MAYDENA SANDS PTY LTD

ACN 111 938 428 ABN 65 111 938 428

RETENTION LICENCE NO. 2/2003

MAYDENA, TASMANIA

ANNUAL REPORT

TO

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ABSTRACT

As a result of that country's economic slowdown, the glass industry in China was negatively impacted during the year, with the architectural glass sector particularly hard hit. Several major producers were forced to severely reduce output.

By way of contrast, the niche sector of display glass shows signs of growth in the low, single digit percentages. A bright spot on the horizon is the potential increase in demand for cover glass and silicon in PV manufacture due to greater focus on renewable energy, including photovoltaic cells, as a result of the recent Paris conference on climate change abatement. Further opportunities for high quality glass are emerging for glass substrates for semiconductor manufacturing.

Although this year's marketing activities were focused on China, enquiries were received not only from other countries in East Asia, but also from Europe and Australia for product across a range of different applications

Continuing improvements by TasRail, the extension of the Tasmanian Freight Equalisation Scheme to assist with transhipment costs of containers via mainland ports, the fall in global oil prices and the lower Australian dollar, all benefit the Maydena Sands project.

Optimisation tests focused on the removal of carbon particles from the sand feed gave a high purity product of 10ppm Fe_2O_3, the best result so far in this series of tests.
Added to this is the successful outcome of a lab-scale trial to produce sodium silicate from silica flour feed.

Keywords:

Maydena; Silica flour;
Silica sand; Carbon;
Sodium silicate; Marketing;
Logistics.

C O N T E N T S

1. INTRODUCTION

This report outlines activities by Maydena Sands Pty. Ltd. during its tenth year of tenure of Retention Licence 2/2003, granted for a four year period to 9.01.2008 and then renewed annually to 09.01.2015.

This tenement has its origins in EL 17/1998 of 7sq.km previously held and operated by J.J. McDonald &Sons Mining Pty. Ltd. The current tenement of 4sq.km is located just south of the sealed Gordon River road approximately 4 km west south west of Maydena (pop. 250 approx.) and about 90 km by road from Hobart (Fig.1). There is good access to and within the prospect area. Power, water, housing and basic facilities are readily available from within a short radius of the prospect. The last few years saw the progressive upgrade of the narrow gauge New Norfolk-Maydena rail line to passenger standard but only as far as the entrance to the Mt Field National Park. After a recent assets review, TasRail resolved to hand over the Derwent Valley Railway line west of Boyer to tourist and heritage operators in a deal yet to be finalised. In this context, mooted upgrades to freight standard of the entire stretch are now highly unlikely. An alternative rail loading facility, a major freight hub at Brighton, approx. 65km by road east of Maydena has been completed and is now fully operational. A 700m long gravel airstrip is located 3 km north west of the silica sand deposit.

The primary target for investigation, assessment and eventual exploitation remains the deposit of silica sand and its silica flour matrix located largely to the west of the Eastern Quarry, about 1 km south east of Pine Hill (Fig.2).

The overall aim of the investigations is to determine if a commercially viable operation can be established, based on products derived from the silica flour, silica sand and silica rock resource in the tenement and on various, changing economic factors.

In view of the growing use of solar power locally and overseas, interest was also maintained in the silica rock potential of the tenement. This raw material, if of sufficiently high quality, is used in the production of high purity silicon metal, an essential component of photovoltaic solar cells. Also of potential interest is the coarser, higher purity sand fraction for use in the manufacture of technical glass, optical glass and solar cell cover glass with high light transmissivity characteristics.

2. PREVIOUS WORK

Exploration by Pioneer Silicon Industries Pty. Ltd. in 1988/89 identified a lag deposit of hard silica rock at the Western Quarry containing a small resource of material deemed suitable for the manufacture of silicon. (Fig.2). From this, approximately 19,500 tonnes of crushed, screened silica rock was produced in 1991 and 1992 for shipment, of which some10,000 tonnes were consigned to Pioneer's silicon smelter at Electrona and about 9,500 tonnes went to Temco's Bell Bay ferrosilicon plant. Extraction, by Duggans Pty. Ltd. under M.L.1396 P/M, virtually ceased upon closure of the Electrona smelter south of Hobart in 1992, although a small parcel of 850 tonnes of silica rock is reported to have been mined in 1995. At the end of the earlier exploration work, a small cutting of white silica sand, first exploited in the 1970s by ANM (now Norske Skog), was located between Pine Hill and the Styx Road in an area now known as the Eastern Quarry Area. Pioneer investigated this deposit in the vicinity of the Eastern Quarry by 23 shallow RC drill holes. Preliminary estimates suggested a resource in the order of some 0.75 – 1.5 million cu. m. of mostly low iron silica sand containing about 10% of high quality lump silica. Pioneer terminated operations at Electrona before any of this latter material could be used for silicon production.

Assay results from a number of subsequent, excavator generated samples by the North West Bay Co. Pty. Ltd. from a number of shallow pits supported the high quality of the resource and, together with sizing determinations on a bulk sample, indicated that the sand might be suitable for the manufacture of table ware glass.

During its tenure of EL 17/1998, which contained these deposits, J.J. McDonald & Sons Pty. Ltd., using the air core drill sampling method, completed 43 drill holes totalling 553 m which outlined a raw material resource of about 6 million tonnes of loose silica ranging in size from very coarse to very fine.

The drilling also demonstrated that the deposit is more variable, complex and higher in iron oxides and other impurities than previous data suggested.

Laboratory sizing determinations indicated that the deposit is a possible source of silica flour as well as glass sand, while geological mapping and interpretation pointed to a small resource potential for hard rock silica as well.

Preliminary bench scale beneficiation and bulk sample processing tests, including acid wash tests on samples of the glass size fraction sand, showed that the -250 micron fraction could be upgraded to a high quality product containing only about 50ppm Fe_2O_3 without major environmental impact, with levels of iron as low as 10ppm a possibility.

Sources of good quality limestone and dolomite were noted in relative proximity to the silica sand deposit for eventual acid neutralization uses.

The company's activities in the marketplace identified the natural silica flour as potentially the deposit's most important component economically. This material provided the major focus for ongoing geological, processing and marketing activities, though the coarser size sand fractions and the hard-rock silica potential remain of interest for future attention under the appropriate market conditions.

In early 2004, EL tenure over the area was converted to a Retention Licence

In late 2004, Directors of J.J. McDonald & Sons Mining Pty. Ltd. formed a new holding and operating company, Maydena Sands Pty. Ltd., to which the Retention Licence and all of the former company's interests in the Maydena area were transferred in April 2005.

Since then, all activities are being conducted under the new Company name.

Details of past activities and outcomes are provided in reports listed in Sections 7 and 8 below.

3. ACTIVITIES FOR PERIOD

These included:

3.1 Work Done

- Geological – all available drill samples were weighed for QA/QC purposes, with attempts to calculate recoveries.

- Beneficiation:

  Additional work completed to finalise assessment of applicability of IPJ system to "heavies" contaminant removal from the silica sand feed.

  Further tests to improve removal of carbon/organic particles from silica flour and sand feed using spirals.

  Wet table test to remove carbon and "heavies" from silica flour and sand feed.

  Acid leach tests on end products of spiral and wet table tests.

  Bench-scale production of sodium silicate using silica flour from wet table tests.

- Market related activities:

  Ongoing market monitoring – silica sand, silica flour, display panels, technical glass and polysilicon for PV applications.

  Attendance at several events including:

  - Semicon/FDD 2015 Exhibition – Shanghai, China
  - China Glass 2015 Exhibition – Beijing, China
  - Gulf Glass 2015 Exhibition – Dubai, UAE
  - Australia-China Business Week 2015 - Hobart

In addition, Contacts or Meetings with a number of companies listed in Section 4.4.4.

- Project Planning and Feasibility:
  - Participation in Tasmanian Freight Equalisation Scheme (TFES) Forum
  - Engagement with Draft TFES Scheme – Ministerial Directions
  - Occasional update contact with Toll Tasmania re the logistics scene in Tasmania and seaborne shipping costs for several overseas destinations
  - Contacts with ANL re logistics and seaborne shipping costs
  - Meeting with TasPorts re port facilities
  - General monitoring of transport logistics – Including TasRail upgrade progress.
  - Monitoring progress towards direct shipping to Asia from Tasmanian ports, especially Bell Bay

- Community relations:

  Occasional contacts with Maydena Development Association.

- Environmental

  No action required.

3.2 Statistical Summary

Test Samples Generated:

Jiangsu Pacific Quartz Co. Ltd.	:	3 x 1Kg
Shanghai Dawnlite Electronics Tech. Co.	:	3 x 1Kg
Schott Jena Glass GmBH	:	2 x 3Kg
LG Chem Ltd.	:	2 x 3Kg

Test Samples Analysed:

No. of Samples Analysed	:	45 (approx.)
No. of Analyses	:	479 (approx.)

3.3 Expenditure

To Dec 2014 (RL Tenure only)	:	$1,094,384.00
Period Jan – Dec 2015		
(Including Oct – Dec 2015 Estimate)	:	$78,300.00 (approx)
Estimated Cumulative Total		
for period of RL Tenure (to Dec 2015)	:	$1,172,684.00 (approx)

3.4 Tenure

Application for a 1sq km reduction of the tenement was approved towards the end of the year. The area relinquished is shown in Fig.3. A separate Partial Relinquishment Report was prepared and submitted.

4. RESULTS

4.1 Geological

4.1.1 Drill Sample Recovery

For QA/QC purposes, and in line with recent, stricter requirements under the JORK Code, efforts were made to assess sample recovery for previous drilling holes DH69-DH130. This was attempted by weighing the remaining sample material collected over 1m intervals and adjusting, where possible, for material removed for assaying and for various beneficiation tests. Each result was compared to a calculated theoretical volume over 1m interval.

Remaining weights showed considerable variation and results were rendered more unreliable due to uncertainty of quantities of material previously removed. Due to these variations and uncertainties, there is doubt about the accuracy and usefulness of the determinations made at this late stage of the drilling phases.

4.2 Beneficiation

4.2.1 IPJ Test

Work completed followed up on some recommendations emanating from test work undertaken in 2014 by GEKKO of Ballarat, Vic. The overall objective of this work was to determine if GEKKO's In-Line Pressure Jig (IPG) could separate contaminant "heavies", including iron minerals from the silica sand. (Krummei. 2014. Appendix 5). Results of this subsequent test work are presented in GEKKO's Executive Summary (Appendix 1, This Report).

The results essentially indicate that the IPG system would not achieve the yields and high levels of purity required by the market for low iron, high purity silica sand and flour.

Further IPJ test work has been discontinued.

4.2.2 Carbon Removal - Spirals

This additional follow-on test work was undertaken on the recommendations based on investigations carried out in 2013 and 2014. (Krummei 2013, 2014). The objective was to determine if carbon removal could be enhanced by desliming the feed and using 7-turn spirals. Details of the test work are given in Appendix 2. Despite the promise of the earlier test work, spirals did not prove fully effective in the removal of the visually unattractive carbon from either the severely contaminated or the higher grade material. This also resulted in higher than expected levels of residual chemical contamination, such as iron (Appendix 2).

4.2.3 Carbon Removal – Wet Tabling

Consequent upon the failure to achieve improved end product using spirals, it was decided to undertake a test using a wet table on the concentrate fraction from the spiral tests. This approach proved successful to the extent that it yielded end product of 70ppm of Fe_2O_3 from the heavily contaminated feed with further improvements to 60 ppm Fe_2O_3 achieved by oxalic acid leaching which also reduced the levels of TiO_2, Al_20_3 and MgO.

Even better results were achieved using the higher grade sample, where acid leaching of the table concentrate using both oxalic and citric acid reduced Fe_2O_3 levels from 30ppm to 10ppm. The latter is the best result achieved in this series of tests. Corresponding reductions in other impurities were also evident. (Appendix 2).

4.2.4 Sodium Silicate

The Sodium Silicate test was undertaken in the light of several enquiries over the last two years for a supply of silicate flour or sand for the production of sodium silicate. The Maydena Sands end products achieved from this experiment were well within the required physical and chemical specifications provided.

This production test was done using a pressure autoclave at laboratory scale.

The result was a high grade sodium metasilicate solution (Appendix 3) for which markets appear to exist in Australia and overseas at the appropriate price.

4.3 Project Planning

4.3.1 Logistics

Road:

In the shorter to medium term, the use of the road transport system to deliver product from mine to port (Bell Bay) becomes less attractive as a result of proposed upgrades to the Midland Highway from Brighton to Launceston, with consequent traffic disruptions and delays. These works are planned to be undertaken over the next few years. This enhances the attractiveness of using rail to move product by rail from the Brighton Transport Hub to Bell Bay, the Port of Burnie or even Hobart for outward shipment.

Rail:

In the light of the foregoing, reliable and efficient rail freight facilities remain critical to the Maydena Sands Project, offering a value proposition competitive with road transport. TasRail is performing better than anticipated as evidenced by a return of customer confidence demonstrated by the volume of freight now being hauled on rail.

In its Annual Report for 2014/2015, TasRail states that delivery and commissioning of the new rolling stock is complete and that the performance of the new wagon fleet has been outstanding. There is strong focus on customer service and price competitiveness, with TasRail estimating to have hauled 68% of all freight on the Brighton to Burnie corridor in 2014/2015. There were only two derailments during the year, one of which was due to faulty track geometry, a significant improvement on past years.

TasRail's multimodal terminal at the Bell Bay Major Industrial Zone is now fully operational, offering an improved range of freight logistics services. In addition, capital works on the Burnie Port Optimisation Project are in progress and intermodal services to Devonport have been reinstated.

These developments are likely to provide an important space for TasRail within the logistics scene in Tasmania.

Ports:

The expanded Tasmanian Freight Equalisation Scheme is likely to encourage an increase in container shipments to and from Tasmania, with consequent impacts on Tasmanian port facilities at Bell Bay, Burnie and Devonport. In this context, the completion of the Bell Bay Intermodal Terminal at Georgetown, capital works on the Burnie Port Optimisation Project and resumption of rail service to the Port of Devonport are welcome developments, as they will facilitate more efficient movement of containers. However, much of this freight is still likely to be transhipped to overseas destinations via the Port of Melbourne, including a recently introduced service by Swire for shipments from Hobart to East Coast mainland ports. A welcome development during the year was the long awaited introduction of direct shipping services from the port of Bell Bay to several East Asian ports by Swire (every three weeks) and MSC (every two weeks). DP World, in conjunction with Chinese interests, is looking to developing better port facilities at Burnie.

4.4 Marketing

The main focus remained on TFT-LCD and other display and touch-screen glass, optical, technical and solar cell cover glass, though silica flour for the manufacture of sodium silicate and applications in the electronics industry was added to the mix.

The PV polysilicon industry was again monitored in the light of recent global attention to non-polluting energy generation.

4.4.1 Overview – Polysilicon

Many major PV panel producers, the major users of solar polysilicon, report increased production for the year mainly in response to strengthening global solar energy demand due to the revolution in energy conservation. Forecasts are generally bullish in the light of a global move towards "clean" energy production. Despite this optimism, and increasing demand for solar cells, polysilicon for the manufacture of PV panels remains in oversupply which is predicted by both PV polysilicon and solar panel producers to extend into the near future at least. This glut is due to continuing overproduction and in part also to dumping of silicon onto the Chinese market. Consequently, spot prices dropped from around US$22/Kg at the end of 2014 to just below US$15/Kg in November 2015 and fluctuated to between US$18 – US$11on the Chinese market. Very few, if any, polysilicon producers are profitable at these prices. This commercial scenario continues to deter establishment of a silicon smelter in Tasmania, based on the Siemens process or its variants.

4.4.2 Overview – Display Glass

According to Corning, global market leader for substrates for display screens,, touch screens and appliance cover glass, the market in 2014 through 2015 remained steady, with a slight overall increase in the low percentage digits evident. Different types of this robust cover glass for applications such i-phones, i-pads and similar uses are increasingly in demand, though saturation levels and levelling off in demand are expected in the medium term.

In the semi-conductor field, glass substrates are emerging as a key enabler of various functionalities. The latter field is broad, highly diversified and has gained considerable interest from the semiconductor industry in recent years. The substrates are of interest due to the surface flatness and the attractive electrical, physical and chemical properties of glass, as well as its ability to provide cost-efficient solutions. According to French consultancy Yolle Developpement, the glass wafer market is expected to grow from a current US$158m. to US$1.3b. by 2018. This growth will most likely be driven, over the next five years, by Wafer Level Packaging platforms, the emerging glass-type 2.5D interposer and the carrier wafer.

4.4.3 Other

There is demand, driven in part by a supply monopoly and in part by diminishing reserves, for ultra high purity silica quartz or quartz sand/flour for the manufacture of quartz crucibles used to grow silicon ingots for upgrade to computer chips, wafers for semiconductor or PV application and sapphire ingots for sturdy cover glass. The quality requirements demand at least 99.99% SiO_2 or better, with minimal, or preferably nil, content of solid, liquid or gaseous inclusions as these can affect the physical stability of crucible walls.

Sodium silicate, or "water glass", has a wide range of industrial uses (see Wikipedia) with a growing market and increasing demand for which Maydena Sands could provide suitable raw material, subject to commercial pricing. This market opportunity will be explored in 2016.

4.4.4 Marketing Activities

TasInvest Forum - Hobart

This one-day event in March 2015 followed on from a similar gathering in November 2015 in the wake of the Chinese President's visit to Tasmania. Attendance numbers were significantly lower than at the former event. There appeared to be no significant interest in investment in mining, with the main focus again mainly on agriculture, aquaculture, tourism, construction and services. Several general, service-related contacts resulted.

Semicon/FPD China 2015 - Shanghai

This large trade exhibition focused on showcasing the broad range of products, producers and production equipment in the semiconductor industry. Of direct interest were producers of quartz crucibles using IOTA standard, ultra high purity quartz sand and flour. 3 X 1kg samples of silica flour, silica sand and silica rock sent to Jiangsu Pacific Quartz for testing as to their applicability for the manufacture of crucibles, were rejected mainly on the basis of higher than acceptable inclusions of gasses and liquids. On the basis of these negative results, approaches to several other quartz crucibles producers were deferred.

3 X 1kg samples of silica flour, silica sand and silica rock were sent to Shanghai Dawnlite Electronics Tech Co Ltd for assessment to use for thin film cover glass for mobile phones, tablets etc. Although comparable in quality to material currently used, the materials were rejected on price considerations.

Contact was re-established with NEG of Japan, third largest producer of TFT-LCD glass substrates. In a new development, glass substrates for semiconductor manufacturing are reported to be gaining traction and considered a growth area. This new trend will be further investigated at Semicon/FPD 2016.

China Glass 2015 - Beijing

Compared to previous years, the mood at this year's annual, large trade exhibition was somewhat subdued due to the overall downturn in the glass industry in China, which impacted on suppliers to the industry as well. Particularly hard hit as a result of the downturn in the Chinese construction boom is the flat glass industry supplying architectural needs, where some producers are said to have cut production by as much as 50%. The negative sentiments generated by this trend exert a dampening effect on attitudes to investment. New contacts made were Avic Glass (Hainan) and AGC (Dalian). TG Tianjiu Glass Co of Taiwan specialises in a variety of glass products using low iron silica. Contacts were renewed with Innoceram, Cencera Corporation and Ruitai. These companies use high purity silica for the production of fused silica and refractories.

Gulf Glass 2015 - Dubai

Participation in this exhibition resulted in several potentially useful contacts including Avic (Sanxin) of China, SORG of Germany and Sibelco Europe. Renewed contact with Italian sand and raw material producer Minerali Industriali introduced that company's proprietary magnetic separator and high pressure roll mill. Both these units may be relevant to the Maydena Sands project in the future. The near-term applicability of the magnetic separator is under assessment.

Of some concern is the emergence of possible competitors in the low iron sands business from Al-Rasheed Company of Saudi Arabia and MULTIMIN of Egypt, both of which promote product assaying 120ppm Fe_2O_3.

Other

Among enquiries dealt with for various volume of product or meetings attended were:

- Mountsharp International Pty. Ltd – Brisbane – Sodium Silicate
- IFSIF Associates – Bangladesh – Silica Sand
- Quingdao Elite General Co. - China – Silica Flour/Sand
- Arc Crystal - UAE – Silica Sand
- Schott – Germany – Silica Flour and Sand
- LG Chem – S. Korea – Silica Flour and Silica Sand
- NEG – Japan – Silica Flour
- Avic Sanxiu – China – Silica Flour and Silica Sand
- OJing Quartz Crucible – China – Quartz Sand
- Jiangsu Pacific Quartz Co. Ltd – China – Silica Flour, Sand, Rock
- Shanghai Dawnlite Electronics Tech.Co.Ltd – China – Silica Flour, Sand, Rock
- Shanghai Qianghua Quartz Co.Ltd – China – Silica Flour
- Pathen Australia Pty. Ltd. – Australia – Silica Sand

Among the more unusual requests for sand was for equestrian use, building materials research and sodium silicate production.

4.5 Environmental

This year's activities had no environmental impacts.

4.6 Rehabilitation

No rehabilitation was necessary.

4.7 Community Relations

Occasional contacts with members of the Maydena Development Association were maintained.

5. CONCLUSIONS AND RECOMMENDATIONS

- In the light of stricter JORC Code provisions, close attention needs to be given to sample recovery determinations in future drilling campaigns at this and other silica sand deposits.

- GEKKO's In-line Pressure Jig is not applicable to the upgrade of the Eastern Quarry sand to the required standards.

- Compared with the use of spirals, wet tabling of sand feed to remove carbon particles, followed by oxalic and citric acid leach, gave excellent results.

- Rail transport facilities in Tasmania continue to show improvement but are offset by proposed road-works along stretches of the Midland Highway.

- The establishment of regular shipping services from the Port of Bell Bay to Asia is a welcome development, as is the recent introduction of a regular shipping service from the Port of Hobart to mainland ports.

- The expansion of the TFES Scheme is a significant game changer for container shipments in and out of Tasmania to mainland ports.

6. PROPOSED FUTURE ACTIVITIES

- Investigations into reducing the levels of CaO, MgO and Al_2O_3 in end products silica flour and silica sand.
- Further tests to maximise carbon free silica flour and sand recovery using wet tabling.
- Undertake tests to compare the relative effectiveness of wet tabling and upward flow classification in the removal of carbon and other contaminants
- Progress quarry and process plant design, site layout and capex/opex estimates.
- Continue work towards determining a reliable mine gate FOB and CIF product price.
- Continue with product awareness and marketing, including attendance at China Glass 2016 and Semicon/FPD China 2016 trade shows.
- Follow up activities on 2015 market contacts, enquiries and opportunities, with the aim to secure off-take arrangements.
- Continue monitoring logistics support systems in Tasmania.
- Maintain contact with State and Local Regulatory Authorities, as well as local community associations, groups and individuals on project related matters.

7. REFERENCES

Barnes, R. et al.	2013	Maydena Sand Mine Project: Ecological Assessment and Recommendations. SEMF Report for Maydena Sands Pty. Ltd.
Keserue-Ponte, F.	2013	Maydena Sands – Base Line Water Summary. SEMF Memorandum.
Krummei, G.K.	2004	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2005
Krummei, G.K.	2005	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2006
Krummei, G.K.	2006	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2007
Krummei, G.K.	2007	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2008
Krummei, G.K.	2008	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2009
Krummei, G.K.	2009	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2010
Krummei, G.K.	2010	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2011
Krummei, G.K.	2011	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2012
Krummei, G.K.	2012	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2013
Krummei, G.K.	2013	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2014
Krummei, G.K.	2014	Retention Licence No. 2/2003, Maydena, Tasmania. Annual Report to 09.01.2015
Krummei, G.K.	2015	Retention Licence No. 2/2003, Maydena, Tasmania. Partial Relinquishment Report – November 2015

McIntosh, et.al.	2012	Late Quaternary extraglacial cold-climate deposits in low and mid-altitude Tasmania and their climatic implications. Geomorphology 129, p. 21-39.
McIntosh, P.D.	2013	Maydena Sands Investigations. Contract report for Maydena Sands Pty Ltd. September 2013. Forest Practices Authority, Hobart.
Productivity Commission	2014	Tasmanian Shipping and Freight Australian Govt Productivity Commission Report 2014.
TasRail	2013	Annual Report 2012-2013
TasRail	2014	Annual Report 2013-2014
TasRail	2015	Annual Report 2013-2015

8. BIBLIOGRAPHY

Bear, I.J.	1975	Technical Note on the identification and Removal of Stain from Zircon Concentrates: AusIMM Proc.No.256 pp 29-31
Calver, C.R.	1990	Limestone Resources of the Maydena-Florentine Valley Area: Tas. Dept. of Mines Report 1990/06
Calver, C.R.	1992	Maydena DDH 1 – Appraisal of the Limestone Resource at Risbys Basin: Tas. Dept. of Mines Report 1992/03
Calver, C.R. & Forsyth, S.M.	1999	Maydena, Tasmania; Digital Geological Atlas, 1:25,000 Series: Tasmanian Geological Survey
Eberhard, R	1994	Inventory and Management of the Junee River Karst System, Tasmania; Forestry Tasmania Report
Forster, M.C.	1992	E.L. 14/88 Maydena, Annual Report – Year 4
Forster, M.C.	1993	E.L. 14/88 Maydena, Annual Report – Year 5
Forster, M.C.	1994	Maydena – Tasmania, Pine Hill High Grade Silica, June 1994
Hansard.	2011	House of Assembly – Government Business Scrutiny Committee – TasRail – 08.12.2011
Hofmann, T.	2009	Applications, Requirements and Trends in the Solar Glass Market. In “Glass Worldwide”, November 2009, p.74.
Houshold, L	1992	Risbys Basin Karst Area – Preliminary Investigation of Geomorphic Features and Cave Fauna. Dept. of Parks, Wildlife & Heritage Report.
Hughes, T.D.	1957	Limestones in Tasmania; Geol. Surv. Tas. Bull. 10
Hughes, T.D. & Everard, G.B.	1953	Limestone Deposits of the Maydena Area; Geol. Surv. Tas. Unpubl. Rept.
Jones, P.A.	1989	Exploration Licence No. 14/88, Maydena, Tasmania. Progress Report on Exploration Activity. 5th August 1988 to 5th July 1989.
Krummei, G.K.	1999	Exploration Licence No. 17/98, Maydena, Tasmania. Annual Report to End September 1999.
Krummei, G.K.	2000	Exploration Licence No. 17/98, Maydena, Tasmania. Annual Report to 04.09.2000.

Krummei, G.K.	2001	Exploration Licence No. 17/98, Maydena, Tasmania. Annual Report to 04.09.2001.
Krummei, G.K.	2002	Exploration Licence No. 17/98, Maydena, Tasmania. Annual Report to 04.09.2002.
Krummei, G.K.	2003 (a)	Exploration Licence No. 17/98, Maydena, Tasmania. Relinquishment Report
Krummei, G.K.	2003 (b)	Exploration Licence No. 17/98, Maydena, Tasmania. Annual Report to 04.09.2003.
McGowan, A	1992	Risbys Basin Karst Area – Survey of Cultural Values and Impact of Proposed Access Tracks and Drill Sites. Tas. Dept. Parks, Wildlife and Environment Report.
Nieminen, R.	2009	Glass Processing Opportunities for the Solar Industry. In “Glass Worldwide”, November 2009, p.80 et seq
Osterloh, S	2002	Origin of the Maydena Silica Flour and Bedrock Silicification, Tasmania. B.Sc (Hons.) Thesis; CODES; School of Earth Sciences, University of Tasmania
Patterson, W	1990	Exploration Licence 14/88 – Maydena. Annual Report on Exploration Activity. 6th July 1989 to 4th August 1990.
TasRail	2011	Annual Report 2010-2011
TasRail	2012	Annual Report 2011-2012
Wrigley, P.K.	1992	Surface Exploration of the Limestone Resource at Roberts Hill, Maydena. Tas. Dept. of Mines Report 1992/32.
Wrigley, P.K.	1993	Evaluation of the Limestone Resource at Roberts Hill, Maydena. Tas. Dept. of Mines Report 1993/03.

APPENDIX 1

EXECUTIVE SUMMARY

FINAL GEKKO REPORT

Executive Summary

This report presents the results of the gravity and magnetic separation sighter tests completed on the Maydena Sands silica sample at Gekko Systems' Metallurgical Laboratory in Ballarat, Australia. The objective of the progam was to obtain an initial indication as to whether the Gekko InLine Pressure Jig could be used to separate the impurities in the silica sand in combination with Wet High Intensity Magnetic Separation (WHIMS).

The results can be summarised as follows:

- The assayed head grade of the as received material was 0.013% Al_2O_3, 0.017% CaO, <1.0 g/t Cr_2O_3, 0.010% Fe_2O_3, 0.004% MgO, <0.001% MnO, 0.003% TiO_2, 0.002% Na_2O, <0.001% K_2O, 0.001% P_2O_5 and the calculated grade by difference for SiO_2 99.95%.
- Separation via gravity concentration followed by WHIMS slightly increased the grade of silica from 99.95% SiO_2 in the feed to 99.96% in the final clean product.
- The grade of most impurities decreased in the final clean product, including 7.7% reduction in Al_2O_3, 41.2% reduction in CaO, 40% reduction in Fe_2O_3, 33.3% reduction in TiO_2 and 25% reduction in MgO. The other impurities did not show any change in grade.
- The two impurities with the highest grades remaining in the final clean product were Al_2O_3 at 0.012% and Fe_2O_3 at 0.006%.
- In the WHIMS non-magnetic fraction, screened at 212 μm, approximately 23% more Al_2O_3, 64% more CaO and 50% more MgO, reported to the minus 212 μm plus 45 μm fraction, compared to the minus 600 μm plus 212 μm fraction. The grade of the other impurities generally remained the same except for TiO_2 which showed an extra 33% in the coarser minus 600 μm plus 212 μm fraction.
- The results from the current tests demonstrate that a combination of the Gekko InLine Pressure Jig with WHIMS has some potential to generate a high grade silica product with low mass yield (14.4 wt% of initial feed). If a higher mass yield of the final clean product is required, further testing would be needed including sending the table tailing to WHIMS, assaying the table concentrate and tailing by size fraction and running multiple passes of the gravity product through the WHIMS to achieve the final product grade.

It is recommended that:

- Additional testwork is carried out by concentrating the same feed via the Wilfley table and sending the table tailing to WHIMS for cleaning by magnetic separation. It is recommended that all WHIMS variables are verified by the client before testing including running multiple passes through the WHIMS to achieve the final product grade. To enable more complete assessment of the Wilfley table performance, samples of feed, concentrate and tailing should be assayed.
- In parallel, the feed as received should be tested through the WHIMS without prior tabling, to fully understand the potential benefit of gravity concentration via the InLine Pressure Jig.
- Assaying of the current testwork Wilfley table tailing and magnetic fraction from the WHIMS test would enable the recovery and hence effectiveness of the gravity concentration stage to be determined. The table tailing assay would also provide some understanding of the likely feed grade of this material if it was sent to WHIMS instead of the concentrate.

Subsequent Testwork

Following the reporting of the original testwork, the client instructed Gekko to proceed with the recommendation in the third paragraph above, to carry out assaying of the table tailing and concentrate magnetic fraction. This section summarises the results of this additional assaying.

The tables below show the mass balance, grades and metal distributions (recoveries) for the Wilfley Table test and also the Wet Magnetic Separation test on the table concentrate.

Table A1: Mass Balance, Grade and Metal Distribution of impurities for Wilfley Table Test

	Mass g	Al2O3	Rec Al2O3	CaO	Rec CaO	Fe2O3	Rec Fe2O3	MgO	Rec MgO	MnO	Rec MnO	TiO2	Rec TiO2	Na2O	Rec Na2O	K2O	Rec K2O	P2O5	Rec P2O5
Feed	17200	0.013	100	0.017	100	0.01	100	0.004	100	0.001	100	0.003	100	0.002	100	0.001	100	0.001	100
Gravity Con (Mags+NonMa	2480	0.012243	11.42	0.010135	7.2	0.008473	10.63	0.003091	11.49	0.001014	14.59	0.002189	15.57	0.002041	10.28	0.001014	14.59	0.001	5.32
Gravity Tail	14720	0.016	88.58	0.022	92.8	0.012	89.37	0.004	88.51	0.001	85.41	0.002	84.43	0.003	89.72	0.001	85.41	0.002	94.65

Table A2: Mass Balance, Grade and Metal Distribution for WHIMS Test

	Mass g	Al2O3	Rec Al2O3	CaO	Rec CaO	Fe2O3	Rec Fe2O3	MgO	Rec MgO	MnO	Rec MnO	TiO2	Rec TiO2	Na2O	Rec Na2O	K2O	Rec K2O	P2O5	Rec P2O5
Gravity Con	1004.72	0.012243	100	0.010136	100	0.008473	100	0.003081	100	0.001014	100	0.002189	100	0.002041	100	0.001014	100	0.001	100
Gravity Con Mags	13.5[illegible]	0.03	3.31	0.02	2.57	0.185	30.15	0.009	3.95	0.002	2.67	0.016	9.88	0.005	3.31	0.002	2.67	0.001	1.35
Gravity Con Non-Mags	991.14	0.012	96.69	0.01	97.33	0.006	69.85	0.003	96.05	0.001	97.33	0.002	90.12	0.002	96.69	0.001	97.33	0.00[illegible]	98.65

The data in Table A1 show that in general the recoveries of impurities to the table concentrate, which are representative of what the Gekko InLine Pressure Jig may achieve, are low at between 5.3% and 15.6%, which demonstrate that the impurities have not concentrated very well. This indicates that there is a limit of impurity separation using the Wilfley Table, or by proxy, the InLine Pressure Jig. As visually reported, in the main report, the gravity concentrate consists of lower impurity grades than the gravity tailing, hence this was the main reason for taking the gravity concentrate for further cleaning via Wet Magnetic Separation (WHIMS), to achieve a higher purity silica product.

The data in Table A2 indicate that WHIMS is quite effective at separating Fe_2O_3 with approximately 30.2% being recovered to the magnetic fraction from the Table concentrate. The other impurities exhibit very low recovery to the magnetic fraction (between 1.35% and 4%) except for TiO_2 which gave approximately 9.9% recovery, helped by its magnetic properties.

In summary, it appears that if a further increase in gravity separation of impurities from the silica feed material is required, then other gravity devices such as spirals or batch centrifugal concentrators may need to be considered, or even alternative separation techniques such as flotation, as it appears the Wilfey Table and hence Gekko InLine Pressure Jig technology is limited for this material. If Fe_2O_3 and TiO_2 are the major impurities that need to be separated, it may be possible to use WHIMS or other magnetic separation technique as a single impurity removal process on the feed as supplied.

APPENDIX 2

CARBON REMOVAL

FURTHER INVESTIGATIONS

MAYDENA SANDS PTY LTD

CARBON REMOVAL

FURTHER INVESTIGATIONS

15/12/15

SUMMARY

This report describes extended test work conducted at Mineral Technologies, in an attempt to extract a saleable product from two extreme examples of material extracted from the Maydena Sands deposit in Tasmania.

One sample was a raw product obtained from an area of the deposit which is severely contaminated with carbon particles and slimes material over a wide particle size range. This material had been the subject of test work in 2014, when coal spirals had been tested as a method of upgrading.

A second sample was a sized 45-250 micron product derived from previous test work, which consisted of essentially high grade silica contaminated with carbon particles.

Test conducted on the severely contaminated material indicated that coal spirals were not effective in fully removing the carbon particles, but that wet tabling was extremely effective in removal of the carbon particles from both the severely contaminated and high grade material.

By application of previously developed magnetic separation and oxalic leaching technology to wet table concentrate obtained from these materials, a carbon-free product with a residual Fe_2O_3 level of 30 ppm in the case of the severely contaminated material and 10 ppm in the case of the high grade sample.

Whilst there may be potential for further improvement in product quality in the case of the concentrate obtained from the severely contaminated sample, the Fe_2O_3 level obtained from the higher grade sample (10 ppm) represents the lowest iron level achieved in any test-work conducted to date on Maydena Sands material and would appear to be within the iron specification and visual quality requirements for the generation of a saleable product.

It is recommended that further investigations be carried out to optimise the use of wet tabling in conjunction with magnetic separation and de-sliming in removal of carbon particles other contaminants and to investigate the possibility of the use of upward flow classification as an alternative to wet tabling for removal of carbon articles.

It is also recommended that citric acid be investigated as an alternative to oxalic acid.

1. SEVERELY CONTAMINATED SAMPLE

1.1. PREVIOUS WORK

An initial series of tests using this sample were conducted at Mineral Technologies in 2014, based on a recommendation that coal spirals may offer a means of upgrading this more difficult material. See "Carbon Removal – Coal Spiral Tests (25/11/14)".

Model LD-7 spirals were recommended by Mineral Technologies for this investigation. These machines are available as a 4-turn version, designed for easily processed material and a more advanced 7-turn version for more difficult material.

Initial test work using the 4-turn Spiral indicated that up to 65% of the material could be recovered in a form visually free of carbon particles by combination of the concentrate and middling products. Sizing and visual analysis of the remaining material suggested that this yield could possibly be increased to 80-90% by passing the tail from this spiral over a second 4-turn spiral.

Following discussion of these results it was suggested by Mineral Technologies that this could probably also be achieved in a single pass, using the 7-turn version.

Accordingly, a second test was then conducted using a 7-turn Spiral. The results of this test indicated that 65.6% of the material could be extracted as a concentrate product containing no visible carbon particles. However it was also found that yield of material visually free of carbon particles could be increased to around 83%, by de-sliming of the remaining material, followed by rejection of the >90 micron fraction.

1.2. SPIRAL TEST ON DESLIMED SAMPLE

This test was virtually a repeat of the 7-turn spiral test described above, with the exception that the slimes content was removed prior to testing, as it was felt that the presence of almost 10% of the material as slimes may have had a deleterious effect on the results obtained.

A 30 kg sample of the material was de-slimed by passing over the LD 7 spiral with the splitters set such that all slimes reported as tailings, whilst the balance reported as concentrate and middlings.

The now de-slimed solids were then repassed over the spiral with the splitters readjusted to produce concentrate, middling and tailing products.

Each product was dried and passed over a Roll Magnet at 20,000 gauss to remove any contained magnetic material. The non-magnetic product in each case was then screened at 250 and 45#.

The mass balances obtained are shown schematically below.

HEAD	
+250#	30.1
<250+45#	58.0
<45#	11.9
Total	100.0

7 TURN SPIRAL PASS 1 (DESLIMING)

SLIMES	
+250#	0.0
<250+45#	0.0
<45#	8.7
Total	8.7

DESLIMED FEED		
Non Mag	+250#	30.1
	<250+45#	58.0
	<45#	1.5
Mag		1.7
Total Feed		91.3

7 TURN SPIRAL PASS 2 (SEPARATION)

MIDDLING		
Non Mag	+250#	5.1
	<250+45#	9.7
	<45#	0.0
Mag		0.3
Total Mid		15.1

TAILING		
Non Mag	+250#	0.0
	<250+45#	11.7
	<45#	1.5
Mag		1.3
Total Tail		14.5

CONCENTRATE		
Non Mag	+250#	25.0
	<250+45#	36.6
	<45#	0.0
Mag		0.1
Total Con		61.7

The results indicated a strong sizing effect with most of the coarse fraction reporting to concentrate with the finer fractions being more or less equally distributed between the middling and tailings.

Whilst it appeared that most of the non-slime carbon particles had now been swept into the tailings there was still visual evidence, although difficult to ascertain, of coarser carbon particles in both the concentrate and middling fractions, thus casting doubt on the effectiveness of this method in fully removing these particles.

1.3. WET TABLE TEST ON SPIRAL CONCENTRATE

The concentrate fraction from the above spiral test was passed over a laboratory wet table to investigate the effectiveness of this machine in further removal of carbon particles.

It immediately became obvious that carbon particles which had been hidden from view became fee as a result of the type of motion generated on the table and were rapidly swept down the table along with coarser silica particles, whereas the balance of the silica particles traversed across the table to produce a carbon-free product.

This effect can clearly be seen in the photograph attached as Appendix No1.

It was also noted that a small strip of heavy mineral was evident at the very top of the table, as can be seen in the photograph attached as Appendix No 2. A sample of this strand was collected and subsequently subjected to bromoform separation for recovery of the >2.8 SG fraction, which was then reserved for visual examination.

Concentrate and tailings products were collected from the test. These products were dried and passed over a roll magnet at 18,000 gauss to remove any magnetics. The non-magnetic fractions were then screened to yield a -250+45 μ fraction, which is considered to be the size range of commercial interest.

The mass balances obtained are shown schematically below.

SPIRAL CONCENTRATE		
Non Mag	+250#	25.0
	<250+45#	36.6
	<45#	0.0
Mag		0.1
Total Con		61.7

WET TABLE

TABLE CONCENTRATE		
Non-Mag	+250#	12.8
	<250+45#	32.5
	<45#	0.0
Mag		0.1
Total Con		45.4

TABLE TAILING		
Non-Mag	+250#	12.2
	<250+45#	4.1
	<45#	0.0
Mag		0.03
Total Tail		16.3

ROLL MAGNET

250# SCREEN

NON MAGNETICS OVERSIZE	
+250#	12.8
Total	12.8

MAGNETICS	
Mag	0.1
Total	0.1

NON MAGNETICS UNDERSIZE	
<250+45#	32.5
Total	32.5

1.4. ANALYSIS OF FRACTIONS

The magnetic and non-magnetic fractions of the middling and tailing products from the spiral test, along with the concentrate and tailings products from the table test were analysed for Fe_2O_3, TiO_2, Al_2O_3, CaO, MgO, K_2O and Na_2O by ALS. The analysis of the magnetic and non-magnetic fractions of the concentrate from the spiral test was back-calculated as the sum of the table concentrate and tailing analysis.

The analysis results were as follows:-

Product	Fraction	Weight (%)	Analysis						
			Fe_2O_3	TiO_2,	Al_2O_3	CaO	MgO	K_2O	Na_2O
De-slimed Spiral Feed*	Total	91.33	0.026	0.027	0.025	0.031	0.005	0.002	0.002
Spiral Concentrate**	N/M	61.6	0.008	0.018	0.020	0.018	0.003	0.002	0.002
	Mag	0.13	4.22	2.28	0.77	1.07	0.296	0.073	0.153
	Total#	61.73	0.017	0.023	0.022	0.020	0.004	0.002	0.020
Spiral Middling	N/M	14.8	0.019	0.015	0.021	0.062	0.005	0.002	0.001
	Mag	0.3	2.67	1.245	0.641	0.771	0.381	0.055	0.104
	Total#	15.1	0.072	0.039	0.033	0.076	0.008	0.003	0.002
Spiral Tailing	N/M	13.2	0.010	0.017	0.023	0.028	0.005	0.004	0.003
	Mag	1.3	0.134	0.200	0.072	0.077	0.019	0.007	0.013
	Total#	14,5	0.021	0.033	0.026	0.031	0.006	0.004	0.004
Table Concentrate	N/M	45.3	0.007	0.020	0.019	0.014	0.003	0.002	0.001
	Mag	0.1	4.56	3.37	0.892	1.150	0.342	0.081	0.167
	Total#	45.4	0.017	0.027	0.021	0.017	0.004	0.002	0.001
Table Tailing	N/M	16.3	0.011	0.012	0.023	0.031	0.005	0.004	0.004
	Mag	0.03	1.535	0.811	0.340	0.808	0.144	0.048	0.111
	Total#	16.33	0.016	0.013	0.024	0.032	0.005	0.004	0.004

* Calculated from Spiral Con, mids and Tail analysis and weights

**Calculated from Table Con and Tail analysis and weights

Calculated from analysis and weight proportions of N/M and Mag fractions

1.5. OXALIC LEACH TESTS

Samples of the non-magnetic fraction from the Table Concentrate and Table Tailings produced in the test-work above were leached at 20% solids with 20 gpl oxalic acid for 2 hours. The resultant solids were also analysed by ALS for Fe_2O_3, TiO_2, Al_2O_3, CaO, MgO, K_2O and Na_2O.

The results were as follows:-

Product	Fraction	Analysis						
		Fe_2O_3	TiO_2,	Al_2O_3	CaO	MgO	K_2O	Na_2O
Table Concentrate N/M	Unleached	0.007	0.020	0.019	0.014	0.003	0.002	0.001
	Oxalic Acid Leached	0.006	0.015	0.017	0.013	0.003	0.002	<0.001
Table Tailing N/M	Unleached	0.011	0.012	0.023	0.031	0.005	0.004	0.004
	Oxalic Acid Leached	0.009	0.010	0.023	0.025	0.003	0.002	0.004

1.6. DISCUSSION OF RESULTS

There are two key issues involved in extraction of a saleable product from this material, namely chemical and visual. The results show that even after de-sliming, the material still contains unacceptably high levels of iron, titanium, alumina and calcium, along with considerable charcoal, which may or may not contain chemical contaminants.

The results indicate coal spirals were partially effective in removal of charcoal particles and in reduction of Fe_2O_3, titanium, alumina and calcium levels. However magnetic separation was required for significant reduction of iron and titanium levels to be achieved.

Wet tabling, on the other hand, appeared to be highly effective in removal of charcoal particles, with some improvement noted in the iron and calcium levels in the non-magnetic fractions

1.7. CONCLUSIONS

It is clear from these results that wet tabling is clearly superior to spirals in removal of charcoal particles and that a combination of wet tabling with magnetic separation will be required to achieve satisfactory reduction in chemical impurities.

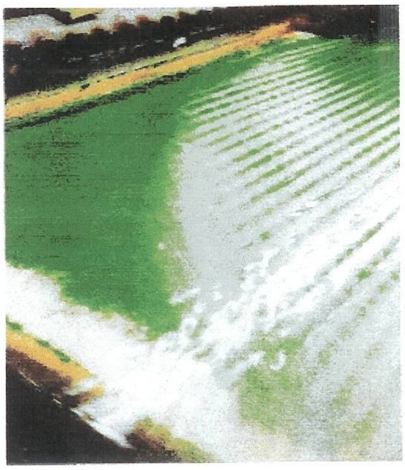
Some further minor improvement can then be obtained by oxalic acid leaching.

APPENDIX No 1

Bottom edge of table, showing black particles reporting with tailings.

APPENDIX No 2

View across table from discharge side showing the barely visible strand of darker heavy mineral.



2. HIGH GRADE SAMPLE

A 45 – 250 micron sample of relatively high grade product presumably extracted during a previous test program on material from the Maydena Sands Deposit was examined. Despite appearing of good colour it was found to contain a considerable quantity of charcoal particles.

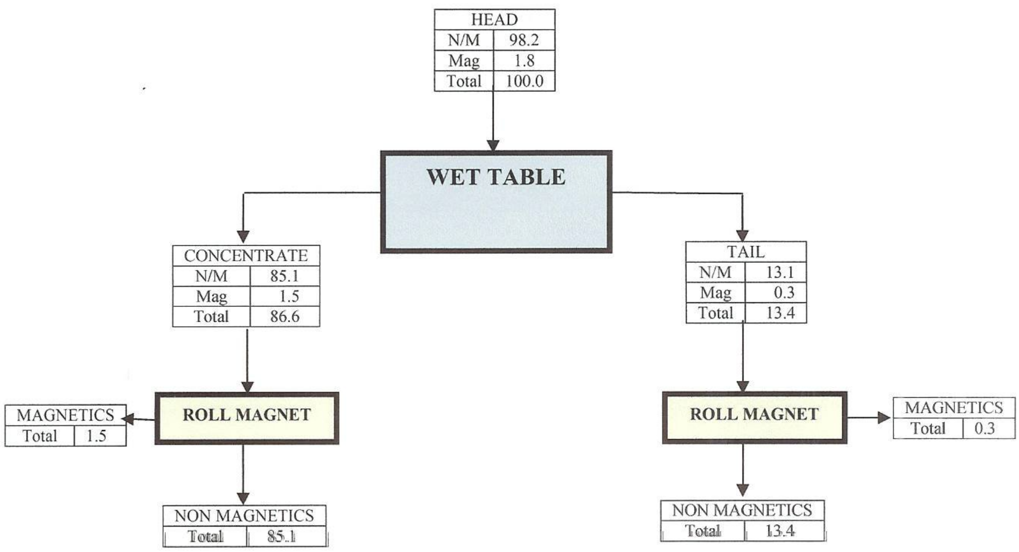
In line with the results obtained in Section 1 above, this sample was wet tabled only. A concentrate, middling and tails fraction were collected. It was clearly seen that all visible black particles reported to the tailing fraction.

As the middling fraction contained no charcoal and was otherwise of identical appearance, it was combined with the concentrate fraction, so that only two products were collected.

Again a faint dark heavy mineral band was observed at the top of the table and a sample of this band was taken and subjected to bromoform separation for recovery of the >2.8 SG fraction, which was reserved for visual examination.

Both the concentrate and tailing products were dried and subjected to magnetic separation at 20,000 gauss for removal of magnetics.

The mass balances obtained are shown below.



2. ANALYSIS OF FRACTIONS

The magnetic and non-magnetic fractions of the concentrate and tailing products from the table test were analysed for Fe_2O_3, TiO_2, Al_2O_3, CaO, MgO, K_2O and Na_2O by ALS.

The analysis of the head material was back-calculated from these results and the from the mass balances.

The analysis results were as follows:-

Product	Fraction	Weight (%)	Analysis						
			Fe_2O_3	TiO_2,	Al_2O_3	CaO	MgO	K_2O	Na_2O
Calculated Head*	Total	100.0	0.005	0.004	0.005	0.012	0.003	0.001	0.001
Table Concentrate	N/M	85.2	0.003	0.002	0.004	0.010	0.003	<0.001	<0.001
	Mag	1.5	0.059	0.012	0.017	0.036	0.010	0.002	0.003
	Total#	86.6	0.004	0.002	0.004	0.010	0.003	0.001	0.001
Table Tail	N/M	13.1	0.004	0.003	0.004	0.020	0.005	0.001	>0.001
	Mag	0.3	0.829	0.602	0.215	0.179	0.041	0.012	0.015
	Total#	13.4	0.020	0.018	0.008	0.025	0.006	0.002	0.001

2.1. LEACH TESTS

The non magnetic fraction of the concentrate product was subjected to leaching with 20 gpl oxalic acid solution at 20 % solids for 2 hours.

As promising results had been obtained in leaching similar impurities from similar materials using citric acid as an alternative to oxalic acid, a sample of the non magnetic fraction of the concentrate product was also leached with20 gpl citric acid at 20% solids for 2 hours.

Product	Fraction	Analysis						
		Fe_2O_3	TiO_2,	Al_2O_3	CaO	MgO	K_2O	Na_2O
Table Concentrate N/M	Unleached	0.003	0.002	0.004	0.010	0.003	<0.001	<0.001
	Oxalic Acid Leached	0.001	0.002	0.006	0.008	0.003	<0.001	0.001
	Citriic Acid Leached	0.001	0.002	0.004	0.008	0.003	<0.001	0.003

2.3. DISCUSSION OF RESULTS

The visual results clearly support wet tabling as being an effective means of removal of charcoal particles. However magnetic separation is again shown as a vital component in reduction of metal contaminant, particularly iron and titanium. There is some evidence that wet tabling is also beneficial in reducing levels of calcium.

However the most interesting results are the low levels of residual Fe_2O_3 achieved by both oxalic and citric acid leaching of the Table concentrate non-magnetics.

These levels of Fe_2O_3 (10 ppm) are the lowest achieved in any test work to date.

2.4. CONCLUSIONS

Previous minimum Fe_2O_3 levels obtained by any of the large range of methods and processes used, have consistently been in the range 20-30 ppm.

Therefore it must be concluded that the improvement noted here must be as a result of the efficient removal of charcoal particles finally achieved by use of wet tabling.

3. RECOMMENDATIONS

These results raise a number of aspects which may warrant further or more closely controlled investigation.

The indications from the results are that magnetic separation, de-sliming and gravity separation appear to be all linked in obtaining the desired reduction in contaminant levels, particularly in the case of reduction of Fe_2O_3 and CaO,

Although coal spirals appeared to be only partially successful in removing carbon particles, the success of wet tabling in removal of carbon particles indicates that this needs to be investigated further, particularly with regard its relationship with the magnetic separation step, which appears to be an essential step in obtaining low residual Fe_2O_3 levels.

There may be some advantage gained by inserting the magnetic separation step prior to wet tabling. There is also the possibility that de-sliming would be more efficiently carried out as part of the wet tabling operation, rather than as a distinctly separate step.

It is also possible that upward flow classification may achieve a similar result to that obtained by wet tabling.

The result obtained using citric acid as an alternative to oxalic acid, in the final Fe_2O_3 polishing step was most encouraging, as this chemical is a natural product (lemon juice) which is totally non-toxic, whereas there are mild environmental concerns with regard to oxalic acid discharge.

It has been found in other leaching experiments on similar materials, that citric acid has been shown to be effective in lowering CaO levels, which may be of commercial interest if successful on this product.

It is therefore recommended that:

1. Further work be undertaken to optimise the wet tabling method, particularly in determining the optimum place for this step in the process circuit with respect to de-sliming and magnetic separation.

2. Some experimentation with upward flow classifiers as an alternative to the use of wet tables, would appear to be warranted.

3. The possible replacement of oxalic acid by citric acid needs to be thoroughly explored, on an economic, quality and environmental basis.

I am able to borrow a laboratory wet table identical to that used in the tests at Mineral Technologies, which would allow a much greater volume of test work to be achieved at much lower cost.

A pilot upward flow classifier can easily be fabricated for comparison with wet tabling.

APPENDIX 3

PRODUCTION OF SODIUM SILICATE

MAYDENA SANDS PTY LTD

PRODUCTION OF SODIUM SILICATE

15/12/15

PRODUCTION OF SODIUM SILICATE SOLUTION

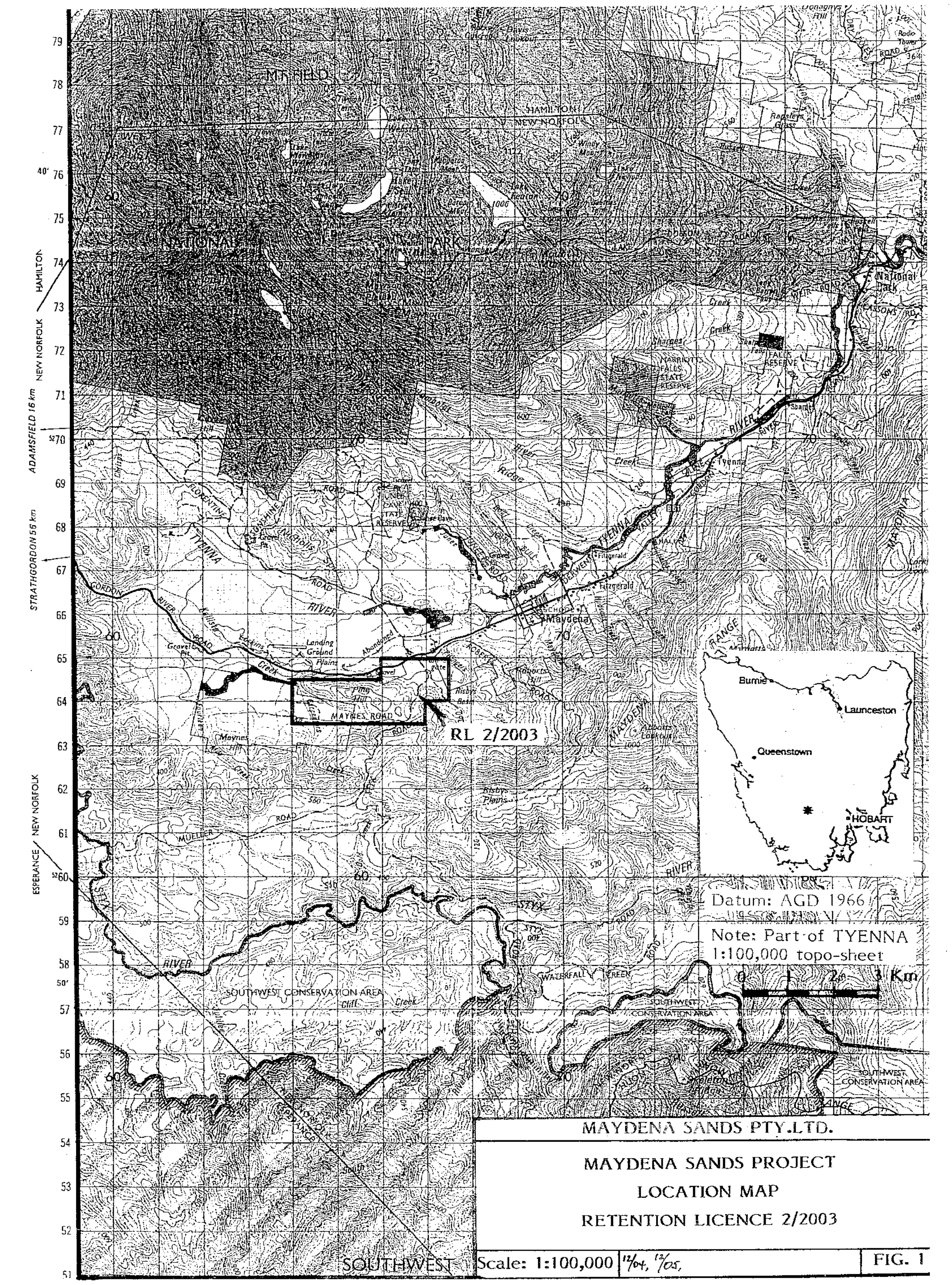
A standard method for the production of sodium silicate solution from silica involves the reaction of 18% caustic soda solution with silica at a liquid/solids ratio of 6/1 in an agitated pressure autoclave reactor using a reaction temperature of 200°C and a retention time of 2 hours. Using this method, a <100 micron sample of Maydena Sands was processed in a 5 litre capacity autoclave with the following results.

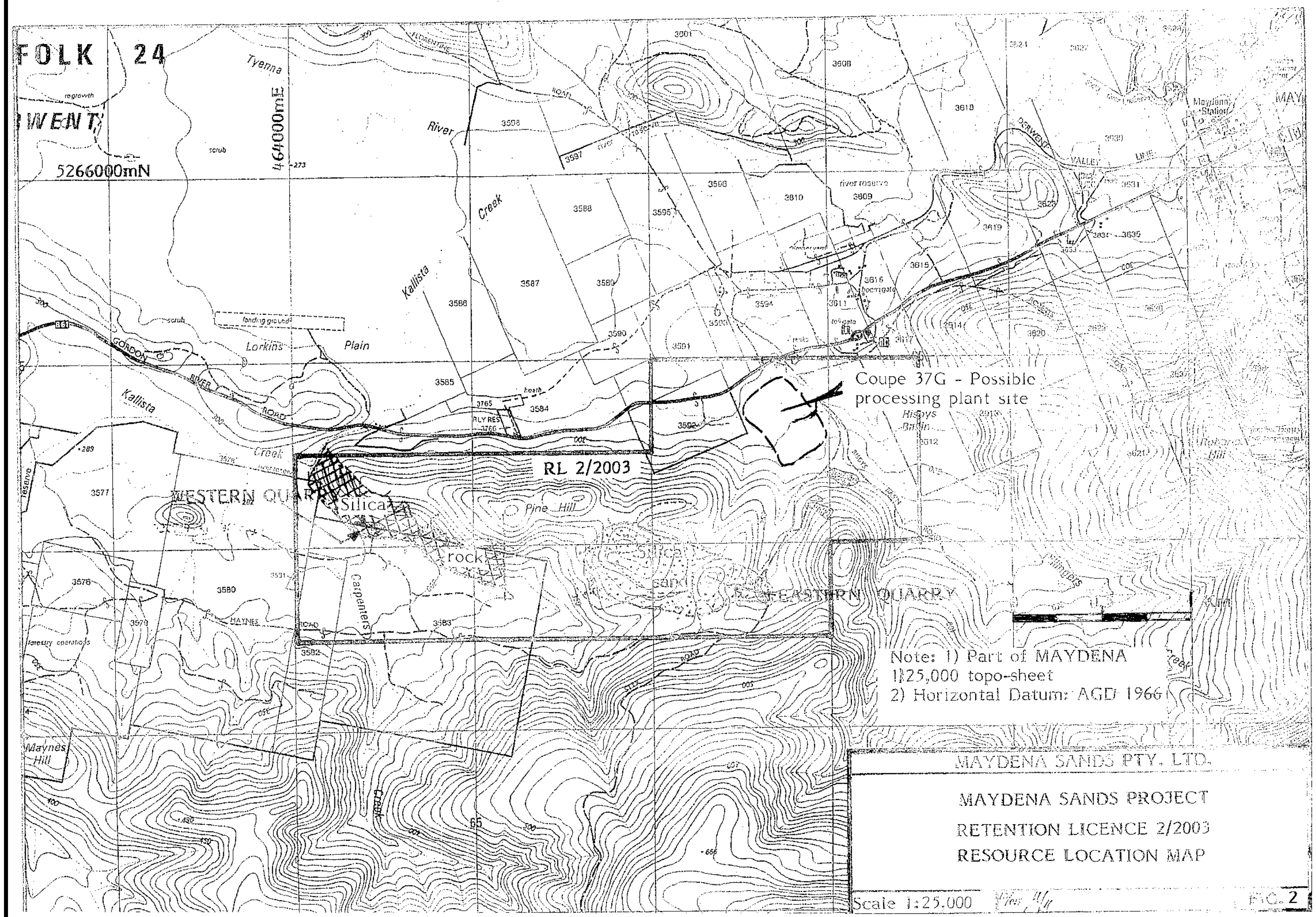
NaOH Solution	Volume	4.2 Litres
	Strength	18%
Silica	Weight	700 g
Silica Reactivity		98%
Final Solution	Volume	4.8 litres
	S.G.	1.225
	Na_2O content (%)	10.00 %
	SiO_2 content (%)	11.30 %
	SiO_2/ Na_2O Molar Ratio	1.18
	Fe	<1 ppm
	Al	<2 ppm
	Ca	<1 ppm
	Mg	<1 ppm

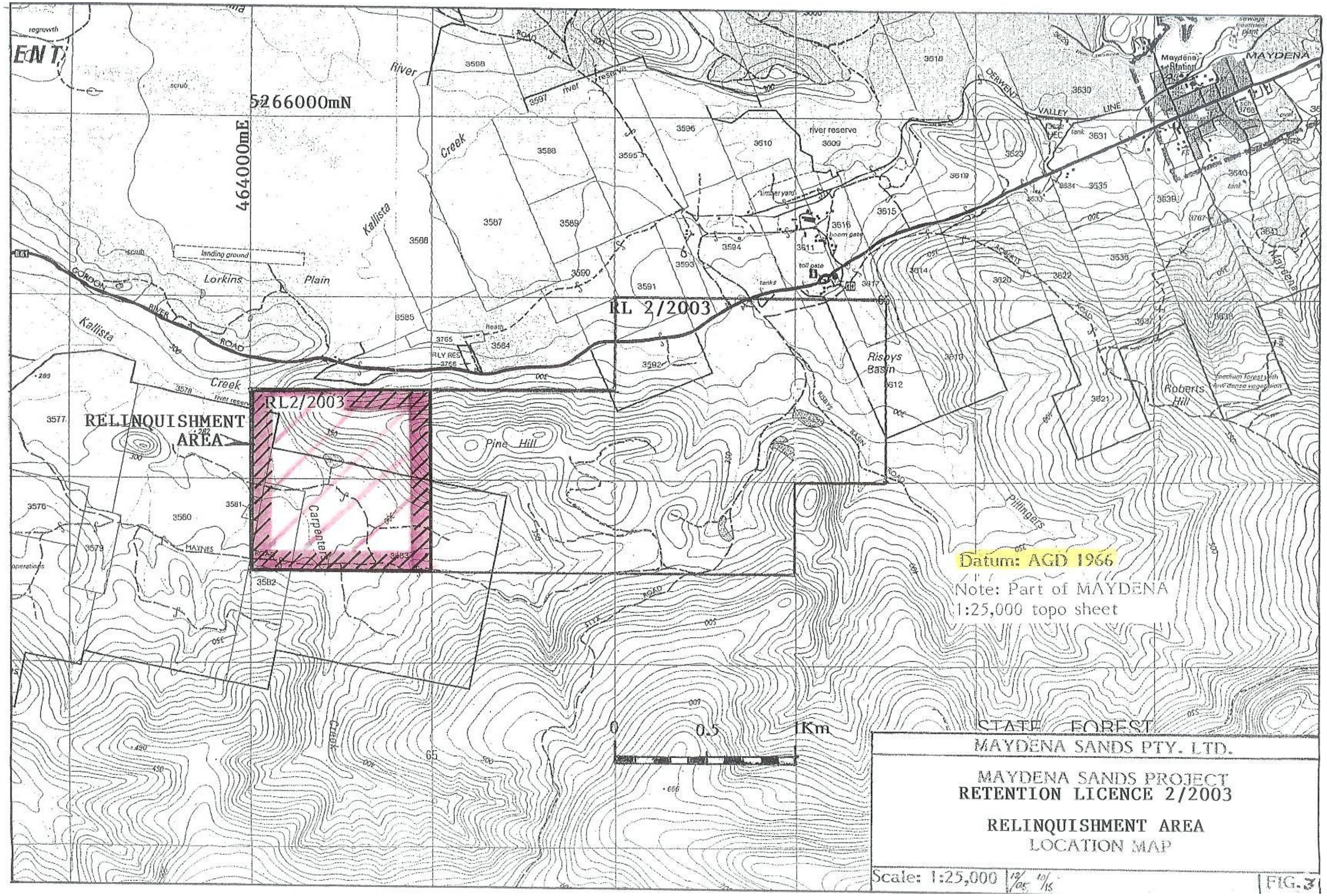
The final solution required filtration to remove a small quantity of un-reacted material, leaving a high grade sodium metasilicate solution.

It is well established in the industry that both the strength of this solution and the SiO_2/ Na_2O molar ratio can be increased by adjustment of the reaction conditions in the autoclave step.

ILLUSTRATIONS


MAYDENA SANDS PTY.LTD.
MAYDENA SANDS PROJECT
LOCATION MAP
RETENTION LICENCE 2/2003
Scale: 1:100,000
FIG. 1
RL 2/2003
Datum: AGD 1966
Note: Part of TYENNA
1:100,000 topo-sheet
0 1 2 3 Km
Burnie
Launceston
Queenstown
HOBART
Maydena
SOUTHWEST CONSERVATION AREA
SOUTHWEST
MAYNES ROAD
ADAMSFIELD 16 km
STRATHGORDON 56 km
NEW NORFOLK
HAMILTON
ESPERANCE


FOLK 24
WENT
5266000mN
464000mE
Tyenna
River
Creek
Kallista
Plain
Lorkins
GORDON RIVER ROAD
WESTERN QUARRY
Silica
rock
Pine Hill
Carpenters
Silica sand
EASTERN QUARRY
Coupe 37G - Possible processing plant site
RL 2/2003
Maynes Hill
Note: 1) Part of MAYDENA 1:25,000 topo-sheet
2) Horizontal Datum: AGD 1966
MAYDENA SANDS PTY. LTD.
MAYDENA SANDS PROJECT
RETENTION LICENCE 2/2003
RESOURCE LOCATION MAP
Scale 1:25,000
FIG. 2



MAYDENA SANDS PTY. LTD.

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RETENTION LICENCE 2/2003

RELINQUISHMENT AREA
LOCATION MAP

Scale: 1:25,000 | FIG.3