By Melissa Weber, R.V. Anderson Associates Limited

Installation of 1,650 mm concrete pressure pipe.

COURTICE COMPLETES CONSTRUCTION ON OUTFALL SEWER

Due to considerable growth, the Regional Municipality of Durham is currently expanding and improving its wastewater infrastructure, including construction of a new water pollution control plant (WPCP) in Courtice. The new Courtice plant will serve urban areas in Oshawa, Whitby, and Courtice currently being served by the existing Harmony Creek WPCP, as well as supporting new growth. Also, Plant No 1 at the Harmony Creek WPCP is reaching the end of its useful life, and will be decommissioned once the Courtice WPCP project is online, and the Plant No 2 at Harmony plant will be decommissioned over the next 20 years.

The initial stage in Courtice is to have a capacity of 68,190 m^3/d and has been designed to accommodate a future expansion to 136,380 m^3/d. The ultimate potential expansion of this plant will be 272,760 m^3/d.

As part of this new facility, an outfall sewer has been constructed, to convey and discharge treated effluent from the WPCP into Lake Ontario. It is sized as 1,650 mm concrete pressure pipe for the peak flow capacity of 408,000 m^3/d, which corresponds to the Phase 2 rated plant capacity of 136,380 m^3/d. It extends approximately 950 m from the shoreline into the lake. Included in this 950 m section is a 180 m diffuser section that terminates at approximately 11 m of water depth. It tapers from 1650 mm to 750 mm and contains a staged diffuser with 45 ports equally spaced throughout the length. There is a 50 m land section of outfall sewer from the effluent drop shaft to the shoreline. The sewer depth and drop shaft location can accommodate anticipated erosion for a 100 year period.

Construction Methods

Conventional, open-cut marine trenching was used for the installation of the pipeline offshore in Lake Ontario. The marine trench was excavated using a crane and clam shell bucket, mounted on a barge, equipped with a heavy duty bucket. Excavation equipment was mounted on a floating barge equipped with spuds to hold it in position while digging. Additional marine equipment included attendant material handling barges, tugs, workboats, and a survey boat.

The geotechnical investigation indicated that dredged material from the marine trench would be classified as non-contaminated and would be suitable for both backfilling of the trench and open-water disposal. During the dredging of the trench, the excavated material required for trench backfilling was temporarily sidecast on the lake bottom. Excess excavated trench material was loaded into dump scows for transporting and disposal at a designated open-water disposal site in the lake, to the south west end of the

pipeline, approximately 5.3 kilometers offshore, and in waters of at least 40 meters in depth.

A steel sheet pile cofferdam was constructed at the shoreline along the pipeline alignment extending approximately 40 metres from water's edge to allow for the first section of the outfall pipeline to be installed at the shore, and in the shallow water depths near shore. The pipe was installed, by divers, while the cofferdam was flooded. This would normally have been done in a dry condition, however, the marine contractor was more comfortable laying pipe underwater.

The cofferdam was constructed with sheet pile walls with sufficient width to accommodate a backhoe and crane required for the excavation of the cofferdam trench and subsequent pipe installation. The outside slopes of the granular fill along the sides and outer end of the cofferdam were protected with a layer of small armour stone (1.0 to 1.5 tonnes per piece) to prevent erosion and scour from wave action during the construction period.

The construction methods for in-water procedures followed a well-planned sequence of events to minimize environmental impacts in the lake and surrounding areas.

Pipe Installation

The top portion of the pipeline trench from shore out to approximately 4.5 metres water depth has 2 layers of armour stone scour protection totaling 1.3 metres depth across the full excavated width of the trench. The upper scour protection layer extends a distance of approximately 400 metres from the shore to provide protection against wave action for the buried outfall pipeline.

The concrete pipeline was bedded in the trench using 50 mm crushed stone under the pipe and up to the spring line (approximately 2.5 metres from the lake bottom). Above the crushed stone bedding, the pipe from 300 m to 868 m, was backfilled with the excavated native trench material that was previously stockpiled on the side of the trench. The marine trench was completely backfilled to the original lake bottom.

Regular marine inspections were also completed to ensure that the outfall sewer was built as planned.

Minimization of Marine Impact

With a project of this nature, being constructed in a water body, the environmental affects are always a large concern for all of the parties involved. For this particular project, the Department of Fisheries and Oceans was heavily involved during the design stage to ensure they were satisfied with the construction method and the mitigation measures being taken to protect the water quality and fish habitat.

The impacts to the fishery and the navigation of the lake were of a short duration and mitigated by the construction techniques used. The physical alignment of the outfall was chosen because it had the least amount of harm to the aquatic habitat, in particular, blasting was not used during the construction period.

One concern was the amount of silt that would be transported in the water, during construction, which could adversely affect fish and plant growth in the lake. To ensure siltation was minimized, a silt fence (moon pool curtains) was placed around the clam bucket removing the material, and turbidity was monitored throughout dredging to ensure silt transport was minimal. The silt levels in the lake were tested before construction began to have a background level of comparison. This level was then used to set a maximum limit of silt during the construction period. If this allowable level was exceeded, work was to be halted until the level of silt decreased. The allowable level was never exceeded during the construction phase of this project. As added protection to aquatic life, it was determined that work in the water could only be completed from July 1 to March 31, which is outside of the fish spawning season.

Works in water was also not performed during high flow conditions and during times of high wind, as waves could transport silt further and cause more harmful affects.

During the shore construction work, sedimentation fencing was placed along the shoreline, to ensure that sediment did not travel into the water from shore. All stockpiles of soil or fill were kept away from the water edge and protected by fencing.

Clam shell bucket entering the water, within the moon pool area.

Approvals

Several agencies were involved in this project, and approvals obtained prior to the beginning of construction of the effluent outfall sewer. The Agencies involved, with the corresponding Act being represented, included:

Department of Fisheries and Oceans – The Fisheries Act

The Ministry of Natural Resources – Lakes and Rivers Improvement Act

Canadian Coast Guard – Navigable Waters Protection Act

Ministry of the Environment – Ontario Water Resources Act

Acknowledgements

- Owner: The Regional Municipality of Durham
- Prime Technical Consultant for Courtice WPCP: CH2MHill Canada
- Dredging and Marine Pipeline Consultant to R.V. Anderson Associates Limited: C.B. Fairn & Associates Ltd.
- General Contractor: McNally Construction Inc.
- Marine Inspection Services: ASI Group