Deep Lake Water Cooling Project
Pre-Design Study

(City Council on June 7, 8 and 9, 2000, amended this Clause by adding thereto the following:

> *"It is further recommended that the Deep Lake Water Cooling Project Pre-Design Study be considered by the Chief Administrative Officer and relevant City staff, for the various federal funding programs being made available through the Federation of Canadian Municipalities' Green Municipal Enabling and Investment Funds, and the Federal Government's Infrastructure Program.")*

The Works Committees recommends the adoption of the report dated May 8, 2000, from the Commissioner of Works and Emergency Services.

The Works Committee reports, for the information of Council, having requested that a brief presentation be made to a future meeting of the Committee on the project.

The Works Committee submits the following report (May 8, 2000) from the Commissioner of Works and Emergency Services:

Purpose:

To provide an update on the status of the Deep Lake Water Cooling (DLWC) project and obtain authorization for expenditure of additional funds to complete necessary predesign work.

Financial Implications and Impact Statement:

At its meeting of September 24 and 25, 1997, the former Metro Council, by adoption of Clause No. 10 of Report No. 12 of The Environment and Public Space Committee, authorized an expenditure of up to $200,000.00 after Municipal Goods and Services Tax (GST) rebate to proceed with a pre-design study of the Deep Lake Water Cooling project, to be jointly funded and managed by Metro (now City of Toronto) and Toronto District Heating Corporation (TDHC) (now Enwave District Energy Limited). Funding for the City of Toronto's share of the cost of the study had been allocated in the Capital Works Program for Water Supply. Subsequent to completion of Phase I of the study, it was necessary to expand the scope of work for Phase II, given the issues which arose for this unique project. Additional funding of up to $200,000.00 net of GST rebate is now required to complete the study. Approved funds for this additional expenditure are available in the submitted 2000-2004 Water and Wastewater Services Division Capital Works Program in capital account WS363 Engineering Studies ($99,000.00 allocated for this project and $101,000.00 re-allocated from a deferred project). Future project costs including detailed design, construction, and commissioning will be borne solely by Enwave.

Recommendations:

It is recommended that:

(1) authority be granted for an additional expenditure of up to $200,000.00, net of GST rebate, to enable completion of the pre-design study;

(2) the existing agreement between the City, Toronto District Heating Corporation and R.V. Anderson Associates Limited be amended to allow additional cost sharing by the City in an amount of $200,000.00 net of GST rebate;

(3) authority be granted for assignment of the City's existing agreement from Toronto District Heating Corporation and R.V. Anderson Associates Limited to Enwave District Energy Limited and R.V. Anderson Associates Limited; and

(4) the appropriate City officials be authorized to take the necessary actions to give effect thereto.

Background:

At its meeting of October 1 and 2, 1998, City of Toronto Council approved a report from the Strategic Policies and Priorities Committee, which proposed that TDHC becomes a corporation regulated by the Ontario Business Corporations Act. Subsequently at its meeting of September 28 and 29, 1999, City Council approved a plan wherein City of Toronto and Ontario Municipal Employees Retirement System (OMERS) would become shareholders of TDHC. In March of this year TDHC undertook a name change to Enwave District Energy Ltd., this being more representative of their current business.

Through a report to the Works and Utilities Committee dated April 7, 1998, an update on the status of the DLWC project was provided. The project's background, as outlined in the report, follows.

Application of the deep lake cooling concept to Toronto was first considered more than a decade ago. Essentially the concept involves using cold water from a deep Lake Ontario source. This renewable resource would be used in a district cooling system that serves the downtown core. The initial concept estimated to cost $600 million was proposed to serve a market bounded by Bloor Street, Jarvis Street, Spadina Avenue and Toronto Bay, through a cooling capacity of 300,000 tons.

The current project is much smaller in scope with an estimated cost of $120 million and a peak cooling capacity of 40,000 tons. The project would involve drawing water at 4 degrees Celsius from deep in Lake Ontario through a new intake at the Island Filtration Plant. Following treatment and transmission to the John Street Pumping Station, the potable water would be diverted through an energy transfer loop to Enwave's central cooling facilities at the Metro Toronto Convention Centre where it would pass through heat exchangers. The water would then

be returned to John Street Pumping Station at not more than 13 degrees Celsius for distribution to the City consumers.

This project has several benefits. If the project proceeds, Toronto Works will obtain a new intake for the Island Filtration Plant. As it will be located further offshore, it will likely provide an improved raw water source that may result in a reduction in use of treatment chemicals and reduced taste and odour occurrence in water supplied from this plant. Further there are several environmental benefits. Using deep lake water as a cooling source would reduce the demand for electricity and enable removal of ozone depleting refrigerants from existing building cooling systems. Based on the estimated peak cooling capacity of 40,000 tons, carbon dioxide emissions would be reduced by approximately 30,000 tons per year, along with reduction in nitrous oxides, sulphur dioxide and fine particle emissions. There would also be economic benefits as district cooling using deep lake water is less costly than conventional cooling using electric chillers.

Metro Council at its meeting on September 24 and 25, 1997, authorized staff to execute an energy transfer agreement with TDHC, and authorized an expenditure of $200,000.00 after Municipal GST rebate to proceed with a pre-design study and Class Environmental Assessment (EA). The pre-design study is required to confirm overall project viability and fully assess the impacts of this project to ensure the work will not compromise the security or quality of the water supply. The EA is required under the Class Environmental Assessment program for Municipal Water and Wastewater projects. The cost of the pre-design study and EA was agreed to be shared with Enwave. Given that the project will significantly benefit the City, Toronto Water Supply is sharing in the risk of the project until project viability has been fully established through the pre-design phase. All additional project costs such as detailed design, construction, start-up and commissioning will be borne by Enwave.

The terms and conditions described in the September 1997 report to Council will essentially form the basis of an Energy Transfer Agreement to be executed following mutual agreement by Toronto Works and Emergency Services and Enwave to proceed with the project following completion of the pre-design study.

Comments:

In March of 1998, the consulting firm of R.V. Anderson Associates was jointly engaged by the City and TDHC to conduct the pre-design study and class EA for this project at a total estimated cost of $380,000.00.

The pre-design study was planned to be completed in two phases. Phase I which has now been completed dealt primarily with those issues that had the greatest potential for affecting project feasibility. These included water treatability and operations, matching City water supply capacity to cooling requirements, assessing risk of contamination of City water supply, issues related to EA and determining preliminary capital and operating costs. This phase I work was completed in May 1998. This study phase concluded that there were no water treatment process limitations, operational impacts can be readily addressed, there is sufficient City water capacity from the Island plant to provide an effective supply for cooling purposes and the quality and security of City water supply will not be compromised.

The EA was completed under the Class Environmental Assessment process as a schedule B project. This requires identification and assessment of the environmental impacts of the proposed works and identification of any measures necessary to mitigate those impacts. For this EA, the specific works include the construction of an intake from the Island plant approximately 2.6 kilometres in length to a point where the lake is 70 metres in depth and the construction of the energy transfer loop, essentially a 1200 mm water main from the John Street Pumping Station (PS) to the Enwave facilities at the Convention Centre and back to the John Street PS. The process included multiple public contact points including two public open house meetings, three public advisory committees meetings, (a public advisory committee was established particularly for this EA) and an agency meeting. The EA report concluded, subject to further public input, that a new deep intake for the Island Filtration Plant and an energy transfer loop from the John Street PS can be constructed in a manner that protects and enhances the environment while maintaining the quality and security of the City's potable water supply.

The EA report was made available to the public for the mandatory 30-day review period on May 4, 1998. During the course of this review Toronto Hydro submitted a "bump up" request which was subsequently withdrawn. The EA was deemed essentially complete for the option as described.

In September 1999, R.V. Anderson Associates Ltd. were given the authorization to proceed with Phase II of the pre-design study. This phase of the study includes preliminary design of the intake and the energy transfer loop, a more detailed assessment of water quality issues, identification of impacts on the Island Filtration Plant, John Street PS and the overall water supply system operations as a result of the DLWC project and development of contingency plans. More refined capital and operating costs are also prepared in order to determine overall project viability.

Subsequent to the completion of the EA and Phase I of the pre-design, related work was carried out by staff from the City and Enwave on the Energy Transfer Agreement, resulting in agreement in principle on key issues. However, the pre-design study must be completed before this agreement can be executed allowing the DLWC project to proceed.

Concurrently, Enwave has initiated work relative to their plant, and has arranged for preliminary geotechnical investigations of the proposed intake route to the 70-metre depth and continuous temperature monitoring at various depths.

Enwave's results of daily temperature monitoring between May and October at various depths in Lake Ontario indicate that on occasion the water temperature increases by a few degrees above the anticipated four degrees Celsius. The duration of these temperature excursions may be up to several days and can occur at any time between May and October. The magnitude and duration of these excursions is reduced at deeper locations. The exact cause of these excursions is not known, however, they are believed to be a result of lake downwelling currents. While the actual temperature fluctuation may appear relatively minor, it does significantly impact the DLWC project.

In order to optimize cooling capacity from the lake, a continuous supply of water close to four degrees Celsius is essential. Increases in water temperature must be compensated for by additional mechanical cooling capacity, resulting in additional capital and operating costs and reducing the environmental benefits of the project. Given the importance of maximizing the amount of "free" cooling as a key component of overall project viability, the consultants have undertaken additional engineering work as authorized by Enwave to address the temperature fluctuations of water drawn from various depths through assessment of various design alternatives.

The original proposal involved construction of a new intake tunnel approximately 2.6 kilometres in length from the Island Filtration Plant terminating at a depth of 70 metres. An alternative approach involves the use of large diameter Polyethylene (PE) pipe in lieu of a tunnel which would be a lower cost option to partially offset the cost of additional mechanical cooling required to address temperature excursion events. This option was not previously assessed, as large diameter PE pipe is a relatively new product.

Another option is the construction of a tunnel to an 85-metre depth from the Leslie Street Spit rather than from the Island Filtration plant. A shaft would be built near the southern tip of the spit. One tunnel would extend approximately 3.6 kilometres in a southerly direction to a point where the water depth is 85 metres; a second tunnel would be built from the shaft in a westerly direction making the connection to the Island Plant. Since the tunnel construction will take place from the mainland, the total estimated construction cost is lower than if construction was to take place from the Island plant even though the total tunnel length is greater.

Assessment of the impacts of the temperature excursions and evaluation of the options to address these impacts have resulted in a significant change to the scope of work previously defined. In particular, since the option to construct an intake to the 85-metre depth from the Leslie Street Spit is quite different from the original option, additional engineering activities are required. Activities include water sampling to verify the suitability of this location as a drinking water supply source. This involves taking samples from the 85-metre depth and analyzing for a number of parameters based on the Ontario Drinking Water Objectives. Given this intake would be closer to the proposed new outfall for the ABTP, dispersion modelling must be carried out to confirm discharges from the ABTP will not impact the new intake. Additional work must be done to select the route and size of the intake options and develop detailed cost estimates. These options must be fully assessed so that the best alternative can be selected to ensure viability of the DLWC project. Additional geotechnical work beyond that envisaged previously is required to be undertaken during pre-design to assess the intake options.

Given the additional options now being considered, the EA must be revised. This involves identification and assessment of environmental impacts, determining mitigation measures and preparation of an EA report for a 30-day public review period. Given the nature of the change and the sensitivity of construction from the Leslie Street Spit, seeking public input prior to the final selection of the preferred alternative is planned. This will include meetings with stakeholders previously involved in the EA process and members of Friends of the Spit, followed by a public open house.

In summary, various activities are required to complete the pre-design study beyond that previously identified.

The total estimated cost for the additional work assessed to be cost-shared is $400,000.00 net of GST rebate, of which the City's share would be $200,000.00. City staff have advised Enwave that this cost-sharing is pending Council approval for the additional funds. Enwave has authorized the consultant to proceed in anticipation of Council authorizing additional funds to cover the City's share in recognition of the need to carry out this additional work expeditiously. Council approval of this expenditure is requested in this report.

Following completion of the pre-design study and mutual agreement between Enwave and the City to proceed with the project, the Energy Transfer Agreement can be finalized and executed. Detailed design could be completed in 2000, and it is anticipated that construction could start in early 2001 with the DLWC project potentially operational by 2003.

Conclusions:

The DLWC project will result in environmental and economic benefits to the City. An Environmental Assessment has been completed and pre-design work is in progress. As a result of new information regarding actual deep lake water temperatures, additional pre-design work is required to identify the optimum intake location which will necessitate a revision to the EA. Approval for additional expenditure of up to $200,000.00, net of GST rebate, is required to allow the City to continue to share the cost of this phase of the project. Future project costs including detailed design, construction, and commissioning will be borne by Enwave.

Contact:

Mr. H.A. Taniguchi, P. Eng.
Director, Water Supply
Phone: (416) 392-8220
Fax: (416) 392-3639
E-mail: htaniguc@city.toronto.on.ca