Mackenzie Valley Highway

Updated Project Description

August 2014

Department of Transportation,
Government of the NWT
Yellowknife, Northwest Territories

Project Number: 123510598


Northwest
Territories Transportation

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1 INTRODUCTION

The Department of Transportation (DOT) of the Government of the Northwest Territories (GNWT) is proposing to extend the Mackenzie Valley Highway (MVH) from Wrigley to Norman Wells. This updated project description replaces the project description contained in the "Mackenzie Valley Highway Environmental Scoping Document" dated January 2013 and is submitted to the Mackenzie Valley Environmental Impact Review Board (MVEIRB) for the purpose of re- scoping the Environmental Assessment of the proposed Mackenzie Valley Highway development (MVEIRB file EA1213-02).

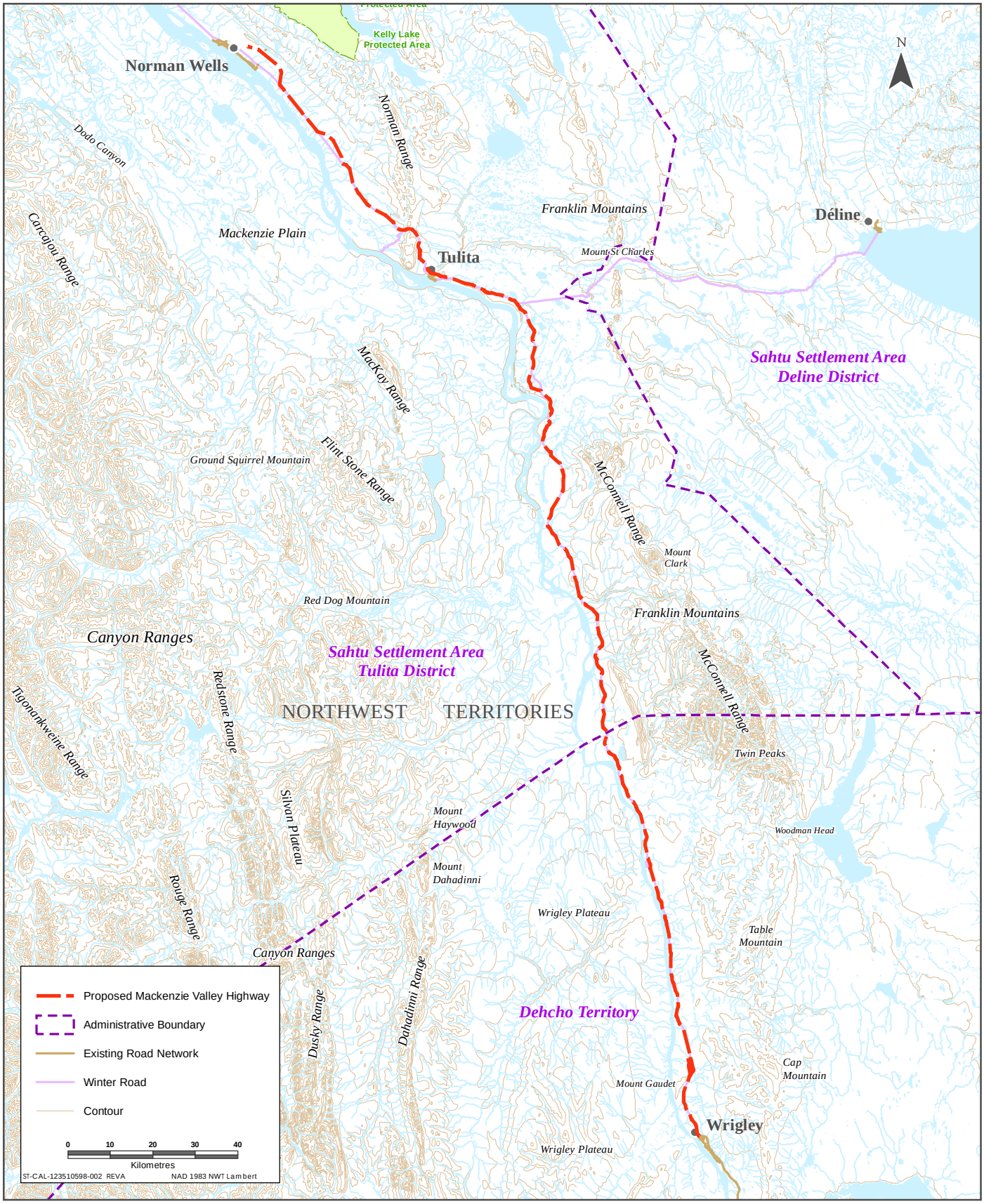
1.1 Project Overview

The Mackenzie Highway (Hwy 1) currently extends from the Northwest Territories/Alberta border to the community of Wrigley in the central Mackenzie Valley. This Project proposes the construction of an all-season highway between the communities of Wrigley and Norman Wells, much of the route following the existing footprint of the Mackenzie Valley Winter Road. The development includes the following components:

- Construction of a 321 km all-season gravel highway from Wrigley to Norman Wells;
- Construction of watercourse crossing structures;
- Construction and operation of temporary and permanent borrow sources;
- Construction and operation of permanent highway maintenance areas;
- Construction and operation of temporary support infrastructure and workspaces including, camps and laydown and staging areas;
- Ongoing highway operations and maintenance; and
- Reclamation of areas not required for ongoing operations.

The Project will pass through the Dehcho Territory and a portion of the Tulita District of the Sahtu Settlement Area (SSA) within the Northwest Territories (NWT). Figure 1-1 illustrates the route of the proposed MVH. Table 1-1 illustrates the length of the proposed Project in each of these regions.

The MVH will be operated and maintained as part of the NWT Public Highway System.



Sources: Base Data - Her Majesty Government of Canada. Thematic Data - ERBC

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Proposed Mackenzie Valley Highway Alignment

MACKENZIE VALLEY HIGHWAY

Figure 1-1

Table 1-1 Mackenzie Valley Highway Route Segment Lengths

Region	MVH KM Post	Length (km)
Dehcho (Wrigley to Sahtu Settlement Area (SSA) Boundary)	690 to 796	106
Tulita District (SSA Boundary to Tulita)	796 - 936	140
Tulita District (Tulita to Norman Wells)	936 to 1011	75
Total		**321**

1.2 Project Approvals

The proposed Project will be constructed on Territorial Lands, Commissioner's Lands and Private lands as identified in the Sahtu Dene and Métis Comprehensive Land Claim Agreement (SDMCCLA). Anticipated project activities requiring approvals and the associated approval agencies are illustrated in Table 1-2.

Table 1-2 Construction Activities and Agency with Jurisdiction - Mackenzie Valley Highway

Project Activities	Approval Agency
Pre- Construction Phase	
Environmental Baseline Studies Programs	Aurora Research Institute
Wildlife Baseline Studies	GNWT Department of Environment and Natural Resources
Fisheries Baseline Studies	Fisheries and Oceans Canada
Archaeological Field Investigations	GNWT Prince of Wales Northern Heritage Centre
Geotechnical Investigations	Mackenzie Valley Land and Water Board
Thermal Analysis	Mackenzie Valley Land and Water Board
Topographic Studies	Mackenzie Valley Land and Water Board
Hydrographical Studies	Mackenzie Valley Land and Water Board
Detailed Design	Mackenzie Valley Land and Water Board
Construction Phase	
Rights to access land	Tulita District Land Corporation GNWT Department. of Lands
Camps and staging areas	Mackenzie Valley Land and Water Board
Right-of-way clearing/winter road/detour construction	Mackenzie Valley Land and Water Board

Table 1-2 Construction Activities and Agency with Jurisdiction - Mackenzie Valley Highway

Project Activities	Approval Agency
Pre- Construction Phase	
Borrow source and access road development	GNWT Department. of Lands Tulita District Land Corporation Mackenzie Valley Land and Water Board
Watercourse crossing construction	Fisheries and Oceans Mackenzie Valley Land and Water Board
Embankment construction	Mackenzie Valley Land and Water Board

2 PROJECT BACKGROUND

2.1 Introduction

The concept of building an all-weather highway through the Mackenzie Valley to connect southern Canada with northern communities originated in the 1960s, although it was not until 1972 that the federal government announced that the Mackenzie Highway would be extended from Fort Simpson to the Dempster Highway. Field surveys and design work for the route was initiated and construction of the highway started in Fort Simpson but was halted approximately 18 km south of Wrigley in 1977, after 210 km were completed. Following devolution of responsibility for the highway system from the federal government, the GNWT developed its Highway Strategy in 1989 committing to the extension of the MVH. By 1994, the remaining 18 km of the highway to Wrigley was completed. Preliminary engineering, environmental and financial studies to support planning for the construction of the remainder of the MVH to Inuvik were undertaken in 1999. More recently, between 2010 and 2012 the DOT GNWT entered in to agreements with Aboriginal organizations in the Tulita District of the Sahtu Settlement Area (SSA) and the Dehcho Region to prepare Project Description Reports (PDRs) which evaluated environmental conditions, included community consultations and presented a preliminary design and routing for the MVH (5658 NWT Ltd., and Govt. Northwest Territories, 2011 and Pehdzeh Ki First Nation and Govt. Northwest Territories, 2011).

The project description presented in this report has considered the results of these past studies and the vast experience of DOT in planning, constructing and operating highways throughout the NWT.

2.2 Purpose of the MVH Project

The vision of an all-weather highway through the Mackenzie Valley to the Arctic Coast has been considered a strategic priority for Canada as far back as 1958 by the federal government. This road was seen as the final link to connect Canada from coast to coast to coast. This vision has been recently restated in a number of GNWT strategic documents, including the Department of Transportation's 2000 Highway Strategy, *Investing in Roads for People and the Economy: A Highway Strategy for the Northwest Territories*, and two funding proposals in pursuit of this vision, *Corridors for Canada* and *Corridors for Canada II*. Connecting Canada to the Arctic coast is also important to the socioeconomic future of Canada. The completion of the Mackenzie Valley Highway to the Arctic coast will provide enormous opportunities for residents of the Northwest Territories and all Canadians. Its completion is a cornerstone of the GNWT's plan for present and future economic development in the NWT. While the GNWT is committed to extending the MVH to the Dempster Highway and is currently constructing an all-weather road between Inuvik and Tuktoyaktuk, fiscal constraints limit the current proposal to extending the highway to Norman Wells.

Construction of the highway from Wrigley to Norman Wells is consistent with the GNWT's vision and is intended to provide the following specific benefits:

- provide a year round transportation link connecting the central Mackenzie Valley with the Northwest Territories all – weather highway system and southern Canada;
- decrease the cost of living for residents by increasing access to goods and services;
- increase access to health care, educational resources, and employment opportunities;
- enable opportunities for communities and families to interact and share social and cultural connections and participate in recreational and sporting activities;
- support resource exploration, development, and production to stimulate the regional economy;
- mitigate effects of climate change on the current winter road system;
- create tourism and hospitality opportunities;
- reduce the cost of delivering government services; and
- delivery of government's commitment to economic development in the NWT.

2.3 Proponent

The GNWT will act as the proponent, coordinating the involvement of other potential partners in the development of the Project. Contact information for the GNWT is provided below.

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3 DEVELOPMENT SCOPE

The proposed Project includes the construction of an all-weather highway between the communities of Wrigley and Norman Wells. The development includes the following components:

- Construction of 321 km all-season gravel highway from Wrigley to Norman Wells;
- Construction of watercourse crossing structures;
- Construction and operation of temporary and permanent borrow sources;
- Construction of permanent highway maintenance areas;
- Construction and operation of temporary support infrastructure and workspaces including, camps; laydown and staging areas; and
- Reclamation of areas not required once construction is completed.

Operation and maintenance of the highway will occur, but are not considered to be within the scope of development subject to assessment. Section 13, Schedule 1 of the Exemption List Regulations, issued under authority of the *Mackenzie Valley Resource Management Act* exempt "operation and maintenance of a highway" from Preliminary Screening because their impact on the environment is considered insignificant.

During preparation of the regional PDRs, installation of a fibre optic cable in the highway Right of Way was initially included as a project component. It is no longer a component of the MVH project proposal.

Planned improvements to the Mackenzie Valley Winter Road (MVWR) are not included in the scope of this project. Only those works which contribute to the construction of the all-weather MVH are intended to be included within the scope of the development subject to environmental assessment. Because the MVWR provides ongoing and critical access for residents and businesses along the Mackenzie Valley, maintenance and/or repair work may need to be undertaken during the course of the MVH's environmental assessment.

3.1 Development Location

The proposed Project is located in the Mackenzie Valley region of the NWT, between Norman Wells in the north and the terminus of the all-weather highway at Wrigley in the south (Figure 1-1). The coordinates of the segments of the Project in each of the settlement regions are presented in Table 3-1.

Table 3-1 Development Location

Project Feature	KM	Latitude (N)	Longitude (W)
Norman Wells (north end)	1011	65°17'34"	126°44'11"
Boundary of Sahtu Settlement Area - Tulita District and Dehcho Region	796	64°01'08"	123°28'44"
Wrigley (south end)	690	63°13'58"	124°16'26"

3.2 MVH Alignment

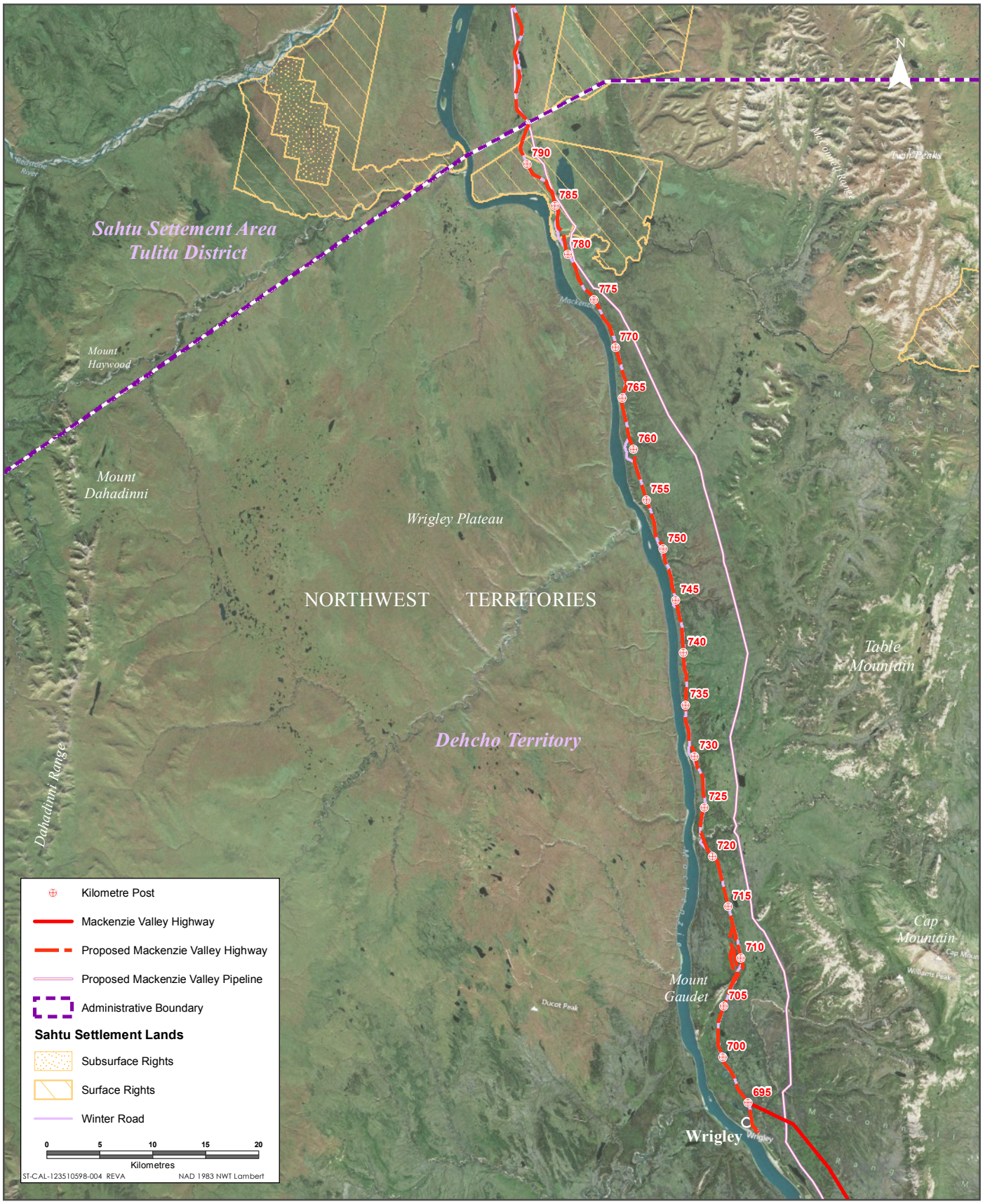
Several potential alignments for the Project had been identified prior to initiation of the most recent routing studies in 2010. These included the original Public Works Canada (PWC) alignment identified in the 1970s, the existing winter road alignment between Wrigley and Norman Wells and the approved Mackenzie Gas Project (MGP) corridor (IORVL 2004).

Studies in 2010 were undertaken which contributed additional options for identifying a preliminary alignment and site-specific alternatives. Available information was used by the authors of the recent PDRs in initial desktop routing studies to suggest a preliminary alignment, minor alternatives, potential watercourse crossing locations and potential borrow material sources, based on the following objectives:

- Utilize the existing winter road alignment from Wrigley to Norman Wells as much as practicable;
- Minimize footprint through traditional use, conservation and special management areas;
- Avoid known potential ice rich and unstable terrain;
- Avoid steep grades and deep valleys;
- Optimize bridge lengths;
- Avoid locations with cultural or heritage resources potential;
- Situate the route on or near potential borrow sources to minimize the need and/or length of temporary or permanent access roads; and
- Optimize natural topography to minimize construction material requirements.

The preliminary alignment and site-specific alignment options were also conditioned by the findings of engineering analysis, previously conducted field study records and overview planning studies, and comments received during consultations.

The two PDRs initiated in 2010 ultimately proposed the alignment shown in Figure 1-1, and again in Figures 3-1 and 3-2. These alignments are subject to further analysis and ground truthing during the detailed design process.



Sources: Base Data - Her Majesty Government of Canada. Thematic Data - ERBC. Imagery provided by Microsoft BING

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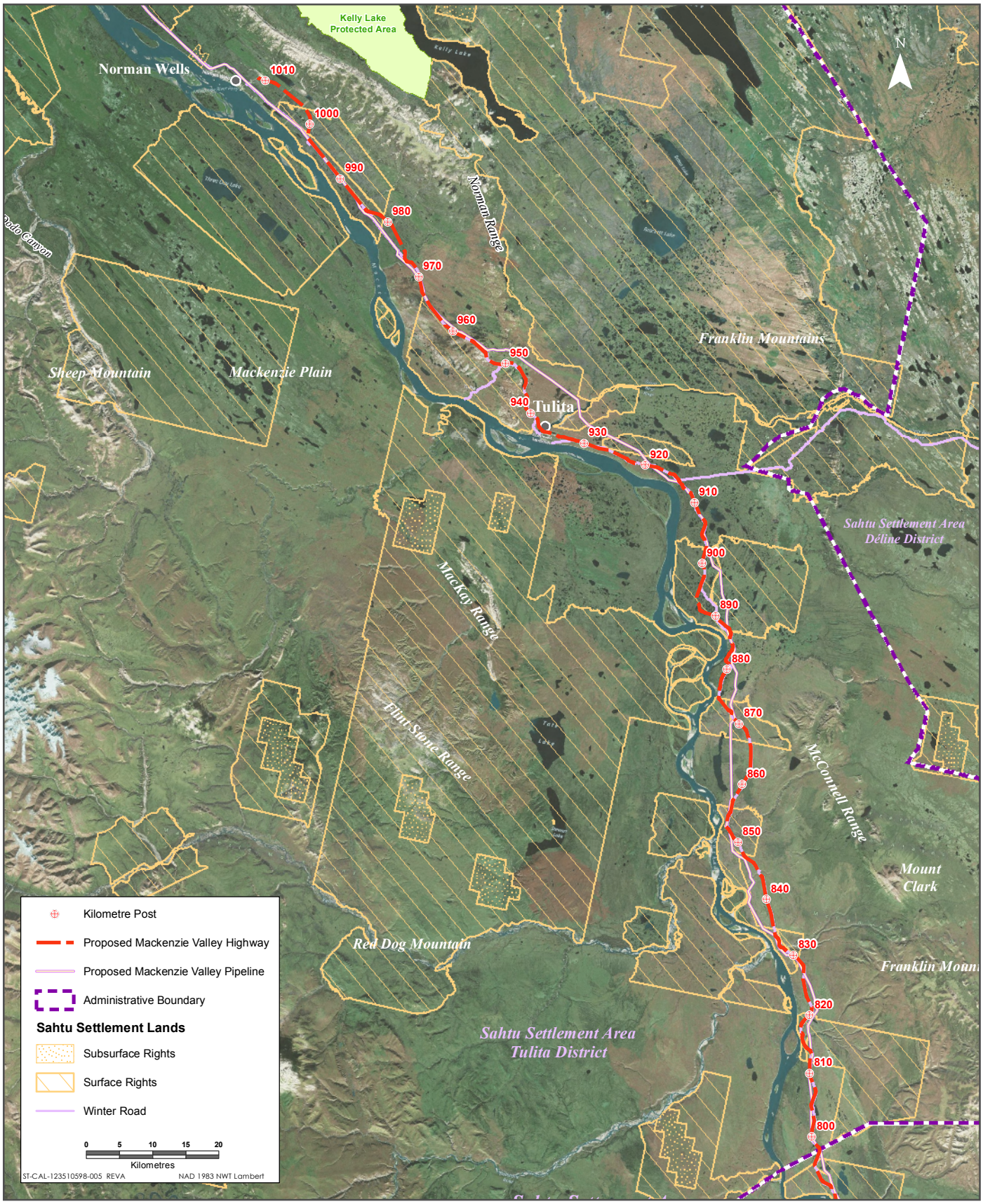
Northwest Territories
MACKENZIE VALLEY HIGHWAY

Dehcho Region Alignment

Figure 3-1



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Sahtu Settlement Area - Tulita District Alignment

Northwest Territories

MACKENZIE VALLEY HIGHWAY

Figure 3-2

3.3 Design Considerations

The route and operational design of the Project is guided by:

- safety requirements;
- engineering and environmental considerations; and
- incorporation of local and traditional knowledge.

The design of the Project takes into consideration and makes considerable use of data and information collected during the planning of the Mackenzie Gas Project.

3.3.1 Design Parameters

The RAU-90 design designation, approved by the GNWT (TAC 2010) has been applied during routing and design analysis. This design standard is considered to be appropriate for passenger and commercial traffic volumes of up to 100 vehicles per day (vpd)[1], well above the estimated traffic volumes for the highway of 50 vpd (including estimated future increases due to development and tourism)[2]. The design criteria may be reduced in some areas where the existing terrain and soil conditions constrain the design alignment of the Project.

The right-of-way (ROW) will be limited to 60 m in width, except where large cut and fill sections will be required. The road surface will average 9 m in width and range in depth. Standard embankment widths and depths may be altered to accommodate site specific conditions. The posted speed limit will be 80 km per hour with advisory speed posted where the design standards have been reduced.

3.3.2 Site Specific Considerations

Site specific design exceptions and operation controls (e.g. reduction in posted speed limits) will be required in some locations to address challenges presented by terrain conditions. Analysis undertaken during preparation of the PDRs has identified several locations where operational controls may be required; however, further analysis will be undertaken during future design activities. There may be design exceptions such as horizontal curves, vertical curves, speeds and grades.

3.3.3 Incorporation of Traditional Knowledge

The DOT continues to take into account traditional knowledge in truthing the footprint suggested in the various preliminary design options, included in previously conducted studies, and as communicated during Project-specific consultations.

[1] RAU 90 Geometric Design Guidelines, Transportation Association of Canada

[2] Project Description Report for the Construction of the Mackenzie Valley Highway, Tulita District, Sahtu Settlement Area

In the Sahtu Settlement Area - Tulita District, traditional knowledge was obtained from the draft Sahtu Land Use Plan (SLUPB 2010)[3], Rakekee Gok'e Godi: Places We Take Care Of (Sahtu Heritage Places and Sites Joint Working Group 2000), Spirit of the Mountains: Shuhtagot'ine Nene and Naats'ihch'oh Traditional Knowledge Study (SENES 2009), Traditional Knowledge Study Report: Great Bear River Bridge (EBA 2006), Mackenzie Gas Project Environmental Impact Statement (IOL et al., 2004), and in project specific consultations July 2010, March 2011 and October 2011.

Traditional knowledge collected during development of the PDRs informed the preliminary design with respect to:

- The location of cultural, wildlife and harvesting areas;
- Proposing areas of potentially sensitive terrain; and
- Identifying potential mitigations;

Traditional knowledge holders will continue to be engaged during subsequent Project phases.

3.4 Development Phases and Schedule

Project activities can be summarized by two phases: pre-construction and construction. It should also be mentioned that the highway will be subject to operation and maintenance activities once it is completed. Subject to regulatory approval and confirmation of federal funding, construction could start in mid-2017 and continue to 2022. It is currently proposed that construction will progress concurrently from both ends of the Project. A procurement process for this Project has not been determined.

3.4.1 Pre- Construction: Supplemental Baseline Collection, Ground Truthing, Detailed Design Production, Construction Planning

Pre-construction activities required during this stage are focused on collecting the data that is necessary to support the subsequent submission of the MVH project to regulatory processes. The work identified below will contribute specific and directly relevant data to the detailed design, construction planning and assessment of potential effects of the project. Specifically, this would include:

- Environmental baseline studies;
- Hydrotechnical investigations at watercourse crossings;
- Thermal Analysis;
- Topographical Analysis;
- Detailed highway and bridge design;
- Geotechnical investigations along the route and at borrow sources;
- Development of monitoring and management plans;

[3] The Sahtu Land Use Plan was approved in August 2013.

- Acquisition of project permits and authorizations; and
- Tendering of construction and supply contracts.

3.4.2 Construction

The construction phase includes:

- ROW clearing;
- Offsite fabrication of bridge components and mobilization;
- Development of supporting infrastructure such as camps, workspaces and staging areas, and fuel storage areas;
- Construction and operation of borrow sources;
- Embankment construction;
- Construction of watercourse crossing structures; and
- Reclamation of abandoned sites after the alignment is ready for traffic (year one or two of operation).

Certain construction activities, such as borrow source development and staging will occur year-round, but some activities including, winter road and highway embankment construction will occur primarily in winter and continue over a four year period. Construction activities and timing are summarized in Table 3-2; further detail is provided in Section 3.5.

Table 3-2 Development Activities and Timing *

Project Activity	Start	Duration
Pre-Development Phase		
Site investigations and assessment (such as environmental studies and engineering, geotechnical investigations, thermal analysis, hydrographical analysis and topographical analysis.)	Winter 2014/15 and 2015/16	2 years
Ongoing public engagement	May 2010	All phases
Environmental Assessment	February 2014	3 years
Detailed design and permitting	Fall 2014	2 years
Completion of Access and Benefits Agreements	Spring 2015	1 year
Construction Contracting and Procurement	2017	During construction
Construction Phase		
Right-of-way clearing	2017	3 years
Development and operation of camps, barge landings, staging areas and temporary workspaces	Fall 2017	Ongoing through construction
Mobilization/demobilization	Summer 2017	4 years
Borrow source development	Fall 2017	4 years

Table 3-2 Development Activities and Timing *

Project Activity	Start	Duration
Installation of watercourse crossing structures	January 2017	4 years
Embankment construction	Winter 2018	4 years
Compaction and surfacing	June 2018	4 years (summer)
Reclamation of abandoned sites after the alignment is ready for traffic (year one or two of operation)	Year 2	4 – 5 years
NOTE: * Timing is subject to completion of EA and receipt of federal funding		

3.4.3 Operation and Maintenance

The operations phase includes ongoing maintenance and repair activities to support highway operation. Operation and maintenance activities will be conducted year-round and as noted in Section 3 are not considered to fall within the scope of the assessment.

3.5 Highway Construction Approach

Construction activities for the MVH will occur year round; however, many activities will be undertaken during winter, depending on the results of thermal analysis. The advantages of winter (December-March) construction are as follows:

- The Project can be accessed using temporary ice roads or snow trails, without the need to construct costly all-weather access roads;
- Winter construction allows the placement of construction material directly onto frozen ground. This approach enables the establishment of a frozen core for the Highway and helps protect sensitive and ice rich terrain; and
- Winter construction reduces effects on wildlife, vegetation and soils;

Winter construction has the following disadvantages:

- Work is challenging for both personnel and equipment, with extreme cold temperatures common at the beginning of the construction season in late December and early January;
- Activities are conducted in periods of minimal daylight;
- Excavation of frozen material in borrow sources will likely require the use of drill and blast methods to be able to source the required volumes of material for construction;
- Excavation and placement of frozen material directly on top of geotextile placed on the natural ground makes it more difficult to achieve compaction of the embankment layers; and
- Potential sensory and physical disturbance to over-wintering wildlife.

Although much of the construction may be executed during winter, it is expected that summer and fall construction will be feasible for some activities, especially in areas where permafrost is not present. With construction expected to be completed over a 4 year period, approximately 3-5 construction spreads will be active in any given year depending on the method of procurement used.

Table 3-3 summarizes the seasonality of proposed construction activities.

Table 3-3 Seasonality of MVH Project Construction Activities

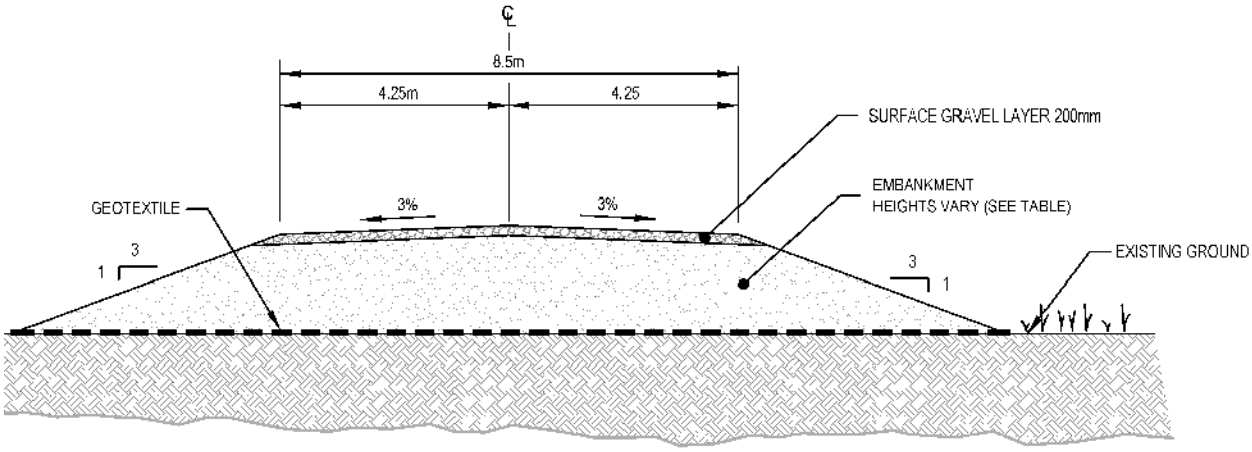
Season	Activities
December-January	Clearing of right-of-way and construction of winter roads; camp set up and mobilization
January-March	Borrow source development; clearing; hauling and embankment construction, mobilization to bridge sites and piling for bridge abutments; erection of bridge piers and abutments, culvert installation
April-June	No activities requiring access off of previously constructed all-weather roadways. Could include production and stockpiling of borrow material assuming equipment has been mobilized to the particular borrow source
July-November	Any activity that does not require overland access or can be accessed by previously constructed segments of the Highway. Could include compaction of previously constructed embankment and placement of surfacing material (if feasible based on geotechnical conditions -amount of thaw and moisture content of material); culvert installation, borrow material processing, launching of bridge girders and deck components mobilization on all-weather roads and/or river barge.

3.5.1 Embankment Construction

The highway embankment construction methods will vary according to a number of factors including the presence of permafrost, ice rich soils, bedrock and other terrain features. The embankment is primarily expected to be constructed using a fill approach; however, a cut-and-fill approach may be utilized in areas where terrain conditions will impact the highway's vertical or horizontal alignment. A generalized highway cross-section based on the fill approach is illustrated in Figure 3-3.

Embankment designs will be finalized during detailed design, following completion of detailed geotechnical investigations and topographical survey. Final embankment designs will be selected to prevent or minimize the expansion of the active layer under the embankment and will take into account predictions of ice content, as well as local terrain and permafrost characteristics.

Right-of-way clearing, geotextile and fill placement will primarily occur in winter but may also be completed during summer depending on the presence of permafrost. Embankment compaction, grading, and surfacing, and base course placement will occur in summer. Where cut-and-fill construction is required, stripping and removal of organic material, and drilling and blasting of rock may occur in summer or winter. Hauling, placement, and compaction of base course will occur in summer. Other site-specific activities, such as bedrock material stockpiling, placement of riprap, infill or low-lying areas or construction of other erosion control mitigation may occur year-round depending on site characteristics and access considerations.



TYPICAL HIGHWAY CROSS SECTION

TERRAIN TYPE	DESCRIPTION	EMBANKMENT HEIGHTS
1	DRY (ICE POOR) TILL AND OUTWASH DEPOSITS	1.4 m
2	WET (ICE-MEDIUM TO ICE-RICH) TILL AND OUTWASH DEPOSITS	1.4 to 1.6 m
3	WET SILTS AND CLAYS (ICE-RICH)	1.6 to 1.8 m
4	THICK ORGANIC PEATLANDS AND ICE-RICH PERMAFROST	1.8 m

ST-CAL-123510598-003 REVA

Sources: Base Data - Her Majesty Government of Canada. Thematic Data - ERBC

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Northwest Territories

MACKENZIE VALLEY HIGHWAY

Typical Embankment Cross Section

Figure 3-3

3.5.2 Watercourse Crossings

The proposed route will cross a number of watercourses requiring construction of bridges or culverts. At this time, detailed investigations of watercourse crossings have not been conducted to confirm the total number and type of watercourse crossings; however, it is anticipated that there are over 300 minor crossings and approximately 40 major crossings. Structures have already been constructed across some of these crossings. some of which already have structures. The final number and location of crossings are subject to change following completion of hydro-technical analysis and detailed design.

3.5.3 Borrow Sources

Granular materials will be required for embankment construction, construction of temporary support facilities and permanent maintenance areas required during the operations phase. Estimated granular quantities for the construction phase are provided in Table 3-4 and are based on preliminary design estimates. Material estimates will be defined to a greater level of accuracy during detailed design.

Potential granular material sources have been identified from preliminary studies and existing information. The selection of the borrow sources to be used for development will be refined and truthed through more detailed investigation and design in the pre-construction phase. Borrow source investigations will include geotechnical investigations and acid and leachate testing to confirm quantity and quality of materials, access planning, evaluation of environmental constraints, consultation with landowners and preparation of management plans for those sources proposed for development. A summary of sources identified during the preliminary design stage, as reported in the PDRs for each region, is presented below.

Table 3-4 Estimated Granular Requirements for Construction of the MVH Preliminary Design

Item	Quantity		
	Sahtu Settlement Area - Tulita District	Dehcho	Total
Embankment	7,310,000 m^3	3,780,000 m^3	11,090,000 m^3
Base course	433,000 m^3	220,000 m^3	653,000 m^3
Gravel sub base	1,200,000 m^3	600,000 m^3	1,800,000 m^3

3.5.3.1 Sahtu Settlement Area - Tulita District Segment

Table 3-5 lists the potential borrow sources identified within the Sahtu Settlement Area - Tulita District.

Table 3-5 Potential Borrow Sources in the Sahtu Settlement Area - Tulita District (south of Norman Wells)[4]

Source No.	Offset and Direction from Alignment (km)	Station	Estimated Requirements (m^3)	Estimated Volume of Source (m^3)
9.037PA	0.90 W	796+400	150,901	4,600,000
9.034PB	0.25 W	803+000	321,783	N/A
9.024AP	0.40 NE	815+700	485,386	1,000,000
9.017P	0.80 N	829+600	225,288	2,700,000
9.010PA	0.70 SW	839+300	332,425	N/A
9.002PB	0.80 SW	850+200	303,614	N/A
1788	2.50 E	863+000	460,754	Unknown
1768	0.00	872+400	483,538	Unknown
20.086P	0.25 N	888+800	511,724	11,700,000
1750	0.00	897+000	209,562	Unknown
8.058P	0.50 NE	907+400	262,669	N/A
1746	0.00	912+000	219,553	Unknown
1942	0.00	926+100	277,138	Unknown
1419	1.00 N	934+800	117,065	
1449	0.00	937+700	14,208	Unknown
1428	0.50 S	949+400	415,500	Unknown
7.090P	0.60 NE	962+700	316,333	N/A
1633	0.00	973+600	181,466	Unknown
7.078P	2.70 NE	988+100	239,458	900,000
7.070P	4.50 NE	996+100	219,467	1,000,000
7.057P	0.50 NE	1011+900	299,369	N/A
		Total	6,047,201	21,900,000

[4] Project Description Report for the Construction of the Mackenzie Valley Highway, Tulita District, Sahtu Settlement Area

3.5.3.2 Dehcho Segment

Table 3-6 lists the potential borrow sources identified within the Dehcho Segment of the Project.

Table 3-6 Potential Borrow Sources in the Dehcho Territory[5]

Name	Ownership	Location	Type	Estimated Volume of source (1000 m^3)	Existing?
Primary Sources					
10.043P	Territorial	9 km S of Wrigley	Granular	19,700	Yes
10.030P	Territorial	17 km N of Wrigley	Granular	684	Yes
10.020P	Territorial	31 km N of Wrigley	Granular	1,600	Yes
10.007P	Territorial	56 km N of Wrigley	Granular	1,200	Yes
9.044PB	Territorial	13 km S of boundary	Granular	15,000	Yes
9.044PA					
9.037PB	Territorial	2 km S of boundary	Granular	4,600	Yes
9.037PA					
9.034PB	Territorial	5 km N of boundary	Granular	3,800	Yes
9.034PB					
Secondary Sources					
9.024AP	Private	18 km N of boundary	Granular	1,000	Yes
10.044BP	Territorial	12 km S of Wrigley	Granular	N/A	Yes
10.038PA	Territorial	1 km N of Wrigley	Granular	N/A	No
10.0120P	Territorial	9 km N of Wrigley	Granular	N/A	No
10.037P	Territorial	3 km N of Wrigley	Granular	N/A	No
10.033P	Territorial	12 km N of Wrigley	Granular	N/A	No
10.022P	Territorial	29 km N of Wrigley	Granular	N/A	Yes
10.014AP	Territorial	38 km N of Wrigley	Granular	N/A	No
10.013P	Territorial	43 km N of Wrigley	Quarry	N/A	No
10.014AP	Territorial	38 km N of Wrigley	Granular	N/A	No
10.013P	Territorial	43 km N of Wrigley	Quarry	N/A	No
10.004P	Territorial	27 km S of boundary	Granular	N/A	No
10.003P	Territorial	23 km S of boundary	Granular	N/A	No

[5] Mackenzie Valley Highway Extension Pehdzeh Ki Ndeh – Dehcho Region

Table 3-6 Potential Borrow Sources in the Dehcho Territory[5]

Name	Ownership	Location	Type	Estimated Volume of source (1000 m^3)	Existing?
10.001P	Territorial	17 km S of boundary	Granular	N/A	No
9.091P	Territorial	12 km S of boundary	Granular	N/A	No
9.038PB	Private	6 km S of boundary	Granular	N/A	No
9.038PA	Private	3 km S of boundary	Granular	N/A	No

3.5.4 Support Infrastructure and Activities

Construction of the Project will require a variety of temporary support infrastructure including camps, staging and stockpile areas, access roads, fuel storage and waste disposal sites.

3.5.4.1 Construction Camps and Contractor Maintenance Areas

Temporary construction camps will be required to house workers, and provide project management and maintenance infrastructure. Camps are expected to be located no more than 50 km apart and will be combined with other infrastructure (e.g., borrow sources) to minimize project footprint. Primary camps will accommodate the 150 -180 workers that are likely to be required on a specific construction spread. Pioneer camps accommodating up to 20 workers may be required at specific facilities such as borrow sources and staging areas.

Primary camps are expected to include the following infrastructure and activities: accommodation, offices, maintenance shops, equipment and material storage, fuel storage, helipads, water use, solid waste and wastewater disposal sites.

3.5.4.2 Staging Areas

In addition to storage areas at camps, stockpile sites and staging areas will be required to store equipment and supplies and provide workspaces during construction. Staging areas will be required at strategic locations to provide for efficient mobilization and construction. Potential locations include:

- Intersection of the MVH with the existing all-weather highways to the south;
- Adjacent to existing resupply infrastructure (e.g. communities);
- At borrow sources; and
- At other strategic locations along the proposed route.

The specific location of staging areas will be identified during the detailed design stage.

Staging areas may include:

- Laydown areas for storage of equipment and supplies (culverts, bridge components, geotextiles, etc.);
- Granular material stockpiles;
- Pioneer camps and maintenance facilities;
- Fuel storage areas;
- Waste storage areas; and
- Helicopter pad and access road.

3.5.4.3 Access/Haul Roads

In some locations all-weather access roads may be required to support year round construction. All-weather access roads will be located along the proposed highway footprint as much as possible but may need to be constructed off the right of way to access borrow sites selected for permanent or long-term use.

The driving surface width of any access or haul road will likely be 10 to 20 m. The cleared width required would be approximately 50 m. The specific alignment and type of all access roads will be confirmed in the early stages of detailed design in the development of the Project.

3.5.4.4 Barge Landings

Equipment and supplies may be mobilized to some construction spreads by barge on the Mackenzie River. Laydown areas will be required at barge landing sites to store materials until they can be mobilized to the highway ROW.

Only established barge landing sites will be utilized, including sites in the following communities:

- Norman Wells;
- Tulita; and
- Wrigley.

3.5.4.5 Explosives

Drilling and blasting operations will be required in:

- borrow pits where the granular material is frozen; and
- bedrock cuts and rock quarries.

Explosives used will be primarily ammonium nitrate and diesel fuel (ANFO) with commercial products used for “wet” holes. Storage of ammonium nitrate prills will be on site in a secured location and in accordance with the appropriate legislation and permits.

Drilling and blasting operations will be timed and controlled taking local fisheries, wildlife, and other relevant environmental factors into account.

3.5.4.6 Fuel and Fuel Storage

Fuel will be stored and used by camps and other operations as required. All fuel will be stored in accordance with the Environmental Code of Practice for Aboveground Storage Tank Systems containing Petroleum Products (CCME 2003) and conditions specified in permits and licences. Fuel management plans and emergency spill response plans will be developed prior to project commencement.

3.5.4.7 Water Use

Water will be required for construction of winter roads, to support summer construction activities and for camp use. Specific volumes of water required and potential locations of water sources will be determined during the detailed design stage.

3.5.4.8 Waste Management

Table 3-7 lists the wastes that are expected to be produced during the construction of the Project. Most of the wastes will be those resulting from camps, which are expected to be similar to those of municipal solid waste (MSW) streams. To minimize risks of animal attraction to camps, all food and food contaminated waste will be stored separate from all other wastes in airtight sealed container(s), and enclosed in animal proof containers while in bulk storage prior to final transport, treatment, or disposal. Industrial waste will encompass all other wastes not defined as camp sourced MSW.

Table 3-7 Wastes expected to be Generated

Type of Waste	Description
Camp Wastes	
Recyclable Material	Paper, glass, bottles, cans, metals, certain plastics
Food Contaminated	Biodegradable waste, food and kitchen waste, animal and vegetable wastes: typical of restaurants, hotels, markets, etc.
Composite	Waste clothing, non-recyclable plastics, etc.
Human Waste	Sewage related, black water
Grey water	Kitchen and washing related liquid waste
Industrial Waste	
Recyclable/reusable Construction and Demolition	Building materials, etc.
Non-recyclable Construction and Demolition	Inert material, such as soil and granular material.
Hazardous Materials	Contaminated soil/snow/water, waste fuel, used oil, other crankcase fluids, solvents, glycol, batteries, tank, drum, container rinsings, empty drums

A Waste Management Plan (WMP) will be developed to ensure wastes are handled, stored, transported, and disposed of in a manner that will prevent the unauthorized discharge of contaminants, mitigate impacts to air, land, water, and minimize risks of animal attraction, while maintaining the health and safety of personnel and wildlife. The WMP will address the generation, treatment, transferring, receiving, and disposal of waste materials for the Highway. The WMP will:

- identify waste sources and related types, including but not limited to liquid, solid, non-hazardous, hazardous and approximate quantities;
- describe all on-site or remote treatment and disposal methods;
- describe all waste streams to be transported off site and final disposal locations;
- describe the related waste segregation strategies for the identified waste sources and types to accommodate their respective storage, treatment, transport, and disposal; and
- describe food and food contaminated waste management methods to mitigate animal attraction from source to transport, treatment, or disposal.

NON- HAZARDOUS WASTES

Non-hazardous wastes will be recycled or disposed of in landfills constructed within the development footprint. Wastes will be incinerated prior to disposal in landfills designed and constructed to meet regulatory requirements. Design and operational procedures will limit the total number of landfills established during construction.

HAZARDOUS WASTE

Hazardous waste generated during construction will be stockpiled at staging areas and transported to approved disposal facilities.

Consistent with Environment and Natural Resources' requirements to track the movement of hazardous waste from registered generators, to carriers, to receivers according to the Guideline for the General Management of Hazardous Waste in the NWT, a Hazardous Waste Management Plan (HWMP) will be developed for the Project. The HWMP will encompass all phases of the development and will apply to transporting, storing, handling and disposal of hazardous wastes. The HWMP will include, but will not be limited to:

- identify hazardous waste sources, types, and approximate quantities to be produced (including liquid, solid, dangerous goods and non-dangerous goods);
- description of waste segregation methods;
- description of all on-site treatment and disposal methods; and
- description of all hazardous wastes that will be transported to approved receiving facilities.

WASTEWATER

Camps will generate wastewater in volumes similar to water use. Wastewater will be treated in accordance with applicable legislation and licence requirements. Wastewater treatment will be addressed in the Waste Management Plan.

3.6 Reclamation and Closure

Once the alignment is ready for traffic (year one or two), reclamation of abandoned sites will begin. Closure will be in accordance with permit requirements.