



## **CITY OF RICHMOND INVITATION TO TENDER**

### **Contract T.3985**

### **Contract: No. 3 Road South Drainage Pump Station Screens Upgrade**

The City of Richmond invites tenders for construction work at the above-mentioned locations. Work under the Contract generally comprises a comprehensive renovation of the existing inlet structure at the Horseshoe Slough Drainage Pump Station.

Work generally entails the following:

- Removal of existing reinforced concrete inlet structure and intake trash screens.
- Construction of expanded inlet structure.
- Installation of City supplied inlet screens.

The *Contract Documents* are available on or after August 20, 2010 during normal business hours at Front of House of the Richmond City Hall at:

6911 No. 3 Road, Richmond, BC, V6Y 2C1

on payment of a non-refundable amount of \$50.00 including HST payable to:

**City of Richmond**

The *Contract Documents* are available for viewing at:

Front of House, Richmond City Hall, 6911 No. 3 Road, Richmond

Tenders are scheduled to close at:

<b>Tender Closing Time:</b>	3:00 PM local time
<b>Tender Closing Date:</b>	September 9, 2010 and will be opened publicly immediately thereafter in Richmond City Hall
<b>Tender Submission Address:</b>	Manager - Purchasing Front of House, Richmond City Hall 6911 No. 3 Road, Richmond, BC, V6Y 2C1

A valid tender consists of a submission delivered on time complete with the required Bid Bond, Undertaking of Surety and Undertaking of Liability Insurance.

The lowest or any tender will not necessarily be accepted.

**Manager – Purchasing**



# City of Richmond

September 1, 2010  
File: 02-0775-50-3985/Vol 01

**Business & Financial Services Department**  
**Finance Division**  
Telephone: 604-276-4218  
Fax: 604-276-4162

**Attention: To All Tenderers**

Dear Sir/Madame:

**Re: Request for Tender T.3985 – No. 3 Road South Drainage Pump Station Upgrade – Addendum One**

This addendum forms part of the Contract Documents and shall be read, interpreted and coordinated with all other parts. The costs of all work contained herein shall be included in the Contract Price. The following revisions supersede the information contained in the original Contract Document to the extent referenced and shall become part thereof.

**Tenderers shall acknowledge receipt of this addendum by inserting its number and date where provided for on the Form of Tender.**

1. Under **SECTION A – INSTRUCTIONS TO TENDERERS PART 1, Submission of Tenders 3.1** page A-4, please remove:

Tender Closing Date: September 9, 2010

and replace with:

Tender Closing Date: September 21, 2010

2. **SECTION H** and **SECTION I** will not be included in Addendum 1, but included in a future addendum, therefore under **SECTION D – DOCUMENTS SPECIFIC TO THIS CONTRACT, Dewatering and Drainage SSP 8** page D-9, please remove:

The *Contractor* shall bear all costs in connection with the effective dewatering of excavations and all other pumping and drainage necessary for the proper construction of the *Work*, including keeping the sub-grade, pipes, structures and trenches free of undesirable accumulations of seepage, subsoil water, surface water or rainwater. Please refer to *Section I – Hydro-geological Study* (to be included in Addendum No. 1) for further details on subsoil water conditions.

No groundwater shall be permitted to discharge into the drainage system unless they meet Federal and Provincial requirements. Discharge of groundwater into sanitary system requires testing and approval from Greater Vancouver Storm and Sanitary District. All such coordination, if necessary, shall be made by the *Contractor*.

Please refer to *Section H – Ground Water Test Results and Analyses* (To be included in Addendum No.1) for information on ground water conditions.

The *Contractor* shall provide a dewatering and discharge strategy that is environmentally compliant, and reflective of the information provided in *Section H and Section I*, prior to start of construction. Specifically one strategy based on well-pointing and one strategy based on not well-pointing.

And replace with:

The *Contractor* shall bear all costs in connection with the effective dewatering of excavations and all other pumping and drainage necessary for the proper construction of the *Work*, including keeping the sub-grade, pipes, structures and trenches free of undesirable accumulations of seepage, subsoil water, surface water or rainwater. Please refer to *Section I – Hydro-geological Study* (to be included in a future addendum) for further details on subsoil water conditions.

No groundwater shall be permitted to discharge into the drainage system unless they meet Federal and Provincial requirements. Discharge of groundwater into sanitary system requires testing and approval from Greater Vancouver Storm and Sanitary District. All such coordination, if necessary, shall be made by the *Contractor*.

Please refer to *Section H – Ground Water Test Results and Analyses* (To be included in a future addendum) for information on ground water conditions.

The *Contractor* shall provide a dewatering and discharge strategy that is environmentally compliant, and reflective of the information provided in *Section H and Section I*, prior to start of construction. Specifically one strategy based on well-pointing and one strategy based on not well-pointing.

Please include the following revised section cover sheets as part of the contract:

Yours truly,

A handwritten signature in black ink, appearing to be 'Kerry Lynne Gillis', written in a cursive style.

Kerry Lynne Gillis  
*Buyer II - Contracting Specialist*

KG:kg

## **SECTION H**

### **GROUND WATER TEST RESULTS AND ANALYSES**

(To be included in future addendum)

## **SECTION I**

### **HYDRO-GEOLOGICAL STUDY (To be included in future addendum)**



# City of Richmond

September 15, 2010  
File: 02-0775-50-3985/Vol 01

**Business & Financial Services Department**  
**Finance Division**  
Telephone: 604-276-4218  
Fax: 604-276-4162

**Attention: To All Tenderers**

Dear Sir/Madame:

**Re: Request for Tender T.3985 – No. 3 Road South Drainage Pump Station Upgrade – Addendum Two**

This addendum forms part of the Contract Documents and shall be read, interpreted and coordinated with all other parts. The costs of all work contained herein shall be included in the Contract Price. The following revisions supersede the information contained in the original Contract Document to the extent referenced and shall become part thereof.

**Tenderers shall acknowledge receipt of this addendum by inserting its number and date where provided for on the Form of Tender.**

## 1. Seepage Analyses

Please find attached the *Seepage Analyses for Upgrade Work to No. 3 Road Pump Station Inlet*, prepared by MEG Consulting Ltd.

Yours truly,

A handwritten signature in black ink, appearing to be "Kerry Lynne Gillis".

Kerry Lynne Gillis  
*Buyer II - Contracting Specialist*

KG:kg

pc: Anthony Fu, P.Eng, Project Manager

## TECHNICAL MEMORANDUM

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**To:** Mr. Anthony Fu, City of Richmond

**Date:** September 15, 2010

**RE:** Seepage Analyses for Upgrade Work to No. 3 Road Pump Station Inlet

**Prepared by:** Thomas Sully, EIT/Lothar Chan, EIT

**Reviewed by:** John P. Sully, P.Eng.

**Doc. No:** 10-040-02 Seepage Analyses

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### 1. INTRODUCTION

The City of Richmond requested that MEG Consulting Ltd. (M+EG) perform a review of the geotechnical conditions present at the No.3 Road pump station inlet and provide input to a foundation assessment. An initial M+EG report addressed the geotechnical design issues for the proposed inlet structure foundation (MEG Consulting Ltd., Foundation Assessment for Upgrade Work to No. 3 Road Pump Station Inlet, Richmond, BC., September 2010). Further to the geotechnical design report, M+EG was asked to perform an assessment of potential seepage that may occur during the construction phase of the pump station upgrade.

Reference should be made to the M+EG foundation assessment report (September 2010) for all relevant geotechnical data.

The following documents were used as reference material in the evaluation:

- MEG Consulting Ltd. Geotechnical Aspects Related to the Upgrade of Pump Station Inlet Screens at No. 3 Road and at Horseshoe Slough, Richmond, BC. May 2005 (submitted to HLE).
- MEG Consulting Ltd. Re: Foundation Assessment for Upgrade Work to No.3 Road Pump Station Inlet, Richmond, BC. September 2010.
- Hunter Laird Engineering Ltd. Drainage Pump Station Inlet Upgrade Package for No. 3 Road Pump Station Upgrade. Dwg. Lc-1119. February 2006.
- MEG Consulting Ltd. Re: Horseshoe Slough Pump Station - Review of Geotechnical Aspects of Pump Station Design, Richmond, BC. May 2009.
- MEG Consulting Ltd. Re: Horseshoe Slough Pump Station Inlet Upgrade - Summary of Geotechnical Field Reviews, Richmond, BC. August 2009.

## **2. LABORATORY TESTING**

Further to the laboratory testing program for the M+EG foundation assessment report, a triaxial constant head permeability test was performed to provide input to the seepage analysis. The test was performed in the M+EG geotechnical testing laboratory in Richmond, BC.

## **3. SEEPAGE ANALYSES**

Installation of the new inlet structure will require excavation into the downstream slope of the existing dyke. It is estimated that the height of the excavated slope will be about 3 m above the base of the inlet base slab. For the analysis we have assumed that the slope will be supported by means of temporary sheet piling. The sheet piles will serve to retain the vertically-cut soil slope, as well as limit seepage into the proposed excavation.

The objective of the seepage analysis to be performed by M+EG is to determine the rate and volume of water infiltration into the working excavation. It is understood that the results of the seepage analyses will be used by the contractor to assist in determining the necessary pumping requirements during construction.

The cross-section used in the analyses was inferred from the site plan provided by Hunter Laird Engineering Ltd. (HLE Inlet Upgrade Package Dwg. Lc-1119). The SEEP/W model profile is presented in Figure 1.

### **3.1 Permeability Coefficients**

Details of the geotechnical conditions at the site are presented in the foundation report submitted previously. Two principal soil layers are interpreted to control the seepage at this site. The dyke itself is represented by a well-graded granular fill which overlies a silt layer which contains variable amounts of clay and sand (Table 1).

The permeability coefficients for the upper dyke fill layer were determined using empirical correlations between soil types and permeability as well as grain size. Typical correlations are published in most soil mechanics texts; correlations are also presented in the SEEP/W manual. The correlations were used with the results of sieve analyses for the dyke fill sample (S1).

Results from the laboratory permeability test were used to determine the hydraulic conductivity of the sandy clayey silt layer. The permeability test was performed on sample SH3. SH3 was selected because it is the sample in the sandy silt layer which contains the highest percentage of sand of the recovered samples; hence, it should provide the largest hydraulic conductivity. The hydraulic conductivity parameters used in the analyses are summarized in Table 1.

A range of conductivity values was used to perform a sensitivity analysis. Maximum and minimum values are provided in Table 1. For the silt layer, which controls the seepage, the upper bound value for conductivity was arbitrarily defined as being 100 times the estimated



value. A ratio of 2 between the horizontal and vertical conductivities was assumed for the fluvial deposits in this area.

**Table 1 Hydraulic Conductivity Parameters for Seepage Analysis**

Elevation (m) <sup>(1)</sup>		Soil Type	Unit Weight (kN/m <sup>3</sup> )	Permeability		
From	To			$k_h : k_v$	Min $k_h$ (m/s)	Max $k_h$ (m/s)
3.3	1.5	Fill	19.0	2	5.5e-005	5.5e-005
1.5	-13.8	ML/CL	18.0	2	1.0e-007	1.0e-005

<sup>(1)</sup> Based on the assumed top elevation of El. +3.3 m for the crest of the dyke

### 3.2 Seepage Analyses

The seepage analyses were performed using the commercially available software SEEP/W (Geoslope International). Both soil layers in the model were considered to be fully saturated with a horizontal to vertical hydraulic conductivity ratio of 2.

For the analyses, a worst case water table was assumed. The water level on the upstream slope of the dyke was modelled at El. +3.0 m. The ground surface on the land side of the dyke was modelled with zero pressure head.

The flow was assumed to be limited by the presence of a sheet pile wall. For the analyses, the sheet piles were assumed to be installed to a nominal depth below the inlet foundation level. Actual sheet pile depths will likely be greater and the resulting seepage will be less than calculated herein. A total sheet pile wall perimeter length varying from 30 to 40 m was used. No seepage through the sheet pile wall itself has been considered in the model, i.e the sheet pile wall is assumed to be impermeable.

Seepage into the excavation was calculated to range from 5 l/hr to 260 l/hr for the minimum and maximum conductivity values used in the analyses. The best-estimate for seepage into the excavation based on the conditions above is considered to be about 150 l/hr.

During the upgrade work at the Horseshoe Slough pump station inlet, a sheet pile wall was used to support the sidewalls of the excavation. Visual inspections of the water inflow at the site would suggest that the inflow to the excavation may be better represented by a value closer to the lower estimate of permeability, giving an inflow of about 10-30 l/hr. Nevertheless, given the uncertainties with regards to the ground conditions and flow conditions, the estimated range of seepage volumes presented above should be considered for the dewatering options.

#### 4. CLOSURE

This technical memorandum presents the seepage analyses for the proposed upgrade works at No. 3 Road pump station. It is concluded that the seepage rate into the construction excavation could possibly range from 5l/hr to 260 l/hr based on the particular assumptions made. A best estimate of 150 l/hr is suggested. The assumptions related to the ground conditions should be reviewed by the contractor as the excavation proceeds. Changes in ground conditions should be communicated to the City of Richmond so that adjustments can be made to the analyses, if necessary.

The above information is supplied at the request of the City of Richmond in order to determine expected seepage volumes during the excavation of the dyke slope for installation of an upgrade to the pump station inlet at No. 3 Road. The results of the analyses are dependent on the assumptions made. The information is to be supplied to the contractor who should verify the assumptions and use his judgement and experience in planning the measures for dewatering. The above analyses are provided as a guide to assist the contractor in designing the dewatering requirements, but the contractor is solely responsible for the adequacy of the measures to be implemented.

All temporary works should be designed so as not to compromise the short- or long-term stability of the dyke. All temporary design should be submitted to the City of Richmond for review and approval prior to commencing construction.

M+EG has prepared this report in a manner consistent with a level of care and skill ordinarily exercised by members of the engineering and geoscience professions currently practicing in British Columbia subject to the time limits and physical constraints applicable to this report and the project being developed. No other warranty, expressed or implied, is made.

The soil conditions and depths of material are based on the results obtained from an interpretation of the geotechnical information available from geotechnical investigations performed in the area.

The classification and identification of geomaterials has been based on commonly accepted procedures employed by the practicing geotechnical community and some judgment is involved. Boundaries between soil types may be transitional as opposed to abrupt. As a result, M+EG does not warrant or guarantee the exactness of the descriptions or any interpretations.

Due to the variability of natural materials, even with a detailed testing and sampling program, the investigation may fail to detect certain conditions that could affect the results of the site response analyses. Similarly the geologic, geotechnical and ground water conditions interpreted to exist between sampling points may differ from actual conditions.

The document has been prepared for the specific site, design objective and development described to M+EG. The factual data, interpretations and recommendations contained in the

report are specific to this project as we understand it and are not applicable to any other project or site location. M+EG cannot be responsible for use of this document, or parts thereof, for other than this project or site unless M+EG is requested to review and, if necessary, revise the document.

The information, recommendations, estimates and opinions contained in this document are for the sole benefit of the City of Richmond. No other party may use or rely on the information contained herein, in whole or any portion, without the written consent of M+EG Consulting Limited.

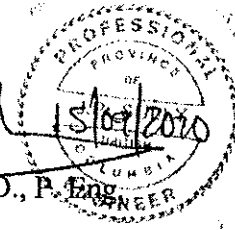
Sincerely,  
MEG CONSULTING LIMITED

Thomas Sully, E.I.T.  
Geotechnical Engineer

Reviewed by:



John P. Sully, Ph.D., P. Eng  
Principal



Lothar Chan, E.I.T.  
Geotechnical Engineer

