

**From:** Carrier Daniel  
**Sent:** 2016-09-02 11:12:37 PM  
**To:** Makrogianoudis Konstantin  
**Cc:** Bourbeau Luc; Mavromatis William; Heldsinger Michael; Cote Dave  
**Subject:** Andritz CHR010 Cost Narrative R0.docx

**Attachments:** [Andritz CHR010 Cost Narrative R0.docx](#)

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Kosta (and team),

Please find attached the current rev0 of our CHR010 cost narrative. Kosta – this is just a consolidated version of the separate chapter files your sent me yesterday – without the Gantt chart in section 1. We will need to incorporate the updated Canmec portion on Tuesday.

Thanks and have a good weekend everyone.

daniel

**Email Header:**

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Date: Fri, 2 Sep 2016 23:12:37 -0400  
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X-Priority: Normal  
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by atlsms571.andritz.com ([143.161.171.11]) with mapi id 14.03.0301.000;  
Fri, 2 Sep 2016 23:12:41 -0400  
CC: Bourbeau Luc; Mavromatis William; Heldsinger Michael; Cote Dave  
Thread-Topic: Andritz CHR010 Cost Narrative R0.docx  
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TO: Makrogianoudis Konstantin;  
From: "Carrier Daniel" <Daniel>  
CKX-Bounce-Address: Daniel  
Subject: Andritz CHR010 Cost Narrative R0.docx

**SUPPLY AND INSTALL AGREEMENT**

**LOWER CHURCHILL PROJECT**

**MUSKRAT FALLS HYDROELECTRIC DEVELOPMENT**

**AGREEMENT NO.: CH0032-01**

**CO-010: ACCELERATION OF SPILLWAY INSTALLATION SCHEDULE**

**PRESENTED BY**

**ANDRITZ HYDRO CANADA INC.**

September 2016

*All information provided within this document is provided on a without prejudice basis, in the context of negotiations with the sole objective of reaching a resolution to this dispute.*

**VOLUME I: ESTABLISHMENT OF ACCELERATION COSTS FOR SPILLWAY  
INSTALLATION**

**Privileged and confidential**

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**SECTION 1: THE CONTEXT****1.1 The Project**

On December 7, 2012, Muskrat Falls Corporation (the Company) issued a call for tenders for the supply and installation of spillway and powerhouse hydro-mechanical equipment at the Lower Churchill project (the Project).

More specifically, the Project (the Works) consisted of the design, procurement, manufacturing, transportation, installation and commissioning of the following components:

- Spillway gates & hoists
- Spillway stoplogs
- Spillway towers & hoist houses
- Spillway electrical building
- Trash rack cleaning machine
- Intake gates & hoists
- Draft tube crane
- Intake trash racks
- Draft tube gates
- Bulkhead gate

Andritz Hydro Canada Inc. (Andritz or the Contractor) was found to be the lowest successful bidder at a price of \$204,938,732. On December 18, 2013, the Company and the Contractor entered into Agreement No. CH0032-01 for the performance of the Project works (the Agreement).

## 1.2 Company and Contractor original schedule obligations for spillway installation

Based on Exhibit 9 of the Agreement, the portion of the Works associated with the installation of the spillway hydro-mechanical equipment was to be performed in accordance with the following milestone dates:

- Milestone I1A (upstream of spillway ready for start of hydro-mechanical works) on February 16, 2015. This Milestone represents an obligation for Company to release the upstream channel to Contractor for execution of the Work associated with the upstream guides' installation and concreting.
- Milestone I1B (downstream of spillway ready for start of hydro-mechanical works) on August 1, 2015. This Milestone represents an obligation for Company to release the downstream area to Contractor for execution of the Work associated with the downstream stoplog guides, gates and hoists installation.
- Milestone M4 (spillway all hydro-mechanical and electrical system, including Trash Cleaner hoist, commissioned and ready for river diversion) on February 13, 2016. This Milestone represents an obligation for Contractor to complete the Work associated with the spillway hydro-mechanical and electrical systems during the period between the release of the areas associated with Milestones I1A / I1B and Milestone M4.

Therefore, the date for *“upstream of spillway ready for start of hydro-mechanical works”* was to be February 16, 2015 and the completion of these works was planned for February 13, 2016.

## 1.3 Company's failure to meet its schedule obligations

The upstream civil works which were being performed under the responsibility of Company and being executed by Company's Civil Contractor incurred a major delay. Accordingly, the *“ready for start date of hydro-mechanical equipment installation”* at the spillway did not occur until November 1, 2015, or 258 days later than contractually required (February 16, 2015) by Milestone I1A. This delayed start also had the effect of prolonging the planned work durations due to the seasonal changes and its effect on the work



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throughput, resulting in 100 days of impact to the original 363 day duration to complete the work for the M4 milestone. The result of both the delayed start and changed work conditions therefore result in an overall consolidated impact to the M4 milestone of 358 days, thereby pushing the completion date for this Control Schedule milestone to Feb 8<sup>th</sup> 2017.

In order to mitigate the Company's own delay to the completion of the M4 milestone, Company requested Andritz to develop a proposal to accelerate this portion of the Works in order to achieve Company's ready for River Diversion in the summer of 2016. More specifically Company unilaterally issued the target date of June 15 2016 for Andritz to achieve "Ready for River diversion". In response to this request, Andritz proposed changes to its execution plan and a cost estimate for the additional effort required to implement the significant acceleration measures aimed at recovering from the 358 day delay to completion of the spillway, which would help Company achieve this goal. The parties failed to reach commercial agreement for this change and consequently, Company unilaterally imposed a directive under change order No. 10 (CO-010) on November 10, 2015, almost 2 weeks after the start of the work, specifically instructing the following:

*"Company directs Contractor to accelerate the installation of the spillway hydro-mechanical equipment, in accordance Attachment 1, Scope of Work Partial Completion Ready for River Diversion, to meet the river diversion requirements on/or before 15 June 2016. This change order covers all additional costs for the acceleration of Andritz's baseline schedule installation logic and durations, including but not limited to the costs for:*

- 1. Increased staff, supervision, and indirect expenses;*
- 2. Additional labour, including sub-contractor costs and overtime;*
- 3. Additional small tools, PPE and consumables;*
- 4. Additional equipment hours; and*
- 5. Lost productivity due to winter working conditions and all other productivity impacts associated with the acceleration.*

*Payment to cover the cost of the acceleration shall be on a lump sum basis and shall be made progressively based on the physical progress of the Work. If completion of the installation of the spillway hydro-mechanical equipment for river diversion is achieved on/or before 15 June 2016, Company will issue a separate Change Order to pay Contractor an incentive payment of \$2,000,000. If Contractor fails to achieve the date of 15 June 2016 for any reason whatsoever, Company will have no obligation to make the incentive payment. This incentive payment is in addition to the Incentive Payment set forth in Section 11.2, Item No. 1, of Exhibit 2 to the Agreement.*

Andritz disagreed with this unilateral directive in many respects, including the price and completion date for river diversion set by Company. Andritz promptly informed Company as such, reserving all its rights, while immediately putting forth all reasonable efforts to implement the directed acceleration measures. In the absence of an agreed price and any commercial terms in advance of performing the works, Andritz also informed Company that it would be tracking and submitting all actual costs resulting from this change for reimbursement, on a monthly basis. Such invoicing continues as of September 2016.

#### **1.4 The impact of the acceleration directive on Andritz' execution plan**

Company's directive to accelerate the spillway works led directly to the implementation of specific measures which represent quantifiable changes to the Andritz execution plan in many areas including, but not limited to the:

- Implementation of night shifts;
- Deployment of additional trade manpower across all work areas;
- Mobilization of additional tools and equipment;
- Mobilization of additional supervision personnel;
- Change in work sequence and scheduling of work on multiple fronts in parallel;
- Modification, negotiation, re-planning & eventual coordination of the work from multiple sub-contractors in parallel and in overlapping work areas;
- Performance of a greater proportion of the works under winter conditions and the alteration of certain facilities, tools, equipment & methodology to adapt to these more severe winter conditions;

These changes to the execution plan had, and continue to have, major impacts on Andritz and its subcontractors. Such impacts include, but are not limited to the:

- Additional cost for the acceleration measures implemented, such as for additional manpower, supervision, work shifts, tools, equipment, and personnel in support of the directive;
- Additional cost from loss of time and productivity arising from, for example, increased congestion in the work areas, diminished learning curve benefits, or inefficiencies inherent to acceleration of the works;
- Additional cost from inefficiencies inherent to the higher than planned quantity of work performed, for example, during winter conditions or on the night-shift;
- Further delays to the Works which have to be recuperated through acceleration.

### **1.5 The impact of the acceleration directive on Andritz' commercial risk**

Beyond the aforementioned costs and impacts of implementing the directed acceleration measures, the acceleration directive had the additional effect of reducing Andritz' ability to mitigate its own risk.

Prior to the issuance of change order No. 10 (CO 010), as a prudent contractor Andritz undertook steps to mitigate or transfer much of its execution risk related to the sub-contracted works on this project, by developing a work plan with limited overlap and by successfully negotiating fixed price agreements with its sub-contractors involved in the spillway works. These sub-contracts included back-to-back contract clauses as well as specific schedule milestones for handover of packages, along with the provision of an associated liquidated damages / bonus structure to avoid delay claims while securing the schedule performance of the sub-contractors within its sub-contractor group. This robust commercial structure also allowed Andritz to deploy normal coordination and supervision personnel on site while ensuring that each of its sub-contractor's scope of work would be executed without interference from its other sub-contractors, in a turnkey manner, thus minimizing Andritz' cost and risk in a commercially effective manner.

As a result of the acceleration directive Andritz' entire sub-contracting risk mitigation strategy was undermined and rendered ineffective. In order to implement the necessary scope, schedule, and work plan changes required of each sub-contractor to achieve

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Company's targeted river diversion date, Andritz had to re-negotiate its existing sub-contract agreements. Consequently, many of the existing sub-contract clauses aimed at transferring certain risks to its sub-contractors had to be severely altered or waived altogether. This lack of commercial protection resulted in a much higher risk to Andritz, above and beyond the significant cost of the acceleration measures.

Furthermore, Andritz' obligation to implement acceleration measures led to an increase in the physical and schedule overlap, and consequently an increase to the potential for interference between all work teams across the Andritz group of sub-contractors. In simplistic terms, as a result of the acceleration directive Andritz faced a higher risk environment with a less effective commercial structure to mitigate such higher risks.

Some examples of these types of impacts are:

- Andritz' reduced ability to mitigate unforeseen events in a commercially reasonable manner being that prior to the acceleration directive such risks had been transferred to its sub-contractors. Such events may occur simply due to equipment breakdowns, or the unavailability, or the late arrival of work crews due to severe weather conditions, which may have a direct impact on another Andritz subcontractor for which Andritz no longer had any commercial protection;
- Andritz' increased exposure to coordination risk caused by the congested multi-subcontract environment resulting from the acceleration measures and a) Andritz' reduced opportunity to mitigate such risk and b) the greater severity of the impact of any such event;
- Andritz' reduced ability to mitigate the impact of unforeseen events to the accelerated schedule in a commercially reasonable manner within its sub-contractor group due to the complete lack of schedule float resulting from the extremely aggressive accelerated river diversion target date imposed by Company;

Not only was Andritz' commercial risks significantly increased as a result of this, but in order to mitigate any such risks in the absence of robust sub-contract agreements, Andritz had no choice but to augment its project site team to deploy additional commercial, execution, and

coordination personnel and expertise in order to manage these issues as they arose in order to mitigate, as much as possible, any impact to Andritz, and subsequently to Company, or to the accelerated schedule.

### **1.6 The impact of the acceleration directive on Andritz' decision-making process**

Andritz responded to Company's directive by immediately implementing those acceleration measures which Company instructed. The direct consequence of Company stipulating the acceleration measures, as well as dictating the target date, and the resulting ongoing scrutiny and involvement of Company in all actions and decisions normally managed by Andritz under its fixed-price agreement had the direct effect of changing Andritz' execution decision-making process for the management of its works.

Prior to the acceleration directive, Andritz would have made its project management decisions on a balanced assessment of cost and schedule benefit, a normal prerogative for a contractor under a fixed-price contract. Under the Company's acceleration directive all decisions related to the planning of manpower, tooling, equipment, supervision, and all other such resources, were now assessed overwhelmingly and often required specifically by Company on the basis of their benefit to the schedule in trying to achieve the June 15 river diversion target date. Making decisions in this manner had a significant economic impact to Andritz, and constitutes a direct effect of Company's unilateral acceleration directive.

Some examples of this type of impact are:

- At Company's request, the addition of manpower above a certain effectiveness ratio simply to secure schedule progress while the additional cost of such a measure would otherwise be justifiable since it results in no quantifiable improvement to the end date;
- The implementation of expensive additional work teams in order to improve the end date by a duration which avoids LD's equal in value to only a fraction of the cost to implement the work teams.

Under normal circumstances Andritz would have made clearly different decisions, thereby avoiding these cost impacts.

### 1.7 Content of this document

This document is composed of the following volumes which provide more details on the cost impacts as outlined in section 1.0.

#### Volume 1

This volume describes in greater detail in which aspects the acceleration directive represents a change to the Andritz contract, and provides explanations and summary quantifications for the resulting impacts to Andritz and its subcontractors. Its scope is limited to the costs incurred from the most recent invoice issued to Company, and will be updated as the acceleration effort, and any resulting impact of the river diversion continues through to completion.

#### Volume 2

Volume 2 contains the various exhibits referred to in Volume 1. These include Project contemporaneous documents such as detailed cost calculations, schedules, timesheets, minutes of meetings, daily logs, and graphs in support of Volume 1.

**SECTION 2: CRT'S COSTS****2.1. CRT's subcontract Agreement**

On July 10, 2014, Company formally executed the option to have Andritz perform the second stage concreting Work. Following this, Andritz engaged negotiations with CRT Construction (CRT) for the sub-contract of this Work.

Due to ongoing civil delays by Company, the "start date" of the work was subject of fluctuation and uncertainty throughout the negotiation process. On September 4, 2015, Andritz finalized the subcontract Agreement with CRT Construction (CRT) under which CRT was to perform the concrete placement and embedment of the following:

- The embedded parts for the spillway gate guides and seal faces.
- The steel rollway liners with anchors in the final rollways, downstream of each spillway gate.
- The embedded parts for the permanent stoplog guides and seal faces.
- The embedded parts for the temporary stoplog guides and seal faces.
- The embedded parts for the Powerhouse Intake Trash rack guides.
- The embedded parts for the Intake Bulkhead Gates guides and seal faces
- The embedded parts for the Intake Gates guides and seal faces.
- The embedded parts for the Draft Tube Stoplogs guides and seal faces

In an effort to optimize schedule and cost, Andritz & CRT set the baseline pouring dates in the sub-contract Agreement as shown below:

- Concreting of Bay 1 upstream embedded parts: June 12, 2015
- Concreting of Bay 2 upstream embedded parts: July 7, 2015

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- Concreting of Bay 3 upstream embedded parts: August 11, 2015
- Concreting of Bay 4 upstream embedded parts: August 31, 2015
- Concreting of Bay 5 upstream embedded parts: September 20, 2015
- Concreting of Bay 1 downstream embedded parts: September 24, 2015
- Concreting of Bay 2 downstream embedded parts: September 28, 2015
- Concreting of Bay 3 downstream embedded parts: October 2, 2015
- Concreting of Bay 4 downstream embedded parts: October 6, 2015
- Concreting of Bay 5 downstream embedded parts: October 10, 2015

As a result of the late “*start date*”, the actual situation resulted in CRT starting its work on February 9, 2016, meaning 8 months later than the planned pouring start date mentioned above. Subsequently, Company’s acceleration directive covered under change order CO-010 had the following schedule impact on CRT’s work portion.

- Performance of a significant portion of the concreting works under much more severe climatic conditions in Labrador from fall to spring (hereinafter referred to as winter conditions) and reduction of CRT’s schedule for upstream work from 17 weeks to 12 weeks
- Reduction of CRT’s schedule for Bays # 3, 4 and 5 from 6 weeks to 3 weeks

The details of these impacts on each item and of their resulting costs are presented in section 2.2 and 2.3 respectively followed by a conclusion in section 2.4.

**2.2 Shifting work from summer to winterlike conditions period**

As indicated before, CRT’s Spillway work was shifted from the summer conditions to winterlike conditions. One of the consequences of Company decision to delay the start work date was that CRT had to perform a significant portion of the



concreting work during the period from March to May, under winterlike conditions, namely:

- Concreting of upstream embedded parts
- Concreting of downstream embedded parts

The performance of this work under winterlike conditions required unplanned cost items associated, but not limited to:

1. Construction of a temporary shelter for concrete transfer between the concrete mixer truck (“CMT”) and the concrete lifting buckets (“CLB”);
2. Purchase of winter work clothing;
3. Modification to the concreting work plan / methodology.

The details of these additional cost items and of the resulting costs are presented below.

#### **2.2.1. Construction of a temporary ready mix shelter**

The design, fabrication and installation of a temporary ready mix shelter was necessary for the following reasons:

- Given the small quantities of concrete to be put in place every hour (between 1 to 3 m<sup>3</sup>), the CMT had to remain at the unloading location for a period ranging from 1 to 2 hours before returning to the concrete plant to recharge.
- As concreting was carried out with a single CMT, two CLBs, used to lift the concrete to the pouring elevation, ensured the continuation of the pouring activity while the CMT returned to the concrete batch plant to be recharged.
- Often, one (1) CLB filled with fresh concrete remained on the ground while pouring was being performed using the second CLB.

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- In order to meet the technical specifications under winterlike conditions, protection had to be provided to control the temperature of the concrete during transfer of the concrete between the CMT and the CLB, and during the standby period of the second filled CLB.
- The required shelter was given design considerations to limit costs by maximizing the usage of easily available material and to cover / protect the back of the CMT and the area where the buckets are filled. The shelter also needed to include a small heated office for the laboratory personnel for concrete sample testing and for storing of equipment. The covered area was also used by workers that were assigned to fill buckets.



The costs breakdowns pertaining to the construction of the shelter are detailed in [Appendix 2.2A](#) of Volume II of this document and are shown below:

- Concrete Shelter Design	:	\$	89,125
- Concrete Shelter Installation	:	\$	40,940
- Concrete Shelter Operation	:	\$	119,590
<b>Cost – Concrete Shelter</b>			<b>\$ 249,655</b>

**2.2.2. Purchase of winter work clothing**

Unplanned winter work clothing was provided to workers performing activities outdoors and under winterlike conditions, such clothing included:

- Winter work jackets
- Winter work gloves
- Winter liners for hard hats

Resulting costs are detailed in Appendix 2.2B of Volume II.

- Winter protection clothing	:	\$	3,450
			3,450
<b>Cost - winter clothing:</b>	<b>:</b>	<b>\$</b>	<b>3,450</b>

**2.2.3. Modification to the concreting work plan and methodology**

The method originally planned for the concreting work involved lifting concrete filled CLB from the ground directly to the pouring location and follow the concreting level as the pouring progressed using lifting equipment such as a crane.

In order to reduce heat loss in winterlike conditions, meet the concrete technical specification and maintain required climatic conditions inside the hoarding for guide alignment, a roof structured of steel containers was added to the top of the spillway to shield the bays from the elements. As the access to the pouring elevations could no longer be reached by lifting equipment such as a crane due to the presence of these containers, a different concreting method of hoppers and trunks (shown below) was chosen.

This method involves installing two hoppers above each guide and connecting the trunks to the hoppers up to the base of the guides.



Hopper



Trunk

Resulting costs are detailed in Appendix 2.2C of Volume II and are summarized below:

- Labour	:	\$	487,918
- Equipment		\$	20,355
- Material		\$	38,331
- Flights & Medical Exams		\$	15,617

**Cost - modified concreting plan : \$ 562,221**

**2.2.4. Summary – Shifting Work from summer to winterlike conditions period**

The total additional costs pertaining to the performance of a portion of CRT's work under winter conditions are presented in the following table:

Description	Amount (\$)
1. Construction of a temporary ready mix shelter	249,655
2. Purchase of winter work clothing	3,450
3. Mobilization to the concreting work plan and methodology	562,221
<b>Sub-total</b>	<b>815,326</b>
<b>Contractor's Mark-up (15%)</b>	<b>122,299</b>

**Total****937,625**

### 2.3 Acceleration costs (17 to 12 weeks)

At the time of the preparation of its tender price and schedule, CRT had planned to use a supervision crew composed of site personnel fulfilling the following roles to perform the concreting activities:

- One (1) Project Manager
- One (1) QA (night)
- One (1) QA (day)
- One (1) Superintendent (night)
- One (1) Superintendent (day)
- One (1) Foreman (night)
- One (1) Foreman (day)

The baseline concreting plan was to use this supervision crew along with a worker crew on a 14 days on / 7 days off site (14/7) turnaround and progress the work in increments.

However, as a result of the acceleration order by Company, CRT had to ensure a constant presence on site to reduce the concreting duration from 17 to 12 weeks. As such, the rotation period was changed to 14/14 for worker crews, this way; direct labour hours were not added.

To support this new schedule, one staff member was added for each occupation listed above for 12 weeks with the exception of the additional Project Manager position which was added for 14 weeks because of the level of preparation required.

As a result of the above, CRT incurred additional costs pertaining to the following:

- Mobilization of a second supervision team
- Mobilization of a second construction crew
  - Additional orientation sessions
  - Mobilization of additional equipment

It is to be noted however that as a result of the reduced overall duration of the works certain savings of management costs are to be made by CRT. These are considered in the calculation of the additional costs.

The details pertaining to the above-mentioned additional costs and savings are presented below.

### **2.3.1. Mobilization of a second team**

As mentioned above, CRT had originally planned to mobilize a supervision crew which consisted of the following:

- One (1) Project Manager
- One (1) QA (night)
- One (1) QA (day)
- One (1) Superintendent (night)
- One (1) Superintendent (day)
- One (1) Foreman (night)
- One (1) Foreman (day)

**Section 2: CRT'S costs**

As a result of the acceleration effort requested by Company, CRT had to mobilize a second supervision crew (B Team) to cover the turn-around of the first team (A Team). As mentioned before, the baseline concreting plan was to use one supervision crew on a 14/7 turnaround basis and to progress the work in increments. The new schedule used two supervision crews with staggered 14/7 turnarounds on 12 hour days to ensure a constant presence on site and overlap for proper handover; thus incurring additional costs pertaining to the following for the additional crew:

2.3.1.1. Supervision Salaries

<b>Function</b>	<b>Duration (weeks)</b>	<b>Weekly rate (\$/w)</b>	<b>Cost (\$)</b>
Project Manager (day shift)	14	4,600	64,400
QA/Engineering responsible (day shift)	12	4,968	59,616
Superintendent (day shift)	12	5,750	69,000
QA/Engineering responsible (night shift)	12	4,227	50,724
Superintendent (night shift)	12	5,750	69,000
Foreman (day)	12	1058	12,696
Foreman (night)	12	1058	12,696
<b>Grand Total</b>			<b>338,132</b>

**Salaries: \$338,137<sup>(1)</sup>**

2.3.1.2 Staff transportation on site

(1) See Appendix 2.2D of Volume II

(2) See Appendix 2.2E of Volume II

**Section 2: CRT'S costs**

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CRT had to mobilize two (2) trucks for the on-site transportation of the two (2) additional superintendents overlapping with the original crew, resulting in the following costs:

Item	Duration (months)	Monthly Rate (\$/m)	Cost (\$)
2 Pick-up Trucks	7	2,875	20,125
<b>Grant Total</b>			<b>20,125</b>

**Onsite Transportation: \$20,125<sup>(2)</sup>**

2.3.1.3 Staff flight transportation for additional staff

As per the industry standard, staff members are allowed one trip between the site and their residence every 14 to 21 days.

The additional supervision personnel (excluding foremen) mobilized to site required 5 such trips, resulting in additional costs for CRT:

Item	Number of flights (flights)	Average flight Rate (\$/flight)	Cost (\$)
Flights for turn-around team (5 people x 5 flights)	25	1,725	43,125
<b>Grant Total</b>			<b>43,125</b>

**Flight transportation:\$43,125<sup>(1)</sup>**

2.3.1.4 Staff fall protection training for additional staff

As per the HSE policy in Newfoundland, all supervision staff required to work at heights needs to participate in a 2-day fall training session. Accordingly, 5 such person-sessions had to be carried out, resulting in the following costs:

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(1) See [Appendix 2.2G](#) of Volume II



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Item	Quantity (Units)	Unit Rate (\$/u)	Cost (\$)
Fall protection training (5 persons x 16 hours) using average rate	80	86.25	6,900
Cost for training	1	6354	6,354
<b>Grant Total</b>			<b>13,254</b>

**Fall protection training: \$13,254<sup>(1)</sup>**

2.3.1.5 Medical exams for additional supervision staff

Each new supervision staff member resulting from the addition of a second supervision crew had to pass a medical exam. This resulted in the following additional costs:

Item	Number of exams (exams)	Exam Rate (\$/exam)	Cost (\$)
Medical Exams: (for additional staff)	5	\$ 374	1,870
<b>Grand Total</b>			<b>1,870</b>

**Medical exams: \$1,870<sup>(2)</sup>**

2.3.1.6 Summary of costs – Additional crew

Description	Cost (\$)
1. Salaries	338,132
2. Staff transportation on site	20,125
3. Staff flight transportation	43,125

(1) See [Appendix 2.2H](#) of Volume II

(2) See [Appendix 2.2I](#) of Volume II

**Section 2: CRT'S costs**

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4. Staff fall protection training	13,254
5. Medical exams	1,869
<b>Total</b>	<b>416,510</b>

**2.3.2. Mobilization of a second construction crew**

The following direct manpower (trade crew) was mobilized to site as part of the acceleration effort:

- Workers
- Concrete superintendents

No cost is claimed for the worked hours by these twenty (20) persons since the same hours would have been spent at a later date. However, the following additional costs were incurred as a result of their mobilization.

**2.3.2.1 Mobilization cost**

Since initially only one trade crew was planned to perform the work, the mobilization cost of this trade crew members was included in CRT's tender price and would have been sufficient for the duration of its work on site.

However, because of the ongoing mobilization delays due to the winterlike conditions, five (5) members of this crew had to be cancelled and new candidates and corresponding flights and medical exams had to be arranged. This additional mobilization effort resulted in additional mobilization costs for CRT.

<b>Item</b>	<b>Number of workers (workers)</b>	<b>Unit Rate (\$/worker)</b>	<b>Cost (\$)</b>
Mobilization of new candidates after cancellation of original crew (5 workers)	5	1,725	8,625
<b>Grand Total</b>			<b>8,625</b>

**Mobilization cost: \$8, 625<sup>(1)</sup>**

**2.3.2.2 Learning curve due to presence of the second crew**

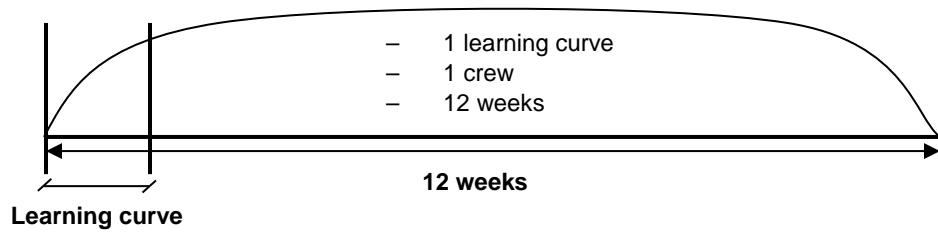
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(1) See [Appendix 2.2J](#) of Volume II

Section 2: CRT'S costs

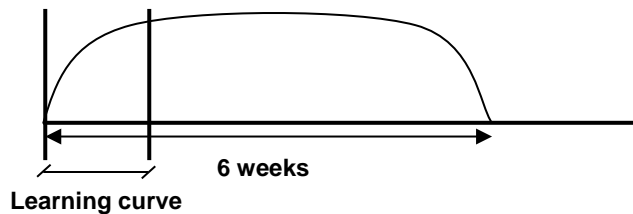
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CRT's upstream spillway work was to be performed using one (1) crew over a period of 17 weeks on a 14/7 turnaround, resulting in 12 weeks of work for the entire spillway. In such case, the loss of time and productivity due to the learning curve at the start of an activity is absorbed over the 12 week period and is included in CRT's price.

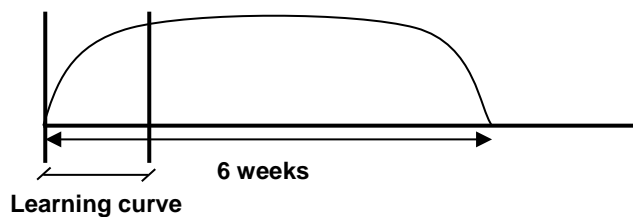


However, the addition of a second crew resulted in two (2) learning curves, one for each crew, absorbed over a 6-week period for each.

First crew



Second crew



- 2 learning curves
- 2 crews
- 6 weeks

As a result, the benefit resulting from the repetitive nature of the tasks being performed and the expected productivity increase over a 17 week period are reduced by the doubling of the learning curve period and the decrease to 50% of the period of increased productivity (6 weeks instead of 12 weeks).

The resulting additional costs are calculated as follows.

Item	Hours (h)	Hourly Rate (\$/h)	Cost (\$)
Learning curve due to presence of a second team (5.5% x 28,500 hours)	1567.5	\$ 105.8	165,842
<b>Grand Total</b>			<b>165,842</b>

**Cost due to the loss in learning curve: \$166,208<sup>(1)</sup>**

2.3.2.3 Summary of costs – Additional mobilization of a second work crew

In summary, the cost of mobilization of a second work crew is as follows:

Description	Cost (\$)
1. Mobilization of new candidates	8,625
2. Loss of learning curve	165,842
<b>Total</b>	<b>174,467</b>

**2.3.3. Orientation sessions**

Under the Agreement terms, an orientation session had to be held for all new personnel, during which the new personnel were advised of several aspects of the Project, including:

- Project Overview
- Safety
- Information on the Innu Nation

(1) See [Appendix 2.2K](#) of Volume II

**Section 2: CRT'S costs**

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Accordingly, orientation sessions were held for the second crew mobilized to site (20 workers). During this period, the first crew has to stay on site for one extra day (than the 14 scheduled days) and be paid at a double time rate.

The resulting additional costs are as follows <sup>(1)</sup>:

Description	Cost (\$)
Orientation for additional crew (20 workers)	21,160
Double time for first crew (20 workers)	32,292
<b>Total</b>	<b>53,452</b>

**2.3.4. Medical exams for additional workers**

Each new trade crew member resulting from the addition of a second trade crew had to pass a medical exam. This resulted in the following additional costs:

Item	Number of exams (exams)	Exam Rate (\$/exam)	Cost (\$)
Medical Exams: (for additional trade workers)	20	\$ 454	9,085
<b>Grand Total</b>			<b>9,085</b>

**Medical exams: \$9,085<sup>(2)</sup>**

**2.3.5. Mobilization of additional equipment**

(1) See [Appendix 2.2L](#) of Volume II

(2) See [Appendix 2.2I](#) of Volume II

**Section 2: CRT'S costs**

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Additional equipment had to be purchased and mobilized to the Job site in order to support the second crew:

- Personal Protection Equipment
- Harness
- Small Tools

The resulting costs are calculated in Appendix 2.2M of Volume II of this document and are summarized below:

<b>Item</b>	<b>Quantity (unit)</b>	<b>Unit Rate (\$/u)</b>	<b>Cost (\$)</b>
PPE for second crew (20 workers x 6 weeks x 80 hours )	9,600	0.86	8,280
Harness for second crew	16	288	4,600
Small Tools for second crew (20 workers x 6 weeks x 80 hours )	9,600	1.50	16,560
<b>Grand Total</b>			<b>29,440</b>

**Additional equipment: \$29,440**

**2.3.6. Credit for reduced duration**

As mentioned before, the mobilization of a second work crew resulted in the reduction of the duration of CRT's concreting work from 17 weeks to 12 weeks (including 1 turnaround week). This in turn, results in a reduction of the overhead costs included in CRT's tender price. Accordingly, a credit for four (4) weeks which represents four (4) percent of the CRT sub-contract Agreement Price Schedule has to be considered when calculating the additional costs caused by the acceleration effort.

This credit is calculated as follows:

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Item	Weeks	Weekly Rate (\$/w)	Cost (\$)
Management Costs (5 weeks – 1 week for turnaround)	4	24,550	98,200
Quality Assurance (5 weeks – 1 week for turnaround)	4	2,739	10,955
<b>Grand Total</b>			<b>109,155</b>

Credit for reduced duration: \$109,155<sup>(1)</sup>

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(1) See Appendix 2.2N of Volume II



**2.3.6 Summary - Acceleration costs (17 weeks to 12 weeks)**

The total additional costs pertaining to the acceleration of CRT's work are presented in the following table:

Description	Amount (\$)
1. Mobilization of a second staff team	416,510
2. Mobilization of a second construction crew	174,467
3. Orientation sessions	53,452
4. Medical exams for additional workers	9,085
5. Mobilization of additional equipment	29,440
6. Credit for reduced duration	(109,155)
<b>Sub-total</b>	<b>573,799</b>
<b>Mark-up (15%)</b>	<b>86,070</b>
<b>Total</b>	<b>660,290</b>

**2.4. Conclusion (Winterlike conditions & Acceleration (17 to 12 weeks))**

The direct consequences of the late *"for start date"* and of Company's change order CO-010 requesting the acceleration of the works, forced CRT to perform a portion of its work under winterlike conditions and to implement several other acceleration measures that led to CRT incurring additional unplanned costs that could not have been foreseen by neither Andritz or CRT at their respective contract signature.

Consequently, CRT incurred the following additional costs:

Winterlike Work	:	\$	937,627
Acceleration	:	\$	660,290
<b>Total</b>		<b>\$</b>	<b>1,597,496</b>

**2.5. CRT's second schedule reduction (6 weeks to 3 weeks, Bays # 3, 4 and 5)**

In addition to the previously indicated acceleration effort, an additional schedule reduction initiative, made necessary by Company's request, was implemented to further reduce the concreting schedule from 6 to 3 weeks in Bays #3, 4 and 5.

As a result of the above, CRT incurred additional costs pertaining to the following:

1. Mobilization of additional supervision
2. Mobilization of additional workers
3. Medical Exams
4. Flight transportation
5. Mobilization of additional equipment
6. Preparation efforts (mobilization of head office personnel)

It is to be noted however that as a result of this additional acceleration effort, certain savings of management costs are to be made by CRT. These are considered in the calculation of the additional costs.

The details pertaining to the above-mentioned additional costs and savings are presented below.

**2.5.1. Mobilization of additional staff**

Further to the previously mentioned supervision resources added to achieve the first schedule reduction, CRT had to mobilize additional supervision personnel on 14 hour days to support the additional trade crews required for this supplementary acceleration.

- Two (2) additional QA/ENGs were required (one (1) on each shift) for concrete testing, quality inspection before, during and after the pours, quality follow-up and documentation.

- Two (2) additional Runners were required to drive staff to/from airport, drive vehicles to town for repair maintenance, shopping trips, move things around and unplanned problems.
- One (1) HR Manager to handle additional workload due to significant increase in direct labour and associated with site hiring tasks, labour relation, establishing of work team structure, preparation and placement of dispatch requests, hiring of tradesman, and all other necessary tasks.
- One (1) Secretary to handle additional workload due to significant increase in direct labour and associated flight booking, camp accommodation, HSE orientation booking, payroll administration, etc.
- Two (2) additional superintendent (one (1) on each shift) required due to increase in direct labour to supervise the execution of the work and ensure proper coordination and productivity of tradesman
- One (1) Project Manager (deputy) was required to assist the existing Project Manager, and supervise and coach new staff resources that were not accustomed to working in Newfoundland.

The resultant costs are summarizing below:

2.5.1.1. Salaries

Function	Duration (weeks)	Weekly rate (\$/w)	Cost (\$)
Project Manager	5	9,200	46,000
QA/Engineering responsible (day shift)	5	11,500	57,500
QA/Engineering responsible (night shift)	5	11,500	57,500
Superintendent 1	6	13,800	82,800
Superintendent 2	6	13,800	82,800
Runner 1	5	6,900	34,500
Runner 2	5	6,900	34,500

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Function	Duration (weeks)	Weekly rate (\$/w)	Cost (\$)
HR Manager	5	6,900	34,500
Secretary	5	4,600	23,000
<b>Grand Total</b>			<b>453,100</b>

**Staff salaries: \$453,100<sup>(1)</sup>**

2.5.1.2. Fall protection training for additional staff

As per the HSE policy in Newfoundland, all supervision staff members required to work at heights had to participate in a 2-day fall training session. Accordingly, 6 such person sessions had to be carried out, resulting in the following costs:

Item	Hours	Hourly Rate (\$/h)	Cost (\$)
Fall protection training (6 people x 20 hours)	120	86.25	10,350
Cost for training	1	2,795	2,795
<b>Grand Total</b>			<b>13,145</b>

**Fall protection training: \$13,145<sup>(2)</sup>**

2.5.1.3 Summary of costs – additional staff

Description	Cost (\$)
1. Salaries	453,100
2. Fall protection training	13,145
<b>Total</b>	<b>\$ 466,245</b>

(1) See Appendix 2.3A of Volume II

(2) See Appendix 2.3B of Volume II

**2.5.2. Mobilization of additional workers**

In order to ensure the early start of second stage concrete pouring tasks of the last three bays and to expedite the post-pour activities, the preparation team trade crew had to be doubled. Furthermore, the pouring team's trade crew inside the bays had to be doubled as well.

There was also an increase in direct manpower due to the loss of productivity from congestion in the work area caused by the presence of other contractors and consequently by the additional resources required to respect the collective agreement. However, it is noted that the resources added for the pouring team were less impacted by this stacking of trades compared to the rest of the teams as the bay being poured was only occupied by resources dedicated to that task.

All of these additional resources necessary for the acceleration effort resulted in additional costs for CRT.

Item	Hours	Hourly Rate (\$/h)	Cost (\$)
Additional hours for acceleration	17,408	120.75	2,102,016
Credit for saved 3 calendar weeks	8,400	120.75	(1,014,300)
30% Loss of productivity due to congestion & learning curve	3,322	120.75	401,132
<b>Grand Total</b>			<b>1,488,848</b>

**Fall protection training: \$1,488,848<sup>(1)</sup>**

**2.5.3. Medical exams for additional staff & workers**

Each new staff member and worker had to pass a medical exam. This resulted in the following additional costs:

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(1) See [Appendix 2.3C](#) of Volume II

Item	Number of exams (exams)	Exam Rate (\$/exam)	Cost (\$)
Medical Exams: (for additional staff)	11	\$ 373.75	4,111
Medical Exams: (for additional workers)	96	\$ 454.25	43,608
<b>Grand Total</b>			<b>47,719</b>

**Medical exams: \$47,719<sup>(1)</sup>**

**2.5.4. Flight Transportation**

As per the industry standard, staff members are allowed one trip between the site and their residence every 14 to 21 days.

The additional staff personnel & workers mobilized to site required such trips, resulting in additional costs for CRT:

Item	Number of flights (flights)	Unit Rate (\$/flight)	Cost (\$)
Flight Transportation: (for additional staff)	12	1,725	20,700
Flight Transportation: (for additional workers)	64	1,725	110,400
<b>Grand Total</b>			<b>131,100</b>

**Medical exams: \$131,100<sup>(2)</sup>**

**2.5.6. Mobilization of additional equipment**

(1) See [Appendix 2.3D](#) of Volume II

(2) See [Appendix 2.3E](#) of Volume II

Additional equipment that would not have originally required had to be purchased and mobilized to the Job site in order to support the added manpower, such as:

- Safety Equipment
- Formwork, panels & accessories
- Radios, supplies & IT equipment
- Trailers, trucks, buses, transport & other equipment

2.5.6.1 Safety Equipment

Each additional worker had to be equipped with personal protection equipment: harness (with lanyard, retractable, carabiner, dog leach, etc.) and small tools (battery drills, concrete drills, skill saws, reciprocating saws, spot lights, levels, vibrators, etc.).

The resultant costs for the various purchased safety equipment to support the added manpower are summarized below:

Item	Quantity (units)	Unit Rate (\$/u)	Cost (\$)
Personal protection equipment, harness & small tools for added workers	12,330	3.45	42,539
Other safety equipment	1	57,500	57,500
<b>Grand Total</b>			<b>100,039</b>

**Safety equipment: \$100,039<sup>(1)</sup>**

2.5.6.2 Additional formwork, panels & accessories

Contrary to what was planned, a significant portion of panel formwork could no longer be removed early enough from the bays where the curing of the second

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(1) See Appendix 2.3F of Volume II

**Section 2: CRT'S costs**

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stage concrete had been achieved to be installed in the subsequent bays. Additional panels were therefore required.

All platforms and hoppers had to be installed/pre-assembled ahead of time and could no longer be re-used from one bay to the other. Additional platform hoppers were therefore required.

The costs for these additional panels and accessories are summarized below:

<b>Item</b>	<b>Quantity (units)</b>	<b>Unit Rate (\$/u)</b>	<b>Cost (\$)</b>
Panels (120 x 2 months)	240	18	4,355
Platforms for hopper	18	3,450	62,100
Hoppers	18	414	7,452
Unions	1	5,750	5,750
Concrete buckets	2	17,250	34,500
<b>Grand Total</b>			<b>114,157</b>

**Formwork, panels & accessories: \$114,157<sup>(1)</sup>**

**2.5.6.3 Radios, supplies & IT equipment**

Due to additional staff requirement, consequently additional radios (communication), office furniture (desk, chair, etc.), lunch room furniture (tables, chairs, microwave, lockers, etc.) and internet hardware were required. The costs for these items are summarized below:

<b>Item</b>	<b>Quantity (unit)</b>	<b>Unit Rate (\$/u)</b>	<b>Cost (\$)</b>
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(1) See Appendix 2.3G of Volume II



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Item	Quantity (unit)	Unit Rate (\$/u)	Cost (\$)
Radios, supplies & IT equipment	1	34,500	34,500
<b>Grand Total</b>			<b>34,500</b>

**Safety equipment: \$34,500<sup>(1)</sup>**

2.5.6.4 Trailers, trucks, buses, transport & other equipment

Equipment necessary for transportation on site, such as pickup trucks, vans & buses were required for additional staff members, supervisors & workers commuting regularly to and from the camp and between different locations on the site. Additional trailers & dry houses were also required to accommodate the additional staff, supervisors & workers.

Furthermore, the increased volume of concrete that had to be poured simultaneously necessitated the mobilization of an additional Concrete Mixing Trailer "CMT" (Ready Mix) was required to carry the additional.

It is to be noted that a credit is considered for a 3-week schedule duration of the supply of a 60T crane.

Eight round trip transporters were required to mobilize and demobilize the additional equipment and installation tools.

Item	Quantity (units)	Unit Rate (\$/u)	Cost (\$)
8 pick-up trucks for 1 month	8	2,645	21,160
8 pick-up trucks mobilization cost	8	1,150	9,200

(1) See [Appendix 2.3H](#) of Volume II

Section 2: CRT'S costs

Item	Quantity (units)	Unit Rate (\$/u)	Cost (\$)
1 bus for 4 weeks	4	1,725	6,900
1 bus mobilization cost	1	2,300	2,300
1 mini-van for 4 weeks	4	1,150	4,600
1 mini-van mobilization cost	1	2,300	2,300
1 CMT for 4 weeks	4	2,875	11,500
1 CMT mobilization cost	1	23,000	23,000
5 trailers for 2 months	10	1,725	17,250
5 trailers mobilization cost	5	34,500	172,500
Transport (Levis – Goose Bay)	8	17,250	138,000
Credit for 60T Crane for 3 weeks	3	5,796	(17,388)
<b>Grand Total</b>			<b>391,322</b>

**Trailers, trucks, buses, transport & other equipment: \$391,322<sup>(1)</sup>**

2.5.6.5 Summary of costs – Mobilization of additional equipment

Description	Cost (\$)
1. Safety Equipment	100,039
2. Additional formwork, panels & accessories	114,157
3. Radios, supplies & IT equipment	34,500
4. Trailers, trucks, buses, transport & other	391,322

(1) See [Appendix 2.3](#) of Volume II

equipment		
<b>Total</b>		<b>\$ 640,018</b>

**2.5.7. Preparation Effort (mobilization of head office personnel)**

In order to successfully reduce by half the period required for pouring of the last three bays second stage concrete, CRT had to mobilize most of its available main office staff in order to organize the acceleration effort (shop, buy, mobilize equipment and material), coordinate the additional resources (hiring, flights, camp booking, training, payroll administration) and closely supervise the execution of the work on site (limit to a minimum for the loss of productivity of the workers & supervisors).

The resulting costs are summarized in the following table.

Item	Quantity (units)	Unit Rate (\$/u)	Cost (\$)
Preparation Effort (mobilization of head office personnel)	1	230,000	230,000
<b>Grand Total</b>			<b>230,000</b>

**Preparation Effort (mobilization of head office personnel):      \$230,000<sup>(1)</sup>**

**2.5.8. Credit for reduced duration**

As mentioned before, the mobilization of a second work crew results in the reduction of the duration of CRT's concreting work from 6 weeks to 3 weeks. This in turn results in a reduction of the overhead management costs included in CRT's tender price. Accordingly, a credit has to be considered when calculating the additional costs caused by the acceleration effort.

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(1) See [Appendix 2.3J](#) of Volume II

**Section 2: CRT'S costs**

This credit is calculated as follows:

<b>Item</b>	<b>Weeks</b>	<b>Weekly Rate (\$/w)</b>	<b>Cost (\$)</b>
Management Costs	3	24,550	73,650
Quality Assurance	3	2,739	8,217
<b>Grand Total</b>			<b>81,867</b>

**Credit for reduced duration: \$81,867<sup>(1)</sup>**

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(1) See Appendix 2.3K of Volume II

**2.5.9. Summary Acceleration costs (6 weeks to 3 weeks, Bays # 3, 4 and 5)**

Description	Amount (\$)
1. Mobilization of additional staff	466,245
2. Mobilization of additional construction workers	1,488,848
3. Medical Exams	47,719
4. Fight Transportation	131,100
5. Mobilization of additional equipment	640,018
6. Preparation Effort (Mobilization of head office personnel)	230,000
7. Credit for Management	(81,867)
<b>Sub-total</b>	<b>2,922,062</b>
<b>Mark-up (15%)</b>	<b>438,309</b>
<b>Total</b>	<b>3,360,371</b>

**2.6. Conclusion (schedule reduction 6 weeks to 3 weeks, Bays # 3, 4 and 5)**

Based on the above, it is clear that as a result of the of Company's change order CO-010 requesting the acceleration of the works, CRT implemented several measures to further accelerate the work.

Consequently, CRT incurred the following additional costs:

Schedule Reduction (6 weeks to 3 weeks)	:	\$	3,360,371
<b>Total</b>		<b>\$</b>	<b>3,360,371</b>

**2.7. General Conclusion - CRT**

In the previous pages of this section, we have clearly demonstrated that CRT had to implement significant measures in order to complete the extensive winter works it had to perform and to comply with the accelerated schedule imposed by Company through change order CO-010.

**Section 2: CRT'S costs**

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It should be emphasized that Andritz demonstrated substantial efforts in the best interest of the project to negotiate down both sum change orders resulting from Company's CO-010.

CRT's first schedule reduction was initially quoted at \$ 1,212,100 and through negotiations; an agreement for \$ 573,799 was reached. This was achieved by CRT's reduction of impact costs for the two team schedule, such as loss due to learning curve, obtaining credits related to the overall reduced duration, and also by Andritz agreeing to provide site services to support the additional personnel. For the schedule reduction from 6 to 3 weeks for bays # 3, 4 and 5, the initial lump sum price \$ 4,341,195. Andritz managed to negotiate it down to \$ 3,696,110 before being finalized at 3,360,371 as shown above.

The resultant additional costs corresponding to these efforts are as follows:

– CRT's winterlike work and schedule reduction (17 weeks to 12 weeks upstream)	:	\$ 1,597,496	
– CRT's schedule reduction (6 weeks to 3 weeks, Bays # 3, 4 and 5)	:	\$ 3,360,371	
	<b>Total</b>	\$	<b>4,957,867</b>

**SECTION 3: CANMEC'S COSTS****3.1. Camnec's subcontract Agreement**

On July 10, 2014, Andritz entered into a subcontract Agreement with Canmec Industriel Inc. (Canmec) under which Canmec was to perform the following works:

- Supply of spillway embedded parts
- Installation of spillway hydro-mechanical equipment
- Supply of intake embedded parts
- Installation of intake hydro-mechanical equipment
- Supply of powerhouse draft tube embedded parts
- Installation of powerhouse draft tube hydro-mechanical equipment

The Agreement provided that the spillway upstream works were to be completed in accordance with the following start dates:

- Installation of embedded parts: February 16, 2015
- Installation of spillway roller gates: September 8, 2015
- Installation of hoist, Hoist Bridge & tower: September 28, 2015

In reality, however, as a result of the late "*for start date*", Canmec started its upstream work on November 1, 2015, or nine (9) months later than planned. Subsequently, Company's acceleration change order CO-010 had the following consequences on Canmec's schedule:

- Mobilization of additional staff personnel
- Mobilization of additional trade crews
- Mobilization of additional tools and equipment

**Section 3: Canmec's costs**

The details of these consequences and of their resulting costs are presented in Appendix 3.1A. A summary of the costs of each of these consequences is presented in articles 3.2, 3.3 and 3.4 of this document.

**3.2. Mobilization of additional staff personnel**

The implementation of mitigation measures due to the project delays requires the mobilization of additional resources (indirect labour and equipment) to complete the work compared to the quantity of resources that would have been required under the original Contract conditions. The addition of more direct workers, support labor as well as expediting the work led to the addition of the supplementary staff (Engineers, Supervisor, Clerk, QA) to coordinate and manage the supplementary staff.

Item	Claimed Amount shown on Canmec's Invoices received to Date (Nov 2015 - Jun 2016)		Canmec's Estimated Forecast * Amount of CH 010 (As of Jun 2016)	
	Hours (h)	Cost (CAD)	Hours (h)	Cost (CAD)
Supervision / Staff	1,890	\$ 230,531	2,500	\$ 306,406
Engineer	5,957	\$ 954,084	7,500	\$ 1,207,476
Health & safety	2,359	\$ 380,677	3,100	\$ 502,364
Quality Assurance & Clerk	1,652	\$ 299,856	2,100	\$ 340,266
Quality Inspector	2,814	\$ 419,673	3,300	\$ 532,645
<b>Grand Total</b>	<b>14,672</b>	<b>\$ 2,284,822</b>	<b>18,500</b>	<b>\$ 2,889,156</b>

*\* Forecast hours and claimed amount continuously updated by Canmec on a monthly basis.*

**Comment 1**

**Explanation of CANMEC's baseline plan and justification for additional hours for each role**



**3.3. Mobilization of additional construction personnel**

Labour productivity is dependent upon several factors which affect performance. In order to evaluate the financial consequences, CANMEC had to analyse the factors related to the new execution conditions for the spillway works. The consequences for trade crews and the resulting costs related to the new execution conditions for the spillway works are as presented below.

Item	Claimed Amount shown on Canmec's Invoices received to Date (Nov 2015 - Jun 2016)		Canmec's Estimated Forecast * Amount of CH 010 (As of Jun 2016)	
	Hours (h)	Cost (CAD\$)	Hours (h)	Cost (CAD\$)
Winter Conditions	3,241	\$ 333,249	3,241	\$ 335,444
Learning	3,430	\$ 356,283	5,020	\$ 529,095
Overstaffing	16,353	\$ 1,704,938	22,000	\$ 2,322,012
Crowding	65,685	\$ 6,875,289	68,000	\$ 7,169,097
Night Shift Premium	0	\$ 490,118	0	\$ 517,500
Stacking	4741	\$ 488,881	7,500	\$ 787,450
<b>Grand Total</b>	<b>93,450</b>	<b>\$ 10,248,758</b>	<b>105,761</b>	<b>\$ 11,660,598</b>

\* Forecast hours and claimed amount continuously updated by Canmec on a monthly basis.

**Comment 2**

Explanation and justification for each of the factors of loss of productivity

**3.4. Mobilization of additional tools and equipment**

The directed acceleration led to the need for more shelter panels, lifting equipment & other construction equipment. The equipment of a value over 1500\$ cannot be absorbed into the contractual markup amount due to its monetary importance.

Section 3: Camnec's costs

Item	Claimed Amount shown on Canmec's Invoices received to Date (Nov 2015 - Jun 2016)	Canmec's Estimated Forecast * Amount of CH 010 (As of Jun 2016)
	(CAD\$)	(CAD\$)
Lifting Equipment	\$ 1,313,031	\$ 2,248,183
Equipment > \$1,500	\$ 1,402,676	\$ 1,495,000
<b>Grand Total</b>	<b>\$ 2,715,707</b>	<b>\$ 3,743,183</b>

\* Forecast hours and claimed amount continuously updated by Canmec on a monthly basis.

**Comment 3**

Explanation of CANMEC's baseline plan and justification for each additional lifting

**Comment 4**

Explanation of CANMEC's baseline plan and justification for additional shelter panels

**Comment 5**

Explanation of CANMEC's baseline plan and justification for each additional equipment over 1500\$

**3.5. Conclusion**

In the previous pages of this section, we have provided the details of the costs that Canmec has incurred and continues to incur as a result of the additional efforts that were implemented in order to complete the extensive winterlike works that had to be performed and to comply with the accelerated schedule imposed by Company through change order CO-010.

The summary of the resulting additional costs corresponding to these efforts are as follows:

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<b>Activity</b>	<b>Invoices received to Date (Nov 2015 - June 2016)</b>	<b>Canmec's Estimated Forecast * (as of June 2016)</b>
Staff	\$ 2,284,822	\$ 2,889,157
Direct Labour	\$ 10,248,758	\$ 11,660,598
Tooling & Equipment	\$ 2,715,707	\$ 3,743,183
<b>Sub-Total</b>	<b>\$ 15,249,287</b>	<b>\$ 18,292,938</b>
<b>Mark-up (15%)</b>	<b>\$ 2,287,393</b>	<b>\$ 2,743,941</b>
<b>Total</b>	<b>\$ 17,536,680</b>	<b>\$ 21,036,878</b>

\* Forecast hours and claimed amount continuously updated by Canmec on a monthly basis.

**SECTION 4: ANDRITZ HYDRO'S COSTS****4.1. Andritz Hydro's CO-010 Impacts**

As demonstrated in the previous Sections, the delayed start of the spillway installation work and Company's issuance of CO-010 requesting the acceleration of the said work caused numerous and significant changes to Andritz's execution plan. These changes had and continue to have major impacts on Andritz and its sub-contractors. Such impacts include, but are not limited to the:

- Additional cost for the acceleration measures implemented, such as for additional manpower, supervision, work shifts, tools, equipment, and personnel in support of the directive;
- Additional cost from loss of time and productivity arising from, for example, increased congestion in the work areas, diminished learning curve benefits, or inefficiencies inherent to acceleration of the works;
- Additional cost from inefficiencies inherent to the higher than planned quantity of work performed, for example, during winter conditions or on the night-shift.

More specifically, and in addition to the impact on the sub-contractors' work, Andritz incurred significant additional costs pertaining to the following:

- Additional supervision personnel
- Inefficiencies inherent to the higher than planned quantity of work performed during winter conditions
- Additional tools and equipment

The details of these alterations are presented in the following pages of this Section. **4.2.**

**Mobilization of additional staff personnel**

Andritz's October 2015 site planning and organizational structure for supervision, coordination and site services staff was severely altered after the reception of CO-010. In the original plan, the sub-contractors were to be supervised in a sequential manner by Andritz's quality control personnel with partial support from available technical supervisors, if and when needed. General coordination was to be performed by the Site Manager with normally required book-keeping support from the site administration assistant.

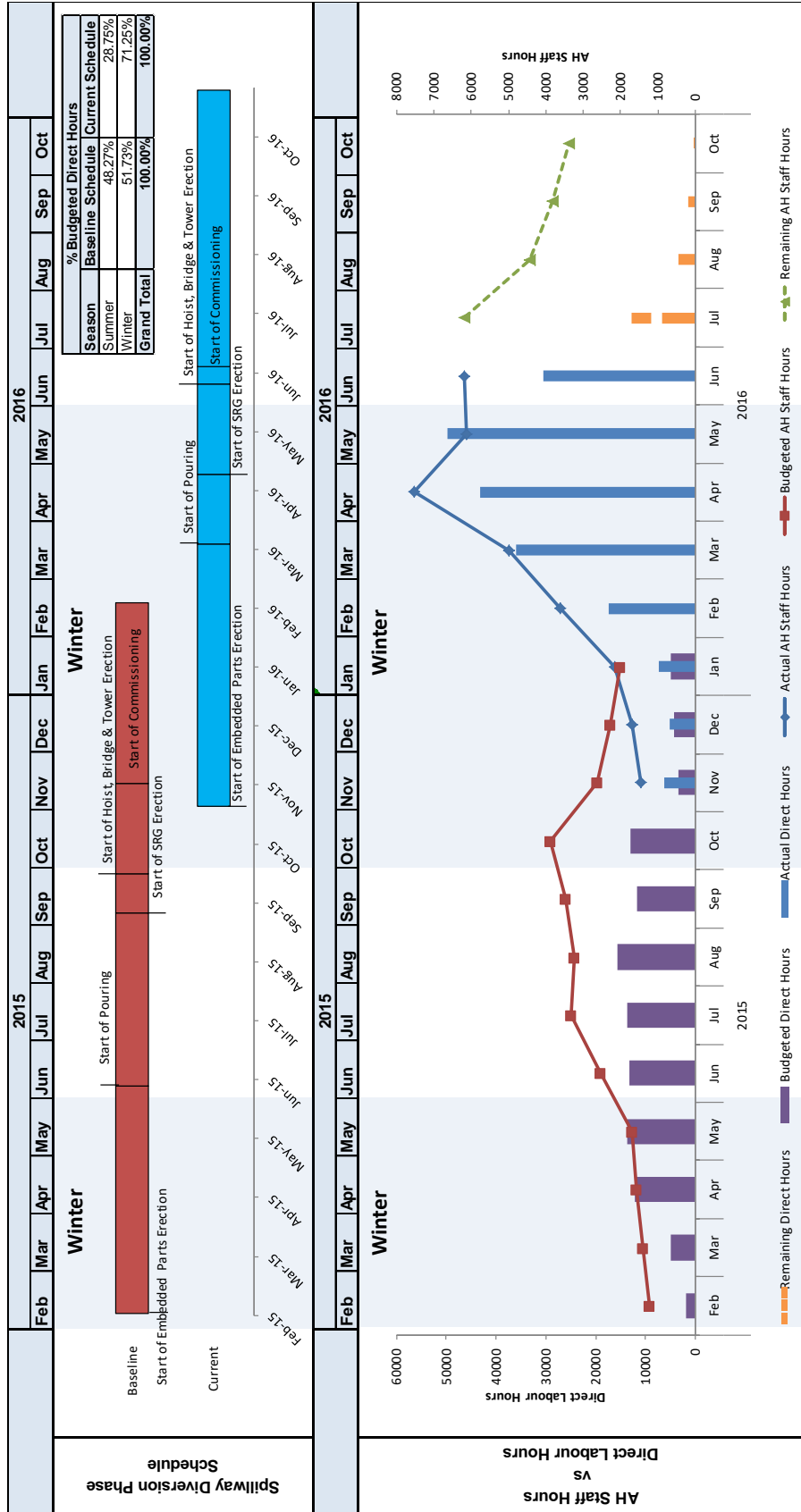
The significant increase in the required trade crews working in a complex and crowded environment complicated the coordination with Company and the supervision and coordination of the construction. In order to respond to this complex environment Andritz had to not only restructure the site organization but also to mobilize additional resources to assist in a multiple fronts approach, and this for both the site staff and the office staff.

The initial Andritz sub-contracting and risk mitigation strategy included the provision of LD's and reduced risk allowance in each firm price subcontract. However, as a result of the drastically modified work plan and accelerated and overlapping schedule, this commercially secured approach was undermined, thereby significantly increasing Andritz's commercial risks, which resulted in the need for additional Andritz staff in order to safely and efficiently manage this more complex and riskier work environment while attempting to mitigate additional risks arising out because of the increased complexity and increased probability of unforeseen events. The evolution of this complex environment is demonstrated in Graph 1 below.

***Graph 1: Correlation between the increase in manpower on site and the increase in Andritz's staff***

Graph 1 highlights the differences between the planned and actual schedules resulting from CO-010. These differences can be compared against the mobilization of additional trade crews and consequently the mobilization of additional staff personnel.

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4.2.1. Site Staff

Initially, Andritz had planned to mobilize the following site personnel:

- One (1) Site Manager
- One (1) Site Administrative Support
- One (1) Site QA Lead
- One (1) Gate Package Leader
- One (1) to three (3) Spillway Supervisors depending on execution phase
- One (1) Site Logistics Manager
- One (1) to (two) 2 Site Electrical Supervisors depending on execution phase
- One (1) to three (3) Commissioning Supervisors depending on execution phase

However, as a result of the acceleration effort and the revised work plan, Andritz had to mobilize additional site personnel and requiring both initially planned crew and additional site personnel to constantly work overtime in support. The details pertaining to the additional personnel and additional hours spent are indicated below:

4.2.1.1 Un-planned Staff added exclusively due to acceleration

Function	Name	Date First Mobilized	Reason(s)
Additional Site Safety Officer for day shift and additional night shift	- Marcel Labelle	Nov-15	<ul style="list-style-type: none"> <li>- The hours spent by these persons are directly linked to the increased total number of workers on site</li> <li>- Additional surveillance and overall involvement of the safety staff on different shifts were required to ensure a safe work environment in this complex environment</li> </ul>
	- Joanne Harte	Dec-15	
	- Billy Syms	Jan-16	
	- Graeme Moulton	Feb-16	
	- Brent Marsh	Feb-16	
	- Derrick Kearny	Apr-16	
Additional	- Bertolini	Feb-16	- The addition of night shift crews generated

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Function	Name	Date First Mobilized	Reason(s)
Night Shift - Spillway Supervisor	Ciorcirian		the need for night shift technical supervision to ensure that no work is stalled because of unforeseen events
	- Scott Morton	Apr-16	
Additional Construction Coordinator	- Claude Cardin	Mar-16	<ul style="list-style-type: none"> <li>- This additional role is a direct consequence of the doubling of direct hours on site and of the increase in the number of sub-contractors working in parallel which was minimal in the original plan.</li> <li>- As the number of workers from each sub-contractor increased, with work of sub-contractors frequently planned in parallel, the addition of a construction coordinator was necessary to assist the Site Manager and Gate Package leader with day to day coordination.</li> </ul>
Additional Supervisor – QA for day shift and additional night shift	- Jean-Francois Frechette	Jun-15	<ul style="list-style-type: none"> <li>- Additional personnel was mobilized to accommodate inspections on multiple fronts and to assist in the surveillance of night shift work</li> <li>- Camnec had to start a night shift during the weeks following the issuance of Change Order 010, thus Andritz had to staff the night shift to ensure proper HSE, Quality and Technical support</li> </ul>
	- Dany Gauthier	Dec-15	
	- John Spithoff	Jan-16	
	- Daniel Belanger	Mar-16	
	- Brandon Quann	Jun-16	
Additional Commercial Coordinator:	- Michael Stephens	Mar-16	<p>Standard commercial coordination is normally handled by the Site manager.</p> <ul style="list-style-type: none"> <li>- An additional Commercial coordinator was required :                             <ul style="list-style-type: none"> <li>- To stabilize the increasing number of commercial issues caused by the complex work environment, such as: claims from multiple sub-contractors impacting one another &amp; changes due to the presence of Company's other Contractors</li> <li>- To collect additional and accurate commercial data in this environment, such as: Minutes of meetings, time sheets &amp; photographs</li> </ul> </li> </ul> <p>To provide commercial support, not customarily</p>
	- Sam Ikezue	Mar-16	



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Function	Name	Date First Mobilized	Reason(s)
			required, to the Site Manager while performing effective reporting to the home office
Labour Relations	- Jacqui Winters	Mar-16	<ul style="list-style-type: none"> <li>- In the original plan, the function of labour relations was to be handled by the Site Resources and Logistics Manager</li> <li>- However, due to the increased number of logistic issues (such as material transport in the heart of winter) occurring in parallel with the increase in manpower, an additional resource was mobilized for a few months (February 2016 and March 2016), to secure sufficient labour on short notice and ensure continued smooth relations in the work place while not abandoning the logistics front</li> </ul>
Scheduler	- Philippe Monette	Jan-16	<ul style="list-style-type: none"> <li>- Initially, Andritz had a part time scheduler located at the home office to overview fulltime site scheduler provide by Canmec</li> <li>- In order to adapt to the fast pace environment caused by the acceleration which required fast updates and constant schedule analysis, the Canmec's scheduler had to be complemented on a full time basis by Andritz's head office scheduler who eventually moved to the site in January 2016.</li> <li>- Another scheduler was hired for the office to ensure continuation of the regular reporting activities.</li> </ul>
Additional Site Administrative Support	- Melissa Wrathell	Apr-16	<ul style="list-style-type: none"> <li>- As the number of workers and staff increased, so did the need for administrative support.</li> <li>- Additional administrative tasks that increased in volume as a result of Change Order 010 included but not limited to, increase in volume of LEM reports to be filled on a daily basis.</li> </ul>
	- Duane Eagles	Nov-15	

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Function	Name	Date First Mobilized	Reason(s)
Additional Deputy Site Manager	- Brian Keating	Sep-15	<ul style="list-style-type: none"> <li>- This additional role was necessary to support the Site Manager with coordination, planning and commercial issues following the increase in the number of construction and staff personnel.</li> <li>- This role became especially crucial when Company instructed Andritz to remove Daniel Bernier as the Site Manager.</li> </ul>

4.2.1.2 Planned site staff required to work additional / overtime hours

As a general, numerous site staff had to do overtime to provide an overlap period for turnover but more specifically to provide handover of instruction and coordination between the day and night shift. In certain cases, authorizing controlled overtime was found to be more effective than providing additional fulltime resources for a similar role.

Function	Name	Date First Mobilized	Reason(s)
Site Safety Officer	- Rodney White	Nov-15	- Additional hours spent on the coordination of the increased numbers of safety officers operating on different shifts, as described in the previous section.
Spillway Supervisor	- Johann Harry	Nov-16	- Additional hours were spent to technically support & supervise the work during the acceleration to avoid stalling of the work during extended work hours.
	- Bertolini Ciorcirian	Feb-16	
	- Andreas Klopf	Apr-16	
	- Alois Masser	May-16	
Supervisor – Commissioning	- Camille Mercier	Apr-16	- Additional administrative and field support hours were required to meet narrower commissioning timeline, commissioning activities in parallel bays as well as additional coordination between the site
	- Marc-Andre Pilon	Apr-16	
	- Emma Penney	Apr-16	

Section 4: Andritz Hydro's costs

Function	Name	Date First Mobilized	Reason(s)
			team, subcontractors, Company and the commissioning team.
Electrical Supervisor	- Wessel van Zyl	Feb-16	<ul style="list-style-type: none"> <li>- Additional electrical supervisor hours were spent to support the acceleration effort of electrical sub-contractors and to limit coordination issues with other sub-contractors</li> <li>- The additional supervisor hours were essential due to the work on temporary power for testing &amp; commissioning, the additional protection for equipment necessary due the supervision in multiple work fronts in parallel and the handover to night crews</li> </ul>
	- Gary Pinette	Mar-16	
Supervisor – Mechanical	- Marco Chamberland	Feb-16	<ul style="list-style-type: none"> <li>- Additional hours were spent to support acceleration efforts by coordinating multiple sub-contractors' activities on top of the bridge &amp; optimization of the use of planned and additional equipment &amp; work fronts.</li> </ul>
	- Nikolay Dimov	Nov-15	
Supervisor - QA	- Michele Castelli	Mar-14	<ul style="list-style-type: none"> <li>- Additional hours spent on the coordination of the increased number of quality assurance personnel operating on different shifts, as described in the previous section.</li> </ul>
Site Logistic (& Resources) Manager	- Brian Keating	Sep-15	<ul style="list-style-type: none"> <li>- Additional hours were required to support CRT during acceleration, in order to mitigate potential concrete pouring delays.</li> <li>- The increased coordination effort due to most of the material transport happening in a narrower timeframe and in the middle of the winter season, compared to the original schedule</li> <li>- Optimization of lifting and transport equipment during parallel handling &amp; transport of equipment between different laydowns</li> </ul>
	- Steve Jarvis	Feb-16	
Site Manager	- Daniel Bernier	Sep-15	<ul style="list-style-type: none"> <li>- Having to completely oversee the work in a schedule driven execution plan, the</li> </ul>

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Function	Name	Date First Mobilized	Reason(s)
	- Randy Skakun	Mar-16	additional presence of the site manager was required, for but not limited to, participation in the transition between shifts, the resolution of commercial issues such as changes caused by the presence of the numerous sub-contractors and quick implementation of mitigation measure due to unforeseen and undesired weather conditions.
	- Mathieu Bertrand	Feb-16	
Site Administrative Support	- Eileen Walsh	Nov-15	<ul style="list-style-type: none"> <li>- As mentioned above, the increase in the number of workers and staff brought with it the need for administrative support</li> <li>- While the addition of personnel to this function helped, additional hours had to be spent by the initial Site Administrative Support to manage the additional staff &amp; workers displacements, camp accommodations, orientations and gate access.</li> </ul>

The delayed start and the order to accelerate the Spillway installation works had a significant impact on Andritz's site staff, resulting in additional costs for Andritz, a summary of which is presented in Table 1 of page 4-14 & Table 2 of page 4-15.

**Cost of additional site staff: \$3,269,618**

We also present on pages 4-16 a graph depicting the cumulative planned and actual/project staff hours (Graph 2).

**4.2.2. Office Staff**

Initially, Andritz had planned to assign the following office staff to the Project:

- One (1) Project Manager
- One (1) Commercial Manager
- One (1) Project Engineer

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- Two (2) Documentation Control
- Two (2) Vendor Quality Planning
- One (1) Project Procurement Expert
- One (1) Planning and Schedule
- Three (2) System Engineers

However, as a result of the delayed start of the Spillway installation works and of Company's order to accelerate the work, Andritz also had to assign the following additional personnel to handle the additional coordination workload constrain by the stringent timing requirement of the contract.

Function (Name)	Name	Start Date	Tasks
Project Administrator	Konstantin Makrogianoudis	Feb-16	<ul style="list-style-type: none"> <li>- To deal with commercial issues occurring both at site and at the office as a result of the acceleration (such as claims, changes, correspondence, compilation of timesheets, compilations of invoices), the additional Project Administrator also contributed to ongoing data analysis to help accurately assess the overall impact of the acceleration effort</li> </ul>
Installation Coordinator	Daniel Bernier	Mar-16	<ul style="list-style-type: none"> <li>- Additional installation coordination was required to support the acceleration efforts of Andritz's installation team and of the multiple sub-contractors working in parallel</li> <li>- Additional effort specifically related to the supervision for tracking and negotiation of purchase order revisions of subcontractors associated with acceleration.</li> </ul>

The breakdowns of costs resulting from this situation are summarized in Table 3 of page 4-17. **Cost of additional office staff: \$244,290**

**4.3. Conclusion (Mobilization of additional staff personnel)**

In summary, the delayed start of the Spillway works and Company's order to accelerate these works resulted in the following additional staff costs for Andritz:

Site Staff	:	\$	3,269,618
Office Staff	:	\$	244,290
<b>Total</b>		<b>\$</b>	<b>3,513,908</b>

**Table 1: Cost summary - Site Staff (Additional Personnel Mobilized for Acceleration) <sup>(1)</sup>**

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(1) See details in Appendix 4.1A of Volume II

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The table below shows the actual (and presently forecasted) cost and associated manhours for the additional site personnel that Andritz mobilized as a direct consequence to the acceleration.

Roles	Names	Actual (Nov 2015 - Jun 2016)	Remaining (Jun 2016 – Oct 2016)	Actual (Nov 2015 - Jun 2016)	Remaining (Jun 2016 – Oct 2016)	CH 010 Total Forecast (As of Jun 2016)
		(Hours)	(Hours)	(CAD)	(CAD)	(CAD)
Site Safety Officer	Derrick Kearny Graeme Moulton Billy Syms Brent Marsh Marcel Labelle Joanne Harte	4521	2458	639,469	386,459	1,025,928
HAL Spillway Supervisor Night	Bertolini Ciorcirlan Scott Morton	929		181,391	1,193	182,584
Construction Coordinator	Claude Cardin	822	0	122,678	1,720	124,398
Supervisor QA	Jean-Francois Frechette Daniel Belanger John Spithoff Dany Gauthier Brandon Quann	3266	2114	392,084	277,475	669,559
Commercial Coordinator	Michael Stephens Sam Ikezue	1097	978	172,327	212,048	384,375
Labour Relations	Jacqui Winters	400	0	43,559	0	43,559
Scheduler	Philippe Monette	1095	556	198,286	112,268	310,554
Site Admin Support	Melissa Wrathell Duane Eagles	956	897	103,393	107,417	210,810
Site Manager	Brian Keating	878	0	124,676	0	124,676
<b>Grand Total</b>		<b>13,964</b>	<b>7,003</b>	<b>\$ 1,977,863</b>	<b>\$ 1,098,580</b>	<b>\$ 3,076,443</b>

**Table 2: Cost summary - Site Staff (Additional Hours Spent by Baseline Site Team for Acceleration)<sup>(1)</sup>**

The table below shows the actual (and presently forecasted) cost and associated hours spent by the baseline site team on overtime as a direct consequence to the acceleration.

Roles	Names	Actual (Nov 2015 - Jun 2016)	Actual (Nov 2015 - Jun 2016)	CH 010 Total Forecast (As of Jun 2016)
		(Hours)	(CAD)	(CAD)
Site Safety Officer	Rodney White	88	11,616	11,616
Spillway Supervisor	Johann Harry Bertolini Ciorcirilan Andreas Klopf Alois Masser	300	44,326	44,326
Supervisor Commissioning	Camille Mercier Marc-Andre Pilon Emma Penney	48	8,016	8,016
Supervisor Electrical	Gary Pinette Wessel van Zyl	230	33,966	33,966
Supervisor Mechanical	Nikolay Dimov Marco Chamberland	123	17,395	17,395
SV QA	Michele Castelli	38	4,332	4,332
Site Logistics Manager	Brian Keating Steve Jarvis	437	61,983	61,983
Site Manager	Daniel Bernier Randy Skakun Mathieu Bertrand	14	1,988	1,988
Site Admin Support	Eileen Walsh	97	9,554	9,554
<b>Grand Total</b>		<b>1375</b>	<b>\$ 193,176</b>	<b>\$ 193,176</b>

**Graph 2: Cumulative monthly progression of actual/baseline staff hours**

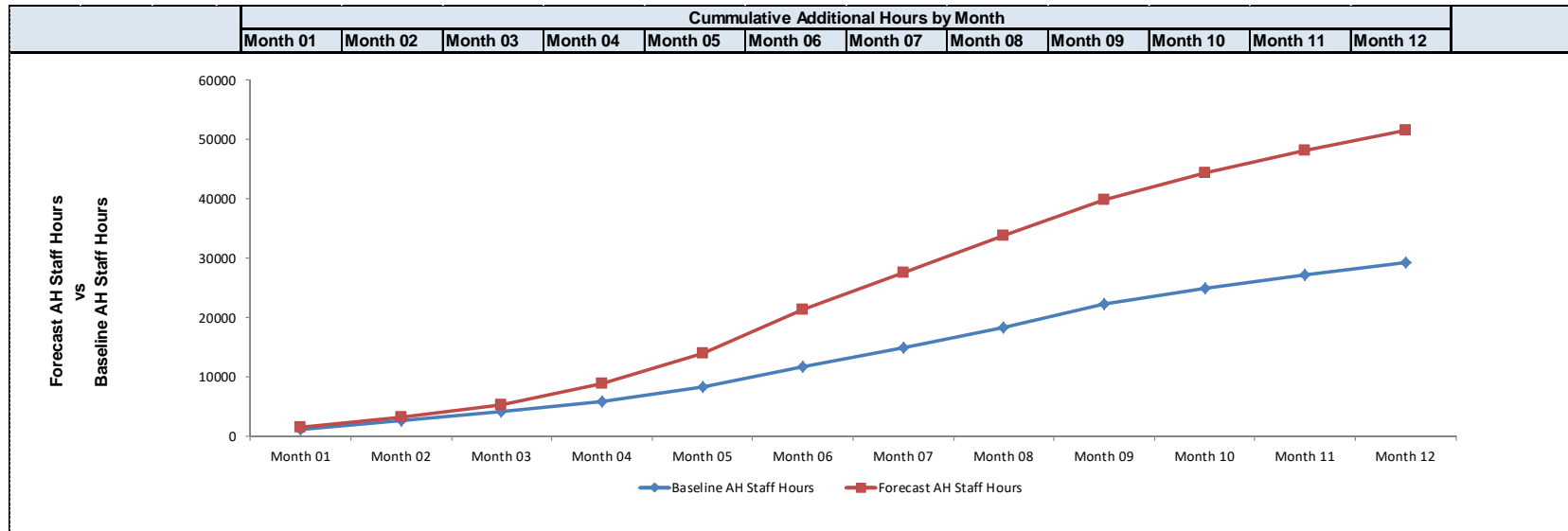
(1) See details in [Appendix 4.1B](#) of Volume II



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Graph 2 compares the actual progression of site staff hours against the baseline hours as of October 2015, prior to the issuance of CO-010.



**Table 3: Cost summary - Office Staff<sup>(1)</sup>**

The table below shows the actual (and presently forecasted) cost and associated hours for the additional site personnel that Andritz mobilized as a direct consequence to the acceleration.

Roles	Names	Actual (Nov 2015 - Jun 2016)	Remaining (Jul 2016 – Oct 2016)	CHO 010 Forecast (As of Jun 2016)	Actual (Nov 2015 - Jun 2016)	Remaining (As of Jun 2016)	CH 010 Total Forecast (As of Jun 2016)
		(Hours)	(Hours)	(Hours)	(CAD)	(CAD)	(CAD)
Project Administrator	Konstantin Makrogianoudis	465	295	760	95,790.00	60,770.00	156,560.00
Installation Coordinator	Daniel Bernier	549	186	735	77,958.00	9,772.00	87,730.00
<b>Grand Total</b>		<b>1,014</b>	<b>481</b>	<b>1,495</b>	<b>\$ 173,748.00</b>	<b>\$ 70,542.00</b>	<b>\$ 244,290.00</b>

(1) See Appendix 4.1C of Volume II

**4.4. Performance of a portion of the Work under winterlike conditions**

As mentioned before, based on the baseline schedule, Andritz was to perform its work at the spillway as per the following dates:

- Start of Embedded parts installation – February 2015
- Start of Concrete pouring – June 2015
- Start of Spillway roller gates installation – September 2016
- Start of Hoist, bridge & tower installation – September 2016
- Start of Commissioning – November 2016

where approximately 50% of the work was planned to be performed during winterlike conditions.

In reality however, as a result of the delayed start of the installation work at the spillway and of Company's instruction to accelerate this work, Andritz was required to perform over 70% of the work under winter conditions, from November 2015 to May 2016:

- Start of Embedded parts installation – November 2015
- Start of Concrete pouring – March 2016
- Start of Spillway roller gates installation – April 2016
- Start of Hoist, bridge & tower installation – June 2016
- Start of Commissioning – June 2016

The performance of this work under winter conditions resulted in the following consequences for Andritz:

- Loss of productivity for the construction crews performing the embedded conduits installation (initially planned in )
- Snow removal

The details of these consequences are presented below.

**4.4.1. Loss of productivity for the construction crews**

Overall productivity of construction crews decreases when performing their work under winter conditions mainly due to the following factors, among others:

- Reduced daylight hours;
- Reduced mobility due to heavy winter clothing;
- Additional time required to put on/remove gloves and coats at the start and end of each shift and at daily breaks;
- Additional time required at the start of each shift to start construction equipment;
- Increase in equipment break as more frequent mechanical and hydraulic problems occur on construction equipment.

As a result of this situation, Andritz's crews performing the embedded conduits and Secondary grounding installation under winterlike conditions suffered a loss of productivity which would not have occurred in the original plan as this work was to be performed in the summer period along with the concreting work. Andritz evaluates this loss of productivity at 24% (loss of productivity factors for work in the January to May period range from 15% to 50%).

Accordingly, Andritz incurred additional costs in the amount of \$ 82,800<sup>(1)</sup>, calculated as follows:

– Planned total labour hours spent during winter	1775 hrs (a)
– Actual total labour hours spent during winter	2460 hrs (b)
– Actual labour hours loss during winter (a – b)	595 hrs (c)
– Incurred productivity loss factor on actual hours	24%

(1) See [Appendix 4.2A](#) of Volume II

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– Winter productivity loss range for this period	15% - 50%
– Average hourly rate	\$ 139.15/hr (d)
<b>Loss of productivity cost (c x d)</b>	<b>\$ 82,800</b>

**4.4.2. Snow Removal**

In order to minimize compounded mark-up from Andritz's subcontractor CRT's works, Andritz decided to directly provide snow removal on and around CRT's work area to support CRT's acceleration efforts. Andritz ensured supply of labour to maintain snow removal services at the top of the bridge. As the planned schedule, concreting at this location would have occurred during the summer period, this item was segregated from other snow removal activities.

This resulted in the following additional costs:

Item	Invoices received to date (Nov 2015 - Jun 2016)		CH 010 Total Forecast (As of Jun 2016)	
	Hours (h)	Cost (CAD)	Hours (h)	Cost (CAD)
Snow removal labour	840	\$ 102,366	1470	\$ 177,708

**Cost - snow removal      \$      177,708<sup>(1)</sup>**

**4.5. Conclusion (impact on performance of a portion of the work under winter conditions)**

In summary, as a result of the delayed start and of Company's order to accelerate the work, the performance of a portion of the work under winter conditions, resulted in the following additional costs for Andritz:

Loss of productivity of construction crews    :    \$      82,800

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(1) See [Appendix 4.2B](#) of Volume II

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Snow removal	:	\$	177,708
<b>Total</b>		<b>\$</b>	<b>260,508</b>

**4.6 Mobilization of additional tools and equipment**

In order to support Andritz's sub-contractors' acceleration efforts and its own additional staff, the following support equipment had to be mobilized:

- Seven (7) diesel generators upstream of the Spillway;
- One (1) generator for electrical commisioning of river diversion;
- Equipment for snow removal;
- Equipment for temporary construction power;
- Equipment to support CRT's acceleration effort; and
- Six (6) vehicules for Andritz's acceleration staff.

This equipment was mobilized for the following reasons:

**4.6.1. Diesel generator for spillway upstream**

Cost for rental, hookup, handling and relocation of seven (7) additional diesel generators were incurred by Andritz for the following reasons:

- To simultaneously power ten (10) hydro-mobiles simultaneously instead of the planned four (4) to six (6) Hydro-mobiles;
- Simultaneous heating of all bays with electrical heaters (in parallel with fuel frost fighters);
- Due to the following change in the installation sequence, the gates had to be installed prior to the completion of all activities requiring not only that the generator be reinstalled and relocated but also the power to the hydro-mobiles, removed and repowered after the installation of the gates in order to continue working on the guides:
  - Guides installation
  - Installation of the spillway roller gates

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- Painting of the guides.
- The quantity of trailers required upstream increased, resulting in a higher demand for power.

These generators were mobilized in november resulting in the following additional costs for Andritz:

Item	Invoices received to date (Nov 2015 - Jun 2016)	CH 010 Total Forecast (As of Jun 2016)
	(CAD)	(CAD)
Fuel	\$ 10,564	\$ 260,000
Rental	\$ 81,256	\$ 100,000
Electrical Work	\$ 0	\$ 100,000
<b>Total</b>	<b>\$ 91,820</b>	<b>\$ 460,000</b>

**Diesel Generators cost      \$ 460,000<sup>(1)</sup>**

**4.6.2. Generators for commissioning for river diversion**

Initially, Andritz had planned to complete the commissioning of the spillway with the permanent power from the spillway electrical building.

However, one (1) additional generator was mobilized on for the following reasons:

- In order to supply temporary power to achieve minimum river diversion;
- This generator will also be used to temporarily feed the permanent electric motors that will lift and lower the gates during commissioning.

The mobilization of this generator resulted in the following additional costs for Andritz:

Item	Invoices received to date (Nov 2015 - Jun 2016)	CH 010 Total Forecast (As of Jun 2016)
	(CAD)	(CAD)
Fuel	\$ 1,842	\$ 52,404

(1) See Appendix 4.3A of Volume II

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Item	Invoices received to date (Nov 2015 - Jun 2016)	CH 010 Total Forecast (As of Jun 2016)
	(CAD)	(CAD)
Rental	\$ 0	\$ 30,000
Electrical Work	\$ 0	\$ 30,000
<b>Total</b>	<b>\$ 1,842</b>	<b>\$ 112,404</b>

**Generator's cost**      \$ 112,404<sup>(1)</sup>

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(1) See Appendix 4.3B of Volume II



**4.6.3. Equipment for snow removal**

Based on its initial work plan, concreting activities were planned to be performed in the summer season.

However, as part of the acceleration effort this work was performed during the period from February to June 2016, under winterlike conditions. Accordingly, Andritz had to maintain snow removal services at the top of the bridge, using a loader.

This resulted in the following additional costs for Andritz:

Item	Invoices received to date (Nov 2015 - Jun 2016)	CH 010 Total Forecast (As of Jun 2016)
	(CAD)	(CAD)
Lifting Equipment	\$ 52,621	\$ 60,000
Electrical Work	\$ 414	\$ 4,000
General Tools	\$ 24,842	\$ 30,000
Transport	\$ 489.04	\$ 1,000
<b>Total</b>	<b>\$ 78,677</b>	<b>\$ 95,000</b>

**Cost of snow removal equipment      \$ 95,000<sup>(1)</sup>**

**4.6.4. Equipment for temporary construction power**

Two (2) generators had to be mobilized to site for the following reasons:

- Due to the change in erection sequence and since permanent construction power was not available to Andritz work areas, Andritz had to temporarily feed the hydro-mobiles with temporary construction power from generators. ;
- This allowed a quicker installation of the Hydro-mobiles work platforms and more work zone flexibility to adapt to the non-completion of milestone I1A,

(1) See [Appendix 4.3C](#) of Volume II

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“upstream of spillway ready for start of hydromechanical works”, by Company’s civil contractor.

As a result, Andritz incurred the following additional costs:

Item	Invoices received to date (Nov 2015 - Jun 2016)	CH 010 Total Forecast (As of Jun 2016)
	(CAD)	(CAD)
Fuel	\$ 13,698	\$ 65,000
Generator rental	\$ 45,667	\$ 50,000
Electrical work	\$ 96,844	\$ 100,000
<b>Total</b>	<b>\$ 156,249</b>	<b>\$ 215,000</b>

**Cost of Temporary Construction Power**      \$ 215,000<sup>(1)</sup>

**4.6.5. Equipment to support CRT’s acceleration effort**

In order to support CRT’s acceleration effort, Andritz has to perform the following additional tasks and to suffer the indicated consequences:

**4.6.5.1      Supply, Hook up and troubleshooting of Generators**

- Eight (8) generators had to be provided and hooked up for the concrete shelter upstream of Bay 3.
- Generators also had to be provided and hooked up in J-Laydown area, on top of Spillway and at Main Office Laydown area to power the additional CRT trailers set up in those locations.

**4.6.5.2      Supply and install manual transfer switches and cabling for generators**

- In order to avoid any potential delay with the pour of the second stage concrete, Andritz supplied and installed manual transfer switches and cabling for generators to provide emergency power.

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(1) See Appendix 4.3D of Volume II

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- Had it not been for the acceleration, Andritz would have not installed this equipment since as per the baseline control schedule permitted a temporary interruption of the concrete pour when being performed by a small pouring crew as it would not have significantly impacted the schedule.

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4.6.5.3. Standby Time during Secondary Concrete pour of gate guides

- Electricians were added to the night shift so that they would be available in case of a potential electrical problem with the construction power and operation of the temporary power generating system. These electricians were dispatched to execute various contractual tasks but there were times when they had no more work in the vicinity of the upstream and downstream sides of the Spillway. In these instances, they were paid to be on stand-by.
- Had it not been for the acceleration, Andritz would have not provided standby electricians since the baseline control schedule permitted a temporary power interruption of the concrete pour when being performed by a small pouring crew as it would not have significantly impacted the schedule.

As a result of the above-mentioned support of CRT's acceleration, Andritz incurred the following additional costs:

Item	Invoices received to date (Nov 2015 - Jun 2016)	CH 010 Total Forecast (As of Jun 2016)
	(CAD)	(CAD)
Consumables	\$ 5,095	\$ 20,000
EHS Equipment	\$ 4,032	\$ 20,000
Fuel	\$ 16,797	\$ 95,000
Generator Rental	\$ 42,996	\$ 50,000
Tooling	\$ 55,173	\$ 75,000
Lifting Equipment	\$ 269,196	\$ 300,000
Transport	\$ 12,761	\$ 30,000
Electrical Work	\$ 38,430	\$ 100,000
<b>Total</b>	<b>\$ 444,480</b>	<b>\$ 690,000</b>

**Support to CRT acceleration**

**\$ 690,000<sup>(1)</sup>**

(1) See [Appendix 4.3E](#) of Volume II

**4.6.6. Vehicles for Andritz's acceleration staff**

- One additional vehicle was provided for every two additional staff members. A total of six (6) additional vehicles were supplied to Andritz's staff to account for the increase in their number due to the acceleration effort.

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This resulted in the following additional costs for Andritz:

Item	Invoices received to date (Nov 2015 - Jun 2016)	CH 010 Total Forecast (As of Jun 2016)
	(CAD)	(CAD)
Vehicles for Andritz' acceleration staff	-	\$ 160,551

**Vehicles for Andritz's staff**      **\$ 160,551<sup>(1)</sup>**

**4.7. Conclusion (Additional tools and equipment)**

The total additional costs incurred by Andritz as a result of the mobilization of additional tools and equipment are presented in the following table:

Description	Total Forecast (as of May 2016)
Diesel Generator Upstream Spillway	\$ 460,000
Electrical - River diversion temp power for Commissioning	\$ 112,404
Equipment for Snow Removal	\$ 95,000
Equipment for Temporary Construction Power	\$ 215,000
Support CRT Acceleration	\$ 690,000
Vehicles of Andritz's acceleration staff	\$ 160,551
<b>Total</b>	<b>\$ 1,732,955</b>

(1) See [Appendix 4.3F](#) of Volume II

**4.6 Conclusion**

Based on the above, the late “*start date*” for Spillway equipment installation work, and of Company’s change Order CO-010 requesting the acceleration of the said work, forced Andritz to incur and continue to incur the following additional costs:

– Mobilization of additional staff personnel	:	\$ 3,513,908
– Performance of a portion of the work under winter conditions	:	\$ 260,508
– Mobilization of additional tools and equipment	:	\$ 1,732,955
		\$5,507,372*
<b>Total</b>		

\*Including Contractor 15% Mark-Up

### SECTION 5: SUMMARY AND CONCLUSION

As per the facts presented in this document, it is clear that Andritz and its sub-contractors incurred and continue to incur substantial costs in relation to the change imposed on them in the form of CO-010.

This document demonstrated justification by itemizing the change while also validating that Andritz, in the best interest of the project, made significant efforts to mitigate costs. The complete resultant costs are as follows:

Item	Invoices received to date (Nov 2015 - Jun 2016)	CH 010 Total Forecast (As of Jun 2016)
	(CAD)	(CAD)
CRT	\$ 4,957,866	\$ 4,957,866
Canmec	\$17,536,680	\$21,036,878
Andritz	\$ 3,220,223	\$ 5,507,372
<b>Grand Total</b>	<b>\$25,714,769</b>	<b>\$31,502,116</b>

<b>Total</b>	<b>\$31,502,116</b>
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