



## Seaway Tie-Up Wall Emergency Reconstruction

### Project Highlights

#### Fast-Track Reconstruction Needed

On January 26, 2010, a 53-m portion of the 500-m long Lower Lock 2 tie-up wall collapsed. Recognizing Hatch's expertise, familiarity with the walls, and the proximity of experts in its Niagara Falls office, the St. Lawrence Seaway Management Corporation (SLSMC) immediately commissioned Hatch to design a replacement structure, including site supervision, on a fast-track, emergency basis. The contractor, Rankin Construction/Decew Construction (Rankin), was retained by SLSMC on a time and materials basis to complete the repair.

Hatch met with SLSMC and Rankin to quickly develop a concept that would put the reconstructed tie-up wall in place before the 2010 shipping season began. Only eight weeks elapsed from the January 26 collapse to initial flooding and the first ship transit on March 25. One week of construction was lost during this period until the Ministry of Labour deemed the site to be safe.

#### Technical Excellence and Innovation

Hatch had to design a repair that could make use of readily available materials for quick construction. Schemes utilizing pre-cast concrete could not be executed in time. Sheet pile cells options were also dismissed due to long delivery time. Cast-in-place concrete had to be kept to a minimum. Hatch made enquiries from steel suppliers and used structural steel beam and steel H piles sizes that were readily available and suited the Contractor's available equipment. The Contractor started driving piles on February 15, approximately two weeks after mobilizing to site. The deck elevation was set as high as possible so that, if necessary, work such as backfilling and pouring of the concrete deck could be completed with the canal flooded. Drawings for H pile installation, pile caps, and steel deck were issued on an as available basis. All connections were field-welded on a 24/7 basis as time did not permit the usual shop detailing and fabrication process. At no time was the Contractor delayed due to lack of design information from Hatch.

Hatch provided a full-time site engineer to monitor construction and to expedite the flow of information. Structural experts from Hatch's Niagara Falls office nearby were called to site many times to evaluate and quickly solve any problems that arose.

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### Congestion, Unstable Geology and Winter Construction Add Complexity

Access to the work area from the land side was limited by the adjacent Welland Canals Parkway and a housing subdivision. Construction equipment could not travel on either side of the tie-up wall adjacent to the collapsed area because of the risk of further collapse. The only access was a ramp at the north end of the tie-up wall and a temporary access road built along the bottom of the canal.

The clay banks are unstable when the canal is dewatered. The instability is caused by the build-up of pore water pressure in the clay which takes a long time to dissipate when the canal is dewatered. Due to time constraints, it was not possible to obtain site-specific geotechnical data and to perform detailed slope stability analyses before final design. The ever-present possibility of further slides or collapses of walls adjacent to the work area necessitated constant vigilance.

The project had to be completed during the winter months of January, February and March, not the best times for construction as cold temperatures created a challenge for welding and concrete curing.

With the collapse site only 100 m from a well established housing subdivision, noise by-laws imposed restrictions on activities such as pile driving.

### Economic, Social and Environmental Impacts Avoided

The SLSMC faced potential claims from shippers and cargo owners if the canal failed to open on schedule. Trucking the freight around the impasse would have greatly increased congestion on roads in St. Catharines and would have added CO<sub>2</sub> emissions into the atmosphere. The timely repair of the tie-up wall avoided all of these negative impacts.





## Seaway Tie-Up Wall Emergency Reconstruction



Photo 1 • Location of collapsed section of Lower Lock 2 tie-up wall

Image: Google Earth



Photo 2 • View of collapsed section (January 26, 2010)

## Seaway Tie-Up Wall Emergency Reconstruction

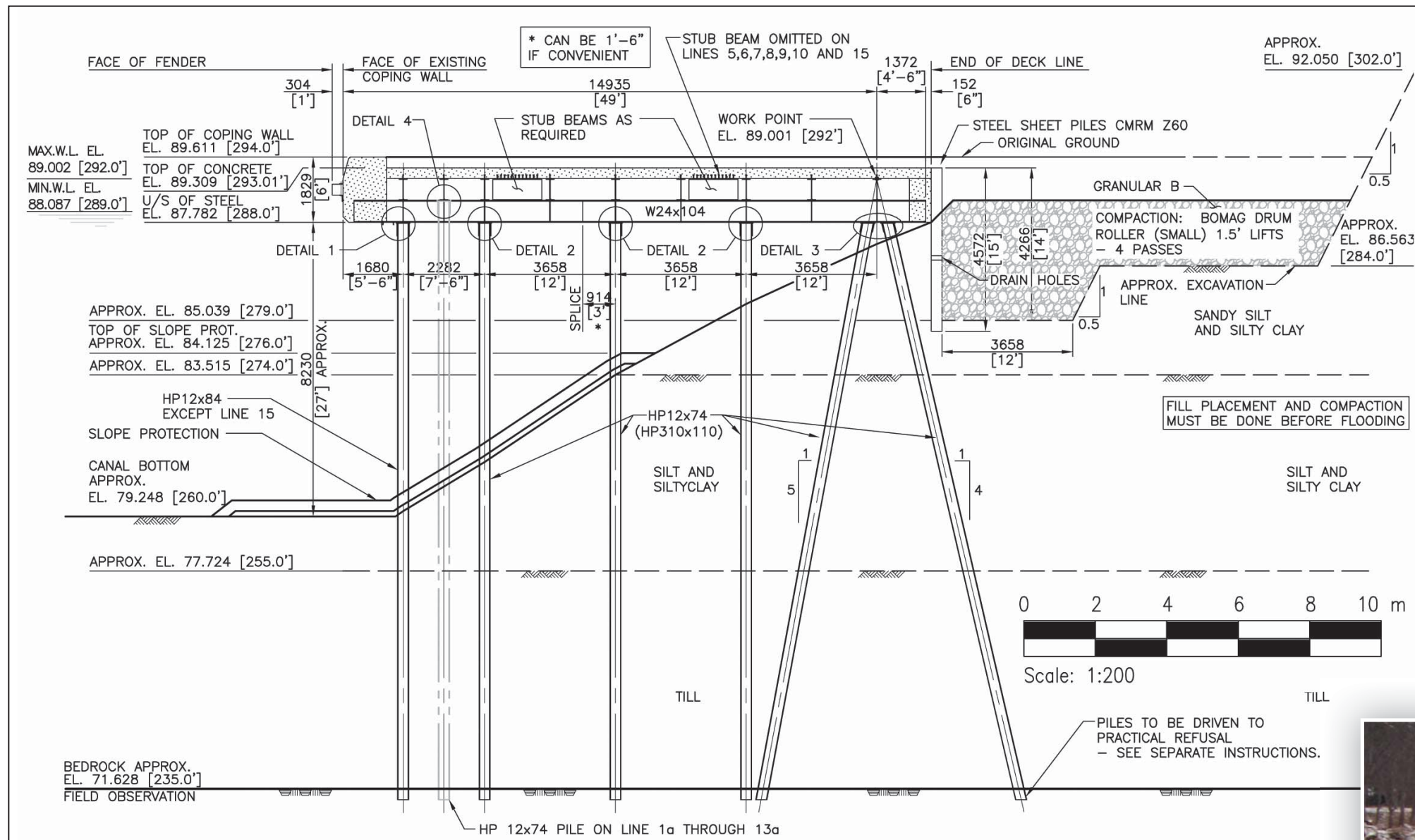


Photo 3 • Removal of debris



Photo 4 • Steel H pile installation

# Seaway Tie-Up Wall Emergency Reconstruction



Typical section through new deck

## Complexity Of The Project

In addition to the time constraints for reconstruction, there were many other challenges:

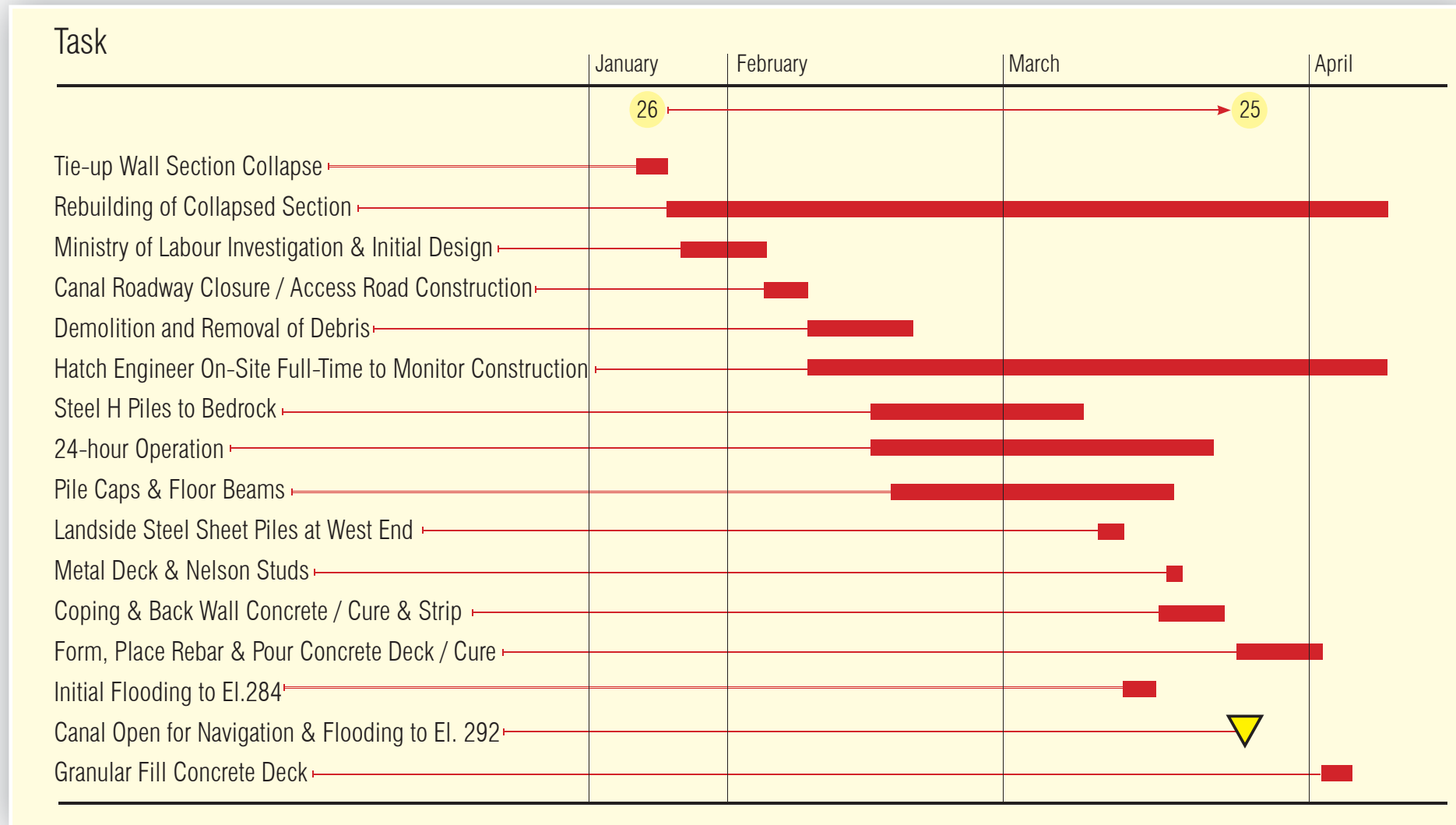
**No site-specific design** - Site conditions, particularly depth to till and bedrock, vary from lock to lock. Although the 2005 report included concepts, no site-specific designs had been prepared at that time for any of the locks. Thus, within a short space of time, the Hatch team had to sift through the many concepts, choose a design appropriate to the emergency condition and perform a final design suitable for construction. The 2005 studies did not include any provision for construction on an emergency basis.

**Access** - Access to the work area from the land side was limited as the Welland Canals Parkway and a housing subdivision were located directly adjacent to the work area. Construction equipment could not travel on either side of the tie-up wall adjacent to the collapsed area in fear of causing another section to collapse. The only access available to the contractor was to ramp down from the north end of the tie-up wall and build a temporary access road along the bottom of the canal to the collapse area.



Photo 5 • View of collapsed deck

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Fast-Track Project Schedule

- The project team dealt with the challenges as follows:
- SLSMC waived certain contractual procedures to avoid unacceptable delays such that Hatch and Rankin could reconstruct as quickly as possible. All parties were informed daily of construction progress. Weekly meetings were held at site.
  - Construction methods were reviewed at brainstorming sessions including Rankin to quickly focus on a solution which featured a simple design using readily available steel H piles supporting a structural steel deck of readily available sections. After a few days of design work, material lists were issued to order materials.
  - The deck elevation was set as high as possible so that, if necessary, work such as backfilling and pouring of the concrete deck could be completed with the canal flooded.
  - Drawings for H pile installation, pile caps, and steel deck were issued on an as available basis. All connections were field welded on a 24/7 basis as time did not permit the usual shop detailing and fabrication process. There were as many as 20 certified welders on site at any one time. Outside independent welding inspection was carried out to ensure quality, particularly for critical welds.
  - As the deck was assembled from the land side, timber mats were placed to allow the 100-tonne pile driving rig to reach the water side pile locations. After the timber mats were no longer required, metal deck and concrete were placed.
  - Hatch provided a full-time site engineer to monitor construction and to expedite the flow of information.
  - At no time was the Contractor delayed due to lack of design information from the Hatch team.



Photo 6 • Pile driving (note rig on top of new deck)



## Seaway Tie-Up Wall Emergency Reconstruction



Photo 7 • Canal view of new H piles, beams, girders and placement of slope protection material



Photo 8 • Deck nearing completion

## Seaway Tie-Up Wall Emergency Reconstruction



Photo 9 • Granular fill placement on reconstructed tie-up wall as ship passes through canal

### Photo credits

Photo 1 : Google Earth  
All others (printed and electronic) : Hatch



## Seaway Tie-Up Wall Emergency Reconstruction

### Key Contact Information

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The St. Lawrence  
Seaway Management  
Corporation

Corporation de Gestion  
de la Voie Maritime  
du Saint-Laurent

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May 2, 2011  
Canadian Consulting Engineering Awards 2011

Peter Last  
Hatch Consultants Inc.

Dear Peter:

Re: Lock 2 Wall Collapse – Rehabilitation Design and Execution

This is an acknowledgement of the excellent response and quality engineering services provided by Hatch for the emergency rebuild of a collapsed section of tie-up wall in the Welland Ship Canal.

On January 26, 2010, a 53 m. long section of wharf-like tie-up wall collapsed into the dewatered canal. The wall had to be rebuilt for the rapidly approaching new shipping season opening on March 20, 2010.

Hatch were able to immediately mobilize an experienced team of designers and site supervisors and was able to not only complete the necessary design work but also maintained the necessary flow of information to the Contractor so that the tie-up wall section was reconstructed in a period of only 8 weeks, allowing the Seaway to re-open on schedule.

It was through your team's excellent collaboration with the Seaway and the Contractor that we were able to execute this project on time and within a reasonable measure of the anticipated budget, and to come up with plans which resulted in a very safe and stable construction sequence.

Thank you so much for your help and your team's excellent delivery of service for this very important project.

Yours truly,

Paul Kosinec  
Sr. Civil Engineer

PK/ab



Canada