REPORT ON THE

TIRISANO ALLUVIAL DIAMOND PROJECT,

(INCORPORATING THE NOOITGEDACHT 131, HARTBEESTLAAGTE 146 AND ZWARTRAND 145 PROPERTIES), VENTERSDORP DISTRICT,

REPUBLIC OF SOUTH AFRICA,

FOR

ROCKWELL DIAMONDS INC.

Effective Date: 29 February, 2012
Signature Date: 23 May, 2012
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Units and Abbreviations

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<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>Ma</td>
<td>Millions of Years before Present</td>
</tr>
<tr>
<td>ct</td>
<td>Carat(s)</td>
</tr>
<tr>
<td>ct/st</td>
<td>Carats per Stone</td>
</tr>
<tr>
<td>ct/100m³</td>
<td>Carats per 100 cubic metres</td>
</tr>
<tr>
<td>cpht</td>
<td>Carats per 100 Tonnes</td>
</tr>
<tr>
<td>tph</td>
<td>Tonnes per hour</td>
</tr>
<tr>
<td>m</td>
<td>Metres</td>
</tr>
<tr>
<td>M</td>
<td>Million</td>
</tr>
<tr>
<td>SG</td>
<td>Specific Gravity</td>
</tr>
<tr>
<td>AMSL</td>
<td>Above mean sea level</td>
</tr>
<tr>
<td>BBBEE</td>
<td>Broad Based Black Economic Empowerment (the more correct term of the usually shortened BEE (Black Economic Empowerment) and used in this report</td>
</tr>
<tr>
<td>DMR</td>
<td>Department of Mineral Resources (Previously known as Department of Minerals and Energy (DME))</td>
</tr>
<tr>
<td>DWAF</td>
<td>Department of Water and Forestry</td>
</tr>
<tr>
<td>DTM</td>
<td>Digital Terrain Model</td>
</tr>
<tr>
<td>QP</td>
<td>Qualified Person, as defined by National Instrument 43-101</td>
</tr>
<tr>
<td>CP</td>
<td>Competent Person, as defined by SAMREC</td>
</tr>
<tr>
<td>DMS</td>
<td>Dense Media Separation plant</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Bottom cut-off</strong></td>
<td>Bottom cut-off refers to the smallest size diamond (in mm) that is recovered in the sampling and mining process.</td>
</tr>
<tr>
<td>JSE</td>
<td>Johannesburg Stock Exchange</td>
</tr>
<tr>
<td>OTCB</td>
<td>Over-the-Counter Bulletin Board</td>
</tr>
<tr>
<td>TSX</td>
<td>Toronto Stock Exchange</td>
</tr>
<tr>
<td>SAIMM</td>
<td>South African Institute for Mining and Metallurgy</td>
</tr>
<tr>
<td>GSSA</td>
<td>Geological Society of South Africa</td>
</tr>
<tr>
<td>SACNASP</td>
<td>South African Council for Natural Scientific Professions</td>
</tr>
<tr>
<td>PLATO</td>
<td>South African Council for Professional Land Surveyors and Technical Surveyors</td>
</tr>
<tr>
<td>Pr. Sci. Nat.</td>
<td>Professional Natural Scientist</td>
</tr>
<tr>
<td>Ni 43-101</td>
<td>National Instrument 43-101</td>
</tr>
<tr>
<td>NAPEGG</td>
<td>The Association of Professional Engineers, Geologists and Geophysicists of the Northwest Territories</td>
</tr>
<tr>
<td>CIM</td>
<td>Canadian Institute of Mining Metallurgy and Petroleum</td>
</tr>
<tr>
<td>SAMREC</td>
<td>South African Code for Reporting of Mineral Resources and Mineral Reserves</td>
</tr>
<tr>
<td>EMPlan</td>
<td>Environmental Management Plan (as required for a prospecting right)</td>
</tr>
<tr>
<td>EMPR</td>
<td>Environment Management Programme (as required for a mining right)</td>
</tr>
<tr>
<td>SLP</td>
<td>Social &amp; Labour Plan (as required for a mining right)</td>
</tr>
<tr>
<td>MPRDA</td>
<td>Mineral and Petroleum resource Development Act (act 28 of 2002)</td>
</tr>
<tr>
<td>Cdn$</td>
<td>Canadian Dollar</td>
</tr>
<tr>
<td>USD</td>
<td>United States Dollar</td>
</tr>
<tr>
<td>ZAR</td>
<td>South African Rand</td>
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Summary

Background

Explorations Unlimited (EU) was retained by Rockwell Diamonds Inc (“Rockwell”) to prepare a Report for the Tirisano project. This report, comprising background information, drill and sample data derived from the property up to 29 February, 2012, is prepared to document the results of exploration work and the resource estimate on the Tirisano property. In addition, it serves to support the trial-mining programme and Pre-Feasibility Study that is underway at the Tirisano mine as part of the on-going ramp up to full production.

This Report has been compiled in accordance with the NI 43-101 Standards of Disclosure for Mineral Projects. The resource estimate has, further, been prepared in agreement with the South African code for Reporting of Mineral Resources and Mineral Reserves (the SAMREC code). The conclusions expressed in this independent resource estimate are appropriate as at 29 February 2012. The estimate is therefore only valid for this date and will change in response to ongoing exploration and production results as well as with variations in economic, market, legal, social or political factors.

The Resource properties, on which this report is based, are:

- **Nooitgedacht 131 IP (“Nooitgedacht”)**
  - Portions 1, 2, 3, 5, 7, 11, R/E farm
  - Tirisano main pit (portions 8 and 9)
- **Hartbeestlaagte 146 IP (“Hartbeestlaagte”)**
  - Portions 1, 2, 3 and the Remaining Extent (R/E farm)
  - Deproclaimed Area
- **Zwartrand 145 IP (“Zwartrand”)**
  - Various portions

These properties (totalling 10,805.57ha) are located some 35km due north of the town of Ventersdorp, in the Northwest Province approximately 150km west of Johannesburg. The project is well located within the alluvial diamond fields of the North West Province. The total reported production from these diamond fields from 1904-1984 is estimated at 14.4 million carats, which would have a present day value of over USD 5 Billion. Opencast mining from the Tirisano project, by prior operators has taken place from 2002 – 2008, as well as intermittent prospecting and bulk-sampling activities which have been taking place since 1979. Rockwell acquired the property in October 2011 and initiated trial mining.

The mineral holdings on this project are summarised below:

<table>
<thead>
<tr>
<th>Property</th>
<th>Portion</th>
<th>Mineral Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nooitgedacht</td>
<td>Portions 1, 2, 3, 5, 7, 8, 9, 11, R/E farm</td>
<td>Mining Right, 2/2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NW 30/5/1/2/2/345MP</td>
</tr>
<tr>
<td>Hartbeestlaagte</td>
<td>1, 2, 3, Re/farm, Deproclaimed</td>
<td></td>
</tr>
<tr>
<td>Zwartrand</td>
<td>Various</td>
<td></td>
</tr>
</tbody>
</table>
Due to the karst-hosted nature of the deposits on the properties, concurrent mining and complete rehabilitation is not possible (as the sinkholes have to be mined out totally before they can be rehabilitated). In this situation, the approved Environmental Management Programmes allow for the excavation of much of the gravel resource before rehabilitation is finalised. Environmental rehabilitation guarantees, to a total of ZAR21,993,912 (USD2.9M) have been lodged with various institutions to comply with statutory requirements.

Geology

The preferred geological model is one of deposition in a karst environment where the dolomite walls of the host-rock are vertical; the mode of gravel deposition is not typical fluvial alluvial; periodic subsidence has taken place during deposition; and deposition has taken place over a long time (since, at least, the Mesozoic) resulting in a build-up of a very thick gravel sequence. The gravel stratigraphy comprises an upper gravel horizon (UGP) and a lower gravel unit (LGP) that are both economically diamondiferous, separated by a sub-economic fine-grained pebble-clay unit (PCP). The LGP, which is characterized by a predominance of quartzite over chert clasts, may be clay-rich or clay-poor, with the clay-poor varieties being the primary exploration target due to their higher average grades. Mineralisation is confined to the gravel packages in-filling karst caverns etched out of the chert-rich dolomites of the Malmani Group. The clay-poor Lower Gravel Package and Upper Gravel Package units are considered to be the major exploration targets as the diamond grades encountered in these units have, historically, supported commercial mining ventures. Although elevated grades have also been associated with the colluvial manganese nodule layer – this unit is not everywhere present on the property and is, therefore, not considered as part of this study.

The airborne and ground gravity surveys (and supported by extensive drilling) indicates that the karst system trends roughly in a NW-SE direction across the properties, and is offset by a number of structural features. There appear to be a succession of sinkholes connected by a series of linkage channels (which pattern is typical of allogenic streams). The overall length of the karst system is in excess of 6,000 m. Widths of the channels are seen to vary from 135-385 m.

Bulk-Sampling and Resource Estimation

To date, 2,391 boreholes have been drilled on the property, totalling 53,576m. The deepest drilling indicates that, in some of the deeper sinkholes, the lower gravels extend down, at least, to 140m (without intersecting bedrock). Geophysical interpretation, however, indicates that final depths of the sinkholes may be in excess of 120m and, potentially, up to 200m in places. Eleven bulk-samples (Pits 1, 2 (A, B, and C), 3, 3A, 5C, 6, 7, 8 and 9) provided 147,895.88m³ of Lower Gravels (LGP), including Transition Zone gravels (TZP) from which 4,318.6ct were recovered for a global grade of 2.85ct/100m³ (with bottom cut-off of 1.6mm) and value of USD466/ct. In addition, 129,557.46m³ of Upper Gravels (UGP) was processed to recover 2,292.00ct at an average grade of 1.77ct/100m³.

During 2008, mining by previous operator Etruscan Diamonds (Pty) Ltd (“Etruscan”) processed gravels from the base of the Tirisano main pit. A total of 218,718m³ was processed, of which 146,881m³ is LGP, 10,293m³ is UGP and 61,534m³ is a blend of both UGP and LGP. During this period, some 6,459.98ct were recovered (1,042.96ct from LGP gravel and 5,417.02ct from the undifferentiated gravels) from the Tirisano main pit. The average recovered grade of these gravels was 2.43ct/100m³ (2.00ct/100m³ and 2.54ct/100m³, respectively). The drop in average grades for this period is thought to be the result of continuing (increasing?) process recovery problems. During the period January – June 2008, a total of 5,552.54ct were sold to various diamond buyers on the open market for an average of USD606/ct.
During this time, mining was confined to the Tirisano main pit on Nooitgedacht. Excavation (and rehabilitation) was done under contract to ALS Contractors (Pty) Ltd. Mineral processing was through two DMS plants (Bateman DMS at 40tph and Manhattan DMS at 50tph) as well as two new rotary pan plants. Final recovery was through an X-Ray (FlowSort) system and hand-sort in a secure glove-box.

Operations highlighted a number of technical issues that needed to be addressed in the on-going mining programme:

- There are continuing issues with processing efficiencies as a result of clay and manganese in the gravels that need to be resolved through a detailed investigation of the gravel metallurgy as well as the processing methodology/equipment.
- Due to the almost random variation in sedimentological horizons within the gravel unit, production data (specifically grade) must be observed continually and reconciled with modelled figures. The geological model also needs to be monitored and refined as operations expose sinkhole fill at depth.
- Sustained attention should be given to finding ways to differentiate between the various gravel horizons in borehole logs, including geochemical and mineralogical studies.
- Since these deposits are “high-volume, low-grade” operations, much effort will be required to replace mined gravels. Consequently, an on-going regional exploration programme will need to be pursued to identify and evaluate additional, similar deposits.
- Sustained attention should be given to finding ways to differentiate between the various gravel horizons in borehole logs, including geochemical and mineralogical studies.

Rockwell is currently refining the geological parameters of the various gravel units. Until this work is completed and additional mineral processing has taken place by Rockwell, this study has accepted the volume and grade estimate declared in the NI43-101 technical report produced as at October 2009 and simply depleted the volume of gravels used by Rockwell during the plant design and commissioning. During the commissioning phase to date, Rockwell has sold 2,394 stones (2,512ct) at USD726/ct. These values, while not truly representative of the entire size range known to exist on Tirisano, can be used as minimum figures until a formal, systematic sampling programme has been completed by Rockwell.

The resource estimate was prepared by T.R. Marshall, PhD, (Pr. Sci. Nat.), a qualified person who is independent of Rockwell and is responsible for the estimate. The result of the resource estimation is below.

<table>
<thead>
<tr>
<th></th>
<th>Indicated Resource volumes (m³)</th>
<th>Inferred Resource volumes (m³)</th>
<th>Grade (ct/100m³)</th>
<th>Value (USD/ct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>25,066,900</td>
<td>15,334,000</td>
<td>2.37</td>
<td>726</td>
</tr>
</tbody>
</table>

In addition to the Indicated and Inferred Resources for the project, exploration targets exist in large areas of both the LGP and the UGP units. Although some drilling and sampling has taken place in these areas, the results are insufficient to be categorized as a resource. Target areas include

- Some 30-40,000m³ of (LGP) gravel estimated to exist in the sinkholes below the present level of Inferred Resources (at 105m), down to the extent of drill data;
- Some 150,000-200,000m³ of gravel within the modelled gravel wireframe, but which does not fall within the inferred categories due, primarily, to lack of borehole coverage;
- The estimated, additional, 5-6Mm³ of (LGP) gravel that is modelled to exist in the sinkholes, if a more geologically reasonable shape is accepted (although not yet defined by drilling);

1 Mineral resources which are not mineral reserves do not have demonstrated economic viability.
• An undefined amount of gravel, specifically southeast of the currently inferred resource area, where gravel is seen to exist (from borehole results), but drill coverage and sampling constraints prevent these from being included within defined resources;

• An indefinable volume of (LGP) material that is located below the present drilling level in the sinkholes. Geophysical modelling cannot be used to identify the base of the bedrock in these structures with any accuracy, and drilling has not penetrated the thick gravels. As a result, it has not been possible to estimate the volume of gravels;

• The “West Run” on Nooitgedacht and Hartbeestlaagte has not yet been drilled or sampled. Some 200ha of area may be underlain by both UGP and LGP gravels.

• Grade ranges for these targets are expected to fall within the values identified by sampling within currently identified resource areas, namely, 1-2ct/100m³ for UGP and 2-3ct/100m³ for LGP units.

• In addition to the LGP and UGP gravels, the entire PCP unit has been identified as an exploration target. Potential volumes of PCP expected to be present on Tirisano are unknown, but thicknesses of 2-15m have been seen in the main mining pit as well as various sampling pits throughout the mine property. Historical results and limited sampling of these deposits indicate that potential grades for these gravels are in the range of 0.4-1.2ct/100m³.

• It is important to note that these statements regarding potential quantity and grade are conceptual in nature, that there has been insufficient exploration to define a mineral resource in these areas and that it is uncertain if further exploration will result in the target being delineated as a mineral resource.

**Trial-Mining and Pre-Feasibility Study**

During 2011, Rockwell embarked on limited production through trial-mining based on the positive results of the Preliminary Economic Assessment completed in November 2010. Although it was planned for the mine re-commissioning to have been completed by end 2011, Rockwell decided to re-engineer the entire concentration and recovery process before finalising this phase. Numerous additional mineralogical and metallurgical studies were initiated to determine the most effective methods for processing the clay-rich gravels that resulted in recovery inefficiencies and lower-than-expected grades.

During 2012, continued trial-mining and economic studies (at a Pre-Feasibility Study level) will determine the mine-plan which will be implemented on the Tirisano mine during its ramp up to full production. During this time, it is expected that the planned modifications to the plant will result in improved grade recoveries. Further, the sale of diamonds on the open market (through both Steinmetz and the tender system at Flawless Diamond Trading House (Pty) Ltd) will result in a realistic, current valuation of the diamonds. At that stage, the results will be presented in a technical report.

**Future (2011/2012) Programme & Budget**

During 2011, the emphasis was on commissioning the plant in preparation for putting the Tirisano project into full production and, consequently, trial-mining and related economic studies were initiated – these studies are scheduled for completion during 2012/2013. SRK has already completed a geotechnical report with recommendations for the long term rehabilitation and mining of the existing and future pits.

The budget for the PFS is estimated at ZAR 94M, excluding ZAR 4.6M capital expenditure. In addition to CAPEX requirements, Rockwell has budgeted ZAR 7M/month for the trial-mining, processing some 85,000m³.
The independent QP has reviewed both the proposed work programme and budget and concurs that they are reasonable for the stage of the project. The author believes that, notwithstanding the problems inherent in resource/reserve estimations in alluvial diamond deposits, the results to date are sufficiently encouraging to proceed to trial-mining from the Indicated Resource areas. The programme is contingent upon financing as well as continued improvement in the diamond market.
INTRODUCTION

1.1 Terms of Reference and Scope of Work

Explorations Unlimited ("EU") was retained by Rockwell Diamonds Inc. ("Rockwell" or "the Company") to prepare a Report for the Tirisano Project in the Ventersdorp District of the North West Province, South Africa. This report, comprising background information, drill and sample data, including the bulk-sampling programmes derived from the property up to 29 February 2012, is prepared to document the results of exploration and other technical studies and the resource estimate on the properties for the 2012 fiscal year. In addition, it serves to support the trial-mining programme and Pre-Feasibility Study that is underway at the Tirisano mine as part of the on-going ramp up to full production.

During October 2011, Rockwell announced the completion of the acquisition of 74% of the Tirisano mine operation (with the balance owned pursuant to South Africa's Black Economic Empowerment regime). The effective date of the transaction was September 1, 2010 on a going-concern basis, although the operation has been on a care and maintenance arrangement for two years.

This report comprises background information, drill and sample data derived from the property up to 29 February, 2012. The conclusions expressed in this report are appropriate as at this date. The estimate is, therefore, only valid for this date and will change with time in response to ongoing exploration and production results as well as with variations in economic, market, legal or political factors.

Six documents, dealing with some or all of the Tirisano project properties, have been filed on www.sedar.com:


Rockwell, listed on the TSX (RDI), the JSE (RDI) and the OTCBB (RDIAF), is a company involved in the exploration and mining of alluvial diamond deposits (Figs. 1.1 and 1.2). On 9 September 2011, Rockwell

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2 Rockwell press release of 11 October 2011
3 Subsequent to the effective date of this report, Rockwell announced its intention to file a Form 15F with the United States Securities and Exchange Commission and voluntarily terminate the registration of its shares from the OTCBB exchange (Rockwell press release dated March 29, 2012)
completed an agreement with Etruscan Diamonds Limited whereby the Company acquired 100% of the equity in Etruscan Diamonds (Pty) Limited (an exploration company) and 74% in Blue Gum Diamonds (Pty) Limited. Blue Gum Diamonds Pty Limited owns the Tirisano mining right and the operation has been on care and maintenance since June 2008. Rockwell’s 26% BEE partner in this venture is Mogopa Minerals (Pty) Ltd ("Mogopa").

In addition, Rockwell and its wholly-owned subsidiary Rockwell Resources RSA (Pty) Ltd ("Rockwell RSA") owns, and Rockwell RSA operates the Klipdam mine (Barkly West); has operated the Holpan mines (currently on care and maintenance) and owns the Makoonskloof Prospect (Middle Orange River) through a 74% shareholding in HC Van Wyk Diamonds Limited ("HCVWD"). Rockwell and Rockwell RSA also own 74% of Saxendrift Mine (Pty) Ltd, the vehicle which holds the Saxendrift, Wouterspan, Niewejaarskraal and Zwemkuil projects. Rockwell’s 26% BEE partner in the HCVWD and Saxendrift holdings is African Vanguard Resources (Pty) Ltd.

Figure 1.1: Location of Rockwell owned mines in South Africa

In addition to these mineral holdings, Rockwell owns a 20% stake in Flawless Diamond Trading House (Proprietary) Limited ("FDTH"), thus providing a unique marketing and sales arm for Rockwell at a fee which is well below the market norm. The acquisition, further, provides Rockwell with access to additional revenue, and allows the Company to gain insight into diamond sales trends which will assist with its short and long term production and growth plans.

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The issued share capital from Etruscan Diamonds Bermuda Limited and Etruscan Diamonds Limited were ceded to Rockwell Resources RSA (Pty) Ltd
Explorations Unlimited (“EU”) is a South African based consultancy owned by Dr Tania R Marshall that has been operating since 1996. EU provides a variety of exploration and prospecting consulting services to the international minerals community, in particular with respect to geological evaluation and financial valuation of alluvial diamond mineral properties. This Report was prepared, primarily, by Dr T R Marshall (Pr. Sci. Nat.). Dr Marshall has over 20 years experience in the alluvial diamond industry, including a background in international mineral exploration and evaluation studies and has had direct experience with alluvial-eluvial diamond mining operations as a consulting geologist and, also, as an operator. Dr Marshall’s experience includes operational and financial aspects of alluvial diamond mining, including mine-planning and costing. Rockwell has accepted that the qualifications, expertise, experience, competence, and professional reputation of Dr Marshall are appropriate and relevant for the preparation of this Report.

Figure 1.2: Corporate shareholdings of Rockwell (2012)

The report was compiled, primarily, by Dr Marshall. Where the document refers to “the author”, the senior (independent) QP, Dr Marshall, is referenced, unless otherwise indicated. The document was co-authored by Mr Glenn Norton who is the Group Technical Manager for Rockwell Diamonds Inc. Mr Norton has over ten years experience in the exploration and exploitation of alluvial diamonds throughout Africa and is Rockwell’s in-house Qualified Person.
This Report has been prepared in accordance with the Canadian NI 43-101 Standards Of Disclosure For Mineral Projects, the NAPEGG guidelines for the Reporting of Diamond Exploration Results, Identified Mineral Resources and Ore Reserves and the Best Practice Guidelines prepared by CIM to assist the QP) in the planning, supervision, preparation and reporting of Mineral Resource and Mineral Reserve (MRMR) estimates. The resource estimate has, further, been prepared with specific reference to the SAMREC code. In particular, the SAMREC Code provides guidelines for the diamond industry. The SAMREC Code has also been incorporated into the JSE Listings Rules. Since Rockwell is dual listed in both Canada and South Africa, reference will continually be made to both CIM and SAMREC resource estimation codes (with CIM taking preference as the company’s primary listing is the TSX).

The conclusions expressed in this independent resource estimate are appropriate as at 29 February 2012. The appraisal is, therefore, only valid for this date and will change with time in response to ongoing exploration and production results as well as with variations in diverse external factors.

1.2 Sources of Information

The comments and recommendations in this report, specific to the Tirisano project, are based, primarily, on information and technical documents and production data supplied by Rockwell. Underlying legal contracts, permissions and agreements have not been reviewed by the author. Other technical/scientific papers and miscellaneous documents referred to are identified within the text or have been referenced in Section 26.

Since Dr Marshall was not on the Tirisano site for the full period of the prospecting, bulk-sampling, and trial-mining, much reliance was placed on the technical management of Rockwell who provided production data and internal audit reports for review. Dr Marshall has reviewed this data and considers it to be reasonable for the purpose of this report. In these aspects, reliance has been placed upon the relevant individuals providing the information, specifically Mr. Glenn Norton (Group Technical Manager), who is registered with SACNASP and SAIMM and may act as QP/CP in his own right.

The mined volumes were surveyed by an independent professional surveyor (F J van der Merwe) who is registered with PLATO and who may act as a CP in his own right. These are provided to Rockwell, under certification, on a monthly basis. The author has relied on these mined volumes in all sections dealing with bulk-sample and trial-mining results. Steps taken to verify this information are presented in section 13.

1.3 Units and Currency

All values are metric, unless otherwise stated. Historical grade and tonnage figures are reported in units as originally published. All budget costs are presented in South African Rands (R) sand United Stat Dollars (USD), for which a nominal exchange rate of USD1 = R8 has been used. Diamond values are expressed in United States Dollars.

1.4 Field involvement of Qualified Person

A site visit to the Tirisano project area was undertaken by Dr Marshall during the week of 28-30 November, 2011 and also on 30 March 2012. During these visit a review was made of all geological, technical and administrative procedures and protocols being practiced by Rockwell personnel. In addition, numerous discussions were held with the management and technical personnel of Rockwell, who readily provided all requested information. EU’s extensive experience in this area (including
previous visits to the Property) as well as that gained from prior investigations of other, nearby deposits was also drawn upon as required.

Mr Norton is Rockwell’s Group Technical Manager and, as such, visits the project area on a weekly basis.

1.5 Use of Data

Neither Explorations Unlimited nor family members have a business relationship with Rockwell or any associated company, nor with any other company mentioned in the Report which is likely to materially influence the impartiality of the Report, or create the perception that the credibility of the Report could be compromised or biased in any way. The views expressed herein are genuine and deemed independent of Rockwell. Moreover, neither the author of the report nor family members have any financial interest in the outcome of any transaction involving the properties considered in this Report, other than the payment of normal professional fees for the work undertaken in its preparation (which is based upon hourly charge-out rates and reimbursement of expenses). The payment of such fees is not dependent upon the content, or conclusions, of this Report or any consequences of any proposed transaction.

Rockwell has warranted that a full disclosure of all material information in its possession or control has been made to EU, and that it is complete, accurate, true and not misleading. Draft copies of the Report have been reviewed for factual errors by Rockwell. Any changes made as a result of these reviews did not involve any alteration to the conclusions made. Hence, the statements and opinions expressed in this document are given in good faith and in the belief that such statements and opinions are not false and misleading at the date of this Report.

Written consent is provided for the filing of the Report with any stock exchange and other regulatory authority and also for any publication by them of the Report for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public. EU reserves the right, but will not be obligated, to revise this Report and conclusions if additional information becomes known to EU subsequent to the date of this Report.
2 RELIANCE ON OTHER EXPERTS

2.1 Legal Opinion

An opinion regarding both the underlying legal contracts, permissions and agreements and the landholdings of the relevant properties has been provided by Chris Stevens (director) of Taback & Associates (Pty) Ltd on 30 January 2012 – *Title Opinion in Respect of Various Prospecting and Mining Rights held within the Rockwell Diamond Group in South Africa (14pp)*.

Chris Stevens is a partner with Tabacks (comprising Mervyn Taback Inc and Taback & Associates) where he leads the firm’s mining and natural resources law department. He advises on all aspects of mining law in South Africa, including in relation to commercial arrangements, conveyancing, litigation, opinion work, black economic empowerment laws and due diligence aspects. He advises many of the South African major mining houses on these aspects, as well as medium size mining companies and junior exploration companies. He further advises numerous American, UK, Canadian and Australian mining companies with interests in South Africa and acts for numerous black empowerment companies in relation to mining transactions. He has also been involved in numerous transactions for South African mining entities in sub-Saharan Africa. He has also been integrally involved in advising numerous mining companies on various aspects of the Mineral and Petroleum Resources Development Act, 28 of 2002, as well as the amendments to that legislation. Chris Stevens co-lectured the LLB course at the University of the Witwatersrand on prospecting and mining law in 1998 to 2007. He lectures at the University of the Witwatersrand to mining and engineering students on compliance aspects and annually lectures at the University of Pretoria for MSc geology students in a compliance course. He sat on the mining law committee of the International Bar Association in 2002 to 2006.

Chris Stevens received B.Com and LLB degrees from the University of Witwatersrand and has been practising mining law since 1987. He was admitted as a notary public in 1990. Chris Stevens speaks at numerous conferences, both in South Africa and internationally in relation to the South African mining industry and, as such, is well qualified to produce reliable legal opinions on the Tirisano project.

The author has not independently verified the status of these contracts, permissions and agreements but has accepted that the legal opinion represents a materially accurate situation. The author has relied on this opinion for the compilation of Section 3.3

2.2 Diamond Valuation

Valuation of the recovered diamonds has been through the industry standard practice of putting representative diamond parcels up for sale, either through Flawless Diamonds Tender House (“FDTH”) or Steinmetz Diamond Group (“SDG”).

FDTH is a marketing and tender sale company (held 20% by Rockwell) that operates a professional run, fully transparent “sealed-bid tender system”. Details of this process are described in a later section.

The SDG group provides rough and polished diamonds to customers internationally and has manufacturing facilities in Botswana, South Africa, Namibia and New York. The group is well-known for its investment in rare and exceptional diamonds as well as for the creation of unique high-end jewellery (amongst which are the 203.04ct De Beers Millennium Star and the 59.6ct fancy vivid Steinmetz Pink.


Values obtained for diamonds through both these means represent actual sales completed in competitive market by registered, practicing, international diamond buyers whose qualifications (and individual identities) are unknown. Since the values thus obtained are actual, realised sales figures, and not simply a valuation with no obligation to purchase, there are no risks associated with the diamond values used in this report. These sales values have been relied upon by the author in all sections relating to mineral resources. The author has checked each brokers note and Kimberley Process Certificate to verify the information provided.
3 Property Description and Location

3.1 Property description and location

The Tirisano Project, located in the North West Province of South Africa (Fig. 3.1) is comprised of a central core of properties on which Etruscan is prospecting diamondiferous gravels. These properties (totalling 10,805.57ha) are located some 35km due north of the town of Ventersdorp, in the Northwest Province approximately 100km west of Johannesburg. The company also has active prospecting licenses on numerous other properties in the district.

Figure 3.1: Location of the Tirisano Project in the North West Province of South Africa

The Resource properties (with a total area of 9,988.3778ha), on which this report is based, are:

**Nooitgedacht 131 IP**
- Portions 1, 2, 3, 5, 7, 11, R/E farm
- Tirisano Main Pit (portions 8 and 9)

**Hartbeestlaagte 146 IP**
- Portions 1, 2, 3 and the Remaining Extent (R/E farm)
- Deproclaimed Area

**Zwartrand 145 IP**
- Various portions excluding the Mogopa village and the African & Asian claim blocks

The Nooitgedacht Property is 4,958.15ha in size (WGS84 35S co-ordinates A, B, C, and H, identified on
Fig. 3.2). Included within the property boundaries, but not part of the project is the “Deprroclaimed area” (some 14ha in extent). This portion is not part of the Tirisano project as the rights are held by the landholder who is also mining on the property. The original Tirisano Mine area (611.56ha) is located on portions 8 and 9 of the greater farm Nooitgedacht.

The Hartbeestlaagte Property is 4,009.33ha in size (C, F, G, and H on Fig. 3.2). The “Deprroclaimed area” (some 68.47ha in extent), is included within the boundaries of the greater farm Hartbeestlaagte and forms part of the project. The Zwartrand Property is located adjacent to the east of Hartbeestlaagte, is 1,226.53ha and bounded by C, D, E, F. However, due to the location of the Mogopa Village on Zwartrand and the exclusion of the African & Asian claims, the effective area available for prospecting (1,020.90ha) is limited to F, I, J, K, L (Fig. 3.2).

3.2 Permits contracts and agreements

3.2.1 Surface ownership / land use rights

The Remaining extent of Portion 8 (Ptn of Ptn 3) of Nooitgedacht 131, the portion of property on which the original Tirisano main pit is situated, is owned by Etruscan. The other portions of Nooitgedacht are owned by various private individuals. The Bakwena Ba-Mogopa Trust is the owner of the surface rights to the Hartbeestlaagte and Zwartrand properties and has held the land since 1922. A sum of ZAR66,965.31 is payable to the Mogopa Trust as a monthly land rental cost.

The mineral rights to all the properties belong to the State (since May 2004). Prior to that, the rights were held by the Bakwena Ba-Mogopa Trust, although numerous parties have held options over various portions of the properties in order to complete the exploration programmes outlined in Section 5.

3.2.2 Mineral rights (Mining/Prospecting Rights, permits, etc)

The Mining Right, in the name of Blue Gum Diamonds (Pty) Ltd, was granted on 12 August, 2008. Unless this mining right is suspended, cancelled or abandoned or lapses, it will be valid for a period of seven years, until 29 September 2015 (further renewals of up to 30 years each are allowed after the initial period has expired). The mining right (NW/3/5/MR) was lodged for registration at the Mineral and Petroleum Titles Registration office in Pretoria on 1 October 2008.

Application was made for consent (in terms of Section11(1) of the MPRDA to transfer 100% of the issued share capital of Etruscan Diamonds (Pty) Ltd held by Etruscan Diamond Bermuda Limited and Etruscan Diamonds Limited to Rockwell Resources RSA (Pty) Ltd. The required documentation was submitted to the DMR on 28 May 2010 and the cession was approved on 25 July 2011 and registration is in progress.

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5 Under the terms of the agreement with Etruscan, Rockwell will assume ownership of this land as well.
6 MPRD Act 28 of 2002, Section 24(4)
Figure 3.2: Location of the Tirisano properties
Table 3.1: Summary of Mining Right

<table>
<thead>
<tr>
<th>Property</th>
<th>Portion</th>
<th>Hectares</th>
<th>New Order Mining Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nooitgedacht 131</td>
<td>Farm, excluding Deproclaimed area (14ha)</td>
<td>4,958.15</td>
<td>Mining Right (<em>Protocol 02/2008 and file NW/345/MR</em>) granted and executed on 30 September 2008 and valid, until 29 September 2015.</td>
</tr>
<tr>
<td>Hartbeestlaagte 146</td>
<td>1,2,3,Re/farm including the Deproclaimed area</td>
<td>4,009.33</td>
<td></td>
</tr>
<tr>
<td>Zwartrand 145</td>
<td>Various portions, excluding the Mogopa village and claim blocks</td>
<td>1,020.90</td>
<td></td>
</tr>
</tbody>
</table>

3.2.2.1 Royalty Payments

As with all mining properties in South Africa, the Saxendrift mine is subject to a State royalty. The minimum and maximum rates for diamonds (unrefined minerals) are 0.5% and 9.0%, respectively. In terms of the Mining and Petroleum Royalties Act, Rockwell has registered as a royalty payer with the South African Revenue Service (“SARS”). To date, ZAR145,383 has been paid in royalties from the Tirisano mine.

3.3 BEE Compliance

The 26% BEE partner on Tirisano mine is Mogopa Blue Gum (Pty) Ltd, which is owned by Mogopa Minerals (Pty) Ltd (“Mogopa”). The Mogopa community has about 350 families and is located in the vicinity of the mining area. The formal terms of the venture between Rockwell and Mogopa remain, essentially, the same as with Etruscan7.

3.4 Environmental Rehabilitation

Due to the nature of the deposits on the properties, concurrent mining and complete rehabilitation is not possible. In this situation, the approved EMPR allows for the excavation of much of the gravel resource before rehabilitation is finalised. In preparation for this, topsoil is removed separately and strategically deposited where it will not be contaminated or mixed with the gravels. As soon as possible, mined-out trenches are completely backfilled, the topsoil is replaced and the area is re-vegetated.

In 2008, an Environmental Impact Assessment was conducted over the area under application by the new order Mining Right and, subsequently, an EMPR was compiled by Myezo Environmental

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Management Systems CC. The EMPR was approved by the Department of Mining and Mineral Resource (DMR) on 30 September 2008. In compliance with legislation, Etruscan had lodged various financial rehabilitation guarantees lodged with recognised financial institutions. In terms of Rockwell’s agreement with Etruscan, these guarantees have been ceded to Rockwell.

The total amount held in guarantee is ZAR15,026,979. The various Nedbank guarantees are held in cash, while the Lombard insurance policy is financed through R2,661,912.28 on deposit at Nedbank (Account # 863703050001), plus the payment of R150,000 monthly into an Old Mutual policy (Account # 15183974, balance currently at R3,836,271).

### 3.4.1 Water Permits

On 22 March 2006, the Department of Water Affairs and Forestry (“DWAF”) issued Etruscan with a water extraction license (License # 23062962) which allows for the extraction of water from the Schoonspruit Dolomite Compartment for use on RE/Hartbeestlaagte, Nooitgedacht and Zwartrand for a period of 10 years from the date of issue. The license allows for the extraction of a maximum volume of groundwater (for all the properties covered by the license) of 1,222,588 m$^3$ per annum for the first year and 1,050,868 m$^3$ annually thereafter for the duration of the license period. Daily extraction volumes may not exceed 3,358 m$^3$ and 2,879 m$^3$ respectively.

The license was issued subject to standard conditions which include the submission of a detailed mine site water balance, a groundwater management plan and baseline water monitoring data. Further, groundwater levels need to be measured periodically and this information, along with actual water usage, forwarded to DWAF.

Rockwell will, in due time, apply to DWAF increase the allowance in accordance with new plant requirements. Rockwell is, further, compiling the necessary documentation for the integrated water management programme required by DWAF.

### 3.5 Social Responsibility

Along with focused business objectives, Rockwell’s social responsibility values and commitments form an integral part of the mining operations. Rockwell is committed to providing increased returns to shareholders while sharing the value created from the operations with a wider set of stakeholders through the alignment and linkage of business and social responsibilities.

#### 3.5.1 Social and Labour Plans

According to the MRPDA, a SLP is required to be submitted to the DMR along with the other requirements for a mining right. The objectives of the SLP (according to the MPRDA) is to promote employment and advance the social and economic welfare of all South Africans; to contribute to the transformation of the mining industry; and to ensure that holders of mining rights contribute toward the socio-economic development of the areas in which they are operating, as well as the areas from which the majority of the workforce is sourced. In harmony with these objectives, the SLP requires that the company address literacy levels and life skills within the workforce as well as implement career progression paths, mentorships, internships and bursary plans for its employees. In addition, the company is required to contribute to the upliftment and development of the local communities through

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8 The current (February 2012) estimation of liability is ZAR21,993,912.
procurement, establishment of a Future Forum and the creation of Small, Micro and Medium Enterprises (SMME’s).

Etruscan had developed a SLP for the period 2009-2013, which was accepted by DMR. In this SLP, Etruscan had committed to spend R2,516,980.00 on Human Resource Development (“HRD”) programmes and R4,540,000 on Local Economic Development (“LED”) programmes over the first five years of the mining right. Now that the mineral right has been ceded, Rockwell will update this SLP in line with company standards and submit it during 2012.

While the Tirisano mine is of strategic importance to Rockwell’s long term growth objectives, it is also expected to contribute positively to the socio-economics of the Ventersdorp area. The Company is committed to initiatives that attract women to mining, which reflects the South African Government’s requirements for female representation in direct mining activities. Some ZAR420,000 has also been approved for on-the-job training (Tirisano mine) during 2012.

The Company has also carried out significant work relating to the safety measures at the mine to comply with the Mine Health & Safety Act (MHSA). The operational team at Tirisano, with the support and guidance of the executive team, remains committed to maintaining and improving the mine’s safety standards.

3.6 Associated Risks

To the extent known, no specific risks exist that may affect access, title or right, or the ability of Rockwell to perform work on the properties comprising the Tirisano project. However, generalised risks associated with prospecting and mining are always present. These issues are discussed more fully in Section 13.1.3 and will not be repeated here.
4 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

4.1 Topography, elevation and vegetation

The property can be described as generally flat to gently undulating (Plate 4.1). Elevation ranges for the property are between 1,520m and 1,580m AMSL. The property slopes from the northwest to the southeast with a drop in elevation of some 60m over 4km (which represents a slope of only 1:67).

Plate 4.1: View of the flat landscape between Hartbeestlaagte and Zwartrand (looking SE). Photo courtesy of Etruscan Diamonds (Pty) Ltd

The natural vegetation of the area is classified as “Savannah Grassland”. Typical grass species (van Oudtshoorn, 2002) comprise *Henterpogn contortus* (Spear Grass), *Themedia trianda* (Red Grass), *Cyndon dactylon* (Couch Grass), *Schizahyrium sanguineum* (Red Autumn Grass) and *Pogsnrthria squarrosa* (Sickle Grass). Exotic species such as *Acacia longispicata* (black wattle bush) and *Eucalyptus globulus* (Blue Gum Trees) are also known to occur. No Red Book Data Species of endangered vegetation occurs on the Property.

Weed species (*Tagetes minuta* (tall khaki weed), *Argemone mexicana* (Mexican poppy) and *Conyza albida* (tall fleabone)) are common in fallow lands. The only exotic and invasive grass species identified on the property are *Arundo donax* (giant reed) and *Pennisetum clandestium* (Kikuyu). Since the Property occurs in an area that has been farmed extensively, only common small animals (including jackal, steenbok, duiker, rabbits, meerkat, porcupine, springbok, anteaters and general bird-life) frequent the area in addition to domestic livestock. A number of vulnerable and near-threatened (Red Data) species have been recorded within the general district.
Primary commercial agriculture contributes about 2.5% to South Africa’s gross domestic product (GDP) and about 8% to formal employment. However, there are strong backward and forward linkages into the economy, so that the agro-industrial sector is estimated to comprise about 12% of the GDP (SA Yearbook, 2008/2009). Some 5.3% of the South African GDP in agriculture and 16.96% of total labour in agriculture is based in the North West. Maize and sunflowers are the most important crops and the North West Province is the biggest producer of white maize in the country.

4.2 Drainage

Surface drainage channels are very poorly defined. The flow generated in the local catchment has only a minor contribution towards the whole catchment because most of the surface water passes through pans and other hollows on the surface and permeates into the ground as a result of the karstic nature of the bedrock. Upstream of the Tirisano mine, the Vetpan is classified as a wetland. Any remaining surface water in the area drains into the Schoonspruit (some 30km south-southeast of the project area).

The mine is located in the Schoonspruit subterranean government water control area proclaimed in 1995 to protect the flow from the Ventersdorp eye (also known as the Schoonspruit eye), a spring that supplies drinking water to the town of Ventersdorp, from being impacted on by uncontrolled abstraction of groundwater for irrigation purposes in the area. The Schoonspruit subterranean government water control area covers about 90% of the Schoonspruit compartment.

Groundwater represents the sole source of water supply for domestic, agricultural, and industrial use around the mine. Groundwater quality at mine is generally good and suitable of domestic use. Groundwater is dominated by Ca, Mg and HCO₃ ions typical of dolomitic environments. The mine has drilled about 20 water boreholes. These have reported yields ranging from zero (dry) to greater than 90m³/hr. Four of these boreholes supply process water to the plant, whilst one provides drinking water to the mine. A private homestead located less than a kilometre north-east of the plant, and Ga-Mogopa village located about 5km south-west of the mine use groundwater for domestic supply. The most prominent spring that occurs in the area is the Ventersdorp Eye, which is located about 22km south-east of the mine and supplies water to the town of Ventersdorp. Flow from the spring is estimated at 24million m³/annum.

4.3 Access

The property is easily accessed via a network of regional tarred and gravel roads, as well as farm tracks on the mine property. From the Ventersdorp office, the mine is 30km distant on a 25km tarred and 5 km gravel road. Ventersdorp is 64km from Klerksdorp and 50km from Potchefstroom, the major population centres in the NorthWest Province and some 100km from Johannesburg. A well-maintained network of high-speed gravel roads and farm tracks provides ingress to all areas of the Tirisano mining and prospecting area. Within the limits of the mine area, water-bowsers spray the roads to limit dust.

4.4 Proximity to population centres and nature of transport

From the Ventersdorp office, the mine is 30km distant along a 25km tarred and 5 km gravel road. Ventersdorp is 64km from Klerksdorp and 50km from Potchefstroom, the major population centres in the NorthWest Province and some 100km from Johannesburg. Ventersdorp can be accessed by road and rail. A helipad is located at the Tirisano Diamond Mine. The nearest operational airfield is located at Potchefstroom, some 45 minutes drive from the mine and a small registered air-strip is to be found at Ventersdorp. The nearest licensed airfield is in Klerksdorp.
4.5 Climate

The area is situated in a dry to moderate rainfall area with annual rainfall figures of 597mm (mostly between December and March), which is exceeded by the average annual evaporation of 2,078mm (South African Weather Services). The area is not known for extreme weather conditions, although summer rainfall often occurs during electric storms and sudden downpours (squalls) can cause localised flooding and difficult operating conditions. The mine has a year round operating season and prevailing climatic conditions do not impact on the mining operation to any significant degree. Disruptions do occur due to poor road conditions following heavy rains and three-to-four hour down-time may occur when soaked gravel stockpiles are too wet to process efficiently. During years of exceptional rainfall flooding may occur, resulting in significant disruptions to production, as well as damage to infrastructure (municipal as well as on-mine).

Summer temperatures vary from 12°C to 34°C and winter temperatures varying from -10°C to 18°C. Wind blow predominantly from the North, NNE and NE at an average speed of 2.5 m/s.

4.6 Infrastructure

To the extent determined by the bulk-sampling, the sufficiency of surface rights for mining operations, the availability and sources of power, water, mining personnel, potential tailings storage areas, potential waste disposal areas, and potential processing plant sites are all described below.

4.6.1 Power

Power is available to the Tirisano project via the National Grid (ESKOM) from the Koster grid. All the necessary transformers and supply lines are in place. Currently, 2.0MVA is available (also 1.0MVA from the Arola substation (AMA 159-33-23) – an application has been made for an additional 1MVA9) and Etruscan had applied for a further 4MVA. Voltage is decreased to 400V through a transformer on site and distributed as required. Rockwell has paid ZAR949,40010 into a trust account to cover various ESCOM guarantees. Additional guarantees may be required once the additional power has been received.

In spite of power outages that affect business and mining ventures in South Africa, Rockwell’s mines continue to operate although, at times, with interruptions. To this end, Rockwell management has implemented remedial actions to mitigate the consequences of the power outages, including:

- All scheduled and planned maintenance is to be conducted during periods of power outages to reduce overall plant downtime.
- Backup generators to run the processing plants in the event of unscheduled power outages.
- A back-up generator set has also been installed at the Barkly West management and administration office to ensure that there is minimal impact on normal business activities of the Company and that all computer functions, back-up servers, and CCTV monitoring systems remain operational.

4.6.2 Water

The underground water in this area has been tested consistently over the past five years and is suitable for human consumption as per South African Bureau of Standards (“SABS”) specifications. A well field has been developed on the eastern portion of the property, consisting of four wells. From these boreholes, the water is pumped into a small pond next to the boreholes from where it is pumped to two

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9 Application dated 27 January 2012
10 Guarantee # M520658 and M515263
large tanks at the plant. Wastewater from the plant is discharged into a slimes dam where suspended material settles and clear water is pumped back to the plant for re-use. The boreholes are pumped intermittently to provide the shortfall from recycling. The issue of monitoring and recording the quantity of groundwater abstracted from the boreholes will be addressed. The Mine is presently licensed only to abstract groundwater, under Section 21(a) of the National Water Act. Both the use of the slimes dam for the disposal of mine waste and dewatering of the mine to facilitate mining will require licensing from DWAF.

4.6.3 Communication

The communication system has been upgraded to link the Barkly West office, the Johannesburg Head Office, Tirisano Mine, Saxendrift Mine, as well as the Klipdam/Holpan mine on a Multiprotocol Label Switching (“MPLS”) network. The system was planned to limit the cost of internal calls between the sites, reducing the monthly Telkom bill. Included in this system is a (1Mb Diginet leased line and a 3Mb Internet breakout) Internet connection between the sites (provided by Internet Solutions). At each site the MPLS network connects to the internet on a centralised firewall.

A Samsung telephone system provides external voice communication as well as VOIP via the main Diginet line. On-mine communication for production personnel is conducted through two-way, short-wave (HF) radios. Three cellular telephone networks are also available for project personnel as well as for personal communication.

4.6.4 Mine residue deposits

4.6.4.1 Coarse dumps

The overburden dumps also had to be placed outside the terrace for backfilling purposes. The factors affecting the location of the overburden dump and tailings dump are similar to those for the fine residue disposal facility. However for the overburden dump and tailings dump an overriding consideration is the requirement for the dump to be located as close as possible to the plant (for the tailings dump) and the pit (overburden dump), thereby minimising costs associated with trucking distances and conveyor of belt lengths. Environmental and geotechnical considerations e.g. underlying soil conditions, although important, are considered less critical for these dumps compared to a fine residue disposal facility. Overburden dumps will be hauled back into the pits. It is anticipated that the overburden dumps will be about 2ha in footprint and approximately 10m in height.

4.6.4.2 Tailings disposal

Rockwell does not intend to construct new slimes dams. Instead, the existing dams at Nooitgedacht 131 IP will be consolidated to be able to cater for the increased production capacity. The final configuration of the dam will have a capacity of some 5Mm³. The slimes dam will drain into return water dams, where some 30% of the water will be recovered. The capacity of the slimes dam is planned for the life of the mine based on normal operating capacity. Decommissioning of the dam must ensure the stability of the structure and will include post mine-closure monitoring.

A detailed Code of Practice (“COP”) regarding mine residue deposits on Tirisano has been completed by Rockwell. The COP was drawn up in accordance with DMR guidelines to assess and manage risks generally associated with both coarse and fine tailings dumps. The designs are based on criteria as per Chamber of Mines guidelines and consider and incorporate all factors having a bearing on potential
health and safety issues. Final design specifications are awaiting sign-off by an independent professional engineering technologist

4.6.5 Waste Disposal

Septic tanks and French drains provide sewage disposal from portable toilet facilities at the mine site. General waste disposal is delivered to the local (Venterdorp) municipality. Oil, grease and related pollutants are removed by the mining contractors to their dump facility in Potchefstroom. Any other hazardous waste is transported to a registered hazardous waste site.

4.6.6 Fuel storage and supply

The mining fleet is supported by on-site fuel tanks comprising 3 x 20,000l of diesel. Both diesel and petrol tanks are fully bunded and are environmentally compliant against accidental spills. Currently, AL2 Staedler is contracted to supply petrol and diesel, while Lubritene (Pty) Ltd supplies lubricants (oil and grease). Both contracts are subject to standard conditions will be reviewed annually. Oil, grease and related pollutants are regularly removed by a contractor (OILKOL).

4.6.7 Staff/Labour

The total monthly wage bill for the Tirisano mine is R2M, inclusive of shared services. With respect to staff, there are a number of challenges that Rockwell faces – such issues are not specific to Rockwell, but are common to all medium-sized mining companies located outside of the major metropolitan areas of South Africa.

- Since the North West Province has a long history of mining, there is no major shortage of technical skills. However, these people skills have to be attracted from other sectors in the mining industry – especially the gold and platinum mines.
- There is still the challenge in the implementation of regulations requiring the employment of historically disadvantaged south Africans (“HDSA’s”) at middle and senior management positions. Rockwell is mitigating this challenge by actively pursuing potential recruits at university level and fast-tracking them to be able to fit into these positions in the future.
- Emerging, yet still medium size, companies are not able to offer the salaries and living/working conditions of the senior mining houses which are often located in more attractive areas.

4.6.8 Security

Thorburn Security Solutions provide guards for patrol and access control. An integrated security system has been implemented that is able to monitor all areas of all the operation remotely – including closed circuit television on all sensitive areas of the plants and final recovery rooms, access control (fingerprint biometrics), motion detection and tracking technology, as well as guard patrols. This one system will monitor all of Rockwell’s operations in the Northern Cape and NorthWest and is also linked to the Johannesburg head office by a dedicated ADSL line.

Security measures are in place throughout the mining and recovery process. Similar procedures are employed in the production mining phase as in the bulk-sampling and trial-mining phases. In summary:
- Due to the extremely low grades found in the in-situ gravels, no security measures are employed at the mine face. Under very specific circumstances, bedrock cleaners may be required to sweep the pit bottom. Under these conditions, security guards are required to supervise the activities.
- At the plant, all areas where people may have access to gravels and, especially, concentrate, are fenced or caged off.
• The area around the sort-house is declared a Red Zone, enclosed with high-security fencing, and monitored by surveillance equipment. Access to all areas of the final recovery is controlled and monitored by closed circuit television.
• At the final recovery, all FLOWSORT concentrates are sent directly to a twin-locked secure box before they are hand-sorted in a glove box.
• The diamonds are moved from the mine to a secure facility by variable means on an irregular schedule.

4.6.9 Accommodation and offices

The company’s main administration office is located in Barkly West (45km NW of Kimberley). An on-site mine office (Plate 4.2) will be responsible for daily mining operations. Two company guesthouses are situated in Ventersdorp. The mine is located near to both Ventersdorp and Mogopa, so no on-site accommodation (in the form of hostels) is required. All staff (including contractors) and labour live at their homes and are provided transport to/from work each day. Currently, only essential security and artisans stay on-site.

Plate 4.2: Mine offices on Tirisano

4.6.10 Essential services

All essential services, including hospital, police, and municipal facilities are available in the town of Ventersdorp and anything else can be obtained within two hours drive (in Klerksdorp, Pretoria or Johannesburg).
5 History

5.1 Previous Ownership

Mineral rights comprising the Properties have belonged to the State since May 2004. Prior to that, the rights were held by the Bakwena Ba-Mogopa Trust. Numerous parties have held options over various portions of the properties.

Etruscan owned and operated the Tirisano mine until it was placed on Care & Maintenance in November, 2008.

5.2 Previous Exploration/Development

5.2.1 Historic

Historic records from the South African Diamond Bureau up to 1984 show that a total of 24,494ct were produced from Nooitgedacht, 11,330ct from the farm Hartbeestlaagte and another 1,039ct from Zwartrand (Marshall, Alluvial diamond Occurrences of the western and southwestern Transvaal, a compilation of production data, 1987). It must be noted that these are only the official production records, and the actual production figures are expected to be somewhat higher. All these diamonds were, presumably, derived from artisanal mining of relatively shallow deposits (Plate 5.1) – upper gravels in the sinkholes and the overlying colluvially-derived manganese layers (locally termed “Rooikoppie” gravels). No records exist for volumes or tonnages mined, so nothing is known regarding historical grades or diamond values, although unverifiable regional average grades of 1.6cpht have been reported.

The artisanal diggers followed the surficial gravels and, in many places, the sinkhole gravels and the linkage channels (locally termed “Runs”). Seen from the air these old diggings appear to delineate part of an ancient channel. Two such runs are known to exist on the properties – the Main Run (also known as the Vetpan Run) and the West Run. The West Run appears to have been mined intermittently between 1974 and 1984, but no reliable production figures are available from this period.

During the period 1979-1983, Newmont South Africa Limited prospected on Hartbeestlaagte and Zwartrand as part of an extensive programme of exploration and bulk sampling of diamondiferous gravels in the area between Lichtenberg and Venterdorp. It has been reported that during Newmont’s programme, "considerable geological and geophysical expertise, mainly in gravity and some EM survey techniques, were developed in locating gravel concentrations, or Runs". Bulk sampling\(^\text{11}\) showed that the better quality and larger stones were found in the eastern part of the North West Province. Consequently, Newmont’s efforts were concentrated here and, in particular, on the farm Zwartrand and the adjoining farm Hartbeestlaagte. Newmont outlined one main target on Hartbeestlaagte (H1a, b, c) and another three on Zwartrand (Z-la, Z-lb and Z-4) (Berezowsky, 1998).

Newmont carried out the following work (Berezowsky, 1998) (Fig. 5.1):

- detailed geological mapping on a scale of 1:2,000, on a grid with east-west lines spaced at 100 metre intervals covering all of the proclaimed lands in both Hartbeestlaagte 146 and Zwartrand 145;
- magnetometer traverses over selected areas delimited two dyke like bodies;

\(^\text{11}\) No details are available regarding diamond recoveries.
• a gravity survey over the grid which apparently showed the area to be extremely anomalous\textsuperscript{12} with two major gravity lows covering almost 50% of the grid;
• regional photogeology analysis for major structural features of the bedrock or basement;
• percussion drilling (1,906 metres at 61 locations on Zwartrand) on fences 100 metres apart and a hole spacing of 60 metres

Plate 5.1: Artisanal diggings along the Nooitgedacht – Zwartrand Run. The diggings in the background are situated where the Tirisano main pit is now located. (Photo courtesy of Etruscan Diamonds (Pty) Ltd)

This work defined two buried gravel bodies on Zwartrand, Z-la and Z-lb, and suggested the potential for a third, Z4. Two of Newmont’s targets were held as 540 claim blocks by African & Asian Minerals (Pty) Limited through a direct purchase from the estate of W.A. Vermaas, to whom they were transferred by Newmont. These blocks, named after gravity anomalies underlying respective areas\textsuperscript{13} are: Z-la (54 claims) 1.2118 hectares; Z-lb (486 claims) 10.9349 hectares; with a total of 12.1467 hectares. The third block, Z-4, is shown on the Newmont maps to measure approximately 1,300 metres by 250 metres, thus covering approximately 32.50 hectares.

\textsuperscript{12} Italics in original document, details unknown
\textsuperscript{13} These measurements refer to the areal extent of the claim blocks and have no reference to gravel occurrence.
Figure 5.1: Location of previous prospecting activities (pre-2000) on Hartbeestlaagte (from Berezowski, 1998)
During 1985, a minor amount of the exposed Z-lb gravels immediately NE of the claims was washed to produce a total of 26.24ct. These operations were undertaken by a small (unknown) company while African & Asian were unsuccessfully attempting to negotiate a joint venture agreement with Newmont. The operations were largely ineffective due to insufficient earthmoving equipment, inadequate supervision and management, and inefficient concentrating/sorting procedures. The grade of the gravels worked, therefore, was unfortunately not determined. This attempt to mine extensions of the Z-lb gravels did not approach the (expected high grade) base of the gravel run and the diamonds produced were from gravels exposed in old workings at the extreme north-eastern edge of the deposit. Therefore, the gravel base and well developed "run" within the claims and to the east of the old workings was thought worthy of further investigation. Newmont's drilling data concluded that the lower gravels, which were not excavated in sufficient quantity to have been effectively sampled, could be expected to contain the majority of the diamond.

During 1993-95 Southern Cross Diamond Ventures carried out a programme on Nooitgedacht, Hartbeestlaagte and Zwartrand wherein 27 holes in four lines were drilled and a sample trench was excavated (Fig.5.1). From this reconnaissance programme, some 6,000 tonnes of gravel were treated from which 99.71ct were recovered for a grade of 1.66cpht. The diamonds averaged 1.5ct/st and were sold locally for USD493/ct.

During 1996, a series of photogeological investigations (Lockett, Field and photogeological mapping of diamoniferous gravels, integration of Newmont gravity data and proposed drilling programme - Hartbeestlaagte and Zwartrand, Ventersdorp District, Northwest Province, South Africa, 1996)(Lockett, Photogeological mapping of diamoniferous gravels on Nooitgedacht, Zwartrand, hartbeestlaagte and adjacent farms., 1996)(Lockett, estimation of area, volume and tonnage for photogeologically interpreted outcropping and possibly buried gravels on farms Nooitgedacht Zwartrand and Hartbeestlaagte, Ventersdorp District, Western Transvaal, South Africa, 1996) were carried on the farms Nooitgedacht, Hartbeestlaagte and Zwartrand by Mountain Ash / Ashton Mining. Subsequently, field traverse and photogeological data were superimposed upon pre-existing Newmont gravity data and a drilling programme was initiated to test all of the mapping-inferred and gravity targets on Zwartrand and Hartbeestlaagte. While the distribution of holes was adequate to provide some indication of the presence and extent of sheet type gravel deposits, a far more detailed drill pattern would have been necessary to establish a realistic amount of pothole type gravel. The drilling programme indicated an exploration target14 of some 14-15M tonnes of gravel on the three farms, containing an estimated 200-250,000ct (De Carcenac, 1998). At the end of the drilling programme in January 1998 Ashton withdrew from the joint venture since these potential gravel volumes and grade ranges did not meet their target figures (I Macdonald, Pers. Comm., 2000).

In 1998, Vaaldiam Resources Ltd signed an option and Joint Venture agreement with Mountain Lake to earn a minimum 50% interest in their properties in the Ventersdorp diamond fields in the Northwest Province of RSA, including the Hartbeestlaagte property. A desktop study was commissioned (Marshall, Comments on the Nooitgedacht alluvial diamond property in the Ventersdorp District RSA, 1998) and a Qualifying Report was completed by A C A Howe of Toronto (Berezowsky, 1998) but Vaaldiam chose not to pursue the project, for reasons not made public.

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14 It is important to note that statements of potential quantity and grade of an exploration target are conceptual in nature, that insufficient exploration has been done to define a mineral resource and that it is uncertain if further work will result in the target being delineated as a mineral resource.
5.2.2 Etruscan Resources (Pty) Ltd

During the period February 2000 to August 2002 Etruscan contracted Zoutpan Diamonds to complete a mini bulk-sample on the Tirisano main pit. Some 5,080.88ct were recovered from 17 pits (the processed volume was not recorded, however). The majority of these gravels have been defined as part of the Lower Gravel Package\textsuperscript{15}, accounting for the better than expected results, as described below.

Diamond recovery from the Zoutpan pits (1.8cph or 3.24ct/100m$^3$ at a 2mm bottom cut-off) included a single 26.8 carat stone that represents 20% of the total diamond recovery from this area. With a total of 4,659 stones recovered, the average stone size was 1.09ct/st (Fig. 5.3). In addition, the diamond size distribution for these stones illustrated a marked shift towards larger stone sizes from above 5 carats (Lock, van der Merwe, & Sperinck, Indepsource estimate of diamondiferous gravels at the Tirisano mine of Etruscan Resources Inc., 2003). The total Hartbeestlaagte parcel realised a value of USD592/ct. This parcel contained two special stones whose value strongly influenced the total parcel value - a 26.8 carat diamond (accounted for over 25% of the parcel value) and a fancy yellow coloured 1.8ct stone (accounting for over 5% of the parcel value).

Later, during the period 2002/2003 RSG Global Pty Ltd (“RSG”) was commissioned to provide an independent mineral resource estimate of the adjacent Tirisano Mine diamond resources as at 23 January 2003 (Lock, van der Merwe, & Sperinck, Indepsource estimate of diamondiferous gravels at the Tirisano mine of Etruscan Resources Inc., 2003). This document was prepared in accordance with the Code and Guidelines for Assessment and Valuation of Mineral Assets and Mineral Securities for Independent Expert Reports (The ValMin Code) as adopted by the Australasian Institute of Mining and Metallurgy (AusIMM) in April 1998).

Although the RSG report was prepared with specific reference to the Tirisano Mine on the farm Nooitgedacht 131 IP, it makes reference to resource delineation drilling in an area straddling the farm boundary between Nooitgedacht in the north and Hartbeestlaagte in the south (the area where bulk-sample Pit #1 is located, as described later). In addition, it is noted that this is located immediately adjacent to the Tirisano mine pit that is excavated into a large gravel-filled sinkhole on the farm boundary. In this sinkhole area at the south end of the current Tirisano mine open pit it is possible to recognise a thickening of the gravel (pre-existing depression); a slumping of the top of the gravel which has been covered by a recent soil profile, topped by a very thin deflation gravel and subsequently covered by a final red sandy soil (subsequent depression); and a present day surface depression (continuing subsidence), confirming the karstic nature of these deposits.

During the time of RSG’s evaluation, no classifiable resource had yet been delineated on Hartbeestlaagte, although the area had also been surveyed geophysically (airborne gravity). The gravity map showed a very clear bedrock channel that had, in part, been confirmed by drilling. The details of this survey, and the results thereof, are presented in Section 8.

In an earlier, internal report by RSG (Van der Merwe, van der Westhuizen, Hill, & Feldtman, 2000) the preferred average global grade was estimated at 2.9ct/100m$^3$ (1.6cph) at a bottom cut-off screen size of 2mm. The production grade achieved by Tirisano Mine since commissioning in November 2002 was 1.8cph from the Zoutpan pits on Hartbeestlaagte, and 1.0cph in the Tirisano open pit on Nooitgedacht. The Hartbeestlaagte diamond recovery (1.8cph) included a single 26.8 carat stone that represents 20% of the total diamond recovery from this area. It was presumed to be appropriate to remove this single stone from the diamond parcel and re-calculate the grade down to 1.46 cph. On this basis it was accepted that the previous grade of 1.6cph (2.9ct/100m$^3$) would apply until further sampling should refine the model.

\textsuperscript{15} see Section 7 for definition of the gravel units
The preferred average global diamond value was estimated by the 2000 RSG study at USD400 per carat (a range of USD300 – 450 was noted). Since commencing production in November 2002, Tirisano Mine sold two parcels of diamonds, one from Nooitgedacht and one from Hartbeestlaagte. The Nooitgedacht parcel realised an average value of USD396/ct and the Hartbeestlaagte parcel realised a value of USD592/ct. A weighted average of the two parcels indicates a value of US$509/ct.

The Hartbeestlaagte parcel contained two special stones whose value was suspected to have strongly influenced the total parcel value. It was suggested that the parcel value be discounted to exclude these two stones, returning an average value for the remaining diamonds was USD458/ct and a weighted value for the two parcels, excluding the special stones, was USD424/ct. This was within the range previously reported and an area value of USD400/ct was accepted until a more representative record of sales was established.

Based on the known occurrences of gravel, and the tenor of the gravels mined on the Nooitgedacht and Hartbeestlaagte farms, this study considered a realistic exploration potential for a significant gravel volume to occur on the farm Hartbeestlaagte. No resource estimation was attempted since insufficient diamond grade and value information was available.

5.2.2.1 Etruscan Mvelaphanda Joint Venture

Under the terms of a 2004 JV agreement with Etruscan, Mvelaphanda (Pty) Ltd (“Mvela”) was to fund and manage a bulk sampling programme and a feasibility study, culminating in a valuation of the Hartbeestlaagte and Zwartrand properties. Mvela’s required expenditure was estimated at R 190M (Cdn $38M at prevailing exchange rates), and was to include the construction of a plant on these properties with an anticipated design capacity of 600 tonnes/hour. This work was to be carried out by Trans Hex Diamonds (Pty) Ltd (“TransHex”) on behalf of Mvela.

Mvela/TransHex, in conjunction with Etruscan, embarked on an R/C drilling programme on Hartbeestlaagte, which comprised 2,595m and 119 holes and cost ZAR195,000. In June 2005, Mvela earned a 50% interest in the Tirisano Diamond Mine by commissioning a plant with a design capacity of 300 cubic metric tonnes per hour throughput and a 50/50 joint venture between Etruscan Diamonds and Mvela was formed with Mvela continuing as operator. The plant, consisting of a screening and scrubbing circuit with a dense media separation plant, had a design capacity of some 50,000 cubic meters per month. During its period of operatorship, Mvela incurred capital and net operating expenditures of in excess of Cdn$13M.

Until the third quarter of 2005, the recovered grade from operations was consistently below the average forecast grade (2.8ct/100m³) because a large volume of uneconomic gravel was processed16. According to incomplete mining/production records, some 697,228m³ were processed for the recovery of 12,056cts, giving a mine grade of 1.73ct/100m³. At this time (end Q3 2005) mining activities progressed into the deeper gravel packages. During the month of November 2005 the grade of diamonds averaged 2.95ct/100m³ and the last 3,200m³ of gravel processed averaged 5.4ct/100m³. However, the period over period operating losses and the low rand/dollar exchange rate resulted in the Tirisano Diamond Mine being placed under care and maintenance during November 2005 and the subsequent impairment of TransHex’s investment in the project17.

Additional problems related to both mining and processing activities at the Tirisano Diamond Mine that

16 Etruscan News Release, 19 September 2007
17 TransHex Group Annual Report 2006
were experienced by the Mvela/Etruscan JV at that time included:

- Mining problems arose due to the depth of the open pit (36m below surface). This resulted in increased mining unit costs and water inflow as the water table is at 40m. The water problem was, generally, kept under control through continuous pumping.
- Processing problems were mostly related to the presence of manganese and clays in the gravels, which difficulties were exacerbated by the poor availability of electricity from the national grid, especially during the summer months.

5.2.2.2 **Etruscan Diamonds (Pty) Ltd**

During the period 2006-2008, Etruscan sampled eleven sites (Fig. 5.2). A total of 264,204.15m³ of gravel was sampled for the estimation exercise (121,830.27m³ of UGP and 142,373.88m³ of LGP). The samples were purposefully selected so as to sample shallow (UGP) gravels on the shoulders of the sinkholes as well as gravels, both UGP and LGP, in the sinkholes. These samples have been used to monitor both diamond grade and value variation with respect to the different lithologies as well as with depth and over time.

The top and bottom cut-off sizes for this sampling programme were -25mm and +1.6mm, respectively. Final grade recoveries of the different gravel units of the bulk-sample pits are presented in **Table 5.1**. Note that grades are given in carats per unit volume rather than per unit weight.

**Table 5.1**: Recovered grades for the 2006/2007 bulk-sampling programme

<table>
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<tr>
<th>Sample Pit</th>
<th>Volume (m³)</th>
<th>Carats (bottom cut-off of 1.6mm)</th>
<th>Grade (ct/100m³)</th>
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<td>UGP</td>
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<td></td>
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</tr>
<tr>
<td>2A</td>
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<td>2B</td>
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<td>7,244.99</td>
<td>2.19</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Value 1</th>
<th>Value 2</th>
<th>Value 3</th>
<th>Value 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average/Total*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>277,435.34</td>
<td>6,610.60</td>
<td>2.38</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. Samples 3A and 8 were not included in the resource estimations due to problems in verifying the data.
2. 2003-2005 data shown here for comparison, but not included in resource estimation data.
4. Average/Total for all samples.
5. Average/Total of UGP and LGP samples only.

The above volumes and grades refer to material extracted during bulk sampling activities and are not mineral resources.
During these programmes, four separate mining/processing contractors were employed, namely, Gothoma Diggings (2006/2007) Badenhorst Diamante (2007/2008), Forever Diamonds (2008) and ALS (2008). All mining pits were designed using guidelines provided by AB Global Mining Consultants from Johannesburg, RSA. The earthmoving equipment and operators belong to the companies that were contracted to mine, process and rehabilitate the bulk-samples.

From 2006-2007 all of the sub-contractors processed gravels through rotary pan plants – the flow-sheet of which is shown in Fig. 5.3. During 2007/2008, the gravels from Pit #6 were processed through the DMS.
Generally, final recovery was by Flow Sort X-ray technology. All areas in the final recovery (of all operations) where diamonds can be accessed are secured by SECURETITE cables. The removal and reattachment of the cables is recorded in the SECURETITE logbook. The final hand sorting took place with at least two people present (on a daily basis), in addition to Etruscan’s security superintendent. In the Etruscan recovery room, the final hand-sorting was inside a glove box.

During 2008 Etruscan placed the Tirisano mine on Care & Maintenance (November, 2008). At the time of closure:

- 2,391 boreholes had been drilled on the property, totalling 53,576m. The deepest drilling indicates that, in some of the deeper sinkholes, the lower gravels extend down, at least, to 140m (without intersecting bedrock). Geophysical interpretation, however, indicates that final depths of the sinkholes may be in excess of 120m and, potentially, up to 200m in places.

**Figure 5.3:** Bulk-sample process flow-sheet (Courtesy of Etruscan)
• The stratigraphy of the deposit was fairly well constrained and it was understood that the primary target gravels are the Lower Gravels (LGP and TZP), which produced higher average grade than the Upper Gravels (UGP).

• Eleven bulk-samples provided 147,895.88m³ of Lower Gravels from which 4,318.6ct were recovered for a global grade of 2.85ct/100m³ (with bottom cut-off of 1.6mm) and value of USD466/ct. In addition, 129,557.46m³ of Upper Gravels (UGP) was processed to recover 2,292.00ct at an average grade of 1.77ct/100m³.

• Trial-mining during 2008 processed gravels from the base of the Tirisano main pit. A total of 208,718m³ was processed, of which 146,881m³ is LGP, 10,293m³ is UGP and 61,534m³ is a blend of both UGP and LGP. During this period, some 6,459.98ct were recovered (1,042.96ct from LGP gravel and 5,417.02ct from the undifferentiated gravels) from the Tirisano main pit. The average recovered grade of these gravels was 2.43ct/100m³ (2.00ct/100m³ and 2.54ct/100m³, respectively). The drop in average grades for this period is thought to be the result of continuing (increasing?) process recovery problems.

• During the period January – June 2008, a total of 5,552.54ct were sold to various diamond buyers on the open market for an average of USD606/ct. The reliability of valuations of parcels smaller than 2,000ct decreases as the size of the parcels decrease to the point where valuations placed on a small number of diamonds from exploration samples are likely to be misleading. However, the total mass of diamonds from the Tirisano project sold on the open market exceeds 12,000ct. As a result, it is expected that the sales value should be a fair reflection of the value of the stones. Nevertheless, as a result of the current economic climate and the huge fluctuations in the rough diamond market, it was not possible to estimate average diamond prices with any certainty – irrespective of the amount of diamonds sold.

Operations highlighted a number of technical issues faced by Etruscan:

• There are continuing issues with processing efficiencies as a result of clay and manganese in the gravels that need to be resolved through a detailed investigation of the gravel metallurgy as well as the processing methodology/equipment.

• Due to the almost random variation in sedimentological horizons within the gravel unit, production data (specifically grade) must be observed continually and reconciled with modelled figures. The geological model also needs to be monitored and refined as operations expose sinkhole fill at depth.

• Sustained attention should be given to finding ways to differentiate between the various gravel horizons in borehole logs, including geochemical and mineralogical studies.

• Since these deposits are “high-volume, low-grade” operations, much effort will be required to replace mined gravels. Consequently, an on-going regional exploration programme will need to be pursued to identify and evaluate additional, similar deposits.

Mineral resources in both Inferred and Indicated categories were estimated for the Tirisano project at 30 June 2008 by Brian J Paull (Pr. Sci. Nat) of A B Global Mining (Pty) Ltd. These resource estimates were reviewed by T.R. Marshall, PhD, (Pr. Sci. Nat.), a qualified person who was independent of Etruscan and who was responsible for the estimate. No additional drilling or bulk-sampling took place on Tirisano since the compilation of the June 2008 resources. After reviewing the estimate, the author depleted the volume of gravels that was mined and processed until the project was put on Care & Maintenance on 25 November 2008. Since no processing took place on Tirisano up to November 2010, these resource estimates were still valid as at 30 November 2010 (Table 5.2).

18 Gravels not classified as UGP or LGP in the mining production logs
19 NAPEGG Guidelines
Table 5.2: Resources estimated for the Tirisano project as at 30 November 2010

<table>
<thead>
<tr>
<th></th>
<th>Indicated Resource volumes (m$^3$)</th>
<th>Inferred Resource volumes (m$^3$)</th>
<th>Grade (ct/100m$^3$)</th>
<th>Value (USD/ct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Gravel Package</td>
<td>16,109,000</td>
<td>8,613,000</td>
<td>1.77</td>
<td>606</td>
</tr>
<tr>
<td>Lower Gravel Package</td>
<td>11,801,500</td>
<td>6,744,000</td>
<td>2.85</td>
<td>606</td>
</tr>
<tr>
<td>Depleted by end-2008</td>
<td>-2,630,600</td>
<td>-23,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>25,279,900</td>
<td>15,334,000</td>
<td>2.37</td>
<td>606</td>
</tr>
</tbody>
</table>

In addition to the Indicated and Inferred Resources for the project, exploration targets exist in large areas of both the LGP and the UGP units. Although some drilling and sampling has taken place in these areas, the results are insufficient to be categorized as a resource. It is important to note that these statements regarding potential quantity and grade of exploration targets are conceptual in nature, that there has been insufficient exploration to define a mineral resource in these areas and that it is uncertain if further exploration will result in the target being delineated as a mineral resource.

Target areas include:
- Some 35-40,000m$^3$ of (LGP) gravel estimated to exist in the sinkholes below the present level of Inferred Resources (at 105m), down to the extent of drill data;
- Some 150-200,000m$^3$ of gravel within the modelled gravel wireframe, but which does not fall within the inferred categories due, primarily, to lack of borehole coverage;
- The estimated, additional, 5-6Mm$^3$ of (LGP) gravel that is modelled to exist in the sinkholes, if a more geologically reasonable shape is accepted (although not yet defined by drilling);
- An undefined amount of gravel, specifically southeast of the currently inferred resource area, where gravel is seen to exist (from borehole results), but drill coverage and sampling constraints prevent these from being included within defined resources;
- An indefinable volume of (LGP) material that is located below the present drilling level in the sinkholes. Geophysical modelling cannot be used to identify the base of the bedrock in these structures with any accuracy, and drilling has not penetrated the thick gravels. As a result, it has not been possible to estimate the volume of gravels;
- The “West Run” on Nooitgedacht and Hartbeestlaagte has not yet been drilled or sampled. Some 200ha of area may be underlain by both UGP and LGP gravels.
- Grade ranges for these targets are expected to fall within the values identified by sampling within currently identified resource areas, namely, 1-2ct/100m$^3$ or UGP and 2-3ct/100m$^3$ or LGP units.
6 GEOLOGICAL SETTING AND MINERALISATION

6.1 Geology

6.1.1 General Geology and Mineral Deposits of South Africa

The geology of South Africa (Fig. 6.1) is extremely varied and spans a period of about 4 billion years (SACS, 1980). The northeast portion of the country is dominated by the granitic rocks and belts of volcanic and sedimentary rocks forming the Archaean Kaapvaal Craton. Much of the rest of the country is covered by Phanerozoic sediments.

![Figure 6.1: The General Geology of South Africa](image)

The earliest clusters of diamondiferous kimberlites, namely Kuruman and Cullinan, intruded into South Africa during the Proterozoic. The main kimberlitic (both diamondiferous and barren) event, however, took place in the late Mesozoic. All the economically viable kimberlites occur on the Kalahari Archon (Kaapvaal and Zimbabwe Cratons), while those occurring in the surrounding Proterozoic basement are non-diamondiferous (Gurney, et al., 1991). Over 2,000 kimberlite pipes, blows and fissures have been
recorded across South Africa, Lesotho, Swaziland, Botswana and Zimbabwe, spanning emplacement age range of approximately 1700 – 40 Ma, with peaks at 1,700Ma, 1,200Ma, 600-500Ma, 240Ma, and 200-80Ma. Kimberlite emplacement was followed by the liberation and entrainment of diamonds and the subsequent deposition of terraces on the ancient Vaal and Orange Rivers.

6.1.2 The Alluvial Diamond Fields of the North West Province

The alluvial diamond fields of the North West Province extend over an area of some 25,000 km². The total reported production from these diamond fields from 1904-1984 (Fig. 6.2) is estimated at 14.4Mct, which would have a present day value of over USD5Billion. This compares with 14.5Mct recovered from the Big Hole at Kimberley from 44 years of mining (Marshall, Alluvial diamond Occurrences of the western and southwestern Transvaal, a compilation of production data, 1987).

The North West Province alluvial diamond fields have, historically, been divided into three districts (Marshall, 1990, The nature, origin and evolution of the diamondiferous gravels of the southwestern Transvaal), namely:
- Northern Field (Lichtenburg-Bakerville);
- Eastern Field (Ventersdorp-Potchefstroom); and,
- Southern Field (Christiana-Schweizer-Reneke-Wolmaransstad).

![Figure 6.2: The alluvial diamond fields of the NorthWest Province](image.png)

The Project is located in the eastern Ventersdorp-Potchefstroom Field, from which over 2.6Mct of diamonds have been derived (Marshall, 1987). It is estimated that the majority of these diamonds have been recovered from the surficial, colluvially-concentrated, manganese gravel layer as well as from the sinkholes (although relatively shallow portions of the sinkholes – typically only Upper Gravels have been
accessed). Early reports (Du Toit, 1951) and production figures (Marshall, Alluvial diamond Occurrences of the western and southwestern Transvaal, a compilation of production data, 1987) indicate that diamond values are reasonably high in the Ventersdorp field (typically +USD 500-750/ct at current diamond prices).

### 6.1.3 Property Geology

The Hartbeestlaagte and Zwartrand properties are located at the contact of the Eccles (chert-rich) and Littleton (chert poor) formations (Fig. 6.3) of the Malmani sub-group (Transvaal Supergroup). Nooitgedacht, and the Tirisano Main pit, lies entirely on the Eccles formation. The Eccles formation is composed of chert-rich dolomite and displays deformation features to the east of the East Gravel Run on Zwartrand 145 IP, where a massive chert breccia forms a boss surrounded by highly deformed dolomite cut by a network of narrow dykes (Berezowsky, 1998). The southern extremities of Hartbeestlaagte and Zwartrand are located on the chert-poor Littleton formation.

Two gravel runs have been identified on the properties – the West and Main Gravel Runs. Only the Main Run, as located on Nooitgedacht and Hartbeestlaagte, has been extensively prospected – the West Run and its possible extensions have not yet been investigated in any detail. Only one run is known on Zwartrand, probably associated with the Main Run on Hartbeestlaagte.

The main Tirisano pit is located close to the contact between the Eccles and Littleton formations and the intersection of a number of small structures that have been identified on the aerial photo interpretation. The shape of the main pit is determined by the intersection of two fractures at, roughly, right angles (Plate 6.1). The large sinkhole, that is the Tirisano main mining pit, is formed at the intersection of these two fractures. Clay and gravel infill indicate that these fractures have been the loci for episodic karst activity in this area since, probably, the Precambrian.

![Plate 6.1: Intersecting fractures and the large sinkhole at the Tirisano main pit](aerial view from the southeast, courtesy of Etruscan)
Figure 6.3:  Property Geology Map
A number of prominent ridges traverse the properties (Plate 6.2). These linear highly silicified chert breccias have been interpreted as remnants of an ancient karstic cavity fill, probably part of the Transvaal-age “Giant Chert formation” (Berezowsky, 1998). The ancient breccias were subsequently silicified becoming resistant to erosion thus forming topographic highs. It is obvious that these quartz ridges have influenced the subsequent kart development – as is evidenced by the offset to the east of the East gravel run at the Hartbeestlaagte/Zwartrand boundary, as well as the apparent cut-out at the southwest corner of Zwartrand.

Plate 6.2: Silicic ridges (remnants of the Giant Chert Formation?) that traverse the property and have an effect on gravel deposition

6.2 Mineralisation

6.2.1 Surrounding Rock Types/Regional Bedrock Geology

The Transvaal Supergroup, which forms the host-rocks to the diamondiferous alluvial gravels, rests unconformably on the Ventersdorp volcanic succession and, in the North West Province, is comprised of the Black Reef Quartzite and the Chuniespoort and Pretoria groups (Table 8.1). In this area of the North West Province, the Ventersdorp Supergroup comprises lavas, agglomerates, tuffs/tuffaceous sediments and conglomerates. The clastic sediments (of the Rietgat formation (part of the Bothaville Formation)) are located on a number of farms between Ventersdorp and Lichtenburg (Von Backstrom, Schumann, Roux, Kent, & Du Toit, 1952). The sedimentary sequence consists of quartzite, gritstone and conglomerate. The coarse clasts of the conglomerate comprise granite, quartzite, quartz, chert, pre-existing conglomerates, and both basic and acid lavas. The clast decrease in size westwards and the entire unit grades into a quartzite.
The Black Reef Quartzite is conglomeratic near its base (SACS, 1980). These conglomerates contain gold eroded from the underlying Witwatersrand rocks and have historically been mined sporadically. The conglomerates are overlain by mature quartz arenites. The Black Reef Quartzite grades upward to the dolomitic Malmani Subgroup through the 10 - 200m thick chert-poor Oaktree Formation. Following on this transition zone is the 300 - 500m thick Monte Christo Formation. This formation can be subdivided into three, namely the Lower, Middle and Upper Monte Christo, as a consequence of their chert content: the Lower and Upper formations being chert rich. Clastic sediments mark the base of the overlying 100 - 200m thick chert-poor zone of the Littleton Formation. This unit, in turn, grades upward into the chert-rich Eccles Formation which is capped by a disconformity.

The uppermost unit is the Frisco Formation, a mixed zone of breccia, shale, chert-poor dolomite and minor iron-formation. These carbonates have a gradational contact with the overlying Penge Iron-Formation. Following the chemical sedimentation of the Chuniespoort Group, the Kaapvaal Craton was uplifted and exposed to weathering and erosion. A karsted surface was extensively developed over the outcropping carbonate formations. Reworking of these deposits resulted in the formation of a widely developed chert breccia (Giant Chert Formation) at the base of the Pretoria Group. The overlying Pretoria Group consists predominantly of quartzite and shale, together with a prominent volcanic unit and minor conglomerate, chemical and volcanic members. Numerous diabase and other basic sills are found at various levels in the Pretoria Group (SACS, 1980).

The lowermost formation of the Pretoria Group, the Rooihoogte Formation, contains a prominent basal conglomerate – the Bevets Conglomerate member. Pebbles are poorly sorted and may display imbrication. Chert pebbles are usually finely laminated or massive and grey in colour. They tend to discolour white when exposed in outcrop. Some pebbles are cracked due to compaction and the cracks are filled by chlorite. The matrix of the conglomerate is composed of quartz and chert grains and diagenetic siderite and chlorite. Siderite in particular, is found to replace detrital chert. The siderite is usually developed as euhedral crystals and contains small amounts of Mg, Ca and Mn. Siderite-rich matrix tends to become dark brown-red on prolonged exposure to the atmosphere.

Mapable units of the Karoo rocks (Dwyka tillites and Ecca shales) are not found within the Ventersdorp district. The closest outcrops are located east and south of Lichtenburg. The tillite is composed of a soft, clayey, unlaminated matrix, wherein unsorted, brecciated clasts of varying sizes are found. The clasts are comprised of predominantly chert and varying types of quartzite, but also include minor amounts of dolomite, conglomerate, lava and Bushveld lavas (Von Backstrom, Schumann, Roux, Kent, & Du Toit, 1952). Examples of striated glacial floors are found near Lichtenburg – the orientation of the proposed glaciers is from northeast to southwest. Although outcrops are rare, Dwyka shales are known to exist beneath the tillite in various places around Lichtenburg. Furthermore, a raft of such shales is preserved, as cave infill, on a farm less than 20km east of Tirisano (Marshall & Norton, The Alluvial Diamond Fields of the Ventersdorp district, 2009). Ecca shales are also still preserved in the cave to the west of Ventersdorp (Martini & Kavalieris, 1976).

---

**Table 6.1:**  
*Simplified Stratigraphy of the North West Province (SACS, 1980)*

<table>
<thead>
<tr>
<th>MESOZOIC-CAINOZOIC</th>
<th>KARROO SUPERGROUP</th>
<th>TRANSVAAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ECCA GROUP</td>
<td>PRETORIA GROUP</td>
</tr>
<tr>
<td></td>
<td>DWYKA GROUP</td>
<td>Rayton Formation</td>
</tr>
</tbody>
</table>

Alluvial diamond gravels
Northern valley facies
<table>
<thead>
<tr>
<th>SUPERGROUP</th>
<th>Magaliesberg Quartzite</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Silverton Shale</td>
</tr>
<tr>
<td></td>
<td>Daspoort Quartzite</td>
</tr>
<tr>
<td></td>
<td>Strubenskop Shale</td>
</tr>
<tr>
<td></td>
<td>Dwaalheuwel (sandstone, conglomerate)</td>
</tr>
<tr>
<td></td>
<td>Hekpoort Andesite (2,222Ma)</td>
</tr>
<tr>
<td></td>
<td>Boshoek Formation (periglacial</td>
</tr>
<tr>
<td></td>
<td>conglomerate)</td>
</tr>
<tr>
<td></td>
<td>Timeball Hill Formation (shales &amp;</td>
</tr>
<tr>
<td></td>
<td>quartzites)</td>
</tr>
<tr>
<td></td>
<td>Rooihoogte Formation (BIF &amp; shales and</td>
</tr>
<tr>
<td></td>
<td>conglomerate), Bevets Member</td>
</tr>
<tr>
<td>Giant Chert formation</td>
<td></td>
</tr>
<tr>
<td>CHUNIESPOORT GROUP</td>
<td>Deutschland Formation</td>
</tr>
<tr>
<td></td>
<td>Penge Iron Formation (2,480Ma)</td>
</tr>
<tr>
<td></td>
<td>Frisco Formation (shaley, chert poor)</td>
</tr>
<tr>
<td></td>
<td>Eccles Formation (chert rich and</td>
</tr>
<tr>
<td></td>
<td>erosion breccia) – Regressive</td>
</tr>
<tr>
<td></td>
<td>environment</td>
</tr>
<tr>
<td></td>
<td>Littleton Formation (shaley, chert</td>
</tr>
<tr>
<td></td>
<td>poor)</td>
</tr>
<tr>
<td></td>
<td>Upper Monte Christo Formation (chert</td>
</tr>
<tr>
<td></td>
<td>poor)</td>
</tr>
<tr>
<td></td>
<td>Middle Monte Christo Formation (chert</td>
</tr>
<tr>
<td></td>
<td>poor)</td>
</tr>
<tr>
<td></td>
<td>Lower Monte Christ Formation (chert</td>
</tr>
<tr>
<td></td>
<td>rich)</td>
</tr>
<tr>
<td></td>
<td>Oak Tree Formation (chert poor) (2,585Ma)</td>
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<tr>
<td>VENTERSDORP</td>
<td>Black Reef Quartzite (2,642Ma)</td>
</tr>
<tr>
<td>SUPERGROUP</td>
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<tr>
<td>PLATBERG GROUP</td>
<td>Rietgat Conglomerate formation</td>
</tr>
<tr>
<td>BOTHAVILLE GROUP</td>
<td></td>
</tr>
<tr>
<td>ALLANRIDGE GROUP</td>
<td>Undifferentiated volcanic pile</td>
</tr>
</tbody>
</table>

### 6.2.2 Post-Gondwana Geomorphology

Several supergene ferromanganese wad deposits (Beukes, Van Niekerk, & Gutzmer, 1999), mined on small scale for industrial applications, are developed preferentially on the Oaktree formation of the Malmani dolomites of the Transvaal Supergroup (although they are known to exist on the other formations, they are best developed on the Oaktree unit). The wad (Plate 8.1) represents an ancient saprolite (Waterval Saprolite) developed in the dolomite on a major unconformity. The ferromanganese wad apparently formed after the break-up of Gondwanaland, during the African cycle of erosion. Conditions must have been humid and warm to allow deep chemical weathering with wad formation, kaolinization, and laterization.

Weathering and leaching of the dolomite surface must have taken place under moderately acidic to weakly alkaline and oxidising ground water conditions. For development of up to 80m thick saprolite, chemical weathering must have taken place over a prolonged period of time, with abundant water circulation in areas of low relief with little mechanical erosion. It is also probable that laterization accompanied the formation of the saprolite. It is most likely that ferromanganese nodules were derived
from a nodular ferromanganese ferricrete that had originally covered the saprolite. All the features of the saprolite would suggest development under warm humid conditions with very effective chemical weathering – similar to that found in humid tropic/sub-tropical areas today.

Plate 6.3: Supergene enriched manganese wad development (defunct Rand London Manganese Mine on Roodepan 180 IP, Ventersdorp district)

6.2.3 Geological Controls

The geological controls on the preferential development of diamondiferous gravels are both lithological and structural:

- Historically, the better deposits have been found on the chert-rich dolomite units of the Malmani Group as well as along the lithological contacts of the chert-rich and chert-poor strata.
- A comparison of alluvial deposits with dykes and other major linear features also indicates that many of the channels have been influenced by these. In addition, sinkhole features are often located at intersections of structural features and also at intersections of structural features with lithological boundaries.

Mineralisation is confined to the gravel packages that in-fill karst caverns etched out of the Malmani chert-rich dolomites. The clay-poor LGP and UGP units\(^{20}\) are considered to be the major exploration targets as the diamond grades encountered in these units have, historically, supported commercial mining ventures. Although elevated grades have also been associated with the colluvial manganese nodule layer – this unit is not everywhere present on the properties and the processing of these gravels can be problematic due to the manganese content.

\(^{20}\) The sedimentary units in-filling the karst features are described in detail in section 7.
Further, a comparison of alluvial deposits with dykes and other major linear features also indicates that many of the runs have been influenced by these. A geophysical study of the alluvial deposits further west in the Lichtenburg district (Stettler, 1979) indicates that most runs occur in leached zones within the dolomite and that sinkholes occur at the intersections of such leached zones (similar features have been identified in the Ventersdorp district). The implications of this are that the drainage pattern was controlled by inherent lines of weakness within the dolomite, as was the localization of sinkholes within that drainage. Even within the present drainage configuration, many of the swallow holes, springs, potholes and marshes, are located preferentially in the chert-rich horizons (or along contact zones) and are localized by structural features. Examples of such are found at Vetpan (Nooitgedacht 131).

There is significant coincidence between joint orientations and that of the dykes and quartz veins intruding the dolomite plain, suggesting preferential intrusion along these planes of weakness. Similarly, a statistical occurrence between the orientation of the dykes and joints, and that of the gravel runs and the gravity anomalies indicates a causal relationship (de Wit, 1981). There is, furthermore, a correlation between the orientation of the gravel deposits and the strike of the chert-dolomite zones at that particular locality. There are some disparities between the orientation of the older, palaeo-solution channels and those found in the present day cave systems, however. Studies of caves in the North West Province (Martini & Kavalieris, 1976) indicate that the dominant structural controls on the younger caves are 92° - 110° and 177° - 190°. These younger cave orientations have been attributed to early Tertiary (African) cavern development along tensiional jointing developed in post-Karoo times, probably contemporaneous with the Gondwana separation. The totally different orientations of the (earlier) gravel-filled solution channels argues for a different, much earlier, age of initial development – most probably pre-Dwyka. This would be in harmony with de Wit’s (1981) interpretation that the erosion and karstification of the dolomite bedrock was evidently well advanced prior to the onset of the deposition of the oldest gravels. This would also be substantiated by the lack of speleothems in these solution channels: pre-Dwyka climates are much colder (glacial) than present and cold climates, while enhancing carbonate solution, inhibit the precipitation of carbonates.

In all known alluvial gravel deposits, diamonds occur in clusters formed by natural traps (examples include, but are not limited to gullies, potholes/sinkholes and gravel bars), and are not evenly spaced throughout those trapsites. In addition, diamonds constitute discrete units of varying size (weight) and usual parameters of grade measurements are not entirely applicable. Individual diamonds are not evenly or uniformly distributed throughout an alluvial deposit; neither are they randomly distributed. Rather, their distribution has been described as a random distribution of clusters of points. The clusters are both randomly distributed in space, and the point density of each cluster is also random (Rombouts, 1987).

### 6.2.4 Nature of Mineralisation

The gravel deposits of the Ventersdorp district are developed in the palaeo-karst features of the Transvaal dolomites. As such, an understanding of karst development is essential to the prospecting and evaluation of these diamondiferous deposits. The details of karst development and its application in the North West Province have been described in detail in the 2006-2008 NI43-101 Technical Reports for Etruscan and summarised in Marshall & Norton (2008) and will not be repeated here. It is important, however, to note that:

- Karst is terrain with distinctive landforms and drainage arising from greater rock solubility in natural waters than elsewhere (Jennings, 1985). Solution is not always the most prevalent process in karst, nor is it necessarily the most dominant one, but it does play a more important role here than in other kinds of landscapes. Its most critical effect lies in the enlargement of underground voids, causing increased permeability of the rock. As more water passes through the rock, the voids become large enough to become caves.
In normal landscapes, small streams in small valleys join to become large rivers in large valleys. In karst, this harmonious pattern is broken up by the development of small, centripetal drainage basins and closed depressions take over the landscape to varying degrees. Superficially it lacks organization and the drainage system has to be sought underground. In karst areas, the total or partial absorption of a watercourse is known as a swallow hole, watersink, or sinkhole.

Though structural and lithological considerations are very important, the regions with the greatest number of sinkhole-type swallowholes are those of both present- and recent- glaciation. Where thick soils or superficial (glacial or alluvial drift) deposits cover karst rocks, dolines can develop through spasmodic subsidence and more continuous piping of these materials into widened joints and solution pipes in the bedrock beneath (Fig. 6.4).

Dolines, are generally circular or oval in plan, with a range of forms; dish and bowl-shaped, conical and cylindrical. In size, dolines vary from a few metres in their dimensions to more than a hundred metres in depth and to several hundred metres in horizontal dimensions. A number of processes are operative in dolines, including solution at or near the surface, cave collapse, piping and subsidence. These processes often work in combination or in sequence to form complex features.

The sinkholes in, and adjacent to the major runs, show varying morphologies ranging from collapse to subsidence doline, yamas (perpendicular or oblique shafts leading to caves at depths), wells, lapies's (solution channels) and buttresses. Residual gravity measurements by Stettler (1979) indicate that the runs are situated in gorge-shaped channels and that potholes occur at the intersections of such channels.

Figure 6.4:  Schematic development of dolines
6.2.5 Mineralisation on the Tirisano Mine properties

The geophysical surveys (and supported by extensive drilling) indicates that the karst system on Nooitgedacht/Hartbeestlaagte extends southeast across the property towards the adjacent farm Zwartrand, and is offset by a number of structural features. There appear to be a succession of sinkholes connected by a series of linkage channels (which pattern is typical of allogenic streams). The overall length of the karst system (on the Tirisano properties) is approximately 5,500 m. Widths of the channels are seen to vary from 135-385 m. Drilling indicates that depths of the sinkholes and channels can exceed 140m. Geophysical modelling indicates that final depths may be +200m.

The mineralised zones that have previously been targeted as potential mineable horizons are the Upper (“UGP”) and Lower (“LGP”) gravel units, especially the more clay-poor units horizons. Geological mapping of outcrops, excavations, drill holes and bulk-sample locations have indicated the gross outline of the occurrence of these units on the Properties. The LGP resource is, typically, confined to the deeper portions of the karst system. UGP deposits generally exist in two locations – on the western shoulder of the karst sinkhole-channel system (as sheet gravel) and overlying the LGP in the sinkholes. It appears, further, that subsidence has been active throughout the system, resulting in the deposition of a Pebble-Clay Package (“PCP”) within the solution channel/sinkholes. Sample results indicate that the PCP unit is thicker on Nooitgedacht than on Hartbeestlaagte.
7 Deposit Types

The karst of the North West Province is, perhaps, unique in the world, due to the peculiar composition of the rock involved and probably also to its climatic history. The caves preserved in this area include the largest known in South Africa and are perhaps among the largest dolomite systems known in the world. The dolomite in the Transvaal has undergone at least four periods of karstification since its deposition in the Proterozoic (Brink & Partridge, 1965). The four periods are:

- Pre-Pretoria Group (Giant Chert)
- Pre-Waterberg (dissolution cavities in the dolomite, filled with red Waterberg sandstone)
- Pre-Karoo (the karst forms suggests development under a cold climate as may be expected from the associated glacial deposits)
- Tertiary-Recent (by early Tertiary times it is conjectured that the Karoo cover in this region was sufficiently thin (and absent in places) to allow for the evolution of a karst landscape.

It is fundamental to the geological and resource models to appreciate that the gravels were deposited in a karst system where:

- the dolomitic bedrock contacts with the gravels may be vertical;
- the mode of gravel deposition is not typical fluvial alluvial;
- periodic subsidence has taken place during deposition;
- deposition has taken place over a long time (at least since the Mesozoic), resulting in a build-up of a very thick gravel sequence.

Detailed mapping of the Tirisano main pit, all available pits and boreholes on both Hartbeestlaagte and Zwartrand, and comparison with other, similar deposits in the North West Province (Marshall & Norton, The Alluvial Diamond Fields of the Ventersdorp district, 2009) has resulted in the development of the model presented below. The following stratigraphic sequence (Fig. 7.1 and Plate 7.1) is seen to be present in both sinkholes and linkage channels (all units may or may not be present at any one site).

Lower Gravel Package (LGP)

The gravel is generally a clast-supported mixed unit. It is characterized by quartzite clasts dominating over chert clasts (60-80% quartzite) and contains clasts of Waterberg arkose/sandstone, weathered Hekpoort andesites, and red diamictite (Pre-Waterberg cave infill) which are very distinctive. The in-situ weathering of these clasts results in a reddish-brown clay matrix. Even the -25mm fraction has a reddish-brown colour when washed. Typically, this unit has a concentration of manganese wad at its upper contact – the result of weathering before it was collapsed into the karst cavern system. This manganese-rich layer is referred to as the lower manganese horizon and is likely an extension of the Waterval Saprolite (Refer Section 6.4) on chert-rich dolomite and gravels. These gravels generally carry elevated diamond grades and are the primary exploration target on Hartbeestlaagte.

Locally developed within the LGP, and typically located towards the top of the package, is a more clay-rich horizon termed the Transition Zone Package (TZP). This unit is generally similar to LGP, but with slightly higher clay contents resulting in a marginally more matrix-supported gravel. An examination of the matrix material indicates that it has been derived from kaolin (decomposed chert-rich dolomitic wall rock) – a consequence of spalling of the wall-rock into the accumulating gravel pile. As a result of the increased clay content, these gravels are distinguished by lower, but still potentially economic, grades and increased processing problems.
Plate 7.1: General Stratigraphy as seen on Hartbeestlaagte

Figure 7.1: Schematic stratigraphic model for the Ventersdorp alluvial diamond deposits
Towards the base of the profile in some of the deeper sinkholes a whitish gravel may occur. Termed the Basal Gravel Package (BGP) this gravel is thought to be a variation within the LGP that has been affected by local leaching. It is not seen everywhere and does not occur as a discrete horizon. The Basal Gravel appears as a whitish gravel, composed of rounded to well-rounded clasts of white-grey quartzites, vein quartz, white-grey chert and minor amounts of white arkose, sandstone and very weathered red speckled quartzites.

In the cobble fraction, the quartzitic clasts are slightly more numerous than chert, but this changes in the pebble-gravel fraction, with chert clasts slightly more dominant. In the finer fractions quartzitic clasts again dominate, with few exotics, including agates, present. In all fractions, there is a lack of Waterberg and red diamicomite clasts. Also present are large, sub-rounded to rounded, chert boulders, as well as angular chert clasts that appear to have be derived from localised spalling of the bedrock. The matrix is comprised of greyish-white and yellow-orange clays. The gravel is reasonably well packed in places, varying from clast- to matrix-supported. It is thought that this unit may simply represent a leached version of the Lower Gravel Package, as broken quartzites reveal a white leached halo surrounding ferruginous quartzites that typify the Lower Gravels).

At the base of the LPG, and intersected only in drilling is a unit described as a “cherty gravel” (Lock, van der Merwe, & Sperinck, Indepsource estimate of diamondiferous gravels at the Tirisano mine of Etruscan Resources Inc., 2003). It has been historically reported that such gravels exists intermittently under the known diamond-bearing mixed gravel, but that it is barren, or at best low grade.

**Pebbly Clay Package (PCP)**

This unit comprised of clays and pebble to small cobble lenses may reach thicknesses of 5-50m. The matrix is a sandy-clay, white to light yellow in colour. Chert clasts > quartzite clasts (60%:40%). The <10mm fraction is rounded to well rounded. It appears to be a fluvial unit that has reworked the underlying LGP/TZP units. Grades are very low and diamonds are small.

**Upper Gravel Package (UGP)**

A coarse, clast supported mixed gravel, with little/no sorting. The matrix is comprised of yellow-brown clays. Chert clasts are more abundant than quartzites clasts. The chert is sub-angular to sub-rounded, while the quartzites are sub-rounded to rounded. The implication is that this unit is reworked LGP with the addition of locally derived, angular cherts. Not only do UGP’s occur as sinkhole/channel infill but they also drape over the surface (locally known as “sheet gravels”). With moderate grades this unit is considered an economic horizon.

A deposit-wide discontinuity is evident between the UGP’s and the underlying units. Further, a second phase of manganese enrichment appears to be associated with the end of deposition of UGP (referred to as the middle manganese horizon). This manganese-rich layer occurs mostly as manganese nodules, in contrast to the lower unit where the manganese typically occurs as wad.

**Clay Package (CP)**

A thick unit (up to 20m) of generally massive clay (with minor grit/pebble lenses) overlays everything. The sheet-like that gets thicker over potholes (subsided areas) but extends between potholes and over 5km away from potholes (Plate 7.2). It is a completely non-diamondiferous overburden.
Plate 7.2: Overburden sequence of Kalahari clays and Hutton Soils

Hutton Soil

The Hutton soil profile is comprised of a stone lag and overlain by windblown sands (locally termed Hutton Sands). In the vicinity of underlying alluvial gravels the stone lag, which is typically only a single-pebble layer, may be up to 1m thick. The gravel unit cuts across all lower layers, depending on the level of erosion. It is a concentrate layer formed by post-depositional colluvial and eluvial processes. Immediately above the manganiferous laterite layer the soil contains abundant iron and manganese nodules, some of which have been transported and others having been formed in-situ (Beukes, Van Niekerk, & Gutzmer, 1999). The transported nodules probably represent nodules (iron and manganese rich) that were reworked from the older Waterval Saprolite (lower manganese horizon). However, many of the transported nodules have been coated in-situ by a new layer of goethite. This goethite may also cement together several nodules to form nodular lumps. A second variety of nodule is only iron-bearing probably formed in-situ as the goethite is the same variety as that which coats the reworked ferromanganese nodules. This unit is referred to as the upper manganese horizon.

The goethite cement also forms lumps composed of colluvial/eluvial gravels, pre-existing ferromanganese and/or goethite nodules and diamonds. This unit was extensively mined by early prospectors – if all the diamonds are liberated from the cement then the grades may often be economical. However, the amount of manganese present in these deposits results in processing and recovery problems for modern plants with the subsequent loss of diamonds. Therefore, although in-situ grades might be elevated, plant through-puts are low, resulting in sub-economic deposits.
During Recent times (around 40,000 yrs) windblown and waterborne sands, silts and muds (of Kalahari origin) were deposited over much of Southern Africa, blanketing all underlying sequences (Plate 7.3). This soil is typically massive and un lithified, composed of quartz grains in a silty clay matrix. Pedogenesis of the sediment led to the formation of the Hutton soil profile.

Plate 7.3: Hutton Sands overlying (manganese) cemented colluvial gravels

In the UGP, chert clasts predominate (+ 60%) over quartzite and other clasts. In the LGP, however, quartzite clasts make up some 50%, red arkose, lavas, sandstone, and shale 40%, and chert is typically less than 10% in the 50-80mm size fraction. In the 25-50mm fraction, the percentage of chert increases to around 15-20%. In all fractions, the clasts are rounded to well-rounded.

The clasts that make up the gravel deposits may have been derived from a number of sources:

- Ventersdorp Supergroup
  - Rietgat Formation (Conglomerate)
- Pretoria Supergroup
  - Rooihoogte Formation (Conglomerate, granulestone, shale, chert units)
  - Timeball Hill Formation (Ferruginous quartzite units)
  - Hekpoort Andesite (andesitic lava, agglomerate, tuff, conglomerate, quartzite, shale and diamicite units)
  - Daspoort and Magaliesberg quartzites (ortho-quartzitic units)
- Karoo Supergroup
  - Dwyka Group (shale and diamicite units)
- Other
  - Pre-existing cave-infill of presumed Waterberg age
7.1 Geological Model

The evolution of the North West Province, as far as it concerns the diamondiferous gravels, can be traced back beyond the Mesozoic. The sequence of events (post-Dwyka) is considered to be as follows (Marshall & Norton, The Alluvial Diamond Fields of the Ventersdorp district, 2009):

Pre- to early-Karoo (345 - 250My)

During the lowered watertables and cold climes associated with the Dwyka glaciation, subterranean solution by phreatic and vadose waters carved out an extensive drainage network in the dolomite plain (Fig 7.2). It is probable that the water derived from the melting Dwyka glaciers may have been the impetus that initiated the collapsing of many of the karstic sinkholes and dolines (especially as subsidence dolines). Most of the channels follow either lithological boundaries (between the chert-rich and chert-poor dolomite strata) or structural features such as dykes, faults and joints. It is unknown whether the conglomerates of the Rietgat Formation (Ventersdorp Supergroup) or the Bevets Conglomerate Member (Pretoria Group) covered the dolomite plain at the time of the glaciation or whether they had since been eroded.

Figure 7.2 Underground solution channels carved out by glacial meltwater during the Palaeozoic

The withdrawal of the glaciers saw the deposition of Dwyka tillite as a thin veneer of material on top of the dolomite plain. This would have been resulted in a semi-unconsolidated gravel unit composed of clasts from the Bevets Conglomerate and Rietgat formations specifically (as well as other formations from the Pretoria Group) that spread out over an area of at least 150 x 100km. A raft of Dwyka shales preserved as cave infill on a farm less than 20km east of Hartbeestlaagte indicates that Dwyka deposits in this area included shale. This was followed by the deposition of thin Ecca shales, remnants of which are still preserved in the cave to the west of Ventersdorp (Martini & Kavalieris, 1976).

Somewhere prior to the onset of the African landscape cycle the gravel on the dolomite plain must have become mixed with the diamonds (pre- or post-glaciation is unclear at this stage). Since diamond characteristics, average grades and qualities/values (USD 500-700/ct) vary little across much of the dolomite plain (over an area of some 30x100km); separate, localised primary sources cannot be the
source of the diamonds. Studies are currently in progress to characterise this original diamond-bearing gravel and identify the provenance(s) of the diamonds.

Post-Karoo (250My - present)

African Landscape Cycle

The African landscape cycle is the one that resulted from uplift and warping associated with the splitting of Gondwanaland in the late Jurassic /early Cretaceous. Uplift and the subsequent lowering of the North West Province landscape resulted in exposing much of the pre-Karoo subterranean caverns to the surface. The surficial gravel was subsequently dumped into these early canyons and sinkholes (as BGP and LGP deposits) that were initiated at the surface as a result of a renewed karst cycle. The drainage channels, which appear to be partly subaerial and partly subterranean, have their headwaters in the Pretoria Group sediments to the north. The subcontinental uplift had also resulted in lowered regional water tables. As a consequence, phreatic and vadose cavern development was initiated below the level of the surface drainage.

During the LGP depositional phase, the deposits appear to have been moved by mass flow, with lots of water and very little, if any, reworking and re-concentration. It is thought that much of the initial deposition may have been subterranean. The subterranean karst structures would have been accessed and enlarged by a combination of subsidence and collapse (Fig. 7.3).

The LGP units are generally red in colour. This is thought to reflect the nature of the source rocks. The matrix of the LGP gravels consists largely of clays derived from sedimentary rocks and basic lavas, indicating the nature of the source material. It may also relate to the warm, humid climatic conditions under which the gravels were deposited. The basal units (BGP) are pale in colour and it is thought that this may be related to deep leaching during the early development of the karst system.

The large red diamicomite rafts were introduced as a result of the collapse of karst bridges or spalling of pre-existing cave-infill associated with the Waterberg karst cycle (Plate 7.4). These red clays also contribute to the nature and colour of the matrix of the LGP gravels.
Plate 7.4: Rafts of Waterberg karst infill in the dolomite wall rock of Tirisano Main Pit

The LGP unit is, typically, characterized by increased concentrations of manganese wad development towards the top of its upper contact. This may be related to a period of intensive weathering during the depositional cycle, representing a depositional hiatus (during which the Waterval Saprolite was formed on the chert-poor iron-rich dolomite units). The late Cretaceous is well known as a period of humid tropical climates during which deep weathering profiles were formed up to depths of 50m in places (Botha & Partridge, 2000) and this may present a time-line in the depositional sequence.

As a result of the higher temperature and rainfall levels during the African cycle, lateritic soils developed across the Venterdorp lava surface and terra rossa soils on the manganiferous dolomite plain. In places, the manganese wad is sufficiently developed to form economic manganese deposits. These manganese deposits predominate in sinkholes within the chert-poor dolomite formations. It is envisaged that deposition continued over an extended time period, to account for the great thicknesses seen in sinkholes (drilling on the Etruscan property indicates that these gravels are in excess of 140m thick).

As the karst system was filled in there was periodic/continuous collapse causing the “down-warped” nature of the gravel contacts and the manganese layer. The gravel fills steepen towards the edges of the sinkholes as a result of continued deepening and sidewall drag or shear (Plate 7.5). As a result, older gravels may extend up the sidewalls, even reaching the surface around the margins of the sinkhole. This causes individual geological units and overburden to dip inwards and thicken towards the centre of the sinkhole.
Plate 7.5: Vertical unit of LGP gravel draping the dolomite bedrock and overlain by thick pebble-clay (PCP) infill (Photo from Goedgedacht 27, Courtesy Gothoma CC)

The African surface is known to be of polycyclic origin (Partridge & Maud, 1987) and it is suggested that minor uplift episodes may have been responsible for the deposition of the Transition Gravels (TZP) and the PCP (Pebble-clay package) units. The TZP was deposited locally in the centre of the collapsing cavern structure – since the deposit is almost identical to the lower LGP, only with more clay, this may correlate with spalling of kaolin-rich cherty-dolomite off of the cavern walls during one of the uplift events. The PCP was deposited on top of the TZP as a fluvial unit – perhaps by localised small, low-energy rivers that reworked the underlying units (Fig. 7.4). The introduction of local chert, along with the low energy regime would have resulted in the dilution of grades typically associated with this unit.

Post-African I Landscape Cycle

The African landscape cycle was interrupted toward the end of the early Miocene (± 18Ma) by regional uplift (Partridge & Maud, 1987). In the central interior, some 150-300m of uplift and warping occurred. This had several effects for the landscape, which are noticeable as an unconformity present between the Lower and Upper gravel packages. A drop in the regional water table levels accompanied the Post-African I uplift, allowing for yet another level of phreatic and vadose cavern development to take place below the level of the African caverns. A second consequence of the lowered base level was that the landsurface itself was lowered by dissolution to leave an inverted topography with the more-resistant gravel deposits forming positive relief.
Figure 7.4  Geological Evolution of the Ventersdorp alluvial deposits

The UGP was deposited as a result of the reworking of the LGP unit, with a concomitant increase in local, angular chert content. This deposition is likely mostly subaerial since the gravels are not only found in the sinkholes/channels, but also spread out on the surface as “sheet gravels” (Fig. 7.4). On Tirisano, the sheet gravels indicate that, at the time of deposition, the east (at Etruscan’s Klipgat mine) was at least 100m higher in elevation than the west. Additionally, the sheet gravels extend up to 4km to the west of the potholes, but are hardly known to the east.

Following deposition of the UGP unit there appears to have been a depositional hiatus, during which an accumulation of nodular manganese developed (middle manganese layer). This landsurface, thus, attained a maximum duration of some 15-16Ma, which is attested to by the imperfect development of the manganese layer. The development of a thick, mature manganese wad was, further, inhibited by the progressive aridification of the Pliocene climates.

Post-African II Landscape Cycle

Continuing lowering of the landsurface by a combination of surface processes and subsurface dissolution exposed more subterranean caverns to the surface. These became filled with chert-rubble from the surrounding plain in the same manner as the diamond-bearing gravels had been dumped into leached karst features. These are the shallow, non-diamondiferous runs found on the dolomite plain from Lichtenburg to Ventersdorp.
The Mio-Pliocene landsurface was terminated at the end of the Pliocene by the Post-African II uplift episode. Concentration of uplift in the eastern parts of the country by as much as 900m greatly accentuated the westward tilt that had been imparted by the earlier Miocene movement and resulted in significant rejuvenation along the major inland drainage systems (Partridge & Maud, 1987). This period of uplift initiated the Post-African II landscape cycle. These tectonic events were accompanied by further aridification of the climates and the encroachment of the Kalahari and Namib sand dunes.

During this time, the Clay (CP) Package was deposited as an extensive, sheet. Thickening of the clay unit over the potholes indicates that subsidence was still continuing. The depositional environment of the clay unit is envisioned as part of the prograding Kalahari succession. Other studies (viz. Beukes, et al., 1999) also indicate that drastic environmental and climatic changes may have taken place in the late Tertiary – early Quaternary, with warm semi-arid to arid conditions prevailing. It is, further, speculated that the deposition of the clay package may be related to the Tertiary/Recent karst cycle as similar infill is found in some of the younger potholes and caves.

Subsequently, Pleistocene glacio-eustatic sea-level fluctuation resulted in the development of the colluvial gravel unit that is seen to cut across all of the outcropping units (CP and UGP). Climatic indications are of more humid conditions, relative to the arid to semi-arid climate under which the Kalahari clay package was deposited.

- Colluvial processes resulted in the formation of a stone-line throughout much of the sub-continent. Where this stone-line occurs over the alluvial gravel deposits it may be up to 70cm thick.
- Lateritization of this unit attests to the more humid climates prevailing at this time.
- The entire area was blanketed by Kalahari sands with converted to Hutton soils in Recent time under mild, savannah conditions. Thicknesses of up to 1.0m are common, with greater thickness occurring over sinkholes, indicating that subsidence was still on-going during the Quaternary.

Presently the Hutton soils may be dissected by stream erosion and vegetated by grass with the development of a thin (40-50cm) humic soil. The soil follows the modern topography, independent of underlying lithology – marking a disconformity that is in the process of formation.
8  EXPLORATION

8.1  Remote Sensing (Satellite Imagery / Aerial Photo interpretation)

In 1996, Ashton Mining commissioned a photogeological study of the Ventersdorp district from Lockett and Associates of Perth, Australia (Lockett, Photogeological mapping of diamondiferous gravels on Nooitgedacht, Zwartrand, hartbeestlaagte and adjacent farms., 1996). This data was acquired by Etruscan (and passed on to Rockwell) and has proved extremely useful for identifying regional areas of interest. It is well known that the chert-rich dolomite lithological units, and especially the Eccles formation have historically, hosted the most significant diamond deposits in the Ventersdorp area. This is presumed to be due to the formation of trapsites in these formations. Further, karst channels tend to form at the contacts of different lithological units and also at structural intersections and structural intersections with lithological boundaries.

It can be seen from the photo-interpretation that the north-west quadrant of Hartbeestlaagte is located on the Eccles formation, or near the boundary between the Eccles and underlying Littleton formations. The Cretaceous gravel run is seen to run south-north from the “Vetpan” and then swing to the southeast as it hits the contact between the Eccles and the Littleton formations. At about or slightly beyond the Hartbeestlaagte/Zwartrand farm boundary the run abuts against a WNW-ESE trending quartz ridge, where a large pothole is developed. The run swings through 90º and heads off to the SW, towards the south-east corner of Hartbeestlaagte, where it, once again, intersects a quartz ridge (NW-SE trending) at the contact between the chert-poor Littleton formation and the chert-rich Monte Christo formation.

Based on this aerial photo interpretation (the lithology and predominance of structural intersections), the north-east quadrant of Hartbeestlaagte and the north-western quadrant of Zwartrand have been identified as highly prospective parts of the property.

8.2  Geophysics

The gravity technique was selected as the preferential geophysical technique to map the target areas, as it provides excellent contrasts in areas where the underlying bedrock is dolomite. Gravity is also an industry-accepted method for mapping depth to dolomite, as a significant density contrasts exist between unweathered dolomite and weathered rock or gravels overlying the dolomite bedrock.

The gravity technique measures gravitational acceleration on a particular point and data is normally acquired in a grid or on parallel profiles. The gravitational acceleration is measured in mGals and higher acceleration is experienced in areas with higher subsurface densities, typically in areas of more shallow bedrock. The gravity method measures the gravitational attraction exerted by the earth at a measurement station on the surface. The strength of the gravitational field is directly proportional to the mass and, therefore, the density of subsurface materials. Anomalies in the earth’s gravitational field result from lateral and depth variations in the density of subsurface materials.

Gravity acceleration is measured in milliGals (mGals) or sometimes in microGals (μGals) for very high-resolution surveys. Gravity acceleration variations as a result of geological changes is very small compared to the average gravity acceleration measured and require the need for very precise measuring and field techniques. Gravity works well in environments where there is a dramatic density contrast between the host and the target mediums.

\[ 1 \text{ mGal} = 10^{-5} \text{ m/s}^2 \]
Gravity is typically used in the following applications:

- Mapping subsurface voids
- Mapping bedrock topography
- Mapping density contrasts

In 2003, Bell Geospace was contracted by Etruscan Diamonds (Pty) Ltd to fly a regional airborne Full Tensor Gradiometry (“FTG”) survey over Etruscan’s area of interest in the Ventersdorp district (Hammond & Murphy, 2003). After an initial test-study over a small area centred on the Tirisano Diamond Mine, some 7,500 line-km of data were acquired. Data lines are spaced 400m with a N-S orientation and tie lines spaced every 1,600m oriented E-W, all at a constant barometric height of 1,745m above mean sea level.

After the completion of the airborne gravity survey, Global Geophysical CC was contracted by Etruscan Diamonds (Pty) Ltd to conduct a ground gravity survey on the farm Nooitgedacht, and this investigation was then expanded to include the farms Hartbeestlaagte (eastern portion) and Zwartrand (western portion). Gravity data was collected with a 25m by 100m grid on average, although later data was acquired on a 50 by 100 m grid. Line orientation was selected to be perpendicular to the strike of the channels to optimize the anomalous effect of the channels, with lines having a south-west to north-east strike on average. It is clear from the interpretation of both the airborne and ground gravity data that the subsurface cavities are not ‘stand-alone’ features, but show continuity. The impact of these for ground water storage and alluvial gravel concentration is significant due to potential leakage from one cavity to the other. Modelling the gravity data in association with available drilling data indicates that the solution cavities on Nooitgedacht (Tirisano main pit section) exceed 60m in depth and that mineable widths of gravels (including the relatively shallow sheet gravels on the shoulders of the cavities) may be up to 800m in places.

The ground gravity survey, completed by A Du Plessis of Global Geophysics CC (Du Plessis, Geophysical characterisation of potholes and depth to dolomite bedrock at Ventersdorp diamond Mine using gravity., 2003) was planned to cover the East Run, as found on Hartbeestlaagte and the diggings on Zwartrand. The specific localisation of the grid was based on the results of the airborne survey. The Residual Gravity Anomaly map (Fig. 8.1) produced by removal of a regional field of block size 1000 x 1000 m shows definite trend of low gravity anomalous zones that can be correlated with alluvial channels and deeper dolomite bedrock. Gravity results were correlated with available borehole information to obtain reasonable estimates for the regional gravity contribution.

The gravity technique was used to infer the presence of alluvial channels and zones of deeper dolomite bedrock on the farms Hartbeestlaagte, Nooitgedacht and Zwartrand. Areas of low gravity can be correlated with areas of deeper dolomite and possibly thicker gravel deposits. However, the gravity technique is not effective in quantification of the absolute depth of features and cannot be used as a stand-alone technique to accurate map depth to bedrock in the absence of ground-truth information. It is very accurate in defining changes in the depth to bedrock; however, the absolute depths cannot be inferred with high accuracy.

Notwithstanding the challenges inherent in the gravity method, an attempt was made to model the potential depth to bedrock in the gravity anomalies. Three profiles were selected in a single anomaly and, a density of 2.0 g/cm³ for gravels and 2.6 g/cm³ for bedrock (weathered dolomite) was chosen as a standard. Based on this information, this particular pothole is estimated to have a maximum depth of some 120m (A du Plessis, Pers. Comm., November 2006). The deepest borehole in this anomaly indicates that the sinkhole is at least 140m deep. It was, subsequently, recommended that further modelling be done on additional anomalies to determine their possible depths. Some of the bigger, deeper anomalies are expected to have maximum depths of up to 200m (Du Plessis, geophysical characterisation of alluvial
gravel deposits using ground gravity on the farms Hartbeestlaagte, Nooitgedacht and Zwartrand, Ventersdorp, 2006).

Figure 8.1: Tirisano project residual gravity (250 m regional) (du Plessis, 2006)

In 2007, Global Geophysical CC (contracted by Etruscan Diamonds (Pty) Ltd) completed a detailed gravity surveys over selected sinkholes on Hartbeestlaagte. This exercise highlighted the strong North-
South structural control on the development of the karst feature (any points related to minor linear drift in the data have been removed, resulting in a clean, real representation of bedrock geology). It also emphasised just how complex the actual edges of the individual sinkholes can be, further highlighting the need for detailed drilling to determine accurate volumes for resource estimation purposes.

Although depth to bedrock determinations are as a useful tool in understanding the full extent of the karst system, no additional measurements have been made since 2007. Since bulk-sampling has only proceeded down to depths of approximately 60m and present mining technology would indicate that 100-110m is a realistic final mining depth, this feature is of current exploration value only.

Of more immediate interest is the expansion of reconnaissance grids over areas currently defined as exploration targets. These targets cover extensive areas on Zwartrand and Hartbeestlaagte and are expected to provide areas for future prospecting with a view to expanding available gravel resources for the Tirisano project.

No further exploration (remote sensing or geophysics) was completed on the Tirisano project since 2007.
9 DRILLING

All drilling to date was completed by Etruscan. A summary is provided here, but further details may be obtained from previous NI43-101 Technical Reports\textsuperscript{22} on the Tirisano mine property.

9.1.1 Drilling Procedures and Protocols

All drilling was carried out using a conventional RC machine with a 76mm (diameter) bit and a 28bar compressor. The drilling contractor is Champ Drilling CC, a local drilling company that has many years of experience drilling for alluvial gravels in the North West Province. All drillhole positions were surveyed and elevated by Etruscan personnel. This method of drilling was found to be successful on Tirisano. When drilling LGP, depths of +100m have routinely been reached. However, 293 holes were abandoned in LGP (mostly due to penetration problems and ground water conditions), indicating that the gravels must be somewhat thicker than seen in the drilling. The great depths of the sinkholes (modelled at in excess of 120m), have created serious problems for the drillers who are only able to penetrate to bedrock in exceptional circumstances. This, in turn, has repercussions for the accurate estimation of gravel volumes that may exist in the sinkholes.

Etruscan had a standard procedure governing the locating and drilling of boreholes. The chips were logged on site and excess material was taken to a sample laboratory in Ventersdorp for storage.

9.1.2 Location

Drilling on the Tirisano properties was completed in a number of phases over a period of 10 years. The various programmes were planned to identify the anomalies identified on the gravity surveys. Both expected sinkholes/channels and shallow areas were targeted. Detailed drilling during 2006 was concentrated on areas where the bulk-sample pits were to be located. The 2007 programme concentrated on detailed drilling in the sinkholes where indicated resources were to be estimated and also on Zwartrand, where little/no drill coverage existed. In total some 51,542m (2,305 holes) were completed as part of the exploration programme.

In order to expand the in-situ resources of the Tirisano project, additional drilling was completed during 2008. Six holes were drilled in the bottom of the Tirisano main pit, 17 holes to the north of the Tirisano main pit and another 74 holes in areas of inferred resources. The purpose of the drilling was to increase the confidence level of identified gravel volumes in order to upgrade them to Indicated Resource status. These holes were drilled on a 50x50m grid and were planned to intersect bedrock. This was not possible in all cases, due to difficult drilling conditions. In addition, 23 boreholes were drilled to assist with the expansion of the Tirisano Main pit. The total drillhole database available to the resource programme is 53,576m (2,391 holes). The area covered by the holes is some 500ha (Fig. 9.1).

9.2 Results

Drill results are used, primarily, to define the presence of gravel units and to estimate their thicknesses. The boreholes are all vertical and the gravel deposits are horizontal (since they are very young, geologically, and are not affected by large scale tectono-structural upheavals). Therefore, the gravel thicknesses (as determined from drilling) are true thicknesses.

\textsuperscript{22} A list of these reports is included in section 1.1 of this document
Figure 9.1: Location of all drillholes on the Tirisano project area.
A reasonable correlation between the gravity survey and the drilling is apparent. Generally, where gravity lows are indicated by the geophysics, deeper sinkholes/channels were identified and, likewise, where gravity highs occur, the gravels are thinner and may occur as “sheet gravels”, if present at all. Drilling in the gravity lows did not always locate gravel. Since gravity anomalies simply reflect differences in rock density, it was not possible to differentiate between karst structures filled with clays and those containing potentially diamondiferous gravels.

A number of cross-sections were drawn through the drillhole data in order to visualize the progression of the karst system across the property. What is immediately apparent is that the bedrock is extremely uneven, the result of variable subsidence since the Mesozoic. Consequently, gravel thicknesses are extremely variable, especially so for the LGP unit where global average thickness values are meaningless.

Although the karst channels are not “channels” in the true fluvial sense, they can be traced from one section to another although they are offset and variable in depth. Also obvious are the presence of bedrock pinnacles within the sinkholes and channels. These features, and the extreme uneveness of the bedrock contact, make gravel volume estimation more complicated. As a result, during the current exploration phase, during which some inferred resources have been upgraded to indicated resources, a much more detailed drilling grid has been require to mitigate against these problems.

Once contoured, this data (Fig. 9.2) indicates that there are discrete areas where the gravels thicken perceptibly. This indicates that, rather than being one homogenous trough, the karst system comprises a number of deeper potions (discrete sinkholes) within the leached out zone. For the most part, the overburden is also thicker in these areas of deeper sinkholes. Average thicknesses of UGP gravels is some 6-8m. Average thicknesses of LGP gravels cannot be determined since many of the drillholes did not reach bedrock. However, thicknesses of 10-40m are common in the drillholes of the deeper sinkholes.

With respect to drilling results, it is pertinent to repeat that the borehole material is not sampled for diamonds (or any other mineral) as a result of the very low grades and high average diamond sizes expected on the Orange River. Consequently, intersections are not composited with respect to diamond results.

### 9.3 Limitations of the drilling programme

The drilling programme highlighted a number of areas that need further study.

- It has not been possible to differentiate between the various gravel packages in boreholes. The most significant is the difference between UGP and LGP, since these units appear to be very similar in borehole, but have quite different grade characteristics. The difference between PCP and the UGP/LGP units is sometimes a little easier to identify, but not always. Consequently, average thicknesses have been assigned to the different gravel units based on bulk-sampling pits. On Nooitgedacht, mining in the Tirisano open pit has indicated that UGP thicknesses average 6m, and the PCP unit is some 12-15m thick. Elsewhere on Hartbeestlaagte, UGP thicknesses still average 6m, but the thicknesses of PCP’s is much attenuated, at around 2m. It appears that the sinkholes on Hartbeestlaagte were not as active as those on Nooitgedacht at the time the PCP was being deposited. Until mining operations suggest otherwise, these average thicknesses will be assigned to the different gravel units.

- Further, it has not been possible to log the details of clay and manganese contents in the gravels in the drilling. This is most significant in the LGP unit, where increases in the percentage of clay or manganese severely affect diamond recoveries. This results in highly erratic recoveries in the present processing facilities.
Figure 9.2: Thickness of gravel profile
• The drilling has not penetrated to the bedrock in all circumstances. The percentage boreholes reaching bedrock has improved over 2006, but it is still insufficient to determine an accurate reflection of the bedrock profile. Many of the boreholes end in gravel or clay and it is unknown how much gravel may exist between the end-of-hole and the actual bedrock contact (which, geophysical calculations estimate, may be in the order of 120m) – resulting in an unknown amount (presumed substantial?) of gravel that may be added to the resource budget in the future.
• The steepness of the bedrock contact, which is clearly evident in the bulk-sampling pits, is not as obvious in the drilling. This is visible in the cross-sections that show angular contacts between the gravel and the bedrock. This situation occurs because of the (relatively) coarse drilling grid. However, in order to identify an almost-vertical bedrock, the drill spacing would need to be so close would be impractical. Consequently, the gravel volume estimated from the drilling is based upon direct tie-lines is somewhat less than might be the case if a more free geological interpretation were applied. Different interpretations indicate that this difference might be in the region of 4-5Mm³. In order not to introduce additional problems into the data, it has been decided to present only the data directly observable from the drilling results.

9.4 Representativeness

As can be seen from Fig 9.1 above, the completed drilling programme on the Tirisano mine properties has covered all outcropping and sub-cropping gravels with a detailed grid. The results are, thus, sufficiently reliable to estimate both inferred and indicated resource volumes, were delineated.

9.5 Proposed future drilling programme

Some 5,000m (±500 holes) of RC drilling is planned for the area to the north and west of the main mining pit, where UGP gravels are known to occur, but have not been sufficiently drilled to convert Inferred Resources to Indicated Resources with the required confidence.
10 SAMPLE PREPARATION, ANALYSIS AND SECURITY

Due to the nature of alluvial diamond deposits, samples are not taken for assay as would be normal for precious or base metal prospects. Alluvial diamond deposits can only be sampled through bulk-samples comprising tens-hundreds of thousands of cubic metres of gravel (Marshall, The Evaluation and Valuation of Alluvial Diamond Deposits, 2012).

Etruscan carried out bulk-sampling programmes on the UGP and LGP gravels on Tirisano property during 2002-2008. The results of the programmes have been presented in Section 5.2 (History).

10.1 Sampling and recovery factors

Details regarding drilling, gravel thicknesses, and geological controls on deposition are presented in Section 7 (Deposit Types) Section 8 (Mineralisation) and Section 9 (Drilling) and will not be repeated here. A number of issues peculiar to alluvial diamond sampling in general have, however, been identified. These impact specifically on the size of the samples and the complexity of statistical estimations.

Low grades

The grade of a diamond deposit is the estimated number of carats contained in one hundred tonnes (cph) or hundred cubic metres (ct/100m³) of gravel and, typically, averages ≤ 1cph (roughly equivalent to 0.001 -0.0001ppm) for inland South African alluvial deposits (Lock, Comparing carats to kilograms, 2003).

Large individual diamond size

Diamonds constitute discrete units of varying size (weight). In all of the inland alluvial deposits of South Africa, average diamond sizes are in the range of 0.5-2.0ct/st. Consequently, they form discrete particle deposits as opposed to disseminated particle deposits. Often the size and value distribution from stone to stone is erratic and it is possible that the majority of the value of a parcel is attributed to a single stone.

Grade variation

In a single gravel unit (or even within a few metres), diamond grades may vary from barren to over 100cph, due to the development of localized trap-sites under favourable bedrock conditions, or hydraulic fractionation within a channel or bar. Consequently, the diamond distribution pattern (grade) of alluvial deposits is such that there is no repeatability of sample results, even from adjacent samples.

Depositional environments

Alluvial streams are highly transient environments. The braided channels are unstable through time and gravel bars are formed and destroyed continuously. Shifting bars and channels cause wide variations in local flow conditions resulting in varied depositional assemblages. Common features in braided stream deposits include irregular bed thicknesses, restricted lateral and vertical variations within the sediments, and abundant evidence of erosion and re-deposition (Schumm1). On a broad scale, most deposits are complex with units of no great lateral extent. Locally, bedrock features play an important role in diamond concentration of the alluvial deposits, with diamonds occurring preferentially in natural traps such as gullies, potholes and gravel bars and, typically, reworked through one or more post-depositional colluvial or eluvial.
Low homogeneity of diamond distribution
Individual diamonds are not evenly or uniformly distributed throughout an alluvial deposit; neither are they randomly distributed. Rather, their distribution has been described as a random distribution of clusters of points (Fig. 10.1), where the clusters are both randomly distributed in space, and the point density of each cluster is also random (Rombouts, 1987).

Lack of associated minerals or geochemical signature
In contrast to kimberlite deposits, alluvial diamond deposits are not characterized by any standard (or deposit-specific) satellite/indicator mineral assemblage that may occur in higher, more easily measureable, concentrations than the diamonds. Neither do the deposits have any associated geochemical signatures that can vary according to diamond grade (or any other geological characteristic).

In order to account for all of these issues, alluvial diamond deposits can only be sampled through bulk-samples comprising tens-hundreds of thousands of cubic metres of gravel. Bulk-sampling is completed in much the same manner as the production mining would be, except on a smaller scale. With positive results, bulk-sampling naturally progresses to trial-mining, during which all of the modifying parameters are determined to allow a decision of whether to proceed to full production.

Diamond recovery is dependent on mechanical recovery through the application of physical properties of both diamond and gravel – density and size variation (to concentrate the heavy mineral portion from the bulk gravel) and fluorescence and wettable properties of the diamond during final recovery. The processing and recovery plants are affected by various issues such as the nature and amount of manganese in the gravels as well as the amount of sand/clay in the matrix.

Gravel bulk-samples are processed through bulk-sampling plants to determine average sample grade and the recovered diamonds are then sold on the open market for a determination of value. Consequently, no samples are dispatched to any analytical or testing laboratories. Further, sample splitting and reduction methods were not employed. Further, the diamond distribution pattern (grade) of alluvial deposits is such that there is no repeatability of sample results, even from adjacent samples of tens of thousand cubic metres in size. Consequently “check-samples” such as are standard in the precious and base-metal industries, are not possible.

10.2 Rockwell Bulk-sampling programme
During 2011, no formal bulk-sampling was completed by Rockwell during this reporting period.
11 DATA VERIFICATION

During 2011, no new exploration data was generated or processed by Rockwell. Consequently, there was no need for data verification. Going forward, however, procedures and protocols govern every phase of data collection – from drillhole location, through bulk-sampling and processing, to final recovery and sales. The independent QP was involved in the drafting up of these protocols and they are reviewed, updated and audited regularly – during each site visit, during the compilation of the report and prior to the initiation of a new phase of exploration or mining. Spot checks are carried out by the independent QP on various aspects of the operation during site visits.

As part of the data verification and resource estimation processes the independent QP and the Group Technical Manager, Rockwell’s non-independent QP, work closely together at each step. Prior to the initiation of new procedures and protocols which may impact on resource estimation results, discussions are held on the potential implications for both short and long term gravel volume, and diamond grade and value assessments. Further, the independent QP audits (both interactively and independently) the procedures used by the Group Technical Manager to produce the resource estimates and models.

It is important to note that, although every data verification and resource estimation process is reviewed and audited by the independent QP, Rockwell also evaluates these issues in parallel, as part of their internal corporate procedures. Any discrepancies, as well as potential issues, are thus identified by each of the parties separately and are dealt with before they can become problems. While the Group Technical Manager has overall control and responsibility for the resource evaluation programme, QA/QC for individual portions of the project are the responsibility of the designated individuals. The standard of record keeping was found upon inspection to be very high and there was sufficient evidence to show that the internal checks referred to above were being carried out on a regular basis. Among the internal checks performed by Rockwell (and reviewed regularly by the independent QP) to ensure that data is complete and accurate are:

- drill-logs are checked and signed off by two different individuals;
- gravel volumes are reconciled by exploration/survey and operations personnel;
- the production records are examined by the management for inconsistent or unexpected data;
- management reconciles the data from the diamond recovery log, mine registry, production records, register of diamonds recovered, and sales slips and;
- management regularly audits the buyers’ records of transactions to ensure that they agree with the sales slips received.
- advanced computer/network security and backup measures are applied regularly, ensuring minimal disruption in the case of computer failures.

When Rockwell obtained the Etruscan data, all original drill-logs and production sheets were manually checked against the electronic database to ensure accuracy.

Mined volumes are sent to Rockwell under certificate from an independent professional surveyor and subsequently captured onto the production database by the Database Co-ordinator and verified by the Group Technical Manager. The procedures and protocols of the surveyor have been reviewed by the independent QP and found to be in accord with industry standard. In addition, the surveyor provides a DTM of the area surveyed to Rockwell. This DTM is imported into SURPAC, which then calculates the volume of the mined area. If the computer calculated volume differs from the surveyor’s volume by more than 5% then the area is re-surveyed. Further, if subsequent mine grades are unexpectedly high or low; the volumes are re-checked or potential errors. This is routinely done by Rockwell staff and reviewed by the independent QP.
All diamond data (total carats and total stones as well as a list of every individual stone recovered) is recorded on the relevant mine and forwarded to the Database Co-ordinator who adds it to the database. Verification and change reports are used to track changes to the digital database by the Database Co-ordinator; copies of which are forwarded to the Group Technical Manager. The independent QP receives and reviews this data regularly.

Payment for diamond parcels is always received by electronic transfer and a formal broker’s note is provided from the buyer and this also serves to indicate compliance with the Kimberley Process. This data is, subsequently, added to the production database. The author examines each brokers note.

As has been described in section 11 of this document, alluvial diamond deposits can only be sampled through bulk-samples comprising tens-hundreds of thousands of cubic metres of gravel (often referred to as trial-mining). Further, the diamond distribution pattern (grade) of alluvial deposits is such that there is no repeatability of sample results, even from adjacent samples of tens of thousand cubic metres in size. Consequently “check-samples” such as are standard in the precious and base-metal industries, are not possible. As a result, the author has had to rely substantially on the production and sales data collected by all the operational personnel. Random sample data have, however, been verified by the independent QP who has audited the information from drilling to modelling. The author has, furthermore, examined all of the original production and sales data files used in the resource estimation process.

With respect to proposed exploration and development programmes and budgets (referred to in section 17), the independent QP has consulted with Rockwell’s Group Technical Manager, Rockwell’s COO, CFO and the Tirisano mine manager. During these consultations, all exploration and mining plans, costing exercises, formal quotations and final budget numbers were reviewed. All processes and the results have been found to be reasonable.
12 MINERAL PROCESSING AND METALLURGICAL TESTING

In the twelve months up to 29 February 2012, limited trial-mining was conducted on the Tirisano mine, as part of an on-going Pre-Feasibility Study (“PFS”). Some 335,654m³ of gravel was processed in order to assist with the design and commissioning of the processing plant. This gravel was derived, primarily, from miscellaneous dumps as well as extracted from in-situ PCP, UGP and LGP units.

This PFS is planned for completion during 2012/2013 and the details of the studies and the results will be presented in a forthcoming technical report.
13 **MINERAL RESOURCE ESTIMATES**

### 13.1 Resource Estimation

CIM, SAMREC and JORC definitions do not deal specifically with the peculiarity of alluvial diamonds deposits when it comes to resource or reserve estimations. The reason for this is that, historically, companies mining such deposits have not been listed on any public exchanges requiring guidance in these matters. However, alluvial diamond deposits can be evaluated according to international classifications – they simply require an understanding of the geological and economic parameters that are peculiar to these deposits. The Indicated and Inferred Resource categories used in this Report follows the CIM definition. The resultant estimations are materially similar to those set out in the SAMREC Code.

CIM Standards define **Inferred Resources** as:

> An ‘Inferred Mineral Resource’ is that part of a Mineral Resource for which quantity and grade or quality can be estimated on the basis of geological evidence and limited sampling and reasonably assumed, but not verified, geological and grade continuity. The estimate is based on limited information and sampling gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes.

Due to the uncertainty that may be attached to Inferred Mineral Resources, it cannot be assumed that all or any part of an Inferred Mineral Resource will be upgraded to an Indicated or Measured Mineral Resource as a result of continued exploration. Confidence in the estimate is insufficient to allow the meaningful application of technical and economic parameters or to enable an evaluation of economic viability worthy of public disclosure. Inferred Mineral Resources must be excluded from estimates forming the basis of feasibility or other economic studies.

For comparison, the 2007 SAMREC code defines an **Inferred (Diamond) Resource** as:

> “that part of a Diamond Resource for which tonnage or volume, grade and average diamond value can be estimated with a low level of confidence. It is inferred from geological evidence and assumed, but not verified, geological and grade continuity and a sufficiently large diamond parcel is not available to ensure a reasonable representation of the diamond assortment. It is based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that may be limited or of uncertain quality and reliability.”

This category, which has a lower level of confidence than that applying to an Indicated Mineral Resource is intended to cover situations where a mineral concentration or occurrence has been identified and limited measurements and sampling completed, but where the data are insufficient to allow the geological and/or grade continuity to be confidently interpreted. Due to the uncertainty which may be attached to some Inferred Mineral Resources, it cannot be assumed that all or part of an Inferred Mineral Resource will necessarily be upgraded to an Indicated or Measured Mineral Resource as a result of continued exploration. Further, confidence in the estimate is insufficient to allow the meaningful application of technical and economic parameters or to enable an evaluation of economic viability worthy of public disclosure.

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23 (CIM, Nov 27, 2010)
24 (SAMREC, 2007)
CIM defines **Indicated Resources** as:

An ‘Indicated Mineral Resource’ is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics, can be estimated with a level of confidence sufficient to allow the appropriate application of technical and economic parameters, to support mine planning and evaluation of the economic viability of the deposit. The estimate is based on detailed and reliable exploration and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes that are spaced closely enough for geological and grade continuity to be reasonably assumed.

Mineralization may be classified as an Indicated Mineral Resource by the Qualified Person when the nature, quality, quantity and distribution of data are such as to allow confident interpretation of the geological framework and to reasonably assume the continuity of mineralization. The Qualified Person must recognize the importance of the Indicated Mineral Resource category to the advancement of the feasibility of the project. An Indicated Mineral Resource estimate is of sufficient quality to support a Preliminary Feasibility Study which can serve as the basis for major development decisions.

The 2007 SAMREC code defines **an Indicated (Diamond) Resource** as:

“that part of a Diamond Resource for which tonnage and volume, densities, shape, physical characteristics, grade and average diamond value can be estimated with a reasonable level of confidence. It is based on exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes. The locations are too widely or inappropriately spaced to confirm geological and grade continuity but are spaced closely enough for continuity to be assumed and sufficient diamonds have been recovered to allow a reasonable estimate of average diamond value.”

The confidence level associated with the Indicated Mineral Resource is sufficient for this information to be applied to global mine design, mine planning; to allow the appropriate application of technical and economic parameters; and to enable an evaluation of economic viability.

It is noteworthy that no measured resources are estimated on Rockwell properties. The CIM and SAMREC codes define measured resources as:

“that part of a Diamond Resource for which tonnage and volume, densities, shape, physical characteristics, grade and average diamond value can be estimated with a high level of confidence. It is based on detailed and reliable exploration, sampling and testing information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drillholes. The locations are spaced closely enough to confirm geological and grade continuity and sufficient diamonds have been recovered to allow a confident estimate of average diamond value.”

Measured Resources, thus, cover the situation where all of these features can be estimated with a high level of confidence – sufficient to confirm geological and grade continuity. Alluvial diamond deposits are well known for their extreme low grades and inhomogeneity, as a result of the characteristics described earlier in Section 11.4 ([Fig. 13.1](#)).

The resulting scenario makes it extremely difficult to estimate the required parameters to a “high level of confidence” (with the exception of diamond value) without over-capitalising the project. M M Oosterveld, an acknowledged expert in the field of diamond distribution, has indicated that even
kimberlite deposits may not be evaluated in terms of measured resources (Lock, 2003). He points to the Orapa kimberlite mine as an example where, although the grade over time has run at some 60cph, the De Beers ore reserve managers still do not feel that they can claim a measured resource with full confidence.

Figure 13.1: The extremely low concentrations of diamonds, combined with low homogeneity results insignificant difficulties in the evaluation of alluvial diamond deposits (after Lock, 2003)

The industry standard for reserve estimation on alluvial diamond mines, based heavily on the De Beers alluvial deposits of Namaqualand and Namdeb, is to estimate some two years of Probable Reserves (at prevailing production rates), two/three years of Indicated Resources and multiple years of Inferred Resources. As the reserves are consumed, there is a continuous cycle of resource/reserve rollover.

## 13.1.1 Previous Resource Estimates

In June of 2008 Etruscan estimated the resources on Tirisano mine (modelled by A B Global Mining (Pty) Ltd using the SURPAC software package and independently audited and verified by the author using Micromine™ v 11). Dr T.R. Marshall (Pr. Sci. Nat.), a qualified person who is independent of both Etruscan and Rockwell is responsible for this estimate. Indicated resource volumes were based on a drilling grid of 50mx50m or less. Depth was limited to 60m, since that was the depth of bulk-sampling for grade confirmation. Inferred Resource volumes were defined by a combination of RC drilling on 100m x 100m and 150m x 100m centres (down to end-of-hole depth or 105m). The bulk-samples had only confirmed grade continuation down to a maximum of 60m. With no data to the contrary, it was assumed (for inferred resource purposes) that the grade remains constant down to the base of the drillholes or 105m. Diamond grade was determined through the bulk-sampling/trial-mining of 486,170m³ of gravel during 2006-2008. Diamond value was estimated through the sale of +5,500ct on the open market during January-June 2008.

By 31 October 2009, the existing resources were depleted by the gravel volumes processed by Etruscan. Unfortunately, the processed volumes were not able to be subdivided into UGP and LGP units and so the total figures were simply depleted from the total Indicated and Inferred estimates. Dr T.R. Marshall (Pr. Sci. Nat.), a qualified person who is independent of both Etruscan and Rockwell is responsible for this estimate.
During 2010, no resources were either added or depleted by Rockwell. Consequently the resources estimated at 31 October 2009 remained unchanged as at 30 November 2010 (Table 13.1 and Fig. 13.1). Dr T.R. Marshall (Pr. Sci. Nat.), a qualified person who is independent of both Etruscan and Rockwell is responsible for this estimate.

**Table 13.1: Resource statement as at 30 November 2010**

<table>
<thead>
<tr>
<th></th>
<th>Indicated Resource volumes (m³)</th>
<th>Inferred Resource volumes (m³)</th>
<th>Grade (ct/100m³)</th>
<th>Value (USD/ct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Gravel Package</td>
<td>16,109,000</td>
<td>8,613,000</td>
<td>1.77</td>
<td>606</td>
</tr>
<tr>
<td>Lower Gravel Package</td>
<td>11,801,500</td>
<td>6,744,000</td>
<td>2.85</td>
<td>606</td>
</tr>
<tr>
<td>Depleted by end 2009</td>
<td>-2,630,600</td>
<td>-23,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>25,279,900</td>
<td>15,334,000</td>
<td>2.37</td>
<td>606</td>
</tr>
</tbody>
</table>

**13.1.2 Current Resource Estimates**

Rockwell is currently refining the geological parameters of the gravel units. At that time the resources will be re-estimated according to these constraints. In the interim, the existing resource volume will be depleted by the volumes of gravels that were used for plant design and commissioning.

No systematic bulk-sampling or trial-mining has taken place on Tirisano during 2011. Mixed gravels totalling some 335,654 m³ has been used to assist with the plant commissioning. Consequently, the resultant grades are not considered reliable for resource estimation. Consequently, the mineral resource estimate as at 29 February 2012 remains largely unchanged from 30 November 2010 (Table 13.2 and Fig. 13.2). Dr T.R. Marshall (Pr. Sci. Nat.), a qualified person who is independent of Rockwell is responsible for this estimate.

The current resource estimate has been calculated by depleting the previous volumes (UGP gravel unit only) that Rockwell has used for plant commissioning during 2012. The diamond values have been derived from the sale of some 2,394 stones (2,512ct) returned values of USD726/ct. These values, while not truly representative of the entire size range known to exist on Tirisano, can be used as minimum figures until a formal, systematic sampling programme has been completed by Rockwell.

**Table 13.2: Resource statement as at 29 February 2012**

<table>
<thead>
<tr>
<th></th>
<th>Indicated Resource volumes (m³)</th>
<th>Inferred Resource volumes (m³)</th>
<th>Grade (ct/100m³)</th>
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<td>6,744,000</td>
<td>2.85</td>
<td>606</td>
</tr>
<tr>
<td>Depleted by end 2008</td>
<td>-2,630,600</td>
<td>-23,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depleted by Feb 2012</td>
<td>-213,048</td>
<td>-23,000</td>
<td></td>
<td>726</td>
</tr>
<tr>
<td>TOTAL</td>
<td>25,066,900</td>
<td>15,334,000</td>
<td>2.37</td>
<td>726</td>
</tr>
</tbody>
</table>
Figure 13.2: Indicated and Inferred Resources identified on the Tirisano project
13.1.3 Prospecting and Mining risks

The prospecting and mining business is speculative. This Report identifies some of the factors that are likely to affect the company and the project, as well as the value of its securities. However, this is not an exhaustive list and investors should seek professional advice for further clarification of the risks involved before deciding whether to invest in the diamond mining industry.

Whether a diamond deposit will be commercially viable depends on a number of factors, some of which are the particular attributes of a deposit, such as the diamond resource (size, quantity and quality), proximity to infrastructure, water availability, financing cost and governmental regulations, including regulations relating to prices, taxes, royalties, land tenure, land use, importing and exporting of diamond and environmental protection. The exact effect of these factors cannot be accurately predicted, but the combination of these factors may result in the project not returning an adequate return on investment capital.

Further, general economic conditions may affect inflation and interest rates which, in turn, may impact upon the projects operating costs and financing. The future viability and profitability of the project is also dependent on a number of other factors affecting performance of all industries and not just the exploration and mining industries, including, but not limited to, the following:

- The strength of the equity and share markets in Canada, Johannesburg and throughout the world;
- General economic conditions in Canada and Johannesburg and their major trading partners and, in particular, inflation rates, interest rates, commodity supply and demand factors and industrial disruptions;
- Natural disasters;
- Social unrest or war on a local or global scale;
- Financial failure or default by a participant in the project or other contractual relationship to which the Company is, or may become, a party;
- Insolvency or other managerial failure by any of the contractors used by the Company in its activities; and
- Industrial disputes.

Underlying strategic risks for prospecting and mining companies do not vary significantly over time. However, the acuteness, and hence the priority of these risks, changes depending on the economic environment (PWC, 2011). Ernst & Young (Hill, 2011) has identified the most significant strategic business risks for the mining and metals sector, for 2012, as:

- Resource nationalism
- Skills shortage
- Infrastructure access
- Social licence to operate
- Capital project execution
- Price and currency volatility
- Capital allocation
- Cost management
- Interruptions to supply
- Fraud and corruption

13.1.3.1 In South Africa

The greatest risks pertaining to the general minerals and mining industry in South Africa are perceived to be the uncertainties relating to the various mining-related Acts and Bills passed since 1994 as well as proposed labour amendment bills. Together with crime and the skills shortage, the inadequacy of
Southern African infrastructure (and more specifically power and water infrastructure), increases in fuel/power prices, labour unrest and strike action, are all viewed as a material constraint to investment. Not to be forgotten, also, is the uncertainty of the effect of HIV/AIDS on the workforce as well as the ever-present threat of resource nationalism from various elements within the ANC Youth League.
Additional Requirements for Advanced Property Technical Reports

Sections 14-21 are not relevant to this report since the existing (as of November, 2010) Preliminary Economic Assessment ("PEA") is not being updated here. Rockwell has initiated trial-mining (at a pre-feasibility study level) on the mine, and the relevant data and results will be presented in a forthcoming technical report.

25 A summary of the key parameters and results of the PEA are presented in Section 15.2 for ease of reference.
14 Adjacent Properties

Diamondiferous alluvial gravels are known to occur on three properties adjacent to Tirisano (Fig. 22.1):

- Private operations are located on the Deproclaimed portion of Nooitgedacht 131 IP
- Witkrans 130 IP was prospected in 1999/2000 by Batton Mining (Pty) Ltd and was being mined by a local prospector during 2007/2008.
- Historical diggings are located on Zwartrand (now incorporated into the Tirisano project). The available information on this property has been described in section 5.2.

Figure 22.1: Location of prospecting/mining activities on properties in the vicinity of the Tirisano Mine

Similar deposits are known from a number of properties in the Ventersdorp district (Fig. 22.1). Some of these, namely Goedgedacht, Klipgat, Zwartplaas and Morgenzon have supported commercial mines in the recent past. Although satellite interpretation, geophysical modelling and surface mapping appears to indicate that all these properties fall on similar (parallel) karst-hosted gravel systems, the mineralisation on these properties is not necessarily indicative of the mineralisation on Tirisano. The author has not independently verified the resource information on all of these properties, unless otherwise indicated.

Only the mineralisation on the two adjacent properties – Deproclaimed portion of Nooitgedacht and Witkrans will be described below.
14.1 Nooitgedacht 131 IP (Deproclaimed Portion)

Historically, over 26,000ct were recovered from Nooitgedacht (Marshall, 1987), from shallow artisanal diggings located on the gravel “run”. No reliable information regarding diamond grades and values is available from these deposits, although it is suspected that mainly colluvial gravels were mined, although some of the deeper pits must have accessed both upper and lower gravels. Currently, private operations still exist on the 14ha “Deproclaimed” area adjacent to the north of the Tirisano main pit on Nooitgedacht 131 IP (Plate 14.1).

Plate 14.1:  Artisanal operation to the north of the Tirisano Mine on the Nooitgedacht Deproclaimed area.  Photo courtesy of Etruscan, view from the north

A number of site visits by the author (at various times during 1990 and, more recently, in November 2010) suggests that colluvial gravels (Plate 14.2) and the LGP units (Plate 14.3) are the primary mining targets. In addition, minor amounts of UGP have also been identified. No formal resource estimation programme is in place on this property, and little is known regarding the depth extent of the deposit. Minor drilling indicates that the gravel extends at least 30m below surface. However, the diamond grades and values being recovered26 here are within the ranges found on the Tirisano mine.

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26 This information was provided to the author by the owner/operator of the mine during a site visit in November 2010.
Plate 14.2: Manganiferous colluvial deposits mined on Nooitgedacht

Plate 14.3: Lower gravels (LGP) being mined on Nooitgedacht, below old diggers heaps
14.2 Witkrans Prospect

This property is located on the western end of the West Run (adjacent to the Tirisano mine to the west) and has been mined episodically on an artisanal scale (Plate 14.4), since the 1920’s. Only some 465.5cts are recorded as being recovered from Witkrans during the period 1927-1943 (Marshall, Alluvial diamond Occurrences of the western and southwestern Transvaal, a compilation of production data, 1987). However, no information regarding diamond grades and quality is available. This run extends eastwards onto the Nooitgedacht property where it was also mined historically.

No prospecting/mining activity is recorded from this property between 1943 and 1999. The land owner converted the farm into a private game-farm, effectively preventing access to the old diggings.

During 1999/2000 Batton Mining (Pty) Ltd (a wholly-owned subsidiary of Antares Mining and Exploration Corporation of Toronto, Canada) completed a limited prospecting programme on Witkrans (K. Johnson, Pers. Comm.). This programme involved geological mapping, ground geophysical surveys, drilling and mini bulk-sampling. The results of this programme are not in the public domain. The company, however, relinquished its rights in mid-2000.

Up until 2008, a local digger was operating a small-scale mine on the shallow gravel. No grade or value results were available and the potential gravel distribution (area or volume) is unknown.

Plate 14.4 West Run on Witkrans 130 IP
15 OTHER RELEVANT DATA AND INFORMATION

15.1 Exploration Targets

In addition to the Indicated and Inferred Resources, exploration targets exist over large areas in both the LGP and the UGP units. It is important to note that these statements regarding potential quantity and grade are conceptual in nature, that there has been insufficient exploration to define a mineral resource in these areas and that it is uncertain if further exploration will result in the target being delineated as a mineral resource. Although some drilling and sampling has taken place in these areas, the results are insufficient to be categorized as a resource:

• Some 33-40,000m$^3$ of (LGP) gravel estimated to exist in the sinkholes below the present level of Inferred Resources (at 105m), down to the extent of drill data;
• Some 150-200,000m$^3$ of gravel within the modelled gravel wireframe, but which does not fall within the indicated or inferred categories due, primarily, to lack of borehole coverage;
• The estimated, additional, 5-6Mm$^3$ of (LGP) gravel that is modelled to exist in the sinkholes, if a more geologically reasonable shape is accepted (although not yet defined by drilling);
• An undefined amount of gravel, specifically southeast of the currently inferred resource area, where gravel is seen to exist (from borehole results), but drill coverage and sampling constraints prevent these from being included within defined resources;
• An indefinable volume of (LGP) material that is located below the present drilling level in the sinkholes. Geophysical modelling is unable to identify the base of the bedrock in these structures with any accuracy, nor has the drill programme been able to penetrate the thick gravels. As a result, it has not been possible to estimate what volume of gravel might exist here, although it is expected to be significant;
• The “West Run” on Nooitgedacht and Hartbeeslaagte has not yet been drilled or sampled. Some 200ha of area may be underlain by both UGP and LGP gravels.
• Grade ranges for these targets are expected to fall within the values identified by sampling within currently identified resource areas, namely, 1-2ct/100m$^3$ for UGP and 2-3ct/100m$^3$ for LGP units.

In addition to the LGP and UGP gravels, the entire PCP unit has been identified as an exploration target. Potential volumes of PCP expected to be present on Tirisano are unknown, but thicknesses of 2-15m have been seen in the main mining pit as well as various sampling pits throughout the mine property. Historical results and limited sampling of these deposits indicate that potential grades for these gravels are in the range of 0.4-1.2ct/100m$^3$.

15.2 Pre-existing Preliminary Economic Assessment

In 2009, a preliminary economic assessment$^{27}$ (“PEA”) was developed, which proposed a 180,000m$^3$/month throughput, resulting in a potential mine life of some 19 yrs. The PEA highlighted two scenarios, initially based on a static diamond price and operating cost and, secondly, on realistically assumed, annual diamond price escalation and increasing operating costs as a result of the peculiarity of mining gem-quality diamonds in Africa. In both scenarios, the Capex cost of ZAR 73M was applied. The key parameters and results of the PEA are shown in Table 15.1.

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$^{27}$ Both indicated and inferred mineral resources were used in this assessment. Under these circumstances, however, it is fundamental to appreciate that the assessment is preliminary in nature, that it includes inferred mineral that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the preliminary assessment will be realized.
Table 15.1: Key parameters and results of the preliminary economic assessment of the Tirisano mine, as of November 2009

<table>
<thead>
<tr>
<th>Tirisano Preliminary Assessment</th>
<th>Key Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicated Resources</td>
<td>25,279,800 m³</td>
</tr>
<tr>
<td>Inferred Resources</td>
<td>15,334,000 m³</td>
</tr>
<tr>
<td>Average Grade</td>
<td>2.37 ct/100m³</td>
</tr>
<tr>
<td>Average sales value (2011)</td>
<td>USD 606/ct</td>
</tr>
<tr>
<td>Proposed monthly throughput</td>
<td>180,000 m³</td>
</tr>
<tr>
<td>Proposed mine life</td>
<td>18.8 years</td>
</tr>
<tr>
<td>Operating Costs (2011)</td>
<td>ZAR 49/m³</td>
</tr>
<tr>
<td>Mining Royalties</td>
<td>0.5-7%</td>
</tr>
<tr>
<td>Capital required to bring mine into production</td>
<td>ZAR 73,000,000</td>
</tr>
<tr>
<td>Earthmoving fleet budget</td>
<td>N/A</td>
</tr>
<tr>
<td>Tax</td>
<td>28%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key Results</th>
<th>Base Case</th>
<th>10% Price Escalation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRR</td>
<td>59%</td>
<td>81%</td>
</tr>
<tr>
<td>NPV at discount values of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15%</td>
<td>ZAR 226,000,000</td>
<td>ZAR 1,084,000,000</td>
</tr>
<tr>
<td>20%</td>
<td>ZAR 153,000,000</td>
<td>ZAR 645,000,000</td>
</tr>
<tr>
<td>25%</td>
<td>ZAR 105,000,000</td>
<td>ZAR 406,000,000</td>
</tr>
</tbody>
</table>

During 2011 it has become apparent that the processing equipment and parameters should be changed significantly in order to deal with bulk-mining of the deposit. This will improve grade recovery appreciably and maximise diamond value. Consequently a Pre-Feasibility Study (“PFS”) has been initiated by Rockwell during 2011, which study is expected to change the parameters of the 2010 PEA. Details of both the study and the results will be described in a forthcoming technical report.

15.3 South African Economy

South Africa is a middle-income developing country, with strong financial and manufacturing sectors(South Africa, 2010). It is a leading exporter of minerals, and tourism is a key source of FX. However, many South Africans remain poor, and unemployment and crime levels are high. In addition, the country has one of the highest rates of HIV/AIDS prevalence in the world, with around one in seven South Africans infected. The country is relatively stable compared with many African countries, but growing corruption scandals surrounding top members of the ruling party is proving detrimental for the business environment; however, the country has a skilful labour force and a well-developed banking system.
Following the economic downturn of 2009, South Africa’s economy grew 2.8% in 2010 and by 3.7% in 2011 and is expected to grow by 3% in 2012 (Economy to grow at 3% in 2012: Busa, 2011). The main economic indicators of the South African economy are shown below (Table 15.2), as at February 2012 (South Africa - National Statistical Data, 2012).

Table 15.2: Economic indicators for South Africa (February, 2012)

<table>
<thead>
<tr>
<th>Interest Rate</th>
<th>Growth Rate</th>
<th>Inflation Rate</th>
<th>Unemployment Rate</th>
<th>Exchange Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5%</td>
<td>3.2%</td>
<td>6.3%</td>
<td>23.9%</td>
<td>7.59</td>
</tr>
</tbody>
</table>

15.3.1 The Mining Industry

Mining in South Africa has been the main driving force behind the history and development of Africa’s most advanced and richest economy. Large scale and profitable mining started with the discovery of a diamond on the banks of the Orange River in 1867, and the subsequent discovery and exploitation of the Kimberley pipes a few years later. Gold rushes to Pilgrim's Rest and Barberton were precursors to the biggest discovery of all, the Witwatersrand Gold field in 1886.

Diamond and gold production may now be well down from their peaks, though South Africa is still no. 2 in gold but South Africa remains a cornucopia of mineral riches. It is the world's largest producer of chrome, manganese, platinum, vanadium and vermiculite. It is the second largest producer of ilmenite, palladium, rutile and zirconium. It is also the world's third largest coal exporter.

With the growth of South Africa’s secondary and tertiary industries, the relative contribution of mining to South Africa's gross domestic product (GDP) has declined over the past 10-20 years. Nonetheless, the industry remains a cornerstone of the economy, making a significant contribution to economic activity, job creation and foreign exchange earnings (Mining and minerals in South Africa, 2011). The sector accounts for roughly one-third of the market capitalisation of the JSE, and continues to act as a magnet for foreign investment in the country.

In 2009, South Africa's mining industry was the largest contributor by value to black economic empowerment (BEE) in the economy, in terms of the value of BEE transactions completed. Further, during the same period, according to the Chamber of Mines of South Africa, the industry contributed: 8.8% directly, and another 10% indirectly, to the country's gross domestic product (GDP).

- Over 50% of merchandise exports, if secondary beneficiated mineral exports are counted.
- About 1-million jobs (500 000 directly).
- About 18% of gross investment (10% directly).
- Approximately 30% of capital inflows into the economy via the financial account of the balance of payments.
- 93% of the country’s electricity generating capacity.
- About 30% of the country’s liquid fuel supply.
- Between 10% and 20% of direct corporate tax receipts (together worth R10.5-billion).
15.3.2 South Africa’s Mineral Legislative Environment

15.3.2.1 Mineral Policy

South Africa has endorsed the principles of private enterprise within a free-market system, offering equal opportunities for all the people. The state’s influence within the mineral industry has, thus far, been confined to the goal of orderly regulation and the promotion of equal opportunity for all citizens. The Minerals and Petroleum Resources Development Act (MPRDA Act 28 of 2002) was introduced to legislate the official policy concerning the exploitation of the country’s minerals. Previously, South African mineral rights were owned by either the State or the private sector. This dual ownership system represented an entry barrier to potential new investors. The new MPRDA was introduced with the objective for all mineral rights to be vested in the State, with due regard to constitutional ownership rights and security of tenure.

In an attempt to assist junior exploration/mining companies, in July 2009 the National Treasury introduced a tax incentive for investors through the introduction of venture capital company (VCC) funds. This is an attempt to assist bottom-end juniors (engaged in mineral exploration, mining and/or refining) in accessing equity funding, in a similar manner to that which the Canadian flow-through share system. The subsequent tax-break allows for both individual and listed company to invest in the junior; the individual is eligible for a 100% tax deduction of the amount invested, which is limited to R750,000/year with a maximum of R2.25M and listed companies (and their group subsidiaries) are eligible for a 100% deduction with no monetary limit. However, these corporate entities do not receive any deductions for share investments that push their holdings above a 10% equity share interest in a VCC. The VCC must be a South African resident company that is unlisted or a junior mining company that may be listed on the Alt-X and must not be a controlled group subsidiary. The VCC is, further, required to invest 80% of their funds in mining juniors with book assets of not more than R100M after capital raising, and small non-mining companies with assets of not more than R10M after capital raising. The junior would also be required to use all the money received for purposes of its trade within 18 months of receipt and would be required to be producing revenue within 36 months.

Arguably the subject that dominated the minds of most mining executives and mining industry investors in 2011 was nationalisation. While calls to nationalise at least 60% of all mining companies were proposed by the Youth League of the African National Congress (ANC), final policy decisions will only be taken at the ANC elective conference in Mangaung in December 2012. It is thought that the ANC is unlikely to go for outright nationalisation of mines, rather opting for increased mineral beneficiation is SA, taxes on unbeneﬁciﬁed mineral exports and enforcing of transformation through the mining charter (Mkokeli, 2011).

15.3.2.2 Mineral and Petroleum Resource Development Act 28 of 2002 (“MPRDA”)

The Mineral and Petroleum Resources Development Act (MPRDA), 2002 aims to:

- recognise that mineral resources are the common heritage of all South Africans
- promote the beneficiation of minerals
- guarantee security of tenure for existing prospecting and mining operations
- ensure that historically disadvantaged individuals participate more meaningfully
- promote junior and small-scale mining.

In terms of the Act, new order rights may be registered, transferred and traded, while existing operators are guaranteed security of tenure. Mining rights are valid for a maximum of 30 years and renewable for another 30 years, while prospecting rights are valid for up to five years and renewable for another three.
DRAFT versions of the amended Mineral and Petroleum Resources Development Act (MPRDA) would not be finalised prior to the ANC National Policy Conference in June 2012, as the revisions would be informed by the ruling party’s resolutions on the role of the state in mining. It would also be at this time when changes to the ANC’s policy on mining, if any, would be incorporated with the amendments. (Janse van Vuuren, MPRDA on hold for ANC mines plan, 2011)

The envisaged time frame for tabling the MPRDA amendments to parliament is during the last quarter of the 2012 legislative program. The DMR has indicated the proposed law changes would also allow for a single licensing system – incorporating applications for water usage and environmental permits – as well as the partitioning of mineral rights. The revised MPRDA would, in addition, make provision for the state’s newly adopted beneficiation strategy. Also, should parliament only debate on the proposed changes to the Act after June, it could allow for proposals made at the ANC’s policy conference, where the governing party is expected to adopt policy stemming from its investigation into nationalisation and the state’s involvement in the industry. (Janse van Vuuren, Revised MPRDA at least a year away, 2011)

15.3.2.3 Broad Based Black Economic Empowerment (BBBEE) and the Mining Charter

The Broad-Based Socio-Economic Empowerment Charter for the South African mining and minerals industry - updated and released in September last year - is being viewed with interest by the industry. While the objectives of the charter remain largely unchanged, the manner of achieving them is being provided for differently. Not only is it couched in more prescriptive terms, but it also contains an emphasis shift away from equity participation issues towards broad-based/socio-economic/skills transfer/procurement-related issues, and contains a sting in the tail for failure to comply with the regime it now imposes (Cornish, 2011)

It can be argued that the Charter is no more than a policy document containing the goals to be achieved by the mining industry in the foreseeable future. But this ignores the flavour of subordinate legislation added to the Charter – particularly in its revised form. It is accepted in certain circles that the Charter has the standing of law. The Charter itself provides that any failure to comply with its provisions will render the mining company in breach of the MPRDA (Janisch, 2011).

The charter retains the 2014 26% BEE ownership target level. It is the method by which this target is to be achieved which has changed. The charter now contains the concept of ‘meaningful economic participation’ – whereby historically disadvantaged South Africans (HDSAs) must, notwithstanding funding commitments to the vendor/third parties, receive a portion of any cash flow generated from the underlying mining asset. Accordingly, “trickle dividends”, which used to be an optional feature in HDSA transactions, will now have to form part and parcel of any HDSA transaction where vendor/third party funding is involved (Cornish, 2011).

The sector is in desperate need of skills development to realise the government’s objective of sustainable transformation and development.

- To this end, a skills levy has been incorporated into the charter. For 2010, 3% of annual payroll must be contributed towards such levy. Thereafter, the levy increases by 0.5% a year until 2014.
- The charter also introduces clear procurement targets. By 2014, mining companies will be obliged to procure 40% of their capital goods, 70% of their services and 50% of their consumer goods from BEE entities.
- With immediate effect, multinational suppliers of capital goods are obliged to contribute 0.5% of their South African mining companies’ annual income into a social development fund to be utilised for the socioeconomic development of communities.
The above targets exclude any non-discretionary procurement expenditure.

Two of the most prominent social aims of the Charter are mine community development and housing and living conditions of mine workers. It is not insignificant that these concepts were expressly incorporated into the Charter (Badenhorst, W, 2011):

- Mine communities form an integral part of mining development. The Charter’s aim is to ensure a meaningful contribution towards community development is made. Mining companies are required to identify projects for their contribution to community development and the financial investments therein must be proportional to the size of the mining investment.

- In addition to community development, the Charter highlights that human dignity and privacy for mineworkers are the hallmarks to enhance productivity and to expedite transformation in the mining industry in terms of housing and living conditions. Mining companies are compelled to improve standards of housing and living conditions - and here the Charter gets specific in requiring the following by 2014:
  - convert and upgrade hostels to family units;
  - attain an occupancy rate of one person per room; and
  - facilitate home ownership options for mine workers.

15.3.2.4 The Minerals and Petroleum Resources Royalty Bill

The royalty bill was introduced on May 1, 2009. In terms of the currently applicable formulae, the applicable royalty rates will vary according to the profitability of the mining company, subject to a minimum rate of 0.5% and maximum rate 9.0% for diamonds (unrefined minerals). The profitability parameter in the formulae is EBIT and it also allows for 100% capital expensing which is an acknowledgement of the high capital costs associated with mining.

\[
Y (u) = 0.5 + \left \{ \frac{EBIT}{(Gross \ sales \times 9)} \right \}
\]

Where:

- \( Y (u) \) = Royalty percentage rate;
- \( EBIT \) = Earnings before interest and taxes (but EBIT can never go below zero).

The formula contains four parameters: (1) an intercept term, 0.5, (2) EBIT, earnings before interest and taxes, (3) gross sales and (4) 9 as a constant:

- The 0.5 essentially acts as a minimum royalty percentage rate (0.5%) in order to ensure that Government (as custodian) always receives some level of royalty payments for the permanent loss of non-renewable resources.

- EBIT essentially measures an extractor’s net operating mining profits in relation to recovered mineral resources to be eventually transferred. Taxes and other Government charges, such as the royalty, are excluded because EBIT is part of the royalty determination. The exclusion of interest effectively neutralises how key methods of financing (i.e. debt or equity) mineral operations are undertaken. EBIT for mineral resources transferred is conceptually viewed as the aggregate amount of:
  1. Gross sales for all transferred mineral resources;
  2. Recoupment in respect of the disposal of assets used to develop mineral resources to the extent the depreciation on those assets offset EBIT;
  3. Operating expenditure incurred (and depreciation allowances applicable to capital expenditure) relating to the extraction and development of mineral resources to the
extent those expenditures are both: (i) deductible under the Income Tax Act, and (ii) bring those minerals to a Schedule 1 or Schedule 2 condition (as applicable).

15.3.2.5 The Diamond Amendment Bill

The 2005 amendments to the Diamonds Act, viz., Diamonds Amendment Act, 2005 and the Diamonds Second Amendment Act, 2005 as well as the 2007 amendment to Regulations under the Diamonds Act took effect on 1 July 2007. These Regulations were also, subsequently, amended on 4 April 2008. The object of the Regulator (SADPMR) in terms of the Diamonds Act, 1986 (as amended) is to ensure equitable and regular supply of rough diamonds to local beneficiators. It makes provision for the establishment of the State Diamond Trader who will facilitate the supply of rough diamonds equitably and a Precious Metals and Diamonds Regulator to promote equitable access to rough diamonds to licensees. The objects of the amendments are to:

- Promote a culture of value addition of minerals by maximising the value of economic benefit of South Africa's mineral wealth;
- Recognise the fact that beneficiating our minerals locally contributes to South Africa's economy;
- Prevent and abolish restrictive and unfair practices with regard to accessibility and availability of minerals and access to markets; and
- Create an internationally competitive and efficient administrative and regulatory regime by means of national licensing system.

In this regard the regulators functions include the implementing, administering and controlling all matters relating to the purchase, sale, beneficiation, import and export of diamonds; and establishing diamond exchange and export centres, which shall facilitate the buying, selling, export and import of diamonds and matters connected therewith.

15.3.2.6 Diamond Export Levy Bill 2007

The Diamond Export Levy Bill was required to give effect to certain provisions of the Diamonds Act, 1986, as amended. The Diamond Export Levy Bill’s main objective is to support the local beneficiation of rough diamonds. The beneficiation of rough diamonds is seen as important to encourage the development of the local economy, skills and employment creation. The Bill proposes a 5% export levy on rough diamonds that should contribute towards local beneficiation, but is low enough so as not to unduly encourage smuggling. The 5% levy applies to all rough (natural unpolished) diamonds that are exported, while synthetic diamonds are exempted. The levy amount will be equal to 5% of the value of a rough diamond exported, as specified on a return described in Section 61 of the Diamonds Act, 1986 or of the value as assessed by the Diamond and Precious Metals Regulator described in section 65 of the Diamonds Act, 1986.

The Bill contains relief measures that may offset the 5% levy in full or in part. A producer is entitled to receive a credit for imported rough diamonds. This credit will offset (in full or in part) a producer’s export duty liabilities. The Minister of Minerals and Energy may also exempt a producer from the 5% export levy if a producer’s activities are supportive of local diamond beneficiation, or the producer has an annual turnover of less than R10 million, and such a producer has offered his or her rough diamonds for sale at the Diamond Exchange and Export Centre but there were no local buyers. However, the diamonds must subsequently be sold for an amount at least equal to the reserve price at which such diamonds were offered at the centre. These conditions preserve South African’s “right of first refusal” with respect to bidding on any rough diamond intended for export.
15.3.2.7 Precious Metals Bill and the Beneficiation Strategy

The Precious Metals Bill amends Chapter XVI of the Mining Rights Act, No 20 of 1967, so as to eliminate the barriers to local beneficiation of precious metals and to rationalise the regulation of matters pertaining to the downstream development of precious metals. The objects of the Bill include:

- To allow for the acquisition and possession of precious metals for the local beneficiation;
- To regulate the precious metal industry;
- To repeal the legislations that create barriers to beneficiation; and
- To amend the over-regulation of the industry by centralising the issuing of jewellers' permits within the Department of Minerals and Energy.

The Beneficiation Strategy, which has been under discussion for some 16 years, is a product of an interdepartmental task team consisting of representatives from the DMMR, DTI (Department of Trade & Industry), the Department of Science & Technology, the Department of Public Enterprises, the National Treasury and the Presidency. A draft (White Paper) was approved by cabinet in June 2011.

Five "pilot commodity value chains" are being developed by the DMR (Leon, P; Veeran, J, 2011). The beneficiation strategy identifies ten strategic mineral commodities and selects five value chains from these, which are intended to demonstrate the inherent value for South Africa in embracing beneficiation in relation to all strategic mineral commodities. The first two commodity value chains were presented to cabinet in October 2011 and will cover the iron and steel industry (which has already been drafted) as well as "energy commodities" (which is still being developed and includes coal, uranium and thorium). These plans were approved on 11 November 2011 (SAPA, 2011). The remaining three commodity chains cover: autocatalytic converters and diesel particulate filters, jewellery fabrication, (including gold, platinum and diamonds) and titanium metal and pigment production.

In order to implement beneficiation strategies, mining licences may, in future, be granted with attached conditions, to ensure a supply of raw material for local industries seeking to further refine, or beneficiate, the extracted minerals (SAPA, 2011). However, for South Africa to succeed in its endeavours, it needs to create the necessary skilled labour force and to establish the necessary industrial development zones with attractive tax advantages and low tariff regimes. Customs systems would also have to be streamlined and harbours decongested to facilitate efficient trading conditions.

15.3.2.8 Kimberley Process

The Kimberley Process is a joint governments, industry and civil society initiative to stem the flow of conflict diamonds – rough diamonds used by rebel movements to finance wars against legitimate governments. The trade in these illicit stones has fuelled decades of devastating conflicts in countries such as Angola, Cote d'Ivoire, the Democratic Republic of the Congo and Sierra Leone. The Kimberley Process Certification Scheme ("KPCS") imposes extensive requirements on its members to enable them to certify shipments of rough diamonds as ‘conflict-free’. The core mandate of the KPSC is to guarantee consumers that the organisation is aware of the origin of the diamonds that the consumers buy.

As of December 2009, the KP has 49 members, representing 75 countries, with the European Community and its Member States counting as an individual participant. In essence, the participants in the KPSC have agreed that they will only allow for the import and export of rough diamonds if those rough diamonds come from or are being exported to another Kimberley Process participant. The KPSC requires that each shipment of rough diamonds being exported and crossing an international border be transported in a tamper-resistant container and accompanied by a government-validated Kimberley Process Certificate. Each certificate should be resistant to forgery, uniquely numbered and include data describing the shipment’s content. The shipment can only be exported to a co-participant country in
the Kimberley Process. No uncertified shipments of rough diamonds will be permitted to enter a participant’s country. Once a certified shipment has entered its country of destination it may be traded – in whole or part – and mixed with other parcels of rough diamonds as long as all subsequent transactions are accompanied by the necessary warranties. Failure to adhere to these procedures can lead to confiscation or rejection of parcels and/or criminal sanctions. Any rough diamonds being re-exported will also require Kimberley Process Certificates, which will be issued in the exporting country. These re-exports can comprise any combination of rough diamonds that have been previously imported through the Kimberley Process Certification Scheme.

In order to strengthen the credibility of the Kimberley Process agreement, as well as to provide the means by which consumers might more effectively be assured of the origin of their diamonds, the World Diamond Council proposed that the industry create and implement a System of Warranties for diamonds. Under this system, which has been endorsed by all Kimberley Process participants, all buyers and sellers of both rough and polished diamonds must warrant that, for each parcel of diamonds “The diamonds herein invoiced have been purchased from legitimate sources not involved in funding conflict and in compliance with United Nations resolutions. The seller hereby guarantees that these diamonds are conflict free, based on personal knowledge and/or written guarantees provided by the supplier of these diamonds.” In addition, each company trading in rough and polished diamonds is obliged to keep records of the warranty invoices received and the warranty invoices issued when buying or selling diamonds. This flow of warranties in and warranties out must be audited and reconciled on an annual basis by the company’s own auditors. Failure to abide by the aforementioned principles exposes the member to expulsion from industry organizations.
16 INTERPRETATION AND CONCLUSIONS

The preferred geological model is one of deposition in a karst environment where the dolomite walls of the host-rock are vertical; the mode of gravel deposition is not typical fluvial alluvial; periodic subsidence has taken place during deposition; and deposition has taken place over a long time (since, at least, the Mesozoic) resulting in a build-up of a very thick gravel sequence. The gravel stratigraphy comprises an upper gravel horizon (UGP) and a lower gravel unit (LGP) that are both economically diamondiferous, separated by a sub-economic fine-grained pebble-clay unit (PCP). The LGP, which is characterized by a predominance of quartzite over chert clasts, may be clay-rich or clay-poor, with the clay-poor varieties being the primary exploration target due to their higher average grades.

Mineralisation is confined to the gravel packages in-filling karst caverns etched out of the chert-rich dolomites of the Malmani Group. The clay-poor Lower Gravel Package and Upper Gravel Package units are considered to be the major exploration targets as the diamond grades encountered in these units have, historically, supported commercial mining ventures. Although elevated grades have also been associated with the colluvial manganese nodule layer – this unit is not everywhere present on the property and is, therefore, not considered as part of this study.

The airborne and ground gravity surveys (and supported by extensive drilling) indicates that the karst system trends roughly in a NW-SE direction across the properties, and is offset by a number of structural features. There appear to be a succession of sinkholes connected by a series of linkage channels (which pattern is typical of allogenic streams). The overall length of the karst system is in excess of 6,000 m. Widths of the channels are seen to vary from 135-385 m.

To date, 2,391 boreholes have been drilled on the property, totalling 53,576m. The deepest drilling indicates that the lower gravels extend down at least to 140m (without intersecting bedrock). Geophysical interpretation, however, indicates that final depths of the sinkholes may be, potentially, up to 200m in places.

Over the period 2006-2008, eleven bulk-samples (Pits 1, 2 (A, B, and C), 3, 3A, 5C, 6, 7, 8 and 9) were excavated to process 147,895.88m³ of Lower Gravels (LGP), including Transition Zone gravels (TZP) and recover 4,318.6ct for a global grade of 2.85ct/100m³ (bottom cut-off of 1.6mm) and USD 466/ct. In addition, 129,557.46m³ of Upper Gravels (UGP) was processed to recover 2,292.00ct at an average grade of 1.77ct/100m³.

Due to the generally low grades and relatively large stone sizes present in alluvial diamond deposits it is imperative that large bulk samples are taken to ensure representivity of results. For Indicated Resources, this study has endeavoured to sample some 2% of the resource with a minimum recovery of 2,000ct for diamond value estimations. For the Inferred Resource portion, the goal was some 0.5% of the resource sampled for grade estimations and a minimum of 500ct for value.

Unfortunately, due to the inability of the drill results to determine accurately the location of clay/manganese rich or poor areas, the bulk-samples have not been able to sample all areas equally (to determine a representative average grade). The samples have, thus, almost been sited randomly. As can be seen from the sample results, clay/manganese rich and poor areas have been sampled, reflecting the full variety of sedimentary features that will be expected throughout the deposit.

During 2008, material from the trial-mining programme was processed from the base of the Tirisano main pit. A total of 218,718m³ of which 146,881m³ was LGP, 10,293m³ was UGP and 61,534m³ is a blend of both UGP and LGP. Within the LGP, there are individual resource blocks where the grades are significantly higher than the average. Intuitively, it has been noticed that these elevated grades appear
to be associated with proximity to bedrock highs, an increase in average clast size and a decrease in clay content. These observations will continue to be monitored to see whether the perceived relationships are real and whether the variations are systematic and measurable.

In addition, increased grades were also noticed at (and immediately below) the manganese wad horizon. This horizon is a curved surface that is at some 27m below surface at the sinkhole edge and at 35-37m below surface towards the centre of the sinkhole. The wad is thought to represent a late Cretaceous landsurface and the increased grades may be the result of surface concentration (by deflation) prior to subsiding into the collapsing sinkhole.

At the date of this report, two sample blocks of 6,677m$^3$ and 52,037m$^3$ have been sampled and processed separately at depth (60m and 64m respectively). The recovered grades of these sample (at 2.80ct/100m$^3$ and 2.0ct/100m$^3$) are similar to (slightly lower than) the 2007 average LGP of 2.85ct/100m$^3$. At this stage, it is assumed that the elevated grades are only associated with the wad horizon and the average grade returns to the sample average of 2.85ct/100m$^3$. If the grades of the samples recovered from deeper than 38m are considered separately, it appears as if the grade is decreasing with depth. It is suspected, however, that this perception has more to do with on-going processing problems associated with a higher clay content. Samples at depths below the manganiferous layer will continue to be monitored in order to determine grade variation trends.

During the period January – June 2008, a total of 5,552.54ct were sold to various diamond buyers on the open market for an average of USD606/ct. The reliability of valuations of parcels smaller than 2,000ct decreases as the size of the parcels decrease to the point where valuations placed on a small number of diamonds from exploration samples are likely to be misleading. However, the total mass of diamonds from the Tirisano project sold on the open market exceeds 12,000ct. As a result, it is expected that the sales value should reflect fairly on the value of the stones. Nevertheless, as a result of the current economic climate and the huge fluctuations in the rough diamond market, it has not been possible to estimate present average diamond prices with any certainty – irrespective of the amount of diamonds sold.

During 2008, sampling (trial-mining) was confined to the Tirisano main pit on Nooitgedacht. Excavation (and rehabilitation) was contracted to ALS Contractors (Pty) Ltd. All gravels were excavated using hydraulic excavators, which are most efficient in selectively removing the overburden and excavating the gravels without much contamination of horizons. After they have been excavated, the gravels are transported to the processing plant stockpile area by articulated dump trucks. Prior to processing through the concentrating plants the ROM gravels was to be prepared through a front-end screening plant to be able to deliver a sized product to the sample stockpile. On the mineral processing side, two streams were designed to feed the DMS plants (Bateman DMS at 40tph and Manhattan DMS at 50tph) as well as two new rotary pan plants (planned combined monthly production targets of 100,000m$^3$). During the commissioning phase, however, the average monthly throughput was some 50-90% of the targets (with most of the production coming from the DMS plant at a reduced production rate of 50,000m$^3$ per month) as a result of numerous processing and recovery problems.

At 25 November end of 2008 the mine was put on Care & Maintenance as a result of the international economic slowdown and, consequent, drop in rough diamond prices.

The Etruscan study highlighted a number of technical issues that need to be addressed in the Rockwell mining programme:

- Continuing issues with processing efficiencies as a result of clay and manganese in the gravels.

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28 NAPEGG Guidelines
Due to the almost random variation in sedimentological horizons within the gravel unit, production data (specifically grade) needs to be continually monitored and reconciled with modelled figures.

Since these deposits are “high-volume, low-grade” operations, much effort will be required to replace mined gravels. Consequently, an extensive regional exploration programme will need to be pursued to identify and evaluate additional, similar deposits.

Sustained attention should be given to finding ways to differentiate between the various gravel horizons in borehole logs, including geochemical and mineralogical studies.

During the period November 2008 to February 2012, no bulk-sampling or trial-mining has taken place on the Tirisano property. Over 300,000m³ of mixed gravels and dump material has been processed by Rockwell – however, this material has only been used to assist with the commissioning of the plant and also to clean up areas prior to the initiation of controlled sampling/mining. Consequently the results (grade) of this processing are not representative of any specific gravel units and cannot be used for resource estimation.

Rockwell is currently refining the geological parameters of the various gravel units. Until this work is completed and additional mineral processing has taken place by Rockwell, this study has accepted the volume and grade estimate declared in the NI43-101 technical report produced as at October 2009 and simply depleted the volume of gravels used by Rockwell during the design and commissioning of the plant. During the commissioning phase to date, Rockwell has sold 2,394 stones (2,512 ct) at USD726/ct. These values, while not truly representative of the entire size range known to exist on Tirisano, can be used as minimum figures until a formal, systematic sampling programme has been completed by Rockwell.

The resource estimate was prepared by T.R. Marshall, PhD, (Pr. Sci. Nat.), a qualified person who is independent of Rockwell and is responsible for the estimate. The result of the resource estimation is below:

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>Volumes (m³)</th>
<th>Grade (ct/100m³)</th>
<th>Value (USD/ct)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicated</td>
<td>25,066,900</td>
<td>2.37</td>
<td>726</td>
</tr>
<tr>
<td>Inferred</td>
<td>15,334,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>40,394,900</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In addition to the Indicated and Inferred Resources, exploration targets exist over large areas in both the LGP and the UGP units. It is important to note that these statements regarding potential quantity and grade are conceptual in nature, that there has been insufficient exploration to define a mineral resource in these areas and that it is uncertain if further exploration will result in the target being delineated as a mineral resource. Although some drilling and sampling has taken place in these areas, the results are insufficient to be categorized as a resource:

- Some 33-40,000m³ of (LGP) gravel estimated to exist in the sinkholes below the present level of Inferred Resources (at 105m), down to the extent of drill data;
- Some 150-200,000m³ of gravel within the modelled gravel wireframe, but which does not fall within the indicated or inferred categories due, primarily, to lack of borehole coverage;
- The estimated, additional, 5-6Mm³ of (LGP) gravel that is modelled to exist in the sinkholes, if a more geologically reasonable shape is accepted (although not yet defined by drilling);
- An undefined amount of gravel, specifically southeast of the currently inferred resource area, where gravel is seen to exist (from borehole results), but drill coverage and sampling constraints prevent these from being included within defined resources;
- An indefinable volume of (LGP) material that is located below the present drilling level in the

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29 Mineral resources which are not mineral reserved do not have demonstrated economic viability
sinkholes. Geophysical modelling is unable to identify the base of the bedrock in these structures with any accuracy, nor has the drill programme been able to penetrate the thick gravels. As a result, it has not been possible to estimate what volume of gravel might exist here, although it is expected to be significant;

• The “West Run” on Nooitgedacht and Hartbeeslaagte has not yet been drilled or sampled. Some 200ha of area may be underlain by both UGP and LGP gravels.

• Grade ranges for these targets are expected to fall within the values identified by sampling within currently identified resource areas, namely, 1-2ct/100m³ for UGP and 2-3ct/100m³ for LGP units.

• In addition to the LGP and UGP gravels, the entire PCP unit has been identified as an exploration target. Potential volumes of PCP expected to be present on Tirisano are unknown, but thicknesses of 2-15m have been seen in the main mining pit as well as various sampling pits throughout the mine property. Historical results and limited sampling of these deposits indicate that potential grades for these gravels are in the range of 0.4-1.2ct/100m³.

During 2011, the emphasis was on commissioning the plant in preparation for putting the Tirisano project into full production. Trial-mining and associated pre-feasibility studies have been initiated, which will continue through 2012/2013. SRK has already completed a geotechnical report with recommendations for the long term rehabilitation and mining of the existing and future pits.

The budget for the PFS is estimated at ZAR 94M, exclusive of ZAR 4.6M capital expenditure. In addition to CAPEX requirements, Rockwell has budgeted ZAR 7M/month for the trial-mining, processing some 85,000m³ monthly.

The author believes that, notwithstanding the problems inherent in resource/reserve estimations in alluvial diamond deposits, the results to date are sufficiently encouraging to permit trial-mining from the Indicated Resource areas. Due to the geological nature and economic characteristics of alluvial diamond deposits in the North West Province, proving-up of substantial reserves ahead of trial mining is not warranted, and is not industry standard in South Africa.

The independent QP has reviewed both the proposed work programme and budget and concurs that they are reasonable for the stage of the project. The programme is contingent upon financing as well as continued improvement in the diamond market.
17 RECOMMENDATIONS

17.1 Proposed Work Programme for 2011/2012

During 2012, it is planned to continue with economic studies of modifying factors considered relevant to the Pre-Feasibility Study (“PFS”). This will comprise an investigation of numerous elements designed to present preliminary estimates of the preproduction capital, ongoing capital, operating costs and operating profit to justify further development on the Tirisano mine. It will include a comprehensive study of the preferred mining method and the establishment of the pit configuration as well as the determination of an effective method of mineral processing. It includes a financial analysis based on realistically assumed assumptions of technical, engineering, operating, economic factors and the evaluation of other relevant factors to determine if all or part of the Mineral Resource may be classified as a Mineral Reserve. The underlying basis of the pre-feasibility study will be probable reserves.

Many of these studies will be conducted in-house, managed by Mr. G A Norton (Group Technical Services manager) who is registered with SAIMM and SACNASP. The programme will be conducted under the auspices of Dr T R Marshall (Explorations Unlimited) as the independent QP, who has extensive experience with the operational aspects of alluvial diamond deposits, including mine planning and is familiar with costs associated with these businesses.

In addition, Dr Kurt Petersen (Metal Dog Minerals) has been retained by Rockwell to improve and sustain the company’s rate of diamond recovery. Dr Petersen has more than 15 years experience in process modelling and simulation, with 10 years specifically in the Diamond industry. His speciality is in the design of Diamond Plants and optimisation of recovery performance.

No systematic prospecting is planned for 2012 – this will be continued once the PFS has been completed. Minor infill drilling will, however, continue ahead of the sampling and trial-mining operations, mostly for better geological control.

17.2 Proposed Budget

The budget for the PFS is estimated at ZAR 94M, excluding ZAR 4.6M capital expenditure (Table 25.1). In addition to CAPEX requirements, Rockwell has budgeted ZAR 7M/month for the trial-mining programme, to process some 85,000m³/month.

Table 17.1: Capex Requirements (to end FY February 2013)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Capex (ZAR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Front-End</td>
<td>3,000,000</td>
</tr>
<tr>
<td>Conveyor structures for 3rd pan section</td>
<td>400,000</td>
</tr>
<tr>
<td>refurbish two pans</td>
<td>100,000</td>
</tr>
<tr>
<td>jet pump and electrical</td>
<td>120,000</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>3,620,000</strong></td>
</tr>
</tbody>
</table>
Replacement projects

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two replacement LDV's</td>
<td>660,000</td>
</tr>
<tr>
<td>Drive chain overhauls</td>
<td>160,000</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>820,000</strong></td>
</tr>
</tbody>
</table>

Sustaining current capacity

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>scrubber liners</td>
<td>200,000</td>
</tr>
<tr>
<td><strong>Total Capital</strong></td>
<td><strong>4,640,000</strong></td>
</tr>
</tbody>
</table>

The independent QP has reviewed both the proposed work programme and budget and concurs that they are reasonable for the stage of the project. Advancement to the subsequent phase of operation is contingent upon positive results in the PFS study.
18 REFERENCES


Baurens, S. (2010). *Valuation of Metals and Mining Companies*. Document produced in collaboration with the University of Zurich, Swiss Banking Institute and Prof T Hens, Zurich.


CIM. (Nov 27, 2010). *CIM Definition Standards*. CIM standing committee on Reserve Definitions.


JORC. (1999). *Australian Code for Reporting of Identified Mineral Reserves and Ore Reserves*. Issued by the Joint Ore Reserve Committee (JORC), comprising Australian Institute of Mining and Metallurgy (AusIMM), Australian Institute of Geoscientists (AMI) and Minerals Council of Australia (MCA).


Sundry Documents
Rockwell production and sales database
Sundry hardcopy and electronic technical and production plans and data.
Respectfully Submitted,

Signed and Sealed

Tania R Marshall (Dr)
Geological Consultant (Pr. Sci. Nat)
SACNASP registration number 400112/96
P O Box 6578
Homestead, 1412
Republic of South Africa
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E-mail: marshall.tania@gmail.com
Date of Signature: 23 May, 2012
Effective Date: 29 February, 2012

Glenn A Norton, B.Sc.Hons
Group Technical Manager (Pr. Sci. Nat.)
SACNASP registration number 400042/06
Level 1, “Wilds View”, Isle of Houghton
Cnr: Boundary & Carse O’Gowrie Road
Houghton Estate, Johannesburg
South Africa, 2198
glenn@rockwelldiamonds.com
19 Certificate of Authors

19.1 Tania Ruth Marshall

I, Tania Ruth Marshall (Pr. Sci. Nat.) do hereby certify that:

1. I am a Geological Consultant with:
   Explorations Unlimited
   P O Box 6578
   Homestead,
   1412
   South Africa

2. I graduated with a degree in Bachelor of Science from the University of Witwatersrand in 1982. In addition, I have obtained a Bachelor of Science (Honours) in Geology in 1984, a Master of Science in Geology in 1987 and a Doctor of Philosophy (Geology) in 1990.

3. I am a member, in good standing, of the Geological Society of South Africa (#38829) and am registered with the South African Council for Natural Scientific Professions as a Geological Scientist since 1996 (SACNASP registration number 400112/96).

4. I have worked as a geologist continuously since my graduation from university in 1987. During this period I have been involved in the exploration and exploitation of alluvial diamond deposits throughout Africa, including the evaluation and valuation of a number of such deposits for both private and public companies. Such operations involving mining and financial analysis (together with mine planning and costing) include the Cangandala alluvial diamond mine in Angola, the Cayco alluvial diamond project in Akwatia, Ghana, the Aredor alluvial diamond mine in Guinea, the Lorelei alluvial diamond mine in Namibia, the Krugersdal/Morgenzon and Roodepan alluvial diamond mines in the Venterdorp district of South Africa, the Schmidtsdrift and Sydney-on-Vaal alluvial diamond mines along the lower Vaal River in South Africa, the London alluvial diamond mine in the Schweizer Reneke district of South Africa, the Kameelfontein alluvial diamond project in the Cullinan district of South Africa, as well as various small-scale alluvial diamond projects in South Africa and Namibia.

5. My experience on alluvial diamond deposits is both as operator and as consultant, during which I have prepared costing estimates for mining and processing operations. In addition, as consultant, I have seen and reviewed operations and their various cost centres.

6. I have read the definition of “qualified person” set out in National Instrument 43-101 (“NI 43-101”) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be an independent “qualified person” for the purposes of NI 43-101.


8. I have visited the Tirisano mine on numerous occasions during 2011/2012; most recently on 30 March 2012.

9. My previous involvement with the Tirisano project is the preparation of the following technical reports:
Africa for Etruscan Diamonds (Pty) Ltd., Etruscan Resources Inc., Etruscan Diamonds Ltd. and Mountain Lake Resources Inc." and dated January 30, 2008


11. I have read National Instrument 43-101 and Form 43-101F1, and the Report has been prepared in compliance with that instrument and form.

12. At the date of signature, to the best of my knowledge, information and belief the report contains all the scientific and technical information that is required to be disclosed so as to make the report not misleading.

13. I consent to the filing of the Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Report.

Dated this 23 May, 2012

Signed and Sealed

Tania Ruth Marshall (Dr)

Geological Consultant (Pr. Sci. Nat.)
SACNASP registration number 400112/96

P O Box 6578
Homestead, 1412
Republic of South Africa
Tel/Fax: +2711 828-2989
E-mail: marshall.tania@gmail.com
19.2 Glenn Alan Norton

I, Glenn Alan Norton (Pr. Sci. Nat.) do hereby certify that:

1. I am the Group Technical Manager of Rockwell Diamonds Inc. of:
   Level 0, “Wilds View”, Isle of Houghton
   Cnr: Boundary & Carse O’Gowrie Road
   Houghton Estate, Johannesburg
   South Africa, 2198

2. I graduated with a degree in Bachelor of Science from Rand Afrikaans University in 1998. In addition, I have obtained a Bachelor of Science (Honours) in Geology in 1999.

3. I am a member, in good standing, of the Geological Society of South Africa (GSSA) # 965050 and the South African Institute of Mining and Metallurgy (SAIMM) # 703861 and am also registered with the South African Council for Natural Scientific Professions as a Geological Scientist since 2006 (SACNASP registration number 400042/06).

4. I have worked as a geologist continuously since my graduation from university in 1999. During this period I have been involved, inter alia, in the exploration and exploitation of alluvial diamond deposits throughout Africa.

5. I have read the definition of “qualified person” set out in National Instrument 43-101 (“NI 43-101”) and certify that by reason of my education, affiliation with a professional association (as defined in NI 43-101) and past relevant work experience, I fulfil the requirements to be an internal “qualified person” for the purposes of NI 43-101.

6. As the Group Technical Manager of Rockwell, I am not independent of the issuer in terms of NI43-101.

7. I am the co-author of this report entitled I am responsible for the preparation of this report entitled “Report on the Tirisano Alluvial Diamond Project, (incorporating the Nooitgedacht 131, Hartbeeslaagte 146 and Zwartrand 145 properties), Ventersdorp District, The Republic of South Africa”, for Rockwell Diamonds Inc.(effective date 29 February 2012)

8. As the Group Technical Manager of Rockwell Diamonds Inc, I oversee the corporate strategy with regards to the exploitation of the company’s resources. This includes the day to day mining and long term mine planning. Incorporated in to these duties is also the acquisition of new resources either through exploration or through the purchase of existing resources and operations. It is also part of my duty to ensure that all the company’s resources and rights are maintained in compliance with the exchanges as well as the various governing bodies in South Africa.

9. I visit the Tirisano Mine for a minimum of one day each week.

10. At the date of signature, to the best of my knowledge, information and belief the information asked for in 43-101 section 81 (2) (ii) is accurate and not misleading.
11. I consent to the filing of the Report with any stock exchange and other regulatory authority and any publication by them for regulatory purposes, including electronic publication in the public company files on their websites accessible by the public, of the Report.

Dated this 23 May, 2012

Signed and Sealed

*Glenn A Norton, B.Sc.Hons*

Group Technical Manager (Pr. Sci. Nat.)
SACNASP registration number 400042/06

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