



New Professionals Committee and  
Student Design Competition Sub-Committee

In collaboration with

Norfolk County

# **WEAO STUDENT DESIGN COMPETITION 2012**

## **PROJECT STATEMENT**

### **EXPANSION OF PORT DOVER WATER POLLUTION CONTROL PLANT**

November 2011

WEAO Student Design Competition 2012

## Project Statement

### EXPANSION OF PORT DOVER WATER POLLUTION CONTROL PLANT

#### BACKGROUND

Norfolk County is a rural city-status single-tier municipality on the north shore of Lake Erie in Southwestern Ontario, Canada. The population in 2006 was 62,563.

Port Dover Water Pollution Control Plant (WPCP) is located at 137 Hamilton Plank Road, Port Dover, Ontario. Figure 1 displays a map showing Norfolk County in relation to the Greater Toronto Area while Figure 2 displays an aerial view of the existing facility.

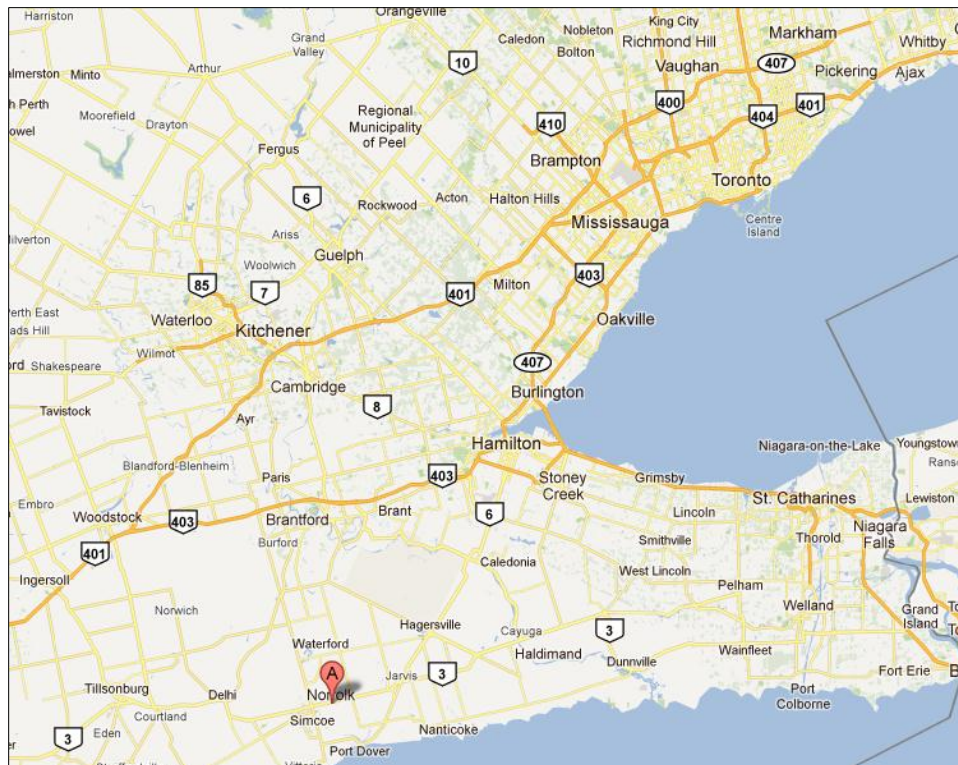


Figure 1. Map showing the Norfolk County in relation to the Greater Toronto Area



**Figure 2. Aerial View of the Existing Port Dover WPCP**

In 1990 the Port Dover WPCP underwent a major upgrade from a primary sewage treatment facility to a secondary sewage treatment facility. The County's Official Plan and more importantly the Lakeshore Secondary Plan identified Port Dover as a hub of residential and tourism growth for the next 16 years. The Lakeshore Secondary Plan predicts that Port Dover will double in population from 6,400 to 12,800 persons by 2026. Norfolk County has to be prepared to accommodate this type of significant growth without adversely impacting the water quality of Lake Erie and the surrounding environment. In preparation of this projected growth, Norfolk County Council has approved in principle a 10 year Capital Budget that identified the following components of the upgrade and expansion of Port Dover WPCP.

**Table 1. Norfolk County Capital Budget Related to Port Dover WPCP**

Year	Action Item	Approximate Budget
2012	Construction of Major Upgrades for the Port Dover WPCP and commencement of the Environmental Assessment for the expansion of the Port Dover WPCP	\$8,800,000
2016	Construction of the further upgrades/expansion to the Port Dover WPCP	\$8,000,000

This design project will involve selection of a preferred alternative for Port Dover WPCP expansion and preliminary design report.

Port Dover is a secondary treatment plant consisting of screening, grit removal, primary clarification, activated sludge with mechanical surface aeration, final clarification, ferrous chloride dosing system for phosphorus removal and single stage anaerobic digestion. The final effluent is disinfected using Sodium Hypochlorite before being discharged into Lake Erie through a plant effluent outfall. See “Port Dover WPCP – Description of Works” for detailed description of existing processes/equipment.

Norfolk County has embarked upon the project of upgrading/expanding the Port Dover WPCP for a number of reasons:

- The 1990 plant was built with a 25 year planning horizon which it will reach in 2015
- The Lakeshore Secondary Plan predicts Port Dover will double in size from 6,400 people to 12,800 people by 2026
- The need to increase process capacity for long term growth
- Resolve hydraulic issues of plant bypassing

The existing Port Dover WPCP is rated for a capacity of 5,400 m<sup>3</sup>/day and a hydraulic peak capacity of 18,000 m<sup>3</sup>/day. The existing effluent limits and effluent objectives for Port Dover WPCP as per the Ministry of the Environment Certificate of Approval are listed in Table 2 below.

**Table 2. Current Port Dover Certificate of Approval Effluent Objectives and Limits**

Parameter	Effluent Objective	Effluent Limit
CBOD <sub>5</sub>	15 mg/L	25 mg/L
TSS	15 mg/L	25 mg/L
Total Phosphorus	0.8 mg/L	1.0 mg/L
(Ammonia + Ammonium) Nitrogen	N/A	N/A
<i>Escherichia Coli</i> (monthly geometric mean density)	200 organisms/100mL	N/A

Flow rates and influent characteristics for Port Dover WPCP are summarized in Table 3 and Table 4, respectively. For more information refer to the attached plant performance data.

Additional wastewater treatment capacity is required to accommodate the build-out of the urban envelope in Port Dover for the year 2026 and beyond. The population serviced by Port Dover WPCP is expected to double by 2026, thus the Port Dover WPCP expansion will need to accommodate this growth.

**Table 3. Flow Rate Data for Port Dover WPCP**

Parameter	Value
Average Daily Flow	3,400 m <sup>3</sup> /day
Daily Peak Flow	18,000 m <sup>3</sup> /day
Hourly Peak Flow	25,000 m <sup>3</sup> /day
Minimum Daily Flow	3,000 m <sup>3</sup> /day
Maximum Monthly Flow	11,000 m <sup>3</sup> /day

**Table 4. Port Dover Influent Characteristics**

Parameter	Average Flow (mg/L)	Maximum Monthly Flow (mg/L)
<b>COD</b>	408	N/A
<b>CBOD<sub>5</sub></b>	200	117
<b>TSS</b>	160	118
<b>TP</b>	5.5	3.5
<b>TKN</b>	35	21

## PLANT BYPASS UPGRADE

The Port Dover WPCP currently experiences bypass issues due to one of the incoming gravity sewers discharging to a bypass manhole, and in turn the bypass manhole has an overflow level that permits discharge of raw sewage to the plant effluent outfall. By-pass events occur when the plant receives flow in excess of 18,000 m<sup>3</sup>/d. Total volume and total duration of by-pass are summarized in Table 5, while by-pass event frequency is summarized in Table 6 below.

**Table 5. Maximum Yearly By-pass Volumes and Durations**

Year	Volume (m <sup>3</sup> )	Duration (hrs)
<b>2006</b>	1038	7.5
<b>2007</b>	449	5.8
<b>2008</b>	7250	90.8
<b>2009</b>	1700	3.7
<b>2010</b>	260	9.1

**Table 6. By-pass Frequency Analysis**

Year	# of By-pass Events
<b>2006</b>	12
<b>2007</b>	12
<b>2008</b>	21
<b>2009</b>	14
<b>2010</b>	10

Please refer to archive drawings for by-pass detailed drawings and other additional information.



## OBJECTIVES

The design team is required to provide the following:

- Preliminary design and layout for Port Dover WPCP expansion/upgrade to meet capacity demand for year 2026 and solve the bypass issues (Phase 1); and
- Conceptual layout for Port Dover WPCP expansion to meet project growth beyond the year 2026 (Phase 2).

The upgraded plant must be constructed within the limits of the existing site and meet the effluent objectives described in the design criteria.

## DESIGN CRITERIA

The design flows and effluent objectives for Port Dover WPCP expansion are summarized in Table 7 and Table 8, respectively. Note that ammonia concentration in the effluent is expected to be regulated after the expansion is complete, therefore the design will need to ensure that suitable nitrification is provided.

**Table 7. Design Criteria for Port Dover WPCP Expansion**

Parameter	Value
Current Design Capacity (average flow)	5,400 m <sup>3</sup> /day
Current Design Capacity (Peak Flow)	18,000 m <sup>3</sup> /day
Projected Maximum Population Increase by 2026	6,400 people
Per Capita Wastewater Flow	569 Lpcd

**Table 8. Proposed Port Dover WPCP Effluent Objectives and Limits**

Parameter	Effluent Objective	Effluent Limit
CBOD <sub>5</sub>	10 mg/L	15 mg/L
TSS	10 mg/L	15 mg/L
Total Phosphorus	0.3 mg/L	0.5 mg/L
(Ammonia + Ammonium) Nitrogen		
Non-freezing period (April 1 – September 30):	3.0 mg/L	5.0 mg/L
Freezing period (Oct 1 – March 30):	5.0 mg/L	9.0 mg/L
<i>Escherichia Coli</i> (monthly geometric mean density)	100 organisms/100mL	150 organisms/100mL

## SCOPE OF WORK

As a minimum, the design of the Port Dover WPCP expansion/upgrade should address the following:

- Optimization and/or expansion of the liquid train to accommodate increased flows
- Optimization and/or expansion of the solids train to accommodate increased flows
- Solve the plant bypass issues to minimize/eliminate bypass events
- Expansion of electrical and standby power facilities; and
- Upgrades to the instrumentation and SCADA system.

## DESIGN REPORT REQUIREMENTS

The design team must provide a design report for the proposed expansion. Please refer to the WEAO SDC Guidelines for the acceptable format of the report. As a minimum, the design report must address the following points:

- Population analysis to determine design flow rates;
- Wastewater characteristics;
- Existing plant process units and auxiliary systems;
- Discussion of alternative treatment processes;
- Selection of the preferred treatment process (including a decision matrix);
- Preliminary sizing of major equipment (aeration basins, clarifiers... etc.);
- Incorporating information from different manufacturers;
- Preliminary sizing of primary and standby power supply;
- Description of the process control logic (instrumentation system);
- Noise and odour controls;
- Minimizing environmental damage during construction;
- Required upgrades to utility supply;
- Preliminary capital cost estimate for Phase 1 expansion;
- Operating and Maintenance Cost for Phase 1 expansion over a 13 year period (2013-2026); and
- Implementation (construction) schedule for Phase 1 expansion.

There is no limit for the number of appendices attached to the design report. However, the appendices must contain, as a minimum, the following:

- Process design and hydraulic calculations for all unit processes. Include all calculation spreadsheets;
- Manufacturer data sheets and catalogues of all major equipment; and
- Design drawings (see below for details).

Design teams may use modeling software, although it is *not required* for the project. If used, the output of modeling software must be included as an appendix and attached to the design report.

## DESIGN DRAWINGS REQUIREMENTS

Design drawings must be provided that clearly show the layout of plant expansion and process flow. As a minimum, the following three drawings must be included:

1. Site Plan, showing all unit processes and yard piping for Phase 1 expansion (solid line), and the general layout for Phase 2 (discontinuous line), in relation to the existing facility (light print);
2. Hydraulic profile for the entire plant based on Phase 1 flows;
3. Process and instrumentation diagram (P&ID) for Phase 1;

The drawings must be printed on 11" x 17" landscape sheets, folded and included as an appendix in the design report.

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## SUPPORTING INFORMATION

The following documents are provided by the Norfolk County to aid in the preparation of the design report:

- Port Dover WPCP CofA – Description of Works.
- Port Dover WPCP Archive Drawings
- Port Dover WPCP Performance Data