

HEEMSKIRK

Announcement



23 November 2016

Heemskirk Mineral Resources and Ore Reserves - 30 September 2016

Heemskirk Consolidated Limited

ASX: HSK
ABN 18 106 720 138

Shares on issue:

562,635,912

Unquoted securities:

Options: 3,152,430
Employee shares: 1,461,808
Partly paid (to 1c, 24c unpaid): 100,000
Partly paid (to 1c, 49c unpaid): 1,500,000

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Website: www.heemskirk.com

Heemskirk Consolidated Limited (ASX: HSK) provides its annual Mineral Resources and Ore Reserves statement as at 30 September 2016.

Estimated Mineral Resources and Ore Reserves of silica at Moberly remain unchanged from last year.



Moberly Silica Deposit (100% owned by Heemskirk)

The Moberly silica deposit occurs on the flank of Moberly Peak approximately 7km north of the regional centre of Golden, British Columbia and about 215km west of Calgary.

The material that is mined at Moberly is the Ordovician Mount Wilson Quartzite unit. Near Golden it reaches a maximum thickness of 480 metres at Horse Creek (less in the mine area) and Mount Moberly is the northern limit of the unit, where it is terminated by a thrust fault. The quartzite is typically grey to buff coloured massive orthoquartzite with some evidence of crudely laminated and cross laminated beds near the base.

At the mine site the geology is simple. Bedding generally strikes around 118° magnetic and is vertical to steeply NE dipping. The rock consists of an orthoquartzite which is variably de-cemented (ie by removal of the silica 'cement' binding the grains) so that most of the mining area consists of 'altered' friable or 'sandy' quartzite to various degrees. There appears to be no systematic variation or control of the de-cementing. The composition of the rock is +99% SiO₂ as quartz, with the remainder being silicate clays and very rare other silicate minerals.

Petrological studies show that the sand grains within the rock vary between 0.841mm to 0.105mm in diameter (20 mesh (#) to 100 mesh (#) on the US scale).

The deposit was mined from the early 1980s to 2009 for silica processed to silica sand for glass making, golf course sand and similar products. Over these almost 25 years, the resource has been exposed and mined over 200m in vertical extent (along bedding), about 800m in strike (along bedding) and over 250m across strike (perpendicular to bedding) and for at least the last 10 years of full scale production, no portion of the pit varied from silica quality suitable for glass making, confirmed by customer analyses undertaken on every shipment. The north-east margin of the quartzite unit has not been exposed in the mine area and the formation can be traced in air photos for at least double the exposed length in the mine area.

Criteria for sand for glass making are SiO₂ +99.5% with Al₂O₃ <0.25%, Fe₂O₃ <0.1% and Cr₂O₃ <0.005%. The Moberly deposit and plant consistently delivered within spec during its operation.

During 2010 – 12 Heemskirk investigated, via an internal pre-feasibility and then a feasibility study (which was updated in early 2015) the possibility of treating the quartzite to produce a 'frac sand' suitable for use in the oil & gas sector as a proppant¹. The studies found the project to be

¹ Frac sand consists of silica sand which, having certain characteristic roundness, sphericity, strength and certain other properties is suitable to act as a proppant in oil and gas wells. Proppants are injected into such wells in order to keep fractures open, allowing the continued free flow of the gas or oil from the reservoir. Frac sand is usually used by customers in certain size brackets, e.g. 20 mesh to 40 mesh, 40 mesh to 70 mesh and 70 mesh to 140 mesh.



economically viable and the project moved to engineering design of a new frac sand plant on the existing plant site and an increased mining rate, within the same mine footprint, with at least a 35 year mine life. The plant engineering is now complete, a finance package agreed to and signed, and construction is underway. Non frac sand residues are saleable either as silica flour (with additional treatment) or as additives for cement making.

Recoveries in test work incorporating a lab scale commercial mixer unit were up to 80% 30# -140# but the Competent Person settled on 70% recovery of 30# to 140# for the estimation of Resources and Reserves to allow for uncertainties in applying the mixers and other processing parameters at full scale. The coarse cut-off for frac product was set at 30# due to the presence of a proportion of grain 'clusters' in the 20# to 30# fraction in the lab scale mixer test work.

Frac sand is defined within a range of qualities (such as grain size, roundness, sphericity, acid solubility, turbidity, crush resistance and conductivity), each measured to ISO or API (American Petroleum Institute) specifications, rather than a single pass/fail specification. Customers specify the range of each quality that is acceptable for their particular use at a particular time (ie well depth, well location, availability of other product, well logistics).

Estimated Mineral Resources and Ore Reserves of silica at Moberly have not changed from last year within the significant figures reported on. Approximately 78,000 tonnes of silica was mined and placed on a stockpile in the pit area. Of this, 47,000 tonnes was hauled to a ROM stockpile at the plant site to be available for plant commissioning in 2017.

As noted above, the estimated recovery of frac sand from the silica ore is 70% to 30#-140# frac sand.

Resources and Reserves of silica at Moberly in 2016 are again reported separately for the traditional markets of Moberly silica – firstly for frac sand (with residues suitable for cement making or further processing into silica flour as an additional resource) and also for glass making. These estimates are largely for the same area of the deposit, but utilising different processing routes and end markets. Therefore the resource estimates are not additive, but rather alternatives to one another. Due to the simplicity of the geometry of the resource blocks, traditional cross-sectional techniques were used in the base estimation in previous years (and unchanged here), based on volumes estimated from AutoCad applied to a digital terrain model (DTM) of the deposit and a 35 year Mine Plan.

Ore Reserves and Mineral Resources this year are again estimated as at 30 September, to align with Heemskirk's financial reporting date.



A. Silica for frac sand, frac sand residues and silica flour markets

These Resources and Reserves are for an alternative processing route and market to the glass sand and other products reported in Section B. Resources and Reserves presented in this Section A are therefore not additive to those presented in Section B but rather are alternatives.

In-situ silica destined for the frac sand market has an estimated 70% yield to 30 mesh to 140 mesh sized sand, with the balance (frac sand residues) suitable for cement additives or further processing to silica flour for high temperature cement additives. Therefore the frac sand is expressed as a tonnage and percent frac sand yield, with the frac sand residue Mineral Resource expressed as *in-situ* tonnage.

Table 1: *In situ* Estimated Mineral Resources of silica suitable for frac sand, at 30 September 2016

Resource Category	Dry tonnes (millions)	
	2015	2016
Measured ^{**}	12.5 million tonnes @ 70% frac sand [#]	12.5 million tonnes @ 70% frac sand [#]
Indicated ^{**}	25.0 million tonnes @ 70% frac sand [#]	25.0 million tonnes @ 70% frac sand [#]
Total Measured + Indicated^{**}	37.5 million tonnes @ 70% frac sand[#]	37.5 million tonnes @ 70% frac sand[#]

* Mineral Resources for frac sand include that proportion modified to produce Ore Reserves of frac sand.

30 mesh to 140 mesh

^ Frac sand Resources are not additive to Resources for glass making etc

Columns may not add up due to rounding

Mineral Resources of silica suitable for frac sand are unchanged from the previous year; less than 100,000 tonnes of silica was mined and all of this has been retained on stockpiles either at the pit or at the plant.

Residues from the production of frac sand (ie -140 mesh) are suitable for use as cement additives, or further processing to silica flour for high temperature cement additives, so the following Mineral Resources for frac sand residues are in addition to the Mineral Resources for frac sand.



Table 2: *In situ* Estimated Mineral Resources of silica as frac sand residues, at 30 September 2016

Resource Category	Dry tonnes (millions)	
	2015	2016
Measured ^{*^}	3.8	3.8
Indicated ^{*^}	7.5	7.5
Total Measured + Indicated^{*^}	11.3	11.3

* No proportion of these Resources are contained in the frac sand Ore Reserves below

[^] Frac sand residue Resources are not additive to Resources for glass making etc

Columns may not add up due to rounding

Resources of frac sand residues are unchanged from the previous year; less than 100,000 tonnes of silica was mined and all of this has been retained on stockpiles either at the pit or at the plant.

A Feasibility Study in 2012 found the Moberly frac sand project to be economically robust at 64% recoveries and other assumptions at the time. The Feasibility Study was updated in early 2015; incorporating increased expected recoveries following a change in plant design and equipment and updating capital and operating costs. The market for frac sand has softened in the past year, but discussions with potential off-takers indicates that prices will remain satisfactory. Recent updates to the economic model continue to demonstrate that the project yields an attractive NPV and IRR.

In the past year the mine haul road has been significantly upgraded to dual lane operation, on a year-round basis if needs be (for the foreseeable future, only Summer and perhaps 'shoulder' seasons will be used for trucking). A finance package for construction has been drawn down as required and at the time of writing, construction of the new frac sand plant and load-out facilities is well under way.

All permits to produce frac sand are in place, except for an amendment to the one pertaining to dust emissions. The amended permit is not required until production commences and Heemskirk is confident that the amended permit will be issued. An Operating Permit to use treated on-site bore water as potable supply is required, and again, Heemskirk is confident that this will be issued, although the project could operate without it.

From the estimated Mineral Resources for frac sand were estimated the following Ore Reserves of frac sand. These are contained within a fully permitted and engineered pit of 35 years duration at a mining rate of 400,000 tpa. Frac sand residue Resources have not been converted to Ore Reserve status.



Table 3: Estimate of Ore Reserves of silica suitable for frac sand, at 30 September 2016

Reserve Category	Dry tonnes	
	2015	2016
Proved [^]	9.3 million tonnes @ 70% frac sand [#]	9.3 million tonnes @ 70% frac sand [#]
Probable [^]	4.6 million tonnes @ 70% frac sand [#]	4.6 million tonnes @ 70% frac sand [#]
Total Proved + Probable[^]	13.9 million tonnes @ 70% frac sand[#]	13.9 million tonnes @ 70% frac sand[#]

[^] Frac sand Reserves are not additive to Reserves for glass making etc

[#] 30 mesh to 140 mesh

Columns may not add up due to rounding

Ore Reserve tonnages of silica for frac sand are unchanged from the previous year; less than 100,000 tonnes of silica was mined and all of this has been retained on stockpiles either at the pit or at the plant.

B. Silica for glass sand and silica flour markets

These Resources and Reserves are for an alternative processing route and market to the frac sand reported in Part A. Resources and Reserves presented in this Section B are therefore not additive to those presented in Section A but rather are alternatives.

In-situ silica for glass making sand and silica flour yields 100% saleable product and so is expressed as *in-situ* tonnes.

Table 4: Estimated Mineral Resources for silica for glass making and golf course sand, silica flour markets at 30 September 2016

Resource Category	Dry tonnes (millions) of silica product	
	2015	2016
Measured*	25.0	25.0
Indicated*	25.0	25.0
Total Measured + Indicated*	50.0	50.0

* Mineral Resources include that proportion modified to produce Ore Reserves.

Columns may not add up due to rounding

The tonnage of Mineral Resources of silica to produce sand for glass making etc is unchanged from the previous year; less than 100,000 tonnes of silica was mined and all of this has been retained on stockpiles either at the pit or at the plant.



From the above *in-situ* Mineral Resources were estimated the Ore Reserves given in Table 5. These are contained within a fully permitted and engineered pit of 35 years duration at a mining rate of 400,000 tpa.

Table 5: Estimated Ore Reserves for silica suitable for glass making sand and silica flour markets at 30 September 2016

Reserve Category	Dry tonnes (millions) of silica product	
	2015	2016
Proved	13.2	13.2
Probable	0.7	0.7
Total Proved + Probable	13.9	13.9

Columns may not add up due to rounding

Ore Reserve tonnages of silica for glass making are unchanged from the previous year; less than 100,000 tonnes of silica was mined and all of this has been retained on stockpiles either at the pit or at the plant.

The information in this report that relates to Mineral Resources or Ore Reserves is based upon information compiled by Malcolm Ward, BSc (Hons), MSc (Queen's), who is a Fellow of the Australasian Institute of Mining and Metallurgy.

Malcolm Ward is employed by and is Principal of Mining Advisory Pty Limited. Malcolm Ward and Mining Advisory Pty Ltd are retained under contract by Heemskirk to provide geological and other services, including the estimation of Ore Reserves and Mineral Resources. The work on Ore Reserves and Mineral Resources is undertaken independently. No remuneration is contingent on the outcome of that aspect of work and Heemskirk is not permitted to review or comment on the Ore Reserves and Mineral Resources estimate and accompanying technical documentation during preparation and afterwards may only comment on the report to correct errors of fact.

Malcolm Ward has sufficient experience which is relevant to the style of mineralisation and type of deposit under consideration and to the activity which he is undertaking to qualify as a Competent Person as defined in the 2012 Edition of the 'Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves'. Malcolm Ward consents to the inclusion in the report of the matters based on his information in the form and context in which it appears.