Minute No. 426
Report – Standing Policy Committee on Infrastructure Renewal and Public Works – June 9, 2009

Item No. 7 **Grant to University of Manitoba in 2009 and 2010 - Applied Research on Plant-Wide Nitrogen Removal Optimization - North End Water Pollution Control Centre**
eFile WS-7.1

COUNCIL DECISION:

Council concurred in the recommendation of the Standing Policy Committee on Infrastructure Renewal and Public Works and adopted the following:

1. That a grant be approved to the University of Manitoba in 2009 and 2010 in the amounts of $90,000.00 plus applicable GST and MRST each year for applied research on plant-wide Nitrogen removal optimization at the North End Water Pollution Control Centre.

2. That the Proper Officers of the City be authorized to do all things necessary to implement the intent of the foregoing.

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DECISION MAKING HISTORY:

Moved by Councillor Clement,

That the recommendation of the Standing Policy Committee on Infrastructure Renewal and Public Works be adopted by consent.

Carried

EXECUTIVE POLICY COMMITTEE RECOMMENDATION:

On June 10, 200, the Executive Policy Committee concurred in the recommendation of the Standing Policy Committee on Infrastructure Renewal and Public Works and submitted the matter to Council.

STANDING COMMITTEE RECOMMENDATION:

On June 9, 2009, the Standing Policy Committee on Infrastructure Renewal and Public Works concurred in the recommendation of the Winnipeg Public Service and submitted the matter to the Executive Policy Committee and Council.

ADMINISTRATIVE REPORT

ISSUE: GRANT TO UNIVERSITY OF MANITOBA IN 2009 AND 2010 FOR APPLIED RESEARCH ON PLANT-WIDE NITROGEN REMOVAL OPTIMIZATION AT THE NORTH END WATER POLLUTION CONTROL CENTRE (NEWPCC)

Critical Path: Standing Policy Committee on Infrastructure Renewal and Public Works

AUTHORIZATION

Author	Department Head	CFO	CAO
Nick Szoke, P. Eng., Mike Shkolny, P. Eng.	Barry MacBride, P. Eng.	M. Ruta	G. Laubenstein

RECOMMENDATIONS

That a grant be approved to the University of Manitoba in 2009 and 2010 in the amounts of $90,000 plus applicable GST & MRST each year for applied research on plant-wide Nitrogen removal optimization at the North End Water Pollution Control Centre (NEWPCC).

IMPLICATIONS OF THE RECOMMENDATIONS

To support scientific research at the North End Water Pollution Control Centre (NEWPCC) on a full-scale basis to optimize plant-wide reduction of nitrogen. The research has the potential to reduce capital costs, as well as operating and maintenance costs associated with upgrades required to comply with effluent ammonia and nitrogen limits stipulated in the Environment Act Licence for this plant.

IMPLICATIONS OF THE RECOMMENDATION(S):

General Implications

	None
X	For the organization overall and/or for other departments
	For the community and/or organizations external to the City of Winnipeg
	Involves a multi-year contract

Comment(s): By providing financial support to University of Manitoba, the City will benefit from the practical knowledge gained from full-scale

scientific research conducted at the North End Water Pollution Control Centre (NEWPCC) to reduce effluent ammonia and nitrogen loading to the Red River and Lake Winnipeg.

Policy Implications

X	No
	Yes

Comment(s):

Regulatory Implications

X	None
	Eliminates or reduces regulatory impact
	Proposes regulatory impact

Comment(s):

Environmental Implications

X	None
	Yes

Comment(s):

Human Resources Implications

X	No
	Yes

Comment(s):

Financial Implications

X	Within approved current and/or capital budget
	Current and/or capital budget adjustment required

Comment(s): Funding will come from the Sewer Utility Retained Earnings

HISTORY

On February 18, 2003, the Province of Manitoba announced the Lake Winnipeg Action Plan to help protect Lake Winnipeg. The plan also established the creation of a Lake Winnipeg Stewardship Board.

In August 2003, the 2003 Clean Environment Commission (CEC) hearings resulted in a report to the Minister that contained the following recommendation under Nutrient Management Strategy:

> *"The City of Winnipeg should be directed to plan for the removal of nitrogen and phosphorus from its municipal wastewaters and to take immediate steps in support of the nutrient reduction targets established for Lake Winnipeg.*

Funds in the amount of $34,070,000 are included in the 2003 to 2008 Capital Budget for the NEWPCC Centrate Treatment Project to remove both Nitrogen and Phosphorus from reject water associated with digestion and dewatering of sludge. The project is essentially complete.

Funds in the amount of $14,500,000 are included in the 2004 to 2008 Capital Budget for the NEWPCC Nutrient Removal (BNR) Project to remove both Nitrogen and Phosphorus from the mainstream plant process.

In December 2006, the Lake Winnipeg Stewardship Board submitted a report to the Minister of Water Stewardship "Reducing Nutrient Loading to Lake Winnipeg and its Watershed - Our Collective Responsibility and Commitment to Action" that contained the following recommendations:

> *"11.1 The Province of Manitoba should continue to require that nutrient reductions be implemented as quickly as possible at the large municipal and industrial wastewater treatment facilities in the cities of Winnipeg, Portage la Prairie, and Brandon"*

In September 2008, the Minister of Conservation requested the Clean Environment Commission to investigate the nutrient reduction and ammonia treatment at the City of Winnipeg's wastewater treatment facilities.

In March 2009, the Clean Environment Commission's review of the need to remove nitrogen, ammonia, and phosphorus resulted in a report to the Minister of Conservation that contained the following recommendations:

> *"8.1) In order to protect the environment, City of Winnipeg wastewater treatment facilities must be regulated and operated in a manner that ensures the following:*
>
> *b) Nitrogen discharges must not exceed 15 milligrams per litre, as determined by the 30-day rolling average."*

DISCUSSION:

Regulatory Background

Biological Nutrient Removal (BNR) upgrades are required at the North End Water Pollution Control Centre (NEWPCC) to comply with stringent effluent nitrogen, ammonia, and phosphorus limits contained in the Environment Act Licence issued for this plant. The upgrade is to be completed and commissioned by December 31, 2014. The Water and Waste Department is finalizing a Master Plan study on NEWPCC wastewater treatment and solids processing options to confirm that sufficient land area exists at the NEWPCC to construct required facilities, and that the upgrades would satisfy Licence compliance requirements. Planning level designs and costs estimates prepared suggest that BNR upgrades at the NEWPCC will be in the range of $340 to 530 million to construct and have an annual operating cost of approximately $18 million per year.

Wastewater Treatment Plant Upgrades

In December of 2008, North America's first large-scale high-strength wastewater treatment facility to remove nitrogen from digested sludge dewatering liquor (centrate) was placed into operation at the NEWPCC. The total construction cost of the project was approximately $34 million. The estimated annual operating cost is $2.1 million per year, of which, $1.6 million is associated with chemicals (sodium carbonate and methanol) and $0.3 million for electricity. The liquid stream (i.e., centrate) from digestion and dewatering at the NEWPCC is only about two percent of the total effluent flow, but it comprises about 30% of the total nitrogen load in the final effluent. The facility contains two parallel Sequencing Batch Reactors (SBRs) that were designed to remove 1600 kg/d of nitrogen through the biological processes of nitrification (conversion of ammonia to nitrate) and methanol-induced denitrification (to convert nitrate to nitrogen gas). The unit operations and processes are currently undergoing commissioning and acclimatization, and are performing as designed.

Applied Research to Optimize Plant-wide Nitrogen Removal at the NEWPCC

The primary object of the research is to maximize the removal of nitrogen in the whole treatment plant, while minimizing the overall capital and operating costs to comply with Regulatory compliance requirements. The proposed applied research is a 2-year 2-part program that will focus on optimizing the performance of the NEWPCC Centrate SBRs and inducing additional reduction of nitrogen in the whole plant through a process referred to as “bioaugmentation”. The two parts of the research involve:

1. Altering the SBRs operating conditions can create an environment favorable to a unique treatment process, referred to as “nitritation”, which can oxidize the ammonia rich centrate stream with less chemicals and energy demands. Altering the operating environment has the potential to save on chemical and electrical operating costs.

2. Bioaugmentation resulting from the controlled introduction of treated liquid and sludge from the SBRs to induce nitrification in the existing mainstream High-Purity Oxygen Activated

Sludge (HPOAS) bioreactors. Maximizing nitrification in the existing HPOAS bioreactors has the potential to reduce the tanks required to meet the nitrogen limits.

Proposed Research Team

The research project will be closely supervised by the Principal Investigator, Dr. Jan Oleszkiewicz, P. Eng., from the University of Manitoba. Dr. Oleszkiewicz is a world-wide recognized expert on wastewater treatment processes. The research will be carried by: two Graduate Studies Student (Mr. N. Szoke of the Water and Waste Department, and another to be named) per year; one Postdoctoral Fellow; one part-time engineering technician; and two undergraduate co-op students (one in the first year and one in the second year).

From the City of Winnipeg, Mr. N. Szoke, P. Eng. will coordinate the research and provide liaison with the University as well as facilitating support from other city employees who will be involved in the work or providing in-kind support at the NEWPCC on a limited part-time basis.

Benefits of City of Winnipeg Involvement:

The proposed scientific research has the potential to reduce the costs the BNR upgrades required at the NEWPCC to comply with Licence compliance requirements. Knowledge gained from this research will help determine possible cost-effective adaptation of the existing infrastructure and processes to remove nitrogen on a plant-wide basis. This information can be used in the future to help improve the cost-effectiveness of engineering designs and operations of proposed upgrades.

If successful:

- Nitritation could reduce the annual chemical and electrical costs by about one-third, or about $600,000 per year, or alternatively,

- Bioaugmentation could reduce the tankage required by more than 10% associated with the full plant upgrade to meet nitrogen limits. Based on planning level estimates, a construction cost saving of greater than $40 million could be realized.

Funds for this project are available in the NEWPCC Nutrient Removal Project.

The financial status of the NEWPCC Nutrient Removal Project is as follows:

Authorized Capital			$ 14,500,000.00
Amount of Previous Awards or Expenditures	$ 0.00		
1 Amount of this Recommendation			**$ 180,000.00**
Estimated Amount of MRST	$ 4,200.00		
Total Estimated Cost	$ 184,200.00		$ 184,200.00
Estimated Residual for Remaining Projects			$ 14,315,800.00

FINANCIAL IMPACT

Financial Impact Statement

Date: April 24, 2009

Project Name: **First Year of Program** **2009**

GRANT TO UNIVERSITY OF MANITOBA IN 2009 AND 2010 FOR APPLIED RESEARCH ON PLANT-WIDE NITROGEN REMOVAL OPTIMIZATION AT THE NORTH END WATER POLLUTION CONTROL CENTRE (NEWPCC)

	2009	2010	2011	2012	2013
Capital					
Capital Expenditures Required	$ 92,100	$ 92,100	$ -	$ -	$ -
Less: Existing Budgeted Costs	92,100	92,100	-	-	-
Additional Capital Budget Required	$ -	$ -	$ -	$ -	$ -
Funding Sources:					
Debt - Internal	$ -	$ -	$ -	$ -	$ -
Debt - External	-	-	-	-	-
Grants (Enter Description Here)	-	-	-	-	-
Reserves, Equity, Surplus	-	-	-	-	-
Other - Enter Description Here	-	-	-	-	-
Total Funding	$ -	$ -	$ -	$ -	$ -
Total Additional Capital Budget Required	$ -				
Total Additional Debt Required	$ -				
Current Expenditures/Revenues					
Direct Costs	$ -	$ -	$ -	$ -	$ -
Less: Incremental Revenue/Recovery	-	-	-	-	-
Net Cost/(Benefit)	$ -	$ -	$ -	$ -	$ -
Less: Existing Budget Amounts	-	-	-	-	-
Net Budget Adjustment Required	$ -	$ -	$ -	$ -	$ -

Additional Comments: Funding for this project are included in the approved Capital Budget and are financed by Sewer Utility Retained Earnings

"Original signed by D. Capp, C.G.A."

je
24-Apr-09

Darlene Capp C.G.A.
Acting Manager of Finance & Administration

CONSULTATION

In preparing this Report there was consultation with:

SUBMITTED BY

Water and Waste Department
Engineering Division
Prepared by: M. A. Shkolny, P. Eng., and N. T. Szoke, P. Eng
Processed By: Tamara Siemens/John Elias
Date: May 8, 2009
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