Washington State Transit Insurance Pool

Capital Adequacy Assessment As of December 31, 2020



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Purpose

Washington State Transit Insurance Pool (the Pool or WSTIP) has retained PricewaterhouseCoopers LLP (PwC) to provide a capital adequacy assessment. This assessment results from the desire of WSTIP management and the Board to ensure that the financial metrics being used to assess WSTIP's financial strength and guide key business decisions are consistent with its member expectations.

The overall approach in this study leverages advances in the broader insurance industry related to the challenges in identifying the appropriate amount of capital required to support risk. Under this capital modeling approach, the capital requirements of the program are the result of an economic model with the key primary inputs being:

- 1. Risk tolerance as defined by management and the Board; and
- 2. A comprehensive risk measurement process which identifies and measures current and future financial risks as well as the interdependence of such risks.

The model is sensitive to changes in the risk profile, such as changes in retention limits. Due to this flexibility, the model can be used to guide financial risk decisions beyond measuring capital adequacy including assessing the effectiveness and capital impact of alternative reinsurance programs; and monitoring the results of changes in the financial strength and credit quality of reinsurers, among others.

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Background

WSTIP began its self-insurance program on January 1, 1989 and currently consists of 26 transit systems. The purpose for forming the Pool was to provide member transit systems with programs of joint self-insurance, joint purchasing of insurance and joint contracting for hiring personnel to provide risk management, claims handling, training and administrative services. Coverages provided by the Pool include automobile liability, general liability, auto physical damage, and property.

The Pool is subject to regulation set forth in the Washington Administrative Code (WAC). The revised WAC 200-100 includes various solvency standards for risk pools in Washington State. Under the defined solvency standard, the unpaid claims estimate at the expected level is compared to primary assets, which are defined as cash and investments less nonclaims liabilities. The second test compares the unpaid claims estimate at the 80% confidence level with primary and secondary assets. Secondary assets mean insurance receivables, real estate or other assets. In each case, the requirement to pass the test is to have more assets than unpaid claims. The Pool passes both tests as of December 31, 2020.

The available financial resources of the Pool to deal with capital events consist of its net position and the ability of the Pool to make up a financial shortfall with a retroactive assessment. The Revised Code of Washington 48.62.141 addresses insufficient assets and program requirements for joint self-insurance programs in Washington.

"Every joint self-insurance program covering liability or property risks ... shall provide for the contingent liability of participants in the program if assets of the program are insufficient to cover the program's liabilities."

Furthermore, section 13 of the interlocal agreement states:

"if the Pool's financial situation warrants, the Board may require supplementary and retroactive contributions and assessments."

While the Pool maintains the ability to replenish capital through a retroactive reassessment, such a strategy is inconsistent with its financial goals. A primary objective of the Pool is to provide stable rates and budget stability to its membership. Quantifying the various financial uncertainties the Pool is exposed to and monitoring the ability of its net position to support these risks is key to this strategy.

The Pool has historically purchased excess insurance and reinsurance above its per occurrence retention. The current per occurrence retention for liability coverage is \$2,000,000 and the current per occurrence retention for property coverage is \$250,000.

The Pool has \$59.1 million invested in fixed income investments including \$48.4 million in the Thurston County Investment Pool (TCIP), \$10.0 million in the Thurston County Treasurer (TCT), \$0.6 million in the State of Washington Local Government Investment Pool (LGIP), and \$0.1 million in U.S. Bank. The average effective duration of the fixed income portfolio is 1.39 years.

The Pool operates with an annual planning and budgeting cycle. Fiscal years run from January 1 through December 31. Rates for the upcoming fiscal year are typically set in September of the preceding fiscal year. Accordingly, there is a fifteen-month gap between when the key financial decisions such as rate levels are made and when the financial implications of those decisions are recognized in the financial statements. A key input into the annual rate level decision is the projected capital adequacy.

Valuation basis

The review is structured to make a comparison between the risk capital need and the economic value of WSTIP. However, the unpaid claim liabilities of WSTIP are expected to be paid out many years into the future but are booked on an undiscounted basis (do not reflect the time value of money). As a result, the reported net position understates the economic value of WSTIP by the amount of the present value adjustment of the claim liabilities.

In order to make the study results more meaningful to the stakeholders, the risk capital need has been adjusted downwards to reflect the claim liability discount value. This adjustment was made on the risk capital need versus adjusting the net position. Such approach allows for a direct comparison between the projected risk capital need from this study with the net position presented on the financial statements.

In this study, the capital need has been measured from a solvency perspective. Solvency is the ability of an entity to meet its long-term debts and financial obligations. The capital need results from quantifying the financial uncertainty of all risks over their lifetime. Solvency is measured by assessing the entity's ability to support these risks with its net position. This viewpoint contrasts with a liquidity perspective. Liquidity is a short-term concept that focuses on an entity's cash flow requirements.

Key findings

1. The capital needs are a function of the financial uncertainties of the program. In reviewing the risk profile of WSTIP, the following risk drivers were identified:

Underwriting risk	Uncertainty around the cost of next year's claims
Reserving risk	Uncertainty around the settlement of prior year claims
Investment risk	Deterioration of the investment portfolio due to market fluctuation
Credit risk	A decline in the financial strength of debtors and reinsurers
Key-person risk	Business disruptions due to key personnel turnover
Fraud risk	Fraudulent activities by internal parties or external vendors
Catastrophe risk	Financial loss and property damages due to natural hazards
Concentration risk	Loss of capital due to the geographical concentration of risks

This assessment focuses on quantifying these financial risks.

It is recognized that other non-financial risks exist for WSTIP, but they were not quantified as part of this review as they generally cannot be addressed through financial means. Examples of non-financial risks include:

Legal and regulatory risk	Lack of awareness or understanding of laws and regulations
Political risk	Uncertainty around the state and federal political environment
Reputation risk	Potential loss of membership due to damage to WSTIP's reputation

These risks are often managed and monitored using more qualitative approaches.



2. Based on the quantification of the financial risks and taking into consideration the interdependencies and correlation between the risks, a range of capital needs at various thresholds was developed.

In the next one-year time horizon, there is 1.0% chance (1-in-100 year event) that WSTIP's financial risks (current balance sheet and next year's business) will result in more than a \$33 million demand on program capital. Other thresholds in the graph can be interpreted similarly.

- 3. The capital needs at various thresholds can be used to construct a risk capital target range. Key considerations of the target range include:
 - Desired capability of WSTIP to withstand capital events
 - Tolerance for a retroactive assessment
 - Options to replenish the capital and continue operations after a capital event
 - Member's expectations regarding rate stability
 - Potential changes in the risk profile
 - · Any restrictions on the use of assets or net position to support a capital event

The current risk target ranges as well as other alternative risk capital target ranges are illustrated as follows.



Risk capital target range alternatives

Current risk capital target ranges:

Short-term goal:

- Lower bound: 1-in-100 year capital event under current retentions (\$33 million)
- Upper bound: 1-in-200 year capital event under current retentions (\$38 million)

Long-term goal:

- Lower bound: 1-in-100 year capital event under \$5 million liability retention (\$38 million)
- Upper bound: 1-in-200 year capital event under \$5 million liability retention (\$44 million)

The Board adopted a set of dual target ranges on June 25, 2015 based on PwC's capital adequacy assessment using data evaluated as of December 31, 2014. The dual ranges were adopted to address the immediate need and adequacy of the Pool to incrementally increase the self-retention level based on market conditions with a long-term goal to be financially capable of supporting a \$5 million liability self-insured retention. PwC performed a subsequent capital adequacy assessment using data evaluated as of December 31, 2017 and the risk capital target range was not updated at that time.

The lower bound (1-in-100 year event) of the current range definition is much lower than that of other pools (most commonly 1-in-200 year event).

The top end of the range should reflect the point where the funding level is deemed excessive and presumably when there would be deliberate steps to release the "excess funding" back to the members. In discussions with management regarding the potential impact of recent financial and world events to WSTIP, it was not clear that a net position in excess of \$44 million (current upper bound) would be deemed excessive by either management and/or the board. The target range should reflect the long-term financial goals and objectives.

In general, other pools have focused on setting an appropriate and defendable lower bound of the target range. The upper bound is more difficult to establish as broader "industry" perspective does not necessarily exist. Absent this guidance, pools have instead recognized it is important to have a defined upper bound but have defined it more indirectly by focusing more on width of the target range. The wider the target range, the more the financial swings can be absorbed in the net position versus the member rate levels.

In practice, the dual-range concept can lead to confusion and is difficult to implement. In comparison, other pools that went through similar exercises have all adopted single target range within their policies. A simpler and clearer target range can be established to address both short-term and long-term financial needs of the Pool.

Risk capital target range alternative 1:

- Lower bound: 1-in-200 year capital event under current retentions (\$38 million)
- Upper bound: 2 times a 1-in-200 year capital event under \$5 million liability retention (\$88 million)
- Lighter green zone: 1-in-200 year capital event under \$5 million liability retention (\$44 million)

The lower bound of the 1-in-200 year capital event is consistent with the 99.5% confidence level expectation contained in the global insurance regulation (Solvency II). Pools often find comfort in adopting a funding guideline based on a global insurance standard.

The upper bound is set at 2 times the 1-in-200 year capital event with the goal of having a sufficiently wide range to absorb the more regular financial fluctuations inherent with risk retention. The wider the target range, the more the financial swings can be absorbed in the net position versus the member rate levels.

The defined target range is segmented by the capital need required to support a 1-in-200 year event under a \$5 million liability retention to distinguish the short-term and long-term capital needs of the Pool.

Risk capital target range alternative 2:

- Lower bound: 2 times a 1-in-50 year capital event under current retentions (\$55 million)
- Upper bound: 3 times a 1-in-50 year capital event under \$5 million liability retention (\$95 million)
- Lighter green zone: 2 times1-in-50 year capital event under \$5 million liability retention (\$63 million)

The rationale for the lower bound of two times a 1-in-50 year capital event is based on the following factors. The quantification of the 1-in-50 year capital event is often considered to be more accurate than a 1-in-200 (or more) year capital event given the pooling industry has been around for less than 50 years. In addition, pools want to have sufficient capital remaining after a significant capital event so that they can continue to operate in subsequent years. The capital events measured as part of this study have a one-year time horizon.

The rationale for the upper bound of 3 times a 1-in-50 year capital event is similar to that of alternative 1.

The defined target range is segmented by the capital need required to support 2 times 1-in-50 year event under \$5 million liability retention to distinguish the short-term and long-term capital needs of the Pool.

Risk capital target range alternative 1 illustration:

The chart below illustrates the historical net position, the respective risk capital target range (alternative 1), and the minimum level of capital necessary (risk capital threshold) as defined in WAC 200-100 (80 percent confidence level).

If the net position drops below the minimum (red zone), immediate corrective action is required to restore the capital adequacy of the Pool. If the net position is above the minimum (yellow zone) but below the target range (green zone), or alternatively above the target range, the Pool will take steps to align the net position with the target range over a reasonable period of time.



4. The risk heat map below illustrates the contribution that each risk category and sub-component makes to the overall level of risk at a 1-in-200 year funding level. If there is a significant change in the risk profile, such as changes in retention or size of membership, the distribution of heat map will change.



From the risk heat map, the following points are noted:



5. The risk capital target will vary depending on the risk profile of the program. The underlying economic model allows the measurement of model sensitivity to changes in program size, retention, investment mix, etc. This feature can be used to assess the capital needs under various alternative program structures.

The following graph illustrates how the risk capital target range changes under various liability retentions.



Impact on target range due to changes in the liability retention

The current liability per occurrence retention limit is \$2 million. As illustrated above, the risk capital target range is highly sensitive to the per occurrence retention limit.

A detailed description of these alternative risk profiles is provided below.

- Current retention: This scenario reflects the financial risks associated with WSTIP, assuming the program size, historical retentions, investments, reinsurance programs and operations are maintained.
- \$500K liability retention: This scenario illustrates the capital needs assuming the retention decreases to \$500,000.
 As the retention limit is decreased, losses will be capped at a lower amount and the program will be subject to less volatility. Therefore, the capital needs will decrease.
- \$1M liability retention: This scenario illustrates the capital needs assuming the retention decreases to \$1 million. As the retention limit is decreased, losses will be capped at a lower amount and the program will be subject to less volatility. Therefore, the capital needs will decrease.
- \$2.5M liability retention: This scenario illustrates the capital needs assuming the retention increases to \$2.5 million. As the retention limit is increased, losses will be capped at a higher amount and the program will be subject to more volatility. Therefore, the capital needs will increase.
- \$3M liability retention: This scenario illustrates the capital needs assuming the retention increases to \$3 million. As the retention limit is increased, losses will be capped at a higher amount and the program will be subject to more volatility. Therefore, the capital needs will increase.
- \$5M liability retention: This scenario illustrates the capital needs assuming the retention increases to \$5 million. As the retention limit is increased, losses will be capped at a higher amount and the program will be subject to more volatility. Therefore, the capital needs will increase.

The following graph illustrates how the risk capital target range changes under various property retentions.



Impact on target range due to changes in the property retention

The current property per occurrence retention limit is \$250,000. As illustrated above, changes in the property retention result in minimal changes to the capital needs.

A detailed description of these alternative risk profiles is provided below.

- Current retention: This scenario reflects the financial risks associated with WSTIP, assuming the program size, historical retentions, investments, reinsurance programs and operations are maintained.
- \$500K property retention: This scenario illustrates the capital needs assuming the retention increases to \$500,000. As the retention limit is increased, losses will be capped at a higher amount and the program will be subject to more volatility. However, the capital needs are minimally impacted by an increase in the property retention over a one-year time horizon.
- 6. Previously, PwC performed a capital adequacy assessment for WSTIP as of December 31, 2017. Compared to the prior 2017 study, the current capital needs to withstand various events have increased.



Capital need - 2017 study vs. 2020 study

Table 1 - Comparison of capital needs at 1-in-200 year event threshold (000s)						
Risk categories	Dec-17	Dec-20				
Underwriting risk	13,510	17,094				
Reserving risk	23,267	23,236				
Asset and credit risk	1,841	1,210				
Operational risk	1,418	1,985				
Total before diversification	40,037	43,525				
Total after diversification	35,700	38,723				

The increase in the capital need is primarily due to volatility in the loss experience and an increase in large losses since the prior study.

Project approach

The insurance industry has replaced simpler financial ratio metrics and formulaic capital adequacy measures with more robust assessments of risks with the advancement of the enterprise risk management framework and computing power for quantifying risks. Such models are also being increasingly used by public entity pools while also recognizing the inherent differences between insurance entities as well as attitudes toward risk.

In June 2019, the Actuarial Standards Boards (ASB) adopted Actuarial Standard of Practice (ASOP) No. 55, **Capital Adequacy Assessment**. The ASOP provides guidance to actuaries when performing professional services with respect to an evaluation of the resiliency of an insurer through a capital adequacy assessment. This standard not only applies to actuaries involved in capital adequacy assessment work for traditional insurance carriers, but also to those that provide such services to public entity pools and captive insurers.

Under this capital adequacy assessment approach, there are three main parameters in determining adequate fund levels:

- Risk drivers: The study uses an economic capital modeling approach in order to reflect the unique risk profile of WSTIP. This is the biggest differentiating characteristic when compared to many of the historical metrics and funding guidelines. From this model, a distribution of capital needs at various return periods, encompassing all major risk categories and expected correlations among risk categories and sub-components, was developed.
- 2. **Risk tolerance**: The Board's desired level of protection helps define its risk capital target. Its risk tolerance statement can be translated into specific thresholds and funding guidelines.
- 3. **Correlation**: Interdependencies between risks are measured through a correlation matrix. Extreme capital events are typically caused by a combination of factors. Accordingly, the interdependence and correlation between the various risk drivers is critical to understanding the ability of an entity to withstand a financial stress.

By visualizing the risk capital target and understanding the sources of risks in quantified terms, this approach helps make informed decisions. The financial implication of various funding strategies can be measured against the financial guidelines and the cost of capital can be weighed against the estimated benefits of alternative program structures.

The sections below discuss the three parameters of the approach in detail.

Risk drivers

The term "risk" in the context of this review means the possibility or potential for deterioration in the net asset or fund value. Some of the sources for potential deterioration in fund value can be found on WSTIP's balance sheet - they would include all asset and liability items that are variable in nature, such as loss reserves, investments, and reinsurance recoverables. Also, the fund is used to protect against potential inadequacy of the budget for future business, which includes one year's worth of business exposure. Lastly, there are operational and administrative events that have a remote chance of occurring and that are not budgeted or reserved for in the financials.

Based on typical categorization of insurance risks and discussions with the management, risks were categorized into the following main groups:

	Underwriting	Reserving	g Asset & credit C	
•	Risk that the next year's business result may deviate from plan	 Risk that the eventual loss and expense may exceed booked reserves 	 Risk that the value of investment assets and receivables may decrease 	Any other unplanned expense that may arise from operations
•	Catastrophic exposures Systemic losses Market cycle Increased severity or frequency of losses Price inadequacy	 Excessive inflation Changes in claims management and system processing 	 Reinsurer failure leading to default on reinsurance recoverable Bond investment – exposed to interest rate risk and default risk Equity investment – exposed to market fluctuation 	 Cyber attack Regulation risk Disaster recovery People related (turnover, fraud, reputational) System and process failure
•	Simulation based approach using historical data	 Simulation based approach using historical data 	 Based on publicly available market information + own asset profile 	 Stress scenario test approach based on discussions

Each category has been further segmented into appropriate sub-categories to quantify the risks arising from these major risk categories. The quantification is done bottom-up as shown in the diagram below: the sub-category level was analyzed and quantified first, and then aggregated to the major risk category levels shown above, and then aggregation of the major categories to the total capital needs and simulating the total capital needs at various thresholds.



Details of the quantification methodologies, assumptions and results are discussed in the next section of this report.

Risk tolerance

A risk appetite statement broadly considers the levels of aggregate risk that an organization is willing to take in pursuit of its objectives, while risk tolerances are narrower and set the qualitative and quantitative boundaries around risk taking, consistent with its risk appetite. For example, a risk appetite statement for a program may be to have enough capital to operate in the long run even after a major capital event. Under the same context, a risk tolerance statement can be expressed as WSTIP would like to have sufficient capital to withstand at least two 1-in-50 year capital events over a one-year time horizon.

The target funding strategy, which links to an entity's overall risk appetite or tolerance should consider the following dimensions:

Indicator	Severity	Frequency	Time horizon				
What is being measured? (all options eventually come back to capital level)	What is the tolerable level of this selected indicator?	What is the tolerable frequency that the selected indicator hits the selected severity?	What time horizon is the fund supposed to protect?				
 Capital needs at various return periods Some insurers look at RBC or AM Best BCAR, etc. to ensure a certain rating 	 Insolvency Reduction in net position to regulatory minimum level 	 Withstand one 1-in- 200 year capital event Withstand two 1-in-50 year capital events in a row 	• The typical time horizon is "one year until runoff," which is most entities' planning cycle				
Extremity							

The core question for the target funding strategy is "extremity", which is the level of protection the Board or management wishes to provide through its funding.

To answer the question of "what level of protection is considered adequate", the risk management framework built by the property and casualty insurance industry was reviewed.

- 1. U.S. insurance regulation by the National Association of Insurance Commissioners (NAIC): While not specifically calibrated to certain confidence levels for various risks, the NAIC's RBC system identified about 4% of P&C insurance companies as below the Company Action Level over the past 5 years. This equates to a 1-in-25 year capital level. It should be recognized, however, that the RBC formula represents a minimum capital requirement for regulatory intervention purposes; therefore, the low threshold should not be used to answer questions such as "What is the adequate level of net assets to achieve WSTIP's financial goals, operate safely and meet members' expectations?"
- European insurance regulation: The new E.U. regulation, Solvency II, clearly states the calibration standard of a 99.5th percentile (1-in-200 year), which is consistent with several western European countries' current requirements. This standard is not meant to be a regulatory minimum; instead it is the recommended level of capital adequacy to provide sufficient policyholder protection.
- 3. **Rating agency models**: Rating agencies, such as AM Best, Standard & Poors, and Moody's, use their own tools and processes to assess insurance entities' capital adequacy. Their capital adequacy assessments are used as one of the core metrics for determining the financial strength rating. Most rating agencies do not specifically indicate at what confidence level their risk factors are calibrated in the capital adequacy assessment. However, the standards for a "secure" rating of B+ appear to target a 99th percentile (1-in-100 year) or higher, based on the factors and stress adjustments that are made in their assessments.

The benchmarks discussed above are from the insurance industry. There are a few important operational aspects unique to governmental insurance pools that need to be considered in setting the risk capital target range.

- Pools do not typically "manage" their books (i.e. not renewing the policy for the members with worse loss experience) while insurance companies do exercise this option. This higher member retention means pools are exposed to risks arising from having to retain members with poor loss experience, which might in turn require the pools to have a stronger financial position than insurance companies.
- One of the main goals for pooling is rate stability, while insurance companies' main goal is generally to generate profit. This means the pools are less likely to be able to react to sudden shifts in costs, therefore requiring a stronger financial position than insurance companies. In addition to providing funds for an extreme capital event, pools also use their capital position as a rate stabilization mechanism.
- Public insurance companies have the ability to raise capital from different sources, while pools only have their members as the sole source of capital.
- Members often depend on pools for services, such as risk management and education, beyond the insurance mechanism of paying for claims.

These unique aspects of the pool operation all indicate a potential need for a stronger financial position for the pools, compared to their insurance industry peers.

Correlation

The following are key characteristics related to correlation and diversification:

- 1. The higher the correlation, the less the diversification effect.
- 2. Diversification benefit is greater if each risk component is more equally sized, under the same correlation assumptions.
- 3. Diversification benefit is allocated back to each risk category, based on each category's contribution to the overall diversification effect. For example, assuming all risk categories are equally sized, operational risk would receive the most diversification effect; because its correlation with other categories is the lowest (see the correlation matrix in the "Quantification of risks" section).
- 4. Smaller items tend to get diversified away, which means a higher percentage of smaller risk items will be reduced due to diversification. This is a characteristic of the allocation method utilized in this review, which is based on contribution of each risk item to overall diversification.
- 5. Correlation matrix needs to be "positive definite". This statistical term basically means that the correlation relationship between a pair of risks needs to make sense based on the correlation relationships that involve one of these risks. For a very simple example, let's assume there are 3 risks being reviewed A, B and C. If A and B are 100% correlated and B and C are 100% correlated, then A and C need to also be 100% correlated.

Quantification of risks

This section discusses the methodologies, main assumptions, and results of the analysis by major risk category, starting from the total capital need down to more granular levels of analysis.

The overall capital needs were calculated from aggregating the capital needs for the major risk categories.

Risk categories	Capital need							
	1-in-20	1-in-50	1-in-100	1-in-200	1-in-250	1-in-500		
Underwriting	8.6	12.0	14.7	17.1	17.8	20.5		
Reserving	12.3	16.7	20.0	23.2	24.1	26.9		
Asset and credit	0.7	0.8	1.1	1.2	1.3	1.3		
Operational	0.8	0.9	1.5	2.0	2.1	2.4		
Total before diversification	22.4	30.5	37.3	43.5	45.2	51.1		
Total after diversification	20.3	27.7	33.7	39.1	40.7	45.9		
Adjustment for reserve discount	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)	(0.4)		
Adjusted Total	19.9	27.3	33.2	38.7	40.2	45.5		

Table 2 - Total capital need under current risk profile (\$m)

Note that the capital needs have been adjusted by \$0.4 million for reserve discount. This is a measure of the time value of money related to the future payout of loss reserves. Since reserves booked in the financial statements are stated on an undiscounted basis, the economic value of the program's net position is understated. This adjustment puts the comparison of net position to estimated capital need on the same basis.

Simply summing up the capital needs from risk categories at all confidence levels, however, may be unduly pessimistic, since this implies that all elements will go bad to the same degree simultaneously. Since not all risk items are fully dependent on each other, there exists a diversification benefit - the total capital need is less than the sum of all 4 risk categories. The diversification benefit is determined by the level of correlation between each pair of risk categories as well as the spread of risk across categories. Lower correlation and greater spread of risk lead to a higher diversification benefit. The correlation assumptions are shown in Table 3.

Table 3 – Correlation matrix

	Underwriting	Reserving	Asset and credit	Operational
Underwriting risk	100%	High	Med	Med
Reserving risk	High	100%	Med	Low
Asset and credit risk	Med	Med	100%	Med
Operational risk	Med	Low	Med	100%



	Underwriting	Reserving	Asset and credit	Operational
Underwriting risk	100%	75%	50%	50%
Reserving risk	75%	100%	50%	15%
Asset and credit risk	50%	50%	100%	50%
Operational risk	50%	15%	50%	100%

As a first step, high, medium or low correlation was selected for each pair of risks. A key consideration was the potential correlation of risks at tail end higher confidence levels, as correlation tends to be higher under more stressed situations than under normal situations. Percentage correlation values for high, medium and low were then assigned.

The logic used in selecting the high, medium and low correlation between major risk categories is as follows:

- 1. **Underwriting and Reserving**: Both risks arise from the core business of pooling and transfer of risk. Therefore, many common factors could cause reserve deterioration and poor future underwriting results simultaneously, such as inflation, tort reform, and emergence of new types of claims, especially for the longer-tailed exposure.
- 2. **Underwriting and Asset/Credit, Reserving and Asset/Credit**: Asset and credit risks tend to arise from macroeconomic financial factors or systemic factors affecting the overall insurance industry. The underwriting results and reserves for longer tailed lines are linked more closely to these factors (e.g., inflation).
- 3. **Underwriting and Operational**: Catastrophic events can both affect underwriting results and the operational expense related to disaster recovery.
- 4. **Reserving and Operational**: The type of extreme events that affect operational risks tend to be prospective events such as catastrophes, while the scope of loss reserves are events that have already occurred and unlikely to be affected by operational mishap.

This type of aggregation is done within each major risk category as well; for example, across risk categories and across any other sub-categories defined during the review. Assumptions used for aggregating across the sub-categories are discussed in major risk category descriptions below.

Overall capital needs under various scenarios

A number of alternative risk profile scenarios were explored:

Table 4 - Total capital need (\$m)

Scenarios	Capital need					
	1-in-20	1-in-50	1-in-100	1-in-200	1-in-250	1-in-500
Current risk profile	19.9	27.3	33.2	38.7	40.2	45.5
\$500K liability & \$250K property	14.5	19.9	24.1	28.2	29.5	33.8
\$1M liability & \$250K property	17.4	23.7	28.6	33.6	35.0	39.6
\$2.5M liability & \$250K property	20.0	27.5	33.5	38.9	40.6	46.1
\$3M liability & \$250K property	21.1	29.1	35.6	41.2	43.2	49.1
\$5M liability & \$250K property	21.8	30.1	36.6	42.7	44.8	50.5
\$2M liability & \$500K property	22.8	31.6	38.0	44.7	46.9	53.4

The capital needs are highly sensitive to the liability per-occurrence retention level.

Underwriting risk

Underwriting risk, also known as pricing risk, represents risk that the actual outcome for the next year will deviate from the budgeted amount. Typical sources of this risk for the business are volatility in the frequency or severity of claims. Since

the expense items are rather predictable, the majority of risk lies within the projected claims cost. Therefore, the number of future claims and the volatility around them have been modeled to measure underwriting risk.

To do this work, the historical unlimited individual claims (before WSTIP retention) were reviewed. A frequency-severity method was used to measure future claims volatility, which is described in further detail in Appendix 1. One major advantage of this frequency-severity approach is that it allows direct application of WSTIP retention, because individual claims are modeled and simulated on a gross basis.

The resulting capital needs arising from underwriting risk by coverage under current retentions, and under various alternative scenarios are shown in Tables 5 and 6.

Table 5 - Underwriting risk under current retention (\$m)

Items	Capital need					
	1-in-20	1-in-50	1-in-100	1-in-200	1-in-250	1-in-500
Auto liability	5.7	7.8	9.6	11.1	11.4	13.2
General liability	2.6	3.7	4.6	5.4	5.7	6.6
Auto physical damage	0.7	1.0	1.2	1.4	1.4	1.6
Property	0.4	0.6	0.7	0.9	0.9	1.1
ULAE	0.6	0.9	1.1	1.3	1.3	1.5
Total before diversification	10.0	13.9	17.1	20.0	20.8	23.9
Total after diversification	8.6	12.0	14.7	17.1	17.8	20.5

Table 6 - Underwriting risk scenarios (\$m)

Scenarios	Capital need						
	1-in-20	1-in-50	1-in-100	1-in-200	1-in-250	1-in-500	
Current risk profile	8.6	12.0	14.7	17.1	17.8	20.5	
\$500K liability & \$250K property	6.1	8.5	10.2	11.9	12.4	14.2	
\$1M liability & \$250K property	7.3	10.2	12.3	14.6	15.2	17.4	
\$2.5M liability & \$250K property	9.0	12.5	15.5	17.8	18.8	21.3	
\$3M liability & \$250K property	9.3	13.0	15.9	18.6	19.5	22.1	
\$5M liability & \$250K property	10.1	14.3	17.3	20.6	21.5	24.3	
\$2M liability & \$500K property	8.8	12.2	15.0	17.4	18.1	20.8	

Changes in the liability retention limit have a significant impact on the underwriting risk.

Correlation assumptions used across items under the underwriting risk category are shown in Table 7.

Table 7 - Correlation between items under underwriting risk							
Items	AL	GL	APD	PR	ULAE		
AL	100%	Med	High	Low	100%		
GL	Med	100%	Low	Low	100%		
APD	High	Low	100%	Low	100%		
PR	Low	Low	Low	100%	100%		
ULAE	100%	100%	100%	100%	100%		

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The logic behind the selected correlation assumptions is as follows:

- 1. Auto Liability and General Liability are moderately correlated because they appear to be subject to some of the same market cycle and tort law influences.
- 2. Liability and Property have low correlation because they are not subject to many of the same external influences and do not appear to share many of the same characteristics.
- 3. Auto Liability and Auto Physical Damage are highly correlated because high severity losses that drive the capital requirement would likely result in third party liability claims as well as physical damage to covered vehicles.
- 4. Unallocated loss adjustment expenses should be perfectly correlated with claim cost, as they are assessed as a percentage of loss.

Reserving risk

Reserving risk measures the potential for actual claims settlement cost deviating unfavorably from the current booked reserves. Typical sources of potential unfavorable reserve development include excessive inflation, emergence of latent or new types of claims, changes in claims management practice and a change in the judicial environment affecting claim settlements.

The historical claim emergence was utilized to quantify the reserve variability. Details of the methods used are discussed in Appendix 1.

The resulting capital needs arising from reserving risk by coverage under current retentions, and under various alternative scenarios are shown in Tables 8 and 9.

Table 8 - Reserving risk under current retention (\$m)

Items	Capital need					
	1-in-20	1-in-50	1-in-100	1-in-200	1-in-250	1-in-500
Auto liability	10.1	13.6	16.1	18.7	19.3	21.4
General liability	2.7	3.8	4.7	5.5	5.8	6.6
Auto physical damage	0.5	0.6	0.7	0.8	0.8	0.9
Property	0.0	0.0	0.0	0.0	0.0	0.0
ULAE	0.5	0.7	0.9	1.0	1.0	1.2
Total before diversification	13.8	18.7	22.4	26.0	27.0	30.2
Total after diversification	12.3	16.7	20.0	23.2	24.1	26.9

Table 9 - Reserving risk scenarios (\$m)

Scenarios			Capita	l need		
	1-in-20	1-in-50	1-in-100	1-in-200	1-in-250	1-in-500
Current risk profile	12.3	16.7	20.0	23.2	24.1	26.9
\$500K liability & \$250K property	9.1	12.4	14.8	17.1	17.9	20.5
\$1M liability & \$250K property	11.0	14.7	17.4	20.1	21.0	23.7
\$2M liability & \$250K property	12.5	17.0	20.3	23.4	24.5	27.6
\$2.5M liability & \$250K property	13.2	18.1	21.8	25.2	26.2	29.9
\$3M liability & \$250K property	13.7	18.7	22.5	25.9	27.2	30.6
\$5M liability & \$250K property	14.0	19.1	22.6	26.2	27.5	31.6
\$2M liability & \$500K property	12.3	16.7	20.0	23.2	24.1	26.9

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Changes in the liability retention limit have a moderate impact on the reserving risk.

Asset and credit risks

Asset and credit risks reflect the risks that the value of investment and credit assets may deteriorate due to changes in macroeconomic conditions or a decline in the financial strength of debtors.

The resulting capital needs by risk category are shown in Table 10.

Table 10 - Asset & credit risk (\$m)

Categories	Capital need					
	1-in-20	1-in-50	1-in-100	1-in-200	1-in-250	1-in-500
Interest rate risk	0.7	0.8	1.0	1.1	1.2	1.2
Reinsurer default risk	0.1	0.2	0.2	0.3	0.3	0.4
Total before diversification	0.8	0.9	1.2	1.4	1.5	1.6
Total after diversification	0.7	0.8	1.1	1.2	1.3	1.3

When interest rates rise, the market values of existing bonds decline in value. The duration of bond assets reflects the degree of the price sensitivity of these assets to interest rate movements. The Pool has \$51.9 million invested in fixed income investments as of December 31, 2020. The average effective duration of the fixed income portfolio is 1.39 years.

If the duration of the bond portfolio is much longer than the duration of loss reserves, then this mismatch further exposes the Pool to asset risk resulting from interest rate changes. In order to measure the net cash flow duration, cash flows from bond assets were offset by expected loss payouts. The net impact of interest rate risk is calculated as the difference of the impact on the bond portfolio and the impact on the reserve discount:

Table 11 – Interest rate risk (\$m)

		Capital need					
	1-in-20	1-in-50	1-in-100	1-in-200	1-in-250	1-in-500	
A. Bond portfolio	1.34	1.50	1.90	2.16	2.21	2.32	
B. Reserve discount	-0.65	-0.72	-0.91	-1.02	-1.05	-1.09	
C. Interest rate risk = max(A+B,0)	0.69	0.78	0.99	1.13	1.16	1.22	

The other component of asset and credit risk relates to the Pool's relationship with its reinsurers. To analyze this default risk, total amount at risk if the reinsurers were to default on their obligations was estimated. The amount at risk include the following items:

Table 12 - Amounts at risk (\$000s)

Subject items	Amount	Note
Prior year reinsurance recoverable	2,332	Actuarial evaluation as of December 31, 2020
Recoverable on the prospective year	432	Estimated by PwC
Additional reinsurance premium for a replacement cover	2,484	125% of reinsurance cost midway through year (assumes higher replacement cost)
GEM Equity	2,044	Financial statements as of December 31, 2020
Total at risk	7,292	

We developed probabilities of reinsurer default at various confidence levels based on the AM Best publication on mid-term default rates of insurers and exponential extrapolation, as shown in Table 13:

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Table 13 - Default rates							
AM best's rating (ICR)	Average	1-in-20	1-in-50	1-in-100	1-in-200	1-in-250	1-in-500
ааа	0.13%	0.30%	0.73%	1.20%	1.70%	1.80%	2.25%
aa+	0.22%	0.50%	1.03%	1.50%	2.00%	2.10%	2.54%
аа	0.31%	0.70%	1.26%	1.70%	2.20%	2.40%	2.84%
aa-	0.44%	1.00%	1.58%	2.00%	2.50%	2.70%	3.14%
a+	0.53%	1.20%	1.78%	2.20%	2.90%	3.20%	3.82%
а	0.66%	1.50%	2.08%	2.50%	3.40%	3.70%	4.50%
а-	0.88%	2.00%	2.50%	2.90%	3.90%	4.30%	5.19%
bbb+	1.10%	2.50%	3.30%	3.90%	4.90%	5.30%	6.18%
bbb	1.27%	2.90%	4.06%	4.90%	5.90%	6.40%	7.30%
bbb-	1.71%	3.90%	5.03%	5.90%	7.80%	8.30%	9.97%
bb+	2.59%	5.90%	7.53%	8.80%	10.80%	11.30%	13.09%
bb	3.87%	8.80%	10.35%	11.80%	13.70%	14.20%	16.06%
bb-	5.19%	11.80%	13.11%	14.70%	16.70%	17.20%	19.29%
b+	6.46%	14.70%	15.90%	17.70%	19.60%	20.10%	22.33%
b	7.78%	17.70%	18.63%	20.60%	22.60%	23.00%	25.49%
b-	8.62%	19.60%	20.48%	22.60%	24.50%	25.00%	27.56%
ccc+ and lower	21.54%	49.00%	62.03%	72.28%	82.74%	86.14%	96.76%
NR	21.54%	49.00%	62.03%	72.28%	82.74%	86.14%	96.76%

For each rating level, the default risk is calculated as the product of the estimated amount at risk and the probability of default at various return periods.

For asset and credit risk, it is assumed that interest rate risk has low correlation with reinsurer default risk.

Operational risk

The operational risk category captures potential for fund deterioration arising from off-balance sheet or unplanned items. The following diagram shows a general risk management framework that categorizes risk events that may be included in an entity's operational risk:



The capital need from the operational risk category is due to risk events that are of low frequency but high severity and that are not mitigated or budgeted for. Difficulties when trying to quantify such risks arise from the lack of experience data. Even within the insurance industry, where much effort has been made to establish risk registers and risk monitoring systems, many insurers have chosen to take the more qualitative approach of monitoring the operational risk events and near-misses and studying the trends in the risk events.

For the purposes of reviewing the fund adequacy, discussing sub-categories of operational risks and relevant potential scenarios with WSTIP management helped to quantify this risk. The following scenarios were discussed based on the program's potential unmitigated exposure and anecdotal experience in the industry and at WSTIP:

Amount (\$000)	Return period	Scenario
640	1-in-250	Key personnel turnover; fraudulent activities by employees, broker, etc.
1,000	1-in-250	System back-up failure or vendor default.
1,280	1-in-250	A major catastrophic event affecting WSTIP's property, business interruption, and potentially staff loss.
	640 1,000 1,280	640 1-in-250 1,000 1-in-250 1,280 1-in-250

Table 14 - Operational risk scenarios

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As shown in Table 14, the scenarios have financial impact and probability estimated for two data points each and fitted distributions through these data points can be used to extrapolate the result to various confidence levels.

Table 15 summarizes the operational risk at various thresholds:

Table 15 - Operational risk (\$m)

Categories	Capital need					
	1-in-20	1-in-50	1-in-100	1-in-200	1-in-250	1-in-500
People	0.3	0.3	0.5	0.6	0.6	0.7
System	0.5	0.6	0.8	1.0	1.0	1.1
Catastrophe	0.3	0.3	0.8	1.2	1.3	1.5
Total before diversification	1.1	1.3	2.1	2.8	2.9	3.3
Total after diversification	0.8	0.9	1.5	2.0	2.1	2.4

Reliance on data

The data used throughout this report are the responsibility of WSTIP. PwC assumes no responsibility and makes no representations with respect to the accuracy or completeness of the information provided. While our work involved reviewing the data for reasonableness and consistency, our actuarial engagement does not include an audit in accordance with generally accepted auditing standards. To the extent that any changes are noted that could potentially have a material impact on our analysis, it is the responsibility of WSTIP to notify us of these changes so that they may be properly reflected.

Data provided by WSTIP included the following:

- Snapshots of claims data evaluated as of December 31 over the last twenty-three years (1998 through 2020)
- Historical and projected exposure
- Current investment yield
- Self-insured retentions
- Details of reinsurance programs
- Investment performance reports
- December 31, 2020 financial statements

Disclosures

This report was prepared for internal use by the management of WSTIP, and not for any other party. Use of this report for other than the stated purpose may be inappropriate. Distribution of this report to WSTIP's external auditors is permitted with the understanding that the report will be distributed in its entirety and that the furnishing of this report is not a substitute for the auditor's own due diligence. Judgments as to the conditions, methods, and data contained in this report should be made only after studying the report in its entirety and understanding the reliance and limitations inherent in the analysis, as described in the subsequent sections. The use of parts of this report in isolation may result in erroneous or misleading conclusions. The Actuarial Services staff of PwC is available to explain or elaborate upon the findings presented in this report, and it is assumed that users of this report will seek out such explanation on any matter in question. Further distribution of this report is not permitted without the written permission of PwC. Other use or further distribution of this report will not result in the creation of any duty or liability by PwC to a third party, and third parties should place no reliance on this report or data contained herein that would result in the creation of any duty or liability by PwC to the third party.

Qualifications of actuaries

Kevin Wick is a Managing Director with PwC and is a Fellow of the Casualty Actuarial Society. Si Yuan (Jordan) He is a Senior Manager with PwC and is an Associate of the Casualty Actuarial Society. Christine Kogut is a Principal with PwC and is a Fellow of the Casualty Actuarial Society. As such, Mr. Wick, Mr. He and Ms. Kogut each meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Christine Kogut was the peer review for this engagement.

Limitations

The analysis and models developed for the analysis utilize methodologies and assumptions that are appropriate to measure specific financial risks of WSTIP, based on WSTIP's historical loss experience. However, the extreme tail end of financial results is difficult to measure with certainty due to the lack of relevant empirical experience and volume of loss history. While the assumptions can be tested against historical data and scenario tests can also provide some validation, there always remains a possibility that actual financial uncertainty may deviate from this assessment.

The aggregation of various financial risks requires correlation assumptions between risks. While assumptions were formulated according to generally accepted actuarial methods, there can be no guarantee that the actual events will not vary significantly from the assumptions used in this assessment.

The quantification of the capital events in the model reflects a one-year time horizon. While WSTIP may have sufficient capital to fund one capital event, there always remains a possibility that multiple capital events may occur in consecutive years. WSTIP should consider its ability to replenish capital after a significant capital event when developing a target capital risk policy.

Furthermore, the capital events developed do not contemplate any substantive changes in the legal, tax and regulatory environments that WSTIP currently operates within.

COVID-19 was declared a pandemic by the World Health Organization (WHO) on March 11, 2020. The degree to which WSTIP's claims are impacted is highly uncertain. The unprecedented nature of the pandemic, its potential impact on claims experience, and the uncertainty associated with actions to temper its impact increase the uncertainty.

Appendix 1 – Methodology

Underwriting risk

PwC utilized a frequency-severity approach as the general framework for estimating underwriting risk. The severity of individual claims and the frequency of claims were separately modeled. Severity parameters and distribution shapes were selected based on historical individual claims, which are developed and trended to the future year level. Development was applied only to open claims. The factors that were applied to the open claims were calculated based on incurred development loss factors and reported claim development factors from the December 31, 2020 actuarial review.

Historical claim frequency per exposure by accident year was examined to project an expected number of claims and the variability around this expected number. The frequency and severity parameters were assumed to be independent.

High severity shock claims were introduced in the modeling to supplement to the program's own claim history.

The main assumptions used in the frequency-severity method are listed below:

Table 16 - Frequency for large losses

Coverage	Large loss threshold	Average # claims	Standard deviation	Distribution
Auto liability	\$100K	8	6	Negative binomial
General liability	\$25K	6	6	Negative binomial
Auto physical damage	\$25K	8	5	Negative binomial
Property	\$0	17	23	Negative binomial

Table 17 - Severity for large losses

Coverage	Average	Standard deviation	Distribution
Auto liability	461,634	895,624	Inverse gaussian
General liability	160,223	255,078	Lognormal
Auto physical damage	80,349	162,143	Lognormal
Property	6,075	31,465	Inverse gaussian

Table 18 - Attritional loss rate

Coverage	Average	Standard deviation	Distribution	Exposure unit
Auto liability	34.30	10.83	Extreme value	Miles
General liability	18.80	14.53	Weibull	Full time equivalents
Auto physical damage	956.50	539.54	Extreme value	Vehicle values (\$millions)
Property	N/A	N/A	N/A	N/A

Using the selected distributions for frequency and severity and catastrophe loss results, simulations were run on ultimate losses for the 2021 underwriting year. Both gross estimates and estimates limited to the current retention level were modeled, as well as other contemplated retention levels. Based on the outcome of the simulations, percentiles of capital needs were developed for the risks analyzed. These percentiles range from a 1-in-5 year event to a 1-in-1000 year event.

Reserving risk

To quantify the reserving risk, incremental development factors using the historical loss data (triangles) were calculated. Distributions around the incremental development factors were then fit by setting the means equal to the selected incremental development factors and the standard deviations equal to the standard deviations of the incremental year over year development. The modeling results were then scaled to match the unpaid claim estimates from the December 31, 2020 actuarial review. Due to a low volume of data in some of the older years, outlier development factors that were distorting the behavior of the simulated LDFs were removed.

Appendix 2 – Financial statements as of December 31, 2020

Comparative Statement of Net Position

As of December 31, 2020

	As of De			cember 31,		
ASSETS		2020		2019		
Current Assets	¢	E4 477 04E	¢	40 520 225		
Accounts Receivable	Ф	04,477,240 09,410	Φ	40,539,335		
		20,410		7,309		
Dranaid Indurance		87,937		23,497		
Prepaid Insurance		823,299		676,689		
		45,435		16,766		
		55,462,326		41,263,876		
Noncurrent Assets Capital Assets Net		105 500		172 011		
Long Torm Investments		425,566		473,011		
Equity in CEM		4,978,775		9,930,717		
		2,044,010		2,044,010		
Deposits held for RPLDP		1,458		1,530		
I otal Noncurrent Assets		7,449,831		12,450,068		
TOTAL ASSETS	\$	62,912,157	\$	53,713,944		
DEFERRED OUTFLOWS OF RESOURCES						
Deferred Outflows - Pension		91,863		83,724		
Deferred Outflows - OPEB		1,382		-		
TOTAL DEFERRED OUTFLOWS	\$	93,245	\$	83,724		
TOTAL ASSETS & DEFERRED OUTFLOWS	\$	63,005,402	\$	53,797,668		
LIABILITIES						
Current Liabilities						
Accounts Payable	\$	138,058	\$	56,927		
Compensated Absences		154,513		99,660		
Unearned Revenues		146,586		123,905		
Unpaid Claims Liability		6,912,000		7,764,007		
OPEB Liability		2,764		3,072		
Total Current Liabilities		7,353,921		8,047,571		
Noncurrent Liabilities						
Compensated Absences		21,543		9,916		
Due to RPLDP		1,458		1,530		
Due to Members		3,782,992		-		
Unpaid Claims Liability - Reserves		6,202,347		3,327,431		
Unpaid Claims Liability - IBNR		8,057,784		7,903,820		
Unpaid Claims Liability - ULAE		844,000		734,000		
OPEB Liability		571,944		355,879		
Net Pension Liability		341,426		326,114		
Total Long-Term Liabilities		19,823,494		12,658,690		
TOTAL LIABILITIES	\$	27,177,416	\$	20,706,261		
DEFERRED INFLOWS OF RESOURCES						
Deferred Inflows - Pension		106,100		221,243		
TOTAL LIABILITIES & DEFERRED INFLOWS	\$	27,283,516	\$	20,927,504		
NET POSITION						
Investment in Capital Assets		425,588		473,811		
Unrestricted Building Reserve		29,166		4,166		
Unrestricted Technology Grant Reserve		424,468		179,093		
Unrestricted Net Position		34,842,664		32,213,094		
TOTAL NET POSITION	\$	35,721,886	\$	32,870,164		
TOTAL LIABILITIES, DEFERRED INFLOWS & NET POSITION	\$	63,005,402	\$	53,797,668		

These interim financial statements have not been audited

Comparative Statement of Revenues, Expenses and Changes As of December 31, 2020

	F	For the years ended December 31,			
		2020		2019	
OPERATING REVENUES					
Member Assessments	\$	18,407,525	\$	16,654,015	
Other Insurance Products		896,258		814,451	
Prior Period Assessment Audit (PPAA)		(3,881,197)		(351,353)	
Other Operating Revenues		87,452		217,588	
TOTAL OPERATING REVENUES	\$	15,510,038	\$	17,334,701	
OPERATING EXPENSES					
Claims & Loss Adjustments		7 218 651		4 447 418	
Purchased Insurance - Liability		1,893,472		1,439,376	
Purchased Insurance - Property		1.358.092		1.039.398	
Other Insurance Products		452,200		431,817	
Payroll & Benefits		1,717,732		1,152,457	
Contracted Services		494,289		442,159	
Risk & Loss Prevention		219,645		252,168	
Training & Education		43,390		159,885	
Technical & Subscription Services		281,025		295,776	
General & Administrative		156,845		428,858	
Depreciation		27,550		20,627	
Capital Asset Audit Adjustment Expense		27,183		-	
TOTAL OPERATING EXPENSES	\$	13,890,076	\$	10,109,939	
TOTAL OPERATING INCOME	\$	1,619,962	\$	7,224,762	
OTHER INCOME (EXPENSE)					
Interest Income	\$	1,231,761	\$	1,039,514	
Change in Equity in GEM	_	-	\$	495,608	
TOTAL OTHER INCOME (EXPENSE)	\$	1,231,761	\$	1,535,122	
TOTAL CHANGE IN NET POSITION	\$	2,851,722	\$	8,759,884	

These interim financial statements have not been audited

Conclusion

We appreciate the opportunity to provide our services to WSTIP. We hope this analysis provides useful guidance. We are available to answer questions on the material presented in this report.

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