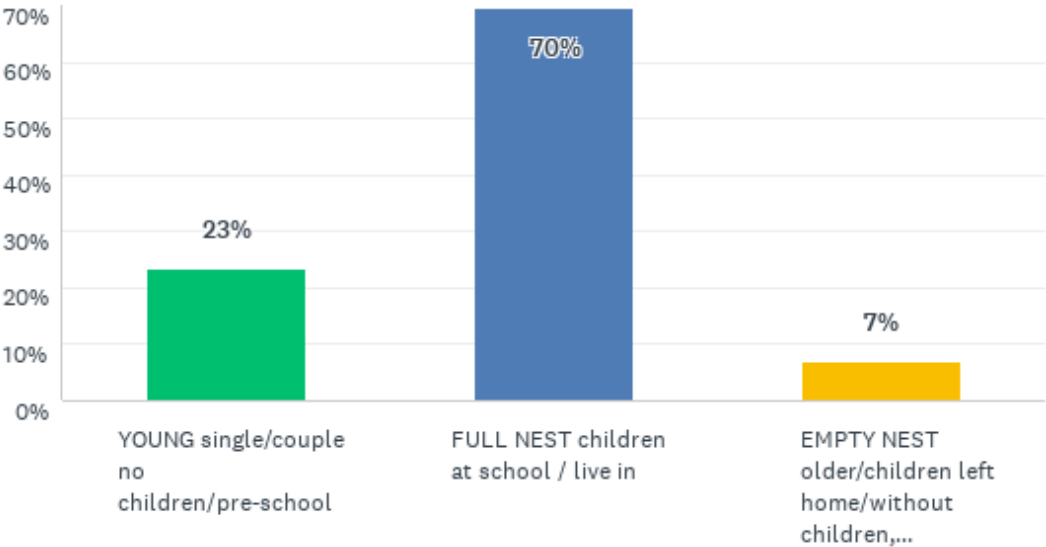


At least **2.3** people in each household make use of taxi transport. This clearly indicates the **high dependency on taxis**. There is however **no scholar transport** provided at the moment

Number of people making use of taxi transport per household

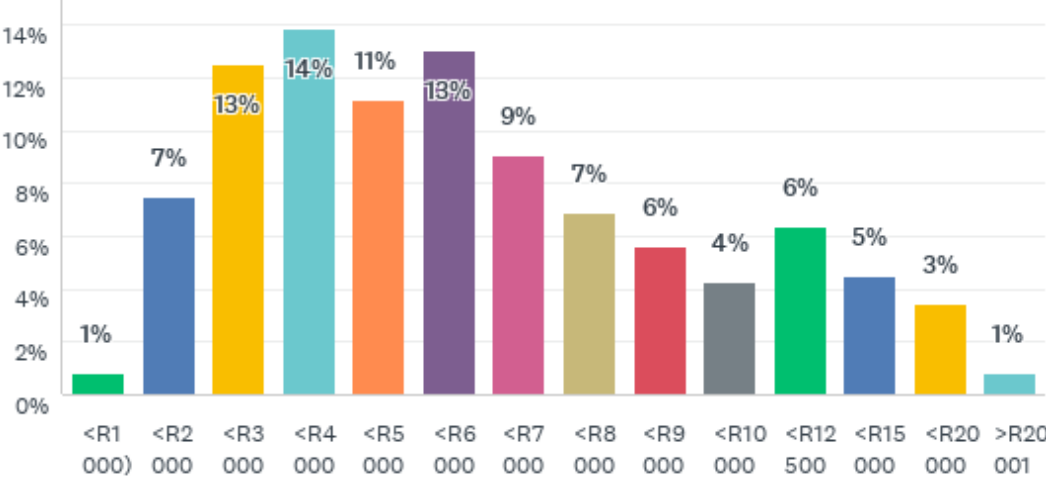


Life cycle of these households

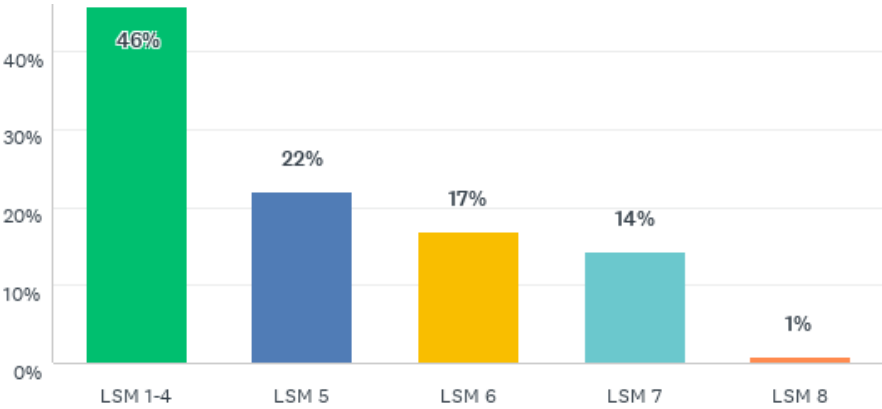


The average household income is between R5 000 and R7 000 per month. This correlates with similar studies elsewhere. Their income (for 80%) was **negatively** influenced by Covid-19. Almost **60%** are in LSM 2-5 Only **1%** of the total sample was disabled.

The total monthly household income

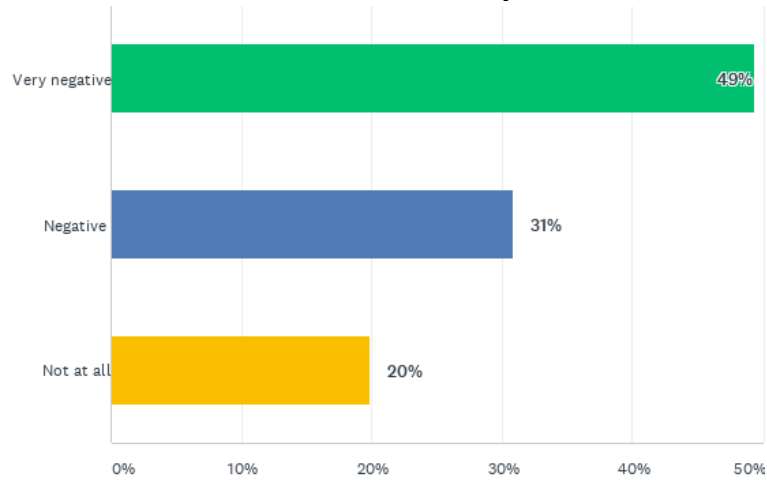


Monthly household income according to LSM categories

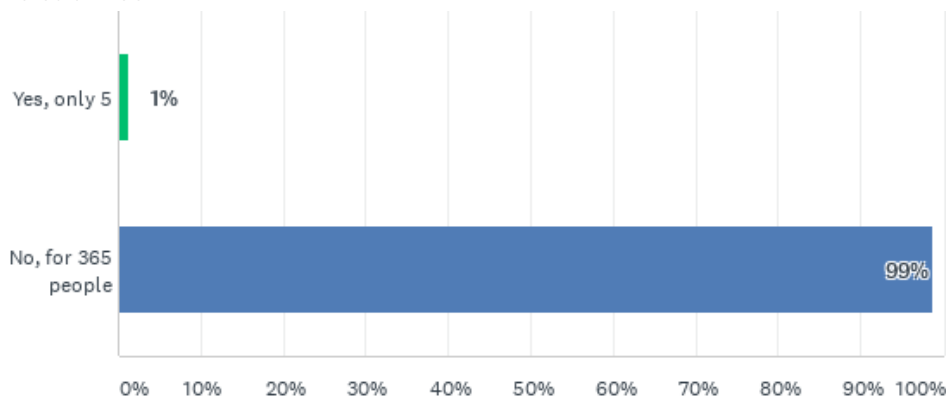


LSM 1-4	<R5 000	LSM 6	R 7 000	R 10 000	LSM 8	R 20 000	R 30 000	LSM 10	R 40 000	R 75 000
LSM 5	R 5 000	R 7 000	LSM 7	R 10 000	R 20 000	LSM 9	R 30 000	R 40 000	LSM 10+	>R75 000

The extend to what households' income were influenced by Covid-19



Persons with disabilities



The taxi commuter is mainly female, 36 years old in the full nest life cycle stage, earning between R 5 000 and R 7 000 per month. The majority are in LSM 2-5 and only 20% have cars.

4.3 Origin and Destination of the Commuters

The main focus of this commuter survey was to clearly distinguish between the different areas the commuters originate from and their destination in the CBD.

4.3.1 Origin

Table 4.1 and Map 2 and 3 clearly indicate the **origin** of the commuters. The most important are:

- Area 2
- Area 4
- Cluster 8
- Cluster 10
- Cluster 11
- Surrounding towns and outside areas.

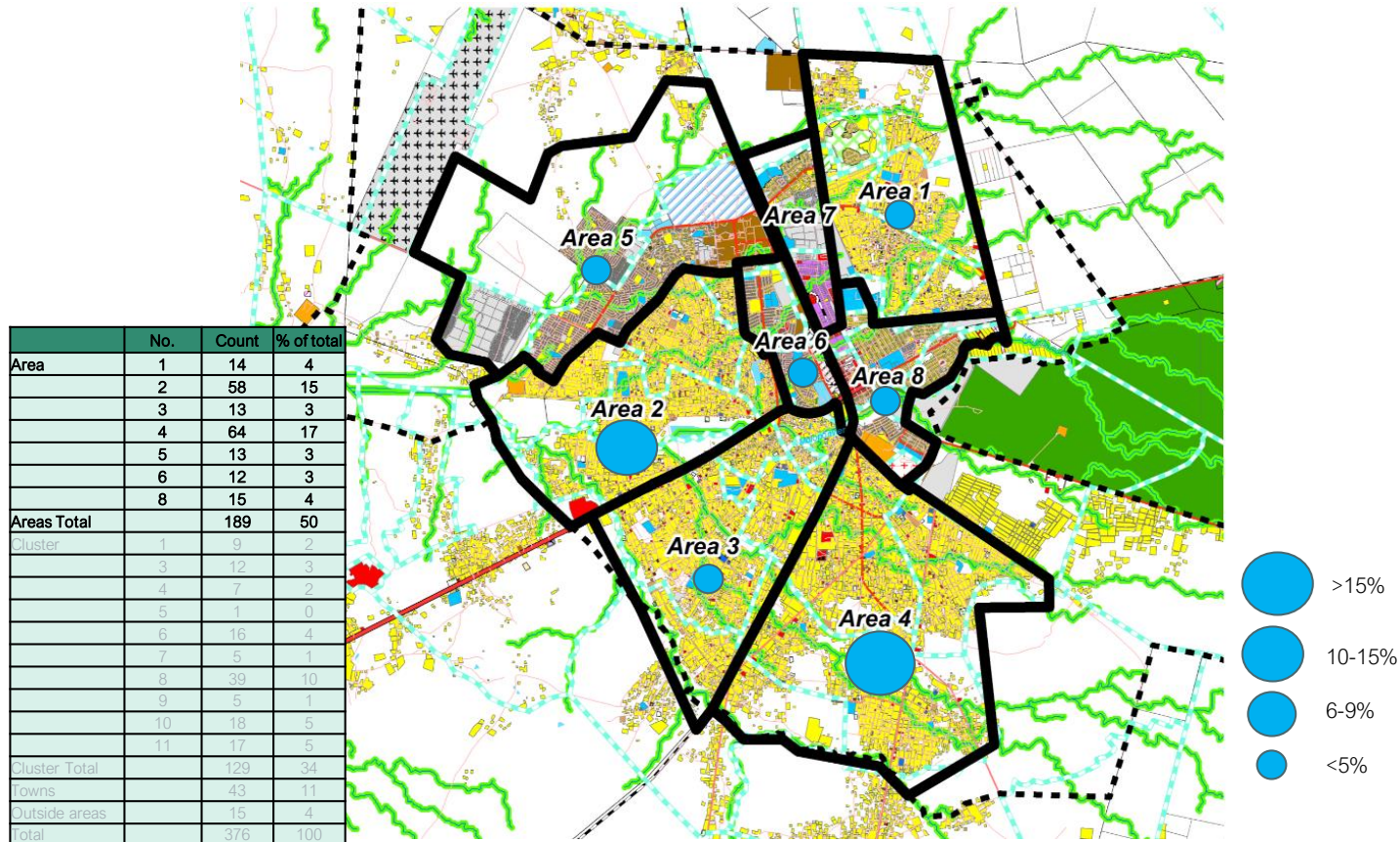
Table 4.1: Origin

Table 4.1 gives an indication of the origin of the commuters. Refer to **Appendix 2** for the full list of areas.

Table 4.1 Origin of Mahikeng CBD Taxi Commuters – A Summary

	No.	Count	% of total
Area	1	14	4
	2	58	15
	3	13	3
	4	64	17
	5	13	3
	6	12	3
	8	15	4
Areas Total		189	51
Cluster	1	9	2
	3	12	3
	4	7	2
	5	1	0
	6	16	4
	7	5	1
	8	39	10
	9	5	1
	10	18	5
	11	17	5
Cluster Total		129	34
Towns		43	11
Outside areas		15	4
Total		376	100

MAP 3: MAHIKENG TOD - COMMUTER ORIGIN FROM SURROUNDING MAHIKENG SUBURBS (AREAS 1-8)



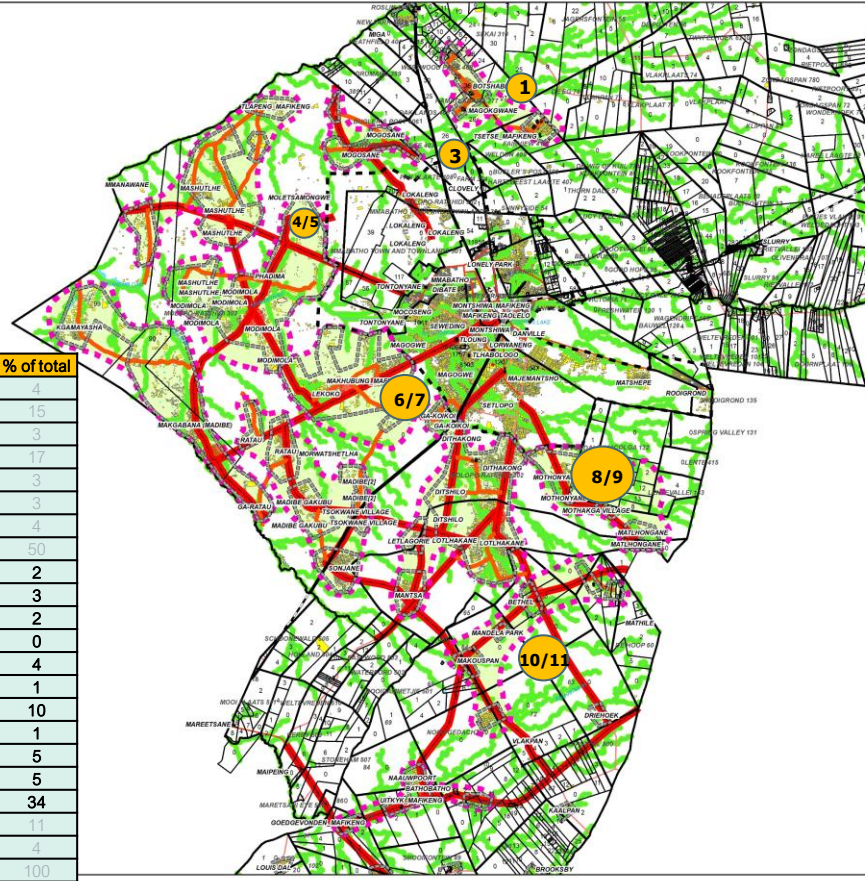
Map Produced by Urban Studies, 2021
Source: Maxim

MAP 4: MAHIKENG TOD – COMMUTER ORIGIN FROM SURROUNDING RURAL SETTLEMENTS (CLUSTERS 1-11)



8/9 Cluster No.

	No.	Count	% of total
Area	1	14	4
	2	58	15
	3	13	3
	4	64	17
	5	13	3
	6	12	3
	8	15	4
	11	17	5
Areas Total		189	50
Cluster	1	9	2
	3	12	3
	4	7	2
	5	1	0
	6	16	4
	7	5	1
	8	39	10
	9	5	1
	10	18	5
	11	17	5
	Cluster Total		129
Towns		43	11
Outside areas		15	4
Total		376	100



RURAL VILLAGES PROPOSALS (CLUSTERS)

- Legend**
- Parent Farms
 - Farm Portions
 - Dams
 - Rivers & Streams
 - Railway
 - Major Road
 - Main Road
 - Secondary Road
 - Land Use:
 - Barot Store
 - Business
 - Cafe
 - Cemetery
 - Church
 - Community Brick Making Factory
 - Community Hall + SASSA
 - Community Project
 - Health Centre
 - Municipal Office
 - Pre-School
 - Residential
 - Residential + Hardware
 - Residential + Mechanic
 - Residential + Tavern
 - Residential + Truck Shop
 - Residential + Walking
 - SASSA
 - School
 - Soap Metal
 - Street Park
 - Sport Complex Not used
 - Tavern
 - Taxi
 - Traditional Office
 - Truck Shop
 - Water Tower

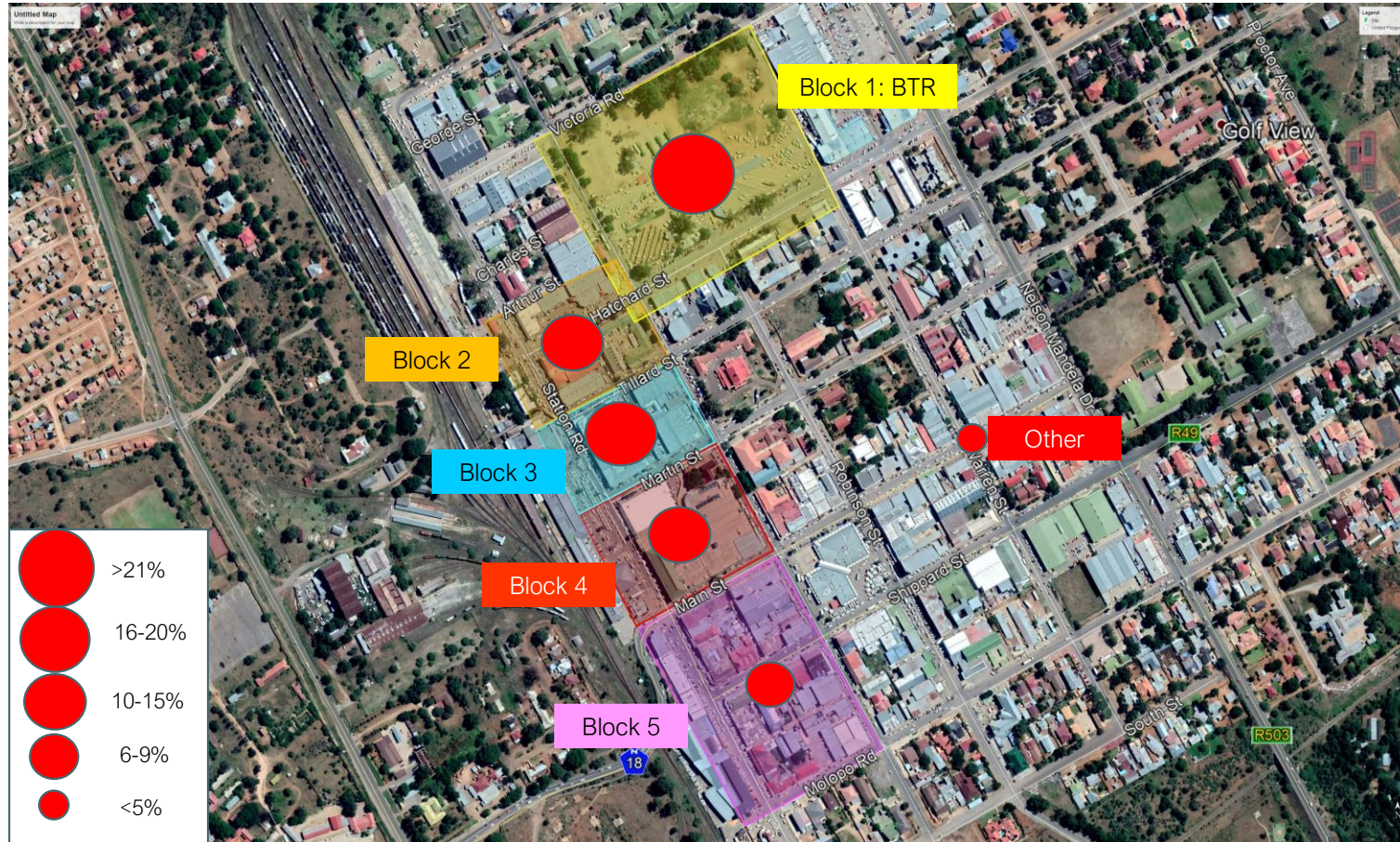
- Proposals**
- Mafikeng Urban Fringe
 - Clusters
 - Village Edge
 - Multi-Purpose Node
 - Main Collector Roads
 - Secondary Collector Roads
 - Natural Open Space
- Circle sizes representing commuter percentages:
- >15%
 - 10-15%
 - 6-9%
 - <5%

Map Produced by Urban Studies, 2021
Source: Maxim

4.3.2 Destination -where did the commuters disembark/got off the taxi

The destination in the CBD is very clear with **54%** disembarking along the **streets**, mainly Station Road and **46%** at Bradford taxi rank. Block 3 (Vicinity of Waltloo in Station Road is the **second** most important area where commuters disembark. (See Map for detail). ***This information is critical and it is an objective of the project to attract / remove taxis from the street to Bradford Park Taxi Rank***

MAP 5: MAHIKENG TOD – WHERE COMMUTERS DISEMBARK



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Map Produced by Urban Studies, 2021
Software: Google Earth Pro

4.4 Commuter Travel Behaviour

4.4.1 Main reasons for using Taxi transport

The main reasons for using taxi transport during the survey period were to do **shopping** (72%), to **pay accounts** (23%), to collect pension and Sassa payments (17%) and to **go to work** (15%). The other reasons include to buy stock, to socialise with friends, to go to school and college, to visit medical facilities, and in transit, all on much lower levels. It confirms the role of the CBD as a destination while work opportunities exist across the Greater Mahikeng area.

The Municipality has communicated the construction of a one stop Government Centre not far from Bradford Park (See Map 8) and the Mahikeng Mall which is now being extended substantially. These anticipated land use changes will possibly have an impact on commuter movements within the CBD of Mahikeng. All this will be taken into consideration.

The main reason for using a taxi /bus to come to the CBD on the day of the interview

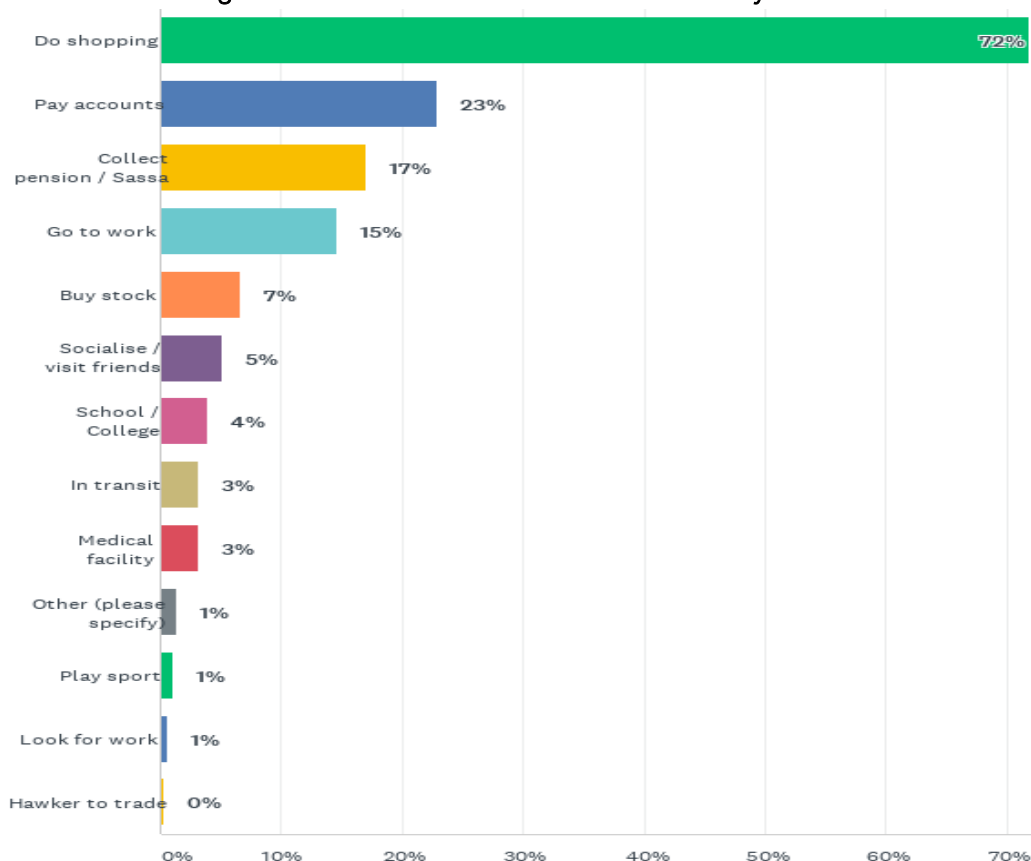


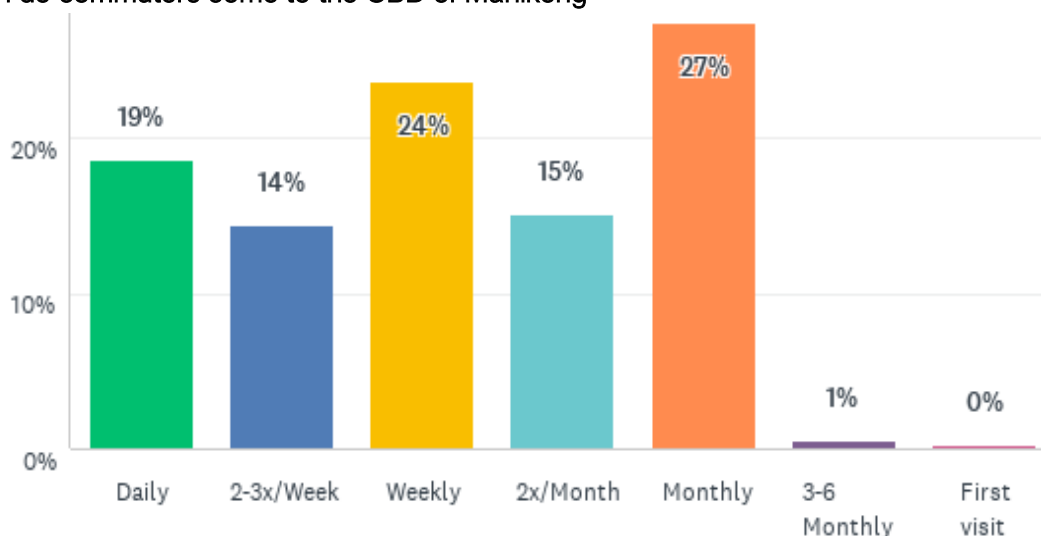
Table 4.2: Reasons for Using Taxi Transport Per Taxi Rank (%)

Taxi used to go to following destinations	Total	Block 1	Block 2	Block 3	Block 4	Block 5
Total Responses	545	139	99	118	92	97
%	100	26	18	22	17	18
Do shopping	274	72	63	57	34	48
Pay accounts	86	25	23	17	11	10
Collect SASSA	64	17	7	29	3	8
Go to work	30	0	0	6	15	9
Buy stock	26	3	2	0	4	17
Socialise / visit friends	19	6	0	4	9	0
School / College	15	4	2	3	5	1
In transit	12	9	0	0	1	2
Medical	12	3	1	1	5	2
Play sport	4	0	0	0	4	0
Look for work	2	0	0	1	1	0

4.4.2 How often/Frequency of using taxi transport

98% make use of taxi transport to the CBD. 19% visit the CBD on a daily basis, this also corresponds with the number of workers coming to the CBD, 14% use taxi transport two to three times per week, and 24% once per week. In total, 57% of all commuters visit the CBD on a weekly basis. 27% of the commuters only visit the CBD once a month. It is also important to note that there are no first visits to the CBD. This confirms well established support with no newcomers

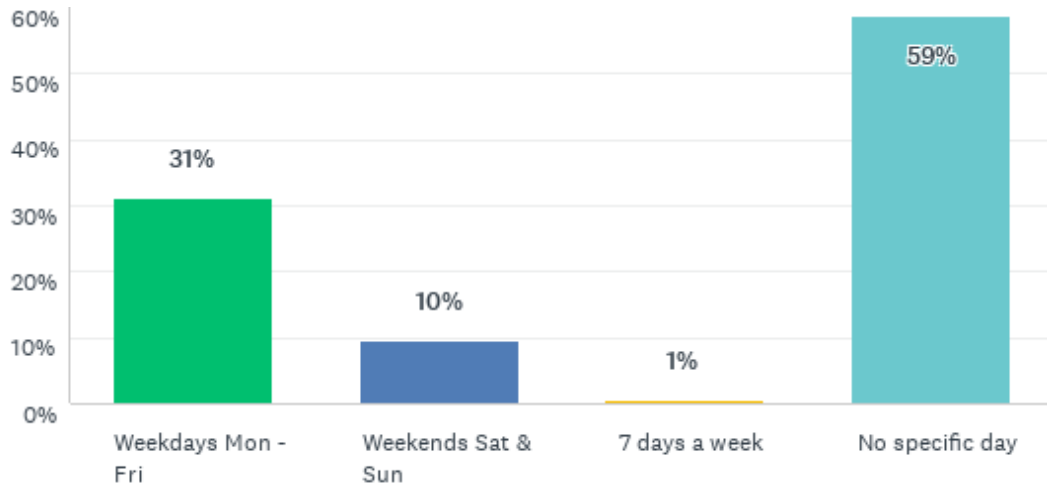
How often do commuters come to the CBD of Mahikeng



4.4.3 When/Visit the CBD of Mahikeng

59% of the commuters visit the CBD on no specific day. 31% however visit the CBD from Mondays to Fridays. The proportion visiting the CBD on a weekend is **much lower**. This is very important information that will be taken into consideration in the future trip generating model,

When commuters normally visit the CBD of Mahikeng



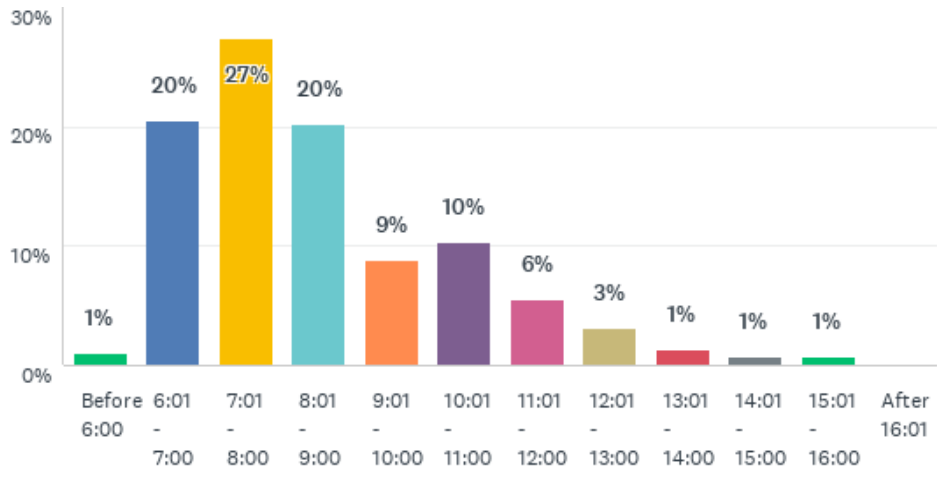
4.4.4 Travel behaviour

The **purpose** of this section is to understand how people operate using taxis as their main mode of transport and to identify specific behavioural patterns.

4.4.4.1 Leaving home

The majority (**67%**) leave home at between **6 and 9 a.m.** while a further **25%** leave home between 9 a.m. and 12 noon. This clearly coincides with the **morning peak hours**.

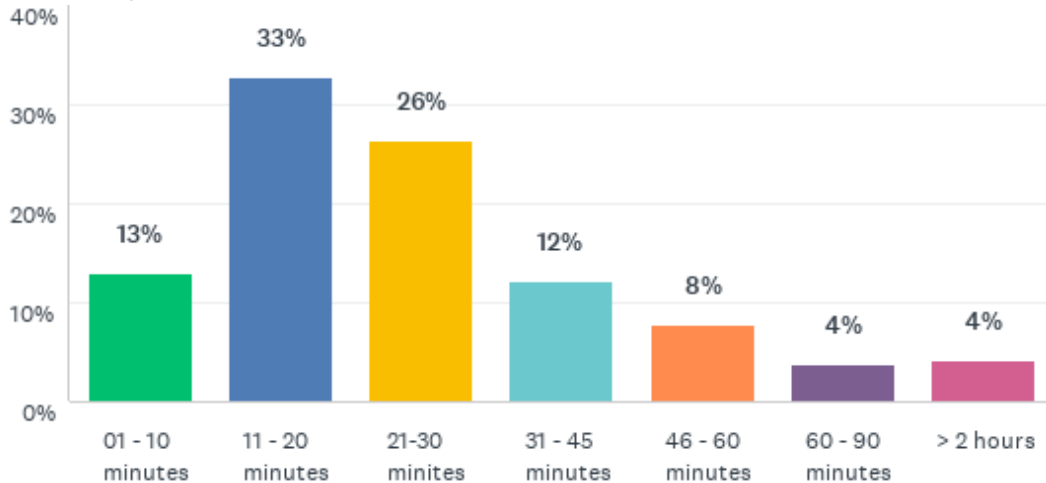
The time of the day commuters normally leave their home to come to the CBD of Mahikeng



4.4.4.2 Travel time

The **median** travel time to the CBD is **22-25** minutes. In total, **72%** travel for less than 30 minutes and 8% travel for longer than one hour. Those travelling for less than 30 minutes include all commuters from the Mahikeng suburbs (Areas 1-8) as well as some from the rural settlements (Clusters 1-8). This information also forms part of the trip generation model.

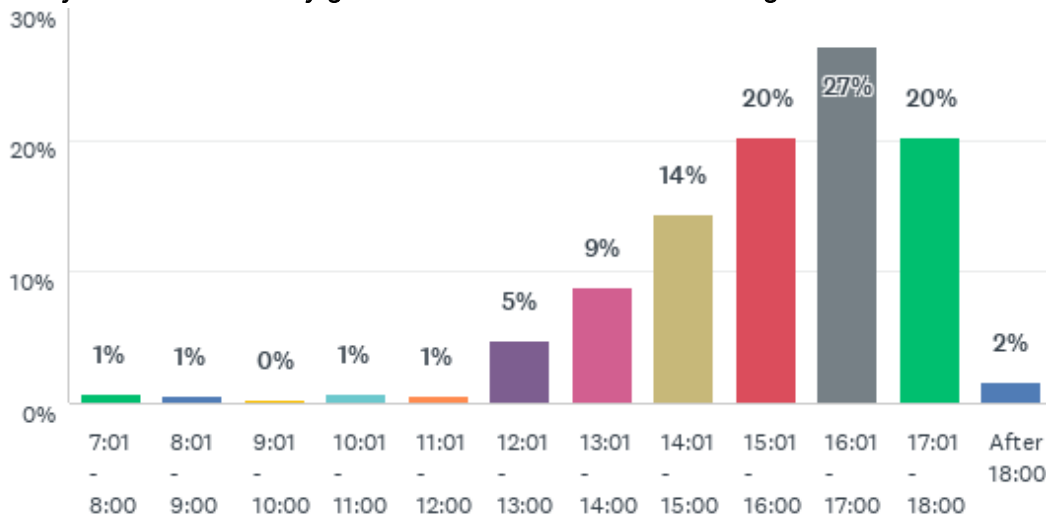
Average time the trip takes from home to the CBD



4.4.4.3 Return trip

The return trip home mainly starts from 3 pm until 6 pm.

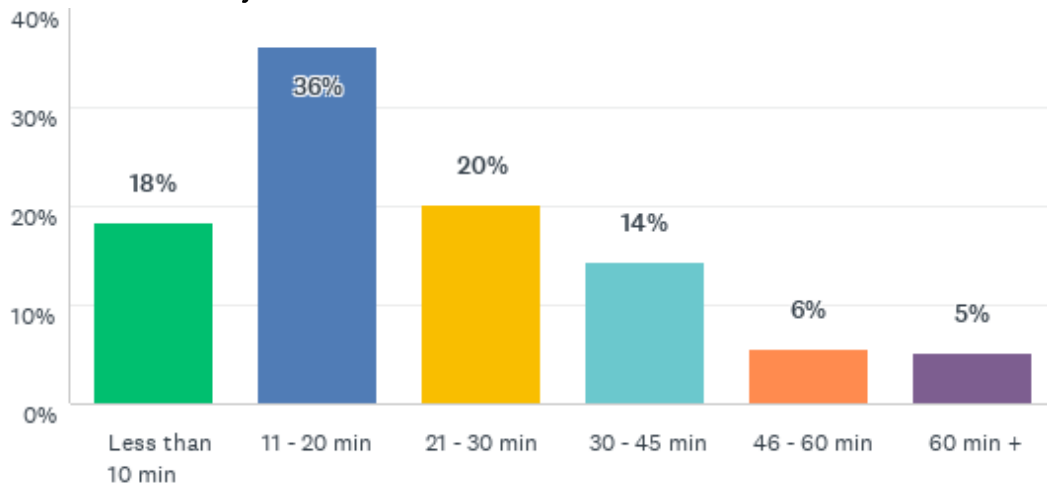
Time of the day commuters usually go home from the CBD of Mahikeng



4.4.4.4 Waiting period

Commuters were asked to indicate the waiting period before taxis leave. In total, **54%** waited less than **20** minutes, and only 5% waited longer than an hour. This is a good indication of the **availability** of taxis

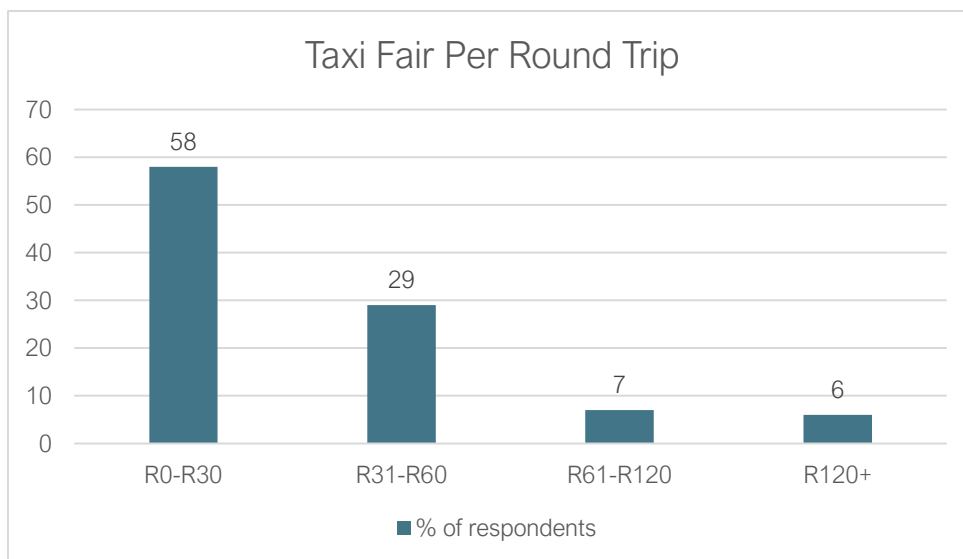
The time commuters normally wait before taxis leave



4.4.4.5 Expenditure on taxi transport

Round Trip

The majority of the commuters spend R24 on a round trip and a further 29% spend R43 on average per round trip, while only a small portion (13%) spend more than R60.



Monthly spend on Transport

43% of the taxi commuters spend up to R500 per month on taxi transport. A further 37% spend between R500 and R750 per month on transport. The average spend per household on taxi transport per month is R525. Bus transport is lower and commuters spend on average R300 per month. This information is only based on 1% making use of bus transport.

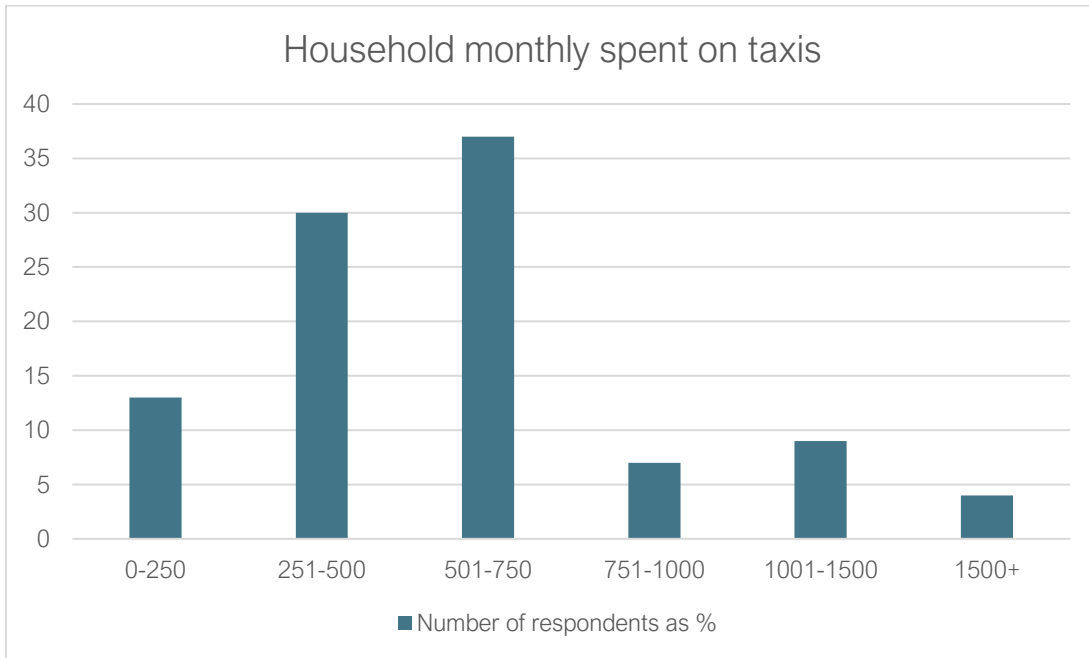


Table 4.3: Cost of Taxi Round Trip

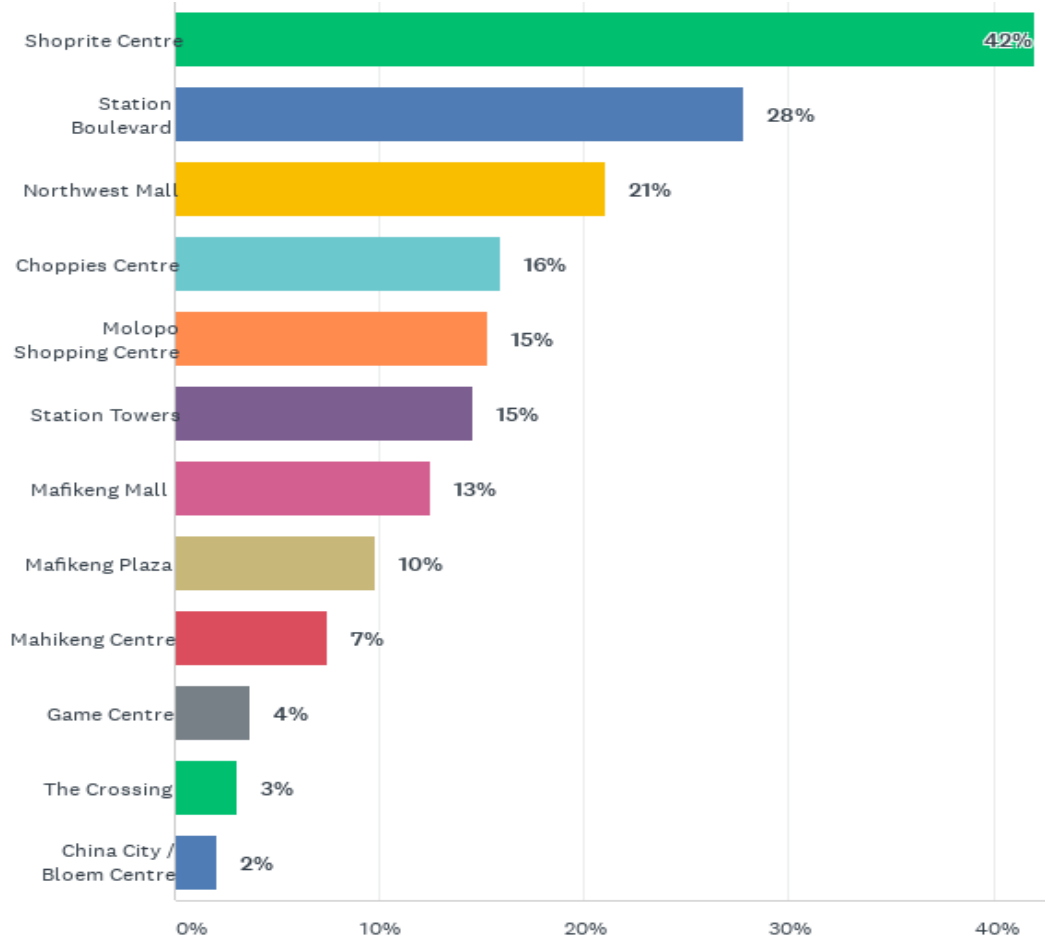
Cost of taxi round trip	Total	% of total
Total Responses	376	
R1-R30	220	59
R31-R60	108	29
R61-R120	26	7
R120 plus	22	5

4.5 Visiting CBD of Mahikeng

4.5.1 Shoppers - Centres Supported

The majority (72%) indicated that they visit the CBD to conduct shopping. The highest support is for the Shoprite Centre, followed by the Station Boulevard, Northwest Mall, Choppies Centre, Molopo Shopping Centre and Station Towers. These are also the areas with the **highest pedestrian activities**.

Centres mostly used for shopping in the CBD



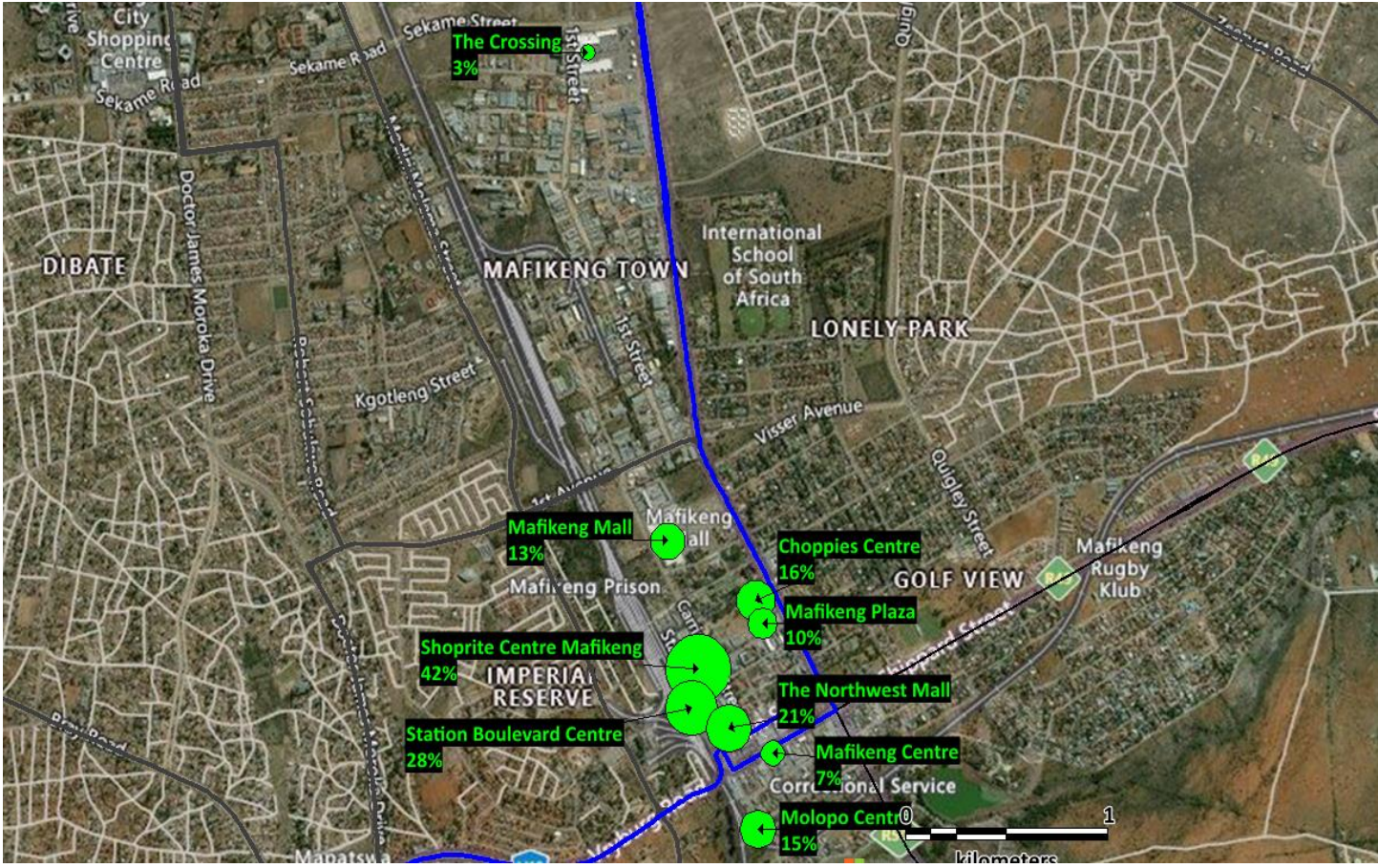
MAP 6: MAHIKENG – RETAIL FACILITIES



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Map Produced by Urban Studies, 2021
Software: MapInfo Pro v19

MAP 7: MAHIKENG – CENTRES MOST USED FOR SHOPPING

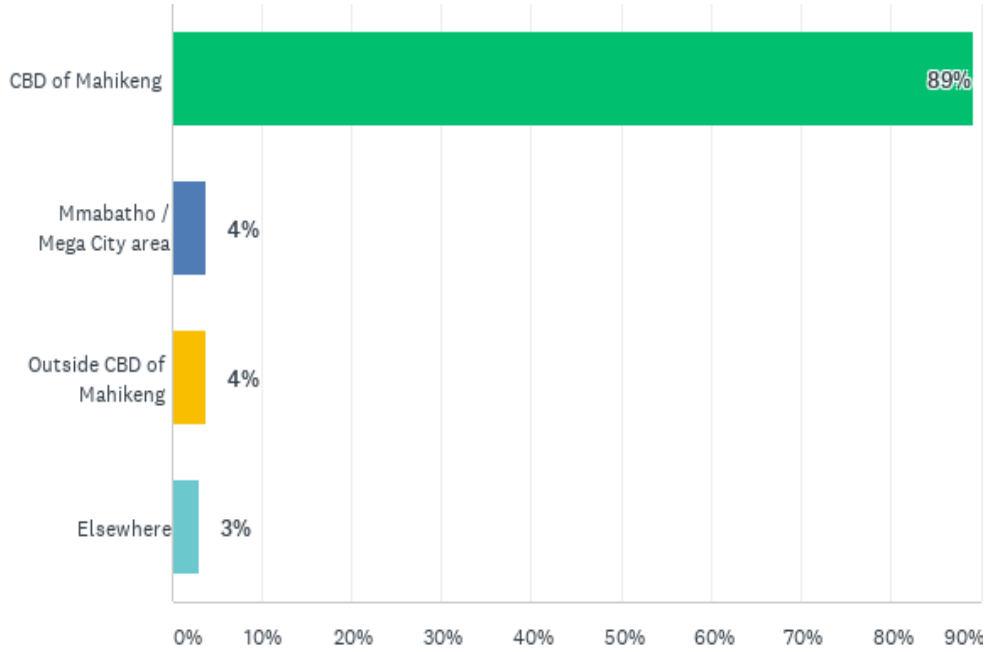


urbanstudies.co.za Map Produced by Urban Studies, 2021
 Software: MapInfo Pro v19

4.5.2 Workers

Of the 15% coming to the CBD to work, 89% work in the CBD of Mahikeng, 4% in Mmabatho, 4% outside the CBD while 3% work elsewhere.

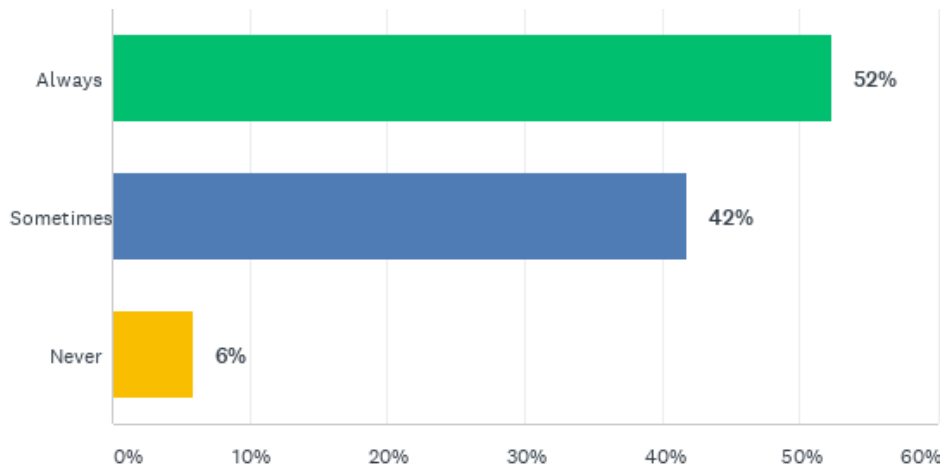
Destination for commuters coming for work



4.6 Use of Bradford Tax Rank

52% of the commuters indicated that they always make use of Bradford tax rank. This also corresponds with the high frequency of weekly visits. 42% indicated that they sometimes (up to once a month) support Bradford tax rank. Only 6% never make use of this facility.

How often commuters make use of the Bradford Tax Rank

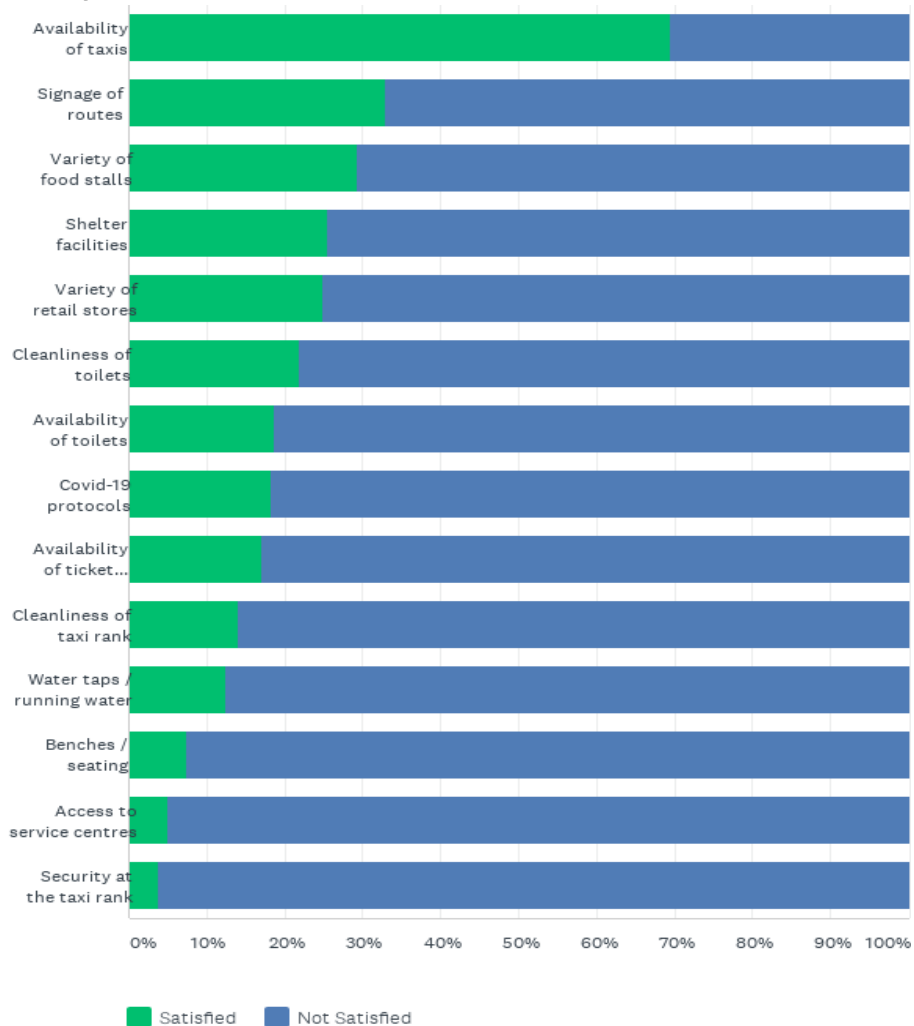


4.6.1 Satisfaction Rating with Bradford Station

Commuters were asked to indicate **how satisfied** they are with specific facilities offered at Bradford Taxi Rank. Commuters are only satisfied with the availability of taxis. This is also reflected in shorter waiting time for taxis to leave.

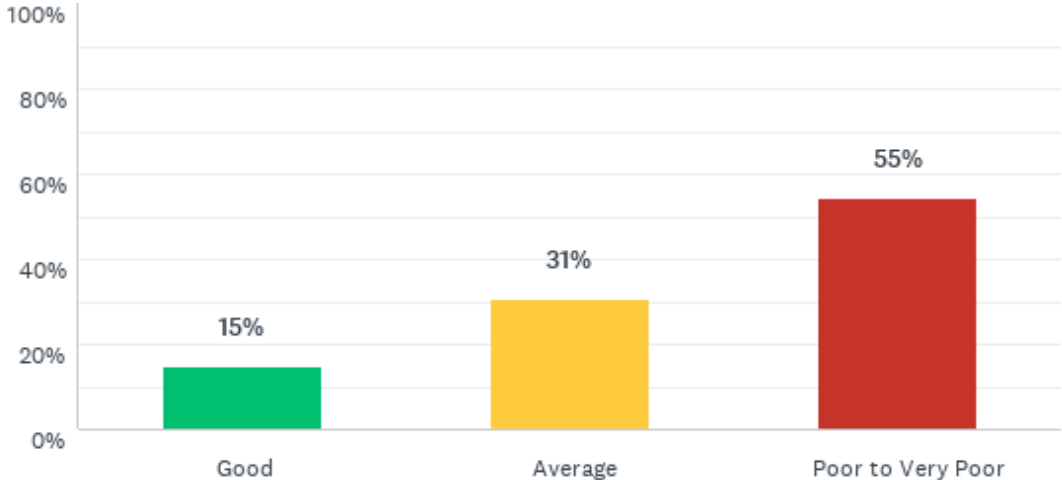
- The rest of the facilities reflect a very **high level of dissatisfaction**, namely:
 - Security at the taxi rank;
 - Access to services;
 - Benches and seating;
 - Availability of running water;
 - Cleanliness;
 - Availability of toilets;
 - Cleanliness of toilets;
 - Variety of retail stores/stalls inside the BTR;
 - Shelter facilities and
 - Variety of food stalls.

Satisfaction Rating - Bradford Taxi Rank



In total, **55%** of all commuters rated the facilities at Bradford taxi rank to be poor to very poor. Only 15% was satisfied with the facilities, while a further 31% indicated an average satisfaction rating.

Rating of the current facilities at Bradford Taxi Rank



4.7 Recommendations

All the **negative ratings** above should be regarded as a very clear indication of recommendations to improve the facilities. The recommendations will also be incorporated with all other studies to indicate the required level of upgrade.

5. RESULTS OF BUSINESS SURVEY

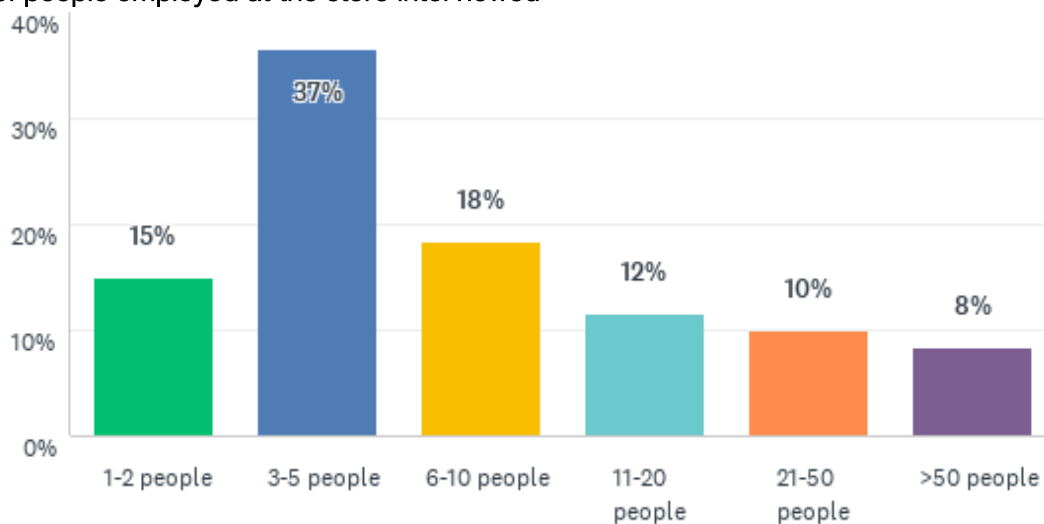
The **main objectives** with the business survey were the following:

- To understand the **operation of businesses** in the CBD of Mahikeng;
- To identify the **strengths and weaknesses**;
- To obtain **recommendations** how to **improve** the CBD and the business environment.

5.1 Characteristics of Businesses in CBD

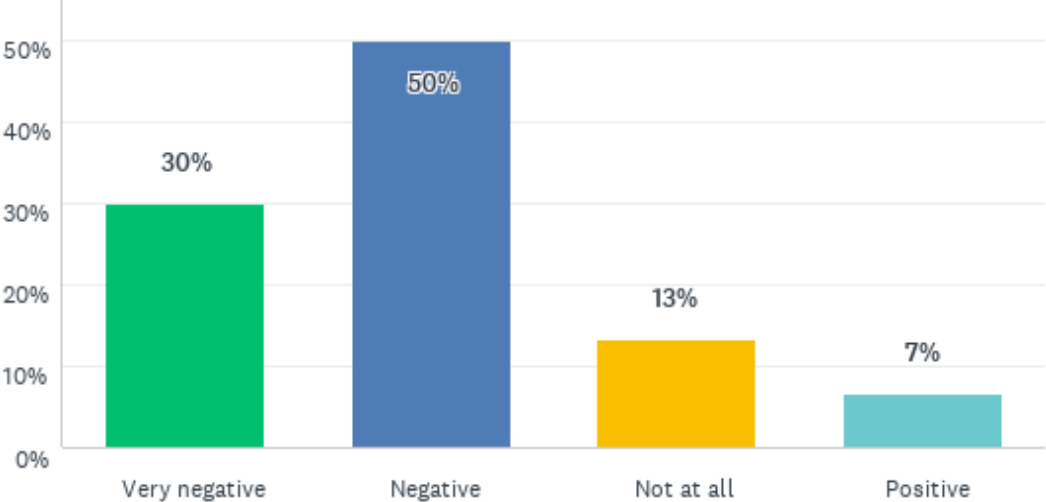
52% of the businesses employ 5 and less people, while **18%** employ more than 20 people per business.

Number of people employed at the store interviewed

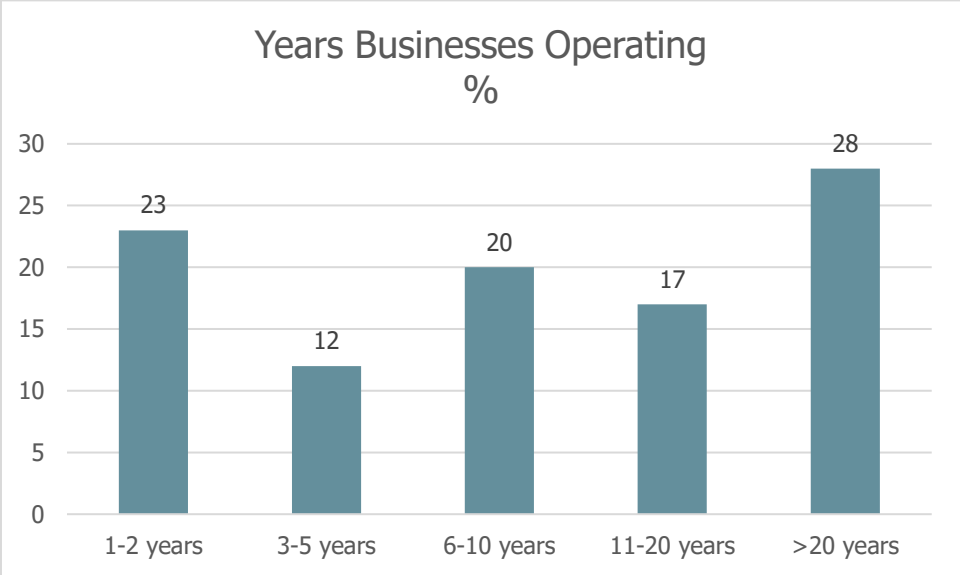


80% was negatively or very negatively influenced by Covid-19. This corresponds with the commuter survey.

The extent of influence by Covid-19 to businesses



35% of the businesses have been at their current address for 5 years or less, while 28% have been at their current address for longer than 20 years. All these figures confirm growth in new business and satisfaction of long-standing businesses.

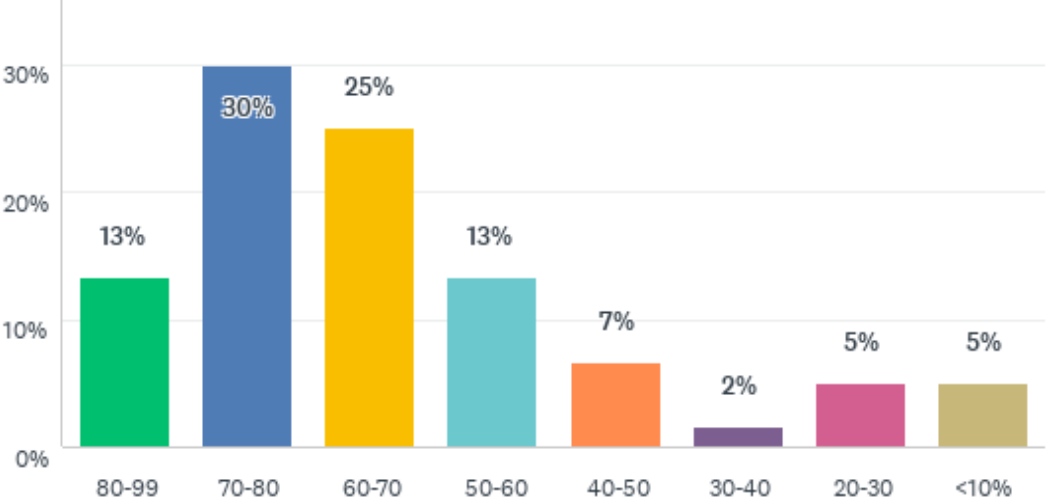


5.2 Workers using Taxi transport and contribution to business

93% of all workers make use of taxi transport. This clearly indicates the importance of taxi facilities for workers.

Between 70% and 100% of the monthly turnover of these CBD businesses is generated from the taxi commuters.

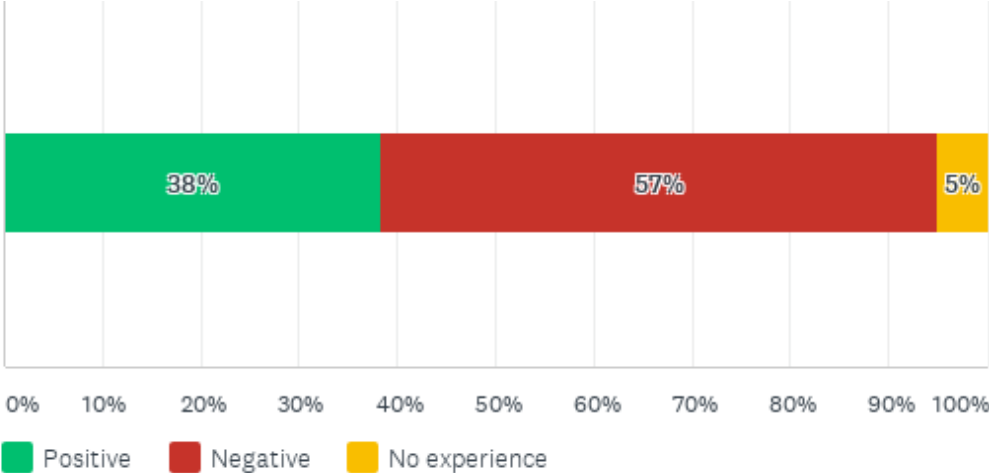
Percentage of taxi commuters contributing to the monthly turnover



5.3 Views and recommendations regarding Bradford Taxi Rank

The business operators were asked to give their **general impression** regarding the Bradford taxi rank. 38% mentioned a positive attitude, and 57% had a negative perception.

Views regarding the Bradford Taxi Rank



The table below gives a clear indication of the **required upgrades** for the Bradford taxi rank. The key issues are:

- Upgrade of existing facilities;
- Improve security;
- Provide the necessary facilities;
- Clean up the area.

Table 5.1:
Recommendations made by Businesses to upgrade Bradford Taxi Rank Facilities.

BRADFORD TAXI RANK	Total
RESPONSES	55
Upgrade and renew existing facilities – the way it looks not good for business	44
Improve security at the rank - sort out Nyaopes & protect the commuters	16
Upgrade toilet facilities – it smells bad & is a health risk	15
Provide shelter for all	9
Clean area on regular basis	7
Provide more permanent structured stalls	4
Marshalls rude	2
Need more busses	2
Need a pick-up taxi from Block 5 to Bradford late hours	2

5.4 Satisfaction Rating by CBD Business Operators

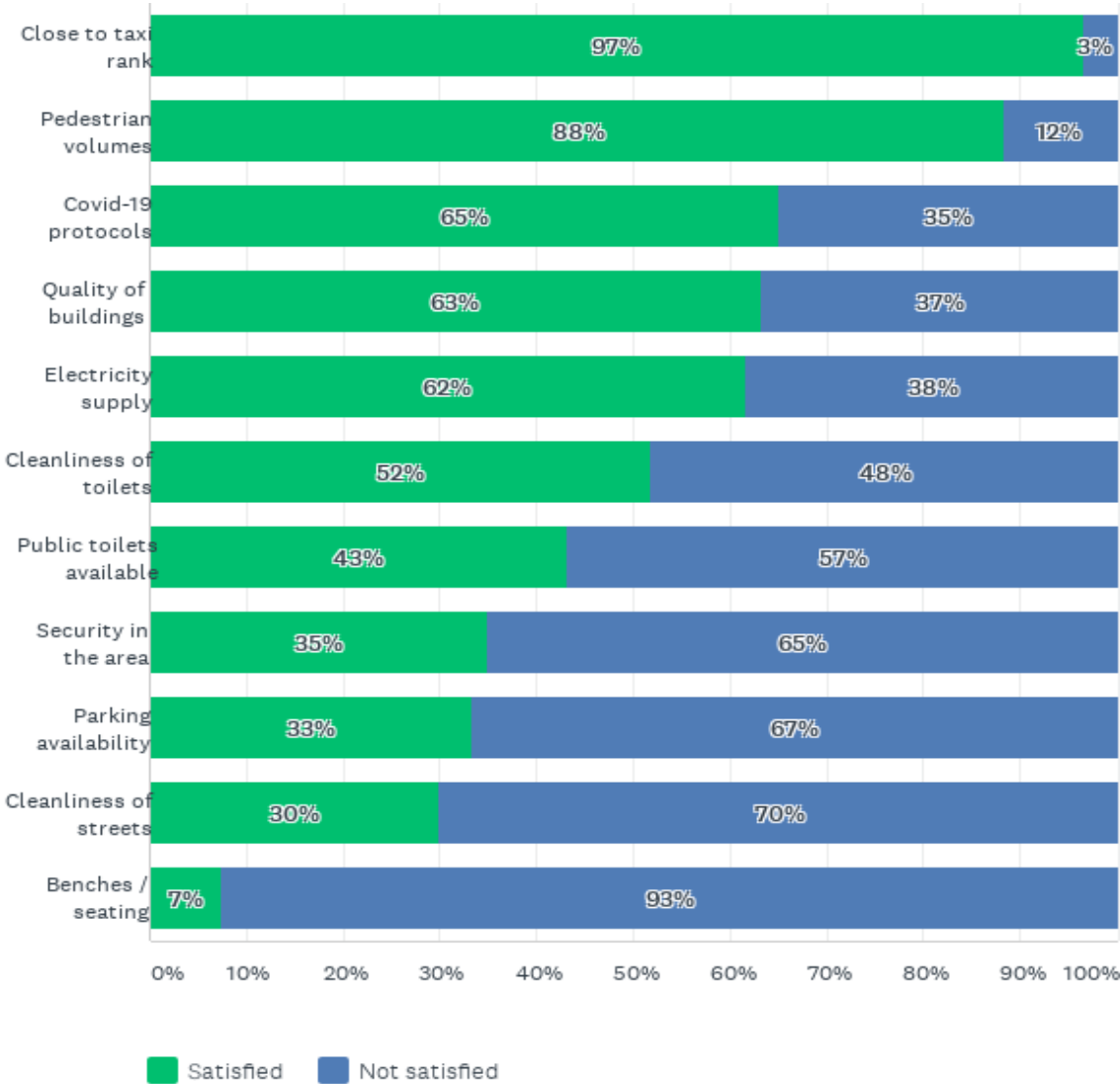
Businessmen were asked to indicate **how satisfied** they are with certain aspects in the CBD of Mahikeng. They are **mainly satisfied** with the following:

- Proximity to the Bradford Taxi Rank;
- Pedestrian volumes;
- Covid-19 protocol;
- Quality of the buildings;
- Electricity supply;
- Cleanliness of toilets.

High dissatisfaction levels are associated with:

- Availability of public toilets;
- Security in the area;
- Availability of parking;
- Cleanliness of the streets;
- Availability of seating and benches.

Satisfaction with certain aspects for businesses in the CBD



Detailed **recommendations** were made with regards to the following:

- The **upgrade and improvement** of the CBD;
- **Crime** related issues;
- **Economic opportunities** and
- The **Bradford Taxi Rank**.

The **key issues** are the following (Table 5.2):

- To maintain the streets and the roads;
- Clean up and improve the infrastructure;
- Increase visible policing and general security;
- Improve the shopping facilities in the CBD;
- Offer incentives for developers;
- Improving of the taxi rank by upgrading all existing facilities;
- Upgrade toilet facilities;

- Provide shelter.
- removing of taxis from informal holding areas;
- pick up drop off areas to the proposed Bradford Park taxi rank is critical to address;
- address the congestion in the CBD;
- address critical need for more formal parking facilities in the CBD parking.

Table 5.2: Recommendations to Improve the Following Aspects in Mahikeng CBD

UPGRAGE AND IMPROVE THE CBD	Total
RESPONSES	58
To upgrade and maintain the roads	31
To maintain services / clean up town	22
Better infrastructure *	16
Address safety issues	10
Proper Leadership *	9
Add seating areas	2
Get help for street-kids	2
Involve with businesses *	2
Need Nando's	2
To improve and maintain parks	2
To plan trees and plants on the sidewalks	2
To upgrade and improve the CBD area	2
CRIME RELATED ISSUES	Total
RESPONSES	58
Increase visible policing	38
Improve police service *	21
Foot patrols / on horse back	19
CCTV cameras	12
Street kids to be off the streets	7
Better lightning in streets in CBD	2
Taxi drivers must be warned not to be involved in violence	2
ECONOMIC OPPORTUNITIES	Total
RESPONSES	54
To create more jobs	18
Improve shopping facilities (CBD) *	13
To offer incentives for developers	6
To attract more businesses	4
Implement a marketing plan	2
Attract more support from region / private sector	2
Formalize trading to trust what they sell	2
Development & training	2
Training for Police officers to be better equipped to handle crime	2
Involve business owners in planning strategies	2
Rehabilitate the street kids & integrate back into society	1

*More specific comments and recommendations were made by the business owners/managers to focus the attention on issues not mentioned elsewhere (Marked with *).*

Table 5.3 includes detailed recommendations how to improve and upgrade the CBD.

Table 5.3: Specific Recommendations made to improve the CBD

UPGRADE OF CBD	
Better infrastructure	Better drainage system
	Create better space for vendors - no space to walk on sideways
	Improve the standard of informal vendor stalls
	Space for off-loading of trucks is limited
	Water not clean for drinking
	Stop signs and lines to be clear
	Ranks to be planned better
	Taxi lanes (have proper way to let the traffic flow) - going around the CBD
Proper leadership	Better work ethics
	Take responsibility in the workplace
	Timeous notifications to be send out for electricity outages
Involve businesses	Be more aware of business owners
	Visit key businesses regularly
CRIME ISSUES	
Improve Police service	Introduce more satellite police stations
	Better control and action needed
	Need to care more about doing their job
	Stop corruption within the service
	Many officers involved in crime activities
	Know the thieves but do not arrest them
	Take criminals down for scaring people to report crime
	Clean up drug dens in suburbs like Golf View
ECONOMIC OPPORTUNITIES	
Improve shopping facilities	Renovate buildings
	Improve electricity supply and prevent load shedding
	Look at rent - too high
	Attract more businesses
	Cleaner work environment

The business survey clearly indicated the dependence of the formal business sector on the support from the commuters and the total taxi industry.

6. RESULTS OF INFORMAL TRADERS/HAWKER SURVEY

The informal traders are even more dependent on the commuters and the activities of the taxi industry as well as the proximity to the taxi rank and high pedestrian areas.

The **main objectives** with the informal trader survey were the following:

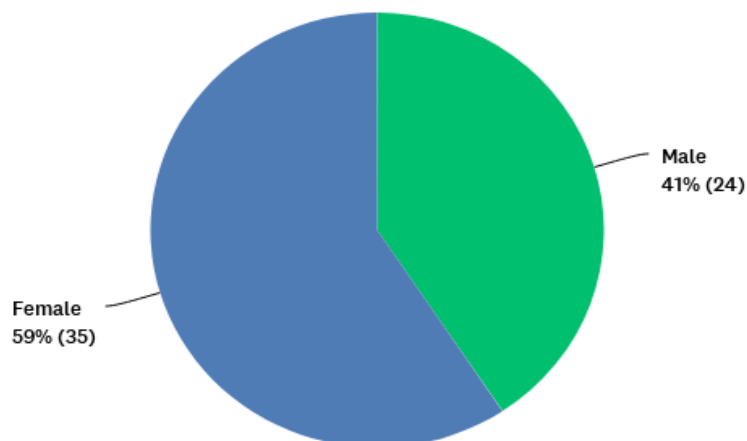
- To better **understand** the informal business sector;
- To indicate their **service** to the taxi commuters and the whole taxi industry;
- To identify their **needs** in terms of operating from the CBD of Mahikeng.

6.1 Characteristics of Informal Traders

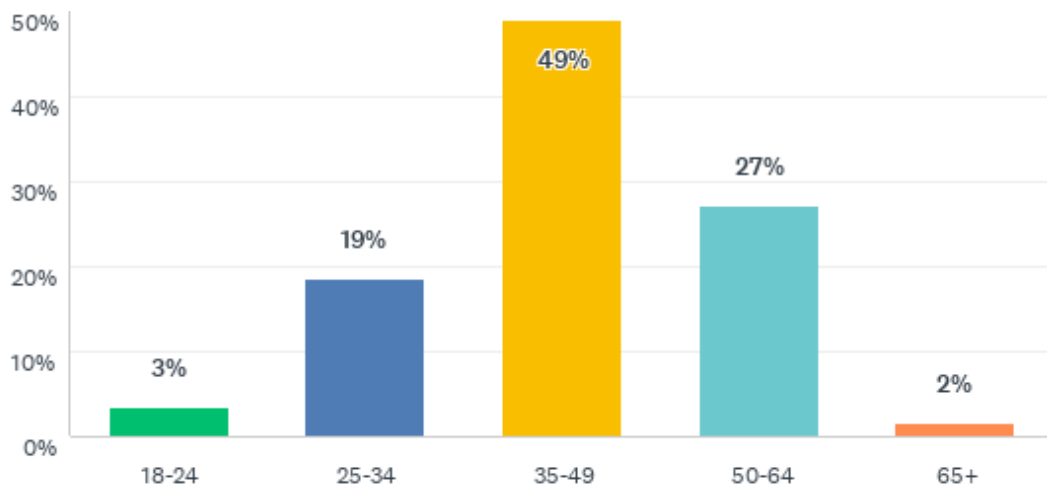
6.1.1 Demographic Profile of the Hawkers/Informal Traders

- **60%** of the operators are female.
- The average age is **40** years;
- **81%** regard themselves as the **main** breadwinner;
- Household sizes vary between **4 and 5** people per household;
- The majority of the households have one or two earners per household;
- **75%** do not own a car.

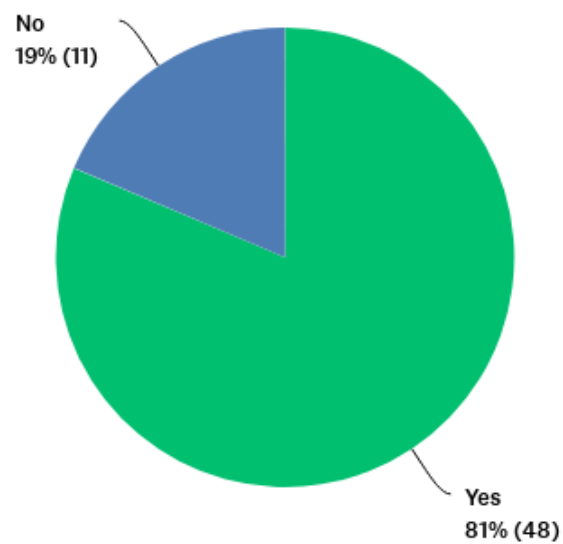
Gender Profile



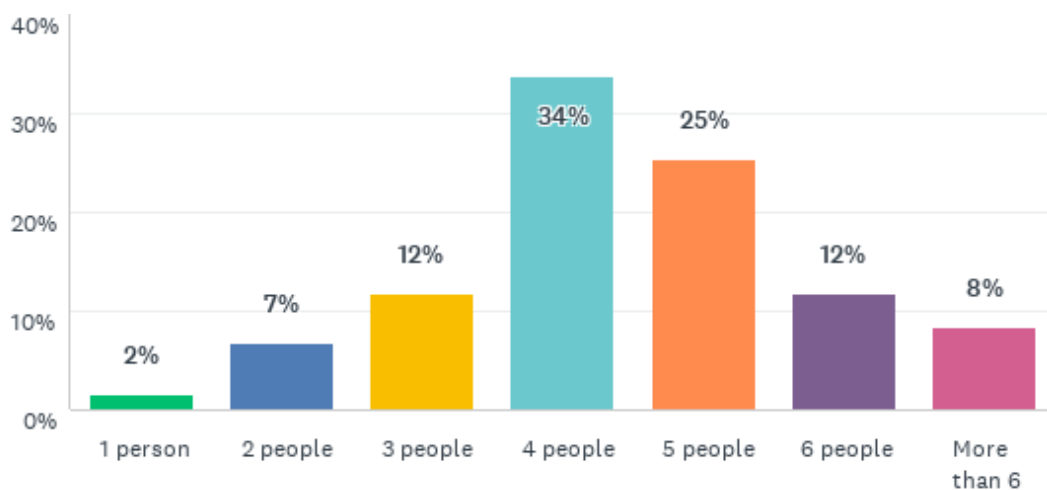
Age of the Hawker



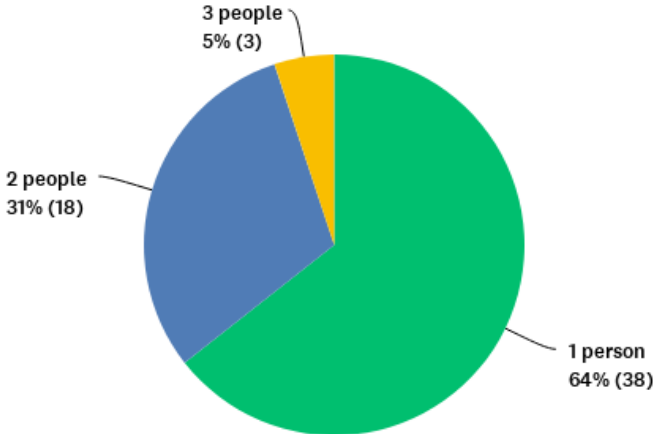
Hawker also the main breadwinner?



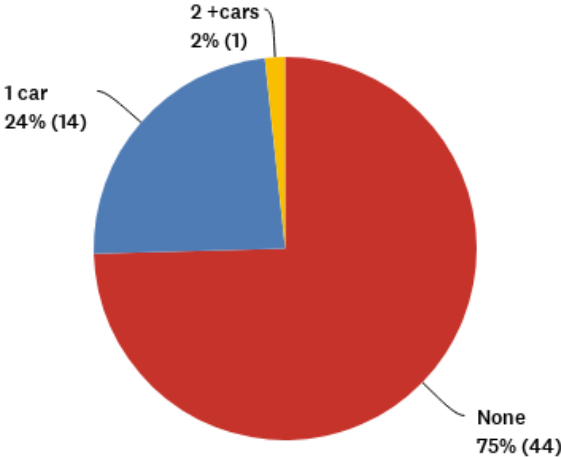
Household size



Number of earners in the household



Number of cars for the household



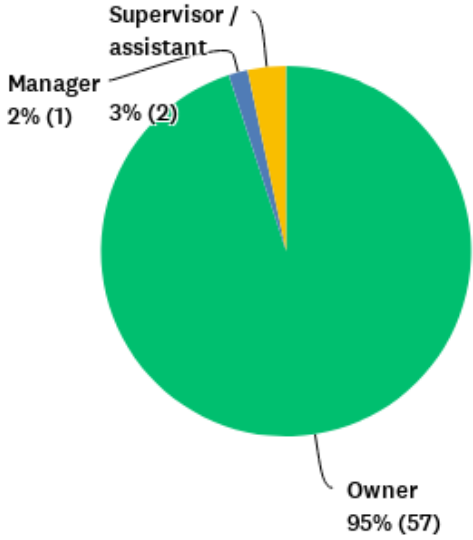
The average monthly household income of the informal traders is between R5 000 and R7 500.

6.1.2 Business Characteristics

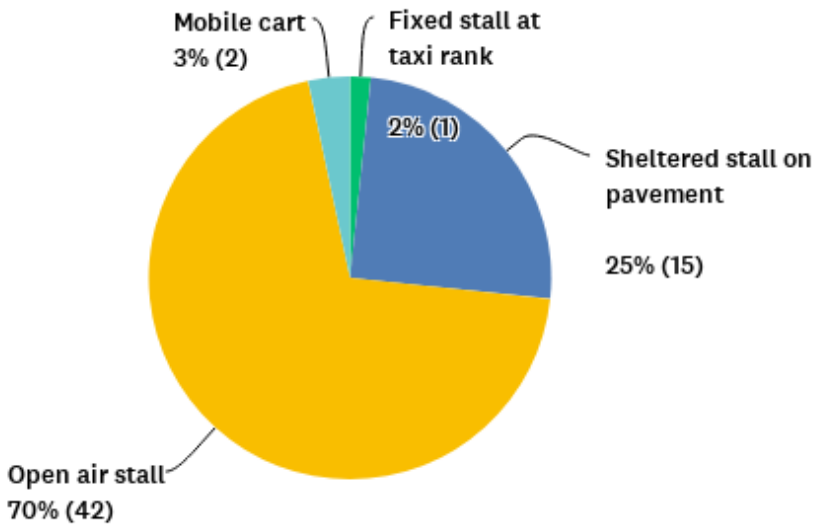
The informal traders mainly consist of:

- 95% of the respondents are also **owners** of the store;
- 75% occupy an open-air stall on the pavement;
- 25% occupy a sheltered stall on the pavement;
- Only 2% indicated that they have a stall inside/fringe of Bradford Taxi Rank.

The respondent's position in the stall



Type of stall the Hawker occupies

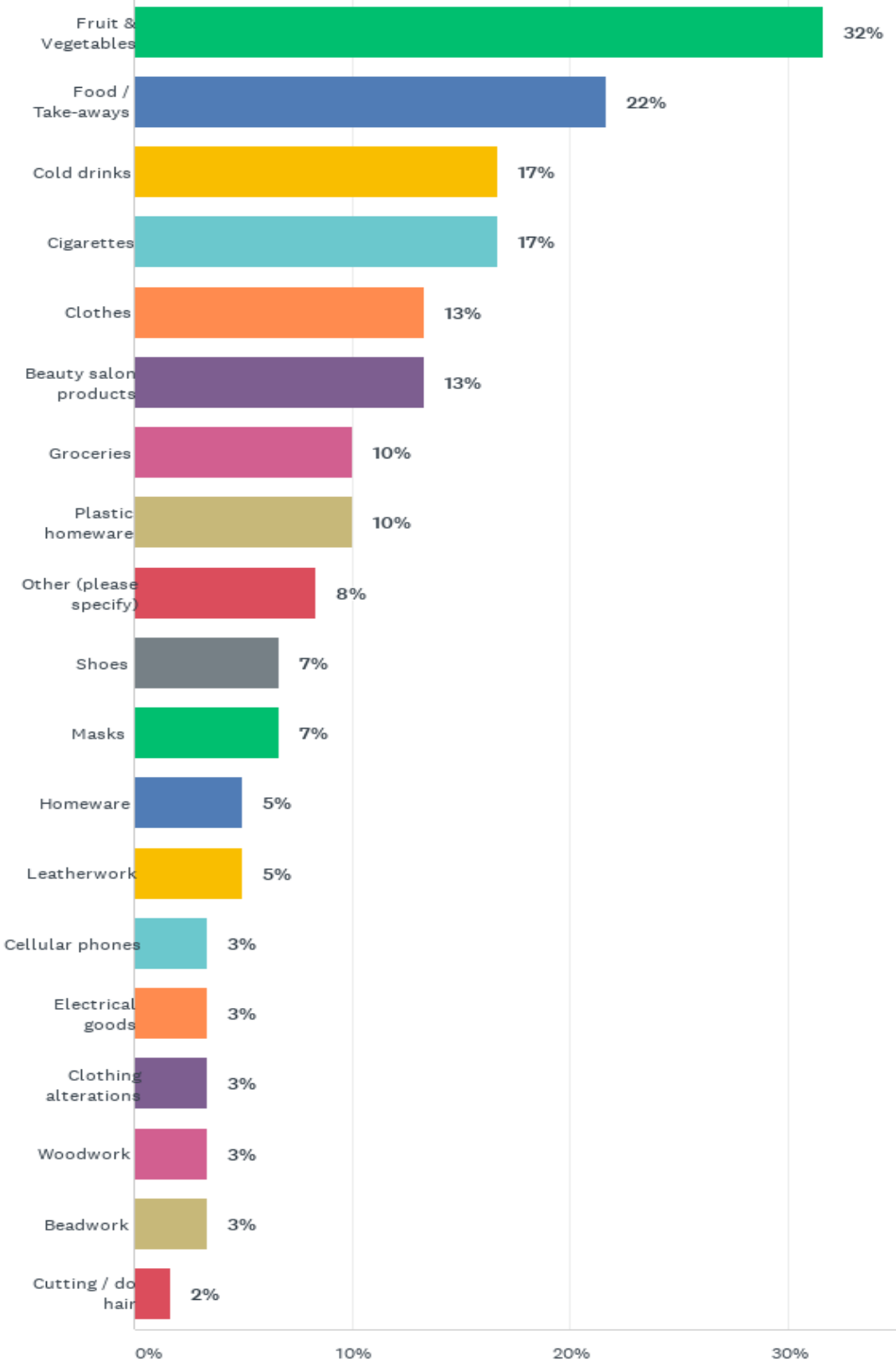


Products that are sold

A wide variety of products are sold. Note the following:

- The importance of food, vegetables and take-away food;
- Clothing and shoes;
- Beauty salon products as well as services;
- Homeware, plastic products and leather ware;
- Cell phones and masks.

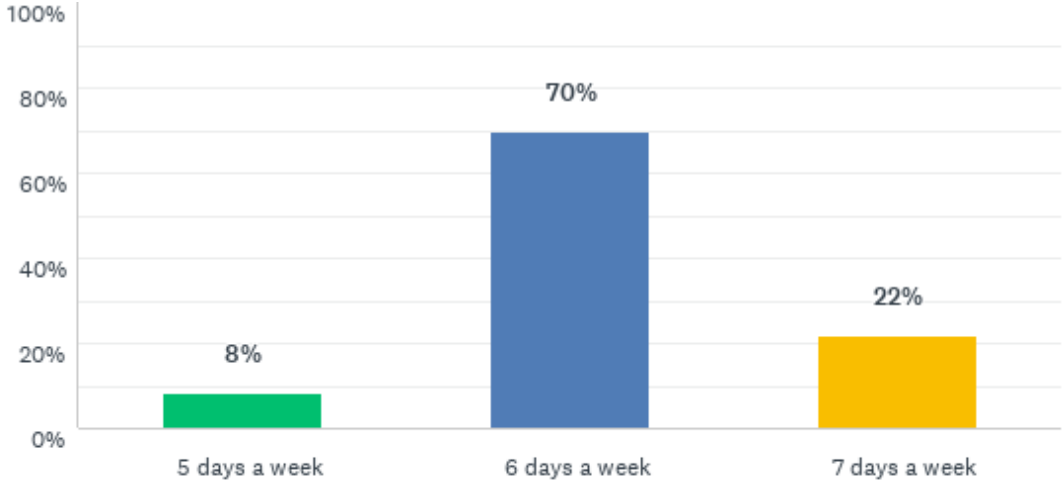
Products that are sold by Hawkers



How often Hawkers trade from their specific location

70% of the informal traders, trade 6 days per week and a further 22% trade 7 days per week. This clearly indicates the **permanent nature** of these informal traders.

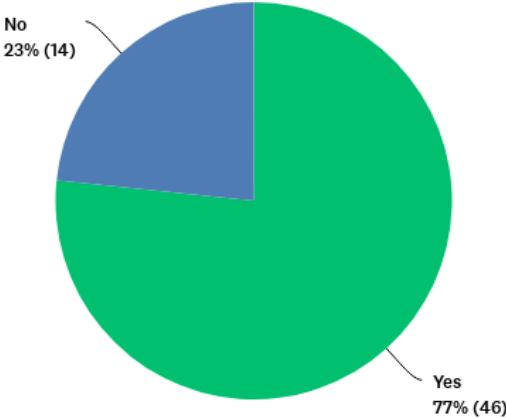
How often Hawkers trade from their specific location



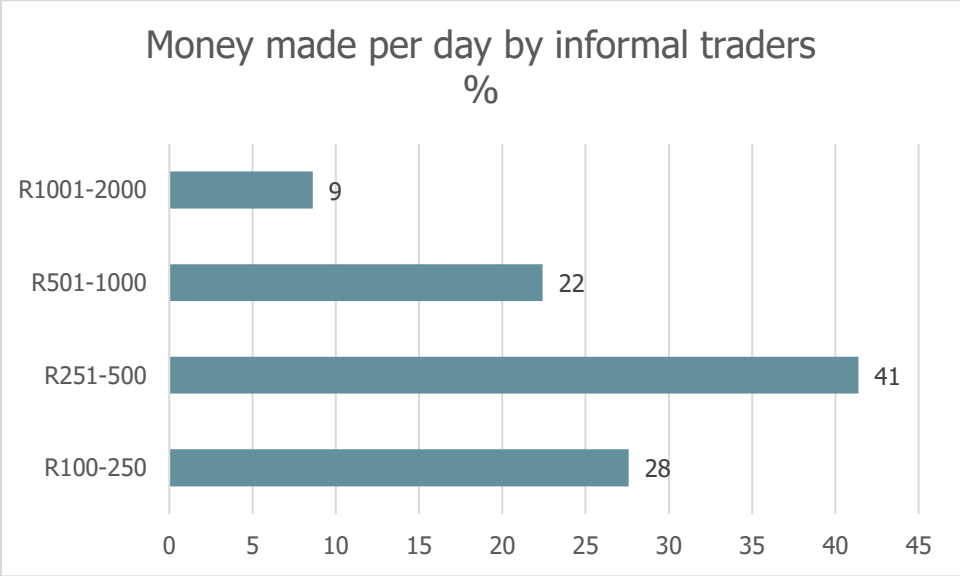
6.2 Daily Turnover

77% of the traders indicated that they have **regular customers**.

Do you have regular customers?

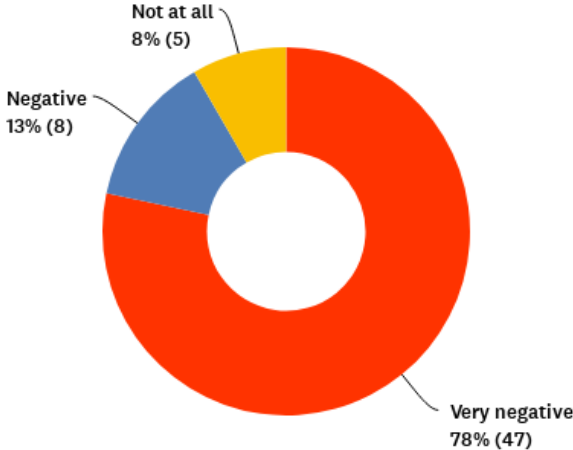


On average the informal traders have a turnover of **R525** per day.



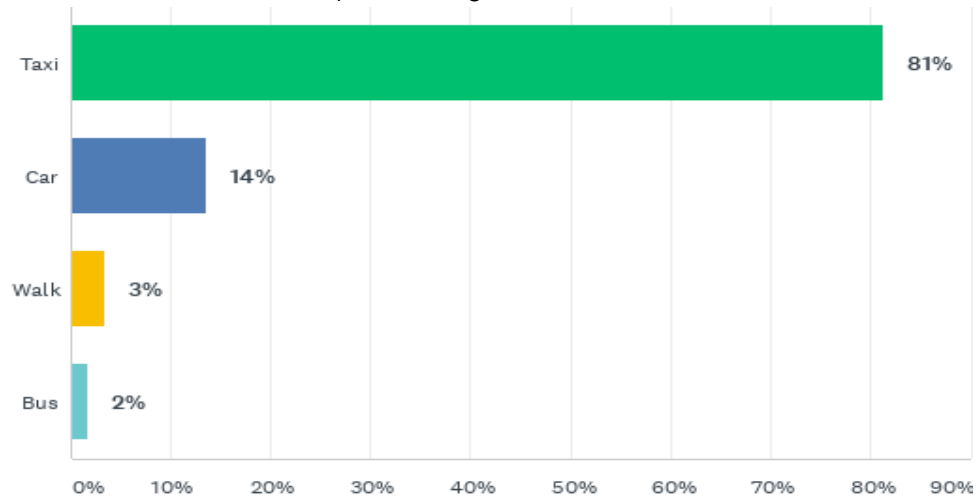
91% indicated the negative impact of Covid-19 on their business.

The extent to which their business was influenced by Covid-19



What transport do you use to get here?

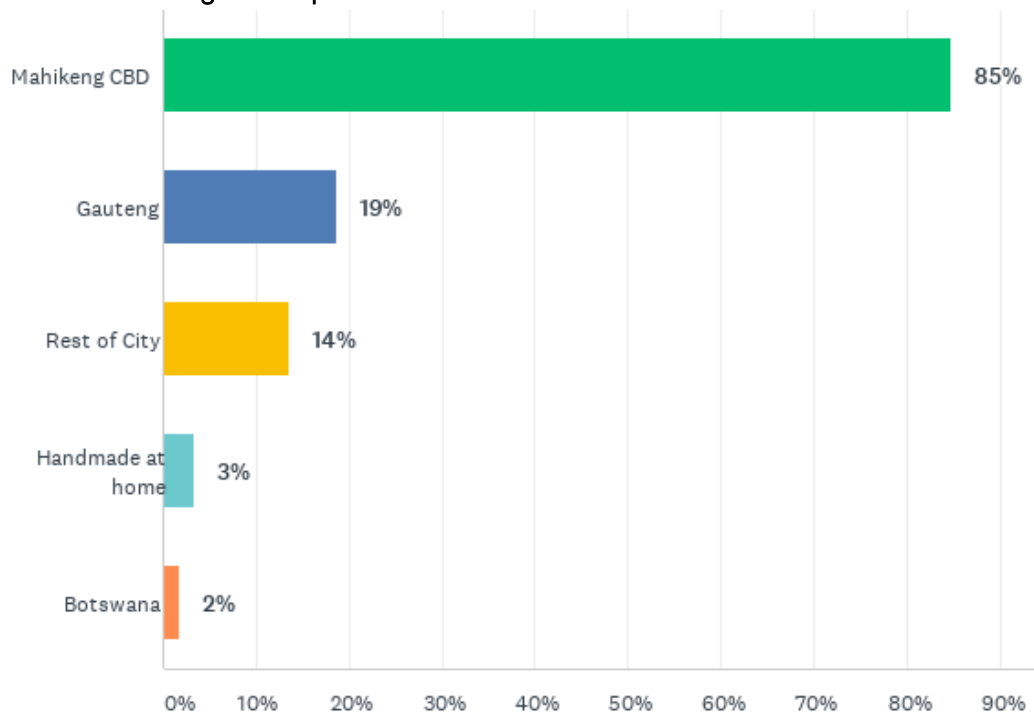
The informal traders mainly make use of taxi transport (81%), while 14% make use of cars. In total 46% also make use of taxis to transport their goods to their stalls.



6.3 Backward Linkages

The backward linkages of all the businesses are very **strongly orientated** towards Mahikeng CBD (85%). There are some backward linkages to Gauteng (19%) and the rest of Mahikeng (14%). The localised nature of this informal sector has a very strong impact on other businesses in Mahikeng. The upgrade of all their facilities will also assist in increasing their turnovers and offer a better product and service.

From where the trader get their products



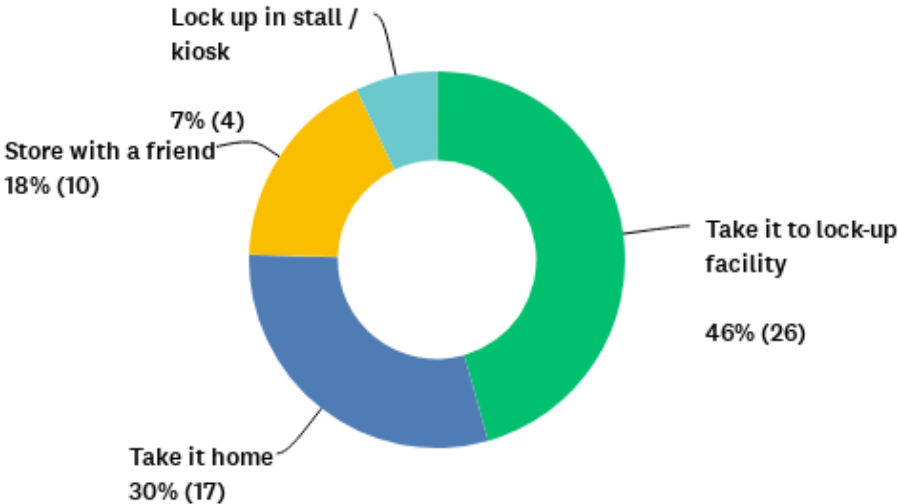
6.4 The Use and Need of Storage Facilities

Storage is a very important component used and needed by the hawkers:

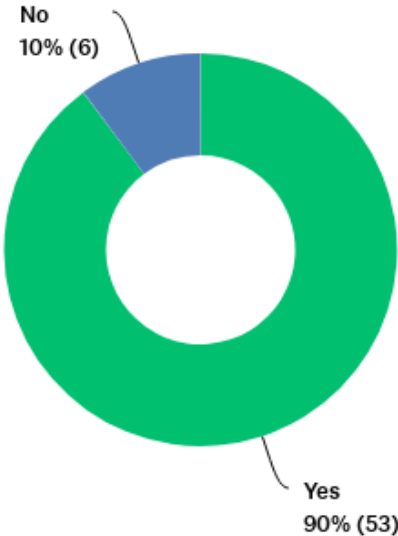
- 46% make use of a **lock-up** facility close to the taxi rank or elsewhere in a building;
- 30% take products home where no paid storage is required;
- 18% store with friends and other informal operators.

90% indicated a need for storage. This is one of the critical components to be addressed.

Where traders store their products at night



Is there a need for storage facilities?

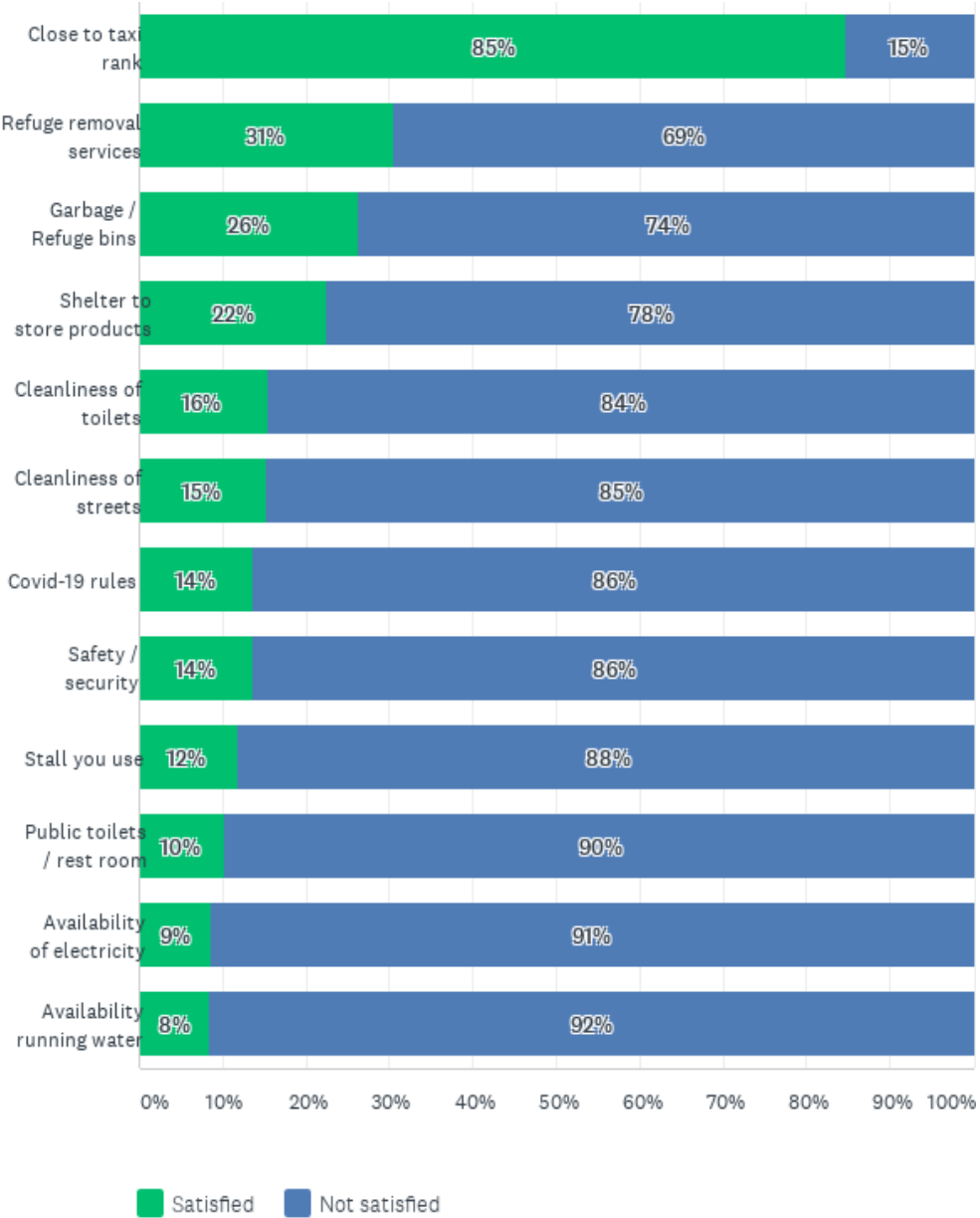


6.5 Satisfaction Rating Regarding CBD Facilities Needed by Hawkers

Similar to the formal businesses, a strong level of **dissatisfaction** is present amongst the informal traders. The critical issues are:

- The availability of running water;
- Electricity;
- Public toilets;
- Safety and security;
- Cleanliness of the streets and the toilets.

Satisfaction rating regarding CBD facilities

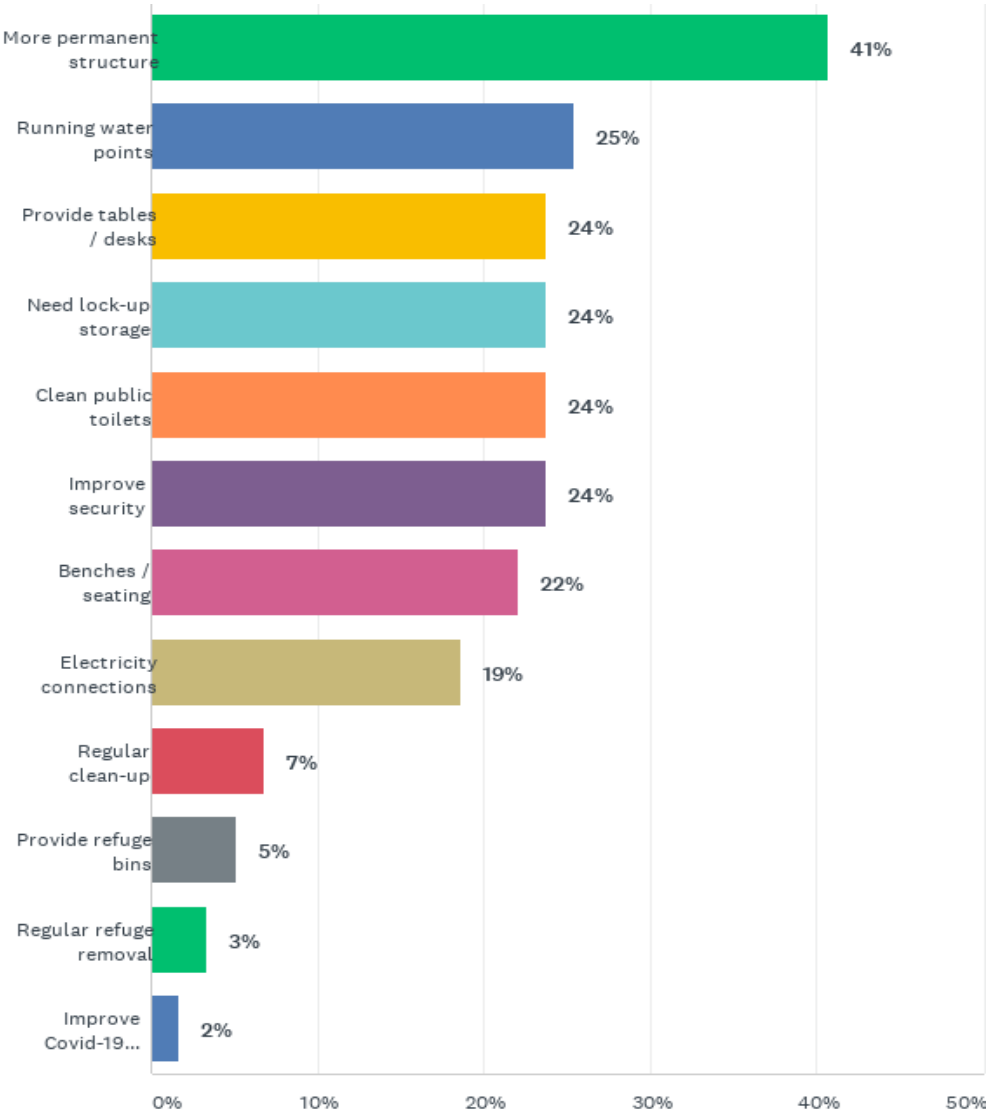


6.6 Recommendations to improve the CBD

A long list of recommendations was made to improve the CBD. The most important include the following:

- Provide permanent structures;
- Provide running water;
- Provide tables and desks;
- A need for lock-up storage facilities;
- Clean up the area;
- Improve security.

Recommendations to improve the CBD made by 59 Informal Traders



This study closely correlates with all previous studies, confirming very specific needs and very specific concerns and weaknesses.

7. RESULTS OF THE TAXI DRIVER SURVEY

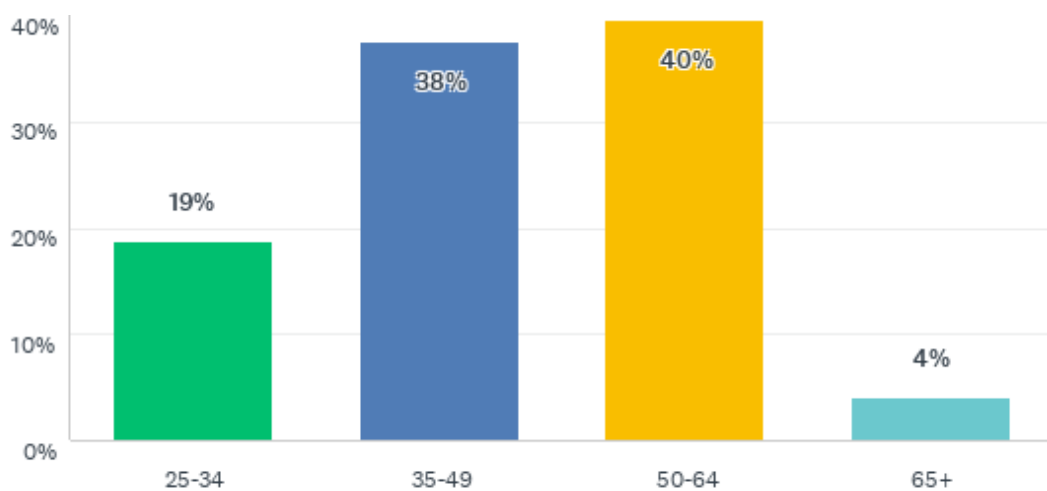
The **main objectives** with the taxi driver survey were to get a clear understanding of the taxi drivers, their operations and their specific needs.

7.1 Demographic Information

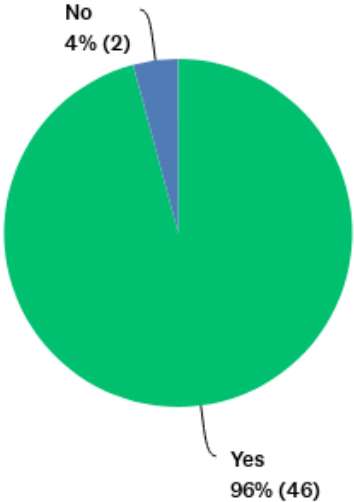
The profile of the taxi driver* is as follows:

- Mainly male;
- 40 years of age;
- The main breadwinner;
- 46% own their taxi;
- 4 – 5 people per household;
- Car ownership is much higher with 60% ownership;
- Mainly in the full nest lifecycle stage;
- The **only** earner of a particular household (79%);
- The total household income is between R5 000 and R6 000 per month.

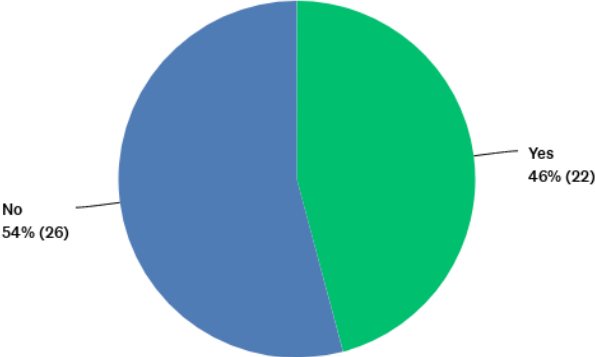
Age of the Taxi Driver / Operator



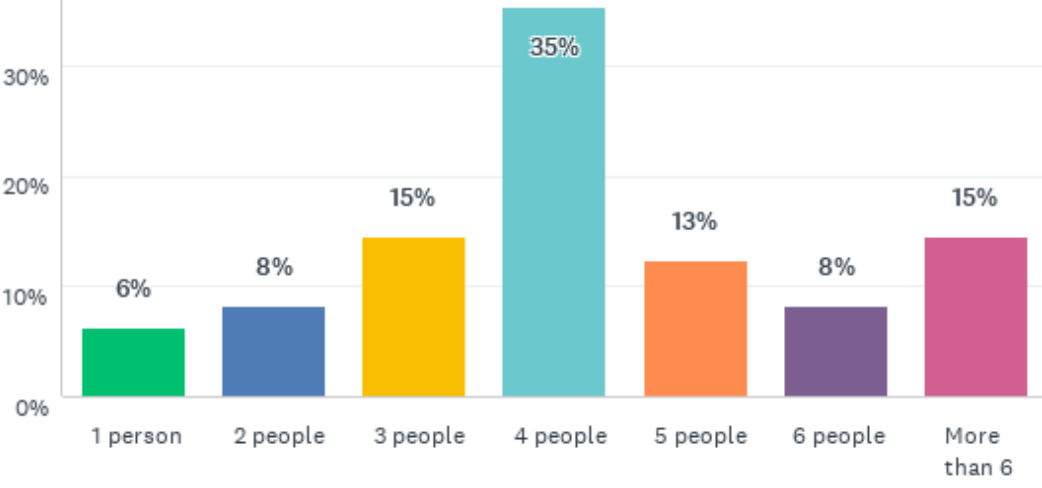
Main breadwinner or not



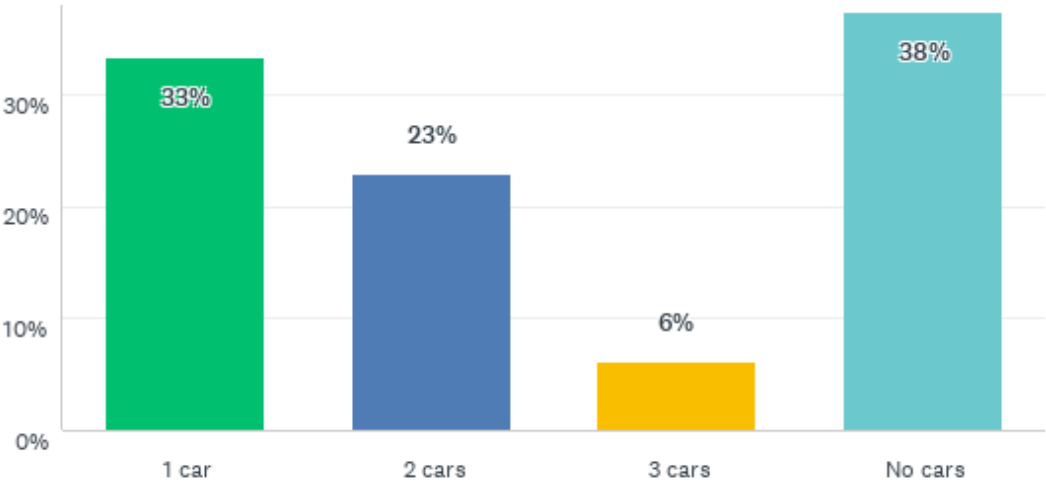
Operators owning their taxi



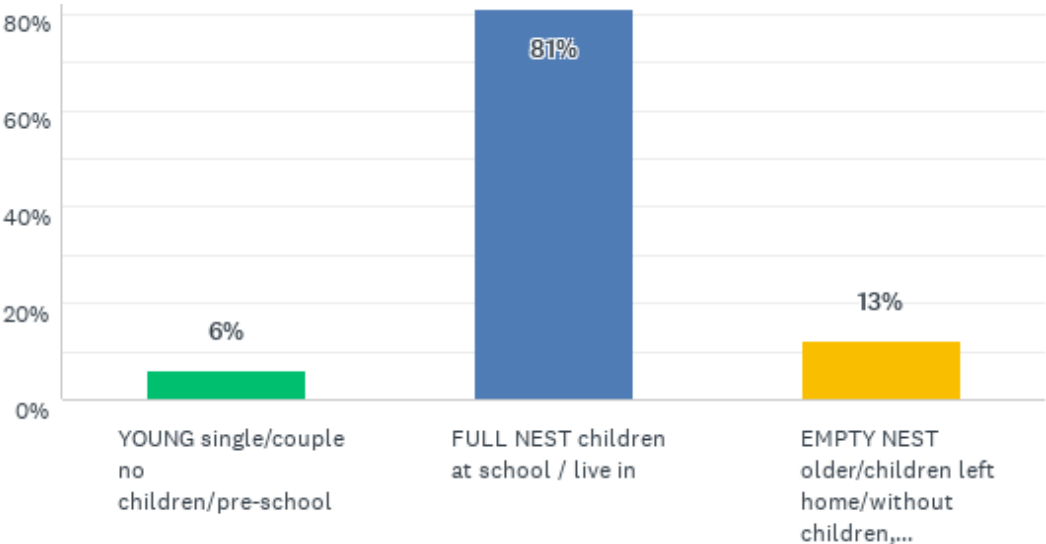
Size of Household



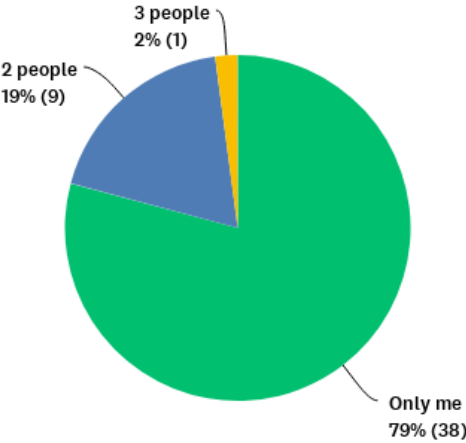
Number of cars in household



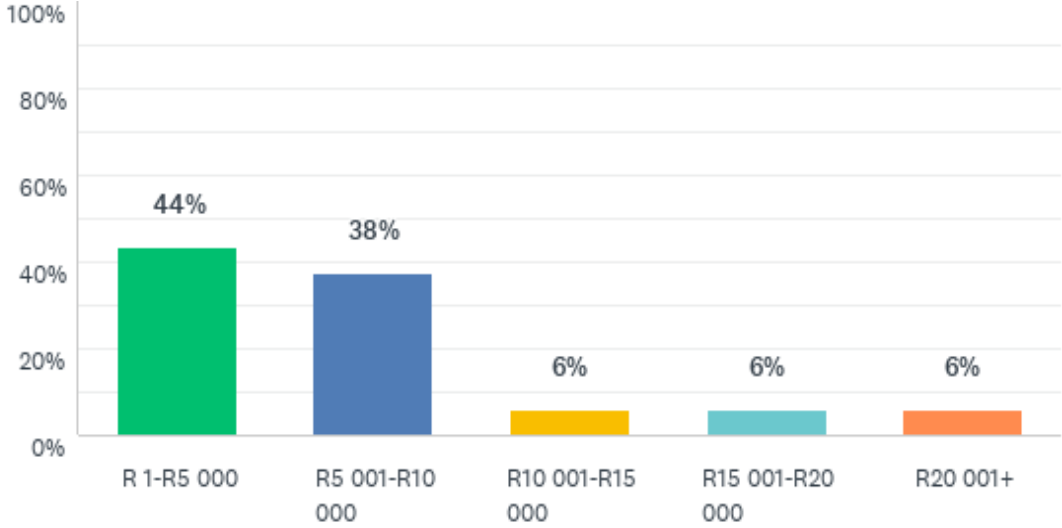
The life cycle of the household



Number of earners in the household



Total monthly household income (Gross without any deductions)

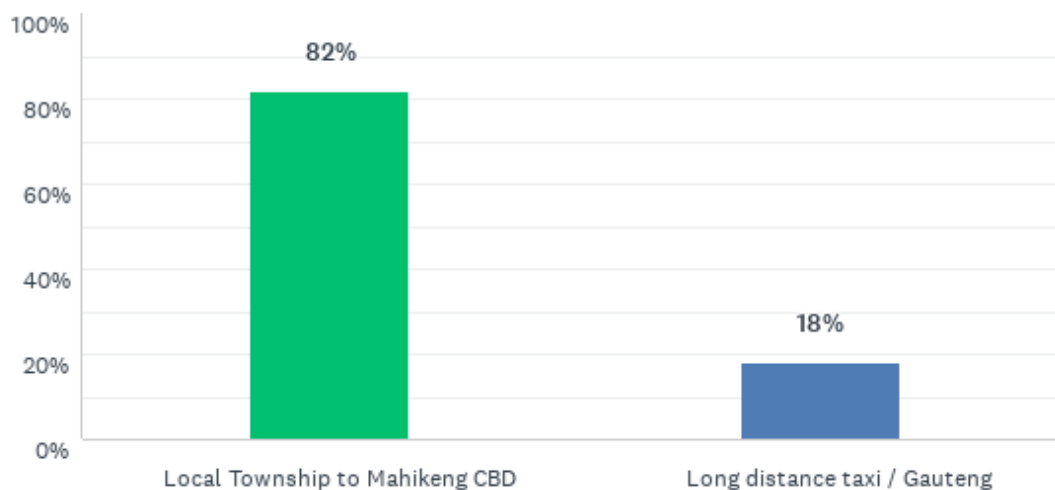


7.2 Taxi Driver Characteristics

7.2.1 Routes

82% of the taxi drivers operate from local townships areas and rural settlements to the Mahikeng CBD. 18% are involved in long distance routes, mainly Gauteng routes.

Operation location of taxi service?



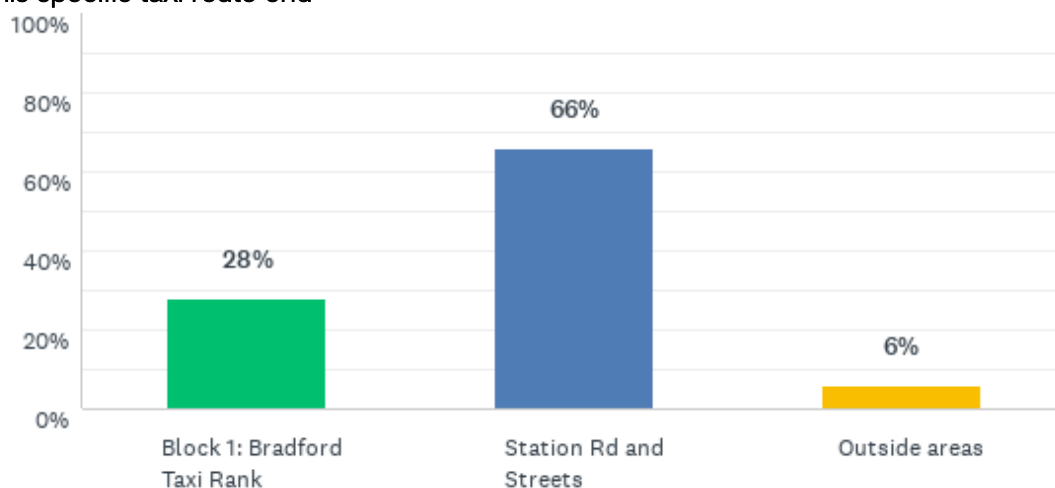
This table gives an indication of the specific areas the taxis operate from. The surrounding towns include Rustenburg, Klerksdorp, Kimberley, Pretoria & Johannesburg.

Table 7.1: Start of Taxi Routes

Start of taxi route	
	Total
Total Responses	47
Unit 13 (Area 2)	30
Bradford Park Taxi Rank	13
Surrounding Towns	13
Mega City Taxi Rank	11
Mafikeng (Area 8)	9
Magogoe (Area 3)	9
Ramatlabama (Area 5)	4
Lomanyaneng (Area 4)	4
Signal Hill (Area 1)	4
Botswana border areas	2
Bethel (Cluster 10)	2
Total	100

66% of these taxis end their route along **Station Road** and **28%** at the Bradford taxi rank.

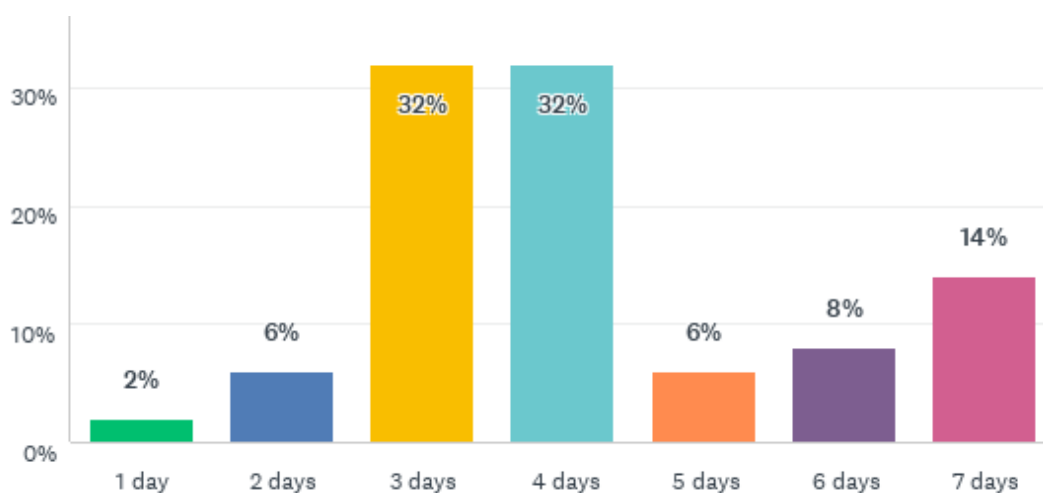
Where this specific taxi route end



7.2.2 Daily operation

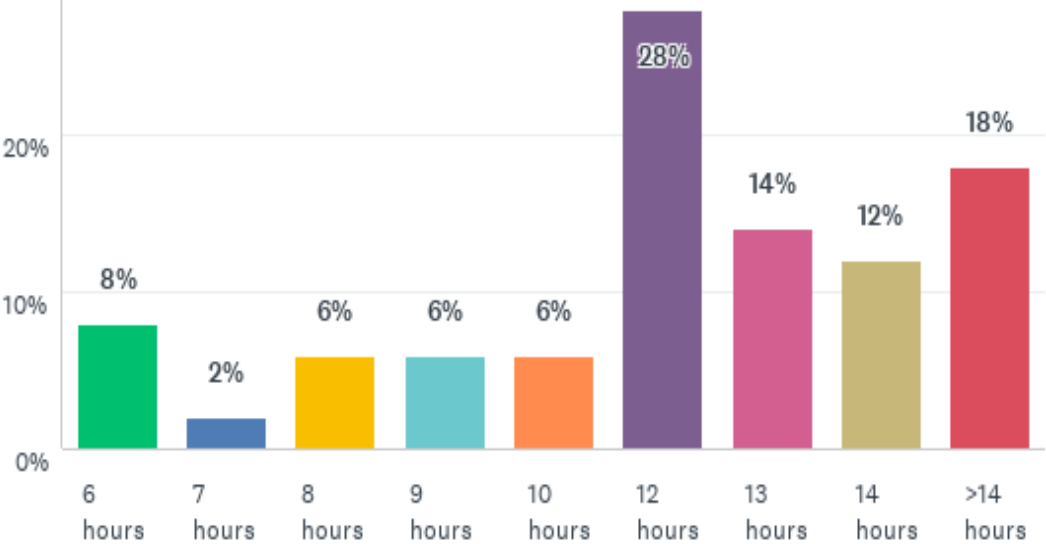
Most of the taxi drivers either work **3 or 4** days per week. Only 14% work all **7 days** per week. This finding differs from other studies where taxi drivers mainly operate 6- 7 days a week. Covid-19 could play a role in this regard. 90% of the taxi drivers indicated that their businesses have been affected negatively by Covid-19. This could also be that there are **too many taxi** drivers.

Days per week that the respondent operate the taxi



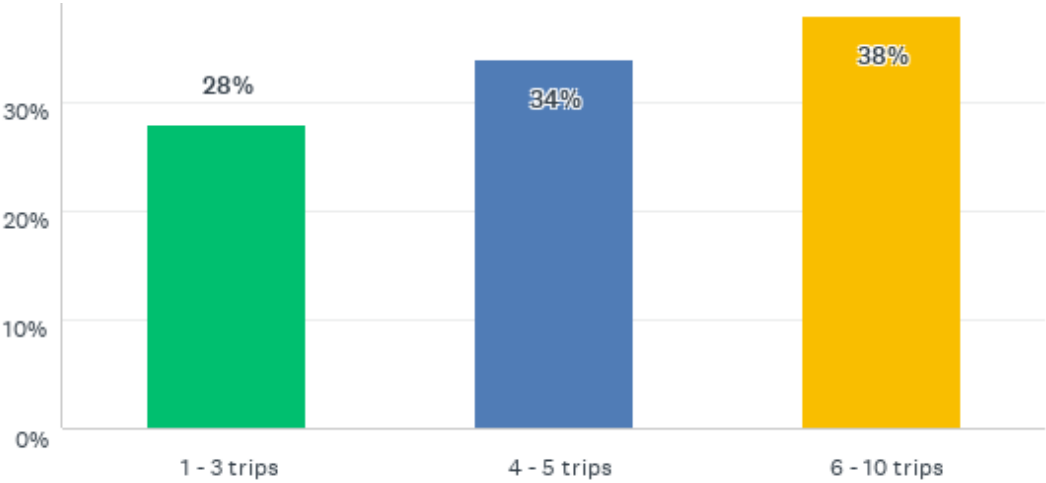
The majority of the taxi drivers work **12 to more than 14** hours per day. This corresponds with similar other studies.

Hours per day the Taxi Driver / Operator operate their taxi



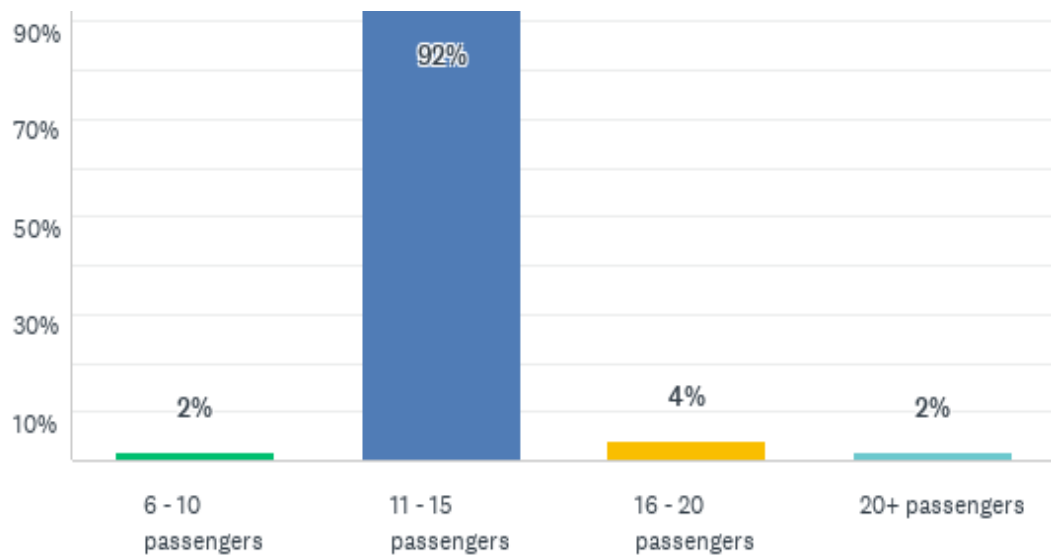
Trips the Taxi Driver / Operator do per day

The majority undertake 6 to 10 trips per day (38%) and 34% undertake 4 to 5 trips per day.

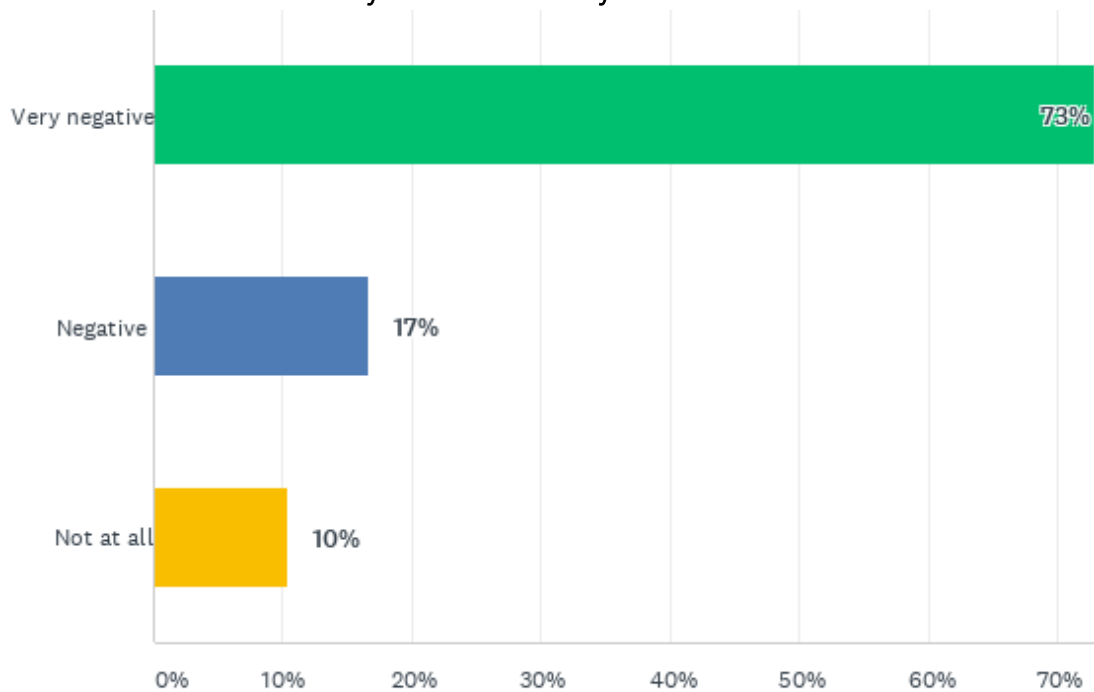


In most cases between 11 and 15 passengers are transported per trip.

Average of passengers per trip



The extent to which the taxi industry was influenced by Covid-19

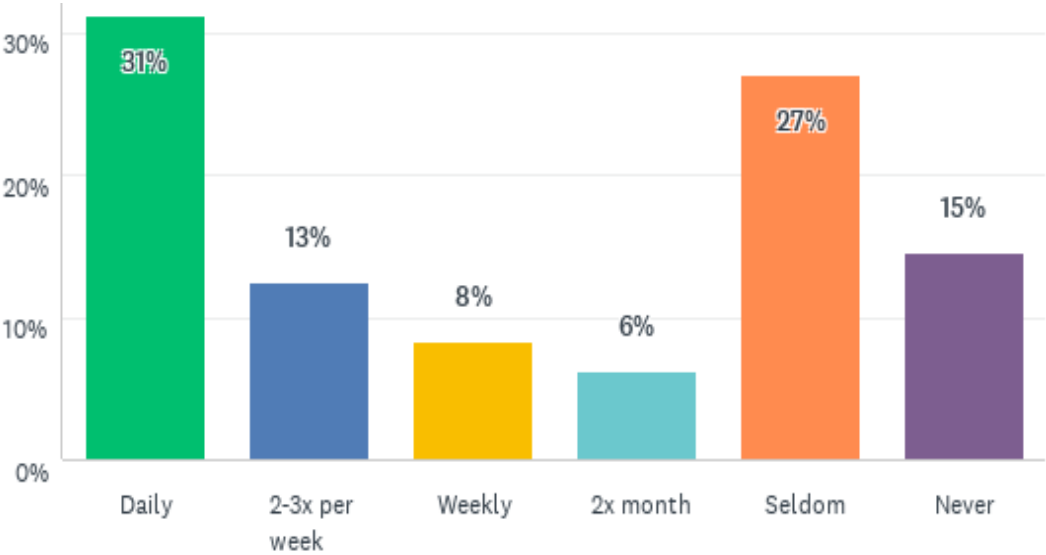


7.3 Bradford Taxi Rank

7.3.1 Use of BTR

31% of all taxi drivers/operators* make use of Bradford taxi rank on a daily basis, while 42% seldom or never support this taxi rank. This is also influenced by the areas/blocks where the interviews were conducted.

How often Bradford Taxi Rank is used

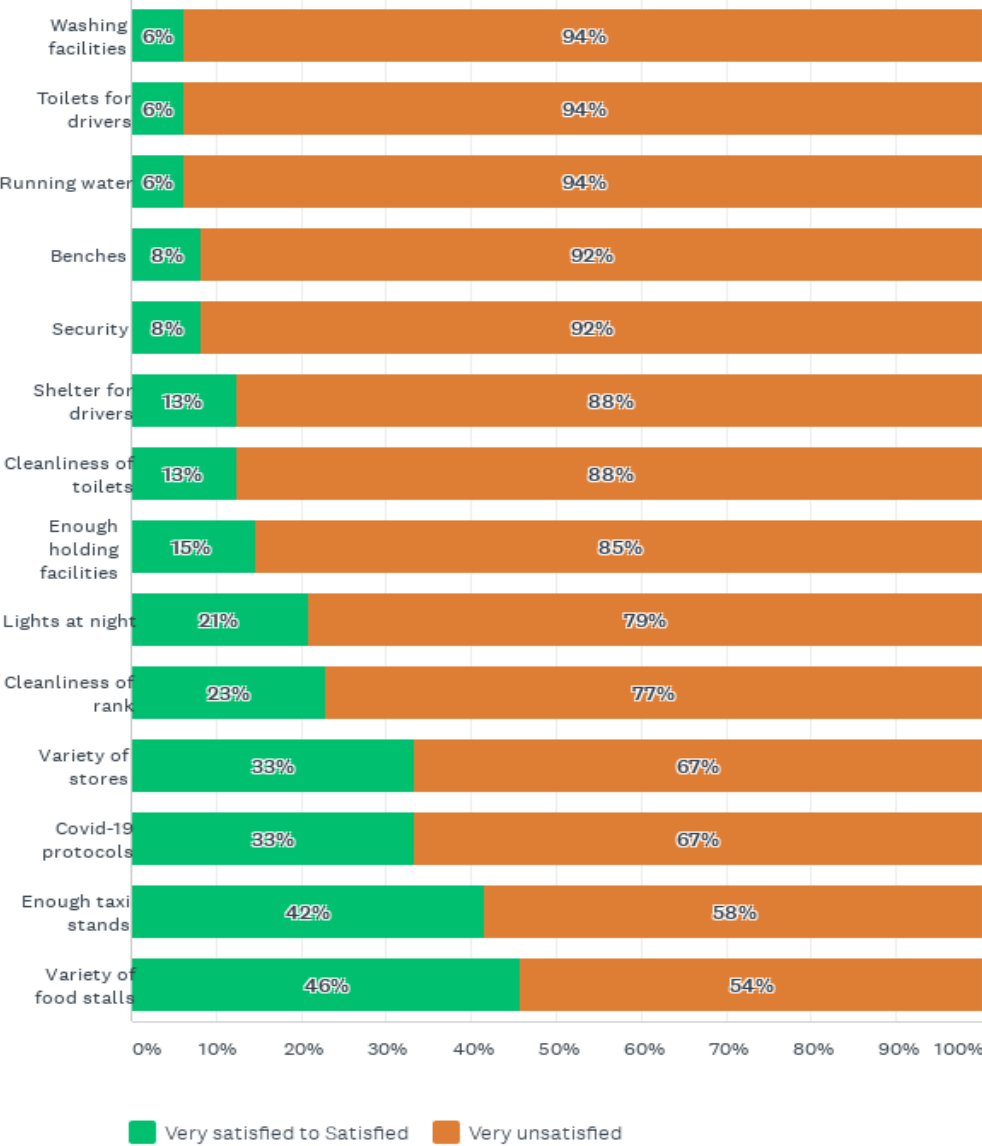


*The Operators included in the Workshop completed a portion of the same questionnaire as the Taxi Drivers. The combined data is reflected here under Sections 7.3 and 7.4

7.3.2 Satisfaction Rating regarding Bradford Taxi Rank

The **taxi drivers/operators** are mainly **dissatisfied** with the facilities at Bradford taxi rank. In all cases the negative ratings are well **above 50%**.

Satisfaction rating regarding Bradford Taxi Rank

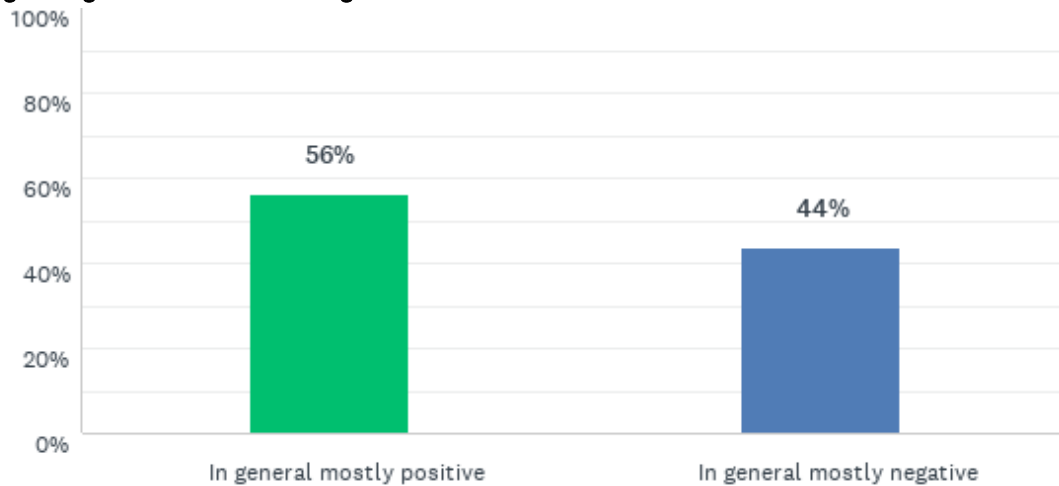


7.4 Proposed Holding Area

7.4.1 Views regarding proposed location

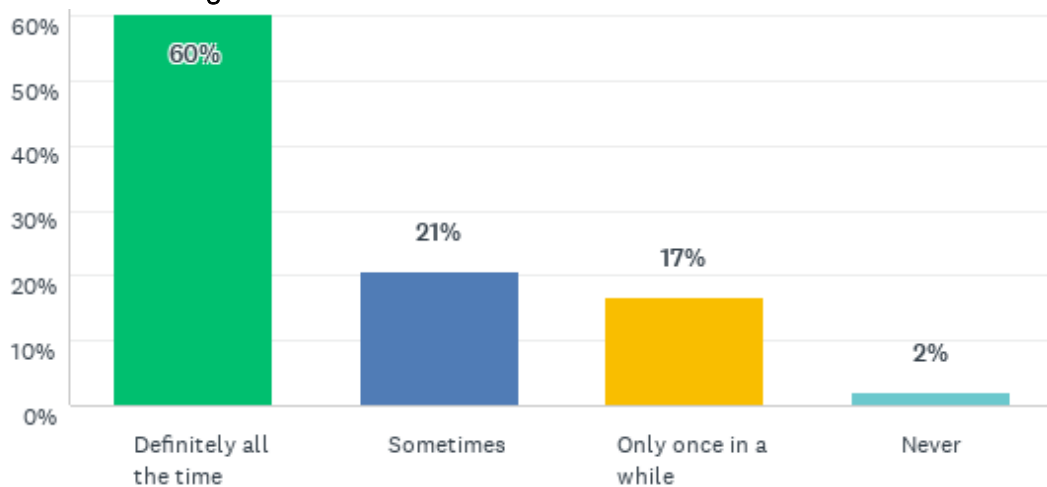
The overall reaction regarding the new proposed holding area from the **taxi drivers/operators** is **more positive** than negative. In total **56%** regard the new holding area as positive.

Views regarding the new taxi holding area

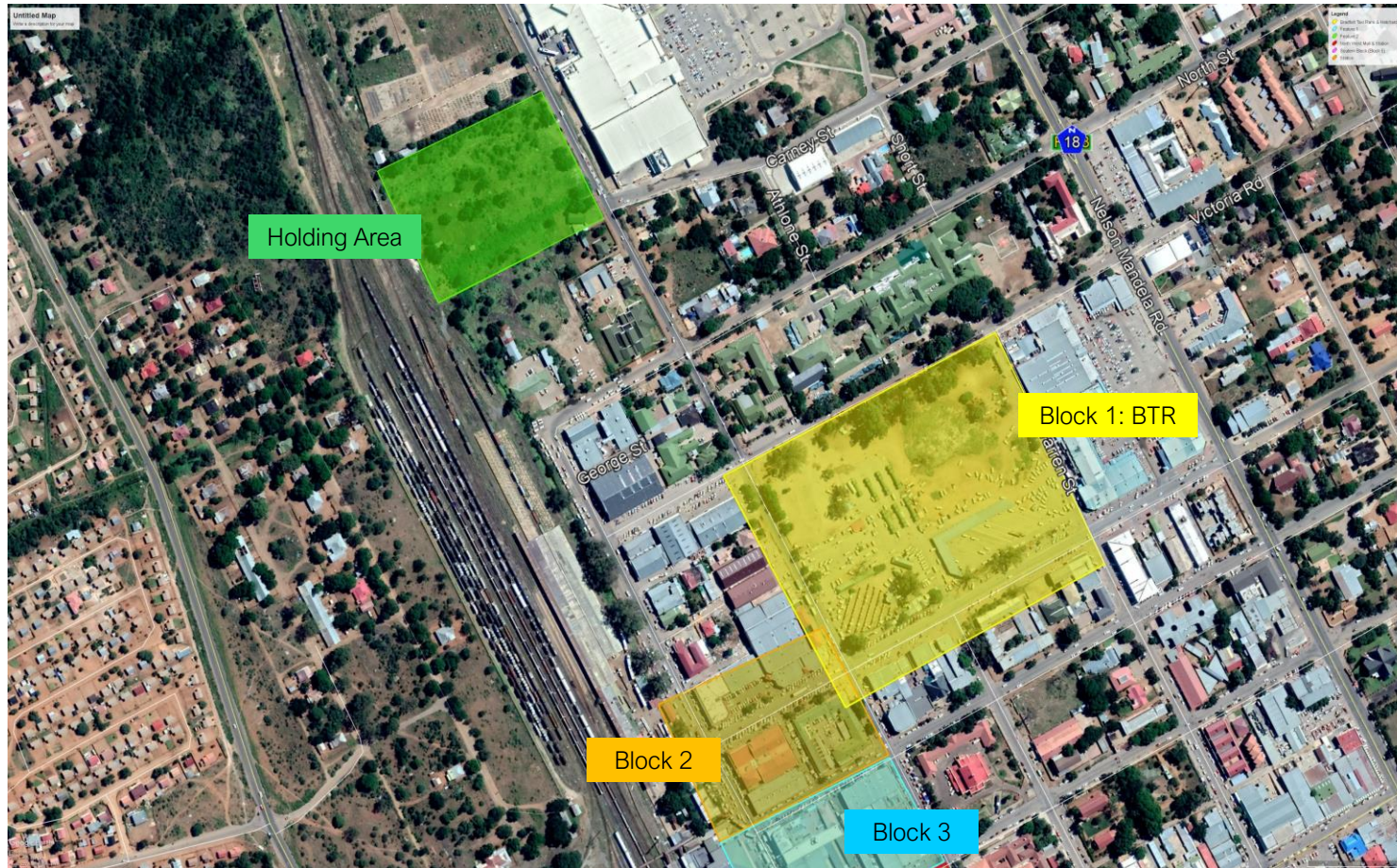


60% of the **taxi drivers/operators** indicated that they **will make use** of the holding area all the time, **21%** from time to time, while **19%** indicated low anticipated use.

Possible use of this holding area



MAP 8: MAHIKENG TOD – HOLDING AREA MICRO VIEW



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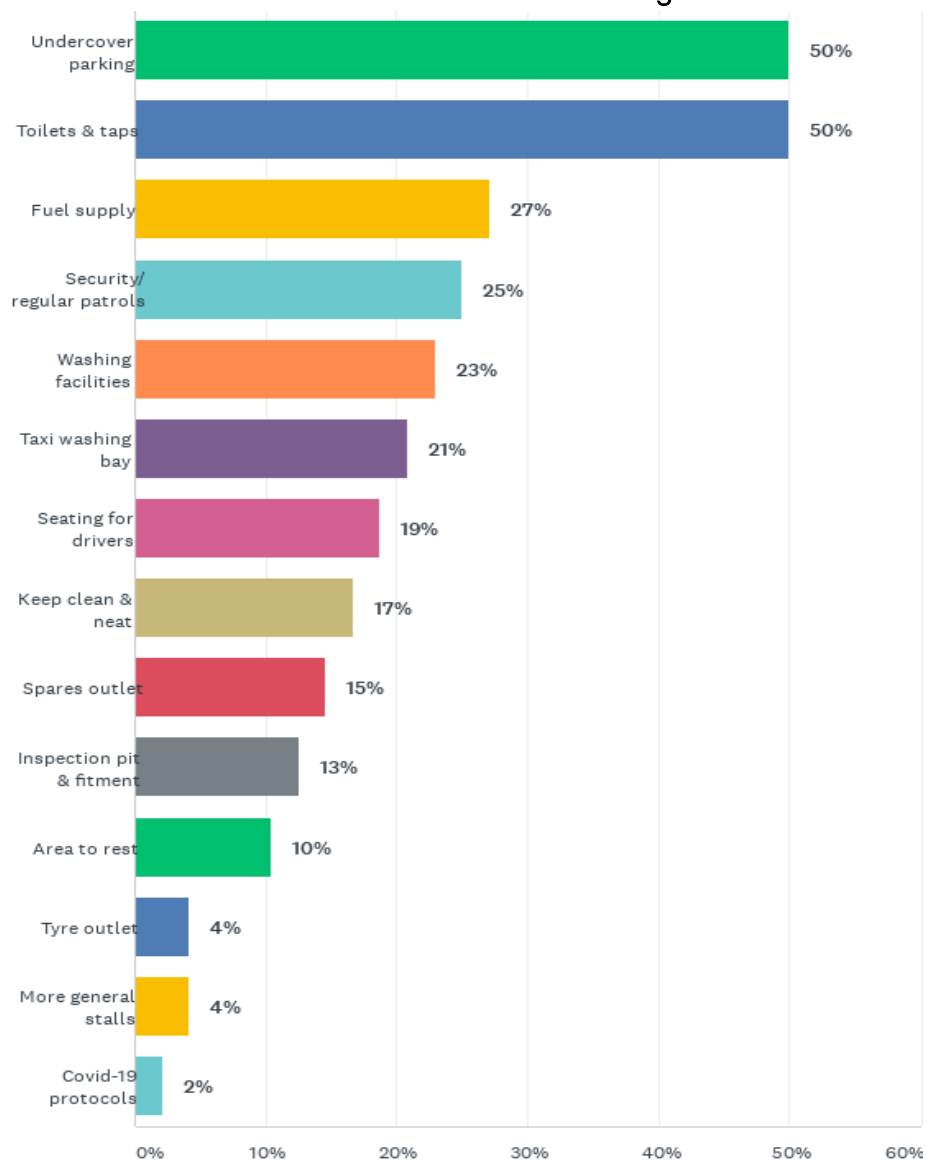
Map Produced by Urban Studies, 2021
Software: Google Earth Pro

7.4.2 Specific facilities and services needed

The table below gives an indication of the facilities needed at the new holding area by **taxi drivers/operators**. The most important **needs** are:

- Undercover parking;
- Toilets and taps;
- Fuel supply;
- Good security and policing;
- Washing facilities(showers), rest areas;
- Taxi washing bays.

Most important facilities / services needed at the new holding area

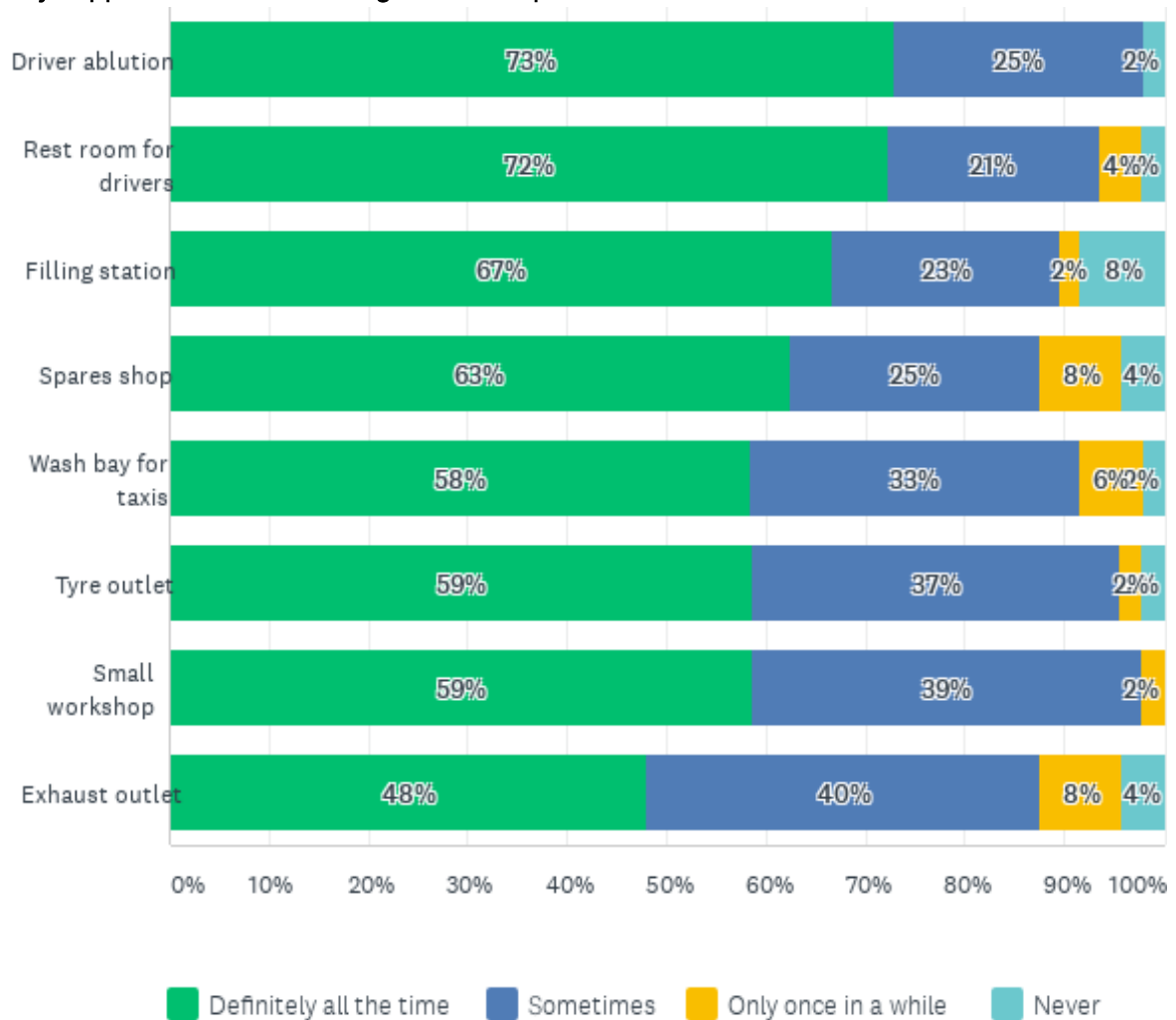


7.4.3 Anticipated support for facilities

The anticipated support for the following facilities will be **high**:

- Driver ablutions with showers;
- Restrooms for drivers;
- Filling station;
- Spare's shop;
- Washing bays for taxis;
- Tyre outlet
- Small workshop.

Likely support at the new holding area for aspects mentioned



The Taxi Driver Survey emphasised other issues needing attention to improve the services, existing facilities and the new proposed holding area.

8. DISCUSSIONS WITH EXECUTIVE MEMBERS AND OPERATORS OF THE DIFFERENT TAXI ASSOCIATIONS

The attendance for the Workshop was from the leadership of the NMMDM Regional Taxi Council and the 8 local taxi associations. All the comments and recommendations made by the Executive Members and Operators of 8 different Taxi Associations are shown below. The reaction on similar questions to of the Taxi Drivers *were covered above in Sections 7.2 and 7.3*

8.1 Key Issues

8.1.1 Management

According to these respondents' little **co-operation exist** between the different taxi associations and the City Council. Confusion exists amongst this group as to the responsibilities of the different stakeholders regarding the maintenance, co-ordination and running of these facilities. The Municipality has embarked upon a process to consolidate the 8 taxi associations into one taxi association for Mahikeng. This has received support from the Taxi Industry.

Rules and regulations are not adhered to and in many cases no specific regulations/rules exist. Taxi drivers are uncontrollable, abuse facilities and show bad behaviour. Entrances to and exits from Bradford Park create major traffic congestions and disputes between drivers (taxi drivers do not adhere to any stop signs). The Municipality must provide traffic officers at high jacking spots and to enforce law and order. Discipline must be established.

There are also issues regarding landownership in and around the Bradford taxi rank. (Council vs Private Property Owners)

On Management the Municipality has also agreed with the Provincial Government that the Municipality will take over the taxi registration and operating licenses administration.

Investigate one transport controlling body to regulate the whole industry and also to enforce laws. One municipality, one executive body and very strict control. A strong recommendation from this group is to centralise everything in a well-managed transport hub.

8.1.2 Maintenance

The maintenance of water works, leakages of water in streets, as well as standing water in taxi ranks creates serious problems. Drainage also creates problems during the rainy season. Toilets are not clean and properly maintained. Streets with potholes are not repaired and cause damage to vehicles.

8.1.3 Future Planning

According to this Group there are currently no plans to solve the problems of the CBD. (However, The Municipality has done an updated SDF and has initiated the Mahikeng CBD revitalization programme of which this project is a critical element. Development plans for the redevelopment and upgrade of the taxi ranks should be prepared. It is very important that these plans should be executed. Reference was made that many plans existed in the past but nothing were implemented.

8.1.4 Buses

The key issue between bus and taxis relates to bus subsidies. Taxis have to compete with the buses and should be treated equally. Reference was made that better drop off points exist for buses.

8.1.5 Bradford Taxi Rank

The Taxi Rank is unregulated, disorganised and a lack of law enforcement.
The layout and type of structure must be discussed with the taxi associations.
Facilities offered at taxi ranks must be top class.
Ensure safety at taxi ranks.

8.1.6 Holding Area and Other Taxi Ranks

Holding area to provide shelters for both taxis and drivers.
Supply all taxi related services and facilities like tyres, fuel, service, workshop etc.
Taxi associations show good support for the new proposed holding area if the necessary facilities are provided.
It is recommended that the Taxi Associations own these new facilities.
Remove all the street taxi parking to be consolidated in the Bradford Taxi Rank.
It is also recommended to focus on Station Road to improve traffic flow.
Unlicensed taxis create major concerns.

8.1.7 Marketing Plan and Funding

Prepare a detailed marketing plan for the Taxi Industry as well as for the CBD.
To find funding from private and overseas investors as well as from government.
Bill board and electronic advertising boards to be erected to market products and especially retail brands to earn additional income.

8.1.8 Redevelopment and Upgrade Strategy

All the above mentioned must be incorporated in a redevelopment and revitalisation strategy for taxi facilities and the CBD.

8.2 SWOT Based on Workshop participants

STRENGTHS <ul style="list-style-type: none">• Good location• Enough space for further development/expansion• Loading bays well organised.• Signage	WEAKNESSES <ul style="list-style-type: none">• Facilities• Maintenance• Not enough• Traffic flow and control.• Unlicenced taxis
OPPORTUNITIES <ul style="list-style-type: none">• Better customer service• Marketing and advertising• Many comments about drop/pickup points/centralise• Tariffs not too price	THREATS <ul style="list-style-type: none">• To do nothing is the single most important threat

9. ECONOMIC IMPACT AND CONTRIBUTION

9.1 Population Numbers

Mahikeng & Mmabotho forms part of the Mafikeng Local Municipality and the Ngaka Modiri Molema District in North West. The market is growing at $\pm 2\%$ per annum. There is currently $\pm 350\,000$ people and $\pm 100\,000$ households in the area. This will increase to $110\,000$ to $112\,000$ households within the next 5 to 8 years.

Table 9.1: Mahikeng Local Municipality - Total Population and Households

Suburbs	Population	Households
Total 2011	291 525	84 239
1% Growth 2020	318 838	92 132
1% Growth 2025	335 102	96 832
2% Growth 2020	348 399	100 673
2% Growth 2025	375 325	108 454

Source: Stats SA

Table 9.2 indicates the population numbers per Area/Cluster used. Note that not all areas are included.

Table 9.2: Total Population and Households Per Areas/Clusters

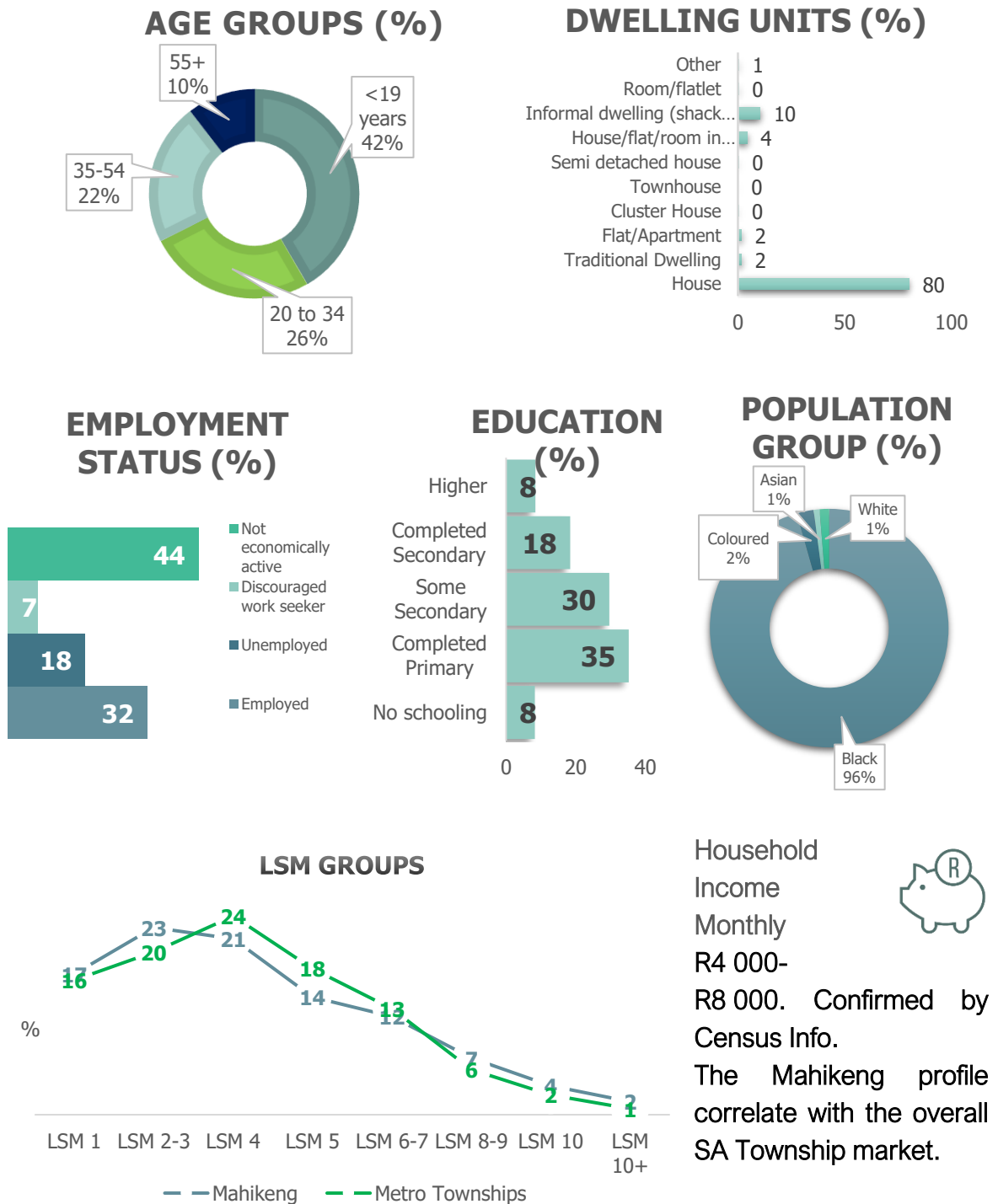
Area/ Cluster	Suburbs		
		Population 2011	Households 2011
1	Leopard Park	415	144
1	Lonely Park SP	9 511	2 708
1	Signal Hill SP	7 501	1 966
1	Top Village SP	3 258	1 063
	Total	20 685	5 881
2	Magogoe SP	22 402	5 980
2	Magogoe Tlhabologo SP	3 595	1 070
2	Motlhabeng SP	7 610	2 645
2	Motsoseng SP	4 069	1 148
2	Seweding SP	12 227	3 277
	Total	49 903	14 120
3	Bokone SP	1 830	613
3	Montshioa SP	6 680	2 360

3	Tloung SP	2 064	681
	Total	10 574	3 654
4	Dihatshwane SP	1 005	267
4	Koikoi SP	4 550	1 202
4	Lomanyaneng SP	14 479	3 885
4	Setlopo SP	10 970	2 705
	Total	31 004	8 059
5	Lokgalong SP	233	64
5	Mmabatho Unit 10	1 828	678
5	Mmabatho Unit 12	2 128	755
5	Mmabatho Unit 13	3 495	1 208
5	Mmabatho Unit 7	1 396	695
	Total	9 080	3 400
6	Imperial Reserve	5 948	2 103
8	Danville SP	4 792	1 031
8	Golf View	2 860	895
8	Mafikeng CBD	951	165
8	Riviera Park	2 741	787
	Total	11 344	2 878
Cluster1	Ikopeleng SP	1 861	536
	Six Hundred SP	3 858	1 072
	Tsetse SP	4 003	1 062
	Total	9 722	2 670
Cluster10	Bethel SP	1 162	337
	Makouspan SP	1 515	317
	Schoongezicht SP2	472	126
	Uitkyk B SP	1 025	264
	Total	4 174	1 044
Cluster11	Kaalpan SP	871	195
	Lombaardslaagte SP	796	220
	Total	1 667	415
Cluster3	Tlapeng SP	1 191	365
Cluster4	Modimola SP	1 944	427
	Makhubung SP	2 482	827
	Ratau SP	668	102
	Total	3 150	929
Cluster7	Madibe-Magelelo SP	184	56

	Morwatshetlha 1 SP	1 198	258
	Morwatshetlha 2 SP	301	102
	Total	1 683	416
Cluster8	Dithakong SP	5 441	1 332
	Mantsa SP	999	258
		6 440	1 590
Cluster9	Matshepe SP	2 252	614

9.2 Demographic & Socio-Economic Profile

The following is a summary of the profile of the Impact Area:



*LSM = Living Standard Measurement – a South African classification used countrywide. The income per LSM category reflects the monthly household income.

LSM 1-4	<R5 000	LSM 6	R7 000	R10 000	LSM 8	R15 000	R25 000	LSM 10	R35 000	R60 000
LSM 5	R5 000	R7 000	LSM 7	R10 000	R15 000	LSM 9	R25 000	R35 000	LSM 10+	>R60 000

Table 9.3 gives an indication of the households per LSM group represented in the area.

Table 9.3: Number of Households per LSM Group

LSM Groups	% of Total	Households 2021	Households 2026
LSM 1-4	62	61 963	68 413
LSM 5	14	14 481	15 989
LSM 6-7	12	12 094	13 353
LSM 8-9	7	6 964	7 689
LSM 10	4	3 569	3 941
LSM 10+	2	1 601	1 767
Total	100	100 673	111 152

Table 9.4: Number of Cars Per Households per LSM Group – Metropolitan and Rural Areas

LSM Groups	Cars per Household Metropolitan Areas	Cars per Household Rural Areas
LSM 1-4	<0,3	0.1-0.2
LSM 5	0,4	0.3
LSM 6	0,6	0.4
LSM 7	1,1	0.6
LSM 8	1,4	0.7
LSM 9	1,6	0.8
LSM 10	2,1	1.0
LSM 10+	2,3	1.1

9.3 Economic Impact and Contribution of the Total Taxi Industry

9.3.1 Impact Based on Taxi Commuters

Based on all the survey data as well as the above-mentioned tables, **±3.8million** passenger trips are generated per month. This adds up to **±45 to 50 million** passenger trips per annum. Based on population growth the number of monthly taxi passengers will increase to **±4.2 million** by 2026.

Table 9.5: Monthly and Annual Taxi Passenger Trips

Variables	%	Total People (2021)	Total Number of Taxi Passenger Trips	Total People (2026)	Total Number of Taxi Passenger Trips
LSM 1-6	82	82 552	3 417 661	90 200	3 734 280
Add outside inflow from towns	10%		3 759 427		4 107 708
Passengers per annum			45 113 121		49 292 496

In total between R62 million and R64 million per month is paid by households for taxi transport. This was **based** on the payment **per trip** as well as the **total household spent** on taxi transport. In total the contribution made by the taxi industry **is almost R800 million** per annum.

Based on both calculations the total expenditure is **very similar**. See Table 9.6 and 9.7.

Table 9.6: Monthly and Annual Spend by Commuters on Transport Based on Fee per Trip

	2021	2026
Cost of Round trip (Ave)	R34	R34
Monthly taxi fees by passengers	R63 910 255	R69 831 036
Annual taxi fees by passengers	R766 923 057	R837 972 432

Table 9.7: Monthly Expenditure on Taxi Transport Per Household

	2021	2026 (Based on current spend)
Ave spend per hh on taxi per month	R680	R680
Per year	R740 988 461	R809 635 200

9.3.2 Impact of Commuters on Formal and Informal Retail

The commuter market spending more than R 5 billion on formal retail products in the CBD per annum. The total spend per annum on retail in the CBD of Mahikeng is calculated at more than R 11 bn.

Table 9.8 Monthly and Annual Expenditure by Commuter Households on Formal Retail in Mahikeng CBD

	Expenditure 2021	Expenditure 2026
LSM 1-6 Taxi Commuter Households	82 522	90 200
Spend per month on retail*	R4 500	R4 500
Total Retail Spend per month by Commuter Households	R371 349 000	R405 900 000
Total Retail Spend by Commuter Households Per year	R4 456 188 000	R4 870 800 000
Total Spend plus 15% inflow from Outside	R5 124 616 200	R5 601 420 000

*Based on Urban Studies 2019/20

The average turnover by all hawkers in the CBD per annum is estimated at R 71 million or R14 800 per month.

Table 9.9 Monthly and Annual Expenditure by Commuters on Informal Retail in Mahikeng CBD

Spending at Informal Traders/Hawkers	
No of traders	400
Ave turnover per day	R525
Operates 6.5 days/week	6.5
Weeks pa	52
Total turnover pa	R70 980 000
Average Monthly turnover per hawker	R14 800

9.3.3 Impact of Taxi Industry on Local Mahikeng Economy

On average 1299 taxis make 8 444 trips per day transporting more than 126 000 commuters currently.

Table 9.10 Total Daily Taxi trips

No. of passenger trips per Month	No of passengers per day	No of taxi trips per day based on 15 passengers per taxi	No. of taxis based on 6.5 trips per day
3 800 000	126 667	8444	1299

54% of all taxis park on street level and 46% go to Bradford Taxi Rank. The morning peak arrivals vary between 260 and 350 taxis per hour. The same applies for taxi departing during the peak afternoon times. These figures closely correspond with the Taxi Drone Count conducted during 11 to 12 May 2021.

Table 9.11 Total Number of Taxis Arriving and Departing During Morning and Afternoon Peaks

	Morning Peak Hours	No. of taxis arriving in morning peak	No. of taxis using Bradford Taxi Rank (46%)
Commuters entering CBD during morning peak	6-7	260	120
	7-8	351	161
	8-9	260	120
Total Taxis Arriving during morning peak	Afternoon Peak Hours	870	400
Commuters leaving CBD during afternoon peak	14-15	182	84
	15-16	260	120
	16-17	351	161
	17-18	260	120
Total Taxis departing during afternoon peak		1052	484

In total almost 1 300 taxis travel almost 160 000km per day, or almost 60 million kms per annum.

Table 9.12: Total Distances Travelled by Taxis per Day, Month and Year

	Distances km	Ave distance in km
Taxis entering CBD from Areas 1-8 (51%)	4307	30 664
Taxis entering CBD from Clusters (34%)	2871	51 103
Taxis entering CBD from Towns (15%)	1267	75 996
Total distance travelled per day (km)		157 763
Total distance travelled per month (km)		4 732 879
Total distance travelled per year (km)		56 794 549

Based on the total distance travelled more than R122m is spent on fuel.

Table 9.13: Total Annual Spend on Fuel by Taxis

Daily Petrol Consumption (8 litre/km)	19 645 litres
Daily Spend on Fuel @ R17,31/litre	R 339 862
Monthly spend on Fuel @ R17,31 / litre	R10 195 845
Annual spend on Fuel @ R17,31 / litre	R122 350 142

According to Table 9.14 almost **72%** the total running costs are for fuel.

Table 9.14: Annual Expenditure on Taxi Operations/Running Costs

Aspects	Taxis (1372)	%
Fuel per month	R131 712 000	72%
Parts per year	R18 384 800	10%
Services per year	R19 345 200	11%
Tyres per year	R13 171 200	7%
	R182 613 200	100%

In total income generated by the Taxi Industry is estimated at R770 million per year(see Table 9.6) of which R294m is income before tax, to the Taxi Associations.

Table 9.15: Estimated Annual Expenditure for Taxi Industry

Total Income taxi industry per year	R766 923 057
Expenses	R182 613 200
Salaries	R141 395 349
Other	R18 261 320
Depreciation**	R129 900 000
Total Expenses	R472 169 869
Total Income for Taxi Association minus Expenses	R294 753 188

* Other – included costs like insurance, head office, panel beating and other maintenance.

** Depreciation based on a taxi price of R500 000, depreciating by 20% p.a.

All the above mentioned clearly indicate how strong the taxi industry contributes to the local economy.

9.4 Bus Operator Survey

In the commuter survey only 1% of the commuters interviewed, make use of bus transport. Table 9.10 gives an indication of the different Bus operating companies interviewed to establish their support for Mahikeng. Note the following:

- Atamelang Bus Service: Tel 018 3812680. Famy Didhade from the Despatch Department. They run a daily bus service between Mahikeng and Johannesburg Buses leaves from Mahikeng at 07:00 from Monday to Friday at 07:00 from MegaCity and return same day at 15:00 from Park Station in Johannesburg. The bus fee per trip is R200.
On Saturdays the bus leaves at 07:00, but returns at 14:00 from Park Station.
On Sundays the bus leaves Mahikeng at 11:00 and returns at 17:00
Therefor 7 trips per week between Mahikeng and Johannesburg. They have a good relationship with the Taxi Associations and do not foresee any growth in their business from Mahikeng right now.
They would participate in the transport processes in planning for the future in Mahikeng.
- Bojanala Bus Company: Tel 014 565 6550
They run buses every day, 7 days a week from Rustenburg to Mahikeng leaving 07:00 or 08:00 from Rustenburg returning 13:00 from Mahikeng. Month ends they have 5 to 6 buses and over the Christmas and New year periods up to 10 bus to and from Mahikeng. The highest number of buses used during that period was 15 to 16 buses. They have an agreement with the Taxi Associations and often have meetings with them to solve problems that may occur.
They will definitely take part in discussions to improve the transport offering in Mahikeng.
- Translux **does not operate** on the Mahikeng route and **do not plan** to do so in the near future.
- Unitrans: Jasen Smallbone Tel 064 757 9738 would **like to be part** of the future planning of transport facilities in Mahikeng. They do not operate a bus service there and only between Kathu, Kuruman and Botswana. They maintain, service, fuel and clean all Gautrain buses as well as the MyCity buses in Cape Town. They could include Mahikeng for a route once they established the need for it.
- Intercap **does not** pass Mahikeng. Difficult to get permits and taxi associations block any further involvement. They would like to be part of the process.

9.5 Development Potential

The development potential will be determined by the micro location as part of the Bradford Taxi Rank as well as the new holding area. The potential is based the current performance and an estimated 15% and 30% capturing of the market. Table 9.16 indicates the following:

- Filling station potential of between 100 000 and 190 000 litres. This will depend on the level of competition, quality of the facilities and the micro location.
- The potential for spare parts, tyres, other motor related is estimated at R1m per annum. The financial viability must be clearly investigated. The competition is already very strong within Mahikeng CBD.

Table 9.16: Market Potential Based on Current Expenditure

Aspects	Taxis (1372)p.a	Estimated Turnover based on 15%	Litre Per Month (15%)	Estimated Turnover based on 30%	Litre Per Month (30%)
Fuel per month	R131 712 000	R1 142 012	95 168	R2 284 023	190 335
Parts per year	R18 384 800	R159 406		R318 812	
Services per year	R19 345 200	R167 733		R335 466	
Tyres per year	R13 171 200	R114 201		R228 402	
	R182 613 200	R1 583 351		R3 166 703	

Market Potential Retail

The estimated retail development potential is based of 3% of the commuter spend is R154 m p.a. This represent a shopping centre of ±5 000m², of which at least 3 000m² should be allocated to a grocery store. This proposed centre should form part of Bradford Taxi Rank and must have a very accessible location. The grocery anchor must be part of a well-known national brand. It is recommended that this project is undertaken together with experienced shopping centre developers.

Market Potential Stalls

The development of formal stalls should only be considered in one of two high pedestrian volume areas, leading from Bradford Taxi Rank to the core of the Mahikeng CBD/Station Road. It is not recommended that any stalls be built in the direction of Mafikeng Mall, because on 13% of the shoppers make use of this centre. 87% of the shopping centre support is towards Mahikeng CBD/Station Road. Currently only 2% of the stalls are fixed in close proximity to Bradford Taxi Rank. The majority are operating form the pavement and relocate during the day from place to place. Fixed structures could easily become not used. There fore the micro location of any future store is of critical importance.

Market Potential Storage

The single most important need expressed was for storage space. There is potential for 50-75 stalls but located in three different hubs/areas/locations. These hubs must be within walking distance from the concentration of the majority of the informal traders.

Potential for Bus Transport

The current use of buses is limited with less than 1% of all commuters using bus transport. Potential exists to increase the availability of more buses. The table below indicates that up to 17 buses could be deployed.

Table 9.17: Market Potential Bus Transport

Total Passenger trips per day	126 667
0,8% use bus	1 013
60 passengers per bus	
Daily Number of Buses	17

9.6 Conclusion

All the above mentioned potential will depend on good accessible locations and to compete against well established facilities already present in the CBD. The storage and stalls should also be located at the most accessible locations.

10. STRATEGIC TRANSPORT DEVELOPMENT GOALS OBJECTIONS AND ACTION PLANS

10.1 ROLE AND FUNCTION OF MAHIKENG AS A TRANSPORT ORIENTATED HUB

All the above-mentioned surveys clearly highlighted the role and function of Mahikeng. The capital status of Mahikeng plays a significant role and contributes to the regional support of the city. At the base of this capital status and regional support is a very strong local and long-distance taxi industry.

The eleven goals identified below are all based on the situational analysis where certain changes and trends, as well as very specific guidelines for further transport development and planning have been identified. The six different market surveys and workshops conducted in Mahikeng form the basis of this strategic transport development goals.

10.2 RELEVANT PLANNING DOCUMENTS AND GUIDELINE POLICIES

The following documents were evaluated and incorporated as base documents for this particular transport development goals and objectives.

- MAHIKENG LOCAL MUNICIPALITY INTEGRATED DEVELOPMENT PLAN 2020-2021
- MAHIKENG LOCAL MUNICIPALITY SPATIAL DEVELOPMENT FRAMEWORK 2019, Maxim Planning Solutions
- MAHIKENG LM -LOCAL INTEGRATED TRANSPORT PLAN, SECOND DRAFT 2018

10.3 SUMMARY OF POPULATION NUMBERS AND PROJECTIONS

There are currently ±350 000 people and an estimated ±110 000 households in the Mahikeng local municipality by 2026. All this information was included in the above-mentioned economic impact analysis. The profile of the households is mainly LSM 1 – 6.

10.4 SUMMARY OF DIFFERENT MARKET SURVEYS AND WORKSHOP

Very clear recommendations were made as to how to **improve, develop and revitalise** the taxi industry, as well as the CBD of Mahikeng.

10.5 SUMMARY OF TAXI INDUSTRY

The number of annual taxi passengers, the number of taxi trips and taxis, as well as the economic contribution of the industry to the local economy were clearly identified in Section 9 above.

10.6 VISION AND PLANNING GUIDELINES FROM ABOVE-MENTIONED DOCUMENTS

In the different documents the following reference was made with regards to the vision and transport planning:

- To be a City that will create and promote an enabling environment for the private and public sector investment in building rural economy of the municipality in the context of the Villages, Townships and Small Dorpies through National Development Plan
- Establish effective, safe and affordable public transport.
- Construction of the Government Precinct in the inner city and the Upgrading of the Bradford Taxi Rank

10.7 STRATEGIC TRANSPORT DEVELOPMENT GOALS

This Transport Development Strategy culminated in eleven very specific goals with objectives linked to each goal. The action steps give broad indications of what should be done, especially during the short to medium term.

GOAL ONE-

TO GET CLARITY ON THE OWNERSHIP AND RESPONSIBILITIES OF THE LOCAL GOVERNMENT AND DIFFERENT TAXI ASSOCIATIONS

OBJECTIVE 1.1

- To get better cooperation between the different taxi associations and the City Council

OBJECTIVE 1.2

- To get clarity regarding land ownership in and around the Bradford taxi rank
- Get clarity on ownership of the land for the holding area

ACTION STEPS

- To lay down very specific guidelines as to ownership, operations and management
- To give guidelines in terms of land ownership
- To give guidelines to the development of additional land for further transport orientated development

GOAL TWO

TO IDENTIFY MANAGEMENT STRUCTURES TO BETTER CONTROL AND MANAGE THE TAXI INDUSTRY

OBJECTIVE 2.1

- Create structures for better cooperation between the taxi association and the City Council

OBJECTIVE 2.2

- Clearly identify the responsibility of different role players in terms of maintenance, coordination and the day-to-day running of the taxi facilities

OBJECTIVE 2.3

- Ensure that rules and regulations are very clear and adhered to

OBJECTIVE 2.4

- Control, train and improve the attitude of taxi drivers

OBJECTIVE 2.5

- Better control and direct traffic flow into and out of the Bradford taxi rank

OBJECTIVE 2.6

- Establish discipline and enforce law and order

ACTION STEPS

- Investigate one transport controlling body to regulate the entire industry, and to enforce the laws
- Centralise everything in a well-managed transport hub – to be investigated

GOAL THREE

ADDRESSING SPECIFIC MAINTENANCE PROBLEMS IN TAXI RANKS AND ALONG MAJOR ROADS

OBJECTIVE 3.1

- To improve the standard of current facilities

OBJECTIVE 3.2

- To provide a clean and safe business environment for hawkers and formal businesses

OBJECTIVE 3.3

- To create an attractive environment for commuters

OBJECTIVE 3.4

- To improve roads and repair potholes

OBJECTIVE 3.5

- To sort out all running water problems, leakages and poor drainage
- To improve general maintenance throughout the taxi ranks and the CBD

ACTION STEPS

- To install facilities to improve the entire CBD to satisfy the needs of the commuters and the business sector

GOAL FOUR

PROVIDE ALL NECESSARY FACILITIES AND UPGRADE EXISTING

OBJECTIVE 4.1

- Provide more storage facilities for hawkers/informal traders
- 46% make use of formal storage space

OBJECTIVE 4.2

- Provide running water

OBJECTIVE 4.3

- Provide electricity points
- Provide public toilets
- Improve safety and security
- Improve cleaning of streets

ACTION STEPS

- Provide permanent structures for the hawkers
- Select the most accessible location to form clusters of storage Hubs
- Lockers from 0.5m x 0.5m, medium size 1mx1m, larger lockers 2m x2m
- Provide lockup storage facilities for ±80-100 traders
- Clean up the area
- Improve security

GOAL FIVE

REDEVELOP, REVITALISE AND IMPROVE BRADFORD TAXI RANK

OBJECTIVE 5.1

- Create a well-functioning, attractive taxi/bus transport hub

OBJECTIVE 5.2

- Ensure that the taxi rank fulfils in all the needs of the commuters, taxi drivers, hawkers and business people

OBJECTIVE 5.3

- Safety at the Bradford taxi rank is one of the most important drivers for future use and success

OBJECTIVE 5.4

- Investigate the feasibility and most appropriate location for formal hawker stalls.

OBJECTIVE 5.5

- Investigate the feasibility, best location and desirability for formal retail facilities.

ACTION STEPS

- Upgrade and renew existing facility
- Improve security at the taxi rank
- Upgrade toilet facilities
- Provide shelter for all
- Clean area on a regular basis
- Provide more permanent structured stalls at accessible locations
- Train and improve the attitude of the marshals
- Link the taxi rank with bus transport
- Address all water related problems
- Provide more off-loading facilities for trucks
- Improve ingress and egress to the taxi rank
- Potential for formal stores will be driven by micro location within the taxi rank
- Potential for hawker stalls will be driven by the micro location within the taxi rank.

GOAL SIX

DEVELOP A FUNCTIONAL NEW HOLDING AREA TO COMPLEMENT BRADFORD TAXI RANK

OBJECTIVE 6.1

- Provide enough parking bays for the current and future taxi volumes

OBJECTIVE 6.2

- Develop a holding hub with the necessary facilities and services

OBJECTIVE 6.3

- Address all the needs of the taxi drivers to improve their work environment

ACTION STEPS

- Provide undercover parking
- Provide toilet facilities
- Provide fuel facilities
- Provide good security and policing
- Provide washing bays for taxis
- Provide restrooms for the taxi drivers
- Keep the area clean and neat
- Consider facilities like a spare part outlet, fitment centre, exhaust and tyre outlets
- Provide a small workshop
- Address problems at smaller taxi ranks throughout the city

GOAL SEVEN

DEVELOP A STRONG BUS FACILITY TO CATER ESPECIALLY FOR LONG DISTANCE TRANSPORT

OBJECTIVE 7.1

- Grow and increase the use of bus transport. 0.8% are using bus transport at the moment

OBJECTIVE 7.2 More daily local buses to Johannesburg and Rustenburg

OBJECTIVE 7.1

- Contact and establish national bus transport facilities. Unitrans may be interested

OBJECTIVE 7.1

- Contact and establish national bus transport facilities

ACTION STEPS

- Prepare a strategic marketing plan to increase use of buses
- Contact Unitrans to link with Mahikeng
- Integrate with existing Bradford Taxi Facilities.

GOAL EIGHT

REDEVELOP / REVITALISE CBD OF MAHIKENG

OBJECTIVE 8.1

- Upgrade and revitalise the CBD to become attractive for more business opportunities

OBJECTIVE 8.2

- Improve and upgrade retail facilities

OBJECTIVE 8.3

- Provide more job opportunities in the CBD of Mahikeng

ACTION STEPS

- Upgrade and maintain the roads
- Improve the infrastructure
- Get more involved with the business sector
- Improve and maintain parks
- Upgrade the sidewalks
- Provide visible policing
- Improve the police services
- Conduct foot patrols
- Install CCTV cameras
- Address the street children problem
- Provide better lighting
- Create more jobs
- Improve the shopping facilities in the CBD
- Provide incentives for developers
- Attract more businesses
- Attract more support from the region and the private sector
- Develop and train hawkers and other business people
- Involve the business sector in future planning
- Improve electricity supply and prevent load shedding

GOAL NINE

CREATE AND DEVELOP A CITY MARKETING PLAN TO ATTRACT MORE INVESTMENTS /FUNDING

OBJECTIVE 9.1

- Clearly highlight the economic importance of Mahikeng

OBJECTIVE 9.2

- Attract more investors through a comprehensive marketing plan

OBJECTIVE 9.3

- Capitalise on the capital status of Mahikeng

ACTION STEPS

- Capitalise on the regional support
- Strengthen the regional hub from 10% to at least 12%
- Utilise the key drivers from the market research to formulate a marketing plan
- Make use of experts to draw up a city marketing plan for Mahikeng

GOAL TEN

FUTURE PLANNING SHOULD INCORPORATE ALL THE ABOVE MENTIONED IN TERMS OF CREATING A TRANSPORT ORIENTATED HUB

OBJECTIVE 10.1

- Ensure that all future planning work together to create a transport orientated hub

OBJECTIVE 10.2

- This transport orientated hub should fulfil the needs of all commuters, businessmen, taxi associations, taxi operators and the City Council

OBJECTIVE 10.3

- The execution of all these plans is of critical importance

ACTION STEPS

- All the different reports clearly highlight specific detail regarding the development of the transport orientated hub, as well as the upgrade of the CBD

GOAL ELEVEN

SECURITY IS THE MAIN DRIVER OF THE TAXI INDUSTRY, THE CBD AND THE SUCCESS OF THE WHOLE AREA

OBJECTIVE 11.1

- To create a safe environment

OBJECTIVE 11.2

- To improve current police activities

OBJECTIVE 11.3

- Safe environment conducive for business trade tourism and outside support

ACTION STEPS

- Improve all security
- Provide visible policing
- Provide all the necessary security facilities with good policing

CONCLUDING REMARKS

The total transport industry contributes more than a **billion rand** to the local economy. It is therefore of utmost importance to make sure that the facilities are of a high standard to attract more commuters, to support more formal and informal businesses, and to create a destination within a safe environment and a safe workplace. This will create more investors confidence and create more job opportunities.

The critical concern raised in various meetings was the fact that many previous reports did not culminate in action plans on the ground. It is of utmost importance to make sure that all the above mentioned must be implemented.

ANNEXURE 1

LIST OF REPRESENTATIVES AND OPERATORS OF THE TAXI ASSOCIATIONS

Name and Surname	Designation	Contact details
Amantle Gaokgorwe	Transportation planning intern	079 381 7932 amygaokgorwe@gmail.com
Malebo Mohlonyane	Town planner (MLM)	067 957 6166 malebomlm@gmail.com
Johan Mans	JM PROF	082 336 7979 Admin@jmprof.co.za
Thenda Masia	Director- planning and development	072 720 4306 Thendo.masia@mafikeng.co.za
Rebone Manyapetsa	Town planner intern (MLM)	071 602 0022 rbotho@gmail.com
Dirk Nico Prinsloo	Urban Studies	082 857 9074 dirknico@urbanstudies.co.za
Dirk A Prinsloo	Urban Studies	082 450 8819 dirk@urbanstudies.co.za
Lesejane MD	MMMTA	076 967 9144
Dintoe R	Bolldta Secretary	063 248 8143 bolldta@gmail.com
Mooketsi M	SETA	083 343 3313
Mashabe V	SETA	073 176 5335 gveetrading@gamil.com
Nkosi J	NMMRTC	083 335 2829 nbazala@gmail.com
Rangwako W	Transport planner (MLM)	083 748 4187 keabetswe.rangwako@gmail.com
Makhoba K	Bolldta	072 140 9282 Akmakhoba@yahoo.co.za
Matsemela M	Santaco	082 493 7222 Lebomatsemela1@gmail.com
Mokomela SB	Molopo TA	072 369 1438
MJ	Molopo	073 620 0002
Letima C	SATA	083 499 4644 letimakci@gmail.com
Motlhala HBT	MMMTA	079 442 8208 hbtmotlhala@gmail.com
Mogote E	Ramogalo	078 261 8165 tiisetsojuniors@gmail.com
Motsumi T	Ramogalo	078 177 9774
Montshioa	MUTA	072 704 5334
Faith Sotshayo	Town planner (MLM)	018 389 0351 Faith.sotshayo@mafikeng.gov.za
Sechoaro OPL	Nowetra	072 565 5404 olihiledistributors@gmail.com
Bantsijang MJ	Nowetra	078 888 8944

ANNEXURE 2
ORIGIN OF COMMUTERS

AREA / CLUSTER (TOTAL DONE)	ORIGIN OF COMMUTERS	%
	TOTAL RESPONSES	376
Area 1 (14)	Lonely Park	1.6
	Signal Hill	1.1
	Leopard Park	0.5
	Top Village	0.3
	Molelwane	0.3
Area 2 (58)	Magogoe	10.9
	Motsoseng	1.6
	Motlhabeng	1.3
	Seweding	1.3
	Mmabatho (outside)	0.3
Area 3 (13)	Thlabologo	1.3
	Bokone	0.8
	Lorwaneng	0.8
	Montshioa Stad	0.3
	Tloug	0.3
Area 4 (64)	Koikoi	6.1
	Lomanyaneng	3.7
	Mayemantsho	3.2
	Setlopo	2.4
	Dihatshwane	1.6
Area 5 (13)	Mmabatho Units 4,7,8,10,12 & 13,15	2.7
	Lokaleng	0.8
Area 6 (12)	Montshioa	2.4
	Imperial Reserve	0.5
	Mmabatho (outside)	0.3
Area 8 (15)	Danville	1.3
	Golf View	1.3
	Bobhelong	0.8
	Mafikeng CBD	0.3
	Riviera Park	0.3
AREAS SUBTOTAL (189 done)		50.3
Cluster 01 (9)	Botshabelo	1.1
	Tsetse	0.8
	Ikopeleng	0.3
	Six Hundred	0.3
Cluster 03 (12)	Thlapeng	1.3
	Disaneng	1.1
	Mashutlhe 1	0.8
Cluster 04 (7)	Mashutlhe	0.8
	Modimola	1.1

Cluster 05 (1)	Makgabana (Madibe)	0.3
Cluster 06 (16)	Makhubung	4.0
	Ratau	0.3
Cluster 07 (5)	Madibe 2	0.8
	Morwatshetlha	0.3
	Mooiplaas	0.3
Cluster 08 (39)	Dithakong	4.5
	Ga-Koikoi	1.6
	Mafikeng	1.6
	Mantsa	1.1
	Lotlhakane	0.8
	Ditshilo	0.5
	Letlagorie	0.3
Cluster 09 (5)	Matshepe	1.1
	Matlhongane	0.3
Cluster 10 (18)	Bethel	3.7
	Schoongezicht	0.8
	Makouspan	0.3
Cluster 11 (17)	Deelpan	1.3
	Louisdal	1.3
	Bathobatho	0.3
	Uitkyk	0.3
	Kaalpan	0.3
	Kopela	0.3
	Kraaipan	0.3
	Lombaardslaagte	0.3
	Mareetsane	0.3
	CLUSTERS SUBTOTAL (129 done)	
Towns	Rooigrond	2.9
	Lichtenburg	2.7
	Delareyville	1.9
	Stella	1.3
	Rustenburg	0.8
	Vryburg	0.8
	Klerksdorp	0.5
	Zeerust	0.5
	TOWNS SUBTOTAL (43 done)	
Outside areas	Botswana	1.3
	Makgobistad	0.8
	Masamani	0.8
	Tshidilamolomo	0.5
	Mabule	0.3
	Potchefstroom	0.3
OUTSIDE AREAS SUBTOTAL (15 done)		4.0
		100