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Actuarial Report on

British Columbia Teachers' Pension Plan

Actuarial Valuation
as at December 31, 2017

Vancouver, British Columbia

September 25, 2018

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Contents

Actuarial Report Highlights

BC Teachers' Pension Plan

December 31, 2017

An actuarial valuation of the Teachers' Pension Plan was completed as at December 31, 2017. Its purpose was to determine the financial position of the Plan as at December 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).

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 Plan 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.
- Following the actuarial valuation as at December 31, 2014, effective July 1, 2016, the employer and member contribution rates were amended as follows:
    - The employer contribution rate to the Basic Account was decreased from 15.0% to 11.23% of salary (integrated at 1.5% with the Yearly Maximum Pensionable Earnings (YMPE), i.e. the contribution rate applied to salary below the YMPE is 1.5% of pay lower than the disclosed rate);

  - The employer contribution rate to the IAA was increased from 1.13% to 3.08% of salary;
  - The member contribution rate to the Basic Account was increased from 11.0% to 11.05% of salary (integrated at 1.5% with YMPE); and
  - The member contribution rate to the IAA was decreased from 3.0% to 2.95% of salary.
- Effective January 1, 2017, the age 56 cap for granting cost-of-living adjustments was lifted.
- Effective January 1, 2017, the plan rules were amended to remove the automatic transfer of any excess interest transfer from the Basic Account to the IAA, and provide for the transfer to be made at the Board's discretion.
- Effective January 1, 2018, the plan rules were amended to implement the following changes for service earned on or after January 1, 2018 collectively referred to as "the 2018 changes":
  - a flat accrual rate of 1.85% of salary;
  - remove the bridge benefit;
  - remove the 35-year cap on pensionable service;
  - remove the rule of 90 for unreduced retirement, and add an unreduced pension with 35 years of contributory service; and
  - the early retirement reduction rate was amended to 4.5% per year below age 61 (or below age 65 with less than two years of contributory service) for all members, except for members who have reached age 55 and have at least 35 years of contributory service, who will be entitled to an unreduced retirement benefit.
- In tandem with the above plan amendments, effective January 1, 2018, the member contribution rate to the Basic Account was amended to a level i.e. non-integrated rate of 9.97% of salary, and the employer rate to the Basic Account was amended to a level rate of 10.15% of salary. Level, non-integrated contribution rates are the same on salaries above and below the YMPE. The member and employer contributions to the IAA remained unchanged at 2.95% and 3.08% of salaries, respectively.

There were no other changes to benefits or contributions since the previous actuarial valuation that had a material financial impact on the plan.

Joint Trust Agreement Conditional Amendments

- Subject to the results of the 2017 valuation showing a surplus, the Joint Trust Agreement as amended (JTA) requires that the Board implement the following changes to the extent the surplus allows:

    - To reduce both the member and employer contributions to the Basic Account by 0.05% of salary each and correspondingly increase both member and employer contributions to the IAA by 0.05% of salary each;

    - Equalize the member and employer Basic contribution rates by reducing the employer Basic contribution rate by 0.18% of salaries;

    - To increase the pension accrual rate from 1.85% to 1.90% of salary for pensionable service accrued after December 31, 2017 for members who are active on or after January 1, 2019;

    - To improve the normal form of pension from a single life pension to a single life pension with a 10-year guarantee for all service, applicable to members who are active on or after January 1, 2019; and

    - Set up a rate stabilization account with any remaining 2017 surplus.

    We have separately shown the impact of these changes in this report and refer to them collectively as the "JTA Conditional Amendments".

Actuarial Methods and Assumptions

The actuarial liabilities include the value of benefits accrued by members as at December 31, 2017, as well as the future benefits expected to be earned by existing members. All benefit changes described above are allowed for. 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 approach 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 - 6.00% (6.50% was used in the previous valuation);
- Annual Salary Increase - 3.25% plus seniority (3.75% plus seniority was used in the previous valuation); and
- Annual Indexing - 0.00% for basic benefits, 2.50% for indexed benefits (3.00% was used for indexed costs in the previous valuation)

Actuarial Position – Before JTA Conditional Amendments

The valuation shows an improvement in the actuarial position of the Basic Account on the entry-age normal contribution basis. A surplus of $1,656 million has emerged since the December 31, 2014 valuation:

Basic Benefits Only ($000's)	2014 Valuation Report	2017 Valuation including 2018 benefit changes
Smoothed Value of Assets	16,821,638	21,216,374
Value of entry age contributions	4,401,401	5,464,169
Value of 2014 required amortization	1,208,929	914,302
Total Assets	**22,431,968**	**27,594,845**
Liabilities	**22,431,968**	**25,939,075**
Surplus (Unfunded Liability)	**0**	**1,655,770**

Main Reasons for Changes in Actuarial Position

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

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

Partially offset by

- Changes in the valuation assumptions, most importantly changes in the economic assumptions.

Member and Employer Contribution Rates - Basic Benefits Before JTA Conditional Amendments

Valuation Year	**2014**	**2014**	**2017**
Benefits	**prior to 2018 benefit changes**	**allowing for 2018 benefit changes**	**allowing for 2018 benefit changes**
Current Contribution Rate	**Integrated**	**Level**	**Level**
Member	11.00%	9.97%	9.97%
Employer	15.00%	10.15%	10.15%
Total	**26.00%**	**20.12%**	**20.12%**
Required Rates prior to Conditional Amendments	**Integrated**	**Level**	**Level**
Entry age normal cost	16.59%	15.04%	15.79%
Required amortization	5.48%	5.03%	-
Total Required Contribution Rate	**22.07%**	**20.07%**	**15.79%**
Surplus ($000)	-	-	741,468
PBSA Accessible Surplus	-	-	-

JTA Conditional Amendments

As there is a surplus and the current Basic contribution rate of 20.12% is more than the minimum required Basic contribution rate, approval of the JTA Conditional Amendments can be considered. In our opinion, no further transfer to the IAA is required, transition can be completed and the JTA conditional amendments can be provided in full. After allowing for the JTA Conditional Amendments the 2017 Basic Account results are as follows:

	2017	
Benefits ($000's)	**allowing for 2018 Benefit Changes**	**also including JTA Conditional Amendments**
Smoothed Value of Assets	21,216,374	21,216,374
Value of contributions at the entry age rate	5,464,169	5,631,726
Value of 2017 required amortization	-	-
Total Value of Assets	**26,680,543**	**26,848,100**
Value of Liabilities	**25,939,075**	**26,204,088**
Surplus	**741,468**	**644,012**
PBSA Accessible Surplus	0	0

Contribution requirements – 2017	allowing for 2018 Benefit Changes	also including JTA Conditional Amendments
Entry age normal cost	15.79%	16.33%
Amortization	-	-
Minimum Required Contribution Rate	**15.79%**	**16.33%**

Contribution Requirements

If the JTA Conditional Amendments are approved, the member and employer contributions should change as follows:

	Member	Employer	Total
Current Basic	9.97%	10.15%	20.12%
Minus adjustment Basic to IAA	(0.05%)	(0.05%)	(0.10%)
Rebalancing Basic Rates	-	(0.18%)	(0.18%)
Additional Permissible Reduction	(1.75%)	(1.75%)	(3.50%)
Total Basic Rate	**8.17%**	**8.17%**	**16.34%**
Current IAA Rate	2.95%	3.08%	6.03%
Plus new IAA	0.05%	0.05%	0.10%
Total IAA	**3.00%**	**3.13%**	**6.13%**
Total Contribution Rate	**11.17%**	**11.30%**	**22.47%**

Supplementary Results

Basic and Indexed Benefits ($000's)	2014 Valuation Report	2017 Valuation including JTA Conditional Amendments
Smoothed Value of Assets	20,419,685	26,027,398
Value of entry age contributions	6,174,607	7,585,946
Value of 2014/17 required amortization	1,208,929	-
Total Assets	**2,7803,221**	**33,613,344**
Liabilities	**30,637,346**	**34,226,580**
Surplus (Unfunded Liability)	**(2,834,125)**	**(613,236)**

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

Benefits Limited to *ITA* Maximums ($000's)		**2014 Valuation Report**	**2017 Valuation including JTA Conditional Amendments**
Surplus (Unfunded Liability) with 2014/17 required amortization	Basic only	5,583	650,254
	Basic and Indexed	(2,822,242)	(606,357)

Compliance

The contribution rates in the table above rates comply with the going-concern requirements of the provincial pension standards legislation (i.e. the *PBSA*).

The *ITA* requires that individual member contributions not exceed the lesser of 9% of salaries or $1,000 plus 70% of the pension credit, though this condition may be waived by the Minister of Finance provided members do not contribute more than half of the cost of benefits. The required member contributions exceed 9% of salaries so it will be necessary to apply to the Minister for an exemption. The employer contributions of 11.30% exceed the member contributions of 11.17% and per the JTA future contribution rate changes will be shared equally, therefore the requirement that the member contributions will not exceed half of the amount required to fund the aggregate benefits is met. The plan has applied for and been granted the waiver at each valuation since 2005.

The Teachers' Pension Board of Trustees
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I. Scope of the Valuation

In accordance with Article 10 of the Joint Trust Agreement (the "JTA") and on the instructions of the Teachers' Pension Board of Trustees (the “Board of Trustees”), we completed an actuarial valuation of the Basic Account of the Teachers' Pension Plan (the “Plan”) as at December 31, 2017 and are pleased to submit this report thereon. The primary purpose of this valuation is to determine the financial position of the Basic Account as at December 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”). Furthermore, it ignores the limits on benefits imposed by the Income Tax Act ("ITA") on registered pension plans - such excess benefits are paid on a current cash basis through the Supplemental Benefits Account, which is maintained at a zero balance.

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.

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 December 31, 2014 and included in our report dated September 21, 2015, determined the financial position of the Plan as amended to December 31, 2014. Since then, a number of changes have been made to the Plan rules. The major changes affecting its financing include:

- 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.
- Following the actuarial valuation as at December 31, 2014, effective July 1, 2016, the employer and member contribution rates were amended as follows:
    - The employer contribution rate to the Basic Account was decreased from 15.0% to 11.23% of salary (integrated at 1.5% with the Yearly Maximum Pensionable Earnings (YMPE), i.e. the contribution rate applied to salary below the YMPE is 1.5% of pay lower than the disclosed rate);
    - The employer contribution rate to the IAA was increased from 1.13% to 3.08% of salary;
    - The member contribution rate to the Basic Account was increased from 11.0% to 11.05% of salary (integrated at 1.5% with YMPE); and
    - The member contribution rate to the IAA was decreased from 3.0% to 2.95% of salary.
- Effective January 1, 2017, the age 56 cap for granting cost-of-living adjustments was lifted.
- Effective January 1, 2017, the plan rules were amended to remove the automatic transfer of any excess interest transfer from the Basic Account to the IAA, and provide for the transfer to be made at the Board's discretion.
- **The 2018 Amendments**: Effective January 1, 2018, the plan rules were amended to implement the following changes for service earned on or after January 1, 2018:
    - a flat accrual rate of 1.85% of salary;
    - remove the bridge benefit;
    - remove the 35-year cap on pensionable service;
    - remove the rule of 90 for unreduced retirement, and add an unreduced pension with 35 years of contributory service; and

- the early retirement reduction rate was amended to 4.5% per year below age 61 (or below age 65 with less than two years of contributory service) for all members, except for members who have reached age 55 and have at least 35 years of contributory service, who will be entitled to an unreduced retirement benefit.

- In tandem with the above 2018 amendments, effective January 1, 2018, the member contribution rate to the Basic Account was amended to a level i.e. non-integrated rate of 9.97% of salary, and the employer rate to the Basic Account was amended to a level rate of 10.15% of salary. Level, non-integrated contribution rates are the same on salaries above and below the YMPE. The member and employer contributions to the IAA remained unchanged at 2.95% and 3.08%, respectively of salaries.

- **JTA Conditional Amendments**: Subject to the results of the 2017 valuation showing a surplus, the JTA requires that the Board implement the following changes:

  - To increase both member and employer contributions to the IAA by 0.05% of salary each;

  - To increase the pension accrual rate from 1.85% to 1.90% of salary for pensionable service accrued after December 31, 2017 for members who are active on or after January 1, 2019;

  - To improve the normal form of pension from a single life pension to a single life pension with a 10-year guarantee for all service, applicable to members who are active on or after January 1, 2019; and

  - Set up a rate stabilization account with any remaining 2017 surplus.

  We have separately shown the impact of these changes in this report and refer to them collectively as “the JTA conditional amendments”.

There were no other changes to benefits or contributions since the previous actuarial valuation 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 contributions at those rates
- **Equals** the present value of all future benefits
- **Minus** the funds on hand.

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

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

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

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

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

The Board has adopted a formal funding policy (most recently revised on December 11, 2015) in which it identified benefit security as its primary funding objective and contribution stability as an important secondary objective. We have taken this into account in carrying out this valuation.

(b) Indexing Treatment

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

In a sense, the IAA operates akin to a defined contribution or money-purchase account in that the value of indexing benefits is limited to the assets in the IAA. Future cost-of-living adjustments are not guaranteed, but are granted at the discretion of the Board, subject to the availability of funds in the IAA. Where there are sufficient monies in the IAA, full CPI indexing is provided; alternatively, if the monies in the IAA cannot 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 Account each time indexing is granted. Thus, the system will limit indexing, if necessary, so that the granting of any increases for indexing should not create (or increase) 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

We determined the financial status of the Plan for the Basic Account only (i.e. ignoring the indexing granted after December 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 rate of pay required to finance the benefits of new entrants to the Plan over their working lifetimes, so that their projected benefits are fully secured by equivalent assets by the time they retire (the "normal cost rate" or the "entry-age rate"). Thus, to the extent actuarial assumptions are realized, the addition of new entrants to the Plan should generate neither unfunded liabilities nor surpluses.

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

This surplus or unfunded liability is amortized over a specified period as outlined in the funding policy, e.g. 25 or 15 years. Minimum required contributions, expressed as a percentage of payrolls, revert to the normal cost rate after the unfunded liability or surplus has been amortized.

(f) PBSA Requirements

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

Accordingly, we have calculated theoretical contribution requirements as follows:

- Calculate the "normal cost rate" (i.e. the "entry-age rate");
- Calculate the surplus (or unfunded liability) using this rate, after taking into account the value of additional contributions required to amortize unfunded liabilities identified at previous valuations;
- If there is an unfunded liability, amortize the balance over 15 years, commencing one year from the current valuation date. If there has been a gain since the last valuation, i.e. the currently scheduled amortization rates applied for the balance of the previously established amortization periods are more than sufficient to amortize the previously identified unfunded liabilities; we apply the gain to amortize or reduce the previously identified unfunded liabilities, starting with the oldest established. This results in a reduction in the required amortization rates, with the revised rates in effect for the previously established periods; and
- If, after removing all previously established amortization amounts there is a surplus, we amortize it over 25 years and test whether the transitional arrangements in the JTA can be met.
- The resulting contribution rate must also comply with the *PBSA* minimum requirement.

(h) JTA Conditional Amendments

Under the transitional funding arrangements of the Joint Trust Agreement as amended, most recently by Amending Agreement No. 5, if there is a surplus as of the valuation date after having fulfilled the requirements of section (g) above, then:

- First, decrease each of the employer and member contribution rates to the Basic Account by 0.05% of salary, with a corresponding increase in contributions to the IAA;
- Next, the employer's contribution rate to the Basic Account is reduced until the employer and member contribution rates to the Basic Account are equal;
- Then, provided the minimum PBSA required total contribution rate to the Basic Account is less than the total Basic Account contribution then in effect after implementing the above changes (the "Current Contribution Rate"),
    - Increase the accrual rate for post-2017 service from 1.85% to the lesser of 1.90% of salary, or the accrual rate that could be provided such that the resulting minimum PBSA required total contribution rate to the Basic Account is equal to the total Basic Account Current Contribution Rate; and

- o Amend the normal form of pension from a single life form to a single life with a 10-year guarantee for pensionable service from January 1, 2018.

Once these two benefit improvements are achieved, Transition is considered complete.

Next, any remaining surplus assets are to be used in the following order:

- Make a transfer to the IAA as necessary to ensure that indexing is fully sustainable and a prudent reserve exists in the IAA;
- Amend the normal form of pension from a single life form to a single life with a 10-year guarantee for accrued service (such that the normal form is a single life with a 10-year guarantee for all pensionable service); and
- Maintain any remaining surplus from the 2017 valuation as a rate stabilization reserve.

The intent once these provisions are implemented is that future costs will be shared equally between members and employers (the employers will continue to pay a small 0.13% rate differential to the IAA). 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 assumptions, and changes to them, with the Board.

Following these discussions with the Board, we adjusted 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).

	Funding Valuation
Annual Investment Return	6.00% (6.50%)
Annual Salary Increase	3.25% (3.75%) plus seniority
Annual Indexing	0% for basic costs 2.5% (3.0%) for indexed costs

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

3. Membership Data

Data as of December 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

No benefits have been excluded for the valuation.

IV. Results of Actuarial Investigations

1. Basic Account – Actuarial Position

Schedule 1 – Statement of Actuarial Position as at December 31, 2017 – Allowing for 2018 benefit changes but prior to the JTA Conditional Amendments

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

($000's)	2014	2014	2017
Benefits	**prior to 2018 benefit changes**	**allowing for 2018 benefit changes**	**allowing for 2018 benefit changes**
Entry Age Normal Cost	**16.59% Integrated**	**15.04% Level**	**15.79% Level**
Market Value of Basic Account	18,690,709	18,690,709	22,919,615
Asset Smoothing Adjustment	(1,869,071)	(1,869,071)	(1,703,241)
Smoothed Value of Basic Account	**16,821,638**	**16,821,638**	**21,216,374**
Actuarial present values of			
• future contributions at entry-age rates	4,401,401	4,611,061	5,464,169
• Present value of existing amortization			
(i) 1.42% to 2020	206,052	n/a	n/a
(ii) 0.97% to 2020[1]	n/a	140,012	80,857
(iii) 1.50% to 2023	314,193	314,193	240,588
(iv) 2.56% to 2026	688,684	688,684	592,857
Total Assets	**22,431,968**	**22,575,588**	**27,594,845**
Liabilities			
Actuarial present values for			
- pensions being paid	10,640,001	10,640,001	12,191,469
- inactive members	304,487	304,487	376,263
- LTD members	276,235	279,978	292,128
- active members	11,074,126	11,214,003	12,926,941
- future expenses	137,108	137,108	152,260
Voluntary contribution balance	11	11	14
Total Liabilities	**22,431,968**	**22,575,588**	**25,939,075**
Surplus (Unfunded Liability)	**0**	**0**	**1,655,770**
Total Assets ÷ Total Liabilities	**100.0%**	**100.0%**	**106.4%**

[1] The amortization requirement of 1.42% of payroll to 2020 was calculated in the 2014 valuation based on the benefits then in force. When the benefits were amended, effective January 1, 2018, this amortization amount was revised to 0.97% of payroll.

2. Change in Actuarial Position

The statement of actuarial position included in Schedule 1 indicates that a surplus of $1,656 million has emerged since December 31, 2014. The $1,656 million surplus is the net result of a number of items, the most significant being gains due to higher than assumed investment returns, higher than assumed contributions and lower than assumed salary increases, offset by changes in the valuation assumptions.

Schedule 2 – Change in Actuarial Position

	Approximate effect ($ millions)
1. Surplus (Unfunded Liability) at December 31, 2014	0
2. Actual income from investments higher than 6.5% assumed rate (on smoothed values)	2,108
3. Actual contributions higher than previously assumed[1]	247
4. Actual salary increases to December 31, 2017 lower than previously assumed	250
5. Pensioner mortality experience gain	62
6. Excess investment return transfer to IAA made in 2016, plus interest	(62)
7. Changes in valuation assumptions	(971)
8. Other factors (a net gain) including changes in plan membership and other differences between actuarial assumptions and actual experience during the inter-valuation period	22
9. Surplus (Unfunded Liability) at December 31, 2017	**1,656**

The $971 million loss due to changes in actuarial assumptions (shown in item (5)) 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

Assumption change	**Approximate effect ($ millions)**
Economic assumptions	(1,006)
Disability assumed retirement age	8
Withdrawal rates	8
Retirement rates	19
Total gain/(loss) from change in valuation assumptions	**(971)**

[1] Mainly because the contribution rate decrease calculated in the 2014 valuation was assumed to occur at the valuation date, while in fact it occurred 18 months after the valuation.

3. Adequacy of Contribution Rates prior to the JTA Conditional Amendments

As discussed in Section III, the required contribution rate consists of the normal cost plus an adjustment to amortise any surplus or unfunded liability. The results in this regard are discussed in more detail below.

(a) Normal Cost Rate

The normal cost has changed from the 2014 valuation to 2017, prior to consideration of the JTA conditional amendments, as follows:

	%
Normal cost at 2014 valuation	**16.59**[1]
2018 benefit changes	0.62
Normal cost at 2014 valuation allowing for 2018 benefit changes	**17.21**[1]
Adjustment to convert to level rate based on 2014 salaries	(2.17)
Level normal cost at 2014 valuation with 2018 benefit changes	**15.04**[2]
Change in normal cost	0.75
Level normal cost at 2017 valuation with 2018 benefit changes	**15.79**[2]

The current service contribution, inclusive of contributions by members, required to finance the basic pensions of new entrants (i.e. the normal actuarial cost) was 16.59% of salaries (integrated at 3%) as at December 31, 2014. After allowing for the 2018 benefit changes, this increased to 17.21% of salaries (integrated). Converting this integrated rate to an equivalent level (i.e. non-integrated) rate based on the 2014 valuation payroll and the existing amortization resulted in an implied normal cost of 15.04% of salaries as at December 31, 2014. The level normal cost as at December 31, 2017, prior to any consideration of the 2019 benefit changes, is 15.79%. The 0.75% increase in normal cost rate is developed in Appendix F and is the net result of a number of items, most significantly the change in the economic assumptions (cost increase of 1.00% of salaries).

[1] Integrated at 3%.

[2] Level i.e. non-integrated rates.

Eckler

(b) PBSA Minimum Rate

($000's)	**2017**
Benefits	**Allowing for 2018 Benefit Changes**
Surplus (Unfunded Liability) with previously scheduled amortization	1,655,770
Value of previously scheduled amortization	914,302
Surplus (Unfunded Liability) without previously scheduled amortization741,468*PBSA* Accessible going concern excess	0
PBSA Minimum Required Contribution Rate	15.79%

The valuation shows a surplus of $1,655,770,000 including the present value of the existing amortization requirements established at previous valuations, which total $914,302,000. As there is a surplus of $741,468,000 excluding the existing amortization requirement, the PBSA allows this amortization requirement to be eliminated entirely. The minimum PBSA required contribution rate is then equal to the normal cost less the 5-year amortization of any surplus in excess of 5% of the net liabilities. Five percent of the net liabilities is $1,023,745,000, which exceeds the 2017 surplus of $741,468,000. Thus, no surplus may be amortized under the PBSA requirements to reduce the contribution rate below the entry-age normal cost. The PBSA minimum required contribution rate is therefore the entry-age normal cost of 15.79% of salaries (level) and the valuation shows a surplus of $741,468,000 as of December 31, 2017, prior to consideration of the JTA provisions.

Schedule 3 – Current and Required Basic Contribution Rates prior to JTA Conditional Amendments

Valuation Year	**2014 (%)**	**2014 (%)**	**2017 (%)**
Benefits	**prior to 2018 benefit changes**	**allowing for 2018 benefit changes**	**allowing for 2018 benefit changes**
Current Contribution Rate	**Integrated**	**Level**	**Level**
Member	11.00	9.97	9.97
Employer	15.00	10.15	10.15
Total	**26.00**	**20.12**	**20.12**
Required rates prior to JTA Conditional Amendments			
Entry age normal cost	16.59	15.04	15.79
Amortization of unfunded liability (surplus)			
• 25-year amortization	2.52	2.38	(1.44)
• 15-year amortization	3.73	3.53	(2.13)
• PBSA required amortization			
to 2020	1.42	0.97	-
to 2023	1.50	1.50	-
to 2026	2.56	2.56	-
Total PBSA Minimum Amortization	**5.48**	**5.03**	**-**
Total Contribution Rate			
• 25-year amortization	19.11	17.42	14.35
• 15-year amortization	30.32	18.57	13.66
• PBSA rate	22.07	20.07	15.79
Total Required Contribution Rate	22.07	20.07	15.79
Surplus including Value of the above PBSA Amortization ($000)	-	-	741,468

As the current contribution rate exceeds the 2017 minimum required contribution rate and there is a surplus, the JTA Conditional Amendments can be considered.

c) JTA Conditional Amendments

We assessed whether the plan could be amended to meet the outstanding JTA Conditional Amendments in the order shown:

- First, decrease each of the employer and member contribution rates to the Basic Account by 0.05% of salary, with a corresponding increase in contributions to the IAA;
- Next, the employer's contribution rate to the Basic Account is reduced until the employer and member contribution rates to the Basic Account are equal;

Then, provided the minimum PBSA required total contribution rate to the Basic Account is less than the total Basic Account contribution after implementing the above changes then in effect (the "Current Contribution Rate"),

- Increase the accrual rate for post-2017 service from 1.85% to the lesser of 1.90% of salary, or the accrual that could be provided such that the resulting minimum PBSA required total contribution rate to the Basic Account is equal to the total Basic Account Current Contribution Rate; and
- Amend the normal form of pension from a single life form to a single life with a 10-year guarantee for pensionable service from January 1, 2018.

Once these two benefit improvements are achieved, Transition is considered complete.

Next, any remaining surplus assets are to be used in the following order:

- Make a transfer to the IAA as necessary to ensure that indexing is fully sustainable and a prudent reserve exists in the IAA;
- Amend the normal form of pension from a single life form to a single life with a 10-year guarantee for accrued service (such that the normal form a single life with a 10-year guarantee for all pensionable service); and
- Maintain any remaining surplus from the 2017 valuation as a rate stabilization reserve.

As shown by the following revised Schedule 1 and 3 below, the surplus is sufficient to achieve all these steps above.

We report on the sustainability of indexing in a separate report, but we can confirm that indexing is sustainable at 100% of the increase in the Consumer Price Index (both prior to and after all the JTA Conditional Amendments). Further, in our opinion no transfer of Basic surplus to the IAA is required at this time. Despite this, if the Board wishes to make a transfer to the IAA, provided no more than the surplus shown in Schedule 1 below is transferred, the benefit improvements shown above can be provided in full.

Schedule 1 Revised – Statement of Actuarial Position as at December 31, 2017 – Allowing for JTA Conditional Amendments

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

	($000's)			
Valuation Year	**2017**	**2017**	**2017**	**2017**
Future Accrual Rate	**1.85%**	**1.90%**	**1.90**	**1.90%**
Normal Form	**Life only**	**Life only**	**G10 on future service**	**G10 on all service**
Entry Age Normal Cost (level)	**15.79%**	**16.21%**	**16.33%**	**16.33%**
Assets				
Market Value of Basic Account	22,919,615	22,919,615	22,919,615	22,919,615
Asset Smoothing Adjustment	(1,703,241)	(1,703,241)	(1,703,241)	(1,703,241)
Smoothed Value of Basic Account	**21,216,374**	**21,216,374**	**21,216,374**	**21,216,374**
Actuarial present values of future contributions at entry-age rates	5,464,169	5,594,491	5,631,726	5,631,726
Present value of required amortization	-	-	-	-
Total Assets	**26,680,543**	**26,810,865**	**26,848,100**	**26,848,100**
Liabilities				
Actuarial present values for				
- pensions being paid	12,191,469	12,191,469	12,191,469	12,191,469
- inactive members	376,263	376,263	376,263	376,869
- LTD members	292,128	293,961	297,231	301,033
- active members	12,926,941	13,084,119	13,131,460	13,182,443
- future expenses	152,260	152,260	152,260	152,260
Voluntary contribution balance	14	14	14	14
Total Liabilities	**25,939,075**	**26,098,086**	**26,148,697**	**26,204,088**
Surplus (Unfunded Liability)	**741,468**	**712,779**[1]	**699,403**	**644,012**
Funded Ratio excluding amortization: Total Assets ÷ Total Liabilities	**102.9%**	**102.7%**	**102.7%**	**102.5%**
PBSA Accessible going concern excess	0	0	0	0
JTA Transition complete	No	No	Yes	Yes

[1] The surplus reduces by $13,376,000 if the normal form is amended for future pensionable service only. The additional surplus required to amend the normal form for past service is $55,391,000. The cost of amending future service, as measured by the change in surplus, is significantly lower than the cost to amend past service. This is because the increase in the future liability is partially offset by the increase in present value of future contributions when considering future service, while the past service amendment has no offsetting contribution value increase.

Schedule 3 Revised – Current and Required Basic Contribution Rates – Allowing for all JTA Conditional Amendments

(%)	Member	Employer	Total
Current Basic Contribution Rate	9.97	10.15	20.12
Minus adjustment Basic to IAA	(0.05)	(0.05)	(0.10)
Rebalancing Basic Rates	-	(0.18)	(0.18)
Equalized and adjusted Basic Rate	**9.92**	**9.92**	**19.84**
Required Contribution Rate			
Entry age normal cost			16.33
Amortization of unfunded liability (surplus)			
• 25-year amortization			(1.25)
• 15-year amortization			(1.85)
• PBSA amortization			0.00
Total Contribution Rate			
• 25-year amortization			15.08
• 15-year amortization			14.48
• PBSA rate			**16.33**
Total Required Contribution Rate			**16.33**
Additional permissible reduction			3.51
Additional permissible reduction shared equally	(1.75)	(1.75)	(3.50)
Total Reduction in Basic Contribution Rates	**(1.80)**	**(1.98)**	**(3.78)**

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. The required contribution rate for basic, non-indexed benefits indicated by this valuation and after applying the requirements of the current JTA is 16.33% of salaries (level). This compares to a current contribution rate of 20.12% of salaries (level). Thus, the current rate may decrease by 3.78% of salaries, allowing for rounding. In line with the PBSA, these amended contribution rates have been calculated assuming they apply from one year after the valuation date i.e. from January 1, 2019.

The revised Basic contribution rates and IAA contribution rates are shown on the next page:

Schedule 4 – Required Total Contribution Rates

	Member	Employer	Total
Current Basic	9.97%	10.15%	20.12%
Minus adjustment Basic to IAA	(0.05%)	(0.05%)	(0.10%)
Rebalancing Basic Rates	-	(0.18%)	(0.18%)
Additional Permissible Reduction	(1.75%)	(1.75%)	(3.50%)
Total Basic Rate	**8.17%**	**8.17%**	**16.34%**
Current IAA Rate	2.95%	3.08%	6.03%
Plus new IAA	0.05%	0.05%	0.10%
Total IAA	**3.00%**	**3.13%**	**6.13%**
Total Contribution Rate	**11.17%**	**11.30%**	**22.47%**

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 required contribution rate of 11.17% of salary exceeds this limit, so it is necessary to apply to the Minister for a waiver. The employer contributions of 11.30% exceed the member contributions of 11.17% and the JTA requires that future adjustments to contribution rates will be shared equally. Therefore, the requirement that the member contributions will not exceed half of the amount required to fund the aggregate benefits is met. A waiver was required, and obtained, following the last valuation.

5. Other Plan Changes

As the valuation shows a surplus which is sufficient to increase future accrual rate to 1.90% of salaries and improve the normal form of pension for future pensionable service to a single life with a 10-year guarantee, as per the JTA, transition is complete. Further, in accordance with the JTA, the remaining surplus has been partially used to amend the normal form for past service, and the remainder of the surplus at this valuation has been retained as a rate stabilization reserve.

If future valuations show a surplus, the Board, subject to the funding policy, may consider:

- A reduction in member and employer contribution rates, to be shared equally;
- Improving benefits;
- Making a transfer to the Inflation Adjustment Account;
- Setting aside a rate stabilization reserve;
- Or any combination of these four alternatives.

6. Accrued Benefits – Funded Ratio

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

Schedule 5 – Accrued Benefits – Funded Ratio at December 31, 2017

Basic Account – Non-Indexed Benefits

	($000's)		
	2014	**2017 allowing for 2018 Benefit Changes**	**2017 allowing for JTA Conditional Amendments**
Fund (Basic Account): Smoothed Value of Assets	**16,821,638**	**21,216,374**	**21,216,374**
Accrued Liabilities			
▪ Pensions being paid	10,640,001	12,191,469	12,191,469
▪ Inactive members	304,487	376,263	376,869
▪ LTD member	276,235	292,128	301,033
▪ Active members	6,305,192	7,111,338	7,162,321
▪ Voluntary contributions	11	14	14
Total Accrued Liabilities	**17,525,926**	**19,971,212**	**20,031,706**
Surplus (Unfunded Liability): accrued service only	**(704,288)**	**1,245,162**	**1,184,668**
Funded Ratio: Fund ÷ Total accrued liabilities	**96.0%**	**106.2%**	**105.9%**

The above schedule indicates that the funded ratio for accrued benefits has improved from 96.0% in 2014 to 106.2% in 2017, prior to consideration of the JTA Conditional Amendments. This is largely for reasons similar to the items in the analysis in Schedule 2, excluding those items related to future contribution rates. The JTA Conditional Amendments marginally reduce the accrued funded ratio from 106.2% to 105.9%.

7. Sensitivity Analysis

Sensitivity Analysis under Standards of Practice

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

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

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

The table below shows the impact on the accrued liability after allowing for all the JTA Conditional Amendments as required by (a) above and the entry-age normal cost as required by (b) above as at December 31, 2017 of a one percentage point drop in the discount rate assumption. All other assumptions were kept unchanged. The figures in this section are based on the results after allowing for the 2019 benefit changes.

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

Impact on liabilities of 1% drop in discount rates	Going Concern 6.0% ($,000's)	Going Concern 5.0% ($,000's)	Increase ($,000's)
Active members	7,162,321	8,613,463	1,451,142
Disabled members	301,033	351,755	50,722
Terminated members	376,869	419,633	42,764
Pensioners and beneficiaries	12,191,469	13,286,168	1,094,699
Total increase in liabilities			**2,639,327**

Impact on normal cost rate of 1% drop in discount rates	Going Concern 6.0%	Going Concern 5.0%	Increase
Current service cost rate	16.33%	21.08%	4.75%

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 after allowing for all the JTA Conditional Amendments. These figures are summarized in the table below:

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

	($000's)		
	6.0%	**5.0%**	**Increase**
Smoothed Value of Fund	21,216,374	21,216,374	0
Actuarial present values of:			
▪ Future contributions at entry-age rates	5,631,726	7,675,034	2,043,308
▪ Future amortization adjustment	-	-	-
Total Assets	**26,848,100**	**28,891,408**	**2,043,308**
Total Liabilities	**26,204,088**	**30,848,074**	**4,643,986**
Surplus/ (Unfunded liability) on entry-age basis	644,012	(1,956,666)	(2,600,678)
Entry Age Normal Cost	16.33%	21.08%	4.75%
PBSA Amortization	0.00%	7.71%[1]	7.71%
PBSA Minimum rate – Schedule 3	16.33%	28.79%	12.46%

8. Supplementary Valuations

Results analogous to those in Revised Schedules 1 and 3 and Schedule 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.

[1] Assumes existing amortization schedules from the 2014 valuation are still in place.

The adjustments to the assumptions are discussed in Appendix B. The fully indexed funding valuation result takes into account IAA contributions of 6.13% in total (3.0% from members and 3.13% from the employer). The figures in this section are based on the results after allowing for the JTA Conditional Amendments.

The key results are summarized below:

Schedule 6 – Indexed Benefits (without tax limits)

	Basic Only	**Basic + Indexed**
Funded position	**($000's)**	**($000's)**
Smoothed Value of Fund	**21,216,374**	26,027,398
Actuarial present values of:		
▪ Future contributions at entry-age rates	5,631,726	7,585,946
▪ Present value of revised amortization requirements	-	-
Total Assets	26,848,100	33,613,344
Total Liabilities	26,204,088	34,226,580
Surplus (Unfunded Liability)	**644,012**	**(613,236)**
Contribution Rates (Level i.e. non-integrated)		
Member – revised, as shown in Schedule 4	8.17%	11.17%
Employer – revised, as shown in Schedule 4	8.17%	11.30%
Total – Revised, as shown in Section 4	**16.34%**	**22.47%**
Entry-age normal cost	16.33%	22.42%
Amortization[1]	0.00%	1.71%
Rounding	0.01%	0.00%
Total – Entry-Age with Amortization and Rounding	**16.34%**	**24.13%**

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

[1] Basic amortization is as required by the *PBSA*; Basic + Indexed amortization is over 15 years.

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

	($000's)	
	Basic Only	**Basic + Indexed**
Assets	21,216,374	26,027,398
Liabilities	20,031,706	25,933,446
Surplus (Unfunded Liability)	1,184,668	93,952
Funded Ratio	106%	100%

Benefits Limited to ITA Maximums

When the income tax limits on benefits are recognized, the above 2017 surplus/unfunded liabilities change marginally. The normal costs change marginally, and there is also a small change in the amortization rates under the indexed runs. The key results are summarized below.

Schedule 8 – Benefits Limited to ITA Maximums – Basic Only

Basic Only	**Without Tax Limit**	**With Tax Limit**
Surplus (Unfunded Liability)	**($000's)**	**($000's)**
Entry Age Basis (including revised scheduled amortization)	644,012	650,254
Accrued Service Only (no scheduled amortization)	1,184,668	1,191,676
Contribution Rate		
Entry Age Normal Cost	16.33%	16.29%
PBSA Amortization	0.00%	0.00%
Total	**16.33%**	**16.29%**

Schedule 9 – Benefits Limited to ITA Maximums – Indexed Benefits

Basic and Indexed	**Without Tax Limit**	**With Tax Limit**
Surplus (Unfunded Liability)	**($000's)**	**($000's)**
Entry Age Basis (including revised scheduled amortization)	(613,236)	(606,357)
Accrued Service Only (no scheduled amortization)	93,952	103,066
Contribution Rate		
Entry Age Normal Cost	22.42%	22.37%
15-year Amortization	1.71%	1.69%
Total	**24.13%**	**24.06%**

9. Test Maximum Surplus and Contributions for Tax Purposes

Section 147.2(2) of the *Income Tax Act* limits employer contributions that may be made to a plan if there is a surplus that exceeds 25% of the actuarial liability - the plan becomes revocable if contributions are made when such surplus exists.

Subsection (c) of Section 147.2(2) of the *Income Tax Act* also provides that the benefits taken into account for the purposes of a contribution recommendation "may include anticipated cost-of-living and similar adjustments where the terms of a pension plan do not require that those adjustments be made but it is reasonable to expect that they will be made".

Indexing at full CPI has been provided since January 1, 1982 under the present Plan terms, and for many years before that under earlier Plan provisions. As discussed earlier, indexing is currently financed on a mixture of a pay-as-you-go basis (from a combined 3%/3.13% member/employer contribution for active members), an excess investment return basis (investment return in excess of the valuation assumption is transferred each year from Basic to IAA in respect of pensioner liabilities, subject to the Board's discretion), and a "terminally-funded" basis (each year the full capitalized cost of any indexing granted is transferred from IAA to Basic). Thus, it may be considered appropriate for the purposes of testing the *ITA* 147.2(2) limits to recognize, in advance, the future indexing of pensions for the present Plan membership. On this basis, the valuation results on the fully indexed basis, recognizing the income tax limits on benefits, would apply.

Thus, while the recommended rate of 22.47% is slightly higher than the 22.37% fully indexed normal cost rate (as shown in Schedule 9), on the premise that it is appropriate for the Plan to recognize future indexing for the purposes of testing the *ITA* contribution limits there is an unfunded liability of $606,357,000. Amortizing this unfunded liability over 15 years results in a contribution rate of 24.06% (22.37% Entry Age Normal Cost + 1.69% 15-year amortization, as shown in Schedule 9). Contributions at this rate, 24.06%, would be acceptable for *ITA* purposes, and in fact for *ITA* purposes the unfunded liability could be amortized even faster, resulting in an even higher acceptable rate. It is therefore clear that the recommended rate is lower than the maximum rate that is acceptable under the *ITA* and therefore, contributions may be paid at the recommended rates.

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

V. Subsequent Events

The results of this valuation allow for the benefit improvements granted with effect from January 1, 2018 as well as those the Board is required to grant under the JTA with effect from January 1, 2019. We are not aware of any other events after the valuation date that would materially 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 purposes of the valuation;

(b) The assumptions are appropriate for 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 December 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[1]
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September 25, 2018

[1] Canadian Institute of Actuaries is the Primary Regulator.

Appendix A: Summary of Plan and Amendments

As at December 31, 2017

Changes to the Plan

The previous valuation was based on the provisions of the Teachers' Pension Plan (plan) as at December 31, 2014.

Between January 1, 2015 and December 31, 2017, the plan text was amended six times incorporating the following changes:

- Effective April 1, 2015, the plan rules were amended to allow the purchase of a leave of absence (or period of reduced pay) if a member contributed to a different employer under the same plan or another registered pension plan during the period, subject to Income Tax Regulation limits.
- Effective September 30, 2015, the plan rules were amended to incorporate relevant new *Pension Benefits Standards Act* (PBSA) legislation including amendments to definitions of spouse and termination of employment, and incorporating required benefit changes such as:
    - immediate vesting of pension entitlements,
    - simplified small benefit tests based on a threshold of 20% of the YMPE,
    - unlocking of pension benefits for shortened life expectancy,
    - enhanced disclosure to members and,
    - application of fund interest rates to voluntary contributions.
- Effective October 1, 2015, the plan rules for re-employed retired members were amended as follows:
    - re-employment provisions do not apply if the person is considered a retired member solely because they are receiving a pension from the plan following the death of a member, and
    - retired members who suspended their pension payments and began re-contributing to the plan before the effective date of the amendment will have their pension determined according to the provisions in place prior to the amendment.

- Improvements in the plan's funding position following the 2014 valuation resulted in amendments to the plan's funding arrangements for the transitional period under Amending Agreement No. 3 to the Teachers' Pension Plan Joint Trust Agreement (JTA) dated December 11, 2015. The JTA amendments provided for the following changes to employer and active member contribution rates effective July 1, 2016:

    - employer and active member contributions to the Basic Account were increased by 0.05% of salaries each, with a corresponding decrease to the IAA contributions, and

    - in addition to the above, an overall reduction of 1.82% in employer contributions based on the combination of a 3.82% decrease to employer Basic Account contributions and a 2.00% increase to employer IAA contributions.

  As a result of the above changes to the JTA, effective July 1, 2016 the plan rules were amended to:

    - increase the member basic contribution rate to 9.55% of pensionable salary below the year's maximum pensionable earnings (YMPE) and 11.05% of pensionable salary above the YMPE; the amendments also decreased the member IAA contribution to 2.95%, and

    - reduce the employer basic contribution rate to 9.73% of pensionable salary below the YMPE and 11.23% of pensionable salary above the YMPE; the amendments also increased the employer IAA contribution to 3.08%.

- Effective January 1, 2017, the plan rules were amended to remove the cap that restricts cost-of-living adjustments (COLA) to only retired members who have reached 56 years of age. Removing the age restriction means that, effective with the granting of COLA on January 1, 2017, all retired members will receive COLA for 2016 regardless of age. Members retiring in 2016 will receive pro-rated COLA based on their pension effective date.

- The 2018 Amendments: Effective January 1, 2018, the plan rules were amended to implement the following changes for service earned on or after January 1, 2018:

    - a flat accrual rate of 1.85% of salary;

    - remove the bridge benefit;

    - remove the 35-year cap on pensionable service;

    - remove the rule of 90 for unreduced retirement, and add an unreduced pension with 35 years of contributory service; and

    - the early retirement reduction rate was amended to 4.5% per year below age 61 (or below age 65 with less than two years of contributory service) for all members, except for members who have reached age 55 and have at least 35 years of contributory service, who will be entitled to an unreduced retirement benefit.

- In tandem with the above 2018 amendments, effective January 1, 2018, the member contribution rate to the Basic Account was amended to a level i.e. non-integrated rate of 9.97% of salary, and the employer rate to the Basic Account was amended to a level rate of 10.15% of salary. Level, non-integrated contribution rates are the same on salaries above and below the YMPE. The member and employer contributions to the IAA remained unchanged at 2.95% and 3.08%, respectively of salaries.

- On March 12, 2018, the Teachers' Pension Board of Trustees approved plan rule amendments—retroactively effective January 1, 2017— for the excess interest transfer from the basic account to the IAA when the plan earns a higher rate of return than assumed by the actuary at the most recent actuarial valuation. The amendments to section 75 (3) (d) remove the direction for an automatic annual interest transfer and give the board discretion to transfer all, or a portion of, the excess interest to the IAA.

The main provisions of the plan are summarized below. Except as otherwise noted, the section references are to the Teachers' Pension Plan Rules as at December 31, 2017. The valuation is based on these provisions.

Note: Surplus assets identified in the December 31, 2014 valuation allowed for plan design changes that are effective January 1, 2018 (The "2018 Amendments" shown above). These changes have been included in this valuation and are incorporated in the summary below. Surplus assets identified in this December 31, 2017 valuation required further plan changes, the impact of these changes is shown separately in this report, and the details of the changes are summarized in "Appendix A Supplemental" provided at the end of this Appendix.

Employer and Employee Eligibility

The plan applies to a board of school trustees constituted under the *School Act*, a francophone education authority established under the *School Act*, an official trustee appointed under the *School Act* and to any other body designated by the board or former board as an employer, on terms and conditions of eligibility specified by the board or former board. [Section 2]

Participation is compulsory for teachers, administrative officers, associated professionals, and certified professionals employed by boards of school trustees or francophone education authorities. [Section 3]

Member Contributions

Section 5 defines the following contributions, which are deducted from a member's salary during a calendar year, effective July 1, 2016:

(a) 9.55% of that part of the member's cumulative salary that does not exceed the YMPE (paid into the basic account);

(b) 11.05% of the member's cumulative salary which is in excess of the YMPE (paid into the basic account); and

(c) 2.95% of the member's entire salary (paid into the IAA).

Effective January 1, 2018, member contributions to the Basic Account were amended to 9.97% of the member's entire salary. (Contributions to the IAA continue at 2.95% of the member's entire salary.)

Prior to January 1, 2018, member contributions ceased after 35 years of pensionable service have been accrued. Effective January 1, 2018, members continue to contribute after 35 years of pensionable service, and member contributions resume for any active members who have over 35 years of pensionable service at that date.

(At the 2014 valuation, the member basic contribution rates in (a) and (b) were 9.50% and 11.00% respectively and the member IAA contribution rate was 3%).

Employer Contributions

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

(a) 9.73% of that part of the member's cumulative salary that does not exceed the YMPE (paid into the basic account);

(b) 11.23% of the member's cumulative salary which is in excess of the YMPE (paid into the basic account); and

(c) 3.08% of the member's salary (paid into the IAA).

Effective January 1, 2018, employer contributions to the Basic Account were amended to 10.15% of the member's entire salary. (Contributions to the IAA continue at 3.08% of the member's entire salary.)

Employer contributions continue to be remitted on behalf of employees who have accrued 35 years of pensionable service.

(At the 2014 valuation, the contribution rates in (a) and (b) were 13.50% and 15.00% respectively and the member IAA contribution rate was 1.13%).

Funding and Transitional Rules

The funding and transitional rules are covered in Articles 10, 15 and Appendix B of the JTA. The JTA was amended by Amending Agreement No.3, dated December 11, 2015 and Amending Agreement No. 4, dated June 16, 2016, and the summary below reflects these changes. The JTA was subsequently amended by Amending Agreement No. 5, and the provisions of that amendment are included in “Appendix A Supplemental” provided at the end of this Appendix.

Plan funding must comply with the *PBSA* requirements for a going-concern valuation. Further, future contribution rate increases in the basic account indicated by a valuation, must be shared equally between employers and members.

The use of emerging surpluses is limited during a transition period, to achieving the following objectives in the following order:

(a) Rebalancing Contributions to the IAA

Excess assets must first be used to reduce the employer contribution rate to the basic account by 2.0%, with a concurrent and corresponding 2.0% increase in the employer contribution rate to the IAA. This step was achieved following the 2014 valuation. Unless the partners otherwise agree, this increase is permanent, and is unaffected by any subsequent adjustment in plan member and employer contribution rates to the basic account. For the purpose of rebalancing, the 0.13% differential in employer and plan member IAA contribution rates will continue.

(b) Rebalancing Contributions to the Basic Account

If the employer contribution rate to the IAA has been increased to 3.13% under subsection (a), excess assets must then be used to rebalance between employers and plan members the contribution rates to the basic account. This is to be accomplished by next using excess assets to reduce the employer contribution rate to the basic account by 2.0%. Following the 2014 valuation and the provision of JTA Amending Agreement No. 3, the excess assets were sufficient to reduce the employer contribution rate to the basic account by 1.82%, leaving a rebalancing adjustment of 0.18% of left to make.

Alteration to Transitional Arrangements Due to the 2014 Valuation (provision 8(f) of Appendix B to the JTA)

In addition to the contribution changes reflected in (a) and (b) above, as adjusted by Amending Agreement No. 3, that amending agreement also provided for a decrease in the member and employer contribution rates to the IAA by 0.05% of salaries each, with a corresponding increase in the Basic Account contribution rates.

Despite conditions (a) and (b) above, if excess assets are identified in a valuation subsequent to the 2014 valuation, they are first to be used to decrease each of the member and employer contributions to the Basic Account by 0.05% of salaries, with a corresponding increase to the IAA, and any remaining excess assets are to be used to implement the provisions in (b) above and (c) below, in that order.

(c) Specified Benefit Improvement

If there is a surplus as of a valuation subsequent to the 2017 valuation date, then:

- First, decrease each of the employer and member contribution rates to the Basic Account by 0.05% of salary, with a corresponding increase in contributions to the IAA;
- Next, the employer's contribution rate to the Basic Account is reduced until the employer and member contribution rates to the Basic Account are equal;
- Then, provided the minimum PBSA required total contribution rate to the Basic Account is less than the total Basic Account contribution then in effect after implementing the above changes (the "Current Contribution Rate"),
    - Increase the accrual rate for post-2017 service from 1.85% to the lesser of 1.90% of salary, or the accrual rate that could be provided such that the resulting minimum PBSA required total contribution rate to the Basic Account is equal to the total Basic Account Current Contribution Rate; and
    - Amend the normal form of pension from a single life form to a single life with a 10-year guarantee for pensionable service from January 1, 2018.

Once these two benefit improvements are achieved, Transition is considered complete.

Next, any remaining surplus assets are to be used in the following order:

- Make a transfer to the IAA as necessary to ensure that indexing is fully sustainable and a prudent reserve exists in the IAA;
- Amend the normal form of pension from a single life form to a single life with a 10-year guarantee for accrued service (such that the normal form is a single life with a 10-year guarantee for all pensionable service); and
- Maintain any remaining surplus from the 2017 valuation as a rate stabilization reserve.

Retirement Benefits: Eligibility Conditions for Pension

The normal retirement age is 65 for all members. Section 50(1) provides that an active member who, on or after September 30, 2015, terminates employment is, on application, entitled to an unreduced pension calculated under section 54, if the member has:

For service accrued before January 1, 2018:

(a) Attained age 55 and the sum of the member's age plus years of contributory service is 90 or more; or

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

(c) Attained age 65.

For service accrued after December 31, 2017:

(a) Attained age 55 with at least 35 years of contributory service; or

(b) Attained age 61 with at least 2 years of contributory service; or

(c) Attained age 65.

Section 50(2) provides for a reduced pension calculated under section 55(1) for service accrued prior to January 1, 2018 and under section 55(3) for service accrued after December 31, 2017, if the terminating member has attained age 55 and completed at least 2 years of contributory service.

Section 50(2) provides for a reduced pension calculated under section 55(2) for service accrued prior to January 1, 2018 and under section 55(4) for service accrued after December 31, 2017, if the terminating member has attained age 55 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, in the form of a single life annuity with no guarantee, 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) 1.3% of the lesser of

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

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

  multiplied by the number of years of pensionable service accrued after December 31, 1965 and before January 1, 2018, 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 after December 31, 1965 and before January 1, 2018, not exceeding 35 years.

(d) 1.85% of the member’s highest average salary multiplied by the number of years of pensionable service accrued after December 31, 2017.

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) 0.7% of the lesser of

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

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

  multiplied by

(b) the number of years of pensionable service after December 31, 1965 and before January 1, 2018, 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).

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 of the balance in that account, including interest at fund interest rates.

Calculation of Reduced Pension

Where a reduced pension is payable under section 50(2) to members who have 2 or more years of contributory service,

- section 55 (1) provides that the lifetime and temporary pensions described above for service accrued before January 1, 2018, are each reduced by a percentage equal to 3% for each year by which the member's age is less than 60, or the sum of the member's age plus years of contributory service is less than 90, prorated for fractions of a year to a maximum of 15%; and
- section 55 (3) provides that the lifetime pension described above for service accrued after December 31, 2017, is reduced by a percentage equal to 4.5% for each year by which the member's age is less than 61.

Where a reduced pension is payable under section 50(2) to members aged between 55 and 65 who have less than 2 years of contributory service

- section 55 (2) provides that the lifetime and temporary pensions, described above for service accrued before January 1, 2018, are each reduced by a percentage equal to 5% for each year by which the member's age is less than age 65, prorated for fractions of a year; and
- section 55 (4) provides that the lifetime pension, described above for service accrued after December 31, 2017, is reduced by a percentage equal to 4.5% for each year by which the member's age is less than age 65, prorated for fractions of a year.

If the member terminates employment, (a) under age 55, (b) with less than 10 years of pensionable service, or (c) has not completed at least 1 year of pensionable service or 2 years of contributory service in the 24 calendar months immediately preceding termination of employment, then the 3% (per year) early retirement reduction factor referred to in section 55(1) for service accrued prior to January 1, 2018 is increased to 5% (per year).

Alternative Types of Pensions

Section 56 provides that a pension may be granted on the single life plan with no guaranteed period (normal form), single life plan with a guaranteed period (5, 10 or 15 years), joint life and last survivor plan, temporary life plan 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.

Section 56(3) provides that where a member has a spouse at retirement, the member is deemed to have elected that 60% of the pension be paid on the joint life and last survivor plan, unless the spouse waives this requirement in writing or there is a written agreement or court order made under Part 5 or 6 of the *Family Law Act* that is filed with the plan administrative agent. A spouse is as defined in the *PBSA*, and includes a common-law or same-sex spouse.

Disability Pensions

Sections 12(7) 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.

Section 60 provides that a member is entitled upon application to a disability pension if the member, before reaching age 60, has terminated employment, is totally and permanently disabled, has completed 2 years of contributory service, is not eligible for a monthly income benefit from a group disability plan, and has not received a lump sum payment in lieu of monthly LTD payments from a group disability plan. Section 63 provides that where a disability pension is payable, the disability pension is an immediate unreduced lifetime pension based on service earned to date.

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 commuted value of the regular pension earned to the date of death. If a spousal waiver has been filed, the surviving spouse cannot be designated as beneficiary;

(b) if the member has not attained age 55 at the date of death, and there is a surviving spouse and a valid spousal waiver has not been filed, the spouse may elect to receive as a benefit either of the following:

  (i) the greater of a refund of member's contributions with interest at the refund interest rates, and the commuted value of the regular pension earned to the date of death; or

  (ii) an immediate pension that is actuarially equivalent to the commuted value of the regular pension earned to the date of death, payable for the life of the spouse;

(c) if the member has attained age 55 on the date of death, and there is a surviving spouse and a valid spousal waiver has not been filed, then the benefit is an immediate pension to the spouse that is actuarially equivalent to the commuted value of the regular pension earned to the date of death calculated as though the member had terminated employment immediately before death, payable for the life of the spouse.

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, subject to the commuted value being payable on a locked-in basis. Under certain limited conditions (small pensions, non-resident status or small commuted values) the *PBSA* permits the election of a lump-sum pay-out, 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)(h) provides that the cost of the deferred indexing described above is funded from the IAA.

Cost of Living Benefits (Indexing)

Section 73 sets out how cost of living benefits are to be administered. It provides that on January 1st of each year, a retired member may receive a cost of living increase, subject to sufficient funds being available in the IAA from which the benefit is funded. The benefit is based on the total amount of pension being received, including previous cost of living increases, less any portion of the pension that is a result of voluntary contributions (which are no longer permitted). The bridge pension to age 65, payable as part of the regular pension formula, and a temporary life annuity arising as a result of converting some or all of the regular pension to one of the optional forms, are subject to indexing increases. The maximum increase is equal to the percentage increase in the Consumer Price Index ("CPI") over the 12 months ending on September 30 of the previous year.

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 IAA on the preceding September 30;

(d) The capitalized value of all cost of living benefits granted annually is transferred from the IAA to the basic account; and

(e) In the event of deflation, the deflation will be recovered before any further cost of living adjustments are granted in the future;

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 IAA and the supplemental benefits account;

(b) The IAA, consisting of:

- (i) the 2.95% contribution by each of the members under section 5(1)(c);
- (ii) the 3.08% employer contributions under section 6(1)(c);
- (iii) the net investment income earned on the IAA; and

(iv) subject to the prior approval of the board, all or such lesser part as the board designates of 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:

(v) amounts transferred to the basic account in respect of capitalized cost of living benefits granted under section 73;

(vi) refunds to plan members in respect of the 2.95% contribution made to this account under section 5(1)(c), or amounts otherwise transferred out of this account in respect of member and employer contributions allocated to this account;

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

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

(ix) amounts transferred to the supplemental benefits account to cover inflation protection on benefits in excess of those registrable under the *Income Tax Act*; and

(Section 10.3 of the JTA also permits the board to transfer portions of any actuarial surplus in the basic account to the IAA.)

(c) The supplemental benefits account, consisting of assets required for the administration and payment of benefits that are non-registrable under the *Income Tax Act*.

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 Teachers' 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 account/IAA 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 permitted (before application of any early retirement reductions, where applicable) is the lesser of:

(i) $2,914.44 in 2017 (increasing thereafter in accordance with an external general wage index) multiplied by the years of service; and

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

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. Non-pension benefits were previously contained in sections 91 through 95 of the plan rules which were repealed effective January 1, 2004.

   Effective May 1, 2002, the member is responsible for paying for 100% of the premiums for coverage under the British Columbia Medical Services Plan for the member and any eligible dependants. An unsubsidized voluntary dental plan came into effect August 1, 2007. An unsubsidized voluntary extended health care plan came into effect January 1, 2012.

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 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. A transfer of reserve agreement for the four public sector plans in British Columbia exists, whereby the plan member may elect to have a reserve transferred and then covered by the rules of the importing plan. Plan members may pay for any shortfall subject to Canada Revenue Agency approval, within the deadlines set out in the agreement. Members can also choose to leave their entitlements with their respective plans and apply for the appropriate benefits available from each plan at termination and/or retirement.

5. A maximum of 5 years taken to raise a child may be recognized as contributory service in establishing eligibility for a pension provided the member has a period of pensionable service immediately before and after the child-rearing period(s).

Appendix A Supplemental – JTA Conditional Amendments

Amending Agreements No. 3, 4 and 5 to the JTA require the Board to implement the following changes if there was a surplus as at December 31, 2017:

- First, decrease each of the employer and member contribution rates to the Basic Account by 0.05% of salary, with a corresponding increase in contributions to the IAA;

- Next, the employer's contribution rate to the Basic Account is reduced until the employer and member contribution rates to the Basic Account are equal;

- Then, provided the minimum PBSA required total contribution rate to the Basic Account is less than the total Basic Account contribution then in effect after implementing the above changes (the "Current Contribution Rate"),

    - Increase the accrual rate for post-2017 service from 1.85% to the lesser of 1.90% of salary, or the accrual rate that could be provided such that the resulting minimum PBSA required total contribution rate to the Basic Account is equal to the total Basic Account Current Contribution Rate; and

    - Amend the normal form of pension from a single life form to a single life with a 10-year guarantee for pensionable service from January 1, 2018.

Once these two benefit improvements are achieved, Transition is considered complete.

Next, any remaining surplus assets are to be used in the following order:

- Make a transfer to the IAA as necessary to ensure that indexing is fully sustainable and a prudent reserve exists in the IAA;
- Amend the normal form of pension from a single life form to a single life with a 10-year guarantee for accrued service (such that the normal form is a single life with a 10-year guarantee for all pensionable service); and
- Maintain any remaining surplus from the 2017 valuation as a rate stabilization reserve.

The cost impact of these changes is reported on separately in this report.

Appendix B: Actuarial Methods and Assumptions

The significant actuarial assumptions are summarized below.

Investment Return	6.00% per annum (6.50% for the previous valuation)
General ("across-the-board") Salary Increases	3.25% per annum (3.75% for the previous valuation)
Seniority Salary Increases	Annual percentages varying by age and sex
CPI Increases	2.50% (3.00% for the previous valuation)
Pension Indexing	▪ Future indexing of pensions and deferred pensions ignored, as will be covered by Inflation Adjustment Account ▪ Future indexing (by inflation) of wage base for disability accruals assumed to be a charge to the Basic Account and to be 2.50% per annum (3.00% for the previous valuation) ▪ Indexing to date is capitalized and forms part of pension
Asset Values	▪ Assets carried at smoothed market values ▪ Smoothed value restricted to a range of 92% to 108% (range of 90% to 110% for the previous valuation)
Costing Method	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 present working status, contribution balance, length of credited service and date of last contribution) would again become contributing members of the Plan and a further proportion (based on similar, but different, criteria) would collect deferred vested pensions.

- The liability for the remaining inactive members was generally calculated as their accumulated refund values (in some cases, depending on the member's status, we held twice the refund value).

In order to test the adequacy of the current contribution rates, we calculated the required member/employer contribution rate for current service in accordance with the entry-age actuarial cost method, based on the data for those members who joined the plan in the last 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 valuation assets consist of:

(i) The Basic Account; and

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

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

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

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

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

2) If the result is a surplus (the result of a gain since the last valuation), apply the gain to amortize or reduce the previously identified unfunded liabilities, starting with the oldest established. If, after removing all previously established amortization amounts there is still a surplus, amortize this surplus over 25 years commencing a year after the valuation date and test whether the transitional arrangements in the Joint Trust Agreement can be met.

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

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

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

2. Treatment of Member and Pensioner Data

Data as of December 31, 2017 were prepared by the Pension Corporation for 45,445 active members, 37,443 pensioners, 1,006 members receiving benefits from a long-term disability plan, 5,278 terminated members eligible for a vested pension, 7,174 other inactive members (including 4 on leave of absence) plus a further 1,236 non-retired individuals with very limited data. The data also included 6,925 active member terminations and 2,214 pensioner terminations during the period January 1, 2015 to December 31, 2017. 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 30 months since the last valuation and no more than 10 months in the valuation year);
- The salary level and the salary increase from the previous valuation was within a reasonable range;

- Pensions in pay increased by a reasonable amount (e.g. in line with the indexation since the last valuation); and

- We examined the additions to and deletions from each of the data files (i.e., the files for active employees, pensioners and terminated members) since the previous valuation to determine whether all Plan members were accounted for in this valuation, to check for duplicate records and to confirm pension amounts.

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

The active member data includes a number of individuals who work less than full time. For the purposes of calculating liabilities and normal actuarial costs, we treated all members as if they were full-time employees after the valuation date; however, in calculating the amortization costs as a percentage of total future payrolls, we reduced the total payroll base by 12% to reflect the part-time employment (unchanged from previous valuation).

The active member data included 2,551 persons who had no salary or service reported for the year ending December 31, 2017, or with a last-contribution-date prior to December 2017. We excluded them from the active member base, and have included them with the inactive data.

Salary details were inappropriate (missing, very low, or very high) for one active member. We assumed that this member had the same average earning as for other actives in the same age-sex category.

The liability for 966 of the 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 61 (60 was applied in the previous valuation) with deferred pensions on the basis of service projected to retirement date (service cap of 35 years was removed effective January 1, 2018) 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 85% of the former figure plus 15% of the latter figure (unchanged from previous valuation).

We also excluded 40 members on long-term disability from the valuation because of missing, invalid or inconsistent detail. Liabilities of twice their accumulated accounts were held for these members.

We divided the 5,278 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 50% of those in this second group who have been inactive for less than 10 years would be reactivated on January 1, 2018 (with salaries set equal to the average salaries for active members in the same age-sex category), and that the remaining members in this group would remain inactive and receive deferred vested pensions. This approach is unchanged from the previous valuation.

We excluded 330 vested members 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 9,725 other inactive members (i.e., including the 2,551 persons reassigned from the active group) into three classes:

(i) Those on leave of absence,

(ii) Those with missing, invalid or inconsistent detail, or whose accumulated accounts were less than $1,500, or who had less than 2 complete years of service, or who have not contributed for at least 10 years, 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 100% of the first group would be reactivated on January 1, 2018, with assumed average salaries equal to the average salaries for active members in the same age-sex category, that 100% of the second group would elect a commuted value or refund of contributions (depending on vesting status), and we set their liability equal to twice their accumulated account, and that 100% of the third group would become vested, with a vested liability equal to twice their accumulated accounts. A similar approach was used in the previous valuation.

With respect to the 1,236 remaining non-retired members with limited data, we held a liability equal to twice their accumulated accounts.

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

	Pension Corp. Data	Valuation Treatment						
		Pensioners	Pensioners with zero liability	Active Members	LTD	Vested	Reactivate	Refund 2 x CWI[1]
Pensioners	37,443	37,413	30					
Active Members	45,445			42,894				2,551
Long Term Disability	1,006				966			40
Terminated Vested	5,278					3,755	1,193	330
Inactive Members	7,174						4	7,170
Limited Data	1,236							1,236
Total Membership	**97,582**	**37,413**	**30**	**42,894**	**966**	**3,755**	**1,197**	**11,327**

3. Actuarial Assumptions

Investment return and general salary increase rates

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

(a) 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. Effective from January 1, 2017, the Board now has discretion to allocate the excess return to the IAA, or to retain it in the Basic Account. A

[1] Contributions with interest

decrease in the investment return assumption, and hence in the excess return threshold, would have at least two effects, if the Board used their discretion to affect the excess transfer to the IAA:

a) It would increase the amount of excess investment return potentially allocated to the IAA, and hence increase the potential for future indexing; and

b) 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, has added significance.

The previous valuation used a long-term investment return assumption of 6.5% per annum. As noted earlier, this also became the threshold rate used to determine excess investment return transfers to the IAA during the post-retirement period; effectively, this was the same as saying that the Basic Account would earn no more than 6.5% per annum during the post-retirement period (assuming for years from 2017 onwards the Board used their discretion to effect the excess transfer to the IAA).

(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 9.3% for 2015, 5.9% for 2016 and 11.8% for 2017. At December 31, 2017, approximately 65.2% of the total portfolio was invested in equities (including private placements, infrastructure and renewable resources), a further 14.0% in real estate, and the balance of 20.8% in fixed income (including mortgages).

(c) Expected returns

After examining the net average investment return earned by the fund's investments, the yield on investments made in recent years, the likely future trend of investment returns in general, the investment practices, and the provisions of this Plan - e.g. the allocation of excess investment income to the Inflation Adjustment Account - we have concluded that a reasonable best estimate of the long term investment return on the plan’s assets is 6.25% (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% (no change from 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 to 6.0% per annum. We continued with our previous valuation assumption for the real return of 3.5%. In other words, there is a margin of 0.25% on the investment return assumption, and a margin of 0.5% on the real return assumption (no change in the margins compared to our previous valuation).

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

	Discount Rate
Weighted average return	6.26%
Diversification and rebalancing effect	0.30%
Provision for investment related expenses	(0.28%)
Rounding	(0.03%)
Estimated net investment return before margin	**6.25%**
Margin for adverse deviation	(0.25%)
Discount return assumption (rounded to nearest 0.25%)	**6.00%**

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 0.28% provides for expected future management fees.

(d) Real return and salary relationships – derive salary assumption

The 6.5% investment return assumption used in the 2014 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 3.5% and applying it to the new 6.0% investment return assumption, we get a revised long-term underlying inflation assumption of 2.5% per annum (i.e. 6.0% - 3.5%). This can also be viewed as a best estimate of future inflation of 2.25% (derived from the best estimate nominal return assumption of 6.25% less the best estimate real return assumption of 4%), 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 2.50%, we get a revised general salary increase assumption of 3.25%. 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 investment return assumption is critical as this is the discount rate for the Basic Account post-retirement liabilities. It also sets the excess investment return threshold which can, at the Board's discretion, put a ceiling on the amount the Basic Account can effectively earn on the portion of the assets that support post-retirement liabilities. For example, if the threshold is 6.0%, then, if the long-term returns exceed 6.0% on average, and the Board so elects, part or all of the excess can be transferred to the IAA, i.e. the Basic Account could retain only 6.0% on these assets.

During the **pre-retirement period**, it is the relationship, i.e. the net difference, between the investment return and general salary increase assumptions that is the key, rather than their absolute levels - projected benefits increase each year by the salary assumption and are then discounted by the investment assumption, i.e. the net result is that the liabilities are effectively being discounted by the net difference between the two assumptions. For example, the long-term assumptions we have used in this valuation (i.e. 6.0% investment return, 3.25% salary, 2.5% underlying inflation) would produce results similar to those using assumptions of 6.25% investment return and 3.5% salary, with 2.75% underlying inflation; or 5.75% investment return and 3.0% salary, with 2.25% underlying inflation, etc. Thus, the underlying inflation assumption itself is not material to the result.

(f) Summary of interrelationships

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

	2014 Valuation	2017 Valuation
1. Investment return = excess investment return threshold	6.50%	6.00%
2. Real return rate	3.50%	3.50%
3. Implied underlying inflation = 1 - 2	3.00%	2.50%
4. Real salary increase	0.75%	0.75%
5. General salary increase = 3 + 4	3.75%	3.25%

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

The 2017 valuation data indicates that average annual earnings increased by about 4.8% from mid-fiscal-2014 to mid-fiscal-2017 (i.e., about 1.6% 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 annualized 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 under the Canada Pension Plan would increase at the general salary increase rate of 3.25% per year from its 2018 level of $55,900, 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 the same rate of 3.75% per year, but from its 2015 level of $53,600, 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 2.95% of salaries to be paid by the members, plus 3.08% paid by the employers. 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 such transfers from the Inflation Adjustment Account do not occur until retirement (theoretically, such transfers should be made on an annual basis as the indexing occurs, so as to reduce the inter-generational transfer of the costs of such indexing). We have therefore adjusted the deferred pension amounts to remove this indexing so that the Basic Account liability is aligned with the allocation of assets between the Basic and IAA accounts. We made the same adjustment in the previous valuation.

The indexing of salaries before retirement in the case of members on long-term disability is, on the other hand, a charge to the Basic Account rather than to the Inflation Adjustment Account. Accordingly, in valuing the deferred pensions for those currently on long-term disability, we have made an allowance for this by applying an escalation assumption (at the full underlying inflation assumption) of 2.5% 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 December 31, 2015 to December 31, 2017.

As in the previous valuation we applied a five-year smoothing technique to these assets. We believe a smoothing approach is appropriate as it cushions the actuarial valuation results against dramatic swings in market value that can occur. After discussion with the Board, it was agreed that an additional constraint on the smoothed value of assets is appropriate, and that the funding policy be modified to provide that the smoothed value is restricted to a range of 92% to 108% of market value. (The funding policy previously applied a range of 90% to 110% of market value).

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

The smoothed value is then restricted to a range of 92% to 108% of market value, if necessary. 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 90% applied as of December 31, 2015.

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

Total Fund Smoothing

Target Return	2015	2016	2017
1. Dec-over-Dec increase in CPI	1.6%	1.5%	1.9%
2. Base return = (1) + 3.5%	5.1%	5.0%	5.4%
Year-end asset values - $000's			
3. Market value	24,459,700	25,529,297	28,116,866
4. Smoothed value	22,013,730	23,868,360	26,027,398
5. Ratio of (4) ÷ (3)	0.900	0.935	0.926
Annual Returns			
6. Market value	9.3%	5.9%	11.8%
7. Smoothed value	9.5%	10.2%	10.8%

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

Year-end Asset Values – $000's

Basic Account	2015	2016	2017
8. Market value	20,204,136	20,914,887	22,919,615
9. Smoothed value	18,183,722	19,554,164	21,216,374
10. Ratio of (9) ÷ (8)	0.900	0.935	0.926
Inflation Adjustment Account			
11. Market value	4,255,564	4,614,410	5,197,251
12. Smoothed value	3,830,008	4,314,196	4,811,024
13. Ratio of (12) ÷ (11)	0.900	0.935	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 intervaluation period, the actual experience showed more deaths than expected, compared to prior intervaluation periods where, in general, we have observed fewer deaths than expected on the basis of the rates used in the previous valuation. In the absence of knowing if this experience is a trend or an anomaly, we continued to use the adjusted 2014 Public Sector Mortality Table (CPM2014Publ), and the CPM

Improvement Scale B (CPM-B) Table. 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.

The resulting mortality assumptions used are as follows (and are unchanged from the assumptions used for the previous valuation):

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

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

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

Withdrawal

We examined the rates of withdrawal for reasons other than death, retirement or disability over the period January 1, 2015 to December 31, 2017 and compared this with the experience observed and the rates used for previous valuations. The observed rates for females in their first two years of service were lower than those assumed in the previous valuation, while the observed rates for both males and females withdrawing after three years of service were higher than assumed in previous valuations. As a result, we have made 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**
	1st year	**2nd year**	**3rd year**	
Males	100%	100%	100%	110%
Females	95%	95%	100%	115%

Sample withdrawal rates are shown in the following tables.

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

Age at entry	2017 Valuation			2014 Valuation		
	1st year	2nd year	3rd year	1st year	2nd year	3rd year
Males						
20	.106	.080	.059	.106	.080	.059
30	.106	.080	.059	.106	.080	.059
40	.106	.080	.059	.106	.080	.059
50	.106	.080	.059	.106	.080	.059
Females						
20	.043	.045	.042	.046	.047	.042
30	.111	.091	.064	.117	.096	.064
40	.098	.056	.047	.104	.059	.047
50	.098	.056	.047	.104	.059	.047

B. Withdrawal Rates Applicable After 3 Years of Service

Attained age	2017 Valuation		2014 Valuation	
	Males	Females	Males	Females
23	.031	.056	.028	.048
33	.020	.037	.018	.032
43	.015	.016	.014	.014
53	.015	.015	.014	.013

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 from those used in the previous valuation. 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 61 (or, immediately, for those older than age 61). Commencement at age 60 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.

Sample Disability Rates

Age	2017 and 2014 Valuations	
	Males	Females
25	.0002	.0001
35	.0002	.0007
45	.0014	.0022
55	.0046	.0059

The rates used for the 2017 valuation are 120% for males and 100% 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. This is unchanged from the previous valuation.

Retirement

We examined the 2015-2017 retirement experience of members retiring from active service and compared this with the experience observed in our previous analyses of the retirement rates and with the rates used in the previous valuation. In general, the actual experience showed fewer retirements than were indicated on the basis of the rates used in the previous valuation. We gave partial recognition to the observed experience by making modest adjustments to the rates previously used for retirement by slightly decreasing the rates for reduced early retirement with age plus service greater than 80 for both males and females, and also slightly decreasing the rates assumed for unreduced retirement for males and females aged 55 to 59 inclusive, and the rates applied to males age 60.

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

Retirement Rates from Active Service

		2017 valuation		2014 valuation	
Age	**Service**	**Males**	**Females**	**Males**	**Females**
55-59	at least 10 years, but age and service less than 80	.05	.06	.05	.06
55-59	age and service at least 80	.11	.11	.12	.12
55-59	age and service at least 90	.42	.36	.44	.39
60	10	.38	.36	.40	.36
61	10	.25	.23	.25	.23
62	10	.25	.23	.25	.23
63	10	.25	.23	.25	.23
64	10	.30	.30	.30	.30
65	0	1.00	1.00	1.00	1.00

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

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

Seniority Salary Scales

Seniority salary increases are in addition to the general salary increases and are intended to reflect increasing seniority, recognition of merit and promotion. We examined the seniority salary scales based both on the earnings history of the active members during the 3-year period ended December 31, 2017 and on the graduated average salaries of the active members as of December 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 Earnings Rates

Age	2017 and 2014 valuations	
	Males	Females
25	.036	.044
35	.038	.021
45	.006	.011
55	.003	.003
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 Contributors 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 Teacher Population

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

Expenses

Administration expenses are paid out of the Teachers' fund. These amounts totalled 0.46%, 0.49% and 0.45% of salaries during 2015, 2016 and 2017 respectively. Projected expenses provided by the Pension Corporation for the next few years anticipate that administration expenses will continue at the rate seen in 2017. Therefore, we continued with the expense provision of 0.45% of salary used in the previous valuation, as part of the normal actuarial costs in the determination of the required contribution rates under the entry-age funding method. 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 to be 1.5% less than the valuation investment return assumption, i.e. at 5.0% per annum.

Recognition of Child-Rearing Periods for Pension Eligibility

We continued to assume that this would only affect female members, and that, on average, it would increase the member's contributory service (which is used for determining pension eligibility) by 2 years; there would, of course, be no increase to the member's pensionable service (which is used for determining pension amounts). The impact of this would be to reduce the eligibility requirement for unreduced pensions between ages 55 and 59, from a rule-of-90 to a rule-of-88 for service earned prior to 2018, from 35 years to 33 years of contributory service for service earned post 2017, and we assumed that there would be no impact on the eligibility assumptions made for other benefits. The same assumption was made in the previous valuation.

Plan Termination

The Standards of Practice issued by the Canadian Institute of Actuaries 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 do not comment on the financial position of the plan if 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 $26,027,398,000;

- We applied an indexing assumption equal to the full assumed underlying inflation rate, i.e. 2.5% per annum. This indexing rate was applied both to pensions after retirement and during the pre-retirement period in the case of deferred vested pensions and disability salary accruals. We loaded the pensions in pay by 1.6% to cover the actual January 1, 2018 indexing increase. The indexing is thereafter assumed to apply annually, in arrears;

- We combined the contribution rates to Basic and IAA.

Maximum Pension Rule – Assumption Changes

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

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

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

While the Plan applies the *ITA* limits only in respect of service after 1991, we have, for ease of calculation, assumed that this limit applies on all service; this assumption does not affect the future normal costs, but the accrued liabilities will be slightly understated. The Plan previously applied a 35-year cap on accruals at the above maximum rate, but this was removed effective January 1, 2018.

For an individual in this Plan to be currently affected by the $2,944.44 maximum, the final average salary must be very high. While current salaries are not such as to cause many problems, the salaries projected in the future through application of the assumed salary increase rates outlined above are such that some individuals would be limited. However, under the income tax rules, the flat $2,944.44 limit is automatically indexed each year after 2018 in accordance with increases in the average wage. Accordingly, we have applied a 3.25% per annum increase to the $2,944.44 limit after 2018. (At the previous valuation the corresponding dollar limit was $2,818.89 for 2015, and was scheduled to be automatically indexed each year after 2015 in accordance with increases in the average wage; a 3.75% increase rate was applied after 2015 to the $2,818.89 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 as at December 31, 2017

Age group[1]	Active members December 31, 2017			New entrants Jan. 1, 2015 to Dec. 31, 2017 and still active Dec. 31, 2017	
	Number	Average annual earnings[2] $	Average service (years)	Number	Average annual earnings[2] $
Males					
20-24	57	49,498	0.6	211	50,852
25-29	719	53,119	1.5	619	52,469
30-34	1,171	61,405	3.6	341	55,631
35-39	1,615	74,689	7.1	228	61,492
40-44	1,868	83,451	11.1	132	64,297
45-49	2,046	87,661	15.5	69	66,068
50-54	1,858	90,068	20.0	47	70,777
55-59	1,381	89,533	22.5	33	82,247
60 & over	743	86,820	22.3	24	69,094
Total	**11,458**	**80,667**	**13.5**	**1,704**	**56,892**
Females					
20-24	355	49,554	0.5	1,167	50,903
25-29	2,869	53,307	1.7	1,723	52,441
30-34	3,985	62,414	3.9	753	56,564
35-39	4,976	72,510	6.7	577	59,939
40-44	4,969	78,412	9.7	388	61,944
45-49	5,075	81,578	13.0	254	63,793
50-54	4,140	84,033	17.6	131	66,469
55-59	3,176	84,775	19.6	75	69,893
60 & over	1,891	83,786	20.4	35	72,986
Total	**31,436**	**75,050**	**10.9**	**5,103**	**55,591**
Total males & females	**42,894**	**76,551**	**11.6**	**6,807**	**55,916**

[1] Age nearest birthday at December 31, 2017 for actives and at entry for new entrants.

[2] Actual earnings in 2017 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.

The average age of the 42,894 active members is 43.7.

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

	Dec. 31, 2014	Dec. 31, 2017	Change 2014 to 2017
Males			
Number	11,145	11,458	+ 2.8%
Proportion of total	27.4%	26.7%	- 0.7%
Average age (at 12.31)	45.4	45.0	- 0.4 years
Average service	14.1	13.5	- 0.6 years
Average salary	$76,924	$80,667	+ 4.9%
Females			
Number	29,499	31,436	+ 6.6%
Proportion of total	72.6%	73.3%	+ 0.7%
Average age (at 12.31)	43.8	43.3	- 0.5 years
Average service	11.4	10.9	- 0.5 years
Average salary	$71,560	$75,050	+ 4.9%

The above comparison indicates an increase in both male and female membership during the 3-year intervaluation period. The proportion of males to females continues to decrease. The average age has decreased slightly for both males and females. The average salary increase is the same for males and females.

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

	Dec. 31, 2014	Dec. 31, 2017	Change 2014 to 2017
Males			
- Number	1,085	1,704	+ 57.1%
- Proportion of total	23.2%	25.0%	+ 1.8%
- Average age at entry	32.1	33.0	+ 0.9 years
- Average salary	$52,046	$56,892	+ 9.3%
Females			
- Number	3,588	5,103	+ 42.2%
- Proportion of total	76.8%	75.0%	- 1.8%
- Average age at entry	30.6	31.8	+ 1.2 years
- Average salary	$51,170	$55,591	+ 8.6%

The average age of new entrants has increased for both males and females. The increase in average salary for new entrants is higher than the average salary increases for actives for both males and females.

Appendix D: Inactive Member Data as at December 31, 2017

1. LOA Members Assumed Reactivated on Valuation Date

	Number	Average annual earnings[1]	Average service
Total males & females	**4**	**$78,807**	**16.0 years**

Average age is 45.5.

2. Members on Long-Term Disability with Projected Deferred Pensions

Age group[2]	Males		Females	
	Number	Average annual deferred pensions[3] $	Number	Average annual deferred pensions[3] $
Under 35	3	37,452	13	36,927
35-39	5	42,843	43	41,029
40-44	13	40,950	71	40,009
45-49	31	41,804	108	37,435
50-54	32	39,755	153	37,487
55-59	64	37,015	214	31,109
60 & over	51	28,647	165	24,406
Total	**199**	**36,467**	**767**	**33,309**

	Number	Average age	Average annual deferred pensions[2]
Total males & females	**966**	**53.1**	**$33,959**

	Number	Average age	Average pensionable service	Average salary	Expected average remaining Service life
Active and LTD Combined	**43,860**	**43.9**	**11.7**	**$76,584**	**12.1**

1 Aassumed same earnings as for active members in same age-sex group.

2 Age nearest birthday at December 31, 2017.

3 Basic lifetime portions payable from age 61; additional temporary amounts payable from age 61 to 65.

3. *Other Inactive Members Entitled to Vested Pensions – 50% valued as deferred and 50% valued as Reactivated*

Age group[1]	Males				
		Data for valuation as reactivated		Data for valuation as deferred	
	Number	Average annual earnings[2] $	Average service (years)	Initial[3] $	Offset at age 65 $
<30	15	54,999	1.1	1,109	384
30-34	69	64,926	2.0	2,105	707
35-39	102	77,314	3.1	3,411	1,090
40-44	96	84,377	4.6	5,805	1,612
45-49	93	88,174	7.1	10,325	2,488
50-54	106	90,206	10.8	17,814	3,863
55-59	52	89,211	12.4	20,433	4,379
60 +	36	85,316	5.5	7,730	1,877
Total	**569**	**82,185**	**6.2**	**9,238**	**2,209**

Age group[1]	Females				
		Data for valuation as reactivated		Data for valuation as deferred	
	Number	Average annual earnings[2] $	Average service (years)	Initial[3] $	Offset at age 65 $
<30	132	54,986	0.9	914	315
30-34	251	64,985	2.1	2,227	750
35-39	406	74,001	3.3	3,718	1,155
40-44	364	79,233	4.2	5,113	1,470
45-49	257	82,062	6.7	9,313	2,360
50-54	227	84,105	8.9	12,953	3,105
55-59	111	84,812	9.0	13,647	3,127
60 +	68	82,692	6.6	9,463	2,333
Total	**1,816**	**75,812**	**4.8**	**6,356**	**1,680**

1 Age nearest birthday at December 31, 2017.

2 Assumed same earnings as for active members in same age-sex group

3 Average annual pensions assumed to commence at the first age at which the member is entitled to an unreduced pension, assuming this is no earlier than age 60 i.e. at various ages between 60 and 65.

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

Age group[1]	Males			Females		
	Average annual vested pensions			Average annual vested pensions		
	Number	Initial[2] $	Offset at age 65 $	Number	Initial[2] $	Offset at age 65 $
Under 39	12	2,046	691	39	1,380	467
40-44	87	2,433	793	338	2,202	719
45-49	192	3,407	1,022	566	3,330	1,022
50-54	162	5,565	1,470	469	5,293	1,452
55-59	126	8,341	1,973	294	5,583	1,459
60 & over	76	6,838	1,641	202	5,177	1,305
Total	**655**	**5,134**	**1,351**	**1,908**	**4,116**	**1,160**

Total Vested – tables 3 and 4	Number	Average age	Average annual vested pension - initial	Average annual vested pension - offset at age 65
Total Vested males & females	**4,948**	**47.1**	**$5,662**	**$1,497**

5. *Remaining Inactive Members*

	Number	Member contributions with interest
Valued at 2 x contribution with interest	**11,327**	**82,058,007**

Average age is 54.8.

[1] Age nearest birthday at December 31, 2017.

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

Appendix E: Pensioner Data as at December 31, 2017

1. *Former Contributors*

		Annual Pensions ($000's)[1]				
Age group[2]	**Number of pensioners[3]**	**Single life**	**Joint life & Survivor**	**Joint life & Survivor with guarantee**	**Single life with guarantee**	**Temporary life**
Male pensioners						
Less than 59	349	156	4,854	1,968	2,277	3,820
60-64	1,647	2,338	24,517	14,663	13,079	19,301
65-69	2,952	12,461	47,541	19,182	21,545	2,514
70-74	3,401	30,224	65,072	6,436	14,418	6
75-79	2,398	42,508	39,553	756	1,726	3
80-84	1,293	27,536	17,840	-	45	-
85-89	717	14,952	7,174	-	-	-
90 & over	302	7,308	2,188	-	-	-
Total	**13,059**	**137,483**	**208,739**	**43,005**	**53,090**	**25,644**
Female pensioners						
Less than 55	16	-	-	-	111	16
55-59	887	1,164	6,341	5,390	8,268	8,350
60-64	3,862	13,042	24,975	22,895	46,782	38,247
65-69	6,247	51,755	40,464	22,929	55,649	4,466
70-74	5,273	76,870	33,165	5,731	23,968	-
75-79	2,738	55,165	12,750	234	2,663	-
80-84	1,332	27,924	4,055	-	105	-
85-89	857	17,240	1,113	-	-	-
90 & over	554	11,180	174	-	-	-
Total	**21,766**	**254,340**	**123,037**	**57,179**	**137,546**	**51,079**
Grand Total	**34,825**	**391,823**	**331,776**	**100,184**	**190,636**	**76,723**
Supplemental Pensions (included above)		**29**	**200**	**36**	**40**	

Average age of the 34,825 pensioners is 71.2.

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1 Including supplements to January 1, 2017.

2 Age nearest birthday at December 31, 2017.

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

2. *Beneficiaries*

		Annual Pensions ($000's)[1]	
Age group[2]	**Number of beneficiaries**[3]	**Single Life**	**Single Life with Guarantee**
Male beneficiaries			
Less than 50	9	60	
50-54	11	106	
55-59	17	308	
60-64	56	964	136
65-69	82	1,493	117
70-74	130	2,109	324
75-79	109	1,816	39
80-84	87	1,454	36
85-89	67	1,049	-
90 & over	31	423	-
Total	**599**	**9,782**	**652**
Female beneficiaries			
Less than 50	9	136	-
50-54	15	191	38
55-59	30	597	105
60-64	85	1,708	229
65-69	167	3,382	382
70-74	328	7,572	215
75-79	322	7,571	-
80-84	299	7,664	-
85-89	318	7,147	-
90 & over	306	7,834	-
Total	**1,879**	**43,802**	**969**
Remaining guarantees	**110**		**2,884**
Grand Total	**2,588**	**53,584**	**4,505**
Supplemental Pensions (included above)		**36**	

Average age of the 2,478 beneficiaries in receipt of a lifetime pension is 77.9.

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1 Including supplements to January 1, 2017.

2 Age nearest birthday at December 31, 2017.

3 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.	2014 Valuation Report	2017 Including JTA Conditional Amendments
Normal ("entry-age") actuarial cost portion	**% Integrated**	**% Level**
Males	16.29	16.10
Females	16.69	16.41
Combined	**16.59**	**16.33**

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

	Combined
	%
Normal Cost at 2014 Valuation	**16.59**[1]
2018 benefit changes	0.62
Normal Cost at 2014 Valuation allowing for 2018 Benefit Changes	**17.21**[1]
Adjustment to convert to level rate based on 2014 salaries	(2.17)
Level Normal Cost at 2014 Valuation with 2018 Benefit Changes	**15.04**[2]
▪ data changes	(0.14)
▪ assumption changes:	
▪ economic assumptions	1.00
▪ LTD retirement age	0.03
▪ withdrawal rates	(0.16)
▪ retirement rates	0.02
Total Change prior to JTA Conditional Amendments	**0.75**
Normal Cost at 2017 Valuation, prior to 2019 benefit changes	**15.79**
▪ JTA Conditional benefit improvements	0.54
Normal Cost at 2017 Valuation, including JTA Conditional Amendments	**16.33**

[1] Integrated at 3%.

[2] This rate, and all those which follow below in the table are level i.e. non-integrated rates.

Calculation of Required Contribution Rate

	2014	2014	2017	2017
	Prior to 2018 benefit changes	Including 2018 benefit changes	Including 2018 benefit changes	Allowing for JTA Conditional Amendments
A. Normal (entry age) actuarial cost	16.59% Integrated	15.04% Level	15.79% Level	16.33% Level
B. Surplus (Unfunded) actuarial liability on entry age basis ($000's)	(1,208,929)	(1,142,889)	741,468	644,012
C. Present value of existing amortization requirements ($000's)				
(i) 3.05% to 2017	229,867	229,867	-	-
(ii) 2.93% to 2020	424,976	424,976	-	-
(iii) 0.97% to 2020	n/a	n/a	80,857	n/a
(iv) 1.50% to 2023	314,193	314,193	240,588	n/a
(v) 2.56% to 2026	688,684	688,684	592,857	n/a
D. Sum of B + C	448,791	514,831	1,655,770	644,012
E. Balance of unfunded liability to be amortized over 15 years ($000's) (= D, or zero if D is greater than zero)	0	0	0	0
F. 5% of net liability (PBSA minimum surplus)	n/a	n/a	1,023,745	1,028,618
G. Excess over PBSA minimum surplus (= B – F, if greater than zero)	n/a	n/a	0	0
	%	**%**	**%**	**%**
H. Reduction to existing amortization (if D is greater than zero)	4.56	5.01	5.03	n/a
I. Total *PBSA* amortization requirement				
(i) to 2020	1.42	0.97	-	-
(ii) to 2023	1.50	1.50	-	-
(iii) to 2026	2.56	2.56	-	-
Total	**5.48**	**5.03**	**0.00**	**0.00**
J. Total *PBSA* Required Contribution Rate	**22.07**	**20.07**	**15.79**	**16.33**

Appendix G: Comparative Results

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

The results herein are analogous to those contained in Schedules 1 through 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 December 31, 2017

Allowing for JTA Conditional Amendments** – **($000's)

	Without Tax Limits		With Tax Limits	
	Basic Only	**Basic + Indexed**	**Basic Only**	**Basic + Indexed**
Assets				
Market value of Fund	22,919,615	28,116,866	22,919,615	28,116,866
Asset smoothing adjustment	(1,703,241)	(2,089,468)	(1,703,241)	(2,089,468)
Smoothed Value of Fund	**21,216,374**	**26,027,398**	**21,216,374**	**26,027,398**
Present value of future contributions at entry-age rates	5,631,726	7,585,946	5,619,314	7,569,029
Present value of required amortization	-	-	-	-
Total Assets	**26,848,100**	**33,613,344**	**26,835,688**	**33,596,427**
Actuarial present values for:				
▪ pensions being paid	12,191,469	15,501,537	12,187,350	15,496,233
▪ inactive members	376,869	562,368	376,869	562,368
▪ LTD members	301,033	376,520	301,033	376,520
▪ active members	13,182,443	17,633,881	13,167,908	17,615,389
▪ future expenses	152,260	152,260	152,260	152,260
▪ Voluntary contribution balance	14	14	14	14
Total Liabilities	**26,204,088**	**34,226,580**	**26,185,434**	**34,202,784**
Surplus (Unfunded Liability)	**644,012**	**(613,236)**	**650,254**	**(606,357)**
Selected 2014 Comparisons (before benefit changes)				
Smoothed Value of Assets	16,821,638	20,419,685	16,821,638	20,419,685
Present Value of future contributions at entry age rate	4,401,401	6,174,607	4,398,354	6,174,607
Present value of required amortization	1,208,929	1,208,929	1,208,929	1,208,929
Total Assets	**22,431,968**	**27,803,221**	**22,428,921**	**27,803,221**
Total Liabilities	**22,431,968**	**30,637,346**	**22,423,338**	**30,625,463**
Surplus (Unfunded Actuarial Liability)	**0**	**(2,834,125)**	**5,583**	**(2,822,242)**

Schedule G3 – Current and Required Contribution Rates – December 31, 2017

Allowing for JTA Conditional Amendments – ($000's)

	Without Tax Limits		With Tax Limits	
	Basic Only %	**Basic + Indexed %**	**Basic Only %**	**Basic + Indexed %**
	Level	**Level**	**Level**	**Level**
Current contribution rates				
Member	9.97	12.92	9.97	12.92
Employer	10.15	13.23	10.15	13.23
Combined member/employer	**20.12**	**26.15**	**20.12**	**26.15**
Required contribution rates				
Entry age normal cost rate	**16.33**	**22.42**	**16.29**	**22.37**
Amortization of unfunded actuarial liability (surplus)				
▪ 25-year amortization	(1.25)	1.16	(1.26)	1.15
▪ 15-year amortization	(1.85)	1.71	(1.86)	1.69
▪ *PBSA* amortization	0.00	n/a	0.00	n/a
Total contribution rate				
▪ 25-year amortization	15.08	23.58	15.03	23.52
▪ 15-year amortization	14.48	24.13	14.43	24.06
▪ *PBSA* rate	16.33	n/a	16.29	n/a
Total required contribution rate	**16.33**	**n/a**	**16.29**	**n/a**
Selected 2014 Comparisons (before benefit changes; integrated rates)				
	Integrated	Integrated	Integrated	Integrated
Member	11.00	14.00	11.00	14.00
Employer	15.00	16.13	15.00	16.13
Combined member/employer	**26.00**	**30.13**	**26.00**	**30.13**
Required contribution rates				
Entry age normal cost rate	**16.59**	**22.43**	**16.58**	**22.43**
Amortization of unfunded actuarial liability (surplus)				
▪ 25-year amortization	2.52	8.44	2.51	8.41
▪ 15-year amortization	3.73	12.48	3.71	12.44
▪ *PBSA* amortization	5.48	n/a	5.44	n/a
Total contribution rate				
▪ 25-year amortization	19.11	30.87	19.09	30.84
▪ 15-year amortization	20.32	34.91	20.29	34.87
▪ *PBSA* rate	22.07	n/a	22.02	n/a
Total required contribution rate	**22.07**	**n/a**	**22.02**	**n/a**

Schedule G5 – Accrued Liabilities and Funded Ratio – December 31, 2017

Allowing for JTA Conditional Amendments – ($000's)

($000's)	Without Tax Limits		With Tax Limits	
	Basic Only	Basic + Indexed	Basic Only	Basic + Indexed
Assets – Smoothed Value	**21,216,374**	**26,027,398**	**21,216,374**	**26,027,398**
Accrued Liabilities				
▪ for pensions being paid	12,191,469	15,501,537	12,187,350	15,496,233
▪ for inactive members	376,869	562,368	376,869	562,368
▪ for LTD members	301,033	376,520	301,033	376,520
▪ for active members	7,162,321	9,493,007	7,159,432	9,489,197
▪ for voluntary contributions	14	14	14	14
Total Accrued Liabilities	**20,031,706**	**25,933,446**	**20,024,698**	**25,924,332**
Surplus (Unfunded Actuarial Liability)	**1,184,668**	**93,952**	**1,191,676**	**103,066**
Funded Ratio – Fund ÷ Total Accrued Liabilities	**105.9%**	**100.4%**	**106.0%**	**100.4%**
Select 2014 Comparisons (before benefit changes)				
Assets	16,821,638	20,419,685	16,821,638	20,419,685
Total Liabilities	17,525,926	23,844,331	17,520,543	23,836,887
Surplus (Unfunded Actuarial Liability)	(704,288)	(3,424,646)	(698,905)	(3,417,202)
Funded Ratio	96.0%	85.6%	96.0%	85.7%

Schedule G6 – Recent Contribution Requirements

	Resulting from December 31, 2011 valuation	Based on December 31, 2014 valuation			Based on December 31, 2017
		As Disclosed in 2014 Report	After JTA Amendment No. 3	After 2018 Amendments	Including JTA Amendments
Basic Account Contribution Rates	**Integrated**	**Integrated**	**Integrated**	**Level**	**Level**
Member	11.00	11.00	11.05	9.97	8.17
Employer	15.00	11.07	11.23	10.15	8.17
Total Basic	**26.00**	**22.07**	**22.28**	**20.12**	**16.34**
IAA Contribution Rates					
Member	3.00	3.00	2.95	2.95	3.00
Employer	1.13	3.13	3.08	3.08	3.13
Total IAA	**4.13**	**6.13**	**6.03**	**6.03**	**6.13**
Total Contribution Rates					
Member	14.00	14.00	14.00	12.92	11.17
Employer	16.13	14.20	14.31	13.23	11.30
Total Contribution Rates	**30.13**	**28.20**	**28.31**	**26.15**	**22.47**