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**Atlas Specialty Steels  
Welland, Ontario  
and  
Environment Canada  
Toronto, Ontario**

**The Full-Scale Welland River  
Reef Cleanup Project**

**Project Assessment Report**

**Executive Summary**

**December 1997**

**P31201.02**

**Acres International Limited  
Niagara Falls, Ontario**

# Niagara River Remedial Action Plan

## The Full-Scale Welland River Reef Cleanup Project

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### Executive Summary

#### BACKGROUND

The Welland River Reef Cleanup Project consisted of the removal of two contaminated sediment deposits (reef formations) and one adjacent floodplain deposit, within Niagara Region in Ontario, Canada. The project was undertaken by Atlas Speciality Steels (Atlas) of Welland, Ontario. An initial sediment removal and treatment demonstration project was carried out in 1991, followed in 1995 by the full-scale demonstration project which effectively removed the deposits.

Contaminated sediments were successfully removed from the Welland River

This Executive Summary is one of three reports which document the Welland River Reef Cleanup Project. It serves as a contextual guide for the project. The other documents; the Environmental Screening Report and the Technical Reference Document Volume 1 (Main Report) and Volume 2, (Supplementary Data) provide detailed environmental, technical and analytical information relating to the project.

Three reports are available providing project information

#### Project Area

The project area is located in the Welland River within the Welland city limits (Figure 1). This stretch of the river is listed as a provincially significant (Class I) wetland.

#### 'Reef' Deposits

During the early 1980s Brock University researchers in conjunction with the Ontario Ministry of Environment and Energy, discovered heavy metal and oil and grease contaminated sediments in the lower Welland River. Reef like deposits, comprising industrial mill scale (granular, metallic particles) and contaminated sediments, were found adjacent to two sewer outfalls (the McMaster Avenue and Atlas 42-in.) used over the previous 50 to 60 years by Atlas Speciality Steels and other industrial and municipal dischargers. Atlas had implemented abatement measures during the 1970s. However, in 1987 Atlas acknowledged responsibility for the mill scale portion of the reef

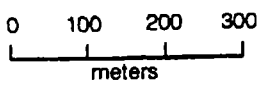
The contamination consisted primarily of historic deposits of metallic particles and associated sediments



**LEGEND**

Reef Deposits

RMON - Regional Municipality of Niagara



APPROXIMATE SCALE  
1 : 10 000

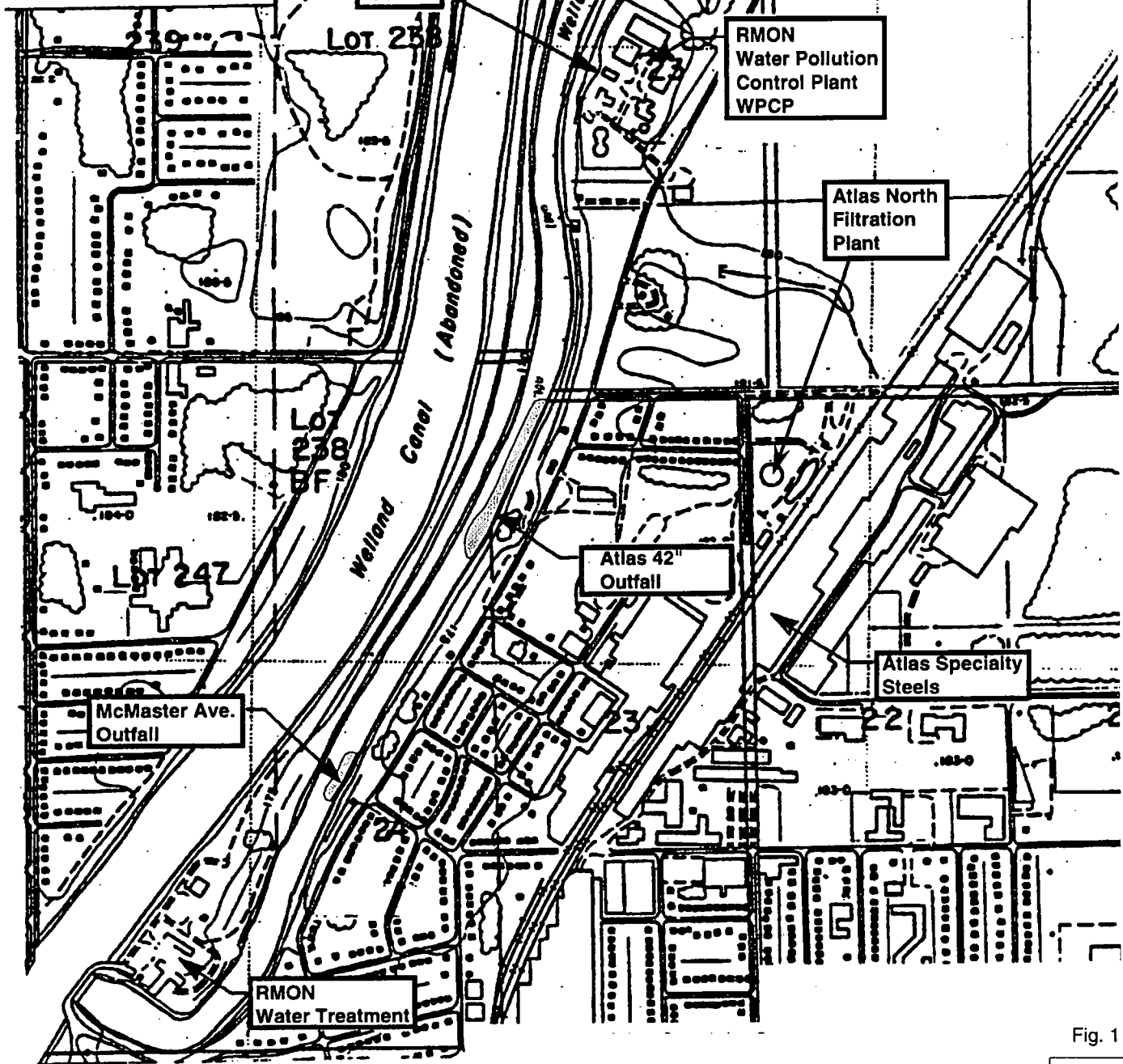


Fig. 1

Atlas Specialty Steels/Environment Canada  
Welland River Reef Cleanup Project  
Project Location



deposits and embarked on site studies. These were undertaken to determine the extent of contamination and to develop remedial plans.

Atlas Specialty Steels assumed a proactive role in site studies

### **Context within the Niagara River RAP**

The Welland River Reef Cleanup Project is located within the Niagara River Area of Concern (AOC), one of 17 AOCs in the Canadian portion of the Great Lakes Basin. The eight Great Lakes States and the Province of Ontario have committed themselves to developing Remedial Action Plans (RAPs) for each AOC within their jurisdiction. The Niagara River RAP is coordinated by a joint federal/provincial RAP team comprised of representatives from a number of government agencies. A Niagara River Public Advisory Committee (PAC) was also established as a separate advisory body to assist the RAP team.

A number of committees had a role in planning and implementation

The Welland River Cleanup Committee (WRCC) was formed in 1990 to bring together agencies and interested parties with a stake in the Welland River watershed so as to provide direction to future cleanup efforts. Table 1 provides an overview of the initial project participation and review committees as they existed for the 1991 pilot-scale and 1995 full-scale demonstrations.

The Welland River Reef Cleanup Project is one component of the Niagara River RAP. The project received the endorsement of both the Niagara River PAC and the RAP Team. The specific goals for the remediation of the reef deposits and assessment of the affected floodplain were established by subcommittees of the WRCC, in consultation with the public and appropriate government agencies.

The Welland River Cleanup Project comprised one component of the Niagara River RAP

Further details on public consultation aspects is contained in the Environmental Screening Report.

### **Funding**

Principal financial support for the project was provided by Atlas Specialty Steels, and Environment Canada through the Great Lakes 2000 Cleanup Fund. Additional funding support came from the Regional Municipality of Niagara, the City of Welland and the Ontario Ministry of Environment and Energy (MOEE).

**Table 1  
Project Participation and Review**

	Welland River Reef Cleanup Committee	Dredging Demonstration Planning Committee		Niagara River Remedial Action Plan - Public Advisory Committee (RAP-PAC)
		Pilot	Full Scale	
Ministry of Environment	•	•	•	•
Ministry of Natural Resources	•	•	•	
Environment Canada	•	•	•	
Wastewater Technology Centre	•	•	•	
Public Works Canada		•		
Regional Municipality of Niagara	•	•	•	•
City of Welland (Engineering)	•	•	•	
Regional Niagara Department of Health	•			•
Brock University	•	•		•
RAP-PAC	•	•	•	
Niagara Peninsula Conservation Authority	•			•
Niagara Ecosystems Task Force	•			•
Niagara Falls Nature Club				•
Niagara River Angler Association				•
Local Industry/Tourism				•
Department of Fisheries and Oceans				•
Regional Niagara Council				•
Niagara Falls City Council				•
Public	•		•	•
Operation Clean Niagara				•
Canadians for a Clean Environment				•
Atlas Specialty Steels	•	•	•	•
Acres International Limited	•	•	•	•

## 1991 PILOT-SCALE DEMONSTRATION PROJECT

In 1991, the pilot-scale project removed approximately 130 m<sup>3</sup> of contaminated sediment from the river, successfully demonstrating the effectiveness of an innovative hydraulic suction dredging technology and a high flow physical/chemical treatment process.

A pilot-scale demonstration project was carried out in 1991

## 1995 FULL-SCALE DEMONSTRATION PROJECT

### Objectives

The goal of the 1995 full-scale project was the removal and treatment of the mill scale and contaminated riverine sediments at the McMaster Avenue and Atlas 42-in. outfalls while minimizing the impact on the environment, without significantly impacting associated floodplain sediments or wetland, or limiting future planning options for those areas. As one of the projects selected for funding under Environment Canada's Great Lakes 2000 Cleanup Fund, the project also provided a chance to demonstrate innovative technologies for the removal and treatment of contaminated sediments and their commercial application in Canada and internationally.

The 1995 project was designed to remove the "reefs" while not causing negative environmental impacts

The chemical and biological testing undertaken for the project indicated that the reef deposits were the most severely contaminated in this section of the Welland River and had a demonstrated biological effect. The intermediate areas adjacent to and between the reefs and the area downstream of the Atlas 42-in reef contained no mill scale and, although contaminated, did not exhibit significant biological effects. As a result, the focus of the cleanup project was the two previously identified reef deposits containing metallic particles and oil intermixed with finer river sediments.

### Cleanup Criteria

The cleanup criteria to be applied to the reef deposits and the associated contaminated sediments were defined as the removal of metallic particles and oil contaminated sediment directly associated with the reef deposits. These deposits were to be removed until contamination levels in the remaining, underlying river bottom sediments did not exceed the Severe Effect Levels (SEL) of the Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario (PSQGs) (MOEE, 1993).

Criteria for sediment remediation were established

These criteria were developed by and approved by the project Technical Review Committee (TRC) of the WRCC.

Sediments would not be remediated to contamination levels below those encountered upstream due to the likelihood of future deposition in the remediated areas of moderately contaminated sediments from upstream.

### Scope of Project

The main elements of the project included the following.

- **Sediment Removal and Transport:** Metallic mill scale and associated contaminated sediments were dredged at both outfall locations. The dredgeate slurry was pumped through a 200-mm diameter polyethylene pipeline to a maximum distance of 1500 m using up to three booster pumps.
- **Sediment Treatment:** Dredgeate was treated at Atlas's North Filtration Plant (NFP) using separation and dewatering equipment and settling lagoons. The equipment consisted of a scalping screen, screw classifier, high 'G' dryers, and associated piping and sump pumps. Chemical coagulants and flocculants were used to enhance settling of fines in the lagoons. Atlas' NFP was used to receive and treat water generated during dredging before it was released back to the river.
- **Sheetpiling and Granular Fill:** Sheetpiling was used to stabilize the river banks during dredging. The dredged areas were backfilled with clean granular fill to assist in the eventual reestablishment of a productive riverine environment.
- **Floodplain Pocket Removal:** 1215 m<sup>3</sup> of mill-scale contaminated sediments within the floodplain, associated with a former shoreline outfall, were removed using conventional land-based excavation equipment. Granular material was used to backfill the excavation.

The project had four main components:

- sediment removal and transport
- sediment treatment
- sheetpiling and granular fill
- floodplain pocket removal

### **Project Organization**

The final project team was as shown in Figure 2. Atlas Specialty Steels was the overall project manager. Acres International Limited was the primary consultant to Atlas and supervised the dredging contractor (Normrock Industries Inc.) and floodplain protection contractor (Ontario Construction Co. Ltd.). The sediment treatment equipment was rented from Derrick Corporation and operated by Atlas staff. Other contractors were hired for various smaller project components. Monitoring of the project was carried out by Environment Canada and the MOEE.

### **Schedule**

The project initially was to start in mid-July 1995. Due to funding constraints, the project actually commenced in September 1995. Sediment removal and treatment was completed by late December 1995, with some floodplain protection work continuing until mid-January 1996.

The project extended over a 4-month period

### **REGULATORY ISSUES**

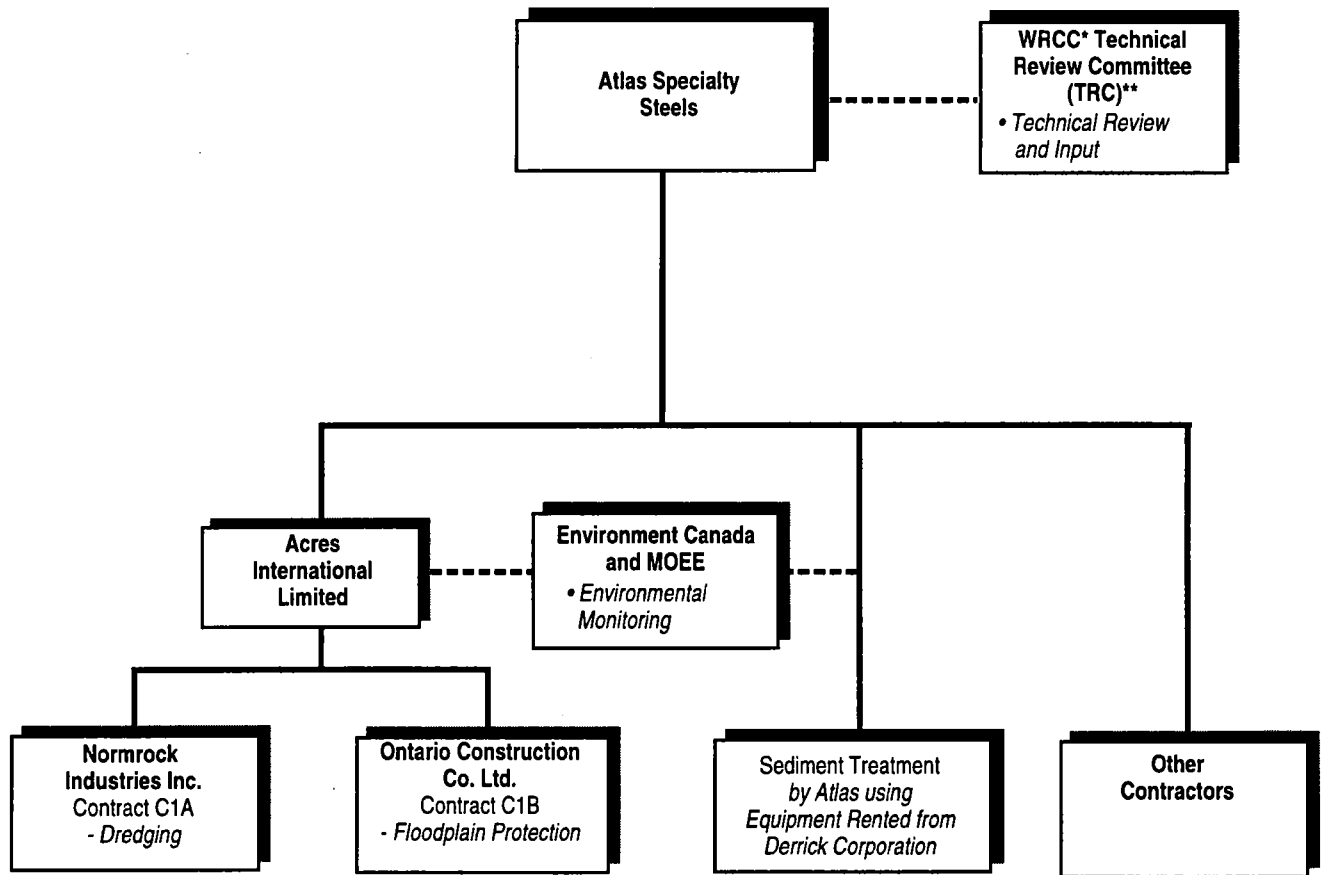
A brief summary of major regulatory issues is provided. A complete discussion can be found in the Environmental Screening Report.

### **River Water Quality**

One of the major concerns of the project was that sediment would be resuspended during the dredging operations and subsequently transported downstream, thereby adversely affecting water quality. To address this concern a water quality monitoring program was implemented to ensure compliance with regulatory (Environment Canada, MOEE, MNR) criteria. Project criteria were set for turbidity and suspended solids beyond which the project would be shut down until appropriate operational modifications had been made. A silt curtain was used to contain the working area of the dredge and thereby isolate resuspended sediments from the river currents. Oil booms were also suspended across the river to trap resuspended oil particles. Water quality objectives were generally met, apart from a few occasions due to high river flows or difficulties with the deployment of the silt curtain.

Sensitive issues were addressed through the regulatory approval process





\* WRCC - Welland River Cleanup Committee

\*\* TRC Memberships

- Acres International Limited
- Atlas Specialty Steels
- City of Welland
- Environment Canada
- Members of the Public
- Ministry of Environment and Energy
- Ministry of Natural Resources
- Niagara River RAP-PAC
- Regional Municipality of Niagara
- Water Technology International Corporation

Atlas Specialty Steels/Environment Canada

Welland River Reef Cleanup Project

**Site Organization During Implementation**

Fig. 2



### **Fisheries**

Due to the lack of benthic organisms and aquatic macrophytes within the reef deposits, their removal would result in a net gain in fisheries habitat. For this reason the project was considered to be consistent with the Department of Fisheries and Oceans (DFO) policy of no net loss of fisheries habitat.

### **Wetlands**

The area adjacent to the dredging operations is part of the Welland River wetland complex, which is a Provincially Significant Class 1 wetland. The area is also classified as fish habitat under the federal Fisheries Act and required approval under the federal Act. By restoring the areas disturbed to productive habitat, through the use of appropriate grading and fill placement, the project received federal and provincial approval.

The project area falls within a Provincially Significant wetland

### **Wildlife**

There were no major concerns relating to wildlife, waterfowl and migratory or shorebirds.

### **Waste Disposal**

Quantities of solids were generated at a number points throughout the treatment process and also during the excavation of portions of the reefs. Testing performed on the solids indicated that they were suitable for disposal in municipal nonhazardous landfills, in accordance with the Environmental Protection Act.

Wastes produced were tested prior to final disposal or discharge

Final effluent from the Atlas NFP were tested regularly throughout the project as part of Atlas' Municipal/Industrial Strategy for Abatement (MISA) responsibilities. This testing regime was supplemented by additional tests as part of the project.

Liquid wastes which, for a short period of time, were pumped to the Regional Treatment Plant were also tested prior to discharge in order to ensure conformity with the plant's operational requirements.

## PROJECT EVALUATION

The project objectives relating to the removal of the river reefs and the floodplain sediments were met. Post-project sediment sampling has confirmed that the mill scale and contaminated sediment had been removed and that the remaining sediments had contaminant concentrations below the PSQG Severe Effect Levels. The project's environmental impacts were also minimized due to a successful monitoring and suspended sediment control program. The project will assist in delisting this section of the Welland River from the Niagara AOC.

The project resulted in the removal of 9822 m<sup>3</sup> of industrial mill scale and contaminated river sediments from the McMaster Avenue and Atlas 42-in. outfall areas. An Amphibex dredge, a combination mechanical/hydraulic suction dredge, excavated a total of 7613 m<sup>3</sup> of material, while a long-reach, land-based backhoe excavated an estimated 2200m<sup>3</sup>.

Almost 10 000 m<sup>2</sup> of contaminated sediment was removed

The project also involved the removal of approximately 1215 m<sup>3</sup> of mixed coarse mill scale and sediments from the floodplain downstream from the Atlas 42-in. outfall using conventional land-based excavating equipment.

The field testing and evaluation of the Amphibex dredging technology was successful. The Amphibex was capable of dredging the industrial mill scale and contaminated river sediment at overall sustained slurry concentrations of between 10% and 20% (by weight) at flows ranging from approximately 1000 to 1800 USgpm. Average slurry solids contents varied with the type of material being dredged, ranging from 6% in predominantly mill-scale material to 28% in fine-grained sediments (by weight).

The Amphibex dredge performed well in difficult conditions

The Amphibex was also well suited to the Welland River environment due to its ability to 'walk' into the water and its ability to position itself within the river without the aid of a cable system. Although the Amphibex encountered river debris while dredging, its conversion capabilities, including the attachment of a rake to its backhoe arm, enabled large items of debris to be removed.

The use of a silt curtain and oil booms generally minimized the amount of suspended solids and oil released during dredging to acceptable levels.

### **Project Challenges**

On several occasions, dredging was stopped due to high turbidity levels. These occurrences were due both to disturbance of fine sediments during dredging and the effect of inputs extraneous to the dredging operation (e.g., stormwater runoff and sewer discharges). Resuspended sediments were at times able to find paths around the silt curtain, normally during periods of high river flow when problems were experienced with mooring of the silt curtain. To improve this situation for similar conditions in the future, a rigidly moored and anchored curtain could be used.

Some difficulty was encountered during the treatment of the slurry from dredging of fine river sediments. In particular the NFP's filters had difficulties processing the sometimes high levels of suspended solids in the discharge from the settling lagoons. Several modifications were initiated that provided greater residence time in the settling lagoons, thereby allowing more of the fine solids to settle out prior to entering the Atlas treatment plant. In spite of these modifications, the fine material continued to pose challenges, particularly during the colder weather toward the end of the project. As a result, toward the end of the project, some of the project flow was directed to the Regional Treatment Plant in an approved program with the Region of Niagara.

When conditions such as those experienced in this project (fine sediments and cold weather) are likely to be experienced, careful attention must be paid to the sufficiency of the hydraulic residence time in settling lagoons and the efficiency of proposed chemical treatments.

### **Post Project Activities**

As indicated above, sediment sampling after dredging was carried out to confirm that the mill scale and contaminated sediment had been removed and that the remaining sediments had contaminant concentrations below PSQG Severe Effect Levels. Environment Canada and the MOEE will undertake a postproject sediment and biological investigation to evaluate the cleanup of the site and assess any biological effects caused by the contaminated sediments. This work will take place within 5 years of the site cleanup.

Sediment tubes were installed within the granular fill used to backfill the dredged areas in order to monitor the characteristics of future sediment deposited by the river.

Fine sediments resulted in a number of problems during treatment

Postproject testing was conducted on the remaining sediments

## Appendix A

### Project Chronology of Significant Events

Date	Description of Event or Milestone
mid-1980s to present	Brock University researchers study impact of industrial contaminants in Welland River
December 1987	Atlas commits to river cleanup
March 1989	Acres initiates first Welland River sediment study
March 1990	Acres initiates preliminary Welland River Floodplain study
June 1990	First WRCC meeting
November 1990	MOE Water Resources Branch initiates sediment bioassay study
December 1990	<p>Unsolicited proposal for Welland River Dredging Demonstration submitted to Environment Canada</p> <p>Atlas/Acres presentation of proposed project to RAP-PAC</p>
March 1991	<p>Acres initiates follow up to preliminary floodplain study</p> <p>Environment Canada approves proposal and Welland River Dredging Demonstration Project initiated</p> <p>First Welland River Dredging Demonstration Planning Committee meeting (held monthly)</p> <p>Phase I of project initiated</p>
April 1991	Merger of WRCC and Demonstration Planning Committee
May 1991	<p>Atlas hosts Welland River Dredging Demonstration open house</p> <p>Phase II of project initiated</p>
June 1991	Permitting and approval process initiated
July 1991	Unsolicited proposal for bench-scale testing submitted to Environment Canada and Water Technology International Corporation

Date	Description of Event or Milestone
August 1991	Proposal for bench-scale testing approved by Water Technology International Corporation
September 1991	Final design of treatment facility completed
October 1991	Phase III of project initiated  Permits and approvals received from regulatory agencies  Dredging in contaminated sediment initiated (October 28)
November 1991	Dredging completed
February 1993	Final Report issued to Welland River Demonstration Planning Committee and Welland Reef Cleanup Committee
April 1993	Agreement in principle by RAP-PAC to planned remediation of contaminated sediments
June 1993	WRCC workshop
April 1994	Special Wetland Working Group formed
October 1994	Establishment of Welland River Reef Technical Review Committee to oversee full-scale dredging demonstration
March 1995	Public meeting
August 1995	Open House
September 1995	Commencement of dredging
December 1995	Dredging completed
January 1996	Fill-placement completed

## REFERENCE

Ontario Ministry of Environment and Energy, 1993. **Guidelines for the Management of Aquatic Sediment Quality in Ontario.** August 1993.

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