MMM GROUP

SOCIÉTÉ CANADIENNE D'ANALYSE DE LA VALEUR
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Better Projects Through Risk Analysis

Case Study - Highway 69 Four-Laning

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COMMUNITIES
TRANSPORTATION
BUILDINGS
INFRASTRUCTURE

Presentation Overview

The results from the Cost / Schedule Risk Assessment were a key tool for demonstrating the need for major design changes to Ministry of Transportation Senior Management and reducing the overall risk to the project construction value and schedule.

Background
- •Client
- •Highway 69 / 400 – Overview
- •Project Overview
- •Ministry Assignment Requirements

Risk Assessment
- •Cost / Schedule Risk Analysis Purpose
- •Cost / Schedule Risk Analysis Procedure

Project Features

Project Risks

Design Changes
- •Contract Phasing
- •Utility Relocations
- •Landfill

Summary

Conclusion

Background

Client

- Ministry Of Transportation of Ontario

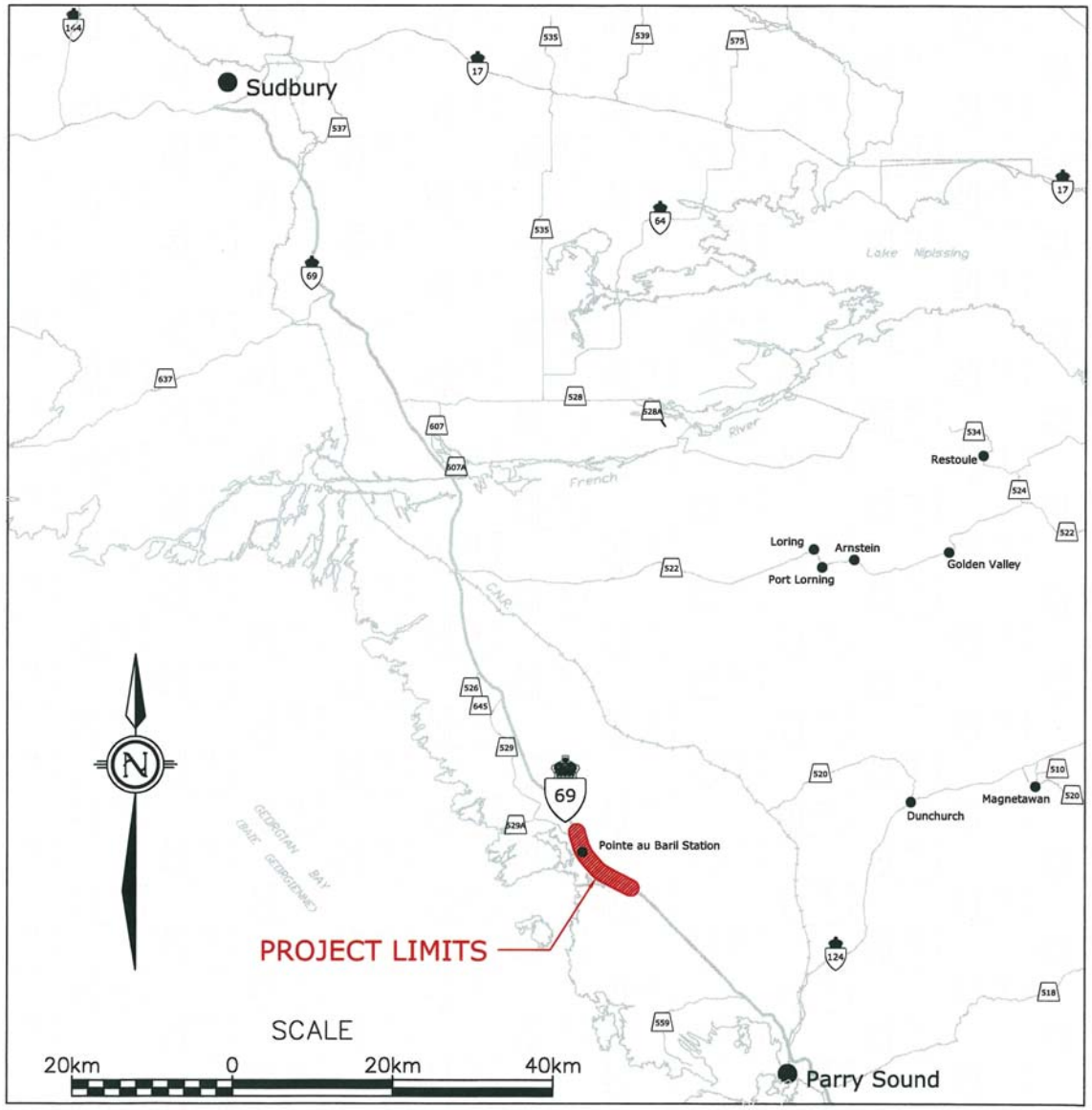
Highway 69 / 400 - Overview

- Highway 69/400 is a major transportation gateway linking Northern Ontario with the southern portion of the province. It extends from Sudbury in the north to Highway 401 in the south.
- As a gateway to Northern Ontario, as a strategic link in the Trans-Canada Highway System, and as the main local commuter and recreational route, use of Highway 69 has grown steadily since it was first opened to Sudbury in the 1950's. In recent decades, growing traffic volumes have resulted in unsatisfactory service levels, as evidenced by the congestion experienced during the summer months.

Background

Project Overview

- This project is part of the Ministry's overall Four-Laning of Highway 69 from Parry Sound to Sudbury.
- The section of Highway 69 reviewed as part of the Cost / Schedule Risk Assessment starts at the south end at the Shawanaga River and goes north approximately 11km to north of Highway 529.
- This section is located approximately 30 km north of Parry Sound, and 120 km south of Sudbury.



PROJECT LOCATION PLAN

Background

Ministry Assignment Requirements

- MMM Group Limited was retained undertake the Detail Design for the Four-Laning of Highway 69
- As part of the assignment MMM was to conduct a risk based cost and schedule estimate workshop, that encompasses all contracts of the assignment, to estimate the cost and schedule necessary to complete construction of the project, develop a risk management plan, and proactively manage the risks in this project for each of the grading contracts.

Risk Assessment

Cost / Schedule Risk Analysis Purpose

- The overriding purpose of a Risk Assessment is to provide a useful, sound and objective, analysis and report that the Project Team will own and act upon to improve, validate/confirm their project cost and/or schedule.

Risk Assessment

Pre-Workshop

- Information Binder provided to all team members detailing the Base Case and providing project background information.
- Site Visit by entire team on Monday February 4th, 2008. This site visit was also used to explain the Cost / Schedule Risk Assessment process and to expand a little on the project specific issues relating to the process
- Develop Draft Schedule and Cost risk analysis model

Workshop (February 20 – 22, 2008)

- Identify risks and populate risk models
- Develop analysis results
- Explore mitigation
- Left with actions to mitigate risks

Post-Workshop

- Report
- Manage risks, update risk register, refresh risk analysis

Project Features

The project includes the following major features:

- Approximately 11 km of new four-lane Highway 69 (4 km of twinning and 7 km of new alignment)
- Parallel service road is provided for the entire length of the four-laning, it is comprised of Site 9 Road and Highway 529. It includes approximately 9 km of sideroad on new alignment (horizontal or vertical) and approximately 3 km of sideroad on existing alignment (Hwy 69 becomes Hwy 529)
- A full access interchange will be provided approximately 2.7 km south of Point Au Baril Station.
- The project includes six bridges
- Local road improvements.
- Provisions for maintaining snowmobile trail access and wild life crossings.

Project Sections

The Ministry of Transportation requirement was that this design would be constructed under two separate construction contracts. Therefore, prior to the workshop, the project was broken into two main contracts.

Each contract was evaluated separately as part of the Cost / Schedule Risk Assessment.

Independent construction cost estimates and schedules were developed for the assessment.

Risks were identified and assigned to the appropriate contract.

Project Risks

Section 1

- Major Risks Identified = 6
- Moderate Risks Identified = 16
- Low Risks Identified = 25

Section 2

- Major Risks Identified = 4
- Moderate Risks Identified = 12
- Low Risks Identified = 14

Design Changes

Following the Cost / Schedule Risk Assessment workshop mitigation was implemented.

The following slides present the some of the mitigation accomplished using design modifications, phasing / staging strategy changes and overall program revisions.

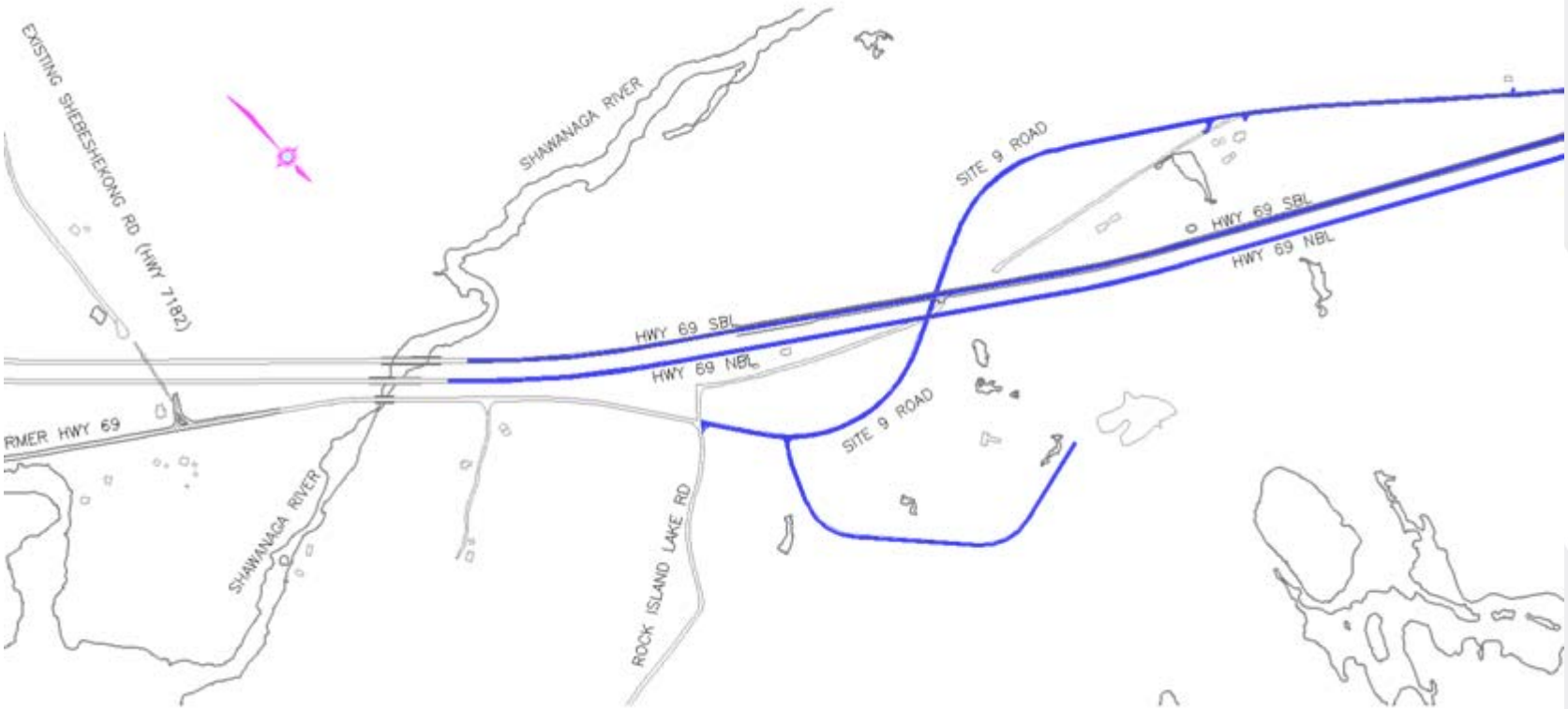
The three specific risks are related to:

- Contract Phasing
- Utility Relocations
- Landfill

Design Changes - Corridor Phasing / Staging

Base Case

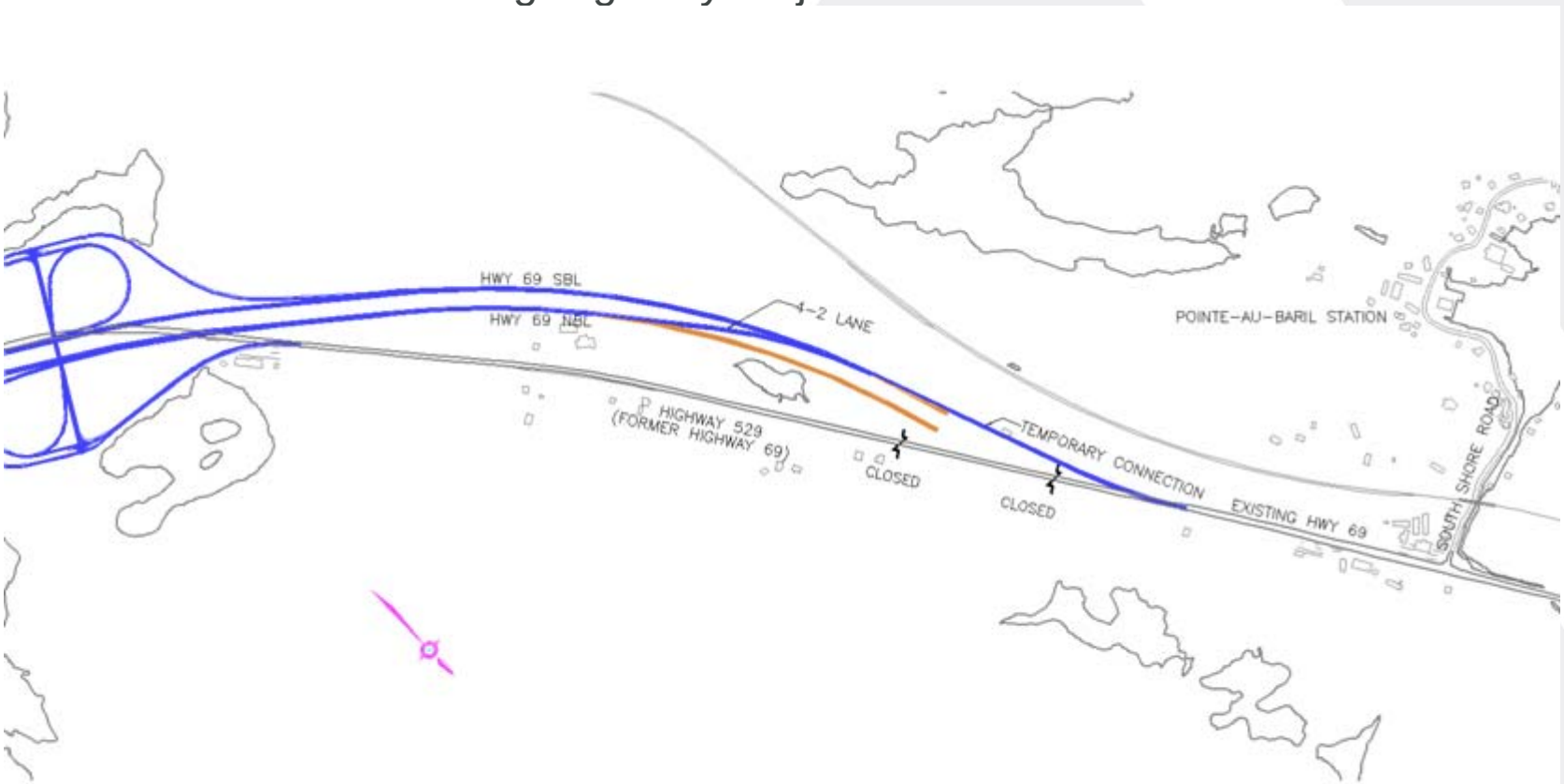
- The base case for the staging was that the contract immediately south of this project would be completed.



Design Changes - Corridor Phasing / Staging

Base Case

- The base case for the staging was that the south contract would connect into existing Highway 69 just before Point-Au-Baril Station.



Design Changes - Corridor Phasing / Staging

Risk

- If south contract is not open then staging of Contract 1 would require significant changes.
- There was a high likelihood that the south contract would experience design delays.
- The big concern was that a final decision on changing the order of the contracts would come late in the design and potentially cause design delays.
  - This risks was identified as having a 75% likelihood of occurring
  - A potential cost impact of greater than $500,000
  - A potential schedule impact of greater than 12 months.
- This risk scored had the highest rating

Design Changes - Corridor Phasing / Staging

Workshop Mitigation

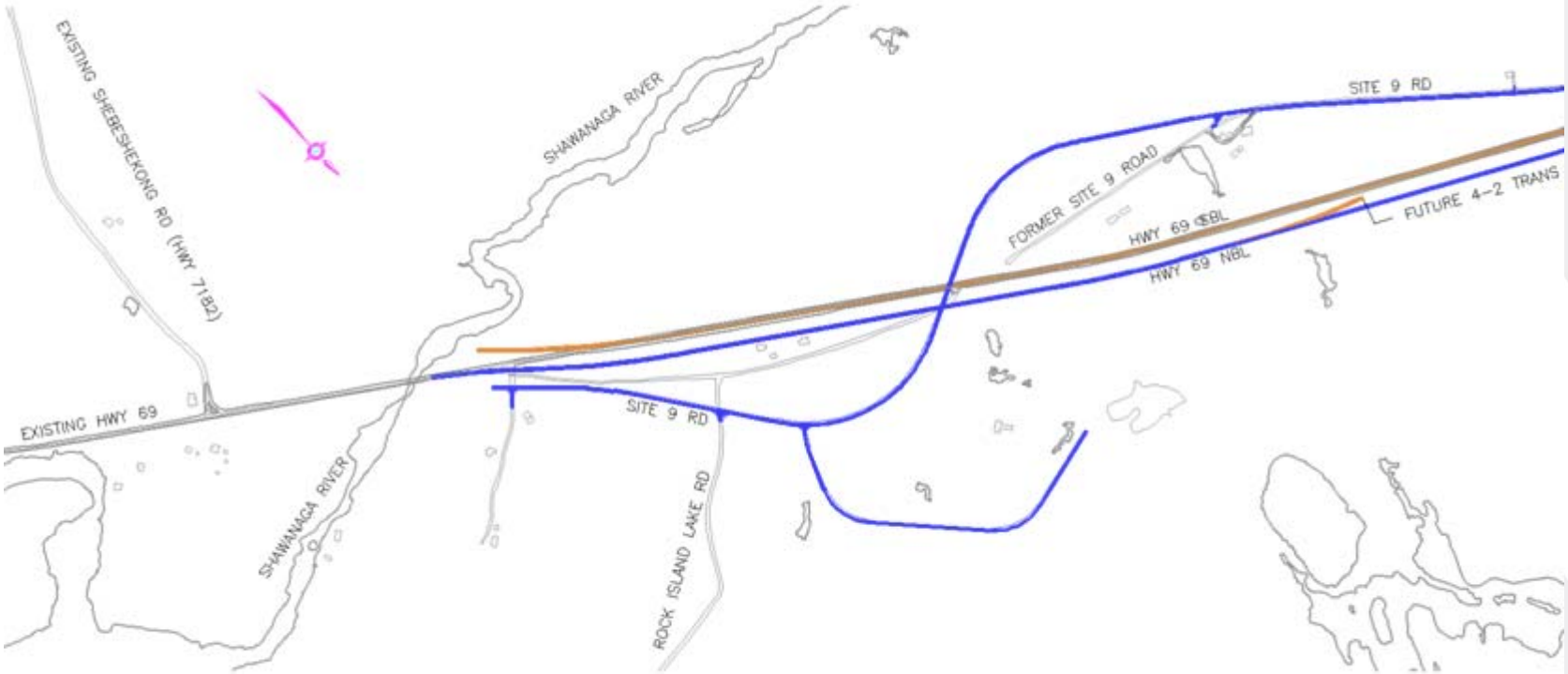
- Consider re-designing the staging based on traffic on existing Hwy 69 at the Shawanaga River.

Post-Workshop Mitigation

- The staging was re-designed to match into existing Hwy 69 at both ends of the project.
- Due to the short length of Contract 1 (7 km) it would not be opened as a divided Hwy at the completion of construction. The opening of the divided highway would be completed under the second contract.
- This change addressed a number of other concerns:
  - It balanced the costs between the two grading contracts.
  - It addressed traffic operations concerns with the initial four-to-two lane transition being located close to Pointe Au Baril Station where there is a reduced posted speed.
  - It eliminated one four-to-two lane transition and associated costs.

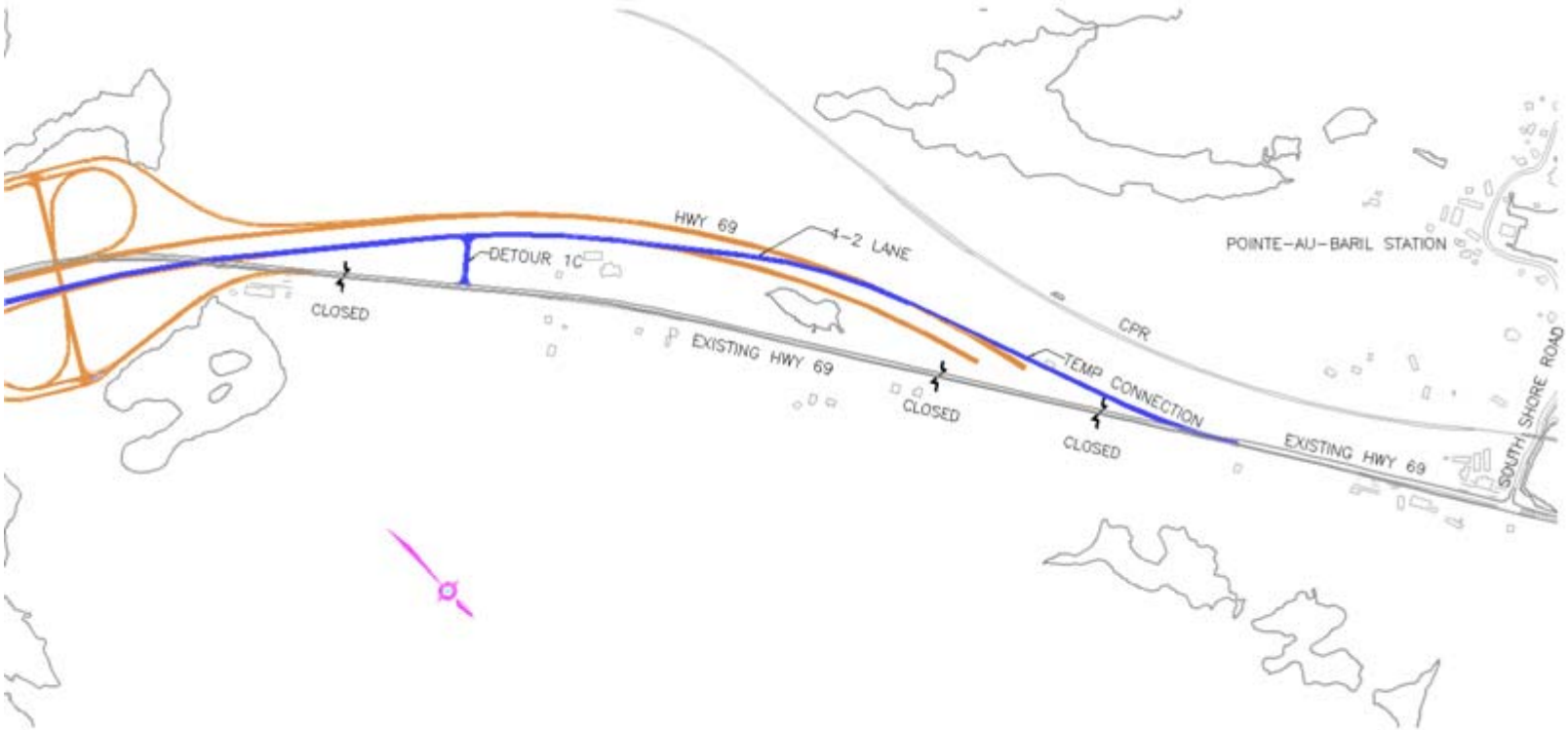
Design Changes - Corridor Phasing / Staging

Contract 1 – South Connection to Existing Hwy 69



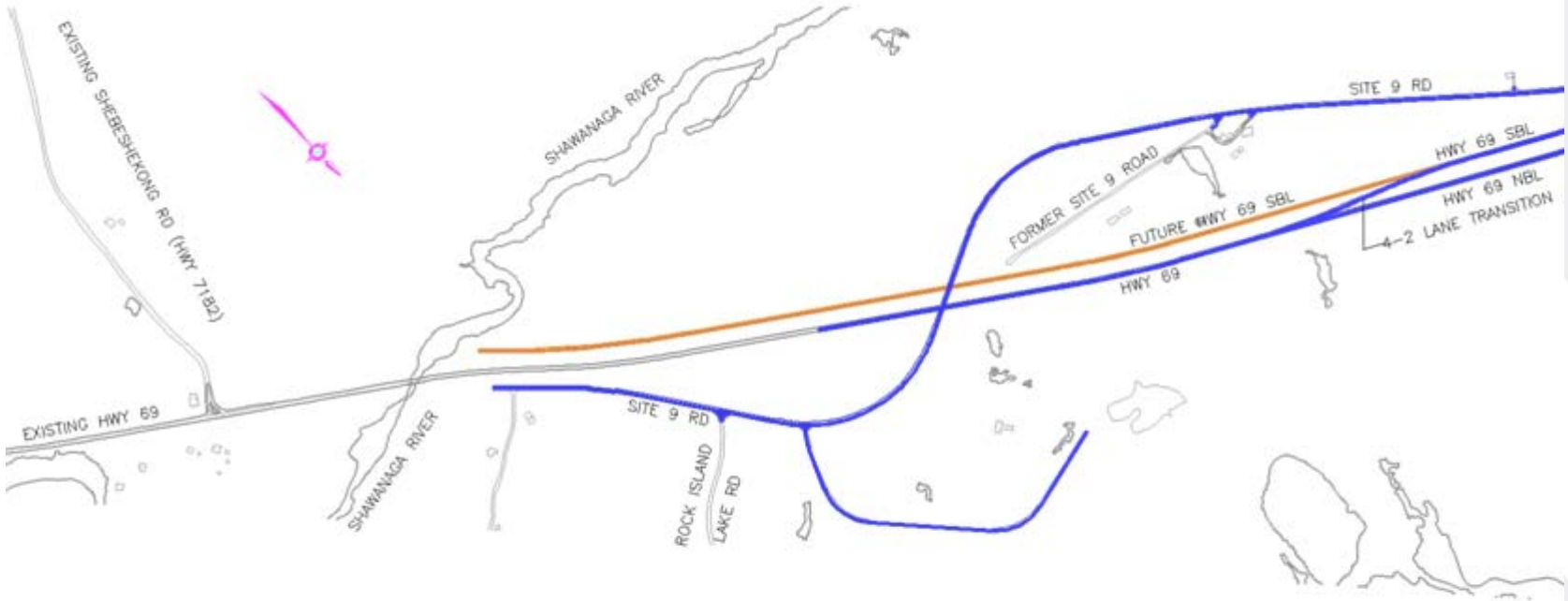
Design Changes - Corridor Phasing / Staging

Contract 1 – North Connection to Existing Hwy 69



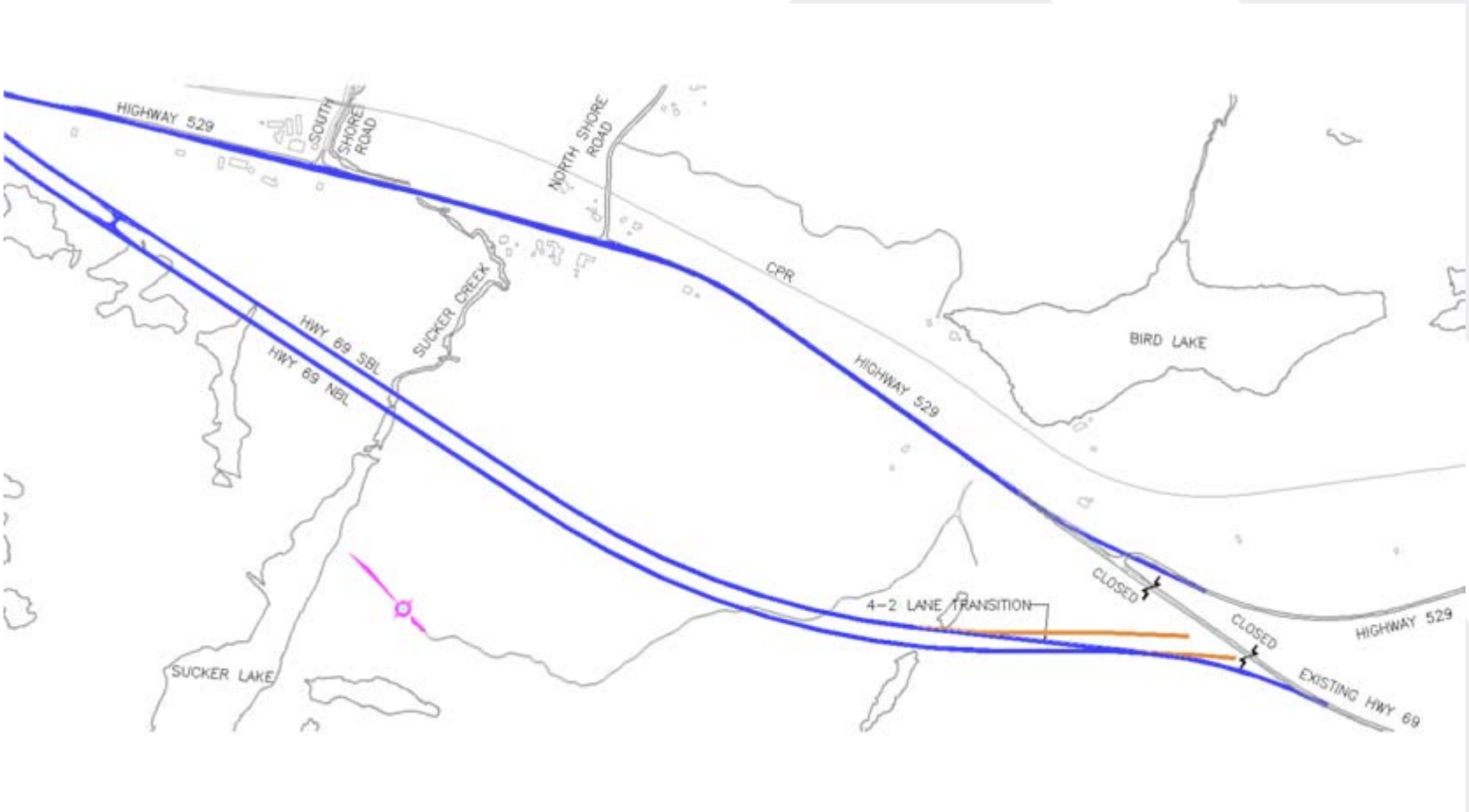
Design Changes - Corridor Phasing / Staging

Contract 2 – South Connection to Existing Hwy 69



Design Changes - Corridor Phasing / Staging

Contract 2 – North Connection to Existing Hwy 69



Design Changes – Utility Relocation Schedule

Base Case

- The base case for construction schedule was to provide approximately four months (January to April) to relocate 8 km of overhead utilities.

Risk

- Utility companies may not meet construction timeframe of four months.
  - This risks was identified as having a 75% likelihood of occurring
  - A potential cost impact of between $100,000 and $500,000
  - A potential schedule impact of between 3 and12 months.

Workshop Mitigation

- Identify impacts and develop relocation strategy as ASAP.
- Secure property ASAP.
- Investigate scheduling relocations in advance of clearing work.
- Adjust construction scheduling to allow additional time for relocations.

Design Changes – Utility Relocation Schedule

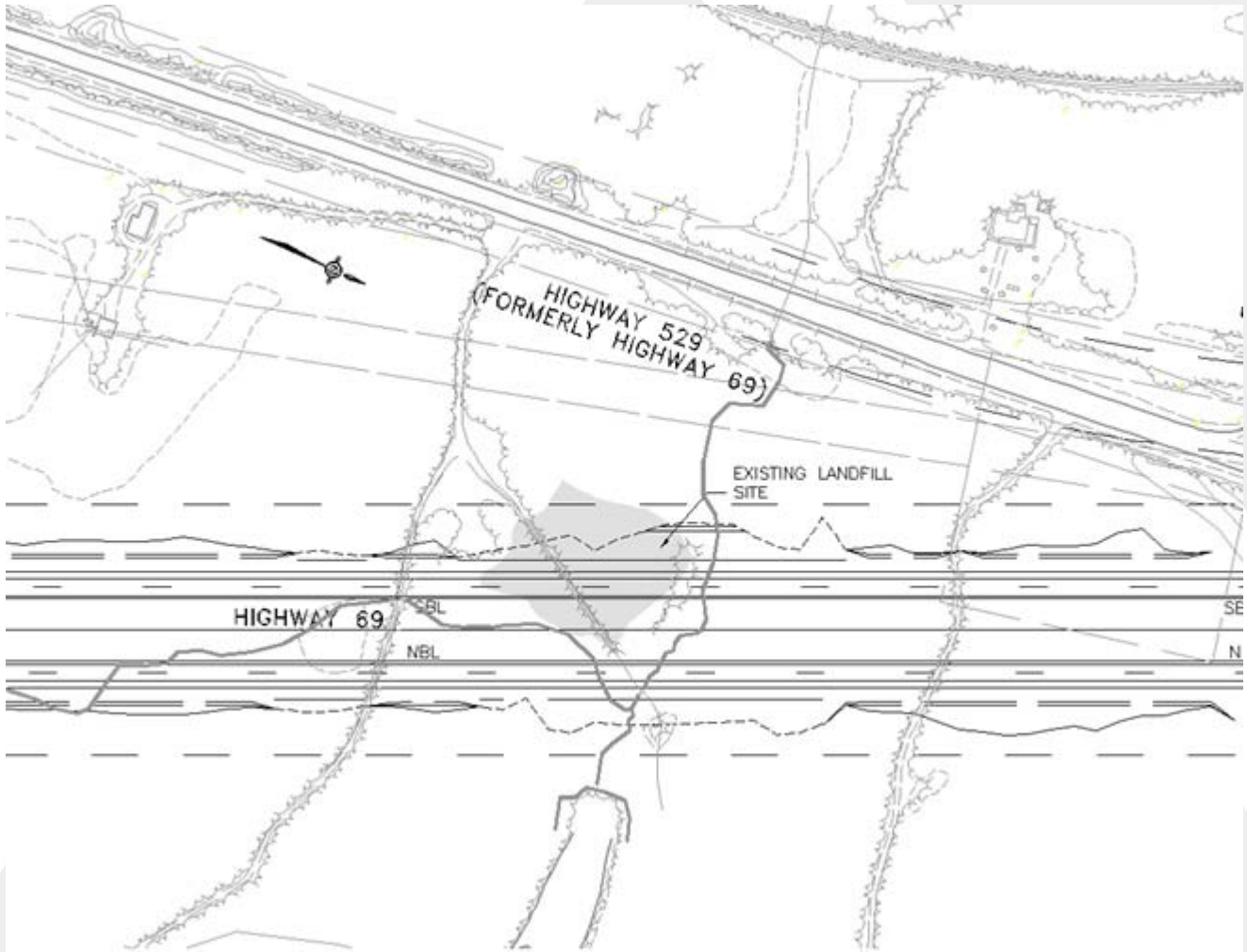
Post-Workshop Mitigation

- Based on the findings of the Risk Assessment the Ministry agreed that the original relocation schedule was to aggressive and has since revised its construction schedule to allow additional time for relocations.

Design Changes – Former Landfill Site

Base Case

The Route Planning Alignment carried the southbound lanes and a portion of the northbound lane embankment over a former land fill site.



Design Changes – Former Landfill Site

Risk

- Addressing the landfill may result in delays and high cost to move or mitigate
  - This risks was identified as having a 75% likelihood of occurring
  - A potential cost impact of greater than $500,000
  - A potential schedule impact of greater than 12 months.
- This risk scored had the highest rating

Workshop Mitigation

- During the work it was suggested to relocate the existing landfill, or re-align the highway away from the landfill.

Design Changes – Former Landfill Site

Post-Workshop Mitigation

- Three options were developed to address the landfill:
  - Relocate the existing landfill.
  - Span the existing landfill with a bridge.
  - Re-align the highway away from the landfill.
- The three options were reviewed based on:
  - Impacts to landfill
  - Environment
  - Bridges
  - Embankments over swamps.
  - Cost

Design Changes – Former Landfill Site

Evaluation of Former Pointe Au Baril Landfill Alternatives					
	Evaluation Factor				
	Existing Landfill	**Environment**	**Bridges**	**Embankments over Swamps**	**Cost**
Option 1 – Relocate the Landfill	**Significant impact as landfill will be relocated outside of the proposed ROW.** **Significant additional investigation is required to determine the exact extent and depths of the landfill.** **Significant risk associated with permitting and construction cost.**	Impacts would be related to creating a new landfill site. There is the potential for disruption of nearby residences related to disturbing the landfill material. EA required for creation of new landfill site. Affects one private property landowner.	**No change to the Sucker Creek bridges.**	**No concerns.**	**$1 M**
Option 2 – Span the landfill	**Minor impact as southbound lane caissons will be located within the limits of the landfill.**	**Minor related to construction caissons.** **Affects one private property landowner.**	**No change to the Sucker Creek bridges.** **Two new structures are required.** **Ongoing maintenance.**	**No concerns.**	**$5 M**
Option 3 – Realign the Highway	**N/A as highway ROW is shifted off the landfill material.**	No impacts related to the landfill. There are a number of Eastern Massassauga rattle snake areas between the landfill and Sucker Creek. Some are identified as high potential for EMR hibernation habitat and observed habitat. The alignment shift does not increase the impacts and moves further away from some of the identified areas. Removes property impact to one private property landowner.	**Sucker Creek bridges changed from curved to tangent.**	**Significantly reduces the highway embankments over a number of swamps**	**Negligible**

Design Changes – Former Landfill Site

Post-Workshop Mitigation

- The re-align Highway 69 to avoid landfill, proved to be the most cost-effective and lowest risk option and has since been implemented.

Summary

Hwy 69 From Shawanaga River to north of Highway 529

The Cost / Schedule Risk Assessment Workshop resulted in the design team focusing on addressing certain critical areas / activities earlier in the design schedule than anticipated.

This allowed for the development of options that reduced the risk in both the construction schedule and program value.

The Cost / Schedule Risk Assessment Workshop findings were a key tool for demonstrating the need for major design changes to Ministry of Transportation Senior Management and reducing the overall risk to the project construction value and schedule.

Questions

For Further Information:

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