CHAPTER 3 DESCRIPTION OF THE STUDY AREA

3.1 INTRODUCTION

The aim of this chapter is to describe the study area in terms of its locality, history, topography, drainage, regional climate, geology and soils.

3.1.1 Locality and site history

The study area is located in the North West Province, approximately 22 km west of Potchefstroom (Figure 3.1). The Machavie Gold Mine was proclaimed in the 1930's after which mining proceeded actively until the early 1940's when the mine was closed. During this time, five tailings dams were established. After closure of the mine, water and wind erosion dispersed the tailings down slope, towards and on to the floodplain of the Kromdraai Spruit. This has resulted in an area of approximately 1,10 km^2 being covered with a layer of sheetwash and aeolian deposited tailings and the development of some tailings dunes (up to 1,50 m high).

3.1.2 Available information

The following information was used during the course of the study

- The 1:50 000 topographic sheet 2626 DB Eleazar.
- The published 1:250 000 Geological sheet 2626 BC West Rand.
- The 1:10 000 orthophotograph 2626 DB 14 Eleazar.
- The 1:50 000 aerial photographs 208 -210 and 247 -249 of job number 670.
- The 1:250 000 Land Type Series 2626 West Rand.

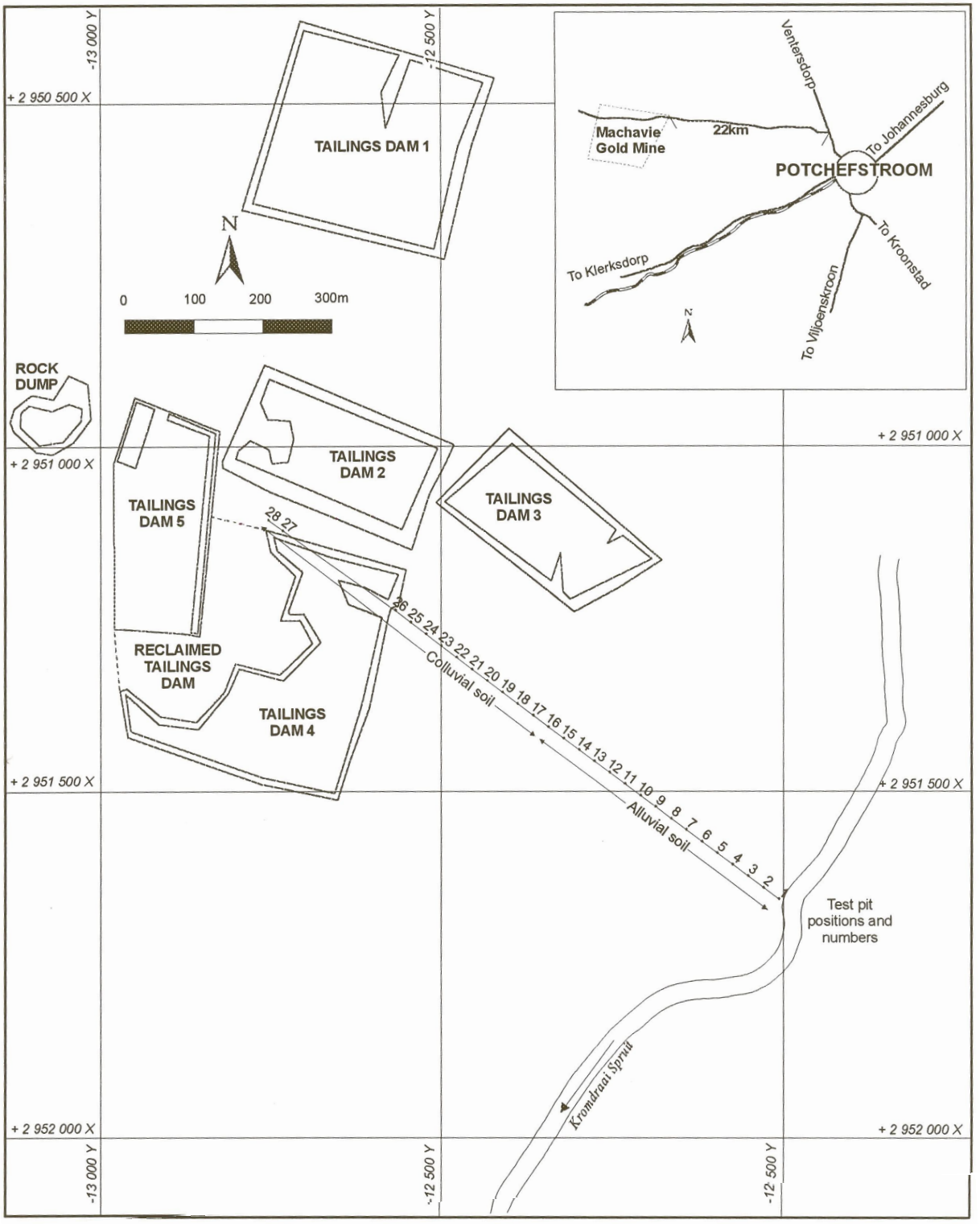


Figure 3.1 Locality of the investigated transect indicating test pit positions relative to the tailings dams and the Kromdraai Spruit.

3.2 CLIMATE

3.2.1 Regional climate of the Potchefstroom - Klerksdorp area.

No site specific climatic data are available for the study area, and therefore the statistics for the Potchefstroom weather station (located at 26° 44' S and 27° 04' E) were used to describe the climate of the area.

3.2.2 Mean monthly and annual rainfall of the Potchefstroom area

Potchefstroom occurs in the summer rainfall region with a long-term average annual rainfall of 613 mm occurring mainly between September and April (Table 3.1). The high evaporation rates of the area imply a water deficit during the whole year (Table 3.1).

Table 3.1 Averaged monthly rainfall and maximum 24 hour rainfall for the Potchefstroom area as well as average monthly A-pan equivalent evaporation data (Weather Bureau, 1995).

MONTH	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average (mm)	119	83	78	61	15	7	4	10	20	55	85	94
Max 24hr rainfall(mm)	95	79	83	83	27	24	23	52	49	53	75	78
Evaporation (mm)	235	195	175	137	115	93	110	156	204	239	233	250

3.2.3 Mean monthly maximum and minimum temperatures

The average minimum and maximum temperatures for the study area are given in Table 3.2. On average, the maximum summer temperature in the area varies between 27,2 °C and 29,2 °C while in winter the average minimum temperature varies between 0,5 °C to 0,7 °C.

Table 3.2 Mean monthly maximum and minimum temperatures (°C) from the Potchefstroom area (Weather Bureau, 1995).

MONTH	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum (°C)	22	28	27	24	22	19	19	22	25	27	28	29
Minimum (°C)	16	15	14	10	4	7	5	4	8	12	14	15

3.2.4 Mean monthly wind direction and speed

The area is characterized by the highest frequency of (in decreasing order) NW, N, NE and SW winds, especially during the warmer months of August to January. The wind speeds recorded over a 30 year period are generally low, 0 - 8 m/s with wind speeds of higher than 14 m/s having a frequency of less than 13 % and occurring only in August and September. The latter are very important in respect of wind erosion because they concide with the end of the dry season, i.e. with the period when the soils and tailings are at their driest, making them very vulnerable to wind eroison.

3.3 SITE DESCRIPTION

3.3.1 Topography and drainage

The study area is at an average elevation of 1379 m above mean sea level and has a gentle sloping topography towards the south. The highest part of the area is a hill located to the immediate west of the mine boundary, at 1560 m above mean sea level. The southern section of the mine boundary is the Kromdraai Spruit at an altitude of 1373 m above mean sea level. Sheetwash, in a southerly direction, is the predominant drainage mechanism of the site. This has resulted in the floodplain of the Kromdraai Spruit being covered by eroded tailings. Concentrated surface flow occurs in a donga that runs through a portion of the site, towards the Kromdraai Spruit.

3.3.2 Vegetation

According to Acocks (1988), the vegetation cover of the area is pure grassveld, comprising of *Cymbopogon-Themeda* veld types. Indigenous trees (e.g. *Rhus* species) are present as thickets. According to Erasmus (1997), the vegetated eroded tailings deposits are covered by *Cynodon dactylon* grass.

3.3.3 Geology

According to the published 1:250 000 Geological Map Series 2626 Wes-Rand, the major part of the study area is underlain by sedimentary rocks of the Transvaal Supergroup while a small portion on the west is underlain by volcanic rocks of the Ventersdorp Supergroup (Figure 3.2) The stratigraphy of the area is shown in Table 3.3.

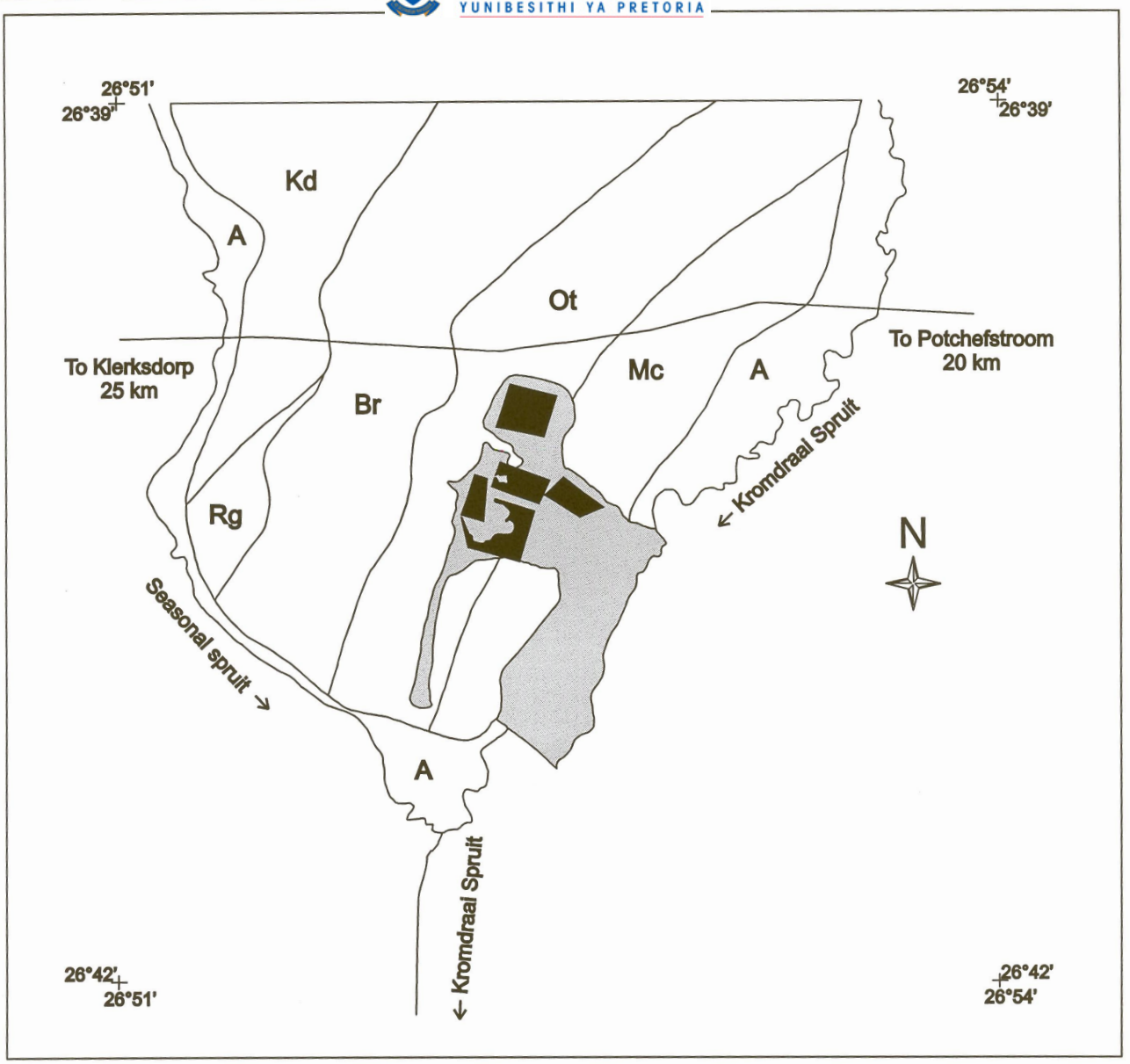
The Transvaal Supergroup in the study area is represented by the Monte Christo and Oaktree Formations (which belong to the Malmani Subgroup of the Chuniespoort Group) and the Black Reef Formation. The composition of each formation is described after Brink (1979). The Monte Christo Formation consists of light coloured chert-rich recrystallised dolomite with stromatolites and basal oolitic bands. The formation is generally 740 m thick in the West Rand area. The Oaktree Formation consists of dark coloured chert-poor dolomite, sometimes with wad and carbonaceous shale towards the base. According to Eriksson & Truswell (1979) the Oaktree Formation consists of six stratigraphic units which include zones of domical stromatolites, thin shale units as well as the convoluted chert marker. Occasional chert partings occur at the top of the formation. The formation is generally 330 m thick in the West Rand area. The Black Reef Formation consists of a basal conglomerate unit overlain by quartzite, wad and carbonaceous shale. The formation is generally 25 m thick in the West Rand area.

The Platberg Group of the Ventersdorp Supergroup occurs in the western portion of the study area. Two formations of the Platberg Group, the Rietgat and the Kameeldoorns Formations occur

in the study area. The Rietgat Formation is composed mainly of greenish-grey amygdaloidal and porphyritic lava, with interbedded shale, tuff, greywacke, conglomerate and impure limestone with algal structures. The Kameeldoorns Formation forms the base of the Platberg Group and is confined mainly to fault troughs. The formation is composed mainly of coarse basal conglomerate and greywacke, agglomerate and tuff, calcareous shale and pure limestone with subordinate greenish-grey lava (Visser, 1989).

Table 3.3 The stratigraphy of the investigated area

Transvaal Supergroup	Chuniespoort Group	Malmani Subgroup	Monte Christo Formation	Chert-rich dolomite
			Oaktree Formation	Chert-free dolomite
			Black Reef Formation	Feldspathic quartzite, shale and conglomerate
Ventersdorp Supergroup	Platberg Group		Rietgat Formation	Greenish-grey amygdaloidal and porphyritic lava, with interbedded shale, tuff, greywacke, conglomerate and impure limestone
			Kameeldoorns Formation	Coarse basal conglomerate and greywacke, agglomerate and tuff, calcareous shale and pure limestone with subordinate greenish-grey lava



LEGEND

- Tailings dams
- Surficial tailings
- A Alluvium

FORMATION	SUBGROUP	GROUP	SUPERGROUP
Mc Monte Christo Formation			
Ot Oaktree Formation	Malmani Subgroup	Chunies Poort Group	Transvaal Supergroup
Br Black Reef Formation			
Rg Rietgat Formation		Platberg Group	Ventersdorp Supergroup
Kd Kameeldoorns Formation			

Figure 3.2 Regional geology of the study area.

3.3.4 Pedology

According to the 1:250 000 Land Type Series 2626 Wes-Rand the soils occurring on the 1:10 000 orthophoto 2626 DB 18 Eleazar comprise Land Types Fa14a and Ba42b (Land Type Survey Staff, 1984). Land Type Fa14a underlies the majority of the area and is characterized by a pedologically young landscape of mixed origin. The dominant soil forming process in this area is by rock weathering, and thus orthic A horizons underlain by lithocutanic b horizons are common. Land Type Fa specifically refers to land in which lime is not encountered regularly in any portion of the landscape. Hillcrest areas in this land type are characterized by rock, Mispah and occasionally shallow Hutton form soils. The upper sideslopes are mainly composed of rock and Mispah soils while the lower sideslopes have more Mispah soils. The valley bottom soils are mainly of the Hutton and Westleigh form soils (Land Type Survey Staff, 1984).

Land Type Ba24b occurs in the western portion of the area. Land type Ba indicates land in which red and / or yellow brown apedal soils (Hutton, Bainsvlei, Avalon, Glencoe and Pinedene soil forms) that are dystrophic and / or mesotrophic, dominate over red and / or yellow brown eutrophic soils. In unit Ba24b more than 10 per cent of the area contains plinthic soils, while red soils occupy more than a third of the total area. Hillcrest areas contain mainly rock and Hutton soil forms, while upper slope areas are dominated my Hutton, Mispah and Avalon soil forms. Lower slopes are dominated by Westleigh, Valsrivier and Glencoe soil forms, while valley bottom areas mainly contain Rensburg soil forms (Land Type Survey Staff, 1984).