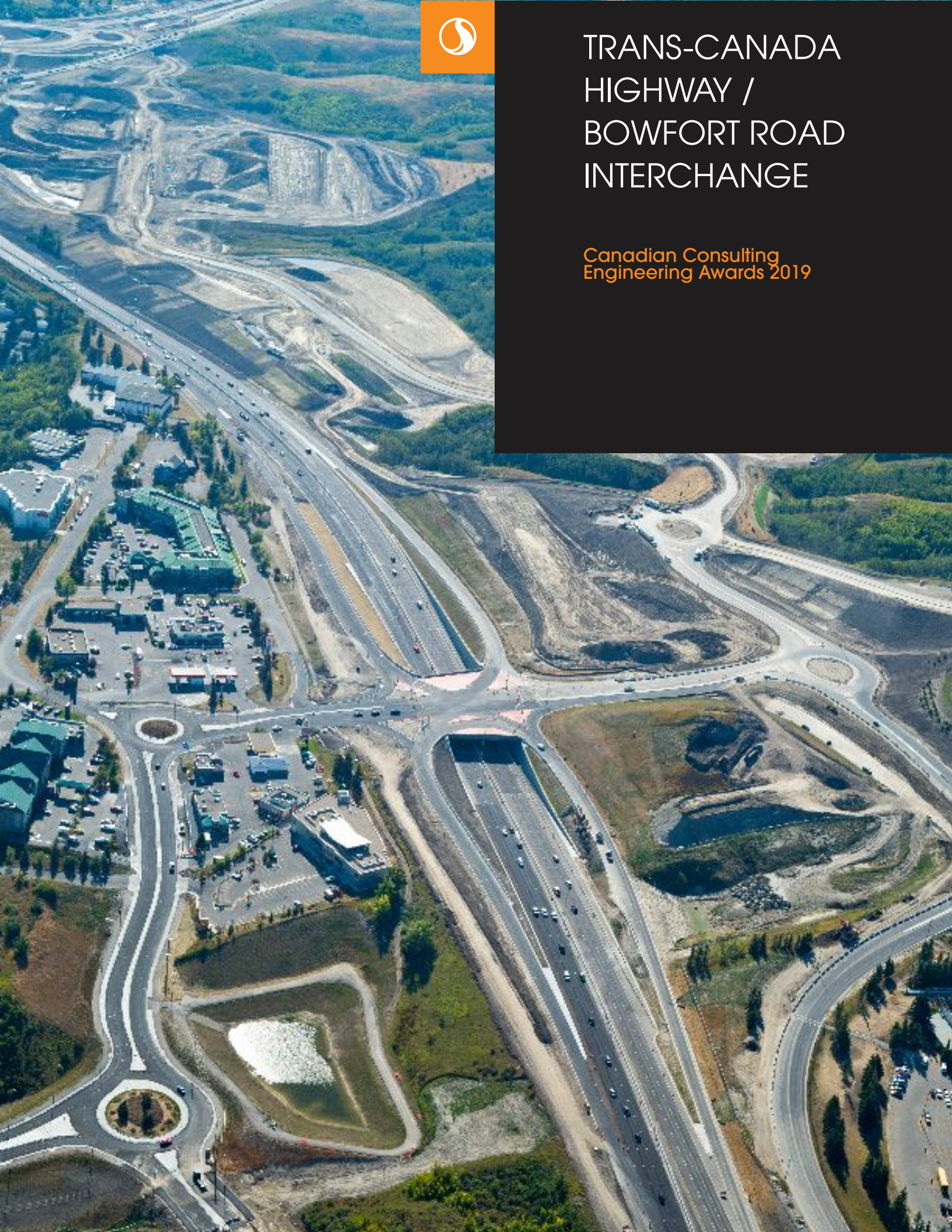




TRANS-CANADA HIGHWAY / BOWFORT ROAD INTERCHANGE

Canadian Consulting
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Introduction

An important link within The City of Calgary’s roadway network, the Trans-Canada Highway passes through the middle of Calgary and is one of the few east-west routes north of downtown that connects the city limits. Prior to this project, the high volume of traffic entering and leaving the west end of Calgary caused a bottleneck for commuters. The Trans-Canada Highway (16th Avenue North) provides a link to provincial and national highway systems. The portion of the highway between the west city limits and Sarcee Trail is the primary entrance for Calgary to and from British Columbia and Rocky Mountain parks. It also serves as a major road servicing WinSport (formerly Canada Olympic Park), a busy recreational area and tourist site to the south, and to businesses and communities north of the highway.

In May of 2014, City of Calgary presented plans to develop a new Trans-Canada Highway and Bowfort Road interchange. Urban Systems was originally engaged by Trinity Development Group to execute the functional planning study for lands to the south, developing design concepts and analyzing the preferred alignment for the interchange.

In April of 2014, Stantec was engaged by The City of Calgary to conduct an independent review and pricing exercise of the functional planning study (including confirming traffic forecasts), and was subsequently in July, awarded the preliminary and detailed design of the interchange. Stantec focused on geometry constraints, constructability and addressing utility conflicts that would be caused by lowering the Trans-Canada Highway by nine meters. An accelerated design and construction schedule was necessary for the opening of the adjacent Trinity Hills development. As part of the preliminary design, a peer review was completed to evaluate the design and constructability to ensure risks such as schedule and cost were mitigated early.

Following the preliminary design, Stantec’s multidisciplinary team completed the detailed design of this challenging and

fast-paced project, including transportation planning and design, structural, electrical, and utility design. Stantec also coordinated the utility relocations for the interchange and roadway upgrades along Bowfort Road and 83rd Street, including two multi-lane roundabouts. Stantec provided environmental services and geotechnical investigations to the environmentally sensitive space along 83th street in the north. Stantec’s scope of work included preliminary design, detailed design, and construction administration and record drawings for and works associated with the interchange and upgrades along Bowfort Road and 83 Street.

Category	Cost
Capital	\$71,700,000
Construction	\$50,100,000
Engineering and Construction Administration	\$6,560,000
Land	Unavailable

After two years of construction, the Interchange officially opened on August 31, 2017, removing the last signalized intersection prior to city limits. The interchange provides Calgarians with better and safer access to businesses and communities in the area, while easing congestion for those entering the City when transitioning from a highway environment to an urban setting. The interchange greatly improves conditions for those traveling west by creating free flow operation, while still providing quality access to businesses that rely on those travelers.

Project Highlights

Q.1 INNOVATION

The previous intersection at Bowfort Road serviced 60,000 vehicles per day with congestion and a single traffic light restricting the flow of traffic. The Bowfort Interchange project increased traffic volume with a new free-flow six lane roadway on the Trans-Canada Highway passes beneath a new grade separation at Bowfort Road.

In addition to improvements to traffic flow, the interchange defines a connection between old and new communities. To the North of Trans-Canada Highway is the community of Bowness (established in the early 1900's) and is one of Calgary's oldest communities. To the south is the WinSport Facility (formally known as Canada Olympic Park), venue of the 1988 Winter Olympics and features the Canada Sports Hall of Fame. Two different developers have begun construction of the new Greenbriar community to the north and the new Trinity Hills community to the south.

The innovation of the project stemmed from a challenging design complimented by forward thinking through constructability to ensure the project could meet an accelerated schedule. On one side of the project was a ski hill, on the other, a river valley. Access to businesses and adjacent land parcels were situated along the existing, below standard Bowfort Road. Two new developments were under construction, relying heavily on an upgraded roadway and interchange. The major requirement of the project was to lower the existing Trans-Canada Highway, with 60,000 vehicles per day, nine meters, only a short distance off the existing roadway. The project schedule for preliminary and detailed design was set at 9 months. This allowed for an 18-month construction schedule, which would coincide the interchange opening with the adjacent Trinity Hills development. Within this time frame, environmental approvals needed to be granted, land purchases and land swap agreements between stakeholders in all four quadrants of the project needed to be attained, coordination with 3rd party utility providers needed occur, and construction tender needed to be prepared that identified a number of these items as being unresolved at the time of tender, without adding additional risk to the City of Calgary. Throughout the whole process, there was a set budget for the project, established several years before the project and concept were developed, that needed to adhere to, without exception.

Execution of design with constructability in mind, is a lost art in the engineering community. We as engineers can design and implement incredible engineering accomplishments. However, those accomplishments typically come at a cost of time and money. For this project, time and money were not available, with construction being one of the biggest risks. Therefore, design with constructability in mind was the only option for this project. To achieve that, you need a team of individuals that have the right experience for the application and the commitment to

deliver on this challenging approach. To further ensure success, it is key to maintain consistency throughout the entire life-cycle of the project.

For this project, the innovative solution to the above challenges was to select a very specific team of local individuals, with specific site and engineering experience, committed to solving the problems at hand. Large infrastructure projects are typically supported by huge teams, with groups working on specific areas of the design. Those designs are then pushed forward to a construction team that has the necessary experience in constructing infrastructure. The team for this project, was built intentionally to support the specific needs of the project.

The lead Project manager, Andrew Vandertol, came out of semi-retirement to lead the project. Andrew had worked on previous planning assignments for this interchange, as early as 1983, 2007, and 2012, and was requested to lead this assignment based on his reputation within the City to deliver fast paced, and complicated projects. The senior engineer, Bill Brownbridge, who was also semi-retired, was brought onto the team based on his reputation of technical excellence, and history of designing and constructing one of the largest underpass projects (GE5) within the City along with his specific experience designing one of the only two existing Single Point Urban Interchanges (SPUI) within the City of Calgary. Those two individuals were supported by one roadway engineer, and three EITs, committed to deliver the project, coordinate designs with all other disciplines and drafters within the outlined schedule.

The above team was successful in delivering the design. The EITs were also involved heavily in design and were placed on site as resident engineers while construction of their original design scope was completed. This assignment was completed under supervision of Stantec's senior construction administration lead, to ensure the intent of the design was followed through and an understanding of how construction occurs in the field. This in-turn provides an ever-lasting benefit to the engineering community as knowledge transfer has occurred between those senior engineers with decades of proven technical excellence on complex project, onto those skillful EITs who were able to exponentially accelerate their knowledge growth.



AERIAL VIEW OF PROJECT
SITE + WINSPORT

Q.2 COMPLEXITY

Compared to conventional interchange projects, the Trans-Canada Highway/Bowfort Road Interchange project presented numerous challenges in the following areas:

- **Geotechnical:** Presence of poor soils in the area that could lead to structural instability for both deep excavations, and large embankment fills. The Stantec geotechnical team performed rigorous analysis for the proposed design and highlighted the areas of risk, during design coordination. Solutions in areas of embankment fills considered light weight fills to mitigate risk, however in the end, monitoring settlement was a more cost-effective approach.
- **Grading:** There was a 44m of ground elevation difference between the north and south side of Trans-Canada highway, with a 9m excavation planned in the middle. City of Calgary's Development and Design Guidelines for Subdivisions (DDGS) and Complete Streets layout specific requirements for construction of new roads. It was important to not only achieve the necessary roadway profiles required across the bridge and new roadways, but also maintain the intent of the design cross section if actual lane widths and curb offsets couldn't be practically achieved.

PHOTOS OF UNDERPASS CONSTRUCTION



- **Traffic Flow:** The flow of traffic at the project location is high (>60,000 vehicles per day), and this volume must be maintained throughout construction of the project. A well-designed detour that maintained the current lane characteristics of Trans-Canada Highway was crucial to the success of construction.
- **Access to WinSport:** WinSport was one of the stakeholders requiring land negotiations, and therefore it was imperative that access to WinSport (and their sporting events) be maintained during the construction of this project. Constant communication with the WinSport representatives were held outlining the future design, and anticipated construction sequencing to gain their trust and cooperation.
- **Stakeholder Coordination:** Presence of multiple stakeholders, with sometimes differing priorities (the City of Calgary, WinSport, business owners, land owners, developers, etc.). An example of this were the two gas stations on either side of Bowfort Road, both required land purchases, and slight modifications to access and trucking operations. Although similar information was provided to both, one negotiation was able to proceed without issue, while the second ended in expropriation of the land, and additional design effort provided to ensure minimal impacts to the site.
- **Local Business Engagement:** Local businesses were constantly concerned about loss of revenue during construction, involving temporary changes to access, or perceived challenges getting in and out of the site. The City endeavored to maintain constant communication with each business owner during the course of construction, to advise them of construction staging and potential changes during construction.
- **Environmental Approvals:** Due to environmentally sensitive areas surrounding the project site a biophysical impact assessment needed to be completed, and Water Act approval obtained prior to the removal of wetland to the north of the TCH. The timeliness of approvals could affect the overall project schedule. In addition, large excavations were occurring adjacent to the Paskapoo Slopes, a site with a previous history of indigenous cultural significance. Sensitivities were required to ensure the proper investigations were completed and communicated prior to construction beginning,
- **Drainage:** All rainwater in the area drains north towards the river. As the north and south sides of the Trans-Canada Highway had different elevations, consideration had to be given to the flow of surface water as we implemented elevation changes. In addition, lowering the Trans-Canada highway 9m created a low-spot in the road, that needed to be drained towards the future pond, 300m away and pipes placed under large embankment fills. Drainage, both across the site, and in the underpass needed to be closely coordinated to ensure it worked around the construction of roadway, utilities, and structures in the area.

Q.3 SOCIAL AND/OR ECONOMIC BENEFITS

PHOTOS SHOWCASING ACCESS IMPROVEMENTS

At the opening event for the interchange, Councilor Ward Sutherland was quoted saying “The interchange is a game-changer for the area,” adding “It makes it easier for people heading to Winsport and the Trinity development to the south, and the businesses and our communities to the north.”

The project resulted in improved traffic flow along a busy corridor which can now accommodate future development within the area. Improvements along Bowfort Road, although minor in comparison to Trans-Canada Highway, provide for continuous flow without signal lights and provide safe and effective access to all the adjacent businesses.

The new complete street corridor through a confined and challenging topography provides safe routes for pedestrians and cyclists. The community that once faced narrow roads and a lack of sidewalks, now benefits from multiple transit stops, easy access to residential communities and businesses, multi-use pathways and bike lanes, clear connections to regional pathways, and pathways on the bridge structure for ease of crossing the expressway. Now there are more choices for how people move around the community, without the heavy reliance on cars.

Stakeholder Coordination

The upgrades to 83 Street and Bowfort Road required extensive coordination with the impacted 3rd party franchise utilities (power, gas, and telecommunications) and Stantec geotechnical, environmental, and storm water management teams. The unique geotechnical and environmental constraints required a balanced, optimized, and constructible design approach that allowed for the staged relocation of many of the existing utilities and minimized impacts to the traveling public. The area of 83 Street had a confined right of way and bordered a naturalized forested area to the east, a designated environmental reserve (ER) to the west, and existing temporary access to a mobile home park that needed to be maintained. Options for construction were limited and required a staged road closure approach to allow for the significant change in grade and widening. Two stages were required to accommodate traffic and access during construction, which required several public information sessions, and communications, as it would impact transit routing, connections for school buses, and access from Bowness to the existing businesses along Bowfort Road. Primarily facilitated by the City of Calgary, the Stantec team supported communication efforts by providing the necessary routing alternatives, and updates on construction timelines.



Added Value

The value our team added to the project was experience and a complete understanding of the area and the requirements of design and construction. The project manager was experienced on fast paced and challenging projects. The overall design of the interchange was lead by an engineer with countless years of experience in interchange design. Design of the roundabouts were led by a designer with over a decade of experience designing and constructing roundabouts on slower speed roads requiring access to businesses. All complicated design solutions were vetted through an experienced construction engineer with consideration as to how a contractor would approach construction. Finally, detour and staging elements for the project were considered equal to that of the overall interchange improvements and approached at the same level importance throughout the project.

Q.4 ENVIRONMENTAL BENEFITS

Drainage through the area and project site was established decades ago with the construction of the Trans-Canada highway. During that time, regulations for capturing storm water and minimizing direct drainage flows into the river were not considered. A key element to this project was to successfully capture storm run-off within and contributing to the project area, and then collect it within a storm pond that would not only control the rate of flow from the site, but also provide enhanced water quality being discharged into the system downstream of the project. Through design and construction of the storm pond, it was essential that the project team, maintain and respect the designated environmental reserve within and adjacent to the project site along Bowfort and 83 Street.

During construction, the project site was considered by the City to have the highest potential release of contaminants (silt and sediment) towards the river, due to the open excavation and natural water course through the project site. We were pleased to announce that throughout the construction, and through many inspections by the City, the project team and contractor were able to successfully control that risk and contain all sediments on site.

Additional environment considerations included maintaining the majority of earthwork material on site. This included a level of balanced cuts and fills for earthworks, but also included successfully negotiation the placement of material within the adjacent Trinity Hills development, to minimize hauling of material large distances from the project site.

One of the more powerful environmental applications of the project was the introduction facilities catering to active mode. These include the design and construction of multi-use pathways, sidewalks, transit facilities and bicycle lanes. Previously the area fell short of these amenities, making access through the area and to local businesses challenging. The new facilities promote safe and accessible options for walking, running, cycling or riding transit, providing alternatives for users to reduce the overall carbon footprint for those living in the surrounding communities.

Environmental approvals

Environmental approvals were needed to allow construction of the interchange to occur. Thorough historical resource studies and biological impact assessments were completed to minimize requirements for further studies prior to construction. To alleviate drainage concerns and address the fill requirements on the north's side, a new storm water pond was proposed five meters above an existing wetland, requiring water act approvals prior to proceeding with construction in this area. This was identified as a critical risk during preliminary design due to approvals by Alberta Environment taking between 9 - 15 months and applied for early in the design phase of the project, with the understanding that approvals still wouldn't be granted until after construction had begun. It was essential to have a plan in place for the contractor to stage his work accordingly, without being held up for approvals.

The site was adjacent to Paskapoo Slopes, which was cited to have areas of indigenous cultural significance and wildlife present. A ravine on the south side of Trans-Canda Highway conveyed drainage through deep culverts under the roadway to the north, and into an existing wetland, surrounded by areas of designated municipal and environmental reserve. The ravine and culverts also conveyed a large portion of the drainage and run off from the WinSport facility down the 83 Street right of way, and through the planned construction site. A thorough Biophysical Assessment was completed, with the understanding that the wetland would need to be removed for future construction of a storm pond. Applications to Alberta Environment were submitted with regular follow up to ensure questions or comments could be resolved quickly without delay of application approvals.



PHOTO OF RAVINE EXCAVATION FOR UTILITIES









