Actuarial Report on

British Columbia College Pension Plan

Actuarial Valuation
as at August 31, 2018

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May 22, 2019

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Contents

Actuarial Report Highlights

BC College Pension Plan

August 31, 2018

An actuarial valuation of the College Pension Plan was completed as at August 31, 2018. Its purpose was to determine the financial (or actuarial) position of the Plan as at August 31, 2018 and to report on the adequacy of the member and employer contribution rates.

Scope of Valuation

The main valuation carried out is:

- **A Funding Valuation** - to determine the financial position of the Basic Account as at August 31, 2018 and to report on the adequacy of the member and employer Basic contribution rates.

In addition, we also carried out:

- **A Sustainable Indexing Valuation** - to determine the rate of indexing that can be sustained in the long term, based on the financial position of the Basic Account and the Inflation Adjustment Account ("IAA"), and the overall level of contributions to the plan.

The funding valuation ignores the limits imposed by the *Income Tax Act* ("*ITA*") on benefits provided from registered pension plans - such excess benefits are paid on a current cash basis through the Supplemental Benefits Account, which is maintained at a zero balance.

We have, however, performed supplementary valuations as follows:

- For basic and indexed benefits, on the assumption that indexed benefits are to be fully funded, in advance, as for basic benefits; and
- Limiting benefits to those permitted under the ITA; this is done both for basic benefits only, and for basic plus indexed benefits.

Key Plan Changes Included in the Valuation

Since the previous valuation, member and employer contribution rates to the Inflation Adjustment Account were increased from 1.57% of salary each as follows:

- to 1.66% of salary each effective April 1, 2017;
- to 1.76% of salary each effective April 1, 2018; and
- to 1.85% of salary each effective April 1, 2019.

There were no other benefit changes of material financial impact.

Actuarial Methods and Assumptions

The actuarial liabilities include the value of benefits accrued by members as at August 31, 2018, as well as future benefits expected to be earned by existing members. Asset values are based on smoothed market values (limited to ±8% of market value for the Funding Valuation, ±5% of market value for the Sustainable Indexing Valuation), plus projected future contributions based on entry-age normal contribution rates and, where relevant, the existing amortization rates.

The contribution rates are tested on the entry-age contribution method. Under this method, a long-term entry-age rate, which would fully fund benefits for future new entrants to the Plan, is calculated. The surplus (unfunded liability) is then amortized according to the requirements of the funding policy of the Board. This approach is designed to maintain costs at a level percentage of payroll over an extended period. The resulting basic account contribution rate is then tested against the going concern requirements of the BC Pension Benefits Standards Act ("PBSA") as required by the Joint Trust Agreement.

Key Long-term Assumptions

Assumptions were set taking into account the funding policy of the Board. The Funding Valuation focuses on setting an appropriate level of contributions to ensure the security of benefits; accordingly, the economic assumptions require margins for adverse deviations. The Sustainable Indexing Valuation focuses on setting a level of indexing, given the contributions committed to the plan, which is equitable across generations. As a result this valuation has been carried out using best estimate assumptions for future investment returns and price inflation. The key long-term assumptions used include (assumptions are unchanged from the previous valuation).

	Funding Valuation	Sustainable Indexing Valuation
Annual Investment Return	6.25%	6.50%
Annual Salary Increase	3.5% plus seniority	3.25% plus seniority
Annual Indexing	0% for basic costs 2.75% for indexed costs	2.50% for fully indexed costs Sustainable level of indexing calculated as valuation output

Funding Valuation Results

The funding valuation shows an improvement in the actuarial position of the Basic Account on the entry-age normal contribution basis. The surplus has increased from $67 million at August 31, 2015 to $303 million at August 31, 2018:

Basic Benefits Only ($000's)	2015	2018
Assets	4,361,338	5,242,698
Liabilities	4,294,246	4,939,473
Surplus (Unfunded Liability)	67,092	303,225

The corresponding supplementary valuation results are:

Basic and Indexed Benefits ($000's)	2015	2018
Assets	5,142,344	6,389,152
Liabilities	5,744,979	6,589,448
Surplus (Unfunded Liability)	(602,635)	(200,296)

When the ITA maximums are recognized, the above funding valuation surpluses (unfunded liabilities) change marginally, to:

Benefits Limited to ITA Maximums: ($000's)		2015	2018
Surplus (Unfunded Liability)	Basic Benefits only	75,866	302,866
	Basic and Indexed Benefits	(591,302)	(203,875)

Main Reasons for Changes in Funding Valuation Actuarial Position

The main reasons for the improvement in the actuarial funding position are:

- Smoothed investment returns higher than assumed; and
- Actual salary increases lower than assumed;

Partially offset by

- Excess investment returns transferred from the Basic account to the IAA.

Member and Employer Contribution Rates – Basic Non-Indexed Benefits

Members currently contribute 8.39% of salaries[1] for basic non-indexed benefits; employers contribute 8.49% of salaries for a total level contribution rate of 16.88% of salaries. The long-term cost for future service (i.e. the entry age normal cost) is 16.50% or 0.38% of salaries lower than the current combined member and employer contributions. In addition, the surplus has increased from $67 million at August 31, 2015 to $303 million at August 31, 2018.

The JTA sets out four alternatives available to the Board when the plan has a surplus in the Basic Account:

- Reducing the contribution rate;
- Improving benefits;
- Making a transfer to the Inflation Adjustment Account;
- Setting aside a rate stabilization reserve.

The Joint Trust Agreement ("JTA") also requires that the contribution rates comply with the going-concern requirements of the *PBSA*. Although the funded position of the plan on the entry-age rate basis has improved to a surplus of $303 million, the *PBSA* only allows amortization of surplus in excess of 5% of the net liabilities. 5% of the net liabilities is $190 million in this case, so only the excess of $113 million can be amortized if this part of the surplus is used to reduce contributions. Amortizing this portion of the surplus over 5 years would allow a reduction in the contribution rate of 3.18% of salaries in total from the current rate. However, given these results, the funding policy requires that the minimum contribution rate is not lower than that resulting from amortizing the excess surplus over 25 years. Amortizing the surplus over 25 years allows for a reduction of 1.10% of salaries in total from the current rate.

If the contribution rate is reduced, the JTA requires that the decrease be shared equally between the members and the employers. Accordingly, the total contribution rate may decrease by a maximum of 1.10% of salaries in total, 0.38% due to the reduction in the entry-age normal cost plus 0.72% of salaries from amortizing surplus (0.55% of salaries each for members and employers) for a minimum permissible Basic contribution rate of 15.78%. Alternatively, the basic benefits may be increased such that the required contribution rate becomes equal to the current contribution of 16.88%, or the contribution rate can remain at 16.88% of salaries and the surplus can be retained in the Basic Account as a rate stabilisation reserve or transferred to the IAA. Variations that combine some, or all, of the alternatives are allowed by the JTA.

[1] All contribution rates are quoted as level rates i.e. the same rate is applied to all salary, and there is no difference on earnings above and below the YMPE.

The following table illustrates the minimum permissible basic account contribution rate:

	Based on valuation results as at August 31	
	2015 (%)	2018 (%)
Current level contribution rates		
Member	8.39	8.39
Employer	8.49	8.49
Combined member/employer	**16.88**	**16.88**
Minimum Basic Account level contribution rates		
Entry-age normal cost rate	16.63	16.50
Amortization of accessible actuarial excess (surplus)		
▪ 25 year amortization	-	(0.72)
▪ 15 year amortization	-	(1.06)
▪ *PBSA* amortization		(2.80)
Basic Account contribution rates		
▪ 25 year amortization	16.63	15.78
▪ 15 year amortization	16.63	15.44
▪ *PBSA* minimum rate	16.63	13.70
Minimum Permissible Basic Account contribution rate	**16.63**	**15.78**

The current funding policy indicates that the Board's priority is:

- first to establish a rate stabilisation reserve,
    - this is achieved by amortizing the surplus over 25 years, rather than the 5 year period required by the PBSA.
- then ensure that the sustainable indexing level does not decline from its current level before taking any other action.
    - If necessary a transfer from the Basic account to the IAA will be made sufficient to ensure this outcome. At this valuation such a transfer is not required.

The above table shows that the Board could reduce the Basic contribution rate, however, it should be noted that the use of surplus to reduce the contribution rate below the Basic entry age normal cost rate of 16.50% of salaries, or to improve the Basic benefits, will have a negative impact on the sustainable indexing limit. This is discussed further below.

We would be happy to discuss alternatives with the Board.

Combined Minimum Permissible Basic plus IAA Contribution Rates

When the minimum permissible Basic contributions are combined with the existing IAA rates, the revised totals are:

	Member	Employer	Total
Current Basic Account contributions	8.39%	8.49%	16.88%
Minus maximum permissible Basic Account reduction	(0.55%)	(0.55%)	(1.10)%
Total Basic Rate (equal to entry age normal cost)	**7.84%**	**7.94%**	**15.78%**
Current IAA[1]	1.85%	1.85%	3.70%
Total Minimum Permissible Rate	**9.69%**	**9.79%**	**19.48%**

These minimum permissible contribution rates comply with the requirements of the provincial pension standards legislation (i.e. the *PBSA*).

The *ITA* requires that individual member contributions not exceed the lesser of 9% of salaries or $1,000 plus 70% of the pension credit, though this condition may be waived by the Minister of Finance provided members do not contribute more than half the cost of benefits.

Both the current member contributions and the minimum permissible member contributions will exceed this limit, so regardless of the decision by the Board with respect to contribution rates, it will be necessary to apply to the Minister for a waiver. The employer contributions currently exceed the member contributions by 0.1% of salaries. As IAA contribution rates are fixed and any future Basic contribution rate changes must be shared equally in terms of the JTA, the requirement that the member contributions will not exceed half of the amount required to fund the aggregate benefits is met. The plan has applied for and been granted the waiver following the 2015 valuation.

Sustainable Indexing Valuation

The results of the Sustainable Indexing Valuation depend on the long term funding commitment to the Basic Account. Different long term Basic Account contribution rates may lead to a different sustainable indexing outcome. For the purposes of this section, we have assumed that the contributions to the Basic account will be reduced to the entry age normal cost of 16.50% of salaries, and that the Basic account surplus is not used for any other purpose than supporting indexing.

On this basis, full indexing of 100% of CPI per year is sustainable in the long term (2015 - maximum indexing of 2.07%). This conclusion will not hold if Basic Account contributions were reduced below the entry age normal cost. Provided the Board does not reduce the Basic contribution rate below 16.50% of salaries, the cap on indexing may be removed.

[1] Effective April 1, 2019.

If the Basic contribution rate is reduced to the minimum permissible rate, indexing at 100% of CPI will not be sustainable and indexing must be capped at a maximum of 2.41% per annum. The main reasons for the improvement in the sustainable indexing level are the same as the reasons for the improvement in the basic account funding position which were summarized on page 5 and are discussed in more detail later in this report, together with the increase in the IAA contribution rates since 2016.

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I. Scope of the Valuation

In accordance with Section 12 of the Joint Trust Agreement (the "JTA")[1] and on the instructions of the College Pension Board of Trustees (the "Board of Trustees"), we completed an actuarial valuation of the Basic Account and the Inflation Adjustment Account of the College Pension Plan (the "Plan") as at August 31, 2018 and are pleased to submit this report thereon. The primary purpose of this valuation is to determine the financial position of the Basic Account as at August 31, 2018 and to report on the adequacy of the member and employer contribution rates.

Two main valuations were carried out:

- **A Funding Valuation –** this primary valuation is to determine the financial position of the Basic Account as at August 31, 2018 and to report on the adequacy of the member and employer Basic contribution rates. The Funding Valuation focuses only on the Basic Account and does not examine the Inflation Adjustment Account ("IAA") and its ability to meet future indexing requirements. Furthermore, it ignores the limits on benefits imposed by the *Income Tax Act* ("*ITA*") on registered pension plans - such excess benefits are paid on a current cash basis through the Supplemental Benefits Account, which is maintained at a zero balance; and
- **A Sustainable Indexing Valuation** - to determine the rate of indexing that can be sustained in the long term, based on the financial position of the Basic Account and the Inflation Adjustment Account, and the overall level of contributions to the plan.

In addition to the above, we have performed supplementary funding valuations as follows:

- For basic and indexed benefits, on the presumption that indexed benefits are to be fully funded, in advance, as for basic benefits; and
- Limiting benefits to those permitted under the *ITA*; this is done both for basic benefits only, and for basic plus indexed benefits.

The intended users of this report are The Board of Trustees, the Financial Institutions Commission of British Columbia ("FICOM") and Canada Revenue Agency ("CRA"). This report is not intended or necessarily suitable for other purposes than those listed above.

[1] The JTA was signed on April 4, 2011 and became effective on June 22, 2012. It incorporates the joint trust arrangements previously covered in Schedule A of the *Public Sector Pension Plans Act*.

II. Changes in Plan

The last valuation of the Plan, prepared as at August 31, 2015 and included in our report dated May 12, 2016, determined the financial position of the Plan as amended to August 2015, but also including, where relevant, the increase in member and employer contributions to the Inflation Adjustment Account effective April 1, 2016. Since then, member and employer contribution rates to the Inflation Adjustment Account have been increased from 1.57% of salary each, as follows:

- to 1.66% of salary each effective April 1, 2017;
- to 1.76% of salary each effective April 1, 2018; and
- to 1.85% of salary each effective April 1, 2019.

There were no other benefit changes that had a material financial impact on the Plan.

The main provisions of the Plan are described in Appendix A.

III. Actuarial Methods and Assumptions

1. Financing Method and Adequacy of Contribution Rates

(a) Funding Criteria

In any pension system, the rates of member and employer contribution should be such that:

- the present value of all future contributions at those rates
- **equals** the present value of all future benefits
- **minus** the funds on hand.

There are numerous financing methods that will satisfy this equation. At one end is the pay-as-you-go or current disbursement method; under this method, contributions are limited to those necessary to finance current benefit disbursements, so that no assets are accumulated. At the other end is the achievement of full funding within a reasonable period; this results in the accumulation of substantial assets.

The general criteria we use in establishing the appropriate level of contributions to the College Pension Plan include the following:

(i) **Benefit security –** the probability of fulfilling the present benefit promises provided in the Plan depends on a mixture of political, economic and financial factors; but, whatever the probability, obviously benefit security is enhanced with a larger accumulation of assets.

(ii) **Stability of contributions –** the financing system should result in contribution rates that are relatively stable over an extended period of time.

(iii) **Allocation of costs –** as far as is practicable, pension costs should be allocated to the generation that incurs them; there is no assurance that future generations will assume the burdens transferred to them by prior generations.

The Board has adopted a formal funding policy (most recently revised in June 2016) in which it identified benefit security as its primary funding objective and contribution stability as an important secondary objective. We have taken this into account in carrying out this valuation.

(b) Indexing Treatment

The current financing provisions are described in Appendix A. Member and employer contributions are at rates set out in the Plan rules. A larger part of these contributions is allocated to the Basic Account, and a smaller portion to the IAA. The future indexing of pensions is based on funds available in the IAA, which derives its funds primarily from these allocated contributions, from excess investment earnings on pensioner reserves in the Basic Account, and from investment earnings within the IAA itself.

In a sense, the IAA operates akin to a defined contribution or money-purchase account in that the value of indexing benefits is limited to the assets in the IAA. Future cost-of-living adjustments are not guaranteed, but are granted at the discretion of the Board, subject to the availability of funds in the IAA. Where there are sufficient monies in the IAA, full CPI indexing is provided; alternatively, if the monies in the IAA cannot support full CPI indexing, then the amount of indexing is limited to the monies available. In either case, the mechanics are such that the capitalized value of the indexing granted is transferred from the IAA to Basic Account each time indexing is granted. Thus, the system will limit indexing, if necessary, so that the granting of any increases for indexing should not create (or increase) a Basic account unfunded liability, or reduce a Basic account actuarial surplus. Accordingly, we did not consider any future indexing in determining the financial status of the Basic Account.

However, we also show supplementary results on the assumption that the assets of, and future contributions to, the Basic Account and the IAA are combined, with benefits to be fully indexed and funded in advance, as for basic benefits.

(c) Basic Account Valuation - Current Financing

We determined the financial status of the Plan for the Basic Account only (i.e. ignoring any indexing granted after August 31, 2018). The methods used are described in Appendix B.

(d) Funding Requirements

The approach taken in this valuation (set out in the following sections) has taken into account the requirements of the Board's funding policy, as well as the requirements of the Joint Trust Agreement.

(e) Normal Cost and Amortization of Surplus or Unfunded Liability

An entry-age funding approach is used. As a first step, contributions are calculated as the level, long-term rate of pay required to finance the benefits of new entrants to the Plan over their working lifetimes, so that their projected benefits are fully secured by equivalent assets by the time they retire (the "normal cost rate" or the "entry-age rate"). Thus, to the extent actuarial assumptions are realized, the addition of new entrants to the Plan should generate neither unfunded liabilities nor surpluses.

Next, the funded position of the plan at the valuation date is considered. The liability takes into account benefits earned to the valuation date as well as benefits expected to be earned for future service by existing members. Asset values are taken at smoothed market values for existing assets, plus projected future contributions in respect of the existing members at the entry-age normal rates, plus the value of any amortization amounts established at previous valuations. The resulting net financial position may be either an actuarial surplus or an unfunded actuarial liability.

This surplus, or unfunded liability, is amortized over a specified period as outlined in the funding policy, e.g., 25 or 15 years (In the case of a surplus, only the surplus in excess of 5% of the net liability is amortized). Minimum contributions, expressed as a percentage of payrolls, revert to the normal cost rate after the unfunded liability or surplus has been amortized.

(f) PBSA Requirements

The Pension Benefits Standards Act ("PBSA") imposes certain minimum funding requirements on pension plans registered in British Columbia. These include the determination of a plan's financial position on a solvency basis as well as the more usual going concern basis, the amortization of unfunded actuarial liabilities over a maximum of 15 years from when they are established (with a one year time lag for jointly sponsored plans for any amortization requirements established on or after September 30, 2015, which is the date the new PBSA came into effect), and special rules regarding the treatment of surplus. While the College Pension Plan is one of a number of British Columbia public sector plans that are exempt from these provisions, the current joint trusteeship arrangement requires that the Plan's financing comply with the PBSA requirements for a going concern valuation. This report therefore complies with the going concern valuation requirements of the PBSA.

(g) Test Contribution Adequacy

Under the *PBSA* going concern requirements, the employers and the members must contribute the full normal actuarial cost (e.g. the "entry-age rate" described in (e) above). In addition, unfunded liabilities must be amortized over not more than 15 years from when they are established, with a one-year time lag. For this purpose the unfunded liability that needs to be amortized from the valuation date is the unfunded liability described above, reduced by the present value of any previously established amortization amounts.

Surpluses may be applied to reduce the contribution requirements. The rate may only be reduced below the normal actuarial cost after a surplus margin of 5% of the net liability has been set aside, with the remaining surplus to be amortized over not less than 5 years. The Board sets out its policy with regard to amortization of surplus in its funding policy.

The Board's funding policy reflects these constraints and, accordingly, we have calculated theoretical contribution requirements as follows:

- Calculate the "normal cost rate" (i.e. the "entry-age rate") and the resulting surplus (or unfunded liability) using this rate;
- If there is an unfunded liability after allowing for the value of any previously established amortization amounts, amortize it over 15 years from the current valuation date.
- If there has been a gain since the last valuation, i.e. the currently scheduled amortization rates applied for the balance of the previously established amortization periods are more than sufficient to amortize the previously identified unfunded liabilities; apply the gain to amortize or reduce the

previously identified unfunded liabilities, starting with the oldest established. This results in a reduction in the required amortization rates, with the revised rates in effect for the previously established periods

- If there is a surplus after removing all previously established amortization requirements, allocate up to 5% of the net liability (the "PBSA minimum surplus") as a rate stabilization reserve. Then calculate the contribution rate arising after amortizing any surplus in excess of the PBSA minimum surplus over a 15-year period and over a 25-year period. The contribution rate with a 15-year amortization of any surplus will be lower than the rate with a 25-year amortization of the same surplus.
- If the current contribution is between the 15 and 25-year rates, then the rate should remain unchanged. Effectively, the surplus in excess of the PBSA minimum surplus is applied as an additional rate stabilization reserve.
- If the current contribution rate is greater than the 25-year contribution rate, then there is "excess surplus". The first priority for this excess surplus will be to support indexing at the current maximum sustainable level by transferring assets to the IAA. The Board may then decide how to apply any remaining excess surplus. Alternatives, as set out in the JTA include:
  - reducing the contribution rate;
  - improving benefits;
  - making a transfer to the Inflation Adjustment Account;
  - setting aside a rate stabilization reserve.
- If the current contribution rate is lower than the 15-year contribution rate, then the rate should be increased to be equal to the 15-year contribution rate.
- The resulting contribution rate will comply with the PBSA minimum requirement.

The JTA requires any contribution rate changes, up or down, to be shared equally by the members and the employers. Thus, we express the future cost requirements as a combined member-plus-employer amount.

2. Sustainable Indexing Valuation

The Sustainable Indexing Valuation is carried out to establish the maximum level of indexing that can be provided over the period until the next valuation in a manner that allows indexing to be sustained in the long term and is fair from the perspective of intergenerational equity.

As for the Funding Valuation, we have used an entry age approach. We start by calculating the long term contribution rate that is required to fund the benefits (including indexing at the target rate) over the life time of a typical new entrant, assuming the Plan has neither a surplus nor an unfunded liability.

Next, we need to calculate how this long term contribution rate should be adjusted to reflect the funded position of the Plan. The assets, consisting of the current funds plus the value of future contributions at this entry age rate, are compared to the liabilities (including the provision for indexing at the target rate). Subtracting the liabilities from the assets gives rise to a surplus or unfunded liability. We amortize this surplus or unfunded liability (in certain cases, adjusted as described below) over an infinite period to obtain the level long-term contribution that is required to support indexing at the target level.

For the target level of indexing to be sustainable, this long term contribution requirement must not exceed the long term contributions that are committed to be paid into the plan, while from an intergenerational equity perspective, we require the long term commitment and long term requirement to be equal.

The calculation of the long term contribution commitment can be complicated when the members and employers are paying amortization amounts into the plan for a temporary period. We therefore defined the long term contribution commitment as the normal cost of the current Basic benefits, plus the fixed IAA contributions. Effectively, these are the amounts that the members and employers can expect to pay in the absence of any unfunded liabilities or surplus.

Any Funding Valuation amortization requirements are excluded from the long term contribution commitment, as these amounts are only payable for a limited period of time. Instead, the effect of these amortization amounts, if any, is allowed for by including their present value as an adjustment to the unfunded liability; the unfunded liability calculated in the Sustainable Indexing Valuation is thus reduced by the present value of any Funding Valuation required amortization amounts.

3. Actuarial Assumptions

The rates of investment return, salary increase, indexing, mortality, withdrawal, disability and retirement experienced by members of the fund were examined for the three year period ending on the valuation date, together with corresponding experience for earlier periods and with other assumptions affecting the valuation results. We discussed the implications of the assumptions, and changes to them, with the Board.

The assumptions and the approach to setting them are described in Appendix B. In summary, the Funding Valuation, used to set the Basic contribution rate, requires margins for adverse deviations, while it is appropriate to use best estimate assumptions when carrying out the Sustainable Indexing Valuation. As a result, certain key assumptions differ between the two valuations and two sets of assumptions are required. For ease of reference we refer to these as the Funding Valuation assumptions and the Sustainable Indexing Valuation assumptions.

Following discussions with the Board, we made adjustments to some of the economic, demographic and other assumptions. The assumptions are discussed in detail in Appendix B; the key economic assumptions are summarized below (assumptions are unchanged from the previous valuation).

	Funding Valuation	Sustainable Indexing Valuation
Annual Investment Return	6.25%	6.50%
Annual Salary Increase	3.50% plus seniority	3.25% plus seniority
Annual Indexing	0% for basic costs 2.75% for indexed costs	2.50% for fully indexed costs Sustainable level of indexing calculated as valuation output

Emerging experience differing from the assumptions will result in gains or losses which will be revealed in future valuations.

4. Membership Data

Data as of August 31, 2018 were prepared by the Pension Corporation. The data are described in detail in Appendix B and numerically summarized in Appendices C, D and E.

5. Benefits Excluded

No benefits have been excluded from the valuation.

IV. Results of the Funding Valuation

1. Basic Account – Actuarial Position

Schedule 1 shows a statement of the actuarial position of the funding valuation of the Plan as at August 31, 2018. This statement ignores liabilities for future indexing granted after the valuation date and assumes that member and employer contribution rates for basic pensions will be made at the entry-age normal cost rate i.e. 16.50% of payroll.

Schedule 1 – Statement of Actuarial Position as at August 31, 2018

Basic Account - Non-Indexed Benefits – Entry-age Normal Cost

	($000's)	
Valuation Year	**2015**	**2018**
Assets		
Market Value of Basic Account	3,639,305	4,319,862
Asset Smoothing Adjustment	(291,145)	(221,676)
Smoothed Value of Basic Account	**3,348,160**	**4,098,186**
Actuarial present values of future contributions at entry-age rates	1,013,178	1,144,512
Total Assets	**4,361,338**	**5,242,698**
Liabilities		
Actuarial present values for		
- pensions being paid	1,618,167	1,986,625
- inactive members		
deferred vested members	97,217	114,620
LTD members	68,519	75,335
other inactive members	34,838	25,659
- active members	2,438,950	2,695,734
- future expenses	36,555	41,500
Total Liabilities	**4,294,246**	**4,939,473**
Surplus (Unfunded Liability)	**67,092**	**303,225**
Funded Ratio: Total Assets ÷ Total Liabilities	**101.6%**	**106.1%**
***PBSA* Accessible going concern excess**	**0**	**113,477**

2. Change in Actuarial Position

The statement of actuarial position included in Schedule 1 indicates that the surplus has increased from $67 million at August 31, 2015 to $303 million at August 31, 2018. The $236 million increase in the surplus is the net result of a number of items, the most significant items being higher than assumed investment returns and lower than assumed salary increases, partially offset by the excess investment return transfers from the Basic Account to the IAA.

Schedule 2 – Change in Actuarial Position

	Approximate effect ($ millions)
1. Surplus at August 31, 2015	**67**
2. Interest on Surplus	13
3. Actual income from investments higher than 6.25% assumed rate (on smoothed values)	317
4. Actual contributions higher than previously assumed	8
5. Actual salary increases to August 31, 2018 lower than previously assumed	50
6. Actual pensioner deaths higher than previously assumed	21
7. Changes in valuation demographic assumptions (retirement and termination rates)	4
8. Excess investment return transfers to the IAA, plus interest[1]	(175)
9. Other factors (a net loss) including changes in plan membership and other differences between actuarial assumptions and actual experience during the intervaluation period	(2)
10. Surplus at August 31, 2018	**303**

3. Adequacy of Contribution Rates

As discussed previously in Section III, the required contribution rate consists of the normal cost plus an adjustment to amortize any surplus or unfunded liability. These components of the required contributions are discussed in more detail below.

(a) Normal Cost Rate

The current service contribution, inclusive of contributions by members, required to finance the basic pensions of new entrants (i.e. the normal actuarial cost) has decreased from 16.63% of salaries as at August 31, 2015 to 16.50% of salaries as at August 31, 2018. This 0.13% decrease in normal cost rate is developed in Appendix F and is the net result of:

[1] Excess investment return transfers were $35.5 million on August 31, 2016, $61.7 million on August 31, 2017 and $66.0 million on August 31, 2018, for a total of $163.2 million. The difference between this and the $175 million shown above is the consequence of investment earnings on these amounts emerging in the IAA rather than the Basic account.

- The change in the new entrant demographic profiles (cost decrease of 0.10%); and
- The change in the termination assumption (cost decrease of 0.04%); offset by
- The change in the retirement assumption (cost increase of 0.01%).

(b) PBSA Required Rate – Minimum Permissible Rate

The minimum PBSA required contribution rate is equal to the normal cost of 16.50% less the 5 year amortization of the accessible going concern excess (surplus in excess of 5% of the net liabilities). Five percent of the net liabilities is $189,748,000, leaving an accessible going concern excess of $113,476,000. Amortizing this over five years, commencing one year after the valuation date, results in a maximum permissible reduction of 2.80%. The PBSA minimum required contribution rate is therefore 13.70% of salaries.

	($000's)	
Valuation Year	**2015**	**2018**
Smoothed Value of Basic Account	3,348,160	4,098,186
Actuarial present values of future contributions at entry-age rates (PV of EANC)	1,013,178	1,144,512
Total Assets	**4,361,338**	**5,242,698**
Total Liabilities	**4,294,246**	**4,939,473**
Surplus (Unfunded Liability)	**67,092**	**303,225**
5% of net liabilities (total liabilities less PV of EANC)	164,053	189,748
***PBSA* Accessible going concern excess (excess of Surplus over 5% of net liabilities)**	**0**	**113,477**
PBSA Minimum Contribution Rate		
Entry-age normal cost rate	16.63%	16.50%
Amortization of PBSA accessible excess over 5 years	-	(2.80%)
PBSA Minimum Permissible Rate	**16.63%**	**13.70%**

(c) Funding Policy Requirements – Contribution Rates

The contribution requirements under the JTA and current funding policy are as follows:

Schedule 3 – Current and Required Basic Contribution Rates

	Based on valuation results as at August 31	
	2015 (%)	**2018 (%)**
Current level contribution rates		
Member	8.39	8.39
Employer	8.49	8.49
Combined member/employer	**16.88**	**16.88**
Minimum Basic Account level contribution rates		
Entry-age normal cost rate	16.63	16.50
Amortization of accessible actuarial excess (surplus)		
▪ 25 year amortization	-	(0.72)
▪ 15 year amortization	-	(1.06)
▪ *PBSA* amortization	-	(2.80)
Basic Account contribution rates		
▪ 25 year amortization	16.63	15.78
▪ 15 year amortization	16.63	15.44
▪ *PBSA* minimum rate	16.63	13.70
Minimum Permissible Basic Account contribution rate	**16.63**	**15.78**

The above results indicate that the current contribution rate of 16.88% of salaries exceeds both the minimum permissible *PBSA* contribution rate of 13.70% of salaries and the funding policy 25-year amortization rate of 15.78% of salaries.

The Board can decide how to use the excess surplus that has arisen, but the current funding policy indicates that the contribution rate should not be reduced below the 25-year amortization rate of 15.78% of salaries. It should be noted that the use of surplus to reduce the contribution rate below the Basic entry age normal cost rate of 16.50% of salaries, or to improve the Basic benefits, will have a negative impact on the sustainable indexing limit. This is discussed further in Section V.

4. Revised Minimum Permissible Contribution Rates

The JTA requires that the Plan's financing comply with the *PBSA* requirements for a going concern valuation. It also indicates that any changes in the Basic Account contribution rate must be shared equally between members and employers.

As noted above, the 25-year amortization contribution rate under the funding policy exceeds the minimum permissible *PSBA* contribution rate. As a result, the current rates may be decreased to the funding policy 25-year amortization rate. This represents a decrease of 1.10% of salaries. Sharing this equally would result in a decrease of 0.55% of salaries each for the members and the employers.

When this is combined with the current IAA contribution rates, the revised minimum permissible rates become:

	Member	Employer	Total
Current Basic Account contributions	8.39%	8.49%	16.88%
Minus maximum permissible Basic Account reduction	(0.55%)	(0.55%)	(1.10)%
Total Basic Rate (equal to entry age normal cost)	**7.84%**	**7.94%**	**15.78%**
Current IAA[1]	1.85%	1.85%	3.70%
Total Minimum Permissible Rate	**9.69%**	**9.79%**	**19.48%**

Under the *ITA*, there is a requirement that individual member contributions may not exceed the lesser of:

(a) 9% of salary, or

(b) $1,000 plus 70% of the member's pension credit

although these conditions may be waived by the Minister of Finance provided that the contributions are "determined in a manner acceptable to the Minister and it is reasonable to expect that, on a long-term basis, the aggregate of the regular current service contributions made under the provision by all members will not exceed 1/2 of the amount that is required to fund the aggregate benefits in respect of which those contributions are made."

Both the current member contributions and the minimum permissible member contributions will exceed this limit, so regardless of the decision by the Board with respect to contribution rates, it will be necessary to apply to the Minister for a waiver. The employer contributions currently exceed the member contributions by 0.1% of salaries. As IAA contribution rates are fixed and any future Basic contribution rate changes must be shared equally in terms of the JTA, the requirement that the member contributions will not exceed half of the amount required to fund the aggregate benefits is met. A similar exemption was required, and obtained, following the 2015 valuation.

[1] Effective April 1, 2019.

5. Other Plan Changes

As the valuation shows a surplus, in addition to reducing the Basic contribution rate to the minimum permissible rate previously discussed, the Board can, subject to the funding policy, also consider:

- Improving benefits;
- Making a transfer to the Inflation Adjustment Account;
- Setting aside a rate stabilization reserve;
- Or any combination of these four alternatives.

The Basic contribution rate after implementing any decisions may not exceed the current contribution rate of 16.88% and the cost of any benefit improvements have to be funded over no less than 25 years.
The current funding policy requires that when there is a surplus, first establish a rate stabilization reserve of up to 5% of the net liability. This has been done in the calculations shown above by amortizing the accessible actuarial excess over 25 years rather than the 5 years permitted by the PBSA. Next it is necessary to ensure that the sustainable indexing maximum does not decline from its current level before taking any other action. If necessary, a transfer from the Basic account to the IAA will be made sufficient to ensure this outcome. At this valuation such a transfer is not required. We are happy to discuss alternatives with the Board at its convenience. It should be noted that the use of the excess surplus to reduce the contribution rate below the Basic entry age normal cost, or to improve the benefits, will have a negative impact on the sustainable indexing limit, as discussed in Section V.

6. Accrued Benefits – Funded Ratio

Another index of funding some readers of the report may want to examine is the accrued benefits funded ratio. The accrued benefits funded ratio is calculated by dividing the Basic Account assets by the total liability for benefits accrued in respect of service to the valuation date. The asset/liability comparison is analogous to that in Schedule 1, except that contributions and benefits in respect of future service to be worked by existing members are excluded from the comparison. The results are shown below.

Schedule 5 – Accrued Benefits – Funded Ratio at August 31, 2018

Basic Account – Non-Indexed Benefits

	($000's)	
	2015	2018
Fund (Basic Account):		
Smoothed value of assets	**3,348,160**	**4,098,186**
Accrued Liabilities		
▪ for pensions being paid	1,618,167	1,986,625
▪ for inactive members	200,574	215,614
▪ for active members	1,367,390	1,478,984
Total Accrued Liabilities	**3,186,131**	**3,681,223**
Surplus (Unfunded Actuarial Liability): for accrued service only	**162,029**	**416,963**
Funded Ratio: Fund ÷ Total accrued liabilities	**105%**	**111%**

The above schedule indicates that the funded ratio for accrued benefits has improved from about 105% to 111%. This is largely for reasons similar to the items in the analysis in Schedule 2.

7. Sensitivity Analysis

Sensitivity Analysis under Standards of Practice

The Canadian Institute of Actuaries Practice-Specific Standards for Pension Plans require disclosure of the effect of using a discount rate (investment return) 1.0% lower than that used for the valuation on:

(a) The actuarial present value, at the calculation date, of projected benefits allocated to periods up to the calculation date, and

(b) The service cost or the rule for calculating the service cost between the calculation date and the next calculation date.

The table below shows the impact on the accrued liability as required by (a) and the entry-age normal cost as required by (b) as at August 31, 2018 of a one percentage point drop in the discount rate assumption. All other assumptions were kept unchanged.

Sensitivity – Impact of 1% drop in investment return on Accrued Benefits and Normal Cost

Impact on liabilities of 1% drop in discount rates	Going Concern 6.25% ($,000's)	Going Concern 5.25% ($,000's)	Increase ($,000's)
Active members	1,478,984	1,730,951	251,967
Disabled members	75,335	86,465	11,130
Terminated members	140,279	164,159	23,880
Pensioners and beneficiaries	1,986,625	2,167,477	180,852
Total increase in liabilities			**467,829**

Impact on normal cost rate of 1% drop in discount rates	Going Concern 6.25%	Going Concern 5.25%	Increase
Current service cost rate	16.50%	20.24%	3.74%

Sensitivity Analysis for Plan Funding

Given that the plan is funded on the entry-age basis, we have also considered the impact of a one percentage point drop in the investment return assumption on the Basic Account non-indexed benefits consistent with Schedule 1. These figures are summarized in the table below:

Sensitivity – Impact of 1% drop in investment return on Plan Funding

	($000's)		
	6.25%	**5.25%**	**Increase**
Smoothed Value of Fund	4,098,186	4,098,186	0
Actuarial present values of:			
▪ Future contributions at entry-age rates	1,144,512	1,456,808	312,296
Total Assets	**5,242,698**	**5,554,994**	**312,296**
Total Liabilities	**4,939,473**	**5,743,687**	**804,214**
Surplus/(Unfunded liability) on entry-age basis	303,225	(188,693)	(491,918)
Entry Age Normal Cost	16.50%	20.24%	3.74%
25 year amortization	(0.72%)	1.06%	2.35%[1]
PBSA Amortization	(2.80%)	1.63%	
Minimum permissible rate	15.78%	21.87%	6.09%

[1] Represents the difference between the highest amortization under each scenario i.e. the difference between the 25 year amortization at 6.25% investment return and the *PBSA* amortization at the 5.25% investment return.

8. Supplementary Funding Valuations

Results analogous to those in Schedules 1, 3 and 5 are shown in Appendix G, on the following bases:

- For basic and indexed benefits combined, on the assumption that indexed benefits are to be fully funded, in advance, as for basic benefits;
- For basic only, and basic plus indexed benefits, including only benefits accrued to the valuation date; and
- Limiting benefits to those permitted under the *Income Tax Act*; this is done both for:
  - basic benefits only; and for
  - basic plus indexed benefits.

The adjustments to the assumptions are discussed in Appendix B. The fully indexed funding valuation result takes into account IAA contributions of 1.85% from each of members and employers. The key results are summarized below:

Schedule 6 – Indexed Benefits (no tax limits)

	Basic Only	Basic + Indexed
	($000's)	($000's)
Smoothed Value of Fund	4,098,186	4,810,781
Actuarial present values of:		
▪ Future contributions at entry-age rates	1,144,512	1,578,371
Total Assets	5,242,698	6,389,152
Total Liabilities	4,939,473	6,589,448
Surplus (Unfunded Liability)	**303,225**	**(200,296)**
Contribution Rates	**%**	**%**
Current Member	8.39	10.24
Current Employer	8.49	10.34
Current Total	**16.88**	**20.58**
Entry-age normal cost	16.50	22.82
Amortization[1]	(0.72)	1.82
Total – entry-age	**15.78**	**24.64**

If assets and liabilities are restricted to accrued service only, i.e. analogous to Schedule 5 earlier, the 2018 surplus (unfunded liability) figures change as follows:

Schedule 7 – Indexed Accrued Benefits (no tax limits) – Funded Ratio at August 31, 2018

	($000's)	
	Basic Only	Basic + Indexed
Assets	4,098,186	4,810,781
Liabilities	3,681,223	4,885,472
Surplus (Unfunded Liability)	416,963	(74,691)
Funded Ratio	111%	98%

[1] Basic amortization is over 25 years for surplus in excess of 5% of the net liability; Basic plus Indexed amortization is over 15 years

Benefits Limited to ITA Maximums

When the income tax limits on benefits are recognized, the above surpluses/unfunded liabilities and normal cost rates change marginally. The key results are summarized below.

Schedule 8 – Benefits Limited to ITA Maximums – Basic Only

Basic Only	Without Tax Limit	With Tax Limit
Surplus (Unfunded Liability)	**$000's**	**$000's**
Entry Age Basis	303,225	302,866
Accrued Service Only	416,963	426,950
Contribution Rate on Entry Age Basis	**%**	**%**
Entry-age normal cost	16.50	16.22
25 years Amortization	(0.72)	(0.71)
Total	**15.78**	**15.51**

Schedule 9 – Benefits Limited to ITA Maximums – Indexed Benefits

Basic and Indexed	Without Tax Limit	With Tax Limit
Surplus (Unfunded Liability)	**($000's)**	**($000's)**
Entry Age Basis	(200,296)	(203,875)
Accrued Service Only	(74,691)	(61,882)
Contribution Rate on Entry Age Basis	**%**	**%**
Entry Age Normal Cost	22.82	22.46
15 year Amortization	1.82	1.85
Total	**24.64**	**24.31**

9. Test Maximum Surplus and Contributions for Tax Purposes

Section 147.2(2) of the *Income Tax Act* limits employer contributions that may be made to a plan if there is a surplus that exceeds 25% of the actuarial liability - the plan becomes revocable if contributions are made when such surplus exists. Subsection (c) of Section 147.2(2) of the *Income Tax Act* also provides that the benefits taken into account for the purposes of a contribution recommendation "may include anticipated cost-of-living and similar adjustments where the terms of a pension plan do not require that those adjustments be made but it is reasonable to expect that they will be made."

Indexing at full CPI was provided from January 1982 to January 2011 under the present Plan terms, and for many years before that under earlier Plan provisions. As discussed earlier, the plan has moved to a sustainable indexing basis effective January 2011, whereby indexing is limited based on the financial position of the plan at the most recent valuation. Under this approach, if the contribution levels supported it, full indexing in line with increases in the cost of living would be provided. Thus, it is appropriate for purposes of testing the *ITA* 147.2(2) limits to recognize, in advance, the future indexing of pensions for the present

Plan membership. On this basis, the valuation results on the fully indexed basis, recognizing the income tax limits on benefits, apply.

Thus, on the premise that it is appropriate for the Plan to recognize future indexing for the purposes of testing the *ITA* contribution limits, there is an unfunded liability, and furthermore, the required contribution rates are lower than the fully indexed normal cost rate. In other words, without even considering any amortization of the unfunded liability, the required rates are acceptable under the *ITA* and contributions may remain at the current level of 20.58%.

We have commented previously (under section 4) on the 9% limit that applies to individual member contributions.

V. Sustainable Indexing Valuation

The Sustainable Indexing Valuation establishes the level of indexing that can be sustained in the long term taking into account the assets of the Plan and the long term funding commitment to the Plan. The valuation basis is different from the Funding Valuation basis as discussed in Section III and Appendix B.

As noted above, the level of indexing that can be sustained may vary depending on the long term funding commitment to the Plan. For the purposes of this section, we have illustrated the impact on sustainable indexing if contributions to the Basic Account are set at the entry-age normal cost of 16.50% of salaries and that the Basic surplus is not used for any other purpose than supporting indexing. Different levels of long term funding commitment and/or other uses of the Basic Account surplus may lead to a different level of sustainable indexing.

1. Long Term Funding Commitment and Amortization Requirements

Based on the results discussed in Section IV, the contribution requirements of the plan can be summarised as:

Long Term Funding Commitment	2018
Normal (entry-age) actuarial cost	16.50%
IAA contributions	3.70%
Long term funding commitment	**20.20%**

2. Results

Based on a long term funding commitment as above, we have calculated that indexing at 100% of CPI is fully sustainable based on the 2018 results. This result is an increase from the equivalently calculated 2015 sustainable indexing level of 2.07%.

Allowing for indexing of 2.50% per year (i.e at 100% of CPI), and using the sustainable indexing assumptions discussed earlier, we obtain the following balance sheet and contribution requirements:

	2018 ($000's)
Sustainable Indexing Target	**2.50%**
Assets	
Market Value of Fund	5,071,002
Asset Smoothing Adjustment	(253,550)
Smoothed Value of Fund	**4,817,452**
Actuarial present values of contributions at Entry Age Normal Cost[1]	1,380,808
Total Assets	**6,198,260**
Total Liabilities	**6,097,090**
Surplus (Unfunded Actuarial Liability)	**101,170**
Contribution Requirements	
Entry Age Normal Cost – based on sustainable indexing target	20.55%
Amortization of (surplus)/unfunded liability over infinite period	(0.35%)
Required contribution	**20.20%**
Long term contribution commitment	**20.20%**

The above results show that, indexing at 100% of CPI is fully sustainable, as the required contribution rate of 20.20% of salaries is equal to the long term contribution commitment. It is thus reasonable to conclude that indexing at 100% of CPI can be sustained in the long term. Provided that the Board does not reduce the Basic contribution rate below the Basic entry age normal cost and that the Basic surplus is used to support indexing and not used for any other purpose, the maximum cap on indexing amount referred to in Section 73 of the plan rules can be removed and the percentage of indexing that can be provided be set at 100% of CPI. This is an increase from the level of 2.07% per year set following the 2015 valuation.

As there is an increase in the maximum sustainable indexing level since the 2015 valuation, there is no requirement for the Board to transfer any of the Basic Account excess surplus to the IAA, however transferring the Basic surplus to the IAA will ensure that it is not used for any other purpose than supporting indexing at 100% of CPI.

If the Basic contribution rate is reduced to the minimum permissible rate, indexing at 100% of CPI will not be sustainable and indexing must be capped at a maximum of 2.41% per annum

The main reasons for the improvement in the sustainable indexing level are similar to the improvement in the basic account funding position, which are discussed in the analysis in Schedule 2.

[1] This allows for indexing at 2.50% and reflects a 6.50% discount rate.

The sustainable level of indexing will be re-evaluated at the next valuation and may be less than the full indexing as a result of future experience losses and any changes to the valuation assumptions at that time.

VI. Subsequent Events

To the best of our knowledge, there are no material subsequent events that would affect the results and recommendations of this valuation. Any investment experience occurring between the valuation date and the report date, which differs from the assumption made, is not reported on in this valuation report and will be reported on in future valuations.

VII. Actuarial Opinion

In our opinion,

(a) the membership data on which the valuation is based are sufficient and reliable for the purposes of the valuation,

(b) the assumptions are appropriate for the purposes of the valuation, and

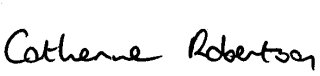
(c) the methods employed in the valuation are appropriate for the purposes of the valuation.

This report has been prepared and our opinions given in accordance with accepted actuarial practice in Canada. Pursuant to the JTA and regulatory requirements, the next valuation should be completed no later than as of August 31, 2021.

VIII. Acknowledgement

We gratefully acknowledge the generous assistance of the staff of the Pension Corporation in the preparation of the data and other items required for this report.

Respectfully submitted,



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Appendix A: Summary of Plan and Amendments as at August 31, 2018

Changes to the Plan

The previous valuation was based on the provisions of the Plan as at August 31, 2015. The main changes made to the Plan provisions up to August 31, 2018, not reported in the previous valuation report, are summarized below.

- Effective April 1, 2017, member and employer contribution rates to the Inflation Adjustment Account were increased from 1.57 per cent to 1.66 percent of members' salary each.
- Effective December 13, 2017, a plan rule amendment was made to improve clarity, update terminology and update references to legislation. Section 96 was updated to add definitions for "Locked-in Retirement Account" and "Life Income Fund" to reflect *Pension Benefits Standards Act* terminology around the transfer of a commuted value on a locked-in basis.
- Effective April 1, 2018, member and employer contribution rates to the Inflation Adjustment Account were increased from 1.66 per cent to 1.76 percent of members' salary each.
- Effective May 17, 2018, a plan rule amendment was made to reflect two new leave types for which the employer is required to pay the employer portion, if the employee chooses to pay the employee portion. The two new leaves of absence include those respecting the disappearance of a child and death of a child.

In addition, effective April 1, 2019, member and employer contribution rates to the Inflation Adjustment Account were increased from 1.76 per cent to 1.85 percent of members' salary, each. This increase has been reflected, where relevant in this report.

The main provisions of the Plan taken into account in the valuation as at August 31, 2018, are summarized below. Except as otherwise noted, the section references are to the College Pension Plan Rules as at May 17, 2018.

Employer and Employee Eligibility

The Plan applies to a body designated under the *College and Institute Act*, and to any other body designated as an employer, on terms and conditions of eligibility specified by the Board. [Section 2]
Participation is compulsory for all members of the senior administrative staff and staff providing educational services (including librarians) who are full-time or who earn more than 50 per cent of the YMPE under the Canada Pension Plan in any calendar year. Enrolment is optional for eligible staff who are part-time and have not yet earned 50 per cent of the YMPE in a calendar year; enrolment is also optional for educational staff who were hired before September 1, 1999. [Section 3]

Member Contributions

Section 5 defines the following contributions which are deducted from a member's salary during a calendar year:

(a) 8.39 per cent of the member's salary (paid into the Basic Account) – effective January 1, 2016.

(b) 1.76 per cent of the member's salary (paid into the Inflation Adjustment Account) – effective April 1, 2018.

Effective April 1, 2019, member contributions paid to the Inflation Adjustment Account increased to 1.85 per cent of the member's salary.

Employer Contributions

Section 6 requires every employer to contribute the following amounts during a calendar year:

(a) 8.49 per cent of the member's salary (paid into the Basic Account) – effective January 1, 2016.

(b) 1.76 per cent of the member's salary (paid into the Inflation Adjustment Account) – effective April 1, 2018.

Effective April 1, 2019, employer contributions paid to the Inflation Adjustment Account increased to 1.85 per cent of the member's salary.

Funding

Section 12 of the College Pension Plan Joint Trust Agreement provides that the Plan funding must comply with the PBSA requirements for a going concern valuation. Further, future contribution rate changes indicated by a valuation must be shared equally between employers and members.

Retirement Benefits: Eligibility Conditions for Pension

Section 50 provides that an active member who, on or after September 30, 2015, terminates employment is, on application, eligible to receive an unreduced pension calculated in accordance with sections 54 and 55 if the member has:

In respect of service prior to January 1, 2016:

(a) attained age 55 and completed at least 35 years of contributory service;

(b) attained age 60 with at least 2 years of contributory service; or

(c) attained age 65.

In respect of service on or after January 1, 2016:

(a) attained age 55 and completed at least 35 years of contributory service;

(b) attained age 65.

A reduced pension is otherwise provided where the terminating member had reached age 55.

An active member who terminated employment prior to September 30, 2015, is entitled, upon application, to an unreduced pension if the member had:

(a) attained age 55 and completed at least 35 years of contributory service;

(b) attained age 60 with at least 2 years of contributory service; or

(c) attained age 65.

A reduced pension is provided to such a terminating member who had reached age 55 and completed at least 2 years of contributory service, or attained age 60 but had not completed 2 years of contributory service.

Under certain conditions, the contributory service requirements mentioned above can include service during certain periods of child rearing.

Section 78 (4) provides that, before authorizing the payment of an immediate pension, the plan administrator may require a member and their employer to declare that no pre-arrangement to return to work with the same employer existed at the time of termination of employment.

Calculation of Unreduced Pension

Section 54 provides that the unreduced lifetime monthly pension payable to a member terminating employment on or after January 1, 2002, in the form of a single life annuity guaranteed for 10 years (the "normal form"), is calculated as the sum of the following:

(a) 2 per cent of the member's highest average salary multiplied by the number of years of pensionable service accrued before January 1, 1966;

(b) 1.7 per cent of the lesser of

  (i) the member's highest average salary; and

  (ii) 1/12 of the YMPE for the calendar year immediately before the effective date of the pension;

  multiplied by the number of years of pensionable service accrued after December 31, 1965 and before January 1, 2016[1];

[1] Prior to September 1, 2009, service was limited to 35 years.

(c) 2 per cent of the excess of the member's highest average salary over the amount determined under paragraph (b) (ii), multiplied by the number of years of pensionable service accrued after December 31, 1965 and before January 1, 2016[1]; and

(d) 2 per cent of the member's highest average salary multiplied by the number of years of pensionable service accrued after December 31, 2015.

In addition, the member is entitled to a monthly benefit, payable until the earlier of the death of the member and the member reaching age 65, that is:

(a) 0.3 per cent of the lesser of

(i) the member's highest average salary; and

(ii) 1/12 of the YMPE for the calendar year immediately before the effective date of the pension

multiplied by

(b) the number of years of pensionable service accrued after December 31, 1965 and before January 1, 2016[1].

(Prior to January 1, 1999, pensions were calculated under a 1.3 per cent/0.7 per cent lifetime/bridge formula for service accrued on or after January 1, 1966. This benefit formula was amended to 1.35 per cent/0.65 per cent for plan members terminating employment between January 1, 1999 to December 31, 2001. The YMPE integrated benefit formula of 1.7 per cent/0.3 per cent applies to plan members who terminated employment on or after January 1, 2002, with respect to pensionable service accrued after December 31, 1965 and before January 1, 2016, whereas the non-YMPE integrated benefit formula of 2 per cent applies with respect to pensionable service accrued by plan members after December 31, 2015.)

Highest average salary means one-twelfth of the average annual salary earned by a member during the 5 years of pensionable service (not necessarily consecutive) in which the salaries were highest (or, if the member has accrued less than 5 years of pensionable service, the total number of years and partial years of pensionable service). [Part 2 Division 2]

The calculation of the pension payable to a deferred member who terminated employment on or after January 1, 2002, and who is entitled to an unreduced pension is detailed in section 54. The pension is calculated on the basis of the single life guaranteed option with a term of 10 years using a benefit formula of 1.7 per cent/0.3 per cent for service accrued up to December 31, 2015 and a benefit formula of 2 per cent for service accrued after December 31, 2015.

Section 45 stipulates that the pension payable to a deferred member who terminated prior to January 1, 2002 will be based on the rules in force at the date of termination.

Accordingly, a member who terminated prior to January 1, 2002, but after January 1, 1999 will receive a pension on the basis of a single life guaranteed option with a term of 10 years, but using a benefit formula of 1.35 per cent/0.65 per cent.

A member who terminated prior to January 1, 1999 will receive a pension in the form of a single life annuity (no guarantee), using a benefit formula of 1.3 per cent/0.7 per cent

A member who has made voluntary additional contributions in the past (these are no longer accepted) will be granted an additional pension or may take a refund, including interest at fund interest rates on those contributions.

Calculation of Reduced Retirement Benefit

Section 55 (1) provides that if a member referred to in section 45 (1) or section 50 terminated employment on or after January 1, 2002 and, on the effective date of the members' pension, the member has not either attained age 65 or age 55 and completed at least 35 years of contributory service, the lifetime and bridge benefits payable to the member need to be reduced as follows:

(a) for pensionable service accrued prior to January 1, 2016:

  (i) sections 55 (2) and 55 (5) provide that if the member has not reached age 60 and has completed 2 years of contributory service, the benefits are reduced by a percentage equal to 3 per cent for each year of age by which the member is less than age 60, unless the member while an active member did not reach age 50, did not complete 10 years of contributory service or did not complete at least 8 months of contributory service in the 24 months preceding their termination of employment, in which case a percentage equal to 5 per cent applies;

  (ii) section 55 (3) provides that if the member has reached age 60 and completed 2 years of contributory service, the benefits are paid without reduction; and

  (iii) section 55 (4) provides that if the member has reached age 60 and has not completed 2 years of contributory service, the benefits are reduced by a percentage equal to 5 per cent for each year of age by which the member is less than age 65;

(b) for pensionable service accrued after December 31, 2015, section 55 (6) provides the benefits are reduced by a percentage equal to 3 per cent for each year of age by which the member is less than age 65.

Where a pension is reduced the reduction is prorated for fractions of years.

Section 55 (8) provides that a reduced pension benefit must have an actuarial present value that is at least equal to the actuarial present value of the pension benefit payable at normal retirement age.

In the case of members who terminated employment on or after January 1, 2002 and prior to January 1, 2016, lifetime and bridge benefits are reduced as outlined above under point (a).

Alternative Types of Pensions

Section 56 provides that a pension may be granted on the single life plan with a guaranteed period (5, 10 or 15 years), joint life and last survivor plan with a guaranteed period (5, 10 or 15 years), temporary life plan or a combination of these plans with the approval of the plan administrator. The amount of any pension granted on a form other than the normal form is calculated on an actuarially equivalent basis.

Where a member has a spouse at retirement, the member is required to elect a 60 per cent joint life and last survivor plan, unless the spouse waives this requirement in writing or there is a written agreement or court order made under Part 5 or 6 of the *Family Law Act* that is filed with the plan administrator. This option provides for a reduced amount payable to the member, continuing to the spouse on death of the member at 60 per cent of the initial reduced amount. A spouse is as defined in the PBSA, and includes a common-law or same-sex spouse.

Disability Pensions

Section 60 provides that a member is entitled upon application to a disability pension if the member, before reaching age 65, is totally and permanently disabled, has completed 2 years of contributory service and is not eligible for a monthly income benefit from a group disability plan. Despite the above provisions, a member who has received a lump sum payment instead of a monthly income benefit under a group disability plan is not eligible to receive a disability pension.

The disability pension is equal to the full unreduced lifetime portion of the pension (i.e. there is no additional bridge pension to age 65) earned to the date of disability.

Part 6 outlines the application process for a disability pension.

Sections 12 (5) and 99 (2) provide that if a member is receiving a monthly income benefit from an approved group disability plan, the member and employer do not make contributions and the member is not entitled to a pension under the Plan, but the period for which the member receives such group disability income benefit is considered pensionable service, with the final pension based on the highest average salary at disablement increased to retirement in accordance with changes in the consumer price index.

Shortened Life Expectancy Benefits

Part 6.1 establishes a member's entitlement to benefits in the event of shortened life. Under this part, a member entitled to receive a benefit from the Plan and having an illness or disability that is certified by a medical practitioner to be terminal or likely to shorten the member's life considerably may, subject to and in accordance to the Pension Benefits Standards Regulation, elect to convert all or part of their benefit to a series of payments for a fixed term or to receive a lump sum equal to or of a lesser amount to the commuted value of the benefit.

Payments made to the member subsequent to a payment made under this part will be actuarially reduced to reflect that payment.

Pre-retirement Death Benefits

The pre-retirement death benefits for active and inactive plan members who die, on or after September 30, 2015, are covered in section 69 as follows:

(a) if there is no surviving spouse or a valid spousal waiver has been filed, the benefit payable to the beneficiary is a payment of the greater of a refund of member's contributions with interest and the full commuted value of the regular pension earned to the date of death. If a spousal waiver has been filed, the surviving spouse cannot be designated as beneficiary.

(b) if the member has not attained age 55 at the date of death, and there is a surviving spouse and a valid spousal waiver has not been filed, the spouse may elect to receive as a benefit either of the following:
    (i) the greater of a refund of member's contributions with interest and the full commuted value of the regular pension earned to the date of death; and
    (ii) an immediate pension that is actuarially equivalent to the full commuted value of the regular pension earned to the date of death.

(c) if the member has attained age 55 on the date of death, and there is a surviving spouse and a valid spousal waiver has not been filed, then the benefit is an immediate pension to the spouse that is actuarially equivalent to the full commuted value of the regular pension earned to the date of death.

If a member terminated employment under the previous vesting and locking-in rules, left contributions on deposit and dies before taking a benefit from the Plan, the contributory service requirement in place at the time of termination (i.e. 10 years, 5 years or 2 years) is used to determine benefit eligibility.

For periods on and after January 1, 2004, interest credits for member's contribution are based on the average yields of 5 year personal fixed term chartered bank deposit rates, published in the Bank of Canada Review as CANSIM Series V122515.

Refunds, Vesting and Portability

Under sections 42 (1) (b) and 45, a terminating member is entitled to a deferred pension equal to the full normal pension accrued to the date of termination; this may be paid on a reduced basis at an early retirement age depending on the service to termination - see above "Eligibility conditions for pension" section.

Sections 42 (1) (c) and 46 provide for the payment of a lump-sum commuted value in lieu of the deferred pension, if the member has not attained age 55, subject to the commuted value being payable on a locked-in basis. Under certain limited conditions (small pensions, or small commuted values) the PBSA permits the election of a lump-sum payout, regardless of age, and on a non-locked-in basis.

Section 100 provides that the deferred vested pension of a terminating member is based on the highest average salary at termination, increased to retirement by the percentage increase granted to pensions for the period between the month of termination and the month the pension becomes effective[1].

Section 75 (3) (h) provides that the cost of the indexing described above is funded from the Inflation Adjustment Account.

A member who terminated employment under age 60 with less than 2 years of contributory service on or after April 1, 2000 and before September 30, 2015, may receive a refund of their contributions plus interest. For periods on and after January 1, 2004, interest credits are based on the average yields of 5 year personal fixed term chartered bank deposit rates, published in the Bank of Canada Review as CANSIM Series V122515.

Cost of Living Benefits (Indexing)

Section 73 sets out how cost of living benefits are to be administered. It provides for increases to retired members on January 1 of each year, with the benefits funded from the Inflation Adjustment Account. The benefit is based on the total amount of pension being received, including previous cost of living increases, less any portion of the pension that is a result of voluntary contributions (which are no longer permitted) and/or any temporary life annuity arising as a result of converting some or all of the regular pension to one of the optional forms, if the temporary annuity commenced before January 1, 2006. (The bridge pension to age 65, payable as part of the regular pension formula, is subject to indexing increases.)

[1] For increases prior to December 31, 1980, the increase in the highest average salary is in accordance with changes in the pension index.

Indexing granted on and after January 1, 2011 is calculated as the lesser of:

(a) the percentage change in the average CPI for the 12 months ending October 31 over the highest average CPI for any previous 12 month period ending October 31, and

(b) the sustainable indexing rate, which is to be recommended by the actuary during the triennial valuation and is subject to the approval of the board,

provided there are sufficient funds in the IAA to meet the cost of the increase.

Pensions will not be reduced in years of deflation. In years immediately following a period of deflation, pensions will only be increased as described above once there is net positive inflation over the period since the pensions were last increased.

Section 73 sets out additional requirements with regards to the cost of living benefit, including:

(a) the same uniform percentage increase will be granted in respect of all pensions eligible for adjustment;

(b) the increase is prorated if the pension has not been in payment for at least 12 months;

(c) the total capitalized value of all cost of living benefits granted on January 1 must not exceed the amount in the Inflation Adjustment Account on the preceding September 30; and

(d) the capitalized value of all cost of living benefits granted annually is transferred from the Inflation Adjustment account to the Basic Account.

The Fund

Section 75 provides that the Pension Fund is divided into the following four accounts:

(a) the **Basic Account**, consisting of all the assets in the fund other than assets in the Inflation Adjustment Account, the Supplemental Benefits Account and the Retirement Annuity Account;

(b) the **Inflation Adjustment Account**, consisting of:

(i) the contributions by each of the members under section 5 (1) (c);

(ii) the matching employer contributions under section 6 (1) (c);

(iii) the net investment income earned on the Inflation Adjustment Account; and

(iv) the income, as determined by the plan administrative agent, that is earned on other fund assets held in the Basic Account in respect of pensions being paid and that is in excess of the investment return anticipated in the most recent actuarial valuation;

less:

(v) amounts transferred to the Basic Account in respect of capitalized cost of living benefits granted under section 73 and 88;

(vi) refunds to plan members in respect of the contributions made to this account under section 5 (1) (c), or amounts otherwise transferred out of this account in respect of member and employer contributions allocated to this account;

(vii) amounts determined by the plan administrative agent in respect of the portions of commuted value payments or other transfers out of the Plan that are attributable to cost of living adjustments;

(viii) amounts transferred to the Basic Account that are equal to the capitalized value of increases in deferred pensions resulting from increases in highest average salaries under section 100; and

(ix) amounts transferred to the Supplemental Benefits Account, if any, as specified by the board;

(Section 12 (3) of the JTA also permits the Board to transfer portions of any actuarial surplus in the Basic Account to the IAA.)

(c) the **Supplemental Benefits Account**, consisting of assets required for the administration and payment of benefits that are non-registrable under the *Income Tax Act*; and

(d) the **Retirement Annuity Account**, consisting of voluntary contributions made under the previous statutes, and interest earnings thereon.

Income Tax Act Limits

The *Income Tax Act* imposes certain limits on the contributions that may be made to, and the benefits that may be paid from, a registered pension plan. However, in total, the contribution requirements from, and the benefit promises to plan members have not been altered under the Plan. To this end, a Supplemental Benefits Account has been created to cover the financing and payment of benefits in excess of those registrable under the *Income Tax Act*.

The excess benefits are paid on a current cash basis, by allocating from the regular employer contributions, the amounts necessary to maintain the Supplemental Benefits Account at a zero balance. Effectively, from a plan member's perspective, it is expected that these procedures will be invisible - the total contribution and benefit obligations remain unchanged. We have ignored the implications of all such internal restructuring in completing the primary, Basic Account valuation. In the plan summary herein, and elsewhere in this valuation report, our references to contributions/benefits to/from the Basic/Inflation Adjustment Accounts are inclusive of the allocations to/from the Supplemental Benefits Account; in general, the allocations to/from the Supplemental Benefits Account have not been referenced.

We have also completed supplementary funding valuations recognizing the income tax limits on pensions. We understand that these limits are applied only in respect of service after 1991. The maximum annual pension permitted (before application of any early retirement reductions, where applicable) is the lesser of:

(i) $2,944.44 (for 2018) multiplied by the years of service; and

(ii) 2 per cent multiplied by the years of service further multiplied by the average of the best 3 years of remuneration paid to the member.

Under the income tax rules, the flat $2,944.44 limit will be automatically indexed each year.

Other Items

1. The College Pension Plan Post Retirement Group Benefit Rules, made under article 13 of the JTA, set out the non-pension (i.e., group) benefits that are provided for retired members. These post-retirement group benefit rules replaced the College Pension Plan Post Retirement Group Benefit Regulation, B.C. Reg. 490/2003, effective June 22, 2012.

   Effective September 1, 2009, the member is responsible for paying 100 per cent of the premium for extended health and dental benefits. Previously, the cost of those benefits was carved out from employer contributions to the IAA. This carve out was limited to a maximum of 1 per cent of pensionable salary (out of the total employer IAA contribution at that time of 1.09 per cent).

   Effective April 1, 2004, the member is responsible for paying 100 per cent of the premiums for coverage under the Medical Services Plan ("MSP").

2. Section 9 of the JTA provides that all expenses incurred in the administration of the Plan are to be paid from the fund.

3. A maximum of five years taken to raise a child may be recognized in establishing eligibility for a pension provided the member has a record of pensionable service immediately before and after the child-rearing period(s). [Section 13]

4. Section 57 enables an employer to request the plan administrative agent to adopt a Special Retirement Incentive Plan (SRIP), whereby the age and service conditions, or the early retirement percentage reductions, or both, may be adjusted. Where the plan administrative agent agrees, the administrative agent must also determine the members eligible for the SRIP, the period it remains open, the conditions applicable to the incentives, the additional costs to the employer, and the timing of these payments to fund the SRIP.

5. In 1999, the definitions of, and references to, approved and reciprocal employers were removed from the Plan by Bill 18 (1997), to comply with *Income Tax Act* requirements. In general, these provisions allowed for portability among various plans (mostly the four public sector plans in B. C.), whereby service and salaries were commonly recognized in all of the plans. The arrangements for the four public sector plans in B.C. were replaced by a transfer of reserve agreement, whereby the plan member

could elect to have a reserve transferred and then be covered for full service by the rules of the importing plan. The College Pension Plan withdrew from the Interplan Pension Transfer Agreement effective October 31, 2002 and negotiated three separate "bilateral" agreements with the Municipal, Public Service and Teachers' Pension Plans. On April 1, 2004, these "bilateral" service transfer agreements with the Municipal, Public Service and Teachers' Pension Plans were replaced with the Public Sector Transfer Agreement.

Effective April 1, 2010, reciprocal transfers between the College, Municipal, Public Service and Teachers' Pension Plans are made exclusively under the National Public Service Pension Transfer Agreement (NTA). Under the NTA, as with the Public Sector Transfer Agreement (and the previous bilateral agreements), if the importing plan's benefits are more generous, the transferred service is pro-rated based on each plan's benefits. Members may pay for any shortfall, subject to CRA approval, within deadlines set by the plans. Members can also choose to leave their entitlements with their respective plans and apply for the appropriate benefits available from each plan at termination and/or retirement.

Appendix B: Actuarial Methods and Assumptions

The significant actuarial assumptions are summarized below.

	Funding Valuation	Sustainable Indexing Valuation
Investment Return	6.25% p.a. (same as previous valuation)	6.5% p.a. (same as previous valuation)
General Salary ("across-the-board") Increases	3.5% p.a. (same as previous valuation)	3.25% p.a. (same as previous valuation)
Seniority Salary Increases	Annual percentages varying by age and sex	Same
CPI Increases	2.75% p.a. (same as previous valuation)	2.5% p.a. (same as previous valuation)
Pension Indexing	▪ Future indexing of pensions and deferred pensions ignored, as will be covered by Inflation Adjustment Account ▪ Future indexing (by inflation) of wage base for disability accruals assumed to be a charge to the Basic Account and to be 2.75% p. a. (same as previous valuation) ▪ Indexing to date is capitalized and forms part of pension liability	▪ Future indexing of pensions and deferred pensions at “Sustainable Indexing Rate” – This rate is calculated and is the primary output of this valuation ▪ Future indexing (by inflation) of wage base for disability accruals assumed to be a charge to the Basic Account and to be 2.5% p.a. (same as previous valuation) ▪ Indexing to date is capitalized and forms part of pension liability
Asset Values	▪ Assets carried at smoothed market values ▪ Smoothed value restricted to a range of 92% to 108% of Market Value	▪ Assets carried at smoothed market values ▪ Smoothed value restricted to a range of 95% to 105% of Market Value
Costing Method	▪ Contributions are based on an entry-age funding approach	▪ Required contributions are based on an entry-age funding approach ▪ Contributions are set equal to the funding valuation basic normal cost plus IAA contributions.

More detail with respect to the above, detail with respect to other assumptions, and comparisons with assumptions and approaches in the previous valuation follow.

1. Actuarial Methods

The plan has been valued on a going concern basis, which assumes that the plan will continue to operate indefinitely. The basis is used to estimate the funded position of the Plan, and to estimate the contributions required to be made to the Plan's fund.

The methodology used to calculate the valuation liabilities shown in the statement of actuarial position was as follows:

- The liability for current pensioners and active members was calculated by projecting the benefit payments to be made to those persons and to their eligible spouses using the actuarial assumptions described below and then discounting those projected payments to the valuation date at the investment return assumption.

- The liability for members currently receiving benefits from a long-term disability plan was calculated as if they would continue to earn service credits and ultimately receive a pension from the Plan.

- The liability for the inactive group (including those entitled to deferred vested pensions) was calculated on the assumption that a proportion (based on present working status, contribution balance, length of credited service and date of last contribution) would again become contributing members of the Plan and a further proportion (based on similar, but different, criteria) would collect deferred vested pensions.

- The liability for the remaining inactive members was calculated as twice their accumulated refund values.

In order to test the adequacy of the current contribution rates, we calculated the required member/employer contribution rate for current service in accordance with the entry-age actuarial cost method, based on the data for those members who joined the plan in the last five years prior to the valuation date and the actuarial assumptions described below. This method produces the level rate of the member/employer contributions sufficient to provide the benefits for the average future new entrants to the plan. The cost so determined is also referred to as the normal actuarial cost and is calculated on an aggregate basis for all entrants as a level percentage of salaries.

The valuation assets consist of:

(i) The Basic Account; and

(ii) The present value of future member and employer contributions at the entry-age normal cost rates, for the closed active group, for the basic non-indexed benefits.

(iii) The present value of any existing amortization requirements established at previous valuations.

The funded position, including the present value of any previously established unfunded liability amortization requirements, is then considered. If the assets exceed the liabilities, then the difference between them gives rise to an actuarial surplus. If the liabilities exceed the assets, then there is an unfunded liability. Adjustments to the normal cost, sufficient to amortize the surplus or unfunded liability were then determined, as a percentage of payroll, as follows:

(1) If the result is an unfunded liability amortize it over the 15 year period commencing September 1, 2019[1] (allowing for the one-year time lag required by the PBSA); and

(2) If the result is a surplus (the result of a gain since the last valuation), apply the gain to amortize or reduce the previously identified unfunded liabilities, starting with the oldest established. If, after removing all previously established amortization amounts there is still a surplus, first set aside a rate stabilization reserve equal to 5% of the net liability, and then amortize any surplus in excess of that amount over 25 years and 15 years to obtain the reference rates required by the funding policy.

The required contributions are the sum of the normal actuarial cost and the amounts required to amortize the unfunded actuarial liability/surplus.

The contribution rates have to comply with the going concern funding requirements of the PBSA. This means that if there is an unfunded liability, it must be amortized over 15 years from one year after the date it is established as described above. If there is a surplus, the contribution rate may not be less than the normal cost, reduced by the rate that amortizes the surplus in excess of 5% of net liabilities over not less than 5 years.

The actuarial procedures followed are substantially the same as those in the previous valuation.

[1] We use an unadjusted 15 year rolling amortization period for the supplementary indexed valuation.

2. Treatment of Member and Pensioner Data

Data as of August 31, 2018 were prepared by the Pension Corporation for 13,822 active members, 1 member on a leave of absence, 8,025 pensioners, 258 members receiving benefits from a long-term disability plan, 6,536 inactive members plus a further 10 non-retired individuals with very limited data, 4,789 active member terminations and 395 pensioner terminations during the period September 1, 2015 to August 31, 2018. The Pension Corporation advised us that the data supplied are generally proper, complete and in accordance with specifications, unless otherwise noted.

Where possible, we compared totals with corresponding details in the Plan's audited Annual Reports. We also subjected the data to a number of tests of reasonableness and consistency, including the following:

- A member's (and partner's as applicable) age is within a reasonable range;
- A member's gender or date of birth did not change;
- A member joined the plan or commenced pension at a reasonable age;
- Accrued service increased by a reasonable amount (e.g. no more than 36 months since the last valuation and no more than 12 months in the valuation year);
- The salary level and the salary increase from the previous valuation was within a reasonable range;
- Pensions in pay increased by a reasonable amount (e.g. in line with the indexation since the last valuation); and
- We examined the additions to and deletions from each of the data files (i.e., the files for active employees, pensioners and terminated members) since the previous valuation to determine whether all Plan members were accounted for in this valuation, to check for duplicate records and to confirm pension amounts.

There were a number of discrepancies recorded during our examination of the data and we sought clarification of these from the Pension Corporation. Where necessary, we modified the data, our assumptions, or both, to compensate for these discrepancies.

The active member data includes a number of individuals who work less than full time. For the purposes of calculating liabilities and normal actuarial costs, we treated all members as if they were full-time employees after the valuation date; however, in calculating the amortization costs as a percentage of total future payrolls, we reduced the total payroll base by 10% to reflect the part-time employment (the same adjustment was applied at the previous valuation).

The active member data included 2,131 persons who had no salary or service reported for the year ending August 31, 2018, or with a last-contribution-date prior to August 2018. We excluded them from the active member base, and have included them with the inactive data as follows:

- We treated the 429 of them who had at least 3 years of service and a basic employee contributions with interest balance of at least $1,500, as if they would be reactivated on August 31, 2018 (we set their salaries equal to the average salaries for active members in the same age-sex category);
- We treated 1,463 of them who had a salary history in the last five years as if they were deferred vested members; and
- We held a liability equal to twice the basic employee contributions with interest balance for the remaining 239 persons.

In the previous valuation, we used a similar approach, except that we held a liability equal to twice the basic employee contributions with interest balance for all those who were not assumed to be reactivated.

Salary details were inappropriate (missing or very low) for 15 active members. We assumed that these 15 members had the same average earnings as for other actives in the same age-sex category.

We calculated the liability for 1 member on a leave of absence on the assumption that the member would be reactivated on September 1, 2018 (with assumed average salary equal to the average salary for active members in the same age sex category).

The liability for 252 of the members on long-term disability was calculated as if these individuals would ultimately collect deferred vested pensions starting at age 63, with deferred pensions on the basis of service projected to retirement date and the actual salaries indexed to the valuation date (where the actual salary detail shown for those members was inappropriate, we used the average salaries for active members in the same age-sex category). We excluded 6 long-term disability members from the valuation because of missing, invalid or inconsistent detail. Liabilities of twice their basic employee contributions with interest balance were held for these members. A similar approach was used in the previous valuation.

We divided the 6,536 inactive members into two classes:

(i) 240 who were those with missing, invalid or inconsistent detail, or whose accrued pension equal to zero, or who were known to have taken a refund after the valuation date, and

(ii) The remaining other 6,296 inactive members.

We calculated liabilities for the second group on the assumption that 100% of this group would receive vested pensions. The liability for the first group was held as twice their basic employee contributions with interest balance. A similar approach was used in the previous valuation. With respect to the 10 remaining non-retired members with limited data, we held a liability equal to twice their basic employee contributions with interest balance.

The data from the Pension Corporation and our treatment of this data is summarised below. Further details on the active member data, the new entrant groups on which our entry-age costs are based, the inactive member data and the pensioner data are summarized in Appendices C, D and E.

	Pension Corp. Data	Valuation Treatment						
		Pensioners	Pensioner with zero liability	Active Members	Long Term Disability	Vested	Reactivate	Refund 2 x CWI[1]
Pensioners	8,025	8,017	8					
Active Members	13,822			11,691		1,463	429	239
Long Term Disability	258				252			6
Terminated Vested	6,536					6,296		240
Leave of absence	1						1	
Limited data	10							10
Total membership	**28,652**	**8,017**	**8**	**11,691**	**252**	**7,759**	**430**	**495**

3. Actuarial Assumptions

Investment Return and General Salary Increase Rates

Our actuarial costing method involves projecting future benefit disbursements and contribution and investment income. In such projections, the most significant assumptions are those that are made for the future rates of return to be earned by the fund and future general salary increases (which are across-the-board increases applying to employees regardless of service, rank or position).

(a) Funding Valuation – Excess Investment Return Threshold

The Funding Valuation investment return assumption is also significant for another reason. Since 1980, the provisions of the Plan relating to the indexing of pensions provide that the income to be credited to the Inflation Adjustment Account in respect of pensions being paid is determined by reference to the amount in excess of the investment return anticipated in the most recent actuarial valuation. A decrease in the investment return assumption, and hence in the excess return threshold, would have at least two effects:

(i) it would increase the amount of excess investment return allocated to the IAA, and hence increase the potential for future indexing; and

(ii) it would increase the costs of the basic non-indexed plan, provided benefit levels are not changed.

[1] Contributions with interest.

An increase in the investment return assumption would have the opposite effects. In this context, the excess investment return threshold takes on benefit design connotations as well, and thus consistency in the assumptions, from one valuation to the next, takes on added significance.

The previous valuation used a long-term investment return assumption of 6.25% per annum. As noted earlier, this also became the threshold rate used to determine excess investment return transfers to the IAA during the post-retirement period; effectively, this is the same as saying that the Basic Account will earn no more than 6.25% per annum during the post-retirement period.

(b) Actual Returns and Asset Mix

We have calculated market value returns on the total fund (i.e. Basic plus IAA), including non-invested assets (i.e. receivables, net of payables), net of investment-related expenses, and assuming that all cash flows occur at mid year, as 6.48% for 2016, 7.30% for 2017 and 10.32% for 2018. At August 31, 2018, approximately 64.6% of the total portfolio was invested in equities (including private placements, infrastructure and renewable resources), a further 14.8% in real estate, and the balance of 20.6% in fixed income (including mortgages).

(c) Expected Returns

After examining the net average investment return earned by the fund's investments, the yield on investments made in recent years, the likely future trend of investment returns in general, the investment practices, and the provisions of this Plan - e.g. the allocation of excess investment income to the Inflation Adjustment Account - we have concluded that a reasonable best estimate of the long term investment return on the plan's assets is 6.50% (no change from the previous valuation). We also concluded that a reasonable best estimate of the real return on the assets, i.e., the investment return in excess of inflation, is 4% (no change from the previous valuation).

In setting the Funding Valuation assumptions, it is necessary to reduce these expected returns by a margin, so that the resulting liabilities have a suitable provision for adverse deviations. Following discussions with the Board regarding the appropriate adjustments to the best estimate assumptions and taking into account the requirements of the Board's funding policy, for the purposes of this valuation we kept our long-term investment return assumption of 6.25% per annum. We also continued with our previous valuation assumption for the real return of 3.5%. In other words, there is a margin of 0.25% on the investment return assumption, and a margin of 0.5% on the real return assumption (no change in the margins compared to our previous valuation).

The following table shows the development of the investment return assumption:

	Discount rate
Weighted average return	6.39%
Diversification and rebalancing effect	0.30%
Provision for investment related expenses	(0.28%)
Value added from active management	0.08%
Rounding	0.01%
Estimated net investment return before margin	**6.50%**
Margin for adverse deviation	(0.25%)
Discount return assumption (rounded to nearest 0.25%)	**6.25%**

To determine the going concern discount rate, our model determined expected long term capital market returns, standard deviations and correlations for each major asset class by using historic returns, current yields and forecasts. We then stochastically generated projected asset class returns for 5,000 paths over 30 years to create expected returns for each major asset class and applied these to the Plan's target asset mix.

The allowance for value added from active management was derived from fee estimates provided by BCI for passively managing the plan's long term asset mix. As the sustainable indexing target is not guaranteed, and the primary objective of the sustainable indexing approach is to improve intergenerational equity, it is not appropriate to include margins in the sustainable indexing basis. The Sustainable Indexing Valuation therefore assumed a nominal investment return of 6.50% and real investment return of 4.0%.

(d) Real Return and Salary Relationships - Derive Salary Assumption

The 6.25% investment return assumption used in this valuation was viewed as consisting of a real return component of about 3.50% per annum plus a long-term underlying inflation assumption of about 2.75% per annum. This can also be viewed as a best estimate of future inflation of 2.50% (derived from the best estimate nominal return assumption of 6.50% less the best estimate real return assumption of 4.0%), plus a margin for adverse deviations of 0.25%.

The general salary increase assumption used in the 2015 valuation was 3.50% per annum. This was viewed as consisting of the underlying inflation assumption of 2.75% per annum, plus a real salary increase component of 0.75% per annum. For this valuation, we continued with the real salary increase assumption of 0.75% and the general salary increase assumption of 3.50%. The real salary increase assumption of 0.75% consists of a best estimate of real salary increases of 0.50%, plus a margin for adverse deviations of 0.25%.

For the Sustainable Indexing Valuation, the general salary increase assumption is 3.25% per annum. This is made up of the best estimate inflation assumption of 2.50% plus real salary increase of 0.75%.

These assumptions are unchanged from the previous valuation. The impact of these assumptions on the Funding Valuation result is discussed further below.

(e) Impact of Investment Return and Salary Assumptions on the Valuation

During the **post-retirement period**, the excess investment return threshold is critical as this is the discount rate for the Basic Account post-retirement liabilities. It also sets the excess investment return threshold, which puts a ceiling on the amounts the Basic Account can effectively earn on the portion of the assets that support post-retirement liabilities. For example, if the threshold is 6.25%, then, provided the long-term returns exceed 6.25% on average, all of the excess will be transferred to the IAA, i.e. the Basic Account will only retain 6.25% on these assets.

During the **pre-retirement period**, it is the relationship, i.e. the net difference, between the investment return and general salary increase assumptions that is the key, rather than their absolute levels - projected benefits increase each year by the salary assumption and are then discounted by the investment assumption, i.e. the net result is that the liabilities are effectively being discounted by the net difference between the two assumptions. For example, the long-term assumptions we have used in this valuation (i.e. 6.25% investment return, 3.50% salary, 2.75% underlying inflation) would produce results similar to those using assumptions of 6.50% investment return and 3.75% salary, with 3.0% underlying inflation; or 6.0% investment return and 3.25% salary, with 2.5% underlying inflation, etc. Thus, the underlying inflation assumption itself is not material to the result.

(f) Summary of Interrelationships

The annual investment return and general salary increase assumptions, and their underlying economic interrelationships, are summarized below. These assumptions are unchanged from the previous valuation.

	Funding Valuation	Sustainable Indexing Valuation
	2015 and 2018	2015 and 2018
1. Investment return = excess investment return threshold	6.25%	6.50%
2. Real return rate	3.50%	4.00%
3. Implied underlying inflation = 1 - 2	2.75%	2.50%
4. Real salary increase	0.75%	0.75%
5. General salary increase = 3 + 4	3.50%	3.25%

(g) Actual vs. Expected Salaries; Adjust Data Salaries

The 2018 valuation data indicates that average annual earnings increased by about 5.0% from mid-2015 to mid-2018 (i.e. about 1.63% per annum), as compared with an expected increase of about 10.9% (i.e. about 3.50% per annum) on the basis of the assumptions used in the 2015 valuation.

The input data salaries provided to us for this valuation were the annualized earnings during fiscal 2018. We took them without further adjustment as being equal to the salary rates on the valuation date (this may slightly understate the actual salary rates at the valuation date). Thereafter, the assumed rates of salary increase are applied continuously during each future year.

(h) YMPE Increase

We assumed that the YMPE under the Canada Pension Plan would increase at the general salary increase rate (Funding Valuation = 3.50% per year, Sustainable Indexing Valuation = 3.25%) from its 2019 level of $57,400. In the previous valuation we assumed that the YMPE would increase at the same rate of 3.50% per year for Funding Valuation and 3.25% per year for Sustainable Indexing Valuation but from its 2016 level of $54,900.

Pension Indexing

(a) Basic Funding Valuation

Indexing supplements on and after January 1, 1982 are provided on an annual basis and are limited to those amounts that can be appropriately financed by the balances available in the Inflation Adjustment Account. Thus we do not need to allow for future indexing in our calculations as the costs of this indexing were fixed at 1.76% of salaries to be paid by each of the members and the employers, as of the valuation date. Effective April 1, 2019, member and employer contribution rates to the Inflation Adjustment Account were increased from 1.76% to 1.85% of salaries each. With respect to indexed supplements granted through August 31, 2018, the present values have been included in the actuarial liabilities for pensions in the course of payment and thus form part of the determination of the recommended contribution.

As in the previous valuation, we ignored the future pre-retirement escalation that applies to vested pensions, since the cost of this "indexing" is also charged to the Inflation Adjustment Account.

With regard to the vested pensions of members who have terminated employment, the amounts of deferred pensions quoted to us include indexing during the deferred period to date. We understand that such transfers from the Inflation Adjustment Account do not occur until retirement (theoretically, such transfers should be made on an annual basis as the indexing occurs, so as to reduce the inter-generational transfer of the costs of such indexing). We have therefore adjusted the deferred pension amounts to remove this indexing so that the Basic Account liability is aligned with the allocation of assets between the Basic and IAA accounts. We made the same adjustment in the previous valuation.

The indexing of salaries before retirement in the case of members on long-term disability is, on the other hand, a charge to the Basic Account rather than to the Inflation Adjustment Account. Accordingly, in valuing the deferred pensions for those currently on long-term disability, we have made an allowance for this by applying an escalation assumption (at the full underlying inflation assumption) of 2.75% per annum during the deferral period to retirement.

(b) Sustainable Indexing Valuation

All current and future pensions are assumed to increase at the sustainable indexing level.

For those on long term disability, we allow for escalation in the deferral period at a rate of 2.5% per annum, which equals the best estimate assumption for inflation. In other words, for the sustainable indexing valuation, the escalation assumption does not include the 0.25% margin taken into account in the funding valuation.

Asset Values

The fund's annual reports record assets on a market value basis. We relied on these annual reports for the asset values used for the years ending August 31, 2016 to August 31, 2018.

As in the previous valuation we applied a five year smoothing technique to these assets. We believe a smoothing approach is appropriate as it cushions the actuarial valuation results against dramatic swings in market value that can occur.

To obtain the unconstrained smoothed value, we first determine the actual return on the basis of market values during the year (taking into account the timing of non-investment related cashflows, i.e. the net contributions minus benefits and non-investment expenses). We then determine an assumed return for the year at a rate equal to the assumed underlying real return rate plus the year-over-year change in the consumer price index. The difference between these two returns is then spread over a five year period, recognizing one-fifth of it in each of the current and four succeeding years. This approach effectively spreads the difference between (a) the total investment return (including both realized and unrealized capital changes) and (b) a hypothetical return based on a long-term real return rate, over a five year period.

(a) Funding Valuation Assets

The smoothed value of assets is then restricted to a range of 92% to 108% of market value, if necessary (the same range was applied in the previous valuation). This means that in periods of significant market decline (growth) the smoothed value does not become too large (low) relative to the market value - effectively the constraint accelerates recognition of very poor (strong) market returns and allows the contribution rate to more appropriately reflect the actual returns earned by the plan. This lower constraint of 92% applied as at August 31, 2015.

The application of this approach to the total fund yields the following results:

Total Fund Smoothing

Target Return	2016	2017	2018
1. Aug-over-Aug increase in CPI	1.1%	1.4%	2.8%
2. Base return = (1) + 3.5%	4.6%	4.9%	6.3%
Year-end asset values – $000's			
3. Market value	4,320,310	4,617,748	5,071,002
4. Smoothed value	4,012,650	4,373,311	4,810,781
5. Ratio of (4) ÷ (3)	0.929	0.947	0.949
Annual Returns			
6. Market value	6.5%	7.3%	10.3%
7. Smoothed value	7.5%	9.4%	10.5%

Using the relationship between the market and adjusted values shown in line 5 above, and applying this relationship to the Basic Account and Inflation Adjustment Account balances, we get:

Year-end asset values – $000's

Basic Account	2016	2017	2018
8. Market value	3,812,417	4,003,009	4,319,862
9. Smoothed value	3,540,925	3,791,113	4,098,186
10. Ratio of (9) ÷ (8)	0.929	0.947	0.949
Inflation Adjustment Account			
11. Market value	507,893	614,739	751,140
12. Smoothed value	471,725	582,198	712,595
13. Ratio of (12) ÷ (11)	0.929	0.947	0.949

(b) Sustainable Indexing Valuation Assets

As mentioned previously, a primary reason for using a sustainable indexing approach is to improve intergenerational equity. Intergenerational equity would be best served by using best estimate assumptions (as we are doing) and not smoothing the assets. However, an important secondary objective is to attempt to stabilise the indexing target over time. This secondary objective is aided by smoothing the assets. In discussion with the Board, it was concluded that using a best estimate basis together with a low smoothing limit would provide a suitable balance between these two objectives. Accordingly, in our assessment we have used the five year smoothed value of assets, restricted to a range of 95% to 105% of the market value of assets. This lower constraint applied as at both August 31, 2015 and August 31, 2018 where the smoothed assets for the sustainable indexing purposes were capped at 95% of market value.

Mortality

Because of limited mortality experience, and given the similarity of the plans, we used the same basis as for the B.C. Teachers' Pension Plan valuation as at December 31, 2017, namely:

(a) The incidence of mortality both prior to and after retirement (other than employees retired on account of disability) was assumed to be in accordance with 70% for males and 60% for females of the rates in the 2014 Public Sector Mortality Table (CPM2014Publ) for ages below 80, and 100% for males and 90% for females of the rates of CPM2014Publ for ages 80 and above, all projected using CPM Improvement Scale B (CPM-B).

(b) For deferred vested pensions, mortality was ignored during the deferral period before retirement.

(c) For employees retired on account of disability we used 75% for males and 80% for females of the mortality rates (applicable in 2012) for similar retirees used for the valuation of the Pension Plan for the Public Service of Canada as at March 31, 2011.

The mortality assumptions were unchanged from the previous valuation.

Withdrawal

We examined the rates of withdrawal for reasons other than death, retirement or disability over the period September 1, 2015 to August 31, 2018 and compared this with the experience observed and the rates used for previous valuations. The observed rates for all members were higher than assumed in previous valuations. As a result, we increased the withdrawal rates used for the previous valuation by 5%**.**

Sample withdrawal rates are shown in the following tables.

A. Withdrawal Rates Applicable in the First 3 Years of Service (These include terminations from disability)

Age at entry	2015 valuation			2018 valuation		
	1st year	2nd year	3rd year	1st year	2nd year	3rd year
Males						
20	.200	.157	.113	.210	.165	.119
30	.200	.157	.113	.210	.165	.119
40	.200	.157	.113	.210	.165	.119
50	.200	.157	.113	.210	.165	.119
Females						
20	.085	.106	.092	.089	.111	.097
30	.220	.221	.143	.231	.232	.150
40	.194	.133	.106	.204	.140	.111
50	.194	.133	.106	.204	.140	.111

B. Withdrawal Rates Applicable After 3 Years of Service

Attained age	Males		Females	
	2015 valuation	2018 valuation	2015 valuation	2018 valuation
23	.088	.092	.127	.133
33	.052	.055	.088	.092
43	.036	.038	.037	.039
53	.036	.038	.034	.036

The withdrawal rates we have used do not extend past age 54.

Disability

The Plan provides for either the payment of a disability pension from the Plan or, for members receiving long-term disability benefits, the continued accrual of pension benefits. Because of limited experience, and given the similarity of the plans, we have continued to use the same rates as for the B.C. Teachers' Pension Plan valuation as at December 31, 2017. Since most members receive continuing disability service credits rather than an immediate pension, we have continued to value the disability cost for active members as a deferred pension (indexed before retirement) with continued accrual of service, rather than as an immediate pension. Based on an examination of those now retired who had, prior to retirement, been in receipt of disability service credits, we assumed that the deferred pensions would commence at age 63 (or, immediately, for those older than age 63). The same assumption was made in the 2015 valuation.

Sample disability rates are shown in the following table. No direct allowance is made for the possibility of an individual recovering from disability prior to retirement - the rates used have been reduced from the observed disability incidence to implicitly allow for such recoveries.

Sample Disability Rates

Age	2015 and 2018 valuations	
	Males	Females
25	.0002	.0001
35	.0002	.0007
45	.0014	.0022
55	.0046	.0059

The rates used for this valuation are 120% for males and 100% for females of the respective rates used for the valuation of the Canadian Public Service Superannuation Plan as at March 31, 2011. This is unchanged from the previous valuation.

Retirement

We examined the 2015-2018 retirement experience of members retiring from active service and compared this with the experience observed in our previous analyses of the retirement rates and with the rates used in the previous valuation. In general, the actual experience show fewer retirements than were indicated on the basis of the rates used in the previous valuation. We gave partial recognition to the observed experience by making modest adjustments to the rates previously used for retirement by slightly decreasing most of the rates for females, and also slightly decreasing the rates assumed for males aged 60 to 63 inclusive.

The rates used in this and the previous valuation, are as follows:

Retirement Rates

Age	Service	2015 valuation		2018 valuation	
		Males	Females	Males	Females
For unreduced retirement pensions					
55-59	35	.25	.25	.25	.22
For members over age 59 (unreduced for pre 2016 service, reduced for post 2015 service if less than 35 years of total service)					
60	10	.28	.32	.25	.32
61	10	.18	.22	.15	.22
62	10	.18	.22	.17	.20
63	10	.18	.26	.14	.24
64	10	.20	.28	.20	.28
65	0	1.00	1.00	1.00	1.00
For reduced early retirement					
55-59	at least 10 years, but age plus service add to less than 80	.02	.04	.02	.03
55-59	age plus service add to at least 80	.10	.12	.10	.12

Even though pensions are available with less than 10 years of service, we have continued to apply the retirement rates before age 65 only to those with 10 or more years of service, on the presumption that those with fewer than 10 years would not retire until age 65.

As for the previous valuation, we assumed that all deferred vested members at the valuation date will retire at age 60, or immediately if older than 60, and that members terminating service in future will subsequently retire at age 55.

Seniority Salary Scales

Seniority salary increases are in addition to the general salary increases and are intended to reflect increasing seniority, recognition of merit and promotion. We examined the seniority salary scales based both on the earnings history of the active members during the 3 year period ended August 31, 2018 and on the graduated average salaries of the active members as of August 31, 2018, and compared these with the experience observed and rates used in the previous valuation. Based on these investigations we decided to continue with the previous salary scales.

The annual seniority increases are assumed to reduce with age. Sample seniority increase assumptions at key ages are shown below. The assumptions represent the assumed seniority increase in the next year.

Sample Seniority Earnings Rates

Age	2015 and 2018 valuations	
	Males	Females
25	.036	.026
35	.022	.018
45	.007	.008
55	.002	.004
65	.000	.000

Proportion of Eligible Terminating Members Electing a Vested Pension

Following the introduction of the new PBSA effective September 30, 2015 which requires that a vested pension is payable for all service, we have valued all terminations as vested pensions. This is unchanged from the previous valuation.

Proportions of Members Married at Death

Given the pre-retirement death benefit, we value a commuted value on pre-retirement death for all members. As the benefit is the same regardless of marital status, the proportions of members assumed to be married at death are irrelevant for this valuation. The same assumption was made in the previous valuation.

Growth of Active College Population

We assumed in all the actuarial projections that there would be no future growth or decline in the College population. The same assumption was made in the previous valuation.

Expenses

Administration expenses are paid out of the College fund. These amounts totaled 0.59%, 0.54% and 0.51% of salaries during fiscal 2016, 2017 and 2018 respectively. The projected expenses provided by the Pension Corporation for the next three years estimate administration expenses will be similar to the levels seen in the past two years. Therefore, we continued with the expense provision of 0.60% of payroll used in the previous valuation, as part of the normal actuarial costs in the determination of the required contribution rates under the entry-age funding method. This provision represents the average projected expenses, expressed as a percentage of projected payroll, over the next valuation period. We also include a provision for the present value of expenses in the statement of actuarial position. The same methodology was used in the previous valuation.

As before, the investment management fees are excluded from our analysis above and from the expense provision we have made as they are reflected in the long-term investment return assumption.

Recognition of Child-Rearing Periods for Pension Eligibility

We continued to assume that this would only affect female members (while males are eligible for this benefit, the take-up rate for males does not justify an assumption that males will utilize it), and that, on average, it would increase the member's contributory service (which is used for determining pension eligibility) by 2 years; there would, of course, be no increase to the member's pensionable service (which is used for determining pension amounts). The impact of this would be to reduce the eligibility requirement for unreduced pensions from 35 years to 33 years, and we assumed that there would be no impact on the eligibility assumptions made for other benefits. The same assumption was made in the previous valuation.

Plan Termination

The Standards of Practice issued by the Canadian Institute of Actuaries generally require that a valuation report include a hypothetical wind-up valuation which reports on the funded status of a pension plan if it were to be wound up on the calculation date. However, this is not required if the plan does not define the benefits payable upon wind-up.

The Joint Trust Agreement, which sets out the governing framework under joint trusteeship, does not address wind-up, and neither do the plan rules, therefore the benefits on wind-up are not defined. Accordingly, as with previous valuations, we make no comment on the financial position of the plan if were to be wound up.

Funding Valuation: Fully Indexed Valuations – Assumption Changes

We made the following changes to the +assumptions when doing the fully indexed valuations:

- We combined the assets in the Basic and Inflation Adjustment Accounts, resulting in a smoothed asset value of $4,810,781,000;
- We applied an indexing assumption equal to the full assumed underlying inflation rate, i.e. 2.75% per annum. This indexing rate was applied both to pensions after retirement and during the pre-retirement period in the case of deferred vested pensions and disability salary accruals. Indexing is applied annually, in arrears; and
- We combined the contribution rates to Basic and IAA, i.e. we assumed a total member contribution rate of 8.39% + 1.85[1]% = 10.24%, and a total employer rate of 8.49% + 1.85[1]% = 10.34%.

Funding Valuation – Maximum Pension Rule – Assumption Changes

As noted earlier, we have not applied the maximum pension rules when doing the primary Basic and Basic-plus-Indexed valuations. We have applied them, as described below, when doing the supplementary valuations with benefits limited to the *ITA* maximums.

The maximum annual pension currently permitted under the income tax rules is the lesser of:

(i) $2,944.44 in 2018 ($3,025.56 in 2019) multiplied by the years of service; and

(ii) 2% multiplied by the years of service further multiplied by the average of the best 3 years of remuneration paid to the member.

While the Plan applies the ITA limits only in respect of service after 1991, we have, for ease of calculation, assumed that this limit applies on all service; this assumption does not affect the future normal costs, but the accrued liabilities will be slightly understated.

For an individual in this Plan to be currently affected by the $2,944.44 maximum the final average salary must be very high. While current salaries are not such as to cause many problems, the salaries projected in the future through application of the assumed salary increase rates outlined above are such that some individuals would be limited. However, under the income tax rules, the flat $3,025.56 limit is automatically indexed each year after 2019 in accordance with increases in the average wage. Accordingly, we have applied a 3.5% per annum increase to the $3,025.56 limit after 2019. (At the previous valuation the corresponding dollar limit was $2,818.89 for 2015, $2,890.00 for 2016, and was scheduled to be automatically indexed each year after 2016 in accordance with increases in the average wage; an increase rate of 3.5% was applied after 2016 to the $2,890.00 limit at the previous valuation.)

[1] The IAA contribution increased from 1.76% to 1.85% effective April 1, 2019 for both members and employers.

As with the previous valuation, in the tax-limited results, we valued the deferred vested pensions not yet in pay, in full, as provided to us, i.e. we were unable to carve out any "excess" portions. Supplemental pensions in pay were carved out.

Appendix C: Active Member Data as at August 31, 2018

Age group[1]		Active members August 31, 2018[2]			New entrants Sept. 1, 2013 to Aug. 31, 2018 and still active Aug. 31, 2018	
	Number	Average annual earnings[3] $	Average Pre 2016 service (years)	Average Post 2015 service (years)	Number	Average annual earnings[3] $
Males						
19-24	12	47,599	0.0	0.2	21	54,556
25-29	63	66,468	0.0	0.7	142	69,054
30-34	294	74,275	0.5	1.1	339	76,676
35-39	514	76,666	1.2	1.4	342	77,468
40-44	643	83,897	2.8	1.7	295	80,754
45-49	754	85,738	4.4	1.9	271	81,272
50-54	887	88,343	6.8	2.0	189	85,328
55-59	904	91,616	9.5	2.1	152	85,102
60 & over	1,108	91,381	10.5	2.1	89	80,283
Total males	**5,179**	**86,315**	**6.2**	**1.9**	**1,840**	**79,073**
Females						
19-24	11	42,628	0.0	0.3	29	56,947
25-29	135	62,531	0.1	0.8	250	65,645
30-34	460	70,301	0.5	1.2	465	71,469
35-39	722	75,906	1.4	1.5	455	74,709
40-44	933	80,812	2.9	1.7	397	77,320
45-49	1,073	83,734	4.5	1.8	326	79,086
50-54	1,092	85,869	6.7	2.0	266	79,233
55-59	1,073	87,614	8.7	2.1	154	80,373
60 & over	1,013	88,438	9.9	2.0	80	83,697
Total females	**6,512**	**82,719**	**5.5**	**1.8**	**2,422**	**75,110**
Total males & females	**11,691**	**84,312**	**5.8**	**1.8**	**4,262**	**76,821**

The average age of the 11,691 active members is 49.6.

[1] Age nearest birthday at August 31, 2018 for actives and at entry for new entrants.

[2] 2,131 actives reclassified as inactive data.

[3] Actual earnings in fiscal 2018 for those employed all year and annualized for others. Zero or very low earnings figures were replaced by the average earnings in the same age-sex group or the closest age group if there is only one member.

A comparison of the August 31, 2018 active membership with the August 31, 2015 active membership is as follows:

Active membership	Aug. 31, 2015	Aug. 31, 2018	Change 2015 to 2018
Males			
- Number	4,901	5,179	+ 5.7%
- Proportion of total	44.8%	44.3%	- 0.5%
- Average age (at 8.31)	51.1	50.5	- 0.6 years
- Average service	8.3	8.1	- 0.2 years
- Average salary	$82,362	$86,315	+ 4.8%
Females			
- Number	6,047	6,512	+ 7.7%
- Proportion of total	55.2%	55.7%	+ 0.5%
- Average age (at 8.31)	49.2	48.8	- 0.4 years
- Average service	7.5	7.3	- 0.2 years
- Average salary	$78,420	$82,719	+ 5.5%

The above comparison indicates a continuing increase in both the male and female membership during the 3 year inter-valuation period, with a slightly larger increase in the number of females and a marginal increase in the percentage of females. The average age has decreased for both males and females.

A comparison of the new entrant subset used at August 31, 2018 with that used at August 31, 2015 in determining the entry-age normal costs is as follows:

New entrants	Aug. 31, 2015	Aug. 31, 2018	Change 2015 to 2018
Males			
- Number	1,557	1,840	+ 18.2%
- Proportion of total	43.0%	43.2%	+ 0.2%
- Average age at entry	42.9	42.3	- 0.6 years
- Average salary	$74,438	$79,073	+ 6.2%
Females			
- Number	2,067	2,422	+ 17.2%
- Proportion of total	57.0%	56.8%	- 0.2%
- Average age at entry	41.6	41.1	- 0.5 years
- Average salary	$70,264	$75,110	+ 6.9%

The average age of new entrants has decreased for both males and females, by approximately the same numbers of months as the reduction in the average age of active population as a whole. The increase in average salary for new entrants is higher than the increase in average salary for the actives for both males and females.

Appendix D: Inactive Member Data as at August 31, 2018

1. Inactive Members Assumed Reactivated on Valuation Date

Age group[1]	Males				Females			
	Number	Average annual earnings[2] ($)	Average Pre 2016 service (years)	Average Post 2015 service (years)	Number	Average annual earnings[2] ($)	Average Pre 2016 service (years)	Average Post 2015 service (years)
Below 35	6	72,471	0.8	0.6	10	69,081	2.5	1.2
35-39	5	77,272	0.9	0.5	33	75,810	2.7	0.7
40-44	19	83,586	2.2	0.5	29	79,952	2.8	0.5
45-49	32	85,389	2.2	0.4	44	83,616	3.7	0.5
50-54	36	87,955	4.3	0.4	34	85,635	4.3	0.6
55-59	41	91,515	2.6	0.3	47	87,439	3.8	0.5
60 & over	47	91,483	4.8	0.5	47	88,575	3.3	0.3
Total	**186**	**87,957**	**3.3**	**0.4**	**244**	**83,502**	**3.4**	**0.6**

	Number	Average age	Average annual earnings[2]	Average service
Total males & females	430	51.6	$85,429	3.9 years

2. Members on Long-Term Disability

Age group[1]	Males				Females			
	Number	Average annual earnings ($)	Average Pre 2016 service (years)	Average Post 2015 service (years)	Number	Average annual earnings ($)	Average Pre 2016 service (years)	Average post 2015 service (years)
35-39	-	-		-	3	87,613	1.1	2.1
40-44[3]	6	76,403	2.1	2.1	10	81,764	4.4	2.3
45-49	6	92,833	5.5	2.3	16	84,601	7.6	2.4
50-54	10	85,471	11.4	2.6	31	85,709	9.0	2.4
55-59	17	91,513	12.4	2.7	45	85,507	14.3	2.5
60 & over	33	86,710	17.0	2.6	75	89,049	17.2	2.5
Total	**72**	**87,324**	**13.0**	**2.5**	**180**	**86,765**	**13.2**	**2.5**

	Number	Average age	Average annual earnings	Average service
Total males & females	252	56.4	$86,924	15.6 years

[1] Age nearest birthday at August 31, 2018.

[2] Assumed same earnings as per the average for active members of the in same age and sex.

[3] 1 male age 30-34 is included in the 40-44 row due to privacy.

	Number	Average age	Average pensionable service	Average salary	Expected average remaining Service life
Active and LTD Combined	**11,943**	**49.7**	**7.8**	**$84,367**	**7.7**

3. Other Inactive Members Assumed Electing Vested Pensions

Age group[1]	Males			Females		
	Average annual vested pensions			Average annual vested pensions		
	Number	Initial[2]($)	Offset at age 65($)	Number	Initial[2]($)	Offset at age 65($)
20-29	59	197	6	72	375	17
30-34	156	402	25	256	671	56
35-39	301	912	76	452	848	83
40-44	383	1,232	120	585	1,443	144
45-49	466	1,731	163	690	1,840	180
50-54	551	2,764	265	739	2,622	261
55-59	617	2,756	262	735	2,661	275
60 & over	872	1,834	204	825	1,538	188
Total	**3,405**	**1,894**	**187**	**4,354**	**1,805**	**186**

	Number	Average age	Average annual vested pension - initial	Average annual vested pension - Offset at age 65
Total males & females	7,759	50.8	1,844	186

4. Remaining Inactive Members

	Number	Member contributions with interest
Value at 2 x contribution with interest	495	$1,093,134

Average age is 51.1.

[1] Age nearest birthday at August 31, 2018.

[2] These pensions are assumed to commence at the first age at which the member is entitled to an unreduced pension (based on the provisions for pre-2016 service) assuming this is no earlier than age 60 i.e. at various ages between 60 and 65.

Appendix E: Pensioner Data as at August 31, 2018

1. Former Contributors

Age group[1]	Number of pensioners[2]	Annual Pensions ($000's)[3]				
		Single life	Joint life & survivor	Joint life & survivor with guarantee	Single life with guarantee	Temporary life
Male pensioners						
Less than 60	95	-	-	1,215	799	359
60-64	441	349	430	6,357	2,413	1,844
65-69	855	2,250	2,425	10,798	4,617	209
70-74	1,051	4,340	6,875	10,726	4,055	-
75-79	721	5,143	7,781	3,115	1,615	-
80-84	310	3,092	3,485	11	18	-
85-89	153	1,466	1,008	-	-	-
90 & over	71	684	196	-	-	-
Total	**3,697**	**17,324**	**22,200**	**32,222**	**13,517**	**2,412**
Female pensioners						
Less than 60	165	-	-	1,171	1,404	517
60-64	746	1,035	364	6,039	6,986	2,595
65-69	1,156	5,207	1,983	8,714	9,877	354
70-74	961	9,198	3,685	3,408	5,833	-
75-79	449	6,337	1,720	552	738	-
80-84	163	2,316	419	-	19	-
85-89	77	827	55	-	-	-
90 & over	55	639	-	-	-	-
Total	**3,772**	**25,559**	**8,226**	**19,884**	**24,857**	**3,466**
Grand Total	**7,469**	**42,883**	**30,426**	**52,106**	**38,374**	**5,878**

Supplemental pensions included in the above amounts are as follows:

Supplemental Pensions included	**174**	**165**	**246**	**141**	**-**

Average age of the 7,469 pensioners is 70.7.

[1] Age nearest birthday at August 31, 2018.

[2] These numbers include only those who were formerly contributors to the plan as well as pre-retirement limited members (i.e. divorced spouses with a pension interest). For the latter group, under the Family Relations Act, any temporary bridge benefit which is payable ceases at the date the original member reaches age 65 and, as a result, it is possible to have a bridge pension payable past the recipient reaching age 65.

[3] Including supplements to January 1, 2018.

2. Beneficiaries

Age group[1]	Number of beneficiaries[2]	Annual Pensions ($000's)[3]	
		Single life	Single life with guarantee
Male beneficiaries			
Less than 60	5	27	17
60-64	8	42	87
65-69	15	189	71
70-74	23	317	152
75-79	16	247	18
80-84	7	35	-
85 & over	7	40	-
Total	**81**	**897**	**345**
Female beneficiaries			
Less than 50	5	-	35
50-54	11	19	109
55-59	19	65	204
60-64	39	245	348
65-69	52	580	380
70-74	73	1,058	430
75-79	84	1,488	89
80-84	54	847	23
85-89	55	627	-
90 & over	51	583	-
Total	**443**	**5,512**	**1,618**
Remaining guarantees	**24**	**-**	**448**
Grand Total	**548**	**6,409**	**2,411**

Supplemental pensions included in the above amounts are as follows:

Supplemental Pensions included	**33**	**13**

Average age of the 524 beneficiaries is 75.1.

[1] Age nearest birthday at August 31, 2018.

[2] These numbers include spouses (or estates) currently receiving benefits where the former contributor is deceased.

[3] Including supplements to January 1, 2018.

Appendix F: Development of Required Contribution Rates

All of the figures shown herein are on a combined member/employer basis, as a level percentage of pay.

	2015	2018
Normal ("entry-age") actuarial cost portion	**%**	**%**
Males	16.30	16.20
Females	16.89	16.76
Combined	**16.63**	**16.50**

The change in the normal actuarial cost from 2015 to 2018 can be traced as follows:

	Combined
	%
Normal Cost at 2015 Valuation	**16.63**
▪ data changes	(0.10)
▪ assumption changes:	
▪ withdrawal rates	(0.04)
▪ retirement rates	0.01
Normal Cost at 2018 Valuation	**16.50**

Calculation of Required Contribution Rate

	2015	2018
A. Normal (entry-age) actuarial cost	16.63%	16.50%
B. Surplus (unfunded) actuarial liability on entry-age basis ($000s)	67,092	
		303,225
	%	%
25 years amortization	0.00	(0.72)
15 years amortization	0.00	(1.06)
PBSA amortization	0.00	(2.80)
Contribution rates after 25 years amortization	16.63	15.78
Contribution rates after 15 years amortization	16.63	15.44
Contribution rates after *PBSA* amortization	16.63	13.70
C. Minimum permissible contribution rate	**16.63%**	**15.78%**

Appendix G: Comparative Results

Comparative Funding Valuation Results on Fully Indexed Basis, and with Income Tax Limits

The results herein are analogous to those contained in Schedules 1, 3 and 5 in the body of the report. For ease of comparison, we have repeated the 2018 Basic Account results; selected 2015 comparisons are also shown. The results are included for:

- Basic (i.e. non-indexed) benefits only, no tax limits;
- Basic plus Indexed, no tax limits;
- Basic only, with tax limits; and
- Basic plus Indexed, with tax limits

Schedule G1 – Statement of Actuarial Position as at August 31, 2018

Present Plan – ($000's)

	Without Tax Limits		With Tax Limits	
	Basic Only	Basic + Indexed	Basic Only	Basic + Indexed
Assets				
Market value of Fund	4,319,862	5,071,002	4,319,862	5,071,002
Asset smoothing adjustment	(221,676)	(260,221)	(221,676)	(260,221)
Smoothed value of Fund	**4,098,186**	**4,810,781**	**4,098,186**	**4,810,781**
Actuarial present values of future contributions at entry-age rates	1,144,512	1,578,371	1,127,555	1,553,472
Total Assets	**5,242,698**	**6,389,152**	**5,225,741**	**6,364,253**
Actuarial present values for:				
▪ pensions being paid	1,986,625	2,556,865	1,977,717	2,545,439
▪ inactive members	215,614	329,394	215,614	329,394
▪ active members	2,695,734	3,661,689	2,688,044	3,651,795
▪ future expenses	41,500	41,500	41,500	41,500
Total Liabilities	**4,939,473**	**6,589,448**	**4,922,875**	**6,568,128**
Surplus (Unfunded Liability)	**303,225**	**(200,296)**	**302,866**	**(203,875)**
Selected 2015 Comparisons				
Total Assets	4,361,338	5,142,344	4,352,808	5,131,378
Total Liabilities	4,294,246	5,744,979	4,276,942	5,722,680
Surplus (Unfunded Liability)	67,092	(602,635)	75,866	(591,302)

Schedule G3 – Current and Required Contribution Rates – August 31, 2018

	Without Tax Limits		With Tax Limits	
	Basic Only (%)	Basic + Indexed (%)	Basic Only (%)	Basic + Indexed (%)
Current contribution rates				
Member[1]	8.39	10.24	8.39	10.24
Employer[1]	8.49	10.34	8.49	10.34
Combined member/employer	**16.88**	**20.58**	**16.88**	**20.58**
Required contribution rates				
Entry age normal cost rate[2]	**16.50**	**22.82**	**16.22**	**22.46**
Amortization of unfunded actuarial liability (surplus[2])				
▪ 25 year amortization	(0.72)	1.23	(0.71)	1.25
▪ 15 year amortization	(1.06)	1.82	(1.06)	1.85
▪ *PBSA* amortization	(2.80)	n/a	(2.79)	n/a
Total required/Minimum permissible contribution rate				
▪ 25 year amortization	15.78	24.05	15.51	23.71
▪ 15 year amortization	15.44	24.64	15.16	24.31
▪ *PBSA* rate	13.70	n/a	13.43	n/a
Total required contribution rate	**15.78**	**n/a**	**15.51**	**n/a**
Selected 2015 Comparisons				
Member	8.39	9.96	8.39	9.96
Employer[4]	8.49	10.06	8.49	10.06
Combined member/employer	**16.88**	**20.02**	**16.88**	**20.02**
Required contribution rates				
Entry age normal cost rate[4]	**16.63**	**22.92**	**16.49**	**22.74**
Amortization of unfunded actuarial liability (surplus)				
▪ 25 year amortization	0.00	4.16	0.00	4.08
▪ 15 year amortization	0.00	6.15	0.00	6.03
▪ *PBSA* amortization	0.00	n/a	0.00	n/a
Total required/Minimum permissible contribution rate				
▪ 25 year amortization	16.63	27.08	16.49	26.82
▪ 15 year amortization	16.63	29.07	16.49	28.77
▪ *PBSA* rate	16.63	n/a	16.49	n/a
Total required contribution rate	**16.63**	**n/a**	**16.49**	**n/a**

[1] Non-indexed costs ignore IAA contribution; indexed costs include IAA contributions of 1.85% for both employee and employer (rate effective April 1, 2019).

[2] The 25 year, 15 year and PBSA amortization requirements are applied to the surplus in excess of 5% of the net liability.

Schedule G4 – Accrued Liabilities and Funded Ratio – August 31, 2018

($000's)	Without Tax Limits		With Tax Limits	
	Basic Only	Basic + Indexed	Basic Only	Basic + Indexed
Assets – smoothed value	**4,098,186**	**4,810,781**	**4,098,186**	**4,810,781**
Accrued Liabilities				
▪ for pensions being paid	1,986,625	2,556,865	1,977,717	2,545,439
▪ for inactive members	215,614	329,394	215,614	329,394
▪ for active members	1,478,984	1,999,213	1,477,905	1,997,830
Total Accrued Liabilities	**3,681,223**	**4,885,472**	**3,671,236**	**4,872,663**
Surplus (Unfunded Actuarial Liability)	**416,963**	**(74,691)**	**426,950**	**(61,882)**
Funded Ratio – Fund ÷ Total Accrued Liabilities	**111.3%**	**98.5%**	**111.6%**	**98.7%**
Selected 2015 Comparisons				
Assets	3,348,160	3,745,950	3,348,160	3,745,950
Total Liabilities	3,186,131	4,247,286	3,175,574	4,233,586
Surplus (Unfunded Actuarial Liability)	162,029	(501,336)	172,586	(487,636)
Funded Ratio	105.1%	88.2%	105.4%	88.5%