

## South Africa

### South Deep Project

Over the past three years the South Deep Project in South Africa has been transitioning from a construction project, with its primary focus on the installation of major capital infrastructure (building of the mine), to an actual mining project with its primary focus on the development and opening up of the ore body, which is a prerequisite for the production build-up to a long-term steady state level.

During 2013, the project continued its positive build-up trajectory, with gold production improving by 12% from 270,400 ounces in 2012 to 302,100 ounces.

The mission critical destress mining, which is the opening up and preparation of the ore body for actual mining, and is a prerequisite for the more productive long-hole open-stope mining, increased by 24% from 43,350m<sup>2</sup> in 2012 to 53,700m<sup>2</sup> in 2013, which is double the run rate of two years ago. This translates to approximately 77% of the steady state target of approximately 70,000m<sup>2</sup> of destress mining per annum, required to support steady state production.<sup>1</sup>

Reef tonnes mined increased by 26% from 122,495 tonnes per month in 2012 to 154,032 tonnes a month in 2013, against a steady state target of between 300,000 and 330,000 tonnes per month, required to support full production.

During the year, South Deep also made good progress with the right-sizing of its cost base, in line with its current production profile and as a consequence of the transition from a capital infrastructure project to a mining development project. The objective was to create a more cost-effective and fit-for-purpose structure by reducing senior management levels, replacing contractors with own employees, where practical, and optimising all support service costs without impeding the trackless mechanised mining and ancillary engineering capabilities critical to the momentum of the build-up. As a consequence of right-sizing, and the increased production during 2013, the AIC for the project reduced by 41% from US\$2,436/oz in the December 2012 quarter to US\$1,436/oz ounce in the December 2013 quarter.

While the improvements in the key production metrics referred to above were all on a positive trajectory, with gold production in line with guidance provided for 2013, it was determined in August 2013 that the rate of improvement in destress mining was inadequate to support the momentum required for the build-up to a steady state full production run rate of approximately 700,000 ounces per annum by the end of 2016, which was then the target.

<sup>1</sup> Excludes contribution from "crush pillars", the roll-out of which started in 2013 and could effectively increase destress levels by 10% to 15% by reducing the area required to be destressed

## 4.1 Ensuring our mines deliver continued

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On 22 August 2013, we announced that a comprehensive review and re-assessment of the entire project would be undertaken. The aim of the review was to determine those factors that were impeding the momentum of the build-up, and to address them. The exhaustive six-month process was completed in February 2014. As a result of this review, a far-reaching strategy was developed – and is in the process of being implemented – to address all of the issues impeding the momentum of the build-up, identified in the review. These are discussed in more detail below. Based on these interventions and on progress made to date, a revised production build-up schedule was determined for South Deep and announced on 13 February 2014.

In terms of the new build-up schedule, production is expected to increase to a steady state run-rate of between 650,000 and 700,000 ounces per annum, at an AIC (including sustaining capital required to maintain that run rate) of approximately US\$900/oz, by the end of 2017, (assuming an exchange rate of R9.50 = US\$1.00).

The table below shows the new build-up schedule for reef tonnes and ounces, the AIC and capital, as well as destress mining over the next seven years.

### The review

The main conclusions drawn from the project review completed in February 2014, and corroborated through an independent external review, was that the capital infrastructure established at South Deep is world class in every respect. The project has the hoisting, processing, backfill and tailings storage capacity, as well as other ancillary infrastructure, to support steady state full production and life of mine requirements. The quality of the resource modelling and exploration resource definition drilling is world class and reflects in the predictability of the ore body.

However, it had become increasingly evident over the past 12 months, and was confirmed by the project review, that the transition of the project from a construction phase to an operational and build-up phase, with a commensurate increased focus on mechanised mining activities, was constrained by a deficit in the specialised operational and supervisory mining skills and culture required for highly productive, modern, mechanised mining.

In countries such as Canada and Australia, where mechanised mining has a decade long history, mechanised mining skills and culture are in good supply. In South Africa, however, mechanised mining is not widely practiced, certainly not on a scale such as South Deep, and the pool of appropriately skilled and experienced people is very limited. Consequently, employees are typically recruited from the traditional labour intensive mining skills pool, and retrained to operate in the mechanised mining environment.

While this approach has met with some success and there are pockets of excellence on the mine, it is now evident that there remains a skills and culture deficit which impacts on all facets of the mechanised mining process. The main impacts can be categorised in three broad areas:

- Constrained underground ore handling and logistical infrastructure causing bottlenecks in the movement of ore out of the mine
- Less than optimal fleet availability and utilisation caused by inadequate workshop facilities, challenging operating conditions, sub-standard fleet maintenance, poor haulage road conditions, operator skills deficits and poor fleet management, all exacerbated by a lack of real time information systems
- Inadequate operator and technician skills across all levels of the mining process

Figure 4.8: Revised production build-up profile for South Deep

|  | 2014      | 2015      | 2016      | 2017      | 2018      | 2019      | 2020      |
|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Ounces (lower limit) (oz)                            |           | 437,000   | 503,000   | 595,000   | 651,000   | 638,000   | 648,000   |
| Ounces (upper limit) (oz)                            | 360,000   | 467,000   | 537,000   | 635,000   | 695,000   | 681,000   | 692,000   |
| Reef Tonnes (tonnes)                                 | 2,117,000 | 2,568,000 | 2,955,000 | 3,497,000 | 3,826,000 | 3,751,000 | 3,809,000 |
| Destress (excluding crush pillars) (m <sup>2</sup> ) | 54,600    | 62,800    | 58,800    | 70,400    | 71,600    | 69,000    | 70,800    |
| AIC (upper limit) (US\$/oz)                          |           | 1,250     | 1,070     | 930       | 865       | 900       | 835       |
| AIC (lower limit) (US\$/oz)                          | 1,350     | 1,170     | 1,000     | 870       | 810       | 845       | 780       |
| Total capital (US\$m)                                | 158       | 180       | 175       | 170       | 175       | 190       | 155       |

Exchange rate R9.50=US\$1.00

These three factors coalesced to negatively impact productivity across all facets of the mining process and, in particular, for destress mining to be behind schedule in the four new mining corridors in the 'new mine' below 95 level. This in turn is germane to the delay in the ramping up of the highly productive long-hole open stope mining in these areas. Currently only approximately 30% of all reef tonnes mined originate from this mining method while, at steady state, approximately 70% of all reef tonnes will be sourced from long-hole open stope mining.

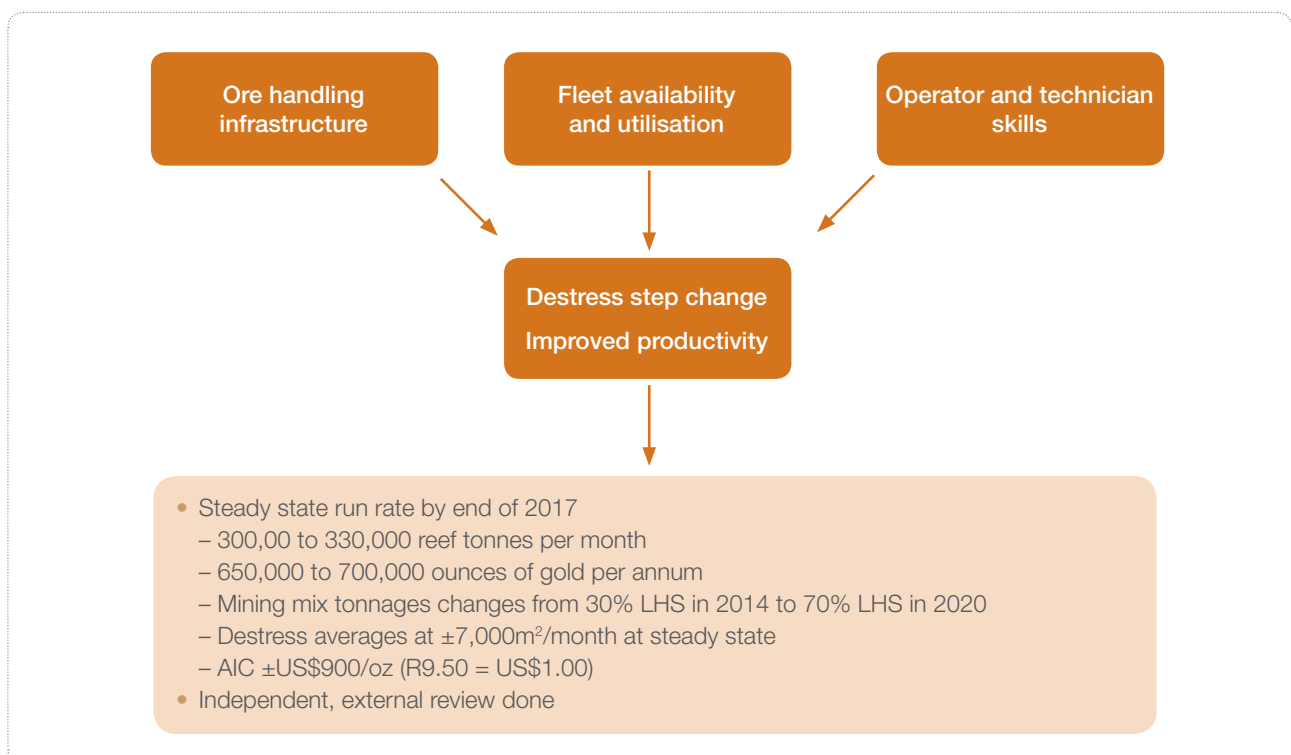
#### De-risking the new build-up schedule

In order to de-risk the new build-up schedule, a comprehensive and wide-ranging intervention has commenced, starting in February 2014. While several components of the intervention are tangible and concrete, such as the commissioning of specific infrastructure by a specific date as discussed below, much of it is less tangible and relates to changes in people behaviour and improvements to systems, procedures, and ways of doing

things. In essence, we will spend much of 2014 on renewing South Deep from the ground up – putting into place the basic building blocks required for success. Unfortunately this means that we may have to sacrifice some of the near-term momentum to secure the medium to long-term promise of this outstanding asset. At the time of writing it is too early to assess the potential impact of this 'renewal' on our short-term targets for 2014.

Central to this intervention is the introduction of 15 mechanised mining specialists from Australia, headed by the seasoned former Agnew General Manager ('GM'), and now South Deep GM, Garry Mills. The team is made up of specialists in all facets of modern, highly mechanised mining and includes, crucially, a specialist in behavioural sciences required for coaching, mentoring and motivation of employees in a mechanised mining environment, and the development of appropriate management and supervisory skills.

Figure 4.9: Addressing the South Deep bottlenecks

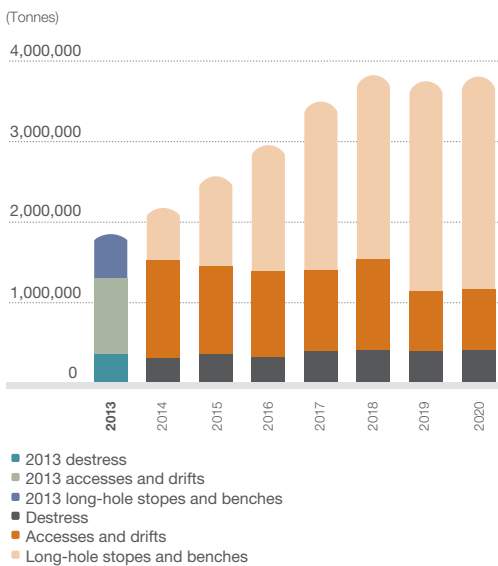


# 4.1 Ensuring our mines deliver continued

This team is integrated with, and working alongside, existing employees, and is focused on helping them to develop the unique mechanised mining culture and mind-set required to succeed, while developing and honing the skills of our operators and artisans through practical, on-the-job training. This intervention has been welcomed by employees and the trade unions alike and is widely seen as a positive step aimed at empowering employees. In order to further enhance productivity, employee relations at all levels in the organisation are being scrutinised to determine areas for improvement. The existing incentive schemes are also being re-designed to provide employees at all levels with greater visibility of and more direct control over their personal earnings power and hence, greater motivation.

A big focus of the strategy to increase mining volumes (from both distress mining and long-hole open stoping) is to de-bottleneck the movement of ore out of the mine. This will be done by engineering out underground ore handling, logistical, and infrastructure constraints and, where required, to fast-track the installation of planned new infrastructure such as ore passes, silos and underground crushers, as well as the upgrading of underground haulage roads.

Figure 4.10: Reef tonnes per mining



The graph shows the build-up schedule of reef tonnes per mining method, and specifically the planned increase of highly productive long-hole open stoping mining, which is the main driver behind the build-up to steady state production. Long-hole open stoping currently provides only 30% of mining volumes. By 2020 long-hole open stoping will account for more than 70% of all mining volumes.

Underground logistics will receive a major boost with the fast tracked commissioning of the new 100 level infrastructure, which includes a major new underground ore silo system which will be completed in 2014. In addition, one new ore pass from 95 level down to 100 level, serving Corridors 3 and 4, will be completed in 2014. This will take the number of ore passes from 95 level down to 100 level, across the four corridors, from three to four. The completion of the new Box 11 in Corridor 1 will also allow the 90 level 1W tonnages to be dropped to 95 level and not transported up to 90 level. As the dual ramping system below 95 level in the 'new mine' is started in 2015, the mine will develop new ore passes for every distress mining horizon, as they progress. These interventions will significantly improve underground ore handling capacity and will reduce the haul distances between current workings and ore passes, with a commensurate improvement in fleet utilisation.

At the core of any successful, highly mechanised mine is the optimal availability and utilisation of its mining fleet. A pivotal cause of sub-optimal fleet availability at South Deep is the inadequacy of its existing underground workshops. In the short term this problem is being ameliorated through the expansion and decongestion of the existing underground satellite workshops, pending the completion early in 2015 of a new large-scale central workshop on 93 level. This new state of the art workshop is expected to significantly improve equipment availability. The amount of heavy mining equipment in South Deep exceeds the amount expected in a mechanised mine of this size and requires rationalisation, the extent of which is still being assessed.

In addition, a comprehensive range of best practice and enhanced fleet maintenance and management practices is being introduced. This includes a focused intervention to improve the skills levels of technicians and artisans responsible for the maintenance of equipment, and that of equipment operators whose operating practices have a direct bearing on equipment availability. It also includes a new 'intelligent' scheduling approach to optimise the deployment of available mobile mining equipment; enhanced equipment replacement schedules; better communication of equipment records; and the roll out of a comprehensive WiFi-based fleet management system.

The revised build-up schedule is based on a life of mine Mine Call Factor ('MCF') that had been restated from 100% to 98%, to reflect the average for the prior 24 months. The revised build-up schedule also reflects historical productivity metrics and is based on productivity levels achieved in 2013, which incorporate, inter alia, prevailing trends in seismicity, fleet availability and utilisation, existing logistical constraints and skills levels. We have also factored in planned improvements in the productivity of our heavy mining fleet over the next four years (2014 to 2017). Simbas have a compound annual productivity growth rate ('CAGR') of 19% over this period, which is not only due to productivity improvements, but also to the progressive change in mining mix to long-hole open stoping (30% long-hole open stoping in 2014 increases to 70% in 2020). Productivity improvements on other rigs, LHDs and trucks have a CAGR ranging between 4% and 8% over the same period.

The production run rates for 2013 have been used as the 'realistic' base rates in the revised build-up schedule, to which the actual 2013 productivity levels referred to above have been applied. In the revised build-up schedule, productivity improvements on these base rates are triggered by the implementation and delivery of the specific de-risking interventions, such as the already scheduled improvements to infrastructure and material handling facilities referred to above; the commissioning of the major new central workshop on 93 level; and, most importantly, the scheduled increase in mining volumes from the highly productive long-hole open stope mining, which will flow from increased destress mining in the four corridors of the 'new mine' below 95 level.

During the production build-up phase the mechanised fleet will be continually optimised to meet specific production requirements and, especially, the significant swing from benching to long-hole open stoping over the next four years. As productivity levels increase it is expected that the number of Category A equipment in the fleet will be reduced to leverage operating costs and overall equipment efficiency levels. The productivity rates quoted above reflect the current plan at a point in time. However, ongoing business improvement means these rates are dynamic and subject to ongoing revision. Any further efficiency improvements have not been factored into the build-up plan.

