

Cornwall Local Plan China Clay

**Cornwall Council
January 2015**

1	The geological background of china clay (kaolin).....	3
2	Current production and reserves of china clay	4
3	Markets, transport and use of china clay	7
4	Government policy and guidance for china clay.....	8
4.1	National Planning Policy Framework (CLG, March 2012)	8
5	History of local planning policy development in Cornwall for China Clay	9
5.1	Cornwall Structure Plan 2004.....	9
5.2	Cornwall Minerals Local Plan 1997	9
5.3	St Austell China Clay Tipping and Restoration Strategy	9
5.4	Cornwall Minerals Development Framework	10
5.5	Cornwall Local Plan.....	10
6	Projected demand and future supply for china clay.....	10
7	Key considerations for planning policy development for china clay...	12
	Appendix 1	13
	Synopsis of a Freedonia Study of World Markets for Kaolin published on 1 December 2009	13
	Appendix 2	14
	Synopsis of Roskill’s The Economics of Kaolin, 12th edition published 01/11/2006	14

	Figure 1.1: Granite Outcrops in SW Britain	3
	Figure 2.1: Geology, currently worked and other permitted china clay sites in Cornwall	4
	Figure 2.2: China Clay Production 2001 - 2012	6

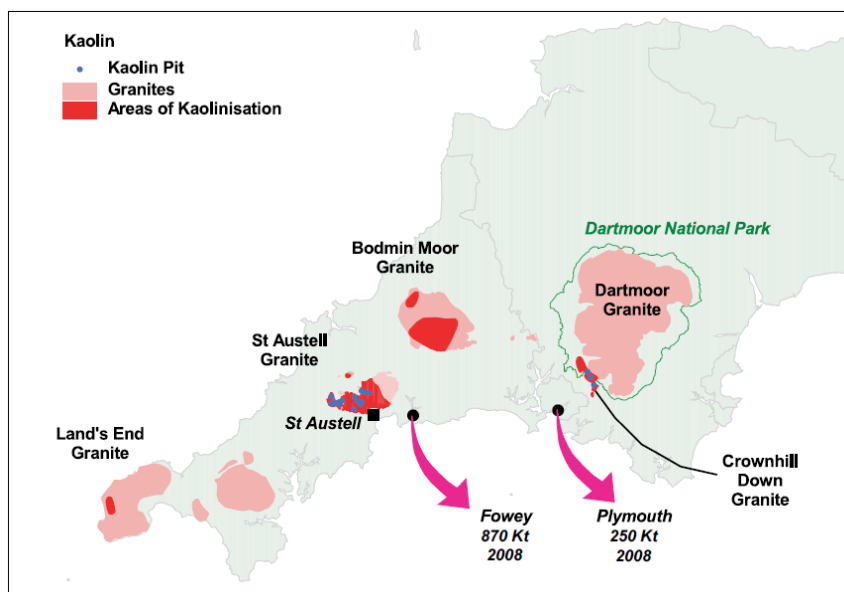
	Table 2.1: Status of permitted china clay extraction sites in Cornwall (2014).....	4
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1 The geological background of china clay (kaolin)

China clay (or kaolin) is a product of altered granite, which has been affected by an interaction of the groundwater with the feldspar minerals within the granite to form kaolinite.

Cornwall has five large bodies ('plutons') of granite and many smaller outcrops rising from a large parent body, the Cornubian Batholith, which is mainly concealed by Devonian and Carboniferous strata. These were formed from molten rocks deep in the earth's crust, during and after the period of Variscan earth movements, between 300 and 270 million years before the present.

Figure 1.1: Granite Outcrops in SW Britain¹



In the case of Cornwall's granite deposits, the alteration is patchy in quality and distribution. The kaolinised zones within the granite tend to be funnel-shaped or trough-like in cross section, several hundreds of metres across at outcrop, and narrowing downwards. Some of the kaolinised bodies are very extensive and deep-seated, with the stems of more than 300m below surface. Kaolinised granite is more friable and generally softer than unaltered rock and consists mainly of quartz or mica, unaltered feldspar (potassium feldspar tends to be less readily altered than the plagioclase feldspars) and kaolinite.

China clay resources are found within 3 of the larger granite bodies namely the Land's End peninsula, Hensbarrow (north of St Austell) and Bodmin Moor, and in smaller bodies at Godolphin/Tregonning and Belowda.

Further information about china clay (kaolin) can be found in the British Geological Survey Mineral Planning Factsheet <http://bgs.ac.uk/mineralsuk/planning/mineralPlanningFactsheets.html> and

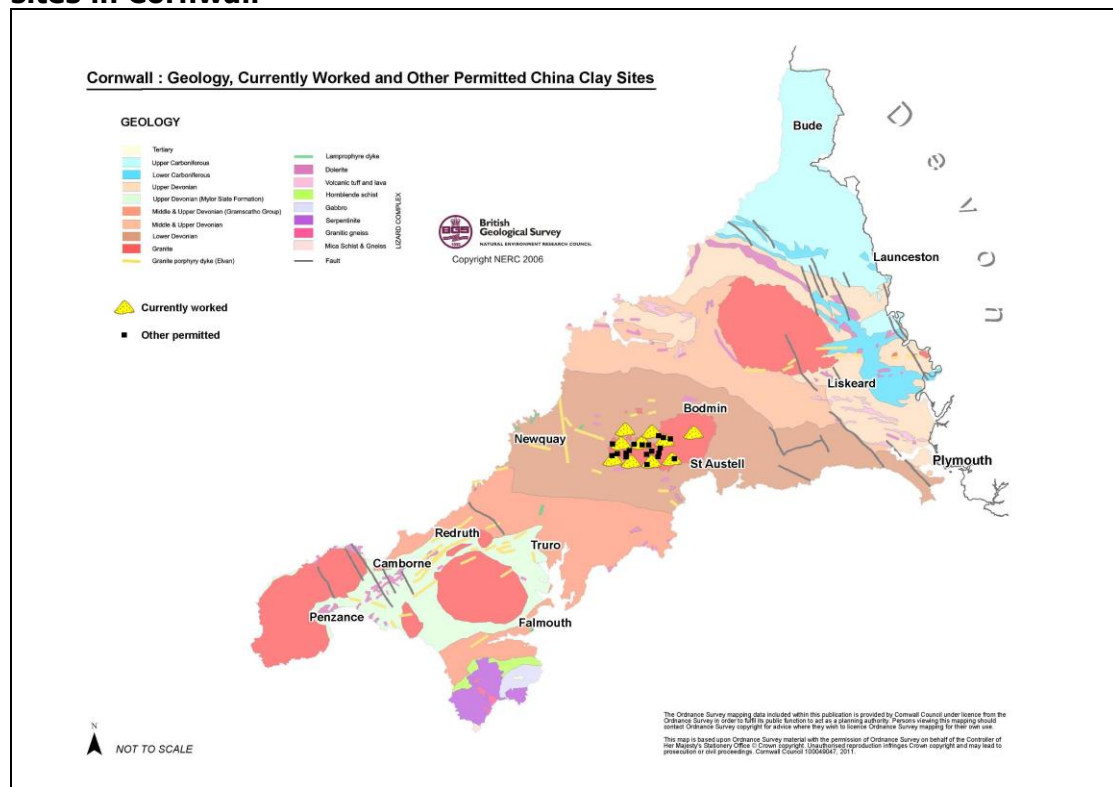
¹ Source Mineral Planning Factsheet Kaolin, CLG BGS 2009

the BGS "Mineral Resource information for Development Plans, Cornwall: Resources and Constraints 1997".

2 Current production and reserves of china clay

The primary china clay (kaolin) deposits of south-west England are world class in terms of their size and quality. They have yielded over 165 million tonnes of marketable clay since production began in the middle of the 18th Century. Although significant quantities were extracted from the Bodmin Moor and Land's End granites in the past, production has recently ceased in these areas. Commercial exploitation of the china clay in Cornwall is now confined to the western and central parts of the Hensbarrow (St Austell) granite. Figure 2.1: Geology, currently worked and other permitted china clay sites in Cornwall.

Figure 2.1: Geology, currently worked and other permitted china clay sites in Cornwall



Extensive planning permissions for winning and working of china clay in the St Austell (Hensbarrow) area extend to some 88 square kilometres, although the area of active extraction, tipping, handling and processing sites is much smaller. Table 2.1: Status of permitted china clay extraction sites in Cornwall (2014) show the existing planning consents for china clay extraction. The planning permissions are subject to Periodic Reviews under the Environment Act 1995 and the majority of these permissions are due to expire in 2042.

Table 2.1: Status of permitted china clay extraction sites in Cornwall (2014)

Site	Status
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Site	Status
Baal Pit	Active (not currently working – site is part of Eco-community proposal)
Blackpool Pit	Active (not currently working – part of site is part of Eco-community proposal, although area with large china clay resource will be retained for future extraction)
Bloomdale Pit	Not currently working (Long term working area)*
Carpalla Pit	Not working (cessation of mining operations)
Dorothy/Littlejohns/Great Longstone Pits	Active (currently working)
Garker Pit	Not currently working (Long term working area)*
Goonbarrow Pit	Active (not currently working)
Goonvean Pit	Active (currently working)
Gothers Pit	Not currently working (Long term working area)*
Gover Pits	Not currently working (Long term working area)*
Greensplat Pit	Active (currently working)
Gunheath Pit	Active (not currently working)
Hendra Pit	Active (currently working for mica deposition only)
Lantern Pit	Not currently working (Long term working area)*
Longstone Pit	Active (not currently working)
Melbur Pit	Active (currently working)
Molinnis	Not currently working (Long term working area)*
Penhale Pit	Active (not currently working – part of site is part of Eco-community proposal)
Rocks Pit	Active (not currently working)
Rosemellyn Pits	Not currently working (Long term working area)*
Rostowrack Pit	Active (currently working)
Trelavour Pit	Active (intermittent working)
Trethowel Pits	Not currently working (Long term working area)*
Treviscoe Pit	Active (currently working)
Virginia Pit	Active (currently working)
Wheal Martyn Pit	Active (not currently working)
Wheal Prosper Pit	Active (not currently working)
Wheal Rashleigh Pits	Not currently working (Long term working area)*
Wheal Remfry Pit	Active (currently working)

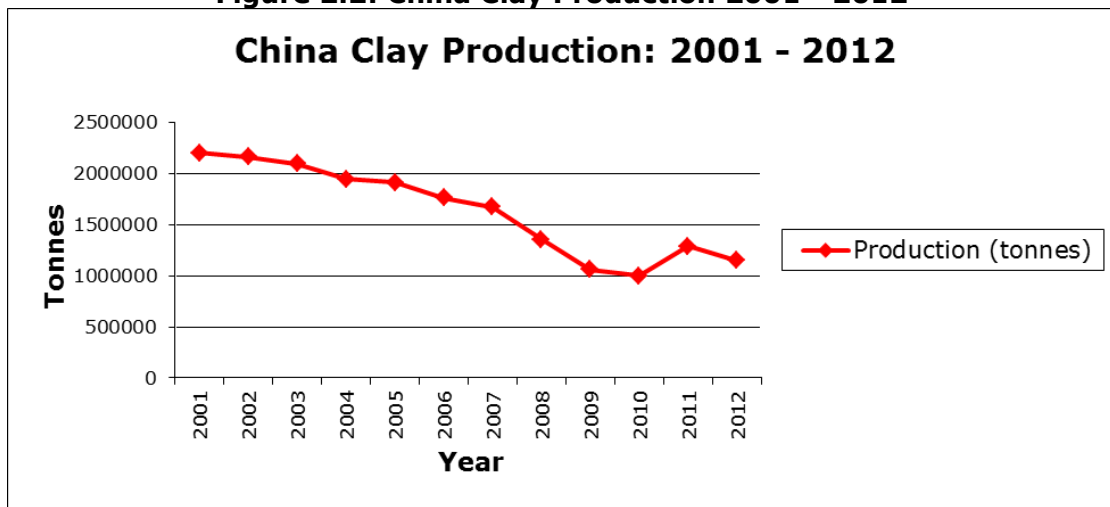
NB In addition:

a) there are related sites with permissions for china clay plant and china clay waste tipping.

b)* under the Review of Mineral Planning Permissions, Environment Act 1995: Sites defined as "Active" may be worked without further determination of planning conditions, subject to the provisions of the Environment Act 1995; sites defined as Long Term Working Areas may not be worked unless a scheme of working and restoration and new conditions has been approved by the Mineral Planning Authority.

The BGS Minerals Yearbook, 2013² estimated that production of china clay in 2012 amounted to 1.15 million tonnes (dry weight). Figure 2.2: China Clay Production 2001 - 2012 shows production of china clay in the UK since 2001.

Figure 2.2: China Clay Production 2001 - 2012



A recent decline in UK production from its peak in 1988 of 2.78 million tonnes is due to the increased competition in Western Europe paper markets resulting from imports, particularly from the Amazon basin and from alternative white pigments such as calcium carbonate.

The British Geological Survey Mineral Planning Factsheet on Kaolin³ indicated that Cornwall produced 88% of the total kaolin sales in 2008 (sales of kaolin were 1.36 million dry tonnes in 2008) and that, at current rates of production, there are proven reserves in and around existing pits to sustain production for of at least 50 years. Using this information it is estimated that Cornwall’s reserves of china clay exceed 60 million tonnes.

Traditionally, china clay is extracted from the kaolinised granite by “wet mining”. High pressure jets of water (‘monitors’) are used to erode the working faces and wash out kaolin in suspension. The slurry produced gravitates to the base of the pit from where it is pumped to the surface for processing. Ripping, drilling and blasting of the granite are also used to access the reserves and improve yields, with unaltered granite removed for tipping or processing into aggregate. Recently, dry mining has been introduced in some areas, with the intention of allowing more selective extraction, reducing energy costs and improving yields. In this technique, the kaolinised granite is extracted by shovel and truck and is transported

²<http://www.bgs.ac.uk/mineralsuk/statistics/UKStatistics.html>

³ www.bgs.ac.uk/downloads/start.cfm?id=1362

to a primary screening plant to remove oversize material. The undersize fraction is disaggregated by high pressure jets of water for subsequent processing in the conventional way.

Processing of china clay is essentially based on wet refining and thickening in which fine kaolinite is removed from coarser impurities such as quartz, using the different settling velocities associated with specific gravity and particle size. Kaolinite is concentrated in the finer particle size fractions and settles much more slowly than silt or sand-size particles. The cut between commercial kaolin and waste is normally at <15 microns, but there is some loss of coarser kaolinite particles with the oversize fraction. Froth is now increasingly used to selectively remove coarser kaolinite particles; this is followed by grinding to break down the kaolinite aggregates and to produce the desired particle size distribution. The introduction of flotation technology has improved kaolinite recovery and has also allowed the retreatment of mica waste residues, into which coarser kaolinite previously had been lost. Clays from different areas are blended at the refinery to meet the requirements of specific customers

The refined clay is thickened in settling tanks and pumped, in slurry form, to the drying plant. It is then filter pressed to remove more water before progressing to the energy intensive drying process. Modern drying plant use natural gas to provide heat and power for a number of drying units, being located close to dryers and enclosed in buildings which provide sound insulation. The exhaust heat is ducted in large insulated pipes to the dryers and this reduces the emissions of greenhouse gases as well as reducing the energy costs, which constitute a significant element of clay production costs. Alternatively tube presses can be used which produce clay at 18% moisture which requires no heat.

On average, the material extracted from the pits contains 12 to 15% of commercially-saleable clay, the remainder being regarded in the past as waste which needed to be tipped on adjacent areas. In the past some waste materials were sold to the local construction industry for use as an aggregate. The quantity of this "secondary" aggregate sold has increased significantly. In 2013 sales of secondary aggregate (including by-products from the extraction of other minerals) totalled approximately 1.81 million tonnes; with 98% being from china clay production.

3 Markets, transport and use of china clay

Refined china clay has many industrial uses grouped into three main markets. Firstly, about 50% of the annual UK production is used as filler and, more recently at a much reduced level, as coating for paper. Secondly, the ceramics industry accounts for some 30% of production exported mainly to Europe, the Middle East and Asia. The clays of the western Hensbarrow area are important for the production of ceramics, having suitable standards of brightness, strength and flow. Thirdly, the remaining 20% of production is used for other industrial processes especially in paint, rubber and plastics.

Britain is the one of world's largest producers of china clay, after Brazil, USA and China. In 2012 exports were valued at approximately £115,499,000 and china clay is the UK's second most valuable minerals export after hydrocarbons. China clay sales peaked in 1998, with an output of 3.26 million tonnes.

Clays are sold in slurry form, as dried pellets, in powder form, and as a loose product.

About 77% of the china clay produced is exported to market by sea (until recently from the Ports of Fowey and Par, but the latter closed at the end of 2007). It is delivered to the port mainly by rail or via a private haul road linking the Ports of Par and Fowey. About 13% of clays are transported to market entirely by rail. About 10% is delivered by road.

4 Government policy and guidance for china clay

The background to government policy in the St Austell China Clay Area can be traced back to the post war years when the national government set a high priority upon reconstructing the nation's economy. China Clay was considered to be a strategic mineral of national importance and its exploitation was considered to underpin the economy of Mid Cornwall. The government set up a Standing Conference for China Clay in 1949 to "co-ordinate the views of the local planning authorities, the industry, the China Clay Council and Government departments on matters such as development plan provision for china clay working, waste disposal and the problems encountered with the granting of planning permissions". The findings of the final report of the China Clay Conference were used in the development of planning policy for Cornwall since the mid 1950s.

4.1 National Planning Policy Framework (CLG, March 2012)

In March 2012 the Government published the National Planning Policy Framework (NPPF), which replaced existing national planning policy. This includes a section on minerals and makes specific reference to the sustainable use of important minerals and also to defining Mineral Safeguarding Areas for minerals of national and local importance, including kaolin.

The NPPF requires local planning authorities to include policies for local and nationally important mineral resources and to safeguard those resources. Great weight should be given to the benefits of mineral extraction including to the economy.

The NPPF is accompanied by a technical guidance document which provides guidance on the implementation of policies contained in the NPPF. This mainly relates to amenity issues, dust, noise, stability and restoration. In 2014 national planning practice guidance was published to provide further guidance on the NPPF.

5 History of local planning policy development in Cornwall for China Clay

Since the incorporation of the recommendations of the findings of the China Clay Conference in the mid 1950's, the development plan for Cornwall defined areas believed to contain deposits of china clay and associated minerals and areas intended for the working of china clay.

Subsequently further work by the china clay companies and local highways and planning authorities resulted in the Long Term Strategy for the St Austell China Clay Area and Short Term Plans. The 'Long Term Strategy' identified the existing and proposed areas for china clay pits, china clay waste tips and micaceous waste disposal areas as well as "Island Settlements" (11 settlements to be the focus of community growth and to be excluded from china clay working). The Long Term Strategy for the St Austell China Clay Area and Short Term Plans were used as material planning considerations prior to the adoption of Structure and Local Plans.

5.1 Cornwall Structure Plan 2004

The Cornwall Structure Plan 2004 has been revoked and therefore none of its policies are extant.

5.2 Cornwall Minerals Local Plan 1997

The Cornwall Minerals Local Plan, which was adopted in 1997, covered the whole of Cornwall and set out local policy for minerals in line with national and regional guidance relating to all mineral sectors. As a result of ongoing monitoring, a Review of the Plan was commenced in 2003. In 2007 the Secretary of State confirmed that the majority of policies in the Cornwall Minerals Plan should be "saved", prior to the adoption of superseding minerals policy. Information about the "saved" policies can be view at: <http://www.cornwall.gov.uk/environment-and-planning/planning/planning-policy/interim-and-adopted-planning-policy/cornwall-county-saved-policies/#MineralsLocalPlanSections>.

In 2009 the County and District/Borough Councils for Cornwall merged to form the unitary Cornwall Council and as a result a single Local Plan (formerly Core Strategy) for Cornwall is being prepared and minerals policy will be included within that Local Plan.

5.3 St Austell China Clay Tipping and Restoration Strategy

The St Austell China Clay Tipping and Restoration Strategy was prepared jointly by the mineral planning authority and china clay industry for the period up to 2050 and beyond and was adopted as supplementary planning guidance by Cornwall County Council in 2000.

Different tipping scenarios (with a range of tipping profiles) were developed and examined to accommodate the predicted levels of solid china clay waste (above that which could be sold for secondary aggregates or backfilled in exhausted pits or parts of pits) on land with lesser environmental and operational constraints. A range of adopted

environmental and operational objectives were used to test the scenarios and identify a number of Preferred Tipping Areas (PTAs) to accommodate the china clay industry's future tipping needs. The Preferred Tipping Areas were located as close as possible to the pits generating the china clay waste. Further information and the full strategy is available at <http://www.cornwall.gov.uk/environment-and-planning/planning/minerals-waste-and-renewable-energy/st-austell-china-clay-tipping-and-restoration-strategy/>. In addition a landscape-led "masterplan" was produced to integrate restoration and after-use proposals throughout the whole area.

The Strategy was updated for the Blackpool Operational Area in 2003 as at this time there was an urgent need for more tipping space to accommodate china clay waste from the anticipated expansion of Blackpool Pit, and the 2003 update identified a Preferred Tipping Space.

5.4 Cornwall Minerals Development Framework

Since the reform of the planning system (as required by the Planning and Compulsory Purchase Act 2004), work has been undertaken to replace the Cornwall Minerals Local Plan. Initially, Cornwall County Council was working towards the production of a Cornwall Minerals Development Framework.

However, since the amalgamation of the former County and District/Borough Councils for Cornwall to form the unitary Cornwall Council minerals policy for Cornwall is now included in the Cornwall Local Plan see Section 5.5 below.

5.5 Cornwall Local Plan

Following creation of the unitary authority for Cornwall in April 2009, minerals planning policy is now included in the emerging Cornwall Local Plan, although it is anticipated that a specific Minerals Safeguarding Plan will be prepared following adoption of the Local Plan.

A consultation document, "Options and Preferred Options for Minerals, Waste and Energy" was prepared in January 2012 and detailed options and preferred options for minerals.

The pre-submission Local Plan – Strategic Policies March 2013 sets out the Council's proposed strategic mineral policies. These aim to support china clay extraction in the St Austell (Hensbarrow) China Clay Area. Proposed policy also seeks to safeguard china clay resources and reserves.

A proposed submission consultation document 'Cornwall Local Plan – Strategic Policies' was also published in March 2014, this took into account representations received during previous consultations. Although the aims of the minerals policies remain unchanged.

6 Projected demand and future supply for china clay

Increased competition in the global markets for paper clays has reduced profitability for many producers. The industry, has responded by effecting structural change and investing in more efficient production methods. Recent years have seen closures in the US and UK and expansion in Brazil. Brazil has enormous deposits of high quality china clay in the Amazon basin, and low production costs, making it highly competitive globally, despite the additional shipping costs.

It is estimated that global demand for china clay will increase and that recovering demand for china clay in paper production will offset lower growth in the ceramics market during this period. These overall predictions are a combination of two trends: a period of growth in recovering western markets; and a deceleration of demand in the faster growing emerging markets. Developing countries are becoming increasingly important to global china clay demand.

It is thought that growth in the ceramics market will expand most rapidly in Asia and Latin America with their growing populations and economies. Other growing markets are likely to include use in the oil and gas industry, where it is used in hydraulic fracturing; and in fibreglass industry where it is used as a re-enforcing agent. Markets in refractory clays in developed countries are likely to decline because of substitute materials.

Global capacity is currently estimated at 27-30million tonnes per annum. Imerys controls the largest sector, producing just under 6million tonnes per annum.⁴

Substantial reserves of china clay remain in the St Austell China Clay (Hensbarrow) area. These are believed to exceed 60 million tonnes.

Goonvean's china clay operations were acquired by Imerys in 2012.

Following restructuring by Imerys Minerals Ltd in 2007, including the closure of the Port of Par, surplus refinery and drying plant at Par, Burgullow/Blackpool and Goonbarrow and the closure/mothballing of several china clay pits throughout the area (including Blackpool Pit), the company made a successful bid to government to for Eco-town status, using land surplus to its china clay operations.

Imerys is now a partner in Eco-bos, a joint venture company, planning to develop 5 Eco-communities (under the Eco-town concept). Cornwall Council is commissioning independent studies of the china clay resources affected by the Eco-town proposals, including an assessment of the quantity, quality and viability of these resources and related matters. This information will be used to update policy and related areas in the St Austell China Clay Area.

⁴ Roskill, "The Economics of Kaolin", Edition 12, 1.11.2006

7 Key considerations for planning policy development for china clay

Consideration 1 To safeguard important china clay and related resources and infrastructure (bulk transport and related processing, storage, handling facilities) for future use and prevent their direct and indirect sterilisation by other development.

Consideration 2 To maintain a sustainable and efficient supply of minerals, and to encourage the sustainable use of minerals including the exploitation of China Clay and Cornwall's secondary aggregate resources, in a fashion which is compatible with opportunities to diversify the economy and develop the Eco-communities.

Consideration 3 To enable the mutually beneficial co-existence of existing and developing communities with the china clay and other mineral industries based on the areas rich mineral resources.

Consideration 4 To provide guidance for the comprehensive and long term restoration of mineral workings in the St Austell China Clay Area which benefits communities, provides opportunities for regeneration and enhances the landscape, wildlife habitats and the conservation of the historic environment.

Appendix 1

Synopsis of a Freedonia Study of World Markets for Kaolin published on 1 December 2009

<http://www.marketresearch.com/product/display.asp?productid=2524952&g=1>

Global demand to reach 25 million metric tons in 2013

Global demand for kaolin is forecast to grow nearly two percent per year to 25 million metric tons in 2013. Over the forecast period, demand for kaolin in paper production is expected to improve, offsetting an expected slowdown in the ceramics market. In general, kaolin demand in advanced economies is projected to recover from the declines of the 2003-2008 period, while demand in the faster growing emerging markets will decelerate.

Developing countries to capture majority of demand

Developing countries are becoming increasingly important to global kaolin demand. In 2008, the advanced economies of Japan, the US and Western Europe accounted for slightly more than one-half of kaolin consumption, down from two-thirds just ten years earlier. Given strong demand gains in the emerging markets of Asia, the developing countries are expected to account for the majority of global kaolin demand in 2013.

Paper market to rebound from recent declines

Demand for kaolin in paper is forecast to rebound from the declines seen between 1998 and 2008. Over that period kaolin suffered from competition with alternative materials (notably calcium carbonate), and that competition is expected to moderate in coming years. By 2008, much of the practical substitution of kaolin by calcium carbonate had already taken place. In addition, emerging markets such as China are expected to post strong gains as their paper industries expand.

Brazil to surpass US as leading exporter of kaolin

International trade in kaolin is widespread, with approximately one-half of kaolin consumed outside of its country of origin in 2008. This is partially due to the concentration of kaolin production in the US, China and Brazil. By 2013, Brazil is expected to surpass the US as the world's leading exporter of kaolin, gaining market share in Western Europe and Asia at the expense of the United Kingdom and the US. Brazil boasts sizable deposits of high-quality kaolin, making it economical to produce kaolin there, despite the additional shipping costs.

Prices to rise more slowly

Kaolin prices are forecast to grow more slowly through 2013 than they did between 2003 and 2008, as more moderate growth of energy costs reduces inflationary pressure. The average price of kaolin sold will also be restrained by the relatively slow growth of the paper market, where kaolin prices are highest. In dollar terms, the kaolin market is projected to grow two percent per year to more than \$3.5 billion in 2013.

Appendix 2

Synopsis of Roskill's The Economics of Kaolin, 12th edition published 01/11/2006

<http://www.roskill.com/reports/kaolin>

Kaolin

Capacity expansions make Brazil the second largest kaolin producer

The kaolin industry has been suffering from increased competition in its main market, paper, since the 1990s. This has led to poor profitability for many producers. The industry is responding to this situation by effecting structural changes, including capacity closures in the USA and UK and expansions in Brazil. Output is concentrated in relatively few countries (USA, China, Brazil, UK and the Czech Republic), which account for 66% of the total. US production grew by an average of 1.2%py from 5.4Mt in 1973 to 7.8Mt in 2005, while Brazilian output rose by an average 10.1%py between 1990 and 2005. Global consumption of kaolin is estimated at 23Mt in 2005. The largest market is as an extender or filler, mainly in paper and paint. These markets used an estimated 13.75Mt or 62.5% in 2005. The main threat facing kaolin in paper is its cost compared to that of alternative minerals, especially calcium carbonate. However, kaolin is increasingly used in conjunction with calcium carbonate to produce high quality printing and writing paper. World paper and board production is forecast to rise by an average 3%py up to 2010, with printing and writing paper output expanding by 4.5%py over the same period. Rising paper production will consume more minerals but much of the increase, especially in filler applications, will be of calcium carbonate rather than kaolin. As a result kaolin demand in this sector is expected to grow at 1%py to 2010.

Report highlights

Global kaolin capacity is estimated at 27-30Mtpy, with six companies each controlling more than 1Mtpy, of which Imerys of France is by far the largest controlling an estimated 5.9Mtpy. These companies control over half of all capacity. Ownership of capacity in developed countries has become steadily more concentrated because of low profitability and pressure from consumers for higher specification products.

Kaolin is an integral part of many traditional ceramics but is mainly used in whitewares such as sanitaryware, floor and wall tile, tableware and decorative ceramics. Kaolin use in sanitaryware and tiles will expand most rapidly in Asia and Latin America because of population and per capita growth. Growing markets are in proppants used in oil and gas wells and supports for catalysts in the oil and gas industry. Overall, the use of kaolin in traditional ceramics is forecast to rise by an average of 1%py to 2010.

Kaolin is used in the manufacture of reinforcing fibreglass. Production of fibreglass is concentrated in the USA, EU and Japan. The world market for

reinforcement fibreglass has been growing at 3-4%py, and is expected to continue, with demand for kaolin in this application forecast to rise by 3%py to 2010.

The steel industry is the main market for refractories but refractory clays have been largely replaced with higher alumina products such as mullite, calcined bauxite and tabular alumina. Kaolin consumption in this sector is expected to decline in developed economies and rise in industrialising ones.

In 2005, exports of kaolin from USA, UK and Brazil were reported as almost 6.8Mt compared with an estimated world production of 22.9Mt. This pattern is expected to continue, but shipments from Brazil are taking market share in the paper sector from producers in the USA and UK.