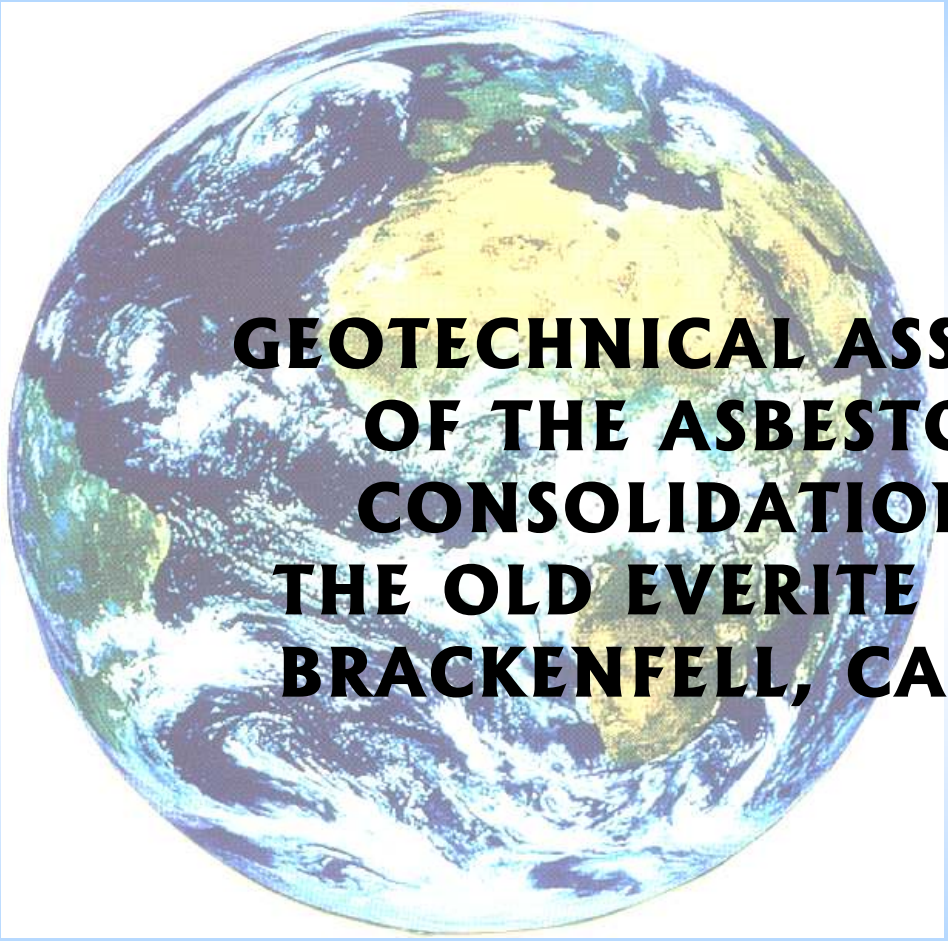
REPORT TO GROUP 5



GEOTECHNICAL ASSESSMENT OF THE ASBESTOS WASTE CONSOLIDATION SITE AT THE OLD EVERITE FACTORY BRACKENFELL, CAPE TOWN

- TOWARDS RE-ENGINEERING FOR LAND RELEASE -

Report Number J–531B-11 **9 November 2011**

Morris Environmental & Groundwater Alliances

industricon

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REPORT TO:

GROUP FIVE

GEOTECHNICAL ASSESSMENT OF THE ASBESTOS WASTE CONSOLIDATION SITE AT THE OLD EVERITE BRACKENFELL FACTORY

- TOWARDS RE-ENGINEERING FOR LAND RELEASE -

Report No. J-531B-11 **4 December 2011**

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CONTENTS

APPENDICES

Version	Date	Comment
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Final	4 December 2011	Nil

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EXECUTIVE SUMMARY

GEOTECHNICAL ASSESSMENT OF THE ASBESTOS WASTE CONSOLIDATION SITE AT THE OLD EVERITE BRACKENFELL FACTORY

- TOWARDS RE-ENGINEERING FOR LAND RELEASE -

When the Everite Brackenfell factory, which had operated since 1945, finally closed in 2000 it was necessary to undertake remediation of parts of the factory precinct that had become contaminated by asbestos wastes. These wastes were consolidated in what is now referred to as the Asbestos Waste Consolidation Site – which comprises an upper and lower platform covering about 10 hectares.

The area is currently vacant land and can be described as being 'sterilised' in that no use, in its current form and condition, is possible or has been envisaged. Although the area has been fenced, security is regularly breached by vagrants, who reside (occasionally) in the area. The area has become overgrown with alien Port Jackson willows and this provides suitable habitat (hideout) for the vagrants, plus is a fire hazard. Health concerns are likely to develop in that the buried asbestos wastes are being exposed at surface by considerable mole activity. It can be said that the site will require a greater level of re-engineering and management into the future to at minimum make it safe.

Given the amount of interest shown by developers in this site, plus the fact that it will remain a 10 ha piece of land surrounded by light industrial type units with high desire for access and development, notwithstanding the long term management and monitoring needs, it is preferable that close-out solutions for the safe management and end-use of the area are explored.

A preliminary subsurface contamination and geotechnical study to investigate the *status quo* and identify land use opportunities was undertaken during 2010. Eight options for possible use of the site were identified with the option of hard surfacing and light industrial type units receiving favour. It was recommended to Group 5 that a detailed geotechnical assessment of the founding conditions was required, plus safety and health issues around the nature and extent of the buried asbestos wastes. This would further inform the potential for safe re-engineering and long-term securing of the site through some form of redevelopment. The detailed assessment has bene completed and the key findings and recommedations are summarised as follows:

- The 10 ha asbestos waste consolidation area currently forms 'sterilised' land;
- The conditions on site are not perfect in that the capping material installed in the early 2000 has been compromised by considerable mole activity, which has brought asbestos wastes to surface.
- Although the site is vegetated with kikuyu and alien Port Jacksons and Rooikrans, this does limit the air-borne dispersion of asbestos wastes. This vegetation is prone to fire in the dry summer months.
- Air monitoring has shown that currently no unacceptable exposure risks exist.
- The site will require in the near future considerable re-engineering and capping to secure it properly into the long term. This is a fairly complex task and it is estimated will cost in excess of R 10 million.

- There will be a need for long-term annual management and maintenance on the site.
- Some form of permanent hard-standing is seen as a suitable option to secure the site into the future.
- Detailed geotechnical assessment has ascertained that parts of the site are (very) compromised in terms of founding conditions and would be difficult, if not extremely expensive, to develop for light industrial uses, ie buildings.
- Differential settlement and unsuitable founding conditions exist in some areas of the site.
- There are however parts of the site where development of light industrial type units is possible and where 'limited industrial' use could occur, such as mini-storage units or vehicle parking.
- Consequently, a mixed landuse on part of this site is possible, with the profits obtained from such being used to off-set the cost of the development of these areas and the need to secure the remaining 'unusable' parts of the site.
- Health and safety issues are manageable for the envisaged re-engineering and it will be necessary to follow the advice of a suitably experienced accredited asbestos inspection authority in this regard. Health and safety issues that require attention are as follows:
  - Ensure that all contractors required to perform work (excavation work excluded) at the site be informed about the potential asbestos exposure risk and the requirement to wear at minimum suitable and approved respirators (i.e. type FFP2) when engaging in the required work.
  - If future development of the site should prove not to be an option, consideration must then be given to clear the existing vegetation and covering with a hardsurface the site so as to stop mole activity from exposing subsurface asbestos. This will make a major contribution in managing any further exposure and contamination risk posed by exposed asbestos.
  - In the interim, and with intervals not exceeding 6 months, background airborne asbestos monitoring should be implemented and performed under various wind conditions to establish whether unacceptable asbestos fibre distribution does not occur. This is prudent due to the slow deterioration of friable asbestos sludge with time.
- The excavation and handling of asbestos wastes requires special attention to manage the health and safety issues, and thus it will be necessary to include the services of a suitably experience contaminant hydrogeologist in the design and project execution phases. There are many 'tricks and traps' to work of this nature that will govern the success of compliance to health and safety needs and the success of the engineering works.
- It will be necessary to bring into the team a suitably experienced environmental assessment practitioner to undertake the EIA aspects in early 2012. We have recommended Chand Environmental for this as they have had experience with a previous asbestos remedial project and compiling the necessary Background Information Documents.
- It will be necessary to bring into the project team the services of a specialist civils engineer to undertake the design and contracts management aspects of the work. We have recommended Mr Andre Jordaan from Kantey & Templer and preliminary discussions have been had with him.
- Urban Dynamics Western Cape is already assisting with the town planning aspects and it will be necessary to retain their services to take the project forward.
- A key issue is to first obtain the opinions of the local regulatory authorities regarding the proposed securing and development of the site. They include the City of Cape Town, provincial Government – Department of Environmental Affairs and Development Planning (DEA&DP), Department of Labour, Department of Water Affairs. The DEA&DP will need to refer the situation and proposals to their National office in Pretoria as it is a hazardous waste issue – all hazardous issues are dealt by the National office. To this end, a feedback workshop was arranged for the 23rd November 2011 at the Kraaifontein Municipal offices. Notes taken at this meeting are attached as Appendix D. There was strong support from the authorities for re-development of the site.
- Public participation and input will be required should the decision be taken to proceed with the development. It is envisaged that this will be covered by the EIA process mentioned above.

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4 December 2011

GEOTECHNICAL ASSESSMENT OF THE ASBESTOS WASTE CONSOLIDATION SITE AT THE OLD EVERITE BRACKENFELL FACTORY

- TOWARDS RE-ENGINEERING FOR LAND RELEASE -

1 INTRODUCTION AND BACKGROUND

When the old Everite Brackenfell operations (Figures 1 and 2) finally closed in October 2000, a 'legacy area' comprising what was known then as the 'Main Dump Site' was left.

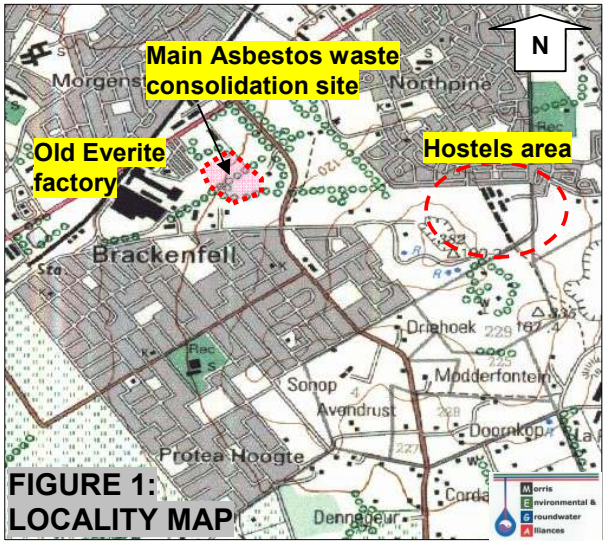

FIGURE 1: LOCALITY MAP

This 10 hectare area is now referred to as the 'asbestos waste consolidation site' and comprises an upper and lower platform. Although the area has been physically closed (ie soil capped with some engineering to manage stormwater), the area has not been officially closed with a closure permit from the regulatory authorities.

Group 5, now the parent company to Everite, wish to ensure that the area is appropriately managed into the future so that **(i)** it does not pose a hazard to the environment, and **(ii)** it is secured in a manner that is appropriate to the landuse setting and does not present a long term management predicament.

The remediation of another historical asbestos waste burial site, located near the old Everite Hostels area (Figure 1), was completed in 2009 – see MEGA-Industricon report J-421-09, 30 November 2009. This has enabled Group 5 to explore opportunities for the release and development of this old Hostels land – planning in this regard, together with what is known as the adjacent Kleinbron site, is currently underway and discussions with the City of Cape Town officials are well advanced for a mutually beneficial development.

In early 2010 Group 5 commissioned the MEGAteam to assess the status of the old waste asbestos consolidation site, plus investigate opportunities for how this portion of land should be managed into the future. A preliminary subsurface assessment was undertaken in 2010 and MEGA report J-531B-10 dated 1st September 2010 was produced.

It must be noted that Group 5 – Everite has, over the past 5 years or so, received several approaches from interested parties to acquire or develop this portion of land. The land is located within the light industrial area of Brackenfell (Figures 1, 2 and 3) and is considered 'desirable' as a development site for similar use. However, Group 5 realize that there are limitations in this regard and thus have not been in a position to accommodate such approaches without understanding the geotechnical, health and safety and related long term environmental and legal responsibility implications.

The 2010 preliminary investigations considered the hazards and risks posed by the site, plus the *status quo* of the subsurface and geotechnical conditions. Options for securing the site through various landuse scenarios were explored in 2010, however, from a low basis of available information. It was recommended that a detailed geotechnical investigation was required to enable better selection of the options with greater technical information on the site's subsurface, plus the health and safety issues. A detailed geotechnical investigation accompanied by assessment of health and safety issues during the on-site works has now been completed. This document forms the report on the findings of this detailed investigation, identifies management needs, and considers these by re-visiting the Options Analysis undertaken in 2010. Recommendations are made. This report is structured as follows:

Section 2: Project team.
Section 3: Background and summary of the 2010 findings.
Section 4: Phase II scope of work…..what we did.
Section 5: Findings of the investigation.
- 5.1 Environmental setting
- 5.2 Safety and health issues
- 5.3 Geotechnical findings

Section 6: Options re-analysis and conceptual scenario.
Section 7: Planning, environmental and engineering needs.
Section 8: Summary of findings and recommended way forward.

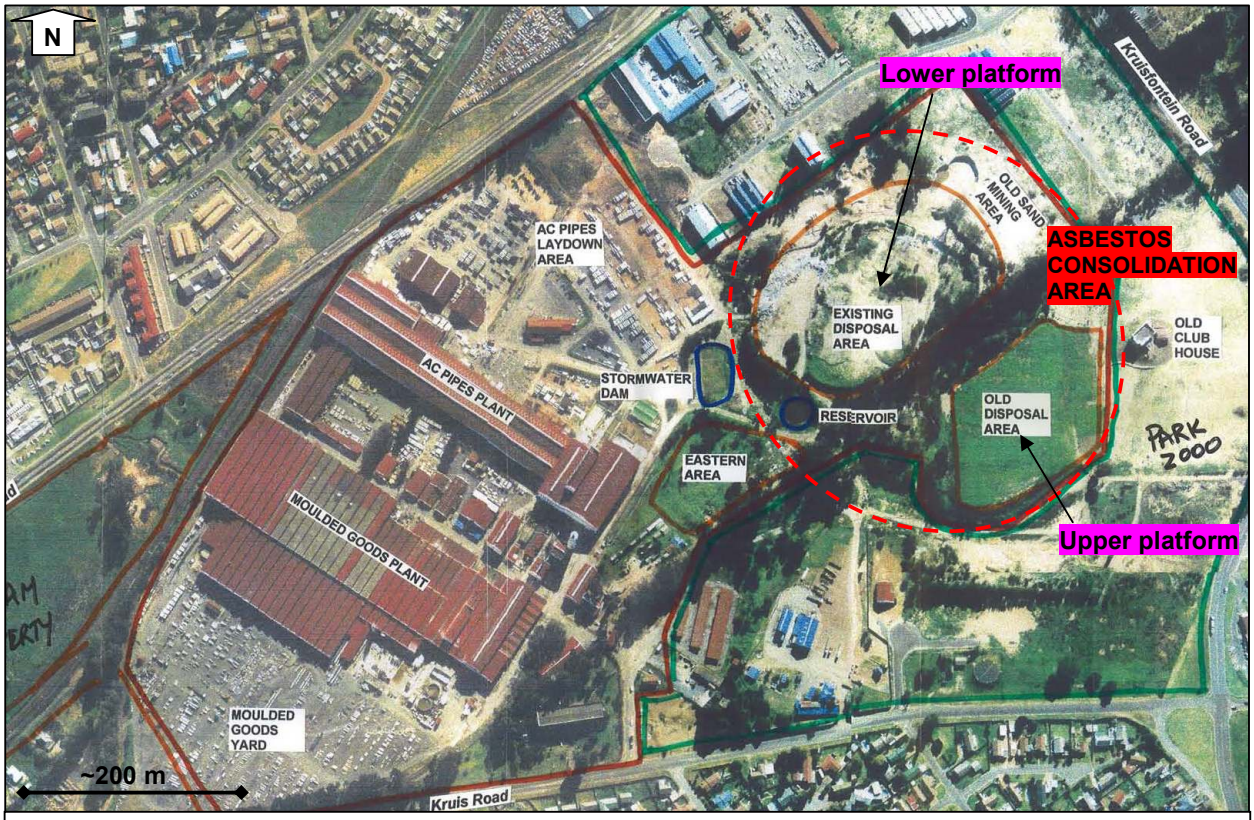

FIGURE 2: THE OLD EVERITE BRACKENFELL FACTORY AREA SHOWING THE ASBESTOS CONSOLIDATION SITE ON THE RIGHT HAND SIDE (~mid1990's)

FIGURE 3: LAYOUT OF THE ASBESTOS CONSOLIDATION SITE SHOWING THE LOCATION OF EXCAVATIONS UNDERTAKEN IN 2010 IP1 to IP26

2 PROJECT TEAM

The project was undertaken through a combined team effort with complimentary expertise to address the various technical aspects. The team comprised the following:

Company and contact person	Aspect of project
MEGA – Ritchie Morris (021-7905793, Mobile 0833814560).	Contamination hydrogeologist, Project Management and technical aspects. On-site supervision of excavations. Visual inspections. Options analysis. Final report preparation by pulling together the info.
Industricon - Mr Pierre Wepener (0828832102). Accredited asbestos inspection authority (AIA).	All health and safety aspects, plus daily monitoring, end inspections and sampling, including sample analysis. Preparation of a SHE report – attached as an Appendix.
Geosure Pty Ltd – Mr Deven Naidoo, Engineering Geologist.	All geotechnical issues for the investigation – founding conditions, material parameters, laboratory analysis. Preparation of a geotechnical report – attached as an Appendix.
Biff Lewis Geomatics (021 – 4423480)	Contour surveying and production of cross sections.
SSB Transport. Owned by Mr Andre Brink (0825521045).	Provided the excavator for the site works. Used an asbestos trained operator who was involved with the remediation at the old Everite Hostels area in 2009. Also provided the cover material for excavations.

In addition to the above, we had discussions with Mr Paul Olden and Mr Wilhelm Schutte of Urban Dynamics Western Cape about potential landuse scenarios for the site. Urban Dynamics is assisting Group 5 with the Hostels area development. Mr Brian Gibson, who is the custodian of Everite historical information, also attended a feedback session on the work progress, providing background to the closure period and how the asbestos wastes were consolidated in this area, plus the public participation undertaken at the time. Preliminary discussion on future civils issues was held with Mr Andre Jordaan of Kantey & Templer.

3 BACKGROUND AND SUMMARY OF THE 2010 FINDINGS

During the operational period of the Everite Brackenfell factory, commencing in 1945, asbestos wastes, comprising sludges and broken sheeting, plus reject pipes, were generated and the original disposal site developed comprising only the upper platform area (Figure 2). When the Brackenfell factory finally closed (2000) it was necessary to undertake remediation of parts of the factory precinct that had become contaminated by asbestos wastes. These wastes were consolidated in the lower part of the disposal area plus parts of the upper area. Associated with this consolidation was some capping of the whole area and installation of stormwater drainage channels.

For terminology use we have divided the lower platform into two parts (1 and 2 – Figure 3). Most of Lower Platform 1 area, including the adjacent (north side) slopes comprises asbestos wastes. Lower platform 2 area is mostly clean, other than some spill-over and minor surface contamination along the toe of the slopes up to the Platform 1 area.

Lower platform 2 – looking along the northern boundary


Upper platform – looking southerly with borehole drill position 1 shown

We show in Figure 4a below a schematic north-south cross-section of the asbestos waste concolidation area .

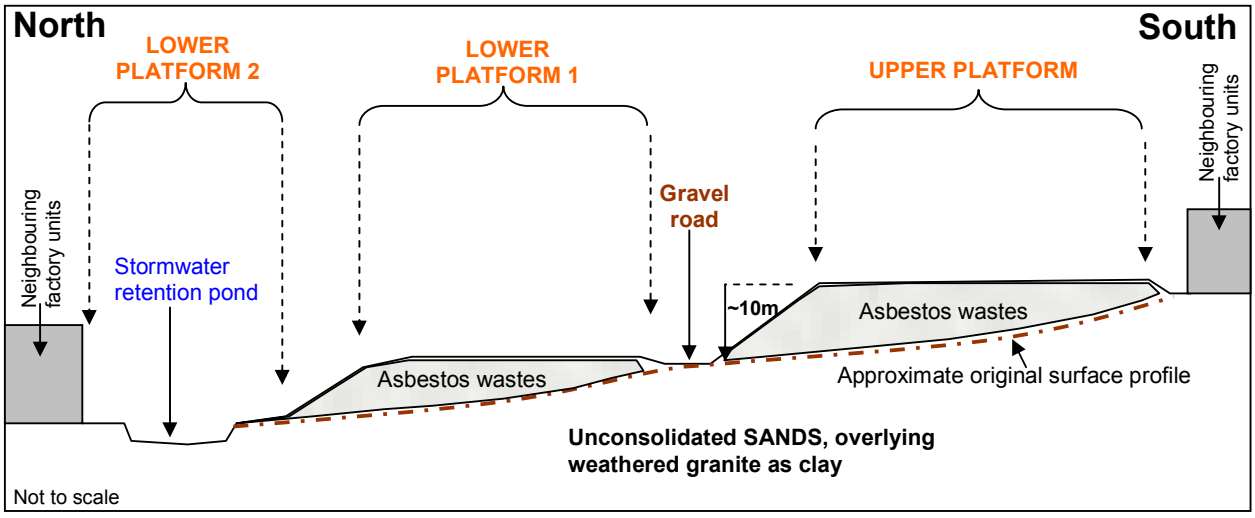

FIGURE 4a : SCHEMATIC CROSS-SECTION A – B SHOWING THE PLATFORMS

The nature of the relief with the artificially formed platforms is shown in Figure 4a. Greater detail on the platforms – thickness of asbestos, underlying geology, etc is given later with surveyed cross-sections.

The 2010 preliminary assessment saw ~26 inspection pits being installed through the upper and lower platform areas. The maximum depth was to ~5 m below grade. The approximate positions of these inspection pits is shown on Figure 3. Profiling was undertaken and a few select samples taken at the time and submitted for screening geotechnical analysis. Details of the work done can be seen in the MEGA 2010 report (J-531B-10 dated 1st September 2010).

Key findings from the 2010 report were as follows:

- The main dumps require a greater level of management and monitoring than was currently occurring.
- At minimum, the following was identified as being necessary:
  - Clearing of the alien vegetation and regular cutting of the grass over the dumps. Irrigation to maintain grass cover in summer may be necessary.
  - An improved soil cover is required over a large part of both the upper and lower dump areas.
  - The boundary fences require repair where they have been breached and improved long-term security will be required.
  - Asbestos signage is required along the boundaries.
- It was confirmed that safety and healthy issues can be managed during site works by instituting proper control methods. No asbestos exposure limits were exceeded during the site assessment works
- This preliminary investigation showed that the hazards associated with the dumps can be reduced if the site were to be re-engineered and appropriately developed.
- It was recommended that options to secure and / or use the site for some other landuse that improves the long-term security and safety of the site should be considered.
- Preliminary geotechnical investigations suggested that there is potential to build light industrial type units on parts of the site. Possibility existed that a wider area could also be developed if some re-engineering of the platforms and compaction were undertaken.
- Eight options were considered for re-engineering and re-use of the asbestos waste consolidation site.

- It was noted however that a greater detail of geotechnical information was required to clarify the landuse options, suitable areas and provide the necessary design details for re-engineering, where necessary.
- Finally, it was noted that the longer term site management and monitoring needs could be reduced were the site's status to be upgraded.

Further to the health and safety aspect noted above, the MEGA-Industricon team has shown that the management of health and safety issues (ie exposure) is possible during large scale asbestos remedial works. For example, the excavation, transport and safe disposal of some 130,000 tons of asbestos wastes from an old factory site in Kuilsriver was successfully undertaken over a 9 month period in 2008 with no health and safety issues materialising or any exposure exceedances. In 2009, around 18,000 tons of fibrous asbestos sludges and broken roof sheeting was successfully removed from another industrial site where it had been buried and was safely disposed to hazardous landfill. Thus, with appropriate precautions and control systems in place, engineering works involving asbestos wastes can be safely undertaken.

The outcomes of the 2010 preliminary subsurface investigations was that a detailed geotechnical investigation of the area of interest was required. An Action Plan for this detailed assessment was submitted by the MEGAteam to Group 5, which was accepted, and the work was undertaken in the second half of 2011.

4 PHASE II SCOPE OF WORK....what we did

The overall objective of the Phase II detailed assessment was to:

> ***"Determine the geotechnical characteristics of the Brackenfell Asbestos Waste Consolidation Site from an engineering perspective and the potential risk to human health from the buried asbestos waste at the site".***

The following information was either sourced or made available and considered as part of the data review:

- Aerial images of the site;
- A copy of report number JW92/01/7738, titled "*Everite, Closure of Brackenfell Waste Disposal Site, Progress Report*", dated July 2001 and prepared by Jones & Wagener.
- A topographic survey of the site was carried out in September 2011 by Biff Lewis Geomatics Inc and plans provided in hard and electronic format.
- Historical information provided by Mr Brian Gibson, the custodian of Everite data, and who was involved with the initial factory closure.

The field work was undertaken during August and September 2011 and comprised the following three focus areas:

- Inspection Pits;
- Boreholes; and
- Dynamic Cone Penetrometer Light (DPL) tests.

Inspection pits

- Thirty five inspection pits, designated IP201 through IP235, were excavated using a track mounted excavator (CAT 320C LME) supplied by SSB Transport. The approximate positions are shown on Figure 4.
- The depth of excavation ranged from 1.7 (IP224) to 5.0m (IP202 and IP203) below existing ground level (EGL).
- The inspection pits were profiled using the South African Geoterminology Guidelines (1990)[1].
- Both undisturbed and disturbed samples were retrieved and the pits were reinstated on completion. Clean sand was imported to cover the excavation positions.
- Copies of the detailed profiles are given in Appendix A together with the full Geosure report.

Boreholes

Three rotary cored boreholes, designated BH1 through BH3, were carried out at the approximate positions given in Figure 4. The borehole installations were carried out by Fairbrother Geotechnical cc. and were drilled NX size (76mm) with standard penetration tests (SPT) at 1 or 1.5m intervals. Wherever feasible a Shelby tube (undisturbed) sample was retrieved from the borehole for testing.

The samples retrieved from the SPT Raymond Spoon and core barrel were profiled in accordance with the South African Geoterminology Guidelines (1990). Copies of the borehole profiles are given in Appendix B of the Geosure report (attached as Appendix A to this report).

Dynamic Cone Penetrometer Light Tests

Thirty five dynamic cone penetrometer light (DPL) tests, designated DPL201 through DPL235, were carried out at the approximate positions given on Figure 5. The DPL tests were carried out adjacent to the 2011 inspection pits, and were advanced to depths in the range 0.6 (DPL223) to 6.0m (DPL204) below EGL.

Plots of the results of the DPL tests comprising blow counts versus depth are given in Appendix C of the Geosure report.

Laboratory analysis

Laboratory analysis was undertaken by the Geosure soils laboratory in Durban and the following types of analysis were performed:

- Indicators;
- Modified AASHTO;
- California Bearing Ratio (CBR);
- Hydrometer Analysis of Fines;
- Triaxial;
- Shear Box;
- Collapse Potential;
- Swell Potential; and
- Standard Oedometer.

The analytical results are discussed in detail and included in the Geosure report (Appendix A), with pertinent findings having been extracted and included in the discussion below (Section 5).

[1] Geoterminology Workshop (1990) – Guidelines for Soil and Rock Logging – SAIEG – AEG – SAICE (Geotechnical Division) pp 47.


224
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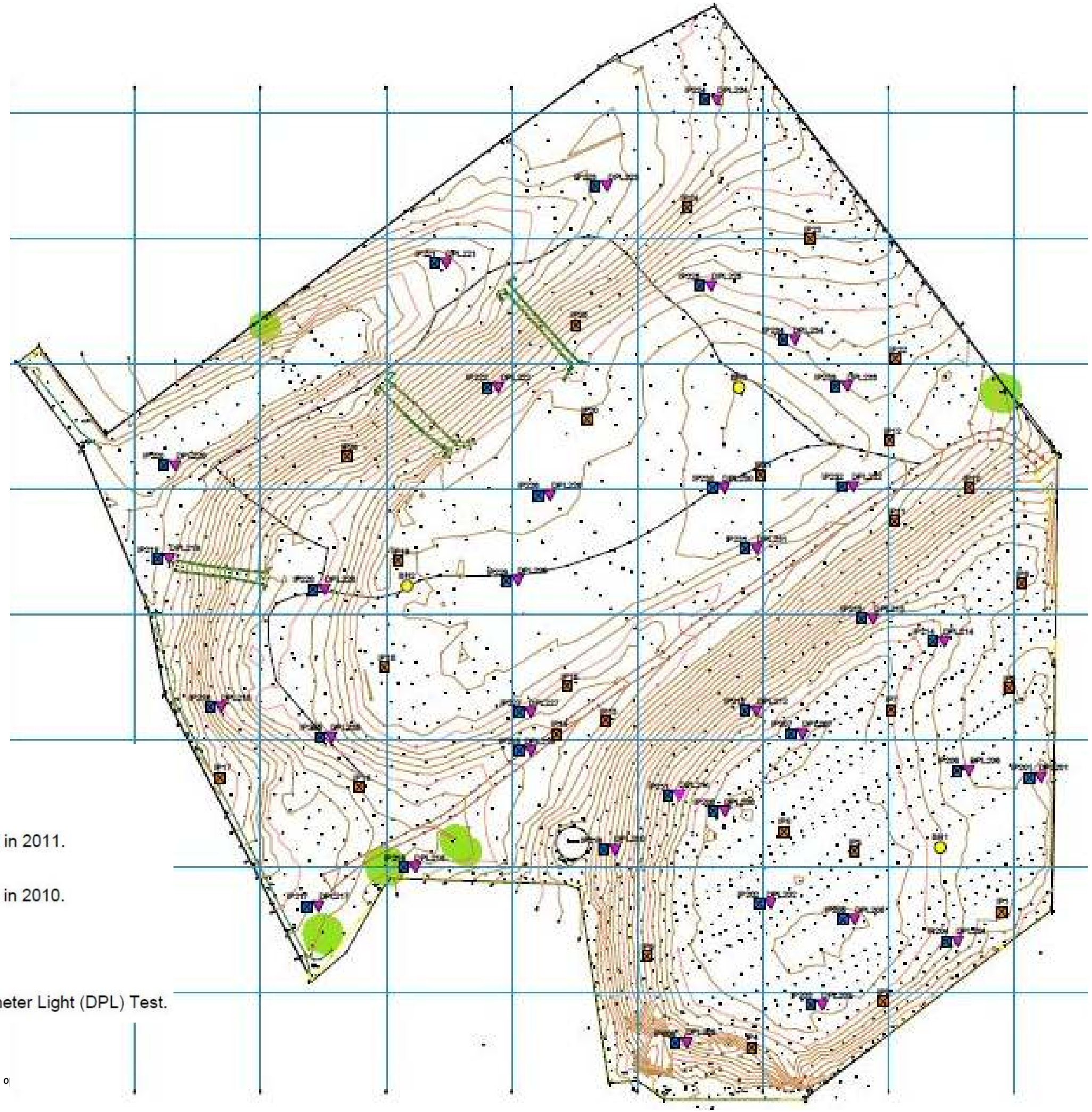
© 2011 AfriGIS (Pty) Ltd.
Image © 2011 GeoEye
© 2011 Europa Technologies
153 m
Imagery Date: 11/30/2010
33°52'29.86" S 18°42'06.01" E elev 113 m
Morris Environmental & Groundwater Alliances
GEOSURE (Pty) Ltd
FIGURE 4: OLD EVERITE BRACKENFELL ASBESTOS CONSOLIDATION AREA – EXCAVATION AND BOREHOLE POSITIONS

FIGURE 5: POSITIONS OF EXCAVATIONS (2010 AND 2011), BOREHOLES, DYNAMIC CONE PENETROMETER LIGHT TESTS.

Please refer to the enlarged printout of the site drawings in the sleeve at the back of the report.



KEY:

IP201 — Approximate position of Inspection Pit carried out in 2011.

IP1 — Approximate position of Inspection Pit carried out in 2010.

BH1 — Approximate position of Boreholes.

DPL201 — Approximate position of Dynamic Cone Penetrometer Light (DPL) Test.

Health and safety monitoring

A comprehensive programme of health and safety monitoring was instituted by Industricon for the detailed assessment work programme. This entailed the following:

- Compilation of a Method Statement for the assessment phase to undertake this work in a safe manner. A copy of this method statement is in Appendix B as part of the Industricon report.
- On commencement of the site works Industricon provided a health and safety induction to all personnel involved with the assessment work – see photograph alongside.
- Daily air monitoring was performed with at least four samples taken each day. Samplers were placed around the works area and also personnel samplers were placed with different workers on the site.
- Analysis of the sample filters was undertaken each day by Industricon and a daily monitoring report generated. A copy of such a report is included with Appendix B.
- A method statement was also prepared for the geotechnical laboratory as to what precautions must be taken when testing the asbestos containing material. A copy of this method statement is included in Appendix B.


Safety briefing


Sampler pump and filter inlet near excavation position


Geosure Laboratory personnel in PPE for sample testing

On completion of all the field work, Industricon were requested to undertake a confirmatory sampling round to ensure that no asbestos exposure was occurring as a result of excavations having been undertaken at the site. This was performed on 26 October 2011 on the upper platform area and a separate report was prepared by Industricon (Appendix B). No exposure to fibres was recorded.

Site security issues

The scope of work also addressed the following site security issues:

Vegetation removal: Complaints had been received from neighbouring factory owners that the alien trees on the site were becoming overgrown and were damaging their property structures.

Labour was employed under the leadership of Mr Andile Sithele who resides at the old Everite Hostels area. The necessary saws and PPE were provided to the labour crew who cleared the sides of the area of interest with a 'firebreak' of ~10m being established – see photographs.

All large trees cut and removed along the site boundaries

Boundary fence upgrades: Messrs 'All About Fencing' from Brackenfell were comissioned to undertake repairs to the boundary fences. This entailed:

- repair to cut sections of fence – the fence was re-cut twice during the repair process, we suspect by the vagrants who set-up overnight shelters in the area,
- the installation of razor wire at main access points,
- repair of the security gate to the upper platform, to which a chain and lock were provided by MEGA.

Water for site activities: water for the site assessment activities was collected by large tanker from the borehole at the neighbouring Xynergistix Transport company site (per favour Xynergistix).

Cover material: Approximately 200 m^3 of clean clayey SAND was imported by SSB Transport and used to cover the excavation positions to prevent the dispersal of any asbestos material that may have been exposed during the excavation process. An attempt was also made to close and cover with grass each excavation position – see photograph.

5 INVESTIGATION FINDINGS

We discuss the findings of the investigation under the following headings:

- Environmental setting – this places the situation into an environmental risk assessment framework;
- Safety and health issues
- Geotechnical findings

Information has been extracted from the various specialist reports that are included as Appendices A and B.

5.1 Environmental setting

The area is currently vacant land and can be described as being 'sterilised' in that no use, in its current form and condition, has been envisaged.

The site is surrounded by light industrial units with access at one current position via the main gate – see Figure 5 alongside. Another gate is located nearby but entry is via the old clubhouse property, now a nightclub.

Additional access would be possible at two other positions with appropirate engineering of these points.

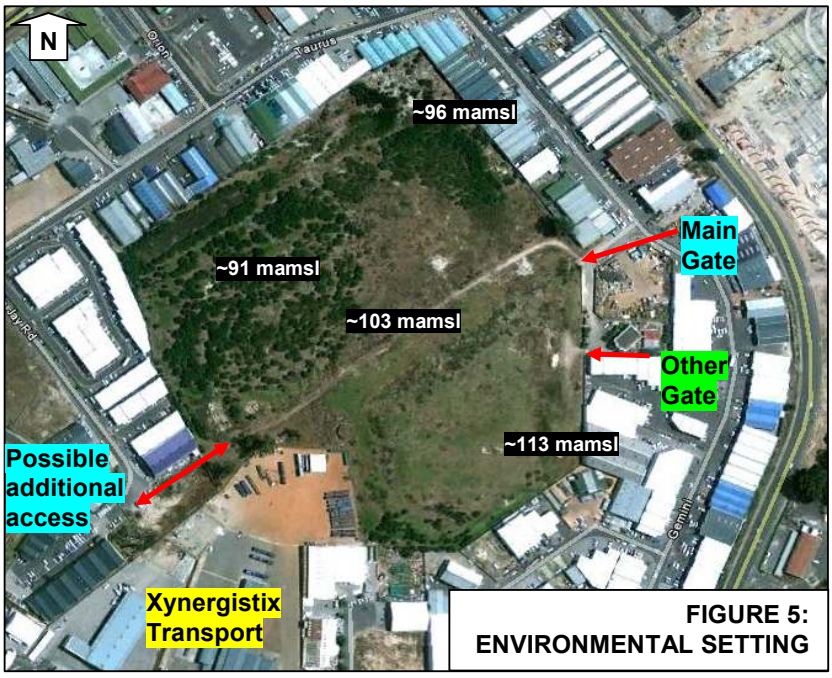


FIGURE 5: ENVIRONMENTAL SETTING

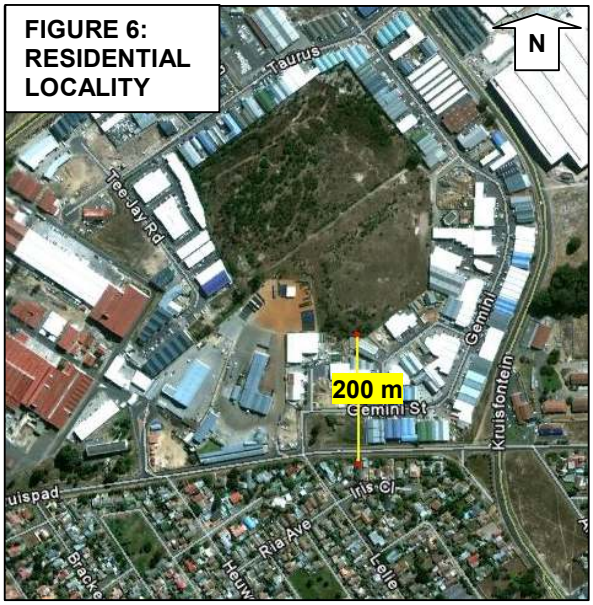
Obviously the potential for such would have to be explored by the town planners with approaches to the City. Figure 5 shows the surrounding landuse, existing and possible access points. Regional gradient is from south-east (elevated) to north-west and the upper platform has an average elevation of ~113 m above mean sea level (m amsl), the lower platform 1 area is at ~103 m amsl and the northern corner,

lower platform 2, is at ~96 m amsl. The base of the stormwater retention pond in the north west side is at ~91 m amsl – see Figure 5 for elevations. We do provide later greater detail on the area's topography with reference to the survey data which is at 0.5 m intervals.

The nearest residential areas are ~200 m to the south (Figure 6), but separated from the site by industrial facilities.

The site is covered with a combination of Kikuyu grass and fairly well established Rooikrans trees (alien wattles). The wetland area is overgrown with reeds and Rooikrans. It is highly unlikely that there are any important (threatened) vegetation species on this site, given its previous use as a waste disposal area.

FIGURE 6: RESIDENTIAL LOCALITY

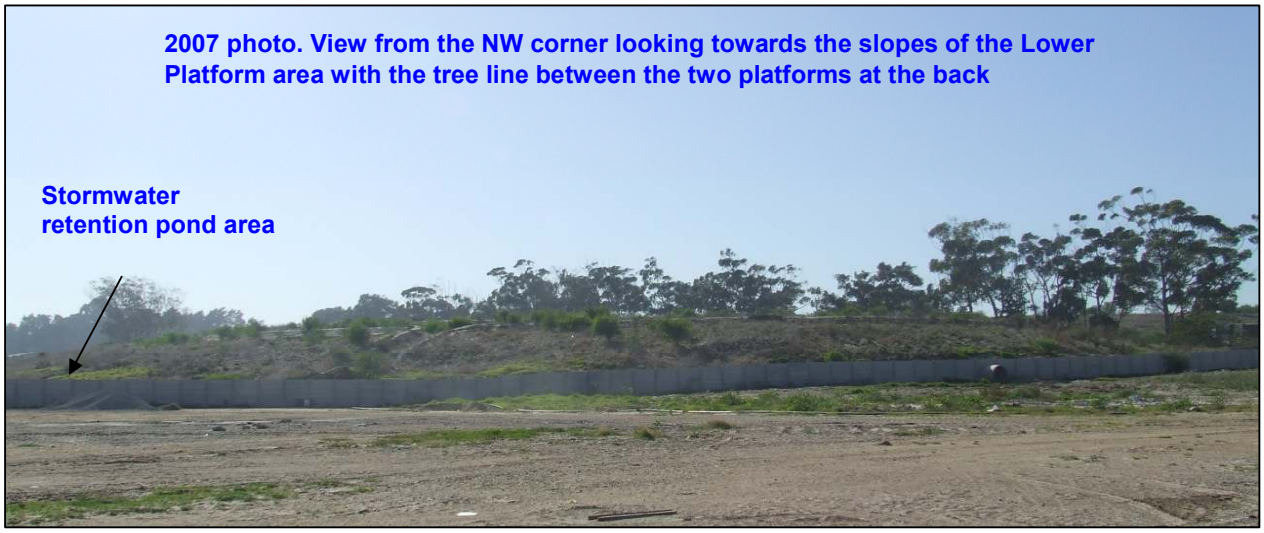


View from upper to lower platform

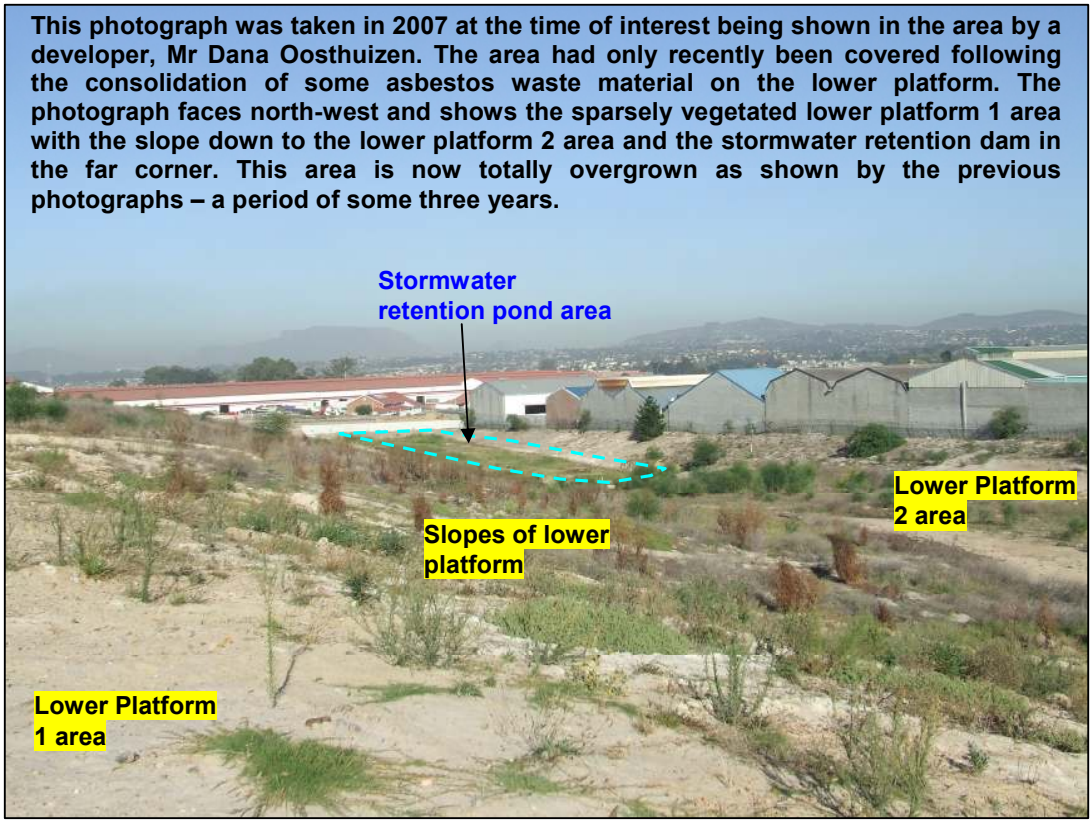
View of the water drainage channel from lower platform 1 to 2

2007 photo. View from the NW corner looking towards the slopes of the Lower Platform area with the tree line between the two platforms at the back

Stormwater retention pond area



The area receives between 600 to 800 mm of rainfall annually and winds are predominantly south-easterly in summer and northerly to north-westerly in winter.



There are no natural water bodies within close proximity of the site, although the stormwater retention pond in the north-west (lower) corner appears to remain wet throughout the year.

It is suspected though that this is due to poor drainage from this area caused by vegetation clogging of the drains. There are also leaking sewers from some of the adjacent factories into this area.

We discuss the geology and hydrogeology under the geotechnical issues.

5.2 Safety and health issues

The safety and health issues are covered in detail in the Industricon report – full copy in Appendix B. We have extracted the most pertinent points and summarize these below. They are discussed under the headings:

- Exposure issues – during the work period and under *status quo* conditions;
- Other hazards.

Exposure issues – during on-site work conditions

Airborne asbestos sampling was undertaken by Industricon to establish potential exposure to airborne asbestos fibres. Sampling for the dispersion of fibres was performed on a daily basis whilst inspection pits were being made with the 20 ton excavator at the site. Three to four samples, split between personal and static type samples, positioned downwind of the work areas, were collected on a daily basis while inspection pits were being made using the 20 ton excavator. Thirteen samples in total were collected whilst the assessment work was in progress at the site.

Daily e-mail feedback on the results of the airborne samples as well as of related geotechnical assessment work performed is attached as an Appendix to the Industricon report. These feedback reports (7 in total) should be perused for detail as to exposure results, assessment work performed, inspections, concerns and how these were addressed. In summary, the feedback reports revealed the following:

The results of the personal samples collected in the breathing zone of high risk persons respectively involved in assessing the subsurface material of each inspection pit and assisting with collecting soil samples and asbestos sludge, were all at a legally acceptable level (i.e. less than 0.2 fibres/ml). The low legally acceptable concentrations (results varied between not detected to <0.01 f/ml) were recorded despite excavating relatively dry friable asbestos sludge in some positions (i.e. slopes of upper & lower dump). The excavation was however undertaken in a controlled (slow & gentle) manner.

Samples collected downwind from where inspection pits were dug and closed up with the 20 ton excavator revealed in all instances airborne concentrations less than 0.01 f/ml (i.e. Asbestos Clearance Indicator). These results confirm that the exposure risk to airborne asbestos fibres was environmentally at an acceptable level. Furthermore, the results also confirm that no unacceptable dispersion of airborne asbestos fibres across the boundaries of the dump site has occurred. Note however, that microscopic investigation confirmed the presence of chrysotile (white asbestos) and amphibole asbestos types (i.e. amosite – brown asbestos & crocidolite – blue asbestos) on the sample filters.

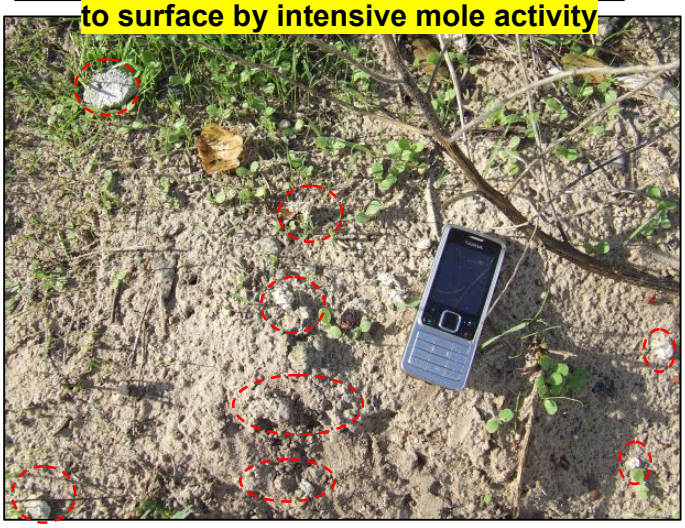
The low acceptable airborne concentrations recorded relate to the subsurface asbestos contaminated material which was relatively damp, fibres that are/were well embedded in compact dense sludge layers and/or captured in solid asbestos cement fragments. In view of this, dust generation was therefore limited during most of the excavations. Even were dust to be generated, it can be managed by dampening the excavation process with a fine water spray – this has been successfully performed at large remedial projects under fairly adverse weather conditions.

Exposure under the *status quo* situation

Air monitoring under the current vegetated state of the site has shown that no major health issues exist at the site boundary. However, the recent monitoring and this assumption were based on the lush, established nature of the vegetation at the end of the wet winter months. Also, wind conditions at the time of monitoring were not excessive. It is known that in summer the grass cover dries out and that fires have occurred through this area. The area is particularly susceptible to such under strong south-easterly summer conditions.

Evidence on site has shown that the asbestos wastes are being brought to surface by considerable mole activity – see photographs. →
Also, asbestos waste is exposed at surface in the carpark of the adjacent night club parking area. There is evidence of asbestos surfacing from the small raised embankment between this carpark and the adjacent upper platform area. It can thus be said that the site will in the near future require considerable securing with an improved cover material. The use of sand as initially occurred will be insufficient – see later discussion on cover needs. ***In summary***, a greater level of site engineering and management will be inevitable into the future.

Asbestos fibrous sludges being brought to surface by intensive mole activity



Recommendations stemming from the Industricon work and related to health and safety issues are as follows: – we include them here for ease of reading, but do also incorporate them into the final set of recommendations at the end of the report.

- Ensure that all contractors required to perform work at the asbestos waste consolidation site be informed about the potential asbestos exposure risks and the requirement to wear at minimum suitable and approved dust masks (i.e. type FFP2).

- Any excavation work must be supervised from a health and safety perspective by an accredited asbestos inspection authority and it will be necessary to compile a method statement plus inform the Department of Labour of the intended activities.
- If future, should a decision regarding the future securing of the site through re-engineering and/or development be delayed for 6 months or more, consideration must then be given to clearing the existing vegetation and establishing a proper capping or hard surfacing of the site so as to stop mole activity from exposing subsurface asbestos. This will make a major contribution in stopping the further exposure and contamination risk posed by exposed asbestos.
- In the interim and with intervals not exceeding 6 months (ie winter and summer seasonal monitoring), background airborne asbestos monitoring should be implemented and performed under various wind conditions to establish whether unacceptable asbestos fibre distribution does not occur. This is prudent due to the slow deterioration of friable asbestos sludge with time and also given the precarious vegetation cover.

In conclusion, the presence of snakes on the site must also be considered when working in this area, particularly Cape cobras, boomslangs and puff adders. Several snakes (Cape cobra) were seen during the site assessment work.

5.3 Geotechnical findings

The site is generally underlain by fill and waste deposits overlying *in-situ* subsoil deposits of Quaternary Age. The above are underlain by residual soils that grade with depth into weathered granite bedrock of the Cape Granite Suite.

Over the asbestos waste areas there is a capping layer of greyish brown, loose, silty SAND with builder's rubble but with minor asbestos contamination. This layer extends to depths in the range 0.2 (IP12 & IP229) to 1.5m (IP9) below EGL.

In the lower platform, this layer is underlain by a further capping layer comprising an orange brown, medium dense, slightly clayey to clayey SAND with ferruginised gravel, extending to depths in the range 0.4 (IP23 &IP229) to 1.0m (IP22) below existing ground level.

The fill below the capping layers generally comprises asbestos waste deposits in the form of sludge – both dry and wet, builder's rubble (pipes, bricks, etc.) and broken asbestos pieces mostly in a sandy matrix. However, in numerous inspection pits a compressible asbestos sludge layer was identified as listed in Table 1 below. The thickness of these asbestos sludge layers are noted.

TABLE 1: SUMMARY OF INSPECTION PITS WHERE COMPRESSIBLE ASBESTOS SLUDGES WERE IDENTIFIED

IP No.	Depth (m)	Thickness (m)
INSPECTION PITS FROM 2011		
IP201	0.6-1.2	0.6
IP202	1.0->5.0	>4.0
IP204	0.8-3.3	2.5
IP205	0.8->4.6	>3.8
IP207	0.7-3.7	3.0
IP208	1.0-2.4	1.4

IP No.	Depth (m)	Thickness (m)
IP209	0.4->4.3	>3.9
IP210	1.1->4.0	>2.9
IP211	1.3->4.3	>3.0
IP214	1.2->3.5	>2.3
IP218	0.2->3.1	>2.9
IP219	0.5-2.6	2.1
IP220	0.3-2.3	2.0
IP222	0.9->3.0	>2.1
IP223	0.2-2.7	2.5
IP225	3.1-4.0	0.9
IP227	0.6->4.7	>4.1
IP229	1.1-3.7	2.6
IP230	1.8->4.2	>2.4
IP231	0.4->4.4	>4.0
IP235	0.5-1.8	1.3
INSPECTION PITS FROM 2010		
IP2	0.7-3.5	2.8
IP3	2.2-3.0	0.8
IP4	0.5->3.0	>2.5
IP6	2.5-4.0	1.5
IP7	0.6-1.6	1.0
IP8	2.7->3.8	>1.1
IP9	1.5->2.8	>2.8
IP16	0.5-1.5	1.0
IP17	1.7-3.0	1.3
IP18	0.8-3.4	2.6
IP19	1.5-3.6	2.1
IP20	1.0-1.7 2.5->4.0	0.7 >1.5
IP21	1.4-2.9	1.5
IP26	1.6-2.6	1.0

It can thus be seen that the asbestos sludge ranges in thickness from ~ 0.6 to >4 m and forms a large part of the waste mix. The fill comprising asbestos products and sludges was observed to extend to depths of approximately 8.5m below EGL in BH2.

Thereafter, the *in-situ* sub-soils commonly comprise a layer of loose to medium dense, sandy sub-soils alternating with bands of clayey layers.

Residual sub-soils were encountered at depths in the range 11.3 (BH1) to 25.6m (BH3) below EGL and generally comprised a reddish orange brown, to orange yellow, stiff to very stiff, silty clay to clayey silt.

Weathered bedrock was only identified in BH3 at a depth of 27.2m below EGL and generally comprised an orange yellow stained red, completely to highly weathered, moderately to highly fractured, extremely soft to very soft rock granite of the Cape Granite Suite.

Some general views of the sub-soils excavated from the inspection pits are shown in the photographs overpage.

View of ASBESTOS SLUDGE and other asbestos waste being excavated from IP222

Close-up view of ASBESTOS SLUDGE being excavated from IP222

View of ASBESTOS SLUDGE layer near base of excavation in IP202

View of asbestos waste (pipes and sheets) being excavated from IP213

View of loosely packed asbestos pipes and other asbestos waste in IP228.

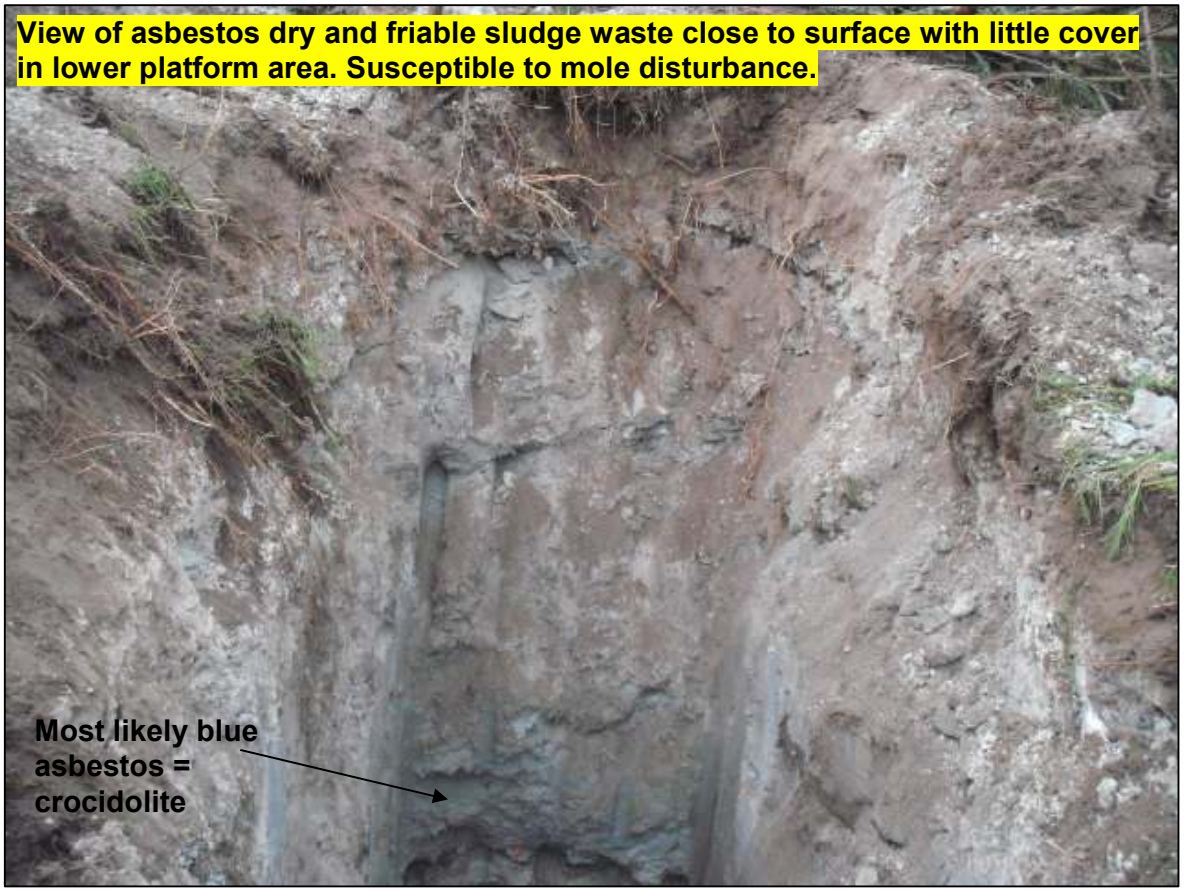
View of *in-situ* sand below fill in IP221.

View of roller blanket used in manufacture of asbestos cement sheeting and large diameter asbestos pipes being excavated from IP226. Note fill has numerous large voids and has been loosely placed.

View of ASBESTOS SLUDGE in IP203. Note bags filled with ASBESTOS SLUDGE (slurry) at base of inspection pit.

View of asbestos waste being excavated from IP212. Note the loose consistency of the fill and sidewall collapse of inspection pit.

View of asbestos dry and friable sludge waste close to surface with little cover in lower platform area. Susceptible to mole disturbance.



Example of dry and friable asbestos sludge

Two views of mixed asbestos wastes with little soil cover in the lower platform area. Note poorly compressed nature of the material.

Groundwater seepage was not observed in any of the inspection pits down to depths of -5 m below EGL. However, perched groundwater seepage can be expected both during and after periods of heavy rainfall and/or during the high rainfall season. These could occur over the solidified layers of asbestos sludge and as saturated zones within the porous (loose) asbestos sludge and waste products.

Groundwater levels measured in the boreholes are summarised in Table 2 below. These levels were recorded on 14 September 2011 and in some instances were only several days after the borehole installation was completed. It is considered that the drilling fluid (stabilising muds) used would have affected the permeability of the subsoils and thus the groundwater levels recorded in the boreholes, and will need approximately 2 weeks to fully breakdown. The level of the groundwater in the boreholes should thus be re-measured into the future – this however is not a crucial issue at this stage for this report and future planning.

TABLE 2: SUMMARY OF GROUNDWATER LEVELS MEASURED IN BOREHOLES

Borehole No.	Measured Water Level in metres below EGL (14 September 2011)
BH1	9.0
BH2	11.2
BH3	7.45

In order to define the engineering properties of the *in-situ* soils and fill materials, the following tests were undertaken on representative soil samples from the site:

- Indicators;
- Modified AASHTO;
- California Bearing Ratio (CBR);
- Hydrometer Analysis of Fines;
- Triaxial;
- Shear Box;
- Collapse Potential;
- Swell Potential; and
- Standard Oedometer.

The laboratory test results are given in Appendix D of the Geosure PTY Ltd report (Appendix A of this overarching document) and summarised in Tables 3 and 4 below.

TABLE 3: SUMMARY OF RESULTS OF PARTICLE SIZE DISTRIBUTION ANALYSIS AND ATTERBERG LIMIT DETERMINATIONS, COMPACTION AND CBR TESTING.

IP No.	Depth (m)	Description	Particle Size %				Atterberg Limits %			GM	MDD kg/m^3	OMC %	CBR Values						Swell %	Insitu Moisture Content %	Material Code & Classification
			Clay	Silt	Sand	Gravel	LL	PI	LS				Compaction MDD %								
													90	93	95	97	98	100			
RESULTS FROM INSPECTION PITS CARRIED OUT IN 2010																					
IP3	0.5-5	Asbestos sludge and sheeting in a silty SAND – Fill	17		66	17	-	SP	1.0	1.22	1482	13.7	9.5	11	12			25	0		A-2-4(0) SC G8
IP7	1.6-4	Sandy GRAVEL with abundant asbestos pipes and builder's rubble – Fill	16		74	10	-	SP	1.0	1.11	1322	11.1	7.9	10	12			24	0		A-2-4(0) SC G8
IP14	0-1.6	Asbestos sludge and sheeting in a silty SAND – Fill	1		99	0	-	NP	0	0.99	1771	9.8	11	13	13			21	0		A-3(0) SW G8
RESULTS FROM INSPECTION PITS CARRIED OUT IN 2011																					
IP205	0-0.8	Greyish brown, silty SAND with boulders - Fill	4		89	7	NP	NP	0	1.16	1830	14.0	1.6	1.7	1.8	1.8	1.9	1.9	0.3	-	A-3(0) SP >G10
IP206	0.23-1.53	Asbestos Sludge with builders rubble and interlayered SAND – Fill	12		61	27	NP	NP	0	1.51	1404	29.4	2.3	3.4	4.3	5.5	6.2	8	0.1	-	A-2-4(0) SM >G10
IP207	0-0.07	Orange brown, silty SAND – Fill	3		91	6	NP	NP	0	1.15	1741	12.2	18	20	22	24	25	28	0.5	-	A-3(0) SP G7
IP214	0-1.2	Light greyish brown, silty SAND – Fill	2		98	0	NP	NP	0	1.01	1739	11.6	8.2	9.9	11	13	14	16	0.0	-	A-3(0) SP G9
IP216	1.4-2.8	Light grey speckled orange, clayey SAND - Insitu	25	38	36	1	40	12	6	0.3										-	A-6(8) ML
IP219	2.6-2.8	Dark grey, clayey SAND – Insitu	0	2	97	1	NP	NP	0											15.0	A-3(0) AP
IP221	0.9-2.6	Brownish white, SAND – Insitu	1		99	0	NP	NP	0	1.07	1829	8.3	10	11	12	13	14	15	0.2	-	A-3(0) SP G8
IP223	0-1.4	Orange brown, asbestos sludge with silty SAND – Fill	10	11	70	9	18	4	2	1.0										11.5	A-2-4(0) SM-SC
IP224	1-1.7	Orange to reddish brown, silty SAND – Insitu	2	10	88	0	NP	NP	0	0.9										34.0	A-3(0) SM
IP225	3.1-4.0	Brownish grey asbestos sludge mixed with SAND – Fill	10		75	15	NP	NP	0	1.28	1729	18.0	7	10	13	17	19	25	0.2	-	A-2-4(0) SP-SM G9
IP230	0.7-1.8	Greyish brown, silty SAND – Fill	2		93	5	NP	NP	0	1.13	1877	13.0	5.3	6.5	7.5	8.6	9.2	11	0.3	-	A-3(0) SP G10

IP No.	Depth (m)	Description	Particle Size %				Atterberg Limits %			GM	MDD kg/m^3	OMC %	CBR Values						Swell %	Insitu Moisture Content %	Material Code & Classification
													Compaction MDD %								
			Clay	Silt	Sand	Gravel	LL	PI	LS				90	93	95	97	98	100			
IP231	1.5-4.4	Grey, asbestos sludge with broken pipes and roots – Fill	38		27	35	72	19	10.9	1.36	1171	30.4	11	14	15	17	18	21	1.8	-	A-7-5(3) SM >G10
RESULTS FROM BOREHOLES																					
BH1	2-2.45	Orange brown, blotched dark brown, clayey SAND – Insitu	11	18	71	0	25	6	3	0.7										-	A-4(0) SM-SC
BH1	3-3.45	Light grey blotched orange brown, sandy CLAY – Insitu	18	27	47	8	38	13	6.5	0.8										-	A-6(3) SC
BH1	4-4.45	Light grey blotched orange brown, sandy CLAY – Insitu	34	37	24	5	41	13	7	0.4										-	A-7-6(10) ML
BH1	5-5.45	Light orange brown, silty SAND – Insitu	2	4	94	0	NP	NP	0	1.0										-	A-3(0) SP
BH1	8-8.45	Light grey to whitish brown, SAND - Insitu	0	2	96	2	NP	NP	0	1.1										-	A-3(0) SP
BH1	9-9.45	Light grey to whitish brown, clayey SAND to SANDY CLAY - Insitu	9	7	77	7	19	5	2.5	1.0										-	A-2-4(0) SM-SC
BH1	10.5-11.0	Orange brown, clayey SAND – Insitu	5	11	81	3	19	5	2.5	1.3										-	A-2-4(0) SM-SC
BH1	13-13.45	Reddish orange brown, silty CLAY to clayey SILT – Residual Granite	23	56	14	7	51	17	8.5	0.3										-	A-7-5(15) MH
BH1	23.5-25	Reddish orange brown, silty CLAY to clayey SILT – Residual Granite	33	54	10	3	46	14	7	0.2										-	A-7-5(16) ML
BH2	21-21.45	Reddish brown, silty CLAY – Residual Granite	52	43	5	0	54	13	7	0.0										-	A-7-5(19) MH
BH2	29.75-30	Orange yellow, silty CLAY – Residual Granite	17	42	41	0	35	9	5.5	0.4										-	A-4(5) ML
BH3	7-7.45	Light grey, clayey SAND – Insitu	9	8	82	1	17	4	2	0.9										-	A-2-4(0) SM-SC
BH3	12-12.45	Light grey, clayey SAND to SANDY CLAY – Insitu	12	24	63	1	14	6	3	0.7										-	A-4(0) SM-SC
BH3	14-15	Dark brown, CLAY – Insitu	17	48	27	8	54	15	7.5	0.5										-	A-7-5(16) MH
BH3	18-18.45	Light grey, silty CLAY – Insitu	28	27	41	4	28	12	6	0.6										-	A-6(4) CL
BH3	18.7-19.5	Light grey, silty CLAY – Insitu	54	34	12	0	57	23	12	0.1										-	A-7-5(27) MH
BH3	22.95-24	Light grey, silty CLAY - Insitu	23	72	5	0	52	17	8.5	0.0										-	A-7-5(23) MH
BH3	25.6-27.2	Orange yellow, silty CLAY – Residual Granite	14	60	25	1	42	14	7	0.3										-	A-7-6(2) ML

IP No.	Depth (m)	Description	Particle Size %				Atterberg Limits %			GM	MDD kg/m^3	OMC %	CBR Values						Swell %	Insitu Moisture Content %	Material Code & Classification
			Clay	Silt	Sand	Gravel	LL	PI	LS				Compaction MDD %								
													90	93	95	97	98	100			
BH3	29.7-33.0	Orange yellow, completely to highly weathered, extremely soft to very soft rock, GRANITE	13	42	35	10	37	7	3.5	0.7										-	A-4(3) ML

LL - Liquid Limit
PI - Plasticity Index
LS - Linear Shrinkage
SP - Slightly Plastic
OMC - Optimum Moisture Content
MDD - Maximum Dry Density
G10 - Classification in Terms of TRH14 (1985)
A-2-4 - Revised US Roads Classification
CBR - California Bearing Ratio
NP - Non-Plastic

TABLE 4: SUMMARY OF RESULTS OF DRAINED SHEAR BOX, CONSOLIDATED DRAINED TRIAXIAL AND STANDARD OEDOMETER TESTS

IP No.	Depth (m)	Description	Ø' (degrees)	c' (kPa)	m_v at 50 kPa Applied Pressure (MN/m^2)	c_v at 50 kPa Applied Pressure (m^2/year)	Initial Void Ratio (e)	Initial Moisture Content (%)	Bulk Density (kg/m^3)	Specific Gravity
#IP203	3.0	Asbestos sludge			Non Collapsible		3.742	141.98	935	1.84
##IP203	3.0	Asbestos sludge			Swell potential = 2.25kPa		4.566	188.19	949	1.84
IP214	1.2-3.5	Asbestos sludge			0.337	1.842	4.107	182.09	1250	2.26
IP216	1.45-2.8	Asbestos sludge	30.36	4.26	0.344	6.308	0.537	22.77	2010	2.52
IP18	0.8-3.4	Asbestos sludge	38.62	145.64	0.162	1.133	4.683	129.0	890	2.20
IP19	1.5-3.6	Asbestos sludge	26.6	86.3	0.288	0.282	4.272	172.2	1137	2.20
*IP19	1.5-3.6	Asbestos sludge	1.8	208						

#Collapse Potential Test
##Swell Potential Test
*Consolidated Drained Triaxial Test

Engineering Properties of Asbestos Sludge

Significant layers of asbestos sludge were identified in numerous inspection pits across the site as listed in Table 1. It was necessary to understand how this material would behave under static and cyclic loading. In an attempt to determine some of the engineering properties, shear box, Triaxial and standard oedometer tests were scheduled on selected undisturbed samples of the asbestos sludge.

It must be appreciated that the above tests were devised for soils and, in some cases weathered bedrock, and have been proven over the years to provide reasonably accurate results for the prediction of soil behaviour under various stress conditions. An attempt has been made here to come up with some parameters for the asbestos sludge that could give an indication of how this material would behave under various stress conditions. The properties of the sludge are very different to those of a soil and hence these results must be interpreted with caution.

Tests carried out indicated that this asbestos sludge material is not collapsible and has a low heave potential.

The results of the shear box tests generally showed fairly uniform angles of friction in the range 26.6^{O} to 38.62^{O}. The cohesion was more erratic ranging from 4.26 (IP216) to 145.64 kPa (IP18).

The Triaxial test showed this material to have a high cohesion (208 kPa) and relatively low angle of internal friction (1.8^{O}).

The oedometer test results show the material to be of low compressibility under low applied pressures but it is likely to undergo extensive settlement when the pressures exceed the preconsolidation pressure.

At relatively low applied foundation pressures (<50 kN/m2 for a footing size 1m x 1m), these samples do not consolidate much (foundations likely to settle <25mm). The time for 90% consolidation of this material is likely to be in the range 1.5 to 3.5 years. The consolidation tests also showed that above certain applied pressures (e.g. 650 and 400 kN/m2 for IP18 and IP19 respectively) settlement could be excessive.

The material also generally had high void ratios, in the range 3.742 to 4.683 with moisture contents in most cases well in excess of 100%. Typically void ratios range from 0.8 for a loose sand up to 2.5 -3.2 for a soft organic clay (moisture contents ~90 to 120%)[2].

These void ratios and high moisture contents are considered atypical of soils and this material may be prone to liquefaction during cyclic loading caused by earth tremors and vibrations from machinery. Hence, the seismic setting concerning earthquakes will need to be better understood.

The asbestos sludges were generally absent along the eastern and northern portions of the site and along the toe of the embankment of the eastern (upper) platform.

Engineering Properties of Building and Asbestos Rubble

Numerous layers of builder's rubble comprising asbestos sheeting, pipes, bricks etc. were identified on site (see photographs). Often these were poorly compacted with large voids visible. It is considered that these materials will undergo excessive settlement when loaded and this material is not a suitable founding medium.

[2]Das, B M (2002). *Principles of Geotechnical Engineering*, 5th ed.,Brooks/Cole, California pp53.

When broken down with sand and sludge and tested in the laboratory these classified in the range G8 to poorer than G10 in terms of TRH14 (1985), thus confirming the variability of the material.

The distribution of the material was rather erratic over the site, but was generally more prevalent along the embankments of the upper and lower platforms.

Engineering Properties of *In-situ* and Residual Materials

The grading results of the shallow *in-situ* sands show these to comprise 70 to 98% sand with minor amounts of clay and silt with *in-situ* moisture contents ranging from 15 to 34%, classifying at G8.

The clayey deeper *in-situ* and residual subsoils identified in the boreholes comprised clays in the range 18 to 54%, silts in the range 24 to 74%, with varying minor amounts of sand.

6 OPTIONS RE-ANALYSIS AND CONCEPTUAL SCENARIO.

It is appropriate, given the greater level of geotechnical information available and detail on the nature and extent of the buried asbestos wastes, to re-interrogate the options analysis undertaken in 2010. We thus consider the following sequence of information:

- Volumes and mass of asbestos waste present
- Broad land-use options
- Engineering issues related to 3 landuse scenarios
- Possible development scenarios

6.1 Volumes and mass of asbestos waste present

The recent deep drilling and excavations has ascertained that the asbestos wastes are up to a maximum of ~8m thick on the lower platform and around 6.5 m thick on the upper platform.

Jones & Wagner Consulting Civil Engineers in their report, JW92/01/773, July 2001, noted an estimated volume of 131,000 m^3 of asbestos waste in these dump areas – based on a maximum thickness of ~6 m.

Considering that additional asbestos waste material was added to the upper and lower platforms in the early to mid 2000's, it would be safe to say that the volume is anywhere between 140,000 to 150,000 m^3. We assume for calculation purposes, and being conservative, a volume of asbestos waste of 145,000 m^3.

Using an average SG of 1.7 for this material, which is based on experience from several asbestos remedial projects, the mass of asbestos waste would be in the region of 250,000 tons.

MAIN DUMP ASBESTOS VOLUMES AND TONNAGE:
~145,000 m^3 equating to ~250,000 tons at an average SG of 1.7

Were this material to be disturbed it would be necessary to apply water dampening for dust control and thus the SG is likely to increase to between 1.8 to 2.0. Thus, if applied to the total volume, the mass of asbestos waste would be somewhere between 260,000 to 290,000 tons.

6.2 Broad land-use options

In 2010 we identified 8 broad landuse options and these are listed below:

TABLE 5: LAND-USE SCENARIOS IDENTIFIED IN 2010

No.	Option considered	Comments
1	Do nothing ie do not develop the land	There will be an unavoidable site improvement cost to properly secure (cap) and permit close the site as a H:H, plus annual management cost thereafter. Estimated site improvement R 12 to 15 million. Annual management = R 100,000.00.
2	Excavate the asbestos material and dispose to existing landfills	Do-able, but very costly. Does enable return on free'd up land. Estimate = R 130 million. May be possible to get a bulk discount on the transport and disposal cost of ~R 20 million. Value of free'd up land = ~ R 50 million.
3	Excavate all the asbestos material and dispose to a new dedicated cell at a landfill	This would most likely be greater than the Option 2 cost.
4	Re-engineer the existing dumps where needed, with some form of development ~ light industrial units or storage	Option appeared feasible.
5	Same as 4, but for storage only	The immediate profit may be lower than option 4, however, if Group 5 were to follow this option themselves, there may be a longer term financial benefit. Low input costs as limited services
6	Sportsfields	This is not considered a feasible option. Not economically viable. Perceived negative factors.
7	Residential – low density	This is not considered a feasible option.
8	Residential – high density	A possibility but a cost benefits analysis would need to be conducted after clarification on the geotechnical conditions has been obtained.

Based on the 2010 preliminary investigation findings, Option 4 was identified as the most desirable way forward with dual benefits of both securing the site, limiting the hazards and the project paying for itself.

We now apply the findings of the detailed geotechnical assessment recently undertaken to these options – next section.

6.3 Engineering issues related to 3 landuse scenarios

Taking into account the geotechncial properties of the site and, in order to manage the associated hazards and risks of exposure to asbestos, the following three options have been considered and are discussed individually below:

- Cap the site with additional cover material and leave as is.
- Cover the site with some layerworks and hardstanding (asphalt or paved surfacing) and use as parking area, staging area etc.
- Light industrial development.

6.3.1 Capping the Site

Simply capping and re-shaping the site with a cover material is considered inadequate for the following reasons:

- Mole activity results in tunnelling through the asbestos waste bringing to surface the asbestos and thus increasing the exposure hazard. It is considered that the moles will tunnel through any soil capping layer unless a highly engineered cap with protective subbase e.g. glass shards, coarse gravel, cement stabilised similar to a road sub-base, etc. is installed.

- The vegetation that covers the platforms and side slopes of the embankment, although densely covered now, is considered seasonal. During low rainfall periods, shrubs and grass may dry out and become a fire hazard. Loss of vegetation will also lead to erosion thus exposing asbestos waste. To properly cap the site the existing vegetation will have to be removed completely. It is most probable that this vegetation will classify as hazardous due to the fact that considerable asbestos will be caught-up in the vegetation matter when it is removed. It will thus have to be disposed as hazardous wastes, but the SG would be fairly low for the grass matter, which could be bailed.

In summary, merely capping the site is not going to be a simple, cheap solution. An engineered, hardened cap will be required. Instead, consideration should be given to forming a hard-standing as a cap or cover, which enables some form of use as discussed below.

6.3.2 Creating a hard-standing

This will involve the importing of suitable materials to construct layerworks and hard-standing that could comprise either asphalt or interlocking blocks. Interlocking blocks are preferred as the platforms could consolidate (settle) unevenly with time, in which case blocks could be removed, the subsided surface re-engineered or filled and blocks replaced.

In addition to covering the platforms, the embankments will need to be protected from erosion and mole activity as well. The following options can be considered and will need to be discussed in detail with the professional team and client regarding effectiveness of cover versus costs:

- Cover the platform and embankment with a paving system that is robust enough so as not to allow moles to tunnel to the surface. This will involve minor reshaping of the embankment and forming some layerworks for paving or a cement stabilised sub-base layer above the asbestos wastes and below a vegetated cap layer.

- Forming a block retaining wall using Loffelstein blocks or similar along the embankment – see photograph example alongside. The safe angle of the block retaining wall should take into consideration the stability of the contained asbestos waste. It would be possible to step-the embankment to improve slope stability. It would be necessary to install a clean protective layer behind the engineered embankment. This could be optimised such that there is more area created for the hard-standing on the platform above.


Example of a Terraforce stepped slope

- Embankments will require engineers design and drawings

Obviously, covering the site with a hard-standing will lead to increased stormwater runoff. Hence, careful consideration will need to be given to the design of the stormwater system and attenuation of stormwater.

Due to the likely compressible nature of the materials present on site, it is recommended that the platform levels remain more or less the same i.e. fills greater than 500 mm must not be constructed.

It is likely that some material exposed at subgrade or formation level will need to be undercut and disposed to a licensed landfill site or, dependent on the design of embankments, used as backfill with a clean cover. The pavement formation layer for the proposed hard-standing should be designed taking into account anticipated traffic loads, volumes and design life of the hard-standing.

The geotechnical risk of failure of embankments posed by this type of development (provided it is well engineered) is considered low to negligible.

Consideration then could be given to using the site as a parking area, truck stop or even lightly loaded storage units – see later discussion.



Examples of small storage units

Looking at some of the storage companies operating in the Cape Town area, a standard garage size store is available for ~ R 1060/month, this is 5.52 m long, 2.88 m wide and 2.40 m high. A half garage unit rents for ~ R 700/month. Thus 100 garage units would cover an area of ~18,000 m^2, and allowing for front access space of 5 m, if we added this, would be ~ 35,000m^2, giving a monthly return of ~ R 100,000.00.

6.3.3 Light Industrial Type Development

Due to the compressible nature of the fill material and asbestos sludges, conventional foundations for even the lightest structures will not be feasible for large parts of this site. These structures and surface beds may undergo excessive total and differential settlement.

It is recommended that any proposed warehouses or factory units be restricted as far as practical to the highlighted areas shown in Figure 203 (of the Geosure report – see next section 5.4, which discusses the possible development areas) where the fill thicknesses were generally less than 4m. This is to avoid costly foundation construction that will need to penetrate at least 4m of fill and to prevent buildings spanning areas of thick asbestos sludge (slurry) that may consolidate (settle) with time resulting in differential settlement and damage to surface beds. This can be avoided by suspending all surface beds but is considered uneconomical for the type of development proposed.

In order to prevent excessive settlement of surface beds, the loadings of these buildings will need to be restricted. Regular periodic maintenance of surface beds not suspended is considered likely. The remainder of the platforms and embankments could be covered with a hard-standing for parking etc. as discussed in the previous section.

In summary: merely capping the area of interest is a complicated and costly scenario as some form of hardened sub-base will be required to prevent mole damage and exposure of the asbestos. A dual option of hard-surfacing and light industrial unit development on the site in select areas is seen as a beneficial outcomes as this would off-set the cost of capping those areas that cannot be used due to compromised founding conditions.

6.4 Possible development scenarios

Based on the 2010 preliminary investigation findings, Urban Dynamics Western Cape (UDWC) came up with a conceptual layout for the site which is shown in Figure 7 alongside. This did not take into account the site's topography to any detail as an up-to-date contour plan was not available for the site in 2010.

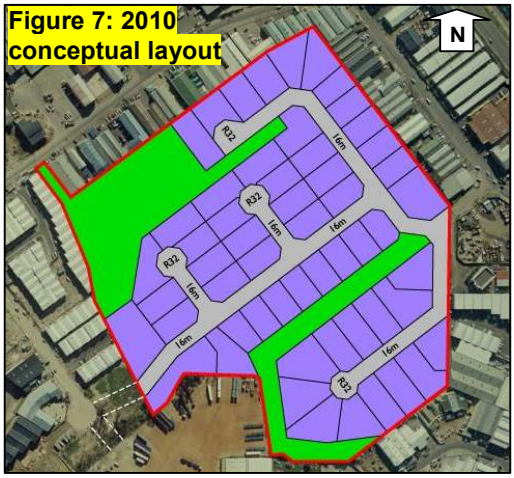


Figure 7: 2010 conceptual layout

Following the surveying undertaken in 2011 by Biff Lewis Geomatics, UDWC was requested to overlay the 2010 conceptual layout onto the countour plan – this is shown in Figure 8. It can be seen that a poor fit of the conceptual layout to contours existed. UDWC were thus requested to remodel the conceptual layout taking into consideration the topography contours (Figure 9).

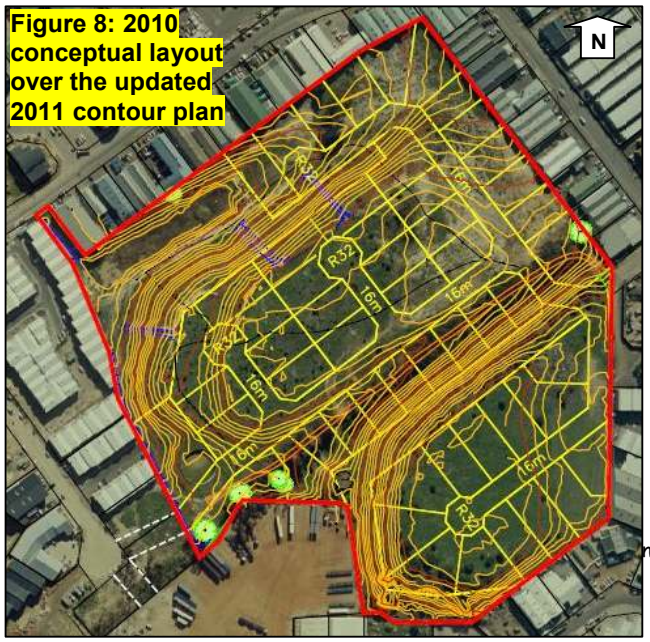


Figure 8: 2010 conceptual layout over the updated 2011 contour plan

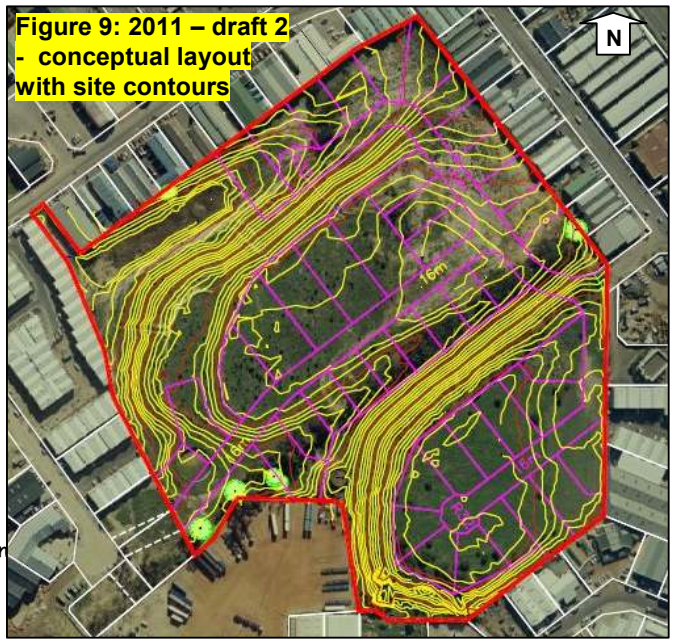
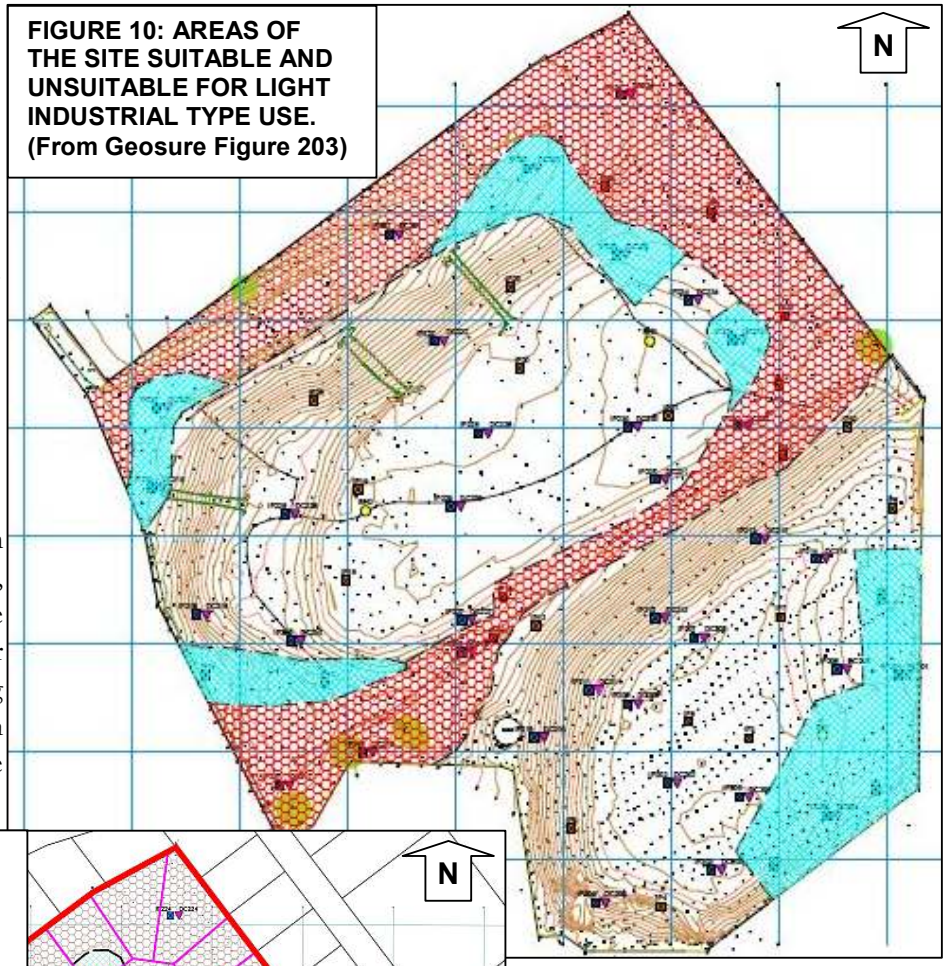


Figure 9: 2011 – draft 2 - conceptual layout with site contours

It can be seen that in the draft 2 conceptual layout that a better fit of the envisaged / assumed light industrial type units occurs over the site with the embankments free'd-up with no development. However, it has now been necessary to revise this conceptual plan taking into consideration the geotechnical findings of this detailed assessment.

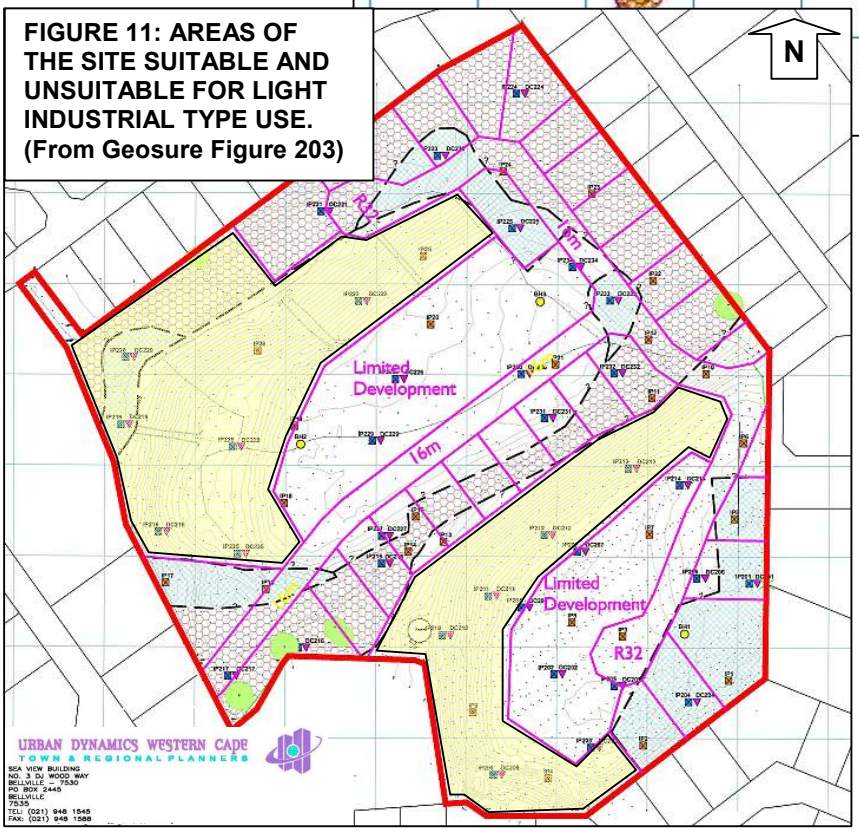
All white shaded areas shown in Figure 10 alongside are considered unsuitable for normal industrial development due to unfavourable founding conditions ie compressible sludges. Any development in these areas will be costly due to the need to pile the foundations and slabs.

FIGURE 10: AREAS OF THE SITE SUITABLE AND UNSUITABLE FOR LIGHT INDUSTRIAL TYPE USE. (From Geosure Figure 203)



With the restrictions on development in mind, UDWC revamped the conceptual layout to cater for the slopes and poor founding areas and came-up with layout 3 as shown in Figure 11 below.

FIGURE 11: AREAS OF THE SITE SUITABLE AND UNSUITABLE FOR LIGHT INDUSTRIAL TYPE USE. (From Geosure Figure 203)



This option has the following aspects:

- It restricts any development from the (yellow-shaded) slope areas,
- It allows 'limited use or development' of the top of the upper and lower platform areas, but away from the lip of the slopes of these areas. Limited development may include truck / vehicle parking or small storage type units as discussed earlier.
- It caters for ~28 small industrial type units.

Figure 11 conceptual layout is seen as a feasible compromise. It will however require some re-engineering of the platform slopes to (both) ensure their long-term stability and manage the mole damage factor with related asbestos exposure. However, as noted earlier, any re-engineering of the slopes, such as a stepped Loffelstein, may free-up some space for light units, such as mini-storage units in the 'limited use/development' areas, which could thus possible be expanded. Thereby off-setting the cost of the slope re-engineering.

7 PLANNING, ENVIRONMENTAL AND ENGINEERING NEEDS

7.1 Planning needs – urban design.

The following planning issues will need to be addressed to take the project forward:

- A market survey of landuse and facility requirements in the area. This should consider the need for additional small industrial type units, need for vehicle parking – given the close proximity of the large Shoprite warehouses, there may be a need for an area to park the distribution trucks that service this warehouse, need for small storage units – given the expansion of residential areas along the N1, plus the proximity to the Okavango fly-off to the N1, the site may be desirable for small storage units. The purpose of the market survey is to establish what sort of mix of light industrial use would be best to accommodate in the available areas of the site and to determine what the financial returns would be on such
- Based on the above, and informed by specific engineering needs (next point, 6.2), it will be necessary to refine the site layout plans taking into consideration services and road access (traffic) issues.
- It will also be necessary to consider landuse zoning issues. The land is currently zoned industrial, thus this fits with the recommended way forward.

7.2 Environmental needs

In June 2010 the National Environmental Management Act (NEMA - 107 of 1998) was updated with regard to the listed activities that trigger the need for authorisation to be obtained first before certain activities may proceed. Government document GRN 544 of 18 June 2010 is Listing Notice 1 which details those activities where a basic assessment process must be followed for certain activities. The development of this site triggers the listed activities and it will be necessary to appoint an independent environmental specialist to undertake the environmental impact assessment process. We have previously recommended that Chand Environmental be approached to address this aspect as they have assisted with public participation issues related to an asbestos cleanup elsewhere in Cape Town.

7.3 Engineering needs

It is considered that the following foundation options will be suitable for light industrial type structures:

- Ground Improvement; or
- Piled Foundations.

7.3.1 Ground Improvement

Ground improvement can be considered for the red hatched area shown in Figure 10 (Figure 203 in the Geosure report) where fills are generally in the range 0 to 2m thick and limited asbestos contamination is present. These areas were restricted to the toe of the upper platform and to the north and east of the lower platform.

The following can be considered:

- Undercut site to a maximum depth of 1.6m such that most or the entire fill contaminated with asbestos waste has been removed. Localised sections may require excavations to go down to at least 2m in order to remove all asbestos waste. Note: a large part of this area is not contaminated with asbestos.
- Excavations should extend to at least 2 metres beyond the footprint of the proposed structure.
- Care must be taken not to destabilise the embankments when undercutting and construction may need to progress in limited sections (eg strip-mining) in order to promote stability of these.
- The undercut asbestos waste will need to be disposed to a licensed landfill site or alternatively, dependent on the design of embankments, used as backfill with a clean cover behind retaining walls.
- The bottom of the excavation should then be compacted to at least 95% Modified AASHTO dry density.
- Carefully sort material from excavation to be used in backfill. Only granular soils must be used in backfill. The maximum particle size should not exceed 75 mm, as this tends to negatively affect compaction.
- Import a G7 material or better to make up deficit due to material being spoiled.
- Backfill may consist of selected granular material from the excavations or imported G7 material compacted to not less than 95% of Maximum Mod AASHTO dry density.
- These should be replaced in layers not exceeding 250 mm (depending on energy of compaction equipment being used) and should be compacted to at least 95% Modified AASHTO dry density to +2% of OMC.
- Footings will need to be founded at 600 mm below ground level. There should be at least 1.0m of re-compacted material beneath the underside of footing. A maximum nett allowable bearing pressure of 75 kN/m^2 is considered applicable for the above foundation treatment. Settlement of a 1m wide footing is likely to be in the range 10 to 20 mm, with differential settlement taken as 50%.
- Strict quality assurance will be required throughout this process.

Alternatively, ground improvement can be restricted for individual footings where re-compacted soils to at least 1.5 times the plan dimension of the footings to at least 1.6m depth can be constructed (localised section may require depths of up to 2m in order to remove all compressible asbestos waste). The advantage of this latter method is that disposal volumes of asbestos waste will be considerably less. However, the downside of this method is that loading of floor slabs may need to be restricted and these may be prone to excessive settlement and may require higher maintenance costs.

One consideration for the above is that permission be sought to encapsulate below the concrete slabs and roadways any asbestos material that may be present in the soils, as long as appropriate compaction occur when layering – this is a feasible option as the hazards and risks can be managed. Services can be installed during the earthworks and title deed restriction can place restrictions on any excavation in the area.

7.3.2 Piled Foundations

Taking the subsoil conditions into account, the following pile types were considered and these are discussed below:

- Pressure Grouted Continuous Flight Auger (CFA) Piles;
- Driven Cast Insitu (DCI) Piles; and
- Percussion Piles (Rotapiles).

Pressure Grouted CFA Piles

It is considered that conventional CFA piles will not be suitable for this site due to the presence of asbestos pipes and other waste products that will obstruct piling. However, this can be overcome by excavating at each pile position and disposing the waste material to a licenced landfill. The excavation should then be filled with a clean granular backfill free of boulders and rubble in which a CFA pile can be installed. The following pile loads given in Table 6 below can be used for CFA piles.

TABLE 6: RECOMMENDED PILE LOADS FOR PRESSURE GROUTED CFA PILES

*Pile Diameter (mm)	Allowable Axial Working Pile Load (kN)
300	350
400	600
500	1000

* - Intermediate pile diameters are also available.

The minimum pile diameter should be restricted to 300 mm.

DCI Piles

It would be important to ensure that DCI are not founded in compressible clay layers. Vibration associated with the driving of these piles can cause damage to nearby structures. There are means of overcoming these negative features and this should be discussed with the piling contractor and addressed in the detailed pile design.

DCI piles are rated as fair to good in handling boulders. However, should the rubble present in the fill obstruct piling then excavation and removal of the rubble followed by replacement with a granular soil free of rubble and boulders will be required (as described for the CFA pile).

The driving of DCI piles may cause liquefaction in the subsoils and this will need to be carefully monitored by installing piezometers that measure pore pressures.

Typical pile sizes and working loads are given as a guideline for budgeting purposes only in Table 7 below.

TABLE 7: TYPICAL PILE SIZES AND ALLOWABLE WORKING LOADS

Pile diameter (mm)	Typical Working Load (kN)
*355	500
410	750
520	1200

*- Recommended minimum pile diameter to be considered for the DCI pile.

Percussion Piles (Rotapiles)

This pile type has excellent penetration ability through boulders and hence should penetrate the rubble easily. However, it is noted that this pile is not particularly suited to soft ground conditions and the suitability of this pile should be discussed with the piling contractor. Another negative feature is that the pile is relatively expensive when compared to the above piles.

It is considered that an unlined pile will be suitable for the site conditions (i.e. the pile will be formed with a temporary casing that will then be removed once the concreting/grouting operations are completed). A summary of the allowable load capacities for various diameters are given in Table 8 below.

TABLE 8: SUMMARY OF ALLOWABLE PILE LOADS FOR ROTAPILES

Diameter (mm)	Typical Working Load (kN)
250	300
300	450
350	600
400	800

Pile Testing requirements

A detailed pile design must be carried out by the piling contractor

It is considered good practice to carry out pile load tests, which is the only reliable means of determining a pile's load capacity.

Whereas a pile load test on such a project will only be carried out on possibly two piles, integrity tests are relatively inexpensive and should be carried out on all the piles. It must be noted that the integrity tests check the integrity of the pile shaft for any structural defects but do not indicate the load settlement characteristics.

For smaller diameter piles, the frequency response test method is recommended and for larger diameter piles, cross-hole sonic logging is recommended. All aspects of integrity testing should be discussed with Geosure prior to finalising in the tender or contract documents.

7.3.3 General construction guidelines

Trenchability Assessment

Soft excavation in terms of SANS 1200 is generally anticipated at this site to at least the depth of the field tests carried out. However, the presence of builder's rubble and asbestos may result in slower excavation rates. Hence, consideration will need to be given to making an allowance for intermediate and hard excavations.

General Earthworks

It is recommended that all earthworks be carried out in accordance with SANS 1200 (current version). All vegetation should be cleared from areas over which fills are to be built.

Fills should be placed in layers not exceeding 200 mm loose layer thickness, and compacted to a minimum of 95% maximum Modified AASHTO dry density. Boulders and rubble larger than 75 mm should not be included in the fill material. Large boulders and rubble within the fill could affect compaction, cause piping within the fill and may also affect foundation excavations. Density control of fill material should be undertaken at regular intervals during fill construction.

The material should be worked within a close range of the Optimum Moisture Content (OMC) level, i.e. -2% to +2% of optimum, otherwise if the material's moisture content is well above the OMC, (particularly in clayey soils) it will heave under construction traffic. The asbestos sludge if exposed at surface soils may be impassable to construction traffic particularly if it has high moisture contents.

Where fill is required it should be placed on horizontal benches cut into the existing slope when it is steeper than 1 vertical in 6 horizontal, with a minimum bench width of 3 metres.

Unstable sidewall conditions were observed in several inspection pits. Thus all temporary excavations formed will need to be battered back at least 1 in 1 (45^{o}) or preferably shored particularly when deeper than 1.5m. All excavations must be inspected and approved for stability before workers enter.

Drainage

The most important factor in the promotion of a stable site is the control and removal of surface water from the site. It is important that the design of the stormwater management system allow for the drainage of accumulated surface water.

Surface water on the platforms should be directed to and collected in open lined drains or piped off the site into the stormwater reticulation system. Run-off from roofs should be piped from gutters through downpipes and discharged into the stormwater reticulation system.

Both during and after construction, the site should be well graded to permit water to readily drain away and to prevent ponding of water anywhere on the surface of the ground. All terraces and earthworks in general should be sloped to a gradient to prevent ponding and ingress of water into the subsurface soils.

The use of earth bunds along fill edges is recommended. This prevents stormwater from overtopping and damaging fill embankments.

Dynamic Compaction

During discussion with various professionals involved, dynamic compaction was discussed as a way of improving the founding characteristics of the site. This method is considered high risk for the following reasons:

- It is understood that the upper and lower platforms have been constructed in a similar manner to mine tailings dams albeit in a more haphazard manner in that there are pockets of coarse rubble interspersed with finer sludge (slurry) and fine to medium-grained sands.
- The sludge has a high moisture content (>100%) with in many cases void ratios in excess of 4 with a concomitant low bulk density. These are not typical of soils and the behaviour of these cannot be easily predicted using soil mechanic models.

- Compacting this waste body will squeeze out the pore water thus saturating layers and may lead to liquefaction of fines and possibly failure of the embankments. Hence, dynamic compaction or any other form of compaction over the central waste body in both platforms is not recommended.
- There are ways of preventing liquefaction during dynamic compaction such as the formation of stone columns that will readily drain saturated soils. However, this is now becoming more of a complex geotechnical solution for the site and tends to lose the primary focus, which is to secure the asbestos waste safely, and thereby preventing human exposure.

It must be borne in mind that the more complex the geotechnical solution for the site, the higher the risk of failure and thus exposure to asbestos. Notwithstanding the higher cost implication.

7.3.4 Civils specialist input and design needs

The findings of this detailed geotechnical investigation will provide input to the civils design, compilation of a Bill of Quantities for a contractor and ultimate execution of the chosen end-landuse. It is seen that this aspect of the work be required in early 2012 and will take the project forward. With this in mind, and at the approval of Group 5, preliminary discussions were had, at the recommendation of MEGA-Geosure, with Mr Andre Jordaan of Kantey & Templer civil engineers. MEGA has worked with Mr Jordaan and K&T on similar industrial site re-engineering where subsurface contamination issues were a key aspect. Following these preliminary discussions, K&T provided a brief letter setting-out civils issues that will need to be considered to take the project forward. These provide an indication of the services and experience they can bring to the team in 2012. It would obviously be necessary to define an exact brief and contract between the overall project team and Group 5.

From the K&T letter (see Appendix C) we have abstracted key points and summarise these below. They recommend a phased approach to take the development forward, comprising 4 phases which are summarised as follows:

<u>PHASE 1</u>

- Assess available information regarding the site with specific emphasis on the geotechnical properties of the dump sites.
- Analyse the topographic model of the site with respect to optimising the developable area with the least amount of earthworks - both on site (cut to fill) and importation of cover material for the asbestos waste.
- Liaise with the town planners to optimise a layout to fit into the opportunities and constraints of the site.
- Investigate suitable slope stability measures to compare increasing the developable areas versus the costs of doing so.
- Prepare an estimate for the cost of remodelling the site, providing roads and buried services for dealing with disposal of foul sewerage, attenuation, treatment and disposal of storm water, provision of potable water and water for fire fighting and electrical power, street lighting and communications.
- Provide a report to the client indicating:
    - Possible layout(s)
    - Estimated cost of development of roads and services

- Constraints of site
- Recommendations for further geotechnical work (if deemed necessary)
- Provisional recommendations for suitable structures

The client could then make a reasonably informed decision whether to proceed or not.

PHASE 2

- Provide a baseline report on the site for submission to Council in support of rezoning – found to be not necessary as it is zoned industrial. This would deal with the engineering of the site as well as the treatment of site effluent (foul sewerage and storm water).
- Provide a baseline report for the Environmental Impact Assessment report dealing with:
  - the proposed engineering measures to be used for the long term stabilising and safeguarding of the site
  - envisaged construction procedures for undertaking the civil engineering works in a safe way for site staff
  - envisaged construction procedures for undertaking the civil engineering works to alleviate impacts for surrounding areas
- Undertake additional geotechnical tests to verify assumptions made during phase 1 (if deemed necessary)
- Report back to Client.

PHASE 3

- Undertake sufficient design for tender purposes; prepare engineering drawings and documentation to be used to obtain tendered prices for the land development for civil and electrical engineering works.
- Submit drawings to Council and obtain approvals
- Call for, receive and adjudicate tenders and report results to clients.

PHASE 4

- Prepare working drawings.
- Administer the contract (site meetings, minutes, payments certificates etc).
- Provide level four monitoring of the works.
- Produce as-built drawings.
- Certify the completed works to Council.

In discussion with K&T, the health and safety aspects around earthworks of this nature were acknowledged, which obviously place some limitiation on how the civils work should occur, what precautions are needed, limitiations in terms of the extent of the works, etc. Thus, it is realized that specialist input to many of the above tasks will require the experience of the MEGAteam that has (i) undertaken the site assessment work to-date, and (ii) has experience in large scale excavation and handling of similar asbestos wastes.

8 SUMMARY OF FINDINGS AND RECOMMENDED WAY FORWARD

Key findings and recommendations from this detailed geotechnical assessment are as follows:

- The 10 ha asbestos waste consolidation site at the old Everite Brackenfell site currently forms 'sterilised' land;
- The conditions on site are not perfect in that the capping material installed in the early 2000 has been compromised by considerable mole activity, which has brought asbestos wastes to surface.
- Although the site is vegetated with kikuyu and alien Port Jacksons and Rooikrans, this does limit the air-borne dispersion of asbestos wastes. However, the vegetation is prone to fire in the dry summer months and thus the limitations on exposure are compromised.
- Air monitoring has shown that currently no unacceptable exposure risks exist.
- The site will require in the near future considerable re-engineering and capping to secure it properly into the long term. This is a fairly complex task and it is estimated will cost in excess of R 10 million.
- There will be a need for long-term annual management and maintenance on the site.
- Some form of permanent hard-standing is seen as a suitable option to secure the site into the long-term.
- Detailed geotechnical assessment has ascertained that parts of the site are (very) compromised in terms of founding conditions and would be difficult, if not extremely expensive, to develop for light industrial uses, ie buildings.
- Differential settlement and unsuitable founding conditions exist in some areas of the site.
- There are however parts of the site where development of light industrial type units is possible and where 'limited industrial' use could occur, such as mini-storage units or vehicle parking.
- Consequently, a mixed landuse on part of this site is possible, with the profits obtained from such being used to off-set the cost of the development of these areas and the need to secure the remaining 'unusable' parts of the site.
- Health and safety issues are manageable for the envisaged re-engineering and it will be necessary to follow the advice of a suitably experienced accredited asbestos inspection authority in this regard. Health and safety issues that require attention are as follows:
  - Ensure that all contractors required to perform work (excavation work excluded) at the site be informed about the potential asbestos exposure risk and the requirement to wear at minimum suitable and approved respirators (i.e. type FFP2) when engaging in the required work.
  - If future development of the site should prove not to be an option, consideration must then be given to clear the existing vegetation and covering with a hardsurface the site so as to stop mole activity from exposing subsurface asbestos. This will make a major contribution in managing any further exposure and contamination risk posed by exposed asbestos.
  - In the interim, and with intervals not exceeding 6 months, background airborne asbestos monitoring should be implemented and performed under various wind conditions to establish whether unacceptable asbestos fibre distribution does not occur. This is prudent due to the slow deterioration of friable asbestos sludge with time.
- The excavation and handling of asbestos wastes requires special attention to manage the health and safety issues, and thus it will be necessary to include the services of a suitably experience contaminant hydrogeologist in the design and project execution phases. There are many 'tricks and traps' to work

of this nature that will govern the success of compliance to health and safety needs and the success of the engineering works.

- It will be necessary to bring into the team a suitably experienced environmental assessment practitioner to undertake the EIA aspects in early 2012. We have recommended Chand Environmental for this as they have had experience with a previous asbestos remedial project and compiling the necessary Background Information Documents.
- It will be necessary to bring into the project team the services of a specialist civils engineer to undertake the design and contracts management aspects of the work. We have recommended Mr Andre Jordaan from Kantey & Templer and preliminary discussions have been had with him.
- Urban Dynamics Western Cape is already assisting with the town planning aspects and it will be necessary to retain their services to take the project forward.
- A key issue is to first obtain the opinions of the local regulatory authorities regarding the proposed securing and development of the site. They include the City of Cape Town, provincial Government – Department of Environmental Affairs and Development Planning (DEA&DP), Department of Labour, Department of Water Affairs. The DEA&DP will need to refer the situation and proposals to their National office in Pretoria as it is a hazardous waste issue – all hazardous issues are dealt by the National office. To this end, a feedback workshop was arranged for the 23rd November 2011 at the Kraaifontein Municipal offices. Notes taken at this meeting are attached as Appendix D. There was strong support from the authorities for re-development of the site.
- Public participation and input will be required should the decision be taken to proceed with the development. It is envisaged that this will be covered by the EIA process mentioned above.

In final conclusion, we thank you for appointing the MEGAteam to undertake this work and trust that it has been done to your satisfaction.

Yours faithfully

Ritchie Morris Pr Sci Nat (86/90)
Environmental hydrogeologist

Morris Environmental & Groundwater Alliances

Pierre Wepener (NHDPH)
Cert. Occ. Hyg. (BIOH) & (SAIOH)

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Mr P Wepener	Industricon	2 as e-copy	4 Dec 2011	
Mr R Morris	MEGAteam	3	4 Dec 2011	
Mr D Naidoo	Geosure	4 as e-copy	4 Dec 2011	
Mr P Olden	Urban Dynamics	5 as e-copy	4 Dec 2011	

APPROVAL SIGNATURE :

APPENDIX A

HEALTH AND SAFETY REPORT

APPENDIX B

GEOSURE GEOTECHNICAL REPORT

APPENDIX C

LETTER FROM KANTEY AND TEMPLER

DECLARATION OF THE SPECIALIST

Note: Duplicate this section where there is more than one specialist.

I …**Ritchie Morris Pr Sci Nat 86/90**, as the appointed Specialist **(environmental hydrogeologist with Geosure Pty Ltd as geotechnical and Industricon as IAAIA**) hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that:

- In terms of the general requirement to be independent:
  - other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the development proposal or application and that there are no circumstances that may compromise my objectivity; or

  - am not independent, but another specialist (the "Review Specialist") that meets the general requirements set out in Regulation 13 of the NEMA EIA Regulations has been appointed to review my work (Note: a declaration by the review specialist must be submitted);

- In terms of the remainder of the general requirements for a specialist, have throughout this EIA process met all of the requirements;

- I have disclosed to the applicant, the EAP, the Review EAP (if applicable), the Department and I&APs all material information that has or may have the potential to influence the decision of the Department or the objectivity of any Report, plan or document prepared or to be prepared as part of the application; and

- I am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations.

13 September 2021

Signature of the Specialist: Date:

Morris Environmental Groundwater Alliances (MEGA)

Name of company (if applicable):

Disclaimer: The investigation and report undertaken by MEGA, Geosure and Industricon, was commissioned by Group 5 in 2010. Report title: Report Number J–531B-11 dated 9 November 2011. GEOTECHNICAL ASSESSMENT OF THE ASBESTOS WASTE CONSOLIDATION SITE AT THE OLD EVERITE BRACKENFELL FACTORY - TOWARDS RE-ENGINEERING FOR LAND RELEASE -. It must be noted that this investigation was done approximately 10 years ago and thus the status quo on site in terms of geotechnical may have changed.