Draft Environmental Impact Assessment Report Monavoni Extension 44

Gaut: 002/08-09/N0588 *October 2013*

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LIST OF ABBREVIATIONS

CBD: Central Business District

CfG: Council for Geoscience

C-Plan: Conservation Plan

DEA: Department of Environmental Affairs

DFA: Development Facilitation Act

EAP: Environmental Assessment Practitioner

ECA: Environmental Conservation Act

EIA: Environmental Impact Assessment

IEMA: Institute of Environmental Management and Assessment

EIAR: Environmental Impacts Assessment Report

CoT: City of Tshwane

DWA: Department of Water Affairs

EMP: Environmental Management Plan

GAPA: Gauteng Agricultural Potential Atlas

GDARD: Gauteng Department of Agriculture and Rural Development

GSDF: Gauteng Spatial Development Framework

I&AP: Interested and affected party

IDP : Integrated Development Plan

MSDF: Metropolitan Spatial Development Framework

NSBA: National Spatial Biodiversity Assessment

NEMA : National Environmental Management Act

SACLAP: The South African Council of the Landscape Architects Profession

SAHRA: South African Heritage Resources Agency

SR: Scoping Report

SDF: Spatial Development framework

TIA: Traffic Impact Assessment

UNCED : United Nations Conference on Environment and Development

WMA: Water Management Area

WWTP: Waste Water Treatment Plant

1. INTRODUCTION

1.1 Background

JR 209 Investments (Pty) Ltd (M & T Development (Pty) Ltd) is planning a proposed township to be known as **Monavoni Extension 44** situated on a **Part of Portion 1 of the Farm Stukgrond 382 –JR**, **City of Tshwane, Gauteng Province.** ***(Refer to Figure 1: Locality Map and Figure 2: Aerial Map).*** The study area is approximately **38,8293 ha** in extent.

Please Note: Enlarged copies of the figures are included as Annexure A

The application is made for the authorization of the establishment of a township consisting of the following land-uses:

- 2 erven zoned "Residential 2" (80 u/ha);
- 2 erven zoned "Special" for Light Industrial and Offices;
- 2 erven zoned "Private Open Space".

The proposed Monavoni X 44 forms part of the larger Monavoni Development by M & T Development for which a Development Framework had been compiled ***(refer to Figure 3 and Annexure B).***

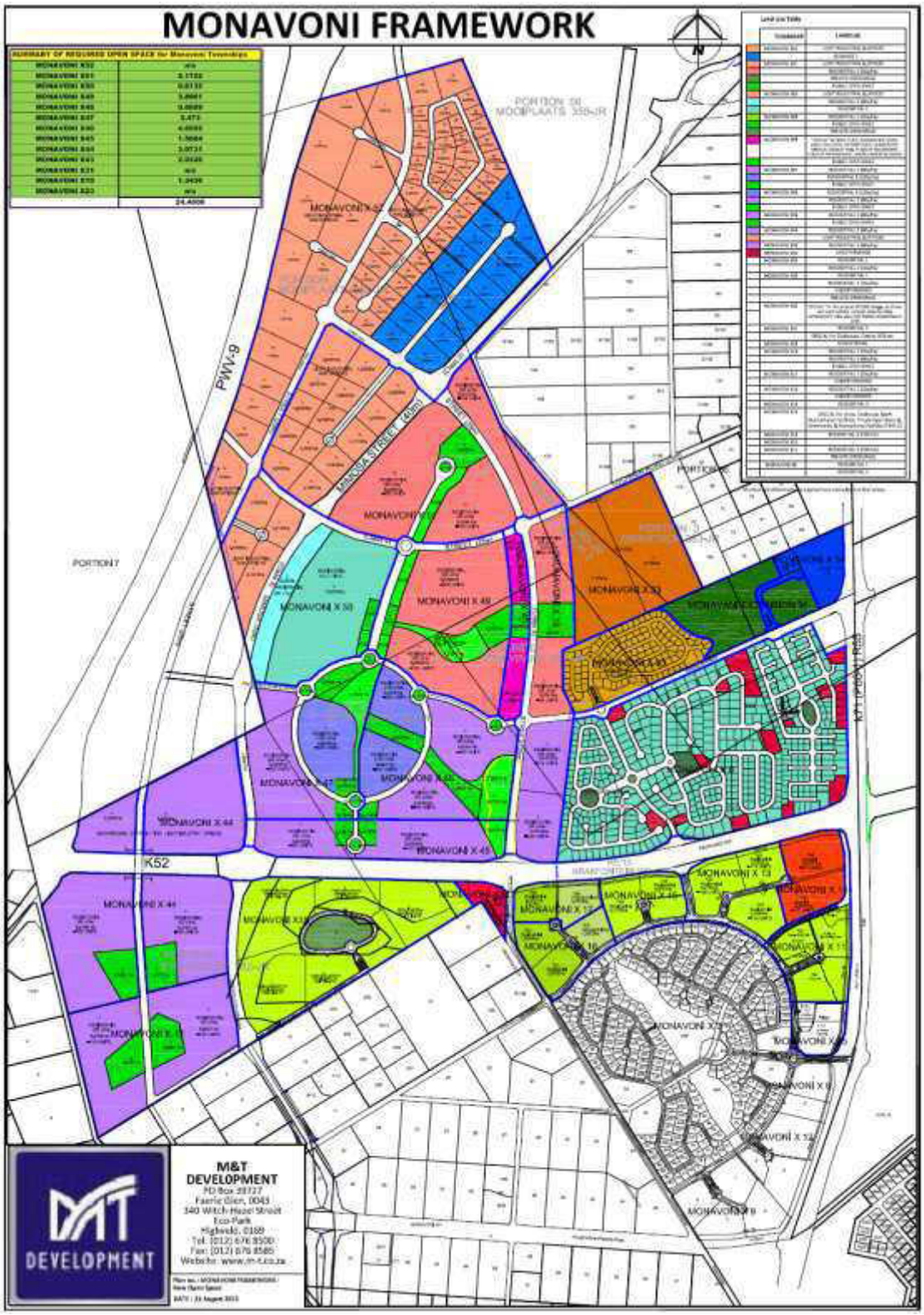


FIGURE 3 – MONAVONI DEVELOPMENT FRAMEWORK

The Monavoni Development Framework had been approved by the City of Tshwane (CoT), Environmental Services Department, Environmental Planning and Open Space Management Section subject to the following conditions:

- No further changes can be made to the Open Spaces as discussed and supported.
- A "green servitude" in favor of the Council (not the general public) for purposes of protecting it for open spaces. The change of zoning of these properties will not be supported by the CoT Environmental Management Services Department.
- A Site and Landscape Development Plan for each township to be drafted by a qualified Landscape Architect must be submitted to the Department for approval. Such plan must include the following information:
  - At least 4m² per dwelling unit with a minimum of 50m² on a property which shall be developed and maintained as a children's playground.

Refer to correspondence from the CoT, dated 09/10/2013, attached as Annexure C.

1.2 Environmental Assessment Practitioner (EAP) - (In Line with Section 32 (2) (a) (i) and (ii)

The Environmental Regulations require that relevant details of the Environmental Assessment Practitioner be included as part of the EIA Report. In this regard attached as ***Annexure D,*** is a copy of the CV of Lizelle Gregory from Bokamoso Landscape Architects and Environmental Consultants. In summary details of the EAP are indicated hereunder:

- **Name:** Lizelle Gregory
- **Company:** Bokamoso Landscape Architects and Environmental Consultants.
- **Qualifications:** Registered Landscape Architect and Environmental Consultant (degree obtained at the University of Pretoria) with 18

years experience in the following fields:

- Environmental Planning and Management;
- Compilation of Environmental Impact Assessments;
- Landscape Architecture; and
- Landscape Contracting

Ms. L. Gregory also lectured at the Technikon of South Africa and the University of Pretoria. She is also a Registered Member of the South African Council of the Landscape Architects Profession (SACLAP) (professional practise number: 97078), The International Association of Impact Assessments (IAIA); The Institute for Landscape Architects South Africa (ILASA); and the Institute of Environmental Management and Assessment (IEMAS).

1.3 Activities Applied For In Terms of NEMA - (In Line with Section 32 (2) (b) & (c)

The Minister of Environmental Affairs and Tourism passed (in April 2006) Environmental Impact Assessment Regulations[1] (the Regulations) in terms of Chapter 5 of the National Environmental Management Act, 1998[2] (NEMA). The Regulations replaced the environmental impact assessment (EIA) regulations, which were promulgated in terms of the Environmental Conservation Act, 1989[3] in 1997. The new regulations came into place on 3 July 2006 and therefore all new applications must be made in terms of the New NEMA regulations and not in terms of the New Regulations of the ECA.

Notice No. R 386 and R 387 of the Regulations list activities which require that the EIA Process be followed. The Activities listed in Notice No. R 386 requires that a Basic Assessment Process be followed and the Activities listed in Notice No. R 387 requires that the Scoping and EIA process be followed.

[1] Environmental Impact Regulations, 2006
[2] Act No. 107 of 1998
[3] Act No. 73 of 1989

Activities Applied for in Terms of NEMA

In terms of Government Notices no. R387 and no. R386 published in the Government Gazette no. 28753 of 21 April 2006 of the National Environment Management Act, 1998 (Act No. 107 of 1998) an Environmental Impact Assessment Process is required for the above-mentioned project, due to the fact that the following listed activities will be triggered / could be triggered:

Table 1: Listed activities in terms of Notice No. R386

Indicate the number and date of the relevant Government Notice:	**Activity No (s) (in terms of the relevant notice) :**	**Describe each listed activity:**
R. 386, 21 April 2006	Activity 1k	The bulk transportation of sewage and water, including storm water, in pipelines with (i) an internal diameter of 0.36 metres or more or (ii) a peak throughout of 120 litres per second of more. ***Reason for inclusion:*** *To make provision for the installation of pipelines above the threshold*
R. 386, 21 April 2006	Activity 1v	Advertisements as defined in classes 1(a), 1(b), 1(c), 3(a), 3(b), 3(I) of the South African Manual for Outdoor Advertising Control. ***Reason for inclusion:*** To make provision for the erection of advertisement boards if required by the proposed development
R. 386, 21 April 2006	Activity 7	The above ground storage of dangerous good, including petrol, diesel, liquid paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1 000 cubic metres at any one location. ***Reason for inclusion:*** *To make provision for the above ground storage of dangerous goods if required by the **light industrial** uses.* ***Please note:** Light industrial land uses include the following: a builder's yard, a car wash, a contractor's yard, dry-cleaners, carpet cleaners, joinery workshop, launderette, laundry, lawnmower workshop, painter's workshop, plumber's workshop, printing workshop, transport depot, panel-beater, motor workshops, a*

		ready-mix plant and any other such industries, workshops or yards which in the opinion of the Municipality do not cause a nuisance to the environment, may be used for similar purposes and may include the retail sale of products ancillary and subservient to the main use on the same property.
R. 386, 21 April 2006	Activity 14	The construction of masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission, but excluding - (a) masts of 15 metres and lower exclusively used (i) by radio amateurs; or (ii) for lighting purposes (b) flag poles; and (c) lightning conductor poles. ***Reason for inclusion:*** *To make provision for the construction of telecommunication masts if required.*
R. 386, 21 April 2006	Activity 15	The construction of a road that is wider than 4 metres of that has a reserve wider than 6 metres, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 metres long ***Reason for inclusion:*** *To make provision for road upgrading required to accommodate the traffic generated by the proposed development.*
R.386, 21 April 2006	Activity 16 (b)	The transformation of undeveloped, vacant or derelict land to – residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 hectare. ***Reason for inclusion:*** *The study area qualifies as residential, mixed retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 hectare and therefore this activity remains applicable.*
R. 386, 21 April 2006	Activity 17	Phased activities where anyone phase of the activity may be below a threshold specified in the Schedule but where a combination of the phases, including expansions or extensions, will exceed a specified threshold ***Reason for inclusion:*** *This activity has been included to make provision for the development to be phased*

R. 386, 21 April 2006	Activity 19	The development of a new facility or the transformation of an existing facility for the conducting of manufacturing processes, warehousing, bottling, packaging or storage, which, including associated structures or infrastructure, occupies an area of 1 000 square metres or more outside an existing area zoned for industrial purposes. ***Reason for inclusion:*** To make provision for the above-mentioned manufacturing processes if required by the light industrial uses.

Table 2a: <u>Original</u> Listed activities in term of Notice No. R387

Indicate the number and date of the relevant Government Notice:	**Activity No (s) (in terms of the relevant notice) :**	**Describe each listed activity:**
R. 387, 21 April 2006	Activity 1 (c)	The construction of facilities or infrastructure, including associated structures or infrastructure, for – 1(c)The above ground storage of a dangerous good, including petrol, diesel, liquid paraffin, in containers with a combined capacity of more than 1 000 cubic metres or more including the storage of one or more dangerous goods, in tank form. ***Reason for inclusion:*** *To make provision for the storage of dangerous goods if required by the light industrial uses.*
R. 387, 21 April 2006	Activity 1 (g)	The construction of facilities or infrastructure, including associated structures or infrastructure, for – 1(g) The use, recycling, handling, treatment, storage or final disposal of hazardous waste. ***Reason for exclusion:*** The proposed development will **not** include the use, recycling, handling, treatment, storage or disposal of hazardous waste. **This activity was therefore excluded from the final list.**
R. 387, 21 April 2006`	Activity 2	Any development activity, including associated structures and infrastructure, where the total area of the development area is, or is intended to be, 20 hectares or more. ***Reason for inclusion:*** *The proposed development is 38.3520 ha in extent.*

R. 387, 21 April 2006	Activity 5	The route determination of road and design of associated physical infrastructure, including roads that have not yet been built for which routes has been determined before the publication of this notice and which has been authorized by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 made under section 24(5) of the Act and published in Government notice No. R. 385 of 2006, where – (a) It is a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act, 1998 (Act No. 7 of 1998); (b) it is a road administered by a provincial authority; (c) the road reserve is wider than 30 metres. The road will cater for more than one lane of traffic in both directions ***Reason for inclusion:*** *Activity 5 was originally included to make provision for the* construction of a section of the K52 if required.

Table 2b: <u>Final</u> Listed activities in term of Notice No. R387

Indicate the number and date of the relevant Government Notice:	**Activity No (s) (in terms of the relevant notice) :**	**Describe each listed activity:**
R. 387, 21 April 2006	Activity 1 (c)	The construction of facilities or infrastructure, including associated structures or infrastructure, for – 1(c)The above ground storage of a dangerous good, including petrol, diesel, liquid paraffin, in containers with a combined capacity of more than 1 000 cubic metres or more including the storage of one or more dangerous goods, in tank form. ***Reason for inclusion:*** *To make provision for the storage of dangerous goods if required by the light industrial uses.*
R. 387, 21 April 2006`	Activity 2	Any development activity, including associated structures and infrastructure, where the total area of the development area is, or is intended to be, 20 hectares or more. ***Reason for inclusion:*** *The proposed development is 38.3520 ha in extent.*

R. 387, 21 April 2006	Activity 5	The route determination of road and design of associated physical infrastructure, including roads that have not yet been built for which routes has been determined before the publication of this notice and which has been authorized by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 made under section 24(5) of the Act and published in Government notice No. R. 385 of 2006, where – (a) It is a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act, 1998 (Act No. 7 of 1998); (b) it is a road administered by a provincial authority; (c) the road reserve is wider than 30 metres. The road will cater for more than one lane of traffic in both directions ***Reason for inclusion:*** *Activity 5 was originally included to make provision for the* construction of a section of the K52 if required.

It is important to note that this application was submitted prior to 2 August 2010, the date on which the Amended NEMA Regulations came into effect. Chapter 9, Regulation 76 of the 2010 Environmental Impact Assessment Regulations deals with transitional arrangements and requires that pending applications, submitted in terms of the 2006 NEMA Regulations, also take the impacts of the newly listed activities into consideration and adequately assess such activities. ***Refer to Annexure E for a discussion on the Transitional Arrangements for the proposed development.***

JR 209 Investments (Pty) Ltd appointed **Bokamoso Landscape Architects and Environmental Consultants**, as independent environmental consultants, to compile an Environmental Impact Assessment (EIA) for the proposed development and its associated listed activities. This EIA has been prepared to comply with Section 32 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998).

1.4 The Town Planning Process

The Town Planning Application was made in terms of Section 96 (1) of the Town Planning and Townships Ordinance, 1986 (Ordinance 15 of 1986) for the establishment of a Township on a Part of Portion 1 of the Farm Stukgrond, 382-JR, to be known as Monavoni Extension 44.

1.5 Scope of Work and Approach to the Study

An application form for environmental authorisation of the relevant activity as well as an Environmental Scoping Report has been submitted to the Gauteng Department of Agricultural and Rural Development (GDARD). The Scoping Report and Plan of Study for EIA which was submitted to GDARD on 26 July 2010 had been accepted by the department ***(refer to Annexure F).***

The department requested that the following be included in addition to the information as required by EIA Regulations:

1. Proposed mitigation measures to ensure that noise levels on site comply with the applicable legislative requirements and Gauteng Noise Control Regulations, 1999 operational and decommissioning phases.
   Refer to Section 6.2.5.3 and EMP (Annexure S).

2. Information on the co-ordination of the spill response procedure as well as training of personnel in managing spills.
   Refer to EMP (Annexure S).

   Precautionary measures to prevent accidental spills and a plan for the monitoring of leakages from the tank. ***Please note: the application is <u>not</u> for a filling station.***
   Light industrial uses include the following: a builder's yard, a car wash, a contractor's yard, dry-cleaners, carpet cleaners, joinery workshop, launderette, laundry,

lawnmower workshop, painter's workshop, plumber's workshop, printing workshop, transport depot, panel-beater, motor workshops, a ready-mix plant and any other such industries, workshops or yards which in the opinion of the Municipality do not cause a nuisance to the environment, may be used for similar purposes and may include the retail sale of products ancillary and subservient to the main use on the same property.

Refer to EMP (Annexure S).

3. A letter from the City of Tshwane (CoT) confirming the change in zoning of the proposed site.

   A Town Planning application in terms of Section 96 of the Town Planning and Townships Ordinance, 1986 will be submitted to the City of Tshwane (refer to Annexure G, Town Planning Application).

4. Discussion on the management of stormwater during construction and operational phase of the proposed project.

   Refer to Section 6.2.7.c and EMP (Annexure S).

5. Confirmation that all stormwater to be discharged directly into the sewer system complies with the requirements of the City of Tshwane and DWA.

   Refer to Section 6.2.7.c *and EMP (Annexure S)*

6. Design drawings of the proposed development which include information on the following:

   (i) Storm water management – ***to be supplied prior to construction (refer to Section 9)***

   (ii) Plans to separate clean and contaminated storm water – ***not applicable***

   (iii) Spill management – ***not applicable***

   (iv) Location of tank and pump islands – ***not applicable.***

   Please note: the application is <u>not</u> for a filling station.

7. Information on air quality management including monitoring of the dust and fugitive emission (VOCs).
   Refer to Section 6.2.5.5 and EMP (Annexure S)

8. Details on how waste will be managed during construction and operational phase taking into consideration the hierarchy of waste management.
   Refer to the Waste Management Plan (Annexure P)

9. Details of the procedure to separate non-recyclable and recyclable waste (e.g. sorting by trained personnel).
   Refer to the Waste Management Plan (Annexure P)

10. (a) Management of non-recyclable waste:
    (i) Details regarding storage facilities for waste (e.g. suitable skips and containers).
    (ii) Frequency of removal of waste from the site and indication of the destination of the waste. It is important that pollution and odours be avoided by regular removal of waste from the site.
    (b) Management of recycled waste:
    (i) Details on the types of waste material that will be recycled on the site;
    (ii) Details pertaining to the sorting, handling, storage and collection procedure for the respective types of waste.
    (iii) Details regarding waste storage areas, taking into account that these areas need to be cleaned and disinfected regularly. Waste needs to be protected from rain, storm water runoff and fire. Therefore it is recommended that waste storage area be roofed.
    (iv) Written proof of consultation with recycles companies also indicating the frequency of removal of the recyclable waste.
    Refer to the Waste Management Plan (Annexure P)

11. Detailed description of the sewage management must be provided, this include the treatment facility that will handle the sewage and the capacity of the facility. A

detailed map of the sewage system (network) and the approval from the Municipality is required.

Refer to Services Master Plan (Annexure O) and Sections 6.2.7.b and 9

12. A traffic impact study must be undertaken as part of the EIA process to indicate the following:
    (i) ingress and egress points;
    (ii) how the proposed development could link to existing road infrastructure; and
    (iii) whether the existing road infrastructure can cope with the increased traffic load. Appropriate mitigation measures must be provided in the case where the traffic of the proposed development would interfere with the current traffic flow in the area.

    Refer to Traffic Master Plan (Annexure Q)

13. It is imperative that the site layout plan must be informed by geotechnical constraints. This layout plan indicating all development components must be submitted to and endorsed by the Council for Geoscience (CfG). In addition, it is recommended that the Council for Geoscience provide comments on whether the relevant geotechnical investigations commissioned have employed established best practice guidelines and methodology in determining the dolomite stability conditions.

    Refer to Annexure H for comments from CfG

14. A description of the compatibility of the soil type to this type of development, as well as the depth of ground water on site must be provided. Attention must be given to expansion and stability properties.

    Refer to Section 6.1.1.1 and 6.1.1.2 and Annexure I

15. The department's C-Plan (C Plan 2) indicates that the site is important due to presence of sensitive vegetation. Therefore, vegetation surveys must be undertaken by suitable qualified specialists registered as Professional Natural Scientists in accordance with the Natural Scientific Professions Act (No. 27 of 2003) within the

field of Botanical Science. Specialists must have qualifications and experience relevant to vegetation science/ecology.

(i) Surveys must take place during the summer season (beginning of November to the end of April).

(ii) Scientifically credible methods must be employed and a reference provided.

(iii) CV of the specialist who undertook the study must be attached on the report.

Refer to Annexure K for Fauna and Flora Survey

16. A comprehensive Environmental Management Plan (EMP) for various phases of the proposed activity (construction, operational and decommissioning phase) must be submitted to the department. The EMP must include:

(i) A discussion on mitigation measures for all potential negative impacts identified as well as the persons responsible for implementing such measures.

(ii) A demonstration of commitment to the adoption and implementation of Cleaner Production and energy efficiency.

(iii) An indication of commitment to the use of Cleaner Technologies.

Refer to Annexure S for EMP

An investigative approach was followed and the relevant physical, social, economic and institutional environmental aspects were assessed. The scope of work includes the necessary investigations, to assess the suitability of the study area and the surrounding environment for the proposed activities. The scoping exercise identified the anticipated environmental aspects in an issues matrix and it also supplied a preliminary significance rating for the impacts identified. The scoping process also assessed the possible impacts of the proposed development on the surrounding environment (including the interested and affected parties).

This document represents the EIA for the proposed development. The EIA must be in line with Section 32 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998) and the Plan of Study for EIA that was submitted as part of the Scoping Report.

The EIA takes into consideration the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity. A description of the property on which the activity is to be undertaken and the location of the activity on the property are described. A description of the proposed activity and any feasible and reasonable alternatives were identified. In addition, a description of the need and desirability of the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have, on the environment and community that may be affected by the activity are included.

An identification of all legislation and guidelines that we are currently aware of is considered in the preparation of this EIA Report. Furthermore a description of environmental issues and potential impacts, including cumulative impacts, are identified and discussed. Information on the methodology that will be adopted in assessing the potential impacts is furthermore identified, including any specialist studies or specialised processes that were/ should be undertaken. The EIA Report eventually determines whether a proposed project should receive the "go-ahead" or whether the "no-go" option should be followed. If the EAP recommends that the project receive the "go-ahead", it will (in most cases) be possible to mitigate the issues identified to more acceptable levels. Reference is also made to the mitigation of identified impacts or for further studies that may be necessary to facilitate the design and construction of an environmentally acceptable facility.

Details of the Public Participation Process (in terms of Sub-Regulation 1) are also included. Sub-Regulation 1 requires that the following information be included as part of the Public Participation Section of the EIA report:

(i) The steps undertaken in accordance with the Plan of Study for EIA,
(ii) A list of persons, organisations and organs that were registered as interested and affected parties;

(iii) A summary of comments received from, and a summary of issues raised by the interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments;

(iv) Copies of any representations, objections and comments received from the registered interested and affected parties.

The mitigation measures and guidelines that are listed in the EIA Report are also summarised in a user-friendly document named an Environmental Management Plan (EMP). A Draft EMP is also a requirement of the EIA Process (Section 32 and 34 of the National Environmental Management Act (NEMA), 1998 (Act 107 of 1998)).

2. REGISTERED OWNERS AND TITLE DEED

The properties are registered as follows:

Table 3: Registered Land Owners and Title deeds

Owner	Property Description	Size	Title Deed
JR 209 Investments Pty (Ltd).	Part of Portion 1 of the Farm Stukgrond 382-JR	38.3520 ha	T171219/2003

Bonds

The property is bonded by Investec Bank via bond B12069/2010.

3. LOCALITY OF THE PROPOSED DEVELOPMENT – (In line with Section 32 (c)

Refer to Figure 1 for the locality map

The proposed township is located on a Part of Portion 1 of the Farm Stukgrond, 382-JR, located within the Monavoni area, Centurion.

The study area is situated to the east of the proposed PWV-9, to the west of the R55, to the north of M34 (Ruimte Road) and the N14, to the west of Mimosa Road (extension), south-west of Sunderland Ridge and to the east of Gardner Ross Golf Estate. The proposed alignment of the Provincial Road K 52 runs through the site.

4. EXISTING ZONING AND LAND USE AND THE PROPOSED LAND-USE

4.1 Existing Zoning and Land Use

In terms of the Centurion Town-Planning Scheme, 1992, the properties are zoned "Agricultural". The study area is currently vacant and undeveloped.

4.2 Proposed Zoning and Land Use – (In line with Section 32 (b)

The proposed application site will consist of 4 erven with the following land uses:

Table 4: Proposed Land-Use

Use Zone	Erf number	Total no. o erven	Total no. o units	Average Erf Size (ha)	Total Area (Ha)	%
Residential 2 (80 u/ha)	1 &2	2	1690	10.5690	21.1381	55.11
"Special" for the purposes of Light Industrial, Offices, Distribution Centres etc.	3 &4	2	N/A	6.2689	12.5379	32.69
Streets	N/A	N/A	N/A	N/A	4.6760	11.20
Total		**4**	**1690**	**N/A**	**38. 3520**	**100**

Refer to Annexure G for the Town Planning Memorandum

5. ALTERNATIVES IDENTIFIED – (In line with Section 32 (f) and (h)

5.1 The "No-Go" Alternative

The developer purchased the property for development purposes and did not consider the "No-Go" alternative due to the following:

- The study area falls within the Gauteng Provincial Urban Edge ***(refer to Figure 4)***;
- The study area falls within an area earmarked for development according to the Monavoni and Western Farms Development Framework 2020;
- According to the GDARD C-Plan version 3 only a section of the study area is regarded as ecologically sensitive ***(refer to figure 5).***
- The study area does not fall within an Agricultural Hub, an area identified for agricultural use by GDARD ***(refer to Figure 6);*** and
- The study area does not fall within the Hennops River Conservancy ***(refer to Figure 7).***

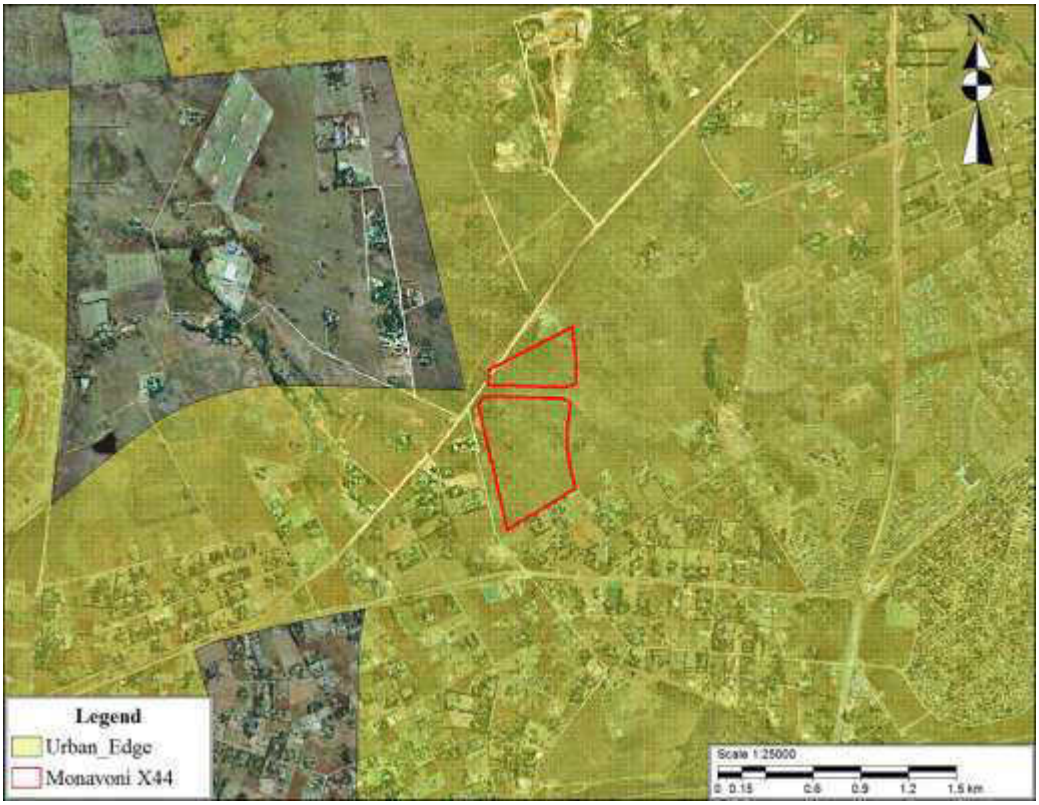


FIGURE 4 – URBAN EDGE 2010

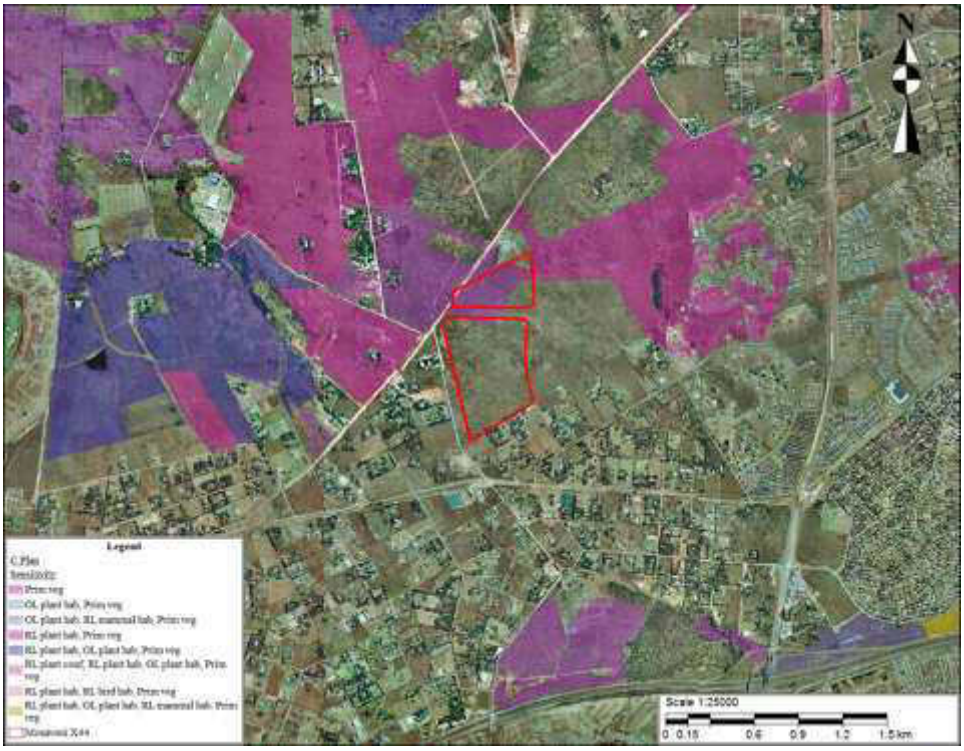


FIGURE 5 – GDARD C-PLAN 3 IRREPLACEABLE SITES

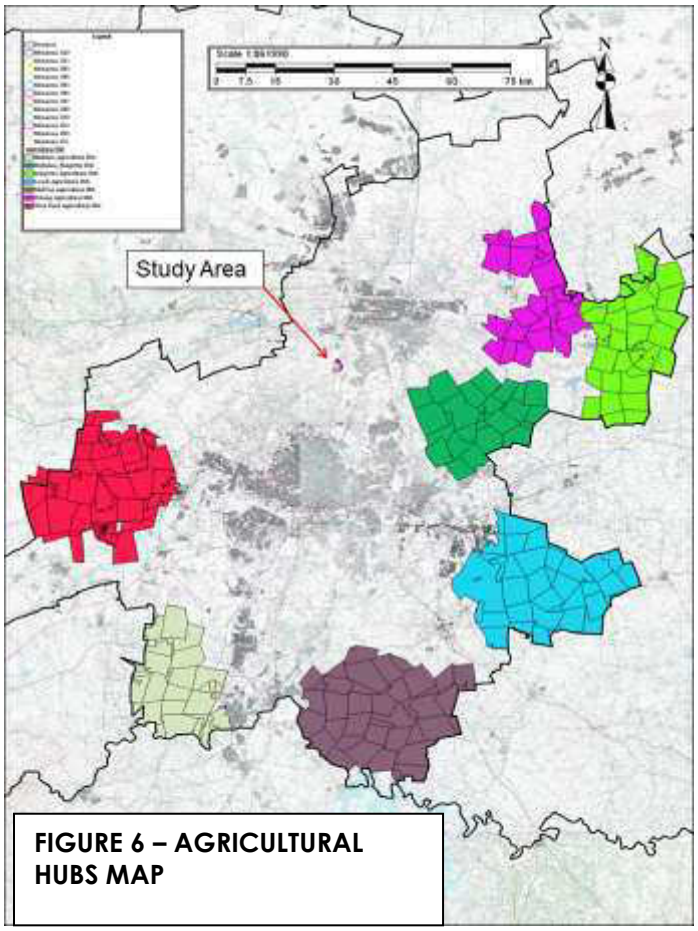


FIGURE 6 – AGRICULTURAL HUBS MAP

FIGURE 7 – CONSERVANCY MAP

To follow now are tables that represent a preliminary comparison between the "No-Go" alternative and the development alternative.

Diagram 1: Environmental Issues - "No-Go" Option

Issue	Short term	Medium term	Long Term	
Geology and soils				Positive / Neutral / Negative
Hydrology				Positive / Neutral / Negative
Vegetation				Positive / Neutral / Negative
Fauna				Positive / Neutral / Negative
Social				Positive / Neutral / Negative
Economic				Positive / Neutral / Negative

No development will not have a significant impact on the geology or hydrology of the study area, especially in the short term. Indirect impacts created by the edge effects of the surrounding developments could however, in the long term, lead to a decrease in vegetative coverage and even to exposed areas. Erosion, siltation and water pollution problems could then be caused. Changes in the surface drainage patterns could also occur.

If no development takes place in the area surrounding the study area, the impacts on the fauna and flora and bio-diversity will not be significant. If development stake place adjacent to the study area (i.e. Monavoni X 31, Monavoni X 43), the edge effect could, in the long term, have an impact on the ecological potential and bio-diversity of the vegetation of the study area.

The study area is currently vacant and informal settlements could establish on the study area and surroundings. This could have a major impact on the safety and security of the surrounding land owners.

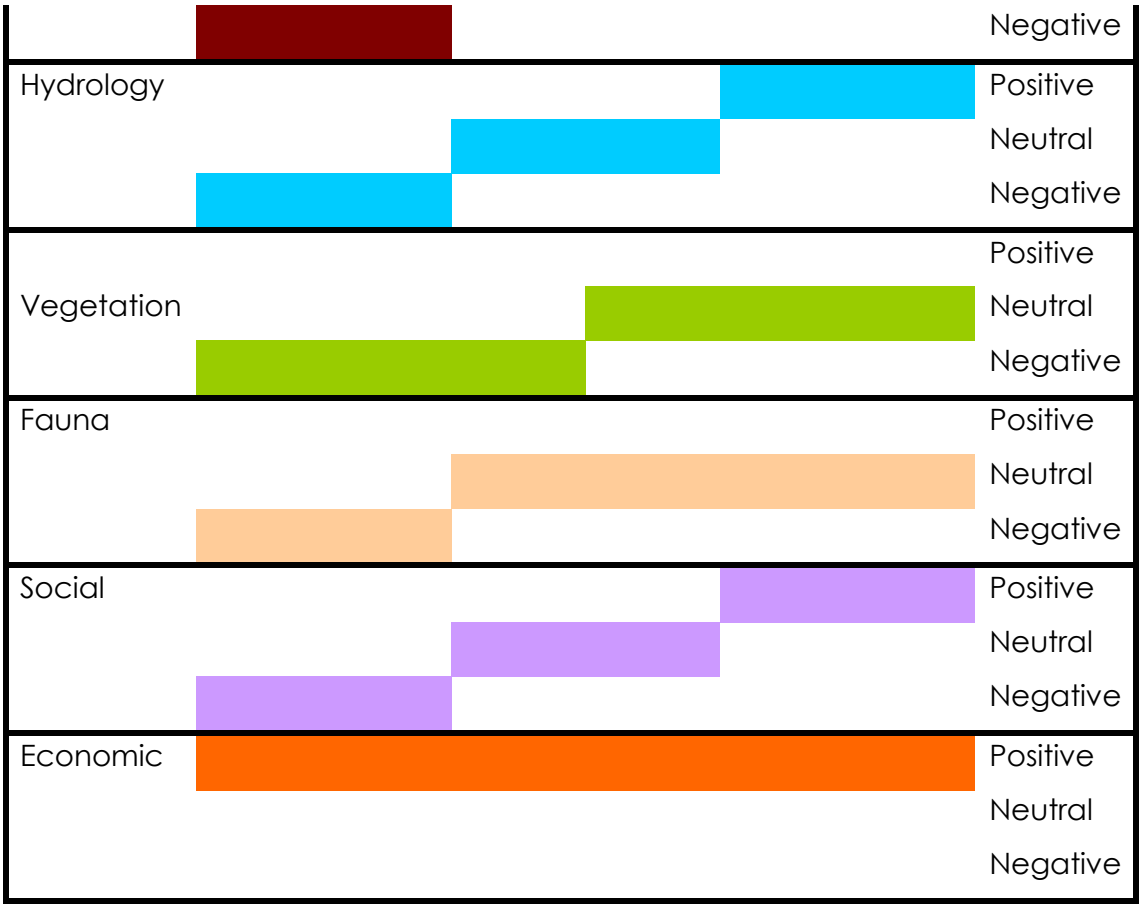
Note: *The "no-go" option is predominantly neutral in the short and medium term, and turns negative in the long term*

Diagram 2: Environmental Issues of the proposed development

Issue	Short term	Medium term	Long Term	
Geology and soils				Positive / Neutral

In the short term (the construction phase), the proposed development will have a negative impact on the geology and hydrology of the study area. It is, however possible to mitigate the impacts to acceptable levels. If well planned, the long term impacts on the hydrology will be neutral or even positive.

Effective temporary and permanent storm water management and guidelines to reduce impacts on water courses and wetlands as well as a dolomite risk management plan will have to be implemented during all the development phases.



The proposed development will have a negative impact on the vegetation and fauna and bio-diversity of the study area in the short and medium term. Some of the natural grassland vegetation will be permanently lost. Weeds and exotic invaders will be removed on a continuous basis throughout the proposed development.

From a social, institutional and economical point of view, the proposed development will have significant positive impacts. The construction phase could cause some minimal social impacts, but in the long term the surrounding community and the larger region will benefit from the proposed development. The construction and operational phase will also create some temporary and permanent job opportunities.

Note: *From the investigations that were done, it is anticipated that the proposed development option is predominantly negative in the short term, turns neutral in the medium term and then positive in the long term.*

5.2 Land-Use Alternatives

5.2.1 Residential only

Many housing developments are planned for the Centurion West Area and the developer regarded the need for a residential development as high. The involved local authority regard the south-western section of Centurion as one of the primary growth areas and this necessitates urban densification on the existing farm portions and agricultural holdings in the area earmarked for urban development.

The local authority identified areas suitable for various land-use types in the area between the R55 and the Gerhardsville Road and the study area falls within the area that was earmarked for residential development.

Furthermore, the developer already developed some residential properties (with mixed densities) in the area and the market proofed to be favourable for residential developments that are in line with the proposed development. However, due to the economic climate a residential development only was not regarded as the preferred land use alternative.

In addition, a detailed Dolomite Stability investigation revealed that only sections of the study area may be considered for residential development. A residential development only is therefore not viable due to geotechnical constraints.

5.2.2 Mixed use consisting of Residential 2 and Light Industrial and Offices *(current proposal)*

A mixed use development consisting of residential, light Industrial, offices, showrooms and distribution centres was considered as the preferred option for the area, because it is in line with the guidelines of the Development Facilitation Act, 1996 (Act 67 of 1995) which include the promotion of:

- Infill development – The proposed application site is a vacant portion of land situated adjacent to future and existing commercial, industrial and residential townships.
- Work opportunities in close proximity to place of residence – a large labour force (skilled, semi-skilled and unskilled) are available in close proximity to the proposed development.
- The site is in close proximity to major routes in the area.

A mixed use development is expected to bring economic growth to the area by offering investors a globally competitive combination of geographic position, infrastructure, services and labour.

The proposed land use complies with numerous planning policies and frameworks ***(Refer to Section 6.2.4)*.**

The proposed mixed use alternative should promote efficient and integrated land development in that it will:

- Promote the integration of social, economic, institutional and physical aspects of land development;
- Promote integrated land development in urban areas;
- Support the availability of residential and employment opportunities in close proximity;
- Promote a diverse combination of land uses;

The market research team of the developer and the agents employed by the developer regard the proposed mixed use development as the most suitable land-use from an economical and social point of view. The geotechnical engineer of the developer is satisfied with the proposed land-uses for the study area and the Town Planners of the developer and the Town Planning Department of the involved local authority regard the proposed land-uses as in line with the land-use planning for the area. From and environmental point of view, the study area is also regarded as suitable for a mixed use development.

The proposed Monavoni Ext 44 Development would not only promote the optimum utilisation of the available services in the direct vicinity, but will also contribute to the upgrading of existing services. The proposed Township Development is fully compatible with the proposals of the area.

5.2.3 Agriculture

The GAPA (Gauteng Agricultural Potential Atlas) indicates that the study area has **high agricultural potential soils *(refer to Figure 8)*.**

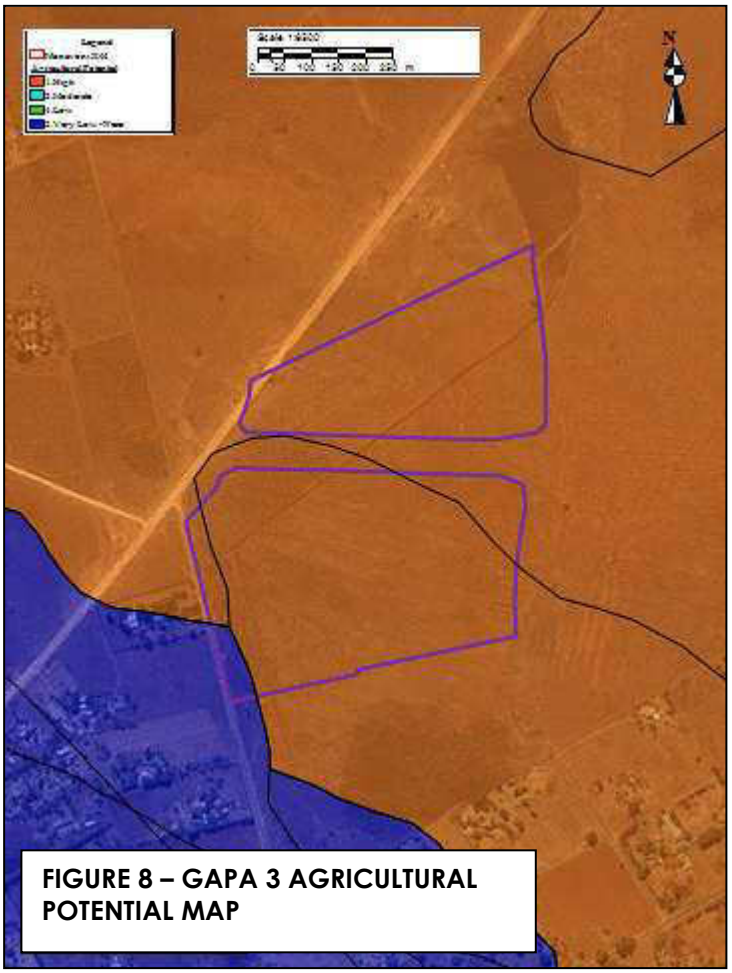


FIGURE 8 – GAPA 3 AGRICULTURAL POTENTIAL MAP

Current land use in the area is not restricted to one specific use and topsoil has been removed from large areas. Very few, if any of the surrounding landowners, use their properties for small-scale or other farming activities. It is clear that none of the surrounding landowners, at this stage or in the recent past have had any intensions of *bone fide* intensive farming activities on their properties.

The study area is situated within an area underlain by dolomitic conditions, and extensive irrigation of such soils is not supported.

According to the Geotechnical stability investigations and Comments from the Council for Geoscience, this proposed site is suitable for residential and commercial development.

Furthermore, the study area is situated within the provincial urban edge ***(refer to Figure 4)*** and is **not** situated within any of the 7 Agricultural Hubs identified for Gauteng ***(refer to Figure 6)***.

Agricultural use was therefore not regard as a viable land use alternative for the study area.

5.2.4 Conservation

The Hennopsvallei Conservancy is located along the north-western boundary of the study area. The site is not affected by any ridges or drainage lines that could create linkages with open space systems within the conservancy. ***Refer to Figure 7 – Conservancy Map and Figure 9 – Tshwane Open Space Framework Region 5 Map.***

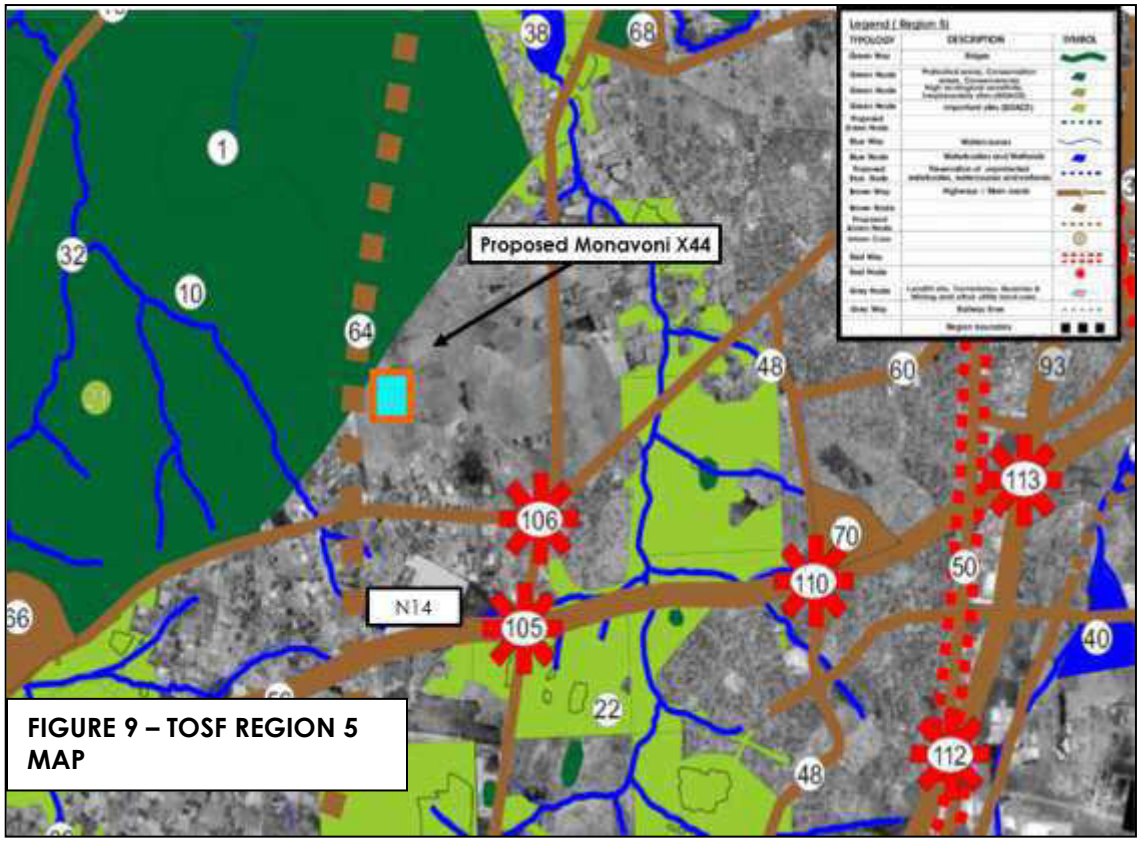


FIGURE 9 – TOSF REGION 5 MAP

In terms of the Tshwane Open Space Framework, the study area is not affected by any green way, blue way, blue node, red node, red way, brown node or brown way. The proposed development Monavoni Ext 44 is however situated adjacent to a green node **(Hennops Rivier Conservancy)** and proposed brown node **(Proposed PWV9).**

Although the study area borders on the Hennops River Conservancy the surrounding area is already disturbed by human activities such as a landfill site (Waste Group lies in the Conservancy) north west of the site and an informal settlement (also within the Conservancy) north of the proposed application site.

5.3 Locality Alternatives

Developable properties in the South-Western section of Tshwane / South-Western section of Centurion are very costly, because The City of Tshwane Metropolitan Municipality identified the area between the R55 and the Gerhardsville Road as a future growth area. As already mentioned the study area falls within an area earmarked for commercial and residential development according to the Monavoni and Western Farms Development Framework 2020.

In addition, the study area is located in close proximity to two major highways, the N14 (R28) and the proposed PWV 9. The site is therefore strategically located within the region and sufficient north south and east west links could be provided to ensure adequate distribution of traffic through the area, based on the current development patterns for the area.

It is also important to note that the involved study area forms part of a larger portion of land that was purchased by the developer for development purposes ***(refer to Figure 3, Monavoni Development Framework).*** The study area is regarded as suitable for the proposed residential/industrial/office development and no locality alternatives were therefore considered.

5.4 Layout alternatives

Although many layout and density alternatives were considered for the study area, the geotechnical conditions of the study area played a major form giving role in the finalized layout. The final layout was also tested against an environmental sensitivity map that was compiled for the study area. ***(Refer to Figure 17 for Sensitivity Map)***.

The final layout is a product of a multi-disciplinary workshop (during the EIA phase) between the appointed professionals. At the workshops each discipline (including the environmental consultant) was afforded the opportunity to share his/ her findings with the other members

of the project team. The environmental consultants also presented the environmental sensitivity map to the project team during the workshops. ***Refer to Figure 10 for a Layout Alternative and Figure 11 and Annexure H, Final Layout Plan.***

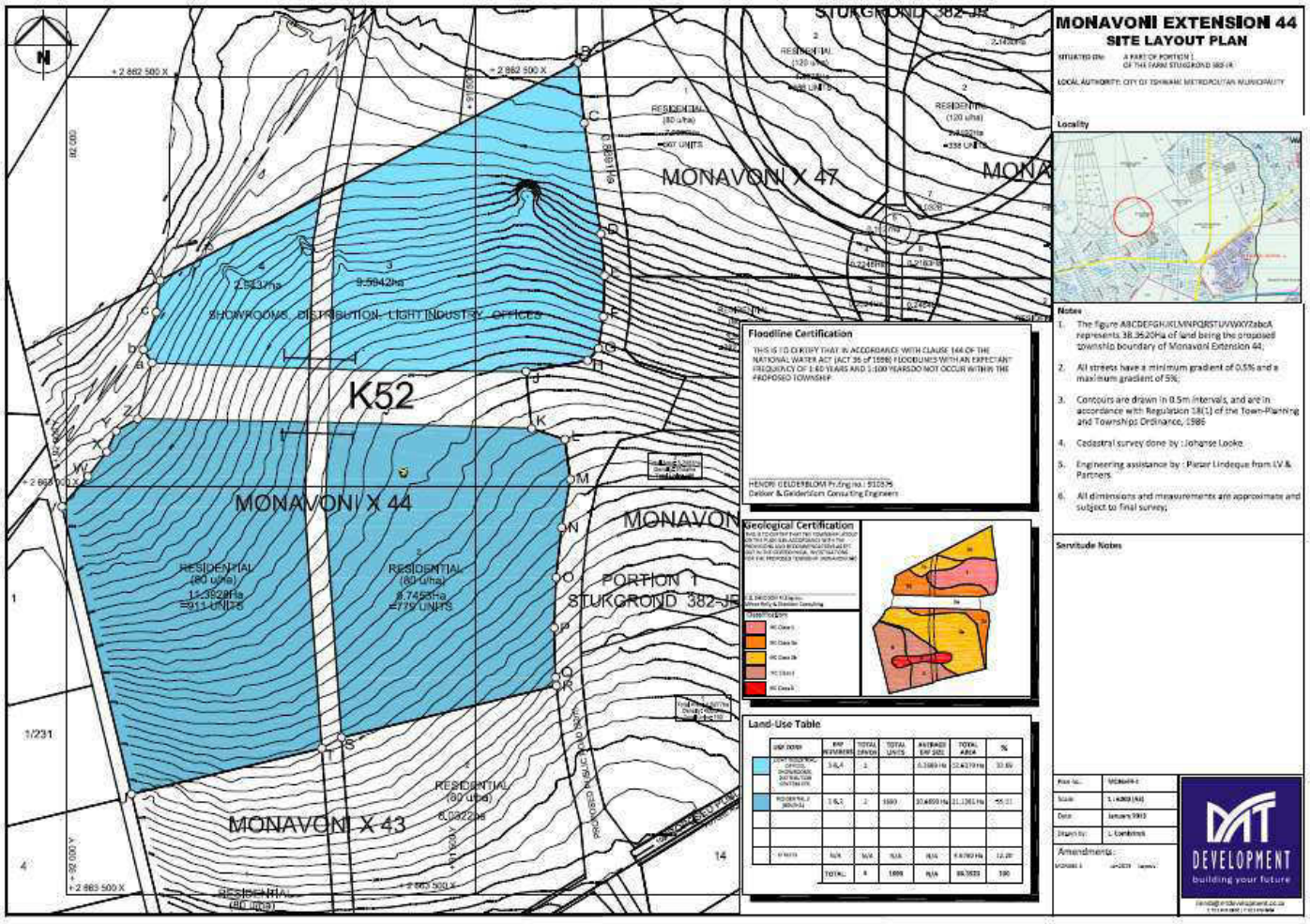


FIGURE 10 – LAYOUT ALTERNATIVE

The Final Layout incorporates two Private Open Space erven in accordance to the Monavoni Framework which had been approved by the CoT Open Space Management Section.

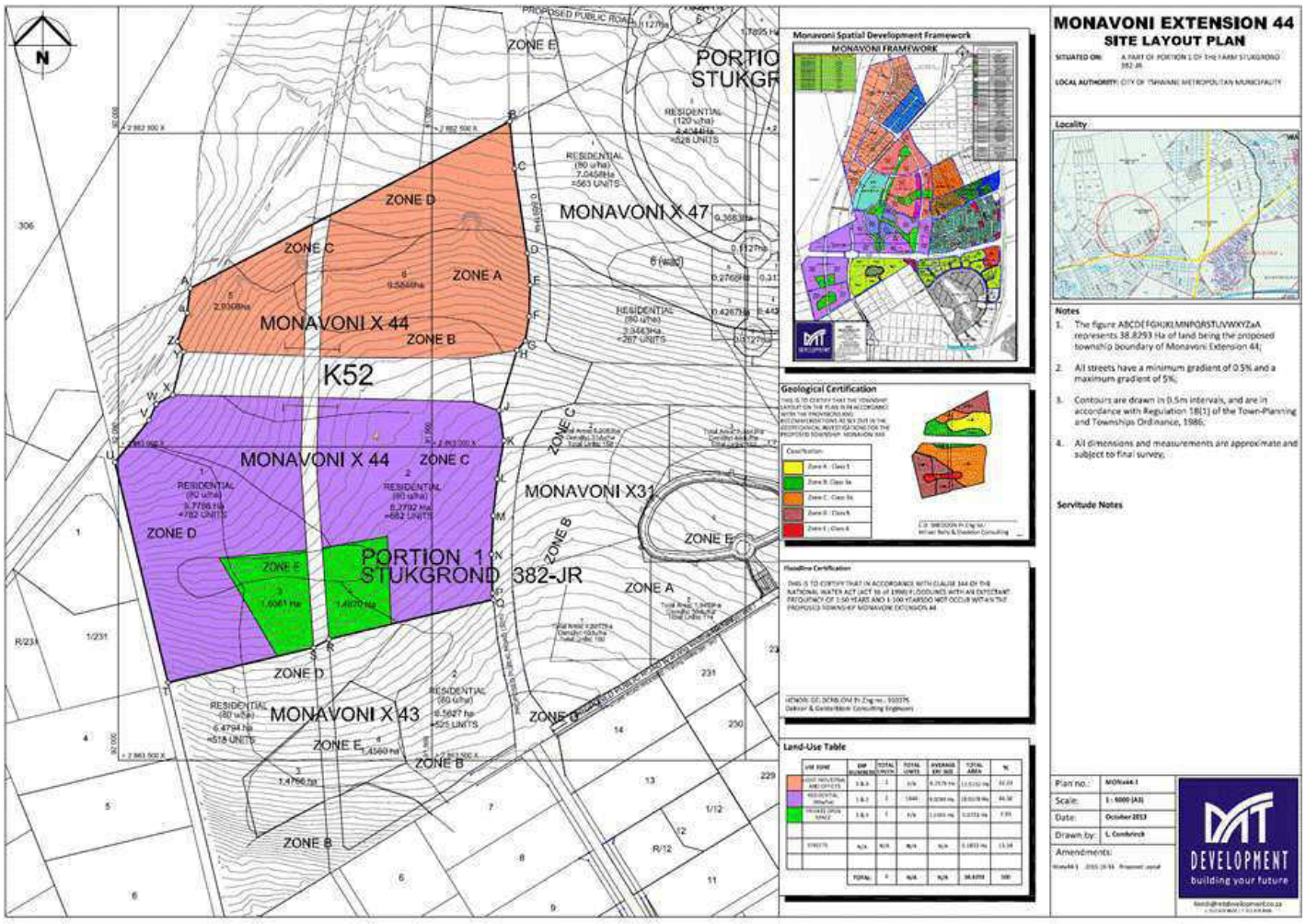


FIGURE 11 – FINAL LAYOUT

5.5 Planning Approach

An investigative approach was followed and the relevant biophysical and socio-economic environmental aspects were assessed.

Legislation and guidelines applicable to the application were considered in the preparation of the report.

All available material and literature were collected and used for the purpose of this study and it was further supplemented with discussion with provincial authorities, local authorities,

other interested and affected parties, as well as by site surveys and photographic recording.

6. THE DESCRIPTION OF THE BIOPHYSICAL AND SOCIO-ECONOMICAL ENVIRONMENTS – (In line with Section 32 (d)

This section briefly describes the biophysical and socio-economical environments. It also lists the anticipated adverse and beneficial impacts of the proposed development on the environment. Where possible, mitigation measures were supplied for the adverse impacts and the significance of the impacts listed was also indicated in specific impact tables. In some cases the impacts (i.e. the availability of water for the proposed development) have already (during the planning phase) been addressed to such an extent that it was not regarded as necessary to carry the impacts over to the significance rating section of the report.

Although it was not necessary to mitigate the positive impacts listed in the impacts tables, the positive impacts identified in this section of the report will also automatically be carried over to the significance rating section of the report to indicate the specific benefits associated with the proposed development. This will also make it possible to compare the severity of the adverse impacts with the advantages of the beneficial impacts and to eventually make an informed decision regarding the proposed development.

The following information incorporates the most important information supplied by specialist studies and reports.

6.1 THE BIO-PHYSICAL ENVIRONMENT

6.1.1 The Physical Environment

6.1.1.1 Geology and Soils

A Dolomite Stability Investigation was conducted by Relly, Milner and Shedden Consulting Earth Scientists ***(refer to Annexure I)***. The report covers the findings of a detailed dolomite stability investigation carried out for the proposed development.

The objectives of the investigation were to assess the dolomite stability of the site with respect to the formation of sinkholes and/or dolines (compaction subsidences). Information from previously drilled boreholes confirmed the presence of dolimitic sediments below this site.

Previous drilling phases were undertaken by Dolomite Technologies in April 2004 and by VGI Consultants in November 2005. Relly, Milner and Shedden Consulting Earth Scientists were appointed in 2009 and were involved in a single phase of drilling which was undertaken in July 2009.

Geology

According to available information the area is underlain by Basement granite in the extreme south-western corner, by quartzite and shale of the Black Reef Formation separating the underlying granite from the overlying dolomite and chert of the Oak tree Formation (Malmani Subgroup) of the Chuniespoort Group. The Black Reef Formation and the overlying Chuniespoort Group forms the basal portion of the Transvaal Supergroup.

The chemical sediments have been intruded by numerous sills and dykes of syenite in this region. The geological map indicates an extensive sill of syenite in the north eastern half of the site. Evidence of syenite was intersected at varying depths in numerous boreholes throughout the application site. The word syenite has been used loosely as a collective

term to indicate the presence of igneous intrusive. Some consultants have referred to the intrusive as diorite.

The hard rock geology is mantled by an irregular layer of overburden material comprising both colluvial and residual soils. Dolomite and scattered syenite rock crop out on the site.

Method

The investigation focussed on re-assessing the existing drilling information and initiating further drilling in areas where subsurface information was regarded to be insufficient. A single phase of drilling was undertaken under RMS supervision.

Interpretation of the Geology

The residual gravity map ***(Appendix B of Annexure I)*** is characterised by a fairly prominent gravity low through trending along the western boundary in a NS direction. A relative gravity high is indicated along the south eastern boundary. The gravity high increases beyond the eastern boundary in Extension 31. A gravity gradient separates the gravity high from the gravity low with the steepest portion on the southern boundary. The gradient is less well defined in the northern half of the site. This northern portion of the site could be described as an "intermediate" gravity plateau.

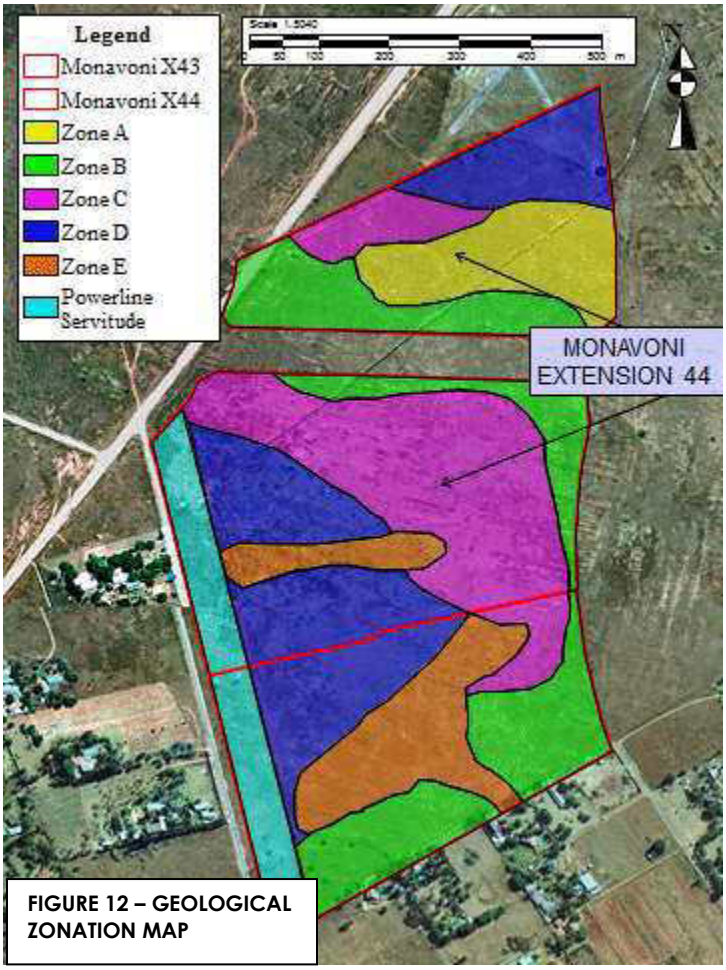


FIGURE 12 – GEOLOGICAL ZONATION MAP

In a dolomitic environment gravity highs are usually associated with shallow dolomite bedrock and gravity lows often represent deeply weathered intrusive or

thick overburden, on this site the gravity high is characterised by syenite intrusive rather than dolomite and the low along the western edge is associated with the presence of granite and quartzite at depth. The correlation between residual gravity and the drilling results is no more than moderate.

The geological picture to emerge from the gravity survey and drilling is one of shallow dolomite intruded by concordant and slightly transgressive syenite sills of varying thicknesses. It is possible that more than one age of intrusive is present but this tends to be of academic importance only since all intrusive sills shave a beneficial influence on the stability of a dolomite site. The site is located at the southern rim of dolomite occurrence south of Pretoria. Dolomite pinches out in a south westerly direction and is absent in the extreme south-western corner.

Stability

The risk classification is based on the results of the gravity survey and the drilling results from 59 percussion boreholes. An assessment of the drilling results favours the site being subdivided into five Inherent Risk zones as dictated by the variation in geological conditions. ***(Refer to Figure 12 – Geological Zonation Map).***

Zone A (Class 1):

Risk: A low risk for any size sinkhole forming and a low risk of doline development is the inherent risk classification in both a dewatering and a non-dewatering scenario.

Development Potential: No restrictions are placed on the type of development that may be regarded as suitable on Class 1 land provided spatial framework policies are taken into account. It should be noted that most types of developments require some form of additional exploratory work except for full residential (RN1-4).

NHBRC Dolomitic Area Designation: This zone is assessed as D 2.

Location: The zone is an elongate area in the northern half of the proposed Monavoni Extension 44 and is extension of a favourable zone as indicated in the proposed Monavoni Extensions 45 & 47.

Zone B (Class 3a):

Risk: A low to medium risk for small and medium size sinkholes forming and a low to medium risk of dolines developing are the inherent risk classification in both a dewatering and a non-dewatering scenario.

Development Potential: Commercial and restricted residential development may be considered in this area provided the appropriate requirements of the draft SANS 1936 document are implemented including footprint investigations.

NHBRC Dolomitic Area Designation: This zone is assessed as D 3.

Location: Zone B occupies an elongate immediately south of Zone A and along the eastern boundary.

Zone C (Class 3b):

Risk: A medium risk for small and medium size sinkholes and a medium to high risk of dolines developing are the inherent risk classification in both a dewatering and a non-dewatering scenario.

Development Potential: Most types of development considered suitable for this site will require footprint investigations for all structures. Additional exploratory work should highlight the presence of any unfavourable subsurface conditions. Full title residential stand at densities of 10 units/ha or less would not require footprint investigations although the irregular occurrence of wad would remain a problem. Commercial, retail and / or industrial development may be considered.

NHBRC Dolomitic Area Designation: This zone is assessed as D 3.

Location: The majority of this zone is located within the central portion of the proposed Monavoni Extension 44, and a separate pocket at the northern end.

Zone D (Class 5):

Risk: A high risk for small size sinkholes and a medium risk of medium size sinkholes forming and a high risk of dolines developing is the inherent risk classification in both a dewatering and a non-dewatering scenario.

Development Potential: Any development will require footprint investigations for all structures. The presence of residual syenite within the ground profile and granite at depth limits the size of a sinkhole that can be expected along the western boundary. Commercial, retail and / or industrial development may be considered.

NHBRC Dolomitic Area Designation: This zone is assessed as D 3.

Location: This zone occurs along the western boundary and a small portion is located in the extreme north-east corner of the proposed Monavoni Extension 44.

Zone E (Class 6/7):

Risk: A high risk of small and medium size sinkholes, a medium risk of large sinkholes and a low risk of very large sinkholes forming and a high risk of dolines developing is the inherent risk classification in both a dewatering and a non-dewatering scenario.

Development Potential: No residential development may be considered in this zone unless additional exploratory work is undertaken, including detailed footprint investigations, confirms the presence of a more favourable class of ground. The use of structures incorporating a basement may allow residential development to take place in this zone. Areas underlain by intrusive syenite below the wad-rich residual dolomite and/or shallow

dolomite pose the most favourable conditions for residential development. This zone is best suited for commercial, retail and industrial development.

Location: Zone E occupies an elongate portion in the southern portion of the site.

The importance of careful water management cannot be over-emphasised as poor water control in one area may lead to some form of instability in another area. It is essential that prospective owners of erven in this development be made aware of the importance of the recommended precautionary measures. An indiscretion on one stand may induce some form of instability on an adjacent property. In an attempt to create and maintain and awareness of the risk of instability in a karst environment, a Risk Management Policy/Plan ***(Annexure I – Appendix H)***, has been drawn up by Relly, Milner and Shedden Consulting Earth Scientists for implementation on this site. The entire community, particularly the Home Owners' Associations, must be informed of the philosophy behind the risk management plan and what it aims to accomplish. The Local Authorities, under whose control the township is, must be aware of the responsibility they face ensuring the implementation of a risk management plan for the entire township. Responsibility for rapid response to instability must be impressed upon senior officials. Protracted delays in the repair and maintenance of bulk services may lead to catastrophic sinkhole development and loss of life. An effective DRMP can greatly reduce the probability if instability occurring within the established township.

Comments from the Council for Geoscience

Refer to Annexure J

The Dolomite Stability Investigation for the proposed Monavoni X 43 and 44 compiled by Relly, Milner and Shedden was submitted to the Council for Geoscience Council (CfG) for comments. According to correspondence from the CfG dated 12 November 2009 the CfG is in broad agreement with the risk assessment of the site. It is however recommended that BH's 44/13 and 6521(39) ***(refer to Annexure I)*** should be incorporated into Zone D, IRC5.

The development potential recommendations and NHBRC designations are supported by the CfG, however it must be noted that some development types in Zone A: IRC1 would be D3, rather than D2 and would require footprint investigations. Footprint investigations will be required for normal residential stands (> 1000m³ by the involved geotechnical engineers.

The CfG supports the proposed Monavoni X 44 development conditional to the following:

- The implementation of the NHBRC precautionary measures, as attached in ***Appendix G, Annexure I*** is essential;
- A Risk Management Plan, as attached as Appendix H, Annexure G must be drawn up for the specific site and be implemented;
- A Site Development Plan must be submitted to the CfG for co-signing;
- All footprint investigations must be submitted to CfG;
- Any residential development must be enrolled with the NHBRC;
- The application of stringent water precautionary measures for this development is essential. The competent person must certify those measures implemented.
- The builder must inform the professional team when the service/foundation trenches are open for inspection to take place. The results of these inspections and quality control must be recorded in a construction report (copy to the Local Authority and the CfG);
- The professional team involved, including RMS, shall carefully consider the appropriate water precautionary measures and then ensure and finally certify that these have been implemented;
- Wet services may not be laid below structures. The builder must certify that they have been placed as such;
- The engineer must incorporate guttering, downpipes, channels and adequate paving around the houses, which should always be functional. All stormwater must be discharged in the municipal stormwater system. Roof water may thus not cascade off the apron and directly into in the soil. The stand should be landscaped in a way that the stormwater is channeled around the building. The site must be assessed after a heavy rainstorm to check that this water flows off the site properly;
- The Local Authority must implement a Risk Management System.

Issues & Impact Identification - Geology and Soils

Table 5: Issues and Impacts – Geology and Soils

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High ☻ Medium ☺ Low ◙ Positive Impact - Not Necessary To Mitigate ☼
1)	Restriction on land use types due to geology.	-	☻
2)	Risk for formation of sinkholes and dolines	-	☺
3)	Stability of structures	-	☻
4)	Excavation problems are likely where dolomite pinnacles are present close to surface and blasting may be required.	-	☻
5)	Erosion	-	☺
6)	Stockpile areas for construction materials and topsoil	-	☺

Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

1) Restriction on land use types due to geology.

The land uses are restricted due to underlying dolomite and the land uses and layout plan for the proposed development must correspond to the stability zonation and development types recommended by the involved geotechnical engineer.

Table 6: Significance of Issue 1 (Restriction on land use types) After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P & C** The layout and land uses must correspond to the stability zonation and development types recommended by the geotechnical engineer.	**L -** To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

2) Risk for formation of sinkholes and dolines

If the NHBRC precautionary measures for development on dolomite are not implemented there is a risk for the formation of sinkholes and dolines.

Table 7: Significance of Issue 2 (Risk for formation of sinkholes and dolines) After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate,

	P/ C / O Mitigation	but not regarded as a fatal flaw **NP**
Medium ☺	**P & C –** The NHBRC precautionary measures for development in dolomitic areas must be implemented. ***Refer to Annexure I – Appendix G***	**H** - To be included in EMP
	P, C & O – A dolomite risk management plan must be compiled for this township in general and copies must be submitted to the Council for Geoscience and the NHBRC. This system must be practical with detailed requirements applicable to the township. This can, however, only be done after the township to be established has been approved. ***Refer to Annexure I – Appendix H***	**H** - To be included in EMP
	P, C & O – The application of strict water precautionary measures for the development is essential. Stormwater management on the study area is extremely important to prevent the concentration of stormwater. No accumulation of surface water is to be permitted and the entire development must be properly drained**.**	**H** - To be included in EMP
	P, C & O – During construction the developer must ensure that a risk management plan is designed and implemented. After completion it will become the responsibility of the Owners' Association. Infrastructure and ground-surface monitoring should be integral part of the risk management plan. Maintenance checks of infrastructure, the inspection of buildings, and the detection and repair/remediation of	**H** - To be included in EMP

	leaking services are amongst the tasks that will need to be undertaken at local council level. Findings should be recorded and entered into a database. Inspectors need to be aware or educated as to what to look for (ponding of water, cracks in the ground). Inspectors should be aware of the procedures to be followed in the event of an emergency. **P, C & O** - The normal drainage precautionary measures and special installation measures for underground wet services, applicable to dolomitic terrain and in compliance with the Tshwane Metropolitan Municipality should be adhered to.	**H** - To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

3) Stability of structures

The foundation recommendations by the geotechnical engineers should be implemented to ensure the stability of structures.

Table 8: Significance of Issue 3 (Stability of structures) After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate,

		but not regarded as a fatal flaw **NP**
High ☻	**P & C –** The precautionary measures for construction on dolomite must be implemented ***(Refer to Annexure I – Appendix G)*.**	**M** - To be included in EMP
	P & C – The foundation recommendations supplied by the geotechnical engineers must be adhered to.	**M** - To be included in EMP
	P & C – Detailed foundation investigations should be done for large structures because residual dolomite material may experience settlements under load or be collapsible.	**M** - To be included in EMP
	P & C – It is recommended that excavations (for foundations and underground services) be inspected on the site to ensure that conditions at variance to that described can be noted and the necessary adjustments made.	**M** - To be included in EMP
	P & C – Detailed foundation inspections should be carried out at the time of construction to identify variances and adjust foundation designs accordingly if need be.	**M** - To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

4) Excavatability problems are foreseen and some blasting exercises may be required

Excavation problems are likely where dolomite pinnacles are present close to surface and blasting may be required.

Table 9: Significance of Issue 4 (Excavatability problems are foreseen and some blasting exercises may be required) After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**C** – Surrounding residents must be informed of blasting exercises at least one week in advance. **C** – Blasting operations should be carefully controlled and the necessary safety precautions must be implemented.	**M -** To be included in EMP **M -** To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

5) Erosion

Unnecessary clearing of vegetation could lead to exposed soils prone to erosive conditions. Insufficient soil coverage after placing of topsoil, especially during construction where large surface areas are applicable could also cause erosion. To cause the loss of soil by erosion is an offence under the Soil Conservation Act (Act No 76 of 1969). The management of surface water run-off during construction is very important to prevent soils

erosion on the site. If construction takes place during the rainy season, sufficient storm water management will be required to manage water runoff.

Table 10: Significance of Issue 5 (Erosion) After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P & C –** A storm water management plan must be compiled for the construction and operational phases of the proposed development.	**M -** To be included in EMP
	P & C – The storm water management plan must be submitted to the local authority and Council for Geoscience for approval.	**M -** To be included in EMP
	P & C – Due to the fact that most of the study area is underlain by dolomite no natural channels will be allowed. All open channels and attenuation ponds must be lined with concrete. Concentrated surface drainage is also not permitted.	**L -** To be included in EMP
	P & C – Large exposed areas during the construction phases should be limited. Where possible areas earmarked for construction during later phases should remain covered with vegetation coverage until the actual construction phase. This will prevent unnecessary erosion and siltation in these	**M -** To be included in EMP

	areas.	
	P & C - Rehabilitate exposed areas immediately after construction in these areas is completed (not at the end of the project).	**M -** To be included in EMP
	P & C – Unnecessary clearing of flora resulting in exposed soil prone to erosive conditions should be avoided.	**M -** To be included in EMP
	P – Specifications for topsoil storage and replacement to ensure sufficient soil coverage as soon as possible after construction must be implemented.	**M -** To be included in EMP
	P & C – All embankments must be adequately compacted and planted with grass to stop any excessive soils erosion and scouring of the landscape.	**M -** To be included in EMP
	C – Storm water diversion measures are recommended to control peak flows during thunder storms.	**M -** To be included in EMP
	P & C – The eradication of alien vegetation should be followed up as soon as possible by replacement with indigenous vegetation to ensure quick and sufficient coverage of exposed areas.	**M -** To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

6) Stockpile areas for construction materials and topsoil

Designated areas for stockpiling of construction materials must be specified by the Environmental Control Officer in an area that is already disturbed. Stockpiling in the wrong areas might be detrimental to fauna and flora and will deplete the soil quality. Topsoil should be stockpiled as specified in the EMP to ensure that the soil quality doesn't deplete and that the grass seed remain in the soil for later rehabilitation of the disturbed areas.

In addition to the impact discussed in the paragraph above, rainwater falling onto stockpiles may become polluted with dust originating from aggregate and other construction material, such as bitumen from pre-mix stockpiles. Therefore stockpiles of topsoil should be correctly covered to prevent this as well as loss of topsoil by wind erosion.

The footprint of stockpile areas will be contaminated with the stored material and will require cleaning before rehabilitation.

Table 11: Significance of Issue 6 (*Stockpile areas for construction materials and topsoil)* After Mitigation

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**C** - Remove vegetation only in designated areas for construction. **C** - Rehabilitation works must be done immediately after the involved works are completed. **C** -All compacted areas should	**M -** To be included in EMP **M -** To be included in EMP **M -** To be included in EMP

	be ripped prior to them being rehabilitated/landscaped.	
	P/C - The top layer of all areas to be excavated must be stripped and stockpiled in areas where this material will not be damaged, removed or compacted. This stockpiled material should be used for the rehabilitation of the site and for landscaping purposes.	**M -** To be included in EMP
	C - Strip topsoil at beginning of works and store in stockpiles no more than 1,5 m high in designated materials storage area.	**M -** To be included in EMP
	C – Stockpiles should be covered correctly.	**M -** To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

6.1.1.2 Hydrology

6.1.1.2.a Surface Hydrology

A non-perennial river (tributary of the Swartbooispruit) flows approximately 820m to the south, south-west of the site. Storm water will drain in a north-western direction towards a proposed stormwater channel.

Refer to Figure 13 – Hydrology Map.

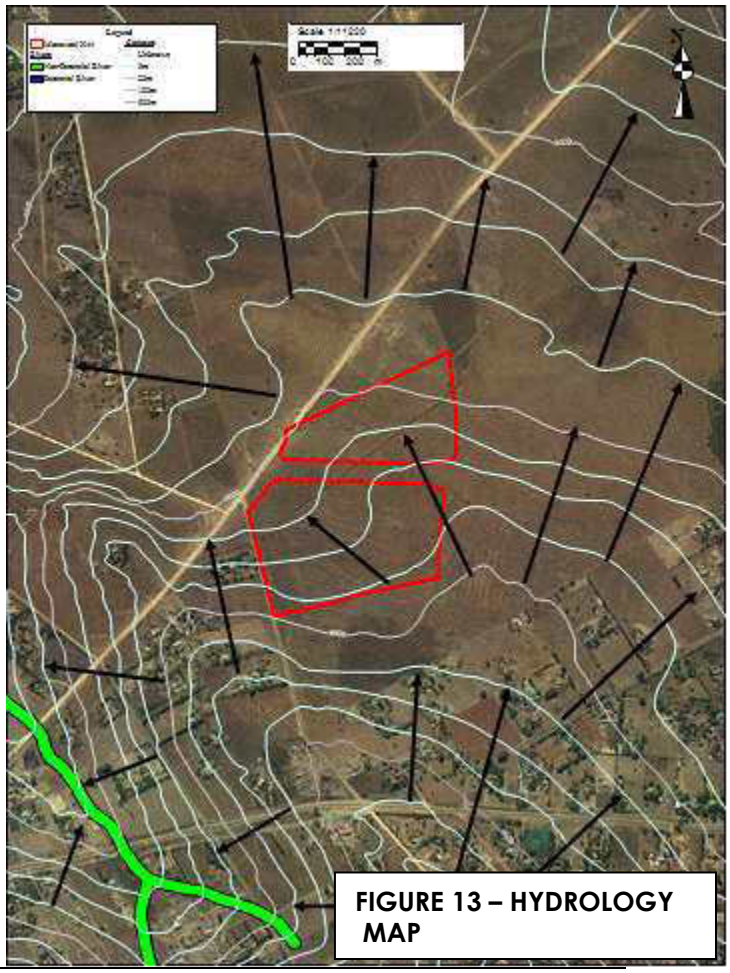


FIGURE 13 – HYDROLOGY MAP

The study area has a gradual slope in a north-westerly direction. It is expected that the slope will be sufficient to allow for natural storm water drainage as well as for the installation of essential services. The topographical characteristics will have no detrimental effect on the development potential of the site.

6.1.1.2.b Sub-Surface Hydrology

Hobbs consulting investigated the groundwater environment in the vicinity of the farms Stukgrond 382-JR and Brakfontein 399-JR, Gauteng Province. ***Refer to Appendix E, Annexure I.***

According to the results of the investigation the area lies within quaternary catchment A21B of the Crocodile (West) and Marico Water Management Area (WMA). This catchment is drained by the Hennops River and its tributaries to Hartbeespoort Dam. The site itself occurs within groundwater region 10, the Karst Belt region, defined by Vegter (2001) as encompassing the Vaalian strata comprising Chuniespoort dolomite and chert and subordinate Black Reef quartzite, conglomerate and shale.

The existence of high-yielding boreholes in the region testifies to the extraordinary yield potential and general availability of dolomitic groundwater resources in the region. The hydro geological map 2526 Johannesburg (scale 1:500 000) indicates that the dolomitic strata support a median borehole yield (excluding dry boreholes) in the range >5 L/s.

Groundwater Occurrence and Yield

The study area is located in the Erasmia compartment as identified by Hobbs (2004). This compartment is formed by roughly north-south trending groundwater divides of which that forming the western boundary as shown in ***Figure 9 of Appendix E, Annexure I***. The divide forming the eastern boundary is located outside the map area.

It is expected that groundwater occurrence within the area will be associated with both dolomitic and intrusive (syenite) strata, i.e. groundwater is likely to be encountered in either or both of these formations. Information presented by Hobbs (1988) indicates borehole yields in the order of 0.8 to 1.3 L/s for dolomite, and 0.1 to 0.6 L/s for syenite.

Groundwater Flow Pattern

The groundwater flow pattern in the subject area is shown by the vector in ***Figure 14 of Appendix E, Annexure I***. This indicates that groundwater drainage locally occurs from southwest to northeast, i.e. out of the granite environment into the dolomitic system. It is also evident, however, that the western margin of the subject area coincides with the groundwater divide that forms the western boundary of the Erasmia compartment. Hobbs (1988) has shown that the regional groundwater flow pattern is centered on the Hennops River. Under these circumstances, the Erasmia compartment drains in a westerly direction, its "decant" position coinciding with the course of the Hennops River.

The groundwater contours across the subject area in ***Figure 14 of Appendix E, Annexure I*** describe a hydraulic gradient in the order of 0.020 (1:50). This is slightly shallower than, but similar to, the surface gradient of 0.024 (1:24).

Water Level Fluctuation

An indication of the possible magnitude of groundwater level fluctuation in the region must be inferred from DWA monitoring data. The latter are sourced form monitoring boreholes, and the closer such borehole is to the subject area, the more representative its record will be. The nearest DWA exploration borehole to the subject area is G37842 located in the Zwartkop Nature Reserve close to the intersection of the Hennops River and the R55 road. The position of this borehole has been documented in a number of similar reports to this, e.g. Hobbs (2003 & 2004b).

Borehole G37842 was visited on 30 August 2003 when it was found to be infested by bees, rendering access for water level purposes impossible. Nevertheless, the record for

monitoring station G37842 is reproduced, together with the coincident rainfall record. The rainfall record is associated with the Wierda Park gauging station no. 0513232 8. The water level record indicates a difference of 4,52m between the shallowest (-7.35 m) and deepest (-11.87 m) values in the period June 1986 to July 1996. It also indicates a remarkable constancy of water level in the period June 1986 to January 1993.

Although the irregularity of water level measurements militates against a rigorous correlation with the monthly rainfall pattern, it would appear that the rainfall in the period January 1986 to January 1993 did not exhibit any major deviations, i.e. excessively wet or dry periods. The average annual rainfall in this period amounted to 623 mm, which is 85 mm below the long term average value of 708 mm recorded in the period January 1974 to December 2001.

It is also evident that the greater water level depth measured in July 1996 followed an exceptionally wet summer. These circumstances are anomalous in that the opposite response in water level might be expected. As a consequence, not too much significance was afforded this value under circumstances where researching the reason for this anomalous response was not necessary for the purposes of the study.

An additional indication of the magnitude of groundwater rest level fluctuation in the Erasmia compartment is provided by Hobbs (2004a). From a comparison of *circa* 1972 groundwater rest level data reported by Temperley (1978) with 1986 data reported by Hobbs (1988), it is apparent that no change in this parameter was recorded in this 16-year period for three localities to the north-northeast of the subject area.

Within the framework of these discussions, it is considered reasonable to conclude that the natural groundwater level fluctuation in the Erasmia compartment and, therefore, in the vicinity of the subject area, did not experience a vertical variation of greater than about 5m in the 24 –year period from 1972 to 1996. Further, it is reasonable to presume that the subsequent period to the present has not witnessed a markedly different response pattern.

Groundwater Use

Groundwater use in the subject area and surrounds is probably limited to domestic water supply, garden irrigation and limited stock watering applications associated with land use activities that are characteristic of small holdings. The conversion of the subject area from agricultural farm land to residential and commercial land use will no doubt mitigate even these small scale water uses.

Conclusion and Recommendation

It was concluded by the specialist that the dolomitic groundwater rest level in the vicinity of the site has not experienced a natural fluctuation of more than 8 m in the past two decades. These circumstances can be expected to continue for as long as no "new" large scale groundwater abstraction (e.g. for irrigation purposes) is developed in proximity to the subject area.

It is recommended that the routine evaluation of groundwater level monitoring data collected by the DWA in the subject area should form part of the risk management plan ***(Refer to Appendix H, Annexure I)*** that is implemented for the proposed residential and commercial development. Since the DWA does not routinely evaluate these data, it will be necessary to source this service from a reputable and experienced groundwater scientist. The principal focus in this regard should be directed at borehole G37813. As a consequence, the developers must take every precaution to secure the continued existence of this DWA monitoring station.

6.1.1.2 c Flood Lines

In terms of the requirements of section 144 of the National Water Act, 1998 (Act 36 of 1998) this proposed township is not affected by a flood line with an expected frequency of 1:50 years or 1:100 years.

Issues and Impacts – Hydrology

Table 12: Issues and Impacts – Hydrology

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High ☻ Medium ☺ Low ◙ Positive Impact/ Neutral - Not Necessary To Mitigate ☼
7)	Siltation, erosion and water pollution could occur in the tributary of the Swartbooispruit if a stormwater management plan is not implemented.	-	☺
8)	Lowering of groundwater	-	☺
9)	Groundwater pollution	-	☺
10)	Removal of vegetation coverage, increased hard surfaces and increased erosion, surface water pollution and siltation problems	-	☻

Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

7) Siltation, erosion and water pollution of the unnamed, tributary of the Swartbooispruit, could occur if a stormwater management plan is not implemented.

If erosion, siltation and water pollution is not addressed, the sustainability of the non-perennial river can be negatively impacted by the development.

Table 13: Significance of Issue 7 (Siltation, erosion and water pollution) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/ C / O –** The storm water design for the proposed development must be designed to: - Prevent bank and riparian zone erosion especially in the upper section of the main tributary. - Reduce and/ or prevent siltation, erosion and water pollution. If erosion, siltation and water pollution is not addressed, the sustainability of the drainage and the open space systems especially in the upper section of the main tributary can be negatively impacted by the development. - Storm water runoff should not be concentrated as far as possible and sheet runoff from paved surfaces need to be curtailed. - Runoff from paved surfaces should be slowed down by the strategic placement of berms.	**M -** To be included in EMP

	- The vegetation must be retained as far as possible, and rehabilitated if disturbed by construction activities to ensure that erosion and siltation do not take place. - No trees should be planted within five meters of the line of the water bearing services.	

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

8) Lowering of groundwater.

Any local or regional artificial lowering of the groundwater may impact negatively on the stability of portions of the site and the surrounding Monavoni area. Although there will be no boreholes on this site boreholes or other activities which could result in the lowering of groundwater may occur on adjacent sites.

Table 14: Significance of Issue 8 (Lowering of groundwater) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
	P/ C / O –	

Medium ☺	• Ongoing monitoring of groundwater levels on and in the immediate vicinity of the site is essential. • Ground water management will need to form an integral part of the Dolomite Risk Management Strategy.	**M -** To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

9) Groundwater pollution

The dolomitic formation is regarded as the best aquifer in South Africa and it has a very high yielding and storage capacity as well as a high recharge potential. The ground water pollution potential on the study area is regarded as high and if not planned and managed correctly, the construction and operational phases of the proposed road could cause sub-surface water pollution.

The storm water management plan must be designed to:

- Reduce and/ or prevent siltation, erosion and water pollution; and
- Improve the surface and ground water quality of the study area and the lower lying areas within the catchment area.

Table 15: Significance of Issue 9 (Ground water pollution) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate** ☼	Mitigation Already achieved √ Must be implemented during planning phase, construction	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M**

	and/ or operational phase **P/ C / O**	High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/C/O** - Compilation of a storm water management plan that will address storm water management during the construction and operational phases of the project	**M** - To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

10) Removal of vegetation coverage, increased hard surfaces and increased erosion, surface water pollution and siltation problems

At present the study area is covered with vegetation and surface drainage is taking place.

The development will add large amount of hard surfaces such as paving and structures with roofs to the study area. The proposed development will also lead to the compaction of soils. The soil layers will thus become less permeable, storm water will be canalised rather than evenly spread. The quantity and speed of the storm water will increase significantly and the quality of the surface water will deteriorate, because of the lack of vegetative coverage. Erosion and siltation will also become a problem.

In order to address this issue, it will be necessary to compile a storm water management plan/ system for the proposed development. The storm water management plan must be designed to:

- Reduce and/ or prevent siltation, erosion and water pollution. If

erosion, siltation and water pollution is not addressed, the long-term sustainability of the water bodies and open space systems lower down in the catchment area cannot be guaranteed; and

- Improve the surface and ground water quality of the study area and the lower lying areas within the catchment area.

Table 16: Significance of Issue 10 (Removal of vegetation coverage, increased hard surfaces and increased erosion, surface water pollution and siltation problems) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P** - Compilation of a storm water management plan that will address storm water management during the construction and operational phases of the project	**M** - To be included in EMP and conditions of approval

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

6.1.1.3 Topography

The slope is gradual and descends in a north-westerly direction. The slope is sufficient to allow for natural storm water drainage as well as for the installation of essential services. The topographical characteristics will have no detrimental effect on the development potential of the site.

As indicated on the Visual Assessment ***(Refer to figure 14)*** the study area is highly visible from the surrounding view sheds, partially visible far from the east and west of the proposed development; and has no visibility from the east and west further from the site.

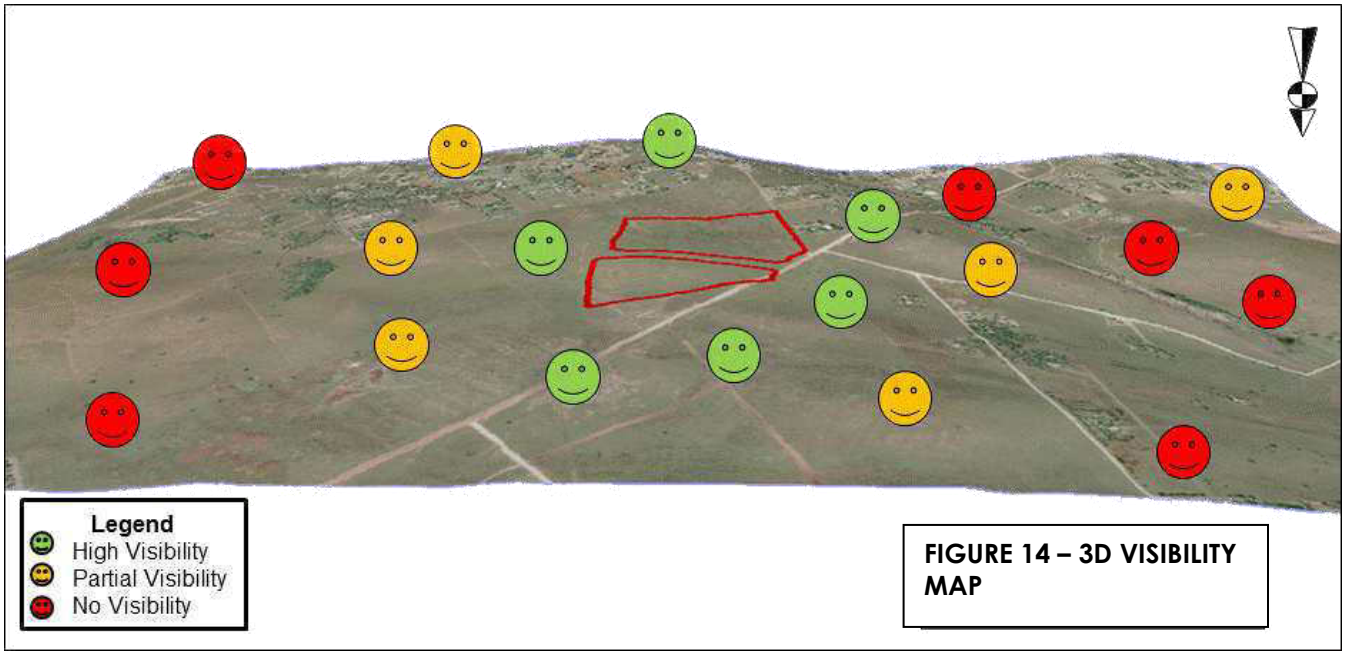


FIGURE 14 – 3D VISIBILITY MAP

Issues & Impact Identification – Topography

Table 17: Issues and Impacts – Topography

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities** **High ☻ Medium ☺ Low ◙** **Positive Impact - Not Necessary To Mitigate ☼**
11	Due to the topography the development will be visible from view sheds in the flatter areas around	-	☺

	the study area. It will also be visible from the proposed PWV9 adjacent to the site and K52 which traverses the site.		
12)	If not planned correctly, roofs and parking areas could reflect the sun into the eyes of oncoming traffic and surrounding landowners.	-	☺
13)	If not planned and managed correctly the lights (interior and exterior) and the signage of the development could cause visual pollution.	-	☻

Discussion of issues identified, possible mitigation measures and significance of issue after mitigation[4]

11) Due to the topography the development will be visible from view sheds in the flatter areas around the study area as well as the proposed PWV 9 and K52.

Table 18: Significance of Issue 11 (the Development Will Be Visible From View Sheds in the Flatter Areas around the Study Area) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P** – Architectural and landscaping guidelines must be supplied in the EMP and the proposed Architectural theme	**M –** To be incorporated as part of the EMP

	must blend in with the surrounding area.	
	P – The colour scheme should be taken from the palette of colours in the natural surroundings.	**M –** To be incorporated as part of the EMP
	P – Existing trees should be retained as far as possible on the site in order to soften the impact of the proposed permanent structures and to bring the scale of the higher structures down to a more human scale.	**M –** To be incorporated as part of the EMP
	P – Landscaping should be done in concurrence with the building construction in order to create an instant visual enhancement of the development.	**M –** To be incorporated as part of the EMP
	P – The landscaping of the proposed development should blend in with the natural vegetation of the area. Trees, shrubs and groundcovers that are endemic to the area and/or indigenous should preferably be used – landscaping that is in line with the natural vegetation of the area will not only help to reduce the visual impact of the development, but it will also create habitats for fauna and flora species.	**M –** To be incorporated as part of the EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

12) If not planned correctly, roofs and parking areas could reflect the sun into the eyes of oncoming traffic and surrounding landowners and hikers.

Although the nuisance factor of this impact is regarded as high, it is easy to mitigate. The roof materials used for buildings and structures must be non-reflective materials and trees with wider canopies should be planted in areas visible from the higher view sheds and shrubs should be planted at strategic points to screen-off cars that are visible from the lower lying surrounding properties. Walls and earth berms could also be used to screen-off the impacts of cars in parking areas.

Table 19: Significance of Issue 12 (Roofs and Parking Areas Could Reflect the Sun into the Eyes of Oncoming Traffic and Surrounding Landowners and Hikers) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/C –** Roof materials used for buildings and structures must be non-reflective materials and not bright. **P** – Suitable plant materials should be used at strategic points to screen off impacts caused by roofs and cars in large parking areas.	**L -** To be included in EMP **L –** To be incorporated as part of the EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

13) If not planned and managed correctly, the lights of the development (exterior and interior) and the lights of signage could cause visual pollution during the night.

If not planned and managed correctly, the exterior lighting (i.e. flood lights) associated with the development could have a visual impact and especially be of nuisance to traffic on nearby roads. The placement of the exterior lighting and the type of exterior light and globes to be used in the landscape will determine the level of pollution.

Table 20: Significance of Issue 13 (The Lights Of The Development (Exterior And Interior) And The Lights Of Signage Could Cause Visual Pollution During The Night) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/C –** The generation of light by night events, security lighting and other lighting shall be effectively designed so as not to spill unnecessary outward into the oncoming traffic, or into the yards of the neighbouring properties or open spaces.	**L -** To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

6.1.1.4 Climate

The climate is typical of the Transvaal Highveld. The summers are mild to hot and the winters are mild with severe frequent winter frost. The study area falls into a summer rainfall region. The moisture index is between 0-20, indicating a sub-humid area.

Climatic data for the site was taken from the Irene weather station.

Wind

Summer prevailing winds is in a north-western direction and winter winds in a south-eastern direction.

Temperature ˚C

In the summer average maximum 26,7 ˚C and the minimum 14,4 ˚C in summer. Winter with average maximum temperature 18, 2 ˚C, minimum 2,7 ˚C.

Rain

Maximum annual rainfall for the area 960 mm, minimum 559 mm, with an average of 717mm.

Lightning

87 Days annually

Hail

4 Days annually

Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes construction and environmental rehabilitation works extremely difficult. Such wet conditions often cause delays to building projects and the draining of water away from the construction works (in case of high water tables) into the nearby water bodies, could (if not planned and managed correctly) have an impact on the water quality of these water bodies.

If dry and windy conditions occur during the construction phase, dust pollution could become a problem. During the summer months dust pollution could be carried over other proposed Monavoni developments surrounding it.

Issues & Impact Identification – Climate

Table 21: Issues and Impacts – Climate

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities** **High ☻ Medium ☺ Low ◙** **Positive Impact - Not Necessary To Mitigate ☼**
14)	Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes it extremely difficult to build in and to do rehabilitation works of disturbed areas.	-	☻
15)	If dry and windy conditions occur during the construction phase, dust pollution could become a problem.	-	☻

Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

14) Should the construction phase be scheduled for the summer months, frequent rain could cause very wet conditions, which makes it extremely difficult to build in and to do rehabilitation works of disturbed areas.

These wet conditions often cause delays to building projects and the draining of water away from the construction works (in the case of high water tables) into the water bodies of the adjacent properties, could (if not planned and managed correctly) have an impact on the water quality of these water bodies.

Table 22: Significance of Issue 14 (Wet conditions): After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/C –** Construction workers and construction vehicles and machinery must stay out of the soggy areas during the wet periods. Barrier tape should be used to demarcate the areas that are drenched with water (especially the ecologically sensitive areas and the areas covered with valuable topsoil) and it should only be removed	**L -** To be included in EMP

	when the appointed Environmental Control Officer (ECO)/ site supervisor/ project manager/ main contractor regard the conditions in the affected areas as favourable. **P** – The main contractor and sub-contractors must be informed of the potential wet conditions that could occur in some of the areas and the contractor must allow for some delays during the wet periods in his tender documents and project programme.	**L –** To be included as part of the EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

15) If dry and windy conditions occur during the construction phase, dust pollution could become a problem.

The negative impact of dust is generally associated with the construction phase and is temporary. The impact should however be considered in context with the surrounding area that currently has a distinctive rural character with a combination of residential development, agricultural activities and open space areas provided by agricultural properties. The dust pollution during the construction phase will most probably not be regarded as that unusual.

Sweeping of the construction site, clearing of builders' rubble and debris as well as the regular watering of the construction site (storage areas, roads etc.) must take place at least once a day.

Table 23: Significance of Issue 15 (Dust Pollution) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/C –** Sweeping of the construction site, clearing of builders' rubble and debris as well as the regular watering of the construction site (storage areas, roads etc.) must take place at least once a day.	**L -** To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

6.1.2 THE BIOLOGICAL ENVIRONMENT

Refer to Annexure I for the Fauna and Flora Survey.

According to GDARD Biodiversity requirements the following biodiversity studies be conducted on the study area: ***(refer to Annexure L)***

- Birds, with specific reference to Whitebellied Korhaan.

- Reptiles, with specific reference to Striped Harlequin Snake.
- Vegetation.
- Should a wetland be located during site investigations, a wetland specialist study will also be required.

No wetland was located during site investigations and therefore no wetland study was conducted.

The study area

Galago Environmental stated that the study area lies in the quarter degree grid square 2528CC (Centurion) and that Mucina and Rutherford (2006) classified the area as Carltonville Dolomite Grassland, a species - rich grassland with shallow soil and slightly undulating plains on dolomite dissected by prominent rocky chert ridges. This grassland falls within a warm- temperature summer- rainfall region with high summer temperatures and severe frequent winter frosts.

This vegetation unit is considered vulnerable with a conservation target of 24 %. Small parts of this unit are conserved in statutory reserves and a few private conservation areas. Almost a quarter of the unit is already transformed by cultivation, urbanization, mining and the building of two dams.

The entire terrain is relatively even and flat. Occasional dead termitaria that may provide near ideal retreats for small fauna, including amphibians and reptiles, were noticed in the north-eastern corner.

6.1.2.1 Vegetation

Four plant communities were identified on or within 200m of the study area: ***(refer to Figure 15)***

- Natural primary grassland;
- Mixed alien and indigenous vegetation;
- Old cultivated fields; and
- Rocky outcrop vegetation.

FIGURE 15: VEGETATION COMMUNITIES MAP

Medicinal plants

Of the 141 plant species recorded on the site, 28 species with medicinal properties were found. Of these, 21 species occurred in the natural primary grassland, 4 in the old cultivated fields and 14 in the rocky outcrop vegetation.

Alien plants

Six alien plant species, of which three were Category 1 Declared weeds, were recorded on the study site. One Category 1 Declared weed species (*Achyranthus aspera*) occurred in the natural primary grassland area. A few specimens of this plant were found under the single *Acacia caffra* tree. Two Category 1 Declared weed species (*Campuloclinium macrocephalum* and *Opuntia ficus-icica*) were observed in the old cultivated fields. Three other alien species not declared, occurred on the old cultivated fields including *Bidens bipinnata*, *Tagetes minuta* and *Zinnia peruviana*. The removal of all Category 1 Declared weeds is compulsory[5].

Orange-listed species

The habitat of the Natural primary grassland and the Rocky outcrop vegetation was suitable for only one of the Orange-listed species known to occur in the 2528CC quarter degree grid square. This species, *Hypoxis hemerocallidea* (African potato) was found

[5] The removal of all Category 1 Declared weeds are compulsory in terms of the regulations formulated under "The Conservation of Agricultural Resources Act" (Act No. 43 of 1983), as amended.

sparsely scattered over the entire study site. A relocation operation was not considered viable.

Red-listed species

The habitat on this site was **not** suitable for the red-listed legume species known to occur on shallow dolomite within 5 km of the site or for the red-listed fern species that occurs on chert in the same area.

Natural Primary Grassland

The Natural primary grassland was dominated by *Themeda triandra* (Red grass). According to Galago Environmental connectivity with natural grassland existed to the north and east of the site, however, the portions to the north are also currently being considered for development.

The species diversity of the Natural primary grassland was high. Of the 105 species recorded, 104 were indigenous species.

Because this vegetation community was deemed natural primary grassland, it was considered sensitive.

The habitat of the Natural Primary Grassland and the Rocky Outcrop vegetation is regarded as suitable for the Orange-listed *Hypoxis hemerocallidea* (African Potato). Species were found sparsely scattered in these two vegetation communities. These plants should be relocated to a safe, suitable area approved by GDARD. The whole site and its surroundings are undeveloped although ecologically disturbed. It is clear that annual veld fires have taken its toll on the quality of the basal cover, and consequently on biodiversity.

The Natural Primary Grassland (including the Rocky Outcrop) on the site was deemed **sensitive.**

Old cultivated fields

The Old cultivated fields vegetation community comprised secondary grassland, well on its way to recovery and dominated by *Hyparrhenia hirta* (Common thatching grass) and *Cynodon dactylon* (Couch grass). Geophytes and perennial herbaceous species occurred scattered throughout the vegetation community.

Connectivity with the natural grassland to the north and west existed, although these areas are also currently being considered for development. The species diversity was low. Of the 34 species recorded, 32 were indigenous species.

This vegetation community was **not** considered sensitive.

Findings and potential Implications

During the most recent site visit, the specialist found that the study site was unchanged except for a deep services trench that ran along the eastern boundary of the site. Division of the large area of Natural primary grassland into small townships corridors of natural vegetation to facilitate connectivity will result in destruction of the natural plant species diversity of the area.

Conclusions and recommendations made by Galago Environmental:

- **No** Red-listed plant species were found.
- The Natural primary grassland on the site was deemed sensitive.
- The Orange- listed *Hypoxis hemerocallidea* (African potato) was found sparsely scattered in the Natural primary grassland and the Rocky outcrop vegetation habitats. These plants should be relocated to a safe, suitable area approved by GDARD.

- Corridors of Natural primary grassland that have not been disturbed by services trenches should be included in all the planned new townships of Monavoni and on the neighbouring sites that are to be developed together with these sites. These corridors should be connected to the rocky outcrop on the study site and on the other portions that are being developed and to the *Acacia karroo* vegetation in the eastern part of Monavoni to facilitate connectivity.
- These areas must be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics etc. to ensure continuous biodiversity.

6.1.2.2 Vertebrate Faunal Survey

Mammals

The local occurrences of mammals are closely dependent on broadly defined habitat types, in particular terrestrial, arboreal (tree-living), rupiculous (rock-dwelling) and wetland –associated vegetation cover. It is thus possible to deduce the presence or absence of mammal species by evaluating the habitat types within the context of global distribution ranges. Sight records and information from residents or knowledgeable locals audit such deductions.

There is only one habitat type, terrestrial on the study area. A few termitaria are present and No bat caves occur on the site.

Observed and expected species richness

Of the 28 mammal species expected to occur on the study site, only three species were confirmed during the site visit i.e. *L. saxatilis, C. hottentotus, C. penicillata,* all of which are widespread and common. With their proven wide habitat tolerance and/or reticent behavior patterns, they display a remarkable ability to co-exist in the close proximity of human activities.

All but three of the species of the resident diversity are common and widespread. All large mammals and many medium-sized disappeared from the study area by initially farming practices, and later urbanization. Range management was geared to cattle farming with little or no attention to wildlife conservation, hence the low species diversity relative to that of historical times.

From a mammal perspective, the terrestrial habitat was in relatively good condition, in spite of the fact that cattle were grazing it at the time of the survey. Fires are a catastrophic event in the seasonal cycles of small mammal populations, and this is curtailed for the sake of cattle grazing.

The 500 meters of adjoining properties on all sides are in similar state of ecological repair and although there is a high degree of connectivity, the fact that only three Endangered species are recognized on the site relegate this ecological mechanism to a low level of importance.

Threatened and Red Listed Mammal Species

The two dwarf shrew species are listed as potential occupants. They have a tendency to use dead termite mounds as refuges, and these structures are used as a coarse indicator of their presence. Their assigned "Indeterminate" Endangered conservation status is, however, indicative of a lack of field data to ascertain their true global conservation status. Under natural conditions, hedgehogs have no problem with surviving; their "Rare"conservation status is the direct result of human predation. Considering the extent of the site and surrounding undeveloped areas, some individuals must have managed to survive.

It is submitted that no other endangered species could have survived the ravages of farming and urbanization. The white-tailed rat is extremely sensitive to habitat conditions which are not met on this site, while habitat requirements for rough-haired golden moles or other golden moles are absent.

Avifauna

The study site is situated within the Dry Highveld Grassland Bioregion of the Grassland Biome and more specifically within the Carletonville Dolomite Grassland vegetation type according to Mucina and Rutherford (2006). Egoli Granite Grassland runs past the south of the study site and the grassland on the study can probably be described as a transition area between the two grassland vegetation types.

Within this vegetation type one distinct bird habitat system was identified.

Open Grassland

The entire study site consists of open natural grassland with a few scattered trees, shrubs and old cultivated fields.

A few small areas within this natural grassland area are disturbed through past and present human activities however the largest surface area consists of natural grassland.

The involved fauna specialist stated that open grassland is the most important habitat type for South Africa's threatened bird species in the region with a proportional importance of 27 % (Barnes 200). The highest diversity of threatened bird species occurs within this grassland habitat of which many are in the highest category of threat (Barnes 2000). The presence and abundance of bird species in this habitat will vary from season to season being lush and green in summer after summer rains and dry and brown or burnt during winter. The area will favour ground living bird species such as lap-wings, francolins, pipits, long claws, larks and chats that either hunt for insects or breed on the ground, in burrows in the ground or between the grasses. Weavers and widow-birds will make use of this area for feeding (seeds) during late summer and early winter when the grass is not burnt and widow-birds and cisticolas will also breed in the tall grass during summer. Aerial feeding birds such as martins, swifts and swallows will hunt for insects over the grasslands.

Observed and Expected Species Richness

Of the 314 bird species recorded for the 2518CC q.d.g.c 101 (32.16%) are likely to occur on the study site and 24 (23.7.6%) of these bird species were actually observed on the study site.

Threatened and Red-listed bird species

Twenty-six Red Data bird species were recorded within the 2528CC q.d.g.c. Thirteen of these have disappeared from the area or were not recorded for this quarter degree grid cell during the time of the southern African Bird Atlas project. It is unlikely that they will ever be seen in this region again except maybe on rare occasions in protected areas. Six of these species used to breed within the said q.d.g.c (Tarboton, 1987) and only one, the African Grass-Owl, has been recorded as a breeding species for the q.d.g.c. during the period of the Southern African bird atlas project. This decline in breeding species is probably due to the large extent of development that took place during a short space of time. As with the African Grass-Owl, the Blue Crane also show a low reporting rate but the habitat on the study site and the level of disturbance will not favour Blue Cranes. The rest of the Red Data species that were recorded shows a very low reporting rate and will more than likely only move through the area on rare occasions.

Reptiles and Amphibians

Method

The list of species which may occur on this site was compiled based on the impressions gathered during this visit, records in the Transvaal Museum, from publications such as the documentation of the herpetofauna of the then Transvaal by Dr. N. H. G. Jacobsen (Unpublished Ph.D. thesis, University of Pretoria, 1989) and his internal departmental report 'The Hepetofauna of Gauteng Province, 1995', including the 'Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland' (Minter, *et al*, 2004). The latest taxonomic

nomenclature was used. The vegetation type was analyzed according to Low and Rebelo (1996) and Mucina and Rutherford (2006).

Findings and potential Implications

Mammals: The proposed development will not result in a loss of ecological sensitive and important habitat units, ecosystem function (e.g. reduction in water quality, soil pollution), loss of sensitive faunal habitat, nor of loss/displacement of threatened or protected fauna.

Avifauna: The open grassland on site offers ideal habitat conditions for the Melodius Lark in terms of breeding and foraging purposes. Several displaying male Melodius Larks were observed on the study site.

The Melodius Lark *(Mirafra cheniana)*

The Melodius Lark is listed in the Eskom Red Data Book of birds of South Africa, Lesotho and Swaziland (Barnes 2000) but has been removed from GDARD list of priority species. It appears to be sensitive to overgrazing (Barnes 2000) and land-use changes in the grasslands may severely impact this species (Stattersfield *et al.* 1998)

White-bellied Korhaan (*Eupodotis senegalensis*)

Criteria for IUCN threatened category: A1c: A2c; C1. Status: Vulnerable

Within Gauteng habitat loss through crop farming, overgrazing, burning and high human densities are the main reasons for the population decline of this species. Even where suitable habitat exists, it is often modified by inappropriate fire regimes and grazing practices (Barnes 2000). The genetic integrity of this species may be threatened as a result of severely fragmented distribution (Barnes 2000).

Habitat: According to Barnes (2000) it inhabits relatively tall vegetation, typically fairly dense grassland in either open or lightly wooded regions. It seems to be most abundant in

hilly areas at the interface between the grassland and savannah biomes (Tarboton *et al*. 1987). They occur in low abundance in severely grazed and recently burnt sites (Barnes 2000).

Although no observations were made of White-bellied Korhaan on the study site the habitat could favour this species.

Reptiles and Amphibians

The vegetation type of the study site is Carletonville Dolomite Grassland (Mucina *et al*, 2006) on a fairly homogeneous clayey to stony substrate of the Timeball Hill Formation (Kent, 1980). The greater part of this site consists of arable land, which was ploughed in the past. The northeastern tip is too stony and was not ploughed and there is a presence of termitaria. Of these, some are dead and provide suitable retreats for small animals, including dry-land amphibians and reptiles. Nevertheless, species diversity and population densities are not expected to be high.

Parts of the terrain, especially the previously ploughed areas, appear suitable as dispersal area for the Near Threatened Giant bullfrog (*Pyxicephalus adspersus*) as the substrate is suitable for burrowing, but no specific sites for the formation of breeding ponds were noticed. Odd individuals from adjacent areas may occasionally occur but the terrain does not appear suitable for the full lifecycle. The intensive development in the general area precludes the future presence of the Giant Bullfrog.

The striped Harlequin Snake (*Homoroselaps dorsalis*), a very rarely recorded species (Only 12 recorded for Gauteng, Jacobsen, 1995) and consequently a Red Data species, has been recorded from Farm Swartkop 383-JR in this quarter degree grid cell. As it is a cryptic species, mostly living underground or in dead termitaria, it is extremely difficult to confirm its presence on a site without destroying every suitable dead termitarium, thereby annulling the possibility of its future existence in the area. It would also be impossible to apply conservation measures which would have a noticeably positive effect. It is fortunate that

this species has a relatively wide range of distribution in northeastern areas of South Africa, which should assure its survival.

Conclusion and Recommendations:

Mammals: Most, if not all the species listed as potential occupants of the site, will be displaced as a result of the proposed development. This will have no effect on the conservation status of most of the species. However, the loss of the three Red Listed species (dwarf shrews and hedgehog) is regrettable, although when expressing the magnitude of the loss in statistical terms it would most probably be negligible.

Birds: Although the habitat on the study site could still favour White-bellied Korhaan, it is doubtful if they will make use of the open grassland due to the human presence. The open grassland habitat on the site offers suboptimal habitat for the Melodious Larks. This species has however been removed from GDARD list of priority species. The proposed development should not have a negative effect on any of the other Red Data bird species listed above due to the high level of human disturbance on site. There's a lack of sufficient breeding, foraging and breeding habitat for the mentioned Red Data bird species.

Reptiles and Amphibians: The site appears to have a limited number of possible amphibian and reptile species. High-density residential development does not allow the survival of viable populations, except for a few commensal species, such as the Speckled Skink, which are able to live in association with humans and their structures.

A specimen of the Striped Harlequin Snake (homoroselaps dorsalis), a Red Data Species, has been recorded from the farm Swartkop 383-JR (Jacobsen, 1995), of which a section west of the R55 is adjacent to the site under investigations. This proves the presence of the species in this area but it is practically impossible to confirm this record. As this snake tends to live underground in burrows or tunnels, where it feeds exclusively on Thread Snakes (*Leptotyphlops spp*.), it is usually only found accidentally when dead termitaria are destroyed. To attempt to confirm the presence of this species in an area, it would be necessary to destroy a large number of dead termitaria, which would reduce the suitability

of the area for the survival of this snake and other reptiles. It appears that this species occurs in relatively low densities and it is recommended that should this snake be encountered during the construction phase of the development, then it must be properly recorded, sent to the Transvaal Museum (if dead) or moved to other areas suitable for its preservation.

The following mitigation measures were proposed by the fauna and flora specialists:

- Should hedgehogs be encountered during the construction and operational phase of the development, these should be relocated to natural grassland areas in the vicinity.
- The contractor must ensure that no fauna species are disturbed, trapped, hunted or killed during the construction phases. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance.
- It is important to note that the trenches for the water pipelines and even those for sewage lines do not need to be wide, which means that the environmental damage caused by the actual digging can be reduced to a minimum. However, while they are open their presence will mean that wildlife of any may fall into them, from where it will be difficult to escape and death may be caused by drowning, excessive exposure to the sun or by being buried alive during the final construction work.
- Environmental damage caused by these trenches may be kept to a minimum by good forward planning and thereby reducing the actual length of time that they are open. Possible damage to wildlife is in direct proportion to the time that these trenches are open and may destroy amphibian and reptilian species.
- The design of the stormwater lines is not known. If large diameter cement pipes are used and the trenches are closed again, potential danger become reduced by filling in the trenches. Open stormwater channels are dangerous, as they will continuously contribute to wildlife destruction.

The following mitigation measures were developed by GDARD (previously GDACE) (Directorate of Nature Conservation, GDACE, 2008) and are applicable to the study site.

- All areas designated as sensitive in a sensitivity mapping exercise (see *Sensitivity Mapping Rules for Biodiversity Assessments*) should be incorporated into an open space system and registered against the title deeds as a conservation servitude. Development should be located on the areas of lowest sensitivity.*
- Development structures should be clustered as close as possible to existing development.*
- An independent suitably qualified individual registered in accordance with the Natural Scientific Professions Act (No. 27 of 2003) should act as the environmental control officer.*
- An appropriate management authority (e.g. the body corporate) that is contractually bound to implement the Environmental Management Plan (EMP) and Record Of Decision (ROD) during the operational phase of the development should be identified.*
- An ecological management plan for the open space system should be compiled by a specialist registered in accordance with the Natural Scientific Professions Act (No. 27 of 2003) in the fields of Botanical / Ecological / Zoological Science. This ecological management plan should form part of the EMP.*
- The ecological management plan should:
  - include a fire management programme to ensure persistence of grassland*
  - include an ongoing monitoring and eradication programme for all non-indigenous species, with specific emphasis on invasive and weedy species*
  - ensure the persistence of all Red and Orange List species*
  - include a monitoring programme for all Red and Orange List species*
  - facilitate/augment natural ecological processes*
  - provide for the habitat and life history needs of important pollinators*
  - minimize artificial edge effects (e.g. water runoff from developed areas & application of chemicals)*
  - include management recommendations for neighbouring land, especially where correct management on adjacent land is crucial for the long-term persistence of sensitive species present on the development site*

  - result in a report back to the Directorate of Nature Conservation on an annual basis*
  - investigate and advise on appropriate legislative tools (e.g. the NEMA: Protected Areas Act 57 of 2003) for formally protecting the area (as well as adjacent land where it is crucial for the long-term persistence of sensitive species present on the development site)*
  - a copy of the ecological management plan should be provided to all neighbouring landowners.*
  - A funding mechanism that will cover the cost of implementing the ecological management plan should be established.*
- All areas earmarked for development should be fenced off from the open space system prior to construction commencing (including site clearing and pegging). All construction-related impacts (including service roads, temporary housing, temporary ablution, disturbance of natural habitat, storing of equipment/building materials/vehicles or any other activity) should be contained within the fenced-off development areas. Access of vehicles to the open space system should be prevented and access of people should be controlled, both during the construction and operational phases. Movement of all indigenous fauna should however be allowed (i.e. no solid walls, e.g. through the erection of palisade fencing), unless otherwise specified in another condition.*
- Compacting of soil should be avoided in areas to be included in the open space system.*
- Connectivity between the open space system and adjacent natural vegetation / open space systems should be ensured.*
- Only species indigenous to South Africa should be used for landscaping / gardens within 200m of the open space system. Plant species indigenous to the natural vegetation of the area are preferred. As far as possible, plants naturally growing on the development site, but would otherwise be destroyed during clearing for development purposes, should be incorporated into landscaped areas. Forage and host plants required by pollinators should also be planted in landscaped areas.*

General mitigatory measures:

- Where possible, trees naturally growing on the site should be retained as part of the landscaping, with specific emphasis on the following species: *Acacia erioloba*, *Boscia albitrunca*, *Combretum imberbe*, *Pittosporum viridiflorum*, *Prunus africana*, *Sclerocarya birrea* subsp. *caffra*. Measures to ensure that these trees survive the physical disturbance from the development should be implemented. A tree surgeon should be consulted in this regard. *
- In order to minimize artificially generated surface storm water runoff, total sealing of paved areas such as parking lots, driveways, pavements and walkways should not be permitted. Permeable material should rather be utilized for these purposes.*

Refer to Figure 16 for the Ecological Sensitivity Map

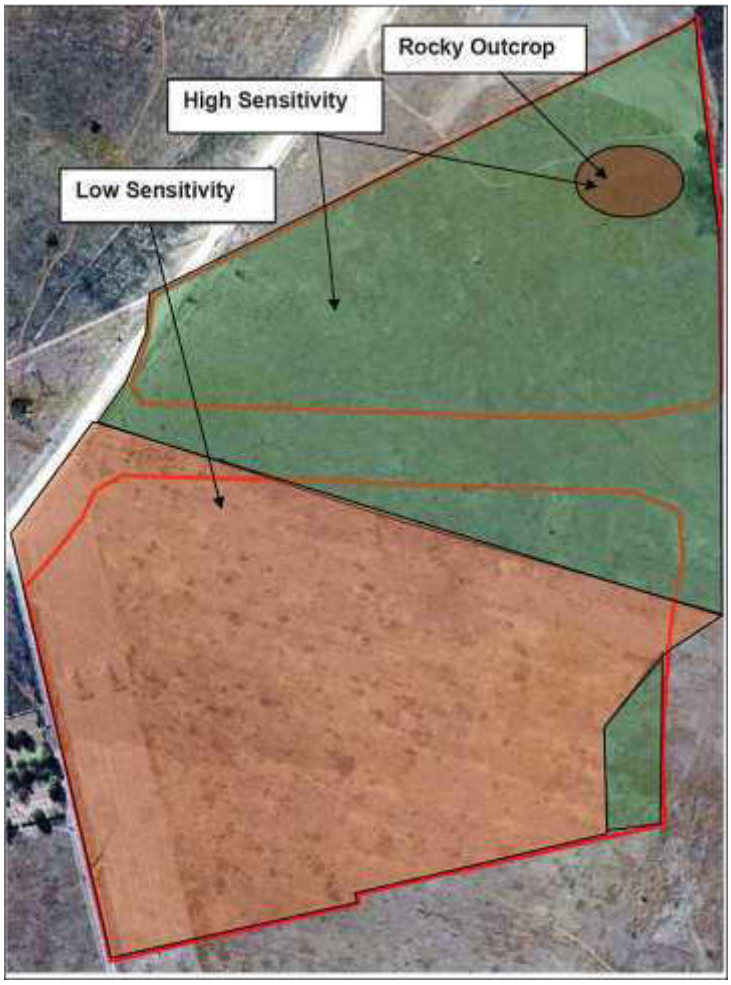


Figure 16 – Ecological Sensitivity Map

6.1.2.3 Presence of caves

According to Relly, Milner and Shedden engineers there are no known caves of significance on the site. Mr. Shedden stated that he had been involved in dolomite investigations in this general region for the past 30 years and that he is unaware of any significant caves on or in the immediate vicinity of the study area. ***Refer to Annexure M for correspondence from Relly, Milner and Shedden engineers.***

Issues & Impact Identification – Flora and Fauna

Table 24: Issues and Impacts – Flora and Fauna

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High ☻ Medium ☺ Low ◙ Positive Impact - Not Necessary To Mitigate ☼
16)	The loss of natural primary grassland	-	◙
17)	The loss of orange listed plants.	-	☻
18)	The eradication of weeds and exotic invaders.	+	☼
19)	If the entire area to be developed is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories.	-	☻
20)	Noise of construction machinery could have a negative impact on the fauna species during	-	☻

	the construction phase.		
21)	During the construction and operational phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed.	-	☻
22)	Loss of habitat can lead to the decrease of fauna numbers and species.	-	◙

Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

16) The loss of Natural Primary Grassland

Some of the sensitive natural primary grassland on the site will be lost due to the proposed development. However, a Monavoni Development Framework plan had been compiled to ensure the protection of corridors of Natural primary grassland in the larger Monavoni development ***(refer to Figure 3).***

Table 25: Significance of Issue 16 (The loss of Natural Primary Grassland) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Low ◙	**C/O-** Corridors of Natural primary grassland must be included as part of the Monavoni Development Framework. These areas must	**NP** - Not possible to mitigate, but not regarded as a fatal flaw.

	be properly managed throughout the lifespan of the project in terms of fire, eradication of exotics etc. to ensure continuous biodiversity.	

Result:

The issue cannot be mitigated, but is not regarded as a fatal flaw. The issue should be assessed in the Significance rating table.

17) The loss of orange listed plants.

Some Orange-listed *Hypoxis hemerocallidea* (African potato) found sparsely scattered in the Natural primary grassland and the Rocky outcrops will be lost due to the proposed development.

Table 26: Significance of Issue 17 (The loss of Orange-listed plants) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P** – These plants should be relocated to a safe, suitable area approved by GDARD.	**L -** To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

18) The proposed development will result in the eradication of exotic invaders and weeds.

Category 1 Declared weeds, Category 2 Declared invaders and one Category 3 Declared invader occurred on the study area and must be eradicated prior to construction and throughout the operational phase of the development.

Table 27: Significance of Issue 18 (The eradication of invasive species) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Positive Impact - Not Necessary To Mitigate ☼	**P/C/O** –Category 1 Declared weeds, Category 2 Declared invaders and one Category 3 Declared invader occurred on the study area and must be eradicated prior to construction and throughout the operational phase of the development. **P/C/O** – No plants not indigenous to the area, or exotic plant species, especially lawn grasses such as Kikuyu and other ground-covering plants, should be introduced in the communal garden / landscaping of the proposed development, as they might spread into the areas of natural vegetation. **P/C/O** – Forage and host plants required by pollinator species in the area should also	**M -T**o be included in EMP **L -T**o be included in EMP **L -T**o be included in EMP

	be used in landscaped areas.	

Result:

Positive impact, the significance of the impact should still be determined / confirmed and assessed in the Significance Rating Table

19) If the entire area to be developed is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories.

Table 28: Significance of Issue 19 (If the entire area to be developed is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories) After Mitigation/ Addressing of the Issue.

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**C** - Where possible, work should be restricted to one area at a time.	**L** -To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

20) Noise of construction machinery could have a negative impact on the fauna species during the construction phase

If not managed correctly, noise pollution (i.e. by machinery without noise muffing devices) could have a negative impact on the surrounding residents and the fauna and birds in the area. This will however only be a short-term impact and it is expected that many of the birds will return to the area during the operational phase.

Table 29: Significance of Issue 20 (Noise of construction machinery could have a negative impact on the fauna species during the construction phase) After Mitigation/ Addressing of the Issue.

Mitigation Possibilities High ☻ Medium ☺ Low ◙ Positive Impact/ Neutral - Not Necessary To Mitigate ☼	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/ C -** Noise should be kept to a minimum and the development should be done in phases to allow faunal species to temporarily migrate into the conservation areas in the vicinity.	**L -**To be included in EMP

Result:

Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table

21) During the construction and operational phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed.

There is always a risk that construction personnel or new residents of the development may disturb, trap, hunt or kill fauna on the study area. This will have a detrimental impact on the local biodiversity and will decrease fauna numbers. The issue can be mitigated if this issue is included in conservation-orientated clauses that may be built into contracts of construction personnel and residents and if council prosecute offenders of these actions.

Caught animals should also be relocated to conservation areas in the vicinity.

Table 30: Significance of Issue 21 (During the construction and operational phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**C/ O** - Should hedgehogs be encountered during the construction and operational phase of the development, these should be relocated to natural grassland areas in the vicinity. **C / O** - Should the Harlequin snake be encountered during the construction phase of the development, it must be properly recorded, sent to the	**L** -To be included in EMP

	Transvaal Museum (if dead) or moved to other areas suitable for its preservation. **C/ O** - The integrity of remaining wildlife should be upheld, and no trapping or hunting by construction personnel should be allowed. Caught animals should be relocated to the conservation areas in the vicinity. Council shall prosecute offenders. **P** - Conservation-orientated clauses should be built into contracts for construction personnel as well as buyers of property within the new development complete with penalty clauses for non-compliance. **P/C** – The trenches for the water pipelines and sewage lines should be as narrow as possible. Environmental damage caused by these trenches may be kept to a minimum by good forward planning and thereby reducing the actual length of time that they are open. Possible damage to wildlife is in direct proportion to the time that	

	these trenches are open and may destroy amphibian and reptilian species. **P/C** – The design of the stormwater lines is not known. If large diameter cement pipes are used and the trenches are closed again, potential danger become reduced by filling in the trenches. Open stormwater channels are dangerous, as they will continuously contribute to wildlife destruction.	

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

22) Loss of habitat can lead to the decrease of fauna numbers.

All mitigation measures for impacts on the indigenous flora of the area should be implemented in order to limit habitat loss.

Table 31: Significance of Issue 22 (Loss of habitat can lead to the decrease of local fauna numbers and species) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal

		flaw **NP**
Medium ☺	**P/ C / O** – All mitigation measures for impacts on the indigenous flora of the area should be implemented in order to limit habitat loss and maintain and improve available habitat, in order to maintain and possibly increase numbers and species of indigenous fauna. **C \ O** - Should hedgehogs be encountered during the construction and operational phase of the development, these should be relocated to natural grassland areas in the vicinity.	**L** - In terms of local fauna population

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

6.2 DESCRIPTION OF THE EXISTING SOCIO-ECONOMIC ENVIRONMENT

6.2.1 Archaeology/Cultural History

Refer to Annexure N for the Archaeology Survey

Introduction

An independent heritage consultant (Dr. Johnny van Schalkwyk) was appointed to conduct a survey to locate, identify, evaluate and document sites, objects and structures of cultural importance found within the boundaries of the study area.

Cultural heritage resources are broadly defined as all non-physical and physical human-made occurrences, as well as natural occurrences that are associated with human activity. These include all sites, structures and artifacts of importance, either individually or in groups, in the history, architecture and archaeology of human (cultural) development.

The objectives were to:

- Identify possible archaeological, cultural and historic sites within the proposed development areas;
- Evaluate the potential impacts of construction, operation and maintenance of the proposed development on archaeological, cultural and historical resources;
- Recommend measures to mitigate any negative impacts on areas of archaeological, cultural or historical importance.

Field survey

A field survey was done according to generally accepted archaeological and was aimed to locating all possible sites, objects and structures. The area that had to be investigated was identified by Bokamoso by means of maps. The area was investigated by walking across it in a number of transects. Special attention was given to topographical occurrences such as trenches, holes, outcrops and clusters of tress were investigated.

Identified sites

- **Stone Age**

No sites, features or objects dating to the Stone Age were identified.

- **Iron Age**

No such sites, objects or features dating to the Iron Age were identified.

- **Historic period**

No sites, objects or features dating to historic times were identified.

Issues & Impact Identification – Cultural and Historical

Table 32: Issues and Impacts – Cultural and Historical

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High ☻ Medium ☺ Low ◙ Positive Impact - Not Necessary To Mitigate ☼
23)	If any cultural or historical artefacts are found during construction it may be destroyed by construction activities.	-	☻

Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

23) If any cultural or historical artefacts are found during construction it may be destroyed by construction activities.

Table 33: Significance of Issue 23 (If any cultural or historical artefacts are found during construction it may be destroyed by construction activities.) After Mitigation/ Addressing of the Issue

Mitigation Possibilities High ☻ Medium ☺ Low ◙ Positive Impact/ Neutral - Not Necessary To Mitigate ☼	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase P/ C / O	Significance of Issue after mitigation Positive ☼ Low/ eliminated L / E Medium M High H Not possible to mitigate, but not regarded as a fatal flaw NP

High ☻ - In the longer term	**P/ C/ O -** It should be noted that in terms of the South African Resources Act (Act 25 of 1999) Section 35(4) no person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or material. **P/ C/ O** - Also important is that Section 34(1) of this act states that no person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit, issued by the relevant provincial heritage resources authority.	**L** – To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

6.2.2 Existing Land Use

6.2.2.1 The Study Area

In terms of the Centurion Town-planning Scheme, 1992, the study area is zoned "Agricultural". The study area is currently vacant and is situated within the Provincial Urban Edge.

6.2.2.2 Surrounding Development and Land Uses

The proposed Monavoni X 44 development forms part of the larger Monavoni Development by M & T Development (JR 209 Investments (Pty) Ltd). ***Refer to Figure 3 for the Monavoni Development Framework***

The following developments are found surrounding the area:

- Proposed Monavoni X 50 development is situated to the north of the study area;
- Proposed Monavoni X 43 is situated directly to the south of the study area;
- Monavoni X 31and proposed Monavoni X 45 and X 47 are situated directly to the east of the study area;
- The study area is bordered by agricultural holdings and the alignment of the proposed PWV 9 to the west; and
- The proposed alignment of the provincial road K52 runs through the site.

6.2.3 The Proposed Land Use

The proposed Monavoni Extension 44 will provide people with a secure living environment in close proximity to working opportunities to be enjoyed by people from different income levels and will consist of 4 erven with the following land uses:

6.2.3.1 Proposed Zonings and Land-Use

Table 34: Proposed Zoning

ZONING	Density (du/ha)	Erf No.	Total no of Erven	Average size (ha)	Total Units	Total Area Ha	%
"Residential 2"	80	1-2	2	9.0289	1444	18.0578	46.50

"Special" for light industrial and offices	N/A	5-6	2	6.2576	N/A	12.5152	32.23
"Private Open Space"	N/A	3-4	N/A	1.5365	N/A	3.0731	7.93
Streets	N/A	N/A	N/A	N/A	N/A	5.1832	13.34
Total	N/A	N/A	6	N/A	N/A	38.8239	100

The allowable land use rights for "light industry" include the following:

Land and buildings used for, inter alia, a bakery, a builder's yard, a car wash, a contractor's yard, dry-cleaners, carpet cleaners, joinery workshop, launderette, laundry, lawnmower workshop, painter's workshop, plumber's workshop, printing workshop, transport depot, panel-beater, motor workshops, a ready-mix plant and any other such industries, workshops or yards which in the opinion of the Municipality do not cause a nuisance to the environment, may be used for similar purposes and may include the retail sale of products ancillary and subservient to the main use on the same property.

6.2.3.2 Need and Desirability

Information supplied by M & T Development Town Planning (refer to Annexure G)

NEED

M&T owns a substantial amount of property within the area of the application site, and have developed various developments in the area. With the developments M&T spent a considerate amount of money to obtain engineering services to the adjacent townships. The already installed services will therefore be optimally utilized as was planned from the previous developments that M&T developed in the adjacent area of the application site.

It was therefore always the idea to expand the Monavoni precinct. The market demand is the main factor that the township has not yet been proceeded with. In the last two years the development market has slowed down considerably with the global recession.

Indicators and previous recessions have shown that the recession will end in the near future, therefore, the development will be at the end stages when the recession is over.

The application site is also located within the urban edge. This is an important aspect to take cognisance of, the reason being that there is limited space available within the urban edge for new developments. It is therefore important to develop new developments within the urban edge, to combat urban sprawl, to save valuable agricultural land.

The application site is in close proximity to informal settlements. The planned mixed use within the proposed development will have a big impact on the informal settlements as it will create work opportunities and have a mixed use development close to the informal settlement, that will enhance the sense of place of the area.

The recent trend has emerged over the last couple of years for offices and industrial properties situated outside of the CBD. The reason for this being that business owner and their workers can live closer to work, and in close proximity to other amenities such as convenient stores. There is also an underprivileged work force that can benefit from jobs.

There are residential erven within the development, and in recent years the residential market has still grown to provide for a growing number of home owners. The growth in the residential market can be contributed to a few factors, which include favourable interest rates, a larger amount of investors in residential property as a result of increasing house prices and more potential home owners. Cost of residential property have increased continuously for the last five years and even though the market has slowed down some in the last 5 years, in line with a decline in the global economy, indications are that the residential market is recovering and house prices are again starting to increase as banks are approving more home loans and people again start to invest in property and property development. Interest rates have again reduced substantially which will ensure a renewed interest in residential development.

A trend in residential development that has not changed is a need for smaller, more affordable residential units, where you can buy a lock-up-and-go unit in close proximity to amenities.

There is also a need for some office developments in any residential development to provide professional suites, medical suites and other offices that are required to be situated in close proximity to residential erven, but with good access from the region. This will also contribute towards a sense of place by having a mixed use zoning.

This township is part of a large property where development up to now, was mainly used for agricultural purposes. Most of the property can be developed at high densities, due to minor environmental sensitivities, such a ridges and important waterways. This property has no sensitivity areas and is not affected by a 1:50 or 1:100 year floodlines.

Security has become the number one priority for new home owners. Throughout South Africa there has been a general move towards safer and secure neighbourhoods. This has also been proven by the amount of street closures for security purposes in traditional neighbourhoods and the fact that most of the new residential and office developments throughout South Africa include security and access control as the main attraction point for new home buyers.

This proposed residential development will provide in a need for secure development where a lifestyle with peace of mind will be established. The development will have 24 hour interactive security, an electric perimeter fence around the development, and manned access control point will be provided at the entrance.

The erven in this development will be set in a pleasant environment, with good access to work opportunities. The development will be attractive to a wide range of homeowners, and businesses with added benefit of security and have access to amenities close by.

DESIRABILITY

Several factors will contribute towards the desirability of the proposed development and these aspects will be discussed in more detail.

Desirability of land uses

The proposed township is situated within a node of estate development such as Stone Ridge Country Estate, Silver Wood Estate, Silver Wood Estate, Raslouw Lifestyle Estate, and Heuwelsig Estate that already constitutes a node for development in the area and this proposed development will complement the existing residential node in the area. The developer has already invested in bringing services to this area and these existing services should be utilised optimally. The development should also facilitate the sensible and economic growth of the area.

All the above elements will contribute towards the creation of a unique lifestyle environment which will be in harmony with the surrounding area and natural elements of the site.

Locality

The proposed township is situated on part of a portion of land in the south western section of the Tshwane metropolitan area. The proposed development is situated in close proximity to two major highways, one existing and one proposed. The N14 (R28) is a major east west link through Tshwane which connects with the N1 highway to form one of two major movement spines through the area.

The proposed PWV 9 situates to the west is a new proposed highway which is one of the few provincial roads which are planned to be constructed as soon as possible. The construction of this highway will alleviate pressure from the N1-21 highway which is to capacity in peak hour traffic. Access to this area will be obtained via Mimosa Street.

Mimosa street is another important north south link which will affect this property. Mimosa Street runs through the development site in a north-east, south-western direction.

The site is therefore strategically located within the region and sufficient north south and east west links could be provided to ensure adequate distribution of traffic through the area, based on the current development patterns for the area.

Access & traffic distribution

The access to the township will be obtained from Mimosa Street, and several planned roads through to be constructed through the broader Monavoni area. Mimosa Street will then provide access to the two parts of the development, one to the north and the other on the south. The density of the township was largely determined by the amount of traffic the proposed roads can accommodate. Some road upgrading will be required as part of this township development to accommodate the additional traffic which would be generated for this development. The details of the road upgrading will be set out in a detailed traffic impact study.

Existing and proposed surrounding and adjoining land uses

The property is situated in an area which is currently characterised by the following land uses.

- *To the west is a rural residential area with many small farming and business operations spread through the area.*
- *To the south and east are some residential estate developments.*
- *Situated to the north is an informal settlement.*

The proposed application site is well situated for its proposed use and the proposed development will be compatible with the surrounding adjoining and adjacent land uses.

Issues & Impact Identification – Proposed Land-Use

Table 35: Issues and Impacts – Proposed Land-Use

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High ☻ Medium ☺ Low ◙ Positive Impact - Not Necessary To Mitigate ☼
24)	Upgrading of municipal services	+	☼
25)	Upgrading of provincial and local roads	+	☼
26)	Economical injection to local businesses	+	☼
27)	Creation of temporary and permanent jobs	+	☼
28)	Increase in adjacent land-values	+	☼
29)	Rates and taxes payable to the local authority	+	☼
30)	The supply of much needed housing in close proximity to employment opportunities	+	☼
31)	Possibility of illegal settlements and increased security problems	-	☻
32)	Traffic increase in the area, will have an impact on the traffic flow.	-	☺
33)	Damage to the existing services and infrastructure during the construction phase and disruptions in services (i.e. electricity, water, damage to Telkom cables) during the construction phase.	-	☻

34)	Dangerous excavations	-	☻

Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

27) Creation of temporary and permanent jobs

The development will create temporary job opportunities during the construction phase and temporary and permanent job opportunities during the operational phase. Should local communities not benefit from these opportunities, it could lead to an influx of people from other areas. Only employing people from the local community could mitigate the potential adverse impact.

Table 36: Significance of Issue 27 (Creation of temporary and permanent jobs) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**C / O** – In order to limit the influx of people from other areas, it is recommended that (where possible) only people from the local communities are employed.	**L –** To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

31) Possibility of illegal settlements and increased security problems in the area mainly associated with the construction phase. During the construction phase, the possibility always exists of illegal settlements being established on and around the study area. This causes a security risk to residents on the surrounding properties in the form of possible theft and other crime related activities.

Table 37: Significance of Issue 31 (Possibility of illegal settlements and increased security problems) After Mitigation/Addressing of the Issue.

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**C** - With the exception of the appointed security personnel, no other workers, friend or relatives will be allowed to sleep on the construction site (weekends included)	**L –** To be included in the EMP
	C - Presence of law enforcement officials at strategic places must be ensured.	**L –** To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

32) Traffic increase during the construction and operational phases of the development will have an impact on traffic flow and the tranquillity of the area. The impact of additional traffic during the construction phase, especially heavy construction vehicles that can slow traffic down, can be mitigated to a certain extent by not allowing construction vehicles to use public roads during peak traffic times, as well as to avoid construction activities on public roads during peak traffic times.

Table 38: Significance of Issue 32 (Traffic increase in the area, will have an impact on the traffic flow and the tranquility of the area) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Medium ☺	**P/ C -** Construction vehicles and activities to avoid peak hour traffic times **P/C -** The recommended road upgrades should be implemented.	**M –** To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

33) Construction of the new development may cause damage to the existing services and infrastructure and will disrupt service provision (i.e. electricity, water, Telkom cables) to local residents on surrounding properties during the construction phase.

Table 39: Significance of Issue 33 (Damage to existing services) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation: Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/ C** – Determine areas where services will be upgraded and relocated well in advance. Discuss possible disruptions with affected parties to determine most convenient times for service disruptions and warn affected parties well in advance of dates that service disruptions will take place.	**M –** To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

34) Dangerous excavations could pose a safety risk to surrounding residents, pedestrians and construction workers.

Table 40: Significance of Issue 34 (Dangerous excavations) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙**	Mitigation Already achieved √	Significance of Issue after mitigation

Positive Impact/ Neutral - Not Necessary To Mitigate ☼	Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/ C -** Although regarded as a normal practice, it is important to erect proper signs indicating the danger of the excavation in and around the development site. Putting temporary fencing around excavations where possible.	**M –** To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

6.2.4 Institutional Environment

The capital costs for the development will essentially be borne by the developer. Relative to this, however there lies an obligation with the local authority to support proposals in its interest (expansion of its tax base) as well as those in the interest of the community (investment and ensuring sustainability of development over time) and the environment.

According to the developer and the market research team, the proposed development will be a significant addition to the ***economical environment*** of the City of Tshwane.

6.2.4.1 On an International Level

Relevant International Conventions to which South Africa is party

- **Convention relative to the Preservation of Fauna and Flora** in their natural state, 8 November 1993 (London);
- **Convention on Biological Diversity**, 1995
  (provided and added stimulus for a re-examining and harmonization of its activities relating to biodiversity conservation. This convention also allows for the in-situ and ex-situ propagation of gene material);
- **Agenda 21** adopted at the United Nations Conference on Environment and Development (UNCED) in 1992.
  (An action plan and blueprint for sustainable development).

6.2.4.2 On a National Level

The Development Facilitation Act, 1995 (Act 67 of 1995)
Information supplied by M & T Development Town Planning

In light of skewed and ineffective spatial functionality National Government provided certain specific guidelines in order to steer development and urban planning into a new direction. Within Chapter 1 of the Development Facilitation Act reference is made to the general principles for land development:

"… (1) The following general principles apply, on the basis set out in section 2, to all land development:

(c) Policy, administrative practice and laws should promote efficient and integrated land development in that they-

(i) promote the integration of the social, economic, institutional and physical aspects of land development;

(ii) promote integrated land development in rural and urban areas in support of each other;

(iii) promote the availability of residential and employment opportunities in close proximity to or integrated with each other;

(iv) optimize the use of existing resources including such resources relating to agriculture, land, minerals, bulk infrastructure, roads, transportation and social facilities;

(v) promote a diverse combination of land uses, also at the level of individual erven or subdivisions of land;

(vi) discourage the phenomenon of "urban sprawl" in urban areas and contribute to the development of more compact towns and cities;

(vii) contribute to the correction of the historically distorted spatial patterns of settlement in the Republic and to the optimum use of existing infrastructure in excess of current needs; and

(viii) encourages environmentally sustainable land development practices and processes

As eminent form the above stipulations the sustainable paradigm of development is enforced by the national government as a direct attempt to correct past skewed development patterns and to lay the foundations for well-functioning cities and regions. Sound planning principles that emanate relate to the concentration and containment of development within a context conducive to overall integration and more dynamic interfacing. As can be expected the golden thread of sustainability reoccur within most provincial and local policies and as result the concept of localized sustainable development are dealt with in more detail.

The National Environmental Management Act; 1998 (Act 107 of 1998)

In terms of regulation no. R387 and R386 published in the Government Notice no. 28753 of 21 April 2006 of the National Environment Management Act, 1998 (Act No. 107 of 1998) an Environmental Impact Assessment Process is required for this project, due to the following listed activities:

- R. 387, 21 April 2006 Activity No. 2, Any development activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be 20 ha or more.
- R.386, 21 April 2006 Activity No. 1 (k), The bulk transportation of sewage and water, including storm water, in pipelines with (i)an internal diameter of 0,36 m or more; or (ii) a peak throughput of 120 litres per second or more.
- R. 386, 21 April 2006, Activity No. 15, The construction of a road that is wider than 4m or that has a reserve wider than 6m, excluding roads that all within the ambit of another listed activity or which are access roads of less than 30 metres long.

This act addresses issues relating to environmental administration and it promotes sustainable development.

If the involved authorities do not take the principles of NEMA into consideration when evaluating an environmental report/ document, the involved authority can be held responsible for any damage to the environment (social, ecological and economical).

It is important to note that this application was submitted prior to 2 August 2010, the date on which the Amended NEMA Regulations came into effect. Chapter 9, Regulation 76 of the 2010 Environmental Impact Assessment Regulations deals with transitional arrangements and requires that pending applications, submitted in terms of the 2006 NEMA Regulations, also take the impacts of the newly listed activities into consideration and adequately assess such activities. ***Refer to transitional arrangements attached as Annexure E.***

National Environmental Management: Air Quality Act (Act No. 39 of 2004)

This act replaced the Atmospheric Pollution Prevention Act (Act No. 45 of 1965), however Part 2 of the act is still applicable. Part 2 deals with the control of noxious or offensive gases and has relevance to the proposed development.

The purpose of the Act is "To reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures; and for matters incident thereto".

It is not foreseen that the proposed development would contribute significantly in terms of pollution by smoke as it is a mixed use development consisting of residential, commercial, light industry and business uses. Dust pollution could be a concern primarily during the construction phase of the proposed project. Dust control would be adequately minimised during this phase by way of water spraying and possible dust-nets, when working close to existing residential dwellings.

National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)

The purpose of the act is to reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; to provide for institutional arrangements and planning matters; to provide for national norms and standards for regulating the management of waste by all spheres of government; to provide for specific waste management measures; to provide for the licensing and control of waste management activities; to provide for the remediation of contaminated land; to provide for the national waste

information system; to provide for compliance and enforcement; and to provide for matters connected therewith.

The proposed development does not trigger any listed activities in terms of the Waste Act.

6.2.4.3 On a Provincial Level

Gauteng Planning and Development Act – (No 3 of 2003)
Information supplied by M & T Development Town Planning

The Provincial Act provides a spatial development framework for the entire Gauteng Province, and focuses on growth and development on a broad level. In brief, this document identifies several spatial development components of which the following areas are relevant to the proposed development:

- Centurion is identified as a *Growth area.*
- The application site is situated *within the provincial Urban Edge* where growth should be stimulated and encouraged.

The GSDF also lists so-called interventions of which the following area applicable to the proposed Monavoni Extension 44.

Development should promote spatial restructuring and development. Key amongst these is that the Province shall encourage development and land use which "…*promotes the more compact development of urban areas and the limitation of urban sprawl and the protection of agricultural resources" and development that "results in the use and development of land that optimises the use of existing resources such as engineering services and social facilities*…"

In summary, the key objectives that are pursued in the existing and proposed legal and policy framework are to:

- Minimise urban sprawl;
- The promotion of a compact town as the dominant model of development;
- Densification of settlements and ensure filling in and mixing of land uses;
- Develop and strengthen public transport-orientated activity corridors (which can only function with a minimum critical mass of users);
- Increase economic efficiency and productivity of urban form and functions.

The need to promote compaction and to combat sprawl suggests a number of types of actions:

- Promoting smaller average site sizes: large lot sprawl is a major form of sprawl in South Africa;
- Encouraging dwellings to go up – to take walk-up forms;
- Promoting various forms of implosion or infill policies, where new growth is encouraged to occur within the existing urban fabric as opposed to beyond the existing edge.

In general the new South African planning ethos, as described in planning policy documents on national and provincial level, provides for the important guiding principle for spatial planning to be provided in a dynamic concentrated development format. Within the context of regional and local spatial planning a true acknowledgement and acceptance needs to exist that the distorted spatial environment should be addressed effectively.

6.2.4.4 On a Local Level

Information supplied by M & T Development Townplanning

Integrated Development Plan (IDP)

The Integrated Development Plan (IDP) for the City of Tshwane was approved by the MEC: Gauteng Department of Planning and Local Government in May 2002. In terms of

development, the IDP provides broad strategies and visions for a city, and is done in conjunction with the community through a public participation process.

The proposed development falls within Planning Zone 3 of the IDP, within an area indicated as "*Higher Development Priority Area*". The site is furthermore situated within the urban edge.

The IDP perceives the vacant land and vast areas of holdings/farmland as prominent character of Centurion. This can be recognized as a weakness due to the security threat that vacant land imposes, as well as the negative influence it has on the image of a neighbourhood, specifically, a residential area. The vacant land, which implies lower residential densities, makes the provision of essential municipal services less viable and more expensive to provide. By developing the existing land within the municipal boundaries and within existing residential developments with higher densities, the phenomenon of urban sprawl can be curbed and the development of urban fibre can be stimulated.

The IDP identifies certain objectives for which compliance therewith is self-explanatory and can be summarized as follows:

- Strengthen and develop nodes of mixed land-use patterns;
- The optimal use of the existing road network, as well as other existing infrastructure;
- The integration, infill and densification of land to ensure the viability of services; and
- The management of development in an environmentally sustainable manner.

The proposed land use for the application site correlates to the envisaged development for the area and utilise these principles listed as important considerations.

Metropolitan Spatial Development Framework (MSDF)

The MSDF provides the overall spatial framework and is structured around five concepts. These concepts are:

- Smart Growth;
- Metropolitan Activity Areas;
- Movement Systems;
- The Urban Lattice; and
- The Environmental Structuring Concept.

The Smart Growth Concept:

Smart Growth describes a collection of urban development strategies aimed at reducing sprawl and promoting growth. One of the strategies have been developed in order to promote Smart Growth within the city, this includes:

- The Densification and Compaction Strategy and

The Densification and Compaction strategy is specifically focussed on addressing development within the urban area and is therefore specifically relevant in as far as Monavoni Extension 44 is concerned.

Tshwane Densification and Compaction Strategy

The Densification and Compaction strategy is specifically relevant in as far as Monavoni Extension 44 is concerned.

The following aspects are considered to be key directives for the Tshwane Densification and compaction Strategy:

- Minimise unmanaged or unfocussed urban growth;
- Create opportunities for the densification of existing low density areas;
- Promote higher density and integrated environments with typical urban characteristics to counteract suburban developments;
- Ensure that residents have access to a range of choices with regard to housing typologies as well as locations;
- Integrate residential development, movement systems, social facilities and employment opportunities;
- Focus residential densification around areas of opportunity (economic opportunity, transport opportunities etc.).

Within the document the sentiment is raised that densification and infill development are sound urban development principles to pursue. Mention is however made that caution should be taken in respect of the incorporation of high density developments in areas not planned to accommodate such scale of development.

Within the document certain recommendations are also provided in terms of where densification should be supported. These include:

- As close as possible to the CBD;
- Close to metropolitan core areas and services;
- In the proximity of areas with job opportunities; and
- Close to public transportation facilities.

Within the strategy it is suggested that densities of 25 units per hectare throughout the metropolitan area should be accepted as low density. Unfortunately the strategy is not specific about what amount of units per hectare is regarded as optimal. Lower densities (25u/ha) should be accommodated in areas with a special low-density character, but should be the exception rather than the rule. The proposed density of the township is 80 dwelling units per hectare.

The proposed alignment of the Provincial Road K52 runs through the proposed township which is classified as a mobility spine. In accordance with the Spatial Development Framework: Southern Region (SDF) it is envisaged to introduce medium to higher densities along mobility routes to maximize the benefits of public transport, making use of alternative access options, so as not to compromise the mobility functions of the spine. Mobility routes are defined as "an arterial along which traffic flows with minimum interruption (optimal mobility).

The position and concentration of buildings may however be dictated by the underlying soil conditions. The SDF states that the underlying dolomite in the region, the sensitive and ridges tend to direct and inform urban development." This clearly shows that the underlying soil conditions in the area do play a major role in the development of sites.

This unequal positioning of buildings may give rise to differing housing typologies, which is in line with the spatial Development Strategy: 2010 and beyond; as well as the Densification and Compaction Strategy (May 2005) (CDS) stating:

"*Ensure balance and diversity in the range of housing options, densities and typology to serve in the needs, desires and income abilities of all residents of the city.*"

The SDF and CDS describe development trends as directly opposing the aims and objectives for compacting and densifying the city with critical issues that needed to be addressed, viz:

- An overemphasis on single erf-single house developments; and
- Low coverage and low height restrictions.

The proposed layout aims to rectify these concerns by providing for both higher coverage and heights by providing for group housing developments. Furthermore, it is also envisaged that a communal open space and recreational facilities be incorporated into the township.

The development nodes are placed onto a lattice to emphasis on development occurring in a linear fashion along linear activity systems. The lattice development concept consists of an interconnected system of development corridors along mobility spines and activity spines that serve as pull factors in a network. The existing R55 and PWV9 road has been identified as such a node and is located in close proximity to the site.

The SDF further states that the metropolitan role and function for the southern region is to provide residential opportunities for all income groups and to accommodate new residential development in a sustainable form.

It is important to note that the geological conditions in the Monavoni area are such that they differ vastly between areas. Good geological conditions cannot be prescribed and it is not guaranteed that all townships will have geological conditions that can support higher densities. It is therefore important to utilize the good geological conditions and allow as high densities as possible to allow for "critical mass of users" in the area to enable public facilities and amenities such as public transport and health facilities or schools.

Spatial Development Framework: Southern Region

The location of the site of application spatially demarcates the area to form part of Tshwane's Southern Region.

The urban development framework for his area is based on an integrated urban lattice on which densification and intensification of development can take place in an integrated manner. A set of linear systems form the framework of the urban development lattice and relays urban energy from the traversing highways to lower order roads where it can be converted into physical development and economic growth.

A system of activity nodes is placed onto the development lattice to provide thrust to development occurring in a linear fashion along highways or other linear activity systems.

The lattice development concept consists of an interconnected system of development corridors along highways, mobility spines, mobility roads, activity spines and activity streets as well as strategically placed nodes serving as pull factors in the network. The development that is placed alongside these roads is enhanced by the activity nodes that are placed on the lattice where there is most access.

Accordingly the urban lattice is based on the four following elements:

- A latticed configuration- maximising access, movement and development choices;
- A Nodal Structure- guiding intense development to specific locations and linked to increased accessibility
- A Precinct Strategy-creating a diverse character along the spines
- Integrated and phased-in public transport- creating opportunities for multiple connections

The existing R55 road linking Pretoria West with Sandton and the future PWV – 9 are deemed to be existing and potential development corridors. These two roads could in combination provide energy in the future for the development of the third development corridor in Centurion. The extension of Sunderland Ridge in a northern direction to accommodate light and high-tech industries is proposed for this section of the new development corridor.

An extremely powerful development lattice is in the process of being established in the immediate vicinity which in future might in prominence challenge corridors such as the N1 and R21. The development lattice is being structured by:

<u>North-South Lattice Components:</u>

- Proposed PWV 9 – Highway
- R55 (Voortrekker Road) – Mobility Spine (Optimal mobility)
- Mona / Mimosa Road (Linkage) – Mobility Road

East –West Lattice Components:

- N14 (R28)– Highway
- M34 Ruimte Road – Mobility Spine
- Proposed K52 – Mobility Spine
- Lochner Road

The road network and road interchanges within the Region must support planning and is an important mechanism to unlock development potential. High intensity areas are located along major routes. Residential densification along the development corridors along highways, mobility spines, mobility roads, activity spines and activity streets are proposed at medium or high density.

In terms of the SDF the potential of the Region is specified as, inter alia, being the development of the PWV 9 as well as residential development in a westerly direction.

Weaknesses of the area are listed as being the insufficient provision of bulk infrastructure and the underlying soil conditions that dictate the intensity of development as well as residential typologies.

It is furthermore mentioned that the area has a relatively low residential density. Residential development in the area should be guided by the principles of the Tshwane Compaction and Densification Strategy which promotes the provision of appropriate higher density at appropriate locations. Densification is said not t be an end in itself but a means to achieve an overall efficient, integrated and sustainable metropolitan area.

From the relevant policy documents the following considerations are relevant in so far as land-use in the Centurion West area (Monavoni) is concerned:

- Potential exists in the western areas for the provision of residential facilities
- PWV 9 combined with the R55 has the potential to capture a vast amount of energy that can be transferred to the local area and promote the sustainability of employment opportunities;

- Acts and policies strongly enforce the concept of integrated land-use in order to foster sustainability by means of reducing travelling time, energy and costs.
- The spatial form should furthermore be founded on a development lattice on which densification and intensification of developments can take place in an integrated manner.

Within the Monavoni landholdings the past number of years has seen a systematic extension of the residential precincts form across the R 55 (Raslouw and Celtisdal) into the Monavoni area.

The process of overall land-use establishment in the Monavoni area currently seem to correctly provide for residential development in an east to west direction. As promoted within the local SDF intense land-use should be captured adjacent to the proposed PWV 9. As mentioned this should be attained and promoted by means of providing a parallel mobility spine which can facilitate access to these planes. The advantages of the location of the property adjacent to the N1 freeway and the R21.

In light of the fact that the construction of the PWV 9 will most probably commence by 2011 it would imply that real potential and energy associated with this potential is maximized the spatial form should currently promote the provision of intensified residential provision from the east.

Micro Development Context

From a micro contextual perspective Monavoni Extension 44 is located on the edge of a vast proposed residential development at an easily accessible intersection. The site is situated to the west of the intersection of the proposed K52 and Mona Road and the proposed PWV 9. The location can thus be considered to be prominent yet orientated towards the proposed type of land-use.

Factors in support of the above statement include, firstly, the fact that the future planning of the area shall imply an extensive increase in the residential opportunities in order to

ensure the feasibility of the envisaged BRT routes and community facilities in the area as well as employment opportunities in the node that is envisaged for the area. All current guidelines promote this interface of residential and commercial land-uses in close vicinity. Secondly, the proposed K52 is classified as a mobility spine with the capability of forming part of the public transportation network by means of the inclusion of the road in bus transport planning. An application for a school site has also been submitted to council, which location is east of the application site.

The desirability of the proposed development can be derived from the design principles that were applied during the compilation of the township layout plan:

- Controlled entrance to enable the development of walled in a security village;
- The location of the application site is in close proximity to planned social amenities such as schools;
- The close proximity of the application site in relation to the planned commercial node that will provide employment opportunities;
- The close proximity of the application site in relation to the planned BRT route and planned bus-top; and
- The planned provision of various housing typologies as a result of the various densities across the application site.

The inclusion of a site development plan and landscape development plan as pre-requisites to the approval of building plans enables the Municipality to see to it that a proper development, with consideration to the neighbouring developments, will take place.

Taking into account the contextual characteristics of the area and the high accessibility of the application site, the proposed township for which there is a need, could be regarded as desirable and strategically situated within a developing area.

The council has implemented a Densification Strategy within the Tshwane area. The principle of this is to obtain optimal concentrations of residential developments in order to

enable the provision of economic and social opportunities in an integrated, vibrant, high-intensity, mixed use as well as to make optimal use of infrastructure. The vast number of proposed residential developments in the area clearly indicates the need for the planning of needed social amenities.

Planning responsibilities of the involved Local Authority

The prerogative to plan development within its jurisdictional area has always constitutionally, in terms of the Development Facilitation Act, 1995, the Local Government Transitional Act, 1993 and recently the Municipal Systems act, 2000 vested in the local authority involved.

In order to ensure that the proposed developments comply with the standards and requirements of the involved local authority, the relevant officials were involved in the planning of the project from the start.

Monavoni and Western Farms Development Framework 2020 (November 2008)
Information supplied by M & T Development Town Planning Division

A development framework was drafted in terms of which areas were earmarked for urban expansion during the period 2008 to 2020. A Development Edge was also proposed in terms of this framework to provide a guideline for the type of land uses that can be allowed inside and outside the Development Edge.

The properties that form part of this application fall within the boundaries of the Development Edge. This area was further divided into a number of Land use Management zones. The aim of these zones is to promote the development of a specific land use character through the application of land use mix and density.

The proposed development must comply with all the relevant legislation and it must strive to comply with the development frameworks, policies and guidelines for the area. The finalized layout must also take cognizance of the applicable institutional framework.

Issues & Impact Identification – Institutional

Table 41: Issues and Impacts – Institutional

	Issue/ Impact	**Positive/ Negative/ Neutral ±**	**Mitigation Possibilities** **High ☻ Medium ☺ Low ◙** **Positive Impact - Not Necessary To Mitigate ☼**
35)	The proposed development will be in line with the international, national, provincial and local legislation, planning frameworks, guidelines, policies etc.	+	☼

6.2.5 Qualitative Environment

6.2.5.1 Visual Impact

The following visual assessment criteria have been used to determine the impact of the proposed Monavoni Extension 44 on the state of the environment – the significance is indicated by the respective colour coding for each of the impacts, being high, medium and low:

Table 42: Visual Impact Criteria

		IMPACT	
CRITERIA	**HIGH**	**MEDIUM**	**LOW**
Visibility	A prominent place with an almost tangible theme or ambience	A place with a loosely defined theme or ambience	A place having little or no ambience with which it can be associated
Visual quality	A very attractive setting with great variation and interest – no clutter	A setting with some visual and aesthetic merit	A setting with no or little aesthetic value
Compatibility with the surrounding landscape	Cannot accommodate proposed development without the development appearing totally out of place – not compatible with the existing theme	Can accommodate the proposed development without it looking completely out of place	The surrounding environment will ideally suit or match the proposed development
Character	The site or surrounding area has a definite character/ sense of place	The site or surrounding environment has some character	The site or surrounding environment exhibits little or no character/ sense of place
Visual Absorption Capacity	The ability of the landscape not to accept a proposed development because of a uniform texture, flat slope and limited vegetation cover	The ability of the landscape to less easily accept visually a particular type of development because of less diverse landform, vegetation and texture	The ability of the landscape to easily accept visually a particular type of development because of its diverse landform, vegetation and texture
View distance	If uninterrupted view distances to the site are > 5Km	If uninterrupted view distances to the site are < 5Km but > 1Km	If uninterrupted view distances to the site are > 500m and < 1000m
Critical Views	Views of the site seen by people from sensitive view sheds i.e. farms, nature	Some views of the site from sensitive view sheds	Limited or partial views of the site from sensitive view sheds

	areas, hiking trails etc.		
Scale	A landscape with horizontal and vertical elements in high contrast to human scale	A landscape with some horizontal and vertical elements in some contrast to human scale	Where vertical variation is limited and most elements are related to the human and horizontal scale

The site is regarded as homogeneous to the surrounding environment and the construction of a new township might cause a visual impact. However, as already mentioned in this report a global development framework was developed for the ±500 ha of land purchased by M & T Development. According to this framework Monavoni Extension 44 will be the sixth residential development in the Monavoni precinct and therefore the visual impact of the proposed development is not regarded as significant. The visual impact can however be mitigated to some extent by following certain guidelines that will give the proposed development an aesthetic value.

Some of the guidelines that are suggested:

- Rooftops should be designed to blend in with the natural colours of the surrounding environment instead of standing out and creating a high visual impact.
- The architecture of the proposed development should complement the architecture of the surrounding developments (i.e. proposed Monavoni X 43, 31 45 and 47).
- Existing trees should be retained at all costs in order to prevent the high visual impact of removed trees. The proposed development will also have an added aesthetical value if the trees are retained, which will in turn add to the market value of the development.
- Landscaping should be of a high standard. As many trees as possible should be planted at early stages of the development in order to ensure a mature look in the near future.

6.2.5.2 Sense of Place

The concept of "a Sense of Place" does not equate simply to the creation of picturesque landscapes or pretty buildings, but to recognize the importance of a sense of belonging. Embracing uniqueness as opposed to standardisation attains quality of place. In terms of the natural environment it requires the identification, a response to and the emphasis of the distinguishing features and characteristics of landscapes. Different natural landscapes suggest different responses. Accordingly, settlement design should respond to nature.

In terms of the human made environment, quality of place recognizes that there are points where elements of settlement structure, particularly the movement system, come together to create places of high accessibility and these places are recognized in that they become the focus of the public investment, aimed at making them attractive, user-friendly and comfortable to experience. The landscape is usually experienced in a sensory, psychological and sequential sense, in order to provide a feel and image of place ("genius loci").

A landscape is an integrated set of expressions, which responds to different influences. Each has its unique spirit of place, or "genius loci". Each landscape has a distinct character, which makes an impression in the mind, an image that endures long after the eye has moved to other settings.

If planned correctly the proposed development could enhance the genius loci of the broader area by establishing a residential township and open spaces. Sense of Place is the subjective feeling a person gets about a place, by experiencing the place, visually, physically, socially and emotionally. The "Sense of Place" of a property/ area within the boundaries of a city is one of the major contributors to the "Image of a City /City Image".

City Image consists of two main components, namely **place structure** and **sense of place.** Place structure refers to the arrangement of physical place making elements within a space, whereas sense place refers to the spirit of a place. It could be defined as follows:

- **Place Structure** refers to the arrangement of physical place making elements within a unique structure that can be easily legible and remembered.
- The **Sense of place** is the subjective meanings attached to a certain area by individuals or groups and is closely linked to its history, culture, activities, ambience and emotions the place creates.

The study area does not have a strong sense of place and the place structure is also not very strongly defined. The larger area with the Schurweberg in the background does however have a sense of place and it should be retained.

6.2.5.3 Noise Impact

The alignment of the proposed K52 traverses the study area and the alignment of the proposed PWV 9 along the western boundary of the study area could have a noise impact and must be taken into consideration during the planning and design of the proposed Monavoni X 44 development.

The construction phase could have a noise impact on the surrounding residents.

The following represent a summary of the mitigation measures to be implemented during the construction and operational phase to reduce the anticipated impact of noise pollution. ***Refer to Annexure S, EMP.***

Mitigation measures for the anticipated noise impact during the construction phase:

- The construction site yard, workshop, concrete batching plant and other noisy fixed facilities should be located well away from noise sensitive areas;
- All construction vehicles, plant and equipment are to be kept in good repair;
- Truck traffic should be routed away from noise sensitive areas where possible;

- Blasting Operations (if required) are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timing of explosions;
- Construction activities are to be contained to reasonable hours during the day and early evenings. Night-time activities near noise sensitive areas should not be allowed. No construction should be allowed on weekends form 14h00 on Saturday afternoons to 06h00 the following Monday morning;
- With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities;
- As construction workers operated in a very noisy environment, it must be ensured that their working conditions comply with the requirements of the Occupational Health and Safety Act (Act No 85 of 1993) and Gauteng Noise Control Regulations, 1999. Where necessary ear protection gear should be worn.

Mitigation measures for the anticipated noise impact during the operational phase of the proposed development

The following noise specific mitigation measures will need to be considered:

- The design, placement and orientation of the extractor fans for the ventilation of the buildings must take the noise impact aspect into consideration. Equipment with the best noise rating must be used. Roof mounted fans may further require attenuators and need to be screened form noise sensitive areas;
- High quality air-conditioning equipment should be installed. Equipment with the best noise rating should be used;
- Where required, high quality refrigeration compressors should be installed. Equipment with the best noise rating should be used. Exterior building installations should be acoustically encapsulated;
- All mechanical equipment is to be well maintained;

- The delivery times for trucks should be limited to the hours of between 07h00 and 20h00 on weekdays and between 08h00 and 14h00 on Saturdays (only if applicable)
- The noise levels must comply with the Gauteng Noise Control Regulations, 1999

6.2.5.4 Light Pollution

As mentioned above, the alignment of the proposed K52 traverses the study area and must be taken into consideration during the planning and design of the proposed development with regard to lighting.

Street and security lighting must be designed in order not to spread light into the eyes of oncoming traffic on the proposed K52 and PWV 9. Internal streets and security lighting should also be designed not to disturb residents at night. Light beams must face downwards and not higher than a 45 degree angle from the ground. ***Refer to Annexure S, EMP.***

6.2.5.5 Air Quality / Dust

Some dust pollution may occur during the construction phase if dry and windy conditions occur, but will only be temporary and will not occur during the operational phase. Dust suppression techniques such as sprinkling the construction site regularly with water and by putting up dust nets will mitigate this impact to an acceptable level. ***Refer to Annexure S, EMP.***

Issues & Impact Identification – Qualitative Environment

Table 43: Issues and Impacts – Qualitative Environment

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities High ☻ Medium ☺ Low ◙ Positive Impact - Not Necessary To Mitigate ☼
13)	If not planned correctly, roofs and parking areas could reflect the sun into the eyes of oncoming traffic and surrounding landowners - ***Please refer to Section 6.1.1.3***		
14)	If not planned and managed correctly the lights (interior and exterior) and the signage of the development could cause visual pollution - ***Please refer to Section- 6.1.1.3***		
36)	Construction works cause visual pollution during the construction phase	-	☺
37)	If not planned and managed correctly, the proposed development could have a negative impact on the "Sense of Place" of the study area and its surroundings.	-	☻
15)	If dry and windy conditions occur during the construction phase, dust pollution could become a problem - ***Please refer to Section 6.1.1.4***	-	☻
49)	If not planned correctly the proposed K52 and PWV 9 could have a noise impact on the residential component of the development	-	☺
50)	The construction phase of the development could have a noise impact on the surrounding	-	☺

	residents		

Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

36) Construction works cause visual pollution during the construction phase.

Table 44: Significance of Issue 36 (Visual Pollution during construction phase) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☺	**P/ C –**All equipment and materials should be stored in a designated area indicated by the ECO. **C** – All areas must be kept neat and tidy and no waste should also be stored in the designated areas and removed on a weekly basis	**M –** To be included in the EMP **M –** To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

37) The study area and its surroundings do not have a unique "Sense of Place", the Schurweberg in the background however does and the design and layout of the development should take this into consideration. The architectural theme of the proposed development should blend in and compliment the surrounding environment fitting into the area.

Table 45: Significance of Issue 37 (If not planned and managed correctly, the proposed development could have a negative impact on the "Sense of Place" of the study area and its surroundings) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P** - Building material and finishes should preferably consist of raw materials and earthy colours should be used; **P** –The Schurweberg in the background should be taken into consideration during the design phase of the project. **P/C/O - If** planned and managed correctly, the proposed development will enhance the "Sense of Place" and value of the study area and its surroundings.	**E –** To be included in the EMP

Result: *The issue is eliminated by implementing the mitigation measures and can also be turned into a positive impact the significance of this positive impact still need be determined confirmed/assessed in the significance rating table.*

Table 46: Significance of Issue49 (If not planned and managed correctly, the proposed K52 and PWV 9 could have a noise impact on the residential component of the development) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P** – The alignment of the K52 must be taken into consideration during the design of the proposed development.	**E –** To be included in the EMP

Result: *The issue is eliminated by implementing the mitigation measures and can also be turned into a positive impact the significance of this positive impact still need be determined confirmed/assessed in the significance rating table.*

Table 47: Significance of Issue 50 (The construction and operational phase of the proposed development could have a noise impact on the surrounding residents) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not**	Mitigation Already achieved √ Must be implemented during planning phase, construction	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M**

Necessary To Mitigate ☼	and/ or operational phase **P/ C / O**	High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**C** - - The construction site yard, workshop, concrete batching plant and other noisy fixed facilities should be located well away from noise sensitive areas; - All construction vehicles, plant and equipment are to be kept in good repair; - Truck traffic should be routed away from noise sensitive areas where possible; Blasting Operations (if required) are to be strictly controlled with regard to the size of explosive charge in order to minimise noise and air blast, and timing of explosions; - Construction activities are to be contained to reasonable hours during the day and early evenings. Night-time activities near noise sensitive areas should not be allowed. No construction should be allowed on weekends form 14h00 on Saturday afternoons to 06h00 the following Monday morning; - With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the contractor should liaise with local residents on how best to minimise impact, and the local population should be kept informed of the nature and duration of intended activities; - As construction workers operated in a very noisy environment, it must be ensured that their working conditions comply with the requirements of the	**M –** To be included in the EMP

	Occupational Health and Safety Act (Act No 85 of 1993) and Gauteng Noise Control Regulations, 1999. Where necessary ear protection gear should be worn. **O-** - The design, placement and orientation of the extractor fans for the ventilation of the buildings must take the noise impact aspect into consideration. Equipment with the best noise rating must be used. Roof mounted fans may further require attenuators and need to be screened form noise sensitive areas; - High quality air-conditioning equipment should be installed. Equipment with the best noise rating should be used; - Where required, high quality refrigeration compressors should be installed. Equipment with the best noise rating should be used. Exterior building installations should be acoustically encapsulated; - All mechanical equipment is to be well maintained; - The delivery times for trucks should be limited to the hours of between 07h00 and 20h00 on weekdays and between 08h00 and 14h00 on Saturdays (only if applicable); - The noise levels must comply with the Gauteng Noise Control Regulations, 1999	**M –** To be included in the EMP

Result: *The issue is eliminated by implementing the mitigation measures and can also be turned into a positive impact the significance of this positive impact still need be determined confirmed/assessed in the significance rating table.*

6.2.6 Agricultural Potential

The GAPA (Gauteng Agricultural Potential Atlas) indicates that the study area has a **high agricultural potential *(refer to Figure 8, Agricultural Potential Map)*.**

Current land use is not restricted to one specific use. Topsoil has been removed from large areas. Very few, if any of the surrounding landowners, use their properties for small-scale or other farming activities. It is clear that none of the surrounding landowners, at this stage or in the recent past have had any intensions of bone fide intensive farming activities on their properties.

The application site is situated within an area underlain by dolomitic conditions, and extensive irrigation of such soils is not supported. The Geotechnical stability investigations and Comments from the CGS, this proposed site is suitable for residential and commercial development.

Furthermore the study area is situated within the provincial urban edge ***(refer to Figure 4)*** and is **not** situated within any of the 7 agricultural hubs identified for agricultural use in Gauteng ***(refer to Figure 6).***

Surrounding developments and activities

The area is bordered by a number of housing developments or existing small holdings to the south and west. To the north the area is bordered by a landfill site as well as an informal settlement. There is no indication of any agricultural activities in the area.

Issues & Impact Identification – Agricultural Potential

Table 48: Issues and Impacts – Agricultural Potential

	Issue/ Impact	Positive/ Negative/	Mitigation Possibilities High ☻ Medium ☺

		Neutral ±	**Low ◙** **Positive Impact - Not Necessary To Mitigate ☼**
38)	Some agricultural land will be lost.	-	◙

38) Some agricultural land will be lost.

Some agricultural land will be lost as a result of the development. However, very few if any of the surrounding landowners, use their properties for small-scale or other farming activities. In fact the area is characterised by typical urban intrusions such as group housing developments etc. In addition the study area falls within the provincial urban edge and does not fall with an Agricultural Hub identified for agricultural use in Gauteng.

Table 49: Significance of Issue 38 (Loss of Agricultural Land) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during **P**lanning phase, **C**onstruction and/ or **O**perational phase **P/ C / O** Mitigation	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
Low ◙	This issue cannot be mitigated.	**NP** - Not possible to mitigate, but not regarded as a fatal flaw

Result: *The issue cannot be mitigated but is not regarded as a fatal flaw. It is however still necessary to assess in the significance rating table.*

6.2.7 Services

CES compiled a Master Plan for Services in the City of Tshwane. The proposed Monavoni X 44 development was taken into consideration for the Master Plan compiled in June 2004/2005. ***Refer to Annexure O, Services Master Plan.***

6.2.7.a Water

Water Distribution System

Distribution Zone

According to the master planning the proposed Monavoni development area should be accommodated in the Mnandi reservoir and the future Mooiplaats reservoir zones ***(refer to Annexure O).***

The involved engineers stated that the proposed Monavoni development is situated outside the water priority area and the developer will have to install/construct certain link services and external bulk services and make pro-rata contributions for services provided by other developers.

Water Demand

According to the original water analysis for the master plan the total annual average daily Demand (AADD) for the development is 6 050 kl/d.

Present situation

The proposed Monavoni development falls within the existing Mnandi reservoir and future Mooiplaats reservoir zones. CES stated that the proposed development can be supplied by the Mnandi reservoir as an interim solution until the Mooiplaats reservoir is constructed. (It is assumed that the temporary 450mm/400mm Ø supply pipe from the Pretoriusrand reservoir site to Mnandi reservoir is operational).

Some upgradings are required to accommodate the development and to comply with the criteria as set out in the master plan ***(refer to Section 1.3, Annexure O).***

Master Plan

According to CES adjustments to the proposed master plan items of July 2004 are required to accommodate the proposed development ***(refer to Section 1.4, Annexure O).***

6.2.7.b Sewerage

Drainage area

The proposed development was taken into consideration for the June 2005 Master Plan.
CES stated that the proposed development falls within the existing Rietspruit drainage area as indicated on ***Figure 2, Annexure O.***

According to CES the proposed development falls outside the Tshwane sewer priority area and the developer will have to install certain link services and make pro-rata contributions for services provided by other developers.

Sewer flow

According to CES the estimated future PDDWF calculated in the master planning study for the proposed development was 3620 kl/d and that the PDDWF for the proposed Monavoni development was calculated at 6726 kl/d for this re-analysis. ***Refer to Section 1.2, Annexure O*** for the anticipated flows for the sub-drainage system which drains towards the proposed development.

Sewer Master Plan

Adjustments to the proposed master plan items are required to accommodate the proposed Monavoni X 44 development and other developments. CES stated that the proposed development will have a pro rata effect on the required items downstream of its connections ***(refer to Section 1.3, Annexure O).***

CES stated that the Sunderland Ridge WCW is already operating beyond capacity and needs to be upgraded to accommodate the proposed Monavoni development.

Accommodation of the development in the present sewer system

In order to accommodate the proposed development in the present system the implementation of some master plan items are required ***(refer to Section 1.4, Annexure O).***

The Sunderland Ridge WCW is already operating beyond capacity and needs to be upgraded to accommodate this and future developments. According to information a phased upgrading is in progress.

6.2.7.c Stormwater Management

A Stormwater Management Plan for the proposed development will be compiled by suitably qualified engineers. The stormwater systems of the development will be designed and installed to the standards and specifications of the relevant authorities, ensuring compliance with the specific requirements related to developments in dolomitic areas.

All stormwater to be discharged directly into the sewer system must comply with the requirements of the City of Tshwane and DWA.

The Stormwater Management Plan will be supplied to City of Tshwane and DWA for approval.

6.2.7.d Solid Waste

(Refer to the Annexure P, Waste Management Plan)

Local Authorities manage solid waste collection through private contractors. The collected solid waste is then transported to landfills via transfer stations which is managed and maintained by the government through private contractors.

The following norms and statutory requirements are utilised where applicable:

- National Solid Waste Management Plan (NSWMP) – 1994
- Government Solid Waste Management Strategy – to minimize solid waste by recycling and composting.

Waste storage and processing systems

A solid waste compactor is envisaged. The waste generated will be temporary stored in different operational waste containers or bins. Waste will be dumped into the static compacter to be provided. The waste will be collected from the waste generating sites and taken directly to the compacter. The compacted waste slugs will be stacked in a container for proposed weekly removal or if required removed daily per arrangement in smaller quantities.

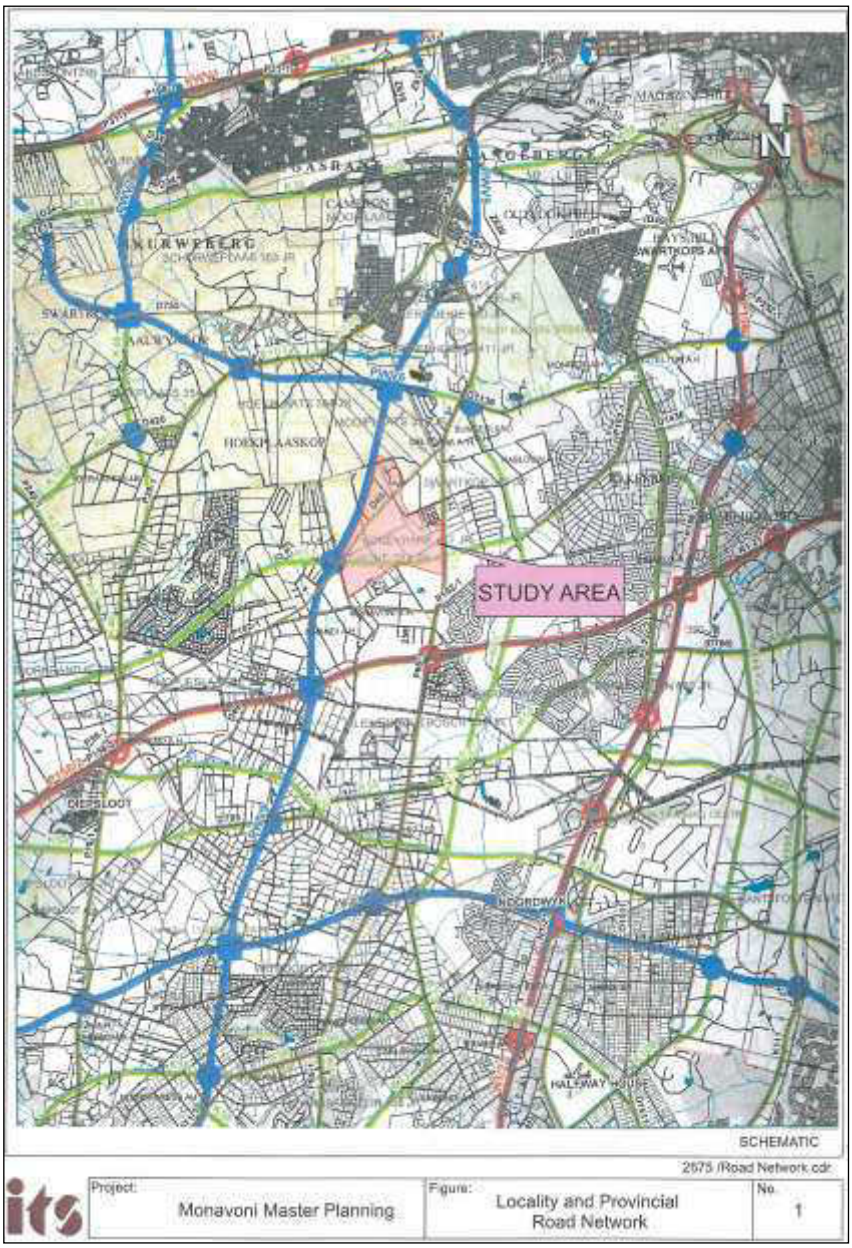


FIGURE 17 – STUDY AREA: MONAVONI MASTER PLAN

6.2.7.e Electricity

The land on which this township is proposed lies within the licensed electricity supply area of the City of Tshwane. The City of Tshwane will in future be responsible for the network modifications that will be required to supply it from the future Monavoni substation.

6.2.7.f Traffic

Refer to ***Annexure Q*** for the **Monavoni Master Plan** conducted by ITS Engineers (Pty) Ltd in August 2009.

Objectives

The objective of the study was to determine the impact of the additional traffic that will be generated by the larger Manavoni development proposed by M & T Development on the adjacent (existing) road network ***(refer to Figure 17, Master Plan Study Area)***. The expected trip generation, distribution and assignment, as well as the required road upgrades to accommodate the proposed development trips, are discussed in the report. The traffic generated by the latent rights in the vicinity of the proposed developments was also taken into consideration for the analysis.

Trip Generation

According to ITS Engineers the larger Monavoni development will generate 9 292 trips during the weekday AM and PM peak hours if the adjustment factor of 0.8 is applied to indicate that 20% of trips will use public transport ***(refer to Annexure Q, Appendix A, Table 1a, 1b and 1c).***

Expected Trip Distribution and Trip Assignment

The additional vehicle trips that will be generated by the proposed development were distributed to the adjacent road network. ITS Engineers based the trip distribution for the study area on the examination of the existing traffic flow patterns in the area, surveys conducted in the previous studies, as well as local knowledge of the area. ***Refer to Annexure Q, Figure 3a, 3b, 3c, 3d and 3e for the expected trip distribution.***

According to ITS Traffic Engineers there are five alternatives in terms of trip distribution and the aim was to check the most suitable trip distribution that will resolve the capacity especially on K71. The following alternatives were investigated:

- Alternative 1: All traffic towards south will use K71
- Alternative 2: 40% of traffic towards south to use PWV9
- Alternative 3: 40% of traffic towards south to use PWV9 until at N14, then 25% will join N14 to join K71 south (PWV9 will be constructed until N14)
- Alternative4: 20% of traffic towards south to use R511 via Ruimte (P102-1)
- Alternative 5: 25% of traffic towards south to use PWV9 until at N14, then 10% will join N14 to join K71 south (PWV 9 will be constructed until N14), also 15% towards south will use D49.

ITS Engineers used Alternative 5 for the purpose of this study as it will reduce chances of adding more traffic on K71 because K71 will not have spare capacity by the time most of the developments will be developed.

Road Upgrades:

The following road upgrades are required to accommodate the larger Monavoni development:

Table 50: Monavoni Masterplan – external road upgrades

Nr.	Route	Section	Upgrade
1	K71	North of Wierda (K103)	Additional through lanes for both directions
2	PWV9	K52 to N14	Construction of 1 lane per direction, Bridge and Ramps to the east
3	K52	K71 to Ruimte (P102-1)	1 lane per direction, new road
4	D49/Magalies	Intersection	1 lane per direction, reconstruction
5	Theron	Ruimte to Von Willich	1 lane per direction, reconstruction
6	K52	K71 to PWV9	1 lane per direction, new road

ITS Engineers stated that the proposed road upgrades will not take place at once, but will be phased with the different extensions of the proposed townships. In addition, it is

foreseen that the proposed upgrades are used as a planning guideline and that as individual townships are established, a more detailed traffic impact study be carried out to determine the detail of the upgrades.

Access

Access to the property will be obtained via a public road that will run through the proposed township Monavoni Extension 43. This road in turn connects to Mona Road. Erven 3 and 4 will obtain access via a proposed bridge or tunnel over the proposed provincial road K52. This will be finalised at a later stage. Mona road connects to the proposed Road K52 and the existing and planned road network of the Monavoni area**.** A line-of-no-access has been indicated along Mona Road.

Conclusion and recommendations by ITS Engineers

- The Monavoni Master Plan should not be regarded as a detailed traffic impact study but as a guideline to determine macro level road upgrades that will be required to accommodate the development
- The road network where the proposed Monavoni developments will be located will require substantial upgrades to accommodate the extent of traffic volumes.
- The upgrades proposed will provide adequate regional capacity that will be able to accommodate the traffic generated by the development.
- ITS Engineers recommended that the proposed Monavoni developments can proceed from a macro planning point of view.

Issues & Impact Identification – Services

Table 51: Issues and Impacts – Services

	Issue/ Impact	Positive/ Negative/ Neutral ±	Mitigation Possibilities

			High ☻ Medium ☺ Low ◙ **Positive Impact - Not Necessary To Mitigate ☼**
39)	**Stormwater** The proposed development will lead to increased hard surfaces and the quantity and the speed of the storm water across the study area and into the water bodies and adjacent properties will increase.	-	☻
40)	Surface water flows will be altered during the construction phase.	-	☻
41)	The use of insufficient drainage systems during the construction phase (i.e. sub-surface drainage systems & no mechanisms to break the speed of the surface water)	-	☻
42)	Some upgrading to the Services Master Plan (Sewer and Water) compiled by CES are required in order to accommodate the proposed development	+	☼
43)	**Electricity** The availability of electricity for the development to be confirmed	-	☺
44)	**Traffic** The proposed development will lead to the increase in traffic on local and provincial roads–	-	☺
45)	The proposed development will contribute largely to the upgrading of local and provincial roads	+	☼
46)	**Waste Management**	-	☺

	The construction and operational phases of the proposed development will create large quantities of builder's and domestic waste to be accommodated by local legal landfill sites.		
47)	The involved local authority will be responsible for the removal of the domestic waste – increased rates and	+	☼
33)	**General** Temporary disruption of services due to relocation and installation of services	-	☻

Discussion of issues identified, possible mitigation measures and significance of issue after mitigation

39) The proposed development will lead to increased hard surfaces and the quantity and the speed of the storm water across the study area and into the water bodies and adjacent properties will increase.

Should contaminated storm water run-off from roads not be managed, it could lead to surface water and ground water pollution. Bio-swale and bio-filters could be installed to minimize the risk of pollutants entering the natural drainage system of the area.

This will also raise flood levels of water bodies in the area, if storm water is not managed correctly.

Table 52: Significance of Issue 39 (The proposed development will lead to increased hard surfaces and the quantity and the speed of the storm water across the study area and into the water bodies and adjacent properties will increase) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation Already achieved √	Significance of Issue after mitigation

High ☻ Medium ☺ Low ◙ **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P** - A comprehensive storm water management plan indicating the management of all surface runoff generated as a result of the development (during both the construction and operational phases) prior to entering any natural drainage system or wetland, must be submitted and approved by the local authority and DWA and submitted to GDARD prior to construction activities commencing. **P/ C -** Surface storm water generated as a result of the development must not be channeled directly into any natural drainage system or wetland. **P** - The storm water management plan should be designed in a way that aims to ensure that post development runoff does not exceed predevelopment values in: •Peak discharge for any given	**L –** To be included in the EMP

	storm; •Total volume of runoff for any given storm; •Frequency of runoff; and •Pollutant and debris concentrations reaching water courses. **P/ C** - Bio-swale and bio-filters could be installed to minimize the risk of pollutants entering the natural drainage system of the area.	

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

40) Due to the excavations that will take place (there will be trenches and topsoil as well as subsoil mounds in and around the study area) the topography of the study area will temporarily be altered. This will however only be a short-term impact and if the levels are restored to normal (the surface drainage patterns from the new levels should not differ too much from the surface water drainage of the original levels) once the construction phase is completed.

Table 53: Significance of Issue 40 (Surface water flows will be altered during the construction phase) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H**

	P/ C / O	Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**P/C –** Construction activities should preferably take place during the winter months. **P/C** - If it is not possible for construction activities to take place during the winter months, construction activities should take place in phases in order to prevent large exposed areas that will cause an increase in the speed of surface water. **P** - When storm water planning is done, every attempt possible should be made to keep the post construction and pre-construction flows similar.	**M –** To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

41) The use of insufficient drainage systems including sub-surface drainage systems and no mechanisms to break the speed of surface water during the construction phase.

Table 54: Significance of Issue 41 (The use of insufficient drainage systems during the construction phase (i.e. sub-surface drainage systems & no mechanisms to break the speed of the surface water) After Mitigation/ Addressing of the Issue

Mitigation Possibilities	Mitigation Already achieved √	Significance of Issue after mitigation

High ☻ Medium ☺ Low ◙ **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**
High ☻	**C** – Implement temporary storm water management measures that will help to reduce the speed of surface water. These measures will also assist with the prevention of water pollution, erosion and siltation. **P/C** - In order to prevent large exposed areas, it is recommended that the construction of the development be done in phases. Each phase should be rehabilitated immediately after the construction for that phase has been completed. The rehabilitated areas should be maintained by the appointed rehabilitation contractor until a vegetative coverage of at least 75% has been achieved. **C** - No excavated materials should be dumped in or near drainage channels.	**L –** To be included in the EMP

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

46) During the construction and operational phases waste would be generated on site. The waste may consist of the following waste streams, namely:

- Liquid waste from vehicles;
- Solid domestic waste; and
- Solid construction waste.

Disposal of some of the above waste streams may lead to soil, water and aesthetic pollution of the site. The soil and water pollution should be localised with little impact on the surrounding environment. Waste disposal on site may stimulate the surrounding population to also dispose domestic waste on the site. This may lead to an uncontrolled situation that would be aesthetically unacceptable to future occupants and costly to rehabilitate.

The disposal of large quantities of waste during both the construction an operational phases would place a burden on landfill sites in the area to accommodate the additional volumes. Although this waste is inert in most cases, it may be of significant proportions and will contribute to the saturation of the formal landfill sites in the area.

Table 65: Significance of Issue 46 (The construction and operational phases of the proposed development will create large quantities of builder's and domestic waste and liquids) After Mitigation/ Addressing of the Issue

Mitigation Possibilities **High ☻ Medium ☺ Low ◙** **Positive Impact/ Neutral - Not Necessary To Mitigate ☼**	Mitigation Already achieved √ Must be implemented during planning phase, construction and/ or operational phase **P/ C / O**	Significance of Issue after mitigation Low/ eliminated **L / E** Medium **M** High **H** Not possible to mitigate, but not regarded as a fatal flaw **NP**

Medium ☺	**C** – Prevent unhygienic usage on site and pollution of the natural assets. Develop a central waste temporary holding site to be used during construction. (Near the access entrance). This site should comply with the following: - Skips for the containment and disposal of waste that could cause soil and water pollution, i.e. paint, lubricants, etc.; - Small lightweight waste items should be contained in skips with lids to prevent wind littering; - Bunded areas for containment and holding of dry building waste. - THESE AREAS SHALL BE PREDETERMINED AND LOCATED IN AREAS THAT IS ALREADY DISTURBED. THESE AREAS SHALL NOT BE IN CLOSE PROXIMITY OF DRAINAGE CHANNELS. **C** - Workers will only be allowed to use temporary chemical	**L** – To be included in the EMP

	toilets on the site. CHEMICAL TOILETS SHALL NOT BE IN CLOSE PROXIMITY OF DRAINAGE CHANNELS. **C** - No French drain systems may be installed. **C** - No bins containing organic solvents such as paints and thinners shall be cleaned on site, unless containers for liquid waste disposal are placed for this purpose on site; All waste must be removed to a recognized waste disposal site on a weekly basis. No waste materials may be disposed of on or adjacent to the site. The storage of solid waste on site, until such time that it may be disposed of, must be in the manner acceptable to the Local Authority **C** - Keep records of waste reuse, recycling and disposal for future reference. Provide information to ECO. (Environmental Control Officer)	

Result: *Although issue can be mitigated, the significance of the impact should still be determined / confirmed assessed in the Significance Rating Table*

6.2.8 Public Participation

Refer to Annexure R

Public participation is an important aspect of the EIA Process. The principles of the National Environmental Management Act govern many aspects of environmental impact assessments, including public participation. These include provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment and ensuring the participation of previously disadvantaged people, women and youth.

Effective public involvement is an essential component of many decision-making structures, and effective community involvement is the only way in which the power given to communities can be used efficiently. The public participation process is designed to provide sufficient and accessible information to interested and affected parties (I&AP's) in an objective manner to assist them to:

- Raise issues of concern and suggestions for enhanced benefits.
- Verify that their issues have been captured.
- Verify that their issues have been considered by the technical investigations.

In terms of Government Notice no. R385 published in the Government Gazette No. 28753 of 21 April 2006 of the National Environment Management Act, 1998 (Act No. 107 of 1998) stakeholders (I&APs) were notified of the Environmental Evaluation Process (during the Scoping Phase) by a public notice in the form of flyers **(these flyers were delivered by hand, faxed or e-mailed to adjacent landowners/ occupiers, the owners/ occupiers of land within 100 metres of the boundary of the site, the municipal ward councillor, the City of Tshwane Municipality, other organs of state and Resident's Associations, (refer to Annexure *R(i)*) for a copy of the flyers, and proof of delivery / faxing / e-mail)** and an advertisement in the local newspaper, Beeld on 21 April 2009 ***(Refer to Annexure R(ii) for proof of advertisement)*** and by a site notice that was erected at a prominent point on the study area ***(Refer to Annexure R(iii) for the site notice).***

Five parties registered as I&APs ***(refer to Annexure R(iv)).***

The following comments and objections were received from I &APs:

- **Brenda Sellak *(refer to Annexure R(v) for correspondence)***

1. Ms. Sellak objects to the proposed development until such time that a full impact assessment be done on the effect of the proposed development on the ground water supply as well as proposed alternatives, should the study prove that the groundwater supply will not support the proposed development.

   Response:

   The proposed Monavoni X 44 development will not make use of boreholes for water supply and will therefore not have an impact on groundwater supply in the area.

2. In addition, she objects to the proposed development until such time that more details are available on areas such as:

   - Sewerage: how and where will the sewerage be managed?

     Response:

     The proposed Monavoni X 44 development was taken into consideration for the Services Master Plan compiled by CES and some upgradings are required. ***Refer to Section 1.3, Annexure O.***

   - Conditions during building – such as noise levels, dust blankets, blasting / compacting. How will the proposed developer address her concerns regarding these issues?

     Response:

     Mitigation measures to be included in the EMP ***(refer to Annexure S).***

   - Security: what security measures will be put in place during construction and building to prevent an increase in crime to the area?

     Response:

     Mitigation measures to be included in the EMP ***(refer to Annexure S).***

- Type of development: what target market are these developments aimed at and will this have a negative impact on the area and/or land values?

  Response:

  The proposed development will be aimed at the middle income group and should have a positive impact on surrounding land values.

The Draft Scoping Report was available for review by I&APs for a period of 30 days and comments were received City of Tshwane and DWA.

- **Comments on Draft Scoping Report received from City of Tshwane Agriculture and Environmental Management Department, Environmental Management Division, Open Space Management Section *(refer to Annexure R(vi))***

  The Department supports the proposed development subject to the following recommendations:

  a) Details regarding the Land-use for "Special" shall be discussed in the EIA report. The department will not support intensive industrial land-uses due to the Hennopsvallei Conservancy adjacent to the site and due to the Sunderland Ridge Industrial area located in close proximity of the study area.

     Response:

     Only light industrial land uses will be included in the proposed development. Refer to ***Section 6.2.3.1*** *for details on the proposed land uses.*

  b) A detailed Geotechnical Report and Dolomite Stability Assessment for the proposed development shall be included within the EIA report. The Report shall include a land-use specific map for Monavoni X 44 in regards to the Geotechnical Stability which will indicate all the Geotechnical zones and allowed land-uses for each zone.

     Response:

     Refer to ***Annexure I*** *for the Dolomite Stability Report compiled by Relly, Milner and Shedden Consulting Earth Scientists*.

c) All conditions in regards to the Monavoni X44 Development, within the letter of Council for Geosciences dated 12 November 2009, page 4&5 shall be included within the final EMP as part of the EIA Report.

Response:

All the conditions had been included in the EMP ***(refer to Annexure S).***

d) A site specific Fauna and Flora Assessment for Monavoni X 44 shall be included within the EIA Report due to the application site been affected by GDARD Irreplaceable Sites. The Report shall include a map which will include the vegetation zones identified on site. Further the Report shall include a letter from GDARD Biodiversity, indicating possible sensitive Fauna and Flora species on the site. The Report shall address all issues and species as identified by GDARD Biodiversity.

Response:

Refer to ***Annexure K*** *for the Fauna and Flora Report compiled by Galago Environmental and* ***Annexure L*** *for the Biodiversity Letter from GDARD.*

e) Due to the Monavoni Development Framework not been approved, the layout within the EIA Report shall uphold and incorporate all sensitive features on site, including the Primary Grassland and Rocky outcrop. These areas shall be included within the development as Open Space. The layout should also be sensitively designed to incorporate as much as possible, the existing indigenous vegetation, clumps and trees on site. A conceptual layout indicating building positions, internal streets, vegetation to be retained and proposed open spaces shall be included in the EIA Report.

Response:

The Monavoni Development Framework had subsequently been approved by the CoT Open Space Management Section ***(refer to Annexure C).***

f) Possible negative Noise pollution from the future K52 road proposed to traverse the application site should be discussed within the EIA Report. Possible mitigation measures and design recommendations for especially the Residential

component of the proposed township shall be discussed and included within the EIA.

Response:

Refer to ***Section 6.2.5.3*** *and* ***EMP, Annexure S.***

g) A Traffic Impact Study for the proposed Monavoni X 44 development must be included within the EIA Report. This Report should aim to address expected traffic volumes and recommendations on road upgrades within the direct vicinity to accommodate the proposed development.

Response:

Refer to ***Section 6.2.7.f*** *and* ***Annexure Q, Traffic Master Plan****.*

h) Comments from Hennopsvallei Conservancy must be included in the final EIA Report. Any issues identified by the Conservancy shall be addressed and included. Proof of notification to the Hennopsvallei Conservancy shall be included within the EIA Report.

Response:

The Draft EIA Report will be submitted to the Hennopsvallei Conservancy for comments.

i) A Stormwater Management Plan must be included within the EIA Report. The plan should aim to prevent pollution, erosion and siltation during both the construction and operational phases. The increase in speed, quantity and quality of surface stormwater should also be addressed.

Response:

Refer to ***Section 6.2.7.c and EMP, Annexure S****. Bokamoso will recommend that the submission and approval of a Stormwater Management Plan to DWA and CoT be included as a condition in the authorisation (if granted).*

j) A Rehabilitation Plan should be implemented after construction and should aim to prevent erosion and aid in the return of natural, endemic and indigenous vegetation cover to at least 80% of the rehabilitated area. The proposed

rehabilitation plan should be discussed as part of the EMP included within the EIA Report.

Response:

Refer to ***EMP, Annexure S.***

k) An Environmental Management plan should be included within the final EIA Report. The EMP should address impacts and mitigation measures for the pre-construction, construction and post-construction activities. All issues and recommendations as indicated above should be included in the final and approved EMP. An Environmental Control Officer and contact details should also be included within the EMP.

Response:

Refer to ***EMP, Annexure S.***

- **Comments on Draft Scoping Report from DWA *(refer to Annexure R(vii))***

a) All municipal by laws must be adhered to.

Response:

Included in the ***EMP, refer to Annexure S.***

b) Provision should be made for a stormwater system. Stormwater polluted by refuse, sewage and other surface pollution should be kept from coming into contact with public streams / clean water systems.

Response:

Refer to ***Section 6.2.7.c and EMP, Annexure S***

c) The proposed development must comply with all Sections of the National Water Services Act, 1997 (Act 107 of 1997).

Response:

Included in the ***EMP, Refer to Annexure S***

d) DWA requires a letter from the municipality stating that there is capacity in the sewage works to accommodate effluent from the development. The development is not recommended until such capacity is confirmed.

Response:

Will be supplied to DWA when available.

e) Stockpiling of any material is not allowed within 100m from a watercourse.

Response:

Included in the ***EMP, Refer to Annexure S***

f) All waste generated on site must be managed and disposed of at permitted/approved dumping site as stipulated in section 20 of the Environmental Conservation Act, 1989 (Act 73 of 1998).

Response:

Refer to ***Section 6.2.7.d, EMP (Annexure S)*** *and* ***Waste Management Plan (Annexure P)***

g) The DWA must be notified of any deviations from the conditions and commitments.

Response:

Included in the ***EMP, Refer to Annexure S***

Registered I & APs were notified of the EIA phase of the development. The Draft EIA Report will be available for review for a period of 40 days ***(refer to Annexure R(viii)).***

Comments received on the draft Report will be addressed in the Final EIA Report.

7. SIGNIFICANCE ASSESSMENT

7.1 Description of Significance Assessment Methodology

The significance of Environmental Impacts was assessed in accordance with the following method:

Significance is the product of probability and severity. Probability describes the likelihood of the impact actually occurring, and is rated as follows:

- Improbable - Low possibility of impact to occur either because of design or historic experience.
  Rating = 2
- Probable - Distinct possibility that impact will occur.
  Rating = 3
- Highly probable - Most likely that impact will occur.
  Rating = 4
- Definite - Impact will occur, in the case of adverse impacts regardless of any prevention measures.
  Rating = 5

The ***severity factor*** is calculated from the factors given to "intensity" and "duration". Intensity and duration factors are awarded to each impact, as described below.

The ***Intensity factor*** is awarded to each impact according to the following method:

- Low intensity - natural and man made functions not affected – Factor 1

- ❑ Medium intensity - environment affected but natural and man made functions and processes continue - Factor 2

- ❑ High intensity - environment affected to the extent that natural or man made functions are altered to the extent that it will temporarily or permanently cease or become disfunctional - Factor 4

Duration is assessed and a factor awarded in accordance with the following:

- ❑ Short term - <1 to 5 years - Factor 2

- ❑ Medium term - 5 to 15 years - Factor 3

- ❑ Long term - impact will only cease after the operational life of the activity, either because of natural process or by human intervention - factor 4.

- ❑ Permanent - mitigation, either by natural process or by human intervention, will not occur in such a way or in such a time span that the impact can be considered transient - Factor 4.

The ***severity rating*** is obtained from calculating a severity factor, and comparing the severity factor to the rating in the table below. For example:

The Severity factor = Intensity factor X Duration factor

= 2 x 3

= 6

A ***Severity factor*** of six (6) equals a Severity Rating of Medium severity (Rating 3) as per table below:

TABLE 56: SEVERITY RATINGS

RATING	FACTOR
Low Severity (Rating 2)	Calculated values 2 to 4
Medium Severity (Rating 3)	Calculated values 5 to 8
High Severity (Rating 4)	Calculated values 9 to 12
Very High severity (Rating 5)	Calculated values 13 to 16
Severity factors below 3 indicate no impact	

A Significance Rating is calculated by multiplying the Severity Rating with the Probability Rating.

The ***significance rating*** should influence the development project as described below:

- Low significance (calculated Significance Rating 4 to 6)
  - Positive impact and negative impacts of low significance should have no influence on the proposed development project.

- Medium significance (calculated Significance Rating >6 to 15)
  - Positive impact:
    Should weigh towards a decision to continue
  - Negative impact:
    Should be mitigated to a level where the impact would be of medium significance before project

can be approved.

- ❑ High significance (calculated Significance Rating 16 and more)
  - Positive impact:
    Should weigh towards a decision to continue, should be enhanced in final design.
  - Negative impact:
    Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to at least medium significance rating.

7.2 Significance Assessment of Anticipated Impacts

Impacts indicated under each section of the environment were each assessed according to the above methodology. ***Table 68*** below contains the results of the significance assessment.

TABLE 57: RESULT OF SIGNIFICANCE ASSESSMENT OF IMPACTS IDENTIFIED TO BE ASSOCIATED WITH THE PROPOSED MONAVONI X 44 DEVELOPMENT (AFTER MITIGATION)

Impact	Probability Rating	Severity Rating		Severity Factor	Severity Rating	Significance Rating
		Intensity	Duration			
CONSTRUCTION PHASE						
Beneficial Impacts						
18. The eradication of weeds and exotic invaders.	5	4	3	12	4	**20 High**
11. Due to the topography the development will be visible from view sheds in the flatter areas around the study area. It will also be visible from the proposed PWV9 adjacent to the site and K52 which traverses the site.	4	2	4	8	3	12 Medium
27. Creation of temporary Job	5	4	2	8	3	15 Medium

opportunities.						
Adverse Impacts						
1. Restriction on land use types due to geology.	5	4	4	16	5	**25 High**
2. Risk for formation of sinkholes and dolines if precautionary measures for construction on dolomite are not followed and if an effective storm water management plan is not implemented.	4	4	4	16	5	**20 High**
3. Stability of structures if foundation requirements from geotechnical engineer and precautionary measures for construction on dolomite are not followed.	3	4	4	16	5	15 Medium
4. Excavation problems are likely where dolomite pinnacles are present close to surface and some blasting may be required.	3	4	4	16	5	15 Medium
5. Erosion may be caused by the construction activities on site.	3	4	2	8	3	9 Medium
6. Incorrect topsoil stockpiling may cause a loss of topsoil or pollution and stockpile areas for construction materials may cause soil and visual pollution.	4	2	4	8	3	12 Medium
7 & 9 Siltation, erosion and ground water pollution could occur if a stormwater management plan is not implemented.	4	2	4	8	3	12 Medium
10. Erosion, surface water pollution and siltation problems due to removal of vegetation coverage and increased hard surfaces.	4	2	4	8	3	12 Medium
11. Due to the topography the development will be visible from view sheds in the flatter areas around the study area. It will also be visible from	4	2	4	8	3	12 Medium

the proposed PWV9 adjacent to the site and K52 which traverses the site.						
14. Construction during the wet season could cause very wet conditions, which makes it extremely difficult to build in and to do rehabilitation works of disturbed areas.	3	2	2	4	2	6 Low
15. Construction during the dry and windy season may cause dust pollution. Although this impact will only be a short term impact, mitigation will be necessary during the construction phase.	3	2	2	4	2	6 Low
16. The loss of natural primary grassland	5	4	4	16	5	**25 High**
17. Loss of orange listed plant species.	3	4	3	12	4	12 Medium
19. If the entire area to be developed is cleared at once, smaller birds, mammals and reptiles will not be afforded the chance to weather the disturbance in an undisturbed zone close to their natural territories.	3	4	3	12	4	12 Medium
20. Noise impact of construction machinery could have a negative impact on the fauna species during this phase.	3	2	2	4	2	6 Low
21. During the construction and operational phase (if not managed correctly) fauna species could be disturbed, trapped, hunted or killed.	3	4	3	12	4	12 Medium
22. Loss of habitat can lead to the decrease of fauna numbers and species, especially the Melodius Lark *(Mirafra cheniana*), the hedgehog and the Harlequin Snake.	5	4	4	16	5	**25 High**
23. Structures of cultural significance may be destroyed.	3	2	2	4	2	6 Low
31. Possibility of illegal settlements and increased security problems.	3	2	2	4	2	6 Low

32. Traffic increase in the area, will have an impact on the traffic flow and the tranquility of the area	5	2	4	8	3	15 Medium
33. Damage to the existing services and infrastructure during the construction phase and disruptions in services (i.e. electricity, water, damage to Telkom cables) during the construction phase.	3	4	4	16	5	15 Medium
34. Dangerous excavations	3	4	4	16	5	15 Medium
36. Construction works cause visual pollution during the construction phase.	3	4	4	16	5	15 Medium
37. If not planned and managed correctly, the proposed development could have a negative impact on the "Sense of Place" of the study area and its surroundings)	3	2	2	4	2	6 Low
40. Surface water flows will be altered during the construction phase	3	2	2	4	2	6 Low
41. The use of insufficient drainage systems during the construction phase (i.e. sub-surface drainage systems & no mechanisms to break the speed of the surface water)	3	2	2	4	2	6 Low
46. The creation of large quantities of builder's and domestic waste to be accommodated by local legal landfill sites.	4	4	2	8	3	12 Medium
OPERATION PHASE						
Beneficial Impacts						
11. Due to the topography the development will be visible from view sheds in the flatter areas around the study area. It will also be visible from the proposed PWV9 adjacent to the site and K52 which traverses the site.	4	2	4	8	3	12 Medium

24. Upgrading of municipal services	5	4	4	16	5	**25 High**
25. Upgrading of provincial and local roads	5	4	4	16	5	**25 High**
26. Economical injection to local businesses	4	2	4	8	3	12 Medium
27. Creation of temporary and permanent jobs	5	4	4	16	5	**25 High**
28. Increase in adjacent land-values	3	4	4	16	5	15 Medium
29. Rates and taxes payable to the local authority of the new residents will increase the income of the local authority.	5	4	4	16	5	**25 High**
30. The supply of much needed housing in close proximity to employment opportunities and supply of needed offices and industrial development.	5	4	4	16	5	**25 High**
35. The proposed development will be in line with the international, national, provincial and local legislation, planning frameworks, guidelines, policies etc.	5	4	4	16	5	**25 High**
Adverse Impacts						
1. Restriction on land use types due to geology: only sections of the site are suitable for residential structures.	5	4	4	16	5	**25 High**
2. Risk for formation of sinkholes and dolines if precautionary measures for construction on dolomite are not followed and if an effective storm water management plan is not implemented.	4	4	4	16	5	**20 High**
8. Risk of the lowering of groundwater	3	4	4	16	5	15 Medium
9. Possible ground water pollution.	3	4	4	16	5	15 Medium
11.	4	2	4	8	3	12

Due to the topography the development will be visible from view sheds in the flatter areas around the study area. It will also be visible from the proposed PWV9 adjacent to the site and K52 which traverses the site.						Medium
12. If not planned correctly, roofs and parking areas could reflect the sun into the eyes of oncoming traffic and surrounding landowners.	2	2	4	8	3	6 Low
13. If not planned and managed correctly the lights (interior and exterior) and the signage of the development could cause visual pollution.	2	2	4	8	3	6 Low
16. Loss of primary grassland areas.	5	4	4	16	5	**25 High**
17. Loss of orange listed plant species.	3	4	4	16	5	15 Medium
22. Loss of habitat can lead to the decrease of fauna numbers and species.	3	2	2	4	2	6 Low
38. Some agricultural land will be lost.	4	2	4	8	3	12 Medium
32. Traffic increase in the area, will have an impact on the traffic flow of the area	5	2	4	8	3	15 Medium
37. If not planned and managed correctly, the proposed development could have a negative impact on the "Sense of Place" of the study area and its surroundings)	3	2	2	4	2	6 Low
39. Increased surface water run-off to storm water management system from hard surfaces such as roofs and paved areas may impact on surface and ground water.	2	2	4	8	3	6 Low
43. The availability of electricity for the development to be confirmed.	5	4	4	16	5	**25 High**
46.	4	4	2	8	3	12

The creation of large quantities of industrial and domestic waste to be accommodated by local legal landfill sites.						Medium
49. Noise impact from the proposed K52 on the residential component of the development.	4	4	2	8	3	12 Medium

7.3 Discussion of Significance Assessment

Twelve beneficial impacts associated with the proposed development are anticipated, of which seven have a high significance rating. The Environmental Management Plan ***(Refer to Annexure S)*** contains measures to achieve maximum gain from the above beneficial impacts. Twelve of the anticipated beneficial impacts are Socio-economic related, and one relate to the bio-physical environment. This indicates that the proposed development should contribute to an improvement in the quality of life of the people residing in the broader area and the quality of the physical environment.

Of the forty four anticipated adverse impacts associated with the construction and occupation phases of the proposed development eight of the anticipated impacts have a high significance rating, twenty three have a medium significance rating and thirteen have a low significance rating.

Measures that are recommended in this report and the Environmental Management Plan (*including the precautionary measures for development on dolomite and Risk Management Plan*) could mitigate the medium anticipated adverse impacts to an acceptable level. No "fatal flaw" adverse impacts, or adverse impacts that cannot be adequately mitigated, are anticipated to be associated with the proposed development of Monavoni Extension 44.

8. Conclusion

The purpose of the EIA (Environmental Impact Assessment) process was to investigate the Biophysical and Socio-economic environments by means of specialist studies to identify further issues/impacts of the proposed Monavoni X 44 development on these environments. Further, it was aimed to provide mitigation measures for adverse impacts and to assess the significance of these impacts over the short and long term.

The most significant issues that were identified are the following: ***Refer to Figures 18, Sensitivity Map.***

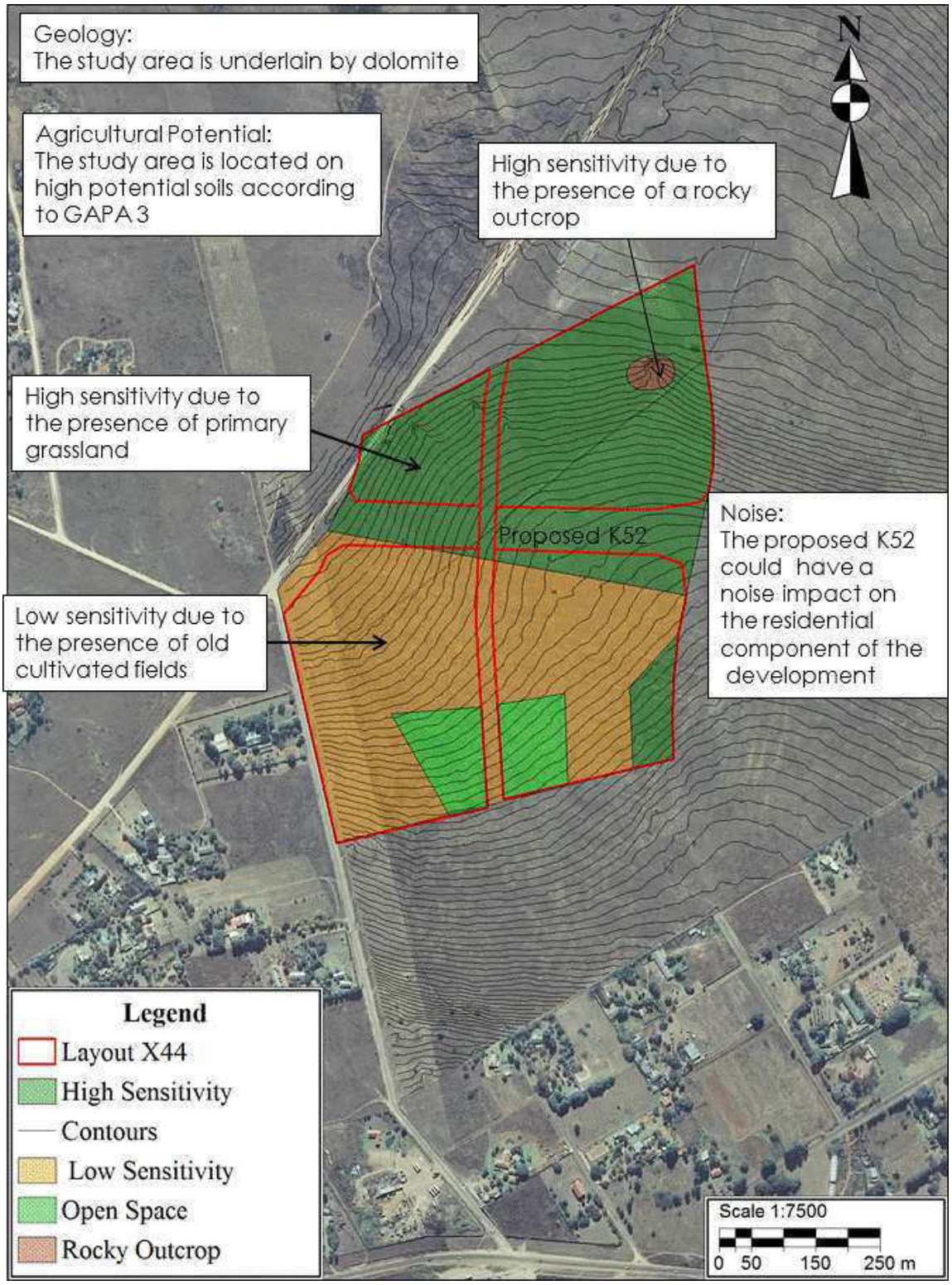


FIGURE 18 – SENSITIVITY MAP

Biophysical Environment:

1) The study area is underlain by dolomite and there is a risk for the formation of sinkholes and dolines.
2) There may be a possible impact of the development on the ground water and surface water quality in the catchment area and a Dolomite Risk Management Plan will have to be implemented.
3) The proposed development will result in the loss of primary grassland areas. However, M&T Development compiled a Monavoni Development Framework for the larger Monavoni development to ensure the protection of corridors of Natural primary grassland in the larger Monavoni development ***(refer to Figure 3).*** As already mentioned the Monavoni Development Framework had been approved by the CoT Environmental Planning and Open Space Management Section ***(refer to Annexure C for correspondence in this regard).*** It is recommended that the rocky outcrop be excluded from the development.

Social and Economical Environment:

1) The developer will deliver a large contribution to the infrastructure in the area.
2) The proposed development will provide a large number of job opportunities both during the construction and the operational phases of the development.
3) The proposed development will contribute to rates and taxes payable to City of Tshwane.
4) The proposed mixed use development falls within an area earmarked for development and will contribute largely to the economy in the area.
5) The loss of agricultural land.
   According to the GAPA 3 the site is characterised by "high" agricultural potential soils. However the study area falls within the provincial urban edge and does not fall within any Agricultural Hub, identified for agricultural use by GDARD ***(refer to figure 5).***
6) The proposed K52 traverses the study area and could have a noise impact on the residential component of the development.

9. RECOMMENDATIONS

It is believed that the impacts identified have not been of such a nature that short and long term mitigation cannot occur and therefore it is recommended that the proposed development be approved subject to:

1) The implementation of the mitigation measures contained in the Environmental Management Plan ***(Annexure S)*** to achieve maximum advantage from beneficial impacts, and sufficient mitigation of adverse impacts;
2) The implementation of a Rehabilitation Plan (as part of the EMP) after construction which should aim to prevent erosion and aid in the return of natural, endemic and indigenous vegetation cover to at least 80% of the rehabilitated area.
3) The implementation of the NHBRC precautionary measures provided for construction on dolomite;
4) The implementation of a Dolomite Risk Management Plan;
5) The provision of Open Spaces according to the approved Monavoni Development Framework and the implementation of a maintenance plan for these open space areas to be included in the EMP;
6) The implementation of a Stormwater Management Plan approved by the local authority and DWA;
7) Confirmation regarding the availability of essential services from the relevant departments of City of Tshwane and the implementation of the upgradings as recommended in the CES Report to be included as a condition in the Authorisation (if authorisation is granted); and
8) The implementation of a Solid Waste Management Plan.

Annexure A

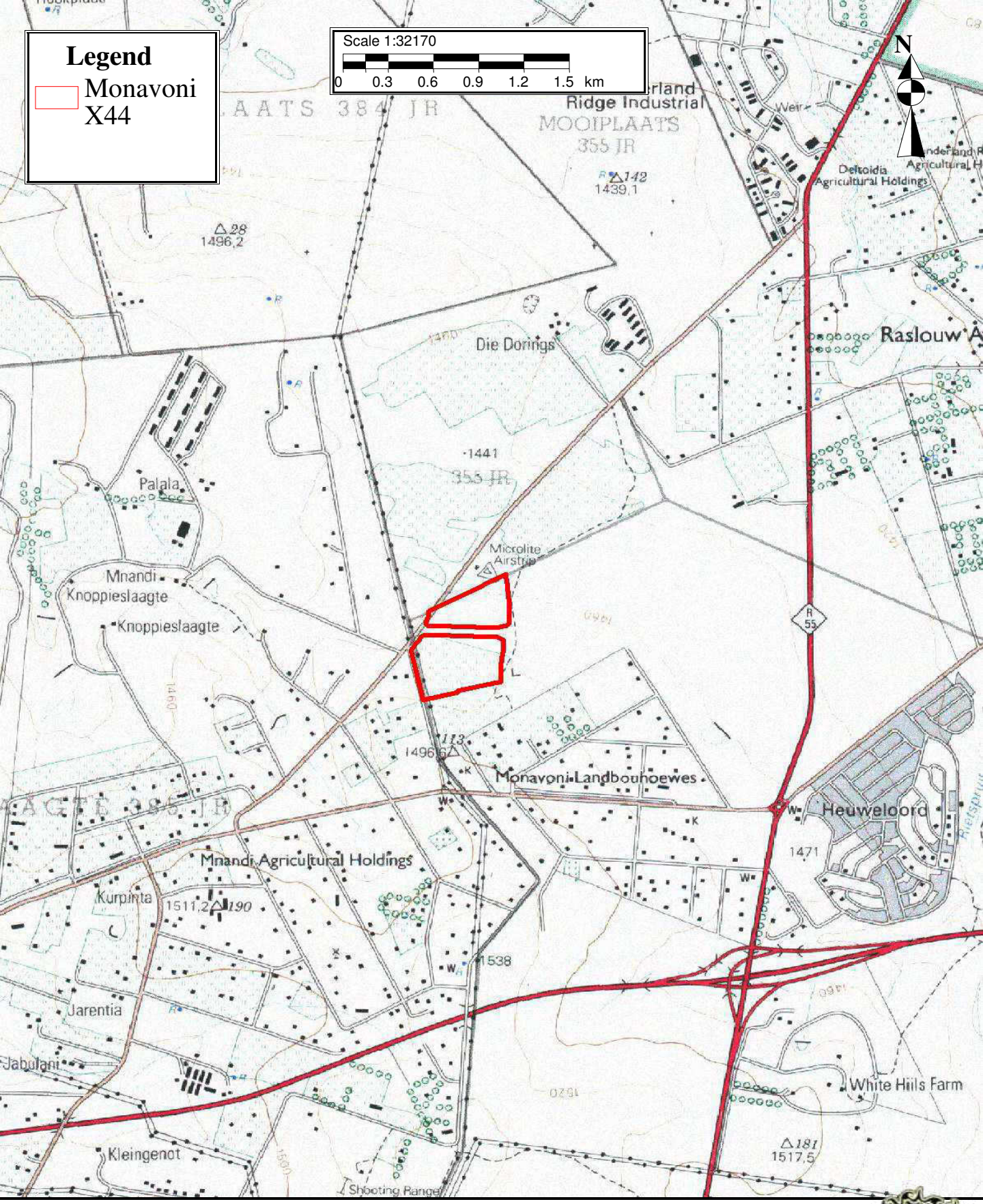


Fig 1: Locality Map

Monavoni X 44

Fig 2: Aerial Map

Monavoni X 44

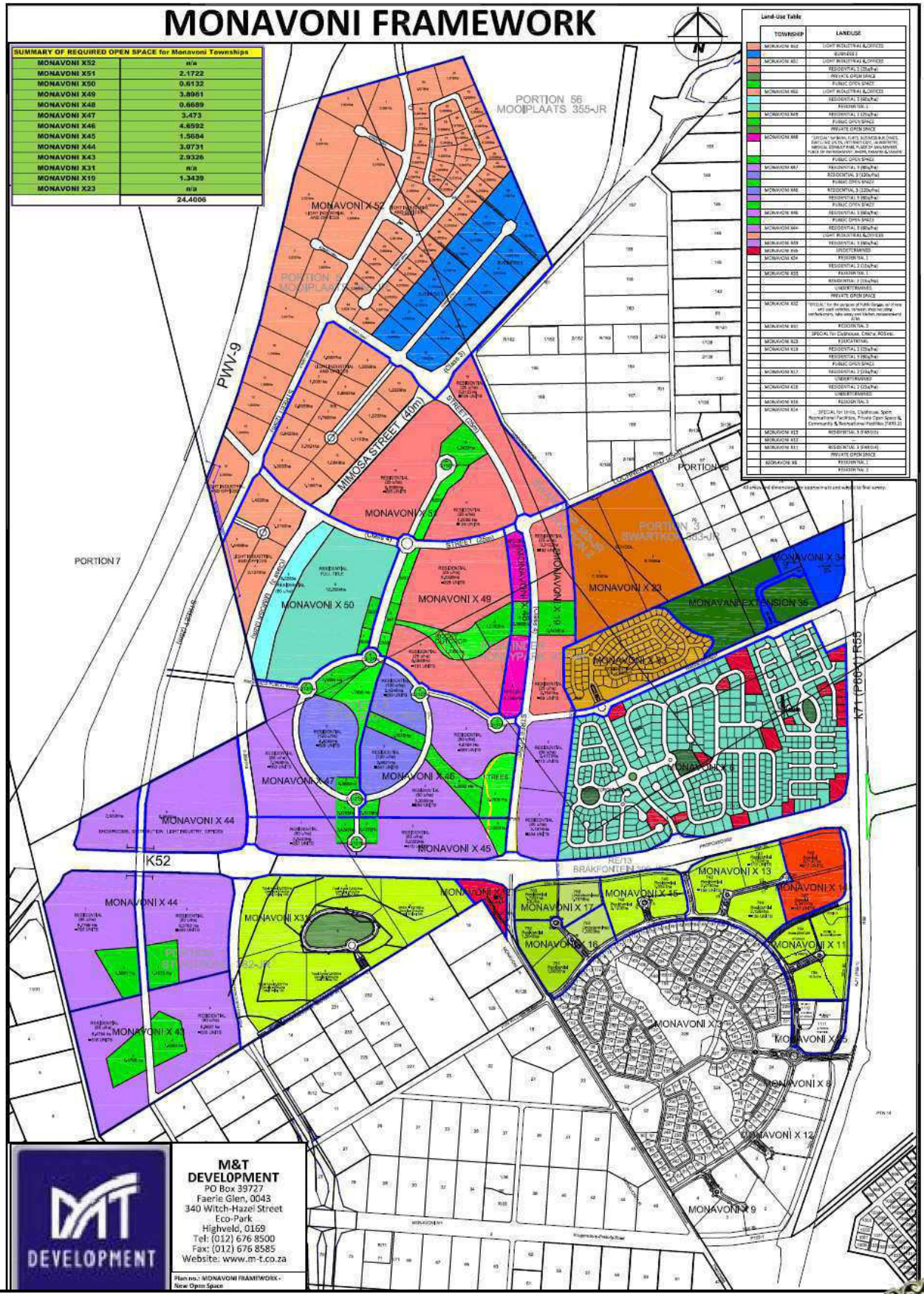


Fig 3: Monavoni Framework

Monavoni X 44

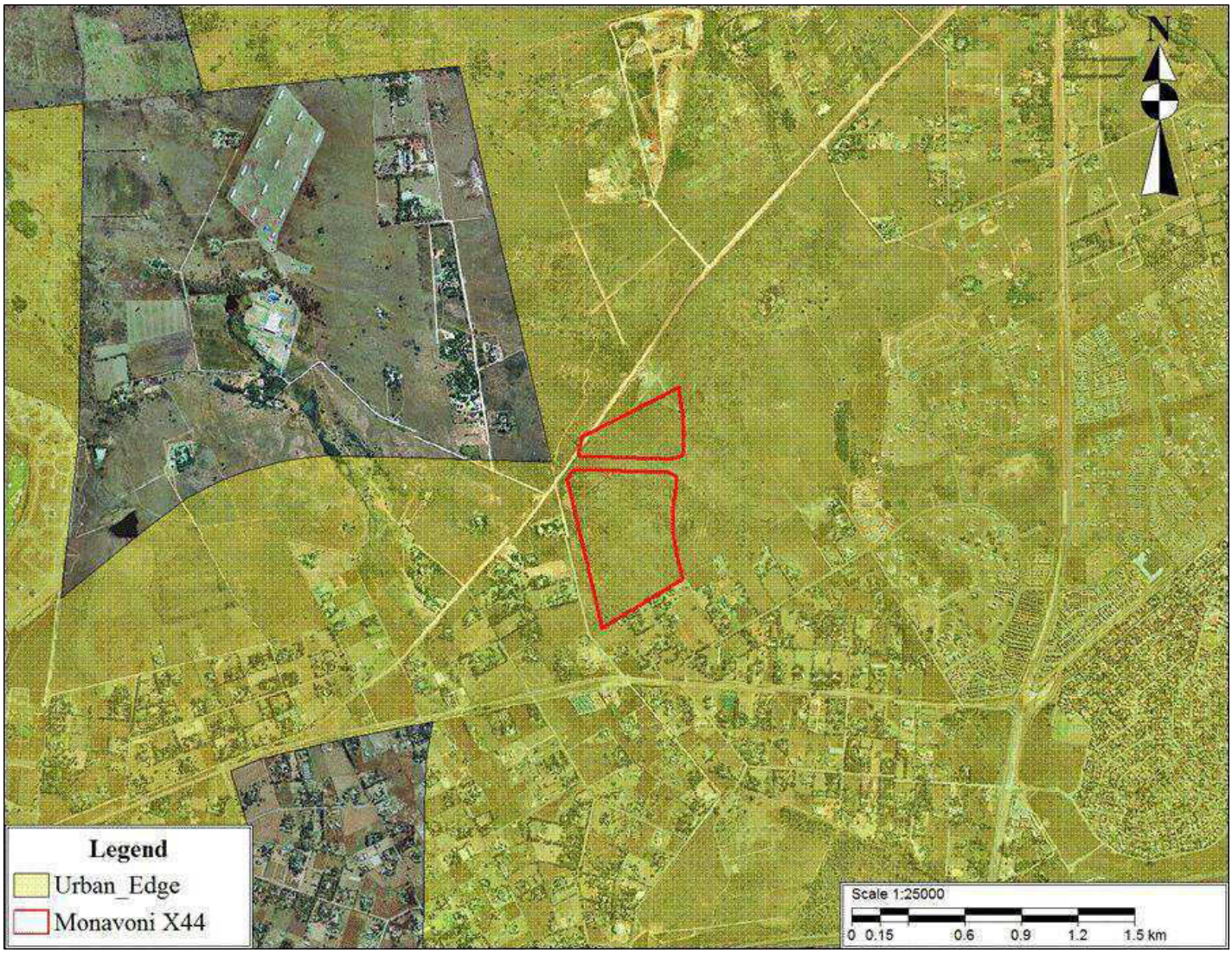


Fig 4: Gauteng Provincial Urban Edge

Monavoni X 44

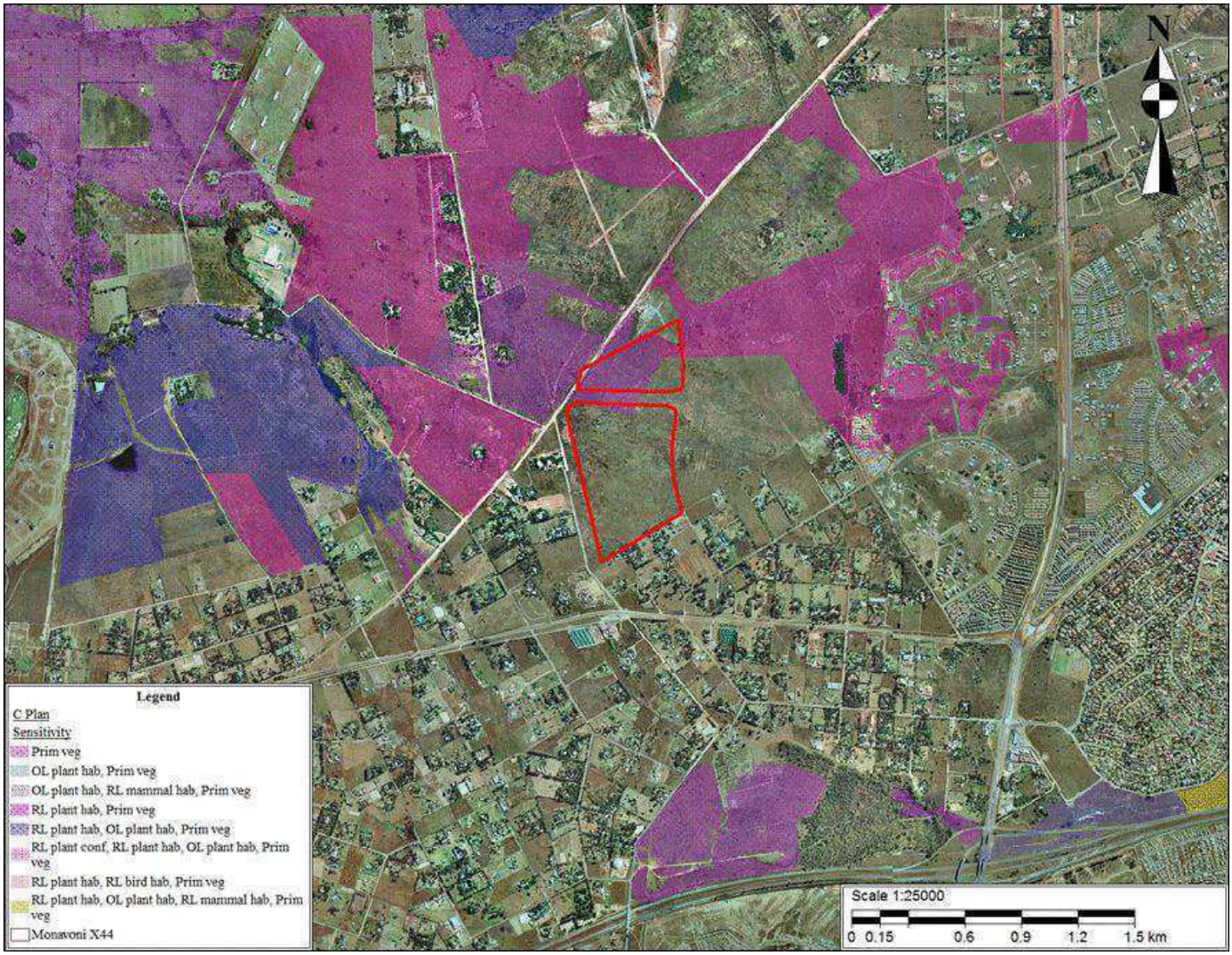


Fig 5: GDARD C-Plan 3 Irreplaceable Sites Map

Monavoni X 44

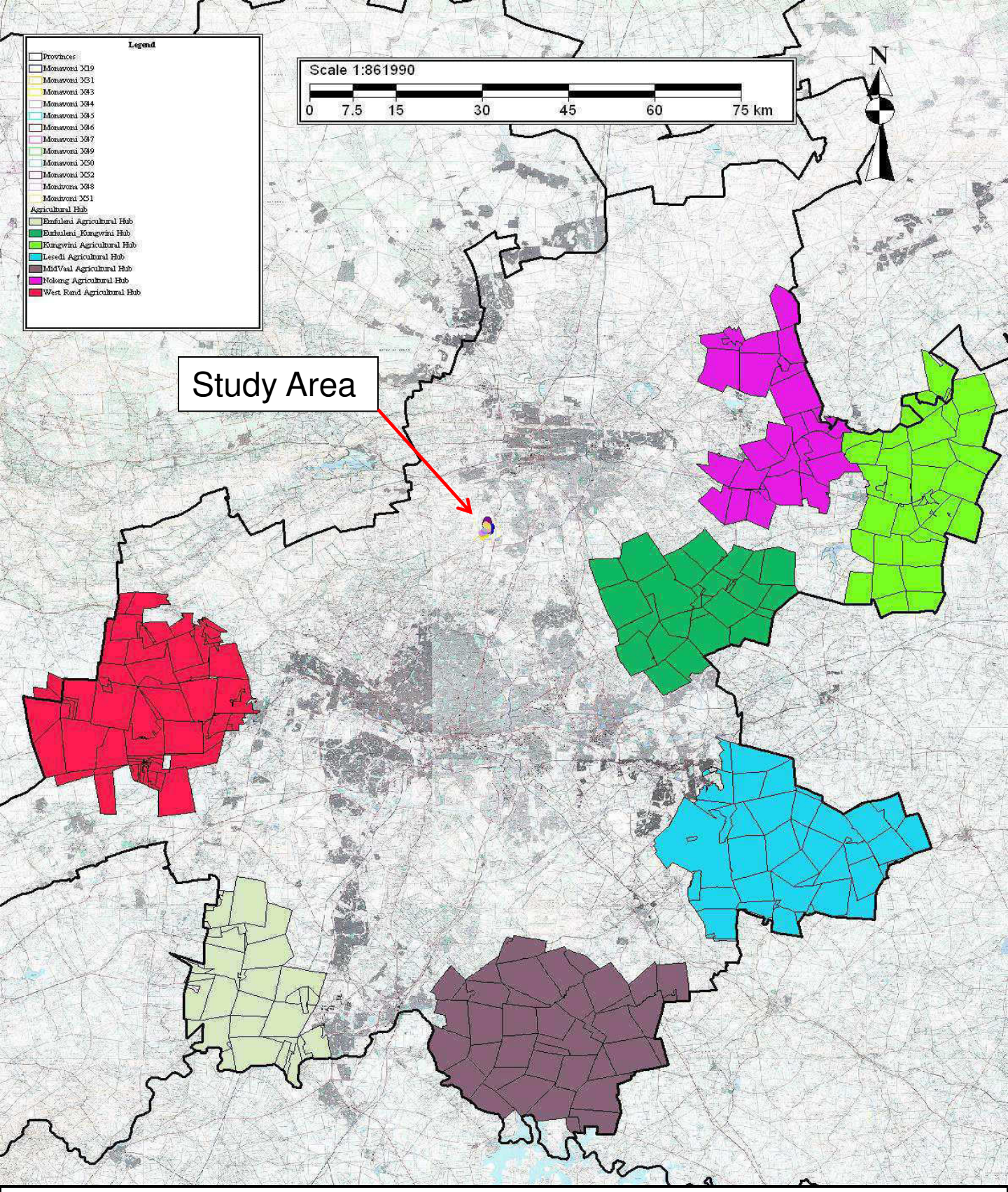


Fig 6: Agricultural Hubs

Monavoni X 44

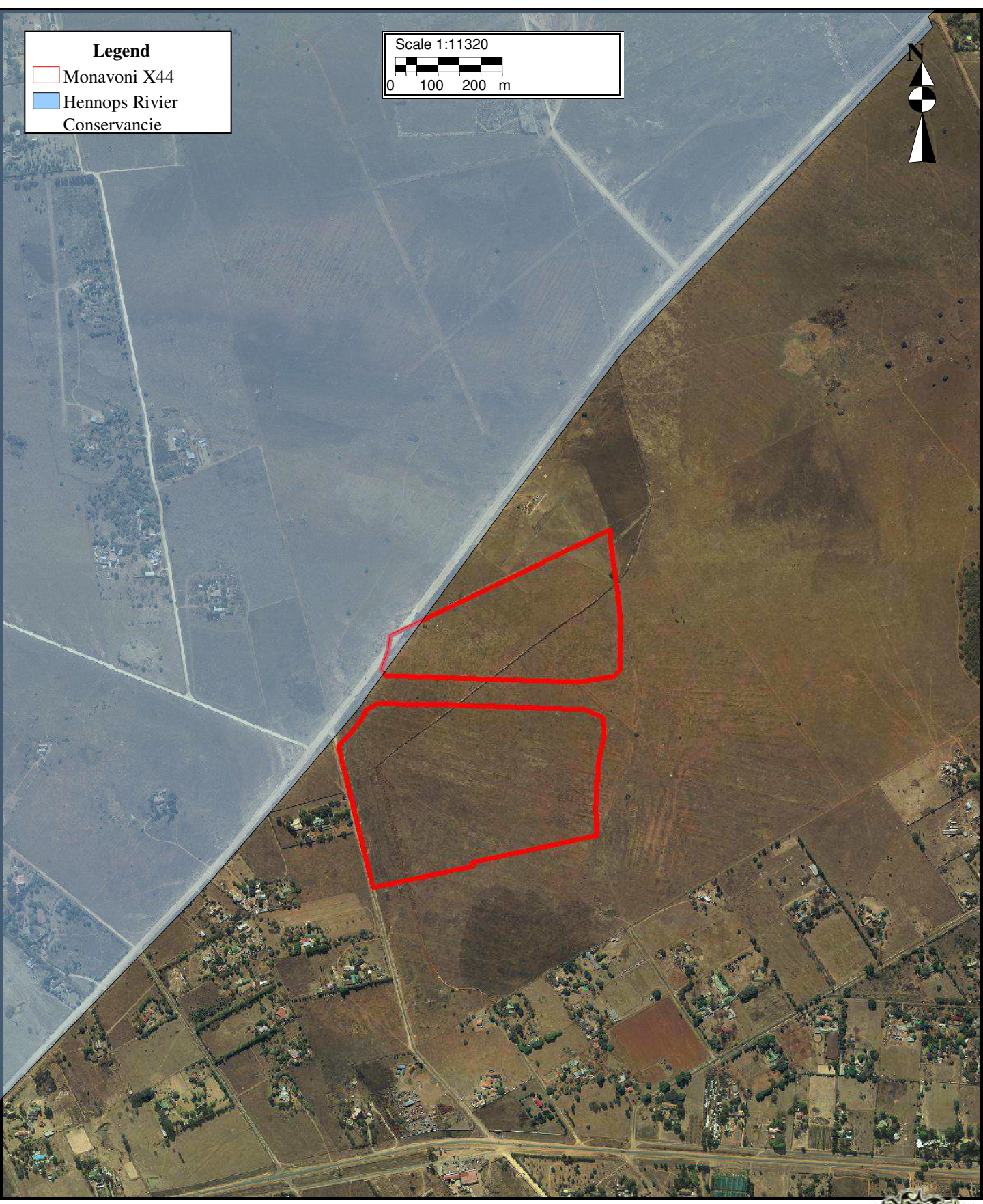


Fig 7: Conservancy Map

Monavoni X 44

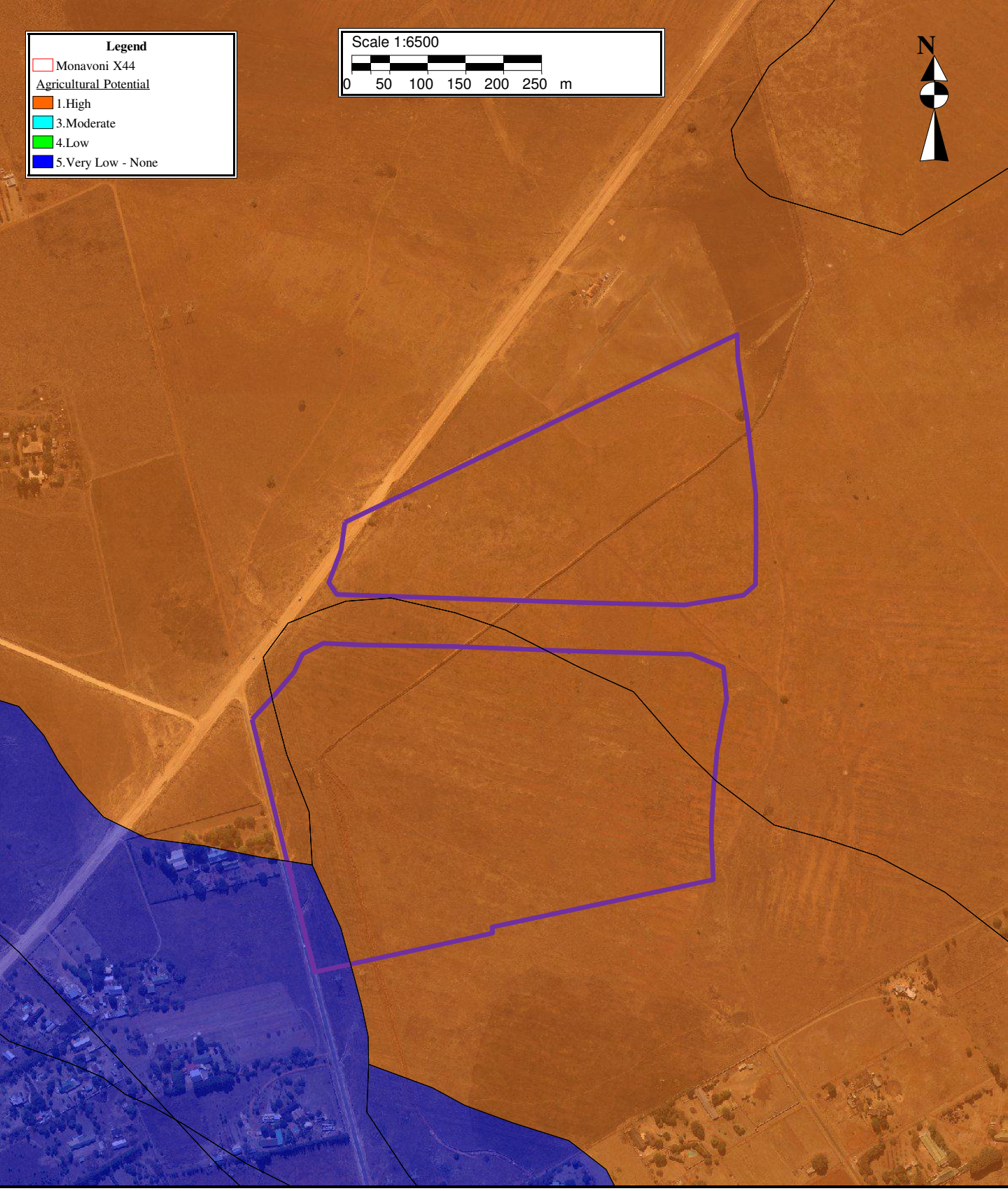


Fig 8: GAPA 3 Agricultural Potential Map

Monavoni X 44

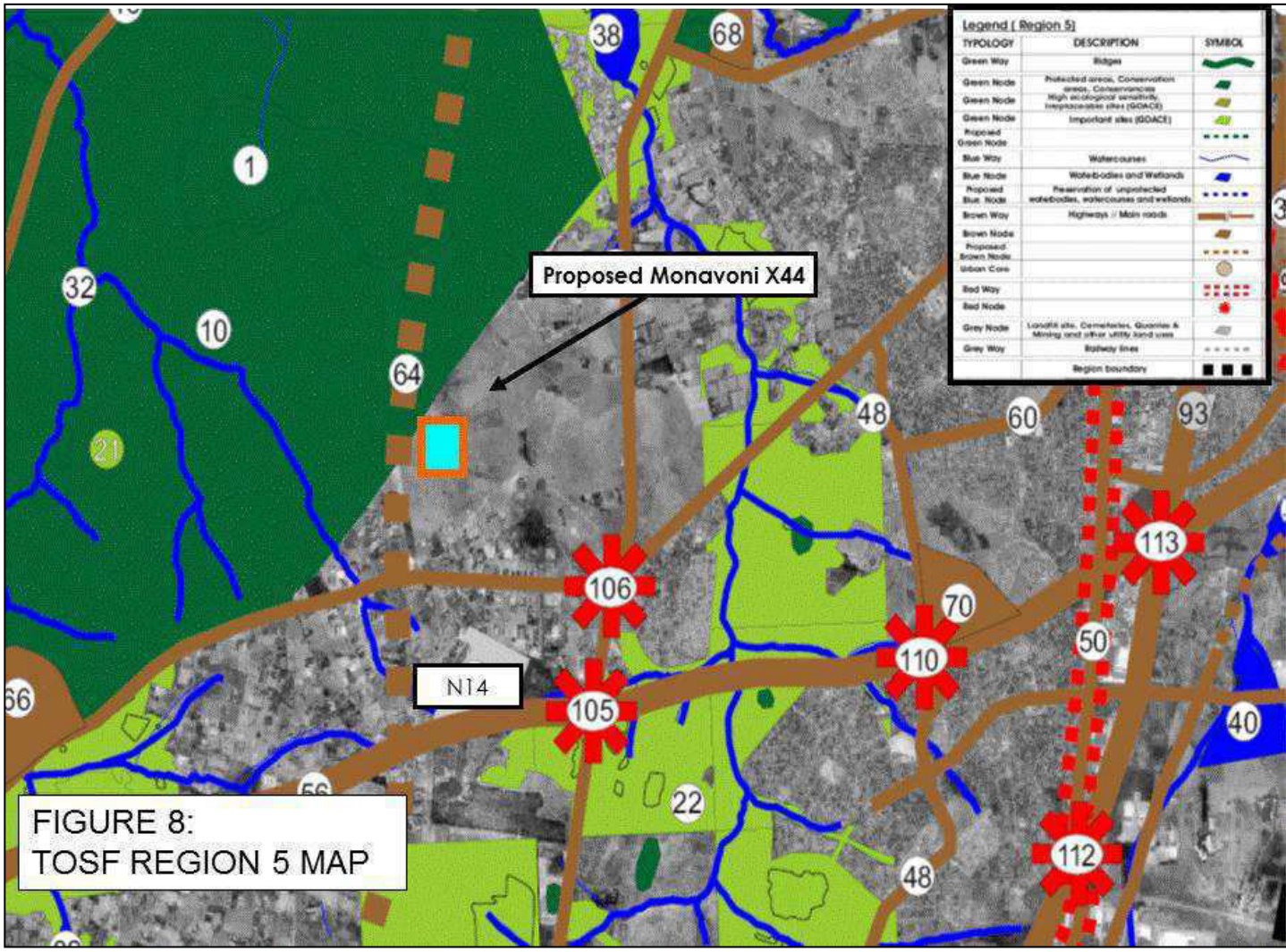


FIGURE 8:
TOSF REGION 5 MAP

Fig 9: Tshwane Open Space Framework

Monavoni X 44

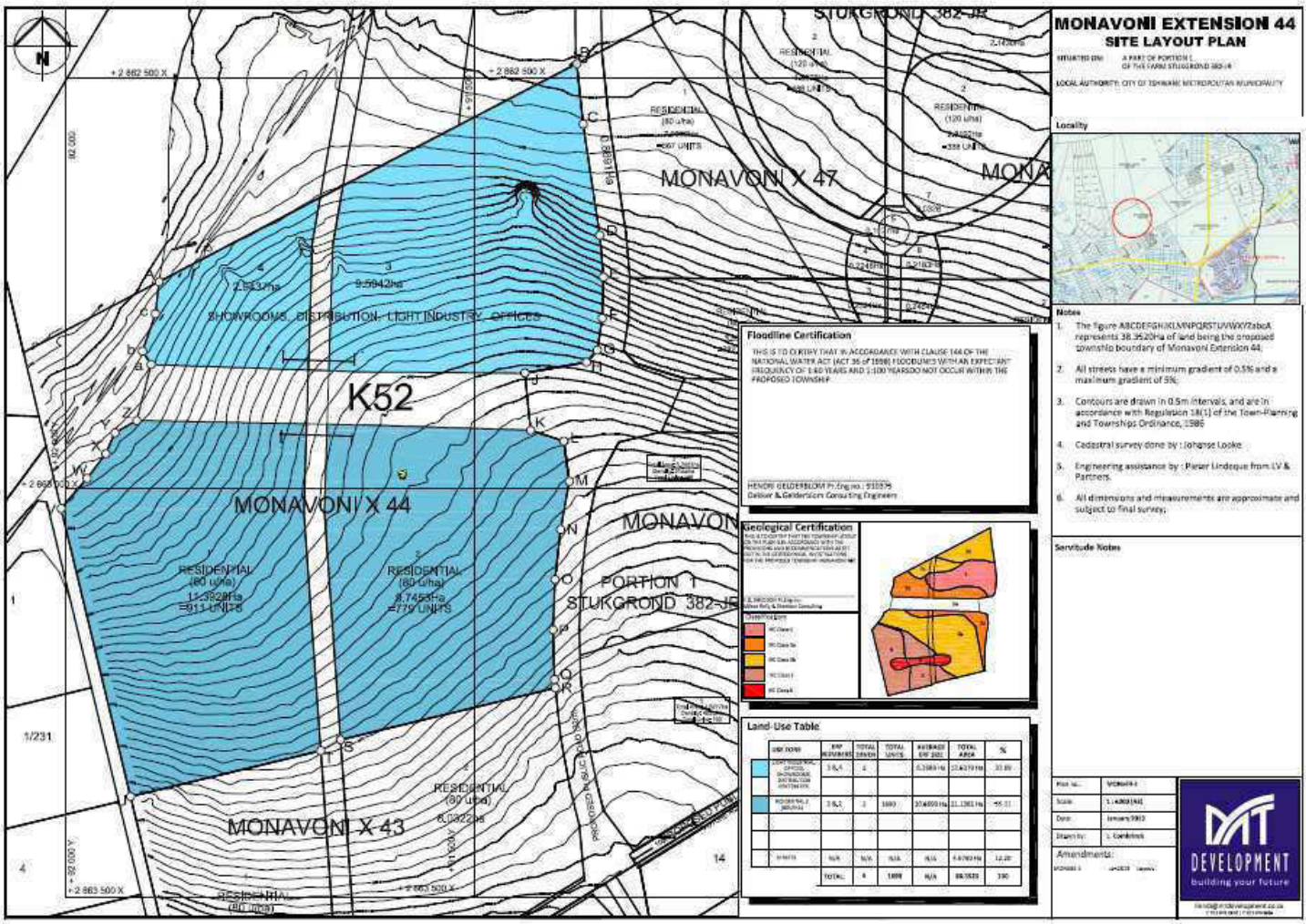


Fig 10: Layout Alternative

Monavoni X 44

Bokamoso Environmental

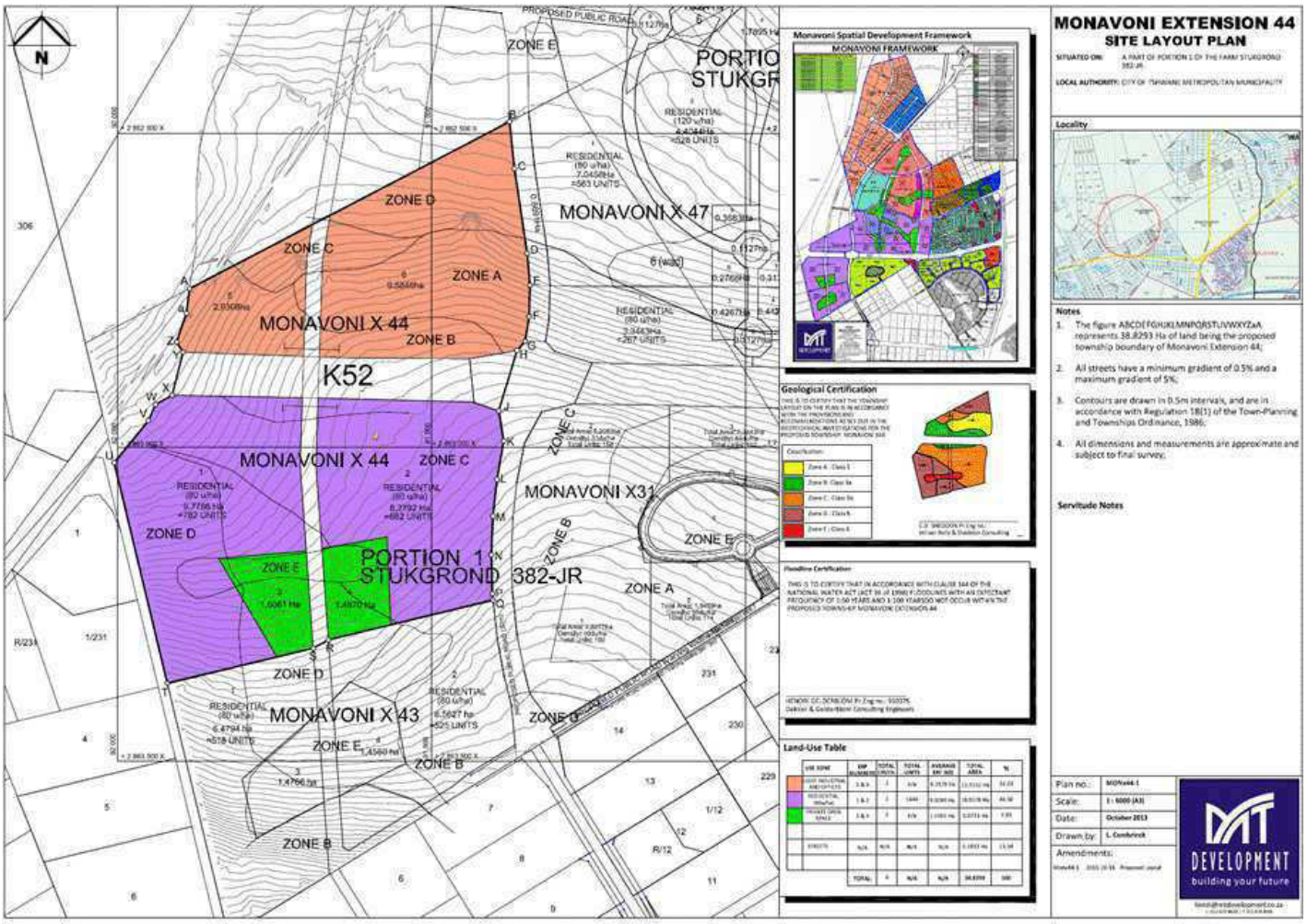


Fig 11: Final Layout

Monavoni X 44

Bokamoso Environmental

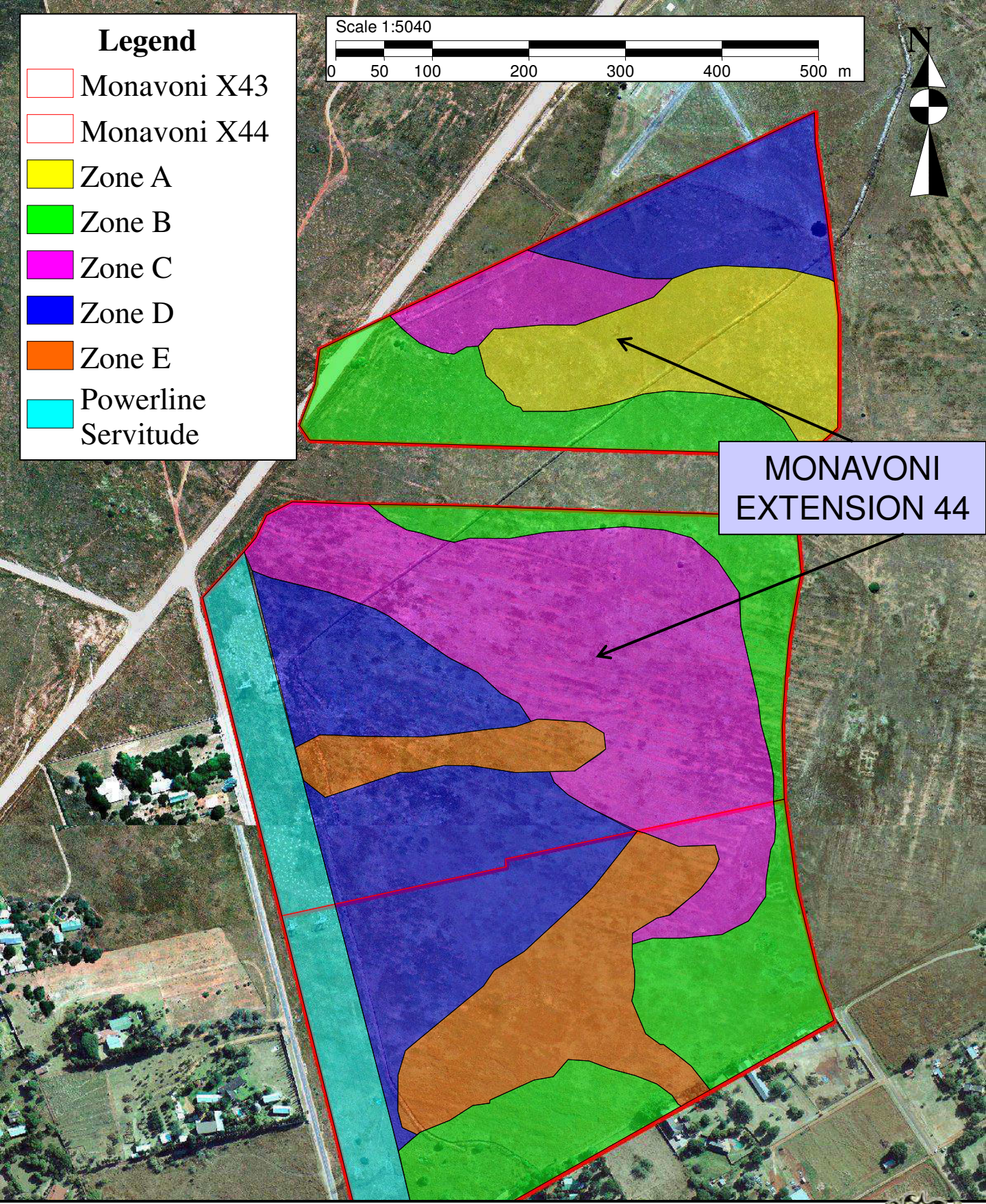


Fig 12: Geological Zonation Map

Monavoni X 44

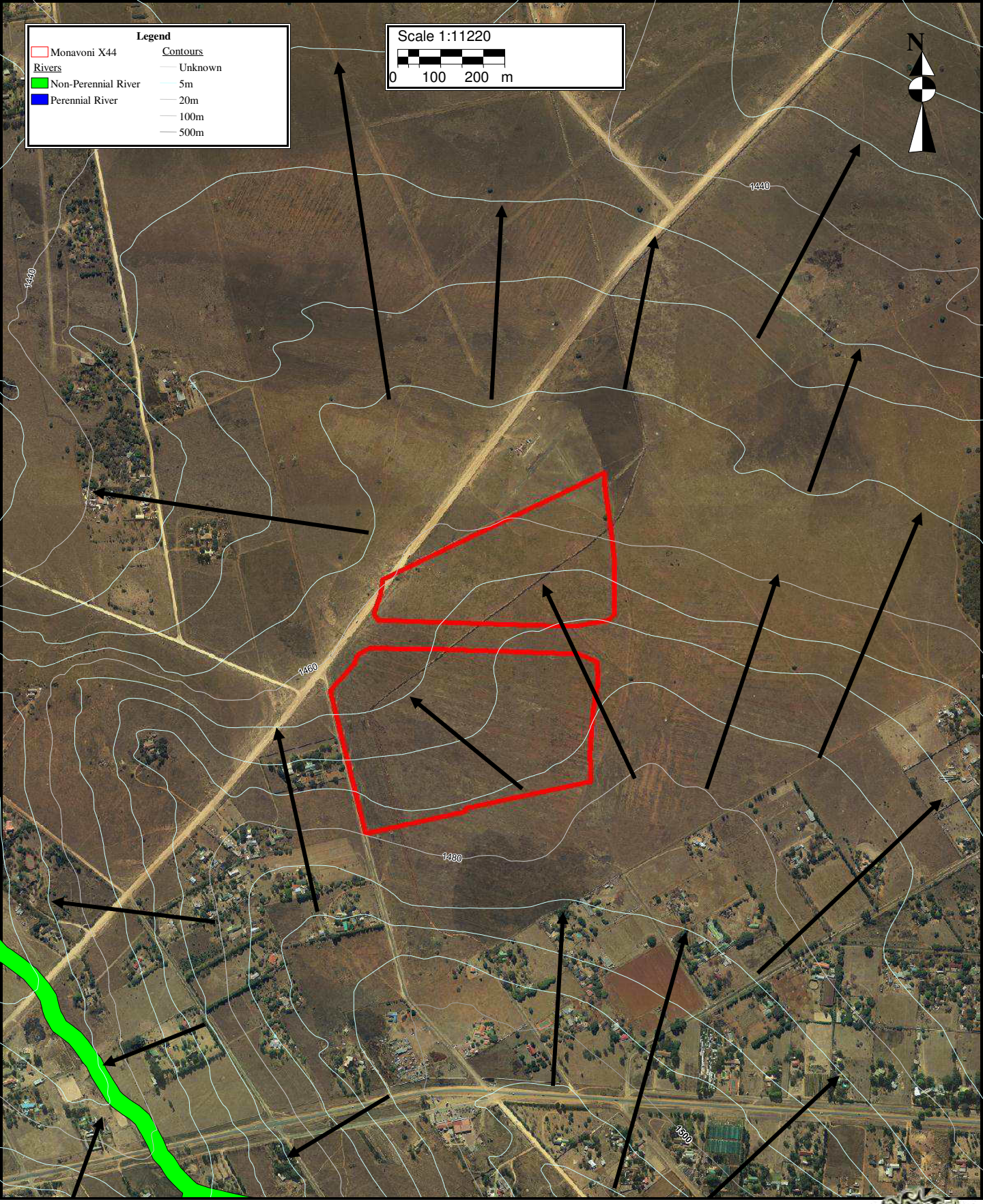


Fig 13: Hydrology Map

Monavoni X 44

Bokamoso Environmental

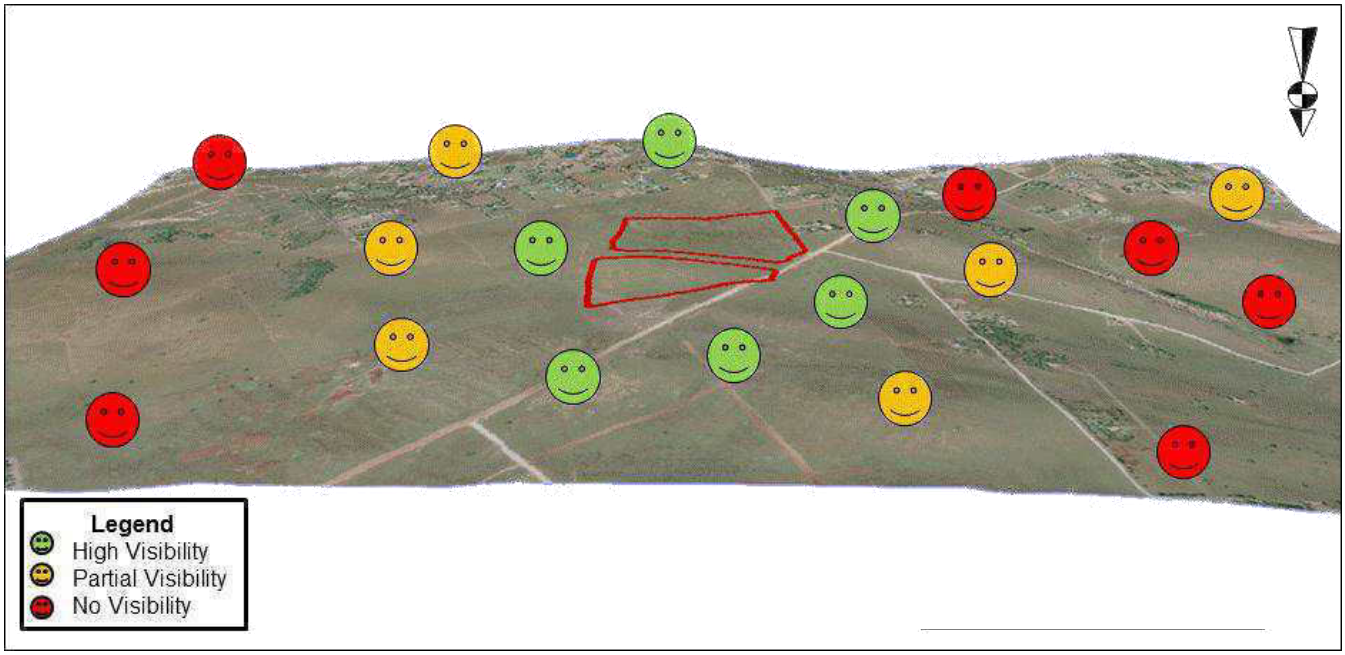


Fig 14: 3 Dimensional Map

Monavoni X 44

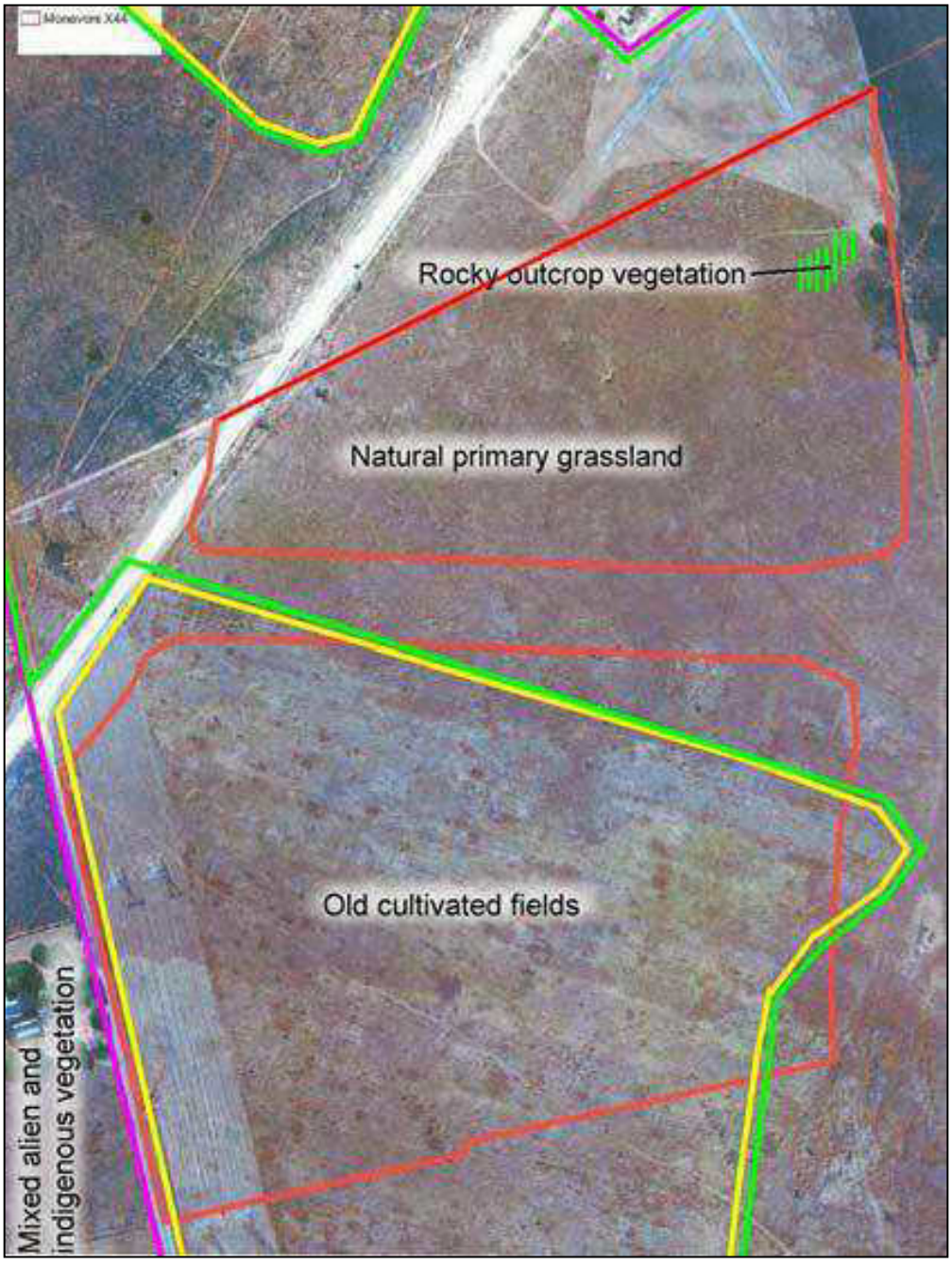


Fig 14: Vegetation Communities Map

Monavoni X 44

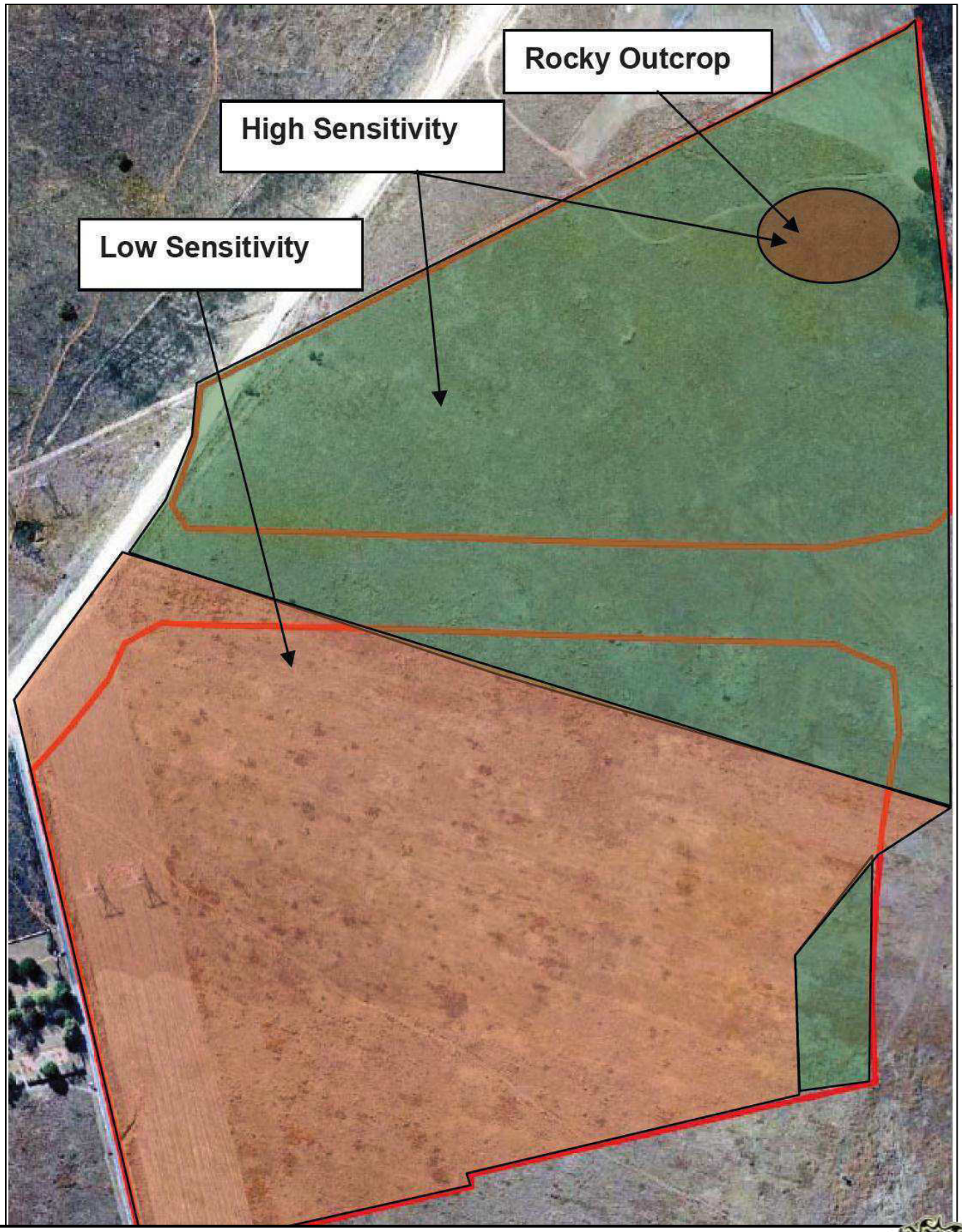


Fig 16: Ecological Sensitivity Map

Monavoni X 44

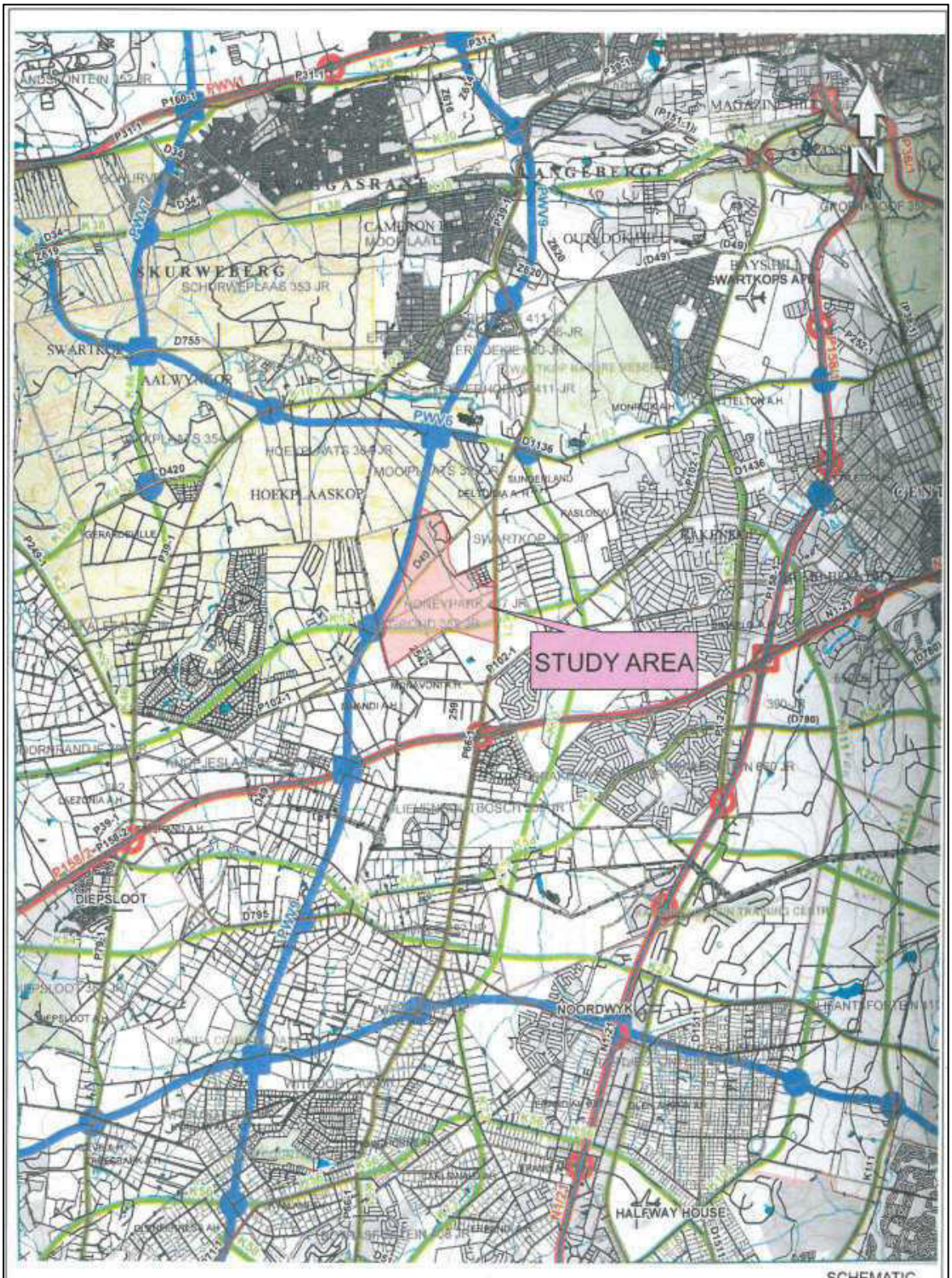


Fig 17: Study Area Monavoni Road Master Plan

Monavoni X 44

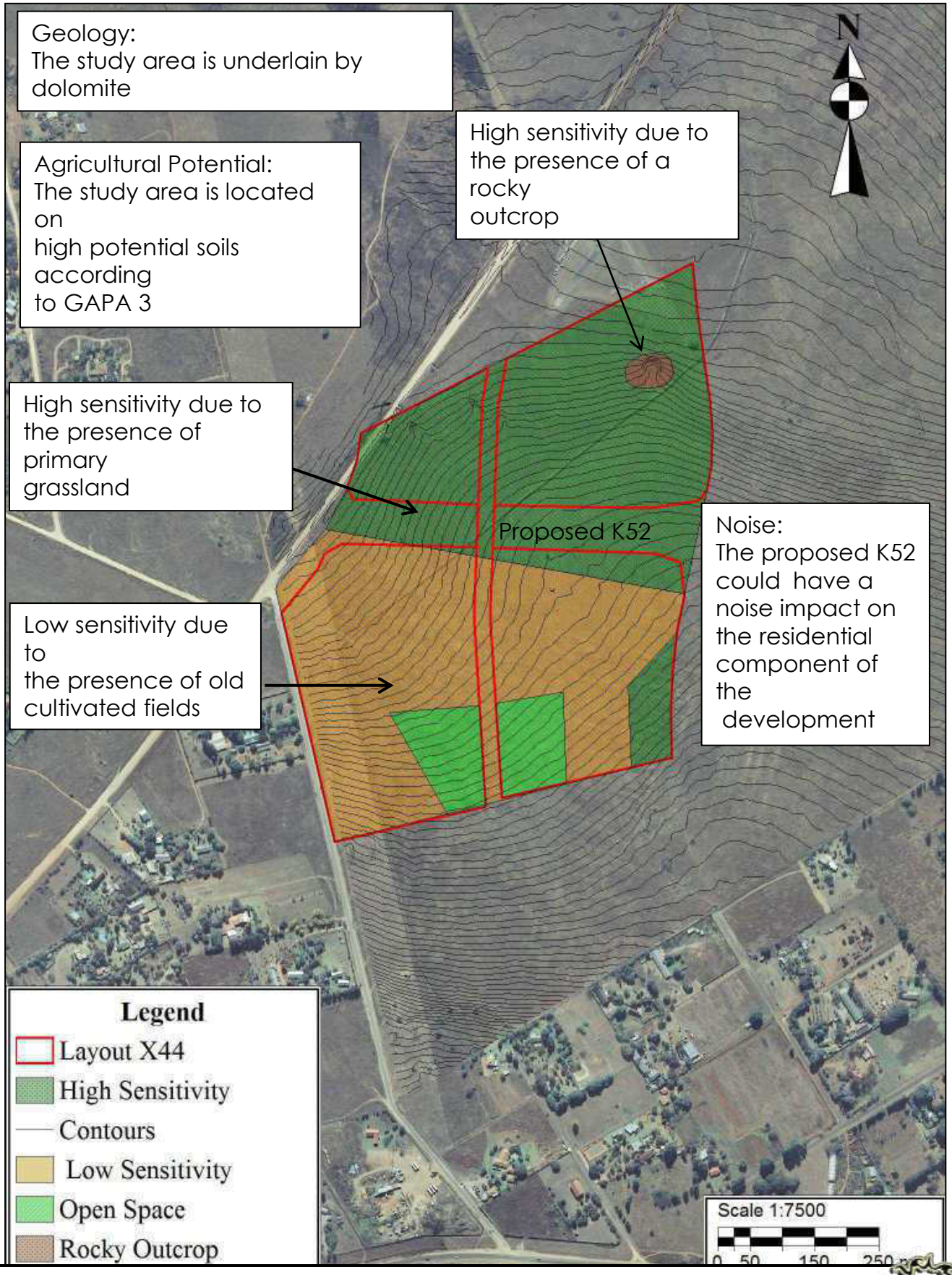


Fig 18 Sensitivity Map

Monavoni X 44

Annexure B

MONAVONI FRAMEWORK

SUMMARY OF REQUIRED OPEN SPACE for Monavoni Townships	
MONAVONI X52	n/a
MONAVONI X51	2.1722
MONAVONI X50	0.6132
MONAVONI X49	3.8961
MONAVONI X48	0.6689
MONAVONI X47	3.473
MONAVONI X46	4.6592
MONAVONI X45	1.5684
MONAVONI X44	3.0731
MONAVONI X43	2.9326
MONAVONI X31	n/a
MONAVONI X19	1.3439
MONAVONI X23	n/a
	24.4006

Land-Use Table

TOWNSHIP	LANDUSE
MONAVONI X52	LIGHT INDUSTRIAL & OFFICES
	BUSINESS 2
MONAVONI X51	LIGHT INDUSTRIAL & OFFICES
	RESIDENTIAL 2 (25u/ha)
	PRIVATE OPEN SPACE
	PUBLIC OPEN SPACE
MONAVONI X50	LIGHT INDUSTRIAL & OFFICES
	RESIDENTIAL 3 (60u/ha)
	RESIDENTIAL 1
MONAVONI X49	RESIDENTIAL 2 (25u/ha)
	PUBLIC OPEN SPACE
	PRIVATE OPEN SPACE
MONAVONI X48	"SPECIAL" for BANK, FLATS, BUSINESS BUILDINGS, DWELLING UNITS, INTERNET CAFE, LAUNDERETTE, MEDICAL CONSULT RMS, PLACE OF AMUSEMENT, PLACE OF REFRESHMENT, SHOPS, THEATRE & TAVERN
	PUBLIC OPEN SPACE
MONAVONI X47	RESIDENTIAL 3 (80u/ha)
	RESIDENTIAL 3 (120u/ha)
	PUBLIC OPEN SPACE
MONAVONI X46	RESIDENTIAL 3 (120u/ha)
	RESIDENTIAL 3 (80u/ha)
	PUBLIC OPEN SPACE
MONAVONI X45	RESIDENTIAL 3 (80u/ha)
	PUBLIC OPEN SPACE
MONAVONI X44	RESIDENTIAL 3 (80u/ha)
	LIGHT INDUSTRIAL & OFFICES
MONAVONI X43	RESIDENTIAL 3 (80u/ha)
MONAVONI X35	UNDETERMINED
MONAVONI X34	RESIDENTIAL 1
	RESIDENTIAL 2 (10u/ha)
MONAVONI X33	RESIDENTIAL 1
	RESIDENTIAL 2 (25u/Ha)
	UNDERTERMINED
	PRIVATE OPEN SPACE
MONAVONI X32	"SPECIAL" for the purpose of Public Garage, sal of new and used vehicles, carwash, shop including confectionary, take-away and kitchen, restaurant and ATM.
MONAVONI X31	RESIDENTIAL 3
	SPECIAL for Clubhouse, Creche, POS etc.
MONAVONI X23	EDUCATIONAL
MONAVONI X19	RESIDENTIAL 2 (25u/ha)
	RESIDENTIAL 3 (80u/ha)
	PUBLIC OPEN SPACE
MONAVONI X17	RESIDENTIAL 2 (23u/ha)
	UNDERTERMINED
MONAVONI X16	RESIDENTIAL 2 (23u/ha)
	UNDERTERMINED
MONAVONI X15	RESIDENTIAL 3
MONAVONI X14	SPECIAL for Units, Clubhouse, Sport Recreational Facilities, Private Open Space & Community & Recreational Facilities (FAR1.2)
MONAVONI X13	RESIDENTIAL 3 (FAR 0.5)
MONAVONI X12	...
MONAVONI X11	RESIDENTIAL 3 (FAR 0.4)
	PRIVATE OPEN SPACE
MONAVONI X6	RESIDENTIAL 1
	RESIDENTIAL 2

All areas and dimensions are approximate and subject to final survey.

M&T DEVELOPMENT
PO Box 39727
Faerie Glen, 0043
340 Witch-Hazel Street
Eco-Park
Highveld, 0169
Tel: (012) 676 8500
Fax: (012) 676 8585
Website: www.m-t.co.za

Plan no.: MONAVONI FRAMEWORK - New Open Space

DATE : 23 August 2013

Annexure C

CITY OF TSHWANE
IGNITING EXCELLENCE

Environmental Management Services Department

4th Floor | 11 Francis Baard Street | Pretoria | 0002
PO Box 1454 | Pretoria | 0001
Tel: 012 358 8871 | Fax: 012 358 8934
Email: livhuwanis@tshwane.gov.za | www.tshwane.gov.za

My ref:	8/3/1/1	Tel:	012 358 8920
Your ref:	MVO Framework	Fax:	012 358 8934
Contact person:	B. H. Masinyana	Email:	boniswam@tshwane.gov.za
Section	EP &OSM	Date:	08 October 2013

STRATEGIC EXECUTIVE DIRECTOR: CITY PLANNING and DEVELOPMENT DEPARTMENT
(Attention: L. Zeelie)

Dear Sir/Madam

MONAVONI OPEN SPACE FRAMEWORK:

Our previous discussions and the meeting which took place on the 13 August 2013 has reference.

CONCLUSION AND CONDITIONS

The Department in principle support the Monavoni Open Space Framework dated 23 August 2013 as submitted subject to the following conditions:

- No further changes can be made to the Open Spaces as discussed and supported.
- A "green servitude" in favor of the Council (not the general public) for purposes of protecting it for open spaces. The change of zoning of these properties will not be supported by this Department.
- A Site and Landscape Development Plan for each township drafted by a qualified Landscape Architect must be submitted to the Department for approval. Such Plan must include the following information:
    - At least 4m² per dwelling unit with a minimum of 50m² on a property which shall be developed and maintained as a children's playground.

Yours faithfully

..... 2013/10/09
Mr. Livhuwani Siphuma Date
EXECUTIVE DIRECTOR: ENVIRONMENTAL MANAGEMENT & PARKS
Letter signed by: Leloko Puling
Designation: Director: Environmental Planning & Open Space Management Section

Annexure E

LEBOMBO GARDENS
36 LEBOMBO ROAD
ASHLEA GARDENS
0081

P.O. BOX 11375
MAROELANA
0161

Tel: (012) 346 3810
Fax: 086 570 5659
E-mail: lizelleg@mweb.co.za
Website: www.Bokamoso.net

Bokamoso ENVIRONMENTAL
Landscape Architects, Environmental Consultants,
Environmental Auditing, Water License Applications

October 2013

Annexure D: Monavoni X 44 - Transitional Arrangements as set out in Section 76(3) of the Amended NEMA Regulations of 2 August 2010

1) Introduction and Background

The Environmental Impact Regulations, 2010 which commenced on 2 August 2010 requires in Section 76(3) the following:

" Where an application submitted in terms of the previous NEMA Regulations, is pending in relation to an activity of which a component of the same activity was not listed under the previous NEMA Notices, but is now listed in terms of Section 24(2) of the Act, the competent authority must dispense of such application in terms of the previous NEMA Regulations and may authorise the activity listed in terms of Section 24(2) as if it was applied for, on condition that all impacts of the newly listed activity and requirements of these Regulations have also been considered and adequately addressed."

2) Comparison between the 2006 and 2010 NEMA Listed Activities

This Environmental Impact Assessment Report submitted for the proposed Twenty One Township 3 Development represents an EIA application in terms of Notice R. 386 and Notice R. 387 published in the Government Notice No. 28753 of the National Environmental Management Act, 1998 (Act No. 107 of 1998). In terms of these Regulations the proposed development qualifies for a Scoping and Environmental Impact Assessment Process.

It is important to note that this application was submitted prior to 2 August 2010, the date on which the Amended NEMA Regulations came into effect. Chapter 9, Regulation 76 of the 2010 Environmental Impact Assessment Regulations deals with transitional arrangements and requires that pending applications, submitted in terms of the 2006 NEMA Regulations, also take the impacts of the newly listed activities into consideration and adequately assess such activities.

2.1 Activities Applied for in terms of the 2006 Regulations and Activities listed in terms of the 2010 Regulations that must be taken into consideration

The 2006 NEMA EIA Regulations consist of two lists of activities (in listing notices GN. R386 and GN. R387). Tables 1 and 2 below list the activities applied for in terms of these regulations. These activities will be thoroughly considered and assessed in the EIA Report.

Table 1: Listed activities in terms of Notice No. R386

R. 386, 21 April 2006	Activity 1 (k)	The bulk transportation of sewage and water, including storm water, in pipelines with (i) and internal diameter of 0,36 m or more; or (ii) a peak throughput of 120 litres per second or more. ***Reason for inclusion:*** *Some of the storm water pipes will have an internal diameter of 360 mm and more.*
R. 386, 21 April 2006	Activity 1 (v)	Advertisements as defined in classes 1(a), 1(b), 1(c), 3(a), 3(b), 3(l) of the South African Manual for Outdoor Advertising Control. ***Reason for inclusion:*** *To make provision for outdoor advertising that may be required in the proposed development.*
R. 386, 21 April 2006	Activity 7	The above ground storage of dangerous good, including petrol, diesel, liquid paraffin, in containers with a combined capacity of more than 30 cubic metres but less than 1 000 cubic metres at any one location. ***Reason for inclusion:*** *To make provision for the above ground storage of dangerous goods if required by the **light industrial** uses.* ***Please note:** Light industrial land uses include the following: a builder's yard, a car wash, a contractor's yard, dry-cleaners, carpet cleaners, joinery*

		workshop, launderette, laundry, lawnmower workshop, painter's workshop, plumber's workshop, printing workshop, transport depot, panel-beater, motor workshops, a ready-mix plant and any other such industries, workshops or yards which in the opinion of the Municipality do not cause a nuisance to the environment, may be used for similar purposes and may include the retail sale of products ancillary and subservient to the main use on the same property.
R. 386, 21 April 2006	Activity 14	The construction of masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission, but excluding - (a) masts of 15 metres and lower exclusively used (i) by radio amateurs; or (ii) for lighting purposes (b) flag poles; and (c) lightning conductor poles. ***Reason for inclusion:*** *To make provision for the construction of telecommunication masts if required.*
R. 386, 21 April 2006	Activity 15	The construction of a road that is wider than 4 m or that has a reserve wider than 6 m, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 m long. ***Reason for inclusion:*** *The internal roads of the development will be wider than 4m*.
R. 386, 21 April 2006	Activity 16 (b)	The transformation of undeveloped, vacant or derelict land to residential; mixed; retail; commercial; industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 hectare. ***Reason for inclusion*:** *Less than 50 % of the boundary of the study area borders development, therefore the development activity will not constitute infill and the total area to be transformed is bigger than 1 ha.*
R. 386, 21 April	Activity 17	Phased activities where anyone phases of the activity may be below a threshold specified in the Schedule but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.

R. 386, 21 April 2006	Activity 19	The development of a new facility or the transformation of an existing facility for the conducting of manufacturing processes, warehousing, bottling, packaging or storage, which, including associated structures or infrastructure, occupies an area of 1 000 square metres or more outside an existing area zoned for industrial purposes. ***Reason for inclusion:*** To make provision for the above-mentioned manufacturing processes if required by the light industrial uses.

Table 2: Listed activities in terms of Notice No. R 387

R. 387, 21 April 2006	Activity 1 (c)	The construction of facilities or infrastructure, including associated structures or infrastructure, for – 1(c)The above ground storage of a dangerous good, including petrol, diesel, liquid paraffin, in containers with a combined capacity of more than 1 000 cubic metres or more including the storage of one or more dangerous goods, in tank form. ***Reason for inclusion:*** *To make provision for the storage of dangerous goods if required by the light industrial uses.*
R. 387, 21 April 2006	Activity 2	Any development activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be, 20 ha or more. ***Reason for inclusion:*** *The development footprint including the development activity as well as all landscaped areas and infrastructure, covers more than 20 ha of the study area.*
R. 387, 21 April 2006	Activity 5	The route determination of roads and design of associated physical infrastructure, including roads that have not yet been built for which routes have been determined before the publication of this notice and which has not been authorised by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 made under section 24(5) of the Act and published in Government Notice No. R. 385 of 2006, where (a) it is a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act, 1998 (Act No. 7 of 1998); (b) it is a road administered by a provincial authority; (c) the road reserve is wider than 30 metres; or

		(d) the road will cater for more than one lane of traffic in both directions. ***Reason for inclusion:*** *To make provision for possible provincial road upgradings.*

Table 3 below lists all the possible activities that could be applicable in terms of the 2010 Amended NEMA Regulations (as required in terms of Section 76 (4) of the Regulations). It is however not necessary for the Department to approve such activities. It is only necessary for the EAP to take these activities into consideration and to assess such activities.

Table 3: Possible Activities that could be applicable in terms of the 2010 Amended NEMA Regulations

Indicate the number and date of the relevant Government Notice:	**Activity No (s) (in terms of the relevant notice) :**	**Describe each listed activity:**
Listing Notice 1, 2010	**Activity 9**	The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water – (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more. excluding where: (a) such facilities or infrastructure are for bulk transportation of water, sewage or storm water drainage inside a road reserve; or (b) where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.
Reason for inclusion: This activity is similar to activity 1 (k) (R. 386, 21 April 2006). This activity is included since the length of the pipes for the bulk transportation of water, sewage or storm water exceed 1000m in length and may have an internal diameter of 0,36 metres or more or with a peak throughput of 120 litres per second or more. Some of the infrastructure may be located outside of road reserves.		
Listing Notice 1, 2010	**Activity 13**	The construction of facilities or infrastructure for the storage and handling, of a dangerous good, where such storage

		occurs in containers with a combined capacity of 80 but not exceeding 500cubic metres.
Reason for inclusion: This activity is similar to activity 7 (R. 386, 21 April 2006) and activity 1(c) (R.387, 21 April 2006)		
Listing Notice 1, 2010	**Activity 22**	The construction of roads outside urban areas, (i) With a reserve wider than 13,5 metres or; (ii) Where no reserve exists where the road is wider than 8 metres, or (iii) For which an environmental authorisation was obtained for the route determination in terms of Activity 5 of Government notice 387 of 2006 or Activity 18 in Notice 545 of 2010.
This activity is similar to activity 15 (R. 386, 21 April 2006), but is not regarded as applicable anymore, because the road is within the urban edge.		
Listing Notice 2, 2010	**Activity 15**	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more.,
Reason for inclusion: This activity is similar to activity 2 (R. 387, 21 April 2006). The development footprint including the development activity as well as all landscaped areas and infrastructure, covers more than 20 ha of the study area.		
Listing Notice 2, 2010	**Activity 18**	The route determination of roads and design of associated physical infrastructure, including roads that have not yet been built for which routes have been determined before the publication of this notice and which has not been authorised by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 made under section 24(5) of the Act and published in Government Notice No. R. 385 of 2006, where (a) it is a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act, 1998 (Act No. 7 of 1998); (b) it is a road administered by a provincial authority; (c) the road reserve is wider than 30 metres; or (d) the road will cater for more than one lane of traffic in both directions.
Reason for inclusion: This activity is similar to activity 5 (R. 386, 21 April 2006). This activity is included to *make provision for possible road upgradings affecting a National Road.*		

3. Conclusion

The activities that were regarded as applicable in the Amended NEMA Regulations of 2010 are very similar in nature to the activities already addressed in the EIA Report. It was not regarded as necessary to incorporate separate assessments and no new impacts or issues to address were triggered through the inclusion of these activities. The impacts and issues identified and the mitigation measures supplied in the EIA Report and the EMP already address all the issues.

Annexure F

DEPARTMENT OF AGRICULTURE AND RURAL DEVELOPMENT

Diamond Corner Building, 68 Eloff & Market Street,
Johannesburg
P O Box 8769, Johannesburg, 2000

Telephone: (011) 355-1900
Fax: (011) 337-2292

Reference:	Gaut 002/08-09/N0588
Enquiries:	Suzan Tshikosi
Telephone	(011) 355 1590
Email:	Suzan.tshikosi@gauteng.gov.za

Lizelle Gregory
Bokamoso Environmental Consultants
P.O. Box 11375
MAROELANA
0161

Fax no: (012) 460 7079

PER FACSIMILE / REGISTERED MAIL

Dear Lizelle Gregory

APPLICATION FOR THE ENVIRONMENTAL AUTHORISATION FOR PROPOSED TOWNSHIP DEVELOPMENT ON PART OF PORTION 1 OF THE FARM STUKGROND 382 JR, TO BE KNOWN AS MONAVONI EXTENSION 44, CITY OF TSHWANE METROPOLITAN MUNICIPALITY: GAUT 002/08-09/N0588

The scoping report and a plan of study for environmental impact assessment which were submitted by you in respect of the abovementioned application and received by the Department on the 26 July 2010 have been accepted by the Department. You may accordingly proceed with undertaking the environmental impact assessment in accordance with the tasks that are outlined in the plan of study for environmental impact assessment.

Please note that in addition to providing information as required by EIA Regulations, the following must also be included in the Environmental Impact Assessment Report (EIAR) to be submitted to the Department:

1. Proposed mitigation measures to ensure that noise levels on site comply with the applicable legislative requirements and Gauteng Noise Control Regulations, 1999 operational and decommissioning phases.
2. Information on the co-ordination of the spill response procedure as well as training of personnel in managing spills.
3. Precautionary measures to prevent accidental spills and a plan for the monitoring of leakages from the tank.
4. A letter from the city of Tshwane Metropolitan Municipality confirming the change in zoning of the proposed site;
5. Discussion on the management of stormwater during construction and operational phase of the proposed project.
6. Confirmation that all stormwater to be discharged directly into the sewer system complies with the requirements of the City of Tshwane Metropolitan Municipality and the Department of Water Affairs.
7. Design drawings of the proposed development which include information on the following:
    i. Storm water management.
    ii. Plans to separate clean and contaminated storm water.
    iii. Spill management.
    iv. Location of tank and pump islands.
8. Information on air quality management including the monitoring of the dust and fugitive emission (VOCs). It should include information on the possible gaseous compounds which may be released by proposed tank/tanks. The likelihood of these emissions exceeding the relevant occupational exposure limits and/or air quality standards, as well as the proposed mitigation measures.
9. Details on how waste will be managed during construction and operation phase taking into consideration the hierarchy of waste management.
10. Details of the procedure to separate non-recyclable and recyclable waste (e.g. sorting by trained personnel).
11. a) Management of non-recyclable waste:
    i. Details regarding storage facilities for waste (e.g. suitable skips and containers).

ii. Frequency of removal of waste from the site and indication of the destination of the waste. It is important that pollution and odours be avoided by regular removal of waste from the site.

b) Management of recycled waste:

i. Details on the types of waste material that will be recycled on site;

ii. Details pertaining to the sorting, handling, storage and collection procedure for the respective types of waste;

iii. Details regarding waste storage areas, taking in to account that these areas need to be cleaned and disinfected regularly. Waste needs to be protected from rain, storm water runoff, and fire. Therefore it is recommended that waste storage area be roofed;

iv. Written proof of consultation with recycles companies also indicating the frequency of removal of the recyclable waste.

12. Detailed description of the sewage management must be provided, this include the treatment facility that will handle the sewage and the capacity of the facility. A detailed map of the sewage system (network) and the approval from the Municipality is required.

13. A traffic impact specialist study must be undertaken as part of the EIA process to indicate the following:

(i) ingress and egress points;

(ii) how the proposed development could link to existing road infrastructure; and

(iii) whether the existing road infrastructure can cope with the increased traffic load. Appropriate mitigation measures must be provided in the case where the traffic of the proposed development would interfere with the current traffic flow in the area.

14. It is imperative that the site layout plan must be informed by geotechnical constraints. This layout plan indicating all development components must be submitted to and endorsed by the Council of Geoscience. In addition, it is recommended that the Council of Geoscience provide comments on whether the relevant geotechnical investigations commissioned have employed established best practice guidelines and methodology in determining the dolomite stability conditions.

15. A description of the compatibility of the soil type to this type of development, as well as the depth of ground water on site must be provided. Attention must be given to expansion and stability properties.

16. The Department's Conservation Plan (C Plan 2) indicates that the site is important due to the presence of sensitive vegetation. Therefore, vegetation surveys must be undertaken by suitably qualified specialists registered as Professional Natural

Scientists in accordance with the Natural Scientific Professions Act (No. 27 of 2003) within the field of Botanical Science. Specialists must have qualifications and experience relevant to vegetation science/ecology.

i. Surveys must take place during the summer season (beginning of November to the end of April).

ii. Scientifically credible methods must be employed and a reference provided.

iii. C.V of the specialist who undertook the study must be attached on the report.

17. A Comprehensive Environmental Management Plan (EMP) for various phases of the proposed activity (construction phase, operational phase and decommissioning phase) must be submitted to this department. The EMP must include:

i. A discussion on mitigation measures for all potential negative impacts identified as well as the persons responsible for implementing such measures.

ii. A demonstration of commitment to the adoption and implementation of Cleaner Production and energy efficiency.

iii. An indication of commitment to the use of Cleaner Technologies.

Please note that the EIA report must also reflect all the requirements as stated in section 30 (2) of Government Notice R543 of Environmental Impact Assessment Regulations of 2010 promulgated in terms of section 24 (5), 24M and 44 of the NEMA act, 1998 (as amended).

Yours faithfully

Adv. I. Nesidoni
Acting Head: Agriculture and Rural Development
Date: 2010/09/03

CC: JR 209 Investments (Pty) Ltd — Attn: Mr. Barry Hertzog, Tel: (012) 991 9700

Director: Compliance & Monitoring (Agriculture & Rural Development) — Attn: Cecilia Petlane, Fax: (011) 335 1850, Tel: (011) 355 1993

Annexure G

APPLICATION FOR A PROPOSED TOWNSHIP, IN TERMS OF SECTION 96 OF THE TOWN PLANNING AND TOWNSHIPS ORDINANCE, 1986, ON A PART OF PORTION 1 OF THE FARM STUKGROND 382-JR:

MONAVONI EXTENSION 44

M&T DEVELOPMENT (PTY) LTD.
P.O. Box 39727
FAERIE GLEN
0043

Tel No.: (012) 676-8584
Fax No.: (012) 676-8585

Project No.: MONAVONI EXTENSION 51
Ref No.: MON X 44 MEMO

Enquiries: Pieter Heukelman/ Cobus Cronje

Date: 8 February 2013

MEMORANDUM IN SUPPORT OF THE APPLICATION IN TERMS OF THE TOWN PLANNING AND TOWNSHIPS ORDINANCE, 1986 FOR THE ESTABLISHMENT OF A TOWNSHIP TO BE KNOWN AS

MONAVONI EXTENSION 44

SITUATED ON A PART OF PORTION 1 OF THE FARM STUKGROND 382 JR

1. PURPOSE OF THE APPLICATION

This application made in terms of Section 96(1) of the Town Planning and Townships Ordinance, 1986 (Ordinance 15 of 1986) is for the establishment of a township consisting of four (4) erven.

Monavoni Extension 44 will comprise of:

- **2** erven zoned "**Residential 2**";
- **2** erven zoned for **"Special"** for Light Industrial, Offices, Showrooms, Distribution Centres.

2. GENERAL INFORMATION

2.1 **Township Name**

The name **Monavoni Extension44** has been allocated to the proposed township by the City of Tshwane Metropolitan Municipality.

2.2 **Property Description**

The township is situated on **Part of Portion 1 of the Farm Stukgrond 382 - JR**.

2.3 **Extent**

The township area measures 38,3520 hectares in extent.

2.4 **Registered owner**

Portion 1 of the Farm Stukgrond 382 - JR is registered in the name of **JR 209 Investments (Pty) Ltd** as set out in Deed of Transfer T171219/2003**.**

2.5 **Title Deed**

There are no restrictive title conditions that will impact the application in a negative way.

2.6 **Servitudes & Encumbrances**

There are no servitudes and encumbrances that will impact the application.

2.7 **Mineral rights**

There are no Mineral rights certificate issued in respect of the properties that affect the township and as the State are now the custodian of all mineral rights, the comment from the Department of Mineral & Energy Affairs will be obtained on the township application and this will include the consent from them as the mineral rights owner.

2.8 **Mortgage Bonds**

The property is bonded by Investec Bank via bond B12069/2010 .

2.9 The site

2.9.1 Locality

The proposed township is situated to the east of the proposed PWV-9, west of the R55, to the north of the M34 (Ruimte Road) and the N14, west of Mimmosa Road (extension), south-west of Sunderland Ridge, and to the east of Gardener Ross Golf Estate.

2.9.2 Topography and Hydrology

The property has a gentle downwards slope in a north western direction. The property is not affected by a 1:50 and 1:100 year floodlines as indicated on the layout plan. The topography will therefore not have any constraints in regards to the township application.

2.8.3 Geology

A Geotechnical Investigation will be conducted to determine the Geology of the site. As soon as the Geotechnical Report is finalised, the report will be handed in at the Council for Geoscience. The comments from the Council of Geoscience will be provided to the council, as soon as we receive it.

A copy of the geotechnical report will also be handed to the Council once it is finalised.

2.8.4 Existing Land use

The application site is vacant and undeveloped.

2.10 Environment

An Environmental Impact Assessment is required for this proposed development in compliance with the Environmental Impact Assessment (EIA) regulations, in terms of the Section 21 of the Environment Conservation Act (Act No. 73 of 1989) as well as the National Environmental Management Act (No. 107 of 1998).

2.11 Legal and Administrative controls

The property is subject to the following legal and administrative controls:

2.11.1 Tshwane Town Planning Scheme, 2008

The property falls within the area of the jurisdiction of the Tshwane Town Planning Scheme, 2008 and is presently zoned for **"Agricultural"** purposes.

2.11.4 Monavoni and Western Farms Development Framework 2020 (November 2008)

A development framework was drafted in terms of which areas were earmarked for urban expansion during the period 2008 to 2020. A Development Edge was also proposed in terms of this framework to provide a guideline for the type of land uses that can be allowed inside and outside the Development Edge.

The properties that form part of this application fall within the boundaries of the Development Edge. This area was further divided into a number of Land use Management zones. The aim of these zones is to promote the development of a

1.10.5 **Tshwane Open Space Framework (November 2005)**

In terms of the Tshwane Open Space Framework the property is situated within a Green node, regarded as a protected area. Protected areas are strategically important Ecological Structuring elements within the Tshwane Open Space Framework and should be conserved. This property however falls in an area, which is regarded to have a **low** Ecological sensitivity. The property is also situated adjacent to a Brown node, the Gardener & Ross Golf estate, which includes informal and formal recreational open space areas such a sports facilities and recreational parks.

In terms of provisional environmental impact assessments and sensitivity maps, the proposed township development will not have a detrimental impact on the environment and will be in line with the requirements of the Tshwane Open Space Framework.

3. MOTIVATION

3.1 PROPOSED USES

This application is for the establishment of a residential township **Monavoni Extension 44** with the following proposed land uses:

- **2** erven zoned "**Residential 2**";
- **2** erven zoned for **"Special"** for Light Industrial, Offices, Showrooms, Distribution Centres.

3.2 NEED

M&T owns a substantial amount of property within the area of the application site, and have developed various developments in the area. With the developments M&T spent a considerate amount of money to obtain engineering services to the adjacent townships. The already installed services will therefore be optimally utilized as was planned from the previous developments that M&T developed in the adjacent area of the application site.

It was therefore always the idea to expand the Monavoni precinct. The market demand is the main factor that the township has not yet been proceeded with. In the last two years the development market has slowed down considerably with the global recession. Indicators and previous recessions have shown that the recession will end in the near future, therefore, the development will be at the end stages when the recession is over.

The application site is also located within the urban edge. This is an important aspect to take cognisance of, the reason being that there is limited space available within the urban edge for new developments. It is therefore important to develop new developments within the urban edge, to combat urban sprawl, to save valuable agricultural land.

The application site is in close proximity to informal settlements. The planned mixed use within the proposed development will have a big impact on the informal settlements as it will create work opportunities and have a mixed use development close to the informal settlement, that will enhance the sense of place of the area.

The recent trend has emerged over the last couple of years for offices and industrial properties situated outside of the CBD. The reason for this being that business owner and their workers can live closer to work, and in close proximity to other amenities such as convenient stores. There is also an underprivileged work force that can benefit from jobs.

There are residential erven within the development, and in recent years the residential market has still grown to provide for a growing number of home owners. The growth in the residential market can be contributed to a few factors, which include favourable interest rates, a larger amount of investors in residential property as a result of increasing house prices and more potential home owners. Cost of residential property have increased continuously for the last five years and even though the market has slowed down some in the last 5

years, in line with a decline in the global economy, indications are that the residential market is recovering and house prices are again starting to increase as banks are approving more home loans and people again start to invest in property and property development. Interest rates have again reduced substantially which will ensure a renewed interest in residential development.

A trend in residential development that has not changed is a need for smaller, more affordable residential units, where you can buy a lock-up-and-go unit in close proximity to amenities.

There is also a need for some office developments in any residential development to provide professional suites, medical suites and other offices that are required to be situated in close proximity to residential erven, but with good access from the region. This will also contribute towards a sense of place by having a mixed use zoning.

This township is part of a large property where development up to now, was mainly used for agricultural purposes. Most of the property can be developed at high densities, due to minor environmental sensitivities, such a ridges and important waterways. This property has no sensitivity areas and is not affected by a 1:50 or 1:100 year floodlines.

Security has become the number one priority for new home owners. Throughout South Africa there has been a general move towards safer and secure neighbourhoods. This has also been proven by the amount of street closures for security purposes in traditional neighbourhoods and the fact that most of the new residential and office developments throughout South Africa include security and access control as the main attraction point for new home buyers.

This proposed residential development will provide in a need for secure development where a lifestyle with peace of mind will be established. The development will have 24 hour interactive security, an electric perimeter fence around the development, and manned access control point will be provided at the entrance.

The erven in this development will be set in a pleasant environment, with good access to work opportunities. The development will be attractive to a wide range of homeowners, and businesses with added benefit of security and have access to amenities close by.

3.3 DESIRABILITY

Several factors will contribute towards the desirability of the proposed development and these aspects will be discussed in more detail.

3.3.1 Desirability of land uses

The proposed township is situated within a node of estate development such as Stone Ridge Country Estate, Silver Wood Estate, Silver Wood Estate, Raslouw Lifestyle Estate, and Heuwelsig Estate that already constitutes a node for development in the area and this proposed development will complement the existing residential node in the area. The developer has already invested in bringing services to this area and these existing services should be utilised optimally. The development should also facilitate the sensible and economic growth of the area.

All the above elements will contribute towards the creation of a unique lifestyle environment which will be in harmony with the surrounding area and natural elements of the site.

3.3.2. Locality

The proposed township is situated on part of a portion of land in the south western section of the Tshwane metropolitan area. The proposed development is situated in close proximity to two major highways, one existing and one proposed. The N14 (R28) is a major east west link through Tshwane which connects with the N1 highway to form one of two major movement spines through the area.

The proposed PWV 9 situates to the west is a new proposed highway which is one of the few provincial roads which are planned to be constructed as soon as possible. The construction of this highway will alleviate pressure from the N1-21 highway which is to capacity in peak hour traffic. Access to this area will be obtained via Mimmosa Street.

Mommosa street is another important north south link which will affect this property. Mimmosa Street runs through the development site in an north-east, south-western direction.

The site is therefore strategically located within the region and sufficient north south and east west links could be provided to ensure adequate distribution of traffic through the area, based on the current development patterns for the area.

3.3.3. Access & traffic distribution

The access to the township will be obtained from Mimmosa Street, and several planned roads through to be constructed through the broader Monavoni area.

Mimosa Street will then provide access to the two parts of the development, one to the north and the other on the south. The density of the township was largely determined by the amount of traffic the proposed roads can accommodate. Some road upgrading will be required as part of this township development to accommodate the additional traffic which would be generated for this development. The details of the road upgrading will be set out in a detailed traffic impact study.

3.3.4 Existing and proposed surrounding and adjoining land uses

The property is situated in an area which is currently characterised by the following land uses.

- To the west is a rural residential area with many small farming and business operations spread through the area.
- To the south and east are some residential estate developments.
- Situated to the north is an informal settlement.

The proposed application site is well situated for its proposed use and the proposed development will be compatible with the surrounding adjoining and adjacent land uses**.**

3.3.5 Development Facilitation Act, 1995

The proposed development will ensure a coordinated development of the larger area by creating a residential enclave in harmony with the open space area. The density for the development will ensure that as many units which can be accommodated on this are being developed, without compromising the surrounding environment. Therefore existing resources will be optimally utilised for this development.

The proposed development will therefore comply in broad terms with the principles of the Development Facilitation Act, 1995 in that it will balance the economic and social needs of the developer with that of surrounding property owners and developments to create a development which will benefit the larger area.

The development will optimise the utilisation of existing resources, including resources relating to agriculture, land, minerals, bulk infrastructure, roads, transportation, and social facilities. This development was planned taking full cognisance of the physical aspects of the property and all aspects relating to existing resources of bulk infrastructure, roads, and transportation were investigated in detail. All existing resources will be fully optimised and the provision of additional service infrastructure will be to the benefit of the larger area.

The natural environment played an integral part in the design of the township and is a very important component of the township establishment process. Cognisance was taken of environmental sustainability and environmental sensitivity of surrounding land uses.

From the above mentioned it is evident that this proposed development takes cognisance of the development principals as set out in the Development Facilitation Act and will aim at compliance with the principles in broad terms.

3.3.6 Streets

All the streets within the township will be public streets that will give access to the various erven in the township, and will also give access to future developments within the surrounding proposed developments.

3.3.7 Street names

Street names will be obtained from the council for the development.

3.4 ENGINEERING SERVICES

Detailed engineering services reports will be submitted as part of this application for township establishment. Engineering services will be designed to the standards of the City of Tshwane for a township.

3.4.1 Roads

Access to the township will be obtained via Mimosa Street. Certain upgrading will be required in line with recommendations of the traffic impact study.

The geometric street layout of the proposed roads for Monavoni Extension 44, are in accordance with the standard of City of Tshwane Metropolitan Municipality.

3.4.2 Stormwater

All roads will be drained through pipe and open channel networks towards the public open space areas and roads, within the boundaries of the township.

The township is not affected by the 1:50 and 1:100 year flood line as indicated on the township layout plan.

3.4.3 Water

The Services Scheme Report will in detail describe how water will be supplied to the application site.

3.4.4 Sewerage reticulation

The Services Scheme Report will in detail describe how the sewerage reticulation will be removed and handled to the application site.

3.4.5 Electricity

The Services Scheme Report will in detail describe how electricity will be supplied to the application site.

4. PLANNING AND DESIGN

The design principles which were incorporated in this development were derived from the Client's brief as well as the incorporation of appropriate engineering and town planning standards. This was done in order to ensure a development which would promote overall safety, from a traffic point of view, cost effectiveness in terms of required engineering services, as well as promoting an integrated, sustainable, and liveable environment. These principles were all adhered to whilst fostering a unique sense of place and creating a unique environment.

The following design principles were adhered to and included in the design:

- Access to and from the township is restricted to access from Mimosa Street. Mimosa Street (25m) will be the main access road to the development. Access from this road is restricted to a few designated access points. The importance of these design criteria is the manner in which it creates the capacity to establish a "walled-in" security estate which ensures the safety and security of all inhabitants.

- The ***traffic distribution*** within the development is regulated by means of a circular road system where possible to ensure that all vehicular movement is distributed in the most efficient manner possible. Road widths within the township are wide enough to ensure free and save pedestrian movement within the proposed township.

5. CONCLUSION

This is an application in terms of Section 96(1) of the Town Planning and Townships Ordinance, 1986 for the establishment of the proposed township Monavoni Extension 44 situated on Part of Portion 1 of the Farm Stukgrond 382 - JR.

Monavoni Extension 44 will comprise of:

- **2** erven zoned "**Residential 2**";
- **2** erven zoned for **"Special"** for Light Industrial, Offices, Showrooms, Distribution Centres.

It has been shown that there is a need for the proposed land use, that the proposed land use will fit in with the surrounding and adjoining land uses, as well as the strategic planning for the area which makes it desirable; that the site will have good access; and that all external engineering services can be provided for the development.

This application has considerable merit, has been discussed with officials at the Council where possible and should be favourably considered.

Annexure H

MONAVONI EXTENSION 44
SITE LAYOUT PLAN

SITUATED ON: A PART OF PORTION 1 OF THE FARM STUKGROND 382-JR.

LOCAL AUTHORITY: CITY OF TSHWANE METROPOLITAN MUNICIPALITY

Monavoni Spatial Development Framework

Locality

Notes

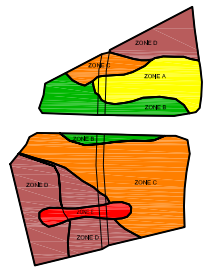
1. The figure ABCDEFGHJKLMNPQRSTUVWXYZaA represents 38.8293 Ha of land being the proposed township boundary of Monavoni Extension 44;
2. All streets have a minimum gradient of 0.5% and a maximum gradient of 5%;
3. Contours are drawn in 0.5m intervals, and are in accordance with Regulation 18(1) of the Town-Planning and Townships Ordinance, 1986;
4. All dimensions and measurements are approximate and subject to final survey;

Servitude Notes

Geological Certification

THIS IS TO CERTIFY THAT THE TOWNSHIP LAYOUT ON THE PLAN IS IN ACCORDANCE WITH THE PROVISIONS AND RECOMMENDATIONS AS SET OUT IN THE GEOTECHNICAL INVESTIGATIONS FOR THE PROPOSED TOWNSHIP: MONAVONI X44

Classification:
Zone A : Class 1
Zone B: Class 3a
Zone C : Class 3b
Zone D : Class 5
Zone E : Class 6



E.D. SHEDDON Pr.Eng no.:
Milner Relly & Sheddon Consulting

Floodline Certification

THIS IS TO CERTIFY THAT IN ACCORDANCE WITH CLAUSE 144 OF THE NATIONAL WATER ACT (ACT 36 of 1998) FLOODLINES WITH AN EXPECTANT FREQUENCY OF 1:50 YEARS AND 1:100 YEARSDO NOT OCCUR WITHIN THE PROPOSED TOWNSHIP MONAVONI EXTENSION 44

HENDRI GELDERBLOM Pr.Eng no.: 910375
Dekker & Gelderblom Consulting Engineers

Land-Use Table

	USE ZONE	ERF NUMBERS	TOTAL ERVEN	TOTAL UNITS	AVERAGE ERF SIZE	TOTAL AREA	%
	LIGHT INDUSTRIAL AND OFFICES	5 & 6	2	n/a	6.2576 Ha	12.5152 Ha	32.23
	RESIDENTIAL (80u/ha)	1 & 2	2	1444	9.0289 Ha	18.0578 Ha	46.50
	PRIVATE OPEN SPACE	3 & 4	2	n/a	1.5365 Ha	3.0731 Ha	7.93
	STREETS	N/A	N/A	N/A	N/A	5.1832 Ha	13.34
		TOTAL:	6	N/A	N/A	38.8293	100

Plan no.:	MONx44-1
Scale:	1 : 5000 (A3)
Date:	October 2013
Drawn by:	L. Combrinck

Amendments:

Monx44-1 2013-10-18 Proposed Layout

DEVELOPMENT
building your future
linndi@mtdevelopment.co.za
t: 012 676 8500 | f: 012 676 8585

Annexure I

RELLY, MILNER AND SHEDDEN
Consulting Earth Scientists

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CONSTANTIA PARK
0010

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Our Ref: 09124mona43

A REPORT

ON

A DOLOMITE STABILITY INVESTIGATION FOR THE PROPOSED TOWNSHIPS OF MONAVONI EXTENSIONS 43 AND 44 ON PORTION 1 OF STUKGROND 382-JR, CENTURION (TSHWANE METRO), GAUTENG.

BY

RELLY, MILNER AND SHEDDEN
PRETORIA

DATE: October 2009

Council for Geoscience

Private Bag X112 Pretoria 0001 SOUTH AFRICA 280 Pretoria Street Silverton Pretoria
Reception: +27 (0)12 841 1911 Internet: http://www.geoscience.org.za

Our Reference: F3051.2
Monavoni Greater Area Extensions 45,46,47
Your Reference:layout maps
Enquiries: G.Heath
Tel: (012) 841 1165
Fax: (012) 841 1148
No. of Pages: 3

6 November 2009

Tshwane Metropolitan Municipality
Department Roads and Stormwater: Geology Section
Centurion Offices
P O Box 14013
Lyttelton
0140

Attention: **The Deputy Manager: Infrastructure Planning and Management**
Hannes Claasen

By Fax: *012 358 3361*

The Deputy Manager Regional Spatial Planning
Lettie van der Berg

By Fax: *012 358 3592*

Dear Sir / Madam,

GREATER MONAVONI AREA (SOUTH), PARTS OF WHICH NOW KNOWN AS MONAVONI 45,46,47

The firm, Relly, Milner and Shedden Consulting Earth Scientists (RMS) submitted their draft report: "A Dolomite Stability Investigation for Proposed Developments on Portions of the farms Swartkop 356-JR, Stukgrond 382-JR and Honeypark 437-JR, Centurion (Tshwane Metro) Gauteng", dated February 2009 on behalf of their client, M&T Developments, to this office for comment on 16 February 2009. Layout plans (X3) have subsequently been received (23/10/2009) requesting our co-signature.

This office acts as Agent to your Municipality in auditing the geoscientific work and emanating recommendations.

The three layout plans for the three extensions show development densities of:

- Extension 45 80u/ha for the and 3b(5) areas.
- Extension 46 120u/ha (Erf 1) for the IRC 3b(5) areas. 80u/ha (Erf 2) for the IRC 3b(5) areas. 80u/ha (Erf 3) for the IRC 3b(5) areas. Erfs 4-6 designated as open space.
- Extension 47 80u/ha (Erf 1) for the IRC 3b(5) areas. 120u/ha (Erf 2) for the IRC 3b(5) areas. Erf 3 designated as open space.
- A rider has been inserted stipulating that the IRC 3a/6 and IRC 6 areas require further investigation.

This office cannot, at this point in time, support the proposed densities which exceed our 2007 Guidelines. No motivation has been supplied in the draft report in terms of the draft SANS 1936 and hence this has not been considered. Indications fro the draft SANS 1936 are though that the IRC 5 areas will not be suitable for these level of densities.

It should be noted that the draft report supplied by RMS indicates our support (28/3/2008) for multi-storey buildings at Monavoni Extension 19. No details have been given that that concept will be applied here and what the specific details are.

If you have any further queries, please do not hesitate to contact this office.

Yours faithfully,

G J HEATH
ENGINEERING GEOSCIENCE UNIT

CC: **Relly, Milner & Shedden**
P O Box 32107
Glenstantia
0010

ATTENTION: **Mr. E Shedden**

By Fax: *012 998 6890*

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Consulting Earth Scientists

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A REPORT

ON

A DOLOMITE STABILITY INVESTIGATION FOR THE PROPOSED TOWNSHIPS OF MONAVONI EXTENSIONS 43 AND 44 ON PORTION 1 OF STUKGROND 382-JR, CENTURION (TSHWANE METRO), GAUTENG.

BY

RELLY, MILNER AND SHEDDEN
PRETORIA

DATE: October 2009

TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

This report (09124mona43) presents the results of a dolomite stability investigation carried out for the proposed proclamation of Monavoni Extensions 43 and 44 situated on Portion 1 of the farm Stukgrond 382-JR in Centurion (Tshwane Metro), Gauteng (see locality plan overleaf).

The purpose of this investigation was to collate existing borehole information from various phases of exploratory drilling over the past 5 years and then to assess the dolomite stability of the site with respect to the formation of sinkholes and/or dolines (compaction subsidences). Existing information has confirmed the presence of dolomitic sediments below the site.

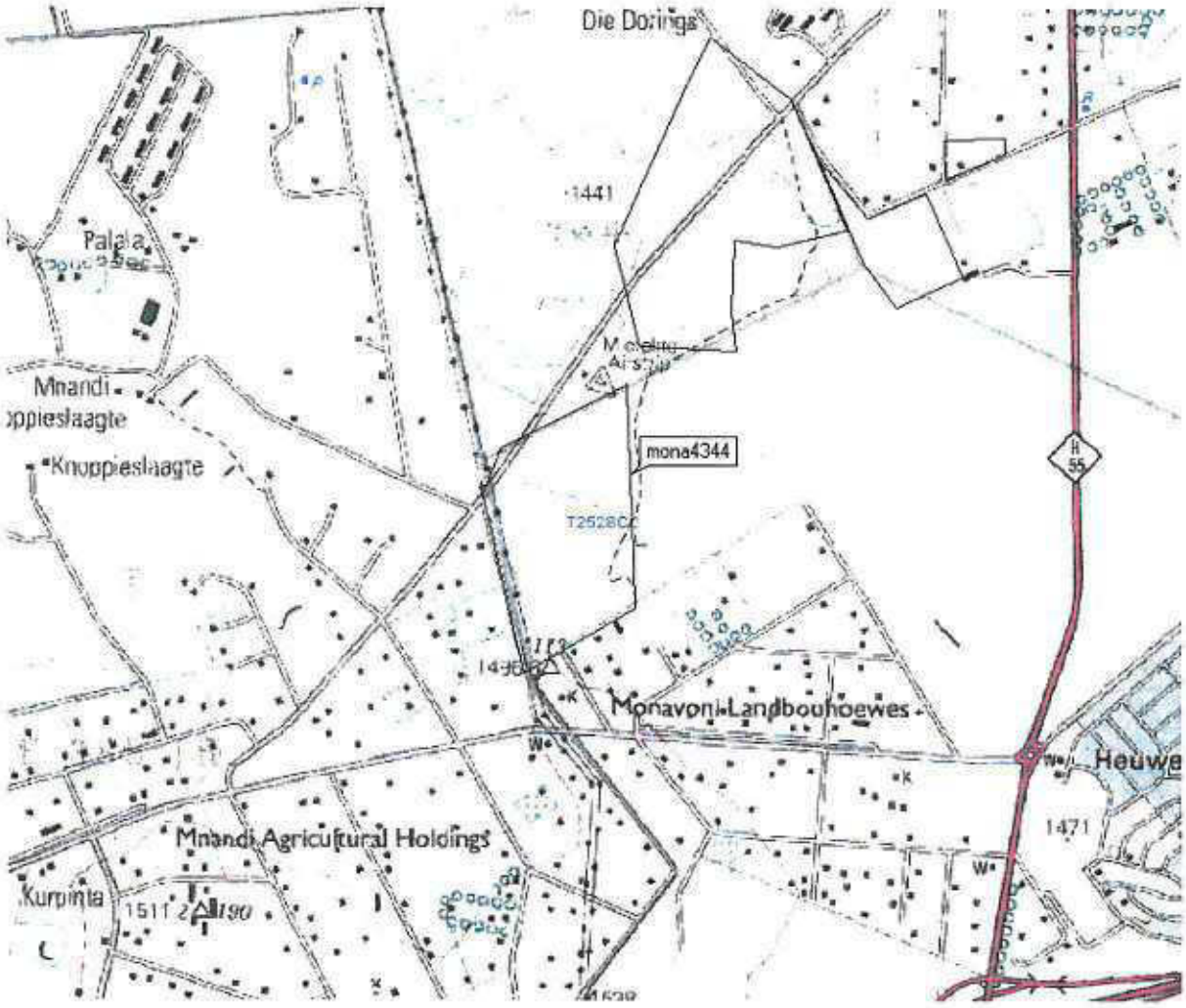
This project was commissioned at the written request of M&T Development (Pty) Ltd, the owner and prospective developer of the site.

The earliest phase of drilling was undertaken by Dolomite Technology in 2004. A second phase was undertaken under the supervision of VGi Consult at the end of 2005. This firm was appointed in 2009 and was involved in a single phase of drilling which was undertaken in July 2009.

2. SITE DESCRIPTION

Monavoni Extensions 43 and 44 occupy a broadly rectangular area of about 50ha. The Extensions are bounded by a farm portion in the north (Portion 7 of Mooiplaats 355-JR), by various holdings of the Mnandi Agricultural Holdings in the west, by various holdings of the Monavoni Agricultural Holdings in the south and by the proposed extension to Mona Avenue in the east. Monavoni Extensions 31 (F3333), 45 and 47 (F3051) lie to the east of the proposed extension to Mona Avenue. A powerline servitude follows the western boundary of the site.

The main access to the site is to be via a newly constructed road along the south eastern boundary from Mona Road. A new road, possibly an extension of Hjelm Road, is to be



LOCALITY PLAN

MONAVONI EXTENSIONS 43 AND 44,

CENTURION, PRETORIA

GAUTENG.

constructed in a northerly direction through the centre of both extensions. There are no roads on the site at present (August 2009) except for a gravel road crossing the extreme northwest corner. The unsurfaced road provides access to a landfill site to the north of the properties. The main arterial road is the proposed, east-west trending K52 route along the northern boundary of Extension 31 and through the middle of Extension 44. The road is still to be constructed.

The entire site is undeveloped farmland previously used for cattle grazing. The developer has excavated a 1,5m deep, 2m wide trench along the western and northern portions of the site in an effort to limit illegal dumping.

Vegetation on the site consists of typical veld grasses with very occasional thorn trees.

The relief of the site is moderate to low with an overall cross-fall of about 40m from the south-western corner to the north-eastern corner. The overall gradient of the slope is about 3,5% to the NE. The south-eastern portion of Extension 43 has a slightly steeper slope with a gradient of about 5%.

3. GEOLOGY

According to the 1:50 000 Geological Series, Sheet No. 2528CC Lyttelton, the area is underlain by Basement granite in the extreme south-western corner, by quartzite and shale of the Black Reef Formation separating the underlying granite from the overlying dolomite and chert of the Oaktree Formation (Malmani Subgroup) of the Chuniespoort Group. The Black Reef Formation and the overlying Chuniespoort Group forms the basal portion of the Transvaal Supergroup.

The chemical sediments have been intruded by numerous sills and dykes of syenite in this region. The geological map indicates an extensive sill of syenite in the north eastern half of the site. Evidence of syenite was intersected at varying depths in numerous boreholes throughout both extensions. The word syenite has been used loosely as a collective term to

indicate the presence of igneous intrusives. Some consultants have referred to the intrusives as diorite.

The hard rock geology is mantled by an irregular layer of overburden material comprising both colluvial and residual soils. Dolomite rock crops out sporadically in the flatter lying areas particularly towards the north-western corner. The trench excavated along the western boundary has exposed numerous pinnacles of hard rock dolomite. The trench has also indicated that many surface exposures of dolomite rock are not necessarily bedrock but large, slab-like "floaters".

Two idealised cross-sections through the site have been drawn up in an attempt to better understand the regional relationship between the intrusive syenite, sedimentary dolomite and underlying non-dolomitic rocks. The cross-section is presented in Appendix F.

4. EXISTING INFORMATION

An unpublished report (VGi3028prcR(Final)) covering the Monavoni Area was prepared by VGi Consult in 2006 and was made available to this firm by the client. The area covers Extensions 43 and 44. The VGi report indicates three different inherent risk characterisation (IRC) categories ranging from Class 4(1) through to Class 6. The report was not submitted to the Council for Geoscience. The profiles of some of the boreholes located within the two Extensions have been mislaid. These boreholes have been removed from our map but may be shown on earlier maps/plans of the area.

5. METHOD OF INVESTIGATION

This investigation focused on the collation and re-assessment of existing drilling information and initiating further drilling in areas where subsurface information was regarded as insufficient. A single phase of drilling was undertaken under RMS supervision.

A composite residual gravity map covering the Greater Monavoni Area was used to position

some of the RMS boreholes. The composite map represents a residual map made up of a number of separate surveys undertaken between 2004 and 2006. The map is included in Appendix B.

6. PERCUSSION DRILLING

A total of fifty-nine, 165mm ϕ, rotary percussion boreholes, totaling 1221m, were drilled in and immediately adjacent to Extensions 43 and 44. This firm supervised the drilling of twenty-one boreholes (total of 576m). The RMS boreholes were drilled by J K Developments cc using a Thor rig operating at a pressure of 1 500kPa (15Bar). The contractor was instructed to drill the boreholes to a maximum depth of 60m or at least 6m into solid rock, whichever occurred first, but with a minimum depth of 10m. Boreholes range in depth from 10m to 40m below the surface with an average depth of about 20m.

Samples were recovered (where possible) for every metre advanced and retained in small labelled plastic bags. The penetration time per metre advance was recorded together with any other information regarding air loss, the presence of cavities and/or the presence of ground water during drilling operations. Where possible, water rest levels were recorded when the boreholes were backfilled some days after completion of the drilling operations.

Detailed descriptions of the samples recovered are given in the Borehole Profiles in Appendix C and the positions of the boreholes are shown on the plan in Appendix D.

7. DRILLING RESULTS

A summary of the results from fifty-nine percussion boreholes drilled on or adjacent to this site is presented in a table in Appendix C.

7.1 Overburden Material: This refers to the "loose, unconsolidated" soil material that overlies the bedrock and includes all residual soils.

The number of boreholes drilled on this site precludes the ability to comment on each and every geological sequence that is intersected. However, the site can be divided into five different geological profiles depending on whether or not granite, quartzite, intrusive syenite or dolomite is present. The majority of the site is characterised by a ground profile of a thin cover of colluvium overlying a variable sequence of residual syenite and/or residual dolomite, often as wad. Wad is the insoluble residue of iron and manganese oxides and other impurities after the dissolution of dolomite rock. This material is highly variable and may be present as silt, clay a combination of both or as "blocky" fragments that still retain some of the original rock fabric. Waddy soil can be highly compressible and is easily erodible in some forms particularly when present as silt. The five different geological profiles used in assessing this site are discussed in more detail in the following paragraphs.

- *Syenite only:* Four boreholes (BH's 44/15, 44/20, 19/139 and 19/155), drilled within the site, intersected syenite from surface to the bottom of each hole. Residual syenite, in the form of silt or sand, grades with depth, into hard rock syenite. The presence of only syenite in boreholes tends to be an exception on this site. Two other boreholes (BH's 19/159 and 19/160), drilled within the proposed K52 route, intersect syenite from top to bottom. Boreholes 44/18 and 44/21 intersect syenite bedrock below between 3m and 5m of wad-rich residual dolomite. Another borehole intersecting mostly syenite is BH 44/14 in the north-eastern part of Extension 44.

- *Syenite and dolomite:* Most of the boreholes drilled in the two extensions intersect a combination of dolomite and syenite within the ground profile. Residual syenite overlies dolomite bedrock in most of the central and northern boreholes. The syenite varies in thickness from two or three metres (BH's 44/07 and 44/13) to about 10m (BH 5823(18)). In some boreholes syenite is separated into two layers by a lens dolomite between 6m and 13m thick. A characteristic of most of these boreholes is the abundance of wad above or below the intrusive syenite yet in one or two boreholes there are very abrupt

contacts between the host rock (dolomite) and the intrusive.

The presence of residual dolomite and/or dolomite bedrock both above and below syenite confirms the sill-like nature of the intrusions. The sills are fairly extensive but it is difficult to assess whether or not the sills represent a single phase of intrusion along planes of weakness in the host rock (possibly along shale partings within the dolomite bedrock) or whether a number of different phases of intrusion have taken place. The seeming lack of continuity along the approximate strike of the dolomite would suggest that the syenite sills tend to be discordant rather than concordant.

- *Dolomite only:* A number of boreholes are terminated in dolomite bedrock without intersecting any indication of syenite. These conditions occur along the western boundary of both Extensions and in the north-eastern corner of Extension 44. The boreholes are range from 10m to about 20m deep. The deeper boreholes in dolomite are as a result of portion of the bedrock yielding penetration times less than 3 minutes per metre advance. The bedrock is generally covered by a fairly thin layer of overburden between 1m and 5m thick although exceptions do occur particularly where thick pockets of wad are present.

- *Thick layers of wad overlying dolomite and/or syenite:* A characteristic of this area is the ubiquitous presence of residual dolomite overburden in the form of wad. A high manganese concentration in the Oaktree Formation is the reason for the abundance of wad in the residual dolomite.

  The weathering process of the dolomite has resulted in the development of thick horizons of wad in certain areas. The composition of the waddy material varies between clay and silt. There appears to be no regularity in terms of wad development with deep pockets adjacent to dolomite outcrop. It is postulated that both the chemical composition of the dolomite bedrock and physical properties such as fracture frequency impact on the overall process of wad

development. It is uncertain whether or not the thermal effect of intrusive syenite influences the process of wad development. Waddy layers from surface or below a thin horizon of colluvium have the most negative effect on development and their extent has been indicated on a plan in Appendix D. These layers vary in thickness from a metre or two to about 14m with an average of about 3m. The wad-rich residual dolomite is intersected in the top 20m of the ground profile where present.

- *Non-dolomitic sediments excluding syenite:* Boreholes (BH's 44/08, 44/09, 7017(49) AND 7002(20)) drilled along the south-western boundary and in the south-western corner intersect non-dolomitic material in the form of Black Reef quartzite and Basement granite at depth. The residual quartzite or granite, in the form of gravelly sand, occurs below layers of wad-rich residual dolomite, lenses of residual syenite and fractured dolomite bedrock.

7.2 **Bedrock:** Bedrock, in a dolomitic environment, is usually defined as the first layer of hard rock at least 6m thick. The definition is necessary to avoid any confusion between large dolomite boulders (floaters), often metres in diameter, and solid bedrock.

According to the above definition, bedrock either as syenite, dolomite, granite or quartzite is encountered in all of the boreholes drilled on this site except two (BH's 19/144 and 7401(50)). The depth to dolomite bedrock ranges from surface (outcrop) to 32m (BH 43/04) below the surface while the depth to syenite bedrock ranges from 6m (BH 44/15) to 27m (BH 7002(20)) below the surface. Hard rock syenite bedrock tends to characterise those boreholes drilled in the northern portion of Extension 44. Dolomite forms the bedrock over the remainder of the site except where boreholes intersect granite on the western boundary. The process of weathering is significantly different for dolomite and syenite. Syenite exhibits a typical weathering profile ranging from residual silt/clay (completely weathered) through sand to very soft rock then soft rock and eventually hard rock at depth. The percussive effect of the drilling

often results in very soft rock syenite being recovered as silty sand/sandy silt. The dissolution (weathering) of dolomite tends to result in either soil (residual dolomite) including wad (insoluble dolomite residue) or hard rock dolomite. There is seldom, if ever, a zone of gradational weathering from very soft rock dolomite through to hard rock dolomite.

Penetration times indicate that bedrock is interested below a depth of 14m in BH 43/02. It was initially assumed to be dolomite but surrounding boreholes suggest that this may not be a valid assumption. The possibility that the bedrock is syenite, granite or quartzite cannot be ruled out.

A feature of a number of the boreholes that have intersected dolomite is the fairly rapid penetration times recorded for a considerable depth in what appears to hard rock dolomite. There is no visible reason for penetration times to suddenly increase to greater than 3 minutes per metre advance. Examples can be seen in BH's 43/04, 44/03, 44/07, 44/10, 44/12, 4/17 and19/144 in which hard rock dolomite appears to have been intersected from a shallow depth although, in terms of penetration times, hard rock is only indicated at depth. In most instances it has been assumed that fracturing is the reason for the more rapid penetration times although the dolomite appears to be slightly "shaly" or graphitic in some boreholes.

8. HYDROLOGY

Ground water strikes occurred at depths of between 25m and 35m below the surface in only three of the new boreholes (BH's 43/04, 44/14 and 44/17) drilled in Extensions 43 and 44. No ground water strikes were recorded in the previously drilled borehole nor were any water rest levels recorded on the profiles. Water rest levels were recorded at depths of between 7m and 10m in 11 of the new boreholes. Rest levels were recorded at least 24 hours after completion of the drilling operations. The rest levels range in elevation from 1475m (BH 43/01) above mean sea level (alms) to 1451mamsl (BH 44/19). The depth to the water rest levels mirrors the topography which slopes from the south west (BH 43/01) to the north east (BH 44/19).

No indication of borehole yields were offered by the drilling contractor and it is difficult to assess whether or not the rest levels represent perched water tables. High yields would suggest a permanent water table rather than a perched one.

The site has been assessed in terms of both a dewatering and non-dewatering scenario. A report prepared for Dolomite Technology by P Hobbs in November 2004 discusses the hydrology of a large area which includes Extensions 43 and 44. According to the report (see Appendix E), the ground water rest level is unlikely to "experience a natural fluctuation of more than 8m". The report further states that existing information indicates that a maximum fluctuation of about 5m has taken place over the last 25 years. Natural fluctuations between 5m and 8m of the ground water rest level should not affect the stability since these conditions have already occurred i.e. the compressible wad layers have already undergone some degree of consolidation. The potential for significant dewatering is relatively low as the area is not intensely farmed. Dewatering is not assessed as a significant threat to the overall stability of the site in particular or the area in general.

The writer is of the opinion that the western boundary of the Erasmia ground water compartment lies further to the west than that indicated in the report. A DWAF map indicates the compartment boundary to lie to the west of Extensions 43 and 44.

No surface drainage features occur on the site.

9. INTERPRETATION OF THE GEOLOGY

The residual gravity map is characterised by a fairly prominent gravity low trough trending along the western boundary in a NS direction. A relative gravity high is indicated along the south eastern boundary. The gravity high increases beyond the eastern boundary in Extension 31. A gravity gradient separates the gravity high from the gravity low with the steepest portion on the southern boundary. The gradient is less well defined in the northern half of the site. This northern portion of the site could be described as an "intermediate" gravity plateau.

In a dolomitic environment gravity highs are usually associated with shallow dolomite bedrock and gravity lows often represent deeply weathered intrusive or thick overburden. On this site the gravity high is characterised by syenite intrusive rather than dolomite and the low along the western edge is associated with the presence of granite and quartzite at depth. The correlation between the residual gravity and the drilling results is no more than moderate.

On this site the gravity lows tend to be areas where irregular subsurface conditions occur compared to the gravity highs or intermediate areas where fairly regular conditions are intersected be it shallow, fractured dolomite or weathered syenite.

The geological picture to emerge from the gravity survey and drilling is one of shallow dolomite intruded by concordant and slightly transgressive syenite sills of varying thicknesses. It is most probable that more than one age of intrusive is present but this is of academic importance only since all intrusive sills have a beneficial influence on the stability of a dolomitic site. The site is located at the southern rim of dolomite occurrence south of Pretoria. Dolomite pinches out in a south westerly direction and is absent in the extreme south-western corner.

10. STABILITY

The modern method of assessing dolomite stability (References 3, 4 and 5) requires that the inherent risk of hazard (sinkhole and/or doline) development and potential hazard (sinkhole) size be determined for each borehole. This is achieved by assessing the geological conditions from the drilling results at each borehole according to a set of standard criteria. These results allow a certain inherent risk characterisation and potential hazard (sinkhole) size to be attached to each borehole. Boreholes exhibiting similar conditions are grouped together and an area is then designated as having a particular risk classification in which certain types of development are recommended. The criteria that need to be assessed are:

i) Nature of the blanketing layer.

ii) Maximum potential space in which a sinkhole may develop.

iii) Presence or absence of voids in overburden and bedrock.

iv) Presence or absence of a mobilising agency.

The probability of instability occurring is related to both the level of inherent risk and the type of development (development risk) that takes place. A high inherent risk area, developed as a cluster, has a greater probability of inducing a sinkhole than a commercial development on the same property because of the higher density of wet services and greater chance of an undetected leak. In an attempt to ensure development is compatible with a certain risk characterisation, appropriate types of development are recommended according to the risk classification of the area.

The comments below are based on the results of a gravity survey and the drilling results from 59 percussion boreholes. An assessment of the drilling results favours the site being subdivided into five inherent risk zones as dictated by the variation in geological conditions.

The various parameters used in the inherent risk characterisation and classification are discussed in the following paragraphs.

ZONE A: CLASS 1

Locality: This zone is an elongate area in the northern half of Extension 44 and is an extension of a favourable zone indicated in Monavoni Extensions 45 and 47 (F 3051.1).

Blanketing Layer: A characteristic of this zone is a very favourable ground profile comprising a cover of residual syenite overlying syenite bedrock. Dolomite bedrock is intersected below a depth of 25m in BH 44/14. Four boreholes are terminated within solid syenite bedrock which occurs at depths of between 6m and 18m below the surface.

Residual syenite is regarded as relatively impermeable and may be classified as an aquitard as it is likely to retard the infiltration of any surface run-off or flow from

leaking services.

Receptacles: Voids are not present within the residual syenite or syenite bedrock. Voids can be expected within the dolomite bedrock below a depth of 25m (BH 44/14).

Mobilising Agency: Any accumulation of water either on the surface or below the surface from a leaking service is a potential mobilising agency. The relatively impermeable nature of the overburden should retard the infiltration of any mobilising agency. The mobilisation potential of the overburden is assessed as low.

Maximum Potential Sinkhole Development Space (MPSDS): This refers to the thickness of overburden in which a sinkhole may develop. The thickness of the MPSDS layer is limited by the first layer of bedrock which varies from about 6m to 18m below the surface in this zone. Since the blanketing layer is entirely residual syenite except below 25m in BH 44/14, the probability of a sinkhole developing is assessed as very low.

Risk Characterisation: A low risk for the development of any size sinkhole and a low risk of doline formation are the inherent risk characterisations (IRC) obtained after evaluating the conditions intersected in the percussion boreholes drilled in this zone. This inherent risk characterisation is applicable to both a dewatering and a non-dewatering scenario because the ground water level occurs within the dolomite/syenite bedrock.

A summary of the materials encountered in the boreholes is given in Appendix C.

Inherent Risk Class: A particular risk class may be determined from the risk characterisation of an area. Certain types of development are considered more appropriate in this risk class. These types of development are believed to be compatible with the level of risk provided the appropriate precautionary measures are implemented.

A summary of the risk characterisations for the boreholes drilled in this zone is given below in Table 1.

TABLE 1

Summary of Risk Characterisation

BH No.	RISK of SINKHOLE FORMATION				RISK OF DOLINES	RISK CLASS	DEVELOPMENT TYPE (Draft SANS 1936)
	Small <2m	Medium >2m-<5m	Large >5m-<15m	Very Large >15m			
44/14	L	L	L	L	L	1(2)	RN1-4;RL 1-3; RH1-3 and C1-10
44/15	L	L	L	L	L	1	RN1-4;RL 1-3; RH1-3 and C1-10
44/20	L	L	L	L	L	1	RN1-4;RL 1-3; RH1-3 and C1-10
19/139	L	L	L	L	L	1	RN1-4;RL 1-3; RH1-3 and C1-10
19/155	L	L	L	L	L	1	RN1-4;RL 1-3; RH1-3 and C1-10
19/159	L	L	L	L	L	1	RN1-4;RL 1-3; RH1-3 and C1-10
19/160		L	L	L	L	1	RN1-4;RL 1-3; RH1-3 and C1-10

Notes: Development potential based on draft SANS 1936 document.

An inherent risk classification of **Class 1** has been assigned to Zone A. There is no restriction imposed on the type of development that may be considered on **Class 1** land provided spatial framework policies are taken into account. It should be noted that most types of development require some form of additional exploratory work (footprint investigations) except for full residential (RN1-4).

ZONE B: CLASS 3a

Locality: Zone B occupies an elongate immediately south of Zone A and along the eastern boundary to a small portion of land in the south-eastern corner of Extension 43 and a small portion in the south western corner of the same Extension.

Blanketing Layer: This zone may be divided into two different ground profiles. The

northern portion and small south eastern portion has a layer of residual syenite between 6m (BH 44/16) and 15m thick overlying dolomite bedrock. A wad-rich layer about 2m thick underlies the syenite in places but is not perceived as a major stability problem. A second occurrence of syenite is encountered in some of the boreholes (BH's 44/16 and 31/9). The south-western corner is characterised by intrusive syenite at depth. The overburden ranges from 13m of chert rubble (BH 7401(50)) to a sequence of shale and quartzite of Black Reef Formation between 13m and 27m (BH7002(20)).

The residual syenite is regarded as relatively impermeable and likely to retard the ingress of surface run-off. The residual dolomite below the syenite is assumed to be permeable.

Receptacles: Voids are not present within the residual syenite, syenite bedrock or sediments of the Black Reef Formation. Voids are assumed to be present within the dolomite bedrock underlying the intrusive syenite.

Mobilising Agency: Any accumulation of water either on the surface or below the surface from a leaking service is a potential mobilising agency. Infiltration of any mobilising agency should be retarded by residual syenite. Ingress of surface run-off will occur above any protective layer of syenite thereby limiting any instability to the layer above the syenite. The zone is assessed as having a low to medium mobilisation potential for sinkhole and doline development.

Maximum Potential Sinkhole Development Space (MPSDS): This refers to the thickness of overburden in which a sinkhole may develop. The thickness of the MPSDS layer in this zone is limited by the first layer of bedrock which occurs at a depth of between 8m (BH 44/16) and greater than 33m (BH 7401(50)) below the surface. A sinkhole developing in a 33m thick layer of overburden would be classified as very large (>15m ø) but the probability of a sinkhole migrating to surface through 20m of residual syenite is very low. An average depth to dolomite is about 10m which would

result in a sinkhole being classified as medium (>2m-<5m ø) sized. The 2m thick layer of erodible wad that underlies the protective capping of at least 6m of residual syenite is not interpreted as a high risk in terms of instability.

Risk Characterisation: A low to medium risk of small and medium sinkholes forming and a low to medium risk of dolines developing are the risk characterisations obtained after evaluating the conditions encountered in the boreholes drilled in Zone B. These conditions are applicable to both a non-dewatering and dewatering scenario since the ground water level lies within the syenite or dolomite bedrock

A summary of the materials encountered in the borehole is given in Appendix C.

Risk Class: A particular risk class may be determined from the risk characterisation of an area. Certain the types of development are believed to be more compatible than others for the assessed level of risk provided the appropriate foundation design and precautionary measures are implemented.

A summary of the risk characterisation for each borehole is given in Table 2 on the next page.

TABLE 2

Summary of Risk Characterisation

BH No.	RISK of SINKHOLE FORMATION				RISK OF DOLINES	RISK CLASS	DEVELOPMENT TYPE (Draft SANS 1936)
	Small < 2m	Medium >2m-<5m	Large >5m-<15m	Very Large >15m			
44/16	L-M	L	L	L	L-M	3a	RN3-4;RH2-3; RL2-3 and C1-10
44/17	L	L	L	L	L	2(3a)	RN3-4;RH2-3; RL2-3 and C1-10
31/9	L	L	L	L	L	2(3a)	RN3-4;RH2-3; RL2-3 and C1-10
19/147	L-M	L	L	L	LM	3a	RN3-4;RH2-3; RL2-3 and C1-10
5220(35)	L	L	L	L	L-M	3a	RN3-4;RH2-3; RL2-3 and C1-10

BH No.	RISK of SINKHOLE FORMATION				RISK OF DOLINES	RISK CLASS	DEVELOPMENT TYPE (Draft SANS 1936)
	Small < 2m	Medium >2m-<5m	Large >5m-<15m	Very Large >15m			
5317(48)	L	L	L	L	L	3a	RN3-4;RH2-3; RL2-3 and C1-10
5823(18)	L	L	L	L	L	3a	RN3-4;RH2-3; RL2-3 and C1-10
6127(60)	L	L	L	L	L	3a	RN3-4;RH2-3; RL2-3 and C1-10
7002(20)	L	L	L	L	L	3a(1)	RN3-4;RH2-3; RL2-3 and C1-10
7401(50)	M	M	L	L	L-M	3a	RN3-4;RH2-3; RL2-3 and C1-10

Notes: Development potential based on draft SANS 1936 document.

An inherent risk classification of **Class 3a** has been assigned to this zone. The limited thickness of the blanketing layer of syenite precludes the inclusion of this area into Zone A. Commercial and restricted residential development may be considered provided the appropriate requirements of the draft SANS 1936 document are implemented including footprint investigations.

ZONE C: CLASS 3b

Locality: The majority of this zone is located within the central portion of Extension 44. A separate pocket occurs at the northern end of the same extension.

Blanketing Layer: The geological characteristics of this zone are similar to Zone B except the blanketing layer of syenite is not as thick nor is it as extensive. The syenite layer is about 2m thick in places although pockets of up to 7m do occur. Waddy layers are often sandwiched between overlying syenite and underlying dolomite bedrock and are generally thicker than the waddy layers intersected in Zone B. The small portion of Zone C in the north is anomalous in that no dolomite bedrock is intersected but syenite intrusive is blanketed by a reasonable thickness of wad-rich overburden almost from surface. Dolomite bedrock is intersected at depths ranging 6m and 21m below the surface in the larger portion of the zone. The bedrock confirmed for a depth 6m at the bottom of each hole except for three boreholes (BH 44/03, 44/18 and 44/21)

where syenite bedrock is confirmed. Boreholes range in depth from 12m to about 27m below the surface. In some instances the dolomite appears to be "solid" rock in the recovered samples but penetration times rarely exceed 2 minutes per metre advance. The "softer" layers of hard rock dolomite are ascribed to closely fractured zones within the solid bedrock.

The overburden, where present, is regarded as permeable and will not retard the ingress of surface run-off except where residual syenite blankets residual dolomite.

Receptacles: Disseminated voids are assumed to be present within the residual dolomite and bedrock but are not expected in residual syenite or syenite bedrock.

Mobilising Agency: Any accumulation of water either on the surface or below the surface from a leaking service is a potential mobilising agency. Infiltration of any mobilising agency should take place with relative ease within the residual dolomite overburden. The zone is assessed as having a medium mobilisation potential for the development of sinkholes and a medium to high mobilisation potential for the development of dolines where residual dolomite occurs at shallow depths. The intermittent presence of syenite within the ground profile has a favourable influence on the mobilisation potential.

Maximum Potential Sinkhole Development Space (MPSDS): This refers to the thickness of overburden in which a sinkhole may develop. The thickness of the MPSDS layer in this zone is limited by the first layer of bedrock which occurs from surface to a depth of about 10m below the surface. A sinkhole developing in a 10m thick layer of overburden would be classified as medium (>2m - <5m ϕ) sized.

Risk Characterisation: A medium risk of small and medium sized sinkholes and a medium to high risk of dolines developing are the risk characterisations obtained after evaluating the conditions encountered in the boreholes drilled in Zone C. These conditions appertain to a both a dewatering and non-dewatering scenario since the

ground water level lies within the solid dolomite bedrock.

A summary of the materials encountered in the borehole is given in Appendix C.

Risk Class: A particular risk class may be determined from the risk characterisation of an area. Certain the types of development are believed to be more compatible than others for the assessed level of risk provided the appropriate foundation design and precautionary measures are implemented.

A summary of the risk characterisation for each borehole is given below in Table 3.

TABLE 3

Summary of Risk Characterisation

BH No.	RISK of SINKHOLE FORMATION				RISK OF DOLINES	RISK CLASS	DEVELOPMENT TYPE (Draft SANS 1936)
	Small < 2m	Medium >2m-<5m	Large >5m-<15m	Very Large >15m			
44/03	L-M	M	L	L	M-H	3b	RN3-4;RH2-3; RL2-3 and C1-10
43/05	L	L-M	L	L	L	3a	RN3-4;RH2-3; RL2-3 and C1-10
44/06	L	M	L	L	H	3b	RN3-4;RH2-3; RL2-3 and C1-10
44/12	L	L-M	L	L	L	3a	RN3-4;RH2-3; RL2-3 and C1-10
44/13	L-M	L-M	L	L	L	3b	RN3-4;RH2-3; RL2-3 and C1-10
44/18	L	L	L	L	H	3a(1)	RN3-4;RH2-3; RL2-3 and C1-10
44/21	L	L	L	L	H	3a(1)	RN3-4;RH2-3; RL2-3 and C1-10
19/133	L	L	L	L	H	3a	RN3-4;RH2-3; RL2-3 and C1-10
19/151	M	L-M	L	L	H	3b	RN3-4;RH2-3; RL2-3 and C1-10
6013(17)	L	L	L	L	L	3a	RN3-4;RH2-3; RL2-3 and C1-10
6521(39)	L-M	L-M	L	L	M-H	3b	RN3-4;RH2-3; RL2-3 and C1-10

Notes: Development potential based on draft SANS 1936 document.

An inherent risk classification of **Class 3b** has been assigned to Zone C. It can be seen

from the table above that pockets of more favourable ground do occur within Zone C but the delineation of these islands of favourable ground will require more detailed drilling. Most types of development considered suitable for this site will require footprint investigations for all structures. Additional exploratory work should highlight the presence of any unfavourable subsurface conditions. Irregular pockets of waddy residuum may require specialised foundations. Full title residential stands at densities of 10 units/ha or less would not require footprint investigations although the irregular occurrence of wad would remain a problem.

ZONE D: CLASS 5

Locality: This zone occurs along the western boundary and a small portion is located in the extreme north-east corner of Extension 44.

Blanketing Layer: A characteristic of this zone is the presence of shallow dolomite bedrock. A protective capping of syenite is generally absent within this zone although isolated exceptions do occur but are usually fairly thin. Some of the boreholes drilled in the west intersect either sediments of the Black Reef Formation or Basement granite underlying dolomite. Borehole 43/02 intersects hard rock below a depth of 14m but a loss of samples below 10m prevents identification of the bedrock. It is probable that the assumed rock represents dolomite although the possibility of Black Reef quartzite cannot be ruled out. The geological map (Appendix A) indicates the Black Reef Formation in the south western corner of Extension 43. Quartzite of the Black Reef Formation is resistant to weathering and generally outcrops to form topographic highs. This is not the case on this site and evidence of the formation is only seen as an occurrence of shale in the 1,5m deep boundary trench. Borehole intersections of the formation are not always easily recognised because of the destructive nature of percussion drilling. Residual granite (sand) and completely weathered quartzite are not easily distinguished in recovered samples. Intrusive syenite is interpreted between 20m and 22m in BH 44/08 which further hampers the accurate separation of the ground profile into a correct lithostratigraphic column. It

appears that the syenite has intruded along planes of weakness associated with the contact between the granite and the overlying Black Reef Formation. The presence of black slate/shale has been taken as confirmation of the presence of the Black Reef Formation. Hard rock granite is confirmed at the bottom of BH's 44/08 and 44/9 at depths of 22m and 25m, respectively.

Residual dolomite is regarded as permeable and is highly erodible when present as waddy silt. Pockets of wad are intersected towards the top of the Black Reef Formation. Residual syenite, where present, is regarded as relatively impermeable and is likely to retard the ingress surface run-off.

Receptacles: Disseminated voids are assumed to be present within the residual dolomite and dolomite bedrock. Voids are not present within the residual syenite or granite bedrock. The base of the dolomite is the base of void formation.

Mobilising Agency: Any accumulation of water either on the surface or below the surface from a leaking service is a potential mobilising agency. Infiltration of any mobilising agency should take place with ease within the residual dolomite. The zone is assessed as having a medium to high mobilisation potential for the dolomitic sediments which are of the order of about 25m thick.

Maximum Potential Sinkhole Development Space (MPSDS): This refers to the thickness of overburden in which a sinkhole may develop. The thickness of the MPSDS layer in this zone is limited by the first layer of bedrock which occurs at a depth of between 1m and 7m below the surface. A sinkhole developing in a 7m thick layer of overburden would be classified as medium (>2m<5m ϕ) sized. The presence of either syenite, quartzite or granite within the ground profile will limit the size of sinkhole development.

Risk Characterisation: A high risk of small sinkholes and a medium risk of medium size sinkholes forming and a high risk of dolines developing are the risk characterisations

obtained after evaluating the conditions encountered in the boreholes drilled in Zone D. The risk assessment appertains to a both a dewatering and non-dewatering scenario.

A summary of the materials encountered in the borehole is given in Appendix C.

Risk Class: A particular risk class may be determined from the risk characterisation of an area. Certain the types of development are believed to be more compatible than others for the assessed level of risk provided the appropriate foundation design and precautionary measures are implemented.

A summary of the risk characterisation for each borehole is given below in Table 4.

TABLE 4

Summary of Risk Characterisation

BH No.	RISK of SINKHOLE FORMATION				RISK OF DOLINES	RISK CLASS	DEVELOPMENT TYPE (Draft SANS 1936)
	Small < 2m	Medium >2m-<5m	Large >5m-<15m	Very Large >15m			
44/07	M	M	L	L	M-H	5(3b)	C2,4-7,9,10; RN3-4; RH 2-3
44/08	M-H	L-M	L	L	M	5(2)	C2,4-7,9,10; RN3-4; RH 2-3
44/09	H	M-H	L	L	L-M	5(2)	C2,4-7,9,10; RN3-4; RH 2-3
44/19	H	M	L	L	H	5	C2,4-7,9,10; RN3-4; RH 2-3
19/132	H	L-M	L	L	L-M	5	C2,4-7,9,10; RN3-4; RH 2-3
19/140	H	L-M	L	L	H	5	C2,4-7,9,10; RN3-4; RH 2-3
19/146	H	L-M	L	L	L-M	5	C2,4-7,9,10; RN3-4; RH 2-3
19/148	H	L-M	L	L	L-M	5	C2,4-7,9,10; RN3-4; RH 2-3
5127(47)	H	L-M	L	L	L-M	5	C2,4-7,9,10; RN3-4; RH 2-3
6714(19)	H	L-M	L	L	L-M	5	C2,4-7,9,10; RN3-4; RH 2-3
7009(38)	H	L-M	L	L	L-M	5	C2,4-7,9,10; RN3-4; RH 2-3

An inherent risk classification of **Class 5** has been assigned to Zone D. The presence of

shallow dolomite creates a high risk for small sinkholes and the associated presence of wad-rich residual dolomite creates a high risk for doline. Any development will require footprint investigations for all structures. The presence of residual syenite within the ground profile and granite at depth limits the size of a sinkhole that can be expected along the western boundary.

ZONE E: CLASS 6//7

Locality: This zone comprises two elongate portions of in the southern portion of the site. The large portion occupies much of the centre of Extension 43.

Blanketing Layer: A characteristic of this zone is the presence of fairly thick layers of wad-rich residual dolomite close to the surface. A protective layer of residual syenite is absent over most of this zone. Layers of wad range in thickness from 3m (BH 44/02) to 14m (BH 19/144). Dolomite bedrock is intersected below depths ranging from 6m (BH 7306(21)) to 17m (BH 19/144) but an average depth is about 15m. Black Reef Formation sediments are interpreted in borehole (BH's 7017(49)) at a depth of 18m below the surface. It is uncertain whether or not the assumed rock below a depth of 14m is dolomite in BH 43/02. The loose overburden conditions between 10m and 13m and the presence of residual dolomite below 7m suggests dolomite as bedrock. Syenite is intersected as bedrock at a depth of 24m below the surface in BH 19/143. The presence of slate in two boreholes (BH's 43/04 and 19/143) possibly indicates the proximity of the Black Reef Formation.

Residual dolomite is regarded as permeable particularly where present as wad and is unlikely to retard the infiltration of any surface run-off or flow from leaking services. Stringers of syenite, where present, should retard infiltration.

Receptacles: Voids are not present within the residual syenite. Voids can be expected within residual dolomite and bedrock.

Mobilising Agency: Any accumulation of water either on the surface or below the surface from a leaking service is a potential mobilising agency. The permeable nature of the overburden should allow infiltration of any mobilising agency with relative ease. The mobilisation potential of the overburden is assessed as high.

Maximum Potential Sinkhole Development Space (MPSDS): This refers to the thickness of overburden in which a sinkhole may develop. The thickness of the MPSDS layer is limited by the first layer of bedrock which varies from about 6m to 17m below the surface in this zone. A sinkhole developing in a 17m thick layer of overburden is regarded medium (>2m-<5m ϕ) to possibly large (>5m-<15m ϕ) sized.

Risk Characterisation: A high risk of small and medium size sinkholes, a medium risk of large sinkholes and a low risk of very large sinkholes developing and a high risk of dolines forming are the inherent risk characterisations (IRC) obtained after evaluating the conditions intersected in the percussion boreholes drilled in this zone. This inherent risk characterisation is applicable to a non-dewatering scenario. Significant dewatering could increase the risk of doline development as a rest level recorded in BH 43/04 indicates ground water to occur within the wad-rich residual dolomite.

A summary of the materials encountered in the boreholes is given in Appendix C.

Inherent Risk Class: A particular risk class may be determined from the risk characterisation of an area. Certain types of development are considered more appropriate in this risk class. These types of development are believed to be compatible with the level of risk provided the appropriate precautionary measures are implemented.

A summary of the risk characterisations for the boreholes drilled in this zone is given in Table 5 on the next page.

TABLE 5

Summary of Risk Characterisation

BH No.	RISK of SINKHOLE FORMATION				RISK OF DOLINES	RISK CLASS	DEVELOPMENT TYPE (Draft SANS 1936)
	Small <2m	Medium >2m-<5m	Large >5m-<15m	Very Large >15m			
43/02	L	M-H	L	L	M-H	6(3b)	C2,4,5,7,9
43/04	M	M-H	L	L	H	6//7	C2,4,5,7,9
44/10	L-M	L-M	L	L	M-H	3b(6)	C2,4,5,7,9
19/134	M	H	L	L	H	6	C2,4,5,7,9
19/136	M	H	L	L	H	6	C2,4,5,7,9
19/143	M	M-H	L	L	H	6	C2,4,5,7,9
19/144	M	M-H	L	L	H	6	C2,4,5,7,9
7017(49)	M	H	L	L	H	6	C2,4,5,7,9
7306(21)	H	H	L	L	H	6	C2,4,5,7,9

Note: Development potential based on draft SANS 1936 document.

An inherent risk classification of **Class 6//7** has been assigned to Zone E even though pockets of more favourable ground lie within the zone. The risk characterisation is based primarily on the high risk of doline development because of thick layers of wad-rich residual dolomite. Residential development should not be considered unless additional exploratory work, including detailed footprint investigations, confirms the presence of a more favourable class of ground. The use of structures incorporating a basement may allow residential development to take place within this zone. Areas underlain by intrusive syenite below the wad-rich residual dolomite and/or shallow dolomite pose the most favourable conditions for residential development.

11. CONCLUSIONS AND RECOMMENDATIONS

The geological conditions underlying this site favour the delineation of the site into five zones with risk classifications ranging from **Class 1** to **Class 6** (References 3, 4 and 5). The development potential of the site is discussed in the following paragraphs.

ZONE A: CLASS 1

Risk: A low risk for any size sinkhole forming and a low risk of doline development are the inherent risk characterisations in both a dewatering and a non-dewatering scenario.

Development Potential: No restrictions are placed on the types of development that may be considered on **Class 1** land provided the spatial framework requirements are met.

Any type of development is conditional upon the implementation of a set of standard precautionary measures detailed in Appendix G.

NHBRC Dolomitic Area Designation: This zone is assessed as **D 2**.

Location: Zone A occupies a tongue of land in the north-eastern portion of Extension 44. The zone is an extension of favourable land from Extensions 31 (F 3333) and 45 (F 3051) to the east. The extent of the zone is indicated on the plan in Appendix D.

ZONE B: CLASS 3a

Risk: A low to medium risk of small and medium size sinkholes developing and a low to medium risk of dolines forming are the inherent risk characterisations in both a dewatering and a non-dewatering scenario.

Development Potential: Certain restrictions are placed on the types of residential development that may be considered in Class 3a land. Full title residential development (RN3-4) on stands of 1000m² or greater is permissible according to the draft SANS 1936 document (Appendix H). Multi-storey low-rise (≤ 3 storeys [RL2-3]) and high-rise (>3 but<10 storeys [RH2-3]) residential development may be considered provided appropriate footprint investigations are undertaken. Most forms of

commercial, retail and/or light industrial development are permissible (C1 to C10 in SANS Table 1) but all require some form of footprint investigation. The developer has indicated his intention to focus on a mix of commercial and residential development.

Development is conditional upon the implementation of general precautionary measures (Appendix G)

NHBRC Dolomitic Area Designation: This zone is assessed as **D 3.**

Location: An elongate portion of land immediately south of Zone A, a narrow strip along the eastern boundary and along the southern boundary. The extent of Zone B is shown on the map in Appendix D.

ZONE C: CLASS 3b

Risk: A medium risk of small and medium size sinkholes, a low risk of large and very large size sinkholes forming and a medium to high risk of doline development are the inherent risk characterisations in both a dewatering and a non-dewatering scenario.

Development Potential: Normal residential development of not less than 1000m^2 stands and high-(>3<10 storey) and low- rise (<3 storeys) residential development may be considered in this zone provided appropriate footprint investigations are undertaken for all multi-storey structures. Commercial, retail and light industrial may be considered. Careful attention should be given to the design and installation of water-bearing services because of the risk of doline development.

NHBRC Dolomitic Area Designation: This zone is assessed as **D 3.**

Location: A NW trending central strip of land through Extension 44 and a small portion in the extreme north of Extension 44. The extent of Zone C is shown on the map in Appendix D.

Development Potential: Residential development is not recommended unless additional exploratory drilling confirms the suitability of the land. Pockets of favourable ground may occur within the large portion of Zone E in Extension 43. Zone E is best suited for commercial, retail and industrial development. Exploratory work is required to ensure suitable founding conditions. Careful attention should be applied to the design and installation of water-bearing services.

NHBRC Dolomitic Area Designation: This zone is assessed as **D 4** unless proved **D3** by additional exploratory work.

Location: The central portion of Extension 43 and a narrow EW strip of land in towards the south-western corner of Extension 44. The extent of Zone E is shown on the map in Appendix D.

The importance of careful water management cannot be over-emphasised as poor water control in one area may lead to some form of instability in another area. It is essential that prospective developers/owners/tenants in any development are made aware of the importance of the recommended precautionary measures. An indiscretion on one stand may induce some form of instability on an adjacent stand. In an attempt to create and maintain an awareness of the risk of instability in a karst environment, it is essential that a comprehensive Dolomite Risk Management Policy be been drawn up for implementation in the proposed township. An example of a DRMP is included in Appendix H. The DRMP should be audited by a committee drawn from the various owners to ensure an integrated approach. The entire community (owners and/or tenants) within the township must be informed of the philosophy behind the risk management plan and what it aims to accomplish. The Local Authorities, under whose control the township is, must be aware of the responsibility they face ensuring the implementation of a risk management plan for the Monavoni Extensions 43 and 44. Responsibility for rapid response to instability must be impressed upon senior officials. Protracted delays in the repair and maintenance of bulk services may lead to catastrophic sinkhole development and loss of life. An effective DRMP can greatly reduce the probability if instability occurring within the established township.

ZONE D: CLASS 5

Risk: A high risk of small sinkholes, a medium risk of medium sinkholes and a high risk of doline development are the inherent risk characterisations in both a dewatering and a non-dewatering scenario.

Development Potential: Normal residential development of not less than 1000m² stands and high-rise (>3<10 storey) residential development may be considered in this zone provided appropriate footprint investigations are undertaken for the high-rise structures. Commercial, retail and light industrial may be considered. Careful attention should be given to the design and installation of water-bearing services because of the high risk of small size sinkhole and doline development.

NHBRC Dolomitic Area Designation: This zone is assessed as **D 3.**

Location: An area along the western boundary and a small portion in the extreme north-east corner of Extension 44. The extent of Zone C is shown on the map in Appendix D.

ZONE E: CLASS 6//7

Risk: A high risk of small and medium sinkholes, a medium risk of large size sinkholes and a high risk of doline developing are the inherent risk characterisations in a non-dewatering scenario. Dewatering may increase the risk of instability as the ground water rest level lies within the waddy layers (BH43/04). The presence of extensive pockets of residual, wad-rich dolomite almost from surface poses the greatest problem particularly in terms of suitable founding conditions. The extensive use of footprint drilling should circumvent structures being erected over very poor conditions.

It may be prudent to re-assess the allocated land use in the spatial framework to better utilise the more favourable ground for residential development and limit commercial development to the less favourable ground.

12. GENERAL

It must be borne in mind that in an investigation of this nature, certain generalisations have to be made to avoid the necessity of an extremely costly drilling program. Consequently, it may be found that conditions at variance with those discussed in this report do occur locally. The variant conditions should be inspected by competent personnel to ensure that these conditions do not pose a problem for a specific development.

The National Home Builders Registration Council (NHBRC) requires that a construction report be prepared during the installation of the infrastructure if any residential component is included within the township. The report requires that ***all service trenches be inspected*** to ensure no variant conditions adversely impact on the development. Failure to map trenches may lead to difficulty obtaining NHBRC enrolment.

Commercial and industrial developments are exempt from NHBRC requirements. Large structures require separate footprint investigations.

E Shedden (Pr Sci Nat)

RELLY MILNER AND SHEDDEN **OCTOBER 2009**

APPENDIX A

REGIONAL GEOLOGY

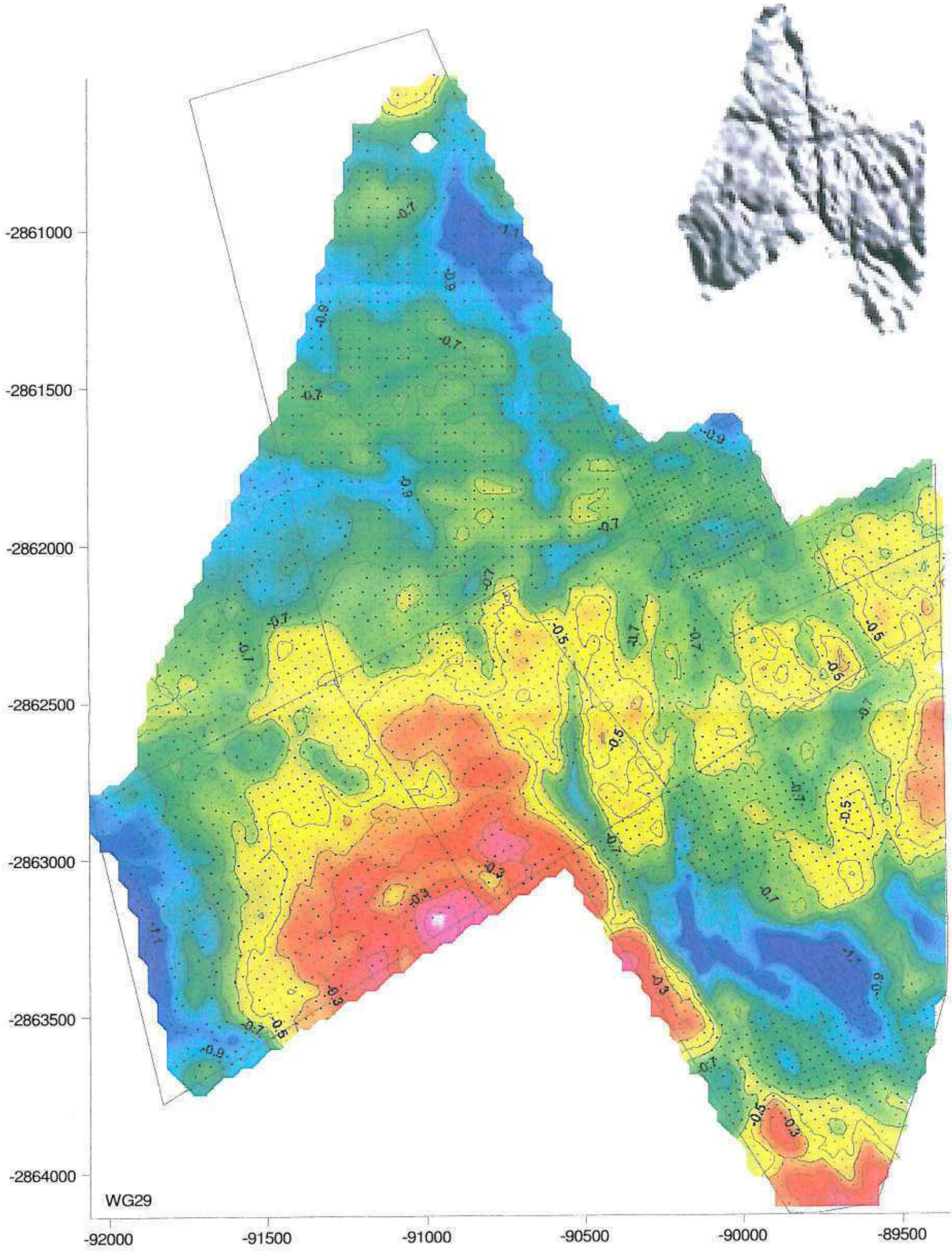
APPENDIX A

REGIONAL GEOLOGY

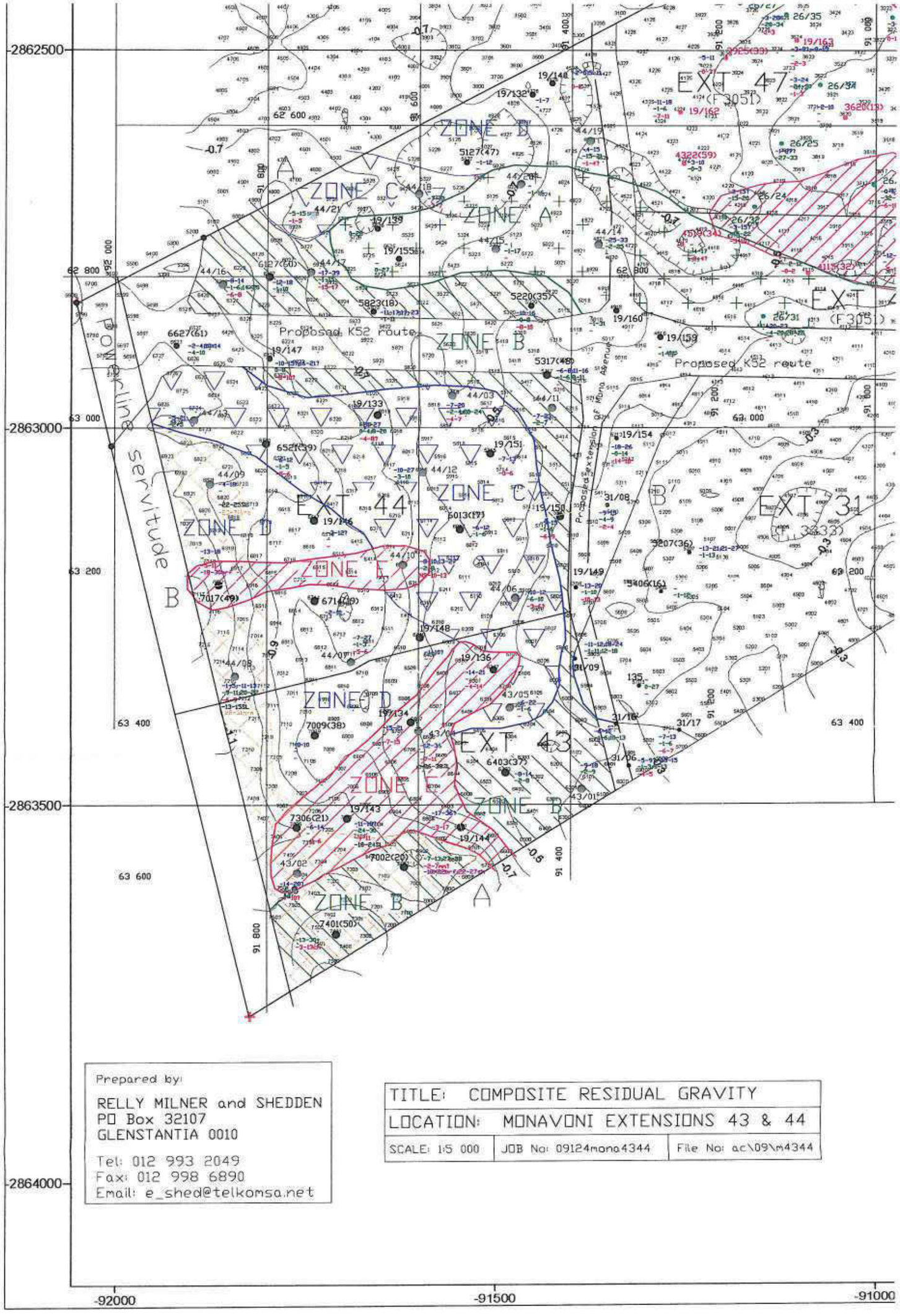
APPENDIX B

COMPOSITE RESIDUAL GRAVITY MAPS

COMPOSITE GRAVITY MAPS



RESIDUAL GRAVITY MAP
MONAVONI EXTENSIONS 43 and 44
(Outlined within larger Monavoni Area)



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TITLE: COMPOSITE RESIDUAL GRAVITY		
LOCATION: MONAVONI EXTENSIONS 43 & 44		
SCALE: 1:5 000	JOB No: 09124mona4344	File No: ac\09\m4344

APPENDIX C

PERCUSSION BOREHOLE PROFILES

Monavoni Extensions 43 and 44

SUMMARY OF DRILLING RESULTS

BH No	Colluvium	RESIDUUM				BEDROCK		Bedrock type/IRC	Collar elevation (m amsl)/ Water strike	Water rest level after 24hr (m) Rest level (mamsl)	Remarks (NS; RPT)
		Wad	Clay/Silt	Chert	Silt/Sand (Syenite)	Weathered/ boulders	Sound				
Monavoni Ext 43											
43/01	0-2S				2-9	9-12D	12-18##	Dolomite/3a	1482/-	-7m(1475)	-
43/02	0-3S		3-4sh 7-10w		4-7		*14-20##*	*Dolomite?*/6	1486/-	Dry	NS >10m RPT 10-13m
43/04		7-11	4-7w			0-4DB 11-14D 18-32D	14-18D 32-36D 36-38SL##	Slate/6	1477/-35m	-7m(1470)	Boulders(?) 0-4m
43/05	0-1S				1-6	6-16D	16-22##	Dolomite/3a(5)	1478/-	Dry	-
Monavoni Ext 44											
44/03	0-1S	4-7			1-4	7-12D 14-18D	12-14D 18-20D 20-24##	Syenite/3b(3a)	1469/-	Dry	-
44/06	0-3S		3-6w				6-10sy 10-12##	Dolomite/3b	1475/-	-7m(1468)	-
44/07	01-S	5-6	3-5w		1-3	6-7DB 7-21D	21-27##	Dolomite/3b	1474/-	-6m(1468)	-
44/08	0-1S	6-9	5-6w 17-21gr		9-11 21-22	1-5D 11-13D 13-15SL 15-17SLgr 22-25gr	25-31##	Granite/3b(1)	1475/-	Dry	Granite as bedrock
44/09	0-2S					2-4DB 4-9D	9-12D 16-18D	Granite/5(1)	1464/-	-9m(1455)	Granite as bedrock

BH No	Colluvium	RESIDUUM				BEDROCK		Bedrock type/IRC	Collar elevation (m amsl)/ Water strike	Water rest level after 24hr (m) Rest level (mamsl)	Remarks (NS; RPT)
		Wad	Clay/Silt	Chert	Silt/Sand (Syenite)	Weathered/ boulders	Sound				
						12-16D 18-22BRF	22-25SL 25-31gr##				
44/10	0-2s				2-8	8-10D 13-21D	21-27##	Dolomite/3a(6)	1471/-	-9m(1462)	NS 10-13m RPT 10-13m
44/11	0-2S				2-7	7-17D	17-23##	Dolomite/3a	1471/-	-10m(1461)	-
44/12	0-3S				3-10	10-21D	21-27##	Dolomite/3a	1470/-	-7m(1463)	-
44/13	0-2S				2-5	5-8D 10-15D	8-10D 15-21##	Dolomite/5(3a)	1462/-	Dry	-
44/14	0-2S				2-8	8-25sy 25-27D	27-33##	Dolomite/2	1465/-25m	Dry	-
44/15	0-1S				1-6		6-17##	Syenite/1	1465/-	Dry	No dolomite
44/16	0-1S	6-8			1-6	8-14D	14-20##	Syenite/3a	1460/-	-7m(1453)	-
44/17	0-1S	15-17			2-10	10-15sy 17-33D	33-39##	Dolomite/2(3a)	1463/-25m	Dry	-
44/18	0-3S	3-6				6-7sy	7-13##	Syenite/6(1)	1462/-	-5m(1457)	-
44/19	0-1S			1-4		4-14D 14-15sy	15-21##	Syenite/5(2)	1459/-	-8m(1451)	-
44/20	0-1S				1-8	8-11sy	11-16##	Syenite/1	1462/-	Dry	No dolomite
44/21	0-1S	1-5				5-9sy	9-15##	Syenite/6(1)	1461/-	Dry?	No WRL
Previously drilled boreholes											
31/06*	0-1si		4-5w		1-4	5-9DB	9-13sy 13-15##	Dolomite/3b	1482/-	Dry	-
31/08*	0-2si		2-4w		4-9	9-10D	10-16##	Dolomite/3a(3b)	1475/-	Dry	-
31/09	0-1S				1-8 12-18	8-11syB 11-12D	18-24##	Dolomite/2	1480/-	Dry	-

BH No	Colluvium	RESIDUUM				BEDROCK		Bedrock type/IRC	Collar elevation (m amsl)/ Water strike	Water rest level after 24hr (m) Rest level (mamsl)	Remarks (NS; RPT)
		Wad	Clay/Silt	Chert	Silt/Sand (Syenite)	Weathered/ boulders	Sound				
							6-12##				
5220(35)					0-8	8-10DB	10-16##	Dolomite/3a	1468/-	-	No WRL
5317(48)	0-1S				1-6 8-11	6-8D	11-16##	Dolomite/3a	1470/-	-	No WRL
5823(18)	0-1S				1-9	9-11sy 11-18D	18-24##	Dolomite/3a	1466/-	-	No WRL
6013(17)	0-1S				1-5	5-6sy	6-12##	Dolomite/3a(5)	1472/-	-	No WRL
6127(60)	0-1S				1-10	10-12sy	12-18##	Dolomite/3a	1462/-	-	No WRL
6403(37)	0-2S				2-8		8-14##	Dolomite/3a	1480/-	-	No WRL
6521(39)	0-1cl				1-5	5-6	6-12##	Dolomite/3a(5)	1465/-	-	No WRL
6627(61)	0-2S					2-4D	8-10sy 10-14##	Dolomite/3a(5)	1464/-	-	No WRL
6714(19)						0-2	2-10##	Dolomite/5	1470/-	-	No WRL
7002(20)	0-2S 2-7fer		13-22qtz		7-13	22-27sh	27-33##	Syenite/1	1485/-	-	No WRL
7009(38)	0-1S						1-10##	Dolomite/5	1477/-	-	No WRL
7017(49)	0-5S	5-11		11-12		12-18D 18-24qtz	24-30##	Quartzite/6(1)	1469/-	-	RPT 7-11m
7306(21)	0-3S	3-6				6-7D	7-14##	Dolomite/6(5)	1482/-	-	RPT 0-10m
7401(50)*	0-3si			3-13	13-35	35-40##		Syenite/3a(1)	1492/-	-	-

NOTES: S=Sand; si=Silt; ch=Chert; SL=Slate; sy=Syenite; sh=Shale; qtz= quartzite; D=dolomite; ?=Uncertain; NS=no samples; RPT=rapid penetration times; ##=end of hole; IRC=Inherent Risk Characterisation; *=Adjacent to Extensions 43 and 44.