# Freight Dock Relocation at Steensby

# Impact on Civil Infrastructure Works

# Trade-off Study

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# 1. Executive Summary

This trade-off study provides information on the impacts to site transport infrastructure for the two options for locating the freight docks (as shown on Figure 3-1).

The current baseline option by Knight Piésold (as defined in the Environmental Impact Study [EIS] – December 2010) consists of locating the freight docks approximately 3 km due east of the access to the ore dock on the mainland. Access to this from the permanent laydown area is by a 4.4 km long transport corridor. The northern 900 m is a separate truck access road and railway which turns into a 2.8 km combined road and rail spur which in turn separates again into an independent truck access road and rail for the final 700 m prior to the freight dock. The rail portion of this freight transport corridor is a spur off the rail loop (Figure 3-1, Point C) and is assumed to be for during the construction period only.

Following construction, during the operation period, freight will be transported to the laydown areas by road only. There are also two additional access roads adjoining the main combined road and rail freight transport corridor. One of the roads services the air strip and the other services an explosives magazine.

The alternative option is based on the design proposed by Aker Kvaerner in 2008 as part of the Definitive Feasibility Study (DFS) – February 2008. This consists of locating the freight dock approximately 4.5 km north of the access to the ore docks on the mainland; however this is outside of the proposed development area as indicated in the EIS.

This option requires a 3.1 km rail spur and 3.0 km access road between the docks and rail yard (Figure 3-1, Point B). The permanent laydown facilities are located along this road approximately 2.5 km from the freight docks. Two rail-road crossings will be required - one at the rail yard (point B) and one immediately prior to the docks.

An explosives magazine storage (used for storage of all explosives and related items prior to being transported to the ammonium nitrate and fuel oil emulsion product [AMFO] mixing plants) has been sited approximately 1.0 km south of the airstrip. Access to this area is by a 2.2 km road south-east of the access road to the airstrip (Figure 3-1, Point A). For this study it has been assumed that the explosives magazine remains in the same location for both options (see Figure 3-1), however, relocating it closer to the freight docks would negate the requirement for this access road spur. The alternative option by Aker Kvaerner includes an access road between the rail yard (point B) and the dock, along which the explosives magazine could be located. It should however be noted that relocation of the explosives magazine from the baseline condition would be subject to the requirements set out by Natural Resources Canada (NRCan) (see below for more details).

## 1.1 Motivation

The motivation behind this trade-off study is to determine if the current baseline proposal by Knight Piésold is the most attractive and viable solution from both an economic and operational perspective, or whether the alternative, previous design suits the site better.

## 1.2 Options Assessed

The two options are based on designs carried out during different stages of feasibility studies. The current proposal is the baseline option by Knight Piésold and is defined in the EIS (Volume 3, figure 3-2.9). The option to relocate the dock further north was the original proposal put forward by Aker Kvaerner in 2008 as part of the DFS.

The proposal for this modification will consist of a variety of impacts on all aspects of the port operations which will be assessed independently. This report will focus on the impacts to transportation routes.

## 1.3 Conclusions

There are no major aspects of either design that out-weighs the other and thus it is concluded that either of the proposals would be a suitable solution.

However EIS Volume 3, Section 2.6.11 states that archaeological considerations and the advantages provided to ship navigation by ice and wind conditions are the main reasons why the freight dock location was revised to the baseline layout. Further studies are recommended in this regard.

In addition, in the alternate option, if the explosives magazine was to be relocated along the access road between the rail yard (point B) and dock, potential construction cost savings could be made by removing the requirement for a 2.2 km access road at this location all together. However the selection of the explosives magazine location should satisfy the requirements of Natural Resources Canada (NRCan).

## 1.4 Impact of change

There will likely be an archaeological impact on relocating the docks as per the alternate option as it is located outside of the development area identified in the EIS and further studies will be required in this area due to known archaeological finds nearby.

## 2. Objective / Scope / Motivation

N / A

# 3. Options Evaluated

The two options evaluated are set out below.

## 3.1 Current Scope (baseline)

Both options are shown on the layout plan in Figure 3-1; these are distinguished as being the baseline option and alternative option.

For the baseline option the freight dock is shown as being located approximately 3 km due east of the ore dock on the mainland. Access to this from the permanent laydown area is by a 4.4 km transport corridor. Of this 1.6 km (total) consists of a separate truck access road and railway (900 m at the northern end of the corridor and 700 m immediately prior to freight dock), with the remaining 2.8 km consisting of combined road and rail. The rail section is shown as a spur from the rail loop (Figure 3-1, Point C) which joins the road shortly afterwards. The route chosen avoids any major grade changes and follows the contours of the land as closely as possible. It has also been assumed that the rail portion will be used during the construction period only.

There are also two additional access roads adjoining the main combined road and rail freight transport corridor. One of these roads services the air strip and the other (2.2 km long) services the explosives magazine.

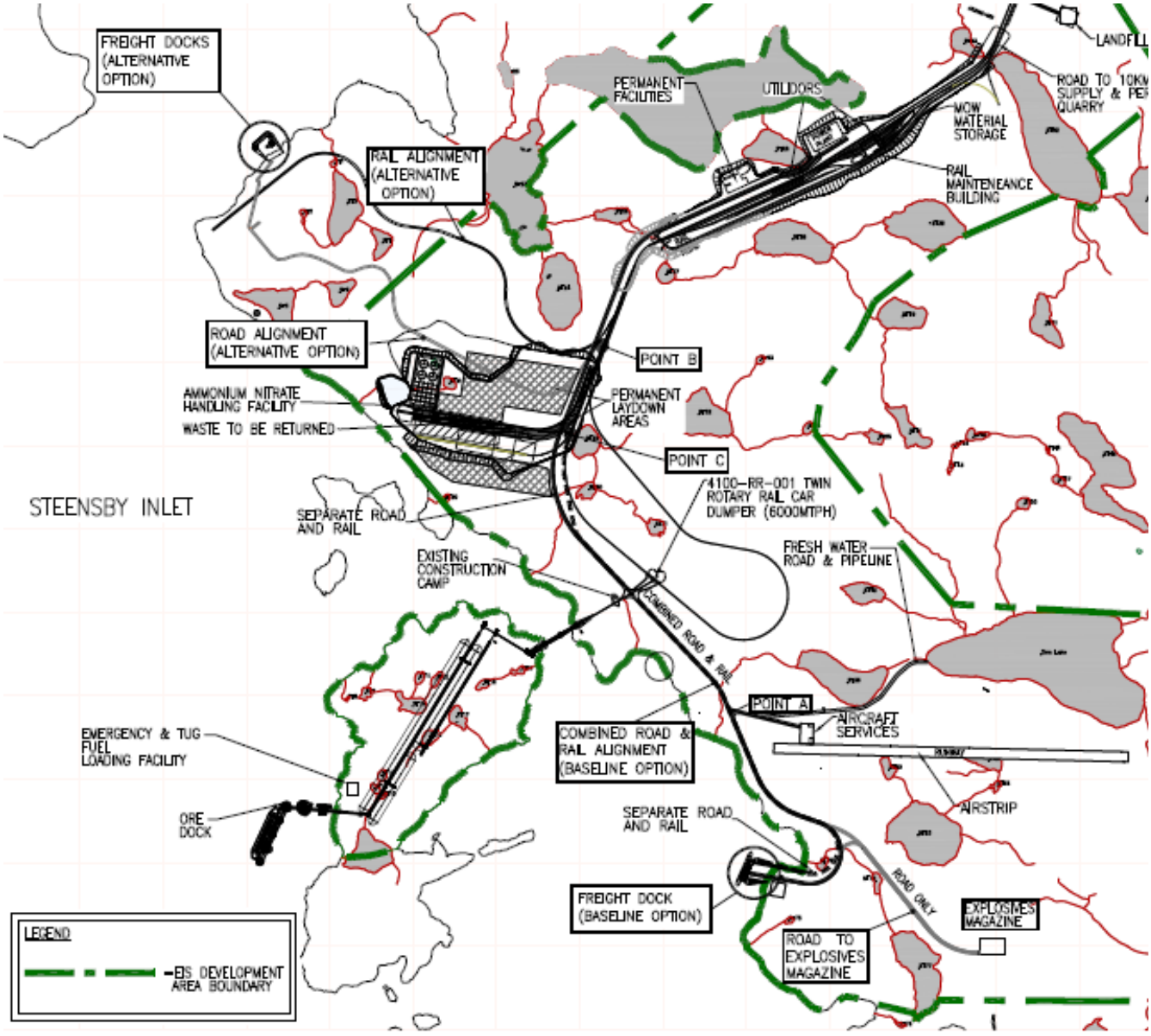


**Figure 3-1: Layout Options**

## 3.2 Option 1 – Alternative Option

The alternative option is based on the Aker Kvaerner 2008 layout as part of the DFS, locating the freight dock approximately 4.5 km north of the ore docks on the mainland (see Figure 3-1) which is outside of the proposed development area identified in the EIS.

Access to the freight dock will be by a 3.1 km rail spur leading from the rail yard (shown as Point B). The proposed alignment appears to require a certain amount of cut and fill but further detailed analysis of the land topography will be necessary to determine this.

A 3 km road has been proposed to link the rail yard to dock running roughly parallel to the railway. This road passes through the permanent laydown area. The distance between the freight docks and permanent laydown area is 2.5 km.

# 4. Evaluation Criterion

## 4.1 Key Drivers for the Review

The suitability of each option will be based on the lengths of road and rail required. It will be assumed that for each option the technical aspects of all other disciplines such as geotechnical and archaeological, along with the road and rail construction methods will be fairly similar and so the unit construction and operating costs involved will thus be comparable.

# 5. Technical Considerations

Considerations on the technical aspects are described as follows.

## 5.1 By Discipline

This study has been undertaken to assess the impacts of the location of the freight dock as identified in the two options on transportation routes including road and rail. The impacts in other disciplines are not considered.

## 5.2 By Area

Table 5-1 shows a brief comparison of both options. Note all distances are approximate.

**Table 5-1: Comparison of Options**

| Infrastructure | Baseline Option (Knight Piésold - EIS) | Alternative Option (Aker Kvaerner – DFS) |
|---|---|---|
| Dist. to permanent laydown areas from freight dock | 4.4 km (1.6 km separate road and rail; 2.8 km combined road/rail) | 2.5 km (2.5 km road or 2.5 km rail) |
| Rail (spur from rail yard to freight docks) | 4.4 km (2.8 km combined road/rail) | 3.1 km |
| Roads | 4.4 km (1.6 km separate truck access road) | 3.0 km (road to dock from rail yard – Point B) |
| Rail-road crossings | 0 | 2 |
| Freight dock | 100 m breasting face 12 m deep water | 100 m breasting face 12 m deep water |

# 6. Operational Considerations

Consideration has been given for operational aspects of the options in the following categories.

## 6.1 Safety

Both options involve either combined road and rail corridors or rail-road crossings which can be considered as a potential safety hazard.

The baseline option consists of a combined rail and road corridor approximately 3.5 km in length and the alternate option has two rail-road crossings – located at the rail yard and one immediately prior to the dock. Both of these could be considered as potential hazards.

Adequate safety warning systems will have to be installed for both options at the rail-road crossings and road / rail corridor.

## 6.2 Labour

N / A

## 6.3 Time

N / A

## 6.4 Product quality

N / A

## 6.5 Costs

Transport fuel costs are a consideration for locating the freight docks. The permanent laydown area is located adjacent to the rail yard (near point B). It has been estimated that during the operational period, freight trucks will operate on a twice-daily (assumed) basis. The freight truck operation has a saving of 1.9 km between the road lengths between the docks and laydown area for each option (in favour of the alternate option).

Maintenance costs will be involved in both options for both the road and rail. For this study it will be assumed that the costs associated with each are similar and does not provide a benefit to either option.

## 6.6 Risks

At the combined road and rail corridor (baseline option) and rail-road crossings (alternate option) the associated risks would be collisions between trains and road vehicles. To mitigate this, an operational plan would need to be considered to ensure there are no accidents. Properly developed and managed, this should not be a major concern.

# 7. Constructability Considerations

Particular constructability issues related to the both options are described below.

The combined road and rail corridor would require a different set of techniques that would not be required in the Aker Kvaerner option, but these are not considered to be extremely challenging and should not pose a risk to the construction costs or schedule. Typical combined road and rail construction techniques involve:

- 'Slab-track' – precast concrete slabs laid both between and either side of the tracks. Rubber pads are typically inserted in the grooves of the rails to prevent material blocking up the void. The rubber pad will deform under a train wheel and rebound to its original shape after.
- Asphalt with rubber pads. As above but asphalt road is constructed in place of the concrete slabs
- Timber panels – typically for low trafficked areas. Thick timber panels are laid between the rails to allow for vehicles to drive on. This will however carry higher maintenance risks and costs.

Based on the 2001 geotechnical investigation, the preliminary interpretation is that neither the Knight Piésold nor Aker Kvaerner proposed freight dock locations have the harbour bottom geotechnical properties to support a gravity based structure (i.e. caisson).

However at both locations, by moving the dock face back toward shore to a point where suitable soil condition may be encountered, there appears to be the opportunity to install either a tieback steel pile wall or circular cell sheet pile wharf face system.

Both locations will require some maintenance dredging of unsuitable materials at the dock face to allow for berthing of general cargo and fuel ships with 10.5 m draft. It is anticipated the baseline proposal will require up to six metres dredging but the alternate option will only require up to three metres dredging (based on preliminary data from Spring 2011 Geotechnical program).

# 8. Project Impacts

The impacts of each option have been considered in the following categories.

## 8.1 Capital Costs

It is assumed that the associated unit costs of road and rail construction are comparable for each option.

While the alternative option involves a total of 1.4 km more roadway and 1.5 km more railway than the baseline option, it can be assumed that this cost is offset by the 2.8 km of combined road and rail construction required. As such the total road and rail construction costs for either option will be comparable.

It is assumed that other than the difference in dredging, all dock construction cost will be comparable for each location and thus with a preliminary quantity difference of 6000 $m^3$ of additional dredging in the baseline proposal, the additional cost in the base case scenario would be in the order of $900,000 (based on preliminary data from Spring 2011 Geotechnical program).

## 8.2 Schedule

N / A

## 8.3 Scope

N / A

# 9. Conclusions and Recommendations

A summary of the overall advantages and disadvantages of each option based on the considerations in this report are shown below.

**Table 9-1: Summary of advantages and disadvantages**

| | Baseline Option (Knight Piésold - EIS) | Alternative Option (Aker Kvaerner – DFS) |
|---|---|---|
| **Advantages** | No rail-road crossing. | No combined road and rail corridors. |
| | | Explosives manufacture and magazine facility sited in a remote location from the freight dock. |
| **Disadvantages** | Combined road and rail corridor has potential for accidents if not properly managed and signalled. | 2 rail-road crossings. |
| | Explosives manufacture and magazine facility located fairly close to freight dock. | Outside of the proposed development area identified in the EIS |
| | Additional 6000 $m^3$ of dredging required for construction of freight dock due to unsuitable ground conditions. | Unknown archaeological conditions |

Based on the facts outlined in this report and the advantages and disadvantages above, it is considered that there are no factors that would favour either option and both would be a suitable design solution from a transportation perspective.

An explosives magazine storage area has been sited approximately 1.0 km south of the airstrip. This facility is to be used for storage of all explosives and related items prior to being transported to the ammonium nitrate and fuel oil emulsion product (AMFO) mixing plants. Access to this area is by a 2.2 km road south-east of the access road to the airstrip (Figure 3-1 - Point A).

For this study it has been assumed that the explosives magazine remains in the same location for both options. However, the Aker Kvaerner proposal already includes for an access road between the rail yard (point B) and the dock, along which the explosives magazine could be located if necessary. Doing so negate the requirement for the 2.2 km access road spur from point A and would make the alternate option more attractive due to the savings made with regards to lengths of road required to construct. However, any relocation of the explosives magazine from the baseline condition would be subject to the requirements set out by Natural Resources Canada (NRCan).