West Corridor Constructors

Highway 401 Expansion Project

Erosion and Sediment Control Lessons Learned on a Large-Scale Transportation Project

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Project Overview

The Ministry of Transportation (MTO) and Infrastructure Ontario (IO) selected West Corridor Constructors (WCC) to design, build and finance the Highway 401 Expansion Project under a Public Private Partnership.

WCC is an integrated Joint Venture comprised of Aecon Infrastructure Management Inc., Parsons Inc., and Amico Design Build Inc.

Project Overview

MTO completes Preliminary Design and Class Environmental Assessment Studies
March 2013, May 2013

Advanced Design-Build Contract for three bridges
2015-2018

MTO and IO Procurement Process to select Project Consortium
2018-2019

Selection of Project Consortium: West Corridor Constructors (WCC)
Spring 2019

WCC Design Commencement
April 2019

WCC Construction Start
October 2019

Substantial Completion (Expected)
Late 2022

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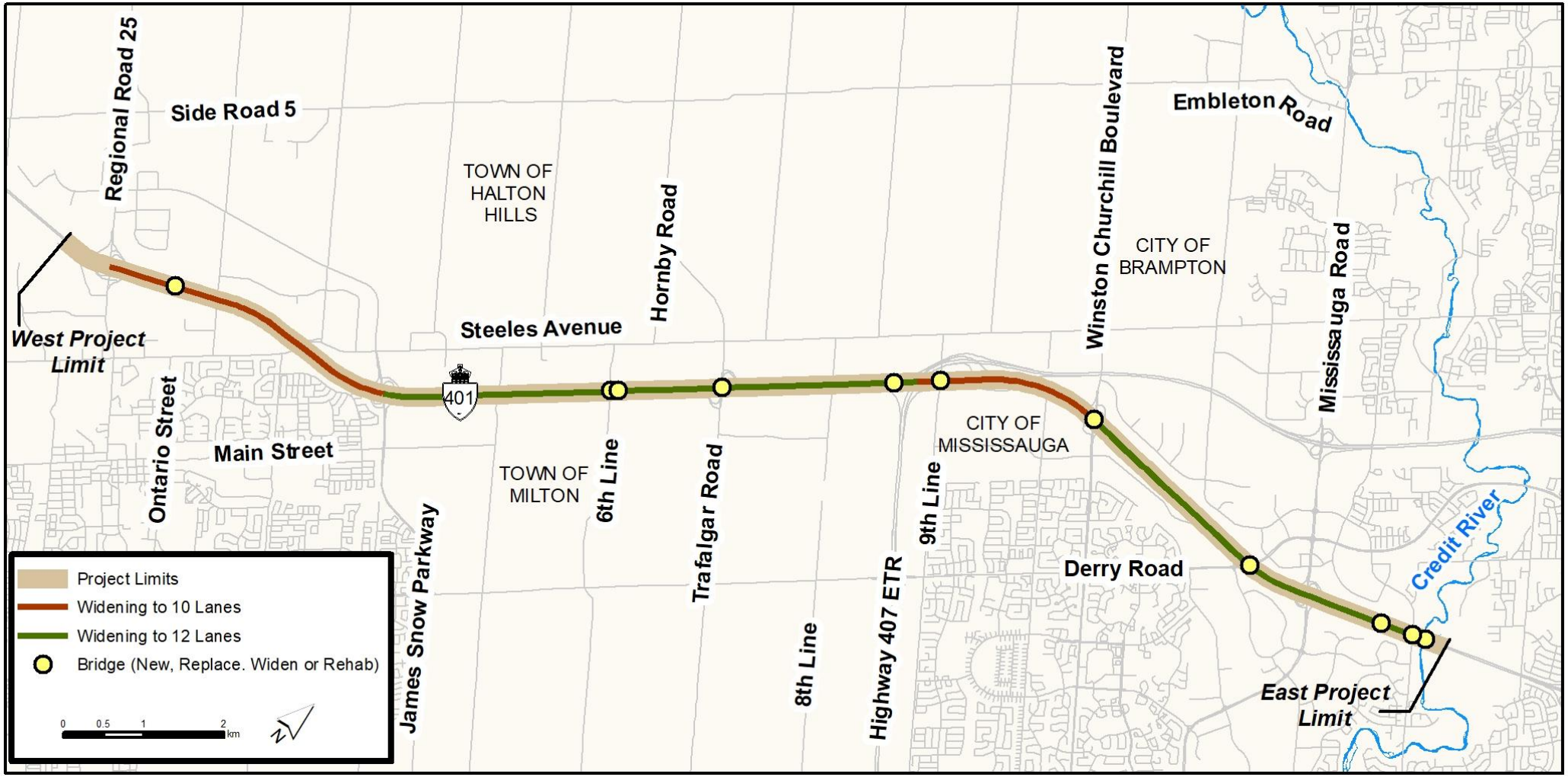
Project Overview

The Highway 401 Expansion Project is approximately 18 km long and includes widening the existing six lane configuration to 10-lanes or a 12-lane Core Collector system.



Project Overview

- Reconfiguration of six interchanges
- High Occupancy Vehicle (HOV) Lanes
- Bridge replacements and rehabilitations
- Structural/non-structural culvert replacements, extensions, rehabilitations
- Stormwater Management Ponds
- Watercourse realignments at Hornby Creek and Mullet Creek
- Fencing (MTO Right of Way and Wildlife Fencing)
- Landscaping and Restoration
- Other supporting facilities such as drainage, lighting, signage, Advanced Traffic Management System and carpool lots

Erosion & Sediment Control Considerations

The project limits fall within the Sixteen Mile Creek and Credit River Watersheds and includes more than 25 drainage and watercourse crossings, some with sensitive fish communities and species covered under provincial and federal legislation.

- Permits and Approvals with ESC requirements:
  - DFO Fisheries Act Permits
  - MECP Endangered Species Act Permit
  - DFO SARA Permit for Redside Dace
  - MECP ESA Letter of Advice for American Eel
  - MECP EASR / Permit to take Water
- Concurrent design and construction
- Staged approach to construction and erosion and sediment control

Erosion & Sediment Control Design Process

Design Process Part 1: Developed a corridor-wide Overall Erosion and Sediment Control Plan prior to Early Works construction

Minimize the area of disturbed soils.
Limit soil exposure.

Attempt to complete disturbance, construction and restoration in phases.

Use cover to protect exposed soil from erosion by wind, rain splash and overland flow.

Preserve existing vegetation. Stabilize exposed soil as soon as possible with vegetation.

Minimize slope steepness and lengths. Break longer slopes into a series of shorter slopes.

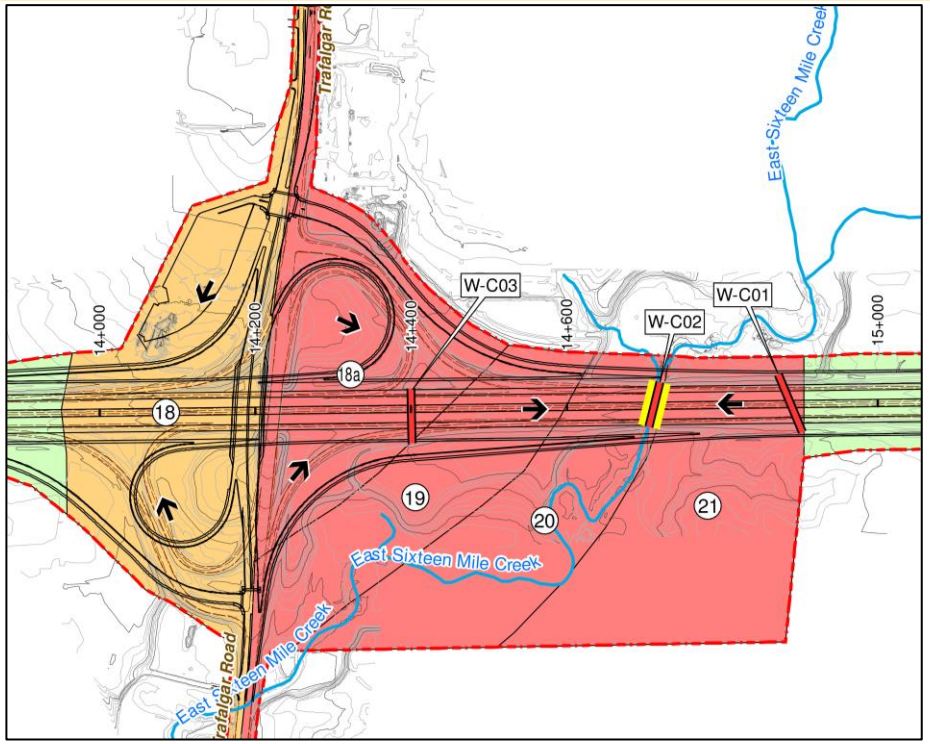
Encourage sheet flow to avoid concentrated flow paths.

Promote surface roughness instead of smooth uniform slopes to facilitate water infiltration.

Erosion & Sediment Control Design Process

Design Process Part 2: Erosion and Sediment Control Overview Risk Assessment

- ESC measures and approaches during construction stages and phases based on the likelihood of erosion and sedimentation
- Critical Areas of Concern – areas that could be affected by erosion and sedimentation and areas with sensitive environmental receptors:
  - Watercourses
  - Species At Risk locations



Polygon No.	Slope Gradient	Soil Type	Soil Erodibility Rating	Slope Length	Erosion Potential	Rationale for Erosion Potential	Consequence Rating	Rationale for Consequence Rating (Receiving Environment Sensitivity)	Erosion and Sediment Risk
16	0-10%	Sandy Loam	Medium	<70m	Low	Relatively flat with medium soil erodibility	High	Direct connectivity to watercourse	High
17	0-10%	Silty Clay	Medium	70m	Low	Relatively flat with medium soil erodibility	Low	Not draining to defined / permanent watercourses	Low
18	10-20%	Silty Clay	Medium	70m	Moderate	Moderate slope with medium soil erodibility	Low	Not draining to defined / permanent watercourses	Moderate
18a	10-20%	Silty Clay	Medium	70m	Moderate	Moderate slope with medium soil erodibility	High	Direct connectivity to watercourse	High
19	10-20%	Silty Clay	Medium	70m	Moderate	Moderate slope with medium soil erodibility	High	Direct connectivity to watercourse	High
20	10-20%	Silty Clay	Medium	70m	Moderate	Moderate slope with medium soil erodibility	High	Direct connectivity to watercourse	High

Erosion & Sediment Control Design Process

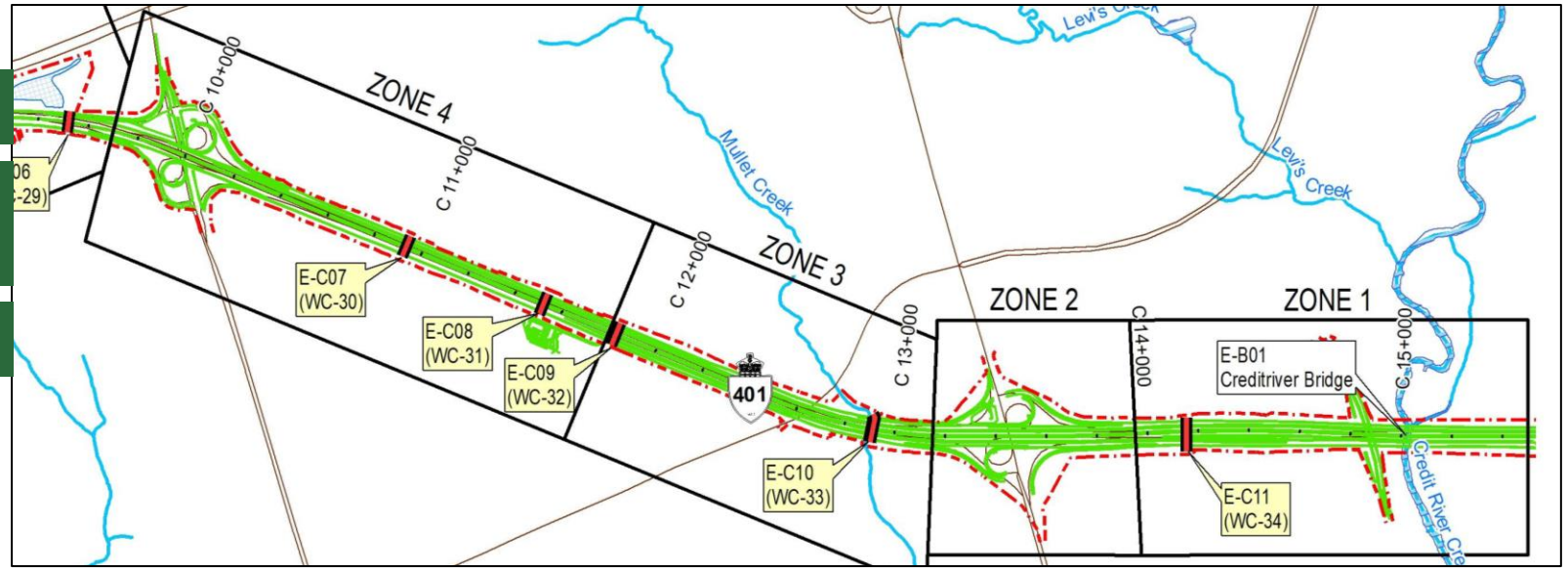
Design Process Part 3: Construction Period Site-Specific Erosion and Sediment Control Plans and Drainage and Sediment Management Plans (ESCPs/DSMPs)

- The ESCPs/DSMPs provide site-specific drainage, erosion and sedimentation measures for controlling the temporary drainage, reducing erosion, and managing sediment-laden runoff generated within the site.
- The ESCPs/DSMPs are updated as the project progresses.

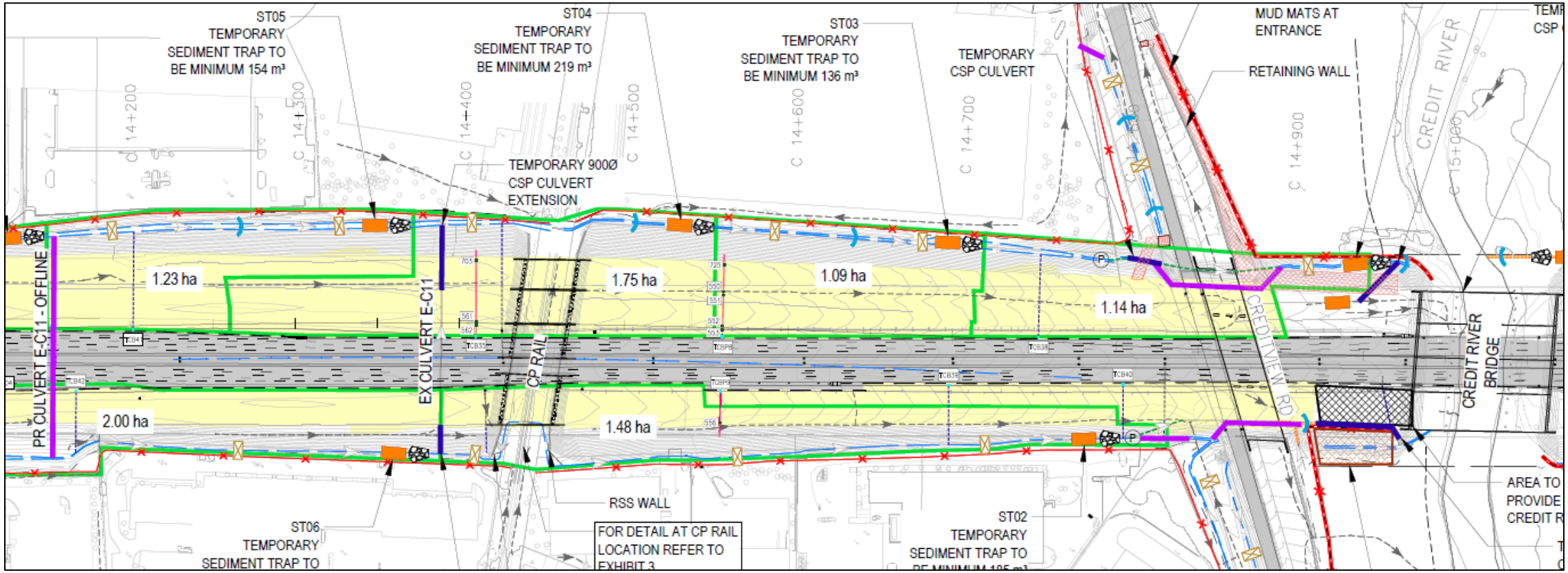
Corridor is divided into 15 Zones

Drawings show ESC measures for each phase/stage of construction

ESCPs/DSMPs updated every 80 days



ESCP/DSMP



LEGEND

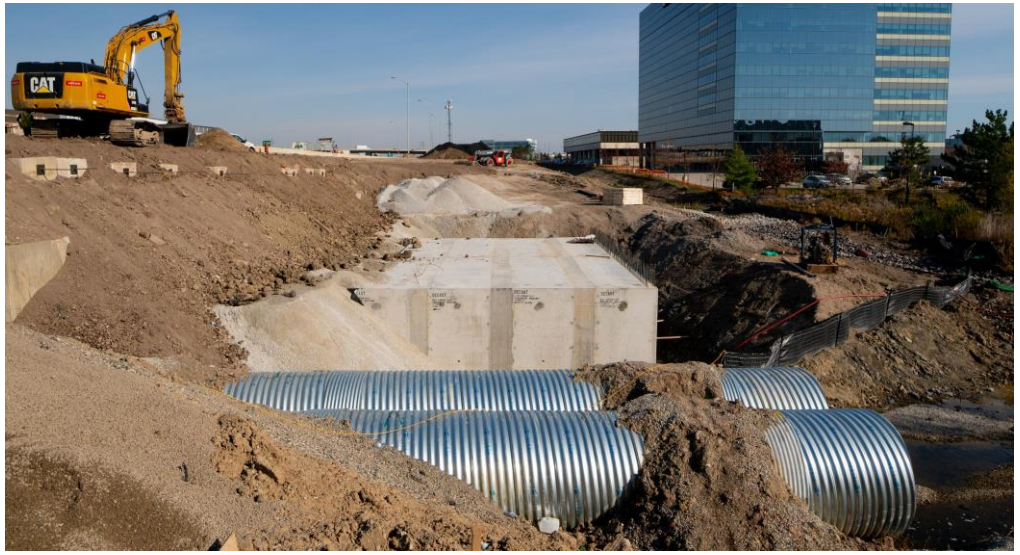
- FLOW DIRECTION
- WATERCOURSES
- HEAVY DUTY SILT FENCE BARRIER (OPSD 219.130)
- TWIN BARRIER SILT FENCE
- TEMPORARY SEDIMENT TRAP (OPSD 219.220)
- STRAW BALE FLOW CHECK DAM (OPSD 219.180) OR SIMILAR APPROVED
- FIBRE ROLL CHECK DAM (OPSD 219.191)
- ROCK FLOW CHECK DAM (OPSD 219.211)
- RIGHT OF WAY
- EXISTING CATCH BASIN
- PROPOSED PERMANENT CATCH BASIN IN TEMPORARY CONFIGURATION
- TEMPORARY CATCH BASIN
- PROPOSED PERMANENT STORM PIPES IN TEMPORARY CONFIGURATION
- TEMPORARY STORM PIPE
- GRADING LIMITS
- EXISTING DITCHES
- PROPOSED DITCHES
- TEMPORARY DITCHES
- DISTURBED DRAINAGE AREA DUE TO CONSTRUCTION ACTIVITIES
- EXISTING CULVERTS
- TEMPORARY CULVERTS / EXTENSIONS
- PROPOSED PERMANENT CULVERT CONSTRUCTION – STAGE 1A
- CONSTRUCTION WORK ZONE – STAGE 1A
- ACTIVE ROADWAY – STAGE 1A
- PUMP + SUMP
- MUD MATS AT TEMP ACCESS ENTRANCE/EXIT
- TEMPORARY ACCESS ROAD

Erosion & Sediment Control Implementation

- First operation was Clearing and Grubbing and installation of ESC measures
  - This needed to be phased and sometimes ESC installation needs an area to be cleared
- ESC measures were first implemented to delineate the Project Lands, to protect the watercourses, and environmental sensitive areas
- As vegetation removals proceeded and area stripped, more ESC measures were implemented in the, such as rock check dams and sediment basins in ditches.

Erosion & Sediment Control Implementation

- ESC measures continued to be installed as areas became available
- Once in-water work timing windows opened, vegetation removal proceeded below the high-water mark
- Field fits were required:
  - Enhanced from ESCP/DSMP
  - Different than ESCP/DSMP
  - Different from Permit requirements



Bridging the Gap Between the ESC Design Process and Implementation

- ESC installation before Vegetation Removals - Sometimes had to be concurrent
- Silt fence was installed to denote lands, once ditches were cut this silt fence needed routine maintenance
  - Removal of ESC once no longer needed
- Field fits of the design. Sometimes things did not work in the field
- ESC needed to be enhanced further to what is in the design
  - In some areas this need was only identified and understood once a rain event occurred

Bridging the Gap Between the ESC Design Process and Implementation

- Timeline for maintenance
- Substituting filter sock for silt fence – silt fence installation, while often prescribed, can cause a lot of disturbance
- Pumping operations needed to be enhanced with ESC and treatment train approach
- Working within a tight corridor - certain setbacks cannot be achieved within project lands

Best Practice Collaboration and coordination with construction team during design. Site visits with design, environmental and construction team.

Managing and Adapting

- Constantly changing site conditions – 18 km of construction and areas at different stages of work
- Some areas of concern not known until construction started
- Working with the construction team - field fits and enhanced ESC measures
- Design Changes – update ESC measures and all relevant parties are consulted
- Construction schedule

ESC needs will change and evolve! Set up a process for communicating and dealing with changes that is **efficient** and **effective** for all parties.

Lessons Learned

Prescribed ESC measures and Permit conditions <u>versus</u> practices found more effective on the ground

- 17(2)(c) ESA Permit specifies "*double rows of heavy duty, non-woven erosion and sediment control fencing with straw bales staked in-between to prevent the migration of sediment or deleterious substances into the Tributaries*"
- Redside Dace Regulated habitat included 30m on either side of occupied watercourses
- WCC needed to proceed with works within the 30m before July 1st
- Approvals for advance work obtained by MECP

Prescribed ESC measures and permit conditions versus practices found more effective on the ground

- Permit to Take Water Requirements – PWQO and CCME
- Very difficult to achieve within a constrained corridor
- Extensive treatment train approach
- Treating water to a higher standard than existing conditions

Monitoring, Communications, Training – Successful Methods

- Daily site inspections to monitor environmental conditions in the field, including ESC measures.
- Construction Team and Environmental Team worked together on field fits, improving ESC measures in the field and dealing with erosion and sedimentation issues.
- Issues and Deficiencies were tracked and closed out within a specific time period.

Consistent communication between Environmental and Construction Team		
Developing relationships with Foreman and Site Superintendents. 	One-on-one discussions to resolve issues at field level were effective. 	**Communication:** Text and phone calls worked; Emails were not as successful. 

Monitoring, Communications, Training – Successful Methods

- Online Tracking System “ParADIM®” for Construction and Environmental Monitoring
  - Can assign deficiencies to specific people. Only Environmental Inspectors can close them.
- Site Visits – WCC Senior Management, Agencies and the Contracting Authority
- All people onsite must take Environmental Training yearly
- Onsite training for Dewatering Set Up and Best Management Practices created

Mitigation & Compensation Measures	Unknown/ Not Applicable	Compliance with Measures	Maintenance Required	Not per Specifications
Erosion and Sediment Controls installed as per specification	o	●	o	o
Stream bank and bed protection methods (swamp mats, pads)	●	o	o	o
Enhanced controls in high-risk areas	o	●	o	o
Apply seed and cover	●	o	o	o
Surface water free of work-related sedimentation	o	●	o	o
Site isolation/containment measures installed prior to areas where in-water work is required (cofferdams)	●	o	o	o

Summary / Key Takeaways

Bridging the Gap Between the ESC Design Process and Implementation	Prescribed ESC measures and Permit conditions versus practices found more effective on the ground
Managing and Adapting	**Monitoring, Communications, Training**
✓ Engage construction during the design process.	✓ Understand availability of ESC measures in the marketplace.
✓ Start ESC design process early since you will need a plan in place for early construction activities to occur.	✓ On large-scale projects, it is ideal to have a schedule for when ESCP/DSMP updates are due to keep it on track.
✓ Review surrounding land uses to incorporate into the Erosion and Sediment Overview Risk Assessment.	✓ Where possible, bring in desired ESC approaches into negotiations of permits and approvals.
✓ You are not going to know about some issues until construction begins. Have effective and immediate corrective actions, to reduce the likelihood of reoccurrence.	✓ Keep communication lines open with all relevant parties.
✓ Site visits are vital.	✓ Create a good tracking system for ESC deficiencies in the field, including when corrective actions are required.

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What's Next?

- Completing construction works
- Removal of ESC Measures
- Updates are available on the project website at www.401expansion-mississauga-milton.ca

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