

Contributory Pension Plan for Salaried Employees of McMaster University Including McMaster Divinity College

Report on the Actuarial
Valuation for Funding Purposes
as at July 1, 2021

January 2022

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To prepare the results in this report, actuarial assumptions are used to model a single scenario from a range of possibilities for each valuation basis. The results based on that single scenario are included in this report. However, the future is uncertain and the Plan's actual experience will differ from those assumptions; these differences may be significant or material. Different assumptions or scenarios within the range of possibilities may also be reasonable, and results based on those assumptions would be different. Furthermore, actuarial assumptions may be changed from one valuation to the next because of changes in regulatory and professional requirements, developments in case law, plan experience, changes in expectations about the future, and other factors.

The valuation results shown in this report also illustrate the sensitivity to one of the three key actuarial assumptions, including the discount rate, and the sensitivity to three adverse scenarios. We note that the results presented herein rely on many assumptions, all of which are subject to uncertainty, with a broad range of possible outcomes, and the results are sensitive to all the assumptions used in the valuation.

Should the Plan be wound up, the going concern funded status and solvency financial position, if different from the wind-up financial position, become irrelevant. The hypothetical wind-up financial position estimates the financial position of the Plan assuming it is wound up on the valuation date. Emerging experience will affect the wind-up financial position of the Plan assuming it is wound up in the future. In fact, even if the Plan were wound up on the valuation date, the financial position would continue to fluctuate until the benefits are fully settled.

Decisions about benefit changes, granting new benefits, investment policy, funding policy, benefit security, and/or benefit-related issues should not be made solely on the basis of this valuation, but only after careful consideration of alternative economic, financial, demographic, and societal factors, including financial scenarios that assume future sustained investment losses.

Funding calculations reflect our understanding of the requirements of the Pension Benefits Act (Ontario), the Income Tax Act, and related regulations that are effective as of the valuation date. Mercer is not a law firm, and the analysis presented in this report is not intended to be a legal opinion. You should consider securing the advice of legal counsel with respect to any legal matters related to this report.

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Section 1

Summary of results

	07.01.2021	07.01.2018
Going Concern Financial Status		
Smoothed value of assets	\$4,967,000	\$3,962,000
Going concern funding liabilities	\$3,688,000	\$3,011,000
Provision for adverse deviations in respect of the going concern liabilities	\$409,000	\$369,000
Funding excess (shortfall)	\$870,000	\$582,000
Hypothetical Wind-up Financial Position		
Wind-up assets	\$5,186,000	\$3,978,000
Wind-up liability	\$4,938,000	\$3,825,000
Wind-up excess (shortfall)	\$248,000	\$153,000
Transfer ratio	107%	106%
Solvency Financial Position		
Wind-up assets	\$5,186,000	\$3,978,000
Solvency asset adjustment	(\$294,000)	\$0
Smoothed solvency assets	\$4,892,000	\$3,978,000
Wind-up liability	\$4,938,000	\$3,825,000
Value of excluded benefits	(\$141,000)	\$0
Solvency liability adjustment	(\$10,000)	\$0
Smoothed solvency liabilities	\$4,787,000	\$3,825,000
Solvency surplus (shortfall)	\$105,000	\$153,000
Solvency ratio ¹	110%	106%

¹ Before smoothing impacts, per pension regulations
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	07.01.2021	07.01.2018
Funding Requirements in the Year Following the Valuation²		
Total current service cost	\$91,000	\$117,000
Estimated members' required contributions	(\$36,000)	(\$41,000)
Estimated University's current service cost	\$55,000	\$76,000
Provision for adverse deviations in respect of current service cost	\$10,000	\$14,000
Expense allowance including provision for adverse deviations in respect of expense allowance	\$28,000	\$25,000
Total estimated University's current service cost	\$93,000	\$115,000
University's current service cost and provision for adverse deviations expressed as a percentage of members' required contributions	258%	280%
Minimum special payments	\$0	\$0
Estimated minimum University contribution ³	\$17,000	\$78,000
Estimated maximum eligible University contribution	\$93,000	\$115,000
Next required valuation date	July 1, 2024	July 1, 2021

² Provided for reference purposes only. Contributions must be remitted to the Plan in accordance with the Minimum Funding Requirements and Maximum Eligible Contributions sections of this report.

³ Assumes that the prescribed application to FSRA will be made to use available actuarial surplus as a contribution holiday.

Section 2

Introduction

To McMaster University

At the request of McMaster University, we have conducted an actuarial valuation of the Contributory Pension Plan for Salaried Employees of McMaster University Including McMaster Divinity College (the “Plan”), sponsored by McMaster University (the “University”), as at the valuation date, July 1, 2021. We are pleased to present the results of the valuation.

Purpose

The purpose of this valuation is to determine:

- The funded status of the Plan as at July 1, 2021 on going concern, hypothetical wind-up, and solvency bases;
- The minimum required funding contributions from July 1, 2021, in accordance with the *Pension Benefits Act (Ontario)* (the “Act”); and
- The maximum permissible funding contributions from July 1, 2021, in accordance with the *Income Tax Act*.

The information contained in this report was prepared for the internal use of the University, and for filing with the Financial Services Regulatory Authority of Ontario and with the Canada Revenue Agency, in connection with our actuarial valuation of the Plan. This report will be filed with the Financial Services Regulatory Authority of Ontario and with the Canada Revenue Agency. This report is not intended or suitable for any other purpose.

In accordance with pension benefits legislation, the next actuarial valuation of the Plan will be required as at a date not later than July 1, 2024 or as at the date of an earlier amendment to the Plan depending on any funding implications.

Terms of Engagement

In accordance with our terms of engagement with McMaster University, our actuarial valuation of the Plan is based on the following material terms:

- It has been prepared in accordance with applicable pension legislation and actuarial standards of practice in Canada.
- As instructed by the University, we have not reflected a margin for adverse deviations in the going concern valuation in excess of the provision for adverse deviations prescribed by the Act.
- We have reflected the University’s decisions for determining the solvency funding requirements, summarized as follows:
 - The same plan wind-up scenario was hypothesized for both hypothetical wind-up and solvency valuations.

- Certain excludable benefits were excluded from the solvency liabilities.
- Solvency smoothing was used.

See the Valuation Results – Solvency section of the report for more information.

Events since the Last Valuation at July 1, 2018

Pension Plan

There have been no special events since the last valuation date.

This valuation reflects the provisions of the Plan as at July 1, 2021. The Plan has not been amended since the date of the previous valuation, and we are not aware of any pending definitive or virtually definitive amendments coming into effect during the period covered by this report. The Plan provisions are summarized in Appendix F.

Assumptions

We have used the same going concern valuation assumptions and methods as were used for the previous valuation, except for the following:

	Current valuation		Previous valuation	
Discount rate:	5.1%		5.6%	
Interest on employee contributions:	5.1%		5.6%	
Post-retirement pension increases:	Year	Rate	Year	Rate
	2022	1.45%	2019	1.89%
	2023	2.00%	2020	2.00%
	2024	2.00%	2021	1.97%
	2025	2.00%	2022	2.03%
	2026	2.00%	2023	1.64%
	2027 onwards	0.60%	2024 onwards	1.10%
Mortality rates:	90% of the rates of the 2014 Public Sector Canadian Pensioners Mortality Table (CPM2014Publ)		85% of the rates of the 2014 Public Sector Canadian Pensioners Mortality Table (CPM2014Publ)	

In addition to the assumption changes, the Provision for Adverse Deviations has decreased from 13.8% to 12.0% to reflect changes to the target asset allocation. A summary of the going concern methods and assumptions is provided in Appendix C.

The hypothetical wind-up and solvency assumptions have been updated to reflect market conditions at the valuation date. A summary of the hypothetical wind-up and solvency methods and assumptions is provided in Appendix D.

Regulatory Environment and Actuarial Standards

There have been a number of changes to the Act and regulations that impact the funding of the Plan.

On May 21, 2019, amendments to the Regulations to the Ontario Pension Benefits Act were released. These amendments were intended to provide additional clarity to the operation of the new funding rules. On May 29, 2019, Bill 100 received Royal Assent. Bill 100 included several amendments to the Pension Benefits Act, including adjustments to permit the use of the Prior Year Credit Balances to pay for University's current service cost.

On September 21, 2020, the Ontario government filed Regulation 520/20, providing potential temporary funding relief for eligible single University defined benefit pension plans registered in Ontario. The new regulation allows sponsors of eligible plans to defer required University contributions starting with those contributions due in October 2020 and ending with contributions due in March 2021. Each deferred monthly contributions plus interest are due to be paid in 2 consecutive monthly payments ranging no later than April/May 2021 to February/March 2022.

On July 2, 2020, the Minister of Finance of Canada released draft regulations that would permit sponsors of pension plans to recognize full pensionable service in 2020 for employees who are working reduced hours or who are receiving reduced earnings. The eligible period of reduced pay will be subject to the limit of five years of full-time equivalent compensation.

On July 23, 2020, the CIA published the final version of Section 3500 of the Standards of Practice on Pension Commuted Values and confirmed that the effective date of the new standards is December 1, 2020.

From the effective date, the revised standards affect the assumptions used to value the solvency and wind-up liabilities for benefits assumed to be settled through a lump sum transfer. The financial impact of those changes is reflected in this actuarial valuation and on a solvency and hypothetical wind-up basis.

Subsequent Events

After checking with representatives of the University, to the best of our knowledge there have been no events subsequent to the valuation date that, in our opinion, would have a material impact on the results of the valuation as at July 1, 2021. Our valuation reflects the financial position of the Plan as of the valuation date and does not take into account any experience after the valuation date.

Impact of Case Law

This report has been prepared on the assumption that all claims on the Plan after the valuation date will be in respect of benefits payable to members of the Plan determined in accordance with the Plan terms and that all Plan assets are available to provide for these benefits. It is possible that court and regulatory decisions and changes in legislation could give rise to additional entitlements to benefits under the Plan and cause the results in this

report to change. By way of example, we bring your attention to the following decisions:

- The Ontario Court of Appeal's 2003 decision in *Aegon Canada Inc. and Transamerica Life Canada versus ING Canada Inc.* restricted the use of original plan surplus where two or more pension plans were merged.
- The Supreme Court of Canada's 2004 decision in *Monsanto Canada Inc. versus Superintendent of Financial Services* upheld the requirement, with retroactive effect, to distribute surplus on partial plan wind-up under the *Pension Benefits Act (Ontario)*.

We are not in a position to assess the impact that such decisions or changes could have on the assumption that all plan assets on the valuation date are available to provide for benefits determined in accordance with the Plan terms. If such a claim arises subsequent to the date of this report, the consequences will be dealt with in a subsequent report. We are making no representation as to the likelihood of such a claim.

Section 3

Valuation results – Going concern

Financial Status

A going concern valuation compares the relationship between the value of Plan assets and the present value of expected future benefit cash flows in respect of accrued service, assuming the Plan will be maintained indefinitely.

The results of the current valuation, compared with those from the previous valuation, are summarized as follows:

	07.01.2021	07.01.2018
Assets		
Market value of assets	\$5,261,000	\$4,053,000
Asset smoothing adjustment	(\$294,000)	(\$91,000)
Smoothed value of assets	\$4,967,000	\$3,962,000
Going concern funding target		
Going concern liabilities:		
• Active members	\$2,164,000	\$2,810,000
• Pensioners and survivors	\$1,317,000	\$23,000
• Deferred pensioners	\$207,000	\$178,000
Subtotal	\$3,688,000	\$3,011,000
Provision for adverse deviations in respect of going concern liabilities as prescribed by the Act	\$409,000	\$369,000
Total	\$4,097,000	\$3,380,000
Funding excess (shortfall) ⁴	\$870,000	\$582,000

The going concern liabilities at July 1, 2021 do not include an additional margin for adverse deviations beyond the provision for adverse deviations prescribed by the Act.

⁴ Funding excess (shortfall) may or may not be equal to the going concern excess (unfunded liability) as described in the Act. Details of the going concern excess (unfunded liability) are provided in Appendix A.

Reconciliation of Financial Status

Funding excess (shortfall) as at previous valuation	\$582,000
Provision for Adverse Deviations (PfAD) at previous valuation	\$369,000
Funding excess (shortfall) before PfAD	\$951,000
Interest on funding excess (shortfall) before PfAD at 5.60% per year	\$169,000
University's special payments, with interest	\$40,000
Expected funding excess (shortfall)	\$1,160,000
Net experience gains (losses)	
• Net investment return	\$524,000
• Impact of asset smoothing	(\$187,000)
• Increase in YMPE/maximum pension	(\$18,000)
• Indexation	\$1,000
• Mortality	\$11,000
• Retirement	\$33,000
• Expenses	(\$185,000)
Total experience gains (losses)	\$179,000
Impact of changes in assumptions	
• Discount rate	(\$236,000)
• Post-retirement pension increase assumption	\$118,000
• Mortality	\$35,000
Total assumption changes impact	(\$83,000)
Net impact of other elements of gains and losses	\$23,000
Funding excess (shortfall) before PfAD	\$1,279,000
Provision for Adverse Deviations at current valuation	(\$409,000)
Funding excess (shortfall) as at current valuation	\$870,000

Current Service Cost

The current service cost is an estimate of the present value of the additional expected future benefit cash flows in respect of pensionable service that will accrue after the valuation date, assuming the Plan will be maintained indefinitely. A provision for adverse deviations in respect of the current service cost is determined in accordance with the Act.

The current service cost and the provision for adverse deviations in respect of the current service cost, during the year following the valuation date, compared with the corresponding values determined in the previous valuation, is as follows:

	2021/2022	2018/2019
Total current service cost ⁵ excluding expense allowance	\$91,000	\$117,000
Estimated members' required contributions	(\$36,000)	(\$41,000)
Estimated University's current service cost excluding expense allowance	\$55,000	\$76,000
Estimated University's current service cost excluding expense allowance as a percentage of members' required contributions	153%	185%
Provision for adverse deviations in respect of the current service cost (based on the percentage defined in Appendix A)		
• As a dollar amount per year	\$10,000	\$14,000
• As a percentage of members' required contributions	28%	34%
Expense allowance		
Expense allowance	\$25,000	\$25,000
Provision for adverse deviations in respect of expense allowance	\$3,000	\$0
• As a dollar amount per year	\$28,000	\$25,000
• As a percentage of members' required contributions	77%	61%
Total estimated University's current service cost		
• As a dollar amount per year	\$93,000	\$115,000
• As a percentage of members' required contributions	258%	280%

The key factors that have caused a change in the University's current service cost, excluding the provision for adverse deviations, since the previous valuation are summarized in the following table:

University's current service cost as at previous valuation	246%
Demographic changes	(21%)
Changes in assumptions	5%
University's current service cost as at current valuation	230%

⁵Total current service cost includes \$6000 in estimated future costs for escalated adjustments as defined in the Act.

Discount Rate Sensitivity

The following table summarizes the effect on the going concern liabilities and current service cost shown in this report of using a discount rate that is 1% lower than that used in the valuation. The effect of a change in the discount rate on the provision for adverse deviations is not reflected.

Scenario	Valuation Basis	Reduce Discount Rate by 1%
Going concern funding liabilities	\$3,688,000	\$4,197,000
Current service cost		
• Total current service cost	\$91,000	\$106,000
• Estimated members' required contributions	(\$36,000)	(\$36,000)
Estimated University's current service cost	\$55,000	\$70,000

Plausible Adverse Scenarios

The financial impact on the going concern results of plausible adverse scenarios that would pose threats to the Plan's future financial condition is presented in Appendix G.

Section 4

Valuation results – Hypothetical wind-up

Financial Position

When conducting a hypothetical wind-up valuation, we determine the relationship between the respective values of the Plan's assets and its liabilities assuming the Plan is wound up and settled on the valuation date, assuming benefits are settled in accordance with the Act and under circumstances consistent with the hypothesized scenario on the valuation date. More details on such scenario are provided in Appendix D.

The hypothetical wind-up financial position as of the valuation date, compared with that at the previous valuation, is as follows:

	07.01.2021	07.01.2018
Assets		
Market value of assets	\$5,261,000	\$4,053,000
Termination expense provision	(\$75,000)	(\$75,000)
Wind-up assets	\$5,186,000	\$3,978,000
Present value of accrued benefits for:		
• Active members	\$3,157,000	\$3,583,000
• Pensioners and survivors	\$1,532,000	\$26,000
• Deferred pensioners	\$249,000	\$216,000
Total wind-up liability	\$4,938,000	\$3,825,000
Wind-up excess (shortfall)	\$248,000	\$153,000
Transfer ratio	107%	106%

Wind-up Incremental Cost

The wind-up incremental cost is an estimate of the present value of the projected change in the hypothetical wind-up liabilities from the valuation date until the next scheduled valuation date, adjusted for the benefit payments expected to be made in that period.

The hypothetical wind-up incremental cost determined in this valuation, compared with the corresponding value determined in the previous valuation, is as follows:

	07.01.2021	07.01.2018
Number of years covered by report	3 years	3 years
Total hypothetical wind-up liabilities at the valuation date (A)	\$4,938,000	\$3,825,000
Present value at the valuation date of projected hypothetical wind-up liability at the next required valuation plus expected benefit payments until the next required valuation (B)	\$5,205,000	\$4,287,000
Hypothetical wind-up incremental cost (B – A)	\$267,000	\$462,000

The incremental cost is not an appropriate measure of the contributions that would be required to maintain the windup position of the Plan even if actual experience is exactly in accordance with the going concern valuation assumptions. For example, the expected return on plan assets (based on the going concern assumptions) is greater than the discount rate used to determine the hypothetical wind-up liabilities.

Discount Rate Sensitivity

The following table summarizes the effect on the hypothetical wind-up liabilities shown in this report of using a discount rate that is 1% lower than that used in the valuation:

Scenario	Valuation Basis	Reduce Discount Rate by 1%
Total hypothetical wind-up liability	\$4,938,000	\$5,616,000

Plausible Adverse Scenarios

The financial impact on the hypothetical wind-up financial position of plausible adverse scenarios that would pose threats to the Plan's future financial condition is presented in Appendix G.

Section 5

Valuation results – Solvency

Overview

The Act also requires the financial position of the Plan to be determined on a solvency basis. The financial position on a solvency basis is determined in a similar manner to the Hypothetical Wind-up Basis, except for the following:

Exceptions	Reflected in valuation based on the terms of engagement
The circumstance under which the Plan is assumed to be wound up could differ for the solvency and hypothetical wind-up valuations.	The same circumstances were assumed for the solvency valuation as were assumed for the hypothetical wind-up valuation.
Certain benefits can be excluded from the solvency financial position. These include: <ul style="list-style-type: none"> (a) any escalated adjustment (e.g. indexing), (b) certain plant closure benefits, (c) certain permanent layoff benefits, (d) special allowances other than funded special allowances, (e) consent benefits other than funded consent benefits, (f) prospective benefit increases, (g) potential early retirement window benefit values, and (h) pension benefits and ancillary benefits payable under a qualifying annuity contract. 	The following benefits were excluded from the solvency liabilities shown in this valuation: <ul style="list-style-type: none"> - Post-retirement indexing
The financial position on the solvency basis needs to be adjusted for any Prior Year Credit Balance.	Not applicable.
The solvency financial position can be determined by smoothing assets and the solvency discount rate over a period of up to 5 years.	Solvency assets and liabilities were smoothed over 5 years.
The benefit rate increases coming into effect after the valuation date can be reflected in the solvency valuation.	Not applicable.

Financial Position

The financial position on a solvency basis, compared with the corresponding figures from the previous valuation, is as follows:

	07.01.2021	07.01.2018
Assets		
Market value of assets	\$5,261,000	\$4,053,000
Termination expense provision	(\$75,000)	(\$75,000)
Net assets	\$5,186,000	\$3,978,000
Liabilities		
Total hypothetical wind-up liabilities	\$4,938,000	\$3,825,000
Difference in circumstances of assumed wind-up	\$0	\$0
Value of excluded benefits	(\$141,000)	\$0
Liabilities on a solvency basis	\$4,797,000	\$3,825,000
Surplus (shortfall) on a market value basis	\$389,000	\$153,000
Solvency liability adjustment	\$10,000	\$0
Solvency asset adjustment	(\$294,000)	\$0
Solvency surplus (shortfall)	\$105,000	\$153,000
Solvency ratio	110%	106%

Plausible Adverse Scenarios

The financial impact on the solvency financial position of plausible adverse scenarios that would pose threats to the Plan's future financial condition is presented in Appendix G.

Section 6

Minimum funding requirements

The Act prescribes the minimum contributions that the University must make to the Plan. The minimum contributions in respect of a defined benefit component of a pension plan are comprised of going concern current service cost, the provision for adverse deviations in respect of the current service cost, and special payments to fund any funding shortfall or solvency shortfall that exceeds the level set out under the Act.

On the basis of the assumptions and methods described in this report, the Plan has a funding excess on a going concern basis inclusive of the provision for adverse deviations, and the transfer ratio is greater than 105%. Under these circumstances, the Act does not require the University to contribute to the Plan until the available actuarial surplus has been applied towards the University's current service cost and the provision for adverse deviations in respect of the current service cost, provided that the required application has been made to regulator. Details on the determination of the provision for adverse deviations and on the available actuarial surplus are shown in Appendix A.

Once the available actuarial surplus has been so applied, monthly University contributions must resume. On the basis of the assumptions and methods described in this report, the rule for determining the minimum required University monthly contributions, as well as an estimate of the employee and University contributions, from the valuation date until the next required valuation are as follows:

Period beginning	Monthly Employee Contribution	Estimated University's contributions			
		Provision for adverse deviations related to monthly current service cost	Monthly current service cost and provision for adverse deviations and expense allowance	Available actuarial surplus applied ⁶	Minimum monthly contributions
July 1, 2021	\$3,000	\$833	\$7,750	\$7,750	\$0
April 1, 2022	\$3,000	\$833	\$7,750	\$6,250	\$1,500
May 1, 2022	\$3,000	\$1,083	\$7,750	\$0	\$7,750
July 1, 2022	\$3,000	\$1,083	\$7,750	\$0	\$7,750
July 1, 2023	\$3,000	\$1,083	\$7,750	\$0	\$7,750

⁶ Notwithstanding the available actuarial surplus in the Plan, the terms of the Plan may require the Company to make current service cost contributions.

Period beginning	University's contribution rule		
	Monthly current service cost ⁷	Provision for adverse deviations in respect of current service cost	Explicit monthly expense allowance ⁸
July 1, 2021	230%	28%	\$2,333
July 1, 2022	230%	28%	\$2,333
July 1, 2023	230%	28%	\$2,333

The estimated contribution amounts above are based on projected members' required contributions. Therefore, the actual University's current service cost and provision for adverse deviations in respect of the current service cost may be different from the above estimates and, as such, the contribution requirements should be monitored closely to ensure contributions resume in accordance with the Act.

Other Considerations

Differences between Valuation Bases

There is no provision in the minimum funding requirements to fund the difference between the hypothetical wind-up and reduced solvency shortfalls, if any.

In addition, although minimum funding requirements do include a requirement to fund the going concern current service cost and a provision for adverse deviations in respect of the current service cost, there is no requirement to fund the expected growth in the hypothetical wind-up or solvency liability after the valuation date, which could be greater.

Timing of Contributions

Funding contributions are due on a monthly basis. Contributions for current service cost and the provision for adverse deviations including the expense allowance must be made within 30 days following the month to which they apply. Special payment contributions must be made in the month to which they apply.

Retroactive Contributions

The University must contribute the excess, if any, of the minimum contribution recommended in this report over contributions actually made in respect of the period following the valuation date. This contribution, along with an allowance for interest, is due no later than 60 days following the date this report is filed.

Payment of Benefits

The Act imposes certain restrictions on the payment of lump sums from the Plan when the transfer ratio revealed in an actuarial valuation is less than one. If the transfer ratio shown in

⁷ Expressed as a percentage of members' required contributions.

⁸ Includes Provision for Adverse Deviations in respect of expense allowance.

this report is less than one, the plan administrator should ensure that the monthly special payments are sufficient to meet the requirements of the Act to allow for the full payment of benefits, and otherwise should take the prescribed actions.

Additional restrictions are imposed when:

- The transfer ratio revealed in the most recently filed actuarial valuation is less than one and the administrator knows or 'ought to know' that the transfer ratio of the Plan has declined by 10% or more since the date the last valuation was filed.
- The transfer ratio revealed in the most recently filed actuarial valuation is greater than or equal to one and the administrator knows or 'ought to know' that the transfer ratio of the Plan has declined to less than 0.9 since the date the last valuation was filed.

As such, the administrator should monitor the transfer ratio of the Plan and, if necessary, take the prescribed actions.

Section 7

Maximum eligible contributions

The *Income Tax Act* (the “ITA”) limits the amount of University contributions that can be remitted to the defined benefit component of a registered pension plan. For purposes of this section on maximum eligible contributions only, any reference to the current service cost includes the provision for adverse deviations in respect of the current service cost.

In accordance with Section 147.2 of the ITA and *Income Tax Regulation* 8516, for a plan that is underfunded on either a going concern or on a hypothetical wind-up basis, the maximum permitted contributions are equal to the employer’s current service cost, including the explicit expense allowance if applicable, plus the greater of the going concern funding shortfall and hypothetical wind-up shortfall.

For a plan that is fully funded on both going concern and hypothetical wind-up bases, the employer can remit a contribution equal to the employer’s current service cost, including the explicit expense allowance if applicable, as long as the surplus in the plan does not exceed a prescribed threshold. Specifically, in accordance with Section 147.2 of the ITA, for a plan that is fully funded on both going concern and hypothetical wind-up bases, the plan may not retain its registered status if the employer makes a contribution while the going concern funding excess exceeds 25% of the going concern funding target.

Notwithstanding the above, any contributions that are required to be made in accordance with pension benefits legislation are eligible contributions in accordance with Section 147.2 of the ITA and can be remitted.

Schedule of Maximum Contributions

Since the surplus does not exceed 25% of the going concern funding target, the University may make monthly contributions of up to 258% of required member contributions until the next valuation.

Section 8

Actuarial opinion

In our opinion, for the purposes of the valuations,

- The membership data on which the valuation is based are sufficient and reliable;
- The assumptions are appropriate; and
- The methods employed in the valuation are appropriate.

This report has been prepared, and our opinions given, in accordance with accepted actuarial practice in Canada. It has also been prepared in accordance with the funding and solvency standards set by *the Pension Benefits Act (Ontario)*.



Chad Spence

Fellow of Society of Actuaries
Fellow of the Canadian Institute of Actuaries

7 March 2022

Date



Bill Watson

Fellow of Society of Actuaries
Fellow of the Canadian Institute of Actuaries

7 March 2022

Date

Appendix A

Prescribed disclosure

Definitions

The Act defines a number of terms as follows:

Defined Term	Description	Result
Going concern assets	Total smoothed value of assets plus the sum of the following:	\$4,967,000
	(a) the present value of special payments in respect of any past service unfunded liability identified in a previously filed report	\$0
	(b) the present value of special payments in respect of any plan amendment that increases going concern liabilities	\$0
	(c) present value of special payments in respect of going concern unfunded liabilities identified in a previously filed report that are scheduled for payment within one year of the date of this report	\$0
Going concern excess / (unfunded liability)	The Going Concern Assets minus the sum of the following:	\$870,000
	a. the going concern liabilities	
	(i) liabilities excluding the value of escalated adjustments	\$3,409,000
	(ii) liabilities in respect of escalated adjustments	\$279,000
	b. the provision for adverse deviations in respect of the going concern liabilities excluding the value of escalated adjustments	\$409,000
	c. Prior Year Credit Balance	\$0

Defined Term	Description	Result
Going concern funded ratio	The ratio of: (a) Total smoothed value of assets (excluding letters of credit) less the Prior Year Credit Balance; to (b) going concern liabilities	1.35
Transfer Ratio	The ratio of: (a) Solvency Assets minus the lesser of the Prior Year Credit Balance and the minimum required employer contributions including the provision for adverse deviations until the next required valuation; to (b) The sum of the Solvency Liabilities and liabilities for benefits, other than benefits payable under qualifying annuity contracts that were excluded in calculating the Solvency Liabilities.	1.07
Solvency Ratio	The ratio of: (a) Solvency Assets related to defined benefits and ancillary benefits plus the total amount of any letters of credit minus the Prior Year Credit Balance (b) the sum of the Solvency Liabilities related to defined benefits and ancillary benefits	1.10
Prior Year Credit Balance	Accumulated sum of contributions made to the pension plan in excess of the minimum required contributions (note: only applies if the Company chooses to treat the excess contributions as a Prior Year Credit Balance).	\$0
Solvency Assets	Market value of assets including accrued or receivable income and excluding the value of any qualifying annuity contracts.	\$5,261,000
Solvency Asset Adjustment	The sum of: (a) the difference between smoothed value of assets and the market value of assets (b) the present value of going concern special payments required to liquidate any past service unfunded liability (c) the present value of going concern special payments identified in July 1, 2018 valuation and scheduled for payment between July 1, 2021 and June 30, 2022. (d) the present value of going concern special payments (identified in this report) that are scheduled for payment within 6 years following the valuation date (e) the present value of any previously scheduled solvency special payments (excluding those identified in this report) (f) the total value of all letters of credit in respect of the special payments due before the valuation date, subject to the limit of 15% of solvency liabilities	(\$294,000) \$0 \$0 \$0 \$0 \$0
		<hr/> (\$294,000)

Defined Term	Description	Result																
Solvency Liabilities	Liabilities determined as if the plan had been wound up on the valuation date, including liabilities for plant closure benefits or permanent layoff benefits that would be immediately payable if the employer's business were discontinued on the valuation date of the report, but, if elected by the plan sponsor, excluding liabilities for, <ul style="list-style-type: none"> (a) any escalated adjustment, (b) excluded plant closure benefits, (c) excluded permanent layoff benefits, (d) special allowances other than funded special allowances, (e) consent benefits other than funded consent benefits, (f) prospective benefit increases, (g) potential early retirement window benefit values, and (h) pension benefits and ancillary benefits payable under a qualifying annuity contract. 	\$4,797,000																
Solvency Liability Adjustment	The amount by which Solvency Liabilities are adjusted as a result of using a solvency valuation interest rate that is the average of market interest rates calculated over the period of time used in the determination of the smoothed value of assets.	(\$10,000)																
Solvency Deficiency	The amount, if any, by which the sum of: <ul style="list-style-type: none"> (a) the Solvency Liabilities (b) the Solvency Liability Adjustment (c) the Prior Year Credit Balance <p>Exceeds the sum of</p> <ul style="list-style-type: none"> (d) the Solvency Assets net of estimated termination expenses⁹ (e) the Solvency Asset Adjustment 	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="text-align: right;">\$4,797,000</td> </tr> <tr> <td></td> <td style="text-align: right;">(\$10,000)</td> </tr> <tr> <td></td> <td style="text-align: right;">\$0</td> </tr> <tr> <td></td> <td style="text-align: right; border-top: 1px solid black;">\$4,787,000</td> </tr> <tr> <td></td> <td style="text-align: right;">\$5,186,000</td> </tr> <tr> <td></td> <td style="text-align: right;">(\$294,000)</td> </tr> <tr> <td></td> <td style="text-align: right; border-top: 1px solid black;">\$4,892,000</td> </tr> <tr> <td></td> <td style="text-align: right;">\$0</td> </tr> </table>		\$4,797,000		(\$10,000)		\$0		\$4,787,000		\$5,186,000		(\$294,000)		\$4,892,000		\$0
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	\$5,186,000																	
	(\$294,000)																	
	\$4,892,000																	
	\$0																	
Reduced Solvency Deficiency / (Solvency Excess)	The sum of: <ul style="list-style-type: none"> (a) 85% of the Solvency Liabilities (b) 85% of the Solvency Liability Adjustment (c) the Prior Year Credit Balance 	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"></td> <td style="text-align: right;">\$4,077,000</td> </tr> <tr> <td></td> <td style="text-align: right;">(\$9,000)</td> </tr> <tr> <td></td> <td style="text-align: right;">\$0</td> </tr> <tr> <td></td> <td style="text-align: right; border-top: 1px solid black;">\$4,068,000</td> </tr> </table>		\$4,077,000		(\$9,000)		\$0		\$4,068,000								
	\$4,077,000																	
	(\$9,000)																	
	\$0																	
	\$4,068,000																	

⁹ In accordance with accepted actuarial practice, for purposes of determining the financial position, the market value of plan assets was reduced by a provision for estimated termination expenses payable from the Plan's assets that may reasonably be expected to be incurred in terminating the Plan and to be charged to the Plan.

Defined Term	Description	Result
	minus the sum of:	
	(d) the Solvency Assets net of estimated termination expenses ⁸	\$5,186,000
	(e) the Solvency Asset Adjustment	(\$294,000)
		<hr/>
		\$4,892,000
		(\$824,000)

Provision for Adverse Deviations

The provision for adverse deviations has been established in accordance with regulations taking into account the following parameters:

Defined Amount		Results						
Fixed Income Component (L)	The sum of the Plan's target allocation of assets (excluding those allocated to annuity contracts and meeting the minimum rating requirement) as described in the regulations according to the investment policy applicable at the valuation date:	35.0%						
	<table border="1"> <thead> <tr> <th>Investment</th> <th>Target</th> </tr> </thead> <tbody> <tr> <td>Universe bonds</td> <td>10.0%</td> </tr> <tr> <td>Long-term bonds</td> <td>25.0%</td> </tr> </tbody> </table>	Investment	Target	Universe bonds	10.0%	Long-term bonds	25.0%	
Investment	Target							
Universe bonds	10.0%							
Long-term bonds	25.0%							
Alternative Investment Component (M)	The sum of the Plan's target allocation of assets (excluding those allocated to annuity contracts) meeting requirements as described in the regulations according to the investment policy applicable at the valuation date:	10.0%						
	<table border="1"> <thead> <tr> <th>Investment</th> <th>Target</th> </tr> </thead> <tbody> <tr> <td>Real assets</td> <td>10.0%</td> </tr> </tbody> </table>	Investment	Target	Real assets	10.0%			
Investment	Target							
Real assets	10.0%							
Investment Component (N)	Plan's target asset allocation for mutual, pooled or segregated funds	0.0%						
Investment Component Fixed Income % (P)	Portion of Investment Component (N) that is allocated to investment categories accounted for in Fixed Income Component (L)	0.0%						
Investment Component Alternative Investment % (Q)	Portion of Investment Component (N) that is allocated to investment categories accounted for in Alternative Income Component (M)	0.0%						
Annuity Contract Allocation (R)	Annuity contracts that have been purchased from an insurance company and excluded from the Fixed Income Component (L) and Alternative Investment Component (M)	0.0%						

Combined Target Asset Allocation for Fixed Income Assets (J)		
Sum of		
• Fixed Income Component (L)	35.0%	
• 0.5 × Alternative Investment Component (0.5 × M)	5.0%	
• Investment Component × Investment Component Fixed Income % (N × P)	0.00%	
• 0.5 × Investment Component × Investment Component Alternative Investment % (0.5 × N × Q)	0.00%	
		40.0%
Divided by		
• 100% - Annuity Contract Allocation (100% - R)	100.0%	
Combined Target Asset Allocation for Fixed Income Assets		40.0%

Combined Target Asset Allocation for Non-Fixed Income Assets (K)	
100% – Combined Target Asset Allocation for Fixed Income Assets (100% - J)	60.0%
Duration of going concern liabilities at valuation date	
= $(F - G) / (G \times 0.01)$ where,	13.41
G = going concern liabilities excluding liabilities in respect of escalated adjustments and liabilities in respect of benefits for which an annuity contract has been purchased at valuation date established using the discount rate determined for this valuation	\$3,409,000
F = going concern liabilities excluding liabilities in respect of escalated adjustments and liabilities in respect of benefits for which an annuity contract has been purchased established using the discount rate minus 1%	\$3,866,000

Benchmark Discount Rate (E)	
Base rate	0.50%
Effective yield from CANSIM Series V39056 (H)	1.84%
1.5% x Combined Target Asset Allocation for Fixed Income Assets (1.5% x J)	0.60%
5.0% x Combined Target Asset Allocation for Non-Fixed Income Assets (5.0% x K)	3.00%
Benchmark Discount Rate	5.94%

Provision for Adverse Deviations	
i. 5.0% for a closed plan and 4.0% for a Plan that is not a closed plan	5.0%
ii. Provision based on Combined Target Asset Allocation for Non-Fixed Income Assets	7.0%
iii. Greater of zero and the	
• Duration of going concern liabilities at valuation date	13.41
Multiplied by:	
– Going concern valuation gross discount rate net of active investment management fees (D), less	5.10%
– Benchmark Discount Rate (E)	5.94%
	0.0%
Provision for Adverse Deviations (i. + ii. + iii.)	12.0%

The available actuarial surplus that may be used according to the Act is established as follows:

Available actuarial surplus		
Excess of		
<ul style="list-style-type: none"> Assets determined on basis of going concern valuation including accrued and receivable income but excluding the value of any letters of credit 		\$4,967,000
Over		
<ul style="list-style-type: none"> Going concern liabilities 	\$3,688,000	
<ul style="list-style-type: none"> Provision for adverse deviations in respect of the going concern liabilities 	\$409,000	
<ul style="list-style-type: none"> Prior Year Credit Balance 	\$0	
		\$4,097,000
		\$870,000 (a)
Excess of		
<ul style="list-style-type: none"> Solvency assets excluding the value of any letters of credits and lesser of Prior Year Credit Balance and minimum required employer contributions, including the provision for adverse deviations until the next required valuation 		\$5,261,000
Over		
<ul style="list-style-type: none"> Wind-up liabilities × 105% 		\$5,185,000
		\$76,000 (b)
The available actuarial surplus = the lesser of a) and b) above		\$76,000

Timing of Next Required Valuation

In accordance with the Act the next valuation of the Plan would be required at an effective date within one year of the current valuation date if:

- The ratio of solvency assets to solvency liabilities is less than 85%.
- The employer elected to exclude plant closure or permanent lay-off benefits under Section 5(18) of the regulations, and has not rescinded that election.

Otherwise, the next valuation of the Plan would be required at an effective date no later than three years after the current valuation date.

Accordingly, the next valuation of the Plan will be required as of July 1, 2024.

Special Payments

As the Plan does not have a funding shortfall and there is a solvency excess, no special payments are required.

Pension Benefits Guarantee Fund (PBGF) Assessment

A PBGF assessment is required to be paid under Section 37 of the Act. The PBGF assessment base is derived as follows:

Solvency assets	\$5,261,000	(a)
PBGF liabilities	\$4,797,000	(b)
Solvency liabilities	\$4,797,000	(c)
Ontario asset ratio	100.0%	(d) = (b) ÷ (c)
Ontario portion of the fund	\$5,261,000	(e) = (a) × (d)
PBGF assessment base	\$0	(f) = max(0, (b) – (e))
Amount of additional liability for plant closure and/or permanent layoff benefits which is not funded and subject to the 2% (3% for years after 2018) assessment pursuant to s.37(4)	\$0	(g)

Appendix B

Plan assets

The pension fund is held by CIBC Mellon Trust Company. In preparing this report, we have relied upon the auditors' report prepared by KPMG without further audit. Customarily, this information would not be verified by a plan's actuary. We have reviewed the information for internal consistency and we have no reason to doubt its substantial accuracy.

Reconciliation of Market Value of Plan Assets

The pension fund transactions since the last valuation are summarized in the following table:

	July 1, 2018 to July 1, 2019	July 1, 2019 to July 1, 2020	July 1, 2020 to July 1, 2021
July 1	\$4,060,000	\$4,326,000	\$4,490,000
PLUS			
Members' contributions	\$33,000	\$31,000	\$32,000
Company's contributions			
• Current service	\$92,000	\$111,000	\$114,000
• Past service	\$35,000	\$0	\$0
Investment earnings	\$102,000	\$113,000	\$106,000
Net Capital gains (losses)	\$139,000	\$105,000	\$679,000
	\$401,000	\$360,000	\$931,000
LESS			
Pensions paid	\$3,000	\$141,000	\$91,000
Lump-sums paid	\$7,000	\$0	\$7,000
Administration and Investment fees	\$125,000	\$55,000	\$62,000
	\$135,000	\$196,000	\$160,000
July 1	\$4,326,000	\$4,490,000	\$5,261,000
Gross rate of return ¹⁰	5.92%	5.07%	17.51%
Rate of return net of expenses ¹¹	2.81%	3.77%	16.02%

¹⁰ Assuming mid-period cash flows.

¹¹ Assuming mid-period cash flows.

The market value of assets shown in the above table is adjusted to reflect in-transit amounts as follows:

	Current Valuation	Previous Valuation
Market value of invested assets	\$5,261,000	\$4,060,000
In-transit amounts		
• Benefit payments	(\$0)	(\$7,000)
Market value of assets adjusted for in-transit amounts	\$5,261,000	\$4,053,000

We have tested the pensions paid, the lump-sums paid, and the contributions for consistency with the membership data for the Plan members who have received benefits or made contributions. The results of these tests were satisfactory.

Investment Policy

The plan administrator has adopted a statement of investment policy and procedures (approved December 17, 2020). This policy is intended to provide guidelines for the manager(s) as to the level of risk that is consistent with the Plan's investment objectives. A significant component of this investment policy is the asset mix.

The plan administrator is solely responsible for selecting the Plan's investment policies, asset allocations, and individual investments.

The constraints on the asset mix and the actual asset mix at the valuation date are provided for information purposes:

	Investment Policy			Actual asset Mix as at July 1, 2021
	Minimum	Target	Maximum	
Canadian Equities	8%	13%	18%	14.6%
Foreign Equities	25%	42%	59%	46.2%
Real Assets	5%	10%	15%	4.9%
Bonds	20%	35%	50%	33.6%
Cash and cash equivalents	0%	0%	10%	0.7%
	100%			100%

Because the Plan's assets (which are invested in accordance with the above investment policy) are not matched to the Plan's liabilities (which tend to behave like long bonds), the Plan's financial position will fluctuate over time. These fluctuations could be significant and could cause the Plan to become underfunded or overfunded even if the University contributes to the Plan based on the funding requirements presented in this report.

Appendix C

Methods and assumptions – Going concern

Valuation of Assets

For this valuation, we have used an adjusted market-value method to determine the smoothed value of assets. Under this method, realized and unrealized capital gains (losses) arising during a given year are spread on a straight-line basis over 5 years in accordance with the schedule shown in the following table:

Year	Percentage of Gains (Losses) Recognized
2020/2021	80%
2019/2020	60%
2018/2019	40%
2017/2018	20%
before 2017	0%

The asset values produced by this method are related to the market value of the assets, with the advantage that, over time, the market-related asset values will tend to be more stable than market values. To the extent that more capital gains than losses will arise over the long term, the smoothed value will tend to be lower than the market value.

The smoothed value of the assets at July 1, 2021 was derived as follows:

Market value of assets			\$5,261,000
LESS			
Unrecognized investment gains/(losses)	2020/2021:	$\$470,000 \times 80\% =$	\$376,000
	2019/2020:	$(\$79,000) \times 60\% =$	(\$47,000)
	2018/2019:	$(\$116,000) \times 40\% =$	(\$46,000)
	2017/2018:	$\$57,000 \times 20\% =$	\$11,000
			\$294,000
Smoothed value of assets			\$4,967,000

The smoothed value of assets shown in the above table is adjusted to reflect in-transit amounts as follows:

	Current Valuation	Previous Valuation
Smoothed value of assets	\$4,967,000	\$3,969,000
In-transit amounts		
• Benefit payments	(\$0)	(\$7,000)
Smoothed value of assets, adjusted for in-transit amounts	\$4,967,000	\$3,962,000

Going Concern Funding Target

Over time, the real cost to the employer of a pension plan is the excess of benefits and expenses over member contributions, if any, and investment earnings. The actuarial cost method allocates this cost to annual time periods.

For purposes of the going concern valuation, we have continued to use the projected unit credit actuarial cost method. Under this method, we determine the present value of benefit cash flows expected to be paid in respect of service accrued prior to the valuation date, based on projected final average earnings. This is referred to as the funding target.

The funding excess or funding shortfall, as the case may be, is the difference between the market or smoothed value of assets and the funding target. A funding excess on a market value basis indicates that the current market value of assets and expected investment earnings are expected to be sufficient to meet the cash flows in respect of benefits accrued to the valuation date as well as expected expenses – assuming the plan is maintained indefinitely. A funding shortfall on a market value basis indicates the opposite – that the current market value of the assets is not expected to be sufficient to meet the plan’s cash flow requirements in respect of accrued benefits, absent additional contributions.

As required under the Act, a funding shortfall (including the prior year credit balance) and the provision for adverse deviations must be amortized over no more than 10 years through special payments beginning one year after the valuation date. A funding excess may, from an actuarial standpoint, be applied immediately to reduce required employer current service contributions unless precluded by the terms of the plan or by legislation.

The actuarial cost method used for the purposes of this valuation produces a reasonable matching of contributions with accruing benefits. Because benefits are recognized as they accrue, the actuarial cost method provides an effective funding target for a plan that is maintained indefinitely.

Current Service Cost

The current service cost is the present value of projected benefits to be paid under the plan with respect to service expected to accrue during the period until the next valuation.

The University’s current service cost is the total current service cost reduced by the members’ required contributions.

The University's current service cost is the total current service cost reduced by the members' required contributions.

The University's current service cost has been expressed as a percentage of the members' required contributions to provide an automatic adjustment in the event of fluctuations in membership and/or pensionable earnings.

Under the projected unit credit actuarial cost method, the current service cost for an individual member will increase each year as the member approaches retirement. However, the current service cost of the entire group, expressed as a percentage of the members' required contributions, can be expected to remain stable as long as the average age distribution of the group remains constant.

Actuarial Assumptions – Going Concern Basis

The present value of future benefit payment cash flows is based on economic and demographic assumptions. At each valuation we determine whether, in our opinion, the actuarial assumptions are still appropriate for the purposes of the valuation, and we revise them, if necessary. Emerging experience will result in gains or losses that will be revealed and considered in future actuarial valuations.

The table below shows the various assumptions used in the current valuation in comparison with those used in the previous valuation.

Assumption	Current valuation		Previous valuation	
Discount rate:	5.10%		5.60%	
Explicit expenses:	\$25,000		\$25,000	
Inflation:	2.00%		2.00%	
ITA limit / YMPE increases:	3.00%		3.00%	
Pensionable earnings increases:	MUFA members 4.0% per year		MUFA members 4.0% per year	
	Clinical Faculty members 4.0% per year		Clinical Faculty members 4.0% per year	
Post-retirement pension increases:	Year	Rate	Year	Rate
	2022	1.45%	2019	1.89%
	2023	2.00%	2020	2.00%
	2024	2.00%	2021	1.97%
	2025	2.00%	2022	2.03%
	2026	2.00%	2023	1.64%
	2027 onwards	0.60%	2024 onwards	1.10%
Interest on employee contributions:	5.10%		5.60%	

Assumption	Current valuation	Previous valuation
Retirement rates:	15% retire when first eligible for an unreduced pension, remainder retire at age 65	15% retire when first eligible for an unreduced pension, remainder retire at age 65
Termination rates:	None	None
Mortality rates:	90% of the rates of the 2014 Public Sector Canadian Pensioners Mortality Table (CPM2014Publ)	85% of the rates of the 2014 Public Sector Canadian Pensioners Mortality Table (CPM2014Publ)
Mortality improvements:	Fully generational using CPM Improvement Scale B (CPM-B)	Fully generational using CPM Improvement Scale B (CPM-B)
Disability rates:	None	None
Eligible spouse at retirement:	Actual marital status	Actual marital status
Spousal age difference:	Actual	Actual

The assumptions are best estimates and do not include a margin for adverse deviations.

Pensionable Earnings

The benefits ultimately paid will depend on each member's final average earnings. To calculate the pension benefits payable upon retirement, death, or termination of employment, we have taken rate of pay on July 1, 2021 and assumed that such pensionable earnings will increase at the assumed rate.

Rationale for Assumptions

A rationale for each of the assumptions used in the current valuation is provided below.

Discount Rate

We have discounted the expected benefit payment cash flows using the expected investment return on the smoothed value of the fund net of fees and less a margin for adverse deviations. Other bases for discounting the expected benefit payment cash flows may be appropriate, particularly for purposes other than those specifically identified in this valuation report.

The discount rate is comprised of the following:

- An **assumed investment return** based on estimated returns for each major asset class that are consistent with market conditions on the valuation date modified to include a provision for increases in market interest rates to a level higher than current historically low levels, on the expected time horizon over which benefits are expected to be paid, and on the target asset mix specified in the Plan's investment policy.
- An **assumed passive investment management expense provision** which represents the hypothetical fees for passive investment management of assets based on estimated fees charged by index managers for balanced mandates.
- An **active investment management expense provision**. We have assumed that these fees would be offset by an equivalent **additional return resulting from active investment management**.
- An **implicit non-investment management expense provision** determined as the average rate of non-investment expenses paid from the fund over the last 3 years. These would include all fees payable from the fund (administration, custodial, audit, consulting, etc.) except those payable to investment managers, to the extent that these fees are not covered in an explicit provision for expenses added to the current service cost.

The discount rate was developed as follows:

Assumed investment return	5.25%
Allowance for administrative, actuarial and passive investment management fees	(0.20%)
Rounding to nearest 10 basis points	0.05%
Net discount rate	5.10%

Expenses

The assumption is based on the average amount of investment and administrative expenses over the last 3 years.

Inflation

The inflation assumption is based on the mid-point of the Bank of Canada's inflation target range of between 1% and 3%.

Income Tax Act Pension Limit and Year's Maximum Pensionable Earnings

The assumption is based on historical real economic growth and the underlying inflation assumption.

Pensionable Earnings

The assumption is based on general wage growth assumptions increased by our best estimate of future merit and promotional increases over general wage growth considering University expectations.

Post-Retirement Pension Increases

The assumption is based on the Plan formula, as well as the future investment return and inflation assumption above.

Retirement Rates

The assumption is based on experience over the years 2002 to 2008. Subsequent experience has been consistent with these rates.

Termination Rates

Use of a different assumption would not have a material impact on the valuation.

Mortality Rates

The assumption for the mortality rates is based on the Canadian Pensioners' Mortality (CPM) study published by the Canadian Institute of Actuaries in February 2014. Considering the characteristics of the group, it was considered appropriate to use the CPM mortality rates from the public sector over the combined public/private sector experience as a reference table.

The mortality rates selected reflect plan-specific experience over the years 2008 to 2020. However, due to the size of the Plan, this mortality experience is not fully credible. The CPM mortality rates from the public sector have been adjusted after considering the plan-specific experience and member and plan-specific characteristics through the Mercer Mortality Model, with those characteristics including pension amount, lifestyle information extracted from postal codes, and broad classification of type of work. Mercer has compiled detailed mortality experience data from a diverse set of large and mid-sized Canadian pension plans and analyzed the experience across a number of those key characteristics. This has led to the creation of numerous mortality tables varying according to the different characteristics, and forms the Mercer Mortality Model.

There is broad consensus among actuaries and other longevity experts that mortality improvement will continue in the future, but the degree of future mortality improvement is uncertain. Two mortality

Mortality Rates

improvement scales published by the Canadian Institute of Actuaries (CIA) are generally adopted for Canadian pension valuations:

- The Canadian Pensioners Mortality (CPM) study published in February 2014 included CPM Improvement Scale B (CPM-B).
- A report released by the Task Force on Mortality Improvement on September 20, 2017 included an analysis of the rate of mortality improvement for the Canadian population and provides for mortality improvement scale MI-2017 to be considered for the purpose of reflecting future mortality improvement in Canadian actuarial work, while acknowledging that it might be appropriate to use alternative mortality improvement assumptions to reflect the nature of the work.

The CIA Committee on Pension Plan Financial Reporting published a revised version of the Educational Note on the Selection of Mortality Assumptions for Pension Plan Valuations on December 21, 2017. The Educational Note indicated that given the recent publication of the CPM-B and MI-2017 improvement scales and the similar data sets used in their development, it may be appropriate to use either scale in the absence of credible information to the contrary, such as the publication of a successor scale by the CIA.

COVID-19 has impacted mortality rates globally. Statistics Canada reported excess mortality in 2020 for the general Canadian population and other peer countries globally have also seen excess mortality over the course of the pandemic. Mortality experience for the plan has been reflected up to the date of the valuation. We have not adjusted the expected mortality rates for Plan members after the valuation date. The long-term implications of the pandemic on mortality rates is unclear as at the date of this report. Credible plan specific experience and relevant broader observed mortality trends after the report date will be reflected in future valuations.

For the current valuation, we have continued to use the CPM-B scale, which is a reasonable outlook for future mortality improvement.

Based on the assumption used, the life expectancy of a member age 65 at the valuation date is 23.8 years for males and 25.7 years for females.

Interest on Employee Contributions

The assumption is based on Plan terms and the underlying investment return assumption.

Disability Rates

Use of a different assumption would not have a material impact on the valuation.

Eligible Spouse

Due to the small plan size, the actual marital status was used.

Spousal Age Difference

Due to the small plan size, the actual spousal age difference was used.

Appendix D

Methods and assumptions – Hypothetical wind-up and solvency

Hypothetical Wind-up Basis

The Canadian Institute of Actuaries requires actuaries to report the financial position of a pension plan on the assumption that the plan is wound up on the effective date of the valuation, with benefits determined on the assumption that the pension plan has neither a surplus nor a deficit.

To determine the actuarial liability on the hypothetical wind-up basis, we have valued those benefits that would have been paid had the Plan been wound up on the valuation date, with all members fully vested in their accrued benefits.

The Standards of Practice of the Canadian Institute of Actuaries require that the scenario upon which the hypothetical wind-up valuation is based be postulated. However, there are no benefits under the Plan contingent upon the circumstances of the plan wind-up or contingent upon other factors. Therefore, it was not necessary to postulate a scenario upon which the hypothetical wind-up valuation is made. No benefits payable on plan wind-up were excluded from our calculations. The plan wind-up is assumed to occur in circumstances that maximize the actuarial liability.

Upon plan wind-up, members are given options for the method of settling their benefit entitlements. The options vary by eligibility and by province of employment, but in general, involve either a lump sum transfer or an immediate or deferred pension.

The value of benefits assumed to be settled through a lump sum transfer is based on the assumptions described in Section 3500 – *Pension Commuted Values* of the Canadian Institute of Actuaries' Standards of Practice applicable for July 1, 2021.

Benefits provided as an immediate or deferred pension are assumed to be settled through the purchase of annuities based on an estimate of the cost of purchasing annuities.

However, there is limited data available to provide credible guidance on the cost of a purchase of indexed annuities in Canada. In accordance with the *Canadian Institute of Actuaries Educational Note: Assumptions for Hypothetical Wind-up and Solvency Valuations with Effective Dates on and after December 31, 2020 and no later than December 30, 2021 (the "Educational Note")*, we have assumed that an appropriate proxy for estimating the cost of such purchase is using the yield on the long-term Government of Canada Real Return bonds, reduced by 0.5%.

The Educational Note provides guidance on estimating the cost of annuity purchases assuming a typical group of annuitants. That is, no adjustments for sub- or super-standard mortality are considered. However, it is expected that insurers will consider plan experience

and certain plan-specific characteristics when determining the mortality basis for a particular group. The Educational Note states that the actuary would be expected to make an adjustment to the regular annuity purchase assumptions where there is demonstrated substandard or super-standard mortality or where an insurer might be expected to assume so. In such cases, the actuary would be expected to make an adjustment to the mortality assumption in a manner consistent with the underlying annuity purchase basis. Given the uncertainty surrounding the actual mortality basis that would be typical of a group annuity purchase, it is reasonable to assume that there is a range of bases that can be expected not to be materially different from the actual mortality basis. Therefore, an adjustment to the regular annuity purchase assumptions would be warranted when the plan's assumed basis falls outside that range. In this context, we have determined that an adjustment to the mortality rates used in the regular annuity purchase assumptions is required.

We have not included a margin for adverse deviations in the solvency and hypothetical wind-up valuations.

The assumptions are as follows:

Form of Benefit Settlement Elected by Member

Lump sum:	70% of active and deferred members under age 55, and 50% of active and deferred members over age 55, elect to receive their benefit entitlement in a lump sum
Annuity purchase:	All remaining members are assumed to elect to receive their benefit entitlement in the form of a deferred or immediate pension. These benefits are assumed to be settled through the purchase of deferred or immediate annuities from a life insurance company.

Basis for Benefits Assumed to be Settled through a Lump Sum

Mortality rates:	100% of the rates of the 2014 Canadian Pensioners Mortality Table (CPM2014) with fully generational improvements using CPM Scale B
Interest rate:	1.80% per year for 10 years, 3.30% per year thereafter (2.16% per year for 10 years, 3.18% per year thereafter, for solvency liability adjustment).

Basis for Benefits Assumed to be Settled through the Purchase of an Annuity

Mortality rates:	100% of the rates of the 2014 Canadian Pensioners Mortality Table (CPM2014Publ) with fully generational improvements using CPM Scale B
Adjustment to mortality rates:	Above mortality rates reduced by 10% to reflect super-standard mortality
Interest rate:	2.90% (2.83% for solvency liability adjustment) per year based on a duration of 11.67 years determined for the liabilities assumed to be settled through the purchase of an annuity.

Post-retirement pension
increases:

Year	Rate
2022	1.45%
2023	1.66%
2024	1.66%
2025	1.52%
2026	1.17%
2027 onwards	0.00%

Retirement Age

Benefits assumed to be payable through a lump sum: Members are assumed to retire with a 50% probability at the age that maximizes the value of their entitlement from the Plan and a 50% probability at the member's earliest unreduced age in accordance with applicable legislation and based on the eligibility requirements that have been met at the valuation date

Benefits assumed to be settled through the purchase of an annuity: Members are assumed to retire at the age that maximizes the value of their entitlement from the Plan, based on the eligibility requirements that have been met at the valuation date

Grow-in: The benefit entitlement and assumed retirement age of Ontario members whose age plus service equals at least 55 at the valuation date reflect their entitlement to grow into early retirement subsidies

Other Assumptions

Final average earnings: Based on actual pensionable earnings over the averaging period

Family composition: Same as for going concern valuation

Maximum pension limit: \$3,245.56 for 2021 increasing at 2.08% per year for 10 years, 3.06% per year thereafter (2.06% per year for 10 years, 2.70% for solvency liability adjustment)

Termination expenses: \$75,000

To determine the hypothetical wind-up position of the Plan, a provision has been made for estimated termination expenses payable from the Plan's assets in respect of actuarial and administration expenses that may reasonably be expected to be incurred in terminating the Plan and to be charged to the Plan.

Because the settlement of all benefits on wind-up is assumed to occur on the valuation date and is assumed to be uncontested, the provision for termination expenses does not include custodial, investment management, auditing, consulting, and legal expenses that would be incurred between the wind-up date and the settlement date or due to the terms of a wind-up being contested.

Expenses associated with the distribution of any surplus assets that might arise on an actual wind-up are also not included in the estimated termination expense provisions.

In determining the provision for termination expenses payable from the Plan's assets, we have assumed that the plan sponsor would be solvent on the wind-up date. We have also assumed, without analysis, that the Plan's terms as well as applicable legislation and court decisions would permit the relevant expenses to be paid from the Plan.

Although the termination expense assumption is a best estimate, actual fees incurred on an actual plan wind-up may differ materially from the estimates disclosed in this report.

Incremental Cost

In order to determine the incremental cost, we estimate the hypothetical wind-up liabilities at the next valuation date. We have assumed that the cost of settling benefits by way of a lump sum or purchasing annuities remains consistent with the assumptions described above. Since the projected hypothetical wind-up liabilities will depend on the membership in the Plan at the next valuation date, we must make assumptions about how the Plan membership will evolve over the period until the next valuation.

We have assumed that the Plan membership will evolve in a manner consistent with the going concern assumptions as follows:

- Members terminate, retire, and die consistent with the termination, retirement, and mortality rates used for the going concern valuation.
- Pensionable earnings, the Income Tax Act pension limit, and the Year's Maximum Pensionable Earnings increase in accordance with the related going concern assumptions.
- Active members accrue pensionable service in accordance with the terms of the Plan.
- Post-retirement pension increases are consistent with the inflation assumption used for the going concern valuation.

Solvency Basis

In determining the financial position of the Plan on the solvency basis, we have used the same assumptions and methodology as were used for determining the financial position of the Plan on the hypothetical wind-up basis, except as noted in Section 5 of this report.

The solvency position is determined in accordance with the requirements of the Act.

Appendix E

Membership data

Analysis of Membership Data

The actuarial valuation is based on membership data as at July 1, 2021, provided by McMaster University.

We have applied tests for internal consistency, as well as for consistency with the data used for the previous valuation. These tests were applied to membership reconciliation, basic information (date of birth, date of hire, date of membership, gender, etc.), pensionable earnings, credited service, contributions accumulated with interest, and pensions to retirees and other members entitled to a deferred pension. Contributions, lump sum payments, and pensions to retirees were compared with corresponding amounts reported in financial statements. The results of these tests were satisfactory.

If the data supplied are not sufficient and reliable for its intended purpose, the results of our calculation may differ significantly from the results that would be obtained with such data. Although Mercer has reviewed the suitability of the data for its intended use in accordance with accepted actuarial practice in Canada, Mercer has not verified or audited any of the data or information provided.

Plan membership data are summarized below. For comparison, we have also summarized corresponding data from the previous valuation.

	07.01.2021	07.01.2018
Active Members		
Number	2	3
Total pensionable earnings for the following year	*	*
Average pensionable earnings for the following year	*	*
Average years of pensionable service	23.8	23.8
Average age	59.7	61.6
Accumulated contributions with interest	*	*
Deferred Pensioners		
Number	30	30
Total annual pension	\$11,694	\$12,030
Average annual pension	\$390	\$401
Average age	61.4	58.7
Pensioners and Survivors		
Number	3	1
Total annual lifetime pension	*	*
Total annual temporary pension	*	*
Average annual lifetime pension	*	*
Average age	*	*

*For individual cells with information on three members or less, are not disclosed for confidentiality reasons.

The membership movement for all categories of membership since the previous actuarial valuation is as follows:

	Actives	Deferred Pensioners	Pensioners and Survivors	Total
Total at 07.01.2018	3	30	1	34
New entrants				
Terminations:				
• Transfers/lump sums				
• Deferred pensions				
Deaths				
Retirements	(1)	(1)	2	0
Beneficiaries				
Corrections		1		1
Total at 07.01.2021	2	30	3	35

The distribution of the active members by age and pensionable service as at the valuation date is summarized as follows:

Age	Years of Pensionable Service							Total
	0-4	5-9	10-14	15-19	20-24	25-29	30 +	
Under 20								
20 to 24								
25 to 29								
30 to 34								
35 to 39								
40 to 44								
45 to 49								
50 to 54								
55 to 59					1			1
60 to 64						1		1
65 +								
Total					1	1		2

The distribution of the inactive members by age as at the valuation date is summarized as follows:

Age	Deferred Pensioners		Pensioners and Survivors	
	Number	Average Annual Pension	Number	Average Annual Pension
Under 45	4	166		
45 – 49	3	*		
50 – 54	4	211		
55 – 59	5	771		
60 – 64	4	289		
65 – 69	3	*	1	*
70 – 74	2	*	1	*
75 – 79	2	*	1	*
80 – 84	1	*		
85 – 89				
90 – 94				
95 – 99	1	*		
100 +	1	*		
Total	30	390	3	*

*For individual cells with information on three members or less, the average pensions are not disclosed for confidentiality reasons.

Appendix F

Summary of plan provisions

Mercer has used and relied on the plan documents, including amendments and interpretations of plan provisions, supplied by McMaster University. If any plan provisions supplied are not accurate and complete, the results of any calculation may differ significantly from the results that would be obtained with accurate and complete information. Moreover, plan documents may be susceptible to different interpretations, each of which could be reasonable, and the results of estimates under each of the different interpretations could vary.

This valuation is based on the plan provisions in effect on July 1, 2021.

The following is a summary of the main provisions of the Plan in effect on July 1, 2021. This summary is not intended as a complete description of the Plan.

Eligibility for Membership Members who joined the Plan between January 1, 2001 and January 14, 2003 have been transferred to the Contributory Pension Plan for Salaried Employees of McMaster University Including McMaster Divinity College 2000 (“Plan 2000”) following the approval of the asset transfer by the Financial Services Commission of Ontario.
No new entrants are permitted after January 14, 2003.

Employee Contributions Effective at the dates and for the periods shown in the table below member required contribution rates for specific member groups as follows:

Contribution Rate below/above YMPE	Faculty Members
4.25% / 5.75%	July 1, 2006 to June 30, 2007
5.0% / 6.5%	July 1, 2007 to July 1, 2011
5.75% / 7.65%	July 2, 2011 to June 30, 2012
6.5% / 8.75%	July 1, 2012 to June 30, 2013
7.0% / 10.0%	July 1, 2013 to June 30, 2018
8.0% / 11.0%	July 1, 2018 forward
Contribution Rate below/above YMPE	Non Faculty Members
3.5% / 5.0%	July 1, 2006 to June 30, 2009
5.5% / 7.0%	July 1, 2009 to February 1, 2014
7.0% / 10.0%	February 2, 2014 forward

Member required contributions are limited to the contribution arising when the applicable employee contribution rate is applied to the Maximum Annual Salary under the Plan. The Maximum Annual Salary is the salary rate that produces an annual pension amount equal to the maximum pension limit under the *Income Tax Act* for that year.

**Retirement
Dates**

Normal retirement is the first day of the month in which the member attains age 65.

Effective February 1, 2014, the number of points required to retire early and receive an unreduced pension and a bridge benefit for members who are not Faculty Members is as follows:

Retirement Date	Points Required
Prior to February 1, 2014	80
February 1, 2014 to December 31, 2014	81
January 1, 2015 to December 31, 2015	82
January 1, 2016 to December 31, 2016	83
January 1, 2017 to December 31, 2017	84
January 1, 2018 forward	85

Effective July 1, 2006 the number of points required to retire early and receive an unreduced pension and a bridge benefit for Faculty Members is as follows:

Retirement Date	Points Required
July 1, 2008 to December 31, 2011	80
January 1, 2012 to December 31, 2012	81
January 1, 2013 to December 31, 2013	82
January 1, 2014 to December 31, 2014	83
January 1, 2015 to December 31, 2015	84
January 1, 2016 to December 31, 2018	85
January 1, 2019 to December 31, 2019	86
January 1, 2020 to December 31, 2020	87
January 1, 2021 to December 31, 2021	88
January 1, 2022 to December 31, 2022	89
January 1, 2023 forward	90

A member may postpone his actual retirement and commencement of pension (with University consent prior to December 12, 2006), but in any event his pension shall commence no later than the 1st of December of the year of attainment of age 71. He will continue to make contributions and his benefits under the Plan will continue to accrue until such postponed retirement date.

Pension Benefits	<p>The amount of annual pension payable to a member at his unreduced retirement age will be:</p> <ul style="list-style-type: none">(a) 1.4% of Best Average Salary up to the Average Year's Maximum Pensionable Earnings times years of pensionable service, plus(b) 2.0% of Best Average Salary in excess of the Average Year's Maximum Pensionable Earnings times years of pensionable service. <p>Best Average Salary means the annualized average of the 48 highest months of earnings while a Plan participant. Average Year's Maximum Pensionable Earnings means the pro-rated average Yearly Maximum Pensionable Earnings, in the same 48 months as are used to calculate Best Average Salary.</p> <p>In addition, members on LTD will have their salary adjusted each July 1st by the percentage increase applied to pensions in payment. This increase will be applied from the later of July 1, 1990 or the July 1st following disability.</p>
Bridge Benefits	<p>Effective July 1, 1997, members who retire early and have attained the unreduced early retirement criteria will receive a bridge benefit equal to \$19.00 per month per year of credited service accrued to June 30, 1996 to a maximum of 20 years of service. The bridge benefit is payable from the later of the member's early retirement date and age 60 and ceases payment on attainment of age 65 or death, if earlier.</p>
Minimum Benefits	<p>If the member's total Required Contributions plus net interest are greater than 50% of the commuted value of a member's retirement and bridge pensions, the excess amount will be refunded to the member as a lump sum payment. In addition, the member will receive a refund of his voluntary contributions with interest, if any.</p>
Early Retirement Pension	<p>A member may retire early with a reduced pension at any time during the 10-year period preceding his normal retirement date. The reduction will be 0.5% for each month by which actual retirement precedes age 65.</p> <p>A member may retire early with an unreduced pension once they have attained the criteria set out in the table above.</p>
Maximum Benefits	<p>The total annual pension payable from the Plan upon retirement, death or termination of employment cannot exceed the lesser of:</p> <ul style="list-style-type: none">• 2% of the average of the best three consecutive years of total compensation paid to the member by the University, multiplied by total credited service; and• \$3,245.56 or such other maximum permitted under the Income Tax Act, multiplied by the member's total credited service. <p>The maximum pension is determined at the date of pension commencement.</p>
Death Benefits	<p>Pre-retirement:</p> <p>On the death of a member prior to retirement, his beneficiary or estate is entitled to receive a death benefit equal to his required contributions accrued to December 31, 1986 accumulated with net interest on the fund, and his beneficiary or estate shall receive the commuted value of the member's pension accrued after December 31, 1986, plus any required contributions</p>

made after December 31, 1986, accumulated with net interest on the fund, in excess of 50% of the commuted value.

In addition, his beneficiary or estate will receive a refund of his voluntary contributions with interest, if any.

Post retirement:

The benefit is payable for life, but guaranteed for seven years in any event. In the case of a member with a spouse, 50% of the benefit is continued to the spouse for life and at least the remainder of the guaranteed seven years' payments will be made. There is no required adjustment in respect of this surviving spouse's benefit.

Prior to July 1, 1997, the normal form of benefit was as described above with a five-year guarantee in place of the seven-year guarantee.

Alternative forms of pension are available in actuarial equivalent amounts and for members who have a spouse and who retire after December 31, 1987, the automatic form of pension will be an actuarially reduced benefit which continues 60% of the pension to a surviving spouse for life.

Termination Benefits

If a Member terminates employment prior to retirement, he may elect to receive one of the following:

- 1) A refund of his required contributions, with Net Interest on the Fund.
- 2) A transfer of the greater of twice his Required Contributions plus Net Interest and the commuted value of his deferred pension to another locked-in registered pension vehicle.
- 3) A deferred pension, payable at Normal Retirement Date, equal to the pension earned to the date of termination.

A Member who has met the minimum locking-in criteria under the *Pension Benefits Act (Ontario)*, determined separately for service and benefits before and after January 1, 1987, may elect only 2) or 3).

In addition, a member is entitled to a refund of the excess of his Required Contributions plus Net Interest over 50% of the commuted value of the deferred pension described in 3) above. The excess is measured separately for required contributions with interest and pension benefits accrued before and after January 1, 1987.

Post-Retirement Pension Increases (COLA)

Pensions in payment will be increased from January 1st each year on a pro-rated basis (using the number of months the pensioner has been retired in the twelve months) by the excess over 4.5% of the average annual rate of return earned on the assets of the Plan over the previous five Plan Years, subject to a maximum of that year's rate of increase in the Consumer Price Index.

Effective July 1, 1997, if there is any year where the percentage calculated under the excess interest formula exceeds the rate of increase in the Consumer Price Index, the excess will be used to provide a supplementary increase to the pensions in pay for which the annual pension increase in any of the three previous years was based on the excess interest formula, provided that the supplementary increase will be limited to 100% of CPI increases in each of the three preceding years.



Appendix G

Plausible adverse scenarios

In this Appendix, the financial impact on the Plan's going concern results (i.e., going concern financial position at the valuation date and current service cost from the valuation date to the next valuation date), on the Plan's hypothetical wind-up and solvency financial positions at the valuation date and on the special payments of plausible adverse scenarios that would pose threats to the Plan's future financial condition is illustrated for the following risks:

- Interest rate risk, the potential that interest rates will be lower than expected;
- Deterioration of asset values; and
- Longevity risk, the potential that pension plan members will live longer than expected.

The following tables summarize the results, where we assumed for:

- Interest rate risk, an immediate parallel decrease in market interest rates of 80 basis points
- Deterioration of asset values, an immediate decrease of 14% in the market value of non-fixed income assets; and
- Longevity risk, that life expectancy from the valuation date at age 65 for a male and a female would increase by 1.7 years and 1.4 years, respectively.

Scenario	Going Concern Valuation Results as at 07.01.2021	Plausible Adverse Scenario Results as at 07.01.2021		
		Interest Rate Risk	Deterioration of Asset Values	Longevity Risk
Market Value of Assets	\$5,261,000	\$5,455,000	\$4,777,000	\$5,261,000
Going Concern Financial Status				
Smoothed value of assets	\$4,967,000	\$5,006,000	\$4,870,000	\$4,967,000
Going concern funding target	\$3,688,000	\$3,831,000	\$3,688,000	\$3,815,000
Provision for Adverse Deviations	\$409,000	\$425,000	\$409,000	\$423,000
Funding excess (shortfall)	\$870,000	\$750,000	\$773,000	\$729,000
Estimated Employer's Current Service Cost including expense allowance and Provision for Adverse Deviations				
July 1, 2021	\$93,000	\$98,000	\$93,000	\$97,000
July 1, 2022	\$93,000	\$98,000	\$93,000	\$97,000
July 1, 2023	\$93,000	\$98,000	\$93,000	\$97,000

Scenario	Hypothetical Wind-Up and Solvency Position as at 07.01.2021	Plausible Adverse Scenario Results as at 07.01.2021		
		Interest Rate Risk	Deterioration of Asset Values	Longevity Risk
Hypothetical Wind-up Financial Position				
Market value of assets	\$5,261,000	\$5,455,000	\$4,777,000	\$5,261,000
Termination expense provision	(\$75,000)	(\$75,000)	(\$75,000)	(\$75,000)
Wind-up assets	\$5,186,000	\$5,380,000	\$4,702,000	\$5,186,000
Wind-up liabilities	\$4,938,000	\$5,469,000	\$4,938,000	\$5,062,000
Wind-up excess (shortfall)	\$248,000	(\$89,000)	(\$236,000)	\$124,000
Solvency Financial Position				
Reduction in wind-up liabilities due to excluded benefits	\$141,000	\$155,000	\$141,000	\$145,000
Solvency liability adjustment	\$10,000	\$428,000	\$10,000	\$10,000
Asset smoothing adjustment	(\$294,000)	(\$449,000)	\$93,000	(\$294,000)
Solvency surplus (shortfall)	\$105,000	\$45,000	\$8,000	(\$15,000)
Solvency ratio	110%	103%	100%	107%
Transfer ratio	107%	100%	97%	104%

Scenario	Minimum Annual Special Payments as at 07.01.2021 ¹²	Plausible Adverse Scenario Results as at 07.01.2021		
		Interest Rate Risk	Deterioration of Asset Values	Longevity Risk
July 1, 2021	\$0	\$0	\$0	\$0
July 1, 2022	\$0	\$0	\$0	\$0
July 1, 2023	\$0	\$0	\$0	\$0

If the University sponsoring the Plan became insolvent and unable to continue making contributions to meet the minimum funding requirements described in the report, the Plan would likely be wound up. The impact of this adverse scenario, as measured at July 1, 2021, would be a surplus in the Plan of \$248,000.

¹² A new special payment is assumed to start 1 year after the valuation date.

The balance of this Appendix provides details of the plausible adverse scenarios selected and the determination of their impact on valuation results.

Interest Rate Risk

The purpose of this scenario is to illustrate the sensitivity of the Plan's valuation results to the potential that interest rates will be lower than expected. For this purpose, we have assumed an immediate parallel decrease in market interest rates underlying fixed income investments, where fixed income investments includes the 'Bonds' category as shown in the investment policy summarized in Appendix B.

Using a methodology consistent with the one used to determine the going concern discount rate, we have determined that a parallel decrease in market interest rates of 80 basis points would have a non-trivial probability (between 1 in 10 and 1 in 20) of occurring within the year following the valuation date. For purpose of this scenario, we have assumed that such a decrease in market interest rates would occur immediately on the valuation date and would have the following impact on the value of assets and going concern assumptions:

Defined Term	Description
Market value of assets	The decrease in market interest rates has been assumed to affect only the market value of the fixed income investments. The decrease is assumed to have occurred immediately on the valuation date.
Smoothed value of assets	Going concern: For purposes of determining the smoothed value of assets, 20% of the change in the market value of asset has been recognized in the smoothed value of assets. Solvency: For purposes of determining the smoothed value of assets, 20% of the change in the market value of asset has been recognized in the smoothed value of assets.
Discount rate assumption	Going concern: It was assumed that the decrease in market interest rates affects only the expected return on assets for the fixed income portion of assets. The discount rate assumption (and interest on employee contributions) was therefore decreased from 5.10% to 4.80%. Hypothetical wind-up: The interest rates used in the valuation were reduced by 80 basis points Solvency: The interest rates used in the valuation were reduced by 80 basis points. For purposes of determining the solvency liability adjustment, the interest rates used in the valuation were reduced by 16 basis points.
Other assumptions	Except as mentioned above, all assumptions used were the same as those used for this valuation. In particular, the discount rate used to value benefits assumed to be settled through a lump sum was not changed.
Provision for Adverse Deviations	The above changes would not affect the calculation of the Provision for Adverse Deviations

Deterioration of Asset Values

The purpose of this scenario is to illustrate the sensitivity of the Plan's valuation results to a deterioration of asset values. For this purpose, we assumed an immediate reduction in the market value of the Plan's non-fixed income assets, where non-fixed income investments include the following categories as shown in the investment policy summarized in Appendix B:

- Canadian Equities
- Foreign Equities
- Real Assets

Using a methodology consistent with the one used to determine the going concern discount rate, we have determined that a decrease of 14% in the market value of value of non-fixed income assets would have a non-trivial probability (between 1 in 10 and 1 in 20) of occurring within the year following the valuation date. For purpose of this scenario, we have assumed that such a decrease would occur immediately on the valuation date and would have the following impact on the value of assets and valuation assumptions:

Market value of assets	The decrease in the market value of the non-fixed income portion of assets is assumed to have occurred immediately on the valuation date.
Smoothed value of assets	For purposes of determining the smoothed value of assets, 20% of the change in the market value of assets has been recognized in the smoothed value of assets.
Going concern assumptions	This scenario is assumed to have no impact on the assumptions used for this valuation.
Wind-up & solvency assumptions	This scenario is assumed to have no impact on the assumptions used for this valuation.

Longevity Risk

The purpose of this scenario is to illustrate the sensitivity of the Plan's valuation results to the potential that pension plan members will live longer than expected. For this purpose, we have determined that a plausible adverse scenario would be to assume that future mortality improvements¹³ will be in line with the average improvements experienced by the Canadian population over the most recent 15-year period available, with uniform improvement rates for all future years but varying by age¹⁴ and gender.

The table below summarizes the improvement rates under the plausible adverse scenario compared to those currently assumed under the CPM-B scale and is based on Canadian population experience from the Human Mortality Database (HMD) from 2002 to 2016.

¹³ i.e. starting one year after the valuation in this context

¹⁴ improvement rates below age 45 are set to those at age 45

Age	Males				Females			
	CPM-B			Adverse Scenario	CPM-B			Adverse Scenario
	2020	2025	2030+		2020	2025	2030+	
20	1.59%	1.20%	0.80%	1.68%	0.98%	0.89%	0.80%	1.47%
30	1.88%	1.34%	0.80%	1.68%	0.98%	0.89%	0.80%	1.47%
40	1.80%	1.30%	0.80%	1.68%	1.17%	0.98%	0.80%	1.47%
50	1.17%	0.98%	0.80%	1.76%	0.98%	0.89%	0.80%	1.34%
55	1.47%	1.13%	0.80%	1.67%	1.11%	0.96%	0.80%	1.14%
60	1.77%	1.28%	0.80%	1.75%	1.24%	1.02%	0.80%	1.34%
65	2.06%	1.43%	0.80%	2.11%	1.36%	1.08%	0.80%	1.65%
70	2.06%	1.43%	0.80%	2.48%	1.36%	1.08%	0.80%	1.77%
75	2.01%	1.41%	0.80%	2.66%	1.36%	1.08%	0.80%	1.93%
80	1.96%	1.38%	0.80%	2.63%	1.36%	1.08%	0.80%	2.03%
85	1.38%	1.03%	0.68%	2.32%	1.31%	0.99%	0.68%	1.98%
90	0.75%	0.62%	0.48%	1.68%	0.75%	0.62%	0.48%	1.60%
95	0.16%	0.25%	0.34%	1.04%	0.16%	0.25%	0.34%	1.12%
100	0.14%	0.22%	0.30%	0.64%	0.14%	0.22%	0.30%	0.80%
105	0.14%	0.22%	0.30%	0.38%	0.14%	0.22%	0.30%	0.55%



Mercer (Canada) Limited

120 Bremner Boulevard, Suite 800

Toronto, ON M5J 0A8

+1 416 868 2000

www.mercer.ca

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