

**Water Environment Association of Ontario – New Professionals Committee &  
 The Regional Municipality of Durham**

**WEAO STUDENT DESIGN COMPETITION 2009-2010**

**Port Darlington WPCP Expansion**

**1. Background**

The Port Darlington Water Pollution Control Plant (WPCP) services the Bowmanville Urban Area. It is estimated that an increase in the existing Port Darlington WPCP rated capacity is required to provide adequate sewage treatment capacity for approximately 15 years. The design for the WPCP expansion is to be based on the Class EA findings completed in 2005. This project will examine design alternatives for the plant expansion to meet the projected design flows and effluent criteria.

The existing Port Darlington WPCP is approved to treat raw sewage as follows:

- Annual average daily flow rate: 13,638 m<sup>3</sup>/d
- Peak flow rate: 34,095 m<sup>3</sup>/d
- BOD<sub>5</sub> =160 mg/L
- Suspended solids =180 mg/L

The following tables summarize actual characteristics of raw sewage for years 2006 and 2007.

For 2006 the following data was recorded or calculated:

- Annual average daily flow rate: 12,144 m<sup>3</sup>/d
- Maximum flow rate: 31,541 m<sup>3</sup>/d
- Annual average per capita flow: 370L/cap/d

	Annual Average Concentration	Annual Average Loading
BOD <sub>5</sub>	83.8 mg/L	1,017 kg/d
Suspended solids	114 mg/L	1,381 kg/d
TKN	30.76 mg/L	374 kg/d
Total phosphorous	4.0 mg/L	49 kg/d
Ammonia + Ammonium	20.7 mg/L	252 kg/d

For 2007 the following data was recorded or calculated:

- Annual average daily flow rate: 10,840 m<sup>3</sup>/d
- Maximum flow rate: 24,080 m<sup>3</sup>/d
- Annual average per capita flow: 318 L/cap/d

	Annual Average Concentration	Annual Average Loading
BOD <sub>5</sub>	109 mg/L	1,182 kg/d
Suspended solids	134 mg/L	1,451 kg/d
TKN	36.17 mg/L	392 kg/d
Total phosphorous	4.8 mg/L	52 kg/d
Ammonia + Ammonium	24.5 mg/L	265 kg/d

Further information is provided in plant reports (See background support information).

Based on the population growth projections for the Bowmanville Urban Area, it is estimated that an increase in the existing WPCP rated capacity to 27,276 m<sup>3</sup>/day (Phase 1 average day flow) will provide adequate sewage treatment capacity for approximately 15 years (to around the year 2023). Projected sewage flows for the ultimate build-out of the Bowmanville Urban Area by the year 2036 are approximately 40,477 m<sup>3</sup>/day (Phase 2 average day flow).

## 2. Objectives

The purpose of the project is twofold:

- Develop conceptual design and layout for phase 1 and phase 2 plant expansion; and
- Develop preliminary design and layout for phase 1 plant expansion

Development of the conceptual design for Phase 2 expansion should explore feasibility of further expanding the existing facility taking into consideration site restrictions and available space.

### 3. Design Criteria

It is proposed that the plant be designed to achieve the following design objectives and effluent limits:

Parameter	Average Concentration	Design Objectives / Compliance limits	
		Existing Capacity	Phase 1 and Phase 2 Expansions
BOD <sub>5</sub> (mg/L)	Monthly Average	15/25	15/25
TSS (mg/L)	Monthly Average	15/25	15/25
Total Phosphorus (mg/L)	Monthly Average	1/1	1 / 1
Total Ammonia as N (mg/L) – Summer	Monthly Average	14/ n/a	10 / 14
Total Ammonia as N (mg/L) – Winter	Monthly Average	14/ n/a	14 / 24
E. Coli (org./100 mL)	Monthly Average	100 / 200-	100 / 200
Total Residual Chlorine(mg/L)	Monthly Average	0.5 /n/a	0 / 0.02

More detailed information is provided on plant performance reports (See background support information)

The recommended alternative as a result of the EA Study included the following treatment train for Phase I expansion:

- Screening
- Grit Removal
- Primary Treatment
- Conventional Activated Sludge (bioreactors designed for enhanced nitrogen removal)
- Secondary Clarification
- Phosphorous Removal
- Disinfection
- Anaerobic Digestion

Different treatment processes can be provided as long as the treatment complies with the above design objectives.

### 4. Scope of Work

The following summarizes the project

- Expansion of the existing secondary treatment WPCP
- Provision of a new effluent disinfection facility
- Provision of a new biosolids storage facility
- Provision of a new hauled waste septage receiving station
- Provision of auxiliary systems to support plant expansion
- Instrumentation and SCADA control system

The Key Project Components to Analyze are:

- Existing plant process units and auxiliary systems,

- Treatment alternatives and layout,
- Wastewater characteristics,
- Effluent criteria,
- Emergency power supply
- Noise and odour controls
- Implementation costs
- Operating and Maintenance Cost (O&M)
- Growth potential
- Implementation schedule
- Rehabilitation of affected areas
- All necessary utilities to be provided

The detailed scope of work is the following (as a minimum):

- Developing and finalizing basic design data for phase 1 and 2 of the project
- Selecting of treatment processes for liquid train and solids treatment
- Developing process flow diagrams
- Developing facilities and site layout for phase 1 of the project
- Developing the updated hydraulic profile of the plant
- Defining operation and control strategies
- Selecting and specifying equipment
- Define sizes and requirements of process facilities
- Process design and sizing calculations
- Hydraulic calculations for sewage and sludge pumping stations, process liquid streams
- Design reports
- Design drawings
- Cost estimate
- Project schedule

## **5. Background Support Information**

The following information was provided by the Region of Durham as background information to assist in the development of this project:

- Technical Memorandum 5 - Existing Port Darlington WPCP Assessment
- Technical Memorandum 2.2 - Historical Wastewater Flows to the Port Darlington WPCP
- Technical Memorandum 1.1 - Review of Port Darlington Water Pollution Control Plant
- Port Darlington WPCP Annual Performance Report 2006
- Port Darlington WPCP Annual Performance Report 2007
- Plant's aerial view