

SECTION C: IMPACT ASSESSMENT

CHAPTER C13: CUMULATIVE IMPACTS

Contents

13	CUMULATIVE IMPACTS	2
13.1	BACKGROUND	2
13.2	SCOPE	2
13.3	MINING AND INFRASTRUCTURE DEVELOPMENT IN THE SOUTH GOBI.....	3
13.4	SOUTHERN GOBI REGIONAL ENVIRONMENTAL ASSESSMENT.....	3
13.5	GROUNDWATER ASSESSMENT OF THE SOUTHERN GOBI REGION	6
13.6	SOUTHERN MONGOLIA INFRASTRUCTURE STRATEGY	7
13.6.1	<i>Town Development</i>	7
13.6.2	<i>Railways</i>	8
13.6.3	<i>Roads</i>	8
13.6.4	<i>Electricity</i>	8
13.6.5	<i>Water Resources</i>	8
13.6.6	<i>Social Issues</i>	9
13.6.7	<i>Environment</i>	9
13.6.8	<i>Financing of Development</i>	9
13.7	SOCIO-ECONOMIC CUMULATIVE IMPACTS	10
13.7.1	<i>Influx</i>	10
13.7.2	<i>Community Health & Safety</i>	13
13.7.3	<i>Labour and Livelihoods</i>	14
13.7.4	<i>Economic Risks</i>	14
13.7.5	<i>“Dutch Disease” and the “Resource Curse”</i>	15
13.7.6	<i>Exposure to Changes in Commodity Prices</i>	17
13.8	CUMULATIVE ENVIRONMENTAL IMPACTS	18
13.8.1	<i>Impacts to the Wildlife of the South Gobi</i>	18
13.8.2	<i>Cumulative Demand for Water</i>	22
13.8.3	<i>Traffic and Dust Generation</i>	23
13.8.4	<i>Waste Generation</i>	23
13.9	GOVERNMENT INITIATIVES TO MANAGE CUMULATIVE IMPACTS	23
13.9.1	<i>Southern Gobi Regional Development Council</i>	24
13.9.2	<i>Financial Arrangements</i>	24
13.10	POSSIBLE FUTURE DEVELOPMENT OF THE OYU TOLGOI PROJECT	24
13.10.1	<i>Phase 2 Development of the Oyu Tolgoi Project</i>	25
13.10.2	<i>Increase in Water Consumption</i>	27
13.10.3	<i>Development of Block Caving at Heruga Deposit</i>	29
13.10.4	<i>Potential Future Rail Transportation of Concentrate to China</i>	30
13.10.5	<i>Development of Mongolian Power Supply</i>	31
13.10.6	<i>Extended Life of Mine Economic Impacts</i>	35

Figures

Figure 13.1:	Proposed Natural Resource Development Projects within the South Gobi	4
Figure 13.2:	Variability in Mongolian Export Values.....	18
Figure 13.3:	Barriers to the Khulan Migration Routes	21
Figure 13.4:	Relationship of Heruga Deposit to other Oyu Tolgoi Deposits	29
Figure 13.5:	Planned Location for Proposed Power Plant at Oyu Tolgoi.....	34

Tables

Table 13.1:	Operational and Planned Mines in Southern Mongolia.....	3
Table 13.2:	Soum Level Population Projections, Years 2010 to 2020	6
Table 13.3:	Indicative Capital Costs for Town Development	7
Table 13.4:	Road Masterplan Projects in Southern Mongolia	8
Table 13.5:	Soum and Aimag Population	11
Table 13.6:	Summary of Project Water Demand and Borefield/Pipeline Design Capacity	28

13 CUMULATIVE IMPACTS

13.1 BACKGROUND

The South Gobi region of Mongolia is experiencing rapid growth in the natural resources sector, and in particular in mining and energy projects. Whilst some of these projects are already under construction or initial operation, further projects are planned or at the concept stage. Hence, the cumulative impacts of mining in the South Gobi are likely to be significant over the mine life of the Oyu Tolgoi Project and beyond.

If planned mining developments proceed, at least ten large projects could together be producing 70 Mtpa of coal and over 2 Mtpa tonnes of copper concentrate, generating an annual US\$5.2 billion in revenues. These developments will occur in a region that has low population density, limited infrastructure and high ecological sensitivity in some areas.

This Chapter of the ESIA describes and evaluates:

- The known/planned infrastructure developments within the South Gobi and summarises the regional studies which have been undertaken to assess the scale and impacts of these developments;
- The Oyu Tolgoi Project in the context of other mining and infrastructure projects within the South Gobi region and considers the cumulative impact of these developments; and
- Further planned development of the Project in the future where additional impacts may be anticipated to occur.

Many of the cumulative impacts described in this Chapter are outside of Oyu Tolgoi's control, but appropriate cross-references are provided to corresponding impact assessment and management plan chapters within this ESIA where proposed mitigation and management requirements are set out.

13.2 SCOPE

The cumulative impacts from this Project as considered by this ESIA can be divided into environmental and socio-economic impacts. Cumulative impacts are those that may be related to foreseeable future development of the South Gobi region and also impacts that may be related to foreseeable future Project expansion or development.

The main *socio-economic* cumulative impacts include:

- housing and social infrastructure demand;
- community health safety and security;
- livelihood transformation (loss of traditional livelihoods which is treated as part of the 'intangible' cultural heritage of Mongolia); and
- "Dutch disease" economic impacts related to economic "boom and bust".

The principal *environmental* cumulative impacts are:

- The cumulative demand for water (from multiple projects);
- Cumulative impacts to wildlife;
- Dust generation; and
- The demand for waste infrastructure and requirements for the disposal of waste.

The scale of these impacts will depend on how other mining operators manage their environmental impacts and how the Government of Mongolia acts to coordinate and facilitate development. However, with the scale of developments planned in the region, some adverse cumulative impacts are inevitable and need to be taken into account in medium and long-term planning.

13.3 MINING AND INFRASTRUCTURE DEVELOPMENT IN THE SOUTH GOBI

The Oyu Tolgoi Project is the largest of a number of actual and planned mining project developments in the South Gobi and in Mongolia generally. A recent World Bank study estimated that mining operations in Southern Mongolia could generate annual revenues of \$5.2bn by 2015¹. While the near-terms projections in this study have already been superseded by events, it does provide a useful indication of the potential order of magnitude of development activities within the South Gobi and Mongolia.

The World Bank study is based on the current and future permitting of a number of mines in the region as set out in *Table 13.1* below – while this table is somewhat dated, it provides an indication of the likely order of magnitude of current and future development within the South Gobi region:

Table 13.1: Operational and Planned Mines in Southern Mongolia

Mine	Commodity	Mine Life (yrs)	Production (000 tonnes/yr)	Estimated Direct Employment	Estimated Start Date
Tavan Tolgoi	Coal	200+	15,000	1,500	2012
Uhaahudag	Coal	40	10,000	1,000	2009
Baruun Naran	Coal	20	6,000	500	2012
Tsagaan Tolgoi	Coal	20	2,000	150	2015
Nariin Sukhait	Coal	40	12,000	150	2003
Ovoot Tolgoi	Coal	50	5,000	400	2008
Sumber	Coal	50	5,000	400	2015
Shivee Ovoo	Coal	200+	14,000	600	2015
Oyu Tolgoi	Copper	50	2,000	4,000	2012
Tsagaan Suvraga	Copper	20	250	1,000	2012
Total				7,800	

Source: World Bank, 2009. Note: Copper production is for 30% copper concentrate

In addition to the studies undertaken by the Oyu Tolgoi Project and other project developers, a number of recent studies have been undertaken that consider the regional impacts of the future development of the South Gobi region. These include:

- Walton, T. 2010. *Southern Gobi Regional Environmental Assessment*. Mongolia Discussions Papers, East Asia and Pacific Sustainable Development Department, Washington D.C.: World Bank;
- Tuinhof, A. and Buyanhisnig, N. 2010. *Groundwater Assessment of the Southern Gobi Region*. Mongolia Discussions Papers, East Asia and Pacific Sustainable Development Department, Washington D.C.: World Bank; and
- Wartlers, Michael, 2009. *Southern Mongolia Infrastructure Strategy*: World Bank.

The following sections provide a summary of each of these reports which provide a useful assessment of likely regional and cumulative impacts across the region. Although not all projections and estimates have proven to be accurate as projects have progressed, and not all projections align with Oyu Tolgoi's own forecasts, these studies remain useful as a starting point in the assessment of potential cumulative impacts of mining activities in the South Gobi region.

13.4 SOUTHERN GOBI REGIONAL ENVIRONMENTAL ASSESSMENT

The objective of this study was to provide guidance and recommendations for the sustainable management of environmental resources as part of the future development of the Southern Gobi Region; in response to the rapid development of mining and related infrastructure in the region.

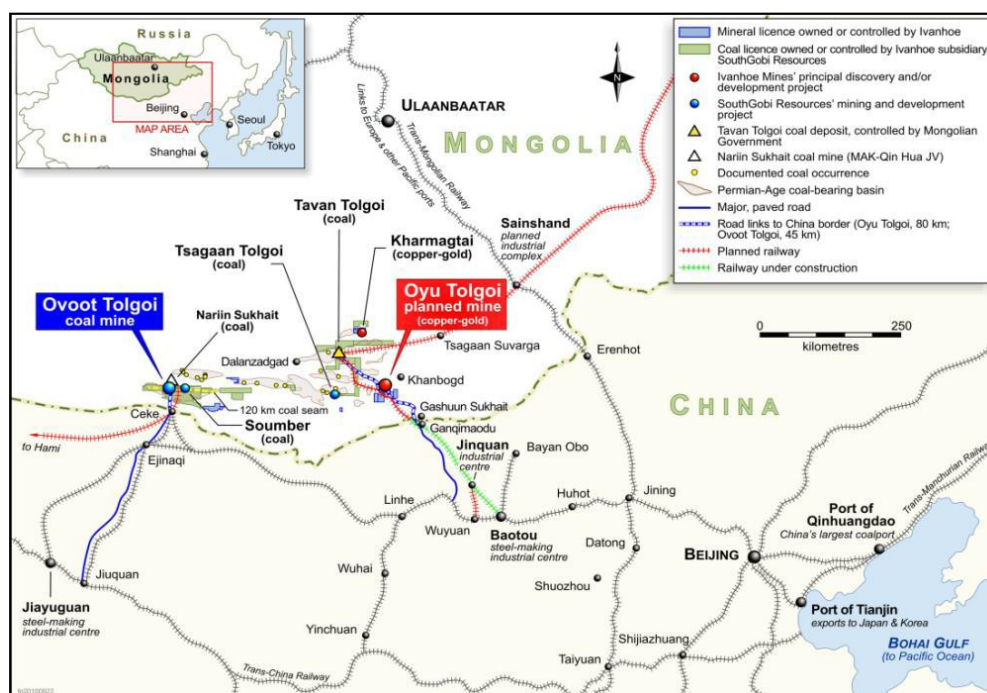
¹ Wartlers, Michael, 2009. Southern Mongolia Infrastructure Strategy. World Bank.
http://siteresources.worldbank.org/INTMONGOLIA/Resources/SMIS_July.pdf

The study defines a base-case and a high-case scenario and assesses impacts on the natural and human environments:

- The **base-case scenario** assumes that current mining operations will continue, expanding according to their respective plans, and that the large new mines that are in or near initial stages of development will proceed into production. The new mines are the copper and gold mine at Oyu Tolgoi, the coal mine being developed by Energy Resources LLC at Tavan Tolgoi, and a larger coal mining operation at Tavan Tolgoi. Minimum ancillary facilities required for the new mines are one coal-fired power plant, probably at Oyu Tolgoi (but still at the concept stage); well fields and connecting transmission mains to supply groundwater for processes at Oyu Tolgoi and the Energy Resources LLC mine; and housing for workers and their families. Large infrastructure to support the base-case includes improved roads to transport coal and other mine outputs south to the China border crossings and, somewhat later, rail lines roughly parallel with the roads.
- The **high-case scenario** includes the mines, ancillary facilities, and infrastructure in the base-case, with additional expansions; plus a copper-molybdenum mine at Tsagaan Suvarga, coalmines at Baruun Naran and Eldev, a large mine-mouth power plant at the existing Shivee Ovoo coal mine, uranium *in situ* leach projects in the northern tip of Dornogovi, and a large cement factory at Khukh Tsav. New major infrastructure included in the high-case scenario consists of a rail connection from Tavan Tolgoi northeastward to the Trans-Mongolia Railway and water pipelines from rivers to the north of South Gobi Region.

Figure 13.1 below illustrates the location and scale of the proposed natural resources projects within the South Gobi region.

Figure 13.1: Proposed Natural Resource Development Projects within the South Gobi



Source: Ivanhoe Mines Ltd.

Key findings of the study include:

- The natural resources and environmental characteristics of the South Gobi Region present unique opportunities and constraints for development – i.e. extensive mineral resources in a remote setting, where the semi-nomadic way of life for herders may both be enhanced and threatened by development;
- The importance of water resources as a constraint. There are large reserves of fossil groundwater that have only been partially identified and assessed, but because they are not recharged, they must be treated as a non-renewable resource that must be used with care;

- Water supply needs for mining and mine-related developments can likely be met by resources within the South Gobi Region up to 2020 and perhaps beyond under the base-case; while under the high-case, additional water resources will be needed;
- Climatic extremes can be catastrophic for local communities, herders, their livestock and wildlife;
- Soils are thin and of poor quality meaning that herders, their livestock and wildlife can be vulnerable to man-induced degradation and weather events (such as dust storms);
- Natural food chains are dependent on the fragile productivity of desert soils and are impacted by the increased commercialisation of livestock herding;
- The direct impacts of mine construction itself are of relatively low importance on a regional scale;
- Coal transportation is already having significant impacts in terms of dust, habitat fragmentation, community health and safety – while a railway would mitigate many of these impacts it is likely that it would have significant impacts on the migration of livestock and wildlife;
- Population will increase dramatically in the *soum* centres in the vicinity of the mining projects. The study assumes that influx will be equal to the number of miners and their family members. **The results are that total mining-related populations in the South Gobi Region will be 30,000 to 80,000, including people already living in the region;**
- The base-case population will require an additional 5,300 housing units and associated demands on water, waste water, waste management and power resources;
- Air quality within the South Gobi Region is routinely above Mongolian ambient air quality limits for dust;
- Mitigation measures are available for many of the likely impacts, with water likely to be a key issue;
- Reducing the current impacts of the transportation of coal and other mine products is a key priority;
- *Aimag* and *soum* administrations are unprepared to handle the anticipated population increases; and
- The key challenge is that of planning and implementing development in the South Gobi Region that is sustainable.

The Oyu Tolgoi Regional Development team has produced more recent population projection estimates at *soum* level, as shown in *Table 13.2*. These calculations used the same methodology as adopted by the Asian Development Bank (ADB) in its population projections for the South East Gobi² but draw on slightly different assumptions based on the more recent data. The figures presented in the table below highlight the predicted substantial increase in the size of Khanbogd *soum* population.

² Asian Development Bank. *Southeast Gobi Urban and Border Town Development Project*. Source URL: <http://www.adb.org/projects/project.asp?id=42184>

Table 13.2: Soum Level Population Projections, Years 2010 to 2020

Soum Centre	Likely Future Function (and distance from Oyu Tolgoi)	Official Population, Census 2010	Population Projections		
			2010	2015	2020
Dalanzadgad	Regional Mining Centre (250 km)	18,746	17,000	22,600	30,000
Khanbogd	Key Urban Service Centre for Oyu Tolgoi (45 km)	3,522	3,500	14,000	20,000
Manlai	Satellite Urban Centre (120 km)	2,441	2,000	2,400	3,000
Bayan Ovoo	Satellite Urban Centre (80 km)	1,600	1,500	1,800	2,200

Source: Oyu Tolgoi Regional Development Team 2010, and Khanbogd Government Office 2010.

According to the ADB projections, population of Khanbogd *soum* is expected to increase significantly by year 2020 (from 3,522 in 2010, 14,000 in 2015 to 20,000 in 2020)³.

These figures from Oyu Tolgoi suggest that the future population forecast proposed by South Gobi Regional Environmental Assessment are reasonable estimates, but will be heavily influenced by the timing and scale of actual mining development versus that forecast in the study. Further information on this can be found on *Chapter D16: Influx Management Plan*.

13.5 GROUNDWATER ASSESSMENT OF THE SOUTHERN GOBI REGION

This study was undertaken to support the economic development of the South Gobi Region and seeks to chart a way forward to assure that water resources development can support economic development in a sustainable manner. Key findings of the study include:

- The current regional water demand is approximately 10,000m³/day for domestic uses and 32,000 m³/day for livestock water supply. The current operational water demand of coal mines is approximately 40,000 m³/day. This demand is expected to increase sharply and may reach approximately 300,000 m³/day by 2020;
- Mine development will trigger population increases and commercial development that will contribute to increased water demand. A preliminary estimate gives total water demand in 2020 of 400-450,000 m³/day of which approximately 300,000m³/day goes to mining;
- Groundwater is the main water resource in the South Gobi Region, almost all of which is fossil, with little or no recharge. Estimates of groundwater potential vary between 200-500 million m³/year over a 25-40 year timeframe and a lowering of the groundwater by 50-100 meters. The lower range of 200 million m³/year is equivalent to 550,000 m³/day and leads to the conclusion that the groundwater potential of the South Gobi Region as a whole is sufficient to cover water demands over the next 10-12 years;
- A number of concepts have been discussed to convey surface water to the South Gobi Region. These plans are at a pre-feasibility level and no consideration has yet been given to their socio-economic, financial and/or environmental feasibility. A preliminary cost comparison shows that groundwater supply is around 50% cheaper than surface water supply, but is likely to have higher operating costs; and

³ Southeast Gobi Urban and Border Town Development Project; PPTA Project Report; Supplementary Appendix A; Asian Development Bank, November 2009.

- Given the uncertainties in demand projections and water supply options, the best way forward is to develop short and medium-term scenarios for matching supply and demand and to update these on a regular basis when new information becomes available.

In summary, a regional groundwater assessment study is needed to bring all information together as the basis for the development of regional groundwater management plans.

From the perspective of Oyu Tolgoi, it will abstract water from a deep saline aquifer in the Gunii Hooloi area and has received approval from the Water Authority for the abstraction of water sufficient to meet water demand for 100,000 tpd operations for the envisaged 27-year mine life. As a result, it will not be subject to any shortfall in water supply and is not anticipated to compete for water resources with other industrial users or with users of local shallow rain-fed aquifers overlying the Gunii Hooloi aquifer.

Under the terms of the Investment Agreement⁴, Oyu Tolgoi has the right to access and use its self-discovered water resources (such as the Gunii Hooloi) on an exclusive basis for purposes connected with the Oyu Tolgoi Project during the life of the Oyu Tolgoi Project, including to construct, commission, operate and rehabilitate the Oyu Tolgoi Project. As a result, and given the lack of other planned projects within Khanbogd *soum*, it is unlikely that Oyu Tolgoi will “compete” for water resources with other projects. Any expansion of Oyu Tolgoi production capacity beyond the currently planned 100,000 tpd may require the permitting of additional water resources which would either come from the Gunii Hooloi (where ongoing investigation is underway to determine whether the size of the know water resource is larger than predicted) or from another local deep groundwater aquifer (yet to be determined). At the same time, improvements in water use efficiency at Oyu Tolgoi may also decrease the amount of additional water that would be required for any future expansion of the Project. Further information on this may be found in *Chapter A4: Project Description*, *Chapter B6: Water Resources Baseline Assessment* and *Chapter C5: Water Resources Impact Assessment*.

13.6 SOUTHERN MONGOLIA INFRASTRUCTURE STRATEGY

This report is focused on the development of the infrastructure which is required in order to support proposed mines in Southern Mongolia. In order for the mines to be developed, it will be necessary to provide towns for the new inhabitants, road and rail links to provide supplies and to transport the mines’ products to markets, and electricity for the mines’ operations. Water resources need to be investigated and supplied to the mines and towns. Key findings of the strategy study are outlined below.

13.6.1 Town Development

The strategy assumes that the population (of the mining-based communities) will increase by around eight (8) times the number of mine employees. By 2015, town development might require investment of US\$1.4 billion. The following table provides a summary of indicative capital costs for town development (see *Table 13.3* below).

Table 13.3: Indicative Capital Costs for Town Development

Population centre	Additional Population	Building Costs (\$m)	Infrastructure Costs (\$m)	Total (\$m)
Tavan Tolgoi	16,772	238	42	280
Nariin Sukhait	7,967	112	29	141
Oyu Tolgoi	33,544	490	69	559
Tsagaan Tolgoi	1,258	18	20	38
Shivee Ovoo	5,032	70	23	93
Dalanzadgad	16,772	238	42	280
Total	81,344	1,166	225	1,391

⁴ Section 6.13.

There are a range of different models for future town growth and development and these will have significant implications for the extent of population influx (fly-in fly-out, gated communities, integrated communities, and/or company towns).

Government leadership and coordination of the process of town development is needed to coordinate acceptable and sustainable regional urban development.

13.6.2 Railways

At a cost of around US\$1.8 million per km, new railways in Southern Mongolia will only be financially justified for freight volumes of at least 2-4 million tonnes per annum. The study concludes that:

- The output from Tavan Tolgoi will be sufficient to justify the construction of a railway into China;
- The combined output of the MAK, MAK-Qinhua and South Gobi Sands mines at Nariin Sukhait and Ovoot Tolgoi will be sufficient to justify construction of a railway;
- The likely freight and passenger volumes generated by towns (e.g. Dalanzadgad) and the mines at Tsagaan Suvraga and Tsagaan Tolgoi are insufficient to justify the construction of a railway. These destinations would be best served by road transport; and
- The output of Oyu Tolgoi will also be insufficient to justify construction of a railway, but it is conveniently located close to the route of the planned Tavan Tolgoi-Gashuun Sukhait railway.

13.6.3 Roads

Mongolia's Road Master Plan, prepared in 2007, calls for the construction of several sealed roads in Southern Mongolia. Their estimated cost is set out in the following table. Where possible, the master plan suggests that mining projects will be encouraged to finance and perform the works for upgrading or new construction. The roads will then be handed back to the Government which would operate them as tollroads to at least cover their current costs (see *Table 13.4* below).

Table 13.4: Road Masterplan Projects in Southern Mongolia

Route	Timing	Distance (km)	Costs (\$m)
Ulaanbaatar – Mandalgovi	2008-10	230	69
Dalanzadgad – Gashuun Sukhait	2008-9	329	99
Nariin Sukhait – Chinese Border	2009	40	12
Mandalgovi – Dalanzadgad	2011-2015	293	88
Total		892	268

13.6.4 Electricity

Without additional generating capacity, there will be an inadequate supply reserve margin from 2011, and electricity demand will exceed supply from 2012. The forecast assumes 3.5% demand growth on the Central Electricity System (CES) centred on Ulaanbaatar, and takes account of the likely development of the Oyu Tolgoi, Uhaahudag and Tavan Tolgoi mines. It is assumed that Nariin Sukhait and Ovoot Tolgoi will be supplied with electricity imported from China. If Chinese imports are not permitted, demand growth will be even greater.

13.6.5 Water Resources

The extent of underground water resources in Southern Mongolia is not known with any precision; however it is considered that fossil groundwater is the most extensive resource.

It appears that there is sufficient groundwater potential to accommodate demand growth until at least 2020. Based on a fairly high estimate of possible demand growth, the demand for water resources in Southern Mongolia could grow from the current consumption of around 50,000 m³/day to around 350,000 m³/day in 2020. A conservative estimate of the extent of water resources in the area suggests there is groundwater potential for 500,000 m³/day (this figure varies between the different regional studies).

Development of a water supply system relying on the abstraction of groundwater reserves could cost in the order of US\$ 260 million, of which around US\$ 35 million would be required for investigative studies and drilling to identify reliable wells.

An alternative option would be to supply Southern Mongolia with surface water, piped from either the Kherlen or the Orhon Rivers. The capital cost of these options would be at least US\$ 400 million each. This option is not supported by Oyu Tolgoi on economic, environmental and political grounds.

The option of groundwater supply is preferable not only because it is cheaper, but because the capital costs can be spread across time and space, as particular mining and town developments proceed. Environmental issues associated with the use of surface water are also likely to be highly significant.

There may eventually be a need for the construction of water pipelines from the Kherlen or Orhon Rivers. But over the next decade the priority will be to rely on groundwater resources in the region, and to increase knowledge of the extent of those resources through a programme of studies and drilling. It is likely that additional studies will reveal additional resources beyond those assumed in the conservative estimate of groundwater potential of 500,000 m³/day.

13.6.6 Social Issues

It will be difficult to developing a comprehensive strategy to ensure that local residents receive a reasonable share of the benefits of mining, because there are so many different institutions responsible for addressing the diverse social impacts.

A first step towards a comprehensive strategy would be the establishment of a regular consultative forum, involving different tiers of government, mining companies, local communities, and NGOs. The forum could provide opportunities for information sharing, decision-making, and dispute resolution. Many of the social impacts will need to be addressed by local governments. Investments in capacity-building of local government should begin ahead of population influx.

Some of the areas to be addressed include:

- Sharing mining revenues;
- Alignment of mining company contributions with government policy;
- Improving employment opportunities through education and training;
- Encouraging women's participation in the labour force;
- Improving town and social services;
- Protecting vulnerable groups;
- Protecting foreign workers; and
- Planning for mine closure.

13.6.7 Environment

Construction of major roads and railways may have serious and regionally-significant impacts on the movement of migratory wildlife. At present, not enough is known about what migration routes are used by these animals, and what sorts of facilities they will use to cross major roads and railways. Studies to identify wildlife behaviour (particularly migration routes) and appropriate wildlife crossing arrangements are a high priority. Requirements to construct wildlife crossings will be included in any environmental management plans for approved roads and railways. Where feasible, transport networks will be planned to minimise disruption to major migration routes.

Dewatering of mines will drain groundwater from large areas around those mines. Development of bores and springs elsewhere could help to offset the environmental consequences, particularly where springs are used by wildlife.

13.6.8 Financing of Development

Development of the infrastructure to support mining in Southern Mongolia could require investments totalling more than US\$5 billion by 2015. The Ministry of Finance will develop a financing plan, which

indicates who would finance the various investment projects, the state budget, donors, or the private sector.

13.7 SOCIO-ECONOMIC CUMULATIVE IMPACTS

The follow sections address the likely cumulative impacts on the socio-economic environment. These impacts take into account the long mine life of the Oyu Tolgoi Project coupled with the likely development of other mining projects within the South Gobi.

The key socio-economic cumulative impacts discussed in this section comprise:

- Population influx;
- Community health and safety;
- Labour and livelihoods;
- Economic risks;
- “Dutch Disease” and the “Resource Curse”; and
- Exposure to changes in commodity prices.

13.7.1 Influx

The population of Mongolia in 2010 was estimated to be 2.9 million people⁵ giving an overall population density of 1.7 persons per km² (making it the least densely populated country in the world). In 2010, Omnogovi *aimag* had an estimated population of 48,500, the third lowest of all Mongolian *aimags*, and making up less than 2% of the national population⁶. One third of the population is classified as urban, whereas two thirds are rural. Population density in Omnogovi *aimag* is 0.28 /km², making it the least densely populated *aimag* in the least densely populated country in the world.

Developing and operating the mines expected to be developed in the South Gobi in the future will rely on increased workforce numbers, not all of which will be able to be sourced from the nearest towns or even from the South Gobi region.

The Project Area of Influence is likely to witness rapid change in the next five years due to mining development. Omnogovi *aimag* is poised to experience a boom in economic activity as a result of the mine development at Oyu Tolgoi and at other locations in the southern Gobi – notably Tavan Tolgoi coal deposit 150 km Northwest of Oyu Tolgoi in Tsogttsetsii *soum*.

Influx Projections and Distribution

There were 48,517 people living in Omnogovi *aimag* in 2010, one-third of whom lived in the *aimag* centre of Dalanzadgad. The three other Project Area of Influence *soums* had small populations of between 1,500 and 3,000 people in total. These *soums* have a high rural population, although Khanbogd *soum*, the most populated of the Project Area of Influence *soums*, has a higher proportion of its population living in the *soum* centre than either Bayan-Ovoo and Manlai. Tsogttsetsii *soum* has recently seen a dramatic increase in population as a result of influx associated with the UHG coal mine, with population doubling in about 18 months. The populations of Dalanzadgad and Khanbogd *soums* are now also showing signs of an acceleration in population increase. Dalanzadgad grew at the rate of 12.4% in 2009 and the Khanbogd population grew by about 9 % during the same period.⁷

As shown in *Figure 13.5*, Khanbogd *soum* is the most populated of its neighbouring *soums* (Bayan-Ovoo and Manlai). Dalanzadgad, the *aimag* capital, has the greatest number of population of nearly 18,000.

⁵ United Nations Population Division: Mongolia Demographic Profile.

⁶ It should be noted that *Aimag* and *Soum* government's population estimates are based on citizen registration.

⁷ Omnogovi *aimag* Statistical Office figures.

Table 13.5: Soum and Aimag Population

Year	Khanbogd (Key Urban Service Centre for Oyu Tolgoi 45 km)	Bayan-Ovoo (Satellite Urban Centre, Oyu Tolgoi 80km)	Manlai (Satellite Urban Centre – Oyu Tolgoi 120 km)	Dalanzadgad (Regional Mining Centre)	Total Aimag
2007 Total Population	2,974	1,539	2,510	15,176	47,299
2010 Total Population	3,522	1,600	2,441	18,746	48,517
Population Growth Rate 2006-7	2.5	1.3	1.6	3.1	2.1
Density km ²	0.2	0.15	0.2	31.9	0.28

Source: 2007, 2010: Omnogovi Aimag Statistical Office, 2010 from Khanbogd Government Office. HH: household, as cited in KTKK Health Impact Assessment, 2010; National Statistics Office, 2010 Census Data.

The influx associated with Oyu Tolgoi and other mining activity in the *aimag* (and in particular Tavan Tolgoi) is projected to more than double the *aimag* urban population in the next ten years. Although accurate population projections are difficult, for some *soum* centers, notably Khanbogd, population is expected to increase by an order of magnitude by year 2020 (from about 2,000 in 2010 to 14,000 in 2020)⁸.

Such rapid growth will stimulate an economic "boom" in the Project Area of Influence and bring unprecedented positive benefits to the region, however it will also place local residents, governments and municipal services and facilities under significant pressure.

This expected influx of workers will depend on the mining methods adopted, broader economic issues that may influence the level of non-direct employee influx and family size alongside other broad demographic trends. Taking this variability into account, it is possible to look at ranges of population figures for affected *soum* centres.

Tavan Tolgoi coal mine, situated 90km east of Dalanzadgad and about 130km west of Oyu Tolgoi is the closest current major project to the Oyu Tolgoi Project. Influx associated with the Tavan Tolgoi mine is likely to impact Tsogttsetsii and to a lesser extent, Dalanzadgad. Construction-related influx impacts from Tavan Tolgoi on Tsogttsetsii may be in the range of 850-1,500 in-migrants. Once into operations, Tsogttsetsii *soum*'s population may grow from the present 2,120 to about 10,000. While a more labour-intensive development strategy could lead to a bigger construction influx, possibly in the range 2,800 – 5,600 in-migrants during construction and growing to more than 24,000 in Tsogttsetsii during operations.

Tsogttsetsii is about 120 km from Oyu Tolgoi, so the influx settlement occurring there will have little direct impact on Oyu Tolgoi or Khanbogd. The most significant impact will result from the greatly increased traffic and flows of people through the South Gobi. In the case of the adoption of a labour-intensive development strategy, Tsogttsetsii could potentially supersede Dalanzadgad as the largest population centre in South Gobi.

As a result of this influx, there will be considerable growth in the demand for housing and social infrastructure. Assuming an average mine worker family size of four members, each job created at a mine site (if it is not a rotational position) could lead to an increase of four community members, at least some of which will be children requiring schooling.

In addition, experience at Khanbogd (near Oyu Tolgoi) and internationally, suggests that for every direct job created at a mine, there is (roughly) one indirect job created to serve these new economic opportunities. Depending on whether these indirect employees relocate with their families or not, this could lead to population multipliers as high as eight new community members for each direct job. While in reality these numbers may be lower, there is also the potential for towns to form a critical mass or size whereby population growth expands beyond that needed to service mine needs alone. With this growth in population will come additional needs for housing and social infrastructure, which will place considerable stress on the capacity of existing *soum* centres and their administrative (and financial) abilities. The Oyu Tolgoi housing strategy is based on a decentralised approach that seeks to ensure that balanced and

⁸ Southeast Gobi Urban and Border Town Development Project; PPTA Project Report; Supplementary Appendix A; ADB November 2009.

sustainable development of the Southern Gobi region and that this is not over-concentrated on Khanbogd. Further details of Oyu Tolgoi's approach are set out in *Chapter C8: Population and Influx Impact Assessment* and *Chapter D16: Influx Management Plan* included within this ESIA.

If well managed, the cumulative impact of these multiple mining projects could be to establish large, sustainable, economic centres in the Southern Gobi. By creating economic opportunities, social services and businesses in the region, the current population pressures on Ulaanbaatar could be reduced and the broad development of Mongolia promoted. This would have the added effect of reducing reliance on the mine sites and mining operations and creating a sustainable business base which is not solely reliant on natural resources. Given the 200+ year life span of several of the large projects, the short-term sustainability issues normally present in the mining industry could in some ways be reduced.

Ability to Absorb Cumulative Influx

While the majority of Oyu Tolgoi and Tavan Tolgoi construction materials and equipment will be procured from China, Dalanzadgad – the capital of Omnogovi *aimag*, will likely emerge as the Mongolian service centre for the two mines as well as other mining projects that are currently in various stages of exploration and feasibility investigation, e.g. to the west of Dalanzadgad around Gurvan Tes.⁹

The attractiveness of Dalanzadgad from the perspective of in-migration consists in its superior infrastructure and housing stock as compared with the other *soums*, as well as better quality business and living environments.

The 2007 *Oyu Tolgoi Influx Risk Assessment* predicted an increase in the range of 10% of the population of Dalanzadgad, resulting from in-migration engendered by employment opportunities related to construction.¹⁰ This influx is likely to be further increased by gravitating to the location of Oyu Tolgoi training facilities in Dalanzadgad, following the establishment of the proposed Vocational Training School (see *Chapter C9: Employment* for further details on Oyu Tolgoi vocational training). However, recent data, which are under preparation by *aimag* authorities, indicate that the population of Dalanzadgad has reached nearly 19,000 in 2010¹¹, compared to 17,000 in 2007. It can be inferred that the population rise has resulted not solely from the natural increase of the population, but also through in-migration which has emerged as a major contributing factor. The population of Dalanzadgad grew at the rate of 12.4% in 2009.

Additional functions that will be catered for in Dalanzadgad and will represent the points of attraction for migration also include:

- A logistical hub for concentration of mines-related goods and services sourced from elsewhere in Mongolia;
- Mines workforce housing base (for some of the workers commuting based on a bus-in/bus-out scheme to regional mining projects); and
- An education and training centre.

Such activities are likely to contribute to a steady on-going growth of the population for which the Oyu Tolgoi Project will be a contributory, but the not the sole, driver.

While Dalanzadgad is likely to be a focus for regional influx, it is considerably better equipped and developed to absorb such influx than any of the rural *soums* in the Project Area of Influence. This greater degree of resilience results from the following:

- Construction-related influx into Dalanzadgad in relation to the size of the host population is likely to be less significant than for the other *soums* where the population is much smaller. Overall, it is anticipated that proportion of the influx will not exceed 10% of the host population;

⁹ Gurvan Tes is one of the *soums* of Ömnögovi *aimag*. Nariin Sukhait Coal Mine is located 25 km south-east from the *soum* centre.

¹⁰ Barclay and Associates 2007. Oyu Tolgoi: Influx Risk Assessment. Background report prepared for Ivanhoe Mines Mongolia, Inc., and Rio Tinto.

¹¹ Census data 2010, National Statistics Office of Mongolia.

- Dalanzadgad has a larger and more skilled resident workforce, many of whom may be well positioned to gain employment with Oyu Tolgoi and other mining projects both during construction and operations. This will lead to increased incomes contributing to the strengthening of Dalanzadgad economy;
- As the aimag (province's) capital, Dalanzadgad has significantly greater government capacity, budgetary resources, and higher capability to leverage additional resources from the central government if required;
- As compared with the other soums in the Project Area of Influence, Dalanzadgad has relatively better established infrastructure, both in terms of utilities and social services;
- There is a larger supply of and better quality housing stock in Dalanzadgad, together with the availability of private construction contractors capable of responding to increased housing demand; and
- Well-established commercial enterprises that can also cater for a range of needs of the growing population.

A buoyant economy, higher standard of living and more favourable business environment in Dalanzadgad may potentially accelerate an intra-regional shift of population from other *soums* in the Project Area of Influence to Dalanzadgad. On the other hand, this trend may be balanced through the growth of Khanbogd and Tsogtsetsii *soums* as a result of the mines' operations (Oyu Tolgoi and Tavan Tolgoi, respectively) and improved economic performance due to mining related income and investment, which may in turn lead to these centres of mining emerging as new commercial hubs of South Gobi region.

Oyu Tolgoi's plans for influx management are set out in *Chapter C8: Population and Influx Impact Assessment*, *Chapter C9: Employment Impact Assessment* and *Chapter D16 Influx Management Plan*.

13.7.2 Community Health & Safety

Community health & safety issues are discussed in *Chapter C12: Community Health, Safety & Security Impact Assessment*, *Chapter D11: Transport Management Plan* and *Chapter D18: Community Health, Safety & Security Management Plan*.

Road Transport Risks

At present, the majority of supplies utilised by the mining projects in the South Gobi Region are transported from Ulaanbaatar via the road through Mandalgovi and Dalanzadgad. Increased mining and commercial activity in the region will increase heavy vehicle movements on this road, leading to increased environmental impacts (dust and noise) as well as increased safety impacts for communities located along the route of the road.

Oyu Tolgoi will undertake driver training and ensure that all vehicles are road-worthy and routinely maintained to mitigate the health and safety risk. Furthermore, application of these driver and vehicle standards in an open manner may have an indirect effect on other drivers on the road, leading to a gradual transfer of awareness of those standards throughout the freight transport industry in Mongolia.

Traffic levels (for both light vehicles and commercial vehicles) are forecast to increase over time across the South Gobi region. This increase in traffic volumes will be outside the ability of Oyu Tolgoi to control. *Chapter B11: Transport and Infrastructure* illustrates how even during the construction phase with Oyu Tolgoi traffic along the Oyu Tolgoi to Gashuun Sukhait road is at its highest, it still represents only approximately half the current traffic volumes on the road.

The provision of adequate transport infrastructure and policing for projected traffic levels will be the responsibility of the Government of Mongolia.

Health Risks/Health Management

With the influx of workers, there is also a potential for prostitution associated with the construction and operations workforce, which carries the risk of the spread of sexually transmitted diseases, either to local communities or to commercial sex workers that might move into the area. In addition, there is increased risk of new disease vectors. Potential issues related to the workforce and local communities include unfavourable interactions that may arise between Project personnel and residents (e.g. conflicts, fighting, prostitution etc). Oyu Tolgoi recognises that the first step in protecting community health and well-being

is to protect its workforce. This is described in more detail in *Chapter C12: Community Health, Safety and Security* and in *Chapter D18: Community Health, Safety and Security Management Plan*.

13.7.3 Labour and Livelihoods

Labour and livelihoods issues are discussed in *Chapter C9: Employment Impact Assessment*, *Chapter C10 Land Use & Displacement Impact Assessment*, *Chapter C11: Cultural Heritage Impact Assessment*, *Chapter D13: Cultural Heritage Management Plan* and *Chapter D15: Resettlement Action Plan*.

The development of the South Gobi Region through the construction and operation of a range of mining projects will lead to the creation of a wide range of other jobs in service and support businesses. While this creates improved employment prospects for local workers, it also presents a challenge to the maintenance of the traditional pastoral way of life.

A number of inter-related issues and challenges combine:

- Increased employment prospects and improved working conditions may make traditional herding lifestyles less attractive across the South Gobi Region. There is a risk that those families that do not have family members who are employed in the new industries and which do not take advantage of the opportunities created may become increasingly “left behind” and marginalised;
- Action by mining companies to support traditional lifestyles can protect a lifestyle that is vulnerable to economic and environmental pressures – and by adopting flexible housing and location strategies they can help to balance the demands of site-based life with traditional pastoralism;
- Increased family incomes may be reflected in larger herd sizes as families capitalise on the increased income from mining-related employment. While this may reflect increased family wealth, it may also increase environmental pressures on pastoral lifestyles by increasing over-grazing; and
- Increased infrastructure development and increased populations will create new markets and routes to markets for herders. Herders will require support to capitalise on these opportunities as market demands and quality standards increase. For example, this may include the establishment of accredited slaughterhouses or similar food processing and marketing activities.

The scale of the various opportunities, and the associated infrastructure requirements, will inevitably lead to economic displacement and resettlement of herders. If this is poorly managed, then additional pressures will be placed on existing grazing areas, leading to reduced herder margins and pressure to abandon herding as an income source. If this is accompanied by large scale pasture degradation, these pressures will increase.

In addition, if herders perceive that life as a mine worker, or as part of an influx population, is preferable to herding, then they will likely migrate to towns and abandon herding. Should this occur on a small scale, it would have the likely effect of balancing against increased grazing. However, if large wage disparities and significant pasture degradation lead to many herders abandoning herding, then this could lead to a permanent and major impact on the culture of the region.

A livelihoods development programme for herders impacted (both physically and economically) by the Oyu Tolgoi Project is included in *Chapter D15: Resettlement Action Plan*, including pastureland management programmes and other targeted measures. In addition, *Chapter C11: Cultural Heritage Impact Assessment* discusses the role of the Oyu Tolgoi Cultural Heritage Programme in preserving traditional livelihoods and traditional heritage resources.

13.7.4 Economic Risks

Economic issues are discussed in *Chapter C7: Economic Impact Assessment*.

According to the recent World Bank data¹², the Mongolian economy is experiencing rapid growth in 2011, the second quarter saw the economy growing at 17.3 percent year on year, compared to 9.9 percent in the first quarter of 2011.

A booming mining industry, especially the Oyu Tolgoi Project, spurred imports, especially of transport equipment and machinery. This pushed Mongolia's trade deficit to US\$ 1349 million in July 2011. On the export side, coal has surpassed copper as the largest export, comprising 38 per cent of all exports, having grown 129 per cent year on year in July. China is the sole destination for Mongolia's coal exports and it is the largest thermal coal consumer in the world. Mongolia's exports of coal are expected to grow with new coal mines coming on board. Crude oil exports were up 42 per cent year on year in June owing to higher oil prices, while copper volumes are declining, as are Chinese metal imports from Mongolia.

Reflecting the higher growth, unemployment declined from 13 percent in December 2010 to 8.7 percent in June. Informal labor markets for unskilled workers are also booming, with real wages nearly doubling between December 2010 and June 2011.

The latest World Bank Quarterly Economic Update (August 2011) notes that poverty was reduced considerably during the previous period of high economic growth rates (2002-8), and considers that current trends in the economy bode similarly well for poverty reduction. However, sharply rising inflation towards the end of the previous boom undermined some of the gains made, particularly for the poor. Hence, keeping a lid on inflation by reigning in excessive government spending and avoiding loose monetary policy will be the key to successfully reducing poverty during the current economic boom.

Unfortunately, Mongolia is again experiencing high levels of inflation. Ulaanbaatar inflation was up 11.4 percent year on year in July 2011, up from 5.5 percent in the previous month. Core inflation, excluding volatile energy and food prices, increased even faster, by 13.7 percent year on year. And as the livestock herd continues to recover from the *dzud* and China's food prices, especially meat, continue to rise (34 percent year on year in July), food prices are likely to remain high.

This inflation is being stoked by increased government spending (up 27 percent, with most of it on wages and transfers), as well as high spending by the private sector—producers and consumers alike—as reflected in the large import bill relative to last year, imports are up by 106 percent.

These implications of these macro-economic issues are discussed below in relation to “Dutch Disease” and the “Resource Curse”.

13.7.5 “Dutch Disease” and the “Resource Curse”

Economic issues are discussed in *Chapter C7: Economic Impact Assessment*.

“Dutch Disease” is the negative impact on an economy of anything that gives rise to a sharp inflow of foreign currency, such as the discovery of large natural resources reserves. The currency inflows lead to currency appreciation, making the country's other products less price competitive on the export market. It also leads to higher levels of cheap imports and can lead to de-industrialisation as industries apart from resource exploitation are moved to cheaper locations. The origin of the phrase is the Dutch economic crisis of the 1960s following the discovery of North Sea natural gas¹³.

A recent World Bank paper has reviewed the experience of the Netherlands to identify some lessons for Mongolia in terms of anticipating and managing the “natural resources curse”¹⁴. Key issues highlighted in this paper included:

- On average, for instance, resource-rich countries grow slower than resource-poor countries. Part of the “curse” is that, again on average, resource-rich countries suffer from weak political and economic institutions. However, the timing of the resource discovery matters: if they are discovered when good institutions are already in place, the rents for the resources are, on average, not captured by exploitative elites, but used to promote national welfare. Mongolia

¹² Mongolia Quarterly Economic Update, August 2011. The World Bank.

¹³ www.ft.com/lexicon

¹⁴ Tehmina Khan and Rogier van den Brink, 2011, The Dutch Disease: Some Lessons for Mongolia, An Eye on East Asia and Pacific, East Asia and Pacific Economic Management and Poverty Reduction, The World Bank, 2011.

fortunately falls into this category, as it was already one of the freest and most democratic societies in East Asia when the large mining projects were discovered.

- **An appreciating currency:** The first challenge facing resource-rich economies is that the inflow of foreign currency into the economy either drives up the nominal exchange rate, or the prices of non-tradable goods and services (for instance, wages) relative to the prices of traded goods and services. Both cause a real appreciation of the currency. This hurts exporting and import competing firms by undermining their competitiveness. In addition, resources (capital and labour) shift from the traded to the non-traded sectors, as the latter become more profitable. This further contributes to the decline of the export and import-competing sector.
- **Ballooning budget:** The second challenge, compounding the economic challenges caused by a real appreciation of the currency in the Netherlands and many other resource-rich countries, is sudden, large increases in government spending, often on wages and social transfers. As the revenues from the resource exports grow, governments find it difficult to resist immediate and sharp increases in spending.
- **Avoiding Dutch Disease using the “Polder model”:** How does a democracy with good institutions deal with the sudden discovery of mineral wealth? Initially, the Dutch followed a path which would later become known as the Dutch Disease: a strongly appreciating currency made the non-mineral sector uncompetitive, further aggravated by highly inflationary and unproductive government spending on wages and social transfers. Undoing the negative effects of the wage spiral and the overly generous social welfare system was painful and took more than a decade. The cure for the Dutch Disease was based on a voluntary, negotiated agreement between the same stakeholders which had been responsible for the Dutch Disease—government, labor and business. It was centered on conservative fiscal policies, including low public debt, and wage restraint. The essence of this agreement formed the basis of the subsequently highly successful Polder Model—a framework which also held up very well during the 2008 global financial crisis. Mongolia has laid a strong legal foundation for a similar macroeconomic and fiscal framework in the three rules which form the basis of the Fiscal Stability Law passed with overwhelming majority in parliament in June 2010. The three rules put strict limits and ceilings on the fiscal deficit, expenditure increases and public debt. However, the essence of the FSL only kicks in 2013, when a structural fiscal deficit of no more than 2 percent of GDP needs to be adhered to. In the transition period, Mongolia would do well to heed the lessons from Holland: curing the Dutch Disease can be long and painful. Preventing the Dutch Disease to afflict the economy in the first place would be the wiser path to take, and, if the story of the Polder Model holds true, will also reward the politicians associated with this path.

At a local/regional level, the Dutch Disease is most likely to manifest itself through price effects from the mining boom. International experience suggests that an increase in the prices of land, housing, goods and services in and around mine sites leads to greater economic disparity. Limited experience to date at Tsogtsetsii (UHG mine) and Khanbogd (Oyu Tolgoi mine) suggests these same price effects will also occur in Mongolia.

While mine workers are cushioned from these cost increases (due to their high relative wages), existing *soum* residents and non-mine related employers may be worse off. Of particular concern are those on fixed wages, notably pensioners and government employees. These individuals will, in the event of local price effects, have a lower purchasing power than others. The elderly and sick will likely become more vulnerable as a result, while those able to move to other jobs in the higher paying private sector will likely do so¹⁵. This may pose a significant risk if teachers and doctors (whose wages are controlled by the government and are lower in rural areas than in Ulaanbaatar) abandon state sector jobs – which will exacerbate the challenges of social service provision in mining areas.

While communities in the South Gobi region are broadly enthusiastic about the economic opportunities that will be created by the development and operation of new mining projects, they are also concerned about the risk of being left out of opportunities – losing out to workers from Ulaanbaatar and foreigners.

¹⁵ Vulnerable groups within the Project’s Area of Influence (focused on Khanbogd *soum*) have been identified by Oyu Tolgoi and measures put in place to ensure that vulnerable groups will be able to share in the benefits arising from the Project (further information on this is set out in *Chapter D15: Resettlement Action Plan*).

One of the international lessons of mining development is that if large revenues are generated and local communities do not benefit, the ensuing social unrest can threaten the sustainability of the mines. Benefits can be shared through direct financial transfers of a share of the mining revenues, and through improved employment and livelihood opportunities.

The Government of Mongolia generates revenues from mining projects through royalties, taxes and other fees. In addition, it is an equity holder in a number of mining projects (including Oyu Tolgoi). 20 percent of mining royalties is intended by law to be allocated to *aimag* budget and 10% to *soum* budgets. In practice, there is limited transparency on internal budget allocations.

In addition, as recently highlighted by the World Bank Mongolia Quarterly Report, mining revenues are contributing to an increasing share of the national budget, and increasing Mongolia's vulnerability to fluctuations in world mineral prices.

The Government of Mongolia is well aware of the possibility for "Dutch disease" and has identified the need for appropriate governance systems to be implemented to minimise the risks of becoming a "resource cursed" nation. Mongolia has the opportunity to use its new-found wealth to invest in community infrastructure and business enablers to ensure the benefits are shared and sustained. Corruption however is an ever-present risk and Mongolia currently ranks 116/178 countries according to Transparency International.

Capacity building activities with the Government of Mongolia and local administrations with NGOs and International Financial Institutions, together with the reporting of mining company tax, dividend and other payments will be an essential first step at national level.

To that end, the implementation of the Extractive Industries Transparency Index (EITI) is playing a key role in strengthening resource revenue management and transparency. The government of Mongolia committed to implement EITI in December 2005. The EITI Board designated Mongolia as EITI Compliant on 19 October 2010.

The management of "boom and bust" risks at a national level are clearly the responsibility of the Government of Mongolia. Since its launch in 2002, Rio Tinto has expressly supported the Extractive Industries Transparency Initiative (EITI). Rio Tinto supports and promotes the EITI and its implementation in those countries where it has projects or mining revenue generating operations, including Mongolia. The International Council on Mining and Metals (ICMM) which Rio Tinto is a member of, endorses, supports and promotes the EITI among its members and represents the mining sector on the EITI Board.

At a local and regional level, Oyu Tolgoi is seeking to develop sustainable communities and economic growth through a range of local content and regional planning initiatives. These are described in detail in *Chapter C16: Influx Management Plan*.

13.7.6 Exposure to Changes in Commodity Prices

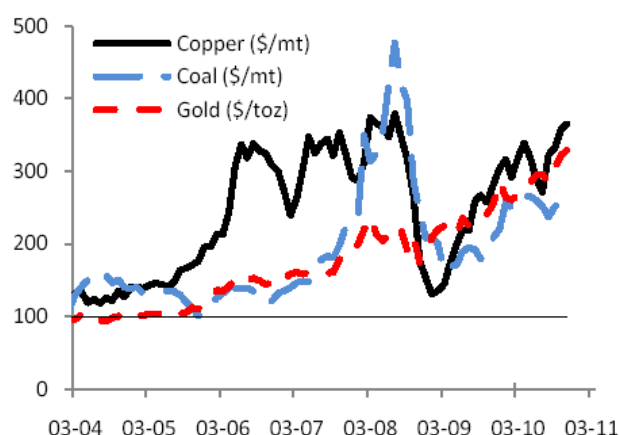
Mongolia's economic outlook depends heavily on global macroeconomic factors: the current uncertainty and poor growth prospects for the global economy are cause for concern. If there is another global recession, Mongolia's small, open economy will be affected. In that case, China's policy reaction will be crucial for Mongolia. If China reacts as fast and as strongly as it did in 2008/2009 then the effects of a global recession on Mongolia will be mitigated, largely owing to Chinese demand for minerals from Mongolia.

As an economy based on the export of natural resources, Mongolia is highly exposed to changes in commodity prices. The global downturn of 2007-9 hit Mongolia hard, predominantly due to the slump in mineral prices which returned the prices of Mongolia's main exports to their 2004 levels. In particular the price of copper fell 60 % to \$3500/tonne in March from \$8700/tonne in April 2008 but has since recovered as outlined below.¹⁶

¹⁶ Mongolia Quarterly Economic Update, August 2011. The World Bank.

Figure 13.2: Variability in Mongolian Export Values

Index=100 in January 2004



13.8 CUMULATIVE ENVIRONMENTAL IMPACTS

The key cumulative environmental impacts associated with the Oyu Tolgoi Project and the future development of the South Gobi region, and as discussed in this section, comprise:

- Impacts to wildlife (habitat fragmentation from road and powerline development);
- Cumulative demand for water;
- Traffic and dust generation; and
- Waste generation.

13.8.1 Impacts to the Wildlife of the South Gobi

Wildlife impacts are discussed in detail in *Chapter C6: Biological Resources and Ecosystem Services*.

Cumulative impacts on the wildlife of the South Gobi Region may arise from a range of development-related issues due to the construction of multiple mining projects in the south Gobi, particularly:

- Habitat fragmentation related to the construction of multiple road corridors and railways; and
- Habitat impacts related to the construction of multiple power lines.

Direct habitat loss under the footprint of project facilities, indirect habitat loss due to avoidance by some species, and direct and indirect mortality will occur as a result of the development and operation of the Oyu Tolgoi Project, particularly in relation to infrastructure developments as discussed in *Chapter C6: Biological Resources and Ecosystem Services*.

Potential impacts on biodiversity related to the development of the Oyu Tolgoi worker housing area, light industrial estate related to the development of Khanbogd (including a power line to Khanbogd) will form part of the scope of Supplemental ESIA documentation to be prepared by Oyu Tolgoi as part of the final site selection process for worker housing.

The South Gobi region is rich in mineral resources and a large number of potential mining concessions have been identified. Individually, mining operations such as Oyu Tolgoi have the potential to impact local wildlife including megafauna, reptiles and amphibians, together with smaller animal populations such as insects. Impacts include direct loss of habitat, direct disturbance through the generation of noise and dust together with indirect impacts such as the transmission of particulates, deposition on foraging crops, alteration of permanent springs and ephemeral water courses and the interruption of migration routes. These impacts are expected to be most pronounced during the construction phase and to decrease significantly during the operational phase of the various projects.

Habitat Fragmentation from Road Developments

In addition to the Oyu Tolgoi to Gashuun Sukhait road, the other principal roads in Khanbogd *soum* comprise¹⁷:

- An improved earth road running from Oyu Tolgoi to Khanbogd (42 km), used by local communities and Oyu Tolgoi workers;
- An earth road running from Khanbogd to Dalanzadgad (250 km), used by local communities;
- A paved road from Tavan Tolgoi to Gashuun Sukhait (270 km), used exclusively by trucks exporting coal to China; and
- A gravel road from Khanbogd to Manlai (110 km) (then Choir and Ulaanbaatar), used by general commercial and community users.

Of these roads, the most significant from a cumulative impacts perspective is the recently-paved (in 2011) Energy Resources LLC toll road from Tavan Tolgoi to Gashuun Sukhait. This road was designed to be temporary with replacement by a permanent rail line to China, however, at the time of preparation of this ESIA, the road has been upgraded to a paved road and the Mongolian Government has not yet made a final decision on the proposed rail link.

Oyu Tolgoi is currently upgrading an existing improved earth road between the Mine Licence Area and Gashuun Sukhait. While few empirical data are available for the Gobi region, traffic volumes of > 2,000 vehicles/day have been shown to have a barrier effect to wildlife (Sawyer & Rudd 2005; Clevenger & Huijser 2011) and volumes of > 4,000 vehicles/day are considered “strong to complete barriers to wildlife movements” in North America (Mueller & Berthoud 1997). In the open environments of southern Mongolia, where wild animals have a much clearer view of long stretches of road and are very wary of vehicles due to hunting pressure and harassment, it is likely that functional barriers to wild ungulates (i.e., some individuals are able to cross, but functional ecological and genetic connectivity may have been lost) may be created by lower traffic volumes than those reported from North American studies.

P. Kaczensky (*in litt.* 2011 in TBC & FFI 2011) has estimated a serious barrier effect for Asiatic wild ass at traffic volumes as low as 400 vehicles/day and a complete ecological barrier at 1,000 vehicles/day¹⁸. A recent traffic census undertaken by Oyu Tolgoi (and reported in *Chapter B11: Transport and Infrastructure*) identified approximately 800 vehicles/day on the coal transportation route and 250 vehicles/day on the Oyu Tolgoi –Gashuun Sukhait road¹⁹, the implication being that while traffic volumes on the Oyu Tolgoi – Gashuun Sukhait road are not yet at levels predicted to cause a significant barrier effect for the Asiatic Wild Ass, traffic volumes on the coal transportation route are already approaching levels at which a complete ecological barrier are created. The World Bank’s *South Gobi Regional Environmental Assessment* (Walton, 2010, p. vx and p. 34) states that, according to information provided by the SGSPA Director in 2008, “gazelle and Asiatic wild ass no longer move between the two sections of the Small Gobi Strictly Protected Area because of traffic volume on the road that passes between them to the border crossing”.

Traffic volumes on the Oyu Tolgoi–Gashuun Sukhait road are expected to decline immediately after construction; however, the upgraded Oyu Tolgoi – Gashuun Sukhait Road will eventually become part of the national highway network and as such, over time, non-mine traffic volumes are expected to increase (>1,600 vehicles/day by 2030). Traffic on the Tavan Tolgoi road will also increase significantly once mining of the main Tavan Tolgoi coal deposit commences. Thus, the marginal cumulative impacts of Oyu Tolgoi-

¹⁷ See *Chapter B11: Transport and Infrastructure* for further details.

¹⁸ The figure of 400 is based on fleeing distances of c. 1 km, maximum speeds of 4 km/h, and thus a need for a break in traffic of 15 minutes for an animal to feel comfortable crossing. This equates to an average of 96 vehicles/day if evenly spaced. Assuming vehicles are not evenly spaced (i.e. bunched), perhaps four times as many cars could still leave similar gaps in traffic – i.e. 400. These are of course very rough approximations, and based on continued hunting (and thus car avoidance). They do, nonetheless, provide some level of assessment tailored to the situation in the area.

¹⁹ Oyu Tolgoi Traffic Census Data. 801 vehicle movements were recorded on the coal transportation route on 28th March 2011. 278 and 225 vehicle movements on the Oyu Tolgoi to Gashuun Sukhait roads were recorded respectively on 30th and 31st March 2011.

related traffic on the upgraded road will be minor due to existing fragmentation effects of the coal truck traffic in the region (especially in consideration of future coal truck traffic volumes). This means that, activities by Oyu Tolgoi to mitigate and minimise the fragmentation impacts of its road cannot be expected to mitigate road fragmentation impacts at a broader scale unless similar measures are also implemented for the coal transportation route.

While complete avoidance of roads creates a barrier effect and fragmentation, fully mitigated roads are not expected to act as full functional barriers to any species in the Oyu Tolgoi Aol (see Section II.3 of Annex B in *Chapter C6: Biodiversity and Ecosystem Services Impact Assessment*). Thus, the fragmentation effect of roads to be upgraded or constructed by Oyu Tolgoi is categorized as a Moderate Risk impact for Asiatic wild ass and goitered gazelle and a Low Risk impact for argali and Houbara bustard.

The Oyu Tolgoi Project has made a world-leading commitment to put in place appropriate and sufficient underpasses along the road upgrade to Gashuun Sukhait. This demonstration is a step towards achieving future regional connectivity of ungulate populations by facilitating similar mitigation of non-project regional infrastructure. These are planned to be appropriate for the wide-ranging species of conservation concern in the region, given best international knowledge to date, and are planned to be sufficient to allow ecological permeability, given known animal daily ranging distances. Given this, the fragmentation impacts of this road upgrade are expected to be negligible in the medium- to long-term (after animals have habituated to the road, and a concurrent anti-poaching programme has sufficiently reduced hunting such that animals have reduced fear of vehicles). In particular, it is considered that cumulative impacts will be negligible given the existing presence of the unmitigated Tavan Tolgoi 'coal road' and its heavy traffic volumes. The 'coal road' runs approximately parallel to the Gashuun Sukhait road upgrade, and is likely to have already fragmented ungulate populations (as discussed below). The residual, cumulative risk of the Oyu Tolgoi road upgrade to Gashuun Sukhait causing fragmentation of ungulate populations was assessed as of likely likelihood (loss of some of the feature would occur in majority of cases) and of minor consequence (would cause an insignificant noticeable portion to be lost), and, therefore, of 'medium' risk

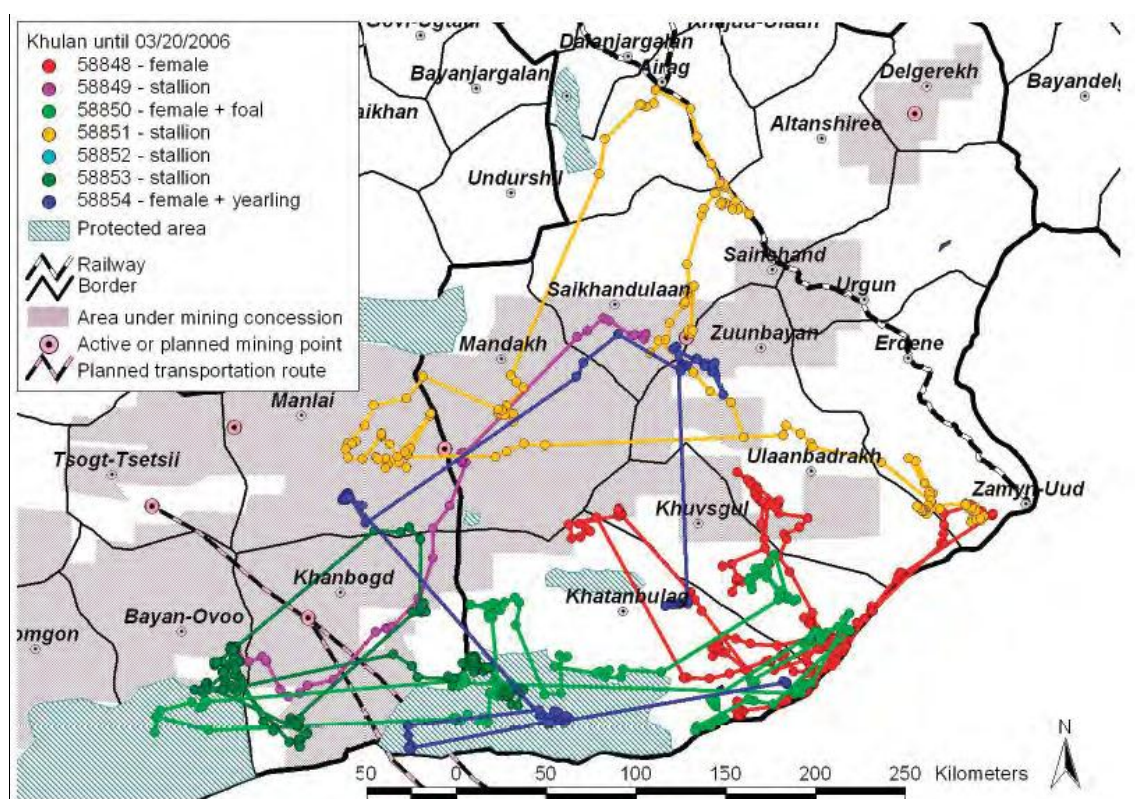
Although few data yet exist to assess impacts, the pre-existing 'coal road' from Tavan Tolgoi to Gashuun Sukhait, and its heavy traffic volumes, is likely to be having a significant fragmentation effect on wide-ranging species in South Gobi. Cumulatively (i.e. over and above this existing road), a well-mitigated Oyu Tolgoi road upgrade to Gashuun Sukhait would be likely to have negligible fragmentation impacts.

Oyu Tolgoi's forward looking approach to mitigating and reducing impacts by means of underpasses and other management actions (detailed in *Section 6.7*) to mitigate the fragmentation impact of roads to habitats and wildlife populations includes:

- Construct appropriate and sufficient underpasses (at ecologically suitable locations such as river beds, approximately every 6 km along the Oyu Tolgoi to Gashuun Sukhait road, as long as practically possible but minimum 12 m long, at least 4.5 m high along the whole length, with solid sides at least as high as highest Oyu Tolgoi vehicles, a natural, non-waterlogged substrate with no obstacles, affording a view of the horizon from either side, and with earth berm along edge of road either side of underpass to funnel wildlife towards underpasses; to be constructed before hand-over to GoM);
- Control illegal hunting in the wider landscape which will help to reduce avoidance distances and encourage use of wildlife crossings;
- Deter vehicles leaving, but facilitate wildlife crossing, the Oyu Tolgoi to Gashuun Sukhait, Oyu Tolgoi to Khanbogd and Oyu Tolgoi airport roads (probably by using immovable boulders or side ditches or posts but this needs further research, to prevent vehicles leaving either side of the road except for agreed herder crossings);
- Restrict Oyu Tolgoi vehicles from parking beside roads except in an emergency or to manage fatigue;
- Engage with key stakeholders to encourage all road users to minimise parking beside roads except in an emergency or to manage fatigue; and
- Provide adequate funding, capacity-building and other support to enable biodiversity mitigation actions to be integrated into regional planning, including infrastructure development, within Khanbogd *soum*.

Figure 13.3 below illustrates existing barriers to migration routes and how the extensive and varied migratory ranges of Khulan interact with existing transport corridors and other features. Regionally, and given the large migration distances, the Oyu Tolgoi road will add to the cumulative impacts caused by the coal transportation route from Tavan Tolgoi to Gashuun Sukhait (within Khanbogd *soum*), the double-fenced Trans-Mongolian railway to the east and the parallel road and fence along the China-Mongolia border (to the south) which have divided the populations of megafauna and prevented them breeding and freely accessing good quality habitats (Takahaiko et al., 2005).

Figure 13.3: Barriers to the Khulan Migration Routes



Source: Kaczensky P. et al, 2006.

2011 to undertake coordinate biodiversity monitoring to improve the effectiveness of biodiversity management initiatives,

Effects of Multiple Powerlines

The impacts of electrical power lines on bird species of conservation interest are described in detail in Chapter C6: Biological Resources and Ecosystem Services.

While the electrical transmission line from the Chinese border to Oyu Tolgoi is the only planned high-voltage power line to traverse the Galbyn Gobi Important Bird Area (MN048), and a power line has also be built along the route of the water supply pipeline from the Gunii Hooloi aquifer (to power water abstraction pumps) a number of local power distribution lines are under consideration and/or planning. These include:

- A transmission line from Oyu Tolgoi to Khanbogd that will be designed and constructed by Oyu Tolgoi on behalf of the Government of Mongolia (see Chapter C8: Population and Influx for further information); and
- Additional transmission lines from Khanbogd to Manlai and Bayan-Ovoo that are proposed by the Government of Mongolia and would be designed and constructed by the Government of Mongolia independently of the Oyu Tolgoi-constructed transmission line to Khanbogd.

Chapter C6: Biological Resources and Ecosystem Services highlights the potential impacts of power transmission lines on the habitat and breeding sites of the Houbara Bustard and the impacts of collision and electrocution for a wider range of bird species. Additional planned transmissions lines would be

outside the Important Bird Area, but may still create potential impacts to birds. Mitigation options available to Oyu Tolgoi to minimise any potential impacts are also described in *Chapter C6: Biological Resources and Ecosystem Services*. Future infrastructure components to be developed under the direct control of Oyu Tolgoi will be subject to the mitigation hierarchy (avoid, minimise, rehabilitate, offset) and will also be subject to both national permitting requirements and any additional studies or activities required to meet international good practice (as defined by EBRD and IFC guidance) and the requirements of the Rio Tinto Biodiversity Strategy.

13.8.2 Cumulative Demand for Water

Cumulative impacts on water have been considered for the following:

- The potential use of the Gunii Hooloi aquifer by other users;
- The demands on water infrastructure through the growth of Khanbogd; and
- Impacts in relation to multiple users of surface water.

Water resource issues are discussed in detail in *Chapter C5: Water Resources Impact Assessment*.

Gunii Hooloi Basin

The Project will use an estimated 15% of the water resources in the Gunii Hooloi basin; leaving the remainder in place for other users. If other mining developments occur in the area of Gunii Hooloi they may exploit the same aquifer (subject to regulatory approval) or identify further basins which can provide a potential water supply which lie outside (e.g. east) of the area explored by Oyu Tolgoi. The water resources of the Galbyn Gobi are not currently planned to be used for the Oyu Tolgoi Project, therefore this aquifer is also potentially available to other users. The Khanbogd community does not overlay the Gunii Hooloi basin and its shallow aquifers are not impacted by the water supply system. In addition, the shallow, rain-fed aquifers used by herders and wildlife in the Gunii Hooloi have very limited connectivity to the deep saline aquifers being used by the Project for its water supply. As a result, impacts to herder wells or springs are not anticipated, but monitoring measures have been put in place to keep water levels and hydrological water movement under ongoing assessment.

Further information is provided in *Chapter C5: Water Resources Impact Assessment* and *Chapter D7: Water Resources Construction Management Plan*.

Increased Water Demand at Khanbogd

The current population of Khanbogd is expected to increase rapidly from c. 2,000 to 20,000 as the Oyu Tolgoi Project and related services mature. At Khanbogd, the community water supply is envisaged to move from individual and community wells which exploit a shallow aquifer in the *soum* centre, towards a reticulated system which draws water from a deeper unexploited aquifer system located north of the *soum* centre. The location and design of the supply wells is currently the subject of on-going studies by Oyu Tolgoi. Groundwater models will be refined to develop a sustainable supply system (inferred to be recharged annually by rainfall on Khanbogd and Duruji Mountain) which will link into a reticulated water supply designed by others. The design will aim to avoid impacts on local herder wells by exploiting a deeper aquifer unit than those used by the herders, and to provide a sustainable water resource for urban development, subject to regulatory approvals.

Further information is provided in *Chapter C5: Water Resources Impact Assessment* and *Chapter D7: Water Resources Construction Management Plan*.

Other Water Users

The base flow of the ephemeral streams across the Project Area of Influence, where sufficient alluvial aquifers are present, provides the base flow for the shallow wells used by herders for watering of livestock. There are no herder winter camps within 10 km of the mine and none along the route of the Gunii Hooloi water supply system. Along the infrastructure route there are 16 herder wells located between 200 m and 1,700 m of the planned road alignment. None of these wells are anticipated to be impacted by the proposed road or power line route. However, one herder's well at the North East corner of the Project Area of Influence was impacted by road construction, where the herder's family had to cross the road to access the well. Oyu Tolgoi has undertaken a hydrogeological investigation (including using geophysical surveys) to identify a replacement well close to the herder's family. This well has been constructed and is now being commissioned.

Further information is provided in *Chapter C5: Water Resources Impact Assessment* and *Chapter D5: Water Resources Construction Management Plan*.

13.8.3 Traffic and Dust Generation

Dust generated by traffic is discussed in *Chapter C2: Climate and Air Quality Impact Assessment*, and is also addressed in *Chapter D2: Atmospheric Emissions Management Plan* and *Chapter D11: Transport Management Plan*.

Increased transportation in terms of increased vehicle movements on un-paved roads will create additional dust and potential road-safety impacts²⁰. Prior to the construction of the dedicated road from Oyu Tolgoi to the Chinese border at Gashuun Sukhait, all Oyu Tolgoi construction traffic will use the existing improved earth road. This is described in *Chapter D11: Transport Construction Management Plan*. It is noted that Oyu Tolgoi can only regulate the driving behaviours of its own vehicles and those of its contractors, it cannot regulate the driving of other vehicles, the control of which rests with the relevant police departments.

Once the dedicated Oyu Tolgoi road is constructed, Oyu Tolgoi traffic will then exclusively use this road, significantly reducing dust emissions and also significantly reducing the risk of road traffic accidents. The 'coal road' is associated with extremely high dust levels which is considered likely to have caused a nuisance to herders. The transfer to the dedicated Oyu Tolgoi road and the use of the newly paved coal transportation route by coal trucks will mitigate this impact. Consideration has been given to potential future developments such as a railway to the Chinese border (discussed in *Section 13.10* below), which would further reduce the impact of dust from road traffic. However, the railway option raises other concerns such as posing a barrier to wildlife, particularly if it is fenced.

13.8.4 Waste Generation

Waste management issues related to increased population and increased economic activity is discussed in *Chapter C8: Population and Influx Impact Assessment*, *Chapter D8 Waste Management Plan* and *Chapter D16: Influx Management Plan*.

The generation of wastes at Oyu Tolgoi has the potential to add to regional pressures on waste disposal infrastructure. Waste infrastructure at the nearest town, Khanbogd, is rudimentary and would not be able to cope with significantly increased volumes. In recognition, Oyu Tolgoi have planned and will build a dedicated Waste Management Centre for all solid wastes generated by the mine. Recyclable materials will be made available to the community through a controlled operation. Reusable materials will be deployed as far as practicable around the mine and processing areas in accordance with the Oyu Tolgoi *Waste Management Plan* as described in *Chapter D8: Waste Management Construction Management Plan* and as also discussed in *Chapter C8: Population and Influx Impact Assessment*.

It is reasonable to assume that waste handling at the Oyu Tolgoi mine will be replicated to a great extent at other planned mines, therefore there will not be a significant cumulative impact. Assuming that other mines adopt a similar approach, off-site transport and the use of external facilities is considered unlikely. During the mine life, Oyu Tolgoi will help Khanbogd (its nearest community) to manage waste handling in a more environmentally-acceptable manner through improved planning and management. It is expected that all mines will either commence their own landfills, or will use landfills in the adjacent *soum* centres (should the capacity for these operations exist or the mining companies support the necessary investment).

13.9 GOVERNMENT INITIATIVES TO MANAGE CUMULATIVE IMPACTS

A recent Asian Development Bank supported Technical Assistance Project²¹ highlighted that adequate and effective regional and urban infrastructure and services are prerequisites for sustainable economic growth, and to serve the projected population influx. Yet in South Gobi, many of the required services are either inadequate or absent: there are generally very low levels of access to water supply and sanitation,

²⁰ As described in *Chapter B11: Transport and Infrastructure*.

²¹ Asian Development Bank: South East Gobi Urban and Border Town Development Project, Project Preparation Report, January 2010

and the smaller urban areas do not have piped water supply networks. Piped water supply networks and sewerage systems serve only the developed or formal areas of the *aimag* center of Dalanzadgad. In general, less than 30 percent of the *aimag* urban population has adequate water service, and only 17 percent have access to adequate sanitation services.

13.9.1 Southern Gobi Regional Development Council

With assistance from Oyu Tolgoi, the "Southern Gobi Regional Development Council" (SGRDC) has been established under the terms of the Oyu Tolgoi Investment Agreement and is chaired by one of the Members of Parliament who represents South Gobi in the People's Great Khural (the other Member of Parliament being the vice-chairman). The SGRDC is a body mandated to coordinate and manage regional and community development issues and impacts associated with the Oyu Tolgoi Project and other major investments in the Southern Gobi Region (Investment Agreement Clause 4.4.2).

The Council is a multi-stakeholder entity that will elaborate the development strategy and plans of the South Gobi region and its mine-impacted communities.

The Council is governed by a Board, which includes representatives of the Government, local governance organisations, private sector entities, civil society organisations and donor and international financial institutions with activities directed towards the South Gobi region. The Council includes senior civil servants of the relevant departments of key Ministries, local government (*aimag* and *soum*) officials, and representatives of Oyu Tolgoi and other mining companies, as well as civil society. In partnership with Government and other investors, Oyu Tolgoi will support implementation of social and economic programmes in accordance with the regional development strategy which the Southern Gobi Regional Development Council will lead and coordinate.

The council supports a working group on Infrastructure and Regional Development, with which Oyu Tolgoi coordinates in developing and implementing regional and community development initiatives. Oyu Tolgoi liaises directly with SGRDC and its working groups on regional development matters.

13.9.2 Financial Arrangements

Under the provision of the Minerals Law²², the Government is obliged to return 10% of mine royalties to the host *soum* government, and 20% of mine royalties to the host *aimag* government. Transfer of these royalties during mine operation would provide local governments with significant resources which could be used for regional and community development projects and programs. However, this does not happen at present, and, under current central government policies and financial constraints, is unlikely to happen as the Oyu Tolgoi Project goes into production, and royalties are paid by Oyu Tolgoi. Oyu Tolgoi will continue to lobby Government, both directly and through the SGRDC, to implement the royalty distribution provisions of the Minerals Law and resolution 272. However, in the meantime, the Oyu Tolgoi assistance to regional and community development will seek to respond to both short- and long-term needs while remaining sufficiently flexible to respond to changing circumstances.

13.10 POSSIBLE FUTURE DEVELOPMENT OF THE OYU TOLGOI PROJECT

This ESIA is based on the initial construction of an open pit copper-gold mining operation at the Southern Oyu deposit, ore concentrator and infrastructure to support an ore processing capacity of 100,000 tonnes per day (tpd) of ore²³. This includes further development of ongoing underground development to establish block caving mining operations at the Hugo North deposit. The expansion of the Project to an ore processing capacity of 160,000 tpd in the future is proposed. Any further expansion beyond this level remains speculative at this stage.

Although the Project potentially has a very long life for a mining operation, there are many uncertainties about future developments. With the start of underground production from Hugo North, an expansion of

²² Minerals Law of Mongolia 2006 and Resolution 272 Regulation on paying, distributing and disbursing the mineral royalties.

²³ This is the average capacity, to allow for maintenance downtime and other stoppages the maximum capacity of the concentrator plant will be 110,000 tonnes per day of ore.

the concentrator is contemplated (during the current 27-year mine life). A pre-feasibility study for the concentrator expansion has been completed²⁴, based on an assumed concentrator throughput of 158,000 tpd of ore²⁵. A final feasibility study is due to be completed in 2012 with further ongoing work to assess and plan such future potential developments based on a revised concentrator throughput of 160,000 tpd²⁶.

As outlined above and described in greater detail in *Chapter A4: Project Description*, initial Project production will be from an open pit copper-gold mining operation at the Southern Oyu deposit, supplemented within 4 years by production from the underground mining operations at the Hugo North deposit. With the ramp-up of underground production an expansion to the capacity of the concentrator plant is planned, based on an expanded concentrator throughput of 160,000 tpd of ore. This Project expansion is currently under engineering design and evaluation (IDOP11) and will require regulatory approval from the Mongolian authorities, including environmental approvals (for which an DEIA has been submitted to and accepted by MNET), and will require the identification and permitting of adequate water resources. Water use requirements for the Project expansion have already been discussed with the GoMand once additional water resource performance data from the Gunii Hooloi aquifer is compiled the necessary regulatory approvals for the mine expansion (e.g. for increased water abstraction from the Gunii Hooloi aquifer) will be sought from the GoM.

A full feasibility study will need to be completed to finalise this increased ore processing figure and to provide details on other necessary inputs (such as increased water resources). The life of the mine may be extended in excess of 60 years as further resources are identified and are upgraded to the status of commercial reserves. If the mine ore processing capacity and/or the life of the mine were to be extended beyond the current 27-year mine life, it is anticipated that the ore would continue to be processed through conventional crushing, grinding and flotation circuits as set out in this ESIA. The pre-feasibility study on the expansion of ore processing up to 160,000 tpd of ore is based on bringing Inferred Resources (see *Chapter A4: Project Description* for further information) into the mine development plan. Inferred Resources are the first level of quantifiable exploration and are typically still considered too speculative geologically to have detailed economic and technical assessment applied to them. Inferred Resources require further exploration to upgrade them to the higher Measured and Indicated categories upon which detailed project development planning and environmental assessment can be undertaken.

Once the feasibility study is completed and there is additional water resources data from the Gunii Hooloi aquifer based on further water resource investigations and the first few years of concentrator production (i.e. at 100,000 t/day of ore), the necessary regulatory approvals for the mine expansion (e.g. for increased water abstraction from the Gunii Hooloi aquifer if required) will be sought from the GoM. Where required, any expansion or further development of the Project would also be subject to meeting applicable environmental and social impact assessment requirements.

Changes to the Project scope would be subject to Oyu Tolgoi Management of Change procedures, as set out in *Chapter D1: Environmental and Social Management Plan Framework*.

13.10.1 Phase 2 Development of the Oyu Tolgoi Project

Phase 2 will be a continuation of the work being carried out during Phase 1 (which comprises initial construction) to put the Project into commercial operation as described in *Chapter A4: Project Description*. The scope of work for Phase 2 relates primarily to the underground mine and includes the following:

- Sinking Shaft No.2;
- Developing the underground works;
- Installing underground infrastructure;
- Constructing the extraction level;

²⁴ Integrated Development Plan: Technical Report, June 2010. AMEC Minproc. This report is referred to as "IDP10".

²⁵ This is referred to in IDP10 as the Life of Mine (Sensitivity) Case.

²⁶ Oyu Tolgoi Integrated Development and Operating Plan, 2011. This report is referred to as "IDOP11".

- Expanding the concentrator to a capacity of 160,000tpd;
- Developing Shafts No. 3 and No. 4;
- Completing infrastructure not finished under Phase 1;
- Conducting work related the power plant²⁷; and
- Carrying out regional development work.

Oyu Tolgoi will employ a Project Director and a small Owner's Team to oversee all of the works under this phase. Oyu Tolgoi will appoint an experienced international Project Management Contractor (PMC) to provide overall management of all aspects of the Project. The PMC will work in conjunction with the Oyu Tolgoi Owner's Team members and will report to the Oyu Tolgoi Project Director. The PMC will be responsible for coordinating activities in all areas of the Project through either EPCM contractors or specialist engineers controlling major contractors. For example:

- The proposed power plant will be managed by a specialist engineering firm that will then be responsible for monitoring and control of a lump-sum turnkey (LSTK) contract;
- Shaft-sinking work will be carried out by a specialist shaft-sinking contractor under a typical contract, but with project controls in place from the overarching PMC;
- Underground development work will be done initially by a specialist mining development contractor, but this will migrate over time to Owner-managed teams for the longer-term expansion of the mining footprint;
- Underground infrastructure work will be carried out by contractors on rate-based contracts for the civil, structural, mechanical, E&I, and piping work. All of these contractors will fall under a specialist EPCM contractor;
- Work in the extraction level will be carried out under a similar format to the above, with a specialist concrete contractor engaged for roadway construction and set installation, working under the control of the EPCM contractor;
- The extension to the concentrator will be managed in the same manner as the original construction carried out under Phase 1 of the Project by a specialist EPCM contractor and Chinese rate-based contractors; and
- Regional development work will generally be carried out by local contractors, with design, engineering, and project management by local engineering / architectural companies.

Oyu Tolgoi will maintain a head office in Ulaanbaatar where the Oyu Tolgoi CEO will be resident. Continuing studies for further expansion of the mine beyond the scope of Phase 2 will be carried out initially in the Vancouver, Canada office of Ivanhoe Mines Ltd. An office will be maintained in Beijing for assistance with procurement and logistics through China. The bulk of the project staff will be based at the Oyu Tolgoi site.

A number of additional studies and analyses will be required to support ongoing project expansion efforts and operational effectiveness.

Expansion of Water Permit

The current estimate of average water demand for the concentrator expansion to 160,000tpd is 918 L/s²⁸, which is marginally above the rate of 870 L/s that has already been approved by the Government of Mongolia for operations at 100,000 tpd. Oyu Tolgoi's strategy is to obtain approval for increases to the currently approved water reserve ahead of any mine expansion plans. The objective of the study will be

²⁷ Required under the terms of the Investment Agreement to provide Mongolian-sourced power to the Project by the end of Year 4 of operations.

²⁸ These numbers are based on the previous basis of design which was based on an ore processing capacity of 150,000 tpd. These are the latest available estimates and are used here for illustrative purposes.

to assess the impact of the concentrator expansion on water demand and to determine the need for obtaining GOM approval for any substantial increase in the approved water demand from the Gunii Hooloi aquifer.

Underground Feasibility Study

The underground part of the copper-gold mine is expected to have a production rates of 84,200 tpd, with a possible expansion to 100,000tpd. The extraction level is approximately 1,300 m below surface. It is planned to extract a total of approximately 437 Mt. The scope of the Underground Feasibility Study includes all activities from extraction to the shaft collars.

Concentrator Expansion Feasibility Study

A feasibility study for expansion of the concentrator will be awarded concentrator to investigate the reserve case expansion requirements. The concentrator expansion will add a third grinding line and 50,000 tpd of production to the plant.

Detailed Integrated Development and Operating Plan

The next phase in the project planning process is the preparation of a Detailed Integrated Development and Operating Plan (DIDOP) that builds on the present IDOP. The DIDOP will integrate a number of capital expansion studies, including those discussed above. The updated data, capital cost estimate, and financial summary will be compiled into a comprehensive report (DIDOP).

Key environmental and social implications of the future development of the Project include:

- Increase in water consumption;
- Development of block caving at the Heruga deposit;
- Potential future rail transportation of concentrate to China;
- Development of a Mongolian power supply for the Project; and
- Altered economic and social impacts due to the extended life of the Project.

Each of these implications is discussed in outline below.

13.10.2 Increase in Water Consumption

An increase in either the life of the ore processing operations or the scale of ore processing operations will require additional water resources to be identified, permitted and be subject to an environmental and social impact assessment process to ensure that environmental and community issues are taken into account in the design and proposed management of the operation.

The average water demand during the initial years of 100,000 tpd mine production is predicted to be 696 L/s based on the conservative assumption of there being no water recovery from the underground or open pit mines. The borefield and supply pipeline have been designed with a capacity of 900 L/s to provide for seasonal peak demand and to provide a margin for refilling the emergency storage lagoons after its emergency use.

The IDP 2010 study has estimated that the average water demand during future mine expansion to an average production rate of 150,000 tpd²⁹ would be 918 L/s at which time, the borefield and supply design requirements is estimated to be 1,200 L/s (see *Table 13.6* below).

²⁹ Although the Project is planned to be expanded up to a throughout of 160,000 tpd, the pre-existing data is respect of 150,000 tpd provides a guide to likely future water consumption. Updated data will be provided in the forthcoming DIDOP report.

Table 13.6: Summary of Project Water Demand and Borefield/Pipeline Design Capacity

Project Water Demand	100,000tpd Mine Production		150,000tpd Mine Production	
	Average Demand (l/s)	Peak Demand (l/s)	Average Demand (l/s)	Peak Demand (l/s)
Concentrator	628	671	665	750
Mines & Infrastructure	69	115	69	115
Design Development Contingency	0	0	184 (25%)	216 (25%)
Total Site Demand	696	785	918	1,081
Margin for Lagoon Refilling	-	100-150		100-150
Borefield/Pipeline Design	-	900	-	1,200

Note: * - Concentrator water demand only.

An increase of ore production capacity to 160,000 tpd would require additional sources of water. The primary source of raw water to meet any additional water requirements is anticipated to be the Gunii Hooloi aquifer and in addition the Galbyn Gobi aquifer is also being evaluated. In addition, Oyu Tolgoi will continue to assess the economic and political viability and environmental sustainability of inter-basin transfer by pipeline of water. Further information on the inter-basin transfers is contained in *Chapter A5: Alternatives Analysis*.

Estimates of groundwater potential in the South Gobi Region are continually subject to change as new information becomes available, for example, as mining companies explore for new sources and test potential yields. A recent estimate, based on conservative assumptions, is that the groundwater potential is 500,000 cubic meters per day for the next 25 to 40 years³⁰. However, because so much of it is fossil groundwater, extraction at that rate cannot go on indefinitely. Studies of the Gunii Hooloi aquifer suggest that it can be exploited at a sufficient rate to support the Oyu Tolgoi for approximately 40 years³¹.

On a regional level, and based on conservative assumptions, there is considered enough groundwater to sustain projected regional development until 2020³². There is insufficient information to support an analysis of the detailed spatial distribution of groundwater potential across the South Gobi Region, and, while the aggregate figures cited may give an indication of the overall limits that the Region's water resources may impose on growth, they do not provide a good basis for detailed project planning. Clearly, the cumulative demand that several mines would exert if they abstract from the same aquifer needs to be considered in project-specific environmental assessments and regulatory approvals for water abstraction. At this stage, there are no known other projects planning to use water resources from either the Gunii Hooloi or the Galbyn Gobi aquifers, so no cumulative impacts are anticipated from industrial water consumption.

The extent to which mining will compete with other uses - livestock and also rural and urban public supply - depends on the specific characteristics of the aquifer that any individual mine will utilise. The Gunii Hooloi aquifer that is planned for use by Oyu Tolgoi is believed not to be connected to shallow aquifers, and it is considered unlikely that currently permitted withdrawals for the Project will affect either the herders' wells or plants such as saxaul (*Haloxylon ammodendron*) that depend on the surface water table in the area above the aquifer. In the case of the Galbyn Gobi aquifer that has been considered as an alternative supply for Oyu Tolgoi, tests have shown a connection between the deep and shallow aquifers

³⁰ Tuinhof, A. and Buyanhisnig, N. 2010. *Groundwater Assessment of the Southern Gobi Region*. Mongolia Discussion Papers, East Asia and Pacific Sustainable Development Department. Washington, D.C.: World Bank.

³¹ Aquaterra, 2007. Referenced in Tuinhof, A. and Buyanhisnig, N. 2010. *Groundwater Assessment of the Southern Gobi Region*. Mongolia Discussion Papers, East Asia and Pacific Sustainable Development Department. Washington, D.C.: World Bank.

³² Acacia Water, 2009. Referenced in Tuinhof, A. and Buyanhisnig, N. 2010. *Groundwater Assessment of the Southern Gobi Region*. Mongolia Discussion Papers, East Asia and Pacific Sustainable Development Department. Washington, D.C.: World Bank.

over at least part of the area the aquifer underlies³³. Further information on these relationships and potential impacts and interactions can be found in *Chapter C5: Water Resources Impact Assessment*.

Ongoing Assessment of Water Resources

Oyu Tolgoi is undertaking an ongoing identification and evaluation of groundwater resources to prove-up further water resources and an extensive groundwater assessment programme is scheduled for 2011. The primary focus of Oyu Tolgoi will be on the identification and quantification of further resources in the Gunii Hooloi aquifer and, to that end, updated reserve estimates will be prepared following final borefield drilling and pump testing and analysis that will be undertaken in 2011 and following initial period of operations in 2013. Review and recommendations for further exploration in the Galbyn Gobi aquifer and other regional aquifers are underway. This approach will provide Oyu Tolgoi with a range of future water supply options and ensure “redundancy” and flexibility in the water resources to be used. If, following this investigation, it is concluded that water resources are only sufficient to support the existing 100,000 t/d operation, then the Project would focus on the development of its highest value (underground) deposits and would continue to operate at that level.

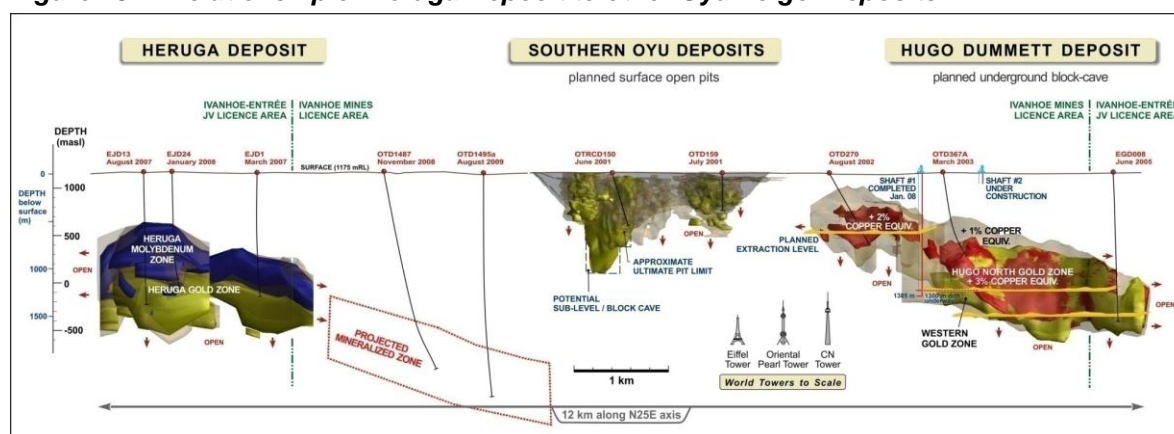
Given the contingencies and conservative assumptions built into Oyu Tolgoi’s water resources model, and the fact that the full extent of the Gunii Hooloi aquifer has not yet been fully defined, it is considered likely by the Project that the Gunii Hooloi aquifer has sufficient water reserves that it could also support potential future increases in the operating capacity of the mine. Any such increase in the demands on the available groundwater resource will be subject to further detailed review to ensure the resource is exploited at a level acceptable to the Government of Mongolia and local stakeholders, such as the Water Basin Committee that will be set up to monitor the Project’s water impacts. Studies by Oyu Tolgoi indicate that there is very limited connectivity between the deep, saline, aquifers to be used by the Project and the shallow aquifers used for herder water supplies³⁴.

13.10.3 Development of Block Caving at Heruga Deposit

As part of the possible future development of the Oyu Tolgoi Project that is under evaluation, the Heruga deposit is being evaluated for underground block caving activities.

The location of the Heruga Deposit within the Mine Licence Area is shown in *Figure 13.4* and its relationship to the other deposits is illustrated below.

Figure 13.4: Relationship of Heruga Deposit to other Oyu Tolgoi Deposits



Source: IDP 10

The Heruga Deposit is the most southerly of the known deposits at Oyu Tolgoi. The deposit is a Copper-Gold-Molybdenum porphyry deposit and with a Molybdenum-rich zone overlying a Gold-rich

³³ Eco-Trade LLC, 2004. Referenced in Tuinhof, A. and Buyanhisnig, N. 2010. *Groundwater Assessment of the Southern Gobi Region*. Mongolia Discussion Papers, East Asia and Pacific Sustainable Development Department. Washington, D.C.: World Bank.

³⁴ Further information to support this is provided in *Chapter C5: Water Resources* of this ESIA.

mineralization zone at depth. The Deposit has been drilled over a 2.3 km length. The deposit is transected by a series of north-northeast trending vertical fault structures that step down 200 to 300 m at a time to the west and have divided the deposit into two structural blocks. The deposit is open to the east, west and south and further mineral resources may be identified.

The development of underground mining operations at the Heuga Deposit would require the following key infrastructure to be constructed:

- Underground mining infrastructure (shafts, headframes, underground development levels and associated equipment);
- Covered conveyor to the crusher and concentrator plant;
- Increased capacity for the tailings storage facility (this would initially be provided within the currently planned facility which has been designed to store up to 1500 Mt); and
- Increased water supply to the concentrator plant (see above).

At the present time, work related to the Heruga Deposit is focused on geological investigation and no detailed planning has been undertaken with regard to mine development or environmental assessment. Given that the Heruga Deposit would be mined by block caving, no significant waste rock would be generated and no additional infrastructure other than that outlined above would be required as the deposit would utilise the pre-existing processing and transportation infrastructure.

The principal additional environmental impact would relate to possible effects of block caving activities on hydrogeology related to surface water and groundwater flows in the vicinity of the deposit as block caving leads to surface subsidence. In particular, this may affect surface (and alluvial) water flow along the Undai watercourse (and associated diversion constructed by Oyu Tolgoi), with potential impacts on downstream water quality and quantity.

13.10.4 Potential Future Rail Transportation of Concentrate to China

The transport of copper concentrate to China will be by access road to the Chinese border at Gashuun Sukhait, and will be sold into the Chinese market. Direct rail transport is considered a long-term transportation solution, particularly considering the strategic location of Oyu Tolgoi between regional coal supplies and the Chinese border. However, as this will require a change of the current Government of Mongolia rail strategy, rail transport to and from the mine is only considered as a potential future development and this is outside the scope of this ESIA.

In 2009 Energy Resources LLC, as part of the development of the Tavan Tolgoi coal mine, proposed to build a 225 km private railway from Tavan Tolgoi to the Gashuun Sukhait border crossing. The Railway would be located entirely within Omnogovi *aimag*, passing through Tsogttsetsii, Bayan Ovoo and Khanbogd *soums* on its way to the Mongolia-China border. Energy Resources would make the railway open for commercial use by other mines. If this railway were to be built, it is proposed that Oyu Tolgoi would build a spur line linking the Project to the railway and Tavan Tolgoi. The spur line would allow coal to be transported from Tavan Tolgoi to the Project and would also facilitate the use of the railway for shipments of copper concentrate from the Project to the Mongolian- Chinese border. The increased Oyu Tolgoi production rate of 160,000 tpd would equate to 2.9 million tonnes of concentrate per year, requiring an average of five trainloads per day. The track system proposed would be a conventional rail system with ballasted tracks and Standard gauge track (1,435 mm).

An alternative rail route linking into the existing Mongolian rail network is feasible but it would involve building a 400 km spur east to link up with existing infrastructure. This route would be more expensive than the proposed 225 km private rail link and it would result in increased land disturbance from rail construction and borrow pits and increased obstruction of east-west migration routes for migratory wildlife.

The expansion of the existing Mongolian network to the Chinese border via the Project and Tavan Tolgoi would present logistical difficulties as well as increased cost. The existing Mongolian railway is on the same wide gauge as the Russian rail network, while China uses the standard narrow gauge. Transportation along any extension of the existing Mongolian network would be longer and more expensive and would require the copper concentrate to be reloaded onto trains capable of travelling on standard gauge rails. This could be achieved by unloading and reloading the copper concentrate or by

replacing the wide gauge bogies on the Mongolian trains with standard gauge bogies to facilitate onward transportation on standard gauge rails.

Presently, the longer 400 km spur east to the existing Mongolian network is favoured by the Mongolian Government as it is consistent with the national rail strategy. This longer route is also favoured by the Russian Government. The Russian Federation has a 50% legacy investment in the Mongolian State Rail Company, Ulaanbaatar Railway. Funding for the eastern extension may also come from Russia. There is concern that if the shorter private railway is built, the 400 km eastern spur will not be built which would have a negative impact on national priorities.

Rail options have not progressed as key decisions on this are awaited from the Government of Mongolia.

Any rail option would have advantages in terms of reducing road transport which would have benefits in terms of road safety and reduction in dust emissions, but would impact wildlife and herder movements as railways lines in Mongolia are required to be fully fenced with box culverts built to allow safe movement across the railway route. Due to the uncertainty of any proposed future rail options, it has not been considered within the ESIA.

13.10.5 Development of Mongolian Power Supply

The power supply assumptions for the Project are based on the Investment Agreement terms which allow power to be provided to the Project from Inner Mongolia until Year 4 after which it is to be sourced from within Mongolia. This provides an opportunity for Oyu Tolgoi to study in-country alternatives and select a suitable option while maintaining the focus on project construction. It is assumed that a power station will be constructed near to a coal source and a transmission line constructed to the Oyu Tolgoi site.

The Oyu Tolgoi Project is energy-intensive with an energy build-up to start-up in excess of 100 MW with further growth to around 200 MW in the longer term. A reliable and stable power supply is required to facilitate operations and safety.

A range of fuel and technology alternatives have been considered to meet the Project's power demands while also meeting the requirement of the Investment Agreement for the Project's long-term power to be sourced from within Mongolia. Alternatives considered include obtaining electrical power from:

- The existing electrical supply grid within Mongolia;
- A new coal-fired power station located within the South Gobi region;
- A new gas-fired power station located within the South Gobi region;
- A new diesel-fired power station located within the vicinity of the Project; and
- The use of renewable energy sources including solar, wind and biomass.

As part of the Environmental and Social assessment for the Power Plant, Oyu Tolgoi will undertake an expanded alternatives analysis to review the feasibility and costs/benefits of different fuel source to determine whether coal represents the only technically and economically viable source of fuel to meet the Project's requirements. If coal represents the only feasible alternative, further assessment will be undertaken to demonstrate that the technology choice meets the appropriate thermal efficiency and emission standards given design constraints (including coal composition, plant location, water availability, size of plant, operational considerations). The assessment will also include consideration of the use of renewable energy as part of the electricity supply mix in conjunction with coal power or as a stand-alone alternative for lighting and/or heating. Oyu Tolgoi will also assess opportunities to promote wider benefits of the Power Plant, for example through utilising a proportion of plant electricity generation capacity to be used to meet community demand for electrical power, and to consider broader initiatives in support of renewable energy at the Oyu Tolgoi site and in the South Gobi Region.

Oyu Tolgoi has undertaken a detailed feasibility study for the Power Plant in parallel with the preparation of a Detailed Environmental Impact Assessment (DEIA) in accordance with the Mongolian regulatory requirements.

Due to the ongoing nature of planning for the Power Plant, as part of the subsequent phase (Phase 2) of the Project, complete information is not currently available for incorporation into this ESIA. As a result, a Supplemental ESIA will be prepared separately for the Oyu Tolgoi Power Plant. The Power Plant will be

subject to the same Project Standards as the Oyu Tolgoi Project and as described in this ESIA. The Power Plant will be subject to the same independent review process which has been implemented by Project Lenders for the main Project ESIA and this will include an independent expert technical opinion on technically and economically viable fuel sources, technology choices related to thermal efficiency and emission standards given design constraints, and the potential to use renewable energy in the energy supply mix.

Based on the analysis conducted to-date, Oyu Tolgoi has concluded that a coal-fired power station represents the only feasible power source for the Project. As outlined above, the analysis of alternative power supplies will be considered in more detail in the Environmental and Social assessment for the Power Plant. With regard to a coal-based power supply, Oyu Tolgoi has considered two options in detail to ensure a reliable and efficient long-term power supply:

- Option 1 – Building a coal-fired power plant (three 150 MW units plus possible future expansion) at Oyu Tolgoi project site; and
- Option 2 – Building a coal-fired power plant (four 150 MW units) at the Tavan Tolgoi project site and erect a double-circuit 220 kV transmission line to the Oyu Tolgoi project site.

In order to provide sufficient power to the Project during construction and pre-commissioning, Oyu Tolgoi is currently operating a diesel generator system with an initial 20 MW capacity operated within the Mine Licence Area. This is planned to be expanded to 40 MW.

The Project's longer term energy needs are proposed to be met by a new Power Plant constructed in the Mine Licence Area, which is scheduled to be commissioned in the fourth quarter of 2014. At this time, the Power Plant would either provide the power required to commission the Oyu Tolgoi Project (and to commence Project operations), or it would replace power supplies imported via a 220 kV power line from the Inner Mongolian electricity grid in the People's Republic of China which is currently planned to be utilised for the commissioning and early operations.

Oyu Tolgoi has completed initial studies to define and appropriately identify the Power Plant Site location within the Mine Licence Area and to define fuel and raw materials requirements, water demand, supply structure, and the capacity of the projected Power Plant, as well as its technological requirements. The Power Plant will be designed to meet Mongolian Standards and Project Standards, including EU emissions requirements³⁵ and IFC EHS Guidelines on Thermal Power³⁶.

Due to the ongoing nature of planning for the Power Plant, as part of the subsequent phase (Phase 2) of the Project, complete information is not currently available for incorporation into this ESIA. As a result, a Supplemental ESIA will be prepared separately for the Oyu Tolgoi Power Plant. The Power Plant will be subject to the same Project Standards as the Oyu Tolgoi Project and as described in this ESIA. The Power Plant will be subject to the same independent review process which has been implemented by Project Lenders for the main Project ESIA and this will include an independent expert technical opinion on technically and economically viable fuel sources, technology choices related to thermal efficiency and emission standards given design constraints, and the potential to use renewable energy in the energy supply mix.

Oyu Tolgoi has undertaken a detailed feasibility study for the Power Plant in parallel with the preparation of a Detailed Environmental Impact Assessment (DEIA) in accordance with the Mongolian regulatory requirements.

Directive 2010/75/EU on Industrial Emissions (Integrated Pollution Prevention and Control)

³⁶ Note that in order to meet Oyu Tolgoi's power requirements and ensure maintenance and unplanned downtime capacity, it is not possible to cost-effectively apply supercritical technology. Two 600MW units would be required, which would far outweigh the electrical demand. As such, the Power Plant equipment proposed for Oyu Tolgoi is a subcritical plant utilising a circulating fluidised bed boiler.

The key parameters of the Oyu Tolgoi Power Plant Project are described in the DEIA for the Power Plant³⁷ as follows:

The plant would consist of up to five units, each comprising a coal-fired circulating fluidized bed boiler with fabric filter, turbine generator and associated auxiliaries.

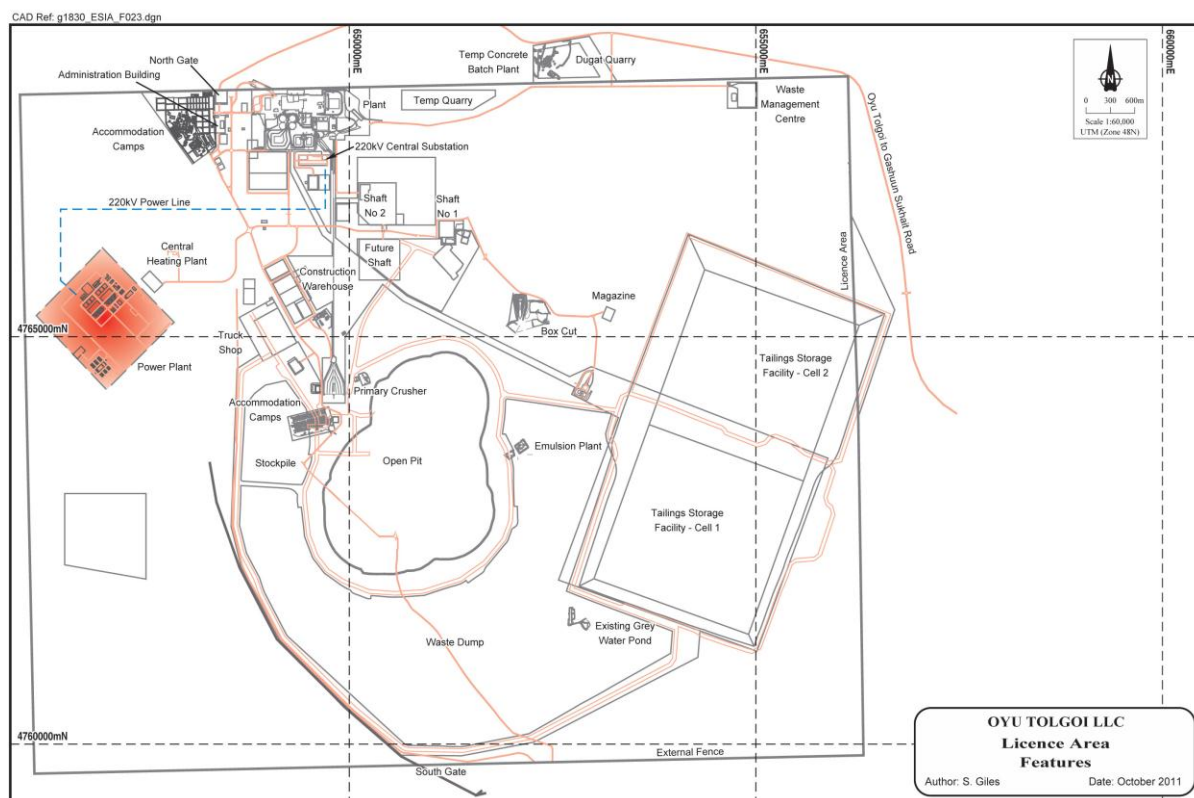
Other station facilities would include:

- Two exhaust stacks;
- Electrical switchyard;
- Water treatment and supply facility;
- Coal receiving, handling and storage facilities;
- Ash removal facilities and other station services equipment;
- Coal would be delivered to the site by trucks or later by train from nearby regional coal mines;
- The power plant is proposed to be air cooled to ensure conservation of valuable groundwater resources;
- The make-up boiler water and other associated water demands of the plant would be supplied from the mine water supply from the Gunii Hooloi aquifer;
- The electric load requirements of the Oyu Tolgoi Mine Project would initially be met by three 150MW Turbine Generators;
- The fourth and fifth units would be installed if required by additional Project loads or demands from external users;
- A Continuous Emissions Monitoring System (CEMS) would be installed at the ductwork to the stack to monitor plant emissions. Analysers are provided for each monitored gas as necessary to meet applicable air quality requirements, including opacity monitors to measure stack particulate emissions. The system would monitor , NO_x and Total Particulates;
- Air emissions would be managed by using fabric filters to remove particulates, addition of limestone (calcium carbonate) for SO_x reduction and optimisation of the fluidised bed combustion temperatures to reduce NO_x generation in the waste gasses;
- Waste coal ash and dust products would be water-conditioned to ensure dust is controlled before being transported to the Oyu Tolgoi mine tailings storage facility for co-disposal with mine tailings; and
- Construction facilities such as workshops, laydown areas and a temporary Power Plant construction worker accommodation camp.

The footprint of the Power Plant Project is almost entirely contained within the Oyu Tolgoi Project Mine Licence Area, as shown in *Figure 13.5*. A single element of the Power Plant Project is located outside the Mine Licence Area; a 5-10 km section of new road to link the Tavan Tolgoi – Gashuun Sukhait road and the Mine Licence Area that would be required to facilitate coal transportation to the Project. The route corridor and subsequent alignment for the link road have not been established.

³⁷ Oyu Tolgoi Coal-Fired Power Plant Project. Detailed Environmental Impact Assessment Report. Nature Friendly LLC, 2011.

Figure 13.5: Planned Location for Proposed Power Plant at Oyu Tolgoi



The Power Plant ESIA will evaluate the infrastructure requirements of the Power Plant. At present it is expected that the needs of the Power Plant Project can be met by existing and already planned infrastructure developments, whether implemented by the Oyu Tolgoi Mine Project or by third parties (with the noted exception of one new section of road outside the Mine Licence Area which will be used for coal haulage).

Interactive and cumulative impacts may occur due to the interaction of the Oyu Tolgoi Power Plant Project with the following:

- The Oyu Tolgoi Mine Project, with respect to:
 - Air emissions;
 - Wastewater discharges;
 - Visual impacts;
 - Noise emissions;
 - Worker construction camps; and
 - Electricity distribution infrastructure.
- Infrastructure owned and operated by others:
 - Coal mine(s) for the supply of coal to the Power Plant; and
 - Roads for the transport of construction materials and coal.

The potential for cumulative impacts will be assessed in the Power Plant ESIA, although it is expected that the impacts of the Power Plant Project will be represent small increments over and above those generated by the other Projects and sources, with the exception of air emissions. These will be assessed and reported in the Power Plant ESIA. Key cumulative impacts that may occur are summarised below:

Land

During power plant construction, land will be disturbed by construction of buildings foundations and storing construction materials

Air Quality

Power plant has potential to emit dust emissions, gaseous pollutants and fly ash during the construction, which requires vehicle movement. Uncontrolled disposal of ash and wastes may pollute soil cover by wind.

Soil

Soil will be disturbed and stripped by vehicle movement and earthworks in the proposed development area. Disturbed soil is vulnerable to wind erosion. Top soil to be disturbed by construction works and used for base of the plant will be stockpiled for future use in the reclamation and rehabilitation of any disturbed areas. If disturbed soil is not rehabilitated, consequences such as soil degradation would be unavoidable. Coal transportation and ash from power station may pollute soil.

Water Resources

If the proposed Power Plant area is located along the Undai river basin, potential soil and air pollution during operation of the power plant may result in pollution of surface water. However impacts may be unlikely and minor because of temporary flow of Undai river and 2-3 occurrences of flood events.

Flora

Vegetation cover will likely be removed for construction of the power plant site. This would be expected to result in destruction of vegetation species and cover. Endangered and rare species could be affected by vehicle movement and construction works.

Fauna

Any failure in installation or operation of power transmission infrastructure and other facilities may result in death or injury of birds due to electrical shock, which is a concern in Mongolia.

Historical and Cultural Heritage

It is expected that there are no impacts from power plant construction on historical and cultural heritage

Society and Economy

Goal and planning of the proposed power plant will have no adverse impacts on social and economy of the region which lacks of power supply.

13.10.6 Extended Life of Mine Economic Impacts

Extension to the life of the Oyu Tolgoi Project will extend the economic and commercial benefits of the Project to the South Gobi region and to Mongolia more widely. This will include:

- Extended employment opportunities for Oyu Tolgoi workers, contractors and suppliers;
- Extended economic inflows into the South Gobi region and Mongolia from salaries and the purchase of goods and services;
- Extended direct and indirect taxation revenues for the Government of Mongolia; and
- Extended dividend income stream for the Government of Mongolia.

The extension of the life of the Oyu Tolgoi mine would increase the likelihood of occurrence of many of the regional cumulative impacts discussed in this Chapter.