

**British Columbia Public Service  
Pension Plan**

Actuarial Valuation  
as at March 31, 2017

Vancouver, B. C.  
December 4, 2017

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## Actuarial Report Highlights

An actuarial valuation of the Public Service Pension Plan was completed as at March 31, 2017. Its purpose was to determine the financial position of the Plan as at March 31, 2017 and to report on the adequacy of the member and employer contribution rates.

### Scope of the Valuation

The main valuation focuses on the Basic Account and the funding of the Basic, non-indexed benefits. It excludes liabilities for:

- Future indexing funded via fixed contributions to the Inflation Adjustment Account (IAA); and
- Post-retirement group benefits provided on a pay-as-you-go basis via carve outs from the IAA contributions.

Furthermore, it 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 Changes Included in the Valuation

Effective September 30, 2015, the plan rules were amended to ensure compliance with the enactment of the new BC *Pension Benefits Standards Act* ("PBSA") and Regulation.

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

### Actuarial Methods and Assumptions

The actuarial liabilities include the value of benefits accrued by members as at March 31, 2017 as well as future benefits expected to be earned by existing members. Asset values are based on smoothed market values (limited to not more than 108%, nor less than 92%, of market value), 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 Board's Funding Policy. This method is designed to maintain costs at a level percentage of payroll over an extended period. The resulting 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 used include:

- Annual Investment Return            6.25% (6.50% was used in the previous valuation)
- Annual Salary Increase            3.50% plus seniority (3.75% was used in the previous valuation)
- Annual Indexing                    0% for basic costs, 2.75% for indexed costs (3.00% was used for indexed costs in the previous valuation)

**Actuarial Position**

The valuation shows an improvement in the actuarial position for the Basic Account on the entry-age normal contribution basis. The surplus has increased from \$194 million at March 31, 2014 (which is after allowance for the elimination of the prior amortization requirements) to \$1,896 million at March 31, 2017:

<b>Basic Benefits Only (\$000's)</b>	<b>2017</b>	<b>2014</b>
Assets	24,649,871	20,471,582
Liabilities	22,753,995	20,277,884
Surplus (Unfunded Liability)	1,895,876	193,698

The supplementary valuation results are:

<b>Basic and Indexed Benefits (\$000's)</b>	<b>2017</b>	<b>2014</b>
Assets	32,786,041	26,958,991
Liabilities	30,090,039	27,553,771
Surplus (Unfunded Liability)	2,696,002	(594,780)

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

<b>Benefits Limited to <i>ITA</i> Maximums (\$000's)</b>		<b>2017</b>	<b>2014</b>
Surplus (Unfunded Liability)	Basic Benefits only	2,117,806	348,912
	Basic and Indexed Benefits	2,975,064	(382,318)

**Main Reasons for Change in Actuarial Position**

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

- Investment returns higher than assumed; and
- Actual salary increases lower than the long-term assumption;

Offset by

- An excess investment return transfer to the IAA; and
- Changes in the economic assumptions.

**Member and Employer Contribution Rates – Basic Non-Indexed Benefits**

Members currently contribute 8.18% of salaries, less 1.5% of salaries up to the Year's Maximum Pensionable Earnings ("YMPE"), for basic non-indexed benefits; employers contribute a matching amount for a total contribution rate of 16.36% (integrated at 3%, i.e. 3% lower than this amount for the portion of members' salaries below the YMPE). The long-term cost rate for future service (i.e. the entry-age, normal actuarial cost) is 16.56% of salaries (integrated at 3%), or 0.20% of salaries higher than the current combined member and employer contributions.

When there is a surplus, the funding policy requires that the contribution rate is calculated with a 15-year and a 25-year amortization period (both commencing one year after the valuation date).

- If the current contribution is between the 15 and 25-year rates, then the rate should remain unchanged. Effectively, the surplus is applied as a rate stabilization reserve.
- If the current contribution rate is greater than the 25-year contribution rate, then there is "excess surplus" and the Board may decide how to apply this 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 contribution rate with a 15-year amortization of surplus is 12.03% (integrated at 3%) and the contribution rate with a 25-year amortization of surplus is 13.50% (integrated at 3%). The current contribution rate of 16.36% of salaries (integrated at 3%) is greater than the 25-year amortization contribution rate and hence, under the funding policy, there is an “excess surplus”.

The Joint Trust Agreement ("JTA") also requires that the contribution rates comply with the going-concern requirements of the *PBSA*. The funded position of the plan on the entry-age rate basis has improved to a surplus of \$1,896 million. However, the *PBSA* only allows amortization of surplus in excess of 5% of the net liabilities (referred to in the *PBSA* as the “plan’s accessible going concern excess”). In this case, 5% of the net liabilities is \$926 million, and the remaining \$969 million of the going concern surplus i.e. the accessible going concern excess, may be used in part or full to reduce contributions. The minimum *PBSA* required contribution rate is then equal to the entry-age normal cost of 16.56% of salaries (integrated at 3%) less the amortization of the accessible going concern excess of \$969 million over a minimum of 5 years, commencing one year after the valuation date. The entry age normal cost may therefore be reduced by 6.12% of salaries for a *PBSA* minimum required contribution rate of 10.44% of salaries (integrated at 3%).

Given that the 25-year amortization contribution rate is greater than the minimum permissible *PBSA* contribution rate, the funding policy determines that the minimum permissible contribution rate is the 25-year amortization contribution rate of 13.50% (integrated at 3%).

If the contribution rate is reduced, the JTA requires that the decrease be shared equally between the members and the employers. Accordingly, the member and employer contribution rates may reduce by 1.43% of salaries each, for a total reduction of 2.86% of salaries, or the basic benefits may be increased such that the required contribution rate becomes equal to the current contribution of 16.36% (integrated at 3%), or the contribution rate can remain at 16.36% of pay (integrated at 3%) 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. 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 IAA rates, the revised totals, net of the amounts assumed allocated to fund post-retirement group benefits, become:

### Minimum Permissible Contribution Rates

	Member	Employer	Total
Current Basic Account	8.18% <sup>1</sup>	8.18% <sup>1</sup>	16.36% <sup>2</sup>
Minus maximum permissible Basic Account reduction	(1.43%)	(1.43%)	(2.86%)
<b>Total Minimum Permissible Basic Rate</b>	<b>6.75%<sup>1</sup></b>	<b>6.75%<sup>1</sup></b>	<b>13.50%<sup>2</sup></b>
Current IAA	1.25%	1.75% <sup>3</sup>	3.00% <sup>2</sup>
<b>Total Minimum Permissible Contribution Rate</b>	<b>8.00%<sup>1</sup></b>	<b>8.50%<sup>1,3</sup></b>	<b>16.50%<sup>2,3</sup></b>

These minimum permissible contribution rates comply with the requirements of 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 provided members do not contribute more than half the cost of benefits. The current member contributions exceed this limit for some of the high earning members of the plan, so if the Board decides to retain the current contribution rate, or to only partially reduce the contributions rates such that some members are paying over 9% of salaries in total, it will be necessary to apply to the Minister for a waiver. The net employer contributions currently exceed the member contributions by 0.5% 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. If the Board decides to reduce the contribution rates such that the aggregate member contributions do not exceed the lesser of 9% of salaries, then a waiver will not be required.

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<sup>1</sup> Integrated at 1.5%, i.e. less 1.5% of salaries up to the YMPE.

<sup>2</sup> Integrated at 3%, i.e. less 3% of salaries up to the YMPE.

<sup>3</sup> Net of 1% assumed to be allocated to post-retirement group benefits after March 31, 2012.

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## I. Scope of the valuation

In accordance with section 10 of the Joint Trust Agreement ("JTA") and on the instructions of The Public Service Pension Board of Trustees (the "Board of Trustees"), we have completed an actuarial valuation of the Basic Account of the Public Service Pension Plan (the "Plan") as at March 31, 2017 and are pleased to submit this report thereon. The primary purpose of this valuation is to determine the financial or actuarial position of the Basic Account as at March 31, 2017 and to report on the adequacy of the member and employer contribution rates.

The main valuation focuses on the Basic Account and the funding of the Basic, non-indexed benefits. It excludes liabilities for:

- Future indexing funded via fixed contributions to the Inflation Adjustment Account ("IAA"); and
- Post-retirement group benefits provided on a pay-as-you-go basis via carve outs from the IAA.

Furthermore, it 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 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.



## II. Changes in plan

The last valuation of the Plan, prepared as at March 31, 2014 and included in our report dated December 18, 2014, determined the financial position of the Plan as amended to April 1, 2014. Since the previous valuation, the plan rules were amended, effective September 30, 2015, to ensure compliance with the new BC *PBSA* and Regulation. Most of these amendments had no financial impact on the benefits for the purpose of the valuation, except for the requirement to provide immediate vesting.

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

The changes, and 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 such 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 a 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, it is clear that benefit security would be 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.

Effective March 9, 2006, the Board adopted a formal funding policy in which it identified benefit security as its primary objective and stability of contributions 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 liabilities 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 indexing in line with the Canada Consumer Price Index ("CPI") is provided; alternatively, if the monies in the IAA cannot provide 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 each time indexing is granted. Thus, the system will limit indexing, if necessary, so that the granting of such supplements should not create (or increase) an unfunded liability, or reduce an 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 the indexing granted after March 31, 2017). 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, percentage rate 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 not generate unfunded liabilities.

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. 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. Contributions, expressed as a percentage of salaries, revert to the normal cost rate after the unfunded liability or surplus has been amortized.

**(f) *PBSA Requirements***

The *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 a going-concern, or going-concern plus 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 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 Public Service Pension Plan is one of a number of British Columbia public sector plans that are exempt from these provisions, the JTA 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 any amortization requirements established on or after September 30, 2015). 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 but, for an equal cost sharing plan, only after a surplus margin of 5% of liabilities has been set aside, with the remaining surplus to be amortized over not less than 5 years.

In order to provide a measure of contribution rate stability, Section 11.5(b) of the JTA requires the Board to use a 25 year period for the amortization of a surplus when considering its application towards benefit improvements without the prior approval of the Plan's partners. The Board set out its policy with regard to amortization of surplus in its March 2006 funding policy. Accordingly, we have calculated theoretical minimum contribution requirements in accordance with the funding policy 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, commencing one year after the valuation date.

- If there is a surplus, calculate the contribution rate with a 15-year amortization period, commencing one year after the valuation date, and the contribution with a 25-year amortization period, commencing one year after the valuation date. The contribution rate with a 15-year amortization of surplus will be lower than the rate with a 25-year amortization of surplus.
- If the current contribution is between the 15 and 25-year rates, then the rate should remain unchanged. Effectively, the surplus is applied as a rate stabilization reserve.
- If the current contribution rate is greater than the 25-year contribution rate, then there is “excess surplus” and the Board may decide how to apply this 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;
  - Any combination of the above alternatives.
- 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 must also comply with the *PBSA* minimum requirement.

The JTA rules require any contribution rate changes, up or down, to be shared equally by the Plan members and the employers (the employers will continue to pay the excess costs for certain smaller groups of members who have more advantageous benefits). Thus, we express the future cost requirements as a combined member-plus-employer amount.

## **2. 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 economic assumptions, and possible changes to them, with the Board.

Following these 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 for the previous valuation are in brackets).

	<b>Funding Valuation</b>
Annual Investment Return	6.25% (6.50%)
Annual Salary Increase	3.50% (3.75%) plus seniority
Annual Indexing	0% for basic costs 2.75% (3.0%) for indexed costs

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

**3. Membership Data**

Data as of March 31, 2017 were prepared by the Pension Corporation. The data are described in detail in Appendix B and numerically summarized in Appendices C, D and E.

**4. Benefits Excluded**

The treatment of post-retirement group benefits does not affect the Basic Account valuation results. With respect to the indexed valuation results, we have reduced the employer contributions to the IAA by 1% of salaries effective April 1, 2012, being the maximum potential amounts that could be allocated to the post-retirement group benefits. We have not otherwise considered the liabilities and the financing for these benefits.

## IV. Results of actuarial investigations

### 1. Basic Account – Actuarial Position

Schedule 1 shows a statement of the actuarial position of the Plan as at March 31, 2017. This statement ignores liabilities for indexing of pensions after the valuation date, and assumes that contributions will be made at the basic, non-indexed, entry-age normal cost rate of 16.56% of future payroll (integrated at 3%).

#### **Schedule 1 – Statement of Actuarial Position as at March 31, 2017**

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

	(\$000's)	
<b>Assets</b>	<b>2017</b>	<b>2014</b>
Market Value of Basic Account	22,065,497	18,213,614
Asset Smoothing Adjustment	(1,632,954)	(1,457,089)
<b>Smoothed Value of Basic Account</b>	<b>20,432,543</b>	<b>16,756,525</b>
Actuarial present values of future contributions at entry-age rates	4,217,328	3,715,057
<b>Total Assets</b>	<b>24,649,871</b>	<b>20,471,582</b>
<b>Liabilities</b>		
Actuarial present values for		
- pensions being paid	9,982,815	8,386,957
- inactive members		
deferred vested members	429,239	410,322
LTD members	509,327	481,308
other inactive members	118,626	104,813
- active members	11,570,761	10,774,508
- future expenses	143,028	119,798
Voluntary contribution balance	199	178
<b>Total Liabilities</b>	<b>22,753,995</b>	<b>20,277,884</b>
<b>Surplus (Unfunded Liability)</b>	<b>1,895,876</b>	<b>193,698</b>
<b>Funded Ratio: Total Assets ÷ Total Liabilities</b>	<b>108.3%</b>	<b>101.0%</b>
<b>PBSA Accessible going concern excess</b>	<b>969,043</b>	<b>0</b>

### 2. Change in Actuarial Position

The statement of actuarial position included in Schedule 1 indicates that the surplus has increased from \$194 million at March 31, 2014 to \$1,896 million at March 31, 2017. The \$1,702 million increase in the surplus is the

net result of a number of items, the most significant being higher than assumed investment returns, lower than assumed salary increases, offset by an excess investment return transfer to the IAA and changes in the valuation assumptions.

**Schedule 2 – Change in Actuarial Position**

	<b>Approximate effect on surplus (\$ millions)</b>
(1) Surplus (Unfunded Liability) at March 31, 2014	194
(2) Interest on Surplus	40
(3) Actual income from investments (on smoothed values) higher than the 6.5% assumed rate	1,539
(4) Actual salary increases to March 31, 2017 lower than previously assumed	423
(5) Actual contributions higher than previously assumed	36
(6) Pensioner Mortality experience gain	46
(7) Retirement experience gain	66
(8) Excess investment return transfer to IAA	(208)
(9) Changes in valuation assumptions	(275)
(10) Other factors (a net gain) including changes in plan membership and other differences between actuarial assumptions and actual experience during the inter-valuation period	35
(11) Surplus (Unfunded Liability) at March 31, 2017	1,896

The \$275 million loss due to changes in actuarial assumptions (shown in item (9)) is the net result of the following (the assumption changes are described in Appendix B):

**Change in Actuarial Position Arising From Change in Actuarial Assumptions**

<b>Assumption changes</b>	<b>Approximate effect (\$ millions)</b>
Economic assumption	(467)
Disability incidence rate	3
Disability assumed retirement age	24
Withdrawal rates	4
Retirement rates	56
Mortality rate	105
<b>Total loss due to assumption changes</b>	<b>(275)</b>



### 3. Adequacy of Contribution Rates

As discussed 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) Change in Normal Cost Rate

The total current service contribution required to finance the basic pensions of new entrants (i.e. the normal cost) has increased from 16.33% of salaries (integrated at 3%) as at March 31, 2014 to 16.56% of salaries (integrated at 3%) as at March 31, 2017. The 0.23% of salaries increase in normal cost rate is explained in Appendix F and is the net result of a number of items, the most significant being:

- the change in the economic assumption (cost increase of 0.43%); offset by
- the change in the mortality assumption (cost decrease of 0.05%);
- the change in the new entrant demographic profiles (cost decrease of 0.04%); and
- the change in the retirement assumption (cost decrease of 0.09%).

#### (b) PBSA Minimum Permissible Rate

The minimum *PBSA* required contribution rate is then equal to the normal cost of 16.56% (integrated at 3%) 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 \$926,833,000<sup>1</sup>, leaving an accessible going concern excess of \$969,043,000. Amortizing this over five years, commencing one year after the valuation date, results in a maximum permissible reduction of 6.12%. The *PBSA* minimum required contribution rate is therefore 10.44% of salaries (integrated at 3%).

#### (c) Funding Policy Requirements

When there is a surplus, the funding policy requires that the contribution rate is calculated with both a 15-year and a 25-year amortization period (both commencing one year after the valuation date).

- If the current contribution is between the 15 and 25 year amortization rates, then the rate should remain unchanged.
- If the current contribution rate is greater than the 25-year contribution rate, then there is “excess surplus” and the Board may decide how to apply this excess surplus. Alternatives, as set out in the JTA include:
  - Reducing the contribution rate;

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<sup>1</sup> Any surplus less than this can be considered to be a compulsory rate stabilization reserve.

- Improving benefits;
- Making a transfer to the Inflation Adjustment Account;
- Setting aside a rate stabilization reserve;
- Any combination of the above alternatives.

- 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 contribution rate with a 15-year amortization of surplus is 12.03% (integrated at 3%) and the contribution rate with a 25-year amortization of surplus is 13.50% (integrated at 3%). The current contribution rate of 16.36% of salaries (integrated at 3%) is greater than the 25-year contribution rate and hence, under the funding policy, there is an “excess surplus”.

The current contribution rates, the contribution rates for current service (on an entry-age basis, i.e. the normal actuarial cost) and the minimum *PBSA* permissible contribution rates are summarized in Schedule 3. It is not necessary for the current contribution to be reduced to the minimum permissible contribution rate, but any decrease in contribution rates must be shared equally between members and employers.

**Schedule 3 – Current and Minimum Permissible Basic Account Contribution Rates**

Current Basic Account contribution rates	Based on valuation results as at March 31	
	2017 (%)	2014 (%)
Member (integrated at 1.5%) <sup>1</sup>	8.18	8.18
Employer (integrated at 1.5%) <sup>1</sup>	8.18	8.18
<b>Combined member/employer (integrated at 3%)<sup>2</sup></b>	<b>16.36</b>	<b>16.36</b>
<b>Minimum Basic Account contribution rates<sup>3</sup></b>		
<b>Entry age normal cost rate (integrated at 3%)</b>	<b>16.56</b>	<b>16.33</b>
Amortization of unfunded liability (surplus)		
▪ 25-year amortization	(3.06)	(0.33)
▪ 15-year amortization	(4.53)	(0.49)
▪ <i>PBSA</i> amortization	(6.12)	-
Basic Account contribution rate (integrated at 3%)		
▪ 25-year amortization	13.50	16.00
▪ 15-year amortization	12.03	15.84
▪ <i>PBSA</i> minimum rate	10.44	16.33
<b>Minimum Permissible Basic Account contribution rate</b>	<b>13.50</b>	<b>16.33</b>

The above results indicate that the current contribution rate of 16.36% of salaries (integrated at 3%) exceeds both the minimum permissible *PBSA* contribution rate of 10.44% of salaries (integrated at 3%) and the funding policy 25-year amortization rate of 13.50% of salaries (integrated at 3%).

The Board can decide how to use the excess surplus that has arisen, but the funding policy indicates that the contribution rate should not be reduced below the 25-year amortization rate of 13.50% of salaries (integrated at 3%).

<sup>1</sup> i.e. less 1.5% of salary up to the YMPE (for each of the members and the employers).

<sup>2</sup> i.e. less 3% of salary up to the YMPE.

<sup>3</sup> Total member plus employer, to be shared equally.

**4. Revised Contribution Rates**

Section 10.3 of 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 2.86% of salaries (after rounding). Sharing this equally would result in a decrease of 1.43% 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:

**Schedule 4 – Current and Minimum Permissible Total Contribution Rates**

	<b>Member</b>	<b>Employer</b>	<b>Total</b>
Current Basic Account	8.18% <sup>1</sup>	8.18% <sup>1</sup>	16.36% <sup>2</sup>
Minus maximum permissible Basic Account reduction	(1.43%)	(1.43%)	(2.86%)
<b>Minimum Permissible Basic Rate</b>	<b>6.75%<sup>1</sup></b>	<b>6.75%<sup>1</sup></b>	<b>13.50%<sup>2</sup></b>
Current IAA	1.25%	1.75% <sup>3</sup>	3.00% <sup>3</sup>
<b>Total Minimum Permissible Contribution Rate</b>	<b>8.00%<sup>1</sup></b>	<b>8.50%<sup>1,3</sup></b>	<b>16.50%<sup>2, 3</sup></b>

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."

The current member contributions exceed 9% of salaries for members earning more than \$192,907 annually (327 active members had salaries above this at the 2017 valuation), so if the Board either decides to retain the current contribution rate or to reduce the contributions such that some members are still paying over 9% of

<sup>1</sup> Integrated at 1.5%, i.e. less 1.5% of salaries up to the YMPE.

<sup>2</sup> Integrated at 3%, i.e. less 3% of salaries up to the YMPE.

<sup>3</sup> Net of 1% assumed to be allocated to post-retirement group benefits.

salaries in total, it will be necessary to apply to the Minister for a waiver. Employer contributions exceed the member contributions by 0.5% of salaries. Therefore, given that future Basic contribution rate changes are shared equally and IAA contributions are fixed at their current level, the requirement that the member contributions will not exceed  $\frac{1}{2}$  of the amount required to fund the aggregate benefits is met.

If the Board decides to reduce the contribution rate such that the total member contribution rate does not exceed 9% of salaries for any member, then a waiver is not required<sup>1</sup>.

A waiver was required, and obtained, following the 2014 valuation.

## 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 16.36% (integrated at 3%) and the cost of any benefit improvement has to be funded over no less than 25 years. We would be happy to discuss alternatives with the Board at its convenience.

## 6. 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.

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<sup>1</sup> The Pension Corporation already applies the \$1,000 plus 70% of the PA limit, by allocating any contributions in excess of this to the Supplemental Benefits Account. Accordingly, there is no need to consider this limit when assessing the need for a waiver.

**Schedule 5 – Accrued Benefits – Funded Ratio at March 31, 2017**

*Basic Account – Non-Indexed Benefits*

	(\$000's)	
	2017	2014
<b>Fund (Basic Account):</b>		
▪ <b>Smoothed Value of Fund</b>	<b>20,432,543</b>	<b>16,756,525</b>
<b>Accrued Liabilities:</b>		
▪ for pensions being paid	9,982,815	8,386,957
▪ for inactive members	1,057,192	996,443
▪ for active members	6,906,680	6,568,753
▪ for voluntary contributions	199	178
<b>Total Accrued Liabilities</b>	<b>17,946,886</b>	<b>15,952,331</b>
<b>Surplus (Unfunded Actuarial Liability):</b>		
▪ for accrued service only	2,485,657	804,194
<b>Funded Ratio:</b>		
Fund ÷ Total accrued liabilities	114%	105%

The above schedule indicates that the funded ratio for accrued benefits has improved from about 105% to 114%. 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 reporting 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 tables below show the impact on the accrued liability as required by (a) and the entry age normal cost as required by (b) as at March 31, 2017 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**

<b>Impact on liabilities of 1% drop in discount rates</b>	<b>Going Concern 6.25% (\$,000's)</b>	<b>Going Concern 5.25% (\$,000's)</b>	<b>Increase (\$,000's)</b>
Active members	6,906,680	8,109,909	1,203,229
Disabled members	509,327	588,732	79,405
Terminated members	547,865	638,514	90,649
Pensioners and beneficiaries	9,982,815	10,876,066	893,251
<b>Total increase in liabilities</b>			<b>2,266,534</b>

<b>Impact on normal cost rate of 1% drop in discount rates</b>	<b>Going Concern 6.25%</b>	<b>Going Concern 5.25%</b>	<b>Increase</b>
Current service cost rate (integrated at 3%)	16.56%	20.03%	3.47%

**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	20,432,543	20,432,543	0
Actuarial present values of:			
▪ Future contributions at entry-age rates	4,217,328	5,482,600	1,265,272
<b>Total Assets</b>	<b>24,649,871</b>	<b>25,915,143</b>	<b>1,265,272</b>
<b>Total Liabilities</b>	<b>22,753,995</b>	<b>26,378,016</b>	<b>3,624,021</b>
Surplus/(Unfunded liability) on entry-age basis	1,895,876	(462,873)	(2,358,749)
Entry Age Normal Cost (integrated at 3%)	16.56%	20.03%	3.47%
25 year amortization	(3.06%)	0.66%	4.08% <sup>1</sup>
PBSA amortization	(6.12%)	1.02%	
<b>Minimum permissible rate (integrated at 3%)</b>	<b>13.50%</b>	<b>21.05%</b>	<b>7.55%</b>

**8. Supplementary 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. In the indexing calculations, we reduced the employer contributions to the IAA from 2.75% to 1.75% on the assumption that 1% will be allocated to the post-retirement group benefits (the maximum permitted).

The key results are summarized below:

<sup>1</sup> Represents the difference between the highest amortization i.e. the difference between the 25 year amortization at 6.25% investment return and the PBSA amortization at the 5.25% investment return.



**Schedule 6 – Indexed Benefits (without tax limits)**

	<b>Basic Only</b>	<b>Basic + Indexed</b>
	<b>(\$000's)</b>	<b>(\$000's)</b>
Smoothed Value of Fund	20,432,543	27,043,667
Actuarial present values of:		
▪ Future contributions at entry-age rates	4,217,328	5,742,374
Total Assets	24,649,871	32,786,041
Total Liabilities	22,753,995	30,090,039
<b>Surplus (Unfunded Liability)</b>	<b>1,895,876</b>	<b>2,696,002</b>
<b>Contribution Rates (Integrated)</b>	<b>%</b>	<b>%</b>
Current Member (integrated at 1.5%)	8.18	9.43
Current Employer (integrated at 1.5%)	8.18	9.93
<b>Current Total (integrated at 3%)</b>	<b>16.36</b>	<b>19.36</b>
Entry-age normal cost (integrated at 3%)	16.56	21.68
25 year amortization	(3.06)	(4.24)
<b>Total – entry-age with amortization (integrated at 3%)</b>	<b>13.50</b>	<b>17.44</b>

If assets and liabilities are restricted to accrued service only, i.e., analogous to Schedule 5 earlier, the 2017 surplus (unfunded liability) figures change as follows:

**Schedule 7 – Indexed Accrued Benefits (without tax limits) – Funded Ratio at March 31, 2017**

	(\$000's)	
	Basic Only	Basic + Indexed
Smoothed Value of Fund	20,432,543	27,043,667
Total Accrued Liabilities	17,946,886	23,665,180
Surplus (Unfunded Liability)	2,485,657	3,378,487
Funded Ratio	114%	114%

**Benefits Limited to ITA Maximums**

When the income tax limits on benefits are recognized, the above 2017 surpluses (unfunded liabilities) and normal cost rates change marginally. The key results are summarized below:

**Schedule 8 – Benefits Limited to ITA Maximums – Basic Account Only**

<b>Basic Account Only</b>	<b>Without Tax Limit</b>	<b>With Tax Limit</b>
<b>Surplus (Unfunded Liability)</b>	<b>\$000's</b>	<b>\$000's</b>
Entry Age Basis	1,895,876	2,117,806
Accrued Service Only	2,485,657	2,705,815
<b>Contribution Rate</b>	<b>%</b>	<b>%</b>
Entry-age normal cost (integrated at 3%)	16.56	16.44
25 year Amortization	(3.06)	(3.33)
<b>Total (integrated at 3%)</b>	<b>13.50</b>	<b>13.11</b>

**Schedule 9 – Benefits Limited to ITA Maximums – Indexed Benefits**

<b>Basic and Indexed Benefits</b>	<b>Without Tax Limit</b>	<b>With Tax Limit</b>
<b>Surplus (Unfunded Liability)</b>	<b>(\$000's)</b>	<b>(\$000's)</b>
Entry Age Basis	2,696,002	2,975,064
Accrued Service Only	3,378,487	3,665,702
<b>Contribution Rate</b>	<b>%</b>	<b>%</b>
Entry Age Normal Cost (integrated at 3%)	21.68	21.52
25 year Amortization	(4.24)	(4.68)
<b>Total (integrated at 3%)</b>	<b>17.44</b>	<b>16.84</b>

**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.

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 has been provided since January 1, 1982 under the current Plan terms, and for many years before that under earlier Plan provisions. Further, there is a fund set aside to fund future indexing and contributions are made to this fund on an ongoing basis. Thus, it is appropriate for purposes of testing the *ITA*

147.2(2) limits to recognize, the future indexing of pensions for the current Plan membership. Accordingly the valuation results on the fully indexed basis, recognizing the income tax limits on benefits, should be considered.

The fully indexed valuation, recognising the income tax limits, shows a surplus of \$2,975 million. The corresponding net liability is \$24,068 million, so the 25% limit is \$6,017 million. Thus the Plan does not have an excess *ITA* surplus. Given that there is a surplus, but not an excess surplus, the maximum contributions to the plan may not exceed those calculated at the fully indexed, income tax limited, entry-age normal cost rate of 21.52% (integrated at 3%). Should contributions exceed this amount, the excess above 21.52% will need to be directed to the Supplemental Benefits Account which is used to finance benefits in excess of the *Income Tax Act* limits.

## V. 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.

## VI. 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 March 31, 2020.

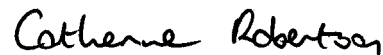
## VII. Acknowledgement

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,



Richard A. Border  
Fellow of the Canadian Institute of Actuaries<sup>1</sup>  
Fellow of the Institute and Faculty of Actuaries



Catherine Robertson  
Fellow of the Canadian Institute of Actuaries<sup>1</sup>  
Fellow of the Institute and Faculty of Actuaries

December 4, 2017

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<sup>1</sup> Canadian Institute of Actuaries is the Primary Regulator.

## Appendix A: Summary of Plan and Amendments as at April 1, 2017

### *Changes to the Plan*

The previous valuation was based on the provisions of the Plan as at March 31, 2014. Since then, the Plan has been amended a number of times. The main changes to March 31, 2017 are summarized below.

- Effective June 24, 2014, a new part was added to the plan rules to implement a dual calculation method for members with pensionable service in either correctional or ambulance paramedic employment and non-correctional/non-ambulance paramedic employment.
- Effective April 1, 2015, the plan rules were amended to allow the purchase of part or all of a leave of absence (or period of reduced pay) if a member contributed to different employers under this plan or another registered pension plan during the period, subject to Income Tax Regulation limits.
- Effective June 17, 2015, the plan rules were amended to make it clear that where a member commences their pension and later becomes re-employed in an employment that would normally require or offer participation in the plan, the retired member must continue to receive their pension and cannot recommence contributions to the plan. The amendment also clarifies that the provision does not apply where the member is receiving a pension from the plan following the death of a member.
- Effective July 1, 2015, employer contribution rates were increased for correctional employees, ambulance paramedics, deputy ministers appointed before September 1, 2001, statutory officers, judges and masters. Employer contribution rates were decreased for members of the British Columbia Legislative Assembly.
- Effective September 30, 2015, the plan rules were amended to implement all changes required under the new *Pension Benefits Standards Act* and Regulation. This included new and modified definitions and the incorporation of required benefit changes such as immediate vesting, change to the small benefit test, unlocking of pension benefits based on a medical practitioner's determination that the member has an illness or disability that is terminal or will considerably shortened their life expectancy, and a change to the interest rate calculation on voluntary contributions from the refund rate or interest to the fund rate of return.

The main provisions of the Plan are summarized below. Except as otherwise noted, the section references are to the Public Service Pension Plan Rules as at April 1, 2017. The valuation is based on these provisions.

The summary herein (and the valuation itself) ignores the additional contributions and enhanced benefits that are provided for certain groups, e.g. judges, MLAs, deputy ministers, BC Ambulance paramedics. Their

additional numbers are not material in the context of the overall valuation results. Adjustments to their contribution rates will be discussed separately with the Board.

***Employer and Employee Eligibility***

The Plan applies to public sector employers, including the government and other employers where application of the Plan is authorized by another enactment, 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 "regular employees" (continuous full time and continuous part time) of government or other Plan employers, or employees who earn at least 50% of the Year's Maximum Pensionable Earnings (YMPE) in one calendar year. Enrolment is optional for regular employees appointed by the Lieutenant Governor in Council, deputy ministers and eligible part-time staff who earn less than 50% of the YMPE in a calendar year and have completed at least two years of continuous employment where there has not been a temporary absence of more than 52 weeks. [Section 3]

***Member Contributions***

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

- a) 6.68% of that part of the member's cumulative salary that does not exceed the YMPE (paid into the Basic Account);
- b) 8.18% of the member's cumulative salary which is in excess of the YMPE (paid into the Basic Account); and
- c) 1.25% of the member's entire salary (paid into the Inflation Adjustment Account).

Member contributions cease after 35 years of pensionable service have been accrued.

***Employer Contributions***

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

- a) 6.68% of that part of the member's cumulative salary that does not exceed the YMPE (paid into the Basic Account);
- b) 8.18% of the member's cumulative salary which is in excess of the YMPE (paid into the Basic Account); and
- c) 2.75% of the member's salary (paid into the Inflation Adjustment Account, less amounts allocated to non-pension benefits).

Employer contributions cease in respect of a member's salary after the member has accrued 35 years of pensionable service.

***Retirement Benefits: Eligibility Conditions for Pension***

The normal retirement age is 65 for all members except for correctional centre employees, who have a normal retirement age of 60. In the following summary of the various eligibility conditions and plan provisions, the age and/or service conditions are first shown for the groups with normal retirement age equal to 65; the age and/or service conditions, if different for those with normal retirement age equal to 60, are shown in parentheses, following the normal age 65 conditions. In addition, certain ambulance paramedics have different provisions which are not included below, as the impact on the Plan as a whole is not material.

Section 50 provides that an active member who terminates employment on or after April 1, 2000, is entitled, upon application, to an unreduced pension calculated under section 54, if the member has:

- a) attained age 55 (50) and the sum of the member's age plus years of contributory service is 85 or more; or
- b) attained age 60 (55) with at least 2 years of contributory service; or
- c) attained age 65 (60).

Section 51(a) provides for a reduced pension calculated under section 55(1) if the terminating member has attained age 55 (50) and completed at least 2 years of contributory service.

Section 51(b) provides for a reduced pension calculated under section 55(2) if the terminating member has attained age 55 (50) but has not completed 2 years of contributory service.

***Calculation of Unreduced Pension***

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

- a) 2% of the member's highest average salary multiplied by the number of years of pensionable service accrued before January 1, 1966,
- b) 1.35% of the lesser of
  - 1) the member's highest average salary, and
  - 2)  $1/12$  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 on and after January 1, 1966 not exceeding 35 years, and
- c) 2% 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 on and after January 1, 1966 not exceeding 35 years.



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

- a) 0.65% of the lesser of
  - 1) the member's highest average salary, and
  - 2)  $1/12$  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 on and after January 1, 1966 not exceeding 35 years.

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).

The calculation of the pension payable to a deferred member who terminated employment prior to March 1, 2002 and who is entitled to an unreduced pension is the same as for a member terminating employment on or after March 1, 2002 except that the pension is payable in the form of a single life annuity (no guarantee), the 1.35% referred to in the calculation of the lifetime pension is 1.3%, and the 0.65% referred to in the calculation of the monthly benefit payable until the earlier of age 65 or the death of the member is 0.7%.

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 at any time prior to termination or retirement, including interest at fund interest rates on those contributions.

### ***Calculation of Reduced Pension***

Where a reduced pension is payable under section 51 to members aged between 55 (50) and 60 (55) who have 2 or more years of contributory service, section 55 provides that the lifetime pension and monthly benefit, described above, are each reduced by a percentage equal to 3% for each year by which the member's age is less than the earlier of age 60 (55) or the age at which the member's age plus years of contributory service total 85 (subsection 55(1)), whichever is less, and the reduction is prorated for fractions of a year.

If the member terminates employment under age 50 (45), or with less than 10 years of contributory service, the 3% (per year) early retirement reduction factor referred to above is increased to 5% (per year).

Where a reduced pension is payable under section 51 to members aged 55 (50) or over who do not have 2 years of contributory service, section 55 provides that the lifetime pension and monthly benefit, described above, are each reduced by a percentage equal to 5% for each year by which the member's age is less than 65 (60) years of age (subsection 55(2)), prorated for fractions of a year.

***Alternative Types of Pensions***

Section 56 provides that a pension may be granted on the single life plan with a guaranteed period of 10 years (normal form), single life plan with a guaranteed period (5 or 15 years), joint life and last survivor plan, temporary life plan in connection with one of the above, or a combination of these plans with the approval of the plan administrative agent. 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% joint life and last survivor option, 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 administrative agent. This option provides for a reduced amount payable to the member, continuing to the spouse on death of the member at 60% of the initial reduced amount. The provision in section 56(3) is worded slightly differently, though we understand it is implemented as described above, as is required under the *PBSA*. A spouse is as defined in the *PBSA*, and includes a common-law or same-sex spouse.

***Long-Term Disability***

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.

***Disability Pensions***

Section 60 provides that a member is entitled upon application to a disability pension if the member, before reaching age 60 (55), has terminated employment, 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. 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. Section 63 provides that where a disability pension is payable, the pension earned to date is increased as permitted under the *Income Tax Act*. Subject to certain limits, this permits the immediate recognition of projected future service in the calculation of the pension.

***Pre-retirement Death Benefits***

The pre-retirement death benefits for active and inactive plan members are covered in section 69, and are as follows:

- a) if there is no surviving spouse or a valid spousal waiver has been filed, the benefit payable to the beneficiary is an amount equal to the greater of a refund of the member's contributions with interest at the refund

interest rates, 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 (50) 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:
  - a. the greater of a refund of member's contributions with interest at the refund interest rates, and the full commuted value of the regular pension earned to the date of death; and
  - b. an immediate pension that is actuarially equivalent to the full commuted value of the regular pension earned to the date of death and payable as if the member had chosen the joint life and last survivor option.
- c) if the member has attained age 55 (50) 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 and payable as though the member had terminated employment immediately before death and had chosen the joint life and last survivor option.

### ***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 date 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 is below age 55 (50), 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 or to December 31, 1980 if earlier, based on the percentage increase granted to pensions each January 1 under section 73. Subsequent to 1980, the highest average salary is 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.

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

### ***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

increase 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). (The monthly benefit to age 65, payable as part of the retirement benefits formula, and a temporary life annuity arising as a result of converting some or all of the lifetime pension to one of the optional forms are subject to indexing increases.) The maximum increase is equal to the percentage increase in the annual change in the 12-month average Consumer Price Index for the period November to October.

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;
- d) the capitalized value of all cost of living benefits granted annually is transferred from the Inflation Adjustment Account to the Basic Account; and
- e) if in calculating the cost of living there is a decrease in the CPI (deflation), pensions will not be reduced and the reduction in the cost of living will be carried forward into subsequent years until it has been recovered.

### ***The Fund***

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

- a) the Basic Account, consisting of all the assets in the fund other than assets in the Inflation Adjustment Account and the Supplemental Benefits Account;
- b) the Inflation Adjustment Account, consisting of:
  - 1) the 1.25% contribution by each of the members under section 5(1)(c);
  - 2) the 2.75% employer contributions under section 6(1)(c), less amounts allocated for the payment of premiums for prescribed non-pension (i.e., group) benefit entitlements;
  - 3) the net investment income earned on the Inflation Adjustment Account; and
  - 4) the income, as determined by the plan administrative agent, that is earned on 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:
  - 5) amounts transferred to the Basic Account in respect of capitalized cost of living benefits granted under sections 73 and 88;

- 6) refunds to plan members in respect of contributions made to this account under sections 5(1)(c), or amounts otherwise transferred out of this account in respect of member and employer contributions allocated to this account;
- 7) 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;
- 8) 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
- 9) amounts transferred to the Supplemental Benefits Account, if any, to cover inflation protection on benefits in excess of those registrable under the *Income Tax Act*; and

(Section 10.3 of the Joint Trust Agreement 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*.

### ***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 Public Service Pension 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 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 currently permitted (before application of any early retirement reductions, where applicable) is the lesser of:

- a) \$2,914.44 in 2017 multiplied by the years of service; and
- b) 2% multiplied by the years of service further multiplied by the average of the best 3 years of remuneration paid to the member.

The Plan also imposes a 35-year cap on accruals at the above maximum rate.

**Other Items**

1. The Post Retirement Group Benefit Rules set out the non-pension (i.e., group) benefits that are provided to retired members. These include the partial subsidy of premiums for extended-health and group-life benefits. The subsidized costs are allocated entirely from employer contributions to the IAA. Non-pension benefits were previously contained in sections 91 through 95 of the Plan rules (repealed effective January 1, 2004). Dental benefits, which were previously subsidized, are now offered through a voluntary member-funded dental plan.
2. Section 3.2 of the Joint Trust Agreement provides that all expenses incurred in the administration of the Plan are to be paid from the fund.
3. 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 plan 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.
4. The benefit provisions are different in a number of respects for certain groups of participants, e.g. judges, MLAs, deputy ministers, ambulance paramedics, etc. These groups are relatively small and should not have a material effect on the results of our valuation and hence we have ignored these differences in our calculations. We have also ignored the normal-retirement-age-60 classification and have treated all active members as if they are subject to normal retirement age 65.
5. The plan has in place transfer agreements with other public sector pension plans in Canada, including the three other main BC public sector pension plans. Under these agreements members may elect to transfer their service from one plan to another. Transfers under the agreement take into account the benefits under the transferring plans and pro-rate service if the importing plan's reserve requirements are higher than those available from the exporting plan. Members may pay for any shortfall, subject to CRA approval, within certain deadlines.

## Appendix B: Actuarial Methods and Assumptions

The significant actuarial assumptions are summarized below.

<b>Investment Return</b>	6.25% per annum (6.50% for the previous valuation)
<b>General ("across-the-board") Salary Increases</b>	3.50% per annum (3.75% for the previous valuation)
<b>Seniority Salary Increases</b>	Annual percentages varying by age and sex
<b>CPI Increases</b>	2.75% (3.00% for the previous valuation)
<b>Pension Indexing</b>	<ul style="list-style-type: none"> <li>▪ Future indexing of pensions and deferred pensions ignored, as will be covered by Inflation Adjustment Account</li> <li>▪ Future indexing (by inflation) of wage base for disability accruals assumed to be a charge to the Basic Account and to be 2.75% per annum (3.00% for the previous valuation)</li> <li>▪ Indexing to date is capitalized and forms part of pension liability</li> </ul>
<b>Asset Values</b>	<ul style="list-style-type: none"> <li>▪ Assets carried at smoothed market values</li> <li>▪ Smoothed value restricted to a range of 92% to 108% of the market value</li> </ul>
<b>Costing Method</b>	Contributions are based on an entry-age funding approach

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 partly as if they would continue to earn service credits and ultimately receive a pension from the Plan and partly as if they would again become contributing members of 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 current 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 generally set equal to their accumulated refund values (in some cases, depending on the member's status, we held twice the refund value).

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

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 three 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 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 salaries, as follows:

- (1) If the result is an unfunded liability, amortize it over the 15 year period commencing April 1, 2018 (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 unfunded liability amortization amounts there is still a surplus, amortize this surplus over both 15 years and 25 years, commencing a year after the valuation date.



The required contributions are the sum of the normal actuarial cost and the amounts required to amortize the unfunded actuarial liability or surplus. If there is a surplus, the funding policy requires that the contribution rate should fall within the range defined by the rate amortizing the surplus over 25 years (25 year rate) and the rate amortizing the surplus over 15 years (15 year rate). If the current rate is less than the 15 year rate, the current rate must be increased, if the current rate is more than the 25 year rate, the contribution rate may be reduced to the 25 year rate, or benefits increased such that the required contribution rate equals the 25 year rate.

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.

## 2. Treatment of Member and Pensioner Data

Data as of March 31, 2017 were prepared by the Pension Corporation for 56,885 active members, 46,187 pensioners, 2,496 members receiving benefits from a long-term disability plan, 10,306 terminated members eligible for a vested pension, 6,547 other inactive members (including 7 on leave of absence) plus a further 223 non-retired individuals with very limited data, 12,186 active member terminations and 3,965 pensioner terminations during the period April 1, 2014 to March 31, 2017. In addition, Pension Corporation also provided separate data for 82 active MLA members (including 1 on long-term disability who we treated as an active member), 18 deferred vested MLA members and 4 other inactive MLA members. 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 3 years since the last valuation and no more than 1 year in the valuation year);
- accrued service was within the 35 years cap;
- 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 4% to reflect the part-time employment (unchanged from the previous valuation).

There were also 2,096 active members coded as having maximum-retirement-age equal to age 60. We ignored this classification and treated all active members as having maximum-retirement-age equal to 65. In addition, certain members, e.g. judges and MLAs, have enhanced benefits. We ignore these enhanced benefits in this valuation. The additional contributions required for members with enhanced benefits will be reported on separately to the Board of Trustees.

The active member data included 2,218 persons who had no salary or service reported for the year ending March 31, 2017, or with a last-contribution-date prior to March 2017. We excluded them from the active member base, and have included them with the inactive data. We also excluded one active member from the valuation process because of missing, invalid or inconsistent detail. A liability of twice their accumulated account was held for this member.

Salary details were inappropriate (missing, very low, or very high) for a further 47 active members. We assumed that these members had the same average earnings as for other actives in the same age-sex category.

The liability for the 2,434 members on long-term disability was calculated in two steps. We first calculated a liability as if these individuals would ultimately collect deferred vested pensions starting at age 62(61 was applied in the previous valuation) where their deferred pensions were calculated on the basis of service projected to retirement date (maximum 35 years) 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 also calculated a liability as if these members would again become contributing members of the plan. In order to allow for the possibility of recoveries from disability we set the liability equal to 80% of the former figure plus 20% of the latter figure (unchanged from the previous valuation).

We also excluded 62 members on long-term disability from the regular valuation process because of missing, invalid or inconsistent detail. Liabilities of twice their accumulated accounts were held for these members.

We divided the 10,324 (including 18 MLAs) terminated members entitled to a vested pension into two classes:

- (i) those with missing, invalid or inconsistent detail, and
- (ii) all other inactive members.

The liability for the first group was held as twice their accumulated accounts. For the second group, we calculated liabilities on the assumption that 100% of these members would receive vested pensions. This approach is unchanged from the previous valuation.

We divided the 8,765 other inactive members (i.e., including the 2,218 persons reassigned from the active group) into three classes:

- (i) those with an accumulated account of at least \$1,500, and who are on leave of absence or who have returned to work after the valuation date;
- (ii) those with missing, invalid or inconsistent detail, or whose accumulated accounts were less than \$1,500, or who had less than 3 complete years of service, or who did not contribute in 2015/16 or 2016/17, or who were known to have taken a refund after the valuation date; and
- (iii) all other inactive members.

We calculated liabilities on the assumption that the first and third groups would be reactivated on April 1, 2017, with assumed average salaries equal to the average salaries for active members in the same age-group category, and that the second group would take immediate refunds. For those in the second group with an accumulated account of at least \$1,500 and 2 or more years of service, but who were not eligible (under our criteria) to be reactivated, we held a liability equal to twice the accumulated account. For the remaining members in the second group (i.e. those with an accumulated account of less than \$1,500 or less than 2 years of service), we held the accumulated account. This is unchanged from the previous valuation.

We held a liability equal to the accumulated account for the 4 MLA inactive members (as they all had less than the 6 years of contributory service required to be vested).

We excluded 966 remaining vested members from the regular valuation process because of missing, invalid or inconsistent detail. Liabilities of twice their account balances were held for these members.

With respect to the 223 remaining non-retired members with limited data, we held a liability equal to twice their accumulated accounts.

Of the total pensioner data, there were 80 members excluded from the valuation because they died prior to the valuation date with no outstanding guaranteed pensions due or they were in receipt of a remaining guarantee only which rounded to zero months remaining, and hence their liability is zero.

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.

			Valuation Treatment							
	Pension Corp. Data	MLA Data	Pensioners	Pensioners with zero liability	Actives	LTD	Vested	Re-activate	Refund CWI <sup>1</sup>	Refund 2 x CWI
Pensioners	46,187		46,107	80						
Active Members	56,885	82			54,748			867	847	505
Long Term Disability	2,496					2,434				62
Terminated Vested	10,306	18					9,358			966
Inactive members	6,547	4						11	6,317	223
Limited data	223									223
<b>Total membership</b>	<b>122,644</b>	<b>104</b>	<b>46,107</b>	<b>80</b>	<b>54,748</b>	<b>2,434</b>	<b>9,358</b>	<b>878</b>	<b>7,164</b>	<b>1,979</b>

### 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).

<sup>1</sup> CWI = contributions with interest.

***(a) Relationship to excess investment return threshold***

The 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.

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 6.5% per annum. As noted earlier, this also becomes 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 only earn a rate of 6.5% 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 14.5% for 2015, 0.0% for 2016 and 12.8% for 2017. At March 31, 2017, approximately 70% of the total portfolio was invested in equities (including private placements, infrastructure and renewable resources), a further 13% in real estate, and the balance of 17% in fixed income.

***(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 6.65% (reduced from 6.75% in 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 4.15% (increased from 4.0% in the previous valuation).

In setting the 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 decreased our long-term investment return assumption from 6.50% to 6.25% per annum. We continued with our previous valuation assumption for the real return of 3.5%. In other words, there is a margin of 0.40% on the investment return assumption (increased from 0.25% in the previous valuation), and a margin of 0.65% on the real return assumption (increased from 0.5% in the previous valuation).

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

	<b>Discount rate</b>
Weighted average return	6.67%
Diversification and rebalancing effect	0.25%
Provision for investment related expenses	(0.25%)
Rounding	(0.02%)
<b>Estimated net investment return before margin</b>	<b>6.65%</b>
Margin for adverse deviation	(0.40%)
<b>Discount return assumption (rounded to nearest 0.25%)</b>	<b>6.25%</b>

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.

For the purposes of establishing the discount rate used in this report, we have assumed that there will be no added-value returns from employing an active management strategy in excess of the associated additional investment management fees. The investment expense allowance of 0.25% provides for expected future management fees consistent with the assumption of no added value returns from active management.

***(d) Real return and salary relationships - derive salary assumption***

The 6.5% investment return assumption used at the last valuation was viewed as consisting of a real return component of about 3.5% per annum plus a long-term underlying inflation assumption of about 3.0% per annum. Continuing with the same real return component of 3.50% and applying it to the new 6.25% investment return assumption, we get a revised long-term underlying inflation assumption of 2.75% per annum (i.e. 6.25% - 3.50%). This can also be viewed as a best estimate of future inflation of 2.5% (derived from the best estimate

nominal return assumption of 6.65% less the best estimate real return assumption of 4.15%), plus a margin for adverse deviations of 0.25%.

The general salary increase assumption used in the 2014 valuation was 3.75% per annum. This was viewed as consisting of the underlying inflation assumption of 3.0% per annum, plus a real salary increase component of 0.75% per annum. For this valuation, when the real salary increase assumption of 0.75% is added to the revised underlying inflation assumption of 2.75%, we get a revised 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%.

The impact of these assumptions on the 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 retain only 6.25%.

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 2.50% underlying inflation, etc. Thus, the underlying inflation assumption in itself is not material to the results.

***(f) Summary of interrelationships***

The 2017 and 2014 annual investment return and general salary increase assumptions, and their underlying economic interrelationships, are summarized below.

	2017 valuation	2014 valuation
1. Investment return = excess investment return threshold	6.25%	6.50%
2. Real return rate	3.50%	3.50%
3. Implied underlying inflation = 1 - 2	2.75%	3.00%
4. Real salary increase	0.75%	0.75%
5. General salary increase = 3 + 4	3.50%	3.75%

**(g) Actual vs. expected salaries; adjust data salaries**

The 2017 valuation data indicates that average annual earnings increased by about 4.0% from mid-fiscal-2014 to mid-fiscal-2017 (i.e., about 1.3% per annum), as compared with an expected increase of about 11.7% (i.e., 3.75% per annum) on the basis of the assumptions used in the 2014 valuation.

The input data salaries provided to us for this valuation were the actual earnings during fiscal 2017. In order to bring these data salaries forward to the valuation date, 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 also assumed that the YMPE would increase at the general salary increase rate of 3.5% per year from its 2017 level of \$55,300, both for the regular valuation and for the purposes of computing the entry-age costs. In the previous valuation we assumed that the YMPE would increase at a rate of 3.75% per year from its 2014 level of \$52,500, both for the regular valuation and the entry-age costs.

**Pension Indexing – Basic 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 are currently fixed at 1.25% of salaries to be paid by the members, plus 2.75% paid by the employers, less amounts paid for group benefits for pensioners (currently capped at 1% of pay). With respect to indexed supplements granted through January 1, 2017, 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 transfers to the



Basic Account from the Inflation Adjustment Account to finance this indexing 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.

### **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 March 31, 2015 to March 31, 2017.

As in the previous valuation, we applied a smoothing technique by adjusting the market values over a five year period. We believe a smoothing approach is appropriate as it cushions the actuarial valuation results against the 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 the 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.

The smoothed value 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. The constraint of 92% applied as of March 31, 2014.

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

**Adjustments to Total Fund**

<b>Target return</b>		<b>2015</b>	<b>2016</b>	<b>2017</b>
1.	March-over-March increase in CPI	1.2%	1.3%	1.6%
2.	Base return = (1) + 3.5%	4.7%	4.8%	5.1%
<b>Year-end asset values - \$000's</b>				
3.	At market value	26,702,019	26,281,387	29,204,977
4.	At smoothed value	24,565,857	24,914,157	27,043,667
5.	Ratio of (4) ÷ (3)	0.920	0.948	0.926
<b>Annual returns</b>				
6.	At market value	14.5%	0.0%	12.8%
7.	At smoothed value	14.6%	3.1%	10.3%

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**

<b>Basic Account</b>		<b>2015</b>	<b>2016</b>	<b>2017</b>
8.	Market value	20,515,558	20,123,427	22,065,497
9.	Smoothed value	18,874,313	19,076,551	20,432,543
10.	Ratio of (9) ÷ (8)	0.920	0.948	0.926
<b>Inflation Adjustment Account</b>				
11.	Market value	6,186,461	6,157,960	7,139,480
12.	Smoothed value	5,691,544	5,837,606	6,611,124
13.	Ratio of (12) ÷ (11)	0.920	0.948	0.926

**Mortality**

We examined the 2014-2017 mortality experience and compared this with the experience observed in our previous analyses of the mortality rates and with the rates used in the previous valuation. In the three year intervalation period, the actual experience showed more deaths than expected, compared to prior intervalation periods where, in general, we have observed fewer deaths than expected on the basis of the rates used in the previous valuation. Our analysis also indicated that there were actually no improvements in mortality in the intervalation period when compared with the mortality improvement scale used in the previous valuation.

For this valuation, we also considered initial analysis from Club Vita Canada. Club Vita Canada's longevity dataset is composed of a subset of Canadian registered pension plans across Canada, and includes plans covering a range of industries in both the private and public sector. Club Vita Canada develops mortality curves, called VitaCurves, based on longevity experience consisting of 1.4 million exposure years and 38 thousand deaths over 2012 to 2014, and vary by the following longevity factors:

- Gender;
- Pensioner type – pensioner or surviving spouse;
- Disability status at retirement for pensioners – disabled or non-disabled pensioner;
- Postal code-based lifestyle/longevity group – five groups for each of males and females;
- Affluence as measured by pension amount or earnings – there are three pension bands for males and females, while there are four earnings bands for males and three for females; and
- Occupation type – currently or formerly employed in a blue or white collar occupation.

Given that the availability of longevity factors varies by plan, and also by members within a plan, the VitaCurves are calibrated based on different combinations of the factors outlined above, resulting in just over 300 baseline mortality tables. The best VitaCurve is assigned to each individual member based on the longevity factors available for that member.

Initial analysis from ClubVita is consistent with our examination of the 2014-2017 mortality experience, i.e. more deaths than expected.

In the absence of knowing if this experience is a trend or an anomaly, we have made partial allowance for the most recent experience by continuing to use the adjusted 2014 Public Sector Mortality Table (CPM2014Publ), and the CPM Improvement Scale B (CPM-B) Table, but we adjusted the latter table to remove the assumed 2015, 2016 and 2017 improvements. Based on historic experience and our current expectations for future experience, we view the use of the CPM-B improvement scale as a best estimate assumption for this plan. In future years, we anticipate using the Club Vita Canada VitaCurves, as more experience is included.

The resulting mortality assumptions used are as follows:

- 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 100% for males and 95% for females of the rates in 2014 Public Sector Mortality Table (CPM2014Publ), projected using CPM Improvement Scale B (CPM-B) with 2015, 2016 and 2017 assumed improvements removed.

This is unchanged from the previous valuation except for the removal of three years of assumed mortality improvements.

- b) For deferred vested pensions, mortality was ignored during the deferral period before retirement. This same assumption was made in the previous valuation.

- c) For employees retired on account of disability we assumed 75% for males and 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. This is unchanged from the previous valuation.

**Withdrawal**

We examined the rates of withdrawal for reasons other than death, retirement or disability over the period April 1, 2014 to March 31, 2017 and compared this with the experience observed and the rates used for previous valuations. Observed withdrawal rates were similar to those used in the previous valuation, with the exception of terminations in the first year of service and termination after 3 years of service for males which were higher than assumed. Accordingly, we have made relatively minor changes to the withdrawal rates used for the previous valuation, by adopting the following multiples of those rates.

***Multiples applied to 2014 rates***

	In the first 3 years of service			After 3 years of service
	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	
Males	110%	100%	100%	105%
Females	110%	100%	100%	100%

Sample withdrawal rates are shown in the following tables.

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

Age at entry	2017 valuation			2014 valuation		
	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year
<b>Males</b>						
20	.177	.141	.136	.161	.141	.136
30	.091	.086	.089	.083	.086	.089
40	.084	.075	.062	.076	.075	.062
50	.067	.051	.055	.061	.051	.055
<b>Females</b>						
20	.112	.122	.147	.102	.122	.147
30	.106	.122	.127	.096	.122	.127
40	.074	.074	.053	.067	.074	.053
50	.059	.060	.049	.054	.060	.049

*B. Withdrawal Rates Applicable After 3 Years of Service*

Attained age	2017 valuation		2014 valuation	
	Males	Females	Males	Females
23	.134	.124	.128	.124
33	.047	.072	.045	.072
43	.023	.030	.022	.030
53	.014	.014	.013	.014

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. We examined the combined experience of members going on disability pensions and on long-term disability and concluded that the experience in the inter-valuation period merited a change in the assumed rates. 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 62 (or, immediately, for those older than age 62). Commencement at age 61 was assumed in the 2014 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.

*Disability Rates*

Age	2017 Valuation		2014 Valuation	
	Males	Females	Males	Females
25	.0003	.0001	.0003	.0001
35	.0004	.0011	.0004	.0011
45	.0023	.0037	.0023	.0036
55	.0075	.0100	.0073	.0098

The rates used for the 2017 valuation are 195% for males and 170% for females of the respective rates used for the valuation of the Pension Plan for the Public Service of Canada as at March 31, 2011. The previous valuation used 190% for males and 165% for females of those respective rates.

**Retirement**

We examined the 2014-2017 retirement experience 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 shows 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 below age 60 and to retirement at some ages above 60.

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

*Retirement Rates*

		2017 valuation		2014 valuation	
Age	Service	Males	Females	Males	Females
<b>For unreduced retirement pensions</b>					
55-59	rule-of-85	.45	.45	.50	.50
60	10	.30	.40	.34	.40
61	10	.20	.22	.22	.22
62	10	.22	.22	.22	.22
63	10	.20	.22	.20	.24
64	10	.22	.20	.25	.25
65	0	1.00	1.00	1.00	1.00
<b>For reduced early retirement</b>					
55-59	at least 10 years, but not rule-of-80	.03	.05	.04	.06
55-59	rule-of-80	.10	.12	.12	.14

Even though pensions (unreduced and reduced) 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.

**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 March 31, 2017 and on the graduated average salaries of the active members as of March 31, 2017, 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 Salary Rate Increases*

Age	2017 and 2014 valuation	
	Males	Females
25	.037	.029
35	.016	.015
45	.007	.009
55	.003	.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. In the previous valuation, we valued all terminations with 2 or more years of service as vested pensions and assumed that those with less than 2 years of service would elect a refund of contributions with interest.

**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 the valuation. The same assumption was made in the previous valuation.

**Growth of active Public Service population**

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

**Expenses**

Administration expenses are paid out of the Public Service Pension Plan fund. These amounts totalled 0.44%, 0.47% and 0.47% of salaries for the 2015, 2016 and 2017 fiscal years respectively. Projected expenses provided by the Pension Corporation for the next few years anticipate that administration expenses will continue at the rates seen in 2016 and 2017. Accordingly, we increased the expense provision included as part of the normal actuarial costs in the determination of the required contribution rates under the entry-age funding method from 0.45% of salary used in the previous valuation to 0.48% of salary. We also included a provision for the present value of expenses in the statement of actuarial position. The same approach 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.



## Refunds

Since we have valued all active terminations as vested pensions, the interest assumed to be earned in the future on member contributions is irrelevant for this valuation. In the previous valuation, we assumed an interest assumption for accumulation and refunds of member contributions of 1.5% less than the valuation investment return assumption, i.e. at 5.0% per annum.

## Plan Termination

The Standards of Practice issued by the Canadian Institute of Actuaries require that a valuation report “disclose the financial position of the plan if it were to be wound up on the calculation date, unless the plan does not define the benefits payable upon wind-up, in which case the actuary should include a statement to that effect”.

While the Joint Trust Agreement deals with plan termination in sections 13.4 and 13.5, it is our, and the Board’s, opinion that the benefits on wind-up are not defined. Accordingly, we no longer comment on the financial position of the plan if it were to be wound up.

## Fully Indexed Valuation – 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, using a smoothed asset value of \$27,043,667,000;
- We applied an indexing assumption equal to the full assumed underlying inflation rate, i.e., 2.75% per annum. This indexing rate was applied to pensions after retirement and, in the case of deferred vested pensions and disability salary accruals, during the pre-retirement period. 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  $8.18\% + 1.25\% = 9.43\%$ , integrated with the CPP (i.e., reduced by 1.5% of salaries below the YMPE). The employer contributions of 2.75% to the IAA were reduced by 1% to account for the carve-out of the non-pension (EHB and Dental) benefits. The 1% carve-out was based on the Board’s funding policy that no more than 1% of the employers’ IAA contributions would be available to pay for post-retirement group benefits. The total employer rate is assumed to be  $8.18\% + 1.75\% = 9.93\%$ , with a 1.5% integration for CPP. A similar approach was used in the previous valuation.

## Maximum pension rule – Assumption Changes

As noted earlier, we have not applied these rules when doing the primary Basic and the fully 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:

- a) \$2,914.44 in 2017 multiplied by the years of service; and
- b) 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. The Plan also imposes a 35 year cap on accruals at the above maximum rate, which we have applied. For an individual in this Plan to be currently affected by the \$2,914.44 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 \$2,914.44 limit is automatically indexed each year after 2017 in accordance with increases in the average wage.

Accordingly, we have applied a 3.50% per annum increase to the \$2,914.44 limit after 2017 (at the previous valuation the corresponding dollar limit was \$2,770, and was scheduled to be automatically indexed each year after 2014 in accordance with increases in the average wage; a 3.75% increase rate was applied after 2014 to the \$2,770 limit at the previous valuation).

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 but given the changes to the pension administration system, we were able to carve out the pensions in pay.

## Appendix C: Active Member Data

Age group <sup>1</sup>	Active members March 31, 2017			New entrants April 1, 2014 to March 31, 2017 and still active March 31, 2017	
	Number	Average annual earnings <sup>2</sup> \$	Average service (years)	Number	Average annual earnings \$
<b>Males</b>					
Less than 25	390	46,174	1.0	623	48,034
25-29	1,653	52,116	2.1	986	54,324
30-34	2,580	61,043	3.9	919	61,165
35-39	2,972	67,409	5.8	649	63,741
40-44	3,231	69,863	7.9	567	66,645
45-49	4,107	72,282	11.5	472	68,383
50-54	4,437	75,034	14.9	367	74,108
55-59	4,285	75,108	17.0	220	76,079
60 & over	3,250	77,437	17.5	82	77,999
<b>Total</b>	<b>26,905</b>	<b>70,285</b>	<b>11.1</b>	<b>4,885</b>	<b>61,712</b>
<b>Females</b>					
Less than 25	377	44,475	1.0	697	45,855
25-29	1,853	49,807	2.1	1,258	51,443
30-34	3,087	57,530	3.9	1,032	55,889
35-39	3,286	61,956	5.8	680	57,416
40-44	3,394	65,957	8.2	580	57,903
45-49	4,289	66,521	11.9	427	57,953
50-54	4,779	66,409	15.3	301	60,892
55-59	4,054	66,204	17.0	188	68,055
60 & over	2,724	65,348	17.4	48	65,541
<b>Total</b>	<b>27,843</b>	<b>63,326</b>	<b>10.9</b>	<b>5,211</b>	<b>54,883</b>
<b>Total males and females</b>	<b>54,748</b>	<b>66,746</b>	<b>11.0</b>	<b>10,096</b>	<b>58,187</b>

Average age of the 54,748 actives is 46.2.

<sup>1</sup> Age nearest birthday at March 31, 2017 for actives and at entry for new entrants.

<sup>2</sup> Based on actual earnings in 2016/17 for those employed all year and annualized for others. Zero, very low or very high earnings figures were replaced by the average earnings in the same age-sex group.

A comparison of the March 31, 2017 active membership with the March 31, 2014 membership is as follows:

	March 31, 2014	March 31, 2017	Change 2014 to 2017
<b>Males</b>			
Number	25,452	26,905	+ 5.7%
Proportion of total	49.0%	49.1%	+ 0.1%
Average age (at 3.31)	47.1	46.7	- 0.4 years
Average service	11.9	11.1	- 0.8 years
Average salary	\$67,818	\$70,285	+ 3.6%
<b>Females</b>			
Number	26,540	27,843	+ 4.9%
Proportion of total	51.0%	50.9%	- 0.1%
Average age (at 3.31)	46.2	45.8	- 0.4 years
Average service	11.6	10.9	- 0.7 years
Average salary	\$60,706	\$63,326	+ 4.3%

The above comparison indicates an increase in the covered membership during the 3 year inter-valuation period. The proportion of females to males has decreased very slightly. The average ages and average service have decreased for males and females. The increase in average salary is higher for females than for males.

A comparison of the new entrant subset used at March 31, 2017 with that used at March 31, 2014 in determining the entry-age normal costs is as follows:

	March 31, 2014	March 31, 2017	Change 2014 to 2017
<b>Males</b>			
Number	3,577	4,885	+ 36.6%
Proportion of total	50.2%	48.4%	- 1.8%
Average age at entry	37.2	36.5	- 0.7 years
Average salary	\$60,423	\$61,712	+ 2.1%
<b>Females</b>			
Number	3,542	5,211	+ 47.1%
Proportion of total	49.8%	51.6%	+ 1.8%
Average age (at entry)	35.4	35.2	- 0.2 years
Average salary	\$52,493	\$54,883	+ 4.6%

The average number of new entrants has increased significantly, and the portion of females to males has increased. The average age of new entrants has decreased for both males and females. The increase in average salary for all new entrants is lower than the increase in average salary for the actives as a whole.

## Appendix D: Inactive Member Data

### 1. Inactive Members Assumed Reactivated on Valuation Date

Age group <sup>1</sup>	Males			Females		
	Number	Average annual earnings <sup>2</sup>	Average service (years)	Number	Average annual earnings <sup>2</sup>	Average service (years)
Under 30	15	\$53,370	3.5	24	\$50,577	3.8
30-34	48	61,353	4.5	122	57,841	5.0
35-39	56	67,649	6.0	116	61,763	6.3
40-44	42	69,936	7.3	91	65,897	8.2
45-49	41	72,206	9.0	66	66,391	9.9
50-54	43	74,954	11.0	74	66,191	14.1
55-59	33	74,802	13.6	37	66,325	12.3
60 & over	31	77,072	15.4	39	65,626	11.8
<b>Total</b>	<b>309</b>	<b>69,619</b>	<b>8.7</b>	<b>569</b>	<b>62,785</b>	<b>8.4</b>

	Number	Average Age	Average annual earnings <sup>2</sup>	Average service
<b>Total - males &amp; females</b>	<b>878</b>	<b>43.3</b>	<b>\$65,191</b>	<b>8.5 years</b>

<sup>1</sup> Age nearest birthday at March 31, 2017.

<sup>2</sup> Assumed same earnings as for active members in same age-sex group.

**2. Members on Long-Term Disability**

Age group <sup>1</sup>	Males		Females	
	Number	Average annual deferred pension <sup>2</sup>	Number	Average annual deferred pensions <sup>2</sup>
Under 30	4	\$23,575	3	\$30,875
30-34	18	32,290	25	23,753
35-39	37	26,744	69	27,518
40-44	45	24,004	112	25,130
45-49	85	25,407	199	24,390
50-54	166	24,209	297	22,494
55-59	220	22,520	414	20,728
60 & over	253	20,551	487	18,962
<b>Total</b>	<b>828</b>	<b>23,040</b>	<b>1,606</b>	<b>21,638</b>

	Number	Average age	Average annual deferred pensions <sup>2</sup>
<b>Total males &amp; females</b>	<b>2,434</b>	<b>54.3</b>	<b>\$22,115</b>

	Number	Average age	Average Pensionable Service	Average Salary	Expected Average Remaining Service life
<b>Active and LTD Combined</b>	<b>57,182</b>	<b>46.6</b>	<b>11.4</b>	<b>\$66,444</b>	<b>9.5</b>

<sup>1</sup> Age nearest birthday at March 31, 2017.

<sup>2</sup> Basic lifetime portions payable from age 62; additional temporary amounts are payable from age 62 to 65.

**3. Other Inactive Members Entitled to Vested Pensions and Not Assumed Reactivated**

Age group <sup>1</sup>	Males			Females		
	Average annual vested pensions			Average annual vested pensions		
	Number	Initial <sup>2</sup> \$	Offset at age 65 \$	Number	Initial <sup>2</sup> \$	Offset at age 65 \$
Under 30	159	1,208	385	196	1,463	460
30-34	235	3,271	946	333	3,066	918
35-39	370	4,106	1,119	488	3,807	1,101
40-44	450	5,928	1,520	693	5,225	1,416
45-49	731	7,280	1,824	1,124	6,656	1,765
50-54	926	9,830	2,321	1,240	8,620	2,229
55-59	658	10,444	2,331	900	8,090	2,065
60 & over	402	8,222	1,908	453	6,514	1,608
<b>Total</b>	<b>3,931</b>	<b>7,568</b>	<b>1,822</b>	<b>5,427</b>	<b>6,484</b>	<b>1,704</b>

	Number	Average age	Average annual vested pension - initial	Average annual vested pension - Offset at age 65
<b>Total males &amp; females</b>	<b>9,358</b>	<b>48.2</b>	<b>\$6,939</b>	<b>\$1,754</b>

**4. Remaining Inactive Members**

Number	Member contributions with interest
9,143 <sup>3</sup>	\$28,635,206

<sup>1</sup> Age nearest birthday at March 31, 2017.

<sup>2</sup> These pensions are assumed to commence at the first age at which the member is entitled to an unreduced pension, assuming no earlier than age 60, i.e., at various ages between 60 and 65.

<sup>3</sup> Includes 1 active, 62 disabled and 966 vested members, with invalid data.



## Appendix E: Pensioner Data

### 1. Former Contributors

Age group <sup>1</sup>	Number of pensioners <sup>2</sup>	Annual Pensions (\$000's)				
		Single life	Joint life & survivor	Joint life & survivor with guarantee	Single life with guarantee	Temporary life
<b>Male pensioners</b>						
< 55	28	-	112	92	186	219
55-59	1,166	206	14,580	4,275	8,452	12,598
60-64	3,776	6,532	47,913	15,760	21,482	41,483
65-69	5,431	18,810	70,673	13,772	26,268	5,438
70-74	4,496	25,434	63,385	7,224	12,815	-
75-79	2,757	23,347	33,023	1,201	2,854	-
80-84	1,898	18,362	18,542	103	71	-
85-89	1,230	12,532	7,894	-	-	-
90 & over	667	8,882	3,886	-	-	-
<b>Total</b>	<b>21,449</b>	<b>114,105</b>	<b>260,008</b>	<b>42,427</b>	<b>72,128</b>	<b>59,738</b>
<b>Female pensioners</b>						
< 55	58	37	125	48	412	182
55-59	1,572	129	7,228	5,634	15,299	13,718
60-64	4,134	9,174	19,287	11,158	36,786	35,910
65-69	4,940	26,388	21,131	7,527	32,592	4,148
70-74	3,735	31,938	13,646	1,691	12,795	4
75-79	2,094	21,450	5,018	67	1,240	-
80-84	1,338	13,264	1,603	-	58	-
85-89	886	7,527	389	-	-	-
90 & over	557	5,186	69	-	-	-
<b>Total</b>	<b>19,314</b>	<b>115,093</b>	<b>68,496</b>	<b>26,125</b>	<b>99,182</b>	<b>53,962</b>
<b>Grand Total</b>	<b>40,763</b>	<b>229,198</b>	<b>328,504</b>	<b>68,552</b>	<b>171,310</b>	<b>113,700</b>
<b>Supplemental Pensions (included above)</b>		<b>1,459</b>	<b>9,772</b>	<b>2,461</b>	<b>562</b>	<b>4</b>

Average age of the 40,763 pensioners is 70.5.

<sup>1</sup> Age nearest birthday at March 31, 2017.

<sup>2</sup> These numbers include only those who were formerly contributors to the Plan.

**2. Beneficiaries**

		Annual Pensions (\$000's)	
Age group <sup>1</sup>	Number of beneficiaries <sup>2</sup>	Single life	Single Life with Guarantee
<b>Male beneficiaries</b>			
Less than 50	11	68	0
50-54	18	244	6
55-59	40	569	17
60-64	67	799	62
65-69	118	1595	117
70-74	109	1481	119
75-79	90	903	14
80-84	89	746	0
85-89	67	428	0
90 & over	32	188	0
<b>Total</b>	<b>641</b>	<b>7,021</b>	<b>335</b>
<b>Female beneficiaries</b>			
Less than 50	23	236	15
50-54	66	712	40
55-59	146	2,295	47
60-64	273	4,933	341
65-69	410	7,083	261
70-74	547	8,411	205
75-79	663	9,476	0
80-84	794	10,201	0
85-89	822	10,127	0
90 & over	793	12,100	0
<b>Total</b>	<b>4,537</b>	<b>65,573</b>	<b>909</b>
<b>Remaining guarantees</b>	<b>166</b>	<b>0</b>	<b>2,748</b>
<b>Grand Total</b>	<b>5,344</b>	<b>72,594</b>	<b>3,992</b>
<b>Supplemental Pensions</b> (included above)		<b>944</b>	

Average age of the 5,178 beneficiaries in receipt of a lifetime pensions is 78.2.

<sup>1</sup> Age nearest birthday at March 31, 2017.

<sup>2</sup> These numbers include spouses (or estates) currently receiving benefits where the former contributor is deceased.

## Appendix F: Development of Required Contribution Rates

All of the figures shown herein are on a combined member/employer basis.

The change in the normal actuarial cost from 2014 to 2017 can be traced as follows:

	<b>Combined %</b>
<b>Normal cost at 2014 valuation</b>	<b>16.33</b>
Data changes	(0.04)
Immediate vesting	(0.01)
Assumption changes:	
▪ economic assumption	0.43
▪ disability incident rates	0.01
▪ withdrawal rates	(0.02)
▪ retirement rates	(0.09)
▪ mortality improvement rates	(0.05)
▪ retirement age for disabled members	(0.03)
▪ change in administration expense assumption	0.03
<b>Total change</b>	<b>0.23</b>
<b>Normal cost at 2017 valuation</b>	<b>16.56</b>

**Calculation of Required Contribution Rate**

	<b>2017</b>	<b>2014</b>
A. Normal (entry-age) actuarial cost (integrated at 3%)	16.56%	16.33%
B. Surplus (unfunded) actuarial liability on entry-age basis (\$000s)	1,895,876	193,698
	<b>%</b>	<b>%</b>
25 years amortization	(3.06)	(0.33)
15 years amortization	(4.53)	(0.49)
<i>PBSA</i> amortization	(6.12)	0.00
Contribution rates after 25 years amortization	13.50	16.00
Contribution rates after 15 years amortization	12.03	15.84
Contribution rates after <i>PBSA</i> amortization	10.44	16.33
<b>C. Minimum permissible contribution rate (integrated at 3%)</b>	<b>13.50%</b>	<b>16.33</b>

The percentages are applied to members' total earnings and are inclusive of approximate Canada Pension Plan member/employer contributions (i.e., 1.5% of each member's salary up to the YMPE for each of the members and the employers, for a 3.0% total reduction).

## **Appendix G: Comparative 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 2017 Basic Account results; selected 2014 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 March 31, 2017**

**Present Plan (\$000's)**

	Without Tax Limits		With Tax Limits	
	Basic Only	Basic + Indexed	Basic Only	Basic + Indexed
<b>Assets</b>				
Market value of Fund	22,065,497	29,204,977	22,065,497	29,204,977
Asset smoothing adjustment	(1,632,954)	(2,161,310)	(1,632,954)	(2,161,310)
<b>Smoothed value of Fund</b>	<b>20,432,543</b>	<b>27,043,667</b>	<b>20,432,543</b>	<b>27,043,667</b>
Actuarial present values of future contributions at entry-age rates	4,217,328	5,742,374	4,188,897	5,694,939
<b>Total Assets</b>	<b>24,649,871</b>	<b>32,786,041</b>	<b>24,621,440</b>	<b>32,738,606</b>
Actuarial present values for:				
▪ pensions being paid	9,982,815	12,806,068	9,803,626	12,573,450
▪ inactive members	1,057,192	1,603,571	1,057,178	1,603,553
▪ active members	11,570,761	15,537,173	11,499,603	15,443,312
▪ future expenses	143,028	143,028	143,028	143,028
Voluntary contribution balance	199	199	199	199
<b>Total Liabilities</b>	<b>22,753,995</b>	<b>30,090,039</b>	<b>22,503,634</b>	<b>29,763,542</b>
<b>Surplus (Unfunded Liability)</b>	<b>1,895,876</b>	<b>2,696,002</b>	<b>2,117,806</b>	<b>2,975,064</b>
<b>Selected 2014 Comparisons</b>				
Total Assets	20,471,582	26,958,991	20,439,801	26,919,264
Total Liabilities	20,277,884	27,553,771	20,090,889	27,301,582
Surplus (Unfunded Actuarial Liability)	193,698	(594,780)	348,912	(382,318)

**Schedule G3 – Current and Required Contribution Rates (integrated at 3%) – March 31, 2017**

	Without Tax Limits		With Tax Limits	
	Basic only %	Basic + Indexed %	Basic only %	Basic + Indexed %
<b>Current contribution rates</b>				
Member <sup>1</sup>	8.18	9.43	8.18	9.43
Employer <sup>1, 2</sup>	8.18	9.93	8.18	9.93
Combined member/employer <sup>1, 2</sup>	16.36	19.36	16.36	19.36
<b>Required contribution rates<sup>3</sup></b>				
Entry age normal cost rate <sup>1</sup>	16.56	21.68	16.44	21.52
▪ 25-year amortization	(3.06)	(4.24)	(3.33)	(4.68)
▪ 15-year amortization	(4.53)	(6.27)	(4.93)	(6.92)
▪ <i>PBSA</i> amortization	(6.12)	n/a	(7.40)	n/a
<b>Total contribution rate<sup>1</sup></b>				
▪ 25-year amortization	13.50	17.44	13.11	16.84
▪ 15-year amortization	12.03	15.41	11.51	14.60
▪ <i>PBSA</i> rate	10.44	n/a	9.04	n/a
<b>Total required contribution rate<sup>1</sup></b>	<b>13.50</b>	<b>n/a</b>	<b>13.11</b>	<b>n/a</b>
<b>Selected 2014 Comparisons</b>				
Member rate <sup>1</sup>	8.18	9.43	8.18	9.43
Employer rate <sup>1, 2</sup>	8.18	9.93	8.18	9.93
<b>Combined member/employer</b>	<b>16.36</b>	<b>19.36</b>	<b>16.36</b>	<b>19.36</b>
<b>Entry age normal cost rate<sup>1</sup></b>	<b>16.33</b>	<b>21.80</b>	<b>16.21</b>	<b>21.65</b>
▪ 25 year amortization	(0.33)	1.01	(0.59)	0.65
▪ 15 year amortization	(0.49)	1.50	(0.88)	0.96
▪ <i>PBSA</i> amortization	0.00	n/a	0.00	n/a
<b>Total contribution rate<sup>1</sup></b>				
▪ 25 year amortization	16.00	22.81	15.62	22.30
▪ 15 year amortization	15.84	23.30	15.33	22.61
▪ <i>PBSA</i> amortization	16.33	n/a	16.21	n/a
<b>Total required contribution rate<sup>1</sup></b>	<b>16.33</b>	<b>n/a</b>	<b>16.21</b>	<b>n/a</b>

<sup>1</sup> Less 1.5% of salary up to the YMPE for each of the members and the employers.

<sup>2</sup> Non-indexed costs ignore IAA contributions; indexed costs include IAA contributions, at 1.25% for members and 1.75% (2.75% gross, 1.75% net of post-retirement group benefits contributions) for employers.

<sup>3</sup> Total member plus employer, to be shared equally.

**Schedule G4 – Accrued Liabilities and Funded Ratio**

**Present Plan – March 31, 2017 (\$000's)**

	Without Tax Limits		With Tax Limits	
	Basic only	Basic + Indexed	Basic only	Basic + Indexed
<b>Funds</b>				
▪ Smoothed Value of Fund	20,432,543	27,043,667	20,432,543	27,043,667
<b>Accrued Liabilities</b>				
▪ for pensions being paid	9,982,815	12,806,068	9,803,626	12,573,450
▪ for inactive members	1,057,192	1,603,571	1,057,178	1,603,553
▪ for active members	6,906,680	9,255,342	6,865,725	9,200,763
▪ for voluntary contributions	199	199	199	199
<b>Total Accrued Liabilities</b>	<b>17,946,886</b>	<b>23,665,180</b>	<b>17,726,728</b>	<b>23,377,965</b>
<b>Surplus (Unfunded Actuarial Liability)</b>				
▪ for accrued service only	2,485,657	3,378,487	2,705,815	3,665,702
<b>Funded Ratio</b>				
Fund ÷ Total accrued liabilities	113.9%	114.3%	115.3%	115.7%
<b>Selected 2014 Comparisons</b>				
Assets	16,756,525	21,795,233	16,756,525	21,795,233
Total Liabilities	15,952,331	21,639,733	15,779,379	21,406,662
Surplus (Unfunded Actuarial Liability)	804,194	155,500	977,146	388,571
Funded Ratio	105.0%	100.7%	106.2%	101.8%