Preliminary Socio-economic Evaluation
of the
Sample Alternatives
for
Faro Mine Closure

FINAL REPORT

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EXECUTIVE SUMMARY

This report provides a broad overview of the potential socio-economic effects of a number of example alternatives for the closure of the Faro mine. The relatively new *Yukon Environmental and Socio-economic Assessment Act*, negotiated as part of the Yukon land claims settlements, requires that socio-economic effects be considered when selecting options and assessing a project.

The work in this study is based on nine example alternatives – three at each site (Faro mine, Rose Creek Tailings and Vangorda/Grum) – and the costing work done on these alternatives by SRK Consulting in its *Example Alternatives for Closure of Anvil Range Mining Complex* (September 2006).

The terms of reference required estimating the labour requirements and economic impact of the different alternatives as well as providing a list of potential effects, issues and opportunities that may arise from a socio-economic perspective arising out of the closure alternative scenarios. The objective of this report is to assist decision makers in understanding potential socio-economic effects that need to be considered in first, identifying a preferred closure strategy and, second, in establishing the scope for preparation of the socio-economic component of the proponents submission under YESAA.

The socio-economic consequences of the project will be felt most strongly primarily in Faro and also to a great extent in Ross River, the two communities of about 400 people closest to the mine site. To a lesser extent, other rural communities such as Carmacks and Pelly Crossing may also be affected.

Economic effects

The report estimates labour requirements and examines local and territory wide workforce availability. Under all alternatives, the project will primarily employ heavy equipment operators, light equipment operators and labourers. The project could also affect the demand for electricians and heavy-duty equipment mechanics. Post-closure direct employment is likely to be small. Training needs should be identified with more precision once the final closure option is selected and the planned remediation schedule is known.

The alternatives for the three different areas, as currently envisaged all start at the same time. This would result in a cycle with high employment at first followed by a rapid decline, which reduces the potential for positive social and economic benefits and increases the likelihood of negative impacts.

Examining the economic impact, the report concludes that this is a very large project relative to the Yukon economy and would dwarf the local economies. A combination of alternatives that spreads capital expenditures over the longest timeframe is the least disruptive to local economies and most consistent with sustainability objectives. The additional cost to the project, if any, of such a strategy has not been examined.

Social effects

The social effects considered include:
1. individual and community health,
2. social effects of increased incomes and employment,
3. housing and community infrastructure,
4. regional land use,
5. resource harvesting, tourism and recreational use.

Regarding individual and community health, the report identifies a number of challenges facing communities and individuals. The previous impacts associated with development of the Faro Mine are well documented. Consideration needs to be given to these five topics in finalizing the closure and reclamation plans because they have both short and long term implications for the local communities affected and the Government of Yukon. It is not possible to fully restore the landscape to the condition that existed before the mine was developed. Faro as a community will still exist and as such, influence future regional land use within the traditional territory of the Ross River Dena. The Ross River Dena need to be comfortable with the preferred closure plan. They need to be able to see that the closure plan acknowledges their land stewardship concerns and provides an opportunity to influence and choose the extent and nature of economic and social benefits that affect their people and the community of Ross River.

The report assumes the Town of Faro will logically be the primary service community for mine-site reclamation and ongoing post-closure site management. This conclusion needs to be balanced with the aspirations of the affected First Nations, primarily Ross River Dena. The key considerations provide important insight to matters regarding the social well-being and social capacity of each community.

Again, work-force accommodation is raised in the context of basic scenarios for staff housing. The current inventory of existing housing units and civic infrastructure in Faro and options of self-contained camps and potential locations is examined – each with associated social and economic effects and impacts. A key data gap identified is the operational condition of the housing and municipal infrastructure in the Town of Faro.

The degree to which closure planning can influence future regional development needs further consideration. There is no regional development strategy or land use plan to guide reclamation design. Regional land use raises important considerations that go beyond strictly closure planning activities. This is clearly an area where various government departments, agencies and stakeholders must consider and reach a level of consensus if the project is to be successful. There are a diversity of issues and interests in the area that must be considered. A key issue is what minimum population is required to sustain the community and infrastructure at Faro and to what degree does the preferred closure option facilitate that transition.

The presence of the mine and development of the community of Faro created a number of competing land use interests. In the most part they are an indirect result of the presence of the mine and local geography. The section on resource harvesting, tourism and recreational use focuses in on competing land use issues that will be affected by the choice of closure approach. For example, determining the post-closure landscape and re-vegetation approach may impact Fannin Sheep habitat and populations. The continued existence of Faro will continue to impact big game outfitters concessions, wilderness tourism opportunities and big game harvesting. These speak to the need for responsible planning that considers all of these issues before decisions are made on a single aspect.

Conclusion

The closure and reclamation of the Faro mine presents opportunities, risks and challenges to the affected communities. The effect on the Yukon economy and individual communities, particularly Faro and Ross River, will be substantial. It will also have large social effects that need to be carefully considered. The *Yukon Environmental and Socio-economic Assessment Act* requires that socio-economic factors be taken in consideration in making a decision regarding the preferred approach and extent of impacts both positive and negative. This project could be a tool for establishing the base for a stable long-term sustainable economy for the affected communities, or it could perpetuate the boom and bust cycle these communities have been subject to in the past, with all its attendant social and economic problems.

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1 Introduction

This paper provides an overview of the potential socio-economic effects for the Faro mine closure example alternatives.[1] As a scoping document, this report identifies issues, opportunities and questions that decision-makers will need to consider in selecting a preferred closure strategy. At that point a comprehensive socio-economic effects assessment will be prepared to satisfy the requirements of *the Yukon Environmental and Socio-economic Assessment Act* (YESAA). The *Yukon Environmental and Socio-economic Assessment Act*, negotiated as part of the Yukon land claims settlements, requires considerably more detailed socio-economic assessments than has been done in the past. The Act mandates, among other things, that:

> *projects are undertaken in accordance with principles that foster beneficial socio-economic change without undermining the ecological and social systems on which communities, their residents, and societies in general, depend.*

The example closure alternatives were developed over a number of years following a series of workshops involving federal and territorial government officials, First Nations, stakeholders, and technical experts.[2] The twelve alternatives, four for each affected area, are:

- Faro mine area
  - Flow-Through Pit
  - Upgrade Faro Creek Diversion
  - Minimize Construction
  - Minimize Water Treatment
- Rose Creek tailings
  - Stabilize in Place
  - Complete Relocation
  - Partial Relocation
  - Minimize Construction
- Grum/Vangorda mine area
  - Backfill Vangorda Pit
  - Stabilize in Place
  - Minimize Construction
  - Minimize Water Treatment

SRK Consulting costed out the twelve alternatives. The costing work was premised on the assumption that the required decommissioning work is carried out in the most efficient fashion from an engineering/project management perspective. Socio-economic factors were not considered. Put another way, if the most efficient method were to hire a large labour force for a short period of time, then their availability is assumed along with the equipment and supplies needed to do the work.

Similarly, who the proponent is that implements the final closure plan alternative is not relevant to the SRK Consulting costing analysis. However, from a socio-economic perspective, it is a major consideration in determining the magnitude of effects both positive and negative. For example, a private contractor would want to focus on completing the work as quickly as possible within the scope of the contract terms to maximize the opportunity for profit. Ideally, one

[1] SRK Consulting, *Example Alternatives for Closure of Anvil Range Mining Complex*, September 2006
[2] For a presentation of how the alternatives were arrived at, see the SRK Consulting report, pp. 4-5.

company would be hired to do everything. Governments on the other hand have broader objectives and responsibilities. It is nevertheless possible to structure contract with the private sector to attempt to meet the broader public policy objectives. Consequently they have to consider the broader public interest and socio-economic consequences associated with the closure project in determining a preferred alternative and project delivery methods.

The focus of this overview is on 9 of the 12 alternatives. As advised by the Faro Mine Closure Planning Office, the three "minimize construction" options are not reviewed. In theory, the twelve example alternatives could lead to a 64 possible combinations or permutations. To illustrate the overall range of potential costs, SRK developed a series of seven combinations of alternatives. Much of the economic analysis is based on those combinations. Evaluating all 64 would have resulted in an unmanageable piece of work. Reclamation work on all three areas could be undertaken at the same time or sequentially. SRK time and cost estimates assume the work is started simultaneously in all three areas.

Table 1 Description of selected combinations of closure alternatives

Combination	Faro	Tailings	Vangorda/Grum
Physical Stabilization 1	Upgrade Faro Creek Diversion	Stabilize in Place	Stabilize Current Situation
Physical Stabilization 2	Upgrade Faro Creek Diversion	Stabilize in Place	Vangorda Pit Backfill
Physical Stabilization 3	Upgrade Faro Creek Diversion	Partial Relocation	Stabilize Current Situation
Physical Stabilization 4	Upgrade Faro Creek Diversion	Partial Relocation	Vangorda Pit Backfill
Relocate Tailings & Stabilize Mine Areas 1	Upgrade Faro Creek Diversion	Complete Relocation	Stabilize Current Situation
Relocate Tailings & Stabilize Mine Areas 2	Upgrade Faro Creek Diversion	Complete Relocation	Vangorda Pit Backfill
Relocate Tailings & Minimize Water Treatment	Minimize Water Treatment	Complete Relocation	Minimize Water Treatment

On the social effects side, potential social effects both positive and negative are identified, listed and discussed. For the purpose of this overview they are not related to specific alternatives unless information is available to do this.

1.1 Communities

The socio-economic effects on the communities of Faro, Ross River, Carmacks, and Pelly Crossing, as well as the Yukon as a whole are examined. The following sections provide the basic socio-economic profiles of the communities. Much of the data used in the profiles is from the 2001 Census as this is the latest available detailed data for Yukon communities. Some 2006 census data may become available in late 2007, but the bulk of the required data will not become available until March 2008. We have also used more recent data collected by the Yukon Bureau of Statistics and data on declared incomes from the Canada Revenue Agency.

The following assumptions underlie the evaluation of all alternatives. The first is recognition that the principal socio-economic impacts and consequences associated with the chosen mine closure and reclamation strategy will be felt in the community of Faro and secondarily Ross River

because of their proximity to the mine itself. While Pelly Crossing is affected by environmental concerns, it is not as directly affected from a socio-economic perspective except to the extent that its residents may work at the site. Carmacks is more likely to be more affected than Pelly Crossing as it is closer to the mine and likely to have much traffic go through it as a result. Whitehorse will inevitably be the major supply point for the project, because of its size, diversity of services available and dominance of the Yukon economy. It is not examined here although a thorough socio-economic assessment under YESAA will have to deal with the effects on Whitehorse.

Faro owes its very existence to the creation of the mine while Ross River does not. As a single industry resource town it could have died and faded away with mine closure as has occurred elsewhere. However, it has refused to do so. A core population remains that believes the community can and should survive. While Faro is now one-third of its size when the mine was fully operational, it remains similar in size to 6 other Yukon communities. The issue then is not whether the community should continue to exist or not once reclamation is complete, but rather to what purpose and in what form and scale. For the purpose of this assessment, it is assumed the community will continue to exist and function as a small, regional service centre with modest growth.

Ross River is a traditional First Nation community and is likely to experience a more natural growth rate reflecting its First Nation roots and growth preferences. It is assumed that if an influx of new people into the Campbell region were to occur, the majority of this future growth would occur in Faro partly because of local preference and partly because the capacity to absorb such growth already exists. This is not to say that there are not growth management and infrastructure capacity issues but rather that the community has some inherent advantages because Faro once held a significantly larger population.

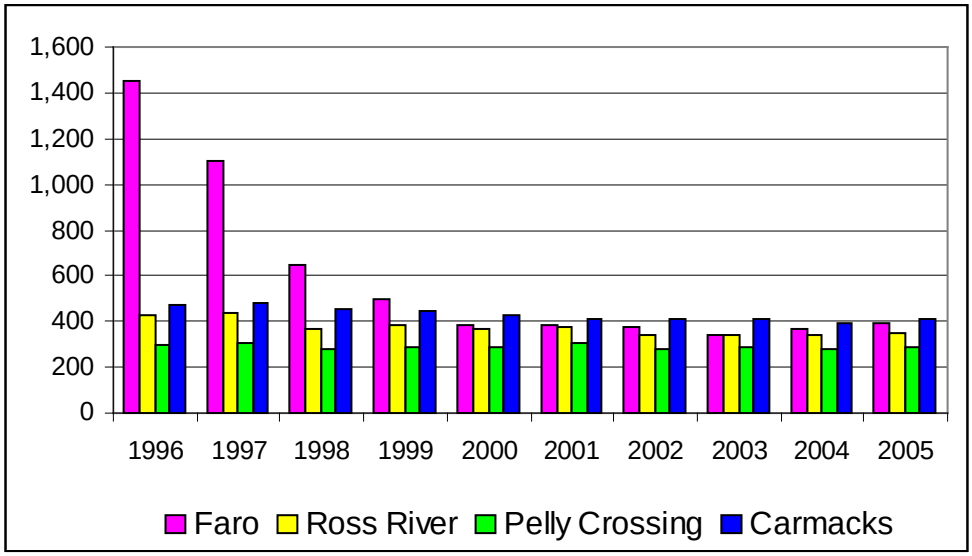
One challenge then, from a socio-economic perspective, is determining what opportunities exist within the sample alternatives that offer the most benefit to long-term community sustainability. The degree to which such opportunities can be leveraged will depend on the respective objectives of the affected governments with an interest in this project and the desires of the two communities most directly affected, Faro and Ross River.

1.1.1 Population and Demographics

The basic outlines of a community's existing socio-economic conditions are set by its demographics — including overall population, patterns of population growth and decline, age and sex ratios, ethnicity, and family and household structure. The structure of families and households can give insights into community stability and its vulnerability to change.

Figure 1 shows the populations of the potentially affected communities in the Yukon from 1996 to 2005. Faro's population declined precipitously after the closure of the mine, going from over 1,400 people to about 380 today. All four communities have around or below 400 people. It seems that communities with a population of between 300 and 400 can survive in the long term in the Yukon: it can be noted that Carcross, Teslin and Mayo also have similar populations.

Figure 1 Population 1996-2005, Faro, Ross River, Pelly Crossing and Carmacks, Yukon Health Care population estimates



Key Considerations:

- *The Yukon's population reached a high point in 1997, fell to a low in 2003 and has been increasing since whereas the communities of Ross River, Pelly Crossing, and Carmacks, although seeing some fluctuations in population, have been largely stable since 1996.*
- *Faro saw a precipitous decline in population following the shutdown of mining operations in early 1998 and has been largely stable since.*

Figure 2 below shows a graph of the changes in Faro's population from 1974 through to 2006. Faro's population was clearly related to the fate of the mine. Population peaks clearly coincide with when the mine was open and declines when the mine closes, but it seems to have stabilized in recent years.

Ross River's population also seems to have been affected by the vagaries of the Faro mine, but nowhere near the same extent.

Figure 3 below shows that Ross River's population increased gradually in the 1970s. Surprisingly, the population jumped considerably after the Faro mine closed in the early 1980s, and rose again in 1994 following the 1993 closure but declined in 1995. After that, it rose following the reopening and declined gradually after the last closure until the last two years (2005 & 2006).

Key Considerations:

- *Faro has undergone wild fluctuations in population as the fortunes of the mine ebbed and flowed. When the mine was fully operational, the population was three times the current size demonstrating a willingness of workers to live in the community rather than commute.*
- *The community has experienced three collapses of its population following each shutdown of the mine — in the early 1980s, the early 1990s, and finally in 1998.*

- *The closures were unexpected compounding both direct and indirect impacts on the community and Yukon economy as a whole. The effect of the closures has been to undermine community stability.*

Figure 2 Faro population, June 1974 to 2006, Yukon Health Care population estimates

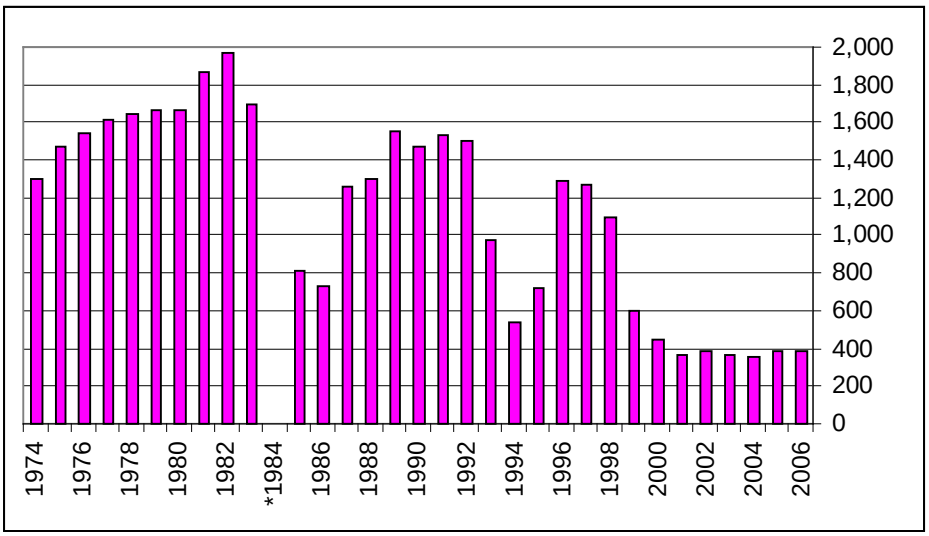
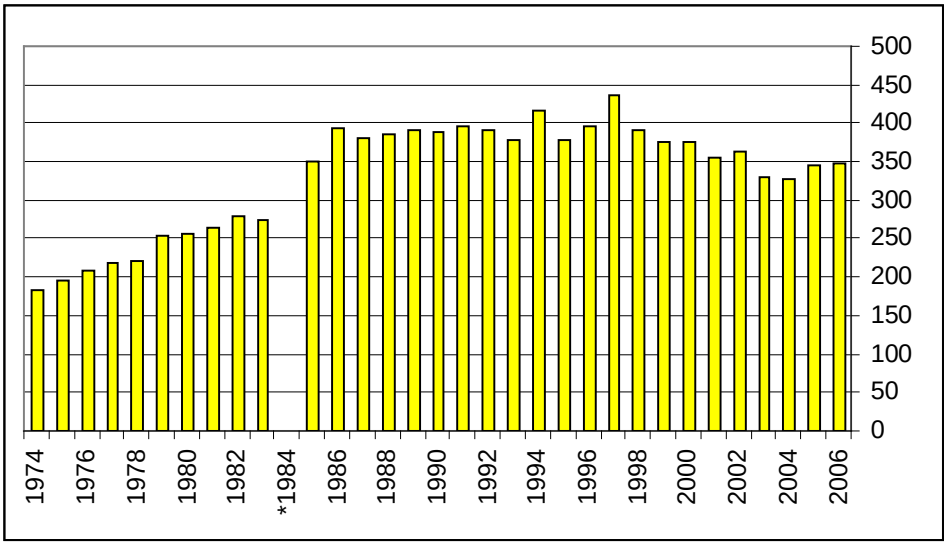


Figure 3 Ross River population, June 1974 to 2006, Yukon Health Care population estimates



2 Economic effects

Most economic impacts will result from spending on the construction phase of reclamation. However, the continued operation of the water treatment system will also have an impact, mainly on Faro, possibly Ross River, and to a minor degree on the Yukon economy as a whole.

Employment effects are of the most interest at this overview stage, especially to identify training needs. Rather than using standard economic ratios, we undertook a detailed analysis of the labour requirements from the SRK costing calculations. We calculated person-hour labour requirements by trade for each of the alternatives and developed total labour costs.

Construction spending will affect Gross Domestic Product (GDP), employment, business revenues, and taxes. The capacity of the local construction industry to handle the project was also examined. As well, the main business opportunities and consumables are identified from the detailed project spreadsheets such as: the provision of lime and fuel.

Impacts will differ at the community and territorial level and are examined separately.

2.1 Employment and Labour Requirements

2.1.1 Methodology

Total employment and labour requirements by trade were calculated using SRK Consultants costing spreadsheets for the reclamation phase. Post closure labour requirements are minimal involving primarily the operation of the water treatment plant. The costing spreadsheets provide total person hours for each task identified for the different alternatives. The fourteen main trades and occupations involved in the Faro work include:

1. Labourer
2. Light Equipment Operator
3. Heavy Equipment Operator
4. Technician[3]
5. Journeyman Carpenter
6. Journeyman Electrician
7. Journeyman Pipefitter
8. Journeyman Welder
9. Driller
10. Driller Helper
11. Helicopter Pilot
12. Surveyor
13. Heavy Duty Mechanic
14. Mechanic Helper

The first step was to assign a “crew” composed of a number of workers from different trades for each of the 209 tasks identified by SRK. Then person-hours for each trade in each of the tasks for each of the nine alternatives were calculated by prorating the total person-hours in the spreadsheet by the crew we assigned.

[3] The types of technicians required are not specified and need to be clarified

Once the total person hours per trade and per alternative were estimated, the time dimension was added. Person-hours for each alternative were allocated to each year based on the percentage of expenditures in that year, giving annual person-hours per alternative for every trade or occupation. The employment figures were then adjusted to account for the 20% contingency in the SRK estimate.

Turning person-hours into person-years or number of workers required is not as straightforward as it may appear. Without a detailed project schedule, this cannot be done with great confidence. The main issue is how many hours a year each worker can work. Some tasks are likely to be seasonal, while others can be conducted year-round. Also, the number of workers depends on where the workers are housed. If they are living in Faro or possibly Ross River, then they might work a "normal" work-year of about 1,900 hours and eight-hour days. On the other hand, in a camp situation, workers are more likely to work 10-12 hours per day, seven days a week in two-week shifts. Of course, both are possible, some longer-term tasks could be done with a normal work force based in local communities and others using temporary workers based in a camp. In the end, given the seasonality of some of the work and the uncertainty relating to housing, it was decided to estimate the number of workers required by assuming the average worker would work approximately 1,500-hours each year.

We did not calculate the project management, clerical and field engineering labour required. SRK estimated the costs for these as a simple percentage of total alternative costs and we could not estimate them with any degree of confidence.

At this stage, it appears that post-closure employment is fairly small and similar for all alternatives with only three full time staff: a site manager, an assistant site manager, and a technician. As well, two part-time technicians and four tradespeople are also identified. Clearly, additional work is required to develop more precise estimates, but this can only be done once the preferred alternatives are selected.

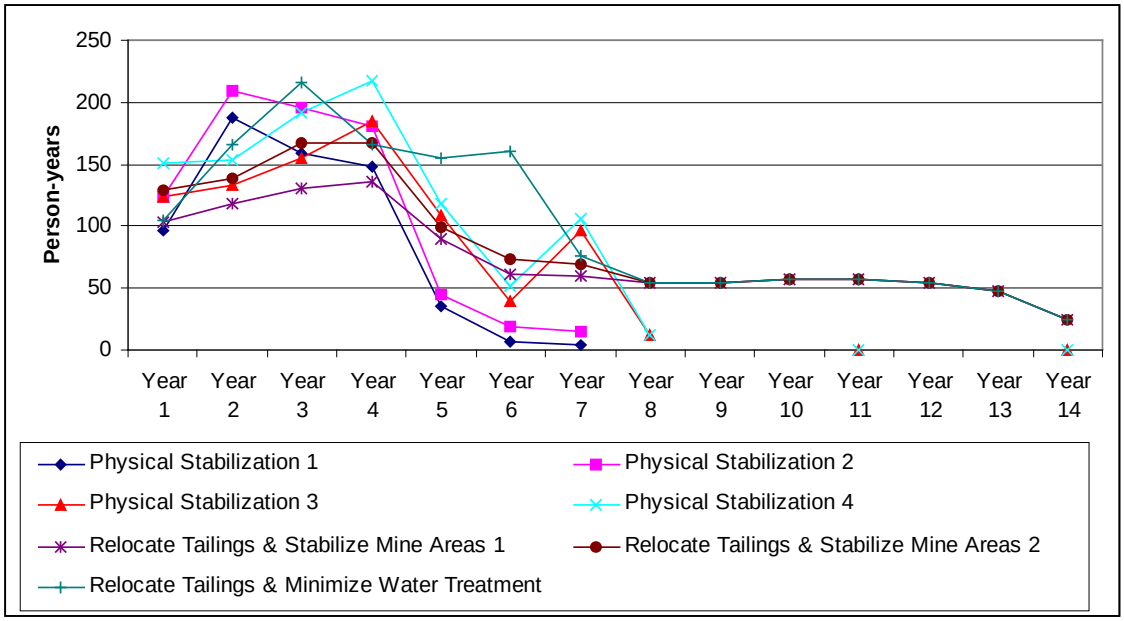
2.1.2 Overall Labour Requirements

Figure 4 below presents the total person-years labour requirements calculated as described above for each of the combinations of alternatives. Most alternatives start with a labour force requirement of over 100 workers, peaking in the second, third or fourth year at well over 150 workers depending on the alternative. In three of the option combinations the workforce would peak at over 200 persons.

The length of time the reclamation works is of the greatest relevance from a socio-economic effects perspective. Avoiding or mitigating the large instability that typically accompanies any significant construction project improves the benefits and reduces the adverse socio-economic effects. In the options that do not involve relocation of tailings, here is a short-3-4 year boom in construction employment followed by a large and sudden decline. This is an unstable pattern from a community development perspective, and would not result in the level of economic and social benefits that the other options provide. Short time periods with high peaks usually necessitate importing labour. Based on the analysis done by SRK, it seems that the alternatives that include tailings relocation create longer-term employment opportunities for about 50 workers. It might be possible to stretch out the time over which the other alternatives are implemented, thereby mitigating the instability they create. Assuming this resulted in the majority of these workers choosing to reside in Faro, the benefits to a community of that size would be substantial.

Similarly, the capacity of Faro to absorb such an influx of workers and consequent effects on infrastructure capacity and community social structure is also more viable. Thus the alternative with the "flattest curve" is most desirable from a community development perspective and it would likely be the least disruptive. At this point this would favour the "*Relocate Tailings and Stabilize Mine Areas 1*", which involves: "*Upgrading the Faro Creek diversion, Complete relocation of tailings,* and *stabilizing the current situation at Vangorda/Grum"* as described in Table 1 on page 2 above.

Figure 4 Overall labour requirements by year and by combination of alternatives



Key considerations:

- *A compressed time schedule assumes manpower and equipment readily available when required and does not take into account other Yukon construction activity that may occur during the same timeframe*
- *A compressed timeframe reduces the potential to create positive benefits at the community level and increases the probability of negative effects occurring.*
- *A "flatter" labour curve implies a longer project life and the potential to break work components into small work packages within the capability of more Yukon businesses.*
- *A "flatter" labour curve provides more training possibilities and a greater probability of local hire.*
- *A compressed schedule works against the affected communities' diversification and sustainability goals while a longer timeframe increases the probability of local benefits.*
- *The workforce potential of affected communities will need to be examined more closely to determine both the capacity of each community to participate in the project as well as their respective willingness to do so. Constraints could include lack of appropriate skills, the nature of the work, work schedule, probable employment duration and other opportunities available.*

2.1.3 Labour Requirements by Trade and Occupation

Appendix C provides detailed information of the labour requirements by trade and by year for each of the proposed alternatives. This section summarizes the data for each identified trade. The trades and occupations have been classified into "Major", "Intermediate", and "Minor" depending on how much work each does. Major trades generally represent occupations with more than 10 workers in them in most combinations. They provide the greatest training opportunities but also the project could put substantial pressure on their demand. The "Intermediate" trades and occupations are those where at least 2 people are required in most combinations of options, while the minor ones are the rest.

The major trades and occupations are:

- Heavy Equipment operator
- Labourer
- Light Equipment Operator, including truck drivers

The intermediate trades and occupations are:

- Journeyman Electrician
- Heavy Duty Mechanic
- Mechanic Helper
- Surveyor
- Technician

The minor trades and occupations are:

- Driller
- Driller Helper
- Helicopter Pilot
- Journeyman Carpenter
- Journeyman Welder
- Journeyman Pipefitter

For reference purposes, Table 2 presents the number of people in relevant trades and occupations in the Yukon according to the 2001 Census. That data may be somewhat outdated, as employment and the labour force has increased since the time the Census was taken. According to the Statistics Canada's *Survey of Employment, Payroll and Hours*, average monthly construction employment increased from 836 in 2001 to 1,062 in 2006.[4]

Table 2 Yukon experienced labour force, relevant occupations, 2001

SOC Code	*Occupation*	*Labour Force*
A121	Engineering, science and architecture managers	15
C031	Civil engineers	50
C131	Civil engineering technologists and construction estimators	20
C111	Applied chemical technologists and technicians	10
C112	Geological and mineral technologists and technicians	25
C054	Land Surveyors	35
C154	Survey technologists and technicians	10
A371	Construction managers	60

[4] Calculated from Statistics Canada, *Survey of Employment, Payroll and Hours*, CANSIM #281-0023.

SOC Code	*Occupation*	*Labour Force*
H013	Contractors and supervisors, pipefitting trades	10
H11	Plumbers, pipefitters and gas fitters	70
H015	Contractors and supervisors, carpentry trades	10
H121	Carpenters	385
H211	Electricians (except industrial and power system)	70
H212	Industrial electricians	15
H326	Welders	45
H017	Contractors and supervisors, heavy construction equipment crews	40
H6	Heavy equipment and crane operators including drillers	415
H412	Heavy-duty equipment mechanics	90
H711	Truck drivers	290
H821	Construction trades helpers and labourers	235

2.1.3.1 Major Trades and Occupations

Given the nature of the reclamation task the bulk of the workforce will be comprised of heavy and light equipment operators and labourers. The following tables present the total demand over the life of each combination of alternatives, including the peak annual employment and the average annual employment for these trades.

Table 3 Heavy Equipment Operator employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	193.8	58.4	27.7
Physical Stabilization 2	233.3	63.0	33.3
Physical Stabilization 3	203.3	44.6	25.4
Physical Stabilization 4	242.7	53.2	30.3
Relocate Tailings & Minimize Water Treatment	245.8	50.6	17.6
Relocate Tailings & Stabilize Mine Areas 1	148.1	27.1	10.6
Relocate Tailings & Stabilize Mine Areas 2	187.5	35.7	13.4

The 2001 Census identified 415 heavy equipment operators (including drillers) in the Yukon. At its peak, most combinations would employ about 10% of the available heavy equipment operator workforce available in the Yukon. On average, during the life of the closure activities, 2 to 8 per cent of available heavy equipment operators will be needed. Unless the activities are highly concentrated in certain times of the year the Yukon could supply the number of operators required, except possibly at peak employment times.

Table 4 Labourer employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	84.6	21.6	12.1
Physical Stabilization 2	110.4	27.2	15.8
Physical Stabilization 3	268.6	56.2	33.5
Physical Stabilization 4	294.4	61.6	36.7
Relocate Tailings & Minimize Water Treatment	498.8	47.8	35.6
Relocate Tailings & Stabilize Mine Areas 1	498.9	50.0	35.6
Relocate Tailings & Stabilize Mine Areas 2	524.7	55.4	37.5

Labourers are generally considered to be an unskilled occupation; with most training received on-the job. The 2001 Census identified 215 construction labourers in the Yukon. While the peak and average requirements of the project are large relative to the number of people who had worked as labourers in 2001, it should be relatively easy to increase the number of labourers assuming that there are no competing large projects.

Table 5 Light Equipment Operator employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	283.1	86.2	40.4
Physical Stabilization 2	345.9	94.3	49.4
Physical Stabilization 3	249.8	55.8	31.2
Physical Stabilization 4	312.6	69.4	39.0
Relocate Tailings & Minimize Water Treatment	407.8	88.4	29.1
Relocate Tailings & Stabilize Mine Areas 1	204.3	37.7	14.6
Relocate Tailings & Stabilize Mine Areas 2	267.0	51.5	19.1

Light equipment operators include off-road dump truck drivers, other truck drivers, compactor and other light equipment operators, etc. These are considered less skilled operators than heavy equipment operators who operate bulldozers, excavators, graders, loaders, etc. Consequently they have lower training requirements. The different combinations of alternatives will require substantial numbers of these workers. The available Yukon data does not distinguish clearly between the different skill requirements of these subtrades possibly because many of these workers have multiple skills largely learned on the job. Sufficient workers are expected to be available.

2.1.3.2 Intermediate Trades and Occupations

The “intermediate” occupations include Electricians, Heavy Equipment Mechanics, Mechanic Helpers, Surveyors, and varied Technicians.

Table 6 Electrician employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	3.8	1.2	0.5
Physical Stabilization 2	3.2	0.9	0.5
Physical Stabilization 3	38.8	7.4	4.8
Physical Stabilization 4	38.2	7.4	4.8
Relocate Tailings & Minimize Water Treatment	94.7	7.1	6.8
Relocate Tailings & Stabilize Mine Areas 1	95.4	7.4	6.8
Relocate Tailings & Stabilize Mine Areas 2	94.8	7.2	6.8

Electricians will be used mainly if the alternatives involving relocation of tailings are selected. They will play a large role in the electrical installation of pumping systems, heat traces, etc. Their numbers in the Yukon (about 85 according to the 2001 Census) represent a fair proportion of the labour force in that trade. Depending on what other projects are under way, there might be a need and an opportunity to train more electricians. Also, our calculations assume that demand for electricians will be more or less evenly distributed throughout the life of the project. If this is not the case, the peak numbers would be higher and the demand might have to be met by importing labour from Outside. Electricians are one of the most highly skilled trades in construction, with a four-year apprenticeship.

Table 7 Heavy-Duty Equipment Mechanics (HDEMs) employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	23.3	7.3	4.7
Physical Stabilization 2	27.8	8.0	4.0
Physical Stabilization 3	20.4	4.3	2.5
Physical Stabilization 4	24.9	5.9	3.1
Relocate Tailings & Minimize Water Treatment	29.1	6.8	2.1
Relocate Tailings & Stabilize Mine Areas 1	10.5	2.6	0.7
Relocate Tailings & Stabilize Mine Areas 2	15.0	4.1	1.1

Heavy-duty equipment mechanics are also a highly skilled trade with a four-year apprenticeship. The numbers above are based on assumptions about the amount of equipment required. Older equipment requires more maintenance and these numbers may be on the low side. On the other hand, if new equipment is purchased for this project, the requirements could be lower. There were about 90 HDEMs in the Yukon in 2001. Most were employed by the Yukon Government, which also has an extensive apprenticeship program. The available data does not distinguish between apprentices and journeymen. Often, there is an almost equal number of apprentices/helpers as there are mechanics, but there may not be a helper on smaller jobs. Adding the two numbers shows that this project would use a fairly large number of HDEMs and helpers compared to the supply in the Yukon. Of course, the actual numbers will depend on the age of the machinery used on the project.

Table 8 Heavy-Duty Equipment Mechanics Helpers and Apprentices employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	21.6	7.8	5.4
Physical Stabilization 2	21.6	7.8	5.4
Physical Stabilization 3	9.8	3.9	2.5
Physical Stabilization 4	9.8	3.9	2.5
Relocate Tailings & Minimize Water Treatment	21.6	5.9	4.3
Relocate Tailings & Stabilize Mine Areas 1	5.9	2.0	2.0
Relocate Tailings & Stabilize Mine Areas 2	5.9	2.0	2.0

Table 9 Surveyors employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1			
Physical Stabilization 2	17.1	4.4	2.4
Physical Stabilization 3	17.1	4.4	2.4
Physical Stabilization 4			
Relocate Tailings & Minimize Water Treatment	10.9	2.1	1.6
Relocate Tailings & Stabilize Mine Areas 1			
Relocate Tailings & Stabilize Mine Areas 2	17.1	4.4	2.4

It appears that not all alternatives will require surveyors, at least as part of the construction crews. Of course, additional surveyors may be required as part of the contract management work, but these have not been included in the calculations. With 40 surveyors and an additional 10 survey technicians in the Yukon in 2001, the local market is expected to be sufficient to meet closure needs.

Table 10 Technicians employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	16.2	4.2	2.3
Physical Stabilization 2	16.3	4.2	2.3
Physical Stabilization 3	51.0	10.7	6.4
Physical Stabilization 4	51.1	10.8	6.4
Relocate Tailings & Minimize Water Treatment	66.4	5.8	4.7
Relocate Tailings & Stabilize Mine Areas 1	70.9	7.3	5.1
Relocate Tailings & Stabilize Mine Areas 2	71.0	7.4	5.1

Table 10 above indicates the number of "technicians" required for the different combinations of alternatives. However, it is not clear at this point which specific qualifications are required. The Yukon has a fair number (about 55) of technicians in the required areas (E.g. civil, geotechnical, geological, soil engineering technologists). The technician employment could provide training opportunities once the requirements and skills are specified.

2.1.3.3 Minor trades and occupations

As was outlined above, the minor trades and occupations include: drillers and helpers, helicopter pilots, carpenters, welders, and pipefitters. There is only a small need for workers in these trades.

Table 11 Drillers and Driller's Helpers employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	3.4	1.1	0.5
Physical Stabilization 2	2.4	0.6	0.4
Physical Stabilization 3	3.8	0.9	0.5
Physical Stabilization 4	2.8	0.6	0.4
Relocate Tailings & Minimize Water Treatment	9.0	2.3	0.8
Relocate Tailings & Stabilize Mine Areas 1	3.0	0.9	0.3
Relocate Tailings & Stabilize Mine Areas 2	1.9	0.5	0.2

Only a small number of drillers and helpers are required. There are no separate data for the number of drillers in the Yukon; they are included in the heavy equipment operators data. Under most combinations, there is not enough work to employ drillers full-time on the project, except for two peak years. There should be no difficulty in finding adequate numbers in the Yukon unless there is a boom in mining or oil and gas exploration.

There is only a very small need for helicopter pilots. While some flying time will be required in all combinations, there is less than one-tenth of a person-year peak employment in any of them. Total employment over the life of any of the combinations is less than one person-year.

Table 12 Carpenter employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	6.4	2.1	0.9
Physical Stabilization 2	6.3	1.9	0.9
Physical Stabilization 3	2.9	0.7	0.4
Physical Stabilization 4	2.8	0.7	0.4
Relocate Tailings & Minimize Water Treatment	1.2	0.2	0.1
Relocate Tailings & Stabilize Mine Areas 1	3.0	0.7	0.2
Relocate Tailings & Stabilize Mine Areas 2	2.9	0.7	0.2

While there is some need for carpenters, the numbers are fairly small, peaking at 2.1 person-years in one combination. There is less than a full person-year's annual work on average. These figures are completely dwarfed by the 385 carpenters in the Yukon in 2001.

Table 13 Welder employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	6.4	2.1	0.9
Physical Stabilization 2	6.3	1.9	0.9
Physical Stabilization 3	2.9	0.7	0.4
Physical Stabilization 4	2.8	0.7	0.4
Relocate Tailings & Minimize Water Treatment	1.2	0.2	0.1
Relocate Tailings & Stabilize Mine Areas 1	3.0	0.7	0.2
Relocate Tailings & Stabilize Mine Areas 2	2.9	0.7	0.2

Again, only one or two welders will be required. Two of the combination of options could provide some full-year employment to one or two welders.

Table 14 Pipefitter employment for different combinations of alternatives, person-years

Combination	*Grand Total*	*Peak*	*Average*
Physical Stabilization 1	1.0	0.4	0.2
Physical Stabilization 2	1.0	0.4	0.2
Physical Stabilization 3	3.9	0.7	0.5
Physical Stabilization 4	3.9	0.7	0.5
Relocate Tailings & Minimize Water Treatment	4.4	0.4	0.3
Relocate Tailings & Stabilize Mine Areas 1	4.3	0.3	0.3
Relocate Tailings & Stabilize Mine Areas 2	4.3	0.3	0.3

No pipefitters will obtain full-year employment on the project under any of the alternatives. Total number of pipefitters in the Yukon in 2001 was about 70.

Key Considerations:

- *The main occupations will be heavy equipment operators, light equipment operators and labourers. Under some alternatives, there will also be a substantial requirement for electricians. Heavy-duty equipment mechanics might also be in short supply, depending on the age of the machinery used.*
- *There is a growing industry wide shortage of journeyman tradespeople in western Canada that may continue to exist when actual closure implementation begins. 2001 data should be used with reservation. It is important to recognize that tradesperson availability in some areas may be a problem either because of the small overall size of the Yukon labour force or because of competing project demands.*

2.1.4 Local Labour Markets

Table 15 shows the employment characteristics of the affected communities in 2001. The data should be updated when the 2006 census information becomes available in March 2008. In 2001, the communities had a labour force participation rate that was comparable to the Yukon's, indicating that the problem was a lack of jobs rather than a lack of willingness to work.

Table 15 Labour force statistics, 2001

	Faro	*Ross River*	*Carmacks*	*Pelly Crossing*	*Yukon*
Working age population (15 years and over)	250	250	300	250	
In the labour force	190	190	225	195	
Employed	160	120	165	135	
Employment rate	64%	47%	55%	57%	70.6%
Unemployed	30	70	60	60	
Unemployment rate	16%	37%	27%	30%	11.6%
Not in the labour force	60	60	75	55	
Participation rate	76%	75%	75%	82%	79.8%

The local labour force includes individuals residing in Faro and Ross River. As well, a portion of the labour force is likely to come from other Yukon communities depending on availability, the hiring protocol chosen, and whether workers are housed in a work camp or the community itself. Carmacks and Whitehorse are other possible sources as well as Pelly Crossing to a lesser degree. Some may also come from outside the Yukon.

The two communities Faro and Ross River differ substantially in the characteristics of their labour force, although they are of similar size. Faro residents include those individuals and families that are long time residents, many of whom have a background in mining and relevant skills. The newer residents of Faro are those who have been attracted to Faro by the low cost of homes, the areas natural attributes and the possibility of earning incomes unrelated to the mining legacy. These newer residents include Canadians and foreigners particularly from Europe who have immigrated to the Yukon and have been attracted to Faro for economic and lifestyle reasons. Residents now include retirees, people who live in Faro and work elsewhere and individuals who see new business possibilities in industries such as tourism.

The labour force in Ross River is reflective of a traditional First Nation community. The population is relatively young and there is fairly high participation in the workforce by both men and women. The women tend to be employed more in full time positions in the community and the men in more seasonal positions that may take them out of the community. Many of the skilled and experienced workers that are easily employable are employed. Others that may have one or more barriers to successful employment may be available for work. Depending on the nature of the barriers to employment, a variety of training opportunities, employment readiness programs and employment related individual and family support programs or services may be required to ensure a successful employment experience.

There is little information on the number of people by different skill levels in rural communities. The best source is the Census. However, the small numbers in the affected communities coupled with Statistics Canada's system of random rounding in order to protect confidentiality makes it possible to draw only the broadest conclusions from the data. With random rounding, Statistics Canada randomly rounds rounded (either up or down) all figures in a tabulation to a multiple of "5".

Figure 5 Community total labour force, and construction and transportation labour force, 2001

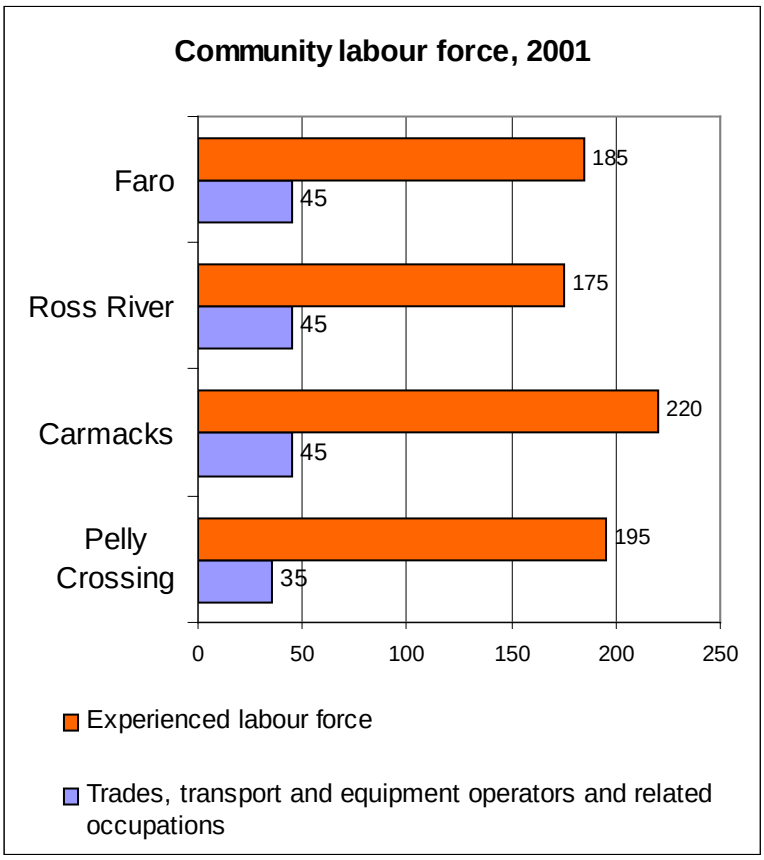


Figure 5 above presents the published 2001 census numbers for the relevant occupations in the affected communities. With labour forces of around 200, there are about 35 to 50 workers in all construction and transportation occupations in each community.

Key Considerations

- *The proportion of workers that may be attracted to this project from communities within the Yukon and Faro and Ross River in particular requires closer examination to predict with any accuracy.*
- *A flatter workforce curve and extended project schedule provides more opportunity to build in skill upgrading and training programs as impact mitigation measures.*
- *Given the small overall size of the Yukon labour force, a flatter workforce curve reduces the risk that certain trades would have to be imported to meet project needs.*

2.2 Multiplier & GDP analysis

Multiplier and GDP analysis is based on capital spending. The operational spending in long term care and maintenance of the water treatment facilities is relatively small, and will not have a measurable effect on the Yukon economy. However, the dollar value is still relatively large in relation to the size of the communities and health of their economies. Construction spending

depends on which set of alternatives is selected. In relative terms it will be significant particularly if the chosen alternative concentrates reclamation activity in the shortest timeframe possible. Whether the impact is inflationary under that scenario depends on manpower availability and the extent of other work planned to occur in the same timeframe that would compete for the same labour source and materials. At the community level, given the dominance of Whitehorse in the Yukon economy, a compressed timeframe may substantially reduce local employment and supply opportunities.

2.2.1 Capital costs

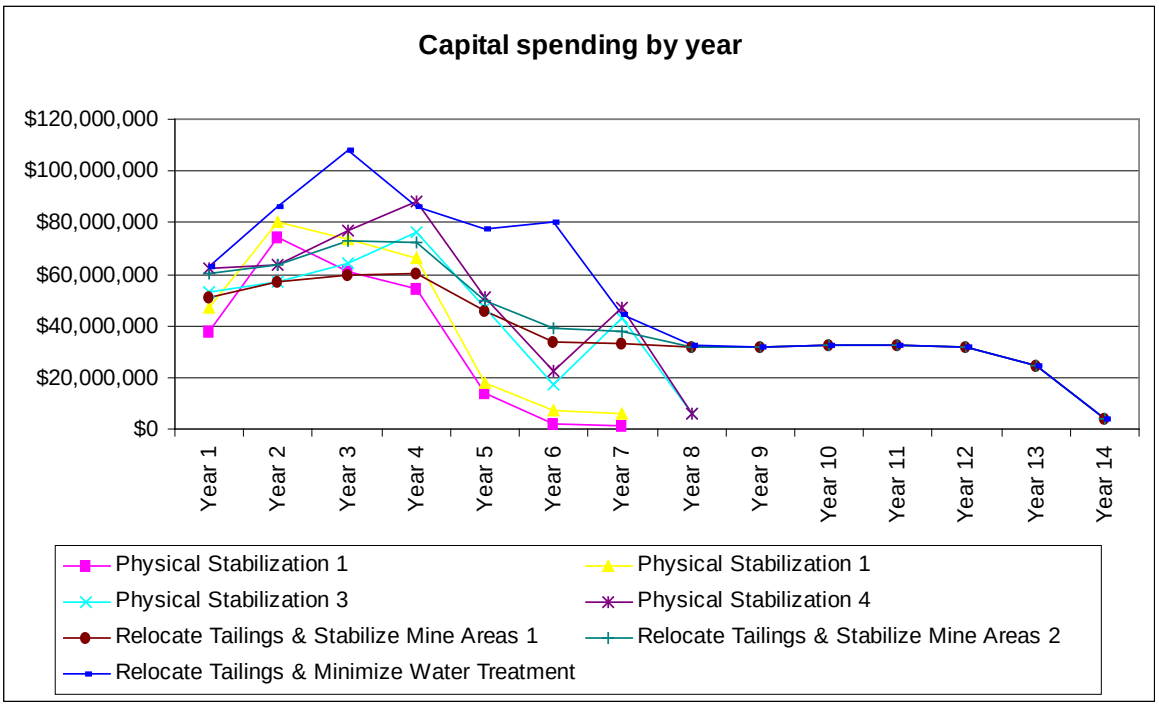
Table 16 presents the total capital costs for each of the primary alternatives from the SRK report.

Table 16 Total capital costs for primary alternatives

Primary Alternative	*Total Capital*
Faro Mine Area	
Flow-through Faro Pit	$80,949,834
Upgrade Faro Creek Diversion	$79,261,768
Minimize Water Treatment	$214,485,277
Rose Creek Tailings	
Complete Relocation	$418,505,397
Stabilization in place	$130,889,513
Partial Relocation	$253,546,276
Vangorda/Grum	
Vangorda Pit Backfill	$86,377,168
Stabilize Current Situation	$34,333,397
Minimize Water Treatment	$103,706,928

Economic impacts are calculated on an annual basis. Figure 6 presents the direct capital spending for the different combinations of alternatives over time. Annual capital spending in initial years varies from $38 million to $108 million depending on the combination selected.

Figure 6 Capital spending by year for combinations of alternatives



Capital spending follows a similar cycle as labour requirements, with high expenditures in the first years going down to zero relatively quickly. The exceptions to these are the alternatives involving the complete relocation of tailings. The combination of alternatives that spreads capital expenditures over the longest timeframe thereby creating the flattest curve is "*Relocate Tailings and Stabilize Mine Areas 1*". This involves upgrading the Faro Creek diversion, complete relocation of the tailings, and stabilizing the current situation at Vangorda/Grum. This option is the least disruptive to Faro's local economy and most consistent with their sustainability objectives. While the longer timeframe carries a higher cost, it has to be weighed against the enhanced social and economic benefits that accrue from a more stable cash injection into the economy.

Note that the above is not a recommendation on which alternatives should be selected, but an observation and illustration. Not all of the 64 combinations have been examined, it should be possible to schedule and sequence different alternatives to minimize instability.

2.2.2 Gross Domestic Product

There are three different ways to measure GDP, which, in theory, should produce the same result:

- **Expenditure:** adding up consumer spending, gross capital expenditures by private businesses and government, government direct spending on goods and services (not transfer payments such as social assistance, employment insurance or pensions) and net exports;
- **Income**: adding up everyone's wages and salaries, income from unincorporated businesses, corporation profits, interest income, and adjustments for depreciation and indirect taxes such as GST;

- **Value added method**: adding up all the value directly produced by each industry. Value added is defined as the total sales of an industry minus what it buys from other industries.

Calculating direct impacts from decommissioning and reclaiming the Faro mine can be done in two ways. Since decommissioning construction activities are part of gross capital expenditures, it can be added directly to the "expenditure" method. However, imports need to be subtracted from this figure to arrive at the direct impacts.

Alternatively, one can use multipliers that are based on an input-output economic model and the value added method. Multipliers are used to calculate the different components of the "Income" method" by each industry. The model and multipliers used is Statistics Canada's *2000 Interprovincial Open Input-Output model*. Unfortunately, induced impacts are not available, as Statistics Canada no longer includes these in its models. While we might have estimated these, we did not want to overstate the effects of the spending. For an idea of the order of magnitude of induced impacts, the 1990 versions of the input-output model showed a total GDP multiplier (includes direct, indirect and induced effects) of 1.31 for "Other engineering construction".

The *2000 Interprovincial Open Input-Output model* only considers effects at the territorial/provincial level. Effects at the community level, especially for communities of this size, are difficult to calculate because the multipliers are usually very small with substantial leakage including imported labour.

Statistics Canada keeps multipliers for direct impacts of "Other engineering construction" confidential, but total direct plus indirect impacts can readily be calculated using published multipliers. The estimated 2000 Yukon multipliers of "*other engineering construction"* on different components of GDP are presented in Table 17 below. The meaning of each multiplier is explained below in the relevant section. To use the multipliers, the annual amount of expenditure is multiplied by the appropriate multiplier to arrive at the final impact within that year

Table 17 Direct + indirect impact multipliers, *Other engineering construction* spending in Yukon, 2000

	Within Yukon	*All Canada*
Wages and salaries	0.328	0.530
Supplementary labour income	0.037	0.056
Mixed income	0.020	0.031
Other operating surplus	0.104	0.207
Indirect taxes on products	0.002	0.007
Indirect taxes on production	0.007	0.015
Total GDP	0.496	0.843
Output	1.222	1.896
International Imports	0.078	0.150
Inventories and other leakages	n/a	0.004
Sum of GDP, imports, and leakages	n/a	0.997
Employment (per million $)	9.858	14.766

The main multiplier of interest for this exercise is the "Total GDP". The "Wages and Salaries" and the "Supplementary labour income" (e.g. fringe benefits, EI, CPP, etc) multipliers appear too

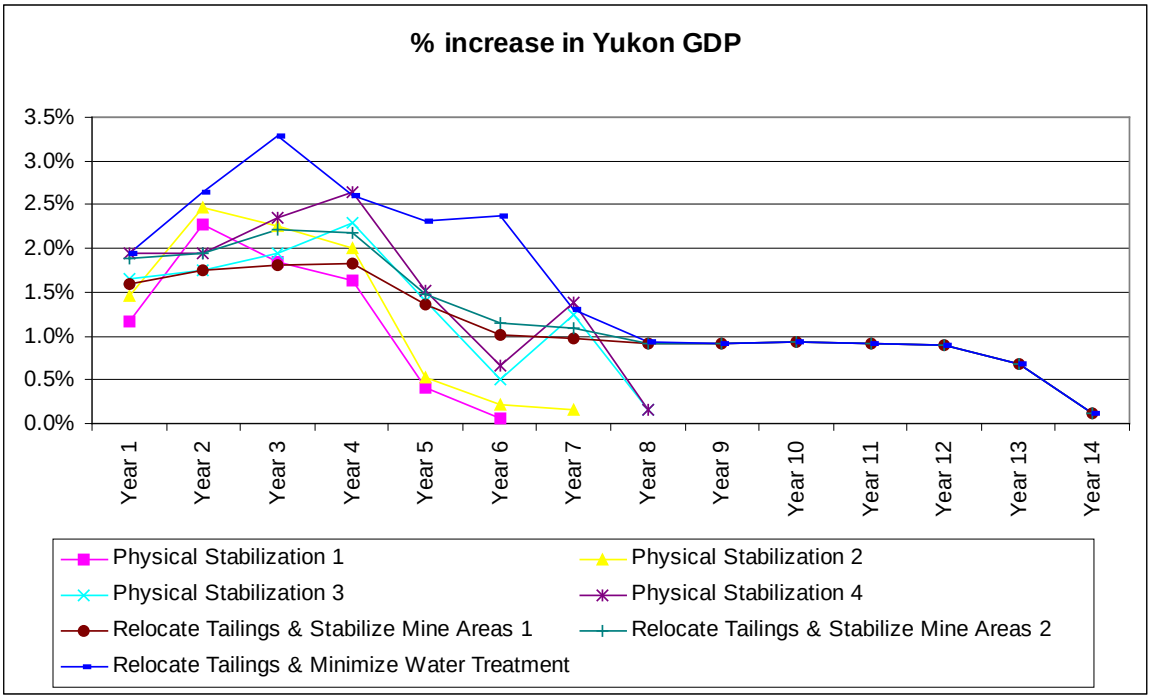
high compared to the engineering estimates of labour costs, which vary between 17.0% and 25.7% of total capital costs, depending on the alternative. The "Total Output" multiplier estimates the total increase in business revenues. However, it involves double counting, as the total cost of the project is added to the revenues of the contractors and then to the revenues of any of the suppliers to the contractors. This needs to be recognized when the socio-economic effects analysis of the preferred alternative is examined.

2.2.3 Overall Impact on Yukon Economy

Presenting the percentage increase in GDP caused by the project expenditures best indicates impact. The Yukon's GDP in 2005 was $1.521 billion. For the purposes of this exercise, we assume a starting GDP of $1.6 billion and an autonomous increase of 1% per year. The overall increase in the Yukon's GDP created by the different combinations of alternatives is presented in Figure 7 below. Economic impacts resulting from mine reclamation work initially range from 1.2% to 3.3% of GDP. For comparison purposes, 2% growth in Gross Domestic Product is considered a large number by economist, resulting in an economic boom.

The construction industry as a whole, including residential, other buildings, transportation engineering construction, other engineering construction, etc., amounts to 9% of the Yukon's GDP. GDP data on transportation engineering and other engineering construction is mostly kept confidential by Statistics Canada, but is available for 2000. In that year, "*Transportation and other engineering construction*" together amounted to 1.9% of GDP. This is a very large project relative to Yukon economy. Assuming that 2000 was a typical year, any of the combinations of alternatives would use a large part of the Yukon's capacity for this type of construction.

Figure 7 Estimated annual percentage increase in GDP, combinations of alternatives

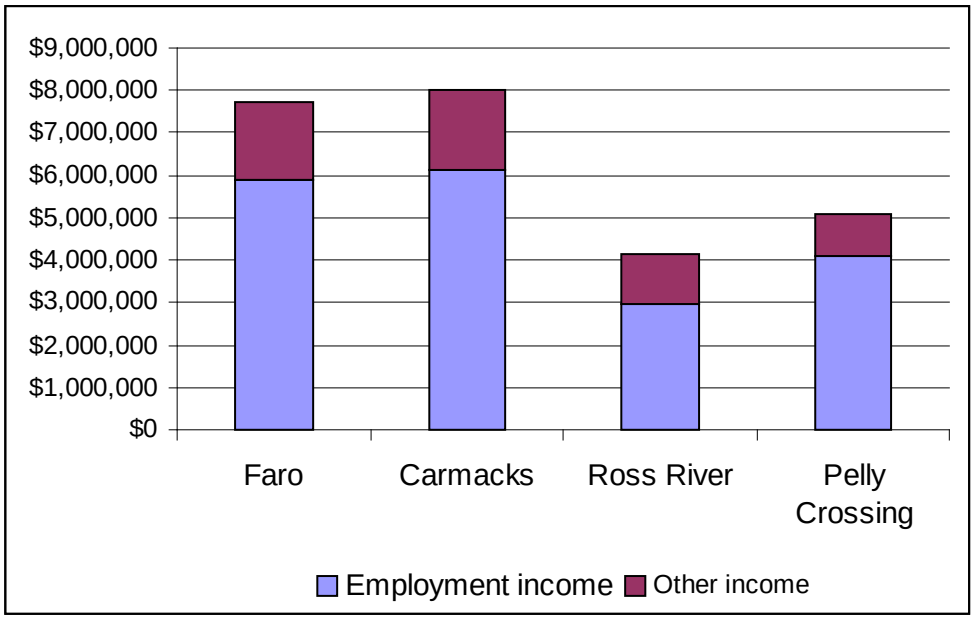


2.2.4 Local Economies

The impact on local economies would be even greater. We estimated the local GDP for the affected communities using 2002 income tax data (the latest available at the community level). This amounts to calculating GDP using the "income method" described above.

Using personal income tax data is likely to provide a reasonably good estimate of the size of local economies as it includes all types of personal income including employment income, transfers such as pensions and social assistance, income from unincorporated businesses, etc. The GST tax credit provides a strong incentive for people on social assistance to produce a tax return, as a return is a requirement for getting it. There is very little corporation income in the affected communities. The other deficiencies in this estimate are that indirect taxes (i.e. GST) should be subtracted and capital cost allowance added to the estimate, but figures are not available for these estimates. Also, the size of the "informal economy" and potentially unreported income is not known, so these numbers might be an underestimate. Nevertheless, income tax data does provide a fairly robust estimate of the size of local economies.

Figure 8 Personal income, affected communities, 2002



Total personal income – the estimate of the size of the local economy – in the potentially affected communities, ranges from about $4 million in Ross River to a high of $8 million in Carmacks. The size of the closure project in terms of potential income generation relative to the potential effect on community income levels will dwarf the size of the local economies.

2.3 Business opportunities

The largest business opportunities resulting from the reclamation of the Faro mine are in

- Heavy equipment supply and work;
- Provision of fuel for equipment;
- Provision of worker accommodation;
- Supply of lime for certain alternatives.

Other business opportunities are partly dependent on the size of the onsite workforce, the conditions of their employment, project schedule and how they are housed. For example, a private company still owns substantial amounts of housing in Faro that could be sold or leased to the implementation contractor. Alternatively, if a work camp approach is taken, there may be contract opportunities to supply cleaning and cooking staff, water service, sewage eduction and garbage disposal services.

There will also be some opportunities for subcontractors in areas such as electrical, plumbing and carpentry work as well as for landscaping and revegetation.

2.3.1 Heavy Equipment Contracting

All of the identified alternatives require substantial heavy equipment work. In the Yukon this has traditionally been carried out by road construction contractors, who also do work for the mining industry. A detailed calculation of the equipment needed was beyond the scope of this study. The SRK engineering costing work would allow estimating the total equipment cost for the different alternatives. Table 18 below presents the total and average annual equipment costs for the different combinations of alternatives. Note that this is only the equipment cost based on hourly rates for the equipment itself and does not include labour, fuel, and overhead or profit. Average annual equipment costs range from $3.3 million to $7.4 million.

A number of contracting options are possible. For the shorter-term alternatives, a single contract could be let, allowing the successful contractor to organize their work most efficiently. To maximize local involvement, the contracts could be split into "work units" accessible to smaller local contractors, or the equipment could be rented from small local contractors at a fixed hourly rate as is often done by the Government of Yukon on small highway projects. On longer contracts, such as for the complete relocation of tailings, it might be advantageous for the authority responsible for the clean up to undertake the work itself.

Table 18 Total and Average annual equipment costs, combinations of alternatives

Combination of alternatives	*Total*	*Average annual*
Physical Stabilization 1	$42,956,759	$6,136,168
Physical Stabilization 2	$51,544,673	$7,390,224
Physical Stabilization 3	$28,449,298	$3,552,798
Physical Stabilization 4	$37,037,213	$4,650,096
Relocate Tailings & Stabilize Mine Areas 1	$46,629,966	$3,326,500
Relocate Tailings & Stabilize Mine Areas 2	$55,217,880	$3,953,528
Relocate Tailings & Minimize Water Treatment	$96,724,183	$6,905,714

2.3.2 Fuel

Any of the mine reclamation alternatives will use substantial quantities of fuel. The amount of fuel required does provide an interesting opportunity for a local business or First Nation. The Ross River Dena already has a fuel distribution enterprise that supplies local mine development

and could conceivably expand their operation to supply the Faro mine reclamation work. Note that the combinations that do not involve tailings relocation tend to require more fuel, and it would be needed over a shorter period of time.

Table 19 Fuel requirements under different combinations of alternatives, litres

Combination	*Total litres*	*Average annual litres*
Physical Stabilization 1	30,661,316	4,379,676
Physical Stabilization 2	39,249,230	5,633,732
Physical Stabilization 3	16,153,855	2,015,867
Physical Stabilization 4	24,741,770	3,113,166
Relocate Tailings & Stabilize Mine Areas 1	24,605,711	1,755,271
Relocate Tailings & Stabilize Mine Areas 2	33,193,626	2,382,299
Relocate Tailings & Minimize Water Treatment	52,882,890	3,775,719

2.3.3 Lime

The amount of lime required during the reclamation phase under each of the alternatives is presented in Table 20 below. For the Faro and Vangorda/Grum areas, minimizing water treatment will result in substantial lime requirements, as will backfilling the Vangorda pit. Stabilization options will not likely require any significant lime volumes during construction. Overall lime requirements will be approximately the same under all alternatives. Where little lime is used during the reclamation phase, it will be required post closure in the long-term, as there is the same amount of acid generating rock and tailings that will eventually need to be neutralized or buffered. It is not a question of how much lime – between 500,000 and 600,000 tonnes – but over what time period it will be required. Note that lime treatment is expected to be needed forever under all the example alternatives except for complete relocation, where they are needed for about 20 years.

Table 20 Lime requirements during reclamation phase and post-closure under different closure example alternatives

Primary Alternative	*Total lime required during construction (tonnes)*	*Average annual requirements during construction (tonnes)*	*Post closure permanent annual lime requirements*
Faro Mine Area			
Flow-through Faro Pit	1,088	155	n/a
Upgrade Faro Creek Diversion	1,088	155	463
Minimize Up-Front Construction	0	0	543
Minimize Water Treatment	32,798	4,678	366
Rose Creek Tailings			
Complete Relocation[1]	518,698	40,393	563
Stabilization in place	0	0	969
Partial Relocation[2]	219,459	30,231	765
Minimize Up-Front Construction	0	0	1,100
Vangorda/Grum			
Vangorda Pit Backfill	16,637	2,415	N/a

Primary Alternative	*Total lime required during construction (tonnes)*	*Average annual requirements during construction (tonnes)*	*Post closure permanent annual lime requirements*
Stabilize Current Situation	0	0	353
Minimize Up-Front Construction	0	0	370
Minimize Water Treatment	16,637	2,377	N/a

Note 1: Treatment requirement for complete relocation only expected to continue for 20 years.
Note 2: Lime requirements under partial relocation will actually diminish considerably after 20 years.

The selection of an alternative requiring the partial or full relocation of tailings might well mean that a limestone mine and lime kiln operation in the Yukon might be viable. This would require a specific feasibility study and assessment of an appropriate lime deposit.

2.4 Main Considerations

The closure project is large relative to the size of the Yukon economy and the capacity of the territorial and local economies. It will use much of the available resources and could crowd out other public and private sector projects requiring access to the same labour and services pool.

The local communities cannot realistically supply the entire labour force for any of the combinations of alternatives. Most of the alternatives will inevitably require bringing in some workers from communities such as Whitehorse and other locations outside the Yukon. It is difficult at this point to fully predict the labour market condition at the time this project is anticipated to proceed. In certain trades, there is currently a nation-wide skills shortage. The ability of Yukon communities to provide the required labour force is dependent on the total number of workers required and the project schedule. The degree to which the worker demand curve can be flattened by extending the project schedule, the greater the probability that needs can be met without importing labour from Outside.

The combinations of alternatives not involving relocating tailings will create a short-term boom (2-4 years), followed by an economic decline with attendant social & economic problems particularly for Faro and Ross River. The degree to which the preferred closure plan and its labour force requirements attracts new residents to the community and helps buy time to allow the community to stabilize and diversify its economy will determine the degree of local acceptability. An option that creates only short-term employment would undermine community plans by reinforcing the past negative cycle.

The costing work done so far assumes that the reclamation and decommissioning work is undertaken simultaneously in all three areas. A sequential approach, while potentially more costly, extends the project timeframe and helps mitigate the negative consequences that a project of this scale could have on the local economies. It might also be benefit the federal government budgeting process as it would require fewer resources in any given year.

The consequences for the Yukon government, which has responsibility for the overall health and well being of Yukon communities, could be significant if the chosen alternative defeats or undermines community diversification intentions.

3 Identification of social effects

3.1 Individual and community health

Individual and community health needs to be considered from two perspectives to fully understand the possible social effects. The First Nation cultural frame of reference is rarely considered. First Nation people view health in four dimensions: physical, emotional, spiritual and mental/intellectual. Health is viewed within a social context with an emphasis on relationships between individuals, families, the natural world and their relationships to their ancestors' and future generations. Ross River, Carmacks and Pelly Crossing have a majority aboriginal populations.

In First Nation terms, the people are given the responsibility of stewardship over land and are seen as belonging to the land, as opposed to the mainstream view of land belonging to people. Therefore, the failure of the First Nation people of that traditional territory to protect the land from development that seriously compromises the integrity of the land for the use of future generations is what needs to be brought into balance. The rehabilitation of the site is one method of bringing that balance back and providing an opportunity for future generations to use the site.

In looking at all communities affected, whether aboriginal or not, it is also important to look at the determinants of health. These are economic, social and environmental factors, outside of health and healthcare delivery that determine the health of individuals and communities. The income and socio-economic status is a powerful predictor of health and wellbeing at an individual and family level. At a community level, the fair distribution of wealth is a predictor of community stability. If a community has large gaps between the richest and poorest members, the community is less likely to experience social stability. Other determinants of health cited by the Public Health Agency of Canada include: social support networks, education and literacy, employment/working conditions, the social and physical environment (including safety and health of the natural environment), personal health practices and coping skills, healthy child development, biology and genetic endowment, gender, culture and access to health services.

Factors affecting individual and community health include:

- The effect on individual and family income and the distribution of wealth in the community;
- The effect on other determinants of health;
- The effect on physical health including the results of the health risk assessment related to consuming land foods and the workplace injuries and illness related to working in mine closure related jobs or spin-off social impacts;
- The emotional and social effect on consumption of alcohol and drugs in the community and related issues of interpersonal violence; effect on levels of depression, anxiety, family breakdown and other mental health issues;
- The intellectual impacts include access to new opportunities for training and learning;
- The spiritual health impacts, taken from a perspective of traditional beliefs related to the spiritual connection to the land, will include the degree to which the new balance with the land is achieved through the reclamation project; and
- The health status profile of the community includes information on births and deaths, illness and injury, communicable disease rates, chronic disease rates etc.

Population health status indicators can also provide baseline and future monitoring related to mental and social well-being, quality of life, life satisfaction, income, employment and working

conditions, education and other factors known to influence health (determinants of heath). The degree to which the mine closure affects the health status profile is also an issue.

Access to health services is also an important determinant of health. The effect of a change in the access to health services in the communities and transportation to access services outside of the communities is an issue. With a larger population, there will be a necessary increase in health services that may require improved local services. If additional resources are not made available, the access to existing services may be reduced due to the increased volume of individuals to be served. Similarly, the access to social services – income support, family services, child welfare services etc. may be impacted by the additional volume of service recipients. A related area is access to policing services to assist in ensuring public safety.

3.2 Social effects of increased incomes & employment

The social effects on the communities can be related back to three driving forces – increased number of new people living in the community or close enough to access the community, increased income to some individuals and families but not all, and employment at the Faro site for short or longer periods but for mainly for a specific term. Increased employment and income levels always have positive and negative effects. Generally it is believed that the positive benefits will usually outweigh the negative aspects but this is not necessarily the case especially if the project results in a boom/bust cycle.

The assessment of social effects related to each option is in direct proportion to the size and the nature of the change in population, the access the newcomers have to the community; the number of jobs made available, and the length of time and seasonality of employment.

In general, the more the increased population effect can be isolated in Faro or near Faro, the better for several reasons. First, Faro already has capacity and was a community of up to 1,750 residents. It is also the community closest to the mine and many of the remaining residents still have a previous connection to mine operations. The community has also experienced the effects associated with having a resident mining population and experience with contractors housed in a work camp. Under this scenario, Ross River and other First Nations communities would largely be protected from the negative influences of outsiders. Unfortunately, this also means that some of the positive economic impact of funds spent in local businesses is a forgone opportunity. Also, in general, the more the employment curve can be "flattened" the greater the potential positive effects that can be derived from the closure and reclamation plan. A flattened employment curve would imply a slow start-up to allow for training, low curve in terms of the size of the workforce with jobs extended as long as possible. It would also allows more time to adjust to the changes that will occur after the project is finished and the labour force drops dramatically.

The impact of the increased local population may have effects on recreational opportunities in the Town of Faro and on the land. If more people are hunting and fishing, for example, it may affect the availability of game and fish in the more accessible areas. This increased activity may also have an effect on the traditional economy including trapping and traditional activities such as berry picking or collection of medicinal plants. These activities have subsistence economic aspects to them but also social aspects when groups and families go out on the land and strengthen their ties to each other, the land and their cultural traditions. The strength of social networks, the strengthening of culture and culture based traditional gender roles are all determinants of health. Land based food is also known for its exceptional nutritional qualities and contributes significantly to the health of families consuming them.

Time on the land is also the time and place for the expression and sharing of traditional values, norms and beliefs as well as the activation of oral tradition based knowledge transfer systems. It is on the land that the knowledge is passed down from generation to generation about the use of the land, navigation, weather prediction, animal behaviour, traditional areas for hunting and fishing and other importation information. It is important to note that the assumption that the land can be returned to its prior condition before the mine began is unrealistic in a First Nation context because the land has changed and oral history constantly evolves and adapts to those changing circumstances. Since the community of Faro will still exist, the landscape cannot be returned to the pre-mine state. To summarize, the potential social effects can be examined through the following indicators and listing of the following considerations;

3.2.1 Positive

- The training opportunities leading to employment and enhanced employability – number and variety.
- The number, quality and length of employment related to jobs that are taken and held by community members.
- The income level of the jobs.
- The availability of contracts or sub-contracts for local business owners.
- The positive aspects of the working environment. (e.g. – safety training, good supervision, opportunities for skills enhancement and advancement etc.)
- The strengthening of existing social networks and the overall social system through employment of connected groups of people.
- The positive impact of newcomers to the area that provide diversity to locally available skills and contribute to the local economy through local spending.
- Incentives for the youth to stay in school to gain access to jobs requiring a Grade 12 education or higher.

3.2.2 Negative

- Negative employment or working conditions such as lack of good quality equipment and lack of supports for sobriety.
- The lack of stability and predictability in available jobs leading to stress and uncertainty.
- The lack of success in marginally employable people taking and successfully keeping jobs.
- The negative impact of newcomers in bringing in drugs and alcohol, their lack of long term social investment in the community and the predominance of men possibly seeking female partners form the local community, disrupting the balance of local social networks and the overall social system.
- The increased gap between the rich and the poor in the community leading to social instability.
- Incentives for youth to leave school if jobs are available with less than a Grade 12 level of education.
- Increased access to drugs and alcohol.
- Increased safety risks to women and children related to alcohol and drug use as well the impact of men in the non-local workforce.
- Acculturation forces affecting the lives of First Nation individuals (culture, language and traditional ways of life) both on and off the job related to education, training, employment and increased number of interracial relationships.
- Disruption of the current balance (equity) between youth and elders and men and women as the men between 18 and 50 are most likely to be employed.

- Traditional fishing, hunting and gathering sites impacted by use by non-local workers.

3.2.3 Both positive and negative

- Increased demand on health and social services may lead to service enhancement and without enhancement, will lead to decreased access to services due to a higher demand with no increased capacity.
- Increased demand for educational services – K -12 for the children and youth and employment related post secondary education that may lead to increased diversity and capacity in the local system. If the system is not enhanced, it may lead to lower levels of service available to a larger population, particularly in Faro.
- Increased demand for law enforcement and justice services due to increased population and potential increase in crime rates. This may lead to enhanced service delivery as with health, social and educational services or additional costs primarily to government.

The capacity of the communities (social capital) to take advantage of the opportunities and work with proponents to mitigate potential negative effects will be challenged. The social capital of a society includes the institutions, relationships, attitudes and values that govern interactions among the people and contribute to social and economic development. It includes the shared values and rules for social conduct expressed in personal relationships, trust and a common sense of "civic" responsibility that makes a society more than a collection of individuals (*YESAB Guide to Socio-economic Effects Assessment*). The community may be successful in meeting the challenge with the related increase in social capital, confidence in political leadership, consultation process and community capacity. If the community fails to meet the challenge, the impact could be political instability and decreased community confidence, social capital and cohesion.

Key Considerations

- *The aboriginal perspective on social effects is rarely carefully considered. Their frame of cultural reference needs to be understood in considering whether the direct, indirect and induced effects of the preferred mine closure project are perceived positively or negatively.*
- *Faro has the capacity, history and stated desire to participate in the mine closure project as much as practical. They also realize that their existence was a direct result of the mine's establishment and their continued existence has an impact on the traditional territory of the Ross River Dena.*
- *Ross River also has a direct interest in which closure alternative is selected because of their moral responsibility as land stewards and because the presence of the mine and townsite has had, and will continue to affect how they use the land in the future.*
- *On balance there is a perception that Faro as a community received more economic benefit from the presence of the mine while Ross River experienced more social disruption.*
- *Since government did not address the issue of whether the townsite should continue to exist when the mine closed, the remaining Faro residents have really pre-empted that decision from being made by taking the initiative to keep the community alive. The degree to which a closure alternative responds to that objective will have a considerable bearing on the social health of the community.*

3.3 Housing & Infrastructure

Given the mine's location and history there are three likely staff housing scenarios, and a fourth less likely but nevertheless possible:

- Option #1 would be a self-contained camp located near the mine mill buildings central to reclamation activity.
- Option #2 would be to install the camp on a site within the existing Faro town site tied into the existing water, sewer and electrical system.
- The third option is for the entity responsible for the clean up to either lease or purchase existing housing within the community to meet their employee needs for the duration of the project life.
- A fourth option would leave employees responsible for finding their own housing.

While this last option is feasible, the larger question is whether potential employees would be prepared to take this risk because it would only further aggravate the boom/bust cycle that has been Faro's past legacy.

Faro currently has the most affordable housing in the Yukon. When the mine closed, the private sector market disappeared. Faro Real Estate Ltd was left with a substantial housing portfolio and no buyers so houses could be purchased at rock bottom prices reflecting the risk of living in a community with an uncertain future. As noted in the introduction, many single industry resource towns have died and subsequently been abandoned when the industry on which they were dependent shut down. Faro is one of the exceptions and a core group of residents decided to stay and try to restructure their community. They have been able to stabilize the population base in the 400 range, even attracting new residents who have moved to the community for lifestyle reasons. The low housing costs have been one of the attractions.

Faro has 2 vacant, 16-unit apartment buildings that have not been occupied for a decade. There is also quite a lot of multiple-family housing of various designs available. All units are connected to the municipal water and sewer system according to Murray Hampton, Manager of Faro Real Estate. Their inventory of properties include:

- 60 "Maisonettes" (flat-fronted row houses) with 4 to 7 units per building in 2 and 3-bedroom configuration.
- 60 "Nelson" units (staggered front cluster houses) with 2 to 6 units per complex. These are smaller 3-bedroom, 2 story units on full concrete basements with carports.
- 25 "duplex" (side-by-side) units with 3 bedrooms and an attached garage.
- 27 "79 Condos" (large 2 and 3 floor units) with 4 and 6 units per building each having 3 bedrooms.

One of the consequences of having a significant inventory of properties is that the most desirable properties (principally the single-family housing) were all acquired first. These properties are spread throughout the community resulting in higher infrastructure servicing and maintenance costs than would have occurred if the community had originally been planned to allow for orderly expansion and contraction during different cycles. In some cases they are also interspaced with other unit types that remain vacant increasing the community's operating and maintenance costs.

It also means that while the community has the theoretical capacity to absorb the employee housing requirements of any of the alternatives under consideration, it is not known what shape the remaining housing or infrastructure is really in. Thus it is not possible at this point, to properly compare the camp versus existing housing stock option in terms of economic cost or social consequence. This needs to be examined.

In terms of simplicity and certainty, the camp option at the mine site would likely be preferable and is a cost effective solution. However it would also probably result in the least amount of

direct local benefit and contribute nothing towards long-term community stability or sustainability. It is however a practical solution if the preferred solution is to complete the reclamation in the shortest possible timeframe.

On the other hand, if the reclamation project is partly approached from an investment in community development perspective then a key consideration in evaluating the options is to consider how each alternative can maximize local benefits by leveraging the most potential out of the project as possible. If this possibility were on the table, then the government's involved need to be very clear on what their expectations of outcomes is. As well governments need to clarify what their respective responsibilities and contributions to this sustainability objective might be. The opportunity the closure plan provides is a means to buy time for the community to diversify their economy and possibly upgrade or replace existing housing and infrastructure to reflect a more compact and less costly to manage community.

This aspect is not presently considered in the alternatives under consideration. For that reason, in this report, we have assumed that Faro would continue as a viable community with modest growth. It is also why it would be prudent to examine in more detail the consequences associated with the possible housing scenarios identified as well as the implications for community sustainability. This would involve a community planning and engineering services review as well as an evaluation of the cost/benefit of a camp versus re-use of existing housing stock.

For the final project definition it would be useful to know more about the existing infrastructure elasticity including threshold service levels, age and condition, operating cost and flexibility to accommodate expansion and contraction. The tax base support relationships are also important. For example, a camp at the mine mill area would provide no tax revenue to the local municipality where a town site location or occupancy of current housing stock would.

A word of caution is also in order. While total labour force requirements per year are known for each alternative, it is not known what proportion of employees are likely to be existing residents of Faro or Ross River or how many may come from elsewhere. Similarly, it is difficult to predict what proportion of employees would choose to commute from somewhere else leaving families behind and how many might consider moving to the community if better quality housing is available for lease or purchase. From a risk perspective, employees familiar with boom/bust resource towns may only consider the relocation option if the project lifespan is as long as possible.

The social impacts associated with camp residency would also be quite different than if employees live in the community with their families. Needs and expectations are different. Since Faro has experienced both situations, this can be anticipated to be a subject of much concern to the community.

3.4 Regional Land Use

The temporal and economic implications of the mine site reclamation project have been partly discussed above in terms of community development with the assumption being the community of Faro remains. Reclaiming the mine site to the pre-existing land use and landscape condition raises a number of regional land use considerations.

First, there is no regional land use plan to provide a frame of reference for how the region as a whole is likely to develop. A regional land use plan is unlikely to be completed within the next decade for this region. As a matter of policy the Yukon Land Use Planning Council will not

consider an area for regional planning until area land claims are finalized and any boundary overlap agreements are in place. There is also no sub-regional or local area plan covering land use in the Faro periphery including the mine site.

Faro updated its Official Community Plan in 2003 and is currently in the process of completing an Integrated Community Sustainability Plan. The community boundary is approximately 208 km². This places approximately 423 ha of the disturbed area around the Grum and Vangorda pits within town boundaries. This means any reclamation work requires a Development Permit issued by the Town. Development includes mining, re-contouring the land, filling the pits, removal of buildings etc.

The Official Community Plan includes the following policy statements:

> "3.4.1 Mine Reclamation – Work with appropriate agencies and government departments to ensure that mine reclamation occurs to the highest standard in order to mitigate any potential environmental hazards for the town, as well as to provide maximum employment benefits for the community.
> "3.4.7 Mining History Tourism – Encourage the development of this opportunity through work with the territorial government, town residents, and other appropriate stakeholders. Implement Phase 1 of the Faro Mining Project with co-financing from the Yukon Government".

The implication of these policy statements is as follows. The OCP is based on the assumption that the community will continue and needs to diversify its economy. Developing a mining museum is part of the tourism strategy and there may be artefacts that are surplused during the reclamation process that might be donated towards that initiative. The other key consideration is the desire of the community to ensure that mining reclamation maximizes local benefits over the longest time frame possible.

Under the Zoning Bylaw, the affected portions of the mine site within municipal boundaries are designated as Hinterland. Mining, quarrying and temporary construction accommodation camps are considered discretionary. Any development must be self-contained with its own water and sewage systems and must not produce noise, odour or air contaminants beyond the site boundary. Faro residents and others use portions of the mine site now such as the roads, cut-lines and trails to access areas beyond the property. These include people accessing other placer and quartz claims, undertaking recreational activities and harvesting renewable resources. All have an interest in how and to what level the mine site land disturbances are reclaimed and over what time period that will occur.

How the remaining quartz claims are disposed of is also of interest. It is generally believed there is still some mineral extraction potential and keeping the claims as an entity would be the preferred solution. In that case, there are access considerations that have to be considered and discussed with affected stakeholders to determine the importance of such roads, trails etc to present and future land use beyond present boundaries. At the same time there is an inherent contradiction that needs to be clarified. If the mine site is fully reclaimed to what extent does that preclude or restrict the possible viability of exploiting any remaining extraction potential from the undeveloped claims?

Another consideration is how the mine closure plan affects future plans to upgrade the Campbell Highway particularly between Ross River and Carmacks. Some of the alternatives require significant quantities of lime that are currently imported to the mine site from outside of the Yukon. Table 21 presents the number of truckloads of lime required under the different

combinations of alternatives, assuming a 50-tonne load per B-train. Although the amounts of lime are considerable, this really translates into a maximum of four or five B-train loads per day. This is less than the daily traffic generated when the mine was fully operational trucking concentrate to Skagway.

Table 21 Total and average annual B-train loads of lime for combinations of alternatives

Combination	*Truckloads -50 tonnes/load*	*Average annual truckloads*
Physical Stabilization 1	22	4
Physical Stabilization 2	355	51
Physical Stabilization 3	4,411	544
Physical Stabilization 4	4,744	586
Relocate Tailings & Stabilize Mine Areas 1	10,396	740
Relocate Tailings & Stabilize Mine Areas 2	10,728	765
Relocate Tailings & Minimize Water Treatment	11,363	810

When the mine was operating and concentrate trucked to Skagway, substantial government funds were expended on highway reconstruction and maintenance. Depending on the final lime volumes required and where they are sourced from, there will be associated costs and impacts on the Yukon highway system. The nearest possible limestone source previously identified is near Eagles Nest Bluff east of Carmacks. This could be a substantial project in itself and would likely impact Carmacks more so than Faro or Ross River. The viability of exploiting this resource is unknown and the principal difference between the alternatives is only the volume of lime needed.

When the mine was fully operational, there was sufficient traffic to justify limited scheduled air service. While air service economics have substantially changed in the interim, if a camp option is chosen and the proportion of workers hired locally remains modest, there may be potential for limited air service tied to crew rotations that approximates a scheduled service. Any benefit would likely accrue to Whitehorse where such air service capability exists. A local benefit could accrue if the air charter operator providing such service were able to sell surplus space on such flights to local residents or unrelated travellers needing to travel to the community.

Since the assumption herein is that Faro will continue and be the focus for subsequent related regional development activity, the capacity of the community to expand and contract needs to be determined. The relevant consideration is what the minimum population required is to sustain the community once closure is complete and to what degree the preferred closure option facilitates that transition.
As noted in the community infrastructure discussion, any alternative that extends the closure project over a longer timeframe helps to cushion the inevitable social and economic dislocation that will occur once the project is complete. In effect, a slower pace buys time to help the community diversify its employment base.

Key Considerations:

- *Approximately 423 ha of the disturbed area around the Grum and Vangorda pits within town boundaries. This means any reclamation work requires a Development Permit issued by the Town.*
- *There is no regional land use context to consider the mine reclamation options in because there is no regional or local area plan except the Official Community Plan for Faro.*
- *There appears to be substantial lime deposits close to the Campbell Highway that may be worth evaluating further as a potential supply source.*
- *If the work camp option is chosen, any work camp proposed within community boundaries but outside the serviced area will need to be fully self-contained.*
- *What happens to the mining claims after the work is completed.*

3.5 Resource Harvesting, Tourism & Recreational Use

In terms of resource harvesting, the environmental research to date suggests that harvesting wildlife using the reclaimed mine site will not present a health risk. Moose, caribou, sheep and bear are the species of immediate harvest interest. All options include runoff and waste water treatment that addresses Pelly River fishery issues. Mule deer have also moved into the area since the mine was opened and are likely to be hunted in the future.

How the landscape is reclaimed and with what vegetation cover types will influence the rate at which re-vegetation and succession occurs. Soil types, local climate and elevation also need to be considered. As noted in the introduction, restoring the landscape to the pre-mining condition, while a worthwhile goal, needs to be carefully thought through because the physical landscape has changed and this will have influenced wildlife activity. The issues of concern are:

- The degree to which the re-vegetation approach chosen provides habitat attractive to species already present or provides a better habitat for some species than others;
- The degree to which the re-vegetation outcome actually replicates previous levels of biodiversity;
- The degree to which the re-vegetation strategy attracts new species that in turn displace existing species;
- The degree to which the re-vegetation strategy improves or inhibits future resource harvesting activity; and
- The degree to which the re-vegetation strategy results in re-establishment or alteration of wildlife movement patterns.

3.5.1 Fannin Sheep

There are two main concerns relating to the presence of the mine on the local Fannin Sheep population. The principal concern is that the mine operations cross the natural migration route between the summer range (Mt. Mye) and winter range in the Sheep Mountain/Blind Creek area and also Rose Mountain. The second concern related to potential effects arising from increased hunting pressure because of the area's accessibility and the presence of the Town of Faro.

Montreal Engineering under contract to Cyprus Anvil first studied the relationship of the Fannin sheep to mine development and operation in 1976. The consultants made no mitigation recommendations other than establishment of a no hunting zone because of the ease of access into

the area. A subsequent study in 1981 documented the actual migration routes and timing of movement. It suggested a combination of management measures including a no-hunting restriction, public awareness campaign and exploration of whether the sheep could be induced to alter their migration route around mine workings. Sheep hunting was closed in Game Management Sub zone (GMS) 4-46 and 4-47 in 1982 just when the mine shut down for the first time. Following the mine re-opening in 1986, additional studies were completed that included recommendations to actively manage the sheep population for non-consumptive use and to consider establishing a "Special Wildlife Management Area". While this did not happen, the Federal Government did place a map notation in 1988 on Mt. Mye as "an area of primary wildlife interest".

The Mt. Mye Sheep Management Plan was completed in 1989. It focused on management of winter range habitat including access restrictions and rerouting of the Blind Creek Road, habitat enhancement and mitigation strategies for mining development on the Vangorda Plateau including establishment of an alternate migration corridor. A conservation officer was posted to Faro all licensed hunting restricted in GMS 4-46. A key part of the 1989 Plan included the development of the wildlife viewing opportunities. By 1998 almost $800,000 had been invested in sheep habitat protection, related mine impact mitigation and the development of the wildlife viewing potential.

Key Considerations:
The following is relevant to the Closure Plan:

- *Attempts to re-route the seasonal migration route around mine workings were unsuccessful. The sheep preferred their historic route and could not be induced to change adapting as necessary to the presence of mining activity;*
- *The habitat map notation includes areas of the mine workings but the area has not yet been formally designated as a Special management or Habitat Protection Area.*
- *Detailed studies on vegetation, forage production, ground-based disturbance, lambing and sheep genetics have been completed suggesting a range carrying capacity of 90 animals. The issue is not restoring habitat but ensuring the connection and natural pathway between winter and summer range is not compromised. Work has also been done on monitoring population dynamics, movement patterns, disturbance response and an evaluation of interpretation effectiveness and regulatory compliance.*
- *The Fannin Sheep Wildlife Viewing Project has become a source of considerable community pride and active stewardship. It is a unique regional attraction and essential anchor component of Faro's tourism development and economic diversification strategy.*
- *Respective mining companies have a long history of working with the community to mitigate their impacts on the local sheep population and have actively supported projects such as the wildlife viewing initiative. The chosen Closure Plan alternative needs to recognize that temporal restrictions may be required during the summer-winter migration period and discuss carefully with the community which roads/trails will be permanently closed, seasonally gated or retained for hinterland access and sheep habitat protection.*

3.5.2 Harvesting

There are safety and security concerns that need to be considered during the reclamation process. In addition to crews actually carrying out reclamation activities, there will be numerous scientific personnel onsite carrying out monitoring activity. The chosen closure alternative needs to address this.

The mine site is located within the Ross River Dena traditional territory. From that perspective the land has been described as our "sanctuary, food larder and cathedral. Once you alter the land you change the culture because you change the language that we use to describes the land". The degree to which the mine landscape precondition can be restored has to be considered in this context. A success indicator then might be the degree to which the new landscape restored the functional viability of the reclaimed site as a food larder. The mine property was also part of a much larger group trapping area so ensuring the restored landscape provides furbearer habitat could be another measure.

The larger unknown is the degree to which the mine closure workforce is likely to exacerbate either recreational or subsistence harvesting pressures that have already been modified as a result of the establishment of Faro as a community. Since the community will exist after the closure is complete, it is the incremental change that is relevant.

The boundaries of three outfitting areas converge at Rose Mountain. Again the degree to which the re-vegetation strategy affects wildlife movement and attracts or displaces species of interest will be of concern to the affected outfitters. Similarly, if for safety reasons, a no-hunting zone needs to be established this may result in more people generally moving further into the areas outfitters use. It would be useful to examine sub zone harvest levels within a defined distance from the mine site to compare harvest activity while the mine was operational and during closure periods. They will also have an interest in having input into determining which roads and trails are retained or reclaimed.

3.5.3 Tourism

From a tourism perspective, the Campbell region's potential is underdeveloped. Faro residents have suggested in the past that the pits and mine were and could still be a tourism attraction. None of the alternatives consider to what degree that may be possible. Interpreting the reclamation process itself could also be another approach of interest to visitors. Certainly the presence of the large dump truck display is an example how mine machinery can be used as artefacts to help tell the mine story without interfering with reclamation activities.

Faro as a community has also changed and is pursuing tourism opportunities as part of its economic development and diversification strategy, as is Ross River. Completion of the Dena Cho Trail between Faro and Ross River is one example of a new land interest in the vicinity of the mine and mineral claims.

It follows logically that local tourism operators will also have an interest in which trails/roads that cross mine property are retained and how the remaining mineral claims are disposed. They will also have an interest in the aesthetic outcome of reclamation activities and in public perception of Pelly River water quality if it is construed to impact on the potential to increase recreational river traffic. The issue that may need to be addressed will be one of perception rather than reality since the environmental studies to date suggest that like the wildlife, there should be no health risk from drinking river water or consuming fish.

3.5.4 Recreational uses

Faro and Ross River residents continue to use the hinterland surrounding the mine and mine properties for recreational purposes including hiking, fishing, hunting, snowmobiling, cross-country skiing and similar pursuits. The degree to which the mine closure labour force will affect

area recreational use is partly dependent on their living circumstances, the project completion schedule and the manner of landscape reclamation. If employees live elsewhere and are housed in a camp environment their use of community recreation facilities and the surrounding landscape is likely to be different than if they become residents and actively participate in all community recreation activities.

Key Considerations:

- *Consideration in the mitigation strategy should include the potential for interpreting the mine's past and reclamation program, as well as enhancing Fannin sheep habitat.*
- *Any decision to maintain or close mine related trails and roads will require careful consultation as they are extensively used to access the backcountry and some have become part of the community trail network.*
- *The decision to retain or close trails will have a significant impact on area wildlife including future hunting activity beyond those effects that may be incurred by the presence of the reclamation workforce.*

4 Considerations in Selecting a Preferred Closure Plan Alternative

In considering a preferred closure option from a socio-economic perspective, it is important to acknowledge that the SRK alternatives only factored in the costs of undertaking the reclamation and closure work from a construction and engineering efficiency perspective. The scale of this project is significant both in terms of employment and economic impact on the Yukon economy. From a community development and social impact perspective, the most efficient approach generates the least local benefit and presents the greatest potential for negative effects.

Assuming the mine site can be reclaimed to the pre-existing mine condition is an unrealistic objective for several reasons. First the community of Faro will continue to exist and all options require some level of permanent water treatment. A more realistic objective is to reclaim as much of the disturbed area as possible to the point where nature can take over. An adaptive management approach will be required that recognizes that the landscape has changed and will continue to change even after the closure plan is complete.

Adaptive management is usually considered in the context of landscape and wildlife management but not necessarily in the socio-economic context. In this situation, the cost of mine closure is similar to a "megaproject" like a pipeline where the impacts are substantial during construction and nominal once built. In this case, government has a choice to make between the less costly approaches that create a period of boom followed by a rapid declinet or taking a longer term view that maximizes Yukon and local community benefits and mitigates potential social and environmental consequences.

Under Chapter 6 of the Devolution Transfer Agreement dealing with the clean-up of Type II mines, the federal government has accepted the financial burden of closure and reclamation. Presumably, the federal government wants to do so in the most cost effective manner that reduces any future liabilities and minimizes any future risk. The solution needs to be affordable, acceptable to all agencies and stakeholders and consistent with the costs of similar clean up responsibilities. The Yukon government wants to make sure that there is no transfer of future costs associated with the remaining liability and there are no unexpected associated costs. Both governments have a vested interest in demonstrating that they are following industry best practices and are responsible land managers.

The territorial government is also interested in ensuring that the greatest degree of economic benefit from this project accrues to the Yukon and any potential negative social effects are minimized. The more the preferred closure alternative improves regional development and provides employment stability the better. As well, the *Yukon Environmental and Socio-economic Assessment Act* requires that the socio-economic effects be given serious consideration in selecting among various options.

The affected First Nations have an interest as land stewards in ensuring the closure plan restores the landscape to the greatest extent possible and leaves no negative legacy on regional biodiversity. They also wish to participate in any direct and indirect economic benefits that will accrue.

Faro, as the community most directly affected has a clear objective to ensure that the closure plan provides the greatest degree of local economic benefit over the longest possible timeframe as it

struggles to diversify the economy and ensure a sustainable future. Any option that undermines that goal will be resisted.

The overview confirms that minimizing large fluctuations in employment will provide the best opportunity to maximize project benefits at the territorial and community level. This means a strategy that stretches the project timeframe, while more costly in the short term actually may provide greater long-term benefit to all affected stakeholders. The small Yukon labour force, the size of the affected communities and the overall closure cost means the socio-economic effects of this project present a variety of leverage opportunities that should be incorporated into the final closure plan. The technical aspects of the example alternatives should be re-examined with a view to prolong the schedule.

The degree to which these opportunities can be explored depends on building a consensus that expands and balances the scope of stakeholder desired outcomes. For example, the added time and cost of sequential reclamation may be offset by the local benefits achieved.

Who the ultimate project proponent is for this project is also a consideration. The simplest approach would be to hire one contractor to undertake all aspects of mine closure for a fixed contract price. However, such an approach significantly reduces the probability of generating substantial local benefit because a contractor's principal interest would be completing the project as quickly as possible. Minimizing project complexity also reduces risk and increases potential profitability.

The closure and reclamation of the Faro mine presents opportunities risks and challenges to the affected communities. It is a very large project that will dwarf the local economies and will be significant at the overall Yukon level. It will also have large social effects that need to be carefully considered. The *Yukon Environmental and Socio-economic Assessment Act* requires that socio-economic factors be taken in consideration while deciding among options. This project could be a tool for establishing the base for a stable long-term sustainable economy for the affected communities, or it could perpetuate the boom and bust cycle these communities have been subject in the past, with all its attendant social and economic problems.

Appendix A: Summary of Key Considerations

This section recapitulates the key considerations presented in the document.

Population

- *The Yukon's population reached a high point in 1997, fell to a low in 2003 and has been increasing since whereas the communities of Ross River, Pelly Crossing, and Carmacks, although seeing some fluctuations in population, have been largely stable since 1996.*
- *Faro has undergone wild fluctuations in population as the fortunes of the mine ebbed and flowed. When the mine was fully operational, the population increased threefold demonstrating a willingness of workers to live in the community rather than commute.*
- *The community has experienced three collapses of its population following each shutdown of the mine — in the early 1980s, the early 1990s, and finally in 1998.*
- *The closures were unexpected compounding both direct and indirect impacts on the community and Yukon economy as a whole. The effect of the closures has been to undermine community stability.*

"Flattening" the Labour Curve

- *A compressed time schedule assumes manpower and equipment readily available when required and does not take into account other Yukon activity that may occur during the same timeframe*
- *A compressed timeframe reduces the potential to create positive benefits at the community level and increases the probability of negative effects occurring.*
- *A "flatter" labour curve implies a longer project life and the potential to break work components into small work packages within the capability of more Yukon businesses.*
- *A "flatter" labour curve provides more training possibilities and a greater probability of local hire.*
- *A compressed schedule works against the affected communities' diversification and sustainability goals while a longer timeframe increases the probability of local benefits.*
- *A flatter workforce curve and extended project schedule provides more opportunity to build in skill upgrading and training programs as impact mitigation measures.*
- *Given the small overall size of the Yukon labour force, a flatter workforce curve reduces the risk that certain trades would have to be imported to meet project needs.*

Workforce Availability

- *The main occupations will be heavy equipment operators, light equipment operators and labourers. Under some alternatives, there will also be a substantial requirement for electricians relative to the Yukon labour force in that trade. Heavy-duty equipment mechanics might also be in short supply, depending on the age of the machinery used..*
- *The workforce potential of affected communities will need to be examined more closely to determine both the capacity of each community to participate in the project as well as their respective willingness to do so. Constraints could include lack of appropriate skills, the nature of the work, work schedule, probable employment duration and other opportunities available.*

- *There is a growing industry wide shortage of journeyman tradespeople in western Canada that may continue to exist when actual closure implementation begins. 2001 data should be used with reservation. It is important to recognize that tradesperson availability in some areas may be a problem either because of the small overall size of the Yukon labour force or because of competing project demands.*
- *The proportion of workers that may be attracted to this project from communities within the Yukon and Faro and Ross River in particular requires closer examination to predict with any accuracy.*

Social Effects

- *The aboriginal perspective on social effects is rarely carefully considered. Their frame of cultural reference needs to be understood in considering whether the direct, indirect and induced effects of the preferred mine closure project are perceived positively or negatively.*
- *Faro has the capacity, history and stated desire to participate in the mine closure project as much as practical. They also realize that their existence was a direct result of the mine's establishment and their continued existence has an impact on the traditional territory of the Ross River Dena.*
- *Ross River also has a direct interest in which closure alternative is selected because of their moral responsibility as land stewards and because the presence of the mine and townsite has had, and will continue to affect how they use the land in the future.*
- *On balance there is a perception that Faro as a community received more economic benefit from the presence of the mine while Ross River experienced more social disruption.*
- *Since government did not address the issue of whether the townsite should continue to exist when the mine closed, the remaining Faro residents have really pre-empted that decision from being made by taking the initiative to keep the community alive. The degree to which a closure alternative responds to that objective will have a considerable bearing on the social health of the community.*

Land Use

- *Approximately 423 ha of the disturbed area around the Grum and Vangorda pits within town boundaries. This means any reclamation work requires a Development Permit issued by the Town.*
- *There is no regional land use context to consider the mine reclamation options in because there is no regional or local area plan except the Official Community Plan for Faro.*
- *There appears to be substantial lime deposits between Faro and Carmacks close to the Campbell Highway that may be worth evaluating further as a potential supply source.*
- *If the work camp option is chosen, any work camp proposed within community boundaries but outside the serviced area will need to be fully self-contained.*

Traditional and Recreational Use of Wildlife

- *Attempts to re-route the seasonal migration route around mine workings were unsuccessful. The sheep preferred their historic route and could not be induced to change adapting as necessary to the presence of mining activity;*
- *The habitat map notation includes areas of the mine workings but the area has not yet been formally designated as a Special management or Habitat Protection Area.*
- *Detailed studies on vegetation, forage production, ground-based disturbance, lambing and sheep genetics have been completed suggesting a range carrying capacity of 90 animals. The issue is not restoring habitat but ensuring the connection and natural pathway between winter and summer range is not compromised. Work has also been done on monitoring population dynamics, movement patterns, disturbance response and an evaluation of interpretation effectiveness and regulatory compliance.*
- *The Fannin Sheep Wildlife Viewing Project has become a source of considerable community pride and active stewardship. It is a unique regional attraction and essential anchor component of Faro's tourism development and economic diversification strategy.*
- *Respective mining companies have a long history of working with the community to mitigate their impacts on the local sheep population and have actively supported projects such as the wildlife viewing initiative. The chosen Closure Plan alternative needs to recognize that temporal restrictions may be required during the summer-winter migration period and discuss carefully with the community which roads/trails will be permanently closed, seasonally gated or retained for hinterland access and sheep habitat protection.*
- *Consideration in the mitigation strategy should include the potential for interpreting the mine's past and reclamation program, as well as enhancing Fannin sheep habitat.*
- *Any decision to maintain or close mine related trails and roads will require careful consultation as they are extensively used to access the backcountry and some have become part of the community trail network.*
- *The decision to retain or close trails will have a significant impact on area wildlife including future hunting activity beyond those effects that may be incurred by the presence of the reclamation workforce.*

Appendix B: Data Gaps

Throughout this report a number of data gaps have been identified. The main ones are:

- *The need for future socio-economic work to use 2006 Census data when it becomes available in 2008.*
- *Local labour force skills inventory and the capacity of the affected communities to supply the required labour force. The census will not provide sufficiently detailed information.*
- *The seasonal aspects of the work, how much can be done year-round and which ones need to be done during the warmer months. This will give a better indication of the number of people required (as opposed to person-years).*
- *The types of "technicians" needed*
- *Baseline data on the health status of the populations in affected communities*
- *Accurate population and demographic numbers, including the current burden of illness and injury in the potentially affected communities (possible from the health insurance program data)*
- *Current social assistance dependency rates for all communities*
- *A recent assessment of social needs and issues*
- *A health, social, education and justice service inventory - currently available services and potential gaps with increased demand*
- *The condition of the housing and municipal infrastructure in Faro and its relation with how the labour force will be housed.*
- *The degree to which the mine site environs can be reclaimed to the pre-existing state including the amount of time required to visibly observe the difference and subsequent effects on wildlife and human use of the area bearing in mind that the community of Faro will continue to exist.*

Appendix C: Faro Closure Alternatives Labour Needs Summary

	Person-years													
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Faro Mine Area Alternative 1 - Flow-Through Pit														
Labourer	3.02	12.03	12.54	13.54	5.51	3.02	0.51							
Light Equipment Operator	5.31	21.21	22.09	23.85	9.72	5.31	0.88							
Heavy Equipment operator	3.90	15.56	16.21	17.50	7.13	3.90	0.65							
Technician	0.55	2.20	2.29	2.47	1.00	0.55	0.10							
Journeyman Carpenter	0.06	0.27	0.27	0.31	0.12	0.06	0.02							
Journeyman Electrician	0.06	0.22	0.24	0.24	0.10	0.06	0.00							
Journeyman Pipefitter	0.02	0.04	0.04	0.04	0.02	0.02	0.00							
Journeyman Welder	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Driller	0.35	1.43	1.49	1.61	0.67	0.35	0.06							
Driller Helper	0.16	0.61	0.63	0.69	0.27	0.16	0.02							
Helicopter Pilot	0.02	0.04	0.04	0.04	0.02	0.02	0.00							
Surveyor	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Heavy Duty Mechanic	0.39	1.96	1.96	1.96	0.78	0.39	0.00							
Mechanic Helper	0.00	1.96	1.96	1.96	0.00	0.00	0.00							
Faro Mine Area Alternative 2 - Upgrade Faro Creek Diversion														
Labourer	7.13	7.13	12.74	15.27	6.12	1.53	1.02							
Light Equipment Operator	12.47	12.47	22.29	26.73	10.70	2.67	1.78							
Heavy Equipment operator	8.92	8.92	15.92	19.11	7.64	1.90	1.27							
Technician	1.35	1.35	2.43	2.90	1.16	0.29	0.20							
Journeyman Carpenter	0.18	0.18	0.29	0.35	0.14	0.04	0.02							
Journeyman Electrician	0.14	0.14	0.24	0.29	0.12	0.02	0.02							
Journeyman Pipefitter	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Journeyman Welder	0.00	0.00	0.00	0.00	0.00	0.00	0.00							

	Person-years													
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Driller	0.08	0.08	0.12	0.16	0.06	0.02	0.02							
Driller Helper	0.04	0.04	0.06	0.08	0.04	0.00	0.00							
Helicopter Pilot	0.02	0.02	0.04	0.06	0.02	0.00	0.00							
Surveyor	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Heavy Duty Mechanic	0.78	0.78	1.96	1.96	0.59	0.00	0.00							
Mechanic Helper	0.00	0.00	1.96	1.96	0.00	0.00	0.00							
Faro Mine Area Alternative 4 - Minimize Water Treatment														
Labourer	2.10	6.70	11.33	7.13	6.70	7.13	0.84							
Light Equipment Operator	13.43	42.98	72.54	45.67	42.98	45.67	5.37							
Heavy Equipment operator	7.33	23.44	39.57	24.91	23.44	24.91	2.94							
Technician	0.27	0.86	1.45	0.92	0.86	0.92	0.12							
Journeyman Carpenter	0.00	0.02	0.04	0.04	0.02	0.04	0.00							
Journeyman Electrician	0.06	0.18	0.31	0.20	0.18	0.20	0.02							
Journeyman Pipefitter	0.00	0.02	0.04	0.02	0.02	0.02	0.00							
Journeyman Welder	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Driller	0.29	0.94	1.59	1.00	0.94	1.00	0.12							
Driller Helper	0.12	0.41	0.69	0.43	0.41	0.43	0.06							
Helicopter Pilot	0.00	0.02	0.04	0.02	0.02	0.02	0.00							
Surveyor	0.16	0.49	0.82	0.51	0.49	0.51	0.06							
Heavy Duty Mechanic	0.78	3.92	5.88	3.92	3.92	3.92	0.00							
Mechanic Helper	0.00	3.92	5.88	3.92	3.92	3.92	0.00							

	Person-years													
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Tailings Alternative 1 - Stabilize In Place														
Labourer	4.04	9.86	6.31	5.06	0.12									
Light Equipment Operator	25.23	61.47	39.40	31.52	0.78									
Heavy Equipment operator	16.70	40.69	26.09	20.87	0.53									
Technician	0.94	2.27	1.47	1.18	0.02									
Journeyman Carpenter	0.57	1.41	0.90	0.73	0.02									
Journeyman Electrician	0.27	0.65	0.41	0.33	0.00									
Journeyman Pipefitter	0.16	0.37	0.24	0.20	0.00									
Journeyman Welder	0.00	0.00	0.00	0.00	0.00									
Driller	0.08	0.20	0.14	0.10	0.00									
Driller Helper	0.06	0.16	0.10	0.08	0.00									
Helicopter Pilot	0.02	0.02	0.02	0.02	0.00									
Surveyor	0.00	0.00	0.00	0.00	0.00									
Heavy Duty Mechanic	1.96	5.88	3.92	3.92	0.00									
Mechanic Helper	1.96	5.88	3.92	3.92	0.00									

	Person-years													
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Tailings Alternative 2 - Complete Relocation														
Labourer	36.01	35.88	33.54	33.54	34.33	33.54	33.54	33.54	33.54	34.38	34.38	33.54	25.69	4.29
Light Equipment Operator	5.94	5.94	5.64	5.64	5.80	5.64	5.64	5.64	5.64	5.80	5.80	5.64	5.64	5.19
Heavy Equipment operator	4.41	4.41	4.19	4.19	4.31	4.19	4.19	4.19	4.19	4.31	4.31	4.19	4.19	3.86
Technician	4.53	4.53	4.29	4.29	4.41	4.29	4.29	4.29	4.29	4.41	4.41	4.29	4.29	3.96
Journeyman Carpenter	0.02	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Journeyman Electrician	6.96	6.86	6.62	6.62	6.80	6.62	6.62	6.62	6.62	6.80	6.80	6.62	6.62	6.10
Journeyman Pipefitter	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.27
Journeyman Welder	0.20	0.20	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.16
Driller	0.02	0.20	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Driller Helper	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Helicopter Pilot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Surveyor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Duty Mechanic	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Mechanic Helper														

	Person-years													
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Tailings Alternative 3 - Partial Relocation														
Labourer	30.30	28.42	30.30	39.71	28.42	12.74	34.48	4.61	0.00	0.00	0.22	0.00	0.00	0.22
Light Equipment Operator	18.11	16.99	18.11	23.74	16.99	7.62	20.62	2.74	0.00	0.00	0.12	0.00	0.00	0.12
Heavy Equipment operator	16.54	15.52	16.54	21.68	15.52	6.96	18.82	2.51	0.00	0.00	0.12	0.00	0.00	0.12
Technician	5.88	5.51	5.88	7.70	5.51	2.47	6.70	0.90	0.00	0.00	0.04	0.00	0.00	0.04
Journeyman Carpenter	0.02	0.02	0.02	0.02	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Journeyman Electrician	5.31	4.98	5.31	6.96	4.98	2.23	6.04	0.80	0.00	0.00	0.04	0.00	0.00	0.04
Journeyman Pipefitter	0.59	0.55	0.59	0.67	0.55	0.24	0.67	0.08	0.00	0.00	0.00	0.00	0.00	0.00
Journeyman Welder	0.33	0.31	0.33	0.45	0.31	0.14	0.39	0.06	0.00	0.00	0.00	0.00	0.00	0.00
Driller	0.12	0.10	0.12	0.14	0.10	0.04	0.12	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Driller Helper	0.08	0.08	0.08	0.10	0.08	0.04	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Helicopter Pilot	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Surveyor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Heavy Duty Mechanic	1.96	1.96	1.96	1.96	1.96	0.78	1.96	0.20	0.00	0.00	0.00	0.00	0.00	0.00
Mechanic Helper	0.00	0.00	0.00	1.96	0.00	0.00	1.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	Person-years													
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Vangorda/Grum Alternative 1 - Backfill Vangorda Pit														
Labourer	6.06	7.04	8.17	6.57	2.74	1.90	1.57							
Light Equipment Operator	17.50	20.31	23.60	18.95	7.92	5.51	4.55							
Heavy Equipment operator	11.52	13.39	15.54	12.41	5.23	3.63	3.00							
Technician	0.14	0.16	0.18	0.16	0.06	0.04	0.04							
Journeyman Carpenter	0.25	0.31	0.35	0.29	0.12	0.08	0.06							
Journeyman Electrician	0.10	0.12	0.14	0.12	0.04	0.04	0.02							
Journeyman Pipefitter	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Journeyman Welder	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Driller	0.08	0.10	0.12	0.10	0.04	0.02	0.02							
Driller Helper	0.04	0.04	0.04	0.04	0.02	0.02	0.00							
Helicopter Pilot	0.02	0.02	0.02	0.02	0.00	0.00	0.00							
Surveyor	3.27	3.80	4.41	3.55	0.15	1.04	0.84							
Heavy Duty Mechanic	0.98	1.37	1.96	1.18	0.20	0.20	0.20							
Mechanic Helper	0.00	0.00	0.00	0.00	0.00	0.00	0.00							

	Person-years													
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Vangorda/Grum Alternative 2 - Stabilize In Place														
Labourer	1.47	2.84	1.90	1.23	0.78									
Light Equipment Operator	6.37	12.29	8.19	5.35	3.35									
Heavy Equipment operator	4.53	8.74	5.82	3.80	2.37									
Technician	0.12	0.22	0.16	0.10	0.06									
Journeyman Carpenter	0.27	0.53	0.35	0.24	0.14									
Journeyman Electrician	0.20	0.39	0.25	0.18	0.10									
Journeyman Pipefitter	0.00	0.00	0.00	0.00	0.00									
Journeyman Welder	0.00	0.00	0.00	0.00	0.00									
Driller	0.27	0.53	0.35	0.24	0.14									
Driller Helper	0.04	0.06	0.04	0.02	0.02									
Helicopter Pilot	0.02	0.04	0.02	0.02	0.02									
Surveyor	0.00	0.00	0.00	0.00	0.00									
Heavy Duty Mechanic	0.20	0.59	0.39	0.20	0.20									
Mechanic Helper	0.00	0.00	0.00	0.00	0.00									

	Person-years													
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14
Vangorda/Grum Alternative 4 - Minimize Water Treatment														
Labourer	5.53	5.88	5.76	5.78	3.61	4.17	2.80							
Light Equipment Operator	19.23	20.50	20.03	20.15	12.58	14.56	9.78							
Heavy Equipment operator	12.94	13.80	13.48	13.56	8.47	9.80	6.59							
Technician	0.12	0.14	0.14	0.14	0.08	0.10	0.06							
Journeyman Carpenter	0.24	0.25	0.25	0.25	0.16	0.18	0.12							
Journeyman Electrician	0.10	0.10	0.10	0.10	0.06	0.08	0.06							
Journeyman Pipefitter	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Journeyman Welder	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Driller	0.00	0.00	0.00	0.00	0.00	0.00	0.00							
Driller Helper	0.04	0.04	0.04	0.04	0.02	0.02	0.02							
Helicopter Pilot	0.02	0.02	0.02	0.02	0.02	0.02	0.00							
Surveyor	2.98	3.19	0.31	3.14	1.96	2.25	1.53							
Heavy Duty Mechanic	1.18	1.57	1.37	1.37	0.78	0.98	0.59							
Mechanic Helper	0.00	0.00	0.00	0.00	0.00	0.00	0.00							