Actuarial Reports

on the Pension Plans for the
Public Service,
Canadian Forces and
Royal Canadian Mounted Police

as at 31 March 2008

Presentation to the Federal–Provincial Pensions Conference
Ottawa, 23 November 2009
Presentation

The purpose of this presentation is to provide you with a brief overview of how our liabilities materialize, how they are quantified and how they are financed.

1. Role and Responsibilities of the Office of the Chief Actuary
3. Assumptions Used in Actuarial Reports
4. Current Service Costs and Liabilities
5. Stochastic Analysis: a tool to measure uncertainty of results
6. Issues Going Forward
The *Public Pensions Reporting Act* defines the legislative responsibilities

- Each pension plan legislation requires, in accordance with the *Public Pensions Reporting Act*, that a cost certificate and actuarial valuation report be prepared, filed with the designated Minister and tabled before Parliament

- *Public Pensions Reporting Act*
  - Section 3: Chief Actuary must conduct actuarial reviews
  - Section 5: Describes content of cost certificate
  - Section 6: Describes content of valuation report
Cost certificate is composed of...

• Current service cost of the plan
  – An amount sufficient to cover the cost of all future benefits accrued in respect of one year of service; or
  – % of pensionable payroll that, if contributed from the date of hire to the expected retirement date, would accumulate to the value required to pay all future benefits to plan participants

• Contributions for prior service elections

• Special payments made by Government to cover any deficits

In doing so, the actuary is responsible for all assumptions used to set contribution rates.
Actuary measures the actuarial liabilities

- Actuarial liabilities of the plans
  - For pensioners, the present value of all future benefits, discounted using actuarial assumptions- projected yields on the Account (pre-April 2000 service) or the Fund (post-March 2000 service); and,
  - For contributors, the present value, discounted using actuarial assumptions (projected yields on the Account or the Fund) of all future benefits accrued as at that date in respect of all prior service.

- Solvency valuation not required
Actuary evaluates the financial status of the plans

- Evaluate financial status of the plan (actuarial surplus / deficit)
  - Best estimate of the difference between plan assets and the actuarial liabilities of the plan
  - Generally calculated as the excess of assets over the actuarial liability, which is the expected present value of future benefits attributable to service to date
  - May vary depending on the actuarial assumptions and methods used
1. Role and Responsibilities of the OCA
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Membership

295,000 contributors
248,000 beneficiaries

21,000 contributors
15,000 beneficiaries

67,000 contributors
109,000 beneficiaries

Public Service:  Avg. Age at retirement has been 58* with 26 years of service
RCMP: Average Age at retirement has been 54* with 31 years of service
CF: Average age at retirement has been 45* with 25 years of service

*Average over past three years
Plan Provisions
Retirement Benefit (Immediate Annuity)

• 2% per year of service
  \[ \times \text{# of years of service not exceeding 35} \]
  \[ \times \text{highest average of pensionable earnings over 5 years} \]

• Payable at retirement age 60 or age 55 with 30 YS \((PS)\)
• Payable at retirement age with 25 YS \((RCMP)\)
• Payable at retirement age with 20/25 YS \((Canadian Forces)\)

• Reduced at 65 by 0.625% (in 2012) \(\times\) CPP Average maximum pensionable earnings \(\times\) # of years of CPP service (max. 35)
  Effective January 1, 2008, the factor of 0.7% was gradually reduced to .625% over five years.

• Pensions are fully indexed to increases in the CPI
• Disability, survivor and children benefits are also provided
Plan Provisions - Financing
Member Contributions

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution rates on earnings up to the maximum covered by the CPP/QPP</td>
<td>4.9%</td>
<td>5.2%</td>
<td>5.5%</td>
<td>5.8%</td>
<td>6.1%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Contribution rates on any earnings over the maximum covered by the CPP/QPP</td>
<td>8.4%</td>
<td>8.4%</td>
<td>8.4%</td>
<td>8.4%</td>
<td>8.4%</td>
<td>8.4%</td>
</tr>
</tbody>
</table>

The increase in member contribution rates decreases the Government’s contribution, but has no effect on the total cost of the Plan.
Average working and retirement life

**Public Service of Canada**
- 26 years of service
- 27 years in retirement

<table>
<thead>
<tr>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
</tr>
<tr>
<td>58</td>
</tr>
<tr>
<td>85</td>
</tr>
</tbody>
</table>

**Royal Canadian Mounted Police**
- 31 years of service
- 32 years in retirement

<table>
<thead>
<tr>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
</tr>
<tr>
<td>54</td>
</tr>
<tr>
<td>86</td>
</tr>
</tbody>
</table>

**Canadian Forces**
- 25 years of service
- 39 years in retirement

<table>
<thead>
<tr>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
</tr>
<tr>
<td>45</td>
</tr>
<tr>
<td>84</td>
</tr>
</tbody>
</table>

2 years more in retirement for women
Presentation

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Valuation Assumptions
for PSSA, CF, RCMP Actuarial Reports – 31 March 2008

Economic Assumptions
• Inflation rate  (From 2.0% in 2010 to 2.4% in 2016 and thereafter)
• Real wage increases  (from 0.8% in 2012 to 1.1% in 2016)
• Real rate of return  (4.0% first four years and 4.3% thereafter for post-March 2000 service)

Demographic and Other Assumptions
• Promotional and seniority salary increases
• Number, age, sex, initial salary of future new members
• Rates of retirement
• Rates of termination / Rates of disability
• Mortality rates and life expectancies
• Proportion of members married
• Administrative expenses
Despite large fluctuations in the past, the rate of inflation has been very stable, at around 2%, since 1992.

Annual Increase in Consumer Price Index

- Average 64-73: 3.9%
- Average 74-83: 9.4%
- Average 84-93: 4.0%
- Average 94-09: 1.9%
- 2.0% until 2012, increasing to 2.4% for 2016+

- Various pension plans assume inflation rate between 1.9% and 2.8%
- An independent panel of actuaries has indicated that the CPP long-term assumption of 2.5% was within the reasonable range.
Assumptions Underlying Real Rate of Return

- “Risk-free” rate
- Equity risk premium (additional return over bonds)
- Real rate of return by asset class
- Asset mix policy: short-term versus long-term
Government of Canada Long Marketable Bonds: a good proxy for the risk-free rate

1990 to 2008: Government of Canada Marketable Bonds, Average Yield: Over 10 Years (V122487)
2009+: Projections

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The fixed income portfolio is a mix of four types of bonds whose assumed yields vary by level of risk.

- The following table summarizes the mix of bonds, along with the assumed spread earned over federal bonds:

<table>
<thead>
<tr>
<th>Proportion in portfolio</th>
<th>Federal</th>
<th>Provincial</th>
<th>Corporate</th>
<th>Real Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion in portfolio</td>
<td>20%</td>
<td>40%</td>
<td>30%</td>
<td>10%</td>
</tr>
<tr>
<td>Spread over federal bonds</td>
<td>-</td>
<td>+40 bps</td>
<td>+100 bps</td>
<td>-40 bps</td>
</tr>
</tbody>
</table>

- It is assumed that only high quality corporate bonds are purchased.
- The real rate of return on fixed income securities is assumed to be 2.8% until 2012 and to increase to 3.2% in 2014 and remain level thereafter.
Over the 106-year period 1900-2005, Canada experienced an equity risk premium of 4.2%.


Over the 109-year period ending in 2008, the Canadian equity risk premium has been 3.7%.
Over the last 50 years, Canadian equities have earned an average real return of 5.1% with a standard deviation of 16.6%.

- Over the same period, U.S. equities have earned an average real return of 5.5%.
- Over the same period, the U.S. equity risk premium in $CDN has exceeded the Canadian ERP by around 50 basis points at 1.7% compared to 1.2%.

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Since 2003, peers have decreased equity holdings in favor of alternative investments such as real return assets.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fixed Income</td>
<td>Equity</td>
</tr>
<tr>
<td>PSPIB¹</td>
<td>34%</td>
<td>65%</td>
</tr>
<tr>
<td>CPPIB¹</td>
<td>1%</td>
<td>97%</td>
</tr>
<tr>
<td>CDPQ²</td>
<td>39%</td>
<td>49%</td>
</tr>
<tr>
<td>OMERS²</td>
<td>25%</td>
<td>63%</td>
</tr>
<tr>
<td>OPSEU²</td>
<td>39%</td>
<td>61%</td>
</tr>
<tr>
<td>Teachers²</td>
<td>38%</td>
<td>46%</td>
</tr>
<tr>
<td>ABP²</td>
<td>50%</td>
<td>40%</td>
</tr>
</tbody>
</table>

1. As at 31 March 2004 and 31 March 2009
2. As at 31 December 2003 and 31 December 2008

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The best estimate asset mix has its fixed income holdings increase over time as the Plan matures and the fund grows.

### Asset Mix

<table>
<thead>
<tr>
<th>Plan Year</th>
<th>Fixed Income Securities</th>
<th>Canadian Equity</th>
<th>U.S. and Foreign Equity</th>
<th>Real Estate and Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>25%</td>
<td>28%</td>
<td>30%</td>
<td>17%</td>
</tr>
<tr>
<td>2010</td>
<td>25%</td>
<td>25%</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>2011</td>
<td>25%</td>
<td>25%</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>2012</td>
<td>25%</td>
<td>25%</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>2013</td>
<td>27%</td>
<td>23%</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>2014+</td>
<td>30%</td>
<td>20%</td>
<td>30%</td>
<td>20%</td>
</tr>
</tbody>
</table>
Real Returns by Asset Class (%)

<table>
<thead>
<tr>
<th>Plan Year</th>
<th>Fixed Income Securities</th>
<th>Canadian Equity</th>
<th>U.S. and Foreign Equity</th>
<th>Real Estate and Infrastructure</th>
<th>Overall Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>2.8</td>
<td>4.7</td>
<td>4.7</td>
<td>3.6</td>
<td>4.0</td>
</tr>
<tr>
<td>2010</td>
<td>2.8</td>
<td>4.7</td>
<td>4.7</td>
<td>3.6</td>
<td>4.0</td>
</tr>
<tr>
<td>2011</td>
<td>2.8</td>
<td>4.7</td>
<td>4.7</td>
<td>3.6</td>
<td>4.0</td>
</tr>
<tr>
<td>2012</td>
<td>2.8</td>
<td>4.7</td>
<td>4.7</td>
<td>3.6</td>
<td>4.0</td>
</tr>
<tr>
<td>2013</td>
<td>3.0</td>
<td>4.9</td>
<td>4.9</td>
<td>3.8</td>
<td>4.2</td>
</tr>
<tr>
<td>2014+</td>
<td>3.2</td>
<td>5.1</td>
<td>5.1</td>
<td>4.0</td>
<td>4.3</td>
</tr>
</tbody>
</table>

- The risk-free interest rate (Long-Term Canada Bonds) increases from 2.4% to 2.8% in 2014.
- The equity risk premium is set at 2.3%.
- Based on a long-term asset mix of 30% in fixed income securities, 50% in equities and 20% in real estate and infrastructure, the expected long-term real rate of return is 4.3%.

An independent panel of actuaries has indicated that the 4.2% assumption for the ultimate annual real rate of investment return on CPP assets was within, but towards the low end of, the reasonable range.
5-Year Average Real Rate of Return of Assets of Canadian Registered Pension Plans

Average 1969-2008 : 4.1% (Average 1967-2006: 4.8%)


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### Mortality Assumptions - Life Expectancy

Average Age at Death for a Person Aged 65 in 2008

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPP (Canada Pension Plan)</td>
<td>84.4</td>
<td>87.1</td>
</tr>
<tr>
<td>Public Service</td>
<td>84.7</td>
<td>87.3</td>
</tr>
<tr>
<td>CF (Other ranks)</td>
<td>83.7</td>
<td>-</td>
</tr>
<tr>
<td>CF (Officers)</td>
<td>85.9</td>
<td>88.0</td>
</tr>
<tr>
<td>RCMP (Regular Members)</td>
<td>85.7</td>
<td>89.3</td>
</tr>
</tbody>
</table>

Life expectancies are expected to increase by about 1 to 1.5 years in 2025.
Presentation

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## Current Service Cost (2008-2009)

**Public Service Pension Plan**

<table>
<thead>
<tr>
<th></th>
<th>Member Portion</th>
<th>Government Portion</th>
<th>Current Service Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution rate</td>
<td>6.1%</td>
<td>12.4%</td>
<td>18.5%*</td>
</tr>
<tr>
<td></td>
<td>(33%)</td>
<td>(67%)</td>
<td>(100%)</td>
</tr>
<tr>
<td>Contributions</td>
<td>$1,090M</td>
<td>$2,231M</td>
<td>$3,321M</td>
</tr>
</tbody>
</table>

**Ratio Government/Members** 2.03

*(expected at 1.92 in 2010-11)*

*Expressed as a percentage of pensionable payroll: $18.0 billion*

*Higher cost because of lower short-term real rate of return and improved CPP coordination factors.*
## Projection of Public Service Liabilities

<table>
<thead>
<tr>
<th></th>
<th>Pension Fund (Service After March 2000)</th>
<th>Superannuation Account (Service Before April 2000)</th>
<th>Fund Liabilities/Total Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Liabilities ($ billions)</td>
<td>Ratio of Liabilities: Actives/Total</td>
<td>Liabilities ($ billions)</td>
</tr>
<tr>
<td>2008*</td>
<td>28</td>
<td>84%</td>
<td>87</td>
</tr>
<tr>
<td>2015</td>
<td>68</td>
<td>70%</td>
<td>91</td>
</tr>
<tr>
<td>2025</td>
<td>164</td>
<td>59%</td>
<td>74</td>
</tr>
<tr>
<td>2035</td>
<td>321</td>
<td>51%</td>
<td>48</td>
</tr>
</tbody>
</table>

* Actuarial surplus of $972 million (Fund); Notional actuarial excess of $4.6 billion (Account) as at 31 March 2008.

- **Tangible assets backing the liabilities invested through PSP Investments could be long-term since the liabilities are heavily weighted towards the actives, thus reducing the assets/liabilities mismatch or, said differently, net cash flows are expected to be positive until 2030.**

- **PSP Investments is managing the assets of one of the youngest pension plans in Canada.**

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Net Cash Flows of $4.1 billion in plan year 2008, which are the difference between contributions (Current Service Cost) of $4.7 billion and $600M of benefits paid from the Fund.

In 2008, benefits paid from the Superannuation Accounts (pre-April 2000 service) reached $7.2 B.
Presentation

1. Role and Responsibilities of the OCA
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5. **Stochastic Analysis: a tool to measure uncertainty of results**
6. Issues Going Forward
Historical Inflation (1924-2008)

Geometric Mean (1924-2008) = 3.0%
Standard Deviation = 4.0%
Using the experience of the last 85 years, ending in 2008, the projected average inflation rate over a 20-year period will be in the range 1.3% to 4.9% with 95% probability.
Historical Canadian Real Equity Returns (1938-2008)

Geometric Mean (1938-2008) = 5.8%
Standard Deviation = 16.5%
Using the experience of the last 71 years, ending in 2008, the projected average real rate of return over a 20-year period will be in the range 0.7% to 10.5% with 95% probability.

Stochastic Analysis 20-year periods

Assumed Target Portfolio

Best-estimate

Range of 9.8%

\[ \mu = 5.6\% \]
\[ \sigma = 2.4\% \]
By removing a 10-year period (1973-1982) of high inflation, 10,000 generated scenarios produced a median real rate of return of 6.5%.

Stochastic Analysis 20-year periods

Assumed Target Portfolio

Best-estimate

Range of 9.1%

$\mu = 6.5\%$

$\sigma = 2.3\%$
Using the experience of the last 25 years, ending in 2006, which is the most favorable period of recent history (1982-2006), 10,000 generated scenarios produced a median real rate of return of 8.7%.
1. Role and Responsibilities of the OCA
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Actuarial Opinion

• The report was prepared pursuant to the Public Pensions Reporting Act and in accordance with accepted actuarial practice and, in particular, with the Canadian Institute of Actuaries’ Standards of Practice.
  – The valuation data are sufficient and reliable;
  – The assumptions are, individually and in aggregate, appropriate for the purpose of determining the financial status as at 31 March 2008;
  – The methodology employed is appropriate;
  – At the time of preparing this report, the global economy and financial markets were going through a difficult period. Should the deterioration of financial markets continue, the impact will be reflected in the next actuarial valuation as at 31 March 2011.
# Sensitivity of Projected Pension Fund Surplus

**Public Service - as at 31 March 2011**

<table>
<thead>
<tr>
<th>Assumption(s) Varied</th>
<th>Projected Actuarial Value of Assets ($ million)</th>
<th>Projected Actuarial Value of Liability ($ million)</th>
<th>Projected Actuarial Surplus ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>None (i.e. current basis)</td>
<td>44,070</td>
<td>42,716</td>
<td>1,354</td>
</tr>
<tr>
<td>Investment return</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- if 2% higher annually next 3 years</td>
<td>44,985</td>
<td>42,716</td>
<td>2,269</td>
</tr>
<tr>
<td>- if 2% lower annually next 3 years</td>
<td>43,175</td>
<td>42,716</td>
<td>459</td>
</tr>
<tr>
<td>- if minus 20% for plan year 2009</td>
<td>36,012</td>
<td>42,716</td>
<td>(6,704)</td>
</tr>
</tbody>
</table>
Public Service Funded Ratio and Current Service Cost for Different Portfolios

<table>
<thead>
<tr>
<th>Portfolios</th>
<th># 1</th>
<th># 2</th>
<th># 3</th>
<th># 4</th>
<th>Best-Estimate</th>
<th># 5</th>
<th># 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equity</strong></td>
<td>0%</td>
<td>0%</td>
<td>15%</td>
<td>35%</td>
<td>50%</td>
<td>65%</td>
<td>80%</td>
</tr>
<tr>
<td><strong>Fixed Income</strong></td>
<td>100%</td>
<td>100%</td>
<td>80%</td>
<td>55%</td>
<td>30%</td>
<td>15%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Real return investments</strong></td>
<td>0%</td>
<td>0%</td>
<td>5%</td>
<td>10%</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Expected Real Return</strong></td>
<td>2.8%</td>
<td>3.2%</td>
<td>3.5%</td>
<td>4.0%</td>
<td>4.3%</td>
<td>4.6%</td>
<td>4.9%</td>
</tr>
<tr>
<td><strong>3-year Standard Deviation</strong></td>
<td>5.9%</td>
<td>6.0%</td>
<td>5.6%</td>
<td>5.9%</td>
<td>6.5%</td>
<td>7.4%</td>
<td>8.3%</td>
</tr>
<tr>
<td><strong>Funded Ratio as at 31 March 2008</strong></td>
<td>76%</td>
<td>83%</td>
<td>88%</td>
<td>98%</td>
<td>103%</td>
<td>109%</td>
<td>116%</td>
</tr>
<tr>
<td><strong>Current Service Cost</strong>**</td>
<td>26.2%</td>
<td>23.8%</td>
<td>22.1%</td>
<td>19.7%</td>
<td>18.5%</td>
<td>17.3%</td>
<td>16.2%</td>
</tr>
</tbody>
</table>

** Current Service Cost required to maintain full funding.
Eliminating Investment Risk of Defined Benefit Plans

- Invest solely in real return bonds
  - Investment policy of 100% risk-free securities, such as Government of Canada real return bonds, to match the pattern of liabilities.
  - Will eliminate almost all investment risk but at an excessive cost.
  - Will be to the detriment of current and future contributors.
  - Will not produce a return sufficient to maintain the plan at status quo.

Benefits scaled back or contributions increased.
Appendix

Actuarial Reports

on the Pension Plans for the

Public Service

Canadian Forces

Royal Canadian Mounted Police

as at 31 March 2008

Presentation to the Federal–Provincial Pensions Conference

Ottawa, 23 November 2009

Thank you
Membership  Active Members (31 March 2008) (by length of service)

Public Service

- 62% of active members have less than 15 years of service

Canadian Forces (Regular)

- 61% of active members have less than 15 years of service

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## Membership

<table>
<thead>
<tr>
<th></th>
<th>PS (March 2008)</th>
<th>CF (March 2008)</th>
<th>RCMP (March 2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retirement pensioners</td>
<td>177,200</td>
<td>73,900</td>
<td>11,500</td>
</tr>
<tr>
<td>Disability pensioners</td>
<td>13,000</td>
<td>11,900</td>
<td>1,500</td>
</tr>
<tr>
<td>Survivors</td>
<td>57,500</td>
<td>23,300</td>
<td>1,700</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>247,700</strong></td>
<td><strong>109,100</strong></td>
<td><strong>14,700</strong></td>
</tr>
</tbody>
</table>

**TOTAL AMOUNT PAID $7.8 B (2007-2008)**
Value of the Pension Promise

* 4.3%, 3.5% and 2.8% are real discount rates used to value the pension promise

(Public Service – male, age 60 with 28 years of service eligible to an unreduced pension of $40,000)

(Canadian Forces – male officer, age 45 with 25 yrs of service eligible to an unreduced pension of $35,000)

(RCMP – male, age 54 with 31 years of service eligible to an unreduced pension of $50,000)
Retirement Rates

Expected ages at retirement for a typical plan member

• **PS:** For a member aged 44 with 12 years of service, the expected retirement age is 59.

• **RCMP:** For a Regular Member aged 39 with 13 years of service, the expected retirement age is 55.

• **CF:** For a member aged 35 with 11 years of service, the expected retirement age is 49.
## Balance Sheets as at 31 March 2008

<table>
<thead>
<tr>
<th></th>
<th>Public Service (in billions of dollars)</th>
<th>Canadian Forces (in billions of dollars)</th>
<th>RCMP (in billions of dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Superannuation Account</td>
<td>Pension Fund</td>
<td>Superannuation Account</td>
</tr>
<tr>
<td>Actuarial Value of Assets</td>
<td>91.6</td>
<td>29.0</td>
<td>44.2</td>
</tr>
<tr>
<td>Actuarial Liabilities</td>
<td>87.0</td>
<td>28.0</td>
<td>42.4</td>
</tr>
<tr>
<td>Excess of Actuarial Value of Assets over Liabilities</td>
<td>4.6</td>
<td>1.8</td>
<td>0.5</td>
</tr>
<tr>
<td>Actuarial Surplus/(Deficit)</td>
<td>1.0</td>
<td>0.3</td>
<td>-</td>
</tr>
</tbody>
</table>