

moles in servitude where
previous pipe went.

SITE INVESTIGATION:

ROUGH-HAIRED GOLDEN MOLE
(Chrysospalax villosus)

&

JULIANA'S GOLDEN MOLE
(Neamblysomus julianae)

RIETVALLEI NATURE RESERVE
&
BROMBERG CONSERVANCY

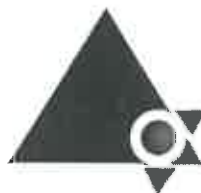
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SECTION A

SURVEY FOR THE PRESENCE OF ROUGH-HAIRED GOLDEN MOLE, CHRYSPALAX VILLOSUS, CONDUCTED AT RIETVLEI NATURE RESERVE ON 20 NOVEMBER 2008.

2.1 INTRODUCTION

2.1.1 Assessment Process

The assessment was undertaken following a request by Dr. Ute Schwaibold for this specialist study as part of the larger Environmental Impact Assessment (EIA) executed for Rand Water. The site was visited on 20 November 2008. See Appendix B at the end of this document for information on the experience and roles of the participants in this specialist study. During the assessment we investigated habitat suitability for, and signs pointing towards the presence of the Rough-haired golden mole (*Chrysospalax villosus*), a red data species (IUCN Red Data List of Threatened Species, 2008) that was thought to occur on Rietvlei Nature Reserve (Figure 1). Historical distribution data from museum records indicate that this species have been documented here (see map compiled from available distribution data in Figure 2).



Figure1.1: An adult rough-haired golden mole (*Chrysospalax villosus*) - Photo: Dr. Gary Bronner



Figure 1.1: Aerial photograph showing the spatial context of the Rietvlei Nature Reserve area where the present survey was conducted. The pink line demarcates the proposed route of the pipeline through Rietvlei Nature Reserve. Numbers 1 to 4 depict the study sites focused on during the survey.

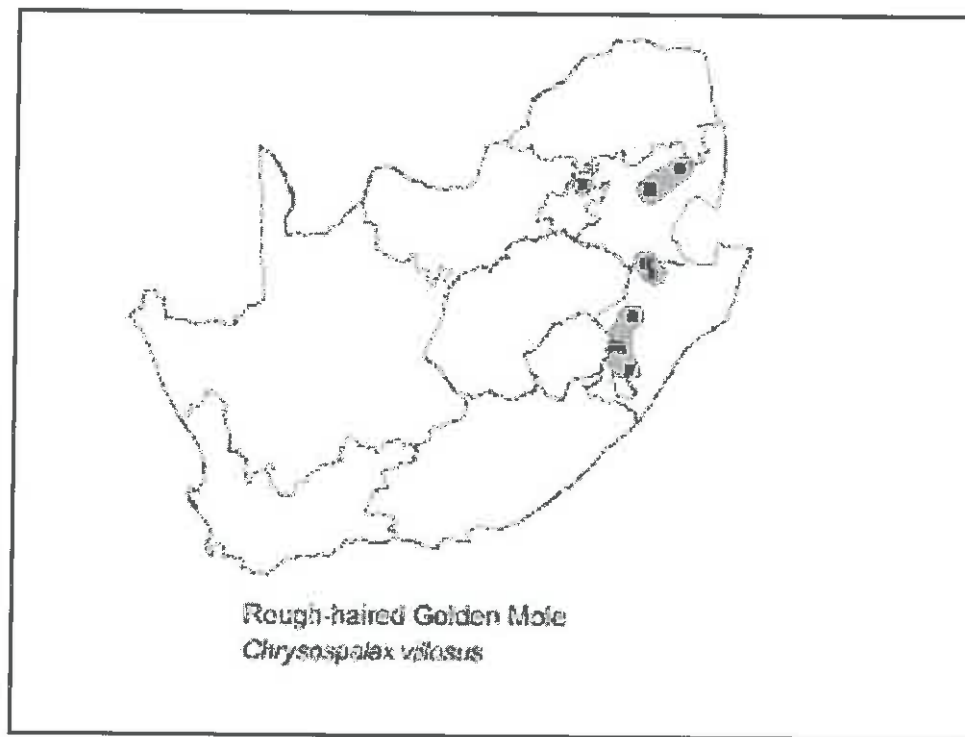


Figure 1.2: The known distribution of the rough-haired golden mole (Map with permission of Mark Keith, University of the Witwatersrand, and is also available on <http://www.calacademy.org/research/bmammals/afrotheria/ASG.html>)

The aim was to investigate the potential impact of the construction of a water pipeline on biodiversity along two alternative routes that were proposed. One of the two alternative routes will pass through Rietvlei Nature Reserve (Gauteng) and have an impact on grassland and wetland habitat in the reserve. The other route (less impact) will have an influence on the habitat at the edge of the reserve along the road from Pretoria to Delmas. We assessed areas along the two alternative routes (indicated on Figure 3 and Figure 4). We documented positive signs of occurrence as well as the presence of suitable habitat, since these moles are extremely elusive animals that are mainly active at night (nocturnal).

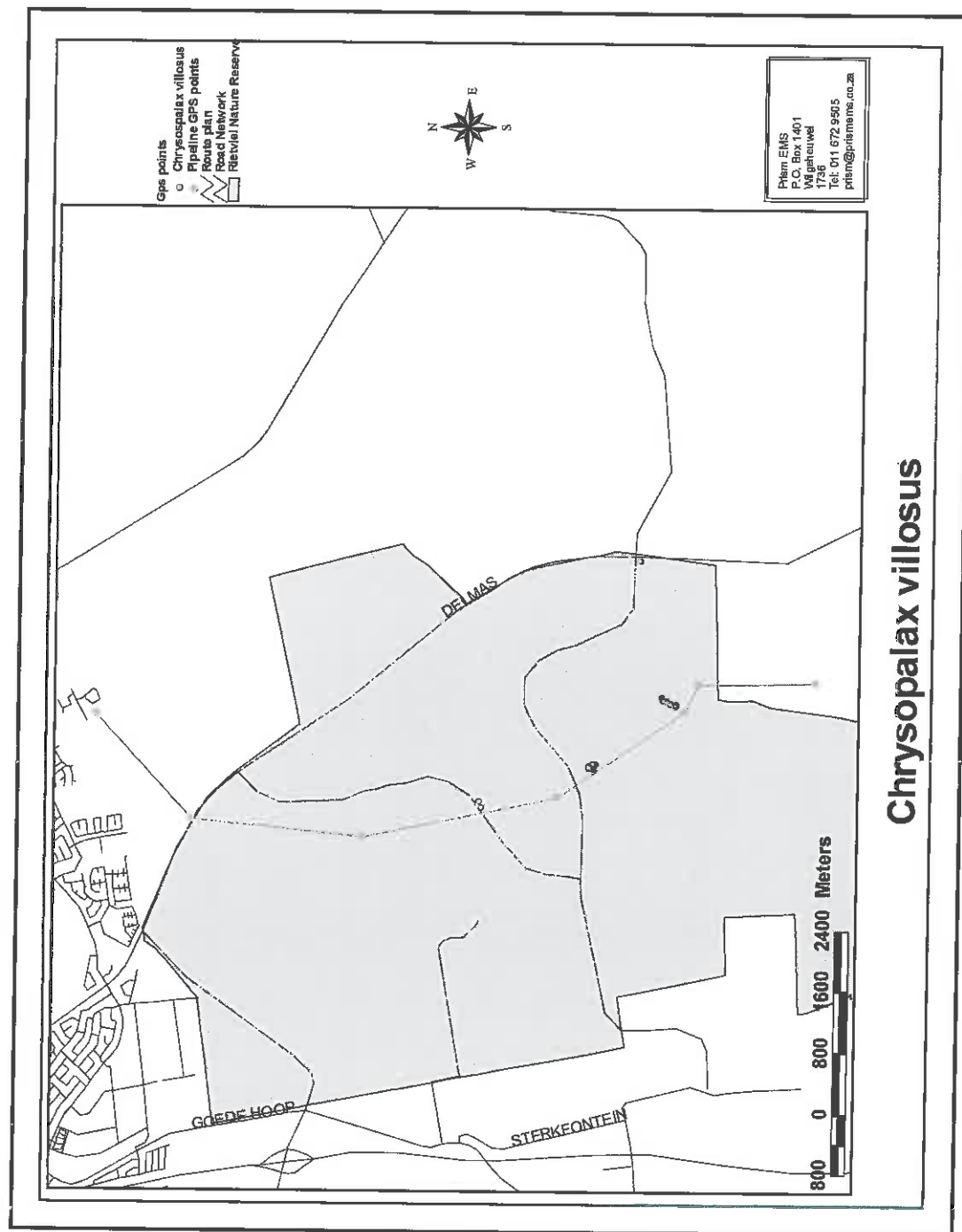


Figure 1.2: GPS coordinates of FOUR sites where suitable habitat for the Rough-haired golden mole was identified, and burrows and/ or signs of activity were recorded.

Site 1) North and adjacent to a water body and tributary of the Rietvlei dam, in the south-eastern section of the Rietvlei Nature Reserve.

Site 2) North east of the overnight hut, below the side slope of the rocky ridge.

Site 3) South east of the Rietvlei dam adjacent to the tar roads in the center of the Rietvlei Nature Reserve.

Site 4) West of the R50 (Delmas road) on the eastern border of the Rietvlei Nature Reserve.

2.2 THE ROUGH-HAIRED GOLDEN MOLE AND THE CONSERVATION THEREOF

2.2.1 Background information

The rough-haired golden mole, endemic to South Africa, has a distribution that is characteristically disjunctive with records from a number of provinces including the Eastern Cape, KwaZulu Natal, Gauteng and Mpumalanga (Figure 2, map with permission of M. Keith). Despite this relatively wide distribution, this species is rare because of its very specific habitat requirements, and it has thus far been caught at only 10 localities. It frequents grasslands and meadows in the Savannah and Grassland biomes of South Africa, and is extremely secretive and elusive. It is also found along the edges of marshes. Detecting the presence of rough-haired golden moles is made all the more difficult by their preference for areas with sandy soils and dense vegetation, normally close to watercourses.

The rough-haired golden mole has a coarse and long pelage and is generally larger than most of the other species of golden mole. The glossy individual hairs of the guard coat on the mid-back are slate-grey at the base with reddish brown to brown at the tip. The under fur is woolly and grey (Figure 1). The claws of the third digit on the front feet are powerful (Skinner & Smithers, 1990).

To date there is a paucity of information about their general biology. They are rarely seen, despite them coming onto the surface at night to root for food. The burrow systems comprise deep, permanent tunnels that link up to a nest, and a number of superficial foraging tunnels that open to the surface via a number of ovoid holes that resemble the holes of freshwater crab chambers (Figure 5). These openings often are filled with shallow soil tailings or soil that has been displaced to the side and back, also similar to those of crabs; sometimes a shallow depression is also found at the burrow entrance, and possibly serves as a latrine. The telltale indicators of rough-haired golden moles are "rootings" made by the leathery nose pad during nocturnal surface foraging bouts. These signs resemble a scuff made by the edge of the heel of a shoe that has been dug superficially into the soil, and are usually located very close to the open holes. In wet soils the imprint of their feet can sometimes also be seen. These trails are only evident during summer rainfall months when the soil is moist enough for burrowing activity. This should be taken into SERIOUS consideration when conducting surveys, and any surveys done in the dry winter months may be very misleading. Surface foraging and activity usually follows a period of rainfall. The diet comprises insects

and earthworms, but has not been documented well and it is possible that they are generalists who will also take any invertebrate or even small vertebrate prey that they come across, as is the case with the Giant golden mole *Chrysospalax terveyani*. If disturbed when on the surface, these moles quickly retreat back to the safety of the nearest burrow, and they apparently have a remarkable ability to retrace their steps even under the cover of darkness.

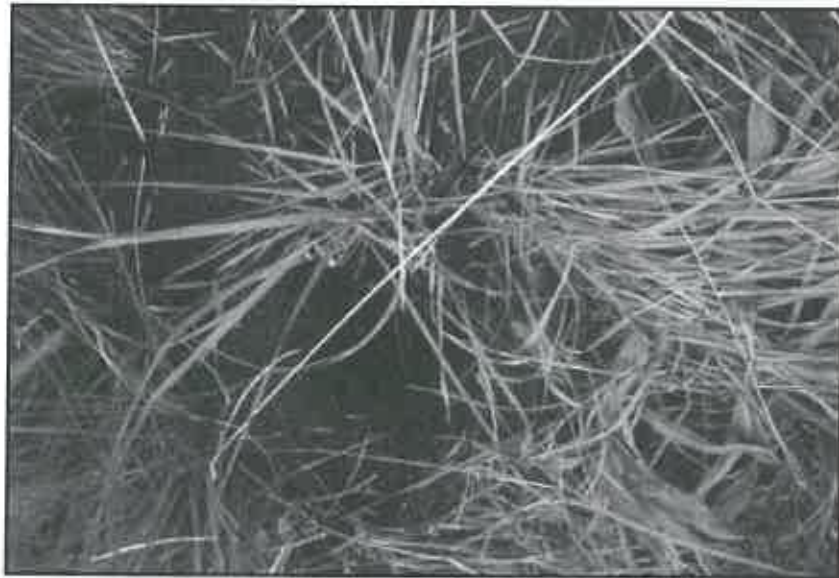


Figure 1.3: A confirmed burrow of *Chrysospalax villosus* at a golf course in KwaZulu Natal. This was taken as the standard according to which the burrows found in the present survey were assessed.

The conservation status of the rough-haired golden mole is currently categorized as vulnerable B2ab(i,ii,iii,iv) (IUCN Red List 2008). The population trend is unknown. The distribution of this mole has probably deteriorated during historical times as a result of habitat alteration associated with mining, power generating plants, as well as urbanization and ecologically unsound agricultural practices in parts of its range. The greatest degradation of its preferred habitat has taken place in the Highveld grasslands of Mpumalanga and Gauteng, as a result of mining shallow coal deposits, to fuel the numerous coal fired power-stations in this region. Rehabilitation of these sites has largely been ineffective and the magnitude of disturbance is likely to increase as human populations grow and the demand for power increases. The widespread practice of allowing cattle to graze in marshes and dense grasslands near water during the dry winter months leads to the trampling and destruction of pristine habitat that is so crucial to the existence of the rough-haired golden mole. Some historically renowned sites for the mole have been completely transformed by urbanization, such as the greater Pretoria West region of Gauteng where extensive searches for this species over the last 10 years have not yielded any sign of their presence.

The Gauteng, KwaZulu-Natal and Mpumalanga provincial conservation departments are currently attempting to document and record potential habitat sites that may support rough-haired golden mole populations. There is major concern with these bodies that this species may be more threatened than its current Red List status suggests. The rareness of this species is exemplified by the capture of one animal in the Rosetta region of KwaZulu-Natal in 2003 – nearly 30 years after the last recorded specimen was captured (in 1974).

2.3 RIETVLEI NATURE RESERVE ASSESSMENT

Rough-haired golden mole burrow systems were found at four sites that were assessed in Rietvlei Nature Reserve and the GPS locations are indicated on Figure 3 and 4. Table 1 summarizes the GPS coordinates of the locations where the burrows were found. The GPS points are also depicted on the aerial photograph in figure 6. Characteristic rooting signs were present at most of these burrow systems indicating recent foraging activity following the good rainfall in the greater Pretoria area since early November 2008. Photographs of each burrow system are given in Appendix A.

Table 1.1: A list of the 23 GPS points taken where golden mole activity was observed in the Rietvlei Nature Reserve. GPS format: Lat/Lon hddd°mm'ss.s" format.

Rietvlei Nature Reserve				
Rough-Haired Golden Mole (<i>Chrysopalax villosus</i>)				
No.	Date and Time	Coordinates		Height
		Latitude	Longitude	
1	2008/11/20 08:52	S25 54 32.5	E28 18 25.0	1500 m
2	2008/11/20 08:52	S25 54 32.5	E28 18 25.0	1496 m
3	2008/11/20 08:55	S25 54 32.3	E28 18 25.3	1495 m
4	2008/11/20 09:02	S25 54 29.9	E28 18 25.7	1497 m
5	2008/11/20 09:14	S25 54 28.5	E28 18 26.8	1498 m
6	2008/11/20 09:14	S25 54 28.5	E28 18 26.8	1497 m
7	2008/11/20 09:28	S25 54 26.5	E28 18 28.3	1496 m
8	2008/11/20 09:41	S25 54 27.0	E28 18 27.1	1495 m
9	2008/11/20 11:08	S25 53 58.1	E28 17 57.9	1514 m
12	2008/11/20 11:20	S25 53 58.7	E28 18 00.1	1517 m
13	2008/11/20 11:23	S25 53 58.8	E28 18 00.0	1516 m
14	2008/11/20 11:24	S25 53 58.5	E28 17 59.8	1513 m
15	2008/11/20 11:33	S25 53 57.2	E28 17 59.9	1518 m
16	2008/11/20 11:38	S25 53 56.3	E28 17 59.1	1519 m
17	2008/11/20 11:40	S25 53 55.8	E28 17 59.0	1517 m
18	2008/11/20 11:40	S25 53 55.8	E28 17 58.9	1517 m
19	2008/11/20 12:15	S25 53 09.7	E28 17 43.8	1485 m
20	2008/11/20 12:22	S25 53 10.7	E28 17 41.7	1484 m
21	2008/11/20 13:41	S25 51 43.6	E28 17 23.1	1493 m
22	2008/11/20 15:27	S25 54 16.1	E28 19 26.2	1497 m
23	2008/11/20 15:31	S25 54 16.0	E28 19 26.1	1496 m
24	2008/11/20 15:32	S25 54 15.8	E28 19 26.0	1497 m

Mole Rat Activity



Figure1.4: GPS points in Rietvlei Nature Reserve where Rough-haired golden mole burrows were recorded

2.4 SITE 1 - EDGE OF MARSH

Four burrow systems were found in the dense grass lining the water body adjacent to the reed beds on the edge of the marsh (Figure 3 and 4, Table 1, GPS points 1 to 6). Similar areas of highly suitable habitat for the rough-haired golden mole extend in the grass all along the edge of the marsh on either side of the dirt road and on both sides of the dam. The vegetation contain species (e.g. *Verbena bonariensis*, *Cyperus esculentus* and *Hypoxis species*) characteristic of the seasonal and temporary zones of the wetland habitat. See Appendix A for photographs.

2.5 SITE 2 - ROCKY GRASSLAND AND ADJOINING MEADOW ON A DRAINAGE LINE

Five golden mole burrow systems (clusters of holes) were found in grassland habitat on the slope of a rocky ridge beneath the tourist hut at site 2 which has deep sandy soil highly suitable for rough-haired golden mole habitat (Figure 3 and 4, Table 1 GPS points 9 - 18). This area forms part of a seasonal drainage zone during the wet season that extends towards a low-lying, moist meadow. See Appendix A for photographs.

2.6 SITE 3 – GRASSLAND SECTION TO THE SOUTH OF THE RIETVEI DAM

This site lies south-east of the Rietvlei dam adjacent to the tar roads in the center of the Rietvlei Nature Reserve at survey point 3 (Figure 3 and 4, Table 1 GPS points 19 to 20). Two burrows were found in close proximity to one another in grassland habitat, near the tar road. However, the soil here is compact with a high clay content, and therefore this area represents marginally suitable habitat for rough-haired golden moles. No photographs are available for this site due to an unforeseen error.

2.7 SITE 4 - VERY DISTURBED AND BURNT PORTION OF GRASSLAND VEGETATION

This site lies adjacent to the dirt road along the fence which runs along the tar road to Delmas at survey point 4 (Figure 3 and 4, Table 1 GPS points 22 to 24). Tunnels were found in two places that could possibly be those of rough-haired golden moles. However, given the level of disturbance, as a result of recent burning, and the absence of foraging "rootings", it can only be regarded as *potential* signs of rough-haired golden mole activity. See Appendix A for photographs.

SECTION B

SURVEY TO ASSESS THE PRESENCE OF JULIANA'S GOLDEN MOLE (NEAMBLYSOMUS JULIANAE) IN THE BRONBERG CONSERVANCY LOCATED IN SHERE AGRICULTURAL HOLDINGS IN EASTERN PRETORIA.

2.1 INTRODUCTION

2.1.1 ASSESSMENT PROCESS

A preliminary investigation was conducted in The Bronberg Conservancy in eastern Pretoria to determine the presence of the Juliana's golden mole (*Neamblysomus julianae*), and potentially suitable habitat for this red data species. The golden moles on this site belong to the Bronberg Ridge sub-population that is currently regarded as Critically Endangered B1ab(iii,iv)+2ab(iii,iv) given the severe threat posed by urbanization and sand mining in the area (IUCN Red Data List of Threatened Species, 2008).

This initial and preliminary assessment focused mainly on the areas within the Bronberg Conservancy in close vicinity of the proposed route for the construction of the water pipeline. The total duration of the site visit was just over two hours, and took place after conducting the survey for section A of the project in the Rietvlei Nature Reserve, in the late afternoon of 20 November 2008. Please refer to Appendix B for information on the experience and roles of the participants in this specialist study. The relevant terrain extends from the base of the ridge, along a steep, extremely rocky slope to the top of the Bronberg ridge.

It is crucial that a second, detailed assessment be conducted to accurately determine the true extent of occurrence of these golden moles within the larger area of occupancy in the Bronberg Conservancy. It is not possible to propose a conservation area or buffer zones sufficient for protecting golden moles in the Bronberg Conservancy, based on the information obtained during this preliminary survey. We attached a quotation for this work, should the client consider our team for the follow-up assessment (please refer to Appendix C).

2.2 THE JULIANA' S GOLDEN MOLE AND THE CONSERVATION THEREOF

2.2.1 BACKGROUND INFORMATION

The Juliana's golden mole is endemic to South Africa. It is a highly range-restricted species that has only been recorded at three locations: Pretoria (Bronberg Ridge), Nylsvlei Nature Reserve and surrounding farms (120km away) and the Pretoriuskop region of the south-western Kruger National Park (400km away). It cannot however, be stated categorically that these three populations are in fact Juliana's golden moles, as they may possibly represent more than one distinct species. Genetic evidence clearly supports the genetic distinctiveness of one of the three populations, making the conservation of each as a separate evolutionary unit, even more important.

The golden mole is specialised for life underground and lacks external ears and eyes, which are not used and are covered with a layer of skin. It possesses strong forelimbs that are equipped with powerful pick-like claws, and a leathery hardened nosepad used to push through the sandy soil while burrowing (Figure 1). These animals live completely underground, they are weak diggers and confined to sandy soils through which they "swim" in search of prey.



Figure2.1: An adult Juliana's golden mole (*Neamblysomus julianae*) Photo: Gary Bronner

The burrow systems comprise deep, permanent tunnels that link up to a nest, and a number of superficial foraging tunnels that are characterised by distinctive ridges of soil along the surface (Figure 2).

The characteristic tunnels produced by this family of insectivores are used by specialists to assess the presence of the animals when doing an EIA, and are detectable to the trained eye for several days after their construction. These trails are only evident during summer rainfall months, when the soil is moist enough for burrowing activity. This should be taken into **SERIOUS** consideration when conducting surveys, and any surveys done during the dry, winter months may be very misleading. Good rain fell in the area about two weeks before this site visit, which allowed for an accurate preliminary assessment of the presence of the golden moles given their tendency to be much more active after rainfall, than otherwise.



Figure 2.2: A typical foraging tunnel produced by Juliana's golden moles. The green arrows indicate the trails that are usually inconspicuous to the untrained eye

The Pretoria population of the Juliana's golden mole occurs mostly along the north and northeastern slopes and footslopes of the Bronberg Ridge. However, activity has also been documented on the southern side (e.g. Olympus) in recent years. These animals are restricted to these areas due to their dire dependency on the suitable sandy soil associated with underlying geology. Suitable habitat for the species is known to stretch from the footslopes towards the top of the ridge.

2.3 BRONBERG CONSERVANCY ASSESSMENT

Juliana's golden mole activity was clearly identified and confirmed in the Bronberg Nature Conservancy during the preliminary assessment conducted on 20 November 2008. A large part of this conservancy is considered prime habitat for Juliana's golden mole.

According to the current proposed route for the pipeline, same will run through Olympus on the southern side of the ridge, then bisect the ridge within the conservancy, and continue on the northern side through Shere Agricultural Holdings. To minimize the visual impact, it is proposed that the pipeline be buried underground in the conservancy. A large part thereof will be below the existing dirt road that runs from the water reservoir downhill to the conservancy gate at the base of the ridge. The reservoir and road is clearly visible on the aerial photograph (Figure 3).

During this investigation, a transect was walked during the preliminary survey that spanned two main areas of the ridge:

Zone A:

Partly and severely transformed habitat at the base of the ridge which extends between the rocky ridge to the east of the entrance gate and the western fence line. The disturbance is mostly as a result of soil compaction caused by the dirt road leading to the water reservoir at the top of the ridge, and large, exotic trees. This zone is situated on the footslopes near the steeper portion of the ridge.

Zone B:

A rocky steep slope of the ridge towards the top thereof, to near the water reservoir. The steep rocky slope area is relatively undisturbed in terms of vegetation. The soil that surrounds the water reservoir is heavily compacted.

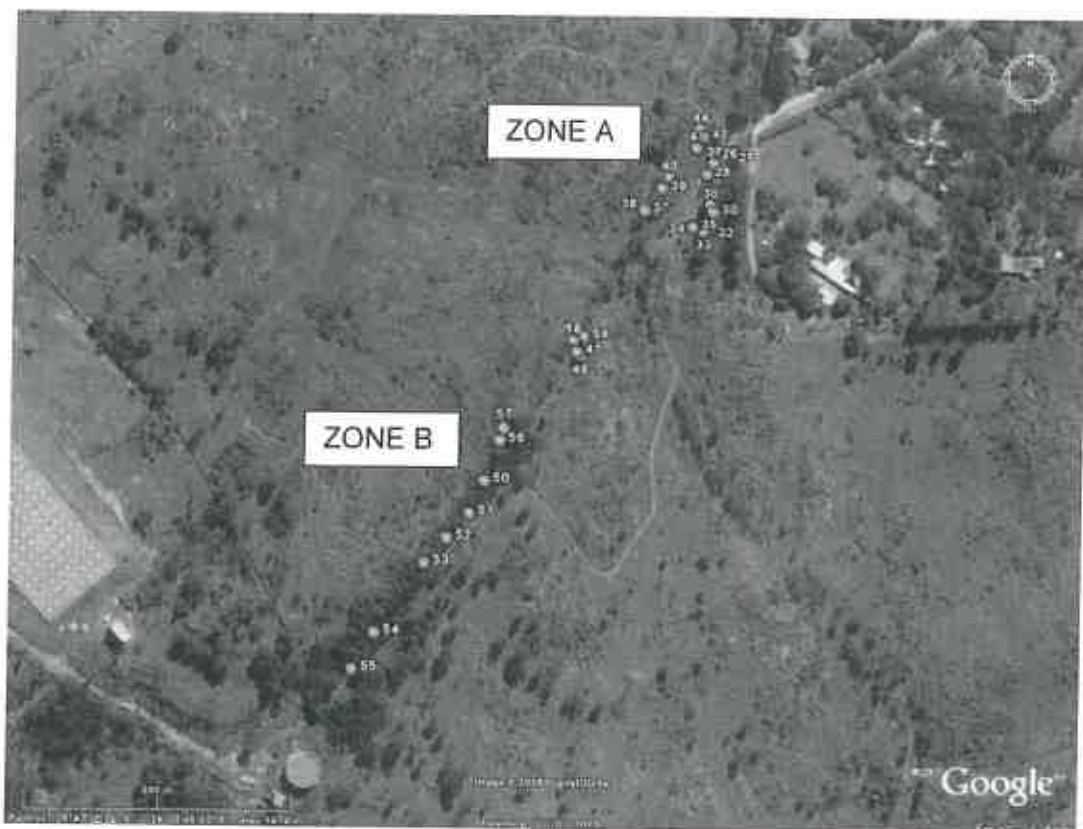


Figure 2.3: Aerial photograph showing the spatial context of the area within the Bronberg Nature Conservancy where the present preliminary survey was conducted on 20 November 2008. The GPS localities indicated demarcates the presence sites of Juliana's golden mole activity along the proposed route for the construction of the pipeline.

2.3.1 RESULTS

The investigation rendered ample evidence of active foraging tunnels indicated as Zone A on Figure 3, at the base of the ridge on either side of the existing dirt road. Evidence was also found in several localities along the transect walked on the slope towards the top, near the reservoir, indicated as Zone B on Figure 3. Table 1 lists the exact GPS coordinates where active Juliana's golden mole tunnels were found.

Table 2.1: Co-ordinates of observed golden mole activity in the Bronberg Conservation area given in Lat/Lon hddd°mm'ss.s" format.

Juliana's Golden Mole (<i>Neamblysomus julianae</i>)				
No.	Date and Time	Coordinates		Height
		Latitude	Longitude	
25	11/20/08 17:31	S25 47 25.9	E28 20 50.2	1427 m
26	11/20/08 17:32	S25 47 25.9	E28 20 49.7	1428 m
27	11/20/08 17:33	S25 47 26.2	E28 20 49.7	1429 m
28	11/20/08 17:34	S25 47 26.5	E28 20 49.5	1427 m
29	11/20/08 17:37	S25 47 26.7	E28 20 49.8	1430 m
30	11/20/08 17:37	S25 47 27.3	E28 20 49.6	1431 m
31	11/20/08 17:39	S25 47 27.5	E28 20 49.7	1432 m
32	11/20/08 17:41	S25 47 27.9	E28 20 49.6	1434 m
33	11/20/08 17:45	S25 47 28.0	E28 20 49.4	1434 m
34	11/20/08 17:45	S25 47 27.9	E28 20 49.1	1434 m
35	11/20/08 17:50	S25 47 27.7	E28 20 47.9	1434 m
36	11/20/08 17:50	S25 47 27.5	E28 20 48.0	1434 m
37	11/20/08 17:51	S25 47 27.5	E28 20 47.7	1433 m
38	11/20/08 17:52	S25 47 27.4	E28 20 47.7	1434 m
39	11/20/08 17:53	S25 47 26.9	E28 20 48.2	1434 m
40	11/20/08 17:56	S25 47 26.6	E28 20 48.4	1432 m
41	11/20/08 17:57	S25 47 25.8	E28 20 49.2	1431 m
42	11/20/08 17:59	S25 47 25.5	E28 20 49.4	1432 m
43	11/20/08 18:00	S25 47 25.4	E28 20 49.3	1433 m
44	11/20/08 18:00	S25 47 25.3	E28 20 49.3	1432 m
45	11/20/08 18:06	S25 47 31.0	E28 20 46.1	1450 m
46	11/20/08 18:08	S25 47 31.3	E28 20 45.9	1447 m
47	11/20/08 18:08	S25 47 31.2	E28 20 45.8	1450 m
48	11/20/08 18:10	S25 47 31.3	E28 20 45.9	1450 m
49	11/20/08 18:14	S25 47 33.1	E28 20 43.9	1460 m
50	11/20/08 18:16	S25 47 34.4	E28 20 43.3	1463 m
51	11/20/08 18:24	S25 47 35.2	E28 20 42.9	1469 m
52	11/20/08 18:25	S25 47 35.8	E28 20 42.3	1472 m
53	11/20/08 18:25	S25 47 36.4	E28 20 41.7	1471 m
54	11/20/08 18:28	S25 47 38.1	E28 20 40.4	1478 m
55	11/20/08 18:29	S25 47 39.0	E28 20 39.8	1480 m
56	11/20/08 18:33	S25 47 33.4	E28 20 43.7	1463 m
57	11/20/08 18:33	S25 47 33.1	E28 20 43.8	1460 m
58	11/20/08 18:39	S25 47 30.9	E28 20 45.7	1451 m
59	11/20/08 18:39	S25 47 30.8	E28 20 46.0	1452 m

These preliminary records clearly indicate that suitable habitat is present from the base to the top of the ridge in the Bronberg Conservancy. This transect represents a corridor of deep sand and sandy pockets amongst boulders that are used as migration routes to and from the ridge by Juliana's golden moles.

The second detailed assessment will reveal how many of these corridors exist in the conservancy area, and whether portions of the ridge are not utilized by golden moles.

Zone A: Details and Photographs

Numerous signs of fresh golden mole activity were detected in the broad stretch of soft, sandy and friable soils extending across the width of the property, from the base of the rocky ridge on the east to the western fence line (GPS points 25 to 46, Figure 3, Figure 4a – 4d). Some tunnels were in close proximity (a few meters away) to a dirt road, where it is currently proposed that the pipe will be submerged.

a)



b)



c)



d)



Figure 2.4: (a – d): Photographic evidence of Juliana's golden mole tunnels found in zone A.

Zone B: Details and Photographs

Fewer tunnels were observed in the lower rocky zone as it is ecologically less suitable habitat, given the hard, shale-like sections with very little sand particles found amongst the boulders and rocks. However, a corridor of highly suitable habitat was present along the small ravine on the western side of the dirt road. It serves as a drainage line and extends from the top of the ridge to the base of the slope. Tunnels were found every few meters all along the transect that was covered (GPS coordinates 47 to 59 Figure 3, Figure 5a – 5d). This migration corridor is a model for similar ones that has been detected in numerous EIA's which this team has conducted along the larger Bronberg Ridge area.

a)



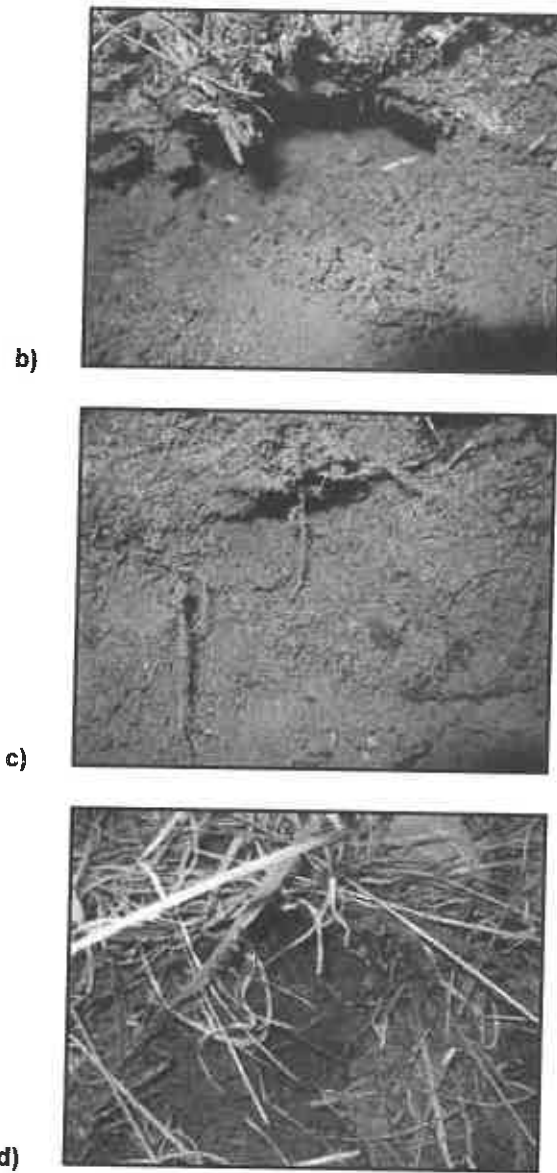


Figure 2.5: (a – d): Photographic evidence of Juliana's golden mole tunnels found in zone B along the steeper slope of the ridge towards the reservoir at the top.

2.4 CONCLUSION

It is crystal clear from the results of the preliminary assessment for the presence of Juliana's golden mole in the Bronberg Conservancy, that the construction of the submerged water pipeline along the proposed route in the conservancy will have detrimental consequences for the golden moles that inhabit this area. It will impact severely on the ecology and dispersal patterns of the resident golden moles in the area, given the major disturbance of the sandy soil that is considered prime habitat for Juliana's golden mole, as well as the underlying geological layers. The construction process will no doubt constitute a huge loss of suitable habitat and the large volumes of sand that will have to be moved will further compact the soil and destroy the subsurface foraging tunnels. The presence of the pipeline will no doubt result in yet another unnatural barrier to north-south (to and from the ridge) and east-west migration of moles in the Bronberg Conservancy, and on the ridge at large. Consequently, the genetic integrity of this critically endangered subpopulation of Juliana's golden mole will be jeopardized.

On the whole, development in this area will be detrimental to the existence of Juliana's golden mole in the Bronberg Conservancy and the larger Bronberg population. **Suggestion:** This property (and adjacent properties) could be proclaimed a part of a conservation area for golden moles to the north of the ridge. The development of a coordinated conservation and sustainable land-use programs throughout the area will contribute substantially towards maintaining north-south dispersal corridors between the higher and lower slopes of the ridge, and also an east-west connectivity on properties where Juliana's golden moles have been located during this, and previous investigations.

2.5 PRELIMINARY ASSESSMENT AND RECOMMENDATIONS FOR THE CONSTRUCTION OF THE PIPELINE, SHOULD A SUITABLE ROUTE BE FOUND WITHIN THE BRONBERG CONSERVANCY

- ✓ a) The pipeline must be constructed above ground.
- b) A sturdy fence must be erected PRIOR to the onset of major construction activities on the demarcated buffer line. ✓
- c) No blasting to occur during construction or establishment of foundations for pillars carrying the pipe
- d) No construction activities to take place in the conservation area or buffer zone. ✓
- e) A single point of access to be placed at the existing gate to the conservancy for access of construction vehicles, heavy machinery and contractors.
- f) No vehicles allowed in the conservation or buffer area before or during construction activities.
- ✓ g) No disturbance of surface vegetation or soil to occur within the buffer line.
- h) Natural vegetation may be rehabilitated by hand labour in the conservation area and buffer zone (e.g. grass by seeding, shrubs and small indigenous trees could potentially be re-established).
- ✓ i) Existing large trees in buffer zone and conservation area at the base of the ridge along the northern fence line must rather be preserved although they are exotic, given that the removal of large root systems will severely disturb the top soil layer where golden mole foraging tunnels are found, but also deeper more permanent tunnels.
- ✓ j) Road access/ servitude for maintenance of the pipe line must be carefully designed. Only brick paving laid by hand in a thick layer of river sand or similar material allowed. No cement foundation for paving is permitted since it will obstruct the movement (dispersal) of moles.
- ✓ k) Drain pipes must be installed underneath the access road bisecting the conservation area for migratory purposes. These pipes must be positioned with great care, and must be filled with suitable sandy, friable soil from existing positively identified mole habitat to allow free migration of the moles from east to west (and visa versa). Further discussion between the specialist scientist and engineer is necessary prior to construction.
- ✓ l) Construction staff must be educated in respect of the sensitivity of the area.
- ✓ m) Environmental Control Officer (ECO) must be appointed to oversee the pre-construction and construction phase of the development to ensure compliance.
- ✓ n) An Environmental Management Plan (EMP) must be prepared for the development and overseen by the ECO.

This study was done without prejudice and with no vested interest in any proposed development.

Sketch

2.8 PRECAUTIONS AND RESTRICTIONS

2.8.1 Site 1 - Edge of Marsh

- a) A buffer zone of at least 150m must be demarcated which must extend from dense grass adjoining the edge of the water body into the terrestrial zone.
- b) The areas where moles occur and within the buffer zone should be fenced off BEFORE building operations start.
- c) Fence must be erected PRIOR to construction activities.
- d) No construction to take place in the area where moles were found, or within the buffer zone.
- e) No building material or dumping of building rubble allowed in the area where moles were found or within the buffer zone.
- f) No construction vehicles to be allowed in the conservation- or buffer areas.
- g) A single access point for vehicles should be demarcated for essential activities, but must not be within 50m of the edge of the marsh.
- h) No disturbance of surface vegetation or soil. Natural vegetation may be rehabilitated into the conservation area and buffer zone (e.g. grass by seeding) should any damage whatsoever occur.
- i) Rehabilitation of the vegetation must take place by means of hand labour.
- j) Pipes must be installed underneath the access road bisecting the conservation area for migratory purposes.
- k) An Environmental Control Officer (ECO) should monitor progress on the building site.

2.8.2 Site 2 - Rocky grassland and adjoining meadow on a drainage line

- a) A buffer zone extending 150m on either side of the proposed route for the pipeline should be enforced, to include the area where golden mole activity was detected.
- b) A sturdy fence must be erected along the demarcated buffer line.
- c) This fence should start on the slope of the ridge immediately below the rocky zone in front of the dwelling, and should be closed off at the end so that no thoroughfare will be possible.
- d) All of the precautions for stipulated for site 1 also apply in terms of construction activities, vehicle access and single access points at site 2.

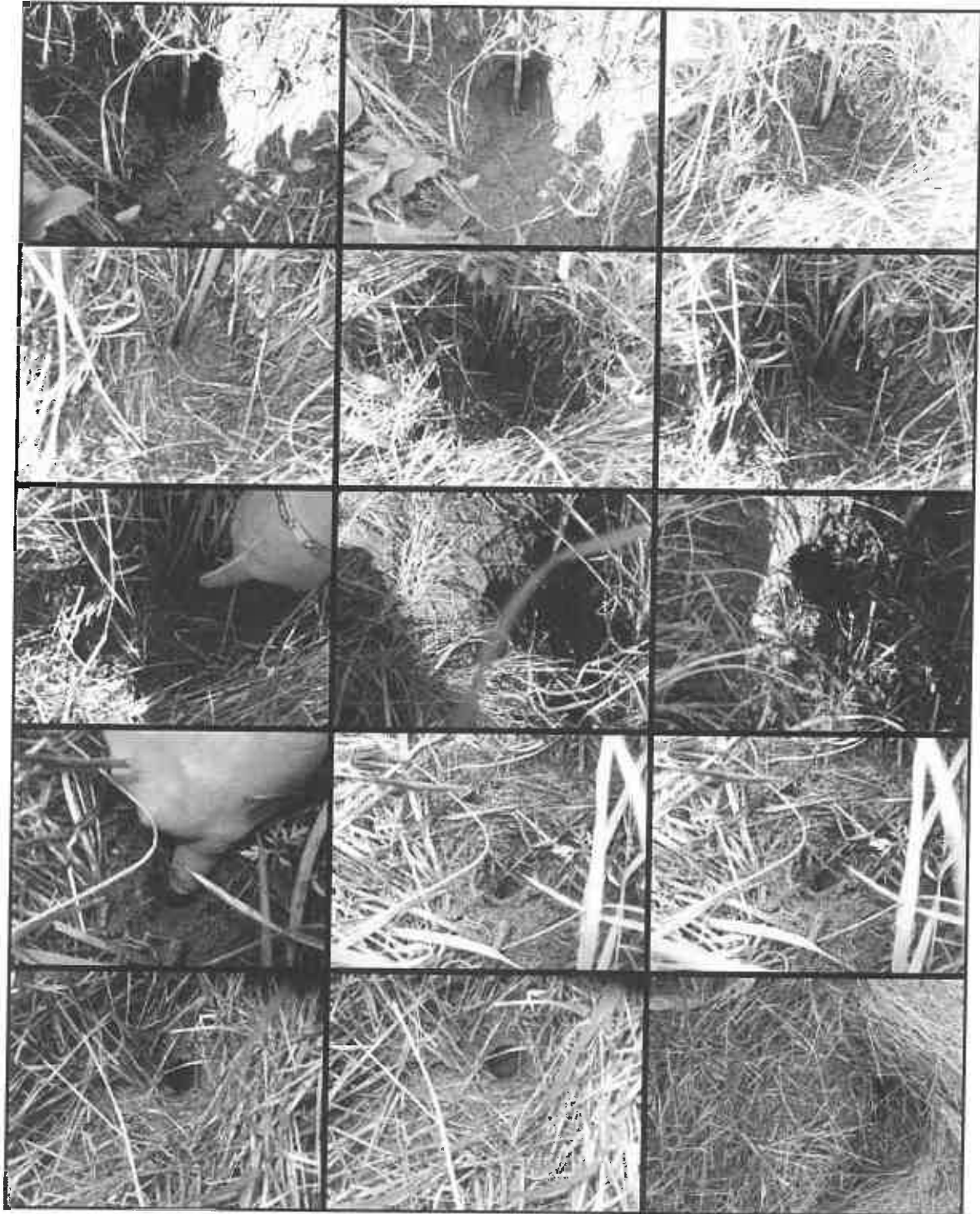
2.8.3 Site 3 - Grassland section to the south of the Rietvei dam

- a) A buffer zone extending 150m on either side of the proposed route for the pipeline should be enforced, to include the area where golden mole activity was detected.
- b) A sturdy fence must be erected along the demarcated buffer line.
- c) Should the pipeline follow this route, care should be taken to fence off this habitat along the construction area to avoid disturbance and compaction as a result of construction activities, vehicles and heavy machinery. A fence should be erected BEFORE construction commences.
- d) All of the precautions for stipulated for site 1 and 2 also apply in terms of construction activities, vehicle access and single access points at site 3.

2.8.4 Site 4 - Very disturbed and burnt piece of grassland vegetation

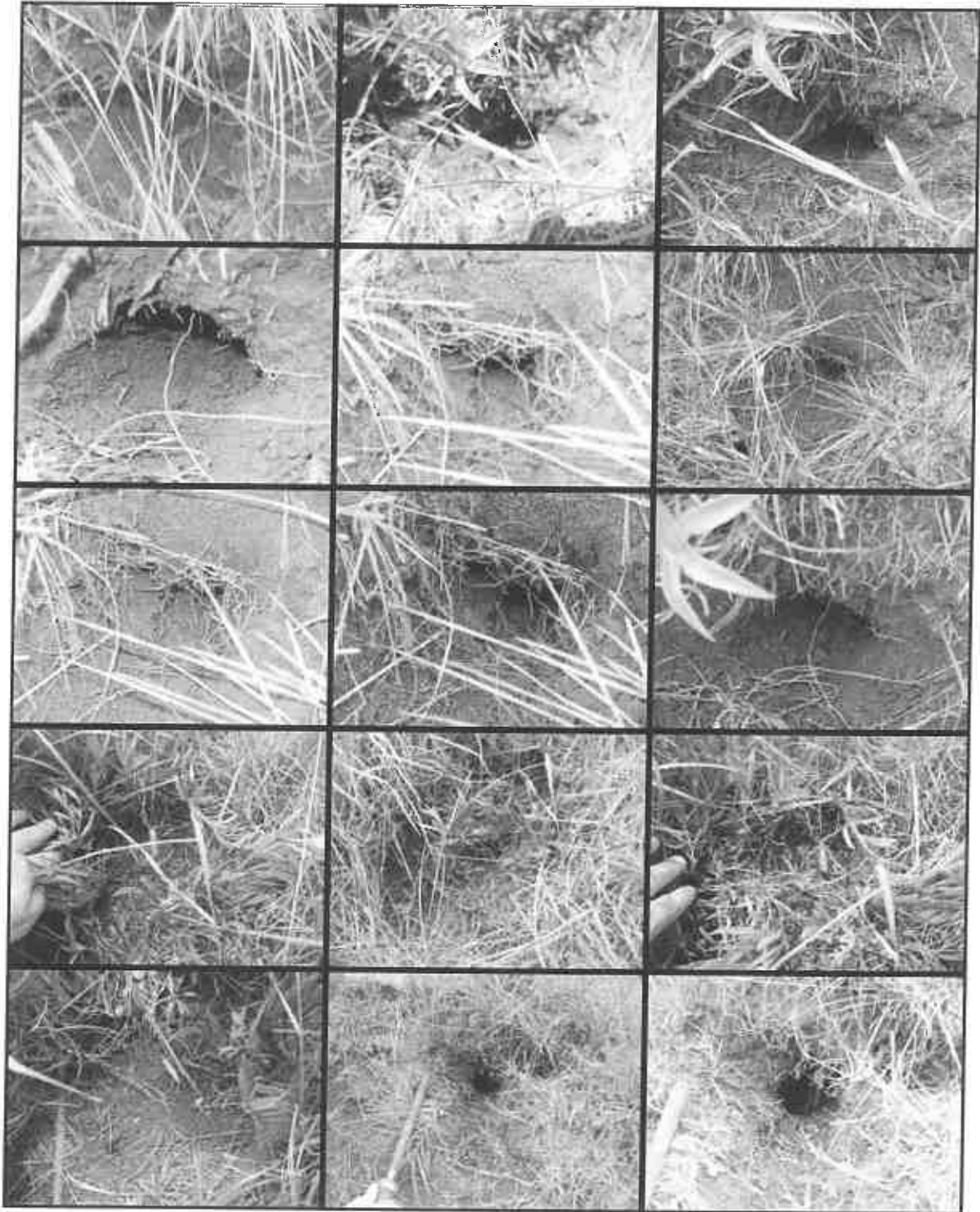
- a) A buffer zone extending 150m on either side of the proposed route for the pipeline should be enforced, to include the area where golden mole activity was detected.
- b) A sturdy fence must be erected along the demarcated buffer line.
- c) Should the pipeline follow this route (less impact), care should be taken to fence off this habitat along the construction area to avoid disturbance and compaction as a result of construction activities, vehicles and heavy machinery. A fence should be erected BEFORE construction commences.
- d) All of the precautions for stipulated for site 1, 2 and 3 also apply in terms of construction activities, vehicle access and single access points at site 4.

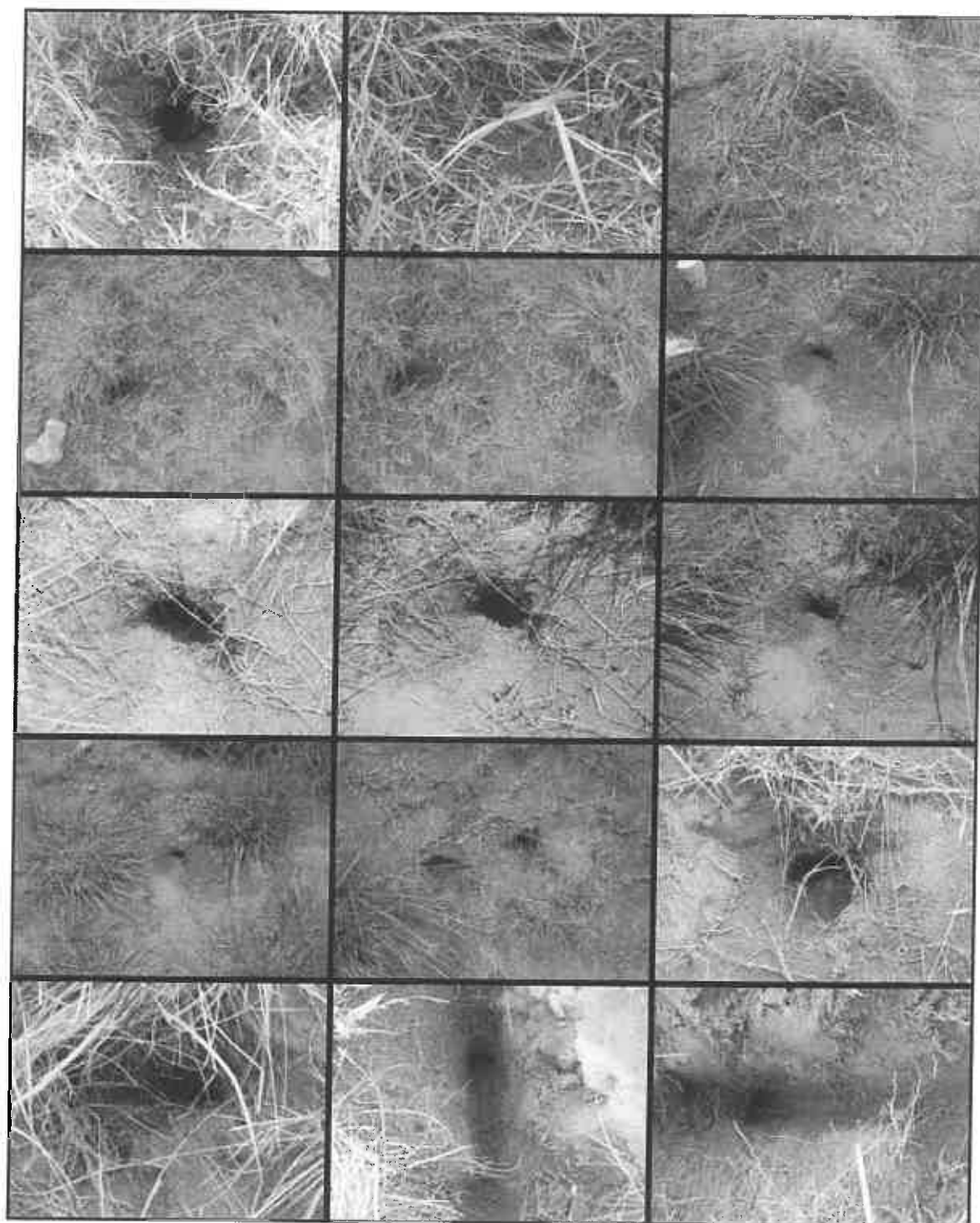
APPENDIX A – PHOTOGRAPHIC RECORD, SITES 1, 2 AND 4
Site 1

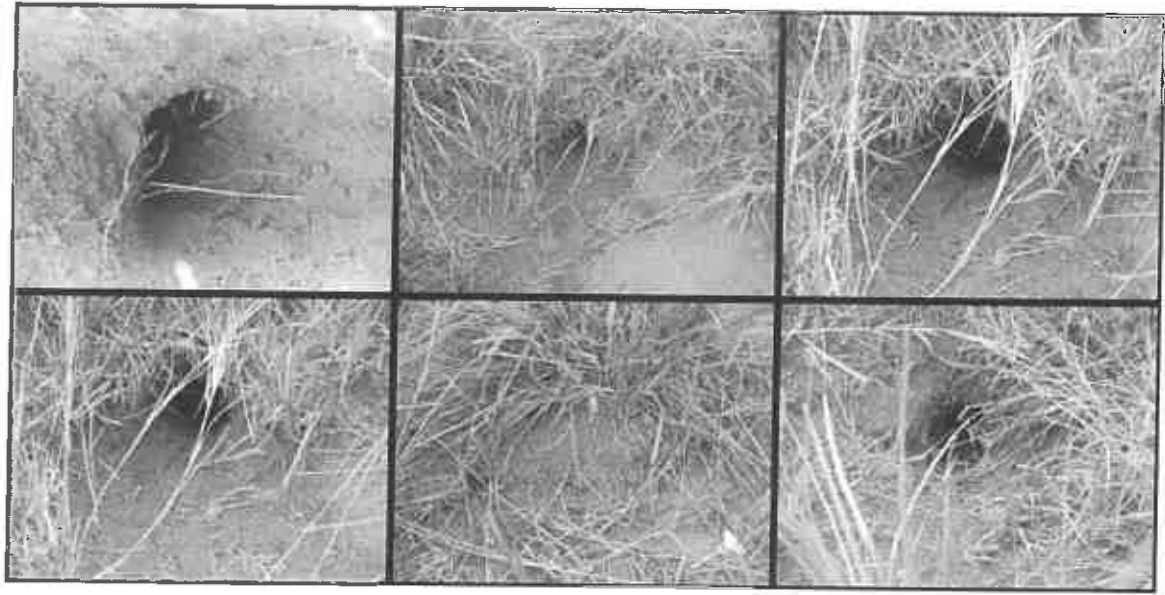




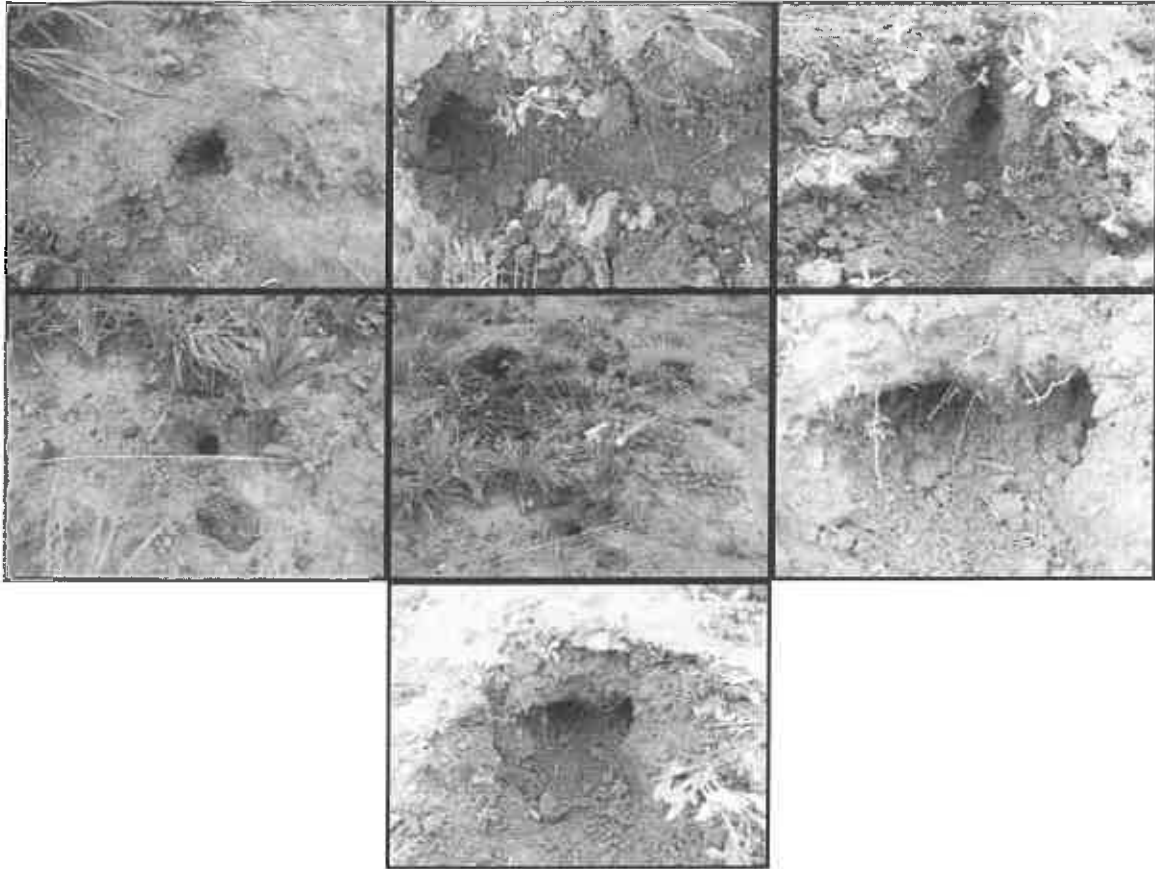
Site 2







Site 4



APPENDIX C: QUOTATION FOR DETAILED SECOND STUDY

**PROPOSED JULIANA' S GOLDEN MOLE
(*Neamblysomus julianae*)
ASSESSMENT**

**TO BE CONDUCTED IN
THE BRONBERG CONSERVATION AREA**

JANUARY 2009

VG0246 H14 RIE/VLEI NATURE RESERVE

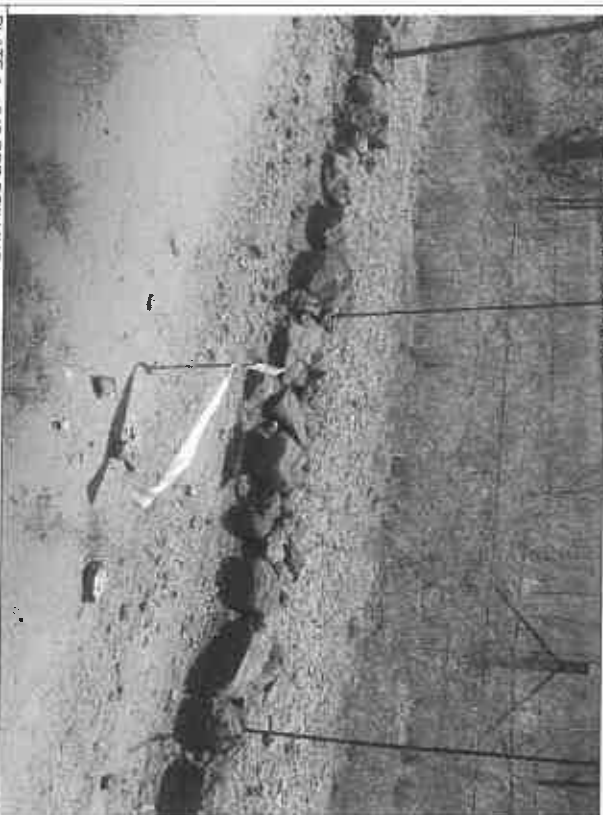


PLATE 1 - 246 PRE DRILLING



PLATE 2 - 246 POST DRILLING



PLATE 3 - 246

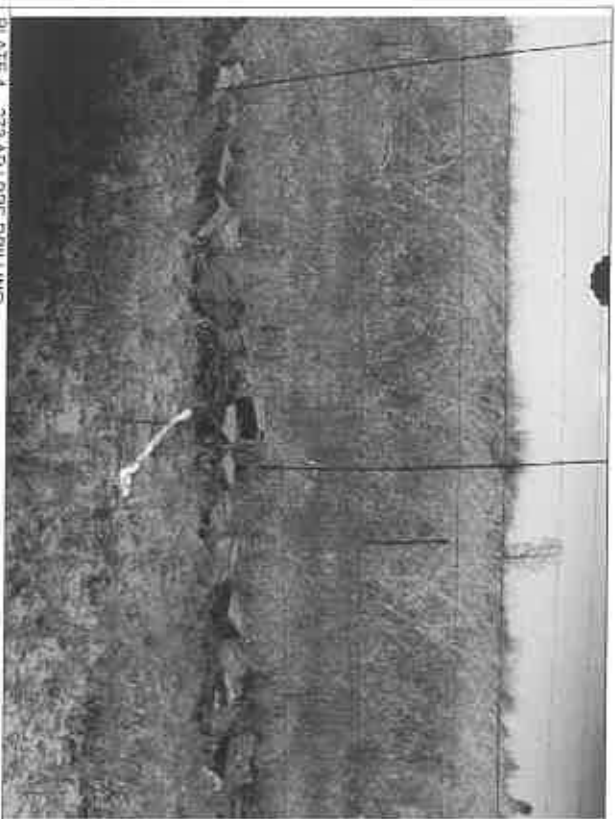


PLATE 4 - 272 ADJ PRE DRILLING



PLATE 5 - 272 ADJ POST DRILLING



PLATE 6 - 272 ADJ



PLATE 7 - 284 ADJ PRE DRILLING



PLATE 8 - 284 ADJ POST DRILLING



PLATE 9 - 284 ADJ

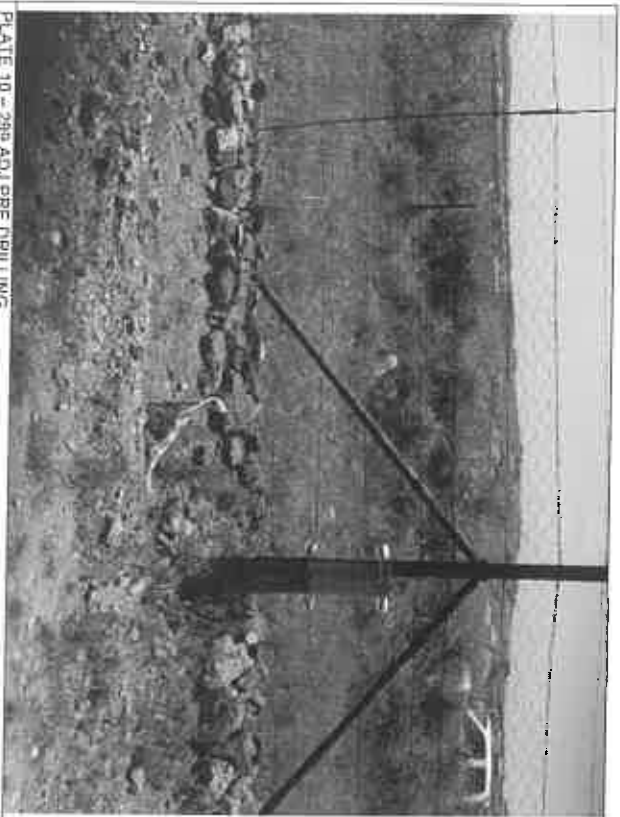


PLATE 10 - 299 ADJ PRE DRILLING



PLATE 11 - 299 ADJ POST DRILLING



PLATE 12 - 299 ADJ



PLATE 13 - 323 ADJ PRE DRILLING



PLATE 14 - 323 ADJ POST DRILLING



PLATE 15 - 323 ADJ



PLATE 16 - 351 ADJ PRE DRILLING



PLATE 17 - 351 ADJ POST DRILLING



PLATE 18 - 351 ADJ



PLATE 19 - 378 ADJ PRE DRILLING



PLATE 20 - 378 ADJ POST DRILLING



PLATE 21 - 378 ADJ

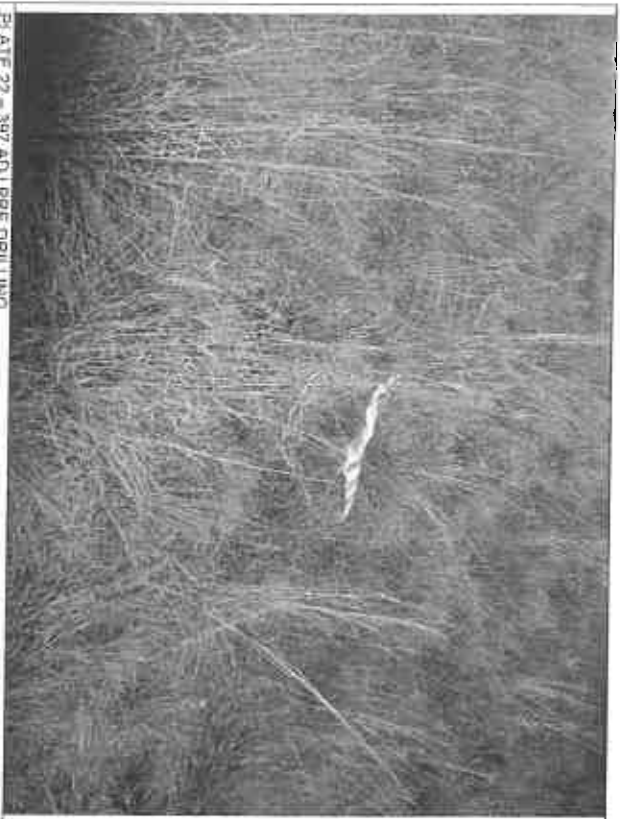


PLATE 22 - 397 ADJ PRE DRILLING



PLATE 23 - 397 ADJ POST DRILLING



PLATE 24 - 397 ADJ



PLATE 26 - 441 ADJ PRE DRILLING



PLATE 26 - 441 ADJ POST DRILLING



PLATE 27 - 441 ADJ



PLATE 28 - 486 ADJ PRE DRILLING



PLATE 29 - 486 ADJ POST DRILLING



PLATE 30 - 486 ADJ



PLATE 31 - 586 PRE DRILLING



PLATE 32 - 588 POST DRILLING



PLATE 33 - 589



PLATE 34 - 617 PRE DRILLING

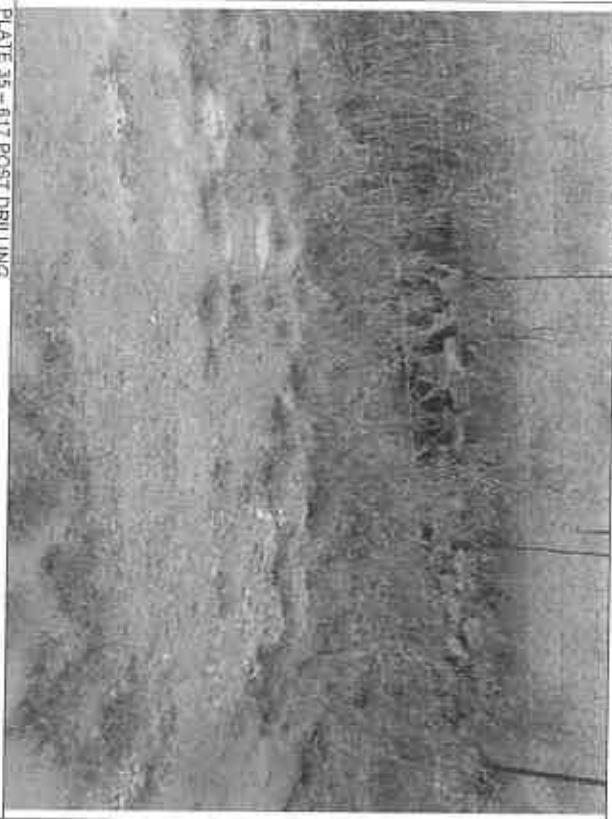


PLATE 35 - 617 POST DRILLING



PLATE 36 - 617

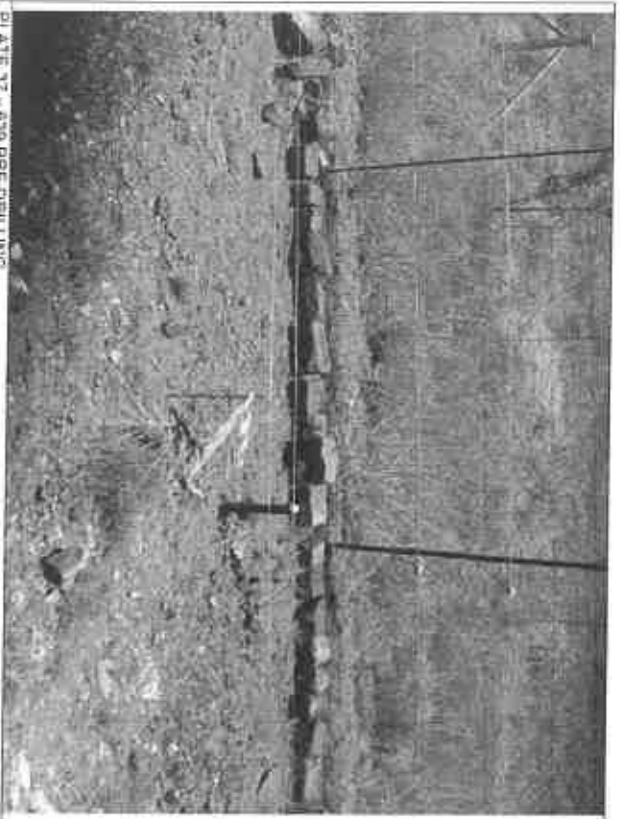


PLATE 37 - 639 PRE DRILLING



PLATE 38 - 639 POST DRILLING



PLATE 39 - 639

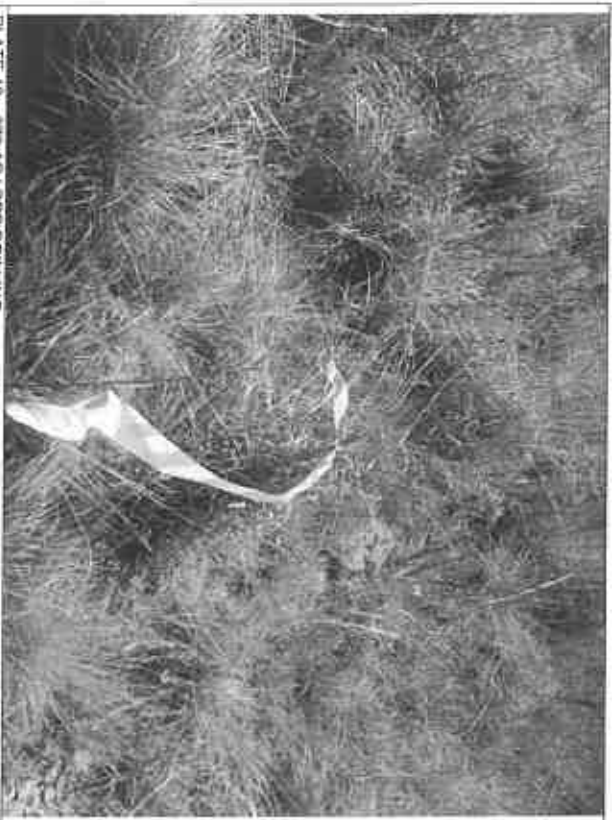


PLATE 40 - 673 ADJ PRE DRILLING



PLATE 41 - 673 ADJ POST DRILLING



PLATE 42 - 673 ADJ



PLATE 43 - 668 ADJ PRE DRILLING



PLATE 44 - 668 ADJ POST DRILLING



PLATE 45 - 668 ADJ

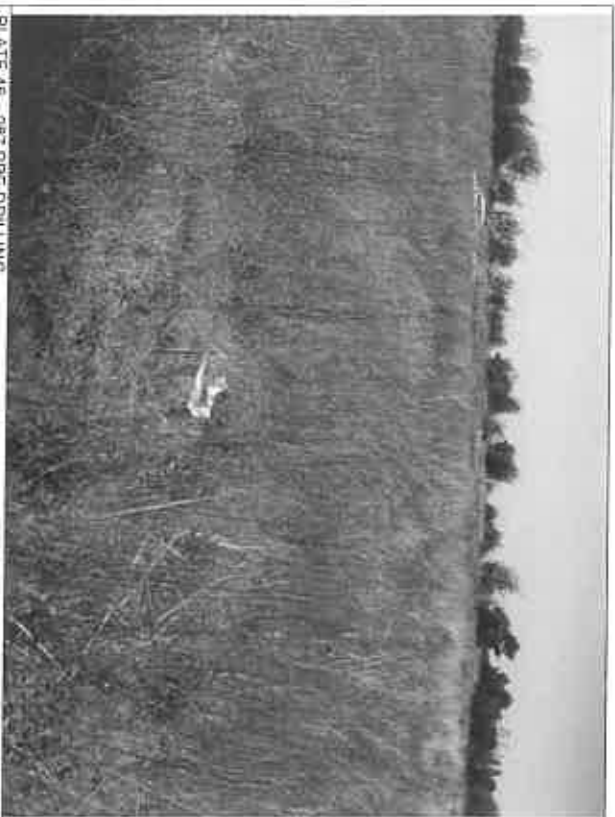


PLATE 46 - 987 PRE DRILLING



PLATE 47 - 987 POST DRILLING



PLATE 48 - 987



PLATE 48 - 1081 PRE DRILLING



PLATE 50 - 1081 POST DRILLING



PLATE 51 - 1081

PLATE 52 - 1100 PRE DRILLING



PLATE 53 - 1100 POST DRILLING

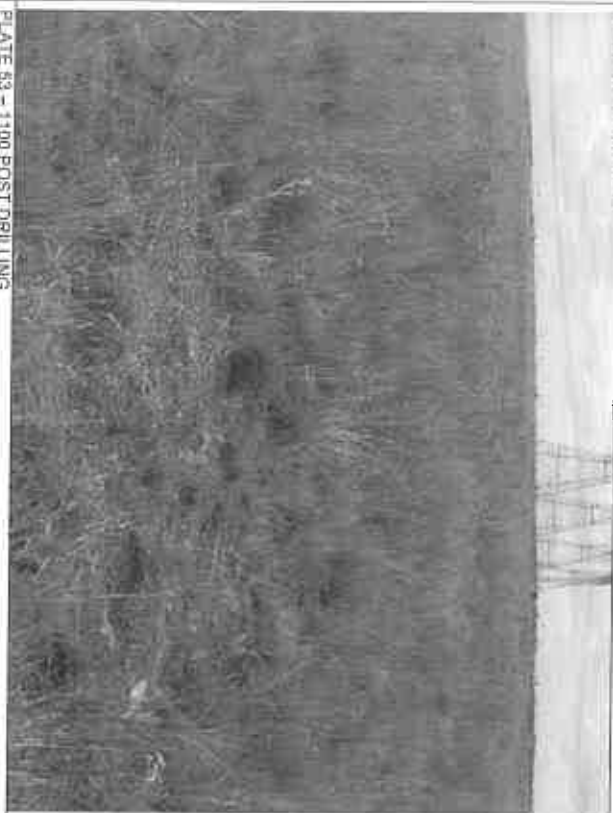


PLATE 54 - 1100



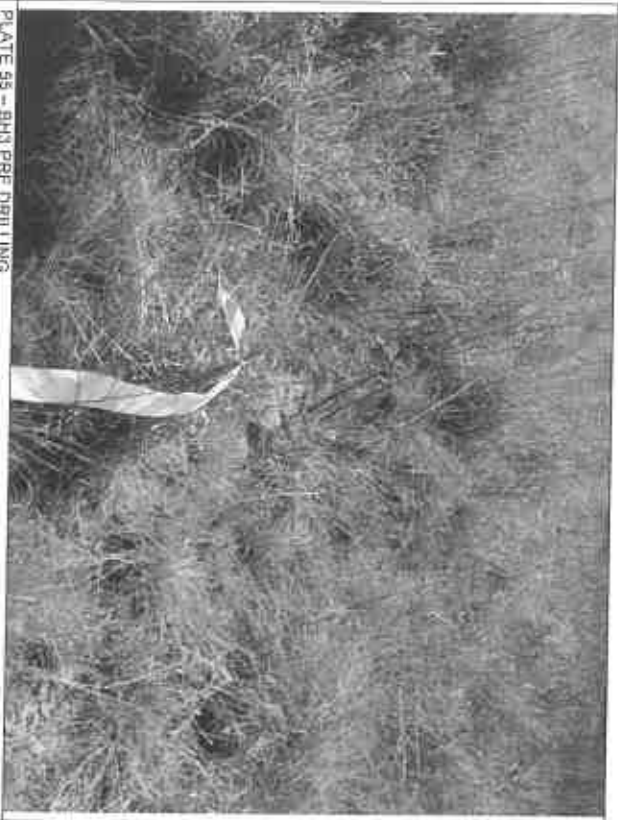


PLATE 55 - BH3 PRE DRILLING

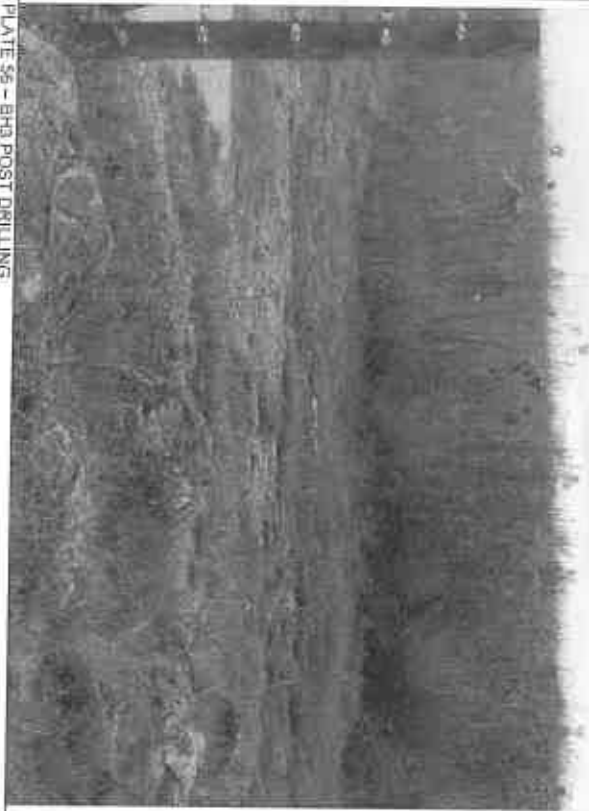


PLATE 56 - BH3 POST DRILLING



PLATE 57 - BH3



PLATE 58 - 514 ADJ POST DRILLING



PLATE 58 - 514 ADJ



PLATE 59 - 673 ADJ POST DRILLING



PLATE 59 - 673 ADJ



PLATE 60 - 722 ADJ POST DRILLING



PLATE 60 - 722 ADJ



PLATE 61 - 870 ADJ POST DRILLING



PLATE 61 - 870 ADJ



PLATE 62 - BH 4 POST DRILLING



PLATE 62 - BH 4